REQUEST FOR PROPOSALS

Research Projects for Narragansett Bay and Its Watershed
September 2017

The New England Interstate Water Pollution Control Commission (NEIWPCC), in cooperation with the Narragansett Bay Estuary Program and its partners, is inviting proposals that support the Narragansett Bay Estuary Program through the execution of scientific research projects focused on the Narragansett Bay Watershed. The purpose of this program is to expand the research capabilities of the Estuary Program through the selection of scientific research projects targeting the data gaps and research needs specifically identified in the 2017 State of the Narragansett Bay and Its Watershed Technical Report. These research projects will help address scientific questions about the Narragansett Bay Watershed and inform future reports issued by the Estuary Program including the next version of the technical report, expected to be completed in 2022. Under this request for proposals (RFP), the Bay and Watershed Research Program will result in subawards with the selected applicants in the total amount of approximately $140,000.

Key elements in brief: This RFP is open to research and educational institutions of higher learning, individuals, county, municipal, and local subdivisions of state government in both Rhode Island, Massachusetts and Connecticut, state and federal (non-EPA) agencies, interstate agencies, tribes, for-profit, and non-profit organizations. The deadline for a one-page pre-proposal is 12:00 (noon) EST on November 14, 2017. The deadline for invited full proposals is 12:00 (noon) EST on January 22, 2018. Projects are anticipated to end no later than June 30, 2019. This RFP includes information on:

I. Overview

II. Project Goal

III. Scope of Work

IV. General Guidelines for Applicants

V. Proposal Requirements and Review Process

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VII. Proposal Evaluation Process

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I. Overview

NEIWPCC

NEIWPCC is a not-for-profit interstate organization, established by Congress in 1947 to serve and assist its member states individually and collectively by providing coordination, research, public education, training, and leadership in the management and protection of water quality in the New England states and New York. NEIWPCC strives to coordinate activities and forums that encourage cooperation among the states, educate the public about key water quality issues, support research projects, train environmental professionals, and provide overall leadership in the management and protection of water quality.

Narragansett Bay Estuary Program

Founded in 1985, the Narragansett Bay Estuary Program is one of 28 nationally designated programs operating under the National Estuary Program. This national program was established by the federal Clean Water Act and seeks collaborative solutions to protect and restore the water quality and ecological integrity of estuaries of national significance. NEIWPCC serves as the host entity for the Narragansett Bay Estuary Program. The Narragansett Bay Estuary Program’s mission is to protect and preserve Narragansett Bay and its watershed, in both Rhode Island and Massachusetts, through partnerships that conserve and restore natural resources, enhance water quality, and promote community involvement.

II. Project Goal

The Bay and Watershed Research Program is designed to support scientific research and monitoring projects that help fill in data gaps and research needs specifically identified in The State of the Narragansett Bay and Its Watershed Technical Report (Technical Report). Accordingly, successful projects will build upon the analysis and findings in the Technical Report and advance the scientific understanding of changes in Narragansett Bay (Bay) and the Narragansett Bay Watershed (Watershed). The Technical Report describes the status and trends for 24 indicators that help to track progress toward the goals to protect, restore, and maintain the chemical, physical, and biological integrity of the Bay and its Watershed. It also identifies the linkages between and among these indicators and describes how those linkages may have changed or could continue to change through time.

The Estuary Program will select research projects in order to develop scientific reports for the Program that will augment the findings of the Technical Report, inform future updates to the Technical Report, and contribute to the Estuary Program’s long history of supporting scientific research. The selected projects will enter into subawards with NEIWPCC to complete the scientific research and develop a final report for the Estuary Program.

III. Scope of Work

The Technical Report includes 24 chapters organized by two groups of indicators: stressor indicators and condition indicators, the latter of which includes aspects of both ecosystem condition and public health. The Bay and Watershed Research Program seeks to support research projects for the benefit of the Narragansett Bay Estuary Program that advance the scientific understanding of the following 24 indicators:
Stressor Indicators

Climate Change Stressor Indicators
Chapter 1. Temperature, Chapter 2. Precipitation, Chapter 3. Sea Level

Landscape Stressor Indicators
Chapter 4. Population, Chapter 5. Land Use, Chapter 6. Impervious Cover,
Chapter 7. Wastewater Infrastructure, Chapter 8. Nutrient Loading

Chemical Stressor Indicators
Chapter 9. Legacy Contaminants, Chapter 10. Emerging Contaminants

Condition Indicators

Bay Ecosystem Condition Indicators
Chapter 14. Estuarine Fish Communities, Chapter 15. Dissolved Oxygen
Chapter 16. Chlorophyll, Chapter 17. Water Clarity

Watershed Ecosystem Condition Indicators
Chapter 20. Freshwater Fish Communities, Chapter 21. Open Space

Condition Indicators of Public Health
Chapter 22. Water Quality Conditions for Recreation, Chapter 23. Marine Beaches,
Chapter 24. Shellfishing Areas

Each of these 24 chapters includes a section that identifies data gaps and research needs (see the compiled list of these gaps and needs in Appendix E). The goal of the Bay and Watershed Research Program is to develop scientific research reports on behalf of the Estuary Program that specifically address the identified data gaps and research needs or develop reports for the Program that are substantially related to the scientific issues discussed in each chapter.

Through this RFP, the selected scientific research projects will focus on the geographic scope of Narragansett Bay and the Narragansett Bay Watershed in the states of Rhode Island and Massachusetts (see the map in Appendix F). While the Technical Report is exclusively focused on this geographic scope, the Narragansett Bay Estuary Program’s study area also includes the Little Narragansett Bay Watershed (Wood-Pawcatuck Rivers) and the Southwest Coastal Ponds Watershed in the states of Rhode Island, Massachusetts, and Connecticut (see the map in Appendix F). A project’s competitiveness will depend on how well it meets the scoring criteria outlined in Appendix D and priority scoring is provided for those research projects that take place within the geographic scope of Narragansett Bay or the Narragansett Bay Watershed. Accordingly, projects in the Little Narragansett Bay Watershed or the Southwest Coastal Ponds Watershed remain eligible but will receive a lower score under the criteria in Appendix D.

IV. General Guidelines for Applicants

Eligibility
This RFP is open to research and educational institutions of higher learning, individuals, county, municipal, and local subdivisions of state government in both Rhode Island, Massachusetts and Connecticut, state and federal (non-EPA) agencies, interstate agencies, tribes, and for-profit and non-profit organizations. Although multiple partners may be involved with a project, a single subawardee will be the recipient of funds, and partners receiving funds through the subawardee will be considered subcontractors. The subawardee will be responsible for the completion of all tasks including those through subcontracted partners. Individuals and representatives from organizations that participated in the development or review of this RFP and its contents may be deemed ineligible to apply according to the Estuary Program’s conflict of interest policies.
Schedule

The project should take no more than 12 months, with all final reports and paperwork received by March 2019 (short projects) or June 2019 (long projects). However, it is desirable for projects to be completed earlier.

The schedule* for this RFP is as follows:

<table>
<thead>
<tr>
<th>Event</th>
<th>Date/Time</th>
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</thead>
<tbody>
<tr>
<td>Pre-Proposals Due to NEIWPCC</td>
<td>November 14, 2017, 12:00 PM EST (noon)</td>
</tr>
<tr>
<td>Applicants Invited to Submit Full Proposals</td>
<td>December 15, 2017</td>
</tr>
<tr>
<td>Deadline for Submission of Full Proposals</td>
<td>January 22, 2018 (noon)</td>
</tr>
<tr>
<td>Announcement of Awards</td>
<td>February 2018</td>
</tr>
<tr>
<td>Project Start Date</td>
<td>April 2018</td>
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</table>

*Schedule is subject to change.

Funding

Approximately $140,000 in total funding is available for this project and it is anticipated that five to eight projects will be chosen. Should the amount of available funding change, we reserve the right to increase or decrease the amount of available funding. No single subaward may exceed $35,000 and proposals with budgets that exceed the identified funding cannot be considered. Final proposal budgets cannot exceed pre-proposal budgets. Contract funds may be used for expenses specifically related to the proposed project, including wages and consultant fees. Expendable and non-expendable equipment directly related to the proposed project may qualify for funding, but requires pre-approval (prior to proposal submission) by NEIWPCC and must be justified in the proposal. Indirect costs are allowed, but must be in line with the following procedures: Applicants with a valid Negotiated Indirect Cost Rate Agreement with their cognizant federal agency must use that rate, and must provide documentation of the negotiated rate. Applicants that do not have a Negotiated Indirect Cost Rate Agreement may charge a maximum indirect rate of 10 percent of direct costs.

Match

Although cost share or match is not required, projects providing non-federal cost share or match will receive favorable consideration over projects without cost share or match (see Appendix D). Cost share or match can be satisfied with cash or in-kind services, or a combination of both. Cash contributions are those funds used to purchase goods or services associated with the project. In-kind contributions represent the value of non-cash contributions provided by the applicant. Any contributions must be clearly explained in the proposal and must be documented.

Deliverables

The primary deliverables for this project will be the following:

1. **Quarterly reports** delivered to the NEIWPCC project manager no later than the 10th day of January, April, July, and October during the duration of the project.
2. **Approved Quality Assurance Project Plan (QAPP)**. See below for additional information about this deliverable.
3. **Draft project report**.
4. **Final project report**.

All deliverables will be submitted in draft form in Microsoft Word format for review by project partners and approval by the Project Manager at NEIWPCC. All final reports will be delivered in Adobe .pdf format upon approval by the Project Manager.

If data are collected under this subaward, the data are expected to be entered into U.S. EPA’s data systems. Specifically, the successful applicant must ensure all water quality data generated in accordance with an
EPA/NEIWPCC- approved Quality Assurance Project Plan, either directly or by subcontract, are transmitted into the Agency’s Storage and Retrieval (STORET) Data Warehouse annually or by project completion using either WQX or WQXweb. Water quality data that are appropriate for STORET include physical, chemical, and biological sample results for water, sediment and fish tissue. The data include toxicity data, microbiological data, and the metrics and indices generated from biological and habitat data. The Water Quality Exchange (WQX) is the water data schema associated with the U.S. EPA, State and Tribal Exchange Network. Using the WQX schema partners map their database structure to the WQX/STORET structure. WQXweb is a web-based tool to convert data into the STORET format for smaller data generators that are not direct partners on the Exchange Network. More information about WQX, WQXweb, and the STORET Warehouse, including tutorials, can be found at http://www.epa.gov/storet/wqx/.

Quality Assurance & Quality Control Requirements
The NEIWPCC Quality Management Plan requires that Quality Assurance Project Plans (QAPPs) are developed and approved for all projects involving environmental data operations (i.e., collection, analysis, and/or manipulation of environmental data). For projects that involve environmental data operations, the contractor will be responsible for developing the project QAPP and submitting it to the Estuary Program and NEIWPCC staff for review after the start of the subaward period. NEIWPCC will provide guidelines for QAPP development. The QAPP must be approved by the EPA, the NEIWPCC Project Manager, and the NEIWPCC Quality Assurance Program Manager prior to any data collection or analysis. If your proposed project will include environmental data operations, development of the QAPP can be completed as a task under this project and should be included in the proposal narrative, timeline, and budget. While preparing your proposal, please account for the additional time and resources necessary for QAPP development. Allow a minimum of 30 days for the development of your QAPP and 90 days for the review and approval of your QAPP by NEIWPCC and EPA QA officers. It is appropriate for an applicant to utilize or build upon an existing, relevant, approved QAPP if one exists.


Questions regarding the QAPP process or the necessity of a QAPP for a proposed project should be directed to the NEIWPCC Project Manager, Heather Radcliffe (contact information in Section IX), by 4:00 PM EST on October 30, 2017.

Deliverables, Ownership, and Credit Due
All materials, software, maps, studies, reports, and other products or data, regardless of physical form or characteristics, produced as a result of this solicitation and funded, in whole or in part, under an agreement with NEIWPCC shall be made available to NEIWPCC, the Narragansett Bay Estuary Program, and the U.S. EPA in the formats in which it is stored or maintained. NEIWPCC, the Narragansett Bay Estuary Program, and the U.S. EPA shall have an unrestricted right to use any materials, software, maps, studies, reports, and other products or data generated using assistance funds or specified to be delivered. The subawardee shall not obtain, attempt to obtain, or file for a patent, copyright, trademark or any other interest in any such materials, software, maps, reports, and other products or data without the express, written consent of NEIWPCC and subject to any other approvals required by state or federal law. Reports and other deliverables will credit NEIWPCC, the Narragansett Bay Estuary Program, and U.S. EPA for any work completed under the subaward.

Geographic Information System (GIS) Data Requirements (If Applicable)
GIS data produced under this project must adhere to the requirements of EPA’s National Geospatial Data Policy (see https://www.epa.gov/geospatial/epa-national-geospatial-data-policy). Specifically, the selected subawardee must provide documentation for all produced data, including source information for each digital data layer (i.e., scale and accuracy, map projection, coordinate system, etc.), and specific information about the data layer itself (i.e., method used, geographic extent of data layer, file format, date of creation, staff contact, description and...
definition of data fields and their contents, related files, if any, and description of data quality and quality assurance methods used). The EPA Metadata Editor (EME) was developed to simplify and standardize metadata development and is a recommended tool for streamlining production of required metadata. The EME and related training materials can be downloaded from https://edg.epa.gov/EME/. Specific technical guidance on geospatial deliverables and acceptable formats can be found at https://www.epa.gov/geospatial/epa-region-2-gis-deliverables-guidance. GIS data produced under this project will be submitted to NEIWPCC as a deliverable.

Surveys & Information Collection
This project is funded through a U.S. EPA Assistance Agreement with NEIWPCC. NEIWPCC cannot use these funds to support a survey without completion of an Information Collection Request (ICR) describing the survey. The ICR must be submitted to the U.S. EPA Office of Management and Budget (OMB) for review and approval. This is an extensive process that can take several months to complete. A survey is defined as the collection of identical data from ten or more non-Federal respondents within a 12-month period. OMB approval must be received before any survey activities supported by NEIWPCC funds can begin. If the selected subawardee is providing non-federal match for this project, these matching funds may be used to support the cost of designing and administering a survey without the development of an ICR. NEIWPCC funds may be used for analysis of the survey data and publication of the results regardless of whether or not an ICR is completed.

Insurance Requirements
NEIWPCC requires its subawardees to maintain workers compensation and liability insurance. More details will be provided to applicants selected for funding. Note this applies for all subawardees, including sole proprietors. If you cannot provide proof of insurance, please do not apply for this funding opportunity.

V. Proposal Requirements and Review Process
Application to the Bay and Watershed Research Program is a two-step process. First, applicants submit a pre-proposal, which will be ranked in a competitive process by a Review Committee. The Review Committee will then invite the highest ranked pre-proposals to submit a full proposal. Pre-proposals must be received by 12:00 (noon) EST on November 14, 2017. Full proposals will then be invited at the recommendation of the Review Committee. Full proposals must be received by 12:00 (noon) EST on January 22, 2018.

The Review Committee is composed of state and federal agency representatives, the Estuary Program and NEIWPCC staff, Estuary Program committee members, or other subdivisions of government. The Review Committee may also include non-governmental members of the Estuary Program’s Science Advisory Committee. Other members of the Science Advisory Committee may be asked to review the scientific validity and technical merit of the pre-proposals and full proposals.

Using the Selection Criteria presented in Appendix D, the Review Committee will assign a score to each pre-proposal, and based on these scores, assign a rank order to each. The average rank score among all reviewers shall be the basis of pre-proposal selection. Only the highest ranked pre-proposals will be invited to submit a full proposal. No guidance will be provided to any applicant during this process. The number of applicants to receive invitations will be at the discretion of the Review Committee. Invitations will be offered to the highest ranked proposals in order of rank by the Review Committee. The goal of the Review Committee is to ensure that the highest ranked and most promising proposals are invited to submit full proposals. The Review Committee has discretion to select among equally scored proposals based on factors such as project diversity or geographic coverage.

The same competitive review process will be followed for the selection of full proposals for funding. Only the highest mean-ranked full proposals will receive funding. In the case of a tie rank score between selected proposals, funding will go to the proposal that represents the best value for the program. However, as in the pre-proposal review, the Review Committee has discretion to select among equally scored proposals based on factors such as
project diversity or geographic coverage. The Review Committee reserves the right to reject any or all pre-proposals or proposals that do not meet the goals and terms of this RFP. If insufficient funds are available for a project or for projects ranked on the cusp of available funding, partial funded may be awarded. However, if the Review Committee believes partial funding will make such a project unfeasible, the project may be bypassed and a lower cost project may be funded.

**STEP 1: Pre-proposals**
Submit pre-proposals electronically through the NEIWPCC website (see VI. Submission Process below). A complete pre-proposal must include a pre-proposal Narrative and any partner commitment letters. The pre-proposal Narrative must not exceed one (1) page single-spaced, typed 8.5" x 11" pages with 11-point font and 1-inch margins, including figures and narrative. Pre-proposals must be accompanied by brief letters on letterhead from each partner affirming their specific role or contribution to the effort. For site-specific projects, if the applicant is not the property owner, the pre-proposals must be accompanied by a letter from the property owner agreeing to the proposed activities (subject to an necessary conditions). Site-specific proposals that lack support of the property owner where work is to be done may be disqualified. Please do not include any other support documentation at this time, as it will not be reviewed.

The pre-proposal narrative must include the following information:
- Description and location of the proposed project and anticipated benefit(s) as they relate to the funding priorities identified in this RFP;
- A specific statement explaining the data gap or research need that this project will fulfill for the benefit of Estuary Program (specify the Chapter and Number in Appendix E) and how the project will support *The State of the Narragansett Bay and Its Watershed Technical Report*;
- Total project budget, making clear the following: total amount requested and nonfederal match; purpose for which funds will be used; other funding sources for this project;
- Timeline for the project (including time for QAPP development, if necessary); and
- Description of qualifications of project partners and their anticipated role in the project.

**STEP 2: Full Proposal (invited by NEIWPCC and the Narragansett Bay Estuary Program only)**
Full proposals will only be accepted after invitation, based upon review and approval of a pre-proposal. Applicants must submit proposals electronically through the NEIWPCC website (see VI. Submission Process below).

Full proposals must include a (1) cover letter, (2) title page with abstract, (3) narrative with citations, (4) timeline, (5) budgets (both overall and task-based budget formats), (6) budget justification, (7) description of qualifications, and (8) letters of commitment or support. Page limits for each of these components are provided in the individual descriptions below. Proposals that do not contain all of the information requested and/or do not meet the format requirements will be eliminated from consideration. Pages that exceed the maximum number specified for each section will not be reviewed. All full proposals submitted to NEIWPCC must be consistent with the corresponding pre-proposal submission, including funding amount requested.

**Cover Letter**
Please include a one-page cover letter, printed on official letterhead and signed by an authorized representative of the lead agency, firm, or institution, with each proposal. The cover letter must state that:
- You are applying for funds under this program,
- You commit to the match you are proposing,
- You acknowledge that funding is provided on a reimbursement basis.
Title Page
For your convenience, an electronic version of the title page is available as a Microsoft Word document at http://www.neiwpcc.org/contractors/opportunities.asp. The title page must adhere to the format provided in Appendix A and include all of the following information, using a maximum of one single-spaced, one-sided, typed 8.5" x 11" page with 11-point font and 1-inch margins:

- **Title**: Use the exact project name as it appears throughout the proposal.
- **Primary Investigator Name and Contact Information**: Provide the name, title, and affiliation of the primary investigator, as well as mailing address, phone number, and email address.
- **Financial Contact Name and Contact Information (if applicable)**: Provide the name, title, and affiliation of the individual responsible for financial/contractual negotiations (if different from primary investigator), as well as mailing address, phone number, and email address.
- **Project Partners (if any)**: Provide the names, titles, affiliations, for each of the additional investigators or support staff who will significantly contribute to the project (if any).
- **Funds Requested**: Provide the amount of money you are requesting from NEIWPCC for the project.
- **Matching Funds**: Provide the amount of matching funds you and/or your partners will be contributing to the project (if any).
- **Federal Tax Identification Number (FID)**
- **DUNS Number**: A DUNS number is a unique, non-indicative 9-digit identifier that verifies the existence of a business entity globally. Contractors must provide NEIWPCC with a DUNS number to comply with an administrative condition of NEIWPCC’s EPA grant (individuals are exempt).
- **Certified Disadvantaged Business Enterprise (DBE)**: Indicate if your organization is a DBE.
- **Project Location Description (City, State)**: Provide the state and city where the primary location where work will be completed.
- **Project Location Coordinates (Latitude, Longitude)**: Provide the latitude and longitude coordinates for the primary location where work will be completed.
- **Abstract**: The abstract must accurately describe the project being proposed and include: (1) the objectives of the project, (2) the methodology to be used, and (3) the expected outputs and outcomes of the project and how it addresses this RFP, including environmental benefits to the study area. The abstract must fit within the title page.

Proposal Narrative
The proposal narrative must not exceed 3 consecutively numbered, single-spaced, typed 8.5" x 11" pages with 11-point font and 1-inch margins. The 3-page narrative must include all of the following information:

- **Problem Description**: Briefly describe the project and its relevance to *The State of the Narragansett Bay and Its Watershed Technical Report*. This section can also include brief background or introductory information. Clearly explain which data gap or research need this project will fulfill for the benefit of the Estuary Program and how the project will support *The State of the Narragansett Bay and Its Watershed Technical Report* (specify the Chapter and Number in Appendix E);
- **Objectives**: Outline how the project will achieve the goal of this RFP.
- **Methodology**: Outline the project’s design and describe the methods and techniques that will be used to meet the project’s goal and tasks.
- **Expected outputs and outcomes**: Describe the project’s expected outputs and outcomes, and list and describe each of the specific deliverables and end-products.
- **Briefly discuss the process to be used to evaluate the effectiveness and success** of the project.

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1 Obtaining a DUNS number is free for all entities doing business with the Federal government. Under normal circumstances the DUNS number is issued within 1-2 business days when using the web form process (http://fedgov.dnb.com/webform).
• **Roles and Responsibilities**: Define the roles and responsibilities of all project participants, collaboration with others, and engagement of end users.

• **Citations**: Include references as appropriate within the proposal narrative.

**Timeline**
Provide a detailed timeline for meeting identified tasks and completing deliverables, with a completion date no later than June 30, 2019. All timelines must be stated in terms of Month #1, #2, #4, etc. rather than specific dates, e.g. “March 5, 2018.” Although the project start date is anticipated to be on or about March 5, 2018, this date may change based on the time the actual agreement is established. The timeline must be no more than one 8.5” x 11” page with 1” margins and 11-point font. NEIWPCC expects that awardees will adhere to the scope and timeline. Be sure that the scope proposed is realistic and achievable.

**Budget**
The project budget must be provided in two formats:

First, provide a complete, detailed budget using the format provided in Appendix B. For your convenience, an electronic version of the budget form is available at [http://www.neiwpcc.org/contractors/opportunities.asp](http://www.neiwpcc.org/contractors/opportunities.asp). The budget must be no more than one 8.5” x 11” page with 1” margins and 11-point font. Along with this budget, provide a brief justification (one page maximum) for the proposed costs in terms of meeting project objectives. Include an explanation of how indirect costs are calculated. Justify subcontracts, if any. Identify and describe current and pending financial resources (including the source) for non-federal cost share or matching funds that are intended to support the project. Entities intending to use a Negotiated Indirect Cost Rate must provide documentation of their rate. This documentation does not count toward the page limit.

Second, prepare a budget that is broken down by project tasks using the format provided in Appendix C. For your convenience, an electronic version of the budget form is available at [http://www.neiwpcc.org/contractors/opportunities.asp](http://www.neiwpcc.org/contractors/opportunities.asp). As you develop this budget, keep in mind that contractual payments will be made based on this budget. This budget must be no more than two 8.5” x 11” pages with 1” margins and 11-point font. Matching funds should not be included in the task-based budget.

Final proposal budgets cannot exceed pre-proposal budgets.

**Qualifications**
The applicant chosen for this project should possess the academic and/or professional expertise and certifications in the relevant subject areas, and have a strong track record in delivering projects of this nature. Selection will be based on the scoring criteria identified in Appendix D. Applicants are encouraged to read and understand the criteria before developing a project proposal. Attention to detail in documenting qualifications that meet the scoring requirements is strongly advised. Documents substantiating project team qualifications (resumes, CVs, descriptions of past projects, etc.) do not count towards the 3 page narrative limit, but must not exceed 3 pages.

**Letters of Commitment**
Projects undertaken in partnership with other organizations, particularly where the partner will provide a service or action must include support letters from each partner stating their specific commitments. If your project includes matching funds and the match is to be provided by partners, letters of commitment for the match from those partners must be included. General “letters of support” should not be included with the application. Letters of commitment do not count towards the 3 page limit for the proposal narrative.
VI. Submission Process
Pre-proposals must be submitted by no later than 12:00 PM EST (noon) on November 14, 2017. Full proposals must be submitted by no later than 12:00 PM EST (noon) on January 22, 2018. No late submissions will be considered. Applicants must submit their proposals electronically through the NEIWPCC website. Unless prior approval is given, proposals received through e-mail, postal delivery, or any other delivery method will not be accepted.

To submit your proposal, go to www.neiwpcc.org/rfp2/ and follow the instructions provided for uploading your file(s). The proposal and all supporting information must be submitted as a single PDF document. This requires Adobe Acrobat or similar Adobe product (the free Adobe Reader does not allow the conversion of documents into PDF format), or a scanner. The file name should be in the following format: “NBEP RESEARCH_NAME OF YOUR ORGANIZATION.” Once you have clicked the “submit” button, please allow adequate time for your submission to process and do not hit the back button or close your browser window. The process is not considered complete until you have reached the confirmation page. If submitted successfully, you will receive an email from NEIWPCC (mail@neiwpcc.org) with the subject line “RFP Submission Confirmation” confirming your submission. For questions regarding submission of proposals, contact Heather Radcliffe, NEIWPCC, hradcliffe@neiwpcc.org, (978) 349-2522.

VII. Proposal Evaluation Process
NEIWPCC will screen all proposals to ensure that they meet all requirements of this RFP. If a proposal is found to be incomplete, the proposal will be eliminated from the competition and NEIWPCC will notify the applicant. To be considered complete, proposals must include all of components described in Section V. Proposal Requirements and Review Process. Pages in excess of the limits specified for each component will not be reviewed. Complete and eligible proposals will be reviewed by a Review Committee and proposals may also be submitted for external peer reviews. The Review Committee will evaluate the full proposals based upon the criteria listed in Appendix D and submit recommended funding to the Estuary Program’s Executive Committee.

VIII. Notification of Awards
Award notification to applicants is expected by February 2018. Award recipients may be asked to submit a revised work plan, timeline, and budget at this time. Projects cannot start until the subaward is signed by both parties. If your project includes environmental data operations, this work may not begin until the QAPP is approved. NEIWPCC will not pay for expenses incurred prior to the subaward start date. Payment for costs incurred will be on a reimbursement basis per the payment schedule and contingent upon completion of quarterly progress reports and project deliverables.

IX. Contacts
For information regarding the application process, contact the NEIWPCC Project Manager:
Heather Radcliffe
New England Interstate Water Pollution Control Commission
(978) 349-2522
hradcliffe@neiwpcc.org

For information regarding the RFP topic, contact the Narragansett Bay Estuary Program:
Tom Borden
NEIWPCC Program Director
Narragansett Bay Estuary Program
(401) 633-0552
tom.borden@nbep.org
APPENDIX A: TITLE PAGE

Project Name:

Organization:

Primary Investigator Name and Contact Information:

Financial Contact Name and Contact Information (if applicable):

Project Partners (if any):

Funds Requested: $  Matching Funds: $

Federal Tax Identification Number:

DUNS Number:

Certified Disadvantaged Business Enterprise (DBE): (Yes or No)

Project Location Description (City, State):

Project Location Coordinates (Latitude, Longitude):

Project Abstract

The abstract must fit within this title page, using a maximum of one single-spaced, one sided typed 8.5” x 11” page with 11 point font and 1” margins (remove this instructional text when completing page and prior to submitting proposal).
# APPENDIX B: PROJECT BUDGET

## PROJECT BUDGET

<table>
<thead>
<tr>
<th>BUDGET CATEGORY (Add/remove itemizing lines below major categories as necessary, but do NOT delete major categories)</th>
<th>MATCH</th>
<th>GRANT REQUEST</th>
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<tbody>
<tr>
<td><strong>A. PERSONNEL</strong> (list individual names and titles below)</td>
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### APPENDIX C: TASK-BASED BUDGET FORMAT

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This scoring sheet is provided for informational purposes. It should not be filled out or submitted by the applicant.

Applicant Name: ______________________________________________________
Project Name: ______________________________________________________
Amount Requested: $____________
Reviewer: ________________________________________

Total Pts.______ (100 max) Rank among all proposals received: ____ (1= best) of ____ (total)

1) OVERALL PROJECT QUALITY, APPROACH, AND EFFECTIVENESS

SCORE: _______ of 25 POINTS

Criteria
The element evaluates to what degree, and how effective, reasonable, and clear a project may be in helping fill in data gaps and research needs specifically identified in the Technical Report or issues substantially related to the scientific issues in the chapter.
___ Project or strategy is reasonable and clear.
___ Project is consistent with the current scientific understanding of the problem and potential solution. The final report of the project will be a beneficial addition to the existing Estuary Program library of research conducted on behalf of the Program.
___ Project has other outstanding qualities with respect to approach and feasibility.

REVIEWER COMMENTS:

2) BENEFIT OF PROJECT TO ADDRESSING DATA GAPS AND RESEARCH NEEDS

SCORE: _______ of 25 POINTS

Criteria
___ Project will meaningfully address Technical Report issues identified by Estuary Program that are lacking data and scientific research.
___ Project outputs will contribute important data and/or research for the Estuary Program’s development of the future Technical Reports.
___ Topic of research is substantially related to the data gaps and research needs specifically identified in the Technical Report.
__ Topic of research will provide foundational data or outputs than can be built upon to increase understanding of Bay and Watershed processes.

**REVIEWER COMMENTS:**

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<th>3) GEOGRAPHIC FOCUS</th>
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**Criteria for geographic scope of research project**
Research Project specifically related to Narragansett Bay and/or its Watershed: 10 pts.  
Research Project specifically related to Little Narragansett Bay Watershed and Southwest Coastal Ponds Watershed: 5 pts.  
Outside Estuary Program’s study area but research is relevant: 2 pts.

**REVIEWER COMMENTS:**

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<th>4) COLLABORATION</th>
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<td><strong>TOTAL SCORE</strong> _______ of 15 POINTS</td>
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**Criteria**
__ Applicant suitably collaborates with partners given the scope or scale of the project.  
__ Applicant includes collaborative strategies and plans to share results and outcomes with end users.

**REVIEWER COMMENTS:**

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<th>5) MATCH</th>
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**Criteria for combined cash and in-kind**
1% to <=25% of requested funds: 3 pt.  
25% to <=40% of requested funds: 5 pts.
>40% to <=80% of requested funds: 7 pts.
>80% to <=200% of requested funds: 10 pts.
>200% of requested funds: 15 pts.

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<td>__ Project can reasonably be completed within the budget constraints and timeframe.</td>
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### REVIEWER COMMENTS:

Reviewer Signature: ________________________________ Date: _____________

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| 6) ADMINISTRATIVE FUNCTIONS AND CAPACITY | \end{tabular}

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APPENDIX E. Compiled List of Data Gaps and Research Needs

This is a compiled list of data gaps and research needs from the 2017 *State of Narragansett Bay and Its Watershed* Technical Report. The Estuary Program has organized the data gaps and research needs from the Technical Report into two major categories: 1) projects where data is available but needs further analysis, or 2) projects that need new data collected.

Chapter 1. Temperature

1. Continuous temperature data in rivers and streams is a major data gap. A sustained river/stream temperature monitoring network in the Narragansett Bay Watershed needs to be established to include long-term monitoring stations in key locations. Lacking that, a conversion factor between air temperature and freshwater temperature (e.g., Morrill et al. 2005) would estimate changes in stream temperature from existing air temperature data.

2. An assessment is needed to determine whether the existing network of fixed sites for collecting water temperature data continuously in the Bay provides adequate information for tracking the long-term changes. Data collection in embayments is a recognized gap. Prior monitoring strategies recommended building capacity to periodically assess water quality conditions in such areas. Rising temperatures are likely to affect shallow and highly urbanized basins before the rest of Narragansett Bay (Oczkowski et al. 2015).

3. Further analysis of trends in air and water temperature datasets is needed. While the Estuary Program and other researchers (e.g., Nixon et al. 2004, Oviatt 2004, Pilson 2008) used 1960 as a start date for regressions, the perception of a recent acceleration in warming may be a consequence of using that date. An analysis of the datasets could determine whether this trend is meaningful and potentially identify other significant trends, such as seasonal variability (e.g., freeze/thaw cycles).

4. Experiments using mesocosms are needed to determine how the Narragansett Bay ecosystem may be affected by climate change (e.g., Bintz et al. 2003). Latitudinal gradient studies would be beneficial to predict future ecosystem and species shifts resulting from changing temperature trends (e.g., Crosby et al. 2017).

Chapter 2. Precipitation

1. The existing network of stream gages in the Narragansett Bay Watershed should be assessed to ascertain key gaps, and data records should be analyzed to characterize variability in rainfall across the watershed and identify where additional rain gages may be needed (e.g., the Pawtuxet River watershed). Sustained funding for the network is critical to ensure adequate hydrologic data is available to support management decision-making.

2. Extreme precipitation and drought in the Narragansett Bay Watershed need to be further investigated using a combination of approaches, such as the Palmer Drought Severity Index, the Crop Moisture Index, and Cornell University’s effort to analyze frequency and intensity of precipitation (Cornell University 2016). The results of these efforts will detail the impacts that extreme precipitation and drought have on water resources management and water quality.

3. The frequency, amount, seasonality (freeze/thaw cycles), and type (rain, snow) of precipitation influence physical, chemical, and biological processes within the Narragansett Bay Watershed. The impacts of climate change on precipitation need to be further explored using downscaling of climate models or other methods. Results of these efforts will increase
knowledge of how sensitive habitats will change, and how to plan for the resiliency of infrastructure.

Chapter 3. Sea Level

1. The STORMTOOLS model should be expanded to include the Massachusetts portion of Narragansett Bay to identify and evaluate high-risk areas.
2. An analysis of the potential impacts of sea level rise on groundwater, drinking water supplies, floodplains, and individual wastewater treatment systems is needed (Walter et al. 2016).
3. Data and research are needed to evaluate the effects of sea level rise on other ecological systems at the landscape and seascape level, such as the impacts on bird, mammal, and amphibian migration and breeding habitat, submerged aquatic vegetation, freshwater wetlands (palustrine and lacustrine), shellfish habitat, and fish passage habitat (diadromous and anadromous fish).
4. A sea level rise trend analysis is needed for Mount Hope Bay using data from the Fall River tide gauge, which NOAA has operated since 1955. This analysis is especially important because of the low elevations of the Taunton River watershed.
5. Enhanced bathymetry data would improve the resolution of the hydrodynamic models that are used to predict flooding potential from sea level rise and storm surge.

Chapter 4. Population

1. There are no critical data gaps or research needs, assuming that detailed US Census Bureau data continue to be collected each decade and that funds are made available to conduct geospatial analyses. This research is needed to provide a more comprehensive understanding of trends and to provide context for other indicators of stressors and conditions in Narragansett Bay and its Watershed. More robust data analyses should be performed to interrelate total population changes with developed area per capita and housing density, two factors that are linked to the effects of population on other landscape and chemical indicators.

Chapter 5. Land Use

1. Data from the NOAA Coastal Change Analysis Program (C-CAP) should be utilized to improve the spatial and classification accuracy of land cover classes and change analysis for the Watershed.
2. Further data analysis to correlate land use and other attributes of the landscape with water quality and habitat conditions is needed to improve understanding of such relationships.
3. Additional research is needed to provide better tools for estimating the value of ecosystem services provided by forest lands in the Watershed. Examples of these ecosystem services are water quality protection for both surface and groundwater, wildlife habitat conservation, climate change adaptation, and stormwater mitigation.

Chapter 6. Impervious Cover

1. Data on sites where stormwater best management practices have been installed are not readily available. To address this important data gap, information could be compiled from state and local permitting records. Mechanisms to capture the data moving forward need to
be developed. The data should include location, drainage area being captured, type of treatment provided, and effectiveness of treatment.

2. Research is needed to examine hydrological regimes and runoff to major rivers and streams at appropriate subwatershed scales to evaluate the relationship between percent impervious cover and various water quality and habitat indicators, such as water temperature, water quality for aquatic life, stream invertebrates, fish communities, and all public health indicators. Likewise, spatial data on impervious cover, in conjunction with other indicators such as land use, should be investigated as a proxy to estimate nutrient loadings from non-point sources at varying watershed scales.

Chapter 7. Wastewater Infrastructure

1. To improve data quality, a more systematic means of periodically updating public sewer service information should be developed, and the information should be made easily accessible and shareable. It should include data on buildings and population that have been connected to the sewer systems over time.

2. There is a need to improve the capacity to compile data from state (Rhode Island) and local (Massachusetts) records to map locations and types of onsite wastewater treatment systems (OWTS), including traditional and advanced systems and cesspools. Data should include buildings that have converted from cesspools to conventional or advanced septic systems, or from conventional to advanced septic systems. This information would allow for further analyses related to water quality and climate change vulnerabilities.

3. To address the above data gaps, one option that can be standard and trackable, for both sewered areas and onsite systems, is to include in the parcel data an attribute or attributes that define the type of sewage treatment, across all towns within the Watershed, when parcel data are updated.

4. There is a need to integrate other readily available data such as soils, natural buffers, streams, and land use, among others, to identify whether groundwater at areas where onsite systems are estimated to be located, based on the preliminary results in this chapter, is likely at higher or lower risk of sewage contamination due to soil properties, proximity to resources of concern, or other constraints. A study similar to the one by Sowah and colleagues (2017) should be replicated in the Narragansett Bay Watershed to develop more robust mapping and information related to high-density onsite systems and their effects on water quality for aquatic life and human health. The Estuary Program has already advanced in this research need, by engaging soil scientists in both Massachusetts and Rhode Island with the US Department of Agricultural, Natural Resources Conservation Service (USDANRCS) to start compiling soil data and properties to develop a suitability map for the Watershed.

5. There is limited data analysis on groundwater across the Watershed, except for areas in Greenwich Bay. This is an outstanding data need that is imperative for understanding groundwater direction, flow, and attenuation, and other factors that can provide a more complete picture of the risks of sewage contamination to surface waters or the Bay, via onsite systems, whether septic systems or cesspools. Alternatively, or while methods are developed for groundwater monitoring, other approaches can be undertaken, such as coordinating with partners at the University of Connecticut to follow their methods to start gathering information about groundwater inputs to the Bay, and consequently assess the
impacts of onsite systems to public health (due to pathogen loadings, primarily) and habitat (due to increase of nitrogen or phosphorus loadings to freshwaters and the estuary).

6. Additional data on the performance of advanced treatment OWTS should be collected. Analysis of data should be completed to evaluate whether advanced systems are achieving expected treatment efficiencies during actual use.

7. Improved field studies and models to estimate nutrient and pathogen loadings from onsite systems are needed to quantify and evaluate the impacts on streams and embayments, such as Greenwich Bay.

Chapter 8. Nutrient Loading

1. A monitoring strategy is needed to address data gaps in the information required to ascertain the ecosystem response to nutrient reductions. It would be expected to include additional monitoring of biological and water quality parameters, such as benthic species and phytoplankton species composition and productivity—two ecosystem components that are expected to be responsive to the changes in nutrient loading. Data should be suitable to validate relevant water quality and ecosystem models.

2. Data used to estimate the contribution to nutrient budgets from nonpoint sources need to be refined. The data should include atmospheric deposition, stormwater contributions, agriculture, and other nonpoint sources.

3. Continued development and validation of a water quality/ecosystem model for Narragansett Bay is needed to provide an additional tool for evaluating nutrient dynamics. Such models need to be linked with validated hydrodynamic modeling and may also need to be appropriately applied to sub-regions of the Bay, particularly embayments.

4. Groundwater inputs of nutrients to estuarine and surface fresh waters in the Watershed continue to be a major data gap.

5. An assessment should be conducted to determine whether there is a need to standardize monitoring of total nitrogen and total phosphorus concentrations year-round at wastewater treatment facilities.

6. Further refinement of nutrient budgets is needed to provide insight into differences among seasonal load changes (winter, summer, and spring) at different scales aligned with potential ecosystem impacts, such as limiting the productivity of the Bay.

Chapter 9. Legacy Contaminants

1. The concentration of legacy contaminants, including mercury, in estuarine and freshwater fish and shellfish is a data gap. More studies using an approach similar to that used by Taylor et al. (2012) and Taylor and Williamson (2017) for mercury are needed to determine the human health risk posed by the uptake of legacy contaminants by fish and other human-consumed biota (e.g., shellfish). Future work would be to expand the state monitoring programs to include estuarine and near-shore fish (i.e., Taylor's work) to create a holistic assessment of mercury in commercially and recreationally important species throughout the Bay. Other legacy contaminants that need to be assessed include, at a minimum, PCBs, pesticides, and cadmium.

2. The concentration of legacy contaminants in river sediments within the Narragansett Bay Watershed is a data gap that can contribute to delays in pursuing riverine restoration actions. Studies like Cantwell et al. (2014) need to be conducted to assess the amount of contaminants in the sediments and water column before and after dam removals.
3. Brayton Power Plant maintained metals-monitoring data in quahogs (Mercenaria mercenaria) that could be incorporated into the status and trends analyses. Given Brayton Power Plant’s pending shut down, it is unlikely this monitoring program will continue. Adding a Mussel Watch monitoring station to Mount Hope Bay would be useful in tracking legacy contaminants in that region.

4. These results are framed around a north-to-south gradient, with the study sites reflecting that preference. However, sediment contaminant maps have pinpointed localized hotspots throughout the Bay—such as near the East Greenwich Wastewater Treatment Facility in Greenwich Bay—that warrant further research (Figures 2 and 4).

5. The climate change section of this chapter showed that there is little knowledge of how these legacy contaminants will behave under a changing climate. While release into the environment is decreasing, these contaminants may still pose health risks due to relic deposits in sediments. Understanding how climate change will affect mobility and toxicity of these contaminants both directly and indirectly is important to inform human and environmental risk assessments.

Chapter 10. Emerging Contaminants

1. Continued research is needed to better understand the potential exposure and assess the likelihood of ecological and human health risks resulting from existing and newly identified contaminants of emerging concern (CECs). This includes research into the fate and transport of CECs in the environment.

2. An assessment should be performed to identify key CECs prior to further investment in initiating a monitoring program. Any monitoring program will need to adapt to changes in the use of CECs. For example, as compounds are banned or phased out from use, compounds that may replace them should be considered for inclusion in monitoring.

3. For CECs that are highly soluble and remain in the dissolved phase of the water column for extended periods of time, it would be beneficial to have an improved understanding of the hydrodynamic processes within Narragansett Bay. This information along with eco-toxicity and bioaccumulation data, the direct measurement of CECs, and the use of spatial models will help to identify potential locations of concern as well as ascertain the transport, behavior, and ultimately the fate of CECs within Narragansett Bay.

Chapter 11. Seagrasses

1. The Rhode Island Eelgrass Task Force’s recommendations for a three-tiered approach to seagrass mapping and monitoring (Raposa and Bradley 2009) need to be implemented in order to conduct seagrass analysis more systematically, including more refined methods to examine extent and condition.

2. Warming temperatures, changes in precipitation patterns, and sea level rise can all affect how seagrass beds survive from year to year. Research is needed to fully understand how Narragansett Bay’s seagrass beds will respond.

3. A better understanding is needed of the life history traits of eelgrass and widgeon grass in Narragansett Bay. More knowledge of the life history traits will aid in conservation and restoration of seagrass beds to maintain or increase acreage or condition of the beds. Of particular interest is widgeon grass, as it is far less studied than eelgrass. Extensive mesocosm experiments on the response of eelgrass to nutrients, temperature, and other interactive factors have been conducted in Rhode Island (e.g., Bintz et al. 2003, Taylor et al.
These types of studies should be pursued for widgeon grass, as well as for seagrass communities composed of both eelgrass and widgeon grass.

Chapter 12. Salt Marsh

1. The multi-parameter Rhode Island Salt Marsh Monitoring Strategy (Raposa et al. 2015) needs to be fully implemented, including refining methods, in order to document status and trends in salt marsh extent in Narragansett Bay, and changes in marsh cover types (after Watson et al. 2017). This information is needed to assess the effects of sea level rise and other stressors on the long-term sustainability of marshes.

2. Research and monitoring is needed to evaluate methods that will facilitate salt marsh resilience to sea level rise (e.g., thin layer deposition; preservation of upland to allow for migration). A cost-benefit analysis coupled with multi-year monitoring could be used to help determine the best methods to improve long-term sustainability.

3. The existing SLAMM maps (RICRMC 2015) identify areas where marshes could migrate landward. Field research and modeling are needed to better understand the process of landward marsh migration under regimes of accelerated rates of sea level rise.

4. Sea level rise is a major factor contributing to the recent trend of Narragansett Bay’s marshes tending toward submergence, but there are also many other factors interacting with sea level rise (e.g., nutrients, grazing, sediment supply, increasing temperature, increasing carbon dioxide). Additional empirical research and modeling are required to understand the complexity of these interactions so that effective adaptation strategies can be implemented.

Chapter 13. Benthic Habitat

1. The sites characterized in 1988 and 2008 should be revisited every five years using sediment profile imagery to quantify benthic habitat type, conspicuous species, and sediment oxygen penetration to link benthic habitat quality with water column conditions.

2. The sediment profile imaging technique used in this analysis may not adequately represent the presence of shellfish such as quahogs, soft-shell clams, and blue mussels, or larger fauna such as mantis shrimp and lobster. There is a need to coordinate benthic monitoring efforts in the upper Bay—such as any future sediment profile imagery surveys, the Narragansett Bay Commission’s benthic video work, and the RIDEM’s fish habitat projects—to provide a more complete assessment of benthic habitats.

3. There is a need for future assessments of benthic habitat quality to incorporate measurements of benthic biogeochemistry, and for future benthic biogeochemistry studies to take a habitat-based approach.

Chapter 14. Estuarine Fish Communities

1. Analyses are needed to better characterize the comparability of the GSO and RIDEM trawl data over time, including an examination of the timing and effects of any gear changes.

2. There is a need to convene experts to advise on other approach(es) to use in the future to characterize changes in estuarine fish communities, including consideration of different or additional focal species, and different or additional metrics, such as a weighted-mean preferred temperature metric (e.g., Collie et al. 2008).

3. Data on estuarine fish communities in the Upper Bay, including the Providence River Estuary and Greenwich Bay, were not included in this analysis. Existing data on those areas
need to be compiled and analyzed to provide a more complete understanding of Bay-wide trends.

4. This chapter only analyzed the RIDEM and GSO datasets through 2012. Data collected since 2012 need to be analyzed to identify more recent changes in the estuarine fish community.

Chapter 15. Dissolved Oxygen

1. A major gap with the Narragansett Bay Fixed Site Monitoring Network and spatial survey is the lack of resource commitment (e.g., funding and personnel) to continue these field monitoring and data processing efforts. The NBFSMN and spatial survey require constant equipment maintenance and costly upgrades. Additionally, gaps in the NBFSMN for dissolved oxygen exist for portions of Mount Hope Bay, the Sakonnet River, and the Lower East Passage where there are no monitoring stations.

2. High inter-annual variability limits the discernment of temporal trends in available datasets. Additional data synthesis studies or longer-term monitoring are needed to further explore the different temporal and spatial scales of dissolved oxygen variability and their relationships to other forcing factors (e.g., seasonal rainfall or temperature) and the physical structure of the water column.

3. The Phillipsdale site, which has unique circulation patterns and is proximal to a major freshwater source (the Blackstone River), was not analyzed for the Hypoxia Index or the Chlorophyll Bloom Index (see “Chlorophyll” chapter). In light of nutrient reductions and changes to the dissolved oxygen and chlorophyll concentrations in other sections of the Bay, the Phillipsdale data need to be analyzed to see how this upper section of the Seekonk River is changing.

4. The combination of dissolved oxygen data and hydrodynamic modeling efforts can provide a better understanding of how hydrodynamic properties of the Bay are influenced by physical forces, such as wind, precipitation, and river flow, and how dissolved oxygen levels respond. Models should be used to better understand the connection between benthic conditions and overlying dissolved oxygen conditions.

Chapter 16. Chlorophyll

1. Collection of additional chlorophyll data is needed in order to be representative of all major sub-regions of Narragansett Bay and improve the spatial resolution of existing datasets.

2. High interannual variability makes it difficult to detect temporal trends in existing datasets. Synthesis studies are needed to further explore the different temporal and spatial scales of chlorophyll variability and their relationships to other influencing factors (e.g., sunlight, pH, and temperature) as well as the physical structure of the water column.

3. Further analysis of the Chlorophyll Bloom Index is needed, including whether the 80th percentile fully encompasses the definition of a bloom, or if a second percentile should be added (such as the 20th percentile). Additionally, all three methods show high variability, and a sensitivity analysis should be done to reduce this variability.

4. Analysis of changes in phytoplankton species composition and abundance over time is needed to understand how species composition impacts chlorophyll concentration trends. The results will also inform any monitoring or analysis for phytoplankton nuisance or harmful algal blooms. Species composition has been studied before (Windecker 2010), and the GSO Phytoplankton Survey and NBC continue to record species-specific information.
5. Controlled mesocosm studies should be done to evaluate the response of the benthic community to increased water clarity and decreased phytoplankton production (i.e., decreased input of organic matter to the benthos). This would address how the ecosystem is responding to nutrient reductions and inform a discussion regarding an appropriate balance of nutrient levels and ecosystem response.

Chapter 17. Water Clarity

1. There are gaps in the availability of clarity data for portions of the Bay, especially the embayments. Devising a plan to achieve more consistent methods, greater frequency of sampling, and better spatial coverage throughout the Bay is appropriate.

2. In devising a sampling plan, attention should be paid to the appropriate sampling intervals in order to reduce variability in the datasets and to enhance the ability to detect change. Accordingly, it would be valuable to conduct a careful analysis of the various datasets and/or a field study to determine an optimal sampling frequency to detect changes in water clarity.

3. The Estuary Program compared \( k \) values for both Secchi depth and PAR to maximize the use of available data. Ideally, one monitoring method—either Secchi depth or PAR—would be used throughout the Bay. However, the Estuary Program will continue to evaluate the comparison between Secchi depth and PAR using data collected in Narragansett Bay. Comparison of \( k \) values from the two monitoring methods would facilitate accurate use of \( k \) as a water clarity metric throughout the Bay.

4. Improving the spatial resolution of coastal water clarity measurements based on satellite remote sensing would reduce the need to take field measurements and would allow for a Bay-wide assessment, including embayments.

5. An event-based study of water clarity is needed to determine how closely total suspended solid loading is related to storm events, and how to manage those loads.

Chapter 18. Water Quality Conditions for Aquatic Life

1. Bi-state coordination across state agencies, MassDEP and RIDEM, could improve and streamline sample water quality of specific streams/rivers/lakes that share state boundaries to provide data that can reflect the most current water quality conditions of individual state-assessed waterbodies; however, limitations by the states and the nature of the assessments, including those discussed in this chapter, should be considered.

2. Coordination between the Estuary Program and state partners is needed to share data that can streamline the tracking of this indicator by linking the time of sampling (year, season) and assessment for each individual waterbody, freshwater or estuarine areas; also, to track new listings and de-listing of water impairments as they occur between cycles of water quality assessments, with the goal of quantifying changes overtime; these can shed light on water quality improvements or decline for aquatic life, more precisely due to the response of increased or reduced nutrient loadings.

3. Many different entities, particularly watershed NGOs and universities, monitor and routinely collect data on nutrients and dissolved oxygen parameters at varying frequencies (i.e., monthly) and scales (i.e., Taunton River watershed). Further evaluation is needed to determine whether water quality data from these efforts could be reconciled, combined, and standardized with the state datasets to improve temporal and spatial coverage for this indicator.
4. Research is needed to understand how landscape stressors (e.g., impervious cover, land use) and climate change stressors (e.g., precipitation, temperature) relate to increases in nutrient enrichment in waterbodies that can result in eutrophication and hypoxia events, harmful to aquatic life, in freshwaters of the Watershed and estuarine waters of the Bay. This should be explored on a variety of scales from larger watersheds to individual catchment areas.

5. There is a need to develop or utilize available tools to allow evaluation of the efficacy of stormwater management practices, including retrofitting of existing infrastructure, at appropriate scales (e.g., sub-Basin). This includes practices designed to treat/retain nitrogen and phosphorus loadings as well as those designed to address peak flows, as precipitation exacerbates the impacts of nutrient enrichment.

6. While cyanobacteria blooms are primarily a public health issue, monitoring cyanobacteria blooms in freshwaters and other harmful algal blooms in marine waters is needed. Data on harmful algal blooms, including inventory of waterbodies with history of blooms, frequency of events, and collection of other parameters during these events, can augment the understanding of the causes and consequences of blooms and the dynamics of bloom suppression, whether nutrient enrichment, oxygen depletion, low stream flows, water levels or flushing, or high-water temperatures, or a combination, can result or predict these blooms.

Chapter 19. Stream Invertebrates

1. Existing macroinvertebrate sampling protocols are not appropriate for all rivers and streams in the watershed. To address coastal streams left unassessed, a multi-year effort of data collection and evaluation is needed and should be conducted at a regional scale to sample a sufficient number of locations in the lowland ecoregion streams. The data should be used to develop a robust biotic index for use in the lowland ecoregions for which the current rapid bioassessment protocol is not appropriate.

2. Further analysis of existing data is needed to evaluate how well the existing monitoring strategies represent the conditions of the wadeable rivers and streams throughout the entire Watershed.

3. Characterization of stream segments (by calculating stream miles) and drainage area (by defining the contributing catchment area to the site) is needed to study the influences of landscape stressors and other factors on stream conditions. The characterization should focus on sites where macroinvertebrate health was poor but habitat conditions were good. The findings could be used to help identify and ameliorate potential threats at sites with good macroinvertebrate health and good habitat quality that need protection.

Chapter 20. Freshwater Fish Communities

1. Further development of freshwater fish communities as an indicator for status and trends reporting will require an expanded effort to collect fish community data. Evaluation of the resources to support the desired level of fish data collection across the Watershed is an appropriate next step.

2. Targeted collection of data on brook trout is needed to better refine brook trout habitat and clarify coldwater stream designations and support the integration and update of the Eastern Brook Trout Joint Venture Salmonid Catchment Assessment and Habitat Patch Layers model.
3. Additional data for freshwater habitats that were not considered here, but may have ecological significance to maintain healthy habitat for fish, should be gathered, created, defined, and analyzed, including intermittent streams, freshwater reaches of tidal rivers, wetlands, and riparian areas. Specialized methods for collection of fishes in these habitats may need to be identified or developed.

4. Development of an indicator related to stream connectivity should be explored. It could reflect stream continuity in miles open, partially open, and obstructed for freshwater fish and other aquatic life communities, following other efforts already started in the Watershed, such as those led by the U.S. Army Engineer Research and Development Center (Foran et al. under review).

5. Provided data collection can be expanded, bi-state efforts and approaches to refine the freshwater fish indicator could involve the development of an IBI or MMI for the Narragansett Bay Watershed. These resulting metrics can be related to the Biological Condition Gradient framework, as has been done in Connecticut (Stamp and Gerritsen 2013).

6. Future data analysis should explore and quantify the relationships between freshwater fish metrics and stressors at appropriate scales (e.g., site, watershed, catchment areas). Armstrong and colleagues (2011) quantified the effects on fluvial fish abundance in response to alterations on stream flow and impervious cover, among other anthropogenic stressors.

Chapter 21. Open Space

1. Geospatial tools should be used to identify unprotected open space parcels adjacent to currently protected open space parcels. Protecting these natural areas would augment habitat connectivity, increase natural buffers to receiving waters, and improve the resilience of the ecosystem to land use stressors and climate change.

2. In addition to CAPS, other tools are useful for open space decision making. Critical Linkages (2012) identifies locations in the landscape that can provide greater ecological benefits to increase connectivity and continuity of habitats. Mass Audubon’s Mapping and Prioritizing Parcels for Resilience tool identifies priority parcels for open space protection based on habitat quality, climate change resilience, parcel size, and adjacency to existing protected parcels. Use of such tools should be pursued to assist with planning efforts in the Narragansett Bay Watershed.

3. Further analyses of riparian buffer protection and restoration opportunities should be developed at a range of watershed scales, including Watershed Planning Areas.

4. Further refinement via a parcel-based analysis is needed to more specifically identify unprotected lands that may provide restoration opportunities such as areas for salt marsh migration as sea levels rise.

5. Spatial analyses of open space changes conducted at intervals of a decade or less, with a focus on protected ecologically significant natural lands, are necessary to track advances and spatial trends in conservation in the Narragansett Bay Watershed.

Chapter 22. Water Quality Conditions for Recreation

1. Data gaps exist with respect to assessing the recreational use of waters in the Taunton River and Blackstone River Basins in Massachusetts and the Coastal Narragansett Bay basin in Rhode Island. Monitoring efforts need to be expanded to address these gaps.

2. Additional research into the fate and transport of pathogens discharged into the ground from onsite wastewater systems is a need. Research should focus on those sub watersheds
or drainage areas in which onsite wastewater treatment systems, including cesspools, are known or suspected of contributing to pathogen pollution problems.

Chapter 23. Marine Beaches

1. The beach indicator should be refined by the development of other metrics. One option to explore is the development of a bi-state dataset that uses bacterial counts normalized by monitoring frequency (number of samples per season per beach) for the period of 2000 to the present to develop a more consistent and sensitive metric. Further analysis using bacteria counts associated with sampling dates will allow for cross-comparison between years with differing monitoring frequency and regulatory stringency. A protocol is needed to evaluate bacterial counts in the context of sampling frequency. Furthermore, the results of future analyses should be compared to current findings to corroborate the preliminary trends noted in this report.

2. Further work is needed to develop appropriate metrics for freshwater beaches in the Narragansett Bay Watershed. Data are limited and were not reviewed for this report.

3. As recent preliminary trends indicate a weakening relationship between rainfall and beach closure events, it will be important to continue to evaluate beach closures in wet years. With an indicator based on bacterial counts, the Estuary Program anticipates that a robust statistical analysis could address temporal trends and relationships with precipitation. Additional factors that influence microbial contamination and its persistence at beaches can be used to develop predictive models on a beach-specific basis. These include wind direction and speed, water temperature, wave height, changes in wastewater infrastructure and land use (Wu and Jackson 2016), and patterns in human use.

4. For High Concern beaches, development of models to support management is of interest. With appropriate input data and validation, predictive models can drive better management to reduce exposure to high-risk conditions. Unlike current microbiological analyses which typically characterize water quality on the previous day, models can predict when a beach should be closed (i.e., at the times when adverse conditions result in high levels of enteric microbes).

5. Detailed analyses of existing management actions such as CSO abatement projects, stormwater infrastructure improvements, and waste management initiatives based on bacterial counts and sampling history as metrics are likely to be useful in informing BMPs. Improvements at specific beaches are likely related to localized management actions. Pinpointing successful management strategies that target sources of contamination will be beneficial from economic, social, and public health perspectives.

6. While continuing to build on the information gained through both state beach monitoring programs, it will also be imperative to relate beach assessments to other programs that evaluate microbial contamination in the Bay’s waters. These include assessments of long-term and comprehensive water quality characterizations of the Bay’s waters to meet standards for recreational uses, including primary and secondary contact, as well as designations of shellfishing areas.

Chapter 24. Shellfishing Areas

1. Conditionally approved areas are monitored frequently, but fewer data are available for prohibited areas. Additional sampling in certain areas may be needed to better document progress of these areas toward water quality improvement goals.
2. Synthesis of existing data and development of site-specific models would improve understanding of relationships among land use, point and non-point sources, and bacterial concentrations in receiving waters.

3. Recent changes showing a decline of prohibited areas and an increase of approved and conditionally approved areas in the Upper Estuary have been attributed to improvements at wastewater combined sewer overflows abatement and other pollution control efforts. However, additional data collection and analysis are needed to reassess the relationship between precipitation and pathogens as conditions continue to change. Additionally, further data synthesis and analysis could be conducted to relate water quality improvements to reduced pathogen loadings due to non-point source management actions.

4. Refinement of this indicator using pathogen data could provide a metric more sensitive to water quality improvements, such as by discerning partial progress toward water quality goals.
APPENDIX F. Map of Estuary Program Study Area