State of Rhode Island and Providence Plantations
**Coastal Resources Management Council**
Oliver H. Stedman Government Center
4808 Tower Hill Road, Suite 3
Wakefield, RI 02879-1900

(401) 783-3370
Fax (401) 783-2069

# APPLICATION FOR STATE ASSENT

To perform work regulated by the provisions of Chapter 279 of the Public Laws of 1971 Amended.

| | |
|---|---|
| Project Location: Lower Kickemuit Reservoir Dam, Warren (No. Street City/Town) | File No. (CRMC USE ONLY): 2021-08-102 |
| Owner's Name: Bristol County Water Authority (BCWA) | Plat: 13B, 21<br>Lot(s): 28, 182 |
| Mailing Address: 450 Child Street<br>City/Town: Warren State: RI Zip Code: 02885 | Contact No.: 401-245-2022<br>Email Address: scoutu@bcwa.com |
| Contractor RI Reg. # Address: Contractor to be selected | Email address:<br>Tel. No. |
| Designer: Pare Corporation Address: 8 Blackstone Valley Place Lincoln, RI 02865 | Tel. No. 401-334-4100 |
| Name of Waterway: Kickemuit River / Lower Kickemuit Reservoir | Estimated Project Cost (EPC): N/A<br>Application Fee: Waiver Requested |

**Describe accurately the work proposed. (Use additional sheets of paper if necessary and attach this form.)**
BCWA proposes to remove the Lower Kickemuit Reservoir Dam and restore the upper Kickemuit River estuary. Proposed work includes removal of the lower dam structure, sediment management, shoreline stabilization, and restoration plantings. Post-removal monitoring of the project site is also proposed to ensure restoration goals are met. The attached project narrative, project plans, and supplemental documentation provide further details on the proposed activities.

**Have you or any previous owner filed an application for and/or received an assent for any activity on this property? (If so please provide the file and/or assent numbers):** Yes, file number: 2005-09-105

**Is this site within a designated historic district?** ☐ **YES** ■ **NO**

**Is this application being submitted in response to a coastal violation?** ☐ **YES** ■ **NO**

**If YES, you must indicate NOV or C&D Number:** _____

**Name/mailing addresses of adjacent property owners whose property adjoins the project site.** Accurate mailing addresses will insure proper notification. MC Applicant must initial to certify accuracy of adjacent property owners and accuracy of mailing addresses.
See attachment A.

STORMTOOLS (Http://www.beachsamp.org/resources/stormtools/) is a planning tool to help applicants evaluate the impacts of sea level rise and storm surge on their projects. The Council encourages applicants to use STORMTOOLS to help them understand the risk that may be present at their site and make appropriate adjustments to the project design.

NOTE: The applicant acknowledges by evidence of their signature that they have reviewed the Rhode Island Coastal Resources Management Program, and have, where possible, adhered to the policies and standards of the program. Where variances or special exceptions are requested by the applicant, the applicant will be prepared to meet and present testimony on the criteria and burdens of proof for each of these relief provisions. The applicant also acknowledges by evidence of their signature that to the best of their knowledge the information contained in the application is true and valid. If the information provided to the CRMC for this review is inaccurate or did not reveal all necessary information or data, then the permit granted under this application may be found to be null and void. Applicant requires that as a condition to the granting of this assent, members of the CRMC or its staff shall have access to the applicant's property to make on-site inspections to insure compliance with the assent. This application is made under oath and subject to the penalties of perjury. 08/04

8/18/2021
Owner's Signature (sign and print)

PLEASE REVIEW REVERSE SIDE OF APPLICATION FORM

RECEIVED
AUG 24 2021
COASTAL RESOURCES MANAGEMENT COUNCIL

/ajt/lat

11/2019

## STATEMENT OF DISCLOSURE AND APPLICANT AGREEMENT AS TO FEES

The fees which must be submitted to the Coastal Resources Management Council are based upon representations made to the Coastal Resources Management Council by the applicant. If after submission of this fee the Coastal Resources Management Council determines that an error has been made either in the applicant's submission or in determining the fee to be paid, the applicant understands that additional fees may be assessed by the Coastal Resources Management Council. These fees must be paid prior to the issuance of any assent by the Coastal Resources Management Council.

The applicant understands the above conditions and agrees to comply with them.

Signature

8/18/2021
Date

Stephen Courtin, BCWA, 450 Child St.
Warren, RI
02885
Print Name and Mailing Address

/ajt 11/2019

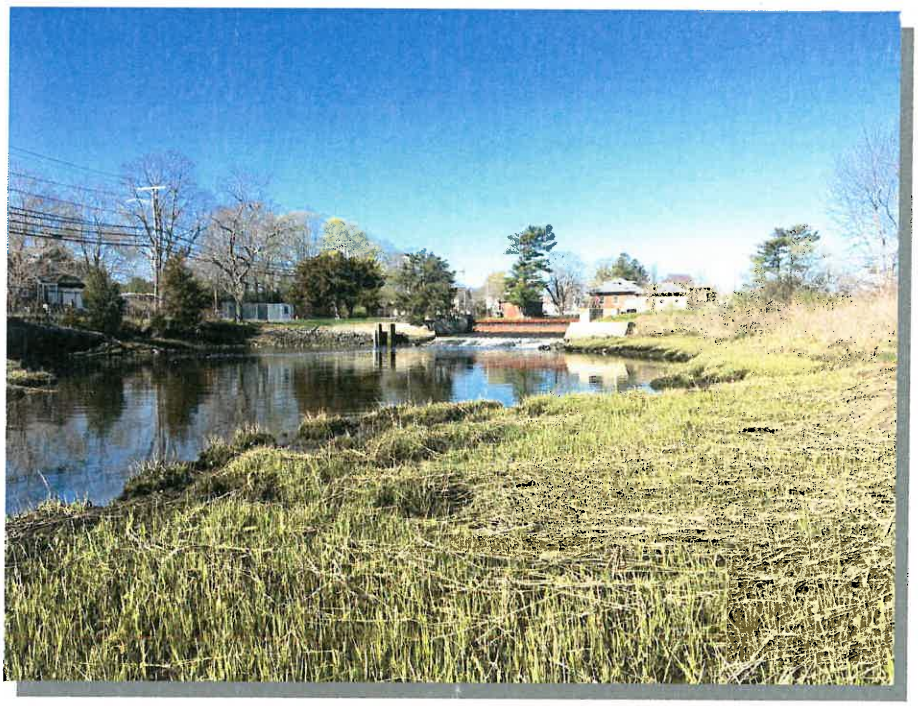
FILE COPY

PARE PROJECT NO. 14217.07

RHODE ISLAND COASTAL RESOURCES MANAGEMENT COUNCIL

# APPLICATION FOR STATE ASSENT

## LOWER KICKEMUIT RESERVOIR DAM REMOVAL
Warren, Rhode Island



Prepared for:

Bristol County Water Authority
450 Child Street
Warren, RI 02885

August, 2021



PARE CORPORATION
CELEBRATING 50 YEARS

Engineers | Scientists | Planners

PARECORP.COM

PARE CORPORATION
CELEBRATING 50 YEARS

August 23, 2021

Mr. Jeffrey Willis, Deputy Director
RI Coastal Resources Management Council
Stedman Government Center
4808 Tower Hill Road
Wakefield, RI 02879-1900

RE: **CRMC Application for State Assent**
**Bristol County Water Authority**
**Lower Kickemuit Reservoir Dam Removal**
**Warren, Rhode Island**
**Pare Project No. 14217.07**

Dear Mr. Willis:

On behalf of Bristol County Water Authority (BCWA), Pare Corporation has prepared this Application for State Assent pursuant to the Coastal Resources Management Program (CRMP) and the Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast for the proposed removal of the Lower Kickemuit Reservoir Dam in Warren. The dam removal is proposed as an ecological restoration project that will restore natural tidal conditions and coastal wetlands to the Upper Kickemuit River. The project is funded in part by the Rhode Island Coastal and Estuarine Habitat Restoration Program and Rhode Island Department of Environmental Management Climate Resilience Fund. Enclosed for your review are four (4) copies of the following materials:

- Signed and completed Application for State Assent and Application for Marine Dredging;
- Supplemental Documentation including Proof of Ownership and Building Official's Form from the Town of Warren;
- Soil Erosion and Sediment Control Plan (Bound Separately) and;
- Full-size (22 x 34") and reduced (8.5 x 11") sets of project plans, entitled "Lower Kickemuit Reservoir Dam Removal" prepared by Pare Corporation, dated August, 2021 (bound separately).

An exemption of filing fees due to the public benefit provided by the project is requested. A digital copy of the complete submission has been sent via email to cstaff1@crmc.ri.gov.

The Lower Kickemuit Reservoir Dam ("the dam") is located on the Kickemuit River immediately upstream of the Child Street (State Route 103) bridge in Warren. The dam was originally constructed in 1883 to provide a public water supply for the towns of Warren and Bristol. While creating a public water supply, the dam also restricted tidal influence of the Kickemuit River and fragmented the Kickemuit River watershed. In 1961, a second dam was constructed approximately 0.8 miles upstream because of saltwater intrusion that was occurring to the water supply. Together, the two Kickemuit dams have effectively degraded the wetland function and value of the Upper Kickemuit River since their construction.

Today, the Upper and Lower Kickemuit Reservoirs have been decommissioned as public water supply and the Lower Kickemuit Reservoir Dam is obsolete. Water quality sampling has shown that saltwater intrusion

8 BLACKSTONE VALLEY PLACE LINCOLN, RI 02865
T 401.334.4100 F 401.334.4108

10 LINCOLN ROAD, SUITE 210 FOXBORO, MA 02035
T 508.543.1755 F 508.543.1881

continues to occur upstream of the dam on a regular basis and the dams continue to promote stagnant conditions which increase nutrient concentrations. In addition to the environmental impairments the dam has caused, it is classified as a Significant Hazard Dam under the RIDEM Dam Safety Regulations and poses a public safety hazard to downstream communities.

BCWA is proposing to remove the Lower Kickemuit Reservoir Dam to proactively restore connectivity and natural tidal conditions to the Kickemuit River while simultaneously removing the risk of a Significant Hazard Dam. The project includes three primary elements which include: removal of the dam, removal, and management of impounded sediment subject to downstream migration, and post removal restoration of the site. The overall restoration effort includes the removal of the Upper Kickemuit Reservoir Dam, which is being permitted through Rhode Island Department of Management (RIDEM) Office of Water Resources Freshwater Wetlands, and the replacement and enlargement of the culverts below Schoolhouse Road by RIDOT at the upper end of the lower reservoir.

Due to the nature of the project as a dam removal, unavoidable impacts will occur to tidal waters and freshwater wetlands in the vicinity of the coast. These impacts include direct construction impacts associated with the physical removal of the dam as well as indirect conversion of upstream wetlands from freshwater to estuarine wetlands. Construction impacts will be contained in the area immediately surrounding the dam and indirect upstream impacts will extend to the northern extent of the Upper Kickemuit Reservoir. Although the conversion of upstream wetlands is classified as a "wetland impact", it is restoration of over 100 years of fragmentation and impairment caused by the dam. Any short-term impacts associated with the dam removal will be mitigated by the myriad ecological benefits associated with restoration of the Kickemuit River.

Applications for the Lower Kickemuit Reservoir Dam Removal are being submitted concurrently to RIDEM for Water Quality Certification and to the US Army Corps of Engineers for coverage under the Rhode Island General Permit as a Pre-Construction Notification activity.

Thank you very much for your consideration and please feel free to contact our office with any questions regarding the submittal.

Sincerely,

J. Matthew Bellisle, P.E.
Senior Vice President

Seaver Anderson
Environmental Scientist

Brian M. Dutra, P.E.
Project Engineer

JMB/SA/BD
Enclosures

cc via email: BCWA
Save the Bay

# TABLE OF CONTENTS



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11. Watershed Watch Water Quality Monitoring Report

12. Restoration Monitoring Plan

13. Historical and Cultural Resources Correspondence

14. Soil Erosion and Sediment Control Plan, bound separately

15. Project Plans entitled "Lower Kickemuit Reservoir Dam Removal", prepared by Pare Corporation, dated August 2021, bound separately

## SECTION 1

Administrative Documentation

*Assent Application Form and Statement of Disclosure*
*Application for Marine Dredging*
*Assent Checklist*
*Application for Marine Dredging Checklist*
*Attachment A: Abutters List*
*Proof of Ownership*
*Building Official's Form*

Rhode Island Coastal Resources Management Council
Oliver H. Stedman Government Center
Wakefield, RI 02879
(401) 783-3370

Rhode Island Department of Environmental Management
235 Promenade Street
Providence, RI 02908-5767
(401) 222-6820

**APPLICATION FOR MARINE DREDGING AND ASSOCIATED ACTIVITIES** pursuant to the Marine Infrastructure Maintenance Act of 1996 and the Marine Waterways and Boating Facilities Act of 2001, Chapter 46-6.1 of the Rhode Island General Laws.

## PURPOSE OF APPLICATION

Agency Use Only
File Number

Date Received

☒ Application for Dredging and Disposal of Dredged Material
☐ Request Renewal of RIDEM Dredge Permit File # _____
☐ Request Renewal of CRMC Dredge Permit File # _____
☐ Request Modification of RIDEM Dredge Permit File # _____
☐ Request Modification of CRMC Dredge Permit File # _____

*(Please Type or Print)*

## APPLICANT INFORMATION

Applicant Name: Bristol County Water Authority c/o Stephen Coutu, Executive Director

*(NOTE: Applicant must be the owner of the property on which the activity is proposed)*

Applicant Address: 450 Child Street Telephone No. 401-245-2022

City/Town: Warren State: RI Zip: 02885

## PROJECT INFORMATION

Project Address: Lower Kickemuit Reservoir Dam, immediately east of 472 Child Street

City/Town: Warren State: RI Zip: 02885

Tax Assessor's Plat(s) and Lot Number(s): Plat 13B, Lot 28 and Plat 21, Lot 182

Project Consultant/Engineer Name: Pare Corporation

Consultant/Engineer Address 8 Blackstone Valley Place, Lincoln, RI 02865

Consultant/Engineer Telephone No. 401-334-4100

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ACTIVITIES ASSOCIATED WITH THE PROPOSED DREDGE PROJECT (check all that apply)*

- ☒ Filling of Waters of the State
- ☐ Marinas – New construction or expansion
- ☐ Site Disturbances
  - __ Residential Development: six (6) or more dwellings
  - __ Commercial, Industrial, State or Municipal Development
  - __ Any project ≥ five (5) acres of disturbance
- ☒ Flow Alterations
- ☐ Point Source Discharge of Pollutants

## GENERAL INFORMATION

Identify program and associated application number for any other RIDEM applications filed for this project

| | | |
|---|---|---|
| _____ | Freshwater Wetlands | Application Number _____ |
| _____ | RIPDES | Application Number _____ |
| _____ | Individual Sewage Disposal System | Application Number _____ |
| X | Other ( Water Quality Certification ) | Application Number TBD* |

*Applications submitted to RIDEM for WQC simultaneously as CRMC Assent/Dredge Application.

If you have any questions, please contact the RIDEM at 222-7500 or CRMC at 783-3379.

## CERTIFICATION OF APPLICANT

I hereby certify that I have requested and authorized the investigation, compilation, and submission of all the information, in whatever form, contained in this Application; that I have personally examined and am familiar with the information submitted herein; and that such information is true, accurate and complete to the best of my knowledge.

Signature of Applicant: _____ Date: 2/10/2021

***Please return this completed application form and all supporting information, as indicated on the accompanying Submittal Checklist to:***

Rhode Island Coastal Resources Management Council
Oliver H. Stedman Government Center
Wakefield, RI, 02879

and

Rhode Island Department of Environmental Management
Office of Technical & Customer Assistance
235 Promenade Street
Providence, RI 02908

* Water Quality Certification required for these activities pursuant to Section 401 of the CWA and the Rhode Island Water Quality Rules may be incorporated into an approval issued as part of this application.

Office Use Only:

Suitable for Public Notice _____ Date: _____

- ☐ Approved
- ☐ Denied
- ☐ Withdrawn

# Attachment A:
# List of Adjoining Parcels
# Lower Kickemuit Reservoir Dam Removal
# Warren, RI

Listed below is the Map/Lot, Owner, and Mailing address information for parcels that adjoin the Lower Kickemuit Reservoir and Dam. The applicant, BCWA, owns six (6) of the adjoining parcels.

Map 20, Lot 148
Bristol County Water Authority
450 Child St.
Warren, RI 02885

Map 20, Lot 15
Bristol County Water Authority
450 Child St.
Warren, RI 02885

Map 20, Lot 557
Sirois, Marcia Trustee
C/O Frerichs Family
43 Kinnicut Ave.
Warren, RI 02885

Map 21, Lot 180
Nassar, John Jr.
43 Schoolhouse Rd.
Warren, RI 02885

Map 21, Lot 179
Botelho, Robert
39 Serpentine Rd.
Warren, RI 02885

Map 21, Lot 181
Kickemuit Cemetery*

Map 21, Lot 241
Lukes Legend, LLC
25 Serpentine Rd.
Warren, RI 02885

Map 21, Lot 240
Howe, Daniel and Esther
19 Serpentine Rd.
Warren, RI 02885

Map 21, Lot 177
Bristol County Water Authority
450 Child St.
Warren, RI 02885

Map 21, Lot 182
Bristol County Water Authority
450 Child St.
Warren, RI 02885

Map 13B, Lot 28
Bristol County Water Authority
450 Child St.
Warren, RI 02885

Map 20, Lot 18
Waterview Condominium Association
510 Child St.
Warren, RI 0288

Map 21, Lot 178
Bristol County Water Authority
450 Child St.
Warren, RI 02885

Right of Way (Child St. and Schoolhouse Rd.)
Rhode Island Department of Transportation
2 Capitol Hill
Providence, RI 02903

*No address or owner information available for Map 21, Lot 181

Town of Warren, Rhode Island
514 Main Street
Warren, RI 02885-4369
Phone: (401) 245-7342 Fax: (401) 245-0595

Office of Tax Assessor
Kristopher Leadem
Assessor

April 28, 2021

CRMC
Stedman Government Center – Suite 3
4808 Tower Hill Rd.
Wakefield, RI 02879-1900

Re: Plat 13B Lot 28
472 CHILD ST, WARRE RI

To Whom It May Concern:

Please accept this letter as confirmation that Bristol County Water Authority is the current owners of Plat 13B Lot 28, known as 472 Child Street in the Town of Warren.

Please let me know if you need any additional information.

Sincerely,

Kristopher Leadem
Tax Assessor
Town of Warren

EXHIBIT A



That certain tract or parcel of land with all buildings and improvements thereon situated on the northerly side of Child Street in the Town of Warren, County of Bristol, State of Rhode Island and is bounded and described as follows:

Beginning at a railroad spike located at the southeasterly corner of the parcel herein described, said corner being the southwesterly corner of property now or formerly belonging to Child Street Associates, said corner also being located along the northerly highway line of Child Street a distance of 29.27 feet west from a Rhode Island Highway Bound as measured along the northerly highway line;

thence continuing in a westerly direction along the northerly highway line of Child Street for a distance of 130 feet more or less to the Kickemuit River;

thence turning and running in a general northerly and westerly direction along the mean high water line of the Kickemuit River to the Kickemuit Reservoir;

thence northeasterly and generally northerly along the easterly side of the Kickemuit Reservoir to the southwesterly corner of property now or formerly belonging to the Bristol and Warren Water Works;

thence turning and running in an easterly direction along the southerly property line of said Water Works property for a distance of 14 feet more or less to a granite bound;

thence continuing easterly in the same straight line along the southerly property line of said Water Works property for a distance of 225.20 feet to a granite bound and property now or formerly belonging to Child Street Associates;

thence turning an interior angle of 95°-23'-33" and running in a southerly direction bounding easterly in part by said Child Street Associates property and in part by property now or formerly belonging to Richard H. & Diane P. Soares for a distance of 667.02 feet to an angle;

thence turning an interior angle of 180°-52'-30" and running in a southerly direction bounding easterly in part by said Soares property and in part by other property now or formerly belonging to said Child Street Associates for a distance of 460.64 feet to the northerly highway line of said Child Street and the point and place of beginning;

said last described line forms an interior angle of 82°-44'-39" with the first described line.

Said parcel contains 8.2 acres more or less.

Said parcel is subject to the following easements of record and recorded in the office of the Town Clerk in Land Evidence Books and Pages: to the Narragansett Electric Company and the New England Telephone and Telegraph Company, Book 108, Page 602 and Book 111, Page 74; to the Town of Warren a Utility Easement Book 113, Page 480; and an embankment easement to the Bristol and Warren Water Works Book 27, Page 4.

TO: **Coastal Resources Management Council**
4808 Tower Hill Road Suite 3
Wakefield, RI 02879
Phone: (401) 783-3370

FROM: Building Official DATE: August 19, 2021

SUBJ: Application of: Bristol County Water Authority (BCWA)

Location: Lower Kickemuit Reservoir Dam

Address: N/A directly east of 450 Child Street Plat No. 13B Lot No. 28

To Construct: Bristol County Water Authority proposes to remove the Lower Kickemuit Reservoir Dam and restore the Kickemuit River channel at the site.

I hereby certify that I have reviewed _____ foundation plan(s).
_____ plan(s) for entire structure
__X__ site plans
Titled: Lower Kickemuit Reservoir Dam Removal

**Date of Plan (last revision):** AUG. 2021

___ and find that the issuance of a local building permit is not required as in accordance with Section _____ of the Rhode Island State Building Code.

__X__ and find that the issuance of a local building permit is required. I hereby certify that this permit shall be issued once the applicant demonstrates that the proposed construction/activity fully conforms to the applicable requirements of the RISBC.

___ and find that a Septic System Suitability Determination (SSD) must be obtained from the RI Dept. of Environmental Management.

__X__ and find that a Septic System Suitability Determination (SSD) need not be obtained from the RI Dept. of Environmental Management.

___ and find that said plans conform with all elements of the zoning ordinance, and that if said plans require zoning board approval, that the applicant has secured such approval and that the requisite appeal period has passed with no appeal filed or appeal is final. The Zoning Board approval shall expire on _____.

Building Official's Signature 8/19/21 Date

__X__ and find that said plans conform with all elements of the zoning ordinance, and that if said plans require zoning board approval, that the applicant has secured such approval and that the requisite appeal period has passed with no appeal filed or appeal is final.

Zoning Officer's Signature 8/19/21 Date

rev 5/11/2001

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## SECTION 2

Project Narrative

# 1.0 Introduction

This written narrative is in support of a CRMC Category B Assent Application for the Lower Kickemuit Reservoir Dam removal in Warren, RI. The dam removal is part of a larger restoration effort proposed by the applicant, Bristol County Water Authority (BCWA), which includes the removal of both the Upper and Lower Kickemuit Dams and replacement of the Schoolhouse Road culvert. The Lower Kickemuit Dam (the "lower dam") is located approximately 100 feet north of Child Street (State Route 108) where it establishes the head of tide in the Kickemuit River. The lower dam is located within the jurisdiction of the RI Costal Resources Management Council (CRMC) while the Upper Kickemuit Dam (the "upper dam") is within jurisdiction of the Rhode Island Department of Environmental Management (RIDEM). The application for removal of the Upper Kickemuit Dam is being submitted separately to RIDEM in an Application to Alter. Due to the interconnected nature of the projects, cumulative impacts of the two dam removals will be addressed in this narrative however, the lower dam removal will be the primary focus.

## *1.1 History and Project Background*

The Lower Kickemuit Dam was originally constructed in 1883 with the purpose of establishing a water supply reservoir. Due to issues with the saltwater intrusion, the Upper Kickemuit Dam was constructed in 1961 approximately 0.8 miles north to as a "salt water protective levee" to maintain the freshwater supply. The upper dam functions as more of a dike than a dam as the lower dam controls water surface elevations in both reservoirs. Today, neither reservoir serve their intended purpose as water supply reservoirs and legislation was passed on July 1, 2021, amending the Bristol County Water Supply Act (Section 46-15.5-2 of RI General Law). The amendment removes the legal obligation of BCWA to maintain the Upper and Lower Kickemuit Reservoirs as public water supply, a copy of the legislation is included as Section 5 of this State Assent. No longer functional as a public water supply, the Lower Kickemuit Reservoir has no formal function and both dams have become obsolete.

In 2012 an Inspection of the Upper Kickemuit Reservoir Dam (upper dam) revealed significant deficiencies and hazards resulting in a Notice of Violation (NOV) from the RIDEM Office of Dam Safety. In response to the NOV corrective solutions were explored, and removal of the upper dam

was determined to be the most beneficial alternative for the Kickemuit River and BCWA. Subsequent hydrologic and hydraulic analysis' indicated that removal of the upper dam without removal of the lower dam would increase flood extents bordering the Lower Kickemuit Reservoir. Mitigation of the increased floodplain was explored in various alternatives including the construction of a retaining wall and earthen berm. Through this alternative analysis it became clear that the most sustainable and resilient option is to remove the Lower Kickemuit Reservoir Dam in conjunction with the Upper Kickemuit Reservoir Dam. In this proposed scenario, flood risk is reduced without the need for structural flood protection measures and ecological benefits are significantly increased.

Save the Bay has partnered with BCWA in this project and partial project funding for engineering and construction has been secured from the RI Coastal and Estuarine Habitat Restoration Trust Fund and RIDEM's Climate Resilience Fund. The project team is continuing to pursue grant funding opportunities to support additional construction funding and monitoring.

### *1.2 Project Purpose*

The intended purpose of the project is to restore connectivity to the Kickemuit River system and alleviate the burden of risk and maintenance associated with an aging Significant Hazard dam. Aquatic connectivity between the freshwater and estuarine portions of the Kickemuit River will be re-established resulting in the restoration of significant tidal estuarine habitat. In the existing condition, wetlands upstream of the Lower Kickemuit Reservoir Dam are impaired due in large part to the stagnant flow conditions established by the dam. Restoration of the tidal flow regime will improve water quality conditions, re-establish the Upper Kickemuit River estuary, and increase shoreline resiliency. Removal of this obsolete infrastructure represents a major step in the restoration of the Kickemuit River system and overall coastal wetland habitat of Narragansett Bay. Existing site conditions, proposed work, and conformance with the Coastal Resource Management Program (CRMP) are discussed in greater detail herein.

# 2.0 Existing Conditions

## *2.1 General*

The Kickemuit River originates at the outlet of the Warren Reservoir located in Swansea, Massachusetts and flows in a southerly direction eventually meeting with Narragansett Bay. The river consists of three sections fragmented by the Upper and Lower Kickemuit dams. It begins north of the upper dam as a freshwater stream located primarily within Swansea. At its confluence with Heath Brook the Kickemuit River crosses the Massachusetts border into Warren, Rhode Island and becomes impounded by the Upper Kickemuit Dam to form the Upper Kickemuit Reservoir. The upper reservoir discharges via low-level outlets to the Lower Kickemuit Reservoir, a narrow freshwater pond approximately 0.8 miles long impounded by the lower dam. The Lower Kickemuit Dam establishes the head of tide in the Kickemuit River separating the tidal Kickemuit River estuary from the upstream freshwater system. The tidal portion of the Kickemuit River flows approximately 2.5 miles south from the lower dam spillway to where it meets Mount Hope Bay.

The Lower Kickemuit Reservoir Dam is located approximately 100 feet northwest of where Child Street crosses the Kickemuit River. The lower dam is bordered by the Waterview Condominium Complex to the north and Child Street to the south. A small maintained grass lawn lies between the dam and Child Street with a chain link fence that runs along its edge to prevent trespassing. BCWA facilities are located along the edge of the lower reservoir directly west of the dam. Downstream of the dam to the east is the tidal portion of the Kickemuit River and bordering coastal wetlands.

## *2.2 Lower Kickemuit Dam*

The Lower Kickemuit Reservoir Dam (National ID RI04342/State ID #479) is a Significant Hazard Potential Dam under the RIDEM Dam Safety Regulations. The dam is approximately 250 feet long and consists of a 50-foot wide spillway, an approximately 95-ft embankment section east of the spillway, a 100-foot embankment west of the spillway, a low-level outlet, and a fish passageway structure. The primary spillway is topped by a series of twenty (20), 24-inch tall by 27-inch wide tide gates, hinged at the top and installed below a continuous concrete beam which is supported by individual concrete piers. A 9-inch tall steel angle is secured to the top of the concrete beam. Water

discharges through the tide gates during lower tides and flows onto an approximately 16-ft long concrete discharge apron before entering the tidally influenced portion of the Kickemuit river north of Child Street. Under high tide conditions the tide gates are closed and prevent discharge over the spillway.

The low-level outlet consists of a lift gate located between the primary spillway and the fishway, west of the primary spillway. The low-level outlet discharges through a 24-inch diameter pipe within the downstream channel. A denil (baffle) fishway is located adjacent to the low-level outlet and embankment west of the spillway. The fishway is controlled via a lift gate at the upstream end of the fish ladder.

Pare completed an inspection of the dam in 2012 and various deficiencies were identified in the inspection including, "a deteriorated primary spillway with leaking flap gates, cracked training walls, and an overgrown left abutment contact; tree growth along the right abutment contact, deteriorated and undermined concrete at the low-level outlet, an upstream wall with aged jointing and emerging growth within joints, and other dam safety deficiencies."

### *2.2 Wetlands*

The Lower Kickemuit Reservoir Dam restricts tidal influence in the Kickemuit River, therefore; upstream of the dam are freshwater wetlands in the vicinity of the coast and downstream are coastal wetlands and tidal waters. Wetland delineations have been performed both upstream and downstream of the dam and Wetland Delineation Reports which include detailed descriptions of wetland areas are included as an attachment in Section 5 of this application. Below are summarized descriptions of the wetlands present both upstream and downstream of the Lower Kickemuit Reservoir Dam.

#### *Lower Kickemuit Reservoir*

Upstream of the dam is the Lower Kickemuit Reservoir, an approximately 26-acre pond impounded by the dam (Waterbody ID: RI0007034L-01). The pond is relatively narrow and bound by Serpentine Road to the east, Schoolhouse Road to the north, and Child Street to the south.

Agricultural and residential land border the reservoir to the west. The Lower Kickemuit Reservoir is classified as a fresh waterbody under the Rhode Island Water Quality Regulations and is therefore defined as a freshwater wetland in the vicinity of the coast. However, recent water quality monitoring performed over the summer of 2020 indicate that water chemistry in the lower reservoir is characteristic of a brackish waterbody with intermediate salinity. Although the reservoir is not subject to the tidal cycle, saltwater intrusion is occurring through the lower dam flap gates and fishway. This has been a historic issue in the reservoir and is the reason the Upper Kickemuit Reservoir dam was built in 1961 as a levee to prevent saltwater intrusion. Further discussion of salinity levels in the reservoir are included in Section 2.3 below. A bathymetric survey of the reservoir conducted by Pare indicates that reservoir depths are primarily between 2 and 4 feet with a maximum depth of 6± feet. The bathymetric survey also revealed the contours of a defined channel which meanders through the lower reservoir. This is the historic channel of the Kickemuit River that existed prior to the construction of the dam.

*Vegetated Freshwater Wetlands in the Vicinity of the Coast*

A narrow fringe of emergent, shrub/sapling, and forested wetlands border the reservoir in areas along Serpentine Road and in front of the Waterview Condominiums. Midway up the eastern side of the impoundment is a more extensive forested and shrub wetland complex borders the reservoir. Wetlands along a section of Serpentine Road and in front of the Waterview Condominiums have been delineated and are included in the attached Wetland Delineation Report. The remaining bordering wetlands have been reviewed in the field and mapped in GIS based upon field observations, elevation data, and analysis of available GIS data. Prevalent species identified in shrub and sapling wetlands include Speckled Alder *(Alnus incana)*, Arrowwood *(Viburnum dentatum)*, and Silky Dogwood *(Cornus amomum)*. Emergent wetlands are primarily dominated by Common Buttonbush *(Cephalanthus occidentalis)* and Cattail *(Typha spp.)*. Forested wetlands border the reservoir shoreline in front of the Waterview Condominiums and are dominated by Red Maple *(Acer rubrum)* with a varying shrub understory co-dominated by Glossy Buckthorn *(Frangula alnus)* and Sweet Pepperbush *(Clethra alnifolia)*. Vegetated wetland boundaries are defined almost entirely by either maintained lawn associated with adjacent development or roadway embankments which limit the extent of wetlands to a narrow border surrounding the reservoir.

*Tidal Waters*

Downstream of the dam is the tidal portion of the Kickemuit River (Waterbody ID: RI0007033E-01A) which extends from the Lower Kickemuit Dam south to the Bristol Narrows where it joins Mount Hope Bay and from here on will be referred to as the Kickemuit River estuary. This portion of the river consists of estuarine open water habitat and is classified as a Type 2 Water: Low-Intensity Use under the CRMP. The estuary is approximately 0.7 miles wide at its broadest point and 2.4± miles long. Edges of the Kickemuit River estuary consist of salt marsh, coastal wetlands, unconsolidated shoreline, and hardened shoreline. The shoreline is moderately developed by residential properties with denser developments concentrated on the western shoreline. According to RIGIS data, eel grass beds vegetate portions of the Kickemuit River estuary (eelline.shp), however there is no submerged aquatic vegetation (SAV) mapped in the project vicinity and no SAV has been observed in the numerous site visits conducted at the lower dam. Shellfishing in the northernmost portion of the Kickemuit River north of the RIDEM range marker located at, "the eastern extension of Patterson Avenue in the Laurel Park section of Warren" is prohibited (RIDEM Notice of Polluted Shellfishing Grounds, 2020). The majority of the river south of this boundary is under a Conditional Closure and is open periodically to shellfishing. Tidal water surface elevations for mean high water (MHW) and mean low water (MLW) were obtained from NOAA Tide Station 8455137, Kickemuit River. The high tide line (HTL) elevation was determined from the 2020 highest predicted tide for NOAA Tide Station 8452944, Conimicut Light. All tidal and grade elevations are referenced to NAVD 88.

Immediately downstream of the Lower Kickemuit Reservoir Dam within the project site, the shoreline consists of manmade shoreline, coastal bluff, and coastal wetlands. Manmade shoreline defines the shoreline along the dam structure and adjacent areas that are armored with riprap as well as areas near the Child Street bridge which consist of concrete wing walls and riprap revetment. Portions of coastal bluff are limited to a discrete section of heavily eroded earthen shoreline between the riprap armored shoreline and Child Street culvert. Coastal wetlands define the shoreline feature in the cove east of the dam and Child Street bridge and are described below.

*Coastal Wetlands*

Coastal wetlands downstream of the dam include salt marsh and contiguous freshwater and brackish wetlands that border the salt marsh. Salt marsh is located in areas of lower elevation northeast of the dam and in two isolated areas along the southern shoreline as identified on the project plans. A low and high salt marsh are well distinguished by vegetative communities. Low salt marsh is vegetated homogenously by Smooth Cordgrass *(Spartina alterniflora)*. High salt marsh is contiguous to the low salt marsh and dominated by High Tide Bush *(Iva frutescens)* and Salt Meadow Cordgrass *(Spartina patens)*. Based upon survey elevations low salt marsh generally occupies elevations that range between 0.5 and 2.5 while high salt marsh appears to occupy areas between elevation 2.5 and 3.5, although the upper limit of high salt marsh is constrained by maintained lawn in this area and would likely extend further inland if left un-maintained.

Three stormwater outfalls were identified in the field that discharge into the coastal wetland complex. The outfalls appear to be promoting the growth of Common Reed *(Phragmites australis)* which dominates coastal wetland areas upgradient of salt marsh and surrounding the outfall locations. A contiguous forested freshwater wetland dominated by Boxelder Maple *(Acer negundo)*, Silky Dogwood *(Cornus amomum)*, and Black Elderberry *(Sambucus nigra)* extends south to the edge of Child Street.

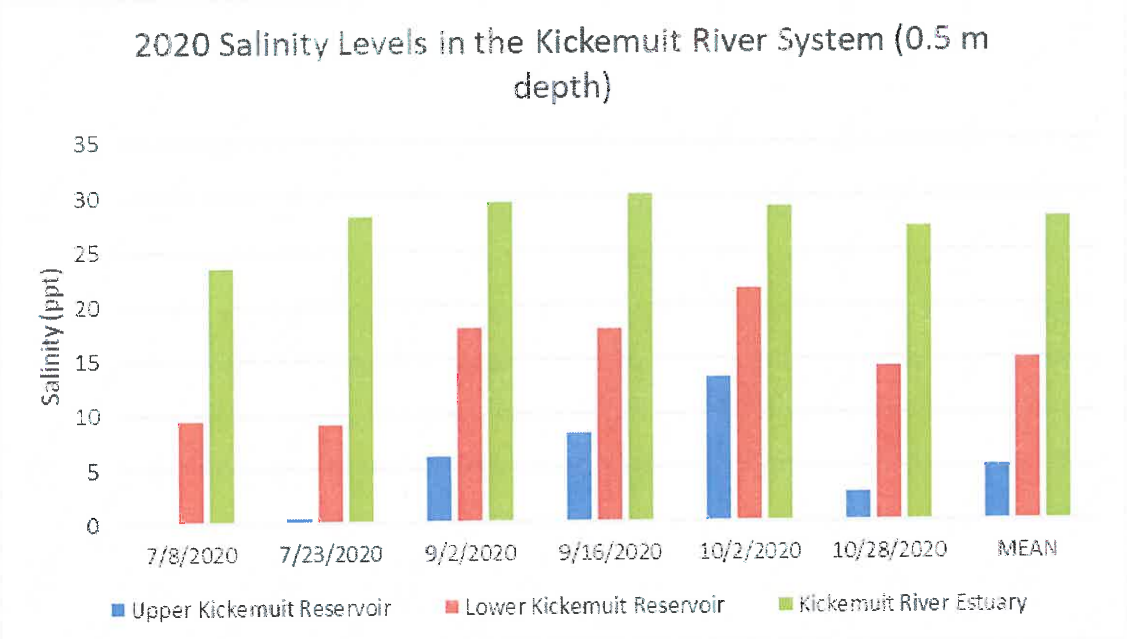
## *2.3 Water Quality*

According to the 2018-2020 State of Rhode Island Impaired Waters Report, Total Maximum Daily Load assessments (TMDLs) were completed in 2006 for the following impairments in the lower reservoir (Waterbody ID: RI0007034L-01): excess algal growth, fecal coliform, total phosphorous, turbidity, and taste and odor. A TMDL was completed in 2010 for fecal coliform in the Kickemuit River estuary. According to the Bristol-Kickemuit River Watershed Plan prepared in 2012 by RIDEM, U.S. EPA, and FB Environmental, water quality impairments are believed to stem primarily from failing onsite wastewater treatment systems (OWTS) located in upper portions of the watershed in Swansea, MA and stormwater runoff from nearby agricultural operations. The report also included waterfowl, particularly geese and swans, as potential bacteria sources.

In order to evaluate current water quality conditions within the Kickemuit system, water quality sampling was conducted in the summer and fall of 2020 by BCWA and Save the Bay in partnership with the University of Rhode Island (URI) Watershed Watch program. Sampling was performed at a bi-weekly basis for six locations on the Lower Kickemuit Reservoir, one location in the Upper Kickemuit Reservoir, and one location in the Kickemuit River estuary from June 23rd to October 28, 2020. BCWA collected samples using a Hanna Multiparameter Meter (Model: H198194) to measure dissolved oxygen (DO), temperature, salinity, total dissolved solids (TDS), conductivity, and pH at five locations in the Lower Kickemuit Reservoir.

Samples were also taken at single locations in the Upper Kickemuit Reservoir, Lower Kickemuit Reservoir, and Kickemuit River estuary and delivered to URI's Water Quality lab for analysis. Salinity levels in both the Upper and Lower Kickemuit Reservoirs were observed to be above normal freshwater conditions and more indicative of mixosaline (brackish) inland water chemistry. Measured salinity across all BCWA samples taken in the Lower Kickemuit Reservoir average 13.66 ppt and salinity measured in the Upper Kickemuit Reservoir Watershed Watch samples averaged 5.12 ppt. Figure 1A below illustrates salinity measured at all three sites analyzed by Watershed Watch. Complete results and a description of current water quality conditions are presented in the Monitoring Results Report prepared by URI Watershed Watch in Section 11 of this Assent application.

**Figure 1:** Bar graph of salinity measured at three locations on the Kickemuit River system.




*2.4 Sediment*

Sediment sampling was performed upstream and downstream of the dam in October of 2019 and March 2020 and compared to both NOAA's Thresholds Effects Concentration (TEC) and Probable Effects Concentration (PEC) as criteria for the evaluation of sediment quality in freshwater systems, and Thresholds Effects Level (TEL) and Probable Effects Level (PEL) for marine systems. The initial round of sampling revealed concentrations of cadmium, lead, and copper in excess of one or more applicable freshwater effects criteria. Additional sampling was conducted in March of 2020 to further delineate potential sources of contamination that would require removal. Overall, 45 samples were collected from the Lower Kickemuit Reservoir and 12 samples were collected from the tidal portion of the Kickemuit River. The additional sampling conducted in 2020 indicated that sediment north of the lower dam has elevated copper concentrations at a depth of 6 and 12 inches. At depths below 12 inches, copper concentrations attenuated below applicable concentration thresholds. Copper was also detected above TEL and PEL criteria downstream of the dam. No samples exhibited copper concentrations in excess of the RIDEM Method 1 R-DEC. Sediment sampling

results and further detail on sampling is included in the Sediment Management Report included as Section 9 of this Assent.

### *2.5 Sea Level Rise*

The site is located in an area of particular vulnerability to sea level rise due to the low-lying topography and proximity to tidal waters in both the Kickemuit River and Palmer River to the west. The CRMC STORMTOOLS web map application indicates that a 1-foot increase in sea levels would regularly over top the lower dam. Water quality sampling results indicate that the upper and lower reservoirs are already in the process of converting to a brackish waterbody as tidal waters regularly enter the lower reservoir through the fish ladder and tide gates. BCWA employees who aided in the collection of water quality samples reported observations of numerous Blue Crabs in the lower reservoir. Additionally, in a 2012 electrofishing survey performed by RIDEM Fish and Wildlife 59 Atlantic Menhaden *(Brevoortia tyrannus)* were surveyed in the lower reservoir, see Section 6.1 for table of complete results. Based upon fisheries data, water quality monitoring data, and observations of tidal elevations (particularly during extreme tidal events) it appears that the tidal regime is in the process of reclaiming these waterbodies and rising sea levels will accelerate this trend.

### *2.6 Rare Species*

According to the RIGIS data layer, natHeritage19, the site is not located within or near any Natural Heritage Area. The U.S. Fish and Wildlife Information for Planning and Consultation (IPaC) mapper lists the Northern Long-eared Bat (*Myotis septentrionalis*), which occupies a majority of the northeastern United States, as a species potentially threatened at the site location. Additionally, 25 Migratory Birds of Concern are identified as being found in the project area. No Critical Habitats of federally listed species are found in the project area. Potential hibernacula and nesting or roosting habitat for migratory birds located within the project LOD is limited to a single Eastern Red Cedar tree located between the fish ladder and dam.

A report was generated through NOAA's Essential Fish Habitat (EFH) mapper to evaluate potential habitat and habitat of particular concern (HAPC) within the vicinity of the project. In addition, an

EFH coordination worksheet was completed for the project (attached in Section 8). The EFH report listed various marine species habitat to be located in the Kickemuit River including Winter Flounder, Atlantic Cod, and Little Skate among others (see Section 8 for full list). HAPC was also identified in the project area for inshore juvenile Cod. In addition to these species reported by the NOAA EFH mapper, there is a known Alewife *(Alosa pseudoharengus)* migration that occurs in the Kickemuit River and is the reason for the denil fishway that was built at the lower dam in 2007. According to communication with RIDEM Department of Fish and Wildlife, Alewife broodstock have been stocked in the Lower Kickemuit Reservoir since 2010. Returns have been poor thus far and spawning success is likely marginal due to the high salinity levels in the lower reservoir in combination with poor water quality. The migratory season for adult Alewife in Rhode Island is generally March 1st to June 1st. The typical out-migration window for juveniles in Rhode Island is September 15 to November 15.

## 3.0 Alternatives Analysis

The selected approach to remove the Upper and Lower Kickemuit dams was developed based upon an evaluation of alternative approaches, with the ultimate goals being protect the downstream public and restore connectivity to the Kickemuit River. Removal of the Lower Kickemuit dam is interconnected with removal of the Upper Kickemuit dam due to proximity of the structures and overlapping impacts to the surrounding environment. The project was initiated by the need to address the Upper Kickemuit Dam safety order (Notice of Violation, dated 2014) received from the RIDEM Dam Safety Program. Several alternatives were evaluated to address the order and bring the Upper Dam into compliance (described in the RIDEM Application to Alter). It was ultimately determined that dam rehabilitation was not a sustainable or practical option due to the reservoirs no longer serving as a water supply, increased environmental impacts, and issues with flooding along Schoolhouse Road not being addressed. It was subsequently determined that removal of the upper dam was the most beneficial option for BCWA, the environment, and the community of Warren. Once removal of the Upper Kickemuit Dam was determined as the preferred alternative, H&H Analyses revealed that downstream modifications would have to be made to mitigate downstream

flooding impacts along Serpentine Road and to the Waterview Condominium complex. The decision-making process that led to removal of both dams is described below.

*Alternative 1: Upper Kickemuit Dam Removal and Offsite Improvements*

To address the downstream impacts associated with the removal of the upper dam, a floodwall was designed for the edge of the lower reservoir adjacent to Serpentine Road, and an earthen berm was designed to extend the higher elevations at the condominium complex to the edge of the lower reservoir to reduce the extent of lateral flooding. While both solutions would be effective at addressing flooding due to the increased water surface elevations from removal of the upper dam, this alternative would result in additional local impacts. The flood wall at Serpentine Road would need to accommodate discharges from overland flow which has historically impacted properties along the west side of the roadway. Given the increased pool level, flap gates would be required to prevent backflow though potential culverts, leading to potential flooding from overland runoff. The flood wall would also have significant impacts to wetlands bordering the Lower Kickemuit Reservoir. The berm at the condominium complex near Child Street would raise grades to meet the ground elevation at the buildings and would require the placement of fill within mapped floodplain. The result would be a wider, level lawn area, but no impact to the view or access of the lower reservoir. While the storage provided within the area of the upper reservoir would offset this loss, the cost of constructing the floodwall and the berm was significant.

*Alternative 2: Upper Kickemuit Dam Removal and Lower Kickemuit Dam Modifications*

As the water surface elevations in the Lower Kickemuit Reservoir are controlled by an earthen embankment dam with a concrete spillway (Lower Kickemuit Dam), the impacts of changing the starting water surface elevation of the lower reservoir during storm events was evaluated. Through this analysis it was determined that flooding could be reduced by removing stop logs above the flap gates at the Lower Kickemuit Dam. However, this would require routine manual operation and would be difficult to accomplish during an actual storm event. Therefore, this alternative was not determined practicable and would increase the existing operation and maintenance responsibilities for the dams.

*Alternative 3: Upper Kickemuit Dam Removal and Lower Kickemuit Dam Removal (Preferred Alternative)*

In the assessment of alternative designs, the possibility of removing both dams was explored as the Lower Kickemuit Reservoir no longer serves its intended purpose as a backup water supply and water quality in the reservoir was known to be poor. It was further determined that during elevated tidal events (i.e., king tides and storm events) the tide overtops the flap gates and impacts the lower reservoir as confirmed by water quality sampling. Hydrologic and Hydraulic (H&H) modeling determined that with removal of the lower dam, removal of the upper dam, and improvement of the culverts below Schoolhouse Road; the goals of the project could be achieved with the added benefit of a restored Kickemuit River estuary and significantly improved watershed connectivity. This alternative does not significantly increase flood impacts and negates the need for structural shoreline protection effectively minimizing overall project impacts. As such, this alternative was proceeded with as the preferred approach.

## 4.0 Proposed Project

The following anticipated construction phasing and sequence is general in nature and is intended to provide an overview of the major project elements. It is not to be construed to dictate the contractor's means and methods. Although arranged sequentially, some of the work items may be undertaken coincidentally. Currently, construction is anticipated to occur from September to December of 2022. Where possible, demolition and removal of the dam structures will be performed from land, however, in-water work will be required in order to properly manage sediment and establish the channel dimensions. The overall project disturbance area consists of approximately 2.5 acres, 1.4 of which consists of work in the Lower Kickemuit Reservoir and the Kickemuit River estuary.

Below is the proposed construction sequence for the dam removal.

1. Establish construction access, install erosion controls and traffic control signage.

2. Hydraulically remove the upper 6 to 12 inches of sediment from two discrete areas identified in the Lower Kickemuit Reservoir.
3. Install coffer dams in the Stage 1 orientation and install two, 36" diameter, temporary diversion pipes along the southern side of the dam.
4. Remove the Stage 1 upstream coffer dam and install an upstream coffer dam in the Stage 2 coffer dam configuration to elevation 5.0.
5. Demolish and remove the dam spillway, tide gates, training walls, and fishway.
6. Shape and grade the channel up to elevation 1.0.
7. Reuse material excavated from around the dam to stabilize and regrade the southern shoreline along Child Street.
8. Adjust downstream coffer dam to Stage 3 orientation and set to elevation 1.0.
9. Complete sediment mitigation by lowering the upstream and downstream coffer dam in stages. Mechanically dredge mobilized sediment within the basin according to the dredge limits shown on Sheet 6.1. Dewater and dispose of material between each stage.
10. Remove the entire upstream coffer dam.
11. Conduct any final sediment clean up as needed to ensure proper sediment removal.
12. Remove downstream coffer dam.
13. Place stabilization stone within Child Street culvert.
14. Restore the southern shoreline with native coastal plantings. Restore remaining disturbed terrestrial area with a native coastal seed mix within the project limits.
15. Install tidal gates to Serpentine Road culverts.
16. Demobilize

### *4.1 Prevention of Erosion and Sedimentation*

The Lower Kickemuit Reservoir Dam is bordered by a number of sensitive environmental resources, including the tidal waters of the Kickemuit River estuary, coastal wetlands, and the Lower Kickemuit Reservoir. The project design includes a number of methods to protect these resources during construction by controlling erosion and containing sedimentation. All of the below methods are in accordance with the most recent edition of the Rhode Island Soil Erosion and Sediment Control Handbook and are described in greater detail in the attached Soil Erosion and Sediment Control Plan (Section 13 of this Assent Application).

#### *4.1.1 Construction Access*

A crushed stone construction entrance pad will be established from Child Street providing access for construction vehicles to the project site. Construction staging will take place in the maintained lawn area south of the dam.

*4.1.2 Control of Water*

Coffer dams will be installed immediately upstream of the dam spillway and at the upstream end of the Child Street culvert in several different configurations to accommodate the dam removal phases. The coffer dams will be constructed with super sacks and sand bags, and will function as turbidity barriers through containment of debris and sediment during the demolition and sediment management phases of the project. Temporary diversion pipes will be used in conjunction with the coffer dams to divert water around the active construction area. A description of the coffer dam installation and configurations are provided below and shown on Sheet 2.4 of the Plans.

- Stage 1: Coffer dams will be installed to allow for the installation of temporary diversion pipes. This requires an upstream coffer dam to be installed to elevation 4.0 just south of the fishway along masonry wall and a downstream coffer dam to elevation 3.0 that spans the Kickemuit River.
- Stage 2: Once the diversion pipes are successfully installed, the upstream coffer dam will be reconfigured to span the dam spillway and prevent water from entering the active work area. In this phase the dam spillway and fishway will be demolished, and a channel will be established to elevation 1.0. The downstream coffer dam will remain in the same orientation in this stage to prevent tidal waters from entering the active work zone.
- Stage 3: The downstream coffer dam will be repositioned to the southeast to allow for shoreline stabilization and grading of the channel banks to occur on the southern side of the site. Diversion pipes will also be removed at this stage. Once the diversion pipes have been removed, a 20-foot section of the upstream coffer dam will be lowered to elevation 1.0 and the remaining upstream coffer dam will be lowered one foot, to elevation 3.0. This will allow for flow to enter the downstream basin carrying with it the upper layer of sediment prone to mobilization. Dredging will occur in several phases while the coffer dams are positioned in the Stage 3 configuration. The coffer dams will be lowered a second time to elevations -2.0 at the upstream coffer dam and elevation 0.0 at the downstream coffer dam. This will allow for controlled mobilization of the remaining impounded sediment which will then be dredged from the settling basin.
- Stage 4: Upon completion of dredging and shoreline stabilization, the upstream and downstream coffer dams will be removed.

### *4.1.3 Sediment Barriers*

As applicable, straw bales, silt fence, compost filter sock, sandbags, or combinations of these may be used for localized terrestrial sediment control. Sediment barriers utilized at the dewatering site will include staked straw bales lined with geotextile fabric and a 2-foot deep stone filter trench.

## *4.2 Dam Removal*

Removal of the Lower Kickemuit Reservoir Dam will include demolition of the spillway and tidal gates, low level outlet, fishway, training walls, surrounding riprap, and stone masonry wall that extends west of the dam. The full vertical extent of the dam structure will be removed from the river with the exception of the embankment northeast of the spillway. The left dam walls and embankment (northern shoreline) will be protected throughout construction and remain in place. This area is intended to function as an access point for the Waterview Condominium residents. Demolition and removal of the dam structures will occur when the coffer dams are positioned in the Stage 2 orientation.

Following demolition of the structural dam elements, coffer dams will be shifted to the Stage 3 configuration and a channel will be excavated and graded out to establish a 60-foot wide channel bottom with 3H:1V embankment slopes on the southern shoreline. Benches will be established at elevation 1.5 on the shoreline slope to provide proper elevation for salt marsh vegetation to establish. Coarse sand, loamy sand and other appropriate natural material excavated from around the dam will be reused on site to establish the proper slopes along the southern shoreline up to the Child Street Bridge. Outside material is not anticipated to be needed for shoreline stabilization measures. The existing stands of *Spartina alterniflora* along the southern shoreline will be re-established on the embankment benches through re-planting.

## *4.3 Sediment Management*

Two phases of sediment removal will occur throughout the project consisting of hydraulic sediment removal from the Lower Kickemuit Reservoir prior to removal of the dam and controlled mobilization and mechanical removal of sediment in the Kickemuit River estuary subsequent to the dam removal. All removed sediment will be dewatered at the former BCWA water treatment plant

located at 472 Child Street immediately west of the project site. The dewatering location is located upgradient of the 100-year floodplain elevation but will be within the 50-foot Perimeter Wetland of the lower reservoir as shown on the plans. RIDEM groundwater classification at the dewatering site is along the boundary of GA and GB. Areas classified as GA include groundwater resources that, "are known or presumed to be suitable for drinking water use without treatment." Groundwater classified as GB includes, "groundwater which may not be suitable for drinking water use without treatment due to known or presumed degradation." Dewatering will take place within areas classified as GB, to avoid impacts to areas of groundwater that may serve as drinking water supply. Figure 8 within Section 3 shows the extent of BCWA service in the surrounding area as well as well depths recorded by the Rhode Island Department of Health for wells dug or drilled since 1972.

Dewatering facilities will consist of a combination of straw-bale with geotextile filter fabric and concrete blocks with plastic sheeting. The dewatering facility will be located at the BCWA plant approximately 700 feet northwest of the dam. Limits of the dewatering facility are shown on Sheet 6.2 of the Drawings. In total, the capacity of the dewatering area is approximately 1,000 cubic yards. Water within the basin will filter through a crushed stone and geotextile fabric interface before allowing it to re-enter the waterway. The exit length is approximately 140 linear feet to reduce the formation of concentrated flows.

#### *4.3.1 Lower Kickemuit Reservoir*

The upper 6 to 12 inches of sediment in two discrete areas, totaling 39,285± square feet, will be removed from the lower reservoir to prevent the downstream migration of copper contaminated sediment once the dam is breached. Calculations indicate that approximately 1,000 cubic yards (cy) of sediment will be removed as part of this phase of sediment management. Removal will be performed with a hydraulic dredge stationed on a barge to minimize impacts. Sediment will be offloaded to dump trucks at the staging area immediately west of the dam. Trucks will then transport the material to 472 Child Street where it will be offloaded and dewatered. Once dewatered, sediment will be transported to a licensed management facility for final disposal. Removal of contaminated material from the reservoir will benefit the overall environment by minimizing continued or increased biological uptake and redistribution of copper in the aquatic ecosystem.

### *4.3.2 Kickemuit River Estuary*

Management of fine impounded sediment will be accomplished through controlled mobilization, containment, and mechanical removal of sediment. In Stage 3 of the Control of Water Plan (Sheet 2.4), coffer dams will be adjusted several times to allow for a phased mobilization of sediment. In between the mobilizations sediment will be removed from the settling basin.

- A 20-foot section of the upstream coffer dam will be lowered to elevation 1.0 and the remaining upstream coffer dam will be lowered one foot to elevation 3.0 allowing flow to pass through the breached dam carrying with it the upper layer of sediment. The downstream coffer dam will attenuate flows causing sediment to drop out.
- Mechanically remove the settling basin placing material into a dump truck for transport to the dewatering facility.
- Lower the upstream coffer dam to elevation -2.0 and the downstream coffer dam to 0.0 allowing for the lower layers of fine sediment to mobilize into the settling basin.
- Mechanically remove material that has mobilized into the settling basin placing it into a dump truck for transport to the dewatering facility.
- Repeat controlled mobilizations as needed to adequately remove the initial release of migration-prone sediment from the lower reservoir. Remove any remaining sediment that has accumulated in the settling basin.

All material removed in this phase is below ecological and human health analytical standards and will be transported to a licensed management facility for final disposal once it has been dewatered.

## *4.4 Stabilization*

Both structural and non-structural stabilization measures will be utilized to restore the site and prevent erosion from occurring in the proposed condition. Stabilization measures will occur at two critical areas within the project site and are necessary to prevent erosion.

The first critical area is along the excavated channel embankment slopes. Salt marsh vegetation (*Spartina alterniflora, Distichlis spicata,* and *Iva frutescens*) will be planted along the established coastal banks as shown in Sheet 8.0. Plantings will align with elevations of existing salt marsh

surveyed along the northern Kickemuit River shoreline in this area. Plantings will help restore salt marsh habitat and provide permanent stabilization. Areas upgradient of proposed salt marsh plantings will be stabilized with a New England Coastal Salt Tolerant seed mix.

Structural measures are required below Child Street as flow velocities through the culvert will increase in the proposed condition. Eight-inch minus trap stone will be placed along the river bottom underneath Child Street and at the culvert approaches to prevent the culvert walls from being undermined by increased flows.

### *4.5 Serpentine Road Improvements*

Ten culverts along Serpentine Road will be improved with tidal gates to prevent back flow of tidal waters to properties along the western side of Serpentine Road. Culvert locations and tide gate details are shown on Sheet 7.0 of the Plans. The tide gates will be mounted to the existing concrete headwalls or pipes, on the reservoir side of the culverts. The tide gates will only be required for use during extreme tide, storm, and precipitation events when water levels exceed culvert invert elevations.

## 5.0 Wetland Impacts

Removal of the Lower Kickemuit Dam will, by design, have significant impacts to upstream freshwater wetlands in the vicinity of the coast. At a broad scale, wetland impacts will include the conversion of impounded wetlands (Upper and Lower Kickemuit Reservoir) to estuarine wetlands influenced by the natural semidiurnal tide cycle. Hydrologic and hydraulic (H&H) modelling indicates that tidal influence will generally extend to the northern end of the Upper Kickemuit Reservoir. Although wetland conversion will be significant in upstream areas, the natural estuary in this area has been adversely impacted for the past 138 years by the Lower Kickemuit Reservoir Dam. The dam has significantly altered and impaired the natural hydrology and ecology of the Kickemuit River system, and the proposed condition represents a more natural and sustainable environment than what currently exists.

The dam removal will restore hydrologic connectivity between the Kickemuit estuary and the Upper Kickemuit watershed. Impacts to shoreline features, tidal waters, and freshwater wetlands in the vicinity of the coast are presented in the below section and have been categorized into direct construction impacts and indirect impacts to upstream and downstream wetlands as a result of removing the dam. As this overall project includes removal of the Upper Kickemuit Reservoir Dam, indirect impacts are cumulative.

### *5.1 Direct Construction Impacts*

Direct construction impacts will be limited to wetlands immediately surrounding the Lower Kickemuit Dam. Construction activities will occur in freshwater wetlands in the vicinity of the coast, manmade shoreline, coastal bluff, and tidal waters. Due to the nature of dam removal and position of the dam relative to wetland areas, construction within the Lower Kickemuit Reservoir and Kickemuit River estuary are unavoidable. The proposed dam removal design has been carefully considered and avoids wetland impacts to the maximum extent practicable. Coffer dams will be installed around in-water work areas to minimize turbidity and sedimentation . Measures to avoid and minimize wetland impacts have been incorporated into the project design and are addressed in Section 7.0 of this narrative. The dam removal inherently provides mitigation for the over 100 years of adverse watershed and habitat fragmentation caused by the dam. Native coastal plantings are proposed along the shoreline of the restored channel which will be a significant improvement from the existing hardened shoreline made up of the dam structure and riprap. Significantly eroded shoreline will also be stabilized and improved with native coastal vegetation. The widespread benefits to the Kickemuit River as a result of the dam removal will far outweigh the relatively discrete construction impacts associated with the physical removal of the dam structure and associated sediment management.

A Post Dam Removal Monitoring Plan has been prepared and is included in Section 12 of this Assent. The Monitoring Plan will document the post-removal conditions and ensure that the proposed restoration goals are met. Below is a table that summarizes the quantitative construction impacts that will occur to tidal waters, coastal wetlands, shoreline features, and freshwater wetlands in the vicinity of the coast . Impacts to tidal waters are based upon the High Tide Line (elevation 3.55) which was derived from NOAA's tide gauge #8452944, Conimicut Lighthouse, highest

predicted tide for 2020. Impacts to the Lower Kickemuit Reservoir are based upon the Ordinary High Water line for the reservoir. Impacts to coastal wetlands, shoreline features, and vegetated freshwater wetlands have been determined from field delineated wetland edges.

**Table 1.1:** Tidal water and coastal wetland impacts.

| Wetland Type | Square Feet of Impact | Cubic Yards of Fill/ Removal | Permanent/ Temporary | Material/ Activity Description |
|---|---|---|---|---|
| Tidal Waters | 1,368± | 138± | Temporary | Temporary fill for control of water and turbidity controls. |
| Tidal Waters | 690± | 160± | Permanent | Mechanical removal of the dam structure. Excavation required to establish channel. |
| Tidal Waters | 13,045± | 7,800± | Permanent | Mechanical removal of sediment mobilized from the Lower Kickemuit Reservoir. |
| Tidal Waters | 912± | 58± | Permanent | Fill for non-structural shoreline stabilization along southern shoreline. |
| Tidal Waters | 1,657± | 41± | Permanent | Trap stone fill for stabilization of Child Street culvert. |
| Coastal Wetlands (Salt Marsh) | 228± | N/A | Permanent | Removal of *Spartina alterniflora* along the southern shoreline. |
| Coastal Wetlands (Salt Marsh) | 222± | 11.5± | Temporary | Super sack coffer dams for control of water. |
| Total (permanent) | 16,532± | Removal: 7,960± Fill: 99± | Permanent | Total permanent impacts to tidal waters and coastal wetlands. |
| Total (temporary) | 1,590± | Fill: 150± | Temporary | Total temporary impacts to tidal waters and coastal wetlands. |

**Table 1.2:** Shoreline feature impacts.

| Shoreline Type | Linear Feet of Impact | Cubic Yards of Fill | Permanent/ Temporary | Material/ Activity Description |
|---|---|---|---|---|
| Manmade Shoreline | 85± | N/A | Permanent | Removal of dam structures and riprap revetment that currently establish the shoreline feature. Wetland Flags SF-1 to SF-10 and SF-15 to SF-17. |
| Coastal Bluff | 66± | 58± | Permanent | Non-structural shoreline stabilization of significantly eroded coastal bank. |
| Total | 151± | 58± * | Permanent | Total shoreline feature impacts. |

* Inclusive of fill reported for tidal waters in Table 1.1.

**Table 1.3:** Freshwater wetlands in the vicinity of the coast impacts. Lower Kickemuit Reservoir impacts calculated based upon OHW elevation.

| Wetland Type | Square Feet of Impact | Cubic Yards of Fill/Removal | Permanent/ Temporary | Material/ Activity Description |
|---|---|---|---|---|
| Lower Kickemuit Reservoir | 2,309± | 152± | Temporary | Supersack coffer dams and temporary diversion pipes for control of water. Temporary construction access. |
| Lower Kickemuit Reservoir | 39,285±** | 1,000± | Permanent | Removal of sediment impacted with Copper Sulfate. |
| Lower Kickemuit Reservoir | 2,088± | 172± | Permanent | Excavation and grading immediately upstream of dam to establish channel and remove dam. |
| Total (Temporary) | 2,309± | 152± | Temporary | Total temporary impacts to freshwater wetlands in the vicinity of the coast. |
| Total (Permanent) | 41,373± | 1,172± | Permanent | Total Permanent impacts to freshwater wetlands in the vicinity of the coast. |

** Approximately 2,398 square feet of impacted Copper Sulfate removal overlaps with temporary and permanent impact activities.

*5.2 Indirect Wetland Impacts*

Removal of the Lower Kickemuit Dam will have significant upstream impacts to freshwater wetlands as the tide will no longer be limited by the dam structure and tidal influence will be expanded upstream to the approximate northern limit of the Upper Kickemuit Reservoir. Thus, indirect impacts will primarily be to freshwater wetlands in the vicinity of the coast. In order to evaluate the indirect upstream impacts of the dam removal, a rigorous evaluation of both upstream and downstream wetlands was conducted. Methods and results of this evaluation are described below.

**Evaluation Methodology**

Conversion of upstream wetlands were evaluated based upon delineation of upstream and downstream wetlands, a wildlife habitat evaluation of the Upper Kickemuit Reservoir, bathymetric surveys of both impoundments, H&H modelling of restored water surface elevations, sediment sampling data, water quality data, fisheries data, review of published literature, and available GIS data. Sediment Sampling, bathymetric mapping and H&H analysis methods are included in Sections 9 and 10 of this application. GIS data utilized in the analysis includes 1-foot topographic contours derived from Lidar data, RIGIS Wetlands (wetlands93.shp), 2018 RIGIS Soils (Soils18.shp), RIGIS Glacial Deposits (Glacial_Deposits.shp), RIGIS Freshwater Rivers and Streams (streams5k.shp), MA DEP Wetlands (wetlandsdep.shp), and aerial imagery from various years up to 2020 also downloaded from RIGIS. Elevations of existing salt marsh below the lower dam were utilized as a reference to approximate elevations of marsh establishment once the dams are removed. Wetlands were classified according to the Cowardin Classification System based upon wetland delineations and wetland assessments performed on the upstream wetland complex. Maps of existing and proposed wetland conditions are included as Figures 6 and Figure 7 in Section 3 of this application as well as on Sheets 5.0 and 5.1 in the attached Plans.

**Results**

The evaluation of upstream wetland impacts indicates that a slight net gain of wetland area will occur as a result of the dam removals. The slight gain in wetland area is due to the establishment of wetlands in what is currently earthen dam embankment, concrete abutments, and appurtenant dam

structures (i.e. tidal gates, outlet structures, fishway). Although the overall wetland area will not significantly change, there will be a significant conversion from freshwater wetlands to coastal wetlands. The Upper and Lower Kickemuit Reservoirs will convert to a tidal river which will fluctuate from water surface elevation -0.9± at Mean Low-Low Water (MLLW) to el. 2.1± at Mean High-High Water (MHHW). Existing Ordinary High-Water (OHW) in the Lower Kickemuit Reservoir is elevation 3.0. Thus, water surface elevation changes translate to a difference of approximately 0.9 feet (10.8 inches) from existing Ordinary High-Water (OHW) during MHHW conditions and a 3.9-foot difference during MLLW conditions. Subtidal riverine conditions will establish at and below MLLW and intertidal mud flats and salt marsh will establish up to the MHHW elevation. Low salt marsh dominated by Smooth Cordgrass *(Spartina alterniflora)* was delineated downstream of the lower dam and elevations generally range from elevation 2.0 to elevation 0.0. High marsh dominated by High-Tide Bush *(Iva frutescens)* and Saltmeadow Cordgrass *(Spartina patens)* ranged from elevations of 2.0 up to 3.5 downstream of the lower dam. It should be noted that the limits of high marsh are constrained by the maintained lawn in this area. It is anticipated that over time salt marsh will inhabit similar elevations upstream of the lower dam in what is currently the Upper and Lower Kickemuit Reservoirs. Tidal freshwater wetlands will establish in the upper extent of tidal influence where groundwater and freshwater streams dilute salinity levels to oligohaline conditions. Tidal freshwater habitat is a relatively rare habitat type in Rhode Island and restoration of this unique habitat would be significant to the biodiversity and ecology of the Kickemuit River providing habitat for rare species such as Big Cordgrass *(Spartina cynosuroides)* and Diamondback Terrapins *(Malaclemys terrapin)*.

Not only will this result in restored habitat for numerous estuarine and diadromous species, but it will increase CRMC jurisdiction to north of Schoolhouse Road allowing for increased wetland protection. Table 2.0, below, summarizes the quantitative conversion of upstream freshwater wetlands as a result of the dam removals.

***Table 2.0***: Conversion of upstream wetlands.

| Wetland Classification (Cowardin Classification System) | Existing Condition Acres ± | Proposed Condition Acres ± | Approximate Change in Acres |
|---|---|---|---|
| Upper Kickemuit Reservoir – PUBHh9 | 13.3 | 0 | -13.3 |
| Lower Kickemuit Reservoir – PUBHh9 | 27.2 | 0 | -27.2 |
| Emergent Cattail Marsh - PEM1E0 | 10.6 | 10.3 | -0.3 |
| Emergent Cattail Marsh (Impounded) - PEM1Fh0 | 5.0 | 0 | -5.0 |
| Emergent Wetland (Phragmites dominant) - PEM5E0 | 3.4 | 3.4 | 0.0 |
| Wet Meadow - PEM1B0 | 4.0 | 4.0 | 0.0 |
| Shrub Wetland (impounded) - PSS1Fh0 | 6.4 | 0 | -6.4 |
| Shrub Wetland - PSS1E0 | 4.4 | 4.2 | -0.2 |
| Forested Wetland (Saturated - PFO1B) | 127.3 | 143.3 | +16.0 |
| Forested Wetland (Seasonally Flooded) - PFO1E | 49.2 | 34.0 | -15.2 |
| Sub-Tidal Riverine - R1UB2L9 | 0 | 14.4 | +14.4 |
| Emergent Estuarine Wetland and Tidal Flats - E2EM1N3 | 0 | 23.2 | +23.2 |
| Emergent Estuarine Wetland (Upper Marsh) E2EM1P3 | 0 | 6.8 | +6.8 |
| Emergent Tidal Freshwater Wetlands - PEM1S9 | 0 | 8.3 | +8.3 |
| Total (rounded) | 250.9 | 251.8 | +0.9 |

The dam removal will restore approximately 52.7 acres of tidally influenced wetlands including tidal river, salt marsh, and tidal freshwater wetlands. As previously stated, restoration of these coastal wetlands will have significant benefits to the Kickemuit River and its watershed. Salt marshes and tidal wetlands are unique to coastal regions and due to this geographic restraint, represent only 3 to 4 percent of wetlands worldwide (Mitsch and Gosselink, 2015). Coastal wetlands are particularly vulnerable in New England due to high population densities and development along coastlines. Combined with sea level rise coastal wetlands are effectively being "squeezed out." The loss of this unique habitat is alarming as coastal wetlands are beneficial in many ways to the environment, economy, and public health of Rhode Island. Some of the functions and values that would be provided by a restored tidal creek and coastal wetlands in the Kickemuit River include: nursery habitat for various estuarine species, exchange of nutrients between fresh and estuarine systems, improved habitat for waterfowl and wading birds, the potential to restore rare species habitat for species such as Diamondback Terrapin *(Malaclemys terrapin)* and Big Cordgrass *(Spartina cynosuroides)* both of which have a presence in the Upper Narragansett Bay and require brackish water composition. In addition to the ecological benefits the project will establish a naturally resilient and more sustainable shoreline that will prove more adaptive with rising sea levels.

There will also be significant benefit provided to diadromous fish that require passage between freshwater and marine habitat to complete their life cycle. Diadromous species known to inhabit the Kickemuit system and are anticipated to benefit from the dam removals include Alewife (Alosa psuedoharengus), American Eel (Anguilla rostrate), and Striped Bass (Morone saxatilis). A denil fish ladder currently provides diadromous fish passage from the Kickemuit River estuary to the Lower Kickemuit Reservoir. RIDEM Fish and Wildlife have conducted a stocking program in the lower reservoir with Alewife brood stock since 2010 in an effort to promote population growth (Phil Edwards, personal communication). Stocking efforts have not resulted in measurable improvement to the Alewife runs in the Kickemuit River potentially due to salinity levels in the lower reservoir which limit spawning success. The replacement of Schoolhouse Road culverts and removal of the upper and lower dams would provide unrestricted passage to approximately 13 miles of stream habitat according to MassGIS and RIGIS hydrographic data. Alewife spawn in streams and flowing waters however, quiescent lakes and ponds have been found to provide more significant and

desirable spawning habitat (Mattocks et al. 2017, ASMFC 2017). Based on the relatively small watershed size and lack of substantial spawning habitat, a large Alewife run is not anticipated to return to the Kickemuit and a large run may have never existed prior to construction of the dams. If individuals return to spawn in the Upper Kickemuit River, passage will be unrestricted and spawning success will be significantly increased from the existing condition. Unrestricted passage will also be provided to catadromous species such as American Eel (Anguilla rostrate). The repeated migrations of diadromous species provide valuable exchange of marine derived nutrients into freshwater systems in the form of excretion and decomposition (Hanson et al. 2010). Alewife and other diadromous species such as American Eel also provide forage to freshwater and marine fish, raptors, waterfowl, and macro-invertebrates at their various life stages from eggs to adulthood (Mattocks et al. 2017, Greene et al. 2009). Revitalization of migratory fish species would provide ecological benefits at all trophic levels in the tidal and freshwater portions of the Kickemuit River.

The dam removals will also restore hydrologic connectivity to the Kickemuit River watershed allowing for increased habitat accessibility, sediment and nutrient transport, and a more natural flow and temperature regime to re-establish. Below is a table summarizing the coastal wetland and watershed connectivity restoration that will result from the dam removals.

**Table 2.1:** Upstream wetlands that will be re-connected to the Kickemuit River estuary.

| Upstream Wetlands | Area or Length | Habitat or Function Restored |
|---|---|---|
| Restored tidal river | 1.4± miles | Tidal Wetlands |
| Restored tidal wetlands | 52.7± acres | Tidal Wetlands |
| RIGIS and MA DEP mapped streams in the upper watershed that will be re-connected. | 15.8± miles | Stream Connectivity |
| Total wetland area upstream of the Lower Kickemuit Dam that will be re-connected to the estuary. | 520± acres | Wetland Connectivity |

### *5.3 Downstream Impacts*

Downstream impacts associated with removal of the dam will be limited to a relatively short period of time immediately following the dam removal. No adverse long-term impacts will occur to downstream tidal waters as a result of the dam removal. Sediment management will minimize downstream turbidity impacts immediately following the dam removal and prevent the sudden release of a sediment plume. Published studies have shown that impacts to downstream suspended sediment from dam removal are minimal and limited to areas in close proximity to the dam immediately following a discharge event (Ralstone et al. 2021). These studies have been performed on much larger dams with significantly greater sediment load than is present in the Kickemuit watershed. In the restored sediment regime following construction, sediment will disperse broadly such that accumulation or entrapment will not occur in isolated areas downstream.

### *5.4 Coastal Flooding Impacts*

Extensive hydrologic and hydraulic (H&H) analyses have been conducted to evaluate flooding impacts associated with removal of both the Upper and Lower Kickemuit Reservoir Dams. The H&H Report which provides in detail the methods and results of various flood event scenarios is included as Section 9 of this application. In general, precipitation driven flood extents will be reduced upstream of the lower dam in all flood events ranging from the 1-year to 100-year storm. Downstream of the lower dam there will be slight increases in precipitation-driven flooding ranging from 0.01 feet to a maximum of 1.30 feet which occurs in the area between Child Street and the lower dam. This minimal increase in downstream flood elevations will not result in significant increases to the lateral inundation extents and no inhabitable structures will be put at additional flood risk. Roadway flooding will be decreased on Schoolhouse Road where it crosses the Lower Kickemuit Reservoir, at the Serpentine Road intersection, and Schoolhouse Road between Hezekiah Drive and Kinnicut Avenue. The reduction in roadway flooding is summarized in Table 3.1 below. Tables 6.1 and 6.2 in the H&H Report, attached as Section 9 of this Assent, provide the existing and proposed peak flow and peak water surface elevations for the 1-year to 100-year storm.

**Table 3.1:** Roadway flooding impacts from precipitation-driven storms (no storm surge).

| **Storm Event** (precipitation driven) | **Existing Condition** (linear ft. of roadway flooding) | **Proposed Condition** (linear ft. of roadway flooding) | **Reduction** (linear ft.) |
|---|---|---|---|
| 10-year | 497± | 0 | 497± |
| 25-year | 715± | 0 | 715± |
| 100-year | 1,075± | 0 | 1075± |

In addition to precipitation-driven flood events, precipitation events were aligned with coastal storm surge and modelled. The modelled scenario takes into account coastal storm surge at peak high tide during the peak of the inflow hydrograph for the corresponding precipitation event (i.e. 10-year storm surge occurring with a 10-year precipitation event). Although the chances of this occurring are relatively low, the analysis was performed to ensure that removal of the lower dam will not significantly increase coastal flood risk.

Due to the relatively low elevation of the lower dam, it provides minimal flood protection from coastal storm surges. Modelling of worst-case scenario storms was performed. Results of the analysis demonstrate slightly higher peak water surface elevations during the 10-year storm surge/precipitation event in the Lower Kickemuit Reservoir when the dam is removed. This is due to minor attenuation provided by the lower dam. Water surface elevation increases by 0.73 to 0.79 feet (±9 inches) in the 10-year storm when it aligns with a 10-year storm surge event at peak high tide and peak runoff. This minimal increase does not result in additional inundation of infrastructure with the exception of an isolated 100-foot section of Serpentine Road that begins to experience inundation of depths less than two inches at peak water levels. Storm surges greater than the 10-year event the lower dam is overtopped and does not provide coastal flood protection. During the 100-year storm and storm surge water surface elevations decrease by 0.50 to 1.15 feet in in the Lower Kickemuit Reservoir with the dam removed. Detailed description of this analysis and the resulting flood elevations for existing and proposed conditions are included in the H&H Report in Section 9 of this Assent.

Based upon rigorous H&H analyses conducted for numerous storm scenarios, removal of the Lower Kickemuit Reservoir Dam will not significantly increase lateral flood extents nor will there be an adverse impact on surrounding infrastructure. The number of inhabitable structures in the floodplain will not increase in the proposed condition, and in a majority of areas floodplain will decrease in lateral extent. As a preventative measure, the applicant is proposing to install tidal gates on ten culverts located underneath Serpentine Road. This is intended to mitigate backflow of saltwater during storm surge events and prevent any potential impacts to property along the west side of Serpentine Road associated with the slight increases in water surface elevation caused by storm surge events.

## 6.0 Agency Coordination and Public Outreach

Pare has coordinated with a number of State and Federal Agencies over the course of planning the project. Agencies include the Rhode Island Historical Preservation and Heritage Commission (RI HPHC) and the Tribal Historic Preservation Officers (THPOs) of the Narragansett and Wampanoag Indian Tribes as part of Section 106 Historic Preservation Act coordination. An initial pre-application meeting was held with RIDEM Freshwater Wetlands, RIDEM Freshwater Fisheries, RIDEM Dam Safety, and CRMC on February 18, 2020. A second pre-application meeting was held on May 7, 2020 in which representatives from the U.S. Army Corps of Engineers (USACE), U.S. Environmental Protection Agency (EPA), RI DEM Freshwater Wetlands and Water Quality, RI CRMC, and National Oceanic and Atmospheric Administration (NOAA) were present. Additional coordination meetings with State Agencies have occurred and relevant meeting minutes are included in Section 7 of this Assent Application.

Public outreach has been conducted in three public presentations to date to inform abutters, Town of Warren residents and the interested public about the project. BCWA held a meeting on December 15, 2020 to present the project. A Warren Town Council Special Meeting was held on February 24, 2021 in which additional modeling and design revisions to address abutters concerns were presented, and questions, comments, and concerns were answered and taken into account in the

proposed design. A meeting was also held with residents of the Kickemuit Waterview Condominiums on February 18, 2021. This meeting was aimed specifically toward informing the condominium residents of the proposed project and impacts relevant to the condominium property. Questions, comments, and concerns held by the condominium residents and residents of Serpentine Road have been considered and taken into consideration in the project design. A fourth public town meeting is planned to take place following the submission of permit applications to provide a project update. At this time, formal letters of support for the project have been received from the Town of Warren, Kickemuit River Council, Warren Conservation Commission and Land Trust, RIDEM Fish and Wildlife, NOAA, RI Infrastructure Bank, RI DOT, and RI Saltwater Anglers Association.

### *6.1 RIDEM Division of Fish & Wildlife*

RIDEM Freshwater Fisheries was consulted during the project planning phase including the initial pre-application meeting on February 18th and a virtual meeting held on November 2, 2020 to discuss potential impacts to both freshwater and anadromous fish species. Philip Edwards, Chief of the RIDEM Division of Fish and Wildlife, was present at both meetings and provided electrofishing survey results of the Lower Kickemuit Reservoir conducted in September of 2012 (see table 4, below). Mr. Edwards indicated that the Lower Kickemuit Reservoir has been stocked with Alewife *(Alosa pseudoharengus)* broodstock since 2010. Spawning success in the Lower Kickemuit Reservoir appears to be poor and is likely due to the poor water quality in the reservoir and high salinity. No official fish counts have been conducted for the Lower Kickemuit Dam fishway since it was constructed in 2007.

**Table 4:** 2012 electrofishing results conducted by RIDEM Fish and Wildlife.

| Common Name | Scientific Name | Count |
|---|---|---|
| Blue Gill | *Lepomis macrochirus* | 120 |
| Atlantic Menhaden* | *Brevoortia tyrannus* | 59 |
| Largemouth Bass | *Micropterus salmoides* | 55 |
| Pumpkinseed | *Lepomis gibbosus* | 41 |
| Golden Shiner | *Notemigonus crysoleucas* | 21 |
| Yellow Perch | *Perca flavescens* | 15 |

| | | |
|---|---|---|
| Brown Bullhead | *Ameiurus nebulosus* | 11 |
| Chain Pickerel | *Esox niger* | 7 |
| American Eel | *Anguilla rostrate* | 6 |
| Black Crappie | *Pomoxis nigromaculatus* | 2 |

*Likely ascended Lower Kickemuit Dam fishway at high tide.

### *6.2 U.S. Fish and Wildlife Service*

The U.S. Fish and Wildlife's (USFWS) Information for Planning and Consultation (IPAC) Tool was utilized to generate an Official Species List for the dam site as well as areas upstream to Schoolhouse Road. According to the species list, there are no Critical Habitats located within the project area. The Northern Long-eared Bat *(Myotis septentrionalis)*, a Threatened Species, is listed within the project area. There are no mapped hibernacula within the project area and tree clearing surrounding the lower dam will be limited to one Eastern Red Cedar located between the spillway and fishway. Indirect upstream impacts are not anticipated to adversely impact nesting habitat for the Northern Long-eared Bat *(Myotis septentrionalis)*. The official USFWS species list is included in Section 7 of this Assent.

### *6.3 NOAA Fisheries*

Representatives from NOAA Fisheries were in attendance at the May 7, 2020 pre-application meeting and have been notified of the project during the planning stages. An Essential Fish Habitat (EFH) List and Assessment Worksheet were completed and are included in Section 7 of this Assent. The dam removal is anticipated to have significant long-term benefit to marine fisheries within the Kickemuit River estuary by removing passage barriers and increasing tidal estuarine habitat. The project purpose aligns with the mission of NOAA Fisheries, and the agency has shown support of the project during pre-application coordination. Measures to mitigate potential impacts to fisheries and benthic fauna during the construction phase have been incorporated into the project design and are described in detail in the EFH Assessment Worksheet.

*6.4 Cultural and Historic Resources*

A project notification letter was submitted to Rhode Island Historical Preservation and Heritage Commission (RIHPC) and Tribal Historic Preservation Office's (THPO's) of the Narragansett and Wampanoag Tribes on April 12, 2021. The Narragansett THPO informed the applicant that the project is within an area that is culturally significant to the Narragansett Tribe and a site visit meeting was held between a tribal representative and project team on May 28, 2021. The meeting provided further information on the proposed dam removals and the THPO indicated support of the project's restoration goals. The applicant will continue to coordinate with the Narragansett Tribe under the Section 106 process.

RIHPC requested additional information on the history of the lower dam, which was provided on June 25, 2021. Significant modifications have been made to the lower dam since its original construction in 1883 including reconstruction of the dam abutments, spillway apron, and training walls. Additionally, construction of the 2006 fishway disturbed a significant portion of the dam structure. RI HPHC concluded in their response that the Lower Kickemuit Reservoir Dam Removal will not result in any adverse impacts to historically significant properties. See Section 13 for a copy of correspondence with historic and cultural agencies.

## 7.0 Consistency with the Coastal Resources Management Program

This Assent application covers all activities associated with the Lower Kickemuit Reservoir Dam Removal in Warren, Rhode Island. According to Table 1 in §1.1.5(A) of the CRMP, the following project elements are listed as Category A, Category A1, or Category B Activities for Type 2 Waters:

- Filling, Removal, and Grading of Shoreline Features (Manmade Shoreline) associated with removal of the dam structure and restoration of the impacted shoreline – Category A1
- Non-structural Shoreline Protection associated with stabilization along the southern shoreline to address existing erosion issues – Category A

- Structural Shoreline Protection associated with erosion prevention measures – Category B

Filling in Tidal Waters and Improvement Dredging are project elements that are prohibited activities in Type 2 Waters. Special Exceptions are requested for these activities and project conformance with the Special Exception criteria is documented in Section 8.0 of this project narrative.

Freshwater Wetlands in the Vicinity of the Coast will be directly and indirectly impacted by the dam removal as addressed in section Sections 5.1 and 5.2, above. Proposed work within the Lower Kickemuit Reservoir is subject to the CRMC Rules and Regulations Governing the Protection and Management of Freshwater Wetlands in the Vicinity of the Coast.

The dam removal is also pursuant to §1.3.2 Alteration to Freshwater Flows to Tidal Waters and Water Bodies and Coastal Ponds. Removal of the dam will alter existing flows from upstream freshwater tributaries that flow into tidal waters of the Kickemuit River estuary.

The following sections are intended to demonstrate that the project as proposed is consistent with the policies for Type 2 waters and complies with the other applicable standards of the Program.

### *7.1 Section 1.3.1(A)1 Category B Requirements*

**a. Project Need**

Removal of the Lower Kickemuit Dam is necessary to accomplish restoration goals in the Kickemuit River system. As stated in Section 1.1 of this narrative, removal of the Upper Kickemuit Dam is the most feasible and practicable alternative to resolve the significant structural issues with the dam. Analysis of flood conditions have made it clear that the lower dam must be removed in coordination with the upper dam for the project to be successful and not increase flooding risk to bordering properties. Not only will the dam removal alleviate the dam maintenance and repair burdens, but it will also restore connectivity to the Kickemuit River system and re-establish a more resilient and adaptive shoreline.

**b. Codes/ Ordinances**

The project has been and will continue to be coordinated with the Town of Warren to its completion. A completed Building Officials Form is included in Section 1 of this Assent.

### c. Description of Coastal Waters and Land Area that will be Affected

The project area is described in Section 2.0 of this Project Narrative and is depicted on the project plans. Approximately 17,672 square feet of tidal waters will be impacted by construction activities. Upon completion of the dam removal activities, these areas will be restored and stabilized and areas that are currently manmade shoreline. Approximately 52.7 acres of upstream freshwater wetlands will be converted from impaired and impounded freshwater wetlands to coastal wetlands.

### d. Impacts to Erosion and/or Deposition Processes

Removal of the dam will allow for natural in-river sediment transport and deposition processes to occur. In the existing condition, sediment is impounded by the dam and does not reach downstream receptors as it would in the natural riverine condition. Removal of the dam will restore the natural long-term sediment transport process allowing for sediment to reach downstream areas that are currently starved of sediment. Bank stabilization measures and marsh restoration are incorporated in the project to prevent erosion from occurring post-dam removal and restore natural plant communities. Erosive conditions that are occurring downstream of the dam will not be adversely impacted by the dam removal and will likely improve as a result of the project due to the restored sediment regime.

### e. Impacts to Plant and Animal Diversity

As discussed in Section 4.0 above, the project is anticipated to have a significant positive impact on the abundance and diversity of plants, nekton, wading birds, and passerines. Approximately 52.7 acres of estuarine habitat will be restored by the dam removal and made accessible to estuarine and diadromous species. This restoration will also re-establish tidal freshwater wetlands and habitat that is suitable for rare species such as Big Cordgrass *(Spartina cynosuroides)*, Diamondback Terrapin *(Malaclemys terrapin)*, and Saltmarsh Sparrow *(Ammospiza caudacuta)*, all of which have been identified in nearby areas of the Upper Narragansett Bay.

### f. Public Access

The project will significantly improve public access to tidal waters and the Kickemuit River shoreline. This includes accessibility for kayakers and small crafts that regularly utilize the Kickemuit River estuary and is currently restricted by the passage barrier caused by the dam. The

possibility will exist for future installation of a public use area without the safety concerns associated with the dam structures.

### g. Water Circulation, Flushing, Turbidity, and Sedimentation

The dam removal will significantly improve water circulation and flushing in the Upper and Lower Kickemuit Reservoirs. The dams currently foster stagnant conditions which lead to higher concentrations of pollutants. The restored hydrologic regime will increase flushing rates and improve water circulation in the upper Kickemuit River.

Sedimentation and turbidity impacts to downstream receptors will be limited to a short-term period immediately following removal of the dam. Measures will be taken to mitigate these potential impacts, including installation of turbidity barriers and coffer dams surrounding work areas, a gradual phased removal of the dam, and removal of sediment impacted by copper sulfate. The Sediment Management Plan describes these measures in greater detail (Section 9).

Long-term sedimentation impacts are not anticipated to occur as a result of the dam removal, the vast majority of sediment transported by the Upper Kickemuit River will be distributed to Mount Hope Bay and will not accumulate in the area immediately downstream of the dam. This is corroborated by post removal monitoring of sediment in coastal dam removals which have shown that increases in turbidity are generally limited to a short time period immediately following the dam removal and sediments prone to downstream migration are dispersed to the main estuary outside of the river network (Ralston et al., 2021). These studies have been conducted on rivers with significantly greater sediment loads than present in the Kickemuit indicating that any sedimentation and turbidity impacts will be modest and short term. Past studies have also suggested that restoration of the natural hydrologic and sediment regime through dam removal can improve downstream marsh accretion and help mitigate erosion (Ralston et al., 2021).

### h. Water Quality

Water quality in the Upper Kickemuit Reservoir and Lower Kickemuit Reservoir have been monitored by the URI Watershed Watch program in support of this project beginning in 2020. The Kickemuit River estuary has also been monitored for water quality as part of this project and in long-term monitoring conducted by Watershed Watch. These monitoring sites will continue to be monitored following the project to monitor any changes in water quality.

Adverse water quality impacts should not occur as a result of the dam removal. Water quality will improve in the Upper and Lower Reservoirs due to restoration of the natural hydrologic regime. The dams currently promote stagnant conditions and poor circulation. The current nutrient and bacteria loading to the watershed will not be impacted by the project, however; the restored flow regime will reduce the concentration of pollutants in the reservoirs by decreasing residence time and improving circulation. The dam removals should not deteriorate water quality downstream of the project site due to higher flushing rates which prevent elevated concentration of pollutants.

### i. Historic and Archaeological Impacts

The RI Historical Preservation and Heritage Commission (HPHC), Narragansett Tribal Historic Preservation Office (THPO), and Wampanoag Tribe of Gay Head (Aquinnah) THPO have been notified of the project in a coordination letter with attachments that was sent on April 12, 2021. Responses from the HPHC are included in Section 13 of this Assent. A meeting was held with the Narragansett THPO representative on May 28, 2021 to provide further detail of the proposed project as discussed in Section 6.4, above. The RI HPHC has indicated in written correspondence that the project will not adversely impact historically significant sites.

The Lower Kickemuit Dam was built in 1883 and has since been altered on several occasions including in 1939 following the hurricane of 1938 and more recently in 2006 with the installation of the fish ladder. Removal of the dam will restore the historic conditions that existed prior to the establishment of the dam. Historic documentation indicates that historic mills were powered by the natural tidal flows in the river prior to construction of the lower dam which was built solely to provide public water supply to the towns of Bristol and Warren and never served to provide hydropower for mill operations. Due to the significant alterations that have occurred to the dam since its original construction and vast cultural and historical significance that was present prior to the dam's existence, it is believed that the dam removal will restore the riverine character that contributes to the Kickemuit's cultural and historical importance.

### j. Conflicts with Water-Dependent Activities

The project will not adversely impact any other water dependent use upon completion of the work. The Lower Kickemuit Reservoir is no longer a backup public water supply and re-establishment of the reservoirs as a freshwater supply is not feasible due to saltwater intrusion and water quality

issues. A survey of private wells surrounding the Upper and Lower Kickemuit Reservoir was conducted using Rhode Island Department of Health RIDEM Well Completion Reports. The completion reports include well depths and property information for wells drilled after 1972. Well data was then linked to GIS parcel data and mapped in the surrounding area, Figure 8 of Section 3 illustrates the distribution of private wells documented since 1972 as well as the extent of BCWA service. The shallowest documented well in proximity to the site is 180-feet deep, while some in closer proximity are 200 feet in depth or greater. Due to the depth of wells and distance from the reservoir, impacts to well function or water quality is not anticipated to occur from the dam removal as any saltwater intrusion to groundwater will be limited to a saltwater wedge along the Kickemuit River shoreline. As described above, the Lower Kickemuit Reservoir currently has elevated salinity levels and saltwater intrusion in groundwater surrounding the reservoir has likely already occurred. BCWA will work with community members to monitor wells identified by property owners who are concerned about potential water quality impacts.

**k. Scenic Impacts**

The proposed dam removals will benefit the scenic qualities of the Kickemuit River. The dam structure will no longer obstruct the natural aesthetic of the river and the improved coastal habitat will attract wildlife that is currently restricted by the dam and impaired impoundment.

## *7.2 Section 1.3.1 (B) Filling, Removing, or Grading Shoreline Features*

Removal of shoreline features is a central element of this project. Manmade shoreline features which consist of the dam training walls, steel flap gates, concrete spillway, fishway, and riprap revetment will be removed to establish a channel through the current dam structure. All alterations to shoreline features will be beneficial and result in a conversion of hardened manmade shoreline to more natural vegetated shoreline. Filling of shoreline features is associated with shoreline protection in areas that either currently exhibit significant erosion or have the potential to erode under the proposed condition. Filling of shoreline features is discussed in Sections 7.2, 7.3, and 7.5 below.

A Soil Erosion and Sediment Control Plan has been prepared in accordance with the RI Soil Erosion and Sediment Control Handbook and is attached in Section 14 of this Assent application as required

in Section 1.3.1 (B)(1)(b). All disturbed shoreline features will be planted with native coastal vegetation as shown in the planting plan to provide natural permanent stabilization of the shoreline feature and result in a reduction of site impervious area from the existing condition. Alterations will be to manmade shoreline associated with the dam structure and no filling or excavation will occur in the adjacent coastal wetlands. The proposed dam removal complies with the CRMP Standards and Policies for Filling, Removing, or Grading of shoreline features adjacent to Type 2 Waters and will result in an overall improvement in the ecological value along the shoreline.

*7.3 Section 1.3.1 (G) Shoreline Protection*

Non-structural shoreline protection is proposed along the southwestern shoreline of the Kickemuit River estuary between Child Street and the Lower Kickemuit Reservoir Dam as well as the shoreline of the breached channel. The portion of shoreline along Child Street is significantly eroded from shoreline flags SF-12 to SF-14. Non-structural protection is proposed to rehabilitate this area and prevent further erosion from occurring. Protection will be accomplished through re-use of material excavated from around the dam during the removal and channel breach process. Based upon sediment sampling conducted upstream and downstream of the lower dam, material is known to consist of fine to coarse sand. Suitability of the material for re-use will be confirmed by the contractor during construction. Once placed along the shoreline, material will be graded to a 3H:1V slope and planted with native coastal vegetation. The proposed non-structural shoreline projection will restore and stabilize approximately 151 linear feet of shoreline. Approximately 58 cubic yards of fill will be required for the non-structural protection.

When the dam is removed peak flows will significantly increase through the Child Street culvert as demonstrated in Table 6.2 of the attached H&H Report in Section 10 of this Assent. The increase in flow and velocity presents a potential erosion hazard to the culvert bed and toe of the culvert walls during high flow events. Stabilization measures are proposed along the length of the culvert to ensure erosion and scour does not pose a hazard to the culvert walls. Stabilization material consists of an 8-inch thick layer of 6-inch minus trap stone. Limitation of the trap stone protection to the culvert bed is not anticipated to disrupt the restored sediment transport processes or dynamics of the Kickemuit system. Approximately 1,657 square feet and 41 cubic yards of fill will be required to provide the proposed structural protection measures.

*7.4 Section 1.3.1 (I) Dredging and Dredged Material Disposal*

Dredging will occur within Tidal Waters associated with the management of sediment mobilized from the Lower Kickemuit Reservoir into the tidal waters of the Kickemuit River between Child Street and the dam. This will result in removal of approximately 8,500 cubic yards of material mobilized from the lower reservoir into the tidal Kickemuit River. The dredge activity is defined under the CRMP as Improvement Dredging as the area is not known to have been previously dredged. The proposed dredging and disposal methods are consistent with CRMC policies and standards set forth in Section 1.3.1 (I) of the CRMP and RIDEM Rules and Regulations for Dredging and the Management of Dredged Materials. A completed Application for Marine Dredging and Associated Activities and Submittal Checklist is included in Section 1 of this application for State Assent. A description of the proposed dredging methods, equipment, transport, dewatering, and disposal is included in Section 4.3 of this Narrative. A special exception has been requested to perform improvement dredging in a Type II Water and is included in Section 8.0, below.

Plan view and cross-sectional views of the proposed lateral and vertical dredging limits include 13,045 square feet of tidal waters as shown on Sheet 6.1 of the Project Plans.

Dredging will be limited to the area immediately downstream of the dam and is unavoidable to adequately manage mobilized sediments and mitigate downstream impacts. Mechanical methods will be used to dredge the mobilized sediment and all attempts will be made to avoid impacts to the natural Kickemuit River substrate. No additional impacts will occur to the shoreline feature as a result of the dredging. It is currently anticipated that dredging will occur during the late fall and will avoid spring adult migratory fish run periods. There are no eel grass beds or oyster reefs within the dredge footprint. A waiver from winter Time of Year restrictions is requested for this project due to the significant long-term ecological benefits it will provide and possibility that dredging may be delayed to the early winter months of November and December due to receipt of permits and/or construction schedule. Fisheries habitat in the proposed dredge area is limited by the presence of the dam and shallow water depths. Benthic habitat will be disrupted during the dam removal period but will be restored following construction.

The proposed dredged material dewatering site is located at 472 Child Street (Assessors Map 21, Lot 182) and owned by the applicant. The parcel is zoned as a Conservation District due to its former use as a water treatment plant but is currently utilized for storage of various maintenance equipment and materials. This site is proximal to the dredge location, under the ownership of the applicant, and within a GB designated groundwater area. The area is currently utilized for the storage of materials and equipment and therefore, no tree or vegetation clearing will be required to establish the site as gravel/crushed stone covers the area. Freshwater wetlands in the vicinity of the site include the Lower Kickemuit Reservoir and a narrow fringe of emergent and forested freshwater wetlands that border the reservoir. The disposal site is located within the 50-foot Perimeter Wetland associated with the adjacent reservoir but is above the 100-year floodplain elevation. When the dredged material is placed in this location the adjacent wetlands will be in the process of permanently converting to a tidal waters and coastal wetlands and the disposal location will be within 200 feet of MHW. Therefore, freshwater wetlands will not be impacted by the disposal of dredged material. Groundwater below the dewatering site is classified as both GB and outside of any Community or Non-community Wellhead Protection areas. Dwellings along Serpentine Road are known to have private wells and are not serviced by BCWA's water supply line and are withing 1740 feet of the dewatering site.

Sediment that will be mobilized and dredged has been sampled at the locations shown on Sheet 6.0 of the Plans. The sediment management report, included in Section 9 of this Assent application includes the characterization of sediment that will be dredged as well as additional sampling that has been performed in the project vicinity.

*7.5 Section 1.3.1 (J) Filling in Tidal Waters*

Filling in tidal waters will consist of temporary fill associated with coffer dams, and permanent fill associated with structural shoreline protection measures proposed in the Child Street culvert. Fill within tidal waters have been minimized to the extent practicable and the proposed fill is required for erosion control measures and temporary control of water during construction. Because filling in tidal waters is prohibited in Type 2 Waters a special exception has been requested in Section 8.0 for the proposed fill activities.

Approximately 1,657 square feet and 41 cubic yards of trap stone will be placed in tidal waters in the Child Street culvert. Approximately 912 square feet and 58 cubic yards of natural fill will be utilized to stabilize the southern shoreline for non-structural shoreline protection. These stabilization measures are addressed in Section 7.3 above.

### 1.1.4 (D) Freshwater Wetlands in the Vicinity of the Coast

Impacts to freshwater wetlands in the vicinity of the coast will be significant as described in Sections 5.1 and 5.2 above. Direct construction impacts include the removal of approximately 1,000 cubic yards of sediment that has elevated copper concentrations. Due to the location of the dam as head of tide barrier, its removal will also require work within the Lower Kickemuit Reservoir. The direct impacts associated with the in-water work will be minimized with the use of coffer dams. Work within this area is unavoidable and necessary to successfully remove the dam.

The indirect impacts to upstream freshwater wetlands are beneficial to Rhode Island's coastal resources and will restore the Kickemuit River estuary to its natural extent. The upstream conversion of these areas is at the core of the project goal and the loss of impounded freshwater wetlands is far outweighed by the gain of more natural and ecologically valuable estuarine wetlands. The impacts to freshwater wetlands upstream of Schoolhouse Road are addressed in an Application to Alter submitted to RIDEM.

## 8.0 Request for Special Exception

The proposed removal of the Lower Kickemuit Reservoir Dam includes dredging and filling within Type 2 Waters. The dredge activity is proposed in an area that has not been previously dredged and is therefore considered improvement dredging. Improvement dredging cannot be avoided to properly manage sediment mobilized by the dam removal. Dredging will be limited to removal of sediments mobilized from the Lower Kickemuit Reservoir that is trapped within the basin between Child Street and the dam. The quantities and proposed footprint of the dredging is provided in Section 5.1 and shown on Sheet 6.1 of the Project Plans. Dredging will not extend to the natural substrate of the basin and will be performed in a manner that minimizes disturbance to the extent practicable through control of water and turbidity barriers. An Application for Marine Dredging is included in Section 1 of this application package. Removal, dewatering, and disposal methods will

comply with the RIDEM Rules and Regulations for Dredging and Management of Dredged Materials.

Filling within tidal waters is required to provide stabilization measures at the Child Street culvert and for temporary fill associated with coffer dams, which are necessary to provide adequate in-water work conditions. Stabilization measures in the Child Street culvert are unavoidable to prevent erosion and scouring from the increased flow velocities through the culvert. Fill material will consist of 8-inch minus trap stone. Fill quantities are provided in Section 5.2 above and are shown on Sheet 4.0 of the Project Plans.

Special Exceptions are required for Improvement Dredging and Filling in Type 2 Tidal Waters. The project meets the requirements for a Special Exception as set forth, below. The proposed prohibited activities are part of a larger overall effort to restore natural estuarine conditions and increase public access to the shoreline.

***Requirement 1***: The proposed activity serves a compelling public purpose, which provides benefits to the public as a whole as opposed to individual or private interests. The activity must be one or more of the following: (a) an activity associated with public infrastructure such as utility, energy, communications, or transportation facilities; (b) a water-dependent activity that generates substantial economic gain to the state; and/or (c) an activity that provides access to the shore for broad segments of the public.

***Project Compliance***: The project serves a compelling public purpose by removing a barrier that currently prohibits public access along the section of shoreline occupied by the dam as well as public boating access to the upper Kickemuit River. In the current condition, the dam restricts public access along the southwestern shoreline of the Kickemuit River and disrupts the natural aesthetic of the river in this area. The dam has deteriorated structurally and is contributing to the impairment of the Lower Kickemuit Reservoir creating both a public health and environmental hazard. Removal of the aging structure will serve significant public benefit as it will improve public access to the shoreline, increase accessibility to tidal waters for passive recreation, and improve the health of the natural environment, which has inherent benefits to the local economy and human health. The dam

removal also creates opportunities to increase public access to the shoreline surrounding the existing dam which is currently prohibited to dam safety issues.

***Requirement 2***: All reasonable steps shall be taken to minimize environmental impacts and/or use conflict.

***Project Compliance:*** As discussed in the Project Narrative and reflected on the project plans, the proposed project was designed to minimize environmental impacts, specifically impacts to wetlands and tidal waters. The dredge component of the project has been included for the purpose of minimizing downstream impacts to the Kickemuit River estuary. Coffer dams will function as turbidity barriers and prevent the release of a downstream sediment plume. Removal of the upstream coffer dam will be performed gradually in a phased approach, as described in Section 4.0 above, to aid in the minimization of impacts. Filling in tidal waters has been avoided to the maximum extent practicable however, is unavoidable to provide the necessary control of water measures for unavoidable in-water work and to account for increased flow velocities through the Child Street culvert. Lining the culvert bottom with trap stone will prevent potential erosion and scouring impacts to the existing culvert. Work has avoided impacts to coastal wetlands to the extent practicable. Disturbed areas will be permanently stabilized with native coastal vegetation resulting in a significant improvement from the existing condition.

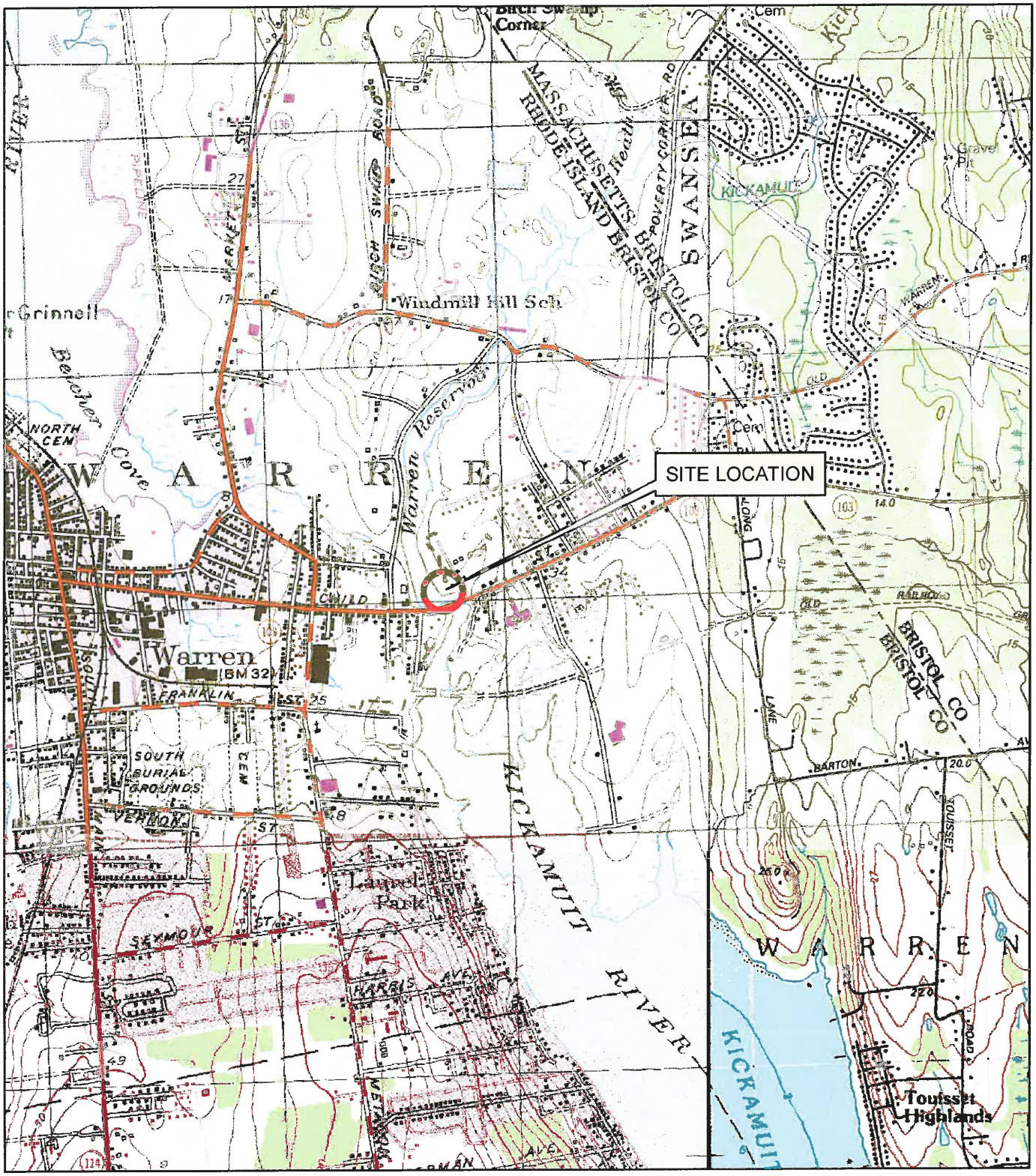
***Requirement 3***: There is no reasonable alternative means of, or location for, serving the compelling public purpose cited.

***Project Compliance:*** The Lower Kickemuit Reservoir Dam has been in place since 1883 and its removal represents the only reasonable alternative to restore the estuary in this area providing public access to the shoreline, passage to passive recreationalists, and restoration of the tidal ecology which will have widespread benefits to the public. Repairing or leaving the dam in place would continue to prevent public access to upper portions of the Kickemuit River, foster impaired environmental conditions, and continue to pose a public hazard with the potential for dam failure. For these reasons

there are no alternative reasonable means to accomplish the project goals and serve the public purpose.

## SECTION 3

Figures




RIGIS

# SITE LOCATION MAP

SCALE: 1"=2,000'

8 BLACKSTONE VALLEY PLACE
LINCOLN, RI 02865
(401) 334-4100

10 LINCOLN ROAD, SUITE 210
FOXBORO, MA 02035
(508) 543-1755

PARE PROJECT No. 14217.05 MAY 2020

# FIGURE 1

LOWER KICKEMUIT RESERVOIR DAM REMOVAL
WARREN, RI


PARE CORPORATION
ENGINEERS - SCIENTISTS - PLANNERS
8 BLACKSTONE VALLEY PLACE
LINCOLN, RI 02865
401-334-4100

RIGIS

1 INCH = 500 FEET
0" 1"
BAR IS ONE INCH ON ORIGINAL DRAWING

# UPPER KICKEMUIT RESERVOIR DAM REMOVAL

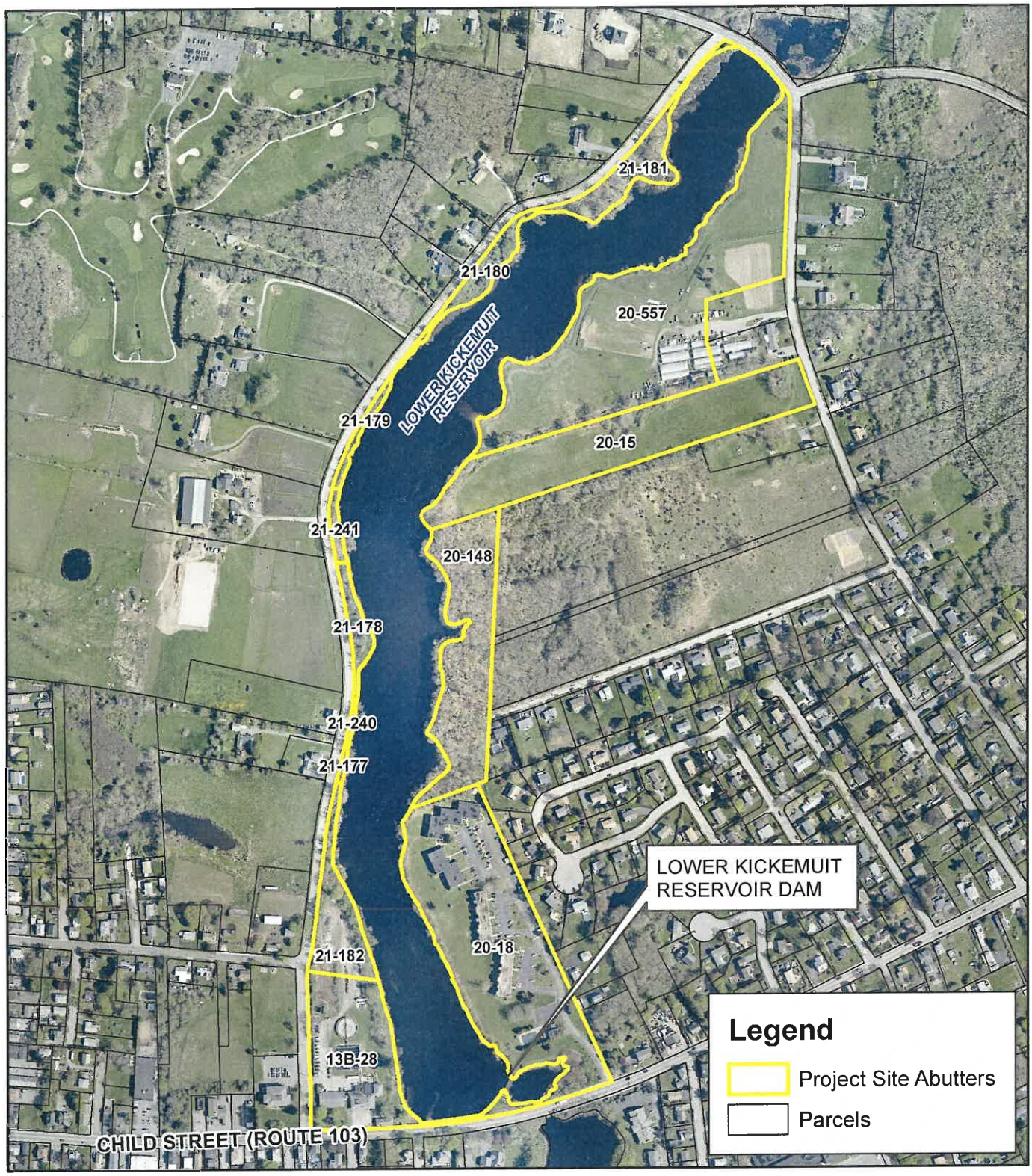
WARREN, RI

N E S W



PROJECT NO. 14217.05
DATE: DECEMBER, 2020
SCALE: AS NOTED

FIGURE 2
AERIAL




# SITE ABUTTERS

SCALE: 1"=500'

8 BLACKSTONE VALLEY PLACE
LINCOLN, RI 02865
(401) 334-4100

10 LINCOLN ROAD, SUITE 210
FOXBORO, MA 02035
(508) 543-1755

PARE PROJECT No. 14217.07

MAY 2021

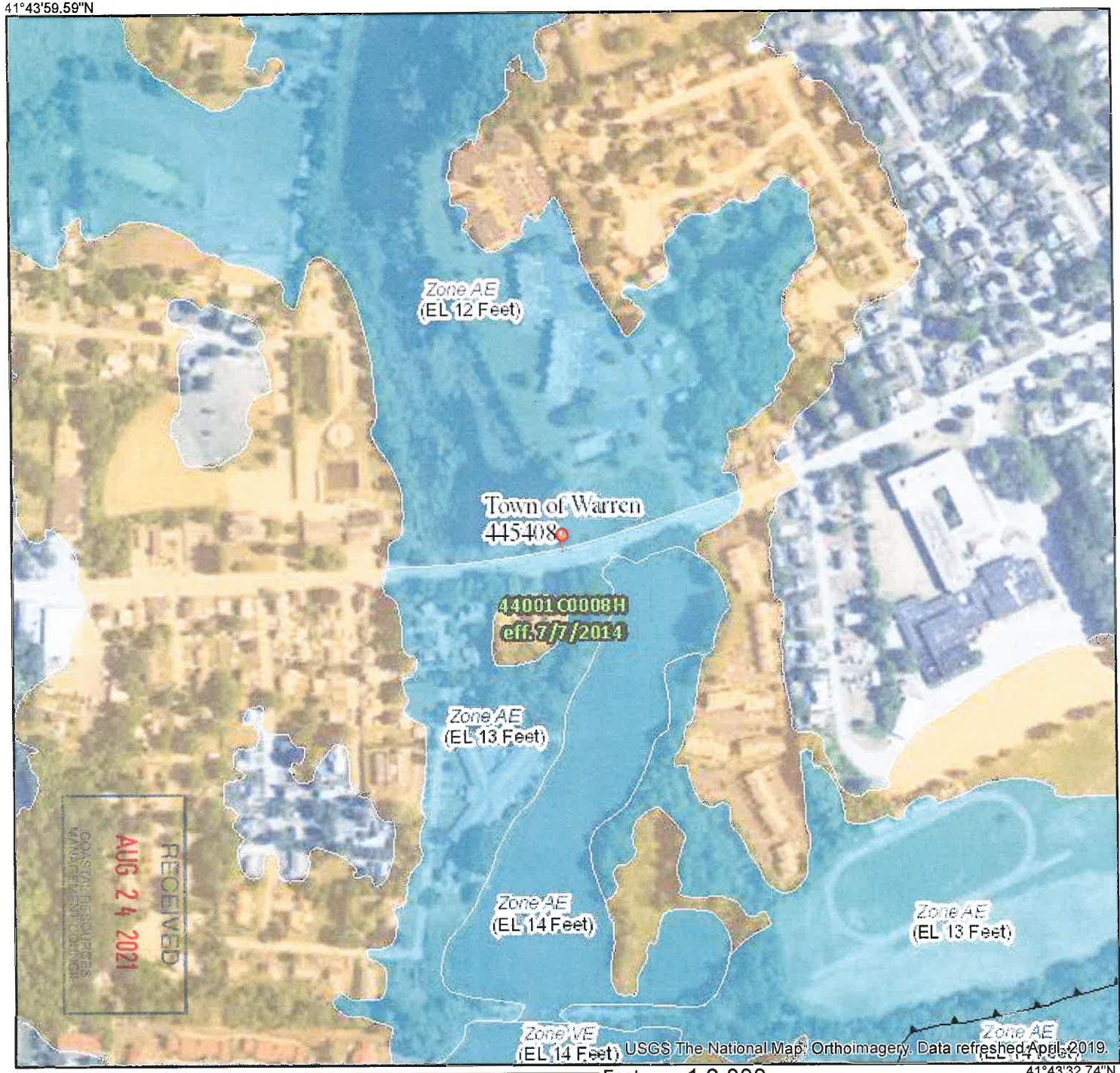
# FIGURE 3

LOWER KICKEMUIT RESERVOIR
DAM REMOVAL
WARREN, RI

# National Flood Hazard Layer FIRMette

FEMA

41°43'59.59"N




71°15'28.25"W

41°43'32.74"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Area of 1% annual chance flood with average depth less than one foot or with drainag areas of less than one square mile *Zone*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

**OTHER AREAS**
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone*

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- 20.2 / 17.5 — Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- 513 — Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

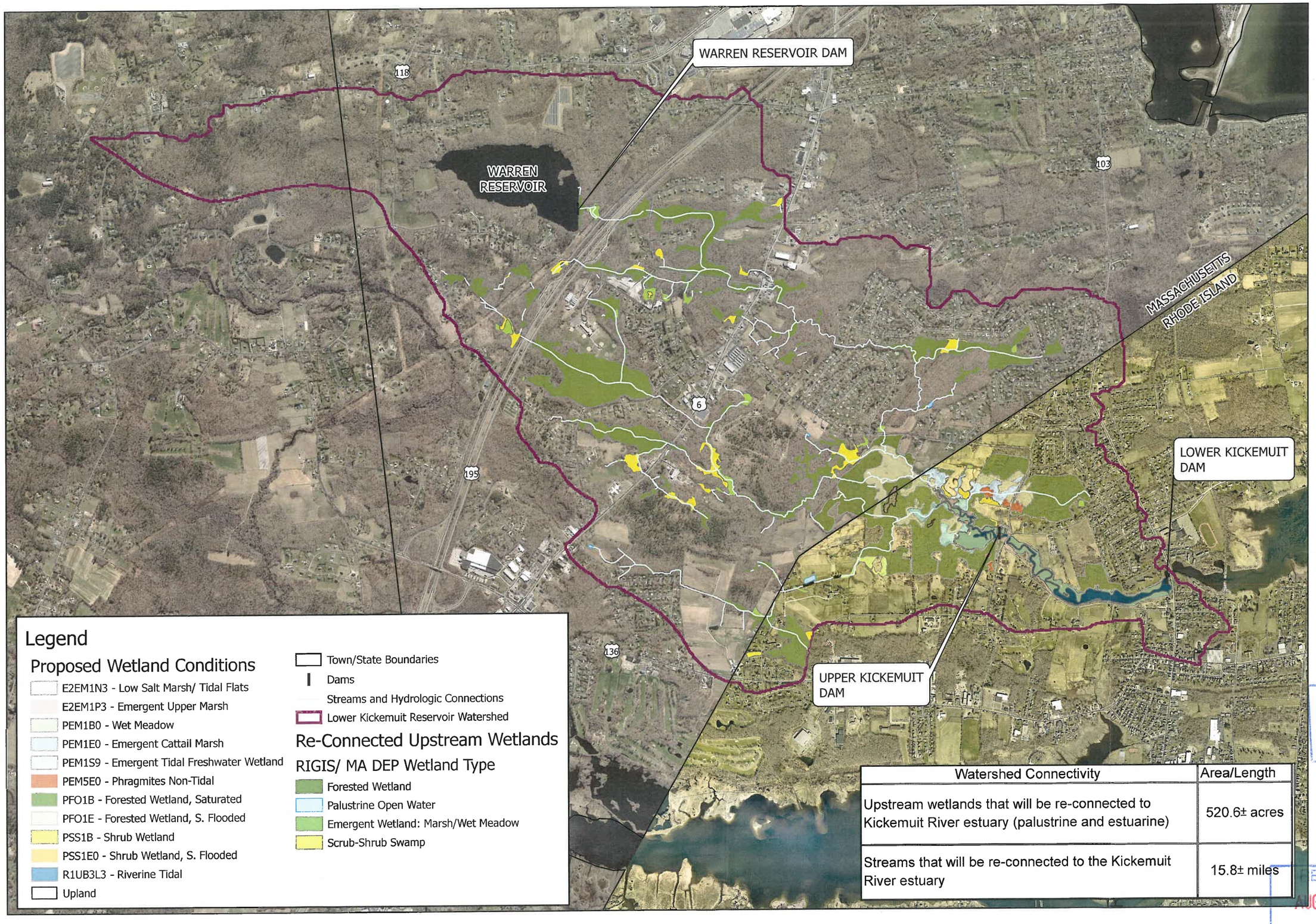
N

The pin displayed on the map is an approximate point selected by the user and does not represe an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/29/2020 at 3:59:34 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.




## Legend

### Proposed Wetland Conditions

- E2EM1N3 - Low Salt Marsh/ Tidal Flats
- E2EM1P3 - Emergent Upper Marsh
- PEM1B0 - Wet Meadow
- PEM1E0 - Emergent Cattail Marsh
- PEM1S9 - Emergent Tidal Freshwater Wetland
- PEM5E0 - Phragmites Non-Tidal
- PFO1B - Forested Wetland, Saturated
- PFO1E - Forested Wetland, S. Flooded
- PSS1B - Shrub Wetland
- PSS1E0 - Shrub Wetland, S. Flooded
- R1UB3L3 - Riverine Tidal
- Upland

- Town/State Boundaries
- Dams
- Streams and Hydrologic Connections
- Lower Kickemuit Reservoir Watershed

### Re-Connected Upstream Wetlands RIGIS/ MA DEP Wetland Type

- Forested Wetland
- Palustrine Open Water
- Emergent Wetland: Marsh/Wet Meadow
- Scrub-Shrub Swamp

| Watershed Connectivity | Area/Length |
|---|---|
| Upstream wetlands that will be re-connected to Kickemuit River estuary (palustrine and estuarine) | 520.6± acres |
| Streams that will be re-connected to the Kickemuit River estuary | 15.8± miles |

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0" 1"
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N E S W

# UPPER KICKEMUIT RESERVOIR DAM REMOVAL

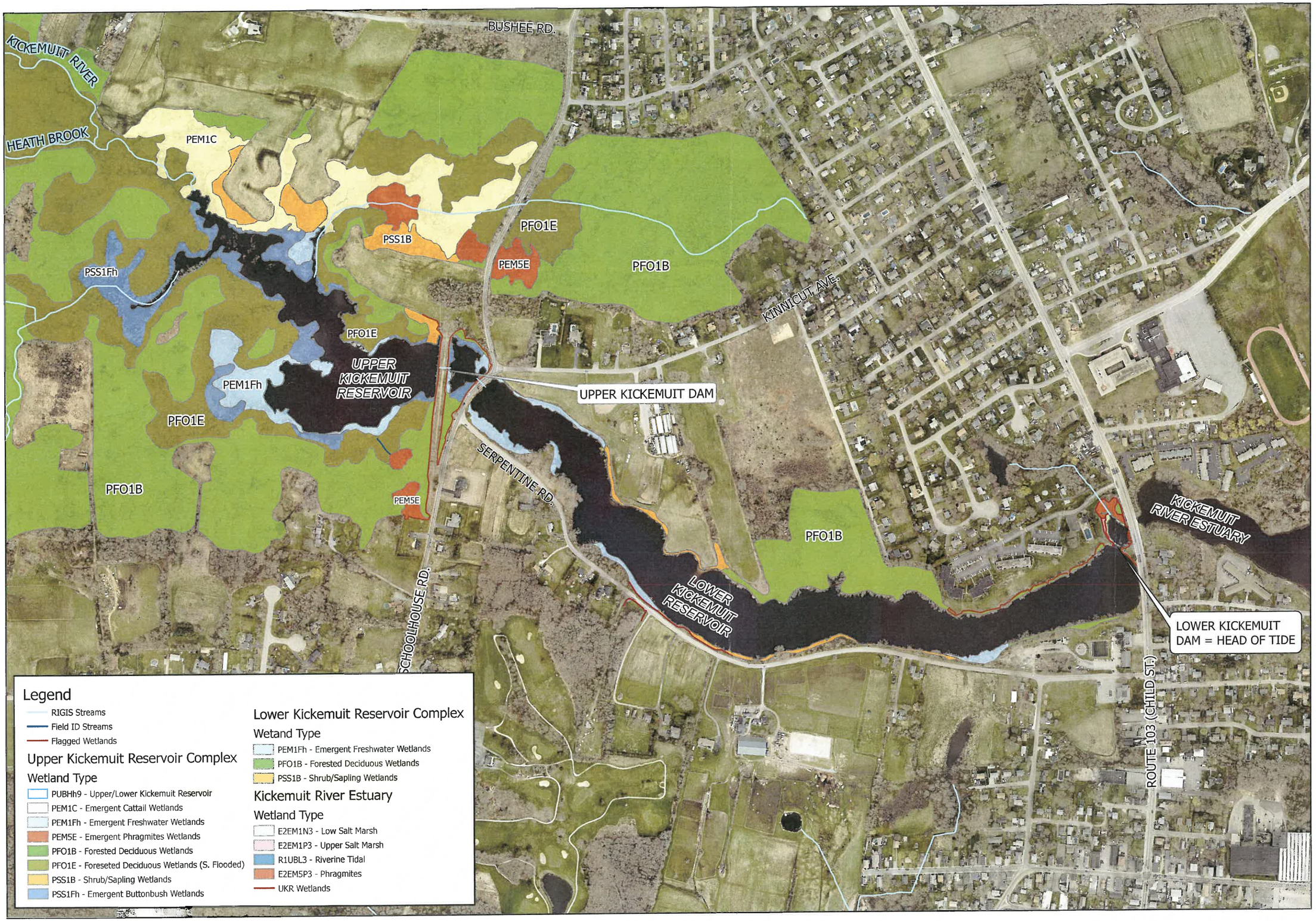
WARREN, RI



PROJECT NO.: 14217.07
DATE: MAY, 2021
SCALE: AS NOTED

## FIGURE 5 RESTORED WATERSHED CONNECTIVITY

RECEIVED
AUG 24 2021
COASTAL RESOURCES MANAGEMENT COUNCIL

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N E S W

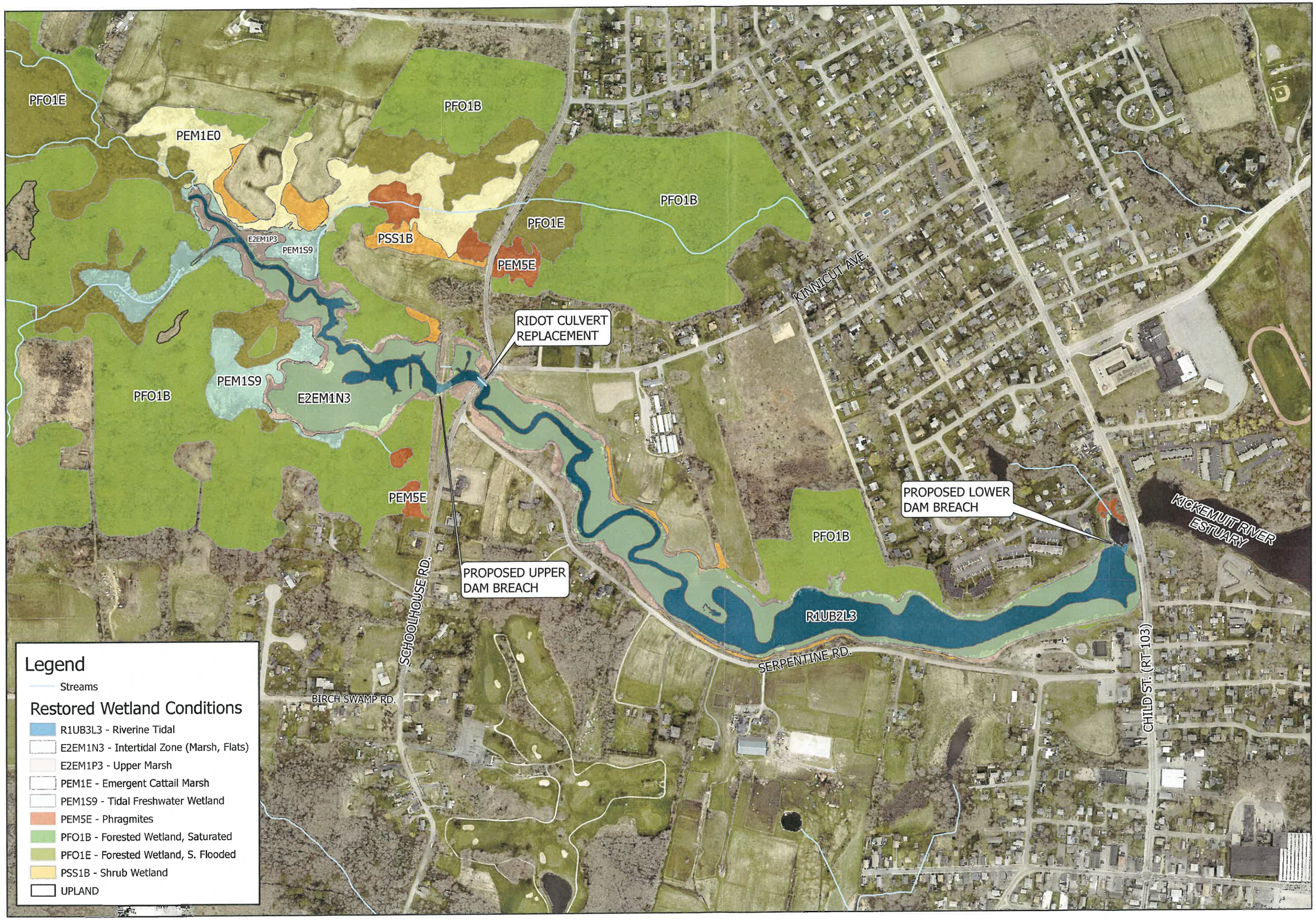
# UPPER KICKEMUIT RESERVOIR DAM REMOVAL

WARREN, RI



PROJECT NO.: 14217.07
DATE: APRIL, 2021
SCALE: AS NOTED

## FIGURE 6
## EXISTING WETLAND CONDITIONS

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N E S W

# LOWER KICKEMUIT RESERVOIR DAM REMOVAL

WARREN, RI



PROJECT NO.: 14217.07
DATE: APRIL, 2021
SCALE: AS NOTED

FIGURE 7
RESTORED WETLAND CONDITIONS

MASSACHUSETTS

RHODE ISLAND

UPPER KICKEMUIT RESERVOIR

KINNICUTT AVE

CHILD ST (Rte 103)

#2 (160 ft)

KICKEMUIT RIVER ESTUARY

#13 (400 ft)

#9 (260 ft)

LOWER KICKEMUIT RESERVOIR

SERPENTINE RD

#12 (300 ft)

#8 (200 ft)

#11 (depth ukn)

#10 (560 ft)

#7 (180 ft)

SCHOOLHOUSE RD

METAC

## Legend

- BCWA Water Main in Vicinity of Project Site
- Parcels
- Parcels with Documented Private Wells

Approximate Well Locations

- RIDEM Well Completion Reports 1972 - Present

(exact well location on parcel is unknown)

*Label indicates depth of well in feet.
All well locations are approximations based upon available data.

ALL DATA ON WELL DEPTH AND PROPERTY IDENTIFICATION WAS OBTAINED FROM PUBLIC RECORD RIDEM WELL COMPLETION REPORTS PROVIDED BY THE RHODE ISLAND DEPARTMENT OF PUBLIC HEALTH. WELL COMPLETION REPORTS WERE RECORDED BEGINNING IN 1972. EXACT LOCATION OF WELLS ON PROPERTIES IS UNKNOWN AND WERE APPROXIMATED TO THE PARCEL CENTER POINT.

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N E S W

# UPPER KICKEMUIT RESERVOIR DAM REMOVAL

WARREN, RI



PROJECT NO.: 14217.05
DATE: DECEMBER, 2020
SCALE: AS NOTED

FIGURE 8

PRIVATE WELL SURVEY

**Photo 1: View of the Lower Kickemuit Dam and adjacent salt marsh facing west toward the dam.**

**Photo 2: View of the tidal Kickemuit River and Child Street culvert facing southwest.**

**Photo 3: View of the Kickemuit river and bordering salt marsh east of the dam, facing north.**

**Photo 4: View of the eastern end of the coastal wetland that is dominated by Common Reed *(Phragmites australis)* facing west from the condominium driveway.**

**Photo 5: View of the fishway structure, manmade shoreline, and Kickemuit River estuary facing east.**

**Photo 6: View of the fishway structure and dam facing north.**

**Photo 7: View of the Lower Kickemuit Reservoir immediately upstream of the dam facing southwest.**

**Photo 8: View of the Lower Kickemuit Reservoir Dam facing southwest during an extreme tide event. Note the tidal flow entering the Lower Reservoir.**

## SECTION 6

Waterbody Classification Amendment Documentation

Department of Health
Three Capitol Hill
Providence, RI 02908-5097
TTY: 711
www.health.ri.gov



7018 1830 0001 1470 2065

July 28, 2020

Pamela Marchand
Bristol County Water Authority
450 Child Street
P.O. Box 447
Warren, RI 02885

To Whom It May Concern:

As requested, this letter is to acknowledge that the Kickimuit is no longer being used as a public water supply by the Bristol County Water Authority. The surface water treatment facility that was associated with this water source is no longer maintained, and the source of water for the Bristol County Water Authority is now Providence Water and the Scituate Reservoir.

Thank you for your time and consideration with respect to this matter.

Sincerely,

June Swallow
Chief – Center for Drinking Water Quality
(401) 222-7787

State of Rhode Island

# 2021 -- H 5059 SUBSTITUTE A

LC000367/SUB A

## STATE OF RHODE ISLAND

**IN GENERAL ASSEMBLY**

**JANUARY SESSION, A.D. 2021**

AN ACT

RELATING TO WATERS AND NAVIGATION -- BRISTOL COUNTY WATER SUPPLY

Introduced By: Representative Jason Knight

Date Introduced: January 22, 2021

Referred To: House Environment and Natural Resources

It is enacted by the General Assembly as follows:

SECTION 1. Section 46-15.5-2 of the General Laws in Chapter 46-15.5 entitled "Bristol County Water Supply" is hereby amended to read as follows:

**46-15.5-2. Legislative declaration.**

Recognizing the importance of protecting, maintaining and utilizing all sources of potable water and recognizing that with the continued demands on the Scituate Reservoir, ~~the existing Bristol County water supplies will remain an important source of water for Bristol County in the future (there being no other logical recipient of this water), it is the intent of the legislature that the existing sources, transmission lines and treatment facilities be maintained and/or upgraded to conform to federal Safe Drinking Water Act standards, 42 U.S.C. § 300f et seq., irrespective of whether ownership and control is maintained by the Bristol County water authority or is turned over to the state water resources board or its successor. Accordingly,~~ this general assembly hereby finds and declares that:

(1) The citizens of Bristol County lack an adequate and secure supply of potable water;

(2) Heretofore acting through the Bristol County water authority, the citizens of Bristol County have presented a proposal for the construction to bring water from the Scituate Reservoir to Bristol County;

(3) The state and its citizens would be better served and the environment enhanced by the construction of an additional connection connecting Bristol County to the Scituate Reservoir; ~~and~~

(4) The need for water in Bristol County is critical and requires immediate and prompt

action on the part of the state, its agencies, boards and commissions~~.~~ ;

(5) ~~Bristol County will require an alternate source of supply in order to construct the improvements to its existing system of reservoirs, wells, and treatment plants.~~

(6) The alternatives authorized by this chapter will be less expensive than the East Providence connection, so-called~~,~~ ; and

(7) Reliance by citizens of East Providence and Bristol County on a single connection would create a hazard to the health, safety and welfare of the citizens of East Providence and Bristol County, and, therefore, the construction of an emergency connection which shall permit water to flow in either direction is a public necessity.

~~(8) The state is mandated to upgrade the current Bristol County water system of reservoirs, wells, treatment plant, and transmission lines, with the first priority being given to the construction of a new raw water transmission line.~~

SECTION 2. This act shall take effect upon passage.

LC000367/SUB A

EXPLANATION

BY THE LEGISLATIVE COUNCIL

OF

A N  A C T

RELATING TO WATERS AND NAVIGATION -- BRISTOL COUNTY WATER SUPPLY

***

This act would repeal Bristol county water supply's obligation to upgrade its transmission lines, treatment facilities and or upgrade them to conform to the Safe Drinking Water Act standards set forth by federal law and would repeal the state's obligation to upgrade the water system of reservoirs, wells, treatment plant and transmission lines for the Bristol county water supply.

This act would take effect upon passage.

LC000367/SUB A

# 2021 -- H 5060

LC000416

# STATE OF RHODE ISLAND

**IN GENERAL ASSEMBLY**

**JANUARY SESSION, A.D. 2021**

---

AN ACT

RELATING TO WATERS AND NAVIGATION -- BRISTOL COUNTY WATER SUPPLY

Introduced By: Representative Jason Knight

Date Introduced: January 22, 2021

Referred To: House Environment and Natural Resources

It is enacted by the General Assembly as follows:

SECTION 1. Section 46-15.5-6 of the General Laws in Chapter 46-15.5 entitled "Bristol County Water Supply" is hereby repealed.

~~46-15.5-6. Existing facilities of the Bristol County water authority.~~

~~(a) The Bristol County water authority will continue to maintain its reservoirs, wells and well sites, transmission lines and water treatment plants in good, sound and safe condition in accordance with its past practices. The Bristol County water authority shall continue to take all steps necessary to protect its legal right to withdraw water from its existing reservoirs, wells and well sites, and shall protect the watershed surrounding said reservoirs to the extent it has legal authority to do so and shall maintain its transmission lines from its existing reservoirs, wells, well sites and water treatment facilities; provided, however, that if in order to protect its legal authority to withdraw water from the existing reservoirs, the Bristol County water authority shall be required to maintain all or part of its facilities in accordance with federal Safe Drinking Water Act standards, 42 U.S.C. § 300f et seq., the capital cost thereof shall be paid for by the state water resources board.~~

~~(b) The Bristol County water authority in co-operation with the water resources board shall prepare a plan to protect, enhance and improve its existing reservoirs, wells, well sites, transmission lines and treatment plants. Upon approval of such plan, the authority shall cause to be prepared definitive construction plans and drawings and shall apply for and prosecute to completion all federal, state and local permits necessary to permit such construction to be lawfully undertaken; provided, however, if at any time, the Bristol County water authority shall have satisfied the~~

~~limitation on its financial commitment as set forth in § 46-15.5-6.1, then it shall no longer be required to undertake such planning, design and permitting unless the water resources board shall lawfully provide one hundred percent (100%) of the cost thereof.~~

~~(c) Upon completion of the construction authorized by such plan, the Bristol County water authority shall utilize the existing system as so improved in the overall management of its water supply and distribution system in compliance with its water supply management plan approved pursuant to chapter 15.4 of this title. If, after all permits for such improvements and enhancements have been received the water resources board shall determine to purchase such existing reservoirs, wells, well sites, transmission lines, and distribution of water treatment facilities, the Bristol County water authority is authorized to sell or lease any one or more of such reservoirs, wells, well sites, transmission lines, or treatment facilities to the board pursuant to the provision of § 46-15.1-7 and the board is authorized to the extent not otherwise permitted by law to acquire such facilities and improve such facilities under the provisions of chapter 15.3 of this title except as specifically provided for in this section. From and after the date of the activation of the additional and emergency connection, the Bristol County water authority shall have no further obligation to expend funds for improvements to its reservoirs, pipelines connecting any one or more of such reservoirs and water treatment facilities unless and to the extent that such funds shall be provided by the water resources board pursuant to existing provisions of the general laws or such provisions as may be hereinafter enacted.~~

~~(d) The state water resources board shall provide funding necessary to maintain the reservoirs, wells and well sites and pipelines connecting any one or more of such reservoirs, wells and well sites, and water treatment facilities of the Bristol County water authority system so as to meet all federal standards related to safe drinking water. Notwithstanding any other provision of law, any amounts so expended by the state water resources board shall be deemed eligible expenditures within the meaning of § 46-15.3-4(4).~~

SECTION 2. This act shall take effect upon passage.

LC000416

EXPLANATION

BY THE LEGISLATIVE COUNCIL

OF

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RELATING TO WATERS AND NAVIGATION -- BRISTOL COUNTY WATER SUPPLY

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This act would repeal the provisions of the general laws which requires the Bristol County water authority to continue to maintain its reservoirs, wells and well sites, transmission lines and water treatment plants in good, sound and safe condition in accordance with its past practices, and to prepare a plan to protect, enhance and improve its existing reservoirs, wells, well sites, transmission lines and treatment plants within its jurisdiction.

This act would take effect upon passage.

LC000416

# SECTION 12

Restoration Monitoring Plan

**Pre and Post-Dam Removal Monitoring Plan for**
**Upper and Lower Kickemuit Reservoir Dams**

Bristol County Water Authority (BCWA) and Save The Bay will conduct monitoring of conditions pre and post removal of the Upper and Lower Kickemuit Reservoir Dams on the Kickemuit River in Warren, RI. The proposed Monitoring Plan will document the re-establishment of a more natural tidal flow regime, water surface elevation changes, restoration of estuarine vegetation, changes in salinity levels, and water quality responses. Results from the Monitoring Plan will help evaluate the attainment of restoration goals. The goals of this project are to restore connectivity to the Kickemuit River watershed to the estuary, increase community and ecological resiliency to climate change including sea level rise and increased precipitation events, reduce flooding of low lying infrastructure, and improve water quality.

This Monitoring Plan follows NFWF's National Coastal Resilience Fund's monitoring metrics and the NOAA Restoration Center's Tier I Monitoring metrics and reporting requirements.

BCWA has filled out the templates for both the salt marsh restoration and the flood plain restoration metrics since the project is a dam removal at head of tide and will restore both salt marsh and floodplains.

**Monitoring approaches for Marsh Restoration and/or Living Shorelines**

| Salt Marsh Restoration | | | | | |
|---|---|---|---|---|---|
| **Metric (include units)** | **Difference to Recommended Methods and Protocols (if any)** | **Spatial extent of metric monitoring** | **Baseline yr** | **Frequency/ Timing** | **Data Limitations/ Considerations** |
| Percent Cover of biomass by species or cover type (% ranging from 0-100) | Use point intercept method from Roman methodology to determine percent cover in the 1 meter quadrant versus a visual estimate (Roman, 2002) | At each quadrant | 2022 | Annually at height of growing season in August to September pre restoration and 3 years post restoration | N/A |
| Elevation (cm) | No difference | At each quadrant | 2022 | Annually | N/A |
| Shoreline Position | No difference | Shoreline quadrants along each transect | 2022 | Annually | N/A |

| | | | | | |
|---|---|---|---|---|---|
| Water level | No difference | Upstream and downstream of the lower impoundment, upstream of the upper impoundment and in the estuary | 2021 | Monitor at 15-minute intervals for one lunar cycle pre and post dam removal | N/A |

**Monitoring approaches for Floodplain restoration**

| Floodplain Restoration | | | | | |
|---|---|---|---|---|---|
| Metric (include units) | Difference to Recommended Methods and Protocols (if any) | Spatial extent of metric monitoring | Baseline yr | Frequency/ Timing | Data Limitations/ Considerations |
| Percent Cover of biomass by species or cover type (% ranging from 0-100) | Use point intercept method from Roman methodology to determine percent cover in the 1 meter quadrant versus visual estimate (Roman, 2002) | At each quadrant | 2022 | Once pre restoration and 3 years post restoration at height of growing season (Aug-Sept) | N/A |
| Elevation (cm) | No difference | At each quadrant | 2022 | Pre and post dam removal at time of vegetation monitoring | N/A |
| Water level | No difference | Upstream of Upper Kickemuit Dam, upstream of Lower Kickemuit Dam, downstream of lower dam in estuary | 2021 | Monitor at 15 minute intervals for one lunar cycle pre and post dam removal | N/A |
| Water Quality | N/A | Upstream of Upper Kickemuit Dam, upstream of Lower Kickemuit Dam, downstream of lower dam in estuary | 2020 | Every two weeks from May through October | Monitoring of dissolved oxygen, salinity, temperature, fecal coliform, chlorophyll, total phosphorus and total nitrogen |

*Duration of Monitoring*

Pre dam removal monitoring began in 2020 through the collection of water quality monitoring data. Water level data is being collected in 2021. Pre restoration monitoring for the other parameters will begin in 2022. Post dam removal monitoring is proposed to extend for three (3) growing seasons after removal of the dam is complete. The monitoring will be conducted by BCWA and Save The Bay staff and qualified technicians selected by BCWA.

*Monitoring Metrics*

Monitoring will be conducted during the height of the growing season from August to September to monitor vegetation communities and hydrologic conditions of the restored Kickemuit River estuary. The proposed monitoring program will require a minimum of three cross-section monitoring transects be established across the site. Transects will be located in the Upper Kickemuit Reservoir, Lower Kickemuit Reservoir, and the Kickemuit River estuary downstream of the lower dam and at least 25 quadrants will be established along the transects. The proposed locations will document changes to the impoundments as well as any effects on the downstream estuary. Monitoring parameters will be evaluated through the following metrics:

- inventory of plant community using the point intercept method (Roman, 2002) at each 1 meter square quadrant
- elevation of each quadrant using an RTK unit that is tied to established bench marks
- photo stations
- water surface elevation using water level loggers upstream of the upper and lower dam and in the estuary
- water quality monitoring upstream of the upper and lower dam and in the estuary including salinity, chlorophyll, dissolved oxygen, temperature, fecal coliform, total phosphorus, total nitrogen, and water clarity (secchi disk) through the University of Rhode Island's Watershed Watch program.

*Analysis and Reporting*

A Monitoring Report will be prepared at the end of the post restoration monitoring period and provided to NFWF, project partners and the community and the appropriate regulatory agencies. Reports will include analysis of the pre and post removal conditions identified in the monitoring metrics. Analysis will include comparison of water surface elevations, changes in elevations, changes to the vegetation community, and changes in water quality. Photo documents, data forms, figures, and graphs will be included as necessary in the reports to document changes to the impoundments.

The report will document whether goals of the restoration area are being met, and any adaptive management recommendations, such as invasive species removal, that need to be implemented.

**References:**

Roman, CT, MJ James-Pirri, and JF Heltshe. 2002. Monitoring Salt Marsh Vegetation. Technical Report, USGS Patuxent Wildlife Research Center, Coastal Research Field Station, Narragansett, RI. 46 pp.