



June 11, 2021

Via Electronic Filing

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20426

**Subject: Ripogenus Hydroelectric Project (FERC No. 2572)
 Penobscot Mills Hydroelectric Project (FERC No. 2458)
 Notices of Intent to File License Application
 and Pre-Application Document**

Dear Secretary Bose:

Great Lakes Hydro America, LLC (GLHA), a subsidiary of Brookfield Renewable and Licensee of the Ripogenus Hydroelectric Project (FERC No. 2572) and Penobscot Mills Hydroelectric Project (FERC No. 2458) (collectively referred to as the “Projects”), herein files with the Federal Energy Regulatory Commission (FERC or Commission) Notices of Intent (NOIs) and a Pre-Application Document (PAD) for the relicensing of the Projects. The Projects are located on the West Branch of the Penobscot River and Millinocket Stream in Piscataquis and Penobscot Counties, Maine.

Each Project’s current FERC license was issued on October 22, 1996 and expires on September 30, 2026. Accordingly, GLHA is pursuing two separate new licenses for the continued operation of the Projects through the Commission’s Integrated Licensing Process (ILP).

The enclosed PAD consists of two volumes. Volume I of the PAD contains public information, and Volume II of the PAD contains single-line diagrams and detailed drawings of Project works, which are considered Controlled Unclassified Information (CUI)/Critical Energy Infrastructure Information (CEII). Pursuant to 18 Code of Federal Regulations (CFR) §388.113, GLHA requests that the Commission consider this non-public information.

Concurrent with this filing and in accordance with 18 CFR §5.5(c), GLHA is providing a copy of this letter to all parties listed in the attached distribution list. Parties with interest in the upcoming relicensing can download an electronic copy of the NOIs and PAD from FERC’s eLibrary system at <https://www.ferc.gov/docs-filing/elibrary.asp> by conducting a search using the docket numbers p-2458 and/or p-2572. In accordance with 18 CFR §5.2, a copy of the NOIs and PAD is also available for review by appointment at GLHA’s offices at 1024 Central Street, Millinocket, ME 04462. Given the restrictions associated with the ongoing COVID-19 pandemic, GLHA is

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not providing paper copies of the NOIs or PAD to Commission Staff in the Office of Energy Projects or Office of General Counsel – Energy Projects.

In accordance with 18 CFR 5.5(e), GLHA is requesting designation as the Commission's non-federal representative for the purpose of consultation under Section 7 of the Endangered Species Act and the joint agency regulations thereunder at 50 CFR 402. GLHA also requests that FERC authorize GLHA to initiate consultation under Section 106 of the National Historic Preservation Act and the implementing regulations at 36 CFR 800.2(c)(4).

If you have any questions regarding the NOIs or PAD, please contact me by phone at (207) 775-5605 or by email at randy.dorman@brookfieldrenewable.com.

Sincerely,

A handwritten signature in blue ink, appearing to read "RD", with a horizontal line extending to the right.

Randall Dorman
Licensing Manager
Brookfield Renewable

Attachment: NOIs and PAD for the Ripogenus and Penobscot Mills Hydroelectric Projects

cc: Distribution List

Ripogenus Hydroelectric Project (FERC No. 2572)
Penobscot Mills Hydroelectric Project (FERC No. 2458)
Pre-Application Document
Distribution List

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Ripogenus Hydroelectric Project (FERC No. 2572)
Penobscot Mills Hydroelectric Project (FERC No. 2458)
Pre-Application Document
Distribution List

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Ripogenus Hydroelectric Project (FERC No. 2572)
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Ripogenus Hydroelectric Project (FERC No. 2572)
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Ripogenus Hydroelectric Project (FERC No. 2572)
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**BEFORE THE
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION**

**NOTICE OF INTENT TO FILE APPLICATION FOR A NEW LICENSE
RIPOGENUS HYDROELECTRIC PROJECT
FERC PROJECT NO. 2572**

Great Lakes Hydro America, LLC

June 11, 2021

Pursuant to 18 Code of Federal Regulations (CFR) §5.5 of the Federal Energy Regulatory Commission's (FERC or Commission) regulations, Great Lakes Hydro America, LLC (GLHA or Licensee), a wholly owned subsidiary of Brookfield Renewable (Brookfield), hereby gives notice and declares its intent to apply for a new license for the Ripogenus Hydroelectric Project (FERC Project No. 2572) (Project).

Pursuant to 18 CFR §5.5(b), GLHA provides the following information:

(1) Licensee's Name and Address:

Great Lakes Hydro America, LLC
1024 Central Street
Millinocket, ME 04462

(2) FERC Project Number:

FERC Project No. 2572

(3) License Expiration Date:

September 30, 2026

(4) Statement of Intent to File Application for New License:

GLHA hereby unequivocally declares its intent to file an Application for a New License for the Ripogenus Hydroelectric Project on or before September 30, 2024.

The application will be for a power license. GLHA will utilize the Commission's Integrated Licensing Process in support of this relicensing.

(5) Principal Works of the Ripogenus Hydroelectric Project:

The principal features of the Ripogenus Project include: 1) a 795-foot-long concrete gravity dam; 2) a 3,850-foot-long tunnel; 3) a powerhouse, known as McKay Station, containing three turbine-generator units; 4) a 20.8 mile-long impoundment having a normal full pond elevation of 941.59 feet with surface area of 29,270 acres as well as Umbazooksus Lake with a surface area of 1,600 acres; 5) a 29.4-mile-long transmission line; and 6) a utility-scale battery energy storage site sized at a capacity of 10 MW for up to 2 hours.

(6) Project Location:

The Ripogenus Hydroelectric Project is located on the West Branch of the Penobscot River in Piscataquis and Penobscot Counties, Maine.

(7) Plant Installed Capacity:

The Project's authorized installed capacity is 37.5 megawatts.

(8)(i) The names and mailing addresses of every county in which any part of the project is located and in which any federal facility that is used by the project is located are:

Piscataquis County
Board of County Commissioners
163 E. Main Street
Dover-Foxcroft, ME 04426

Penobscot County
Board of County Commissioners
97 Hammond Street
Bangor, ME 04401-4913

There are no federal lands or facilities associated with the Project.

(8)(ii)(A) The names and mailing addresses of every city, town, or similar political subdivision in which any part of the project is or is to be located and any federal facility that is or is to be used by the project is located:

Name	Mailing Address
Chesuncook Township Rainbow Township Township 2 Range 12 WELS Township 3 Range 11 WELS Township 3 Range 12 WELS Township 3 Range 13 WELS Township 4 Range 12 WELS Township 4 Range 13 WELS Township 4 Range 14 WELS Township 5 Range 12 WELS Township 5 Range 14 WELS Township 6 Range 12 WELS Township 6 Range 13 WELS Township 6 Range 14 WELS	c/o Maine Land Use Planning Commission Moosehead Region PO Box 1107 Greenville, Maine 04441-1107
Indian Purchase Township 3 Township 1 Range 8 WELS Township 1 Range 9 WELS Township 2 Range 9 WELS Township 2 Range 10 WELS	c/o Maine Land Use Planning Commission Eastern Region 191 Main Street East Millinocket, Maine 04430
Town of Millinocket	197 Penobscot Avenue Millinocket, Maine 04462

There are no federal lands or facilities associated with the Project.

(8)(ii)(B) The names and mailing addresses of every city, town, or similar political subdivision that has a population of 5,000 or more people and is located within 15 miles of the Project dam:

There are no cities, towns, or similar political subdivisions that have a population of 5,000 or more people within 15 miles of the Project dam.

- (8)(iii) The names and mailing addresses of every irrigation district, drainage district, or similar special purpose political subdivision (A) in which any part of the project is located, and any federal facility that is or is proposed to be used by the project is located, or (B) that owns, operates, maintains, or uses any project facility or any federal facility that is or is proposed to be used by the project:**

There are no irrigation or drainage districts or similar special purpose political subdivisions associated with or in the general area of the Project. There are no federal lands or facilities associated with the Project.

- 8(iv) The names and mailing addresses of every other political subdivision in the general area of the project that there is reason to believe would likely be interested in or affected by the notification:**

There are no other political districts or subdivisions that are likely to be interested in or affected by the notification.

- 8(v) The names and mailing addresses of affected Native American Tribes:**

The Project includes no tribal land. No affected Native American Tribes have been identified to date. Per 18 CFR §5.7, FERC will hold an initial tribal consultation meeting no later than 30 days of filing of the Notice of Intent (NOI) and Pre-Application Document (PAD). The following is a listing of federally-recognized Native American Tribes within the state of Maine:

Aroostook Band of Micmacs
Educational Center
7 Northern Road
Presque Isle, ME 04769

Passamaquoddy Tribe
Indian Township
PO Box 301
Princeton, ME 04668

Houlton Band of Maliseet Indians
88 Bell Road
Littleton, ME 04730

Passamaquoddy Tribe
Pleasant Point
PO Box 343
Perry, ME 04667

Penobscot Indian Nation
12 Wabanaki Way
Indian Island, ME 04468

Distribution

In accordance with 18 CFR Section 5.5, GLHA is distributing this NOI to appropriate Federal, state, and interstate agencies, Native American Tribes, local governments, and members of the public likely to be interested in the proceeding. A complete listing of agencies, Tribes, local governments, non-governmental organizations, and individuals that are receiving this NOI is provided with the June 11, 2021 transmittal letter for this NOI. The information required to be made available to the public pursuant to 18 CFR Section 16.7 is located at the offices of Brookfield Renewable at 150 Main Street, Lewiston, Maine 04240 and 1024 Central Street, Millinocket, Maine 04462.

All correspondence and service of documents relating to this NOI and subsequent proceedings should be addressed to:

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Licensing Manager
Brookfield Renewable
150 Main Street
Lewiston, Maine 04240
Phone: 207-755-5605
E-Mail: Randy.Dorman@BrookfieldRenewable.com

Non-Federal Representative

In accordance with 18 CFR 5.5(e), GLHA is requesting designation as the Commission's non-federal representative for the purpose of consultation under Section 7 of the Endangered Species Act and the joint agency regulations thereunder at 50 CFR 402. GLHA also requests that FERC authorize it to initiate consultation under Section 106 of the National Historic Preservation Act and the implementing regulations at 36 CFR 800.2(c)(4).

SUBSCRIPTION

This Notice of Intent to File an Application for New License for the Ripogenus Hydroelectric Project, FERC No. 2572, is executed in the State of New York, County of Warren, by Thomas Uncher, Vice President, Great Lakes Hydro America, LLC, 399 Big Bay Road, Queensbury, NY 12804, who, being duly sworn, deposes and says that the contents of this Notice of Intent are true to the best of his knowledge or belief and that he is authorized to execute this document on behalf of Great Lakes Hydro America, LLC. The undersigned has signed this Notice of Intent this ____ day of June 2021.

GREAT LAKES HYDRO AMERICA, LLC

By 

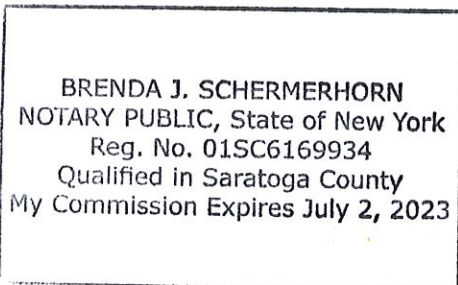
Thomas Uncher
Vice President

VERIFICATION

Subscribed and sworn to before me, a Notary Public of the State of New York this 8th day of June 2021.


(Notary Public)

(My Commission Expires July 2, 2023)/seal



**BEFORE THE
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION**

**NOTICE OF INTENT TO FILE APPLICATION FOR A NEW LICENSE
PENOBSCOT MILLS HYDROELECTRIC PROJECT
FERC PROJECT NO. 2458**

Great Lakes Hydro America, LLC

June 11, 2021

Pursuant to 18 Code of Federal Regulations (CFR) §5.5 of the Federal Energy Regulatory Commission's (FERC or Commission) regulations, Great Lakes Hydro America, LLC (GLHA or Licensee), a wholly owned subsidiary of Brookfield Renewable (Brookfield), hereby gives notice and declares its intent to apply for a new license for the Penobscot Mills Hydroelectric Project (FERC Project No. 2458) (Project).

Pursuant to 18 CFR §5.5(b), GLHA provides the following information:

(1) Licensee's Name and Address:

Great Lakes Hydro America, LLC
1024 Central Street
Millinocket, ME 04462

(2) FERC Project Number:

FERC Project No. 2458

(3) License Expiration Date:

September 30, 2026

(4) Statement of Intent to File Application for New License:

GLHA hereby unequivocally declares its intent to file an Application for a New License for the Penobscot Mills Hydroelectric Project on or before September 30,

2024. The application will be for a power license. GLHA will utilize the Commission's Integrated Licensing Process in support of this relicensing.

(5) Principal Works of the Penobscot Mills Hydroelectric Project:

The Penobscot Mills Hydroelectric Project (FERC No. 2458) consists of five developments: Millinocket Lake Storage, North Twin, Millinocket, Dolby, and East Millinocket.

The principal works of the Millinocket Lake Storage Development include: 1) an impoundment having a normal full pond elevation of 480.0 feet with a surface area of 8,640 acres; 2) a concrete and earth-filled dam, measuring approximately 635 feet in length, located at the outlet of Millinocket Lake; and 3) a pumping station containing two pumps, located approximately 6.2 miles from the dam, two 4-foot-6-inch diameter steel pipes measuring approximately 544 feet in length, and a concrete outlet structure discharging to Ambajejus Lake (within the North Twin impoundment). No hydroelectric generating facilities are located at this development.

The principal works of the North Twin Development include: 1) an impoundment having a normal full pond elevation of 491.92 feet with a surface area of 17,790 acres; 2) a concrete and earth-filled dam measuring approximately 1,051 feet in length, including an intake structure and powerhouse containing three turbine-generator units and appurtenant equipment; 3) a series of six earthen dikes having a combined length of 2,530 feet, located upstream of the dam; 4) a 60 Hz substation containing six transformers; and 5) a transmission line approximately 4.2 miles in length that extends to the last transmission pole structure before entering GLHA's Millinocket Substation #4.

The principal works of the Millinocket Development include: 1) an impoundment having a normal full pond elevation of 458.7 feet with a surface area of 1,344 acres; 2) a concrete dam ("Stone Dam") measuring approximately 1,262 feet in length; 3) a gatehouse located at the dam, containing ten gates and a sluiceway; 4) three earthen dikes in Quakish Lake with a total length of 1,854 feet; 5) five earthen dikes in

Ferguson Pond with a total length of 3,195 feet, a "western" canal leading from the gatehouse to Ferguson Pond, and an "eastern" canal that leads from Ferguson Pond to the intake structure, all of which are used to convey water from the gatehouse at Stone Dam to the intake structure located approximately 7,300 feet from Stone Dam; 6) an intake structure containing seven headgates, located at the entrance of the penstocks; 7) six 10-foot-diameter steel penstocks and one 11-foot-diameter steel penstock ranging in length from 1,007 feet to 1,024 feet; 8) a powerhouse containing seven operable turbine-generator units, of which five are located within the former Grinder Room and two in the Generator Room; 9) two transformers, one having a rated capacity of 30/40/50 MVA and one at 24/34/40 MVA; and 10) two 60 Hz transmission lines approximately 300 feet in length (one 6.9 kV and one 13.8 kV).

The principal works of the Dolby Development include: 1) an impoundment having a normal full pond elevation of 336.2 feet with a surface area of 2,048 acres; 2) a concrete and earth-filled dam measuring approximately 1,395 feet in length, including an intake structure and powerhouse integral with the dam containing four operable turbine-generator units and other appurtenant equipment; 3) a 60 Hz substation containing one transformer having a rated capacity of 15/20 MVA and a second transformer with a rated capacity of 5 MVA; and (4) a transmission line extending approximately 2 miles to the last transmission pole structure before entering GLHA's Powersville Substation.

The principal works of the East Millinocket Development include: 1) an impoundment having a normal full pond elevation of 287.2 feet with a surface area of 128 acres, 2) a concrete and earth-filled dam measuring approximately 717 feet, 6 inches long, including an intake structure and powerhouse containing six turbine-generator units, and 3) a tailrace measuring approximately 1,050 feet long.

The Project also contains two utility-scale battery energy storage sites each sized at a capacity of 10 MW for up to 2 hours (or combined capacity of 20 MW for 2-hour duration) and are located at the Millinocket Substation #4 and Powersville Substation.

(6) Project Location:

The Penobscot Mills Hydroelectric Project is located on the West Branch of the Penobscot River and Millinocket Stream in Piscataquis and Penobscot Counties, Maine.

(7) Plant Installed Capacity:

The Project's authorized installed capacity is 67.9 megawatts.

(8)(i) The names and mailing addresses of every county in which any part of the project is located and in which any federal facility that is used by the project is located are:

Piscataquis County
Board of County Commissioners
163 E. Main Street
Dover-Foxcroft, ME 04426

Penobscot County
Board of County Commissioners
97 Hammond Street
Bangor, ME 04401-4913

There are no federal lands or facilities associated with the Project.

- (8)(ii)(A) The names and mailing addresses of every city, town, or similar political subdivision in which any part of the project is or is to be located and any federal facility that is or is to be used by the project is located:**

Name	Mailing Address
Grindstone Township Hopkins Academy Grant Township Indian Purchase Township 3 Indian Purchase Township 4 Township A Range 7 WELS Township 1 Range 8 WELS Township 1 Range 9 WELS Township 1 Range 10 WELS Township 2 Range 8 WELS Township 2 Range 9 WELS	c/o Maine Land Use Planning Commission Eastern Region 191 Main Street East Millinocket, Maine 04430
Town of East Millinocket	53 Main Street East Millinocket, Maine 04430
Town of Millinocket	197 Penobscot Avenue Millinocket, Maine 04462

There are no federal lands or facilities associated with the Project.

- (8)(ii)(B) The names and mailing addresses of every city, town, or similar political subdivision that has a population of 5,000 or more people and is located within 15 miles of the Project dam:**

Town of Lincoln
29 Main Street
Lincoln, Maine 04457

- (8)(iii) The names and mailing addresses of every irrigation district, drainage district, or similar special purpose political subdivision (A) in which any part of the project is located, and any federal facility that is or is proposed to be used by the project is located, or (B) that owns, operates, maintains, or uses any project facility or any federal facility that is or is proposed to be used by the project:**

There are no irrigation or drainage districts or similar special purpose political subdivisions associated with or in the general area of the Project. There are no federal lands or facilities associated with the Project.

8(iv) The names and mailing addresses of every other political subdivision in the general area of the project that there is reason to believe would likely be interested in or affected by the notification:

There are no other political districts or subdivisions that are likely to be interested in or affected by the notification.

8(v) The names and mailing addresses of affected Native American Tribes:

The Project includes no tribal land. No affected Native American Tribes have been identified to date. Per 18 CFR §5.7, FERC will hold an initial tribal consultation meeting within 30 days of filing of the Notice of Intent (NOI) and Pre-Application Document (PAD). The following is a list of federally-recognized Native American Tribes within the state of Maine:

Aroostook Band of Micmacs
Educational Center
7 Northern Road
Presque Isle, ME 04769

Passamaquoddy Tribe
Indian Township
PO Box 301
Princeton, ME 04668

Houlton Band of Maliseet Indians
88 Bell Road
Littleton, ME 04730

Passamaquoddy Tribe
Pleasant Point
PO Box 343
Perry, ME 04667

Penobscot Indian Nation
12 Wabanaki Way
Indian Island, ME 04468

Distribution

In accordance with 18 CFR Section 5.5, GLHA is distributing this NOI to appropriate Federal, state, and interstate agencies, Native American Tribes, local governments, and members of the public likely to be interested in the proceeding. A complete listing of agencies, Tribes, local governments, non-governmental organizations, and individuals which are receiving this NOI is provided with the June 11, 2021 transmittal letter for this NOI. The information required to be made available to the public pursuant to 18 CFR Section 16.7 is located at the offices of Brookfield

Renewable at 150 Main Street, Lewiston, Maine 04240 and 1024 Central Street, Millinocket, Maine 04462.

All correspondence and service of documents relating to this NOI and subsequent proceedings should be addressed to:

Randall Dorman
Licensing Manager
Brookfield Renewable
150 Main Street
Lewiston, Maine 04240
Phone: 207-755-5605
E-Mail: Randy.Dorman@BrookfieldRenewable.com

Non-Federal Representative

In accordance with 18 CFR 5.5(e), GLHA is requesting designation as the Commission's non-federal representative for the purpose of consultation under Section 7 of the Endangered Species Act and the joint agency regulations thereunder at 50 CFR 402. GLHA also requests that FERC authorize it to initiate consultation under Section 106 of the National Historic Preservation Act and the implementing regulations at 36 CFR 800.2(c)(4).

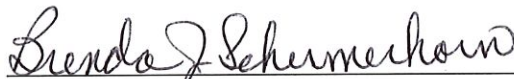
SUBSCRIPTION

This Notice of Intent to File an Application for New License for the Penobscot Mills Hydroelectric Project, FERC No. 2458, is executed in the State of New York, County of Warren, by Thomas Uncher, Vice President, Great Lakes Hydro America, LLC, 399 Big Bay Road, Queensbury, NY 12804, who, being duly sworn, deposes and says that the contents of this Notice of Intent are true to the best of his knowledge or belief and that he is authorized to execute this document on behalf of Great Lakes Hydro America, LLC. The undersigned has signed this Notice of Intent this ____ day of June 2021.

GREAT LAKES HYDRO AMERICA, LLC

By Tom Uncher
Vice President**VERIFICATION**

Subscribed and sworn to before me, a Notary Public of the State of New York this 8th day of June 2021.


(Notary Public)

(My Commission Expires July 2, 2023)/seal

BRENDA J. SCHERMERHORN
NOTARY PUBLIC, State of New York
Reg. No. 01SC6169934
Qualified in Saratoga County
My Commission Expires July 2, 2023

PRE-APPLICATION DOCUMENT
VOLUME I OF II
PART 1 OF 2
RIPOGENUS HYDROELECTRIC PROJECT (FERC NO. 2572)
PENOBSCOT MILLS HYDROELECTRIC PROJECT (FERC NO. 2458)



GREAT LAKES HYDRO AMERICA, LLC
Millinocket, Maine

JUNE 11, 2021

**PRE-APPLICATION DOCUMENT
RIPOGENUS HYDROELECTRIC PROJECT (FERC NO. 2572)
PENOBSCOT MILLS HYDROELECTRIC PROJECT (FERC NO. 2458)**

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PRE-APPLICATION DOCUMENT
RIPOGENUS HYDROELECTRIC PROJECT (FERC NO. 2572)
PENOBSCOT MILLS HYDROELECTRIC PROJECT (FERC NO. 2458)

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Acronym List

µg/L	micrograms per liter
µS/cm	microsiemens per centimeter
ACHP	Advisory Council on Historic Preservation
APE	area of potential effects
BES	battery energy storage
BOD	biological oxygen demand
CEII	Critical Energy Infrastructure Information
CFR	Code of Federal Regulations
cfs	cubic feet per second
CRMP	Cultural Resources Management Plan
CUI	Controlled Unclassified Information
CZMA	Coastal Zone Management Act
DBH	diameter breast height
DLA	Draft License Application
DO	dissolved oxygen
DWA	deer wintering areas
ECPA	Electric Consumers Protection Act of 1986
EFH	essential fish habitat
EIS	Environmental Impact Statement
EMDC	Eastern Maine Development Corporation
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission or Commission
FPA	Federal Power Act
GLHA	Great Lakes Hydro America, LLC
GMCME	Gulf of Maine Council on the Marine Environment
GNP	Great Northern Paper
GOM DPS	Gulf of Maine Distinct Population Segment
GPA	Great Ponds
GPD	gallons per day

Acronym List

HBI	Hilsenhoff Biotic Index
Hp	horsepower
Hz	Hertz
IFIM	Instream Flow Incremental Methodology
ILP	Integrated Licensing Process
IPaC	Information Planning and Consultation
ISONE	Independent System Operator of New England
ISR	Initial Study Report
ITS	Interconnected Trail System
IWWH	Inland Waterflow/Wading Bird Habitats
kV	kilovolt
kVA	kilovolt-ampere
kW	kilowatt
LSM	Lake Stewards of Maine
LUPC	Land Use Planning Commission
MBI	Midwest Biodiversity Institute & Center for Applied Bioassessment and Criteria
MDACF	Maine Department of Agriculture, Conservation and Forestry
MDEP	Maine Department of Environmental Protection
MDIFW	Maine Department of Inland Fisheries and Wildlife
MDMR	Maine Department of Marine Resources
mg/L	milligram per liter
MNAP	Maine Natural Areas Program
MPDES	Maine Pollutant Discharge Elimination System
MRLC	Multi-Resolution Land Characteristics Consortium
MRS	Maine Revised Statutes
MRSA	Maine Revised Statutes Annotated
MSCORP	Maine State Comprehensive Outdoor Recreation Plan
MSHPO	Maine State Historic Preservation Officer
MVA	megavolt-amperes
MW	megawatt

Acronym List

MWh	megawatt hours
NAI	Normandeau Associates, Inc.
NEPA	National Environmental Policy Act
NGOs	non-governmental organizations
NHPA	National Historic Preservation Act
NLCD	National Land Use Cover Dataset
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NOIs	Notices of Intent
NPS	National Park Service
NRCC	Northeast Regional Climate Center
NRCM	Natural Resources Council of Maine
NRHP	National Register of Historic Places
NSBP	National Scenic Byways Program
NSCC	National System Control Center
NTU	nephelometric turbidity units
NWI	National Wetland Inventory
NWQMC	National Water Quality Monitoring Council
NWSRS	National Wild and Scenic River System
°C	degrees Celsius
°F	degrees Fahrenheit
PAD	Pre-Application Document
PCU	platinum-cobalt units
PHABSIM	Physical Habitat Simulation
PIN	Penobscot Indian Nation
PM&E	protection, mitigation and enhancement
PMF	Probable Maximum Flood
POI	point of interconnection
PRC	Penobscot River Corridor
PSP	Proposed Study Plan
PURPA	Public Utility Regulatory Policies Act

Acronym List

RM	river mile
RSP	Revised Study Plan
RTE	rare, threatened, and endangered
SD1	Scoping Document 1
SD2	Scoping Document 2
SHRU	salmon habitat recovery units
SMP	Shoreland Management Plan
SVP	significant vernal pools
TCP	traditional cultural properties
TMDL	Total Maximum Daily Load
TWS	The Wildlife Society
U.S.C.	U.S. Code
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USR	Updated Study Report
WQ	water quality
WUA	weighted useable area
WUP	Water Use Plan
YOY	young of year

Section 1.0

Introduction and Background

1.1 Introduction

Great Lakes Hydro America, LLC (“GLHA” or “Licensee”), a subsidiary of Brookfield Renewable, is the Licensee of the Ripogenus Hydroelectric Project and the Penobscot Mills Hydroelectric Project (hereinafter referred to individually as the “Ripogenus Project” or “Penobscot Mills Project” or collectively as the “Projects”).

On October 22, 1996, the Federal Energy Regulatory Commission (“FERC” or “Commission”) issued new, 30-year licenses for the Projects, which expire on September 30, 2026. In accordance with the Commission’s regulations, GLHA must file its Notices of Intent to File an Application for a New License (NOIs) and Pre-Application Document (PAD) no later than 5 years prior to expiration of the licenses (i.e., by September 30, 2021) and file the Applications for New Licenses no later than 24 months before the existing licenses expires (i.e., by September 30, 2024).

In support of preparing an application for new licenses, GLHA has elected to use the Commission’s default Integrated Licensing Process (ILP) for preparing its relicensing application. The ILP is designed to bring efficiencies to the relicensing process by integrating GLHA’s pre-filing consultation activities with the Commission’s National Environmental Policy Act (NEPA) scoping responsibilities. GLHA believes that the ILP will be the most effective and efficient process for these proceedings.

As noted above, the ILP is formally initiated through GLHA’s filing of the NOIs and this PAD. Accordingly, GLHA has prepared a NOI for each Project and, given the proximity of the two Projects and the common license expiration dates, a single PAD for the Projects. In accordance with 18 Code of Federal Regulations (CFR) §5.5(c), GLHA is distributing notification of these filings to the appropriate federal and state resource agencies, Indian Tribes, local governments, non-governmental organizations (NGOs), and members of the public likely to be interested in the proceeding. A complete list of the parties receiving the notification of the NOIs and this PAD is provided with the June 11, 2021 transmittal letter of the NOIs and PAD.

In accordance with 18 CFR §5.8, the Commission will review the NOIs and PAD and, within 60 days of receipt, the Commission will notice the commencement of the relicensing proceeding, request comments related to the PAD, solicit study requests, and issue Scoping Document 1 (SD1). At the Commission's discretion, a public scoping meeting and site visit will be conducted within 30 days of issuing SD1, or within 90 days of the filing of the NOIs and this PAD. The Commission will provide details regarding the logistics for the Commission's NEPA scoping processing, including the potential meeting and site visit. Section 3 of this PAD provides additional details regarding the relicensing process plan and schedule, as well as participation in the relicensing process.

1.2 Background

The Projects are located on the West Branch of the Penobscot River (West Branch) and Millinocket Stream in Piscataquis and Penobscot Counties, Maine. The following provides a summary of the Project facilities. Section 4 of this PAD provides additional details.

The Ripogenus Project is located on the West Branch in Piscataquis County, Maine, with the approximately 30-mile-long transmission line also extending into Penobscot County, Maine. The principal features of the Ripogenus Project include: 1) a 795-foot-long concrete gravity dam; 2) a 3,850-foot-long tunnel; 3) a powerhouse, known as McKay Station, containing three turbine-generator units with an authorized installed capacity of 37.5 megawatts (MW); 4) a 20.8-mile-long impoundment having a normal full pond elevation of 941.59 feet with a surface area of 29,270 acres and Umbazooksus Lake with a surface area of 1,600 acres; 5) a 29.4-mile-long transmission line; and 6) a battery energy storage system sized at a capacity of 10 MW for up to 2 hours.

The Penobscot Mills Project is located on the West Branch and Millinocket Stream in Piscataquis and Penobscot Counties, Maine, and includes five developments, in descending order from upstream to downstream, Millinocket Lake Storage, North Twin, Millinocket, Dolby, and East Millinocket, with a total authorized installed capacity of 67.9 MW.

The principal works of the Millinocket Lake Storage Development include: 1) an impoundment having a normal full pond elevation of 480.0 feet with a surface area of 8,640 acres; 2) a concrete and earth-filled dam, measuring approximately 635 feet in length, located at the outlet of

Section 1Introduction and Background

Millinocket Lake; and 3) a pumping station containing two pumps, located approximately 6.2 miles from the dam, two 4-foot-6-inch-diameter steel pipes measuring approximately 544 feet in length, and a concrete outlet structure discharging to Ambajejus Lake (within the North Twin impoundment). No hydroelectric generating facilities are located at this development.

The principal works of the North Twin Development include: 1) an impoundment having a normal full pond elevation of 491.92 feet with a surface area of 17,790 acres; 2) a concrete and earth-filled dam measuring approximately 1,051 feet in length, including an intake structure and powerhouse containing three turbine-generator units and appurtenant equipment; 3) a series of six earthen dikes having a combined length of 2,530 feet, located upstream of the dam; 4) a 60 Hertz (Hz) substation containing six transformers; and 5) a transmission line approximately 4.2 miles in length that extends to the last transmission pole structure before entering GLHA's Millinocket Substation #4.

The principal works of the Millinocket Development include: 1) an impoundment having a normal full pond elevation of 458.7 feet with a surface area of 1,344 acres; 2) a concrete dam (Stone Dam) measuring approximately 1,262 feet in length; 3) a gatehouse located at the dam, containing ten gates and a sluiceway; 4) three earthen dikes in Quakish Lake with a total length of 1,854 feet; 5) five earthen dikes in Ferguson Pond with a total length of 3,195 feet, a "western" canal leading from the gatehouse to Ferguson Pond, and an "eastern" canal leading from Ferguson Pond to the intake structure, all of which are used to convey water from the gatehouse at Stone Dam to the intake structure located approximately 7,300 feet from Stone Dam; 6) an intake structure containing seven headgates, located at the entrance of the penstocks; 7) six 10-foot-diameter steel penstocks and one 11-foot-diameter steel penstock ranging in length from 1,007 feet to 1,024 feet; 8) a powerhouse containing seven operable turbine-generator units, of which five are located within the former Grinder Room and two are in the Generator Room; 9) two transformers, one having a rated capacity of 30/40/50 megavolt-amperes (MVA) and one at 24/34/40 MVA; and 10) two 60 Hz transmission lines approximately 300 feet in length (one 6.9 kilovolt [kV] and one 13.8 kV).

The principal works of the Dolby Development include: 1) an impoundment having a normal full pond elevation of 336.2 feet with a surface area of 2,048 acres; 2) a concrete and earth-filled dam measuring approximately 1,395 feet in length, including an intake structure and powerhouse

integral with the dam containing four operable turbine-generator units and other appurtenant equipment; 3) a 60 Hz substation containing one transformer having a rated capacity of 15/20 MVA and a second transformer with a rated capacity of 5 MVA; and (4) a transmission line extending approximately 2 miles to the last transmission pole structure before entering GLHA's Powersville Substation.

The principal works of the East Millinocket Development include: 1) an impoundment having a normal full pond elevation of 287.2 feet with a surface area of 128 acres; 2) a concrete and earth-filled dam measuring approximately 717.5 feet long, including an intake structure and powerhouse integral with the dam containing six turbine-generator units; and 3) a tailrace measuring approximately 1,050 feet long.

The Project also contains two battery energy storage systems each sized at a capacity of 10 MW for up to 2 hours (or combined capacity of 20 MW for 2-hour duration) and are located at the Millinocket Substation #4 and Powersville Substation

1.3 Project Histories

Throughout much of the 19th and 20th centuries, the West Branch was used in the spring and early summer to transport timber harvested during the winter in nearby wooded areas to the mills located downstream. In order to tap the vast potential of the forests surrounding the West Branch and to improve log driving methods, numerous dams were constructed over time on the West Branch and its many tributaries. During the 20th century, a number of hydromechanical, hydroelectric, and water storage facilities throughout the West Branch basin were developed.

The Ripogenus and Penobscot Mills Project developments were originally constructed between the mid-19th century and turn of the 20th century to meet the hydromechanical and hydroelectric demands of the Millinocket and East Millinocket Mills, which were constructed in 1900 and 1906, respectively. The North Twin Development is located at a site that was developed for water storage in 1846. The Millinocket Lake Storage Dam was originally constructed in 1883 to support log driving. These dams provide storage and regulation of flows from the West Branch, as does GLHA's additional storage dams in the Upper West Branch watershed including the Ripogenus Project and Storage Project (FERC No. 2634).

Section 1Introduction and Background

Originally built in the late 19th century, the Ripogenus Dam underwent numerous changes through 1923. In 1923, the dam was modified and the normal full pond elevation of the Ripogenus impoundment was raised four feet to elevation 941.59 feet, which resulted in a surface area of 29,270 acres. Ripogenus Dam has remained essentially unchanged since 1923. In 1953, McKay Station was constructed, utilizing water impounded from the dam for hydroelectric generation.

The Penobscot Mills Project developments were constructed around the turn of the 20th century to meet the hydromechanical and hydroelectric demands of the Millinocket and East Millinocket Mills.

- The original Millinocket Lake Storage dam was built in about 1883, with the existing concrete dam built in 1910 approximately 500 feet downstream of the original timber crib structure, which raised the normal full pond elevation to 480.0 feet with a surface area of 8,640 acres. The pumping station was constructed in 1950.
- The original North Twin Dam was built in 1846 and created the North Twin impoundment with a normal full pond elevation of 483 feet. Since that time, the dam underwent numerous changes until 1903 when a new concrete dam was constructed and increased the normal full pond elevation to 491.92 feet with a surface area of 17,790 acres. In 1935, the powerhouse and fishway were constructed at the North Twin Dam.
- At the Millinocket Development, Stone Dam, which impounds Quakish Lake, was built in 1900 along with the penstocks and Millinocket Mill (including the grinder and generator rooms). In 1921, the original waterwheels were replaced with turbine-generator units.
- The Dolby Development was built in 1907 and created Dolby Pond with a normal full pond elevation of 336.2 feet and a surface area of 2,048 acres.
- The East Millinocket Development was built in 1907.

The Commission issued original licenses for the Ripogenus Project on December 20, 1968, and for the Penobscot Mills Project on October 14, 1968, both of which expired on December 31, 1993. On June 28, 1991, the Commission issued an order amending the licenses to reflect a change in

the Licensee's name from Great Northern Paper Company to Great Northern Nekoosa Corporation. On May 8, 1992, the Commission issued an order transferring the licenses from Great Northern Nekoosa Corporation to Great Northern Paper, Inc. The Projects each operated under annual licenses until the new licenses were issued to Great Northern Paper, Inc. on October 22, 1996. On May 19, 2000, the Commission issued an order transferring the licenses from Great Northern Paper, Inc. to GNE, LLC, and on August 26, 2002, FERC issued an order amending the licenses to reflect a change in the Licensee's name from GNE, LLC to Great Lakes Hydro America, LLC (the current Licensee). Copies of the October 22, 1996 licenses for the Projects, as well as the August 26, 2002 order reflecting the change in Licensee's name, are provided in Appendix A.

1.4 Post-ECPA Relicensings

Over the past 20 years, hydropower owners, Federal and state resource agencies, Indian Tribes, NGOs, and the public have participated in numerous relicensing proceedings throughout the state. Many of these proceedings considered project licenses that had been issued prior to the establishment of contemporary standards for environmental review of hydropower projects. The current licenses for the Ripogenus and Penobscot Mills Projects are different in that they were issued following the passage and implementation of the Electric Consumers Protection Act of 1986 (ECPA) and underwent NEPA analysis through the development of an Environmental Impact Statement (EIS).

The ECPA amended the Federal Power Act (FPA) to require that FERC go beyond consideration of the power and other developmental values of hydroelectric projects in order to give "equal consideration" to non-developmental values, including conserving energy; protecting, mitigating damage to, and enhancing fish and wildlife and related habitat; protecting recreational opportunities; and preserving other features of environmental quality. Consistent with today's relicensing proceedings, the ECPA requires the Commission to balance between developmental and non-development resources and values, which results in the level of studies and protection, mitigation, and enhancement (PM&E) measures common of today's modern relicensing proceedings and resulting licenses. Specifically, with Congress's passage of the ECPA in 1986, the treatment of non-developmental resources and FERC's responsibilities changed through the following four primary modifications to the FPA.

Section 1Introduction and Background

- Section 4(e) – FERC must give equal consideration to developmental and non-developmental (e.g., aquatic and terrestrial resources) values in all licensing decisions.
- Section 10(a) – FERC must consider federal and state resource agency recommendations for ensuring that a project is best adapted to comprehensive plans for developmental and non-developmental resources.
- Section 10(j) – FERC must consider federal and state resource agency recommendations pursuant to the Fish and Wildlife Coordination Act to protect, mitigate damages to, and enhance fish and wildlife resources.
- Section 18 – Authorizes the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) to prescribe upstream and downstream fishway passage requirements.

The modifications to the FPA resulting from Congress's passage of the ECPA have become standard measures considered by all parties in today's relicensing process, as well as the resulting modern licenses under which recently relicensed hydropower projects operate. Prior to the passage of the ECPA, such measures did not influence the Commission's relicensing process or the resulting license articles. As a result of the Commission's increased responsibilities relative to non-developmental resources and values associated with the relicensing proceeding, the ECPA also resulted in increased interaction between FERC, license applicants, federal and state resource agencies, Indian Tribes, NGOs and the public; a greater number and increased scope of studies to evaluate the associated resources; and a higher percentage of resource agencies' recommendations incorporated into new licenses (U.S. General Accounting Office [GAO] 1992).

Unlike other recent and ongoing hydropower relicensings in Maine, the Ripogenus and Penobscot Mills Projects will be two of the first hydropower projects in Maine to undergo a second round of relicensing subject to the FPA as amended by the ECPA. In addition, whereas the Commission typically prepares an Environmental Assessment to support the issuance of a new license, in support of issuing the existing Ripogenus and Penobscot Mills Project licenses, the Commission prepared an EIS and performed the additional level of environmental evaluation and consultation associated with this increased level of analysis. The Ripogenus and Penobscot Mills Projects are

the only hydropower projects in Maine with existing licenses subject to both the ECPA and EIS analysis. This level of evaluation is reflective in the level of study and consultation performed in support of the Projects' existing licenses, as well as the PM&E measures and subsequent monitoring activities required by the existing licenses.

The previous relicensing of the Projects was a massive undertaking that exhaustively studied and modified many aspects of the Projects' original licenses. Additionally, subsequent to the issuance of the licenses in 1996, significant additional monitoring occurred at both Projects to evaluate the success of the measures required by the licenses.

As a result, the Projects operate under an array of highly beneficial and effective PM&E measures that enhance aquatic and terrestrial habitats throughout the Project areas, while serving as a critical component for the seasonal management of water flows throughout the Penobscot River Basin. These PM&E measures comprehensively address resource interests specific to the Project areas, as well as the larger river basin. These interests include water quality; management and balancing of flows within and downstream of the West Branch; aquatic and terrestrial resources; whitewater and recreational opportunities; cultural resources; and land management.

Additionally, these PM&E measures are founded on and backed by sound science and detailed studies as documented within each Project's License Application, EIS, Water Quality Certification, FERC license, and subsequent monitoring. The existing licenses advance the public benefit of renewable energy from the Projects, while simultaneously advancing the public benefit of the environmental health of the West Branch and mainstem of the Penobscot River. Examples of the PM&E measures that resulted from the previous relicensing include:

Ripogenus Project

- Operation of the Project in store-and-release mode for flood mitigation and to maintain required downstream flows during low inflow periods.
- Flows into the bypassed reach (Upper Gorge) for increased angling opportunities.
- Flows into the West Branch downstream of McKay Station for enhanced landlocked salmon habitat and fishery as well as daily opportunities for whitewater rafting from May through September.

Section 1Introduction and Background

- Flows into the Holbrook Side Channel for enhanced landlocked salmon spawning and nursery habitat, which was determined effective based on five years of post-license monitoring performed in consultation with the resource agencies.
- Modifications at Umbazooksus Lake for wetlands enhancement, which was determined effective based on post-license monitoring (4 events in 1998, 2000, 2002, and 2004) performed in consultation with the resource agencies.
- Deployment of artificial nesting platforms for loons and aquatic birds, which was determined effective based on the 12 years of monitoring (1998-2010).
- Installation and enhancement of recreation facilities pursuant to the license, which were determined adequate for existing and future use based on periodic monitoring (every 6 years through the existing license term) of recreation facility use.
- Investigation and monitoring to evaluate whether Project operations were linked to mercury concentrations in fish and aquatic organisms pursuant to the license.
- Establishment of the 200-foot Shoreline Buffer Zone and 250-foot Conservation Easement area on Licensee-owned land (affecting more than 50% of the shoreline) around the Ripogenus impoundment for protection against land use changes, aesthetic and terrestrial effects, and enhanced habitat for bald eagles.
- Implementation of the Programmatic Agreement and Cultural Resources Management Plan (CRMP) for the protection of identified cultural and historic resources, including data recovery efforts via excavation, and reporting of identified sites.

Penobscot Mills Project

- Operation of the North Twin and Millinocket Lake Storage Developments in store-and-release mode for flood mitigation and to maintain required downstream flows during low inflow periods.
- Operation of the North Twin impoundment to maintain a relatively stable impoundment elevation for recreation during the recreation season.
- Operation of the Millinocket, Dolby, and East Millinocket Developments in run-of-river mode for stable impoundment elevations and to maintain consistent downstream flows.

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- Flows into Millinocket Stream from Millinocket Lake Storage Dam for increased adult and spawning landlocked salmon habitat and fishery as well as to support the stocked trout fishery, which was determined effective based on 10 years of post-license monitoring performed in consultation with the resource agencies.
- Flows into the West Branch (2,000 cubic feet per second [cfs]) from the Millinocket and Millinocket Lake Storage Developments for enhanced water quality and aquatic habitat.
- Operation and maintenance of the upstream fishway at the North Twin Development for the movement of resident species.
- Modifications at Umbazooksus Lake (instead of enhancements at Deep Cove on the North Twin impoundment) for wetlands enhancement, which was determined effective based on post-license monitoring (4 events in 1998, 2000, 2002, and 2004) performed in consultation with the resource agencies.
- Deployment of artificial nesting platforms for loons and aquatic birds, which was determined to no longer be necessary because loons were successfully nesting naturally at the impoundment based on the 12 years of monitoring (1998-2010).
- Establishment of 2,300 acres of land surrounding the Back Channel as a Wildlife Management Area and implementation and maintenance of various measures for the enhancement of wildlife habitat in the area.
- Installation and enhancement of recreation facilities pursuant to the license, which were determined adequate for existing and future use based on periodic monitoring (every 6 years through the term of the existing license) of recreation facility use.
- Investigation and mapping of submerged navigational hazards on North Twin and Millinocket Lake Storage impoundments for enhanced recreation use of the impoundments.
- Investigation and monitoring to evaluate whether Project operations were linked to mercury concentrations in fish and aquatic organisms pursuant to the license.
- Establishment of the 200-foot Shoreline Buffer Zone on Licensee-owned land around the Project's impoundments for protection against land use changes, aesthetic and terrestrial effects, and enhanced habitat for bald eagles.

Section 1Introduction and Background

- Implementation of the Programmatic Agreement and CRMP for the protection of identified cultural and historic resources, including data recovery efforts via excavation, and reporting of identified sites.

Great Northern Paper (GNP), the Projects' owner at the time, initiated the FERC relicensing process of the Projects in the late 1980s and filed license applications for the Projects with the Commission in December 1991, which were significantly supplemented with responses to additional information requests filed with the Commission in December 1992, February 1993, July 1993, November 1993, February 1994, and April 1994.

As noted in GNP's July 8, 1993 filing with the Commission, throughout the relicensing process GNP invited all interest groups to participate in the consultation process established by the Commission's regulations. The comprehensive consultation process resulted in a significant level of stakeholder input into the relicensing proceedings and the forum in which the resource interests of the stakeholders and associated PM&E measures were systematically evaluated. For example, through July 1993, GNP had performed over 100 studies in preparing the license applications for the Projects.

GLHA recognizes that the present relicensings will entail a certain level of study and analysis. However, GLHA also recognizes that unlike other hydropower projects within the State, the Projects are each undergoing their second post-ECPA relicensing, meaning the resources have been extensively studied consistent with today's relicensing standards and that the Projects' established PM&E measures have been evaluated and licensed as being equally considered and balanced, as well as consistent with the Commission's Comprehensive Development Standard. Therefore, GLHA maintains that a full suite of new studies is not needed, that the vast body of information on which today's certifications and licenses are soundly based and should be relied upon for these relicensings. In addition, consistent with the Commission's criteria for study requests, the scope and extent of any new study be focused on addressing specific data gaps necessary to inform the development of license requirements.

Based on the totality of studies conducted, settlement agreements reached, PM&E measures incorporated, and water quality certifications issued, FERC's 1996 licenses concluded that the

Projects are best adapted to serve the public interest. GLHA maintains that nothing has significantly changed that would alter this conclusion. If anything, the fight against climate change as well as socioeconomic challenges to the region only amplify the importance of ensuring that these relicensing proceedings do not result in a reduction of the Projects' ability to produce clean, renewable energy.

With this, and as described in more detail below, GLHA's overall approach and overarching interest in these relicensings centers on:

- Maintaining the sound balance between power and non-power values that exists today as achieved through the extensive proceeding that resulted in the Projects' existing licenses;
- Preserving the Projects' renewable energy and capacity provided to the local electrical grid, as well as preserving the economic viability and significant investments made by GLHA over the terms of the Projects' existing licenses; and
- Recognizing and leveraging the collective value of the Projects' existing PM&E measures, environmental monitoring activities over the terms of the Projects' licenses, and associated body of existing information as a legitimate basis for decision-making.

1.5 Carbon-Free and Base-load Electricity

The proven science of and intense societal interest in solving climate change cannot be ignored, and neither can the fact that hydropower is a recognized carbon-free energy source vitally needed in the fight against climate change. Every bit of renewable and carbon-free energy matters, and GLHA's interests align with the fact that the clean, renewable energy afforded by the Projects is indeed significant and must be maintained at present levels.

Hydropower is a critical source of renewable electricity for attaining the resilient, reliable, and clean grid of the future. Unique among renewable resources, hydropower can be dispatched on-demand and sustain output for extended durations, equipping it to provide supplies when intermittent solar and wind facilities are not generating electricity. Flexibility and dependability make hydropower a key resource for integrating an unprecedented influx of renewable power as states make deep cuts in carbon emissions to avert the worst impacts of climate change. Stored water reserves enable hydropower facilities to serve as a backstop in the event of unplanned

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outages and adds fuel security to the grid especially during extreme cold weather, when other generators may face limited access to coal and natural gas supplies to maintain operations.

GLHA anticipates that some stakeholders may view the carbon-free energy generated by the Projects as insignificant in the overall context of climate change and greenhouse gas avoidance, and that the introduction of new PM&E measures would outweigh the value of the Projects' renewable generation. These stakeholders may believe that renewable energy generated by the Projects can be further reduced in the service of implementing new PM&E measures beyond those that were carefully considered and balanced through the previous relicensing and which have been implemented to benefit the greater Penobscot River Watershed and local communities through the existing licenses. GLHA would disagree with these perspectives. Reductions in the flexibility and amount of the Projects' renewable generation would have deleterious environmental effects, and GLHA expects stakeholders would have very different perspectives if new sources of fossil-fuel generation were necessary to replace the Projects' combined 105.4 MW of renewable energy.

In addition to these considerations, the need for power, grid stability, and reliability are also important aspects GLHA will promote in these relicensing proceedings. Peak demands for power can vary greatly depending on the time of day and from season to season. Hydropower facilities that have peaking ability or other operational flexibility provide not only a reliable source of renewable and carbon-free energy to the grid, but they are also needed and used to maintain the balance between electricity supply and demand. The flexibility and storage capacity of hydropower supports continued development of intermittent renewable energy sources, such as solar or wind, by providing quick responses to changes in output. The base-load energy and grid stability provided by hydropower is very different than, and wholly complimentary to, that provided by solar or wind energy.

The electrical output from the Projects is sold to the New England wholesale electricity market administered by the Independent System Operator of New England (ISONE). The Projects generate carbon-free, renewable power and provide peaking and variable output generation of value to the grid. Power from the Projects helps meet the Nation's and regional carbon reduction goals, reduces reliance on natural gas to meet sudden changes in demand, and facilitates adoption of other intermittent renewable energy sources. The State of Maine has mandated 100 percent

reduction in greenhouse gas emissions economy-wide by 2050 (compared to 1990 levels) (ISONE 2021). Hydropower will be an essential component of meeting this ambitious goal.

Stakeholders may approach this relicensing with a mindset that the benefits of the Projects are negligible or that other interests should take priority over clean, renewable energy generation (i.e., the existing balance of developmental and non-developmental resources should be upset). GLHA would strongly disagree. The value of the Projects in displacing fossil-fuel generation and facilitating the penetration of other renewables in Maine is real and significant. ISONE has recognized the value of and need for additional, dispatchable, emission-free resources to balance the intermittency of wind and solar on the grid (ISONE 2021). These values should be afforded the same, equitable consideration as non-developmental resources. In fact, the ECPA requires equal consideration of developmental values, and GLHA believes that the current license conditions have created a balance that was affirmed by the parties to the previous proceeding and which should not be undone by the pending proceedings. To reduce the amount and flexibility of renewable energy generated by the Projects would be contrary to the stated goals of federal and state environmental agencies, NGOs, the State of Maine, the ISONE, and the Licensee.

If the existing flexibility, operational ranges, or peaking capabilities of the Projects as presently licensed were further limited or curtailed, the ISONE would need to rely more heavily on natural gas burning facilities to meet peak power demands now and into the foreseeable future. The existing Projects' licenses allow GLHA to generate carbon-free, renewable electricity at the Projects, while supporting state and federal goals for renewable energy production and helping facilitate the development of other renewable sources of energy. It is GLHA's interest and expectation that the Projects' future licenses will allow the same, consistent with the existing licenses.

1.6 Flow Management

As established through the previous relicensing, the Ripogenus Project and the store-and-release developments of the Penobscot Mills Project (North Twin and Millinocket Lake Storage), in combination with the upstream Storage Project (FERC No. 2634) provide the necessary resources to manage water levels and flows throughout the West Branch and the mainstem of the Penobscot River. As recognized by the stakeholders involved in the previous relicensings, the operational

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flexibility of these impoundments provide the ability to maximize the balancing of downstream flows and water levels in support of flood control, public safety, dam safety, supplemental flows during seasonal low flow periods, fish spawning and migration, recreation, whitewater boating, water quality, local electrical grid stability, and baseload renewable energy generation. In particular, the Projects' current licensing provide the re-regulating operational flexibility to help reduce the detrimental effects of natural high and low water periods within the larger Penobscot River basin.

The Projects' combined operations provide stakeholders of the larger Penobscot River basin with a valuable tool to manage river flows in support of stakeholder interests. Without the existing storage capacity and operational flexibility developed by the stakeholders through the previous relicensings, the basin and downstream river users would be routinely subject to higher variable flows throughout the system – including flooding, public safety, dam safety, and environmental impacts throughout the downstream reaches.

The Project storage impoundments are managed on an annual cycle to dampen the variability and occasional extremes of seasonal precipitation and runoff through storage within the impoundments. This storage allows for continuous flows to downstream aquatic habitat and spawning areas within the West Branch and the mainstem of the Penobscot River during times of lower inflows to the system. In addition, the storage allows flows from the West Branch to be reduced during higher seasonal flow periods when the combined flows from the East and West Branches have the potential to adversely impact human life, property, and environmental resources downstream along the mainstem Penobscot River.

During normal operations and normal inflow years, the Project storage impoundments elevations are held relatively stable during the summer months and are gradually drawdown starting in the fall with a target low elevation by late winter in anticipation for the spring thaw and freshet. In the spring, the impoundments' elevations rise based on inflows, spring thaw, and precipitation with the goal to reach normal full pond elevation by late spring.

In this capacity, as compared to allowing these inflows to be released to the downstream reaches and potentially cause flooding, public safety, and dam safety impacts, the Projects act as a re-

Section 1Introduction and Background

regulating system in support of providing a more constant flow for downstream resources and impacts. In support of managing the impoundment levels and downstream flows, GLHA tracks seasonal inflows to the impoundments (e.g., through snow surveys). Under the Projects' existing licenses, GLHA is provided the flexibility to provide the required minimum flows in support of aquatic and riverine resources, while providing the tools to help reduce the potential impacts (e.g., flooding, public safety, and dam safety) resulting from higher water years.

Section 2.0

Purpose of the Pre-Application Document

This PAD follows the content and requirements of the Commission's regulations defined in 18 CFR §5.6. The purpose of the PAD is to provide a description of the existing Project facilities and operations and proposed structural or operational modifications to the Projects. At this time, GLHA is not proposing any structural or operational modifications to the Projects concurrent with this relicensing; however, GLHA reserves the right to propose such modifications based on the consultation and potential study activities to be performed.

In addition, the purpose of the PAD is to provide FERC and interested parties with existing information relevant to the Projects, including Project background, relicensing process and schedule, the Projects' existing PM&E measures, operations, engineering, environmental and natural resources, recreation, cultural resources, and socioeconomic aspects related to the Projects. This existing, relevant, and reasonably available information enables FERC, GLHA, and interested parties to identify issues and determine if there are any information needs in support of informing the development of license requirements. In addition, the PAD is the foundation for the license application and is a precursor to FERC's NEPA scoping documents and environmental analysis.

2.1 Search for Existing, Relevant, and Reasonably Available Information

In support of preparing this PAD, HDR, on behalf of and in conjunction with GLHA, has undertaken an extensive effort to identify and review existing, relevant, and reasonably available information related to the Projects. This search consisted of the following primary activities:

1. A comprehensive search of GLHA's files and available documentation;
2. The distribution of PAD information questionnaires to numerous parties requesting the identification of any information related to the Projects, the Project vicinities, and the region; and
3. A review of publicly-available information.

The PAD questionnaire was distributed to stakeholders on January 6, 2021 and is included along with responses to the questionnaire in Appendix B. Relevant information obtained from GLHA's search for information has been summarized in the applicable resource sections of this PAD.

2.2 Consultation Performed to Date

Preliminary consultation with potential stakeholders was conducted in support of preparing this PAD to obtain available information. As discussed in the previous section, parties with an interest in the Projects were identified and provided a PAD questionnaire, which requested that the recipient provide or direct GLHA to existing, relevant, and reasonably available information regarding the Projects and the surrounding environment, as well as identify resource areas of interest.

Additional consultation was conducted with the Maine Department of Inland Fisheries and Wildlife (MDIFW) and the USFWS regarding rare, threatened, and endangered (RTE) species, critical habitat, essential fish habitat (EFH), and unique or exemplary natural communities, as applicable. Information received from MDIFW and USFWS has been included in Section 5.7 of this PAD. Consultation with the Maine Coastal Program was conducted to confirm that the Projects are not located in the coastal zone as identified by the State's coastal zone management plan. On May 21, 2021, the Maine Department of Marine Resources (MDMR) confirmed that the Projects were outside of Maine's Coastal Zone Management Act (CZMA)-designated coastal zone, and a CZMA consistency review was not required. A copy of this correspondence is provided in Appendix B of this PAD.

The resource areas identified during this preliminary consultation, as well as an initial list of areas of interest and proposed studies, are presented in Section 6.0 of this PAD.

Section 3.0

Process Plan and Schedule

3.1 Process Plan and Schedule

GLHA has elected to use the Commission's default ILP in support of obtaining new licenses for the Projects. Consistent with 18 CFR §5.6(d)(1), GLHA has developed the Process Plan and Schedule presented in Table 3.1-1. The Process Plan and Schedule outlines the specific timeframes, estimated due dates, and responsible parties for each of the Commission's ILP activities. GLHA is committed to working with FERC and the relicensing participants to maintain this schedule.

Table 3.1-1
ILP Process and Schedule for the Projects

Activity	Responsible Parties	Time Frame	Estimated Date
File NOIs and PAD (18 CFR §5.5(d))	GLHA	As early as 5.5 but no later than 5 years prior to license expiration	June 11, 2021
Initial Tribal Consultation Meeting (18 CFR §5.7)	FERC	No later than 30 days of filing NOI/PAD	July 11, 2021
Issue Notice of NOI/PAD and SD1 (18 CFR §5.8(a))	FERC	Within 60 days of filing NOI/PAD	August 10, 2021
Conduct Scoping Meeting and Site Visit (18 CFR §5.8(b)(viii))	FERC	Within 30 days of NOI/PAD Notice and issuance of SD1	September 9, 2021
File Comments on PAD, SD1, and Study Requests (18 CFR §5.9(a))	Stakeholders	Within 60 days of NOI/PAD Notice and issuance of SD1	October 9, 2021
Issue Scoping Document 2 (SD2), if necessary (18 CFR §5.10)	FERC	Within 45 days of deadline for comments on PAD, SD1, and study requests	November 23, 2021
File Proposed Study Plan (PSP) (18 CFR §5.11(a))	GLHA	Within 45 days of deadline for comments on PAD, SD1, and study requests	November 23, 2021
Conduct PSP Meeting(s) (18 CFR §5.11(e))	GLHA	Within 30 days of filing PSP	December 23, 2021
File Comments on PSP (18 CFR §5.12)	Stakeholders	Within 90 days of filing PSP	February 21, 2022
File Revised Study Plan (RSP) (18 CFR §5.13(a))	GLHA	Within 30 days of deadline for comments on PSP	March 23, 2022
File Comments on RSP (18 CFR §5.13(b))	Stakeholders	Within 15 days of filing RSP	April 7, 2022
Issue Study Plan Determination (18 CFR §5.13(c))	FERC Director	Within 30 days of filing RSP	April 22, 2022

Section 3

Process Plan and Schedule

Activity	Responsible Parties	Time Frame	Estimated Date
Request Formal Study Dispute Resolution Process, if necessary (18 CFR §5.14(a))	Agencies and Tribes with Mandatory Conditioning Authority	Within 20 days of Study Plan Determination	May 12, 2022
Convene Dispute Resolution Panel (18 CFR §5.14(d))	Dispute Resolution Panel	Within 20 days of notice of study dispute	June 1, 2022
Comments on Study Plan Disputes (18 CFR §5.14(i))	GLHA	Within 25 days of notice of study dispute	June 6, 2022
Third Panel Member Selection (18 CFR §5.14(d)(3))	Dispute Resolution Panel	Within 15 days of when Dispute Resolution Panel convenes	June 16, 2022
Dispute Resolution Panel Technical Conference (18 CFR §5.14(j))	Dispute Resolution Panel, GLHA, Stakeholders	-	-
Dispute Resolution Panel Findings and Recommendations (18 CFR §5.14(k))	Dispute Resolution Panel	Within 50 days of notice of study dispute	July 1, 2022
Study Dispute Determination (18 CFR §5.14(l))	FERC Director	Within 70 days of notice of study dispute	July 21, 2022
Conduct 1 st Season of Studies (18 CFR §5.15)	GLHA	-	2022
File Study Progress Reports (18 CFR §5.15(b))	GLHA	Provide summary updates every three months	May, Aug, Nov, 2022
File Initial Study Report (ISR) (18 CFR §5.15(c))	GLHA	Pursuant to the Study Plan Determination	April 22, 2023
Conduct ISR Meeting (18 CFR §5.15(c)(2))	GLHA and Stakeholders	Within 15 days of ISR	May 7, 2023
File ISR Meeting Summary (18 CFR §5.15(c)(3))	GLHA	Within 15 days of ISR Meeting	May 22, 2023
File Comments on ISR, ISR Meeting Summary, and New Study Requests (18 CFR §5.15(c)(4))	Stakeholders	Within 30 days of ISR Meeting Summary	June 21, 2023
File Response to Comments on ISR, ISR Meeting Summary, and New Study Requests (18 CFR §5.15(c)(5))	GLHA	Within 30 days of comments on ISR Meeting Summary	July 21, 2023
Resolution of Disagreements (18 CFR §5.15(c)(6))	FERC Director	Within 30 days of response to comments on ISR Meeting Summary	August 20, 2023
Conduct 2 nd Season Studies, if necessary	GLHA	-	2023
File Study Progress Reports (18 CFR §5.15(b))	GLHA	Provide summary updates every three months	May, Aug, Nov, 2023

Section 3

Process Plan and Schedule

Activity	Responsible Parties	Time Frame	Estimated Date
File Updated Study Report (USR), if necessary (18 CFR §5.15(f))	GLHA	Pursuant to the approved study plan or no later than 2 years after Commission approval, whichever comes first	April 21, 2024
Conduct USR Meeting, if necessary (18 CFR §5.15(f))	GLHA and Stakeholders	Within 15 days of USR	May 6, 2024
File USR Meeting Summary, if necessary (18 CFR §5.15(f))	GLHA	Within 15 days of USR Meeting	May 21, 2024
File USR Meeting Summary Comments and New Study Requests (18 CFR §5.15(f))	Stakeholders	Within 30 days of USR Meeting Summary	June 20, 2024
File Response to Comments on USR Meeting Summary and New Study Requests (18 CFR §5.15(f))	GLHA	Within 30 days of comments on USR Meeting Summary	July 20, 2024
Resolution of Disagreements (18 CFR §5.15(f))	FERC Director	Within 30 days of filing response to comments on USR Meeting Summary	August 19, 2024
File Draft License Application (DLA) (18 CFR §5.16(a))	GLHA	No later than 150 days prior to deadline for filing Final License Application	May 3, 2024
File Comments on DLA (18 CFR §5.16(e))	Stakeholders	Within 90 days of DLA	August 1, 2024
File Final License Application (18 CFR §5.17)	GLHA	No later than 24 months before the existing license expires	September 30, 2024

Notes:

1. This process plan and schedule provides estimated due dates for the Projects' relicensing activities. FERC will issue the Projects' official process plan and schedule via SD1 and SD2 (if necessary).
2. If a due date falls on a weekend or holiday, the deadline is the following business day.
3. Early filings or issuances will not result in changes to the estimated due dates.
4. All Director's determinations are subject to request for rehearing to the Commission pursuant to 18 CFR §375.301(a) and 385.713. Any request for rehearing must be filed within 30 days of determination.
5. Shaded actions are not necessary if there are no requests for study dispute, or the filing of meeting summary disagreements or study plan amendment requests.
6. "--" = cell intentionally left blank.

3.2 Scoping Meeting and Site Visit

Pursuant to 18 CFR §5.8(b), and at the Commission's discretion, FERC will hold a scoping meeting on or before September 9, 2021. The scoping meeting will be held at a location to be selected by FERC in the general vicinity of the Projects, or it may be conducted through a virtual setting. FERC will issue a public notice regarding details of the scoping meeting that will include the meeting date, meeting location, and additional instructions for participating in the meeting. FERC will also coordinate with GLHA to perform a site visit to the Projects. The site visit will be

performed concurrent with the scoping meeting, or at a later date if the scoping meeting is performed through a virtual setting.

Due to the Novel Coronavirus Disease (COVID-19), FERC may waive 18 CFR §5.8(b)(viii) of the Commission's regulations and not conduct a public scoping meeting or site visit in support of the relicensing process. Instead, FERC may solicit written comments, recommendations, study requests, and information regarding SD1, which is scheduled to be issued on or about August 10, 2021. In addition, FERC may conduct the site visit, if needed, later in the process, such as in conjunction with the study plan meeting required by 18 CFR §5.11(e) of the Commission's regulations. Decisions related to the scoping meeting and site visit will be at the Commission's discretion.

3.3 Participation in the ILP

Notice of the filing of the NOIs and this PAD has been provided to the appropriate Federal and state resource agencies, Indian Tribes, local governments, NGOs, and members of the public likely to be interested in the proceeding. A complete list of the parties receiving the notification of the NOIs and this PAD is provided with the June 11, 2021 transmittal letter of the NOIs and PAD. Any interested party who would like to be included or be removed from the distribution list, should contact:

Randall Dorman
Licensing Manager
Brookfield Renewable
150 Main Street
Lewiston, Maine 04240
Phone: 207-755-5605
E-Mail: Randy.Dorman@BrookfieldRenewable.com

3.4 Communications and Distribution Protocols

Over the course of the relicensing process, communications will take place through public meetings, virtual meetings, conference calls, and written correspondence. All phases of formal consultation and correspondence require adequate documentation to establish the consultation record. The following provides a general framework for the dissemination of information and for documenting consultation among the relicensing participants.

3.4.1 Meeting Notices and Summaries

Consistent with the Commission's ILP, GLHA will hold public relicensing meetings in support of developing GLHA's Relicensing Application. For such meetings (e.g., the Proposed Study Plan Meeting), GLHA will provide advance notification to the relicensing distribution list and will seek to provide 15 days advance notice of the meeting date, although in some circumstances, and as allowed by the Commission's ILP regulations, a shorter advance notice period may be required. Where applicable, for meetings led by GLHA, meeting summaries will be prepared and made available by GLHA. To the greatest extent practical, meeting notices and summaries will be distributed electronically (e.g., email or through the Commission's eLibrary, with an email notice to the distribution list). At the Commission's discretion, notifications, and meeting summaries for relicensing meetings for which FERC is responsible, will be developed and distributed by FERC.

3.4.2 Distribution of Relicensing Materials

The distribution list associated with the June 11, 2021 transmittal letter for the NOIs and this PAD provides the list of federal and state resource agencies, Indian Tribes, local governments, NGOs, and members of the public likely to be interested in the proceeding. These parties are currently included on the distribution list for the relicensing proceedings. This list will be used to distribute electronic copies of major relicensing documents and will be updated with additions and modifications upon request. As noted above, please contact the individual listed in Section 3.3 if any party would like to be included or be removed from the distribution list.

To the greatest extent practical, GLHA will distribute relicensing materials and documents in electronic format through email and/or through email notifications that a given document has been filed with FERC through FERC's eLibrary at <http://www.ferc.gov/docs-filing/elibrary.asp> by searching under Dockets P-2458 and P-2572. Upon request, GLHA will provide hard copies of applicable relicensing documents to relicensing participants. Requests for hard copies should be sent to Mr. Randy Dorman using the contact information provided in Section 3.3 of this PAD, and they should clearly indicate the name and publication date of the requested document as well as FERC Project Nos. P-2458 and P-2572. A reproduction charge and postage costs may be assessed for hard copies requested by the public. Federal, state, and tribal entities will not be subject to document processing or postage fees.

Section 3Process Plan and Schedule

Given that electronic means (e.g., email and notifications of document availability) will be the primary method of distributing relicensing materials over the course of the relicensing proceeding, GLHA will continue to coordinate with the relicensing parties following the filing of this PAD to obtain the appropriate email addresses for those individuals who desire to continue to receive such materials.

Certain documents may be restricted from public access in accordance with FERC's regulations protecting Controlled Unclassified Information (CUI)/Critical Energy/Electric Infrastructure Information (CEII) (18 CFR 388.113), or in cases where the document contains sensitive information (e.g., sensitive species locations or cultural resources). GLHA will address requests for such information on a case-by-case basis and in accordance with applicable laws and regulations throughout the relicensing process.

Section 4.0

Project Location, Facilities, and Operations

4.1 Applicant Contact Information

The following provides the name, business address, and contact information of the designated persons authorized to act as agent for the Licensee throughout the licensing process.

Tom Uncher
Vice President
Great Lakes Hydro America, LLC
399 Big Bay Road
Queensbury, NY 12804

Copies of all correspondence should also be sent to:

Randall Dorman
Licensing Manager
Brookfield Renewable
150 Main Street
Lewiston, ME 04240
Randy.Dorman@brookfieldrenewable.com

Cate Russell
HDR Engineering
970 Baxter Blvd, Suite 301
Portland, ME 04103
Cate.Russell@hdrinc.com

4.2 Project Location and Lands

The Projects are located on the West Branch and Millinocket Stream in the towns listed in Table 4.2-1 in Piscataquis and Penobscot Counties, Maine (Figure 4.2-1 through Figure 4.2-8). The FERC Project boundary for each Project is shown on the Exhibit G drawings provided in Appendix C.

The facilities and structures of the Projects are discussed in the sections below and are also depicted in the Exhibit F drawings and single-line diagrams provided in Volume II of II of this PAD, which are being filed separately as CUI/CEII in accordance with 18 CFR §388.113.

Section 4

Project Location, Facilities, and Operations

Table 4.2-1
Location of Ripogenus and Penobscot Mills Projects

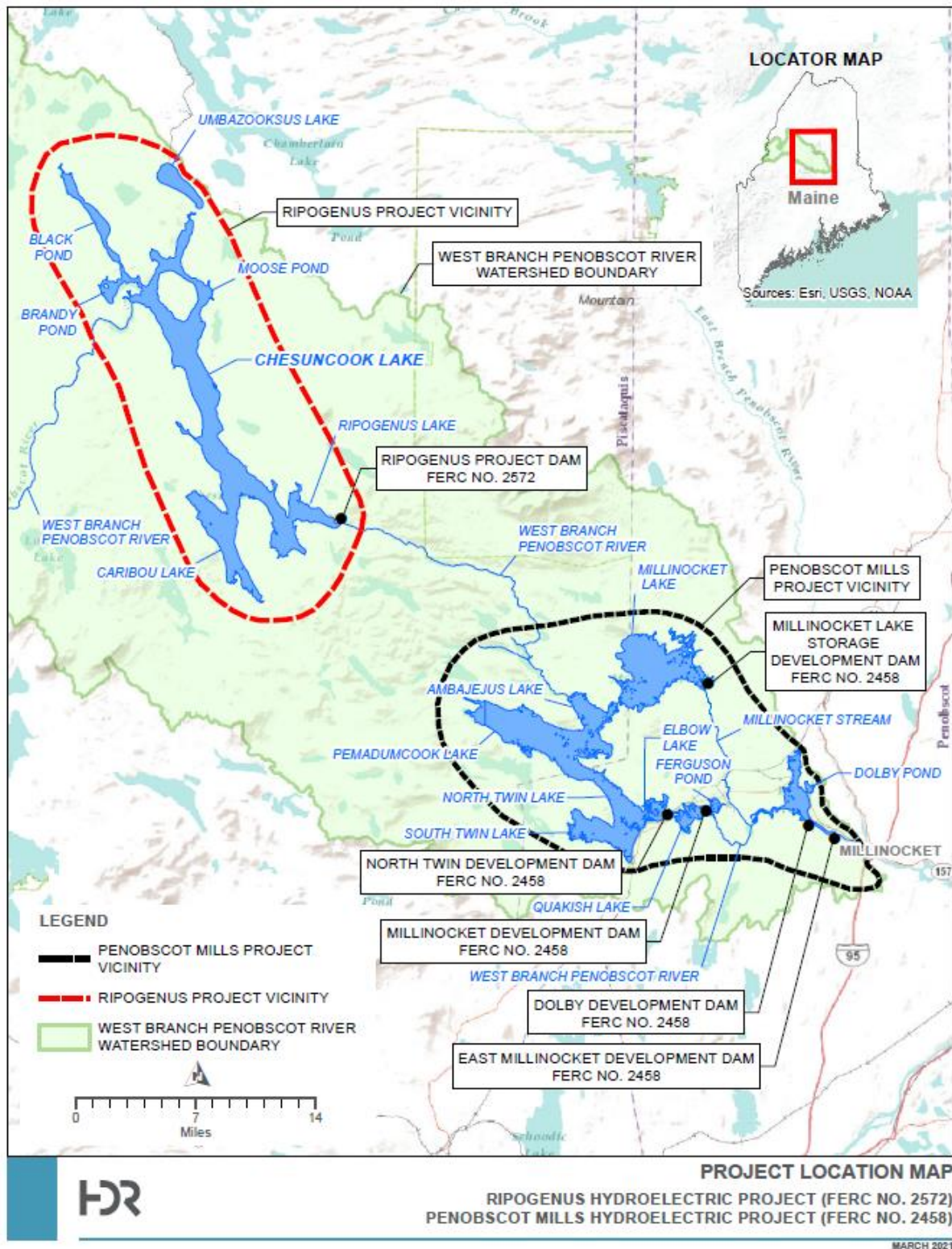
Project	Development	Counties	Towns ¹	River	River Mile
Ripogenus	Ripogenus	Piscataquis and Penobscot	Chesuncook Township Indian Purchase Township 3 Rainbow Township Town of Millinocket Township 1 Range 8 WELS Township 1 Range 9 WELS Township 2 Range 9 WELS Township 2 Range 10 WELS Township 2 Range 12 WELS Township 3 Range 11 WELS Township 3 Range 12 WELS Township 3 Range 13 WELS Township 4 Range 12 WELS Township 4 Range 13 WELS Township 4 Range 14 WELS Township 5 Range 12 WELS Township 5 Range 14 WELS Township 6 Range 12 WELS Township 6 Range 13 WELS Township 6 Range 14 WELS	West Branch	48.3 ²
Penobscot Mills	Millinocket Lake Storage	Piscataquis and Penobscot	Township 1 Range 8 WELS Township 1 Range 9 WELS Township 2 Range 8 WELS Township 2 Range 9 WELS	Millinocket Stream	18.7 ³
	North Twin	Piscataquis and Penobscot	Indian Purchase Township 3 Indian Purchase Township 4 Township 1 Range 9 WELS Township 1 Range 10 WELS	West Branch	14.9 ²
	Millinocket	Piscataquis	Millinocket Hopkins Academy Grant Township Indian Purchase Township 3	West Branch	12.3 ²
	Dolby	Piscataquis	East Millinocket Grindstone Township Millinocket Township A Range 7 WELS	West Branch	4.2 ²
	East Millinocket	Piscataquis	East Millinocket Township A Range 7 WELS	West Branch	2.3 ²

1. Includes towns, townships, and ranges within the Project boundary including the Project's transmission lines.
2. RM is the location of the dam measured from the confluence of the East and West Branches at Nicatou Island.
3. RM is the location of the dam measured from the confluence of the East and West Branches at Nicatou Island, including Millinocket Stream. The dam is 7.8 miles upstream of the Millinocket powerhouse tailrace on Millinocket Stream.

Section 4

Project Location, Facilities, and Operations

**Figure 4.2-1
Projects' Location Map**



**Figure 4.2-2
Ripogenus Project**

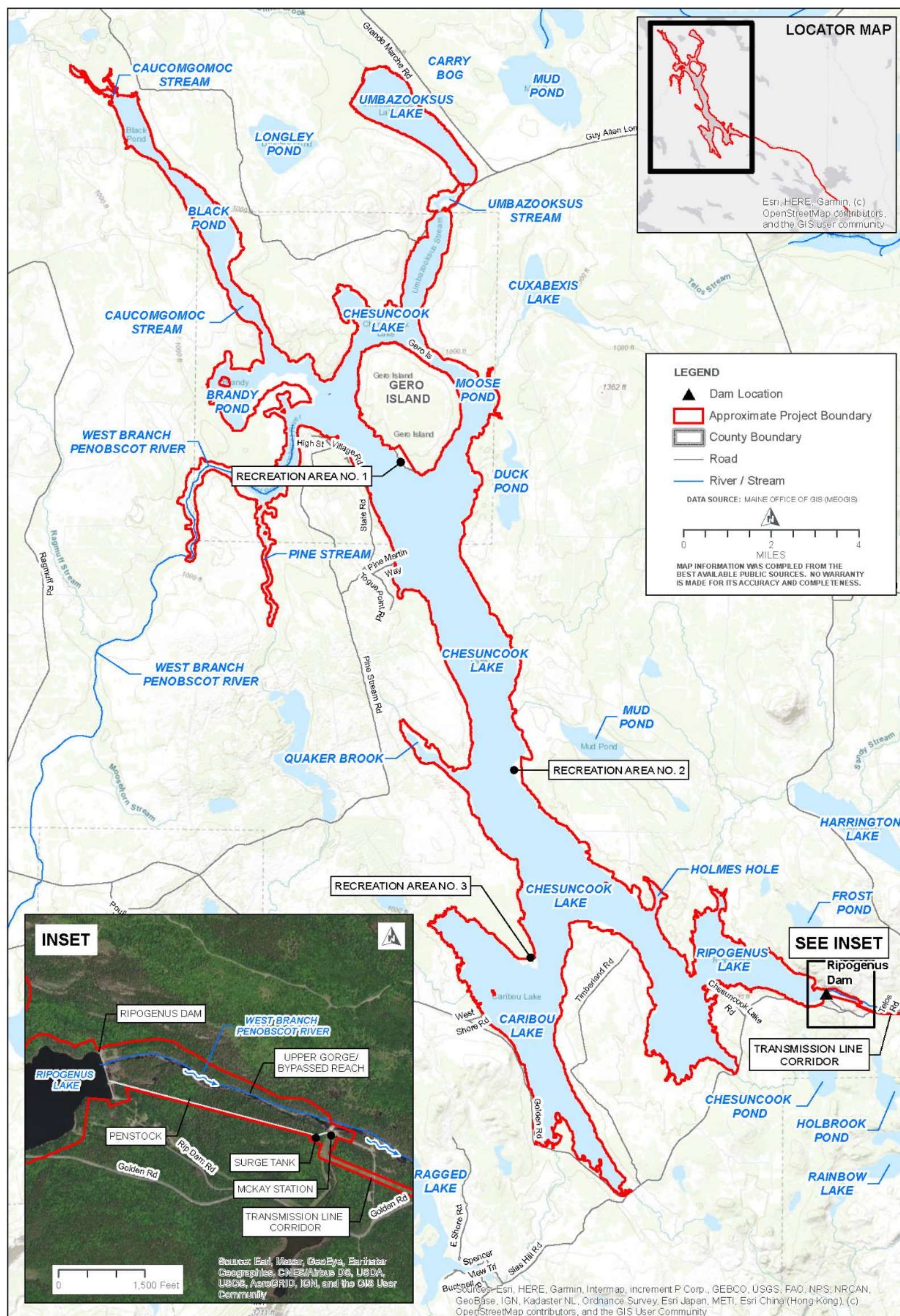


Figure 4.2-3
Penobscot Mills Project

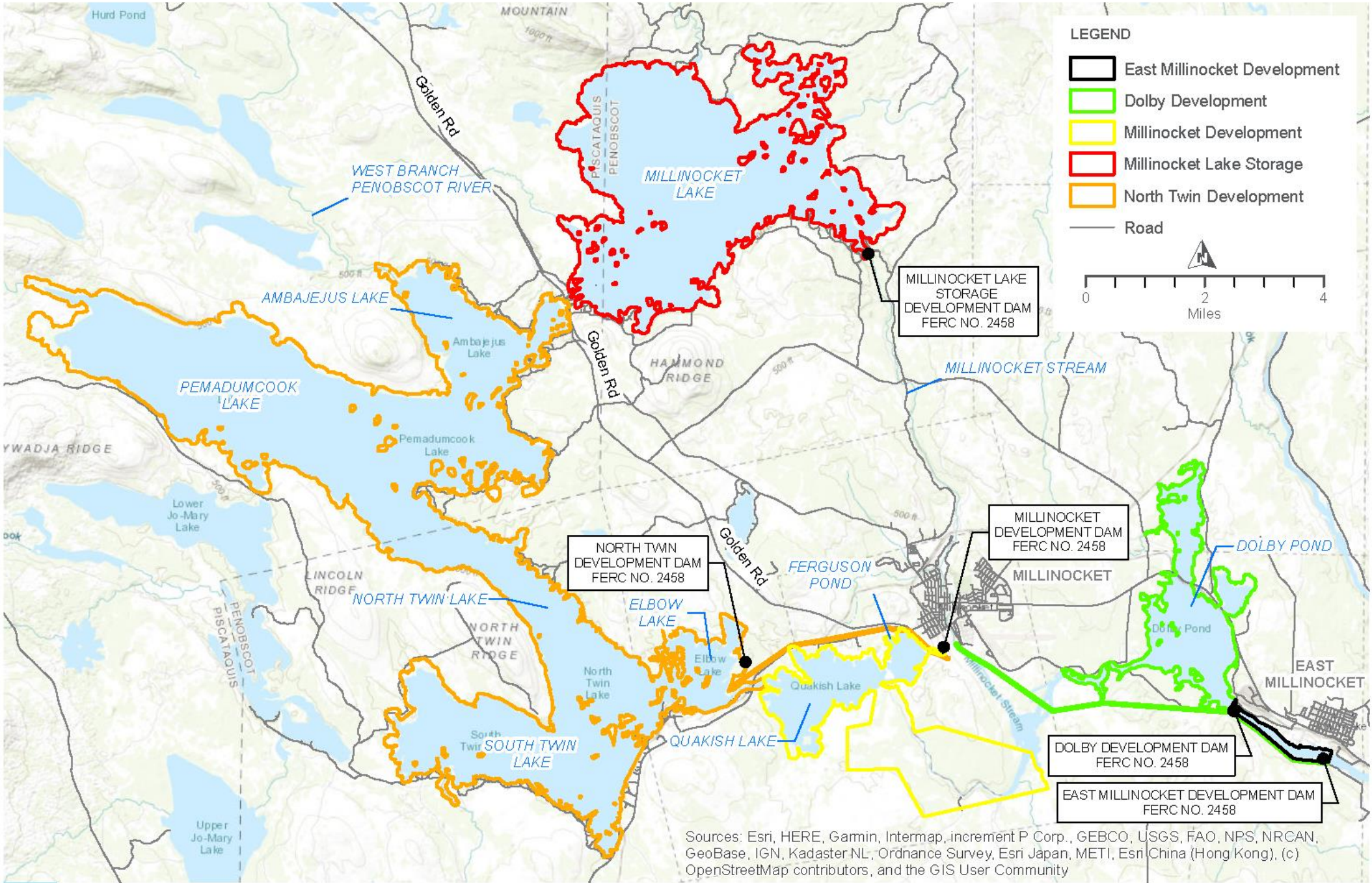


Figure 4.2-4
Millinocket Lake Storage Development

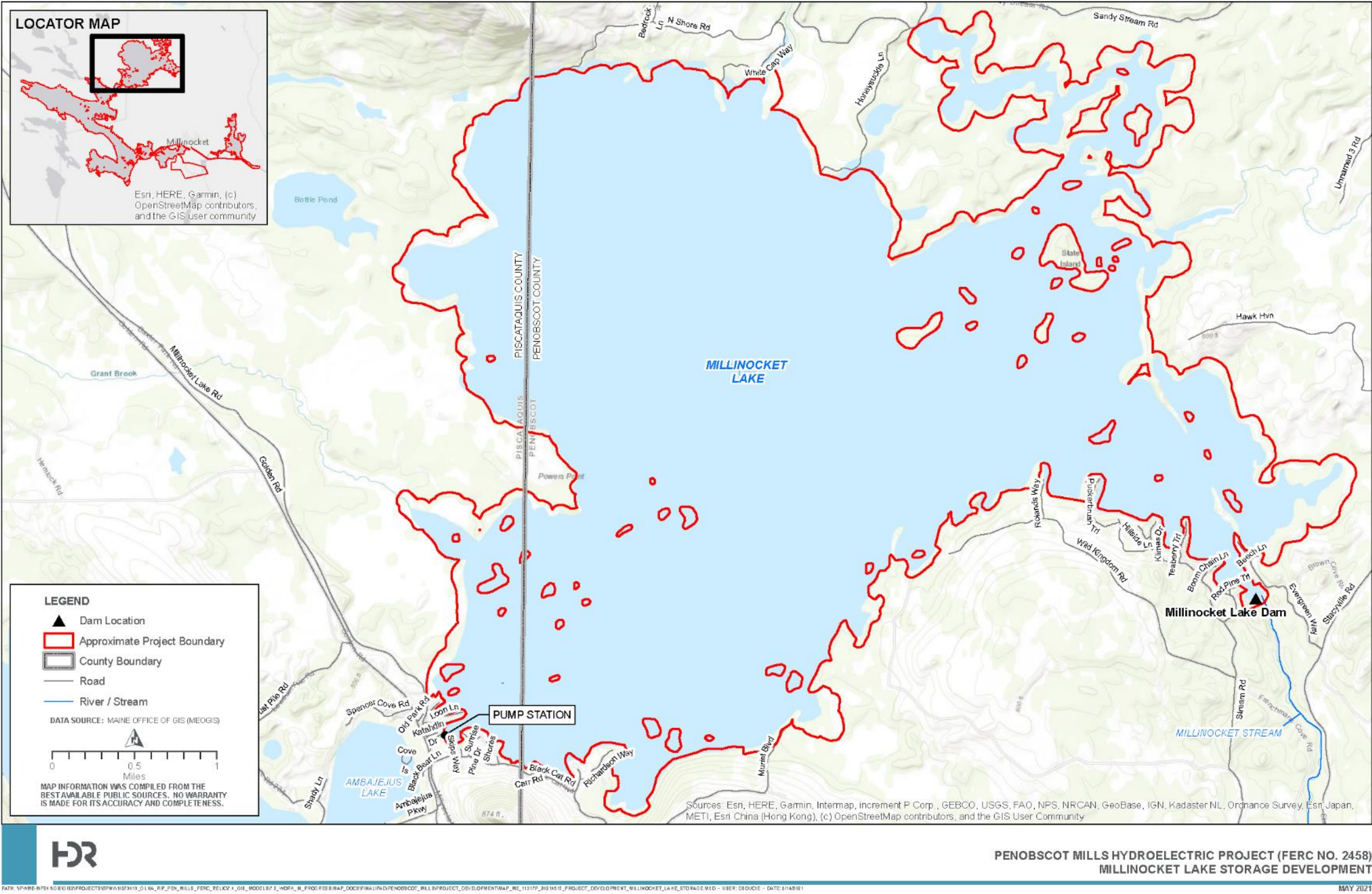
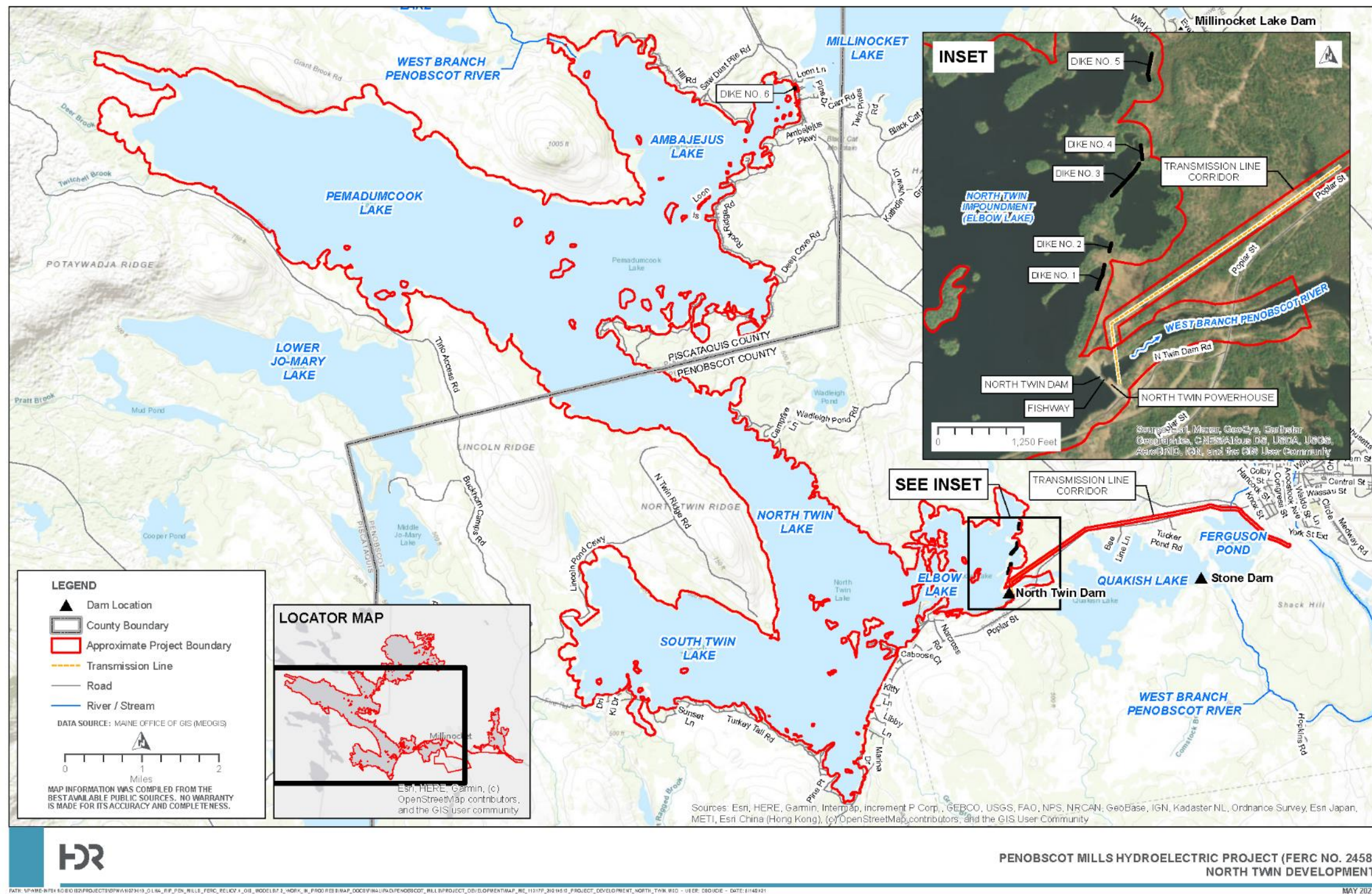
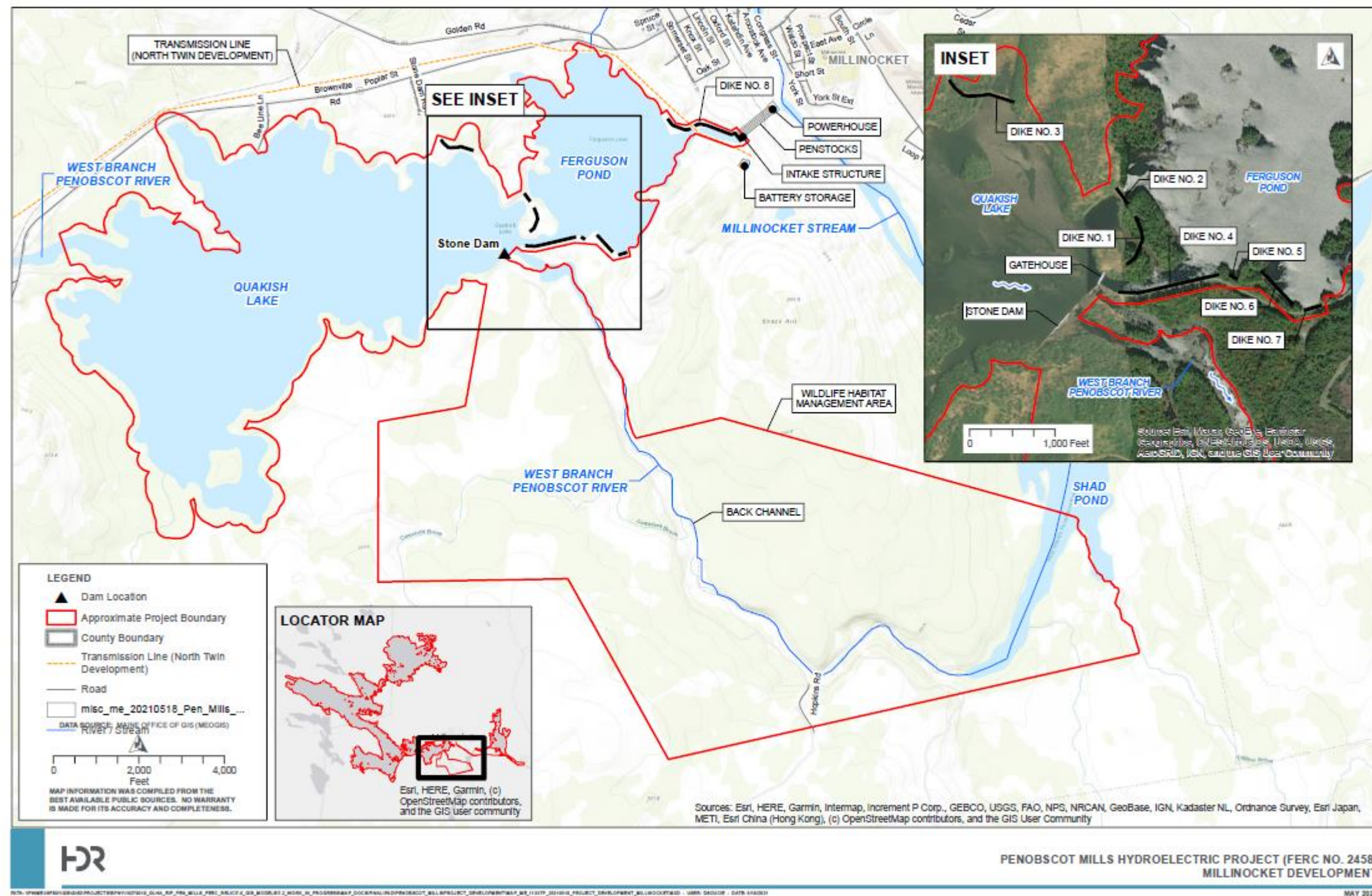


Figure 4.2-5
North Twin Development



**Figure 4.2-6
Millinocket Development¹**



¹ The Millinocket Development includes the penstocks and the right to maintain the penstocks but does not include the land over them. As indicated on Exhibit F-19, the Project Boundary for the Millinocket Development includes the Generator Room (Units 7 and 8) and the portion of the Grinder Room that contains Units 1, 2, 3, 4, 5, and 6.

Figure 4.2-7
Dolby Development

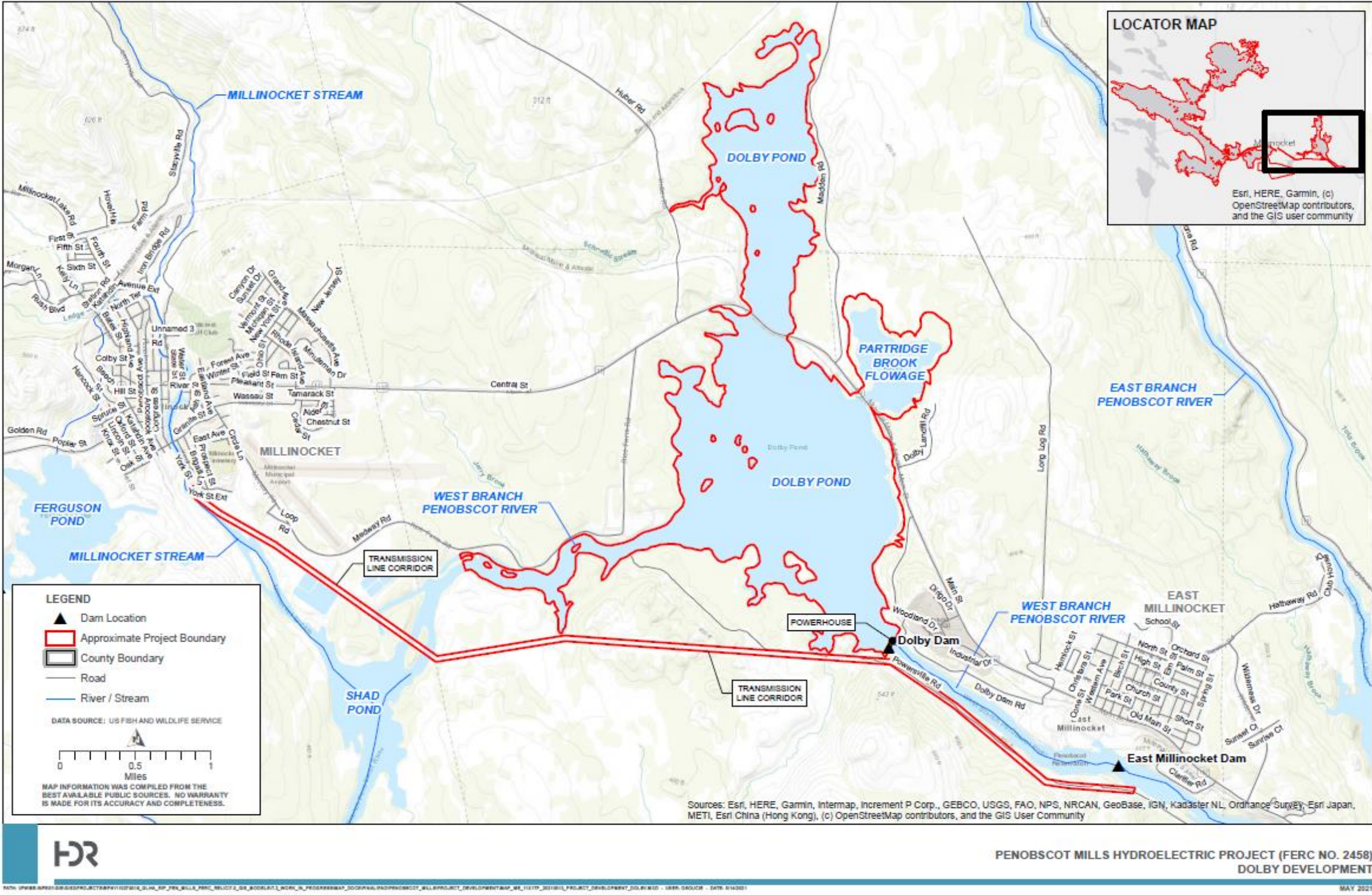
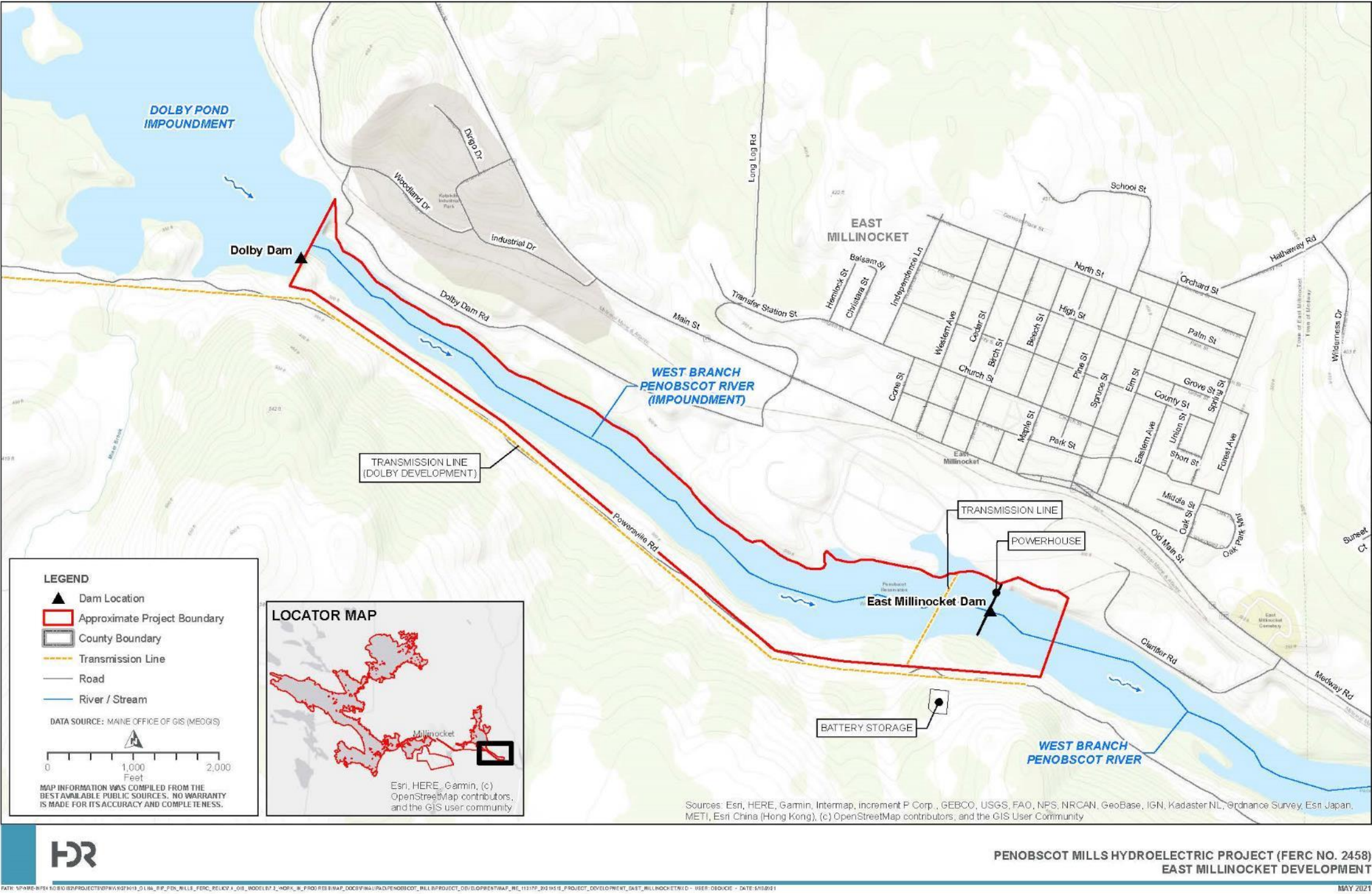


Figure 4.2-8
East Millinocket Development



4.3 Existing Project Facilities

4.3.1 Ripogenus Project

The Ripogenus Project is located approximately 21 RM² upstream of the Penobscot Mills Project on the West Branch, which flows into Ambajejus Lake (within the North Twin impoundment). The total authorized installed capacity of the Ripogenus Project is 37,530 kilowatts (kW).

The Ripogenus Project consists of a dam and impoundment, an intake structure, a tunnel and penstocks, a powerhouse, a tailrace, a 115 kV substation, a transmission line, and appurtenant facilities. The powerhouse, known as McKay Station, is located approximately 0.75 RM downstream of the Ripogenus Dam.

The following sections describe the physical composition, dimensions, and general configuration of the Project facilities. All elevations are U.S. Geological Survey (USGS) datum.

Dam and Spillway

Ripogenus Dam is a concrete structure with a short earth-filled end section that crosses the West Branch in a north-south direction. The bridge deck across the top of the dam is at elevation 942.59 feet. The dam extends approximately 795 feet between two vertical rock faces and has a maximum height (base of structure to bridge deck) of approximately 83 feet.

The 795-foot-long dam is comprised of four separate sections including two spillway sections totaling approximately 480 feet in length, a 37-foot-wide intake structure, a 178-foot-long gate section, and a 100-foot-long earth section. Collectively, the spillway, intake, and gated sections comprise approximately 695 feet of the dam. The earthen embankment section comprises the remaining 100 feet of the dam. A series of concrete piers situated across the crest of the dam support the stoplogs and crest gates and also support the concrete bridge deck that is located atop the dam.

² As measured from the downstream end of the Ripogenus Project Boundary to the upstream end of the Penobscot Mills Project Boundary (for the North Twin Development). The Ripogenus Dam is located 33.4 RM upstream from the North Twin Dam.

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The 480-foot-long concrete ogee spillway section comprises the southern section of the dam. A 37-foot-wide intake section bisects the stanchion stoplog section approximately 220 feet from the southern spillway abutment. The spillway section includes 22 stoplog bays (14 of which are equipped with trippable stanchions) and two crest gates.

The stoplog gates are situated atop the concrete ogee spillway, which has a crest elevation of 929.59 feet. Each of the stoplog gate openings are approximately 17 feet wide by 10 feet, 8 inches high, with a 3-foot-thick concrete pier separating each of the bays. The top of the stoplog gates is at an elevation of approximately 941.59 feet and seals against the concrete support beams. The concrete support beams of the bridge deck extend from the top of the stoplog gates to the top of the dam at elevation 942.59 feet. Fourteen of the gates are equipped with quick-release devices (e.g., trippable stanchions) to ensure rapid release during a severe flood event.

The two steel crest gate openings are each 17 feet wide by 10 feet, 8 inches high and have a sill elevation of 929.59 feet and a top elevation of 941.59 feet. The crest gate section originally contained two stoplog gates identical to those presently found on either side of the crest gates. The crest gates were installed to reduce the need to release the stoplog sections during an extreme high-water condition. The gate operators are located above the gates on the concrete deck.

The gated sluice section of the dam measures approximately 178 feet in length and is located north of the spillway section. The gated sluice section contains a deep gate sluice section and a surface log sluice section. Each of the four deep waste gate openings measures approximately 8 feet wide by 9 feet high. The invert elevation of the gates is 882.59 feet. The gatehouse is located on the concrete deck directly above the four deep gates. The gatehouse is a steel-framed, concrete structure that measures approximately 100 feet long, 17 feet wide, and 21 feet high. It contains the deep gate operator, which is placed on rails so that it can be used to power the lifting mechanisms for all four deep gates.

The log sluice section is located approximately 25 feet from the north end of the gatehouse. The sluice is a concrete structure approximately 34 feet, 6 inches wide, with two steel gates at the upstream edge. The original gate openings were reduced in size, and new gates were installed.

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Each gate opening currently measures approximately 6 feet wide by 14 feet high. Two concrete training walls extend downstream of the log sluice section.

The remaining portion of the dam, an earth-filled section, is approximately 100 feet in length and connects the log sluice section to the northern shore. The earth-filled section has a top elevation of 942.59 feet. A concrete cut-off wall, located immediately upstream of the northernly earth-filled section of the dam, extends approximately 134 feet from the north end of the abandoned sluiceway into the north embankment.

Flows from the dam enter the 0.75-mile-long bypassed reach, known as the Upper Gorge.

Impoundment

Ripogenus, Caribou, and Chesuncook Lakes and Black, Brandy, and Moose Ponds constitute the impoundment that is created by the Ripogenus Dam. The impoundment extends approximately 20.8 miles up the West Branch. The mean depth of the Ripogenus impoundment is approximately 35.8 feet. Maximum depth of the impoundment is approximately 150 feet.

At the normal full pond elevation of 941.59 feet, the Ripogenus impoundment has a surface area of 29,270 acres and a gross storage capacity of approximately 710,000 acre-feet. The usable storage capacity of the impoundment with the maximum drawdown of 44 feet (elevation of 897.59 feet) is approximately 688,705 acre-feet.

The Project also includes Umbazooksus Lake, a 1,600-acre former storage impoundment, which is located less than one mile upstream of the Ripogenus impoundment. In 1998, storage and release operations were discontinued, and the outlet gate was permanently opened resulting in a run-of-river flow regime. Umbazooksus Lake provides no additional storage capability to the Ripogenus impoundment.

Intake

The Project intake structure is located approximately 220 feet from the southern spillway abutment. The intake structure controls the flow of water into the tunnel that extends downstream to McKay Station. The concrete intake structure, protected by trashracks, is approximately 37 feet wide. The trashracks are constructed of 3-inch by 3/8-inch bar steel with a clear spacing of

2-5/8 inches. The invert of the intake is at elevation 898.09 feet. An 18-foot-high by 20-foot-wide electrically operated slide gate is located on the upstream side of the intake structure and is used to control the flow of water into the tunnel. The gate is operated by a chain-type hoist powered by an electric motor located on the concrete deck of the intake structure above the gate. The intake provides a transition from an 18 foot by 20-foot rectangular opening to an 18-foot-diameter section that connects to a 16-foot-diameter vertical shaft. The vertical shaft drops approximately 100 feet to a concrete-lined, 16-foot-diameter tunnel.

The concrete-lined tunnel is approximately 3,850 feet long and conveys water from the dam to the powerhouse. From the vertical shaft, the tunnel extends approximately 3,658 feet east, through rock, to a 16-foot-diameter vertical shaft connection with a 44-foot-diameter, 104-foot-high surge tank. Fifty feet, six inches of the surge tank are in the bedrock and lined with concrete, while fifty-three feet, six inches are above ground and consist of a pre-stressed concrete structure. The tunnel continues approximately 192 feet past the surge tank, connecting with three 10-foot-diameter penstocks that lead to the powerhouse.

Powerhouse

The Ripogenus powerhouse (McKay Station) is located on the south bank of Ripogenus Gorge at the base of a 75-foot-high cliff, approximately 0.75 mile downstream from the dam. The powerhouse has a concrete substructure and a steel-framed, brick superstructure approximately 130 feet long (east to west) by 45 feet wide. The powerhouse contains three vertical shaft turbine-generator units and appurtenant equipment.

The powerhouse has two floor levels and a balcony. The three generators are located on the upper floor (elevation of 776.59 feet). The hydraulic gate positioners for the Dow valves, emergency generator, and other appurtenant equipment are located on the lower floor (elevation of 765.09 feet). The balcony (elevation of 787.92 feet) located on the west end of the powerhouse supports electrical panels and the Energy Optimization System. A stairway leads from the balcony to the roof where the switchgear is located.

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A concrete platform containing three transformers is located adjacent to the north wall of the powerhouse, over the tailrace. Electricity produced from the generators is transmitted to these transformers and then to the Project switchgear located on the McKay Station roof.

Turbines and Generators

The Project has three vertical Francis type turbines with a total authorized capacity of 37,530 kW (generator limited). The total rated capacity of the three turbines is 51,510 horsepower (Hp) (38,632.5 kW), and the total hydraulic capacity is 3,500 cfs (Table 4.3-1). There are three generators at the Project with a total installed capacity of 37,530 kW (Table 4.3-2).

Table 4.3-1
Type, Rated Capacity, and Hydraulic Capacity of Turbines at the Ripogenus Project

Unit No.	Turbine Type	Rated Capacity		Hydraulic Capacity (cfs)
		Hp	kW	
1	Vertical Francis	16,590	12,442.5	1,100
2	Vertical Francis	16,590	12,442.5	1,100
3	Vertical Francis	18,330	13,747.5	1,300
Total		51,510	38,632.5	3,500

Table 4.3-2
Type and Rated Capacity of the Generators at the Ripogenus Project

Unit No.	Type	Rated Capacity (kW)
1	ATI	12,150
2	ATI	12,150
3	AV	13,230
Total		37,530

Tailrace

The tailrace is formed of excavated bedrock and is located at a point where the station is adjacent to the main river channel. The tailrace enters the main river channel at an approximately 90-degree angle. The normal tailwater elevation at the McKay Station is 758.5 feet at the Project's hydraulic capacity of 3,500 cfs.

Transmission Line

The Ripogenus Project transmission lines start at the substation at McKay Station and extends approximately 29.4 miles to Millinocket Substation #4, located at the former Millinocket Mill. Three transformers located on a concrete platform over the tailrace transform the 6,900 V power produced by the Project generators to 115 kV for transmission over the Project transmission lines. Two of the transformers have a rating of 13,500 kilovolt-ampere (kVA), and the remaining one is rated at 15,000/20,000 kVA.

The transmission line includes a 200-foot right-of way and has a rated capacity of 530 amps. An additional 4,160 V transmission tie extends 0.75 mile from the McKay Substation to the dam to supply backup power to the gate operators and to Ripogenus Village.

Battery Storage

The Ripogenus Project contains one utility-scale battery energy storage (BES) site that operates as a single asset (BES system). The battery storage is located within the Ripogenus Project's 115 kV transmission line right-of-way adjacent to the Millinocket Substation #4 (within the Penobscot Mills Project).

The BES system is sized at a capacity of 10 MW with a 2-hour duration (20 megawatt hours [MWh] total capacity). This system operates with another BES system located at GLHA's Powersville Substation (associated with the Penobscot Mills Project) in Township A Range 7 WELS for a total capability of 20 MW for up to 2 hours (40 MWh total capacity).

The Millinocket Substation #4 BES system is located to the west of and adjoining the 60 Hz, 34.5 kV-115 kV substation. The site is approximately 158 feet by 82 feet and is fenced in. The site contains nine Tesla Megapack systems, five 480V-34.5 kV transformers, and a 34.5 kV electrical collection system that is connected to the 34.5 kV electrical switchgear located in the substation control building

4.3.2 Penobscot Mills Project

As discussed above, the Penobscot Mills Project consists of four hydropower developments and one storage development. The four hydropower developments are (listed in descending order from

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upstream to downstream), North Twin, Millinocket, Dolby, and East Millinocket, which are located between RM 15 and 2, respectively, on the West Branch. The Millinocket Lake Storage Development is located on Millinocket Stream, which enters the West Branch downstream of the Millinocket Development. The primary features of the Penobscot Mills Project include five dams, five impoundments, and four powerhouses. The total authorized installed capacity of the Penobscot Mills Project is 67.9 MW (Table 4.3-3).

Table 4.3-3
Authorized Installed Capacity of the Penobscot Mills Project

Development Name	Authorized Installed Capacity (kW)
Millinocket Lake Storage	-
North Twin	7,012.5
Millinocket	37,374.8
Dolby	16,513
East Millinocket	6,975
Total	67,875.3

The North Twin impoundment is at the upstream end of the Project and receives flow from the Ripogenus Project. Releases from the North Twin Development pass through three other developments and associated generation facilities of the Penobscot Mills Project including Millinocket, Dolby, and East Millinocket. The Millinocket Lake Storage Development includes a pumping station located on the opposite end of the lake from the dam. Water from the Millinocket Lake Storage Development is either pumped to Ambajejus Lake (within the North Twin impoundment) or is discharged to Millinocket Stream, which enters the West Branch at Shad Pond (downstream of the Millinocket Development) and passes through the Dolby and East Millinocket Developments.

The Project's developments were originally constructed around the turn of the 20th century to meet the hydromechanical and hydroelectric demands of the Millinocket Mill, constructed in 1900, and the East Millinocket Mill, constructed in 1906. The North Twin Development is located at a site that has been developed for water storage since 1846. The Millinocket Lake Storage Dam was originally constructed in 1883 to provide storage for log driving. Both of these dams provide extensive storage and regulation of water flow, much like GLHA's other storage dams including the Ripogenus Project and the Storage Project (FERC No. 2634) in the Upper West Branch

watershed. The following sections describe the physical composition, dimensions, and general configuration of the Project facilities.

4.3.2.1 Millinocket Lake Storage Development

The Millinocket Lake Storage Development is located on Millinocket Stream in Penobscot and Piscataquis Counties, Maine. No generating facilities are located at the Millinocket Lake Storage Development, and it is used solely for water storage. Water in Millinocket Lake is either released from the dam into Millinocket Stream and passes through the Dolby and East Millinocket Developments, or it is pumped into Ambajejus Lake (within the North Twin impoundment). As further described below, the development consists of: 1) an impoundment having a normal full pond elevation of 480.0 feet with a surface area of 8,640 acres; 2) a concrete and earth-filled dam measuring approximately 635 feet in length and located at the outlet of Millinocket Lake; and 3) a pumping station containing two pumps, located approximately 6.2 miles from the dam, two 4-foot, 6-inch-diameter steel pipes measuring approximately 544 feet in length, and a concrete outlet structure discharging to Ambajejus Lake (within the North Twin impoundment).

Dam and Spillway

The Millinocket Lake Storage Dam is located at the outlet of Millinocket Lake and crosses Millinocket Stream in an approximately east-west direction. The dam is located approximately 7.8 miles upstream of the Millinocket Development tailrace.

The dam is an approximately 635-foot-long, concrete and earth-filled structure and includes two earthen embankments totaling 462 feet in length, two spillway sections totaling 115 feet in length, and a 58-foot-long gate section.

The earthen embankments includes: 1) a 432-foot-long section on the west end of the dam with a crest elevation of 487.0 feet, and 2) a 30-foot-long, 8-foot-wide (at top) section on the east side of the dam with a crest elevation of 485.6 feet. A concrete core wall is located in a portion of the 30-foot-long embankment section. The upstream sections of the embankments are protected with riprap.

A 19-foot-long spillway section abuts the western embankment, and a 96-foot-long spillway abuts the eastern embankment. Both spillway sections have a crest elevation of 480.0 feet.

An approximately 58-foot-long gated section is located between the two spillway sections, which contains four lift gates and one log sluice gate. Each of the four gates and the log sluice gate are 8 feet wide and 10 feet high; however, the four lift gate openings are only 9 feet high. Three of the gates are equipped with hand-operated, rack-and-pinion operators. The three gates are also operable by connecting a portable electric motor assembly to the hand crank stem.

Pumping Station

The pumping station is located on the west side of Millinocket Lake, approximately 6.2 miles from the dam, and it is used to pump water from Millinocket Lake into Ambajejus Lake within the North Twin impoundment. The pumping station consists of a concrete substructure and a brick superstructure approximately 25 feet by 53 feet in plan, with an adjoining 5 feet by 24 feet intake section. Trashracks consisting of 3/16-inch bar steel with a clear spacing of 1 inch are located at the pumping station intake. Two vertical wet pit pumps each with a capacity of 250 Hp and 122 cfs (total capacity of 244 cfs), pump water approximately 570 feet (inclusive of the pumping station, or 544 feet not inclusive of the pumping station) to Ambajejus Lake within the North Twin impoundment. Two underground, 4.5-foot-diameter pipes extend approximately 544 feet from the pumping station to the outlet structure. The outlet structure consists of a concrete substructure and concrete wingwalls. Two steel gates (5 feet, 7 inches wide by 5 feet, 10 inches high) at the outlet structure can be used to prevent backflow from the North Twin impoundment when the pumps are not operating.

Impoundment

Millinocket Lake has a surface area of approximately 8,640 acres at the normal full pond elevation of 480.0 feet. The mean depth of Millinocket Lake is 23.6 feet. The gross storage capacity and usable storage capacity of Millinocket Lake is approximately 45,370 acre-feet, with a 6.2-foot drawdown capability (based on elevation 473.8 feet).

4.3.2.2 North Twin Development

The North Twin Development is located on the West Branch in Penobscot and Piscataquis Counties to the west of Millinocket, Maine, approximately 14.9 RM above the confluence of the East and West Branches. The North Twin Dam is located approximately 33.4 miles downstream of the Ripogenus Dam and 2.6 miles upstream of Stone Dam (of the Millinocket Development).

As further described below, the North Twin Development consists of: 1) an impoundment having a normal full pond elevation of 491.92 feet with a surface area of 17,790 acres; 2) a concrete and earth-filled dam measuring approximately 1,051 feet in length, including an intake structure and powerhouse containing three turbine-generator units and appurtenant equipment; 3) a series of six earthen dikes having a combined length of 2,530 feet, located upstream of the dam; 4) a 60 Hz substation containing six transformers; and 5) a transmission line approximately 4.2 miles in length that extends to the last transmission pole structure before entering GLHA's Millinocket Substation #4.

Dam and Spillway

The North Twin Dam is an approximately 1,051-foot-long concrete and earth-filled structure located at the outlet of Elbow Lake (within the North Twin impoundment). The dam crosses the West Branch in an approximately southeast-northwest direction. The dam includes a 500-foot-long, earthen dike; a 114-foot-wide intake structure and powerhouse; a 34-foot-wide fishway section with two gated log sluices; a 117-foot-wide Tainter gate section; and a 286-foot-long earthen embankment.

The 500-foot-long earthen dike is located on the southeastern end of the powerhouse. The dike extends approximately 309 feet along the southeastern shore before turning at a right angle and traveling approximately 180 feet to the powerhouse. The portion of the dike located adjacent to the southeastern shore has a crest elevation of 498.1 feet. An approximately 309-foot-long concrete core wall with a crest elevation of 497 feet is located within this section of the earthen dike. The portion of the dike located adjacent to the powerhouse is surmounted by a paved roadway with elevations ranging from 494.6 to 498.6 feet. A line of sheet pile having a top elevation of 498.6 feet

has been added to that portion of the dike located adjacent to the powerhouse to protect it from being overtopped during the Probable Maximum Flood (PMF).

Next to the earthen dike, there is a 114-foot-wide intake structure and powerhouse. On the other side of the powerhouse, there is a 34-foot-wide concrete section, which contains a pool and weir design fishway and two gated log sluice sections.

Two gates measuring approximately 6 feet by 13 feet and 9 feet by 22 feet, respectively, are located in the concrete section adjacent to the fishway. The gate located closer to the fishway originally contained a sluice, which was used to sluice logs through the dam to the downstream mills. The steel portion of the log sluice located downstream of the first gate was removed during the 1970s upon cessation of log drives on the West Branch. Prior to the installation of the Tainter gates in 1965, the remaining sluice gate was used for flow control. These gates are not required to pass the PMF and are not currently used.

Adjacent to the fishway and gated log sluices, there is a 117-foot-wide section with two steel Tainter gates and associated piers. Each Tainter gate is approximately 50 feet wide and 27 feet, 3.6 inches high. The invert elevation of the gates is 464.62 feet. An earthen dike having a top elevation from 494.62 feet to 498.7 feet extends approximately 286 feet from the Tainter gate section to the northern shore. A former waste gate structure, located adjacent to the Tainter gate section, has been buried with earth fill to create a portion of the referenced earthen dike section. This earthen section measures approximately 100 feet in length and has a top elevation ranging from 494.62 feet to 498.7 feet. A concrete parapet wall having a top elevation of 498.7 feet is located atop the entire section. The remaining portion of the earthen dike section is approximately 186 feet long with crest elevations ranging from 498.7 feet to 497.9 feet. A concrete core wall within the earthen dike section extends approximately 150 feet from the Tainter gate section and has a top elevation of 497 feet.

Impoundment

The North Twin impoundment includes Elbow, South Twin, North Twin, Pemadumcook, and Ambajejus lakes. The North Twin impoundment is approximately 11.8 miles long and has a surface area of approximately 17,790 acres at the normal full pond elevation of 491.92 feet. The

mean depth of the impoundment is approximately 27.7 feet. The gross storage capacity of the impoundment that is impounded by the dam is approximately 346,000 acre-feet. Usable storage capacity of the impoundment is approximately 344,355 acre-feet (15.0 billion cubic feet), with a drawdown capability of 22 feet.

Intake

The North Twin intake structure consists of a concrete substructure containing nine water passages and a brick superstructure located atop the downstream half of the substructure. The intake substructure is approximately 37 feet by 114 feet in plan, and the superstructure is 19 feet by 114 feet in plan.

Each of the nine water passages located in the intake is approximately 8 feet wide and 13 feet high. A steel gate is located within each of the nine water passages. These steel headgates are used to control the flow of water to the turbines. Trashracks are located along the upstream side of the intake substructure. The trashracks are constructed of 3/8-inch bar steel with a 2-5/8-inch clear opening between the bars. A trash rake mounted on rails is located on the exterior deck of the intake structure.

Powerhouse

The North Twin powerhouse consists of a concrete substructure and a brick superstructure measuring approximately 50 feet by 114 feet in plan that contains three turbine-generator units. The powerhouse is integral with, and located immediately downstream of, the intake structure. Three generators, governors, exciters, and other appurtenant equipment are located on the main floor of the powerhouse (elevation of 479.62 feet). The switchgear is located along the upstream side of the powerhouse on a balcony (elevation 491.12 feet) above the main floor.

Turbines and Generators

There are three vertical turbines located within the North Twin powerhouse with an authorized installed capacity of 7,012.5 kW (turbine limited). Units 1 and 2 are fixed-blade units and are located at the southeastern end of the powerhouse. Unit No. 3 is a Kaplan turbine with an adjustable blade runner. The total rated capacity of the three turbines is 9,350 Hp (7,012.5 kW), and the total

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hydraulic capacity is 4,500 cfs (Table 4.3-4). There are three Synchronous (ATB) generators at the development with a total rated capacity of 9,840 kW (Table 4.3-5).

**Table 4.3-4
Type, Rated Capacity, and Hydraulic Capacity of Turbines at the North Twin Development**

Unit No.	Turbine Type	Rated Capacity		Hydraulic Capacity (cfs)
		Hp	kW	
1	Vertical Fixed Blade	3,050	2,287.5	1,350
2	Vertical Fixed Blade	3,050	2,287.5	1,350
3	Vertical Kaplan	3,250	2,437.5	1,800
Total		9,350	7,012.5	4,500

**Table 4.3-5
Type and Rated Capacity of Generators at the North Twin Development**

Unit No.	Type	Rated Capacity (kW)
1	Synchronous (ATB)	3,200
2	Synchronous (ATB)	3,200
3	Synchronous (ATB)	3,440
Total		9,840

Tailrace

Water exits the powerhouse through six tailrace bays, each of which are approximately 14 feet wide. A concrete retaining wall extends approximately 28 feet downstream of the powerhouse and protects the downstream side of the southeastern earthen dike. The tailrace is approximately 104 feet wide and conveys the water from the units back to the river. The normal tailwater elevation is 460.7 feet at the total hydraulic capacity of 4,500 cfs.

Fishway

An upstream fishway is located adjacent to the powerhouse for the upstream movement of resident fish. There are three gates located upstream of the fishway at different depths to control the flow of water into the chambers of the fishway at various impoundment elevations. Each gate is 1 foot, 3 inches wide by 2 feet high. The chambers of the fishway extend downstream of the gate approximately 98 feet along the northeastern side of the powerhouse. The existing fishway is a pool, weir (1-foot-wide Cipoletti slots), and orifice (2-inch drain size) design. There is an 8-inch

gravity pipe to provide attraction flows that runs from the area of the spillway/log sluice to the fishway entrances. The intake to the pipe has a slide gate control with an upstream removable basket type trashrack. The pipe has a “Y” configuration at its discharge to attract fish to both fishway entrances. Each leg of the “Y” has a control valve and discharge at the surface in line with the present entrance flows.

Transmission Line

An outdoor substation containing six transformers is located on the northeast side of the powerhouse. Each transformer has a rated capacity of 2,500/2,800 kVA. The transmission line extends on a series of wood poles for approximately 4.2 miles to the last transmission pole structure before entering GLHA’s Millinocket Substation #4 located at the former Millinocket Mill. The 34.5 kV, 1/0 ASCR transmission line has a capacity of 194 amps.

Auxiliary Dikes

There are five auxiliary dikes located along the eastern shore of the impoundment with a combined length of approximately 1,850 feet. The dikes have a crest elevation between 497.6 feet and 498.1 feet and a minimum top width of 10 feet. The dikes are constructed of common earth fill and sheet pile located within the fill.

A sixth dike, measuring approximately 680 feet in length, is located approximately 11 RM upstream of the North Twin Dam between Ambajejus Lake (within the North Twin impoundment) and Millinocket Lake (the Millinocket Lake Storage impoundment). The top elevation of the earthen dike varies from 495.0 feet to 497.6 feet. A 450-foot-long portion of the dike contains sheet pile to an elevation of 495 feet and has a top elevation of 500.5 feet. The sheet pile has been added to protect the dike from being overtopped during the PMF.

4.3.2.3 Millinocket Development

The Millinocket Development consists of: 1) an impoundment having a normal full pond elevation of 458.7 feet with a surface area of 1,344 acres; 2) a concrete dam (“Stone Dam”) approximately 1,262 feet long located on the West Branch approximately 12.3 RM above the confluence of the East and West Branches of the Penobscot River; 3) a gatehouse located at the dam containing ten

gates and a sluiceway; 4) three earthen dikes in Quakish Lake with a total length of 1,854 feet; 5) five earthen dikes in Ferguson Pond with a total length of 3,195 feet, a "western" canal leading from the gatehouse to Ferguson Pond, and an "eastern" canal that leads from Ferguson Pond to the intake structure, all of which are used to convey water from the gatehouse at Stone Dam to the intake structure located approximately 7,300 feet from Stone Dam; 6) an intake structure containing seven headgates, located at the entrance of the penstocks; 7) six 10-foot-diameter steel penstocks and one 11-foot-diameter steel penstock ranging in length from 1,007 feet to 1,024 feet; 8) a powerhouse containing seven operable turbine-generator units, of which five are located within the former Grinder Room and two within the Generator Room; 9) two transformers, one having a rated capacity of 30/40/50 MVA and one at 24/34/40 MVA; and 10) two 60 Hz transmission lines approximately 300 feet in length (one 6.9 kV and one 13.8 kV).

Dam and Spillway

Stone Dam is a concrete gravity structure located at the outlet of Quakish Lake. It directs water into the western canal which leads to Ferguson Pond. The 1,262-foot-long concrete dam consists of a 300-foot-long overflow spillway section with no flashboards; a 358-foot-long spillway section with 30-inch-high flashboards; a 52-foot-wide waste gate structure; a 428-feet, 5-inch-long spillway with a 2-foot, 9-inch-high rubber inflatable dam; and a 124-foot-long gatehouse.

The concrete gravity sections of the dam extend from the southwestern end of the dam to the western canal gatehouse. The 300-foot-long overflow spillway section is located on the southwestern end of the dam and has a crest elevation of 458.95 feet. This section does not contain flashboards and is used as an overflow spillway during high flow events when the water level rises above the spillway crest elevation.

The two remaining spillway sections are a total of 786 feet long and are separated by a 52-foot-wide waste gate structure, which was a former log sluice. The 357.6-foot-long spillway section on the south side of the waste gate structure has a crest elevation of 456.2 feet and is surmounted with 30-inch-high flashboards. The waste gate structure consists of a concrete section containing four steel waste gates. Three of the four gates are 9 feet wide by 6 feet high. The remaining gates are 11 feet wide by 6 feet high. The gates are no longer used for dam operations as a result of personnel safety issues. The 428-foot, 5-inch-long spillway section between the waste gate and gatehouse,

which previously had wooden flashboards, has been retrofitted with a 2-foot, 9-inch-high, single-span, Bridgestone rubber dam system. The system is comprised of one airtight dam fastened to the upstream edge of the spillway using a special clamping system. Air is supplied to the rubber dam for inflation through a fitting in the abutment of the dam that is connected to two high capacity air blowers. Inflation or deflation of the rubber dam may be done in one of two modes: Manual or Automatic. Remote monitoring and control from Brookfield's National System Control Center (NSCC) is the normal mode of operation. Instead of gate operation, the NSCC operator remotely inflates or deflates the rubber dam to pass the appropriate flows. Flows from the dam enter the 4.5-mile-long Back Channel before flowing into Shad Pond.

A 124-foot-long gatehouse is integral with the dam and is located at the head of the western canal. The gatehouse consists of a concrete substructure topped by a wood frame superstructure. The structure measures approximately 16 feet by 124 feet in plan and contains ten gate openings and a 12-feet, 6-inch-wide sluiceway on the northeastern side of the gatehouse. One of the ten gate openings has been sealed and is used for the headwater sensors of the Energy Optimization System. Six of the nine operable steel headgates are 7 feet, 6 inches wide by 11 feet high; two are 7 feet wide by 11 feet high; and one is 8 feet wide by 11 feet high. The sluiceway is approximately 12 feet, 6 inches wide and 9 feet, 6 inches high and is equipped with stoplog slots.

Three dikes with a total length of approximately 1,854 feet are located along the northern shore of Quakish Lake. Two of the dikes are located in close proximity to the gatehouse and have top elevations of 468.0 feet and 468.5 feet. The other dike, located approximately 2,500 feet upstream from the dam, has a top elevation of 468.0 feet. The dikes are used to confine the flowage limits of Quakish Lake and have been designed to withstand the PMF.

Impoundment

Stone Dam, located approximately 2.6 miles downstream from the outlet of the North Twin impoundment, impounds Quakish Lake and conveys flow into Ferguson Pond. Quakish Lake has a surface area of approximately 1,344 acres at a normal full pond elevation of 458.7 feet. Quakish Lake is approximately 8,600-feet-long. The gross storage capacity of Quakish Lake is approximately 8,100 acre-feet, with negligible usable storage. Ferguson Pond has no usable storage capacity but conveys water from Stone Dam to the intake structure.

Intake

The gatehouse is used to regulate the flow into the western canal, which conveys water from Quakish Lake to Ferguson Pond. The western canal is approximately 150 feet wide and 1,400 feet long. A 225-foot-long, concrete gravity spillway section extends downstream from the southern gatehouse abutment to Dike No. 4. The spillway section has a crest elevation of 458.2 feet and is topped by 6-inch-high flashboards, allowing it to serve as a spillway during high flows.

Five earthen dikes with a total length of 3,915 feet are located along the perimeter of Ferguson Pond. Four of the dikes are interspersed along the southern shore of Ferguson Pond. The dikes have a top elevation of 462.0 feet and are used to confine the flowage limits of Ferguson Pond. The remaining dike is located on the north side of the eastern canal and has a top elevation of 462.0 feet. The eastern canal conveys water from Ferguson Pond to the intake structure. The eastern canal is approximately 150 feet wide and 1,300 feet long.

The intake structure consists of a concrete substructure with seven gate openings, surmounted by a wood frame superstructure. Six gates, each measuring 12 feet, 6 inches wide by 12 feet, 6 inches high, control the flow of water into the six 10-foot-diameter penstocks that lead to the units located in the Grinder Room in the former mill complex. The remaining gate, measuring 13 feet, 6 inches wide by 13 feet, 6 inches high, controls the flow of water into the 11-foot-diameter penstock that leads to the generating units located in the Generator Room.

The trashracks for the 10-foot-diameter penstocks are constructed of 3/8-inch by 3-inch bar steel with a clear spacing of 2-7/8 inches. The trashracks for the 11-foot-diameter penstock are constructed of 3/8-inch by 3-inch bar steel with a clear spacing of 2-1/2 inches. The intake superstructure is approximately 216 feet long by 24 feet wide by 225 feet high.

The six 10-foot-diameter steel penstocks extend from the intake structure approximately 1,007 feet to the five turbines in the former Grinder Room. The 11-foot-diameter steel penstock is approximately 1,024 feet long and conveys water to the two turbine units in the Generator Room.

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Powerhouse

Seven operable turbine-generator units are located within the confines of the former Millinocket Mill. A portion of the former Grinder Room, in which five hydroelectric units are located, is included in the Development. The other two hydroelectric units are located in the Generator Room, which is located adjacent to the Grinder Room. The Grinder Room is 174.5 feet wide by 210 feet long, and the Generator Room is 52 feet wide by 122 feet long.

Turbines and Generators

The Millinocket Development contains seven operable (Units 1, 3, 4, 5, 6, 7, and 8) and one inoperable (Unit 2)³ horizontal Francis turbines with a total authorized installed capacity of 37,374.8 kW (turbine limited). Five of the turbines (Units 1, 3, 4, 5 and 6) are located in the former Grinder Room, and two of the turbines (Units 7 and 8) are located in the Generator Room. The seven operable turbines have a total rated capacity of 49,833 Hp (37,374.8 kW) and their total hydraulic capacity is 4,305 cfs (Table 4.3-6). There are seven operable Synchronous generators at the development with a total rated capacity of 38,640 kW (Table 4.3-7).

**Table 4.3-6
Type, Rated Capacity, and Hydraulic Capacity of Turbines at the Millinocket Development**

Unit No.	Turbine Type	Rated Capacity		Hydraulic Capacity (cfs)
		Hp	kW	
1	Horizontal Francis	6,980	5,235	662
2	Horizontal Francis	7,000	5,250	695
3	Horizontal Francis	7,000	5,250	695
4	Horizontal Francis	7,242	5,431.5	566
5	Horizontal Francis	7,242	5,431.5	566
6	Horizontal Francis	7,242	5,431.5	566
7	Horizontal Francis	7,242	5,431.5	600
8	Horizontal Francis	6,885	5,163.8	650
Total¹		49,833	37,374.8	4,305

¹Unit 2 is not included in the total rated and hydraulic capacities.

³ Units 2 is currently out-of-service and, therefore, is not included in the total rated capacity or hydraulic capacity of the station; however, GLHA routinely evaluates rehabilitation of the unit based on market conditions and other factors

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**Table 4.3-7
Type and Rated Capacity of Generators at the Millinocket Development**

Unit No.	Type	Rated Capacity (kW)
1	Synchronous	5,440
2	Synchronous	5,580
3	Synchronous	5,580
4	Synchronous	5,580
5	Synchronous	5,510
6	Synchronous	5,510
7	Synchronous	5,580
8	Synchronous	5,440
Total¹		38,640

¹Unit 2 is not included in the total rated capacity.

Tailrace

Water exits the turbines through seven, 25-foot-wide tailrace bays discharged directly into the river at an approximate right angle to Millinocket Stream. The normal tailwater elevation of Millinocket Station is approximately 347.4 feet.

Transmission Line

Power generated from Units 3, 4, 5, 6, and 7 are transmitted across Millinocket Stream to a transformer rated at 24/34/40 MVA in Substation #1, where the voltage is stepped-up from 6.9 kV to 34.5 kV. Power generated from Units 1 and 8 are also transmitted across the powerhouse tailrace to a transformer rated at 30/40/50 MVA in Substation #1, where the voltage is stepped-up from 13.8 kV to 34.5 kV. The 34.5 kV, 795 KCMIL ASCR transmission line has a capacity of 194 amps and connects to Millinocket Substation #4. The transmission lines are each approximately 300 feet long.

4.3.2.4 Dolby Development

The Dolby Development is located on the West Branch approximately 4.2 RM upstream of the confluence of the East and West Branches and 1.9 miles upstream of the East Millinocket Dam.

The development consists of: 1) an impoundment having a normal full pond elevation of 336.2 feet with a surface area of 2,048 acres; 2) a concrete and earth-filled dam measuring approximately

1,395 feet in length, including an intake structure and powerhouse integral with the dam containing four operable turbine-generator units and other appurtenant equipment; 3) a 60 Hz substation containing one transformer having a rated capacity of 15/20 MVA and a second transformer with a rated capacity of 5 MVA; and (4) a transmission line extending approximately 2 miles to the last transmission pole structure before entering GLHA's Powersville Substation.

Dam and Spillway

Dolby Dam is a concrete and earth-filled structure located at the outlet of Dolby Pond that crosses the West Branch in a generally southwest-northeast direction. The 1,395-foot-long dam includes a 27-foot-long concrete abutment, four spillway sections with a total length of 521 feet, two 6-foot-long abutments, a 76-foot-wide waste gate, a 209-foot-wide intake with an integral powerhouse, and 300-foot-long and 250-foot-long earthen dikes.

The 27-foot-long concrete abutment is located adjacent to the southwestern shore. The spillway consists of four sections with a total length of approximately 521 feet that extends from the concrete abutment to the powerhouse. The spillway sections have a crest elevation of 332.2 feet with 4-foot-high flashboards extending to an elevation of 336.2 feet. The spillway is divided by a pair of abutments of a former log sluice (located approximately 218 feet from the southwestern abutment), which has now been converted to a spillway section, and by a waste gate structure (located approximately 60 feet from the powerhouse).

The former log sluice structure was approximately 34 feet wide and contained two concrete abutments located on each side of a 22-foot-long portion of the spillway. The abutments are 6 feet wide and have a top elevation of 340.7 feet.

A 76-foot-wide waste gate structure is located approximately 60 feet southwest of the powerhouse. The waste gate structure contains six gate openings. Each gate opening contains a steel gate measuring approximately 6 feet wide by 9 feet, 2 inches high, operated by electrically driven operators.

A 550-foot-long earthen dike extends from the northeastern end of the powerhouse to the northern shore. The earthen dike has a top elevation of 343.2 feet and is topped with a 12-foot-wide travel

surface. A concrete core wall is located within the portion of the earthen dike located closest to the powerhouse.

Impoundment

The impoundment is approximately 4.2 miles long (2.3 miles through the river course) and has a surface area of approximately 2,048 acres at a full pond elevation of 336.2 feet. The gross storage capacity of the impoundment is approximately 41,956 acre-feet, with negligible usable storage.

Intake

The intake structure consists of a concrete substructure approximately 23 feet wide by 209 feet long and is located immediately upstream of the powerhouse. The intake substructure contains nine water passages that are used to convey water to the four operable turbines. Each of the water passages is equipped with a headgate to control the flow of water into the turbines.

Eight sets of trashracks, having a total length of 174 feet, extend across the upstream side of the intake structure. The trashracks for bays 2 through 4 are constructed of 3/8-inch bar steel with a clear spacing of 1-5/8-inches between the bars. The trashracks for bays 5 through 8 are constructed of 3/8-inch bar steel with a clear spacing of 2-5/8-inches between the bars. The gate operators are located on the deck of the intake structure at an elevation of 343.2 feet.

A concrete block building houses the gate operators and trash rake for bays 5 through 8. The building measures approximately 23 feet wide by 121 feet long and is located on top of the concrete deck. There is no intake superstructure associated with bays 1 through 4.

Powerhouse

The Dolby powerhouse consists of a concrete substructure and brick superstructure measuring approximately 115 feet wide by 167 feet long in plan, with an 82-foot by 36-foot addition located on the western side of the powerhouse to house the No. 8 Unit. The powerhouse contains four operable turbine-generator units. The turbine-generators located in the No. 1, 2, 3, and 4 bays have been removed from service.

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Turbines and Generators

There are four operable turbines (Units 5, 6, 7 and 8)⁴ located in the Dolby powerhouse: three inclined Kaplan and one vertical, fixed-blade, which have a total authorized installed capacity of 16,513 kW (generator limited with the exception of Unit 8). These turbine units have a total rated capacity of 22,732 Hp (17,049 kW) and a total hydraulic capacity of 4,750 cfs (Table 4.3-8). There are four Synchronous generators at the development with a total rated capacity of 17,098 kW (Table 4.3-9).

Table 4.3-8
Type, Rated Capacity, and Hydraulic Capacity of Turbines at the Dolby Development

Unit No.	Turbine Type	Rated Capacity		Hydraulic Capacity (cfs)
		Hp	kW	
5	Inclined Kaplan	7,472	5,604	1,520
6	Inclined Kaplan	5,680	4,260	1,200
7	Inclined Kaplan	5,680	4,260	1,200
8	Fixed Blade	3,900	2,925	830
Total		22,732	17,049	4,750

Table 4.3-9
Type and Rated Capacity of Generators at the Dolby Development

Unit No.	Type	Rated Capacity (kW)
5	Synchronous (AKW)	5,300
6	Synchronous (AV)	4,144
7	Synchronous (AV)	4,144
8	Synchronous (ATB)	3,510
Total		17,098

Tailrace

Water exits the four operable turbines through four tailrace bays into a 189-foot-wide tailrace. Bays No. 1, 2, 3, and 4 are no longer used. Normal tailwater elevation is approximately 287.2 feet (the East Millinocket impoundment extends to the Dolby Development). The tailrace is bordered on the northeast side by a 240-foot-long concrete retaining wall. A 53-foot-long training wall is

⁴ Turbine-generator units 1, 2, 3 and 4 are currently out-of-service; however, GLHA routinely evaluates rehabilitation of these units based on market conditions and other factors.

located between Bays 7 and 8, and an 86-foot-long training wall is located along the southwestern end of Bay 8.

Transmission Line

There is one 60 Hz outdoor substation located on the southeastern side of the powerhouse. The 60 Hz substation contains one transformer having a rated capacity of 15/20 MVA, which is supplied from Units 5, 6, and 7. A second transformer with a rated capacity of 5 MVA is supplied by Unit 8. The two transformers step-up the units' terminal voltage from 6.9 kV to 34.5 kV for transmission to Substation #5. The 34.5 kV, 477 KCMIL ASCR transmission line, which is approximately 2 miles long, has a capacity of 715 amps.

4.3.2.5 East Millinocket Development

The East Millinocket Development is located at the former East Millinocket Mill, approximately 2.3 miles upstream of the confluence of the West and East Branches of the Penobscot River and 1.7 miles upstream of Black Bear Hydro Partners, LLC's Medway Hydroelectric Project (FERC No. 2666).

The East Millinocket Development includes: 1) an impoundment having a normal full pond elevation of 287.2 feet with a surface area of 128 acres; 2) a concrete and earth-filled dam measuring approximately 717 feet, 6 inches long, including an intake structure and powerhouse containing six hydroelectric units; and 3) a tailrace measuring approximately 1,050 feet long.

Dam and Spillway

The 717-foot, 6-inch-long East Millinocket Dam crosses the West Branch in a generally east-west direction. It consists of a 116-foot-long earth embankment, 212-foot-long spillway section, a 59-foot-wide waste gate structure, 154-foot-long spillway section, 7-foot-wide timber crib section, 23-foot-wide sluice gate, and a 146-foot, 6-inch-wide intake structure integral with the powerhouse. The 116-foot-long earthen embankment section is located on the western side of the dam and has a top elevation of 295.2 feet and a top width of approximately 15 feet. There is a concrete wingwall along the upstream toe of the earthen embankment and a concrete core wall within it.

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Two concrete spillway sections, measuring a total of approximately 366 feet in length, span the river between the earthen embankment section and the timber crib section, which is located next to a former log sluice adjacent to the powerhouse. The spillway sections have a crest elevation of 283.2 feet and are topped with 4-foot-high flashboards. The two spillway sections are separated by a 59-foot-wide waste gate structure located near the center of the dam. The waste gate structure contains two, 23-foot-wide waste gates.

The timber crib section is 7 feet wide and forms the western wall of the former log sluice. The timber crib section sits atop the concrete apron of the dam. The powerhouse borders the former log sluice on the east. The sluice was removed from service in the 1970s upon completion of log drives on the West Branch. A 23-foot-wide, fixed-steel closure panel has been placed in the former gate opening.

Impoundment

The East Millinocket impoundment extends from the dam approximately 1.9 miles upstream to the tailwater of Dolby Dam. The surface area of the impoundment is approximately 128 acres at the normal full pond elevation of 287.2 feet. The gross storage capacity of the impoundment is approximately 1,950 acre-feet with negligible usable storage capacity.

Intake

The intake structure consists of a concrete substructure measuring approximately 146 feet, 6 inches long by 54 feet wide. The intake contains 12 gate openings that lead to 6 covered flumes in which the turbines are located. Trashracks are located immediately upstream of the gate openings. The trashracks are constructed of 3/8-inch bar steel with 1-1/4-inch clear spacing between the bars. Each of the 12 gate openings are 9 feet by 11 feet and are equipped with a steel headgate connected to a hand-operated gate hoist, which controls the flow of water into the intake. The deck covering the flumes is at an elevation of 294.2 feet.

Powerhouse

The powerhouse consists of a concrete substructure and a brick superstructure measuring approximately 56 feet wide by 146 feet, 6 inches long in plan. The powerhouse is located on the east side of the river, adjacent to the former East Millinocket Mill, and it originally served as the

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Grinder Room for the East Millinocket Mill. The grinder lines have been removed and the synchronous motors converted to use as generators. The powerhouse contains six generating units and appurtenant equipment.

Turbines and Generators

The powerhouse contains six horizontal Francis turbines with a total authorized installed capacity of 6,975 kW (turbine limited). These units have a total rated capacity of 9,300 Hp (6,975 kW) and total hydraulic capacity of 4,200 cfs (Table 4.3-10). The turbines were originally used to power the mill grinder lines with the synchronous motors being used to assist the turbines in powering the grinder lines. The grinder lines have since been removed. The electric motors are now used to generate carbon-free electricity. The turbine gates are controlled through a mechanical linkage of gears and levers.

There are six Synchronous (TS) generators at the development with a total rated capacity of 9,952 kW (Table 4.3-11). The present-day generators originally served as electric motors to drive the grinders. After the removal of the grinders from the turbines, and the conversion of the plant to producing hydroelectric energy, the generators were rewound for 60 Hz operation.

Table 4.3-10
Type, Rated Capacity, and Hydraulic Capacity of Turbines at the East Millinocket Development

Unit No.	Turbine Type	Rated Capacity		Hydraulic Capacity (cfs)
		Hp	kW	
1	Horizontal Francis	1,550	1,162.5	700
2	Horizontal Francis	1,550	1,162.5	700
3	Horizontal Francis	1,550	1,162.5	700
4	Horizontal Francis	1,550	1,162.5	700
5	Horizontal Francis	1,550	1,162.5	700
6	Horizontal Francis	1,550	1,162.5	700
Total		9,300	6,975	4,200

Table 4.3-11
Type and Rated Capacity of Generators at the East Millinocket Development

Unit No.	Type	Rated Capacity (kW)
1	Synchronous (TS)	1,600
2	Synchronous (TS)	1,600
3	Synchronous (TS)	1,600
4	Synchronous (TS)	1,952
5	Synchronous (TS)	1,600
6	Synchronous (TS)	1,600
Total		9,952

Tailrace

The tailrace consists of a 1,050-foot-long channel with an average width of 110 feet, which directs water from the powerhouse back to the main channel of the river. The normal tailwater elevation is 261.5 feet at the total hydraulic capacity of 4,200 cfs.

Transmission Line

Generation produced from each of the six units is passed directly into two 6,900-volt buses. Six breakers, each having a rated capacity of 1,200 amps, are located between each generator and the buses. Generation from the two buses is connected to a transformer rated at 10.5/12 MVA, which steps-up the generator terminal voltage from 6.9 kV to 34.5 kV for transmission to Substation #5. The transformer is part of Substation #3, which is located at the former East Millinocket Mill. The 34.5 kV, 477 KCMIL ASCR transmission line, which measures approximately 2 miles in length, has a capacity of 715 amps.

4.3.2.6 Battery Energy Storage System

The Penobscot Mills Project contains two utility scale battery energy storage sites that operate as a single asset (BES system). One of the battery storage sites is located at the Powersville Substation (within the transmission right-of-way for the Dolby and East Millinocket Developments); the other battery storage site is located partially within the Penobscot Mills Project boundary and partially within the Ripogenus Project boundary.

The BES system is sized at a capacity of 10 MW with a 2-hour duration (20 MWh total capacity). This system operates with another BES system located at GLHA's Millinocket Substation #4 for a total capability of 20 MW for up to 2 hours (40 MWh total capacity).

The Powersville Substation battery storage is located to the west of, and adjoining the, 60 Hz 34.5 kV-115 kV substation. The site is approximately 158 feet by 80 feet. The site contains nine Tesla Megapack systems, five 480 V-34.5 kV transformers, and a 34.5 kV electrical collection system that is connected to a 34.5 kV breaker located in the substation.

4.3.3 Estimate of Dependable Capacity and Average Energy Production

The combined dependable capacity of the Projects, based on the ISONE Seasonal Claimed Capability ratings listed in the 2021-2022 Forecast Report of Capacity, Energy, Loads, and Transmission (CELT Report), is 96.6 MW for summer and 101.1 MW for winter (ISONE 2021). Monthly and annual generation for the Projects are provided in Table 4.3-12 through Table 4.3-17.

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Table 4.3-12
Monthly and Annual Generation (MWh) for the Ripogenus Project, 2016-2020

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
2016	28,188	23,532	25,097	23,299	8,866	12,289	19,541	20,742	21,208	13,887	14,029	12,365	18,587
2017	12,629	15,891	17,509	18,341	20,133	19,947	20,546	20,193	16,768	19,133	16,928	22,740	18,396
2018	24,618	19,653	23,106	19,215	26,285	20,974	19,840	21,503	17,325	15,301	15,778	17,724	20,110
2019	24,656	23,654	22,952	22,075	28,242	21,290	25,527	21,152	19,037	14,039	14,090	19,939	21,388
2020	24,775	22,996	23,853	22,680	24,187	20,059	21,665	19,024	15,487	9,694	10,310	14,694	19,119
Average	22,973	21,145	22,503	21,122	21,543	18,912	21,424	20,523	17,965	14,411	14,227	17,492	19,520

Table 4.3-13
Monthly and Annual Generation (MWh) for the North Twin Development of the Penobscot Mills Project, 2016-2020

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
2016	5,034	4,585	4,882	5,458	5,081	4,167	3,744	3,921	3,785	3,428	2,937	3,092	4,176
2017	2,997	3,466	2,942	3,446	4,611	4,288	4,950	4,105	4,288	3,546	4,304	4,544	3,957
2018	4,861	4,553	4,228	3,955	5,204	3,824	4,221	4,099	4,177	3,189	3,245	4,377	4,161
2019	4,903	4,408	4,271	3,816	5,186	4,205	5,015	4,189	4,414	3,601	3,830	3,251	4,257
2020	4,717	3,856	3,117	4,507	5,186	3,622	3,727	3,259	3,060	3,065	3,136	4,873	3,844
Average	4,502	4,174	3,888	4,236	5,053	4,021	4,331	3,914	3,945	3,366	3,491	4,027	4,079

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Table 4.3-14
Monthly and Annual Generation (MWh) for the Millinocket Development at the Penobscot Mills Project, 2016-2020

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
2016	9,197	10,103	9,423	8,871	9,950	10,513	13,154	12,478	11,894	12,290	12,338	12,490	11,058
2017	12,645	12,171	12,505	12,290	12,856	12,370	10,615	10,178	12,436	12,984	11,510	11,725	12,024
2018	11,317	11,030	12,769	11,799	10,298	10,952	11,920	12,302	11,796	8,250	11,567	11,337	11,278
2019	11,398	12,862	14,954	14,839	14,530	12,622	15,364	14,062	15,754	14,701	14,868	13,020	14,081
2020	17,410	15,792	15,944	14,033	15,498	12,974	14,873	12,722	11,700	12,841	12,423	16,078	14,357
Average	12,393	12,392	13,119	12,366	12,626	11,886	13,185	12,348	12,716	12,213	12,541	12,930	12,560

Table 4.3-15
Monthly and Annual Generation (MWh) for the Dolby Development at the Penobscot Mills Project, 2016-2020

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
2016	9,609	8,889	9,801	9,615	8,761	7,145	6,481	6,822	6,221	6,320	6,714	6,242	7,718
2017	5,657	7,397	6,819	8,557	6,764	7,568	8,226	6,485	7,694	6,558	8,400	8,956	7,424
2018	9,110	7,782	8,497	7,978	7,985	5,087	6,210	1,369	5,869	3,489	6,386	8,659	6,535
2019	9,903	8,467	9,679	9,101	9,404	7,186	6,949	7,023	7,589	7,693	8,525	8,124	8,304
2020	9,940	9,312	8,288	9,648	8,980	5,098	4,992	3,750	3,154	4,062	3,425	7,700	6,529
Average	8,844	8,370	8,617	8,980	8,379	6,417	6,572	5,090	6,105	5,624	6,690	7,937	7,302

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Table 4.3-16
Monthly and Annual Generation (MWh) for the East Millinocket Development at the Penobscot Mills Project, 2016-2020

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
2016	3,884	3,406	3,815	3,775	3,001	1,963	2,073	2,786	2,693	2,740	2,752	2,123	2,918
2017	2,005	2,718	2,406	3,209	2,013	2,688	2,838	2,669	3,166	2,630	3,051	3,431	2,735
2018	4,013	3,840	4,071	3,648	3,398	2,101	2,408	2,520	2,681	2,195	2,507	3,540	3,077
2019	2,946	2,460	3,095	3,197	3,244	2,686	3,348	2,567	2,830	2,783	3,312	2,478	2,912
2020	3,192	2,276	2,530	3,067	2,820	2,426	2,760	2,202	1,966	2,039	2,185	2,730	2,516
Average	3,208	2,940	3,183	3,379	2,895	2,373	2,685	2,549	2,667	2,477	2,761	2,861	2,831

Table 4.3-17
Monthly and Annual Generation (MWh) for the Penobscot Mills Project (All Developments), 2016-2020

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
2016	27,723	26,982	27,921	27,719	26,792	23,788	25,451	26,007	24,592	24,778	24,740	23,948	25,870
2017	23,304	25,752	24,671	27,502	26,243	26,914	26,629	23,436	27,584	25,717	27,265	28,656	26,140
2018	29,301	27,205	29,565	27,379	26,884	21,964	24,760	20,290	24,524	17,122	23,705	27,913	25,051
2019	29,150	28,197	31,999	30,953	32,364	26,698	30,675	27,840	30,586	28,778	30,535	26,873	29,554
2020	35,258	31,236	29,879	31,255	32,483	24,120	26,352	21,933	19,879	22,008	21,169	31,382	27,246
Average	28,947	27,875	28,807	28,962	28,953	24,697	26,774	23,901	25,433	23,681	25,483	27,754	26,772

4.4 Project Operations

The Ripogenus and Penobscot Mills Projects are operated as a combined system. A diagram depicting the current operational requirements for the Projects and the associated flow of water through the system is provided as Figure 4.4-1.

4.4.1 Ripogenus Project

As established through the previous relicensing, the Ripogenus Project operates as a store-and-release development with an annual seasonal drawdown that allows for management of water levels and flows downstream of the Ripogenus Project, including the downstream reaches of the West Branch and the mainstem of the Penobscot River. As recognized by the stakeholders involved in the previous relicensing, the operations of the Ripogenus Project serve as a re-regulating impoundment that works in coordination with the upstream Storage Project (FERC No. 2634) and the downstream North Twin and Millinocket Lake Developments (of the Penobscot Mills Project) to maximize the balancing of downstream flows and water levels in support of flood control, public safety, dam safety, supplemental flows during seasonal low flow periods, fish spawning and migration, recreation, whitewater boating, water quality, local electrical grid stability, and baseload renewable energy generation. In particular, the size of the Ripogenus impoundment in combination with the Project's operational flexibility provides the storage resource that minimizes the detrimental effects of natural high and low water periods within the larger Penobscot River basin.

The Ripogenus Project impoundment, in combination with the upstream Storage Project and the downstream North Twin and Millinocket Lake developments, provide stakeholders of the larger Penobscot River basin with a valuable re-regulating tool to manage river flows in support of stakeholder interests. Without the existing storage capacity and operational flexibility developed by the stakeholders through the previous relicensings, the basin and downstream river users would be routinely subject to higher variable flows throughout the system – including flooding, public safety, dam safety and environmental impacts throughout the downstream reaches.

The Project's impoundment is managed on an annual cycle to dampen the variability and occasional extremes of seasonal precipitation and runoff through storage within the impoundment.

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This storage allows for continuous flows to downstream aquatic habitat and spawning areas within the West Branch and the mainstem of the Penobscot River during times of lower inflows to the system. In addition, the storage allows flows from the West Branch to be reduced during higher seasonal flow periods when the combined flows from the East and West Branches have the potential to adversely impact human life, property, and environmental resources downstream along the mainstem Penobscot River.

Normal full pond elevation of the Ripogenus impoundment is 941.6 feet with a maximum drawdown of 44 feet (based on operational limitations of the Project). During normal operations, the Ripogenus impoundment is maintained between normal full pond elevation (941.6 feet) following seasonal inflow to the impoundment and a target elevation of 913.6 feet prior to the seasonal inflow, which equates to a target seasonal drawdown range of 28 feet.

During normal operations and normal inflow years, the Ripogenus impoundment elevation is held relatively stable during the summer months and is gradually drawn down starting in the fall with a target low elevation by late winter in anticipation for the spring thaw and freshet. In the spring, the Ripogenus impoundment elevation rises based on inflows from the upstream Storage Project, spring thaw, and precipitation with the goal to reach normal full pond elevation by late spring. In this capacity, as compared to allowing these inflows to be released to the downstream reaches and potentially causing flooding, public safety, and dam safety impacts, the Project acts as a re-regulating impoundment in support of providing a more constant flow for downstream resources and impacts.

In support of managing the impoundment levels and downstream flows, GLHA tracks seasonal inflows to the impoundment (e.g., through snow surveys). As recognized by Project stakeholders, even with significant efforts to estimate inflows to the impoundment, the system is subject to natural variability in regional precipitation, which results in events such as 10-year and 100-year storm events, as well as low inflow or drought events (e.g., 2002 and 2020-2021).

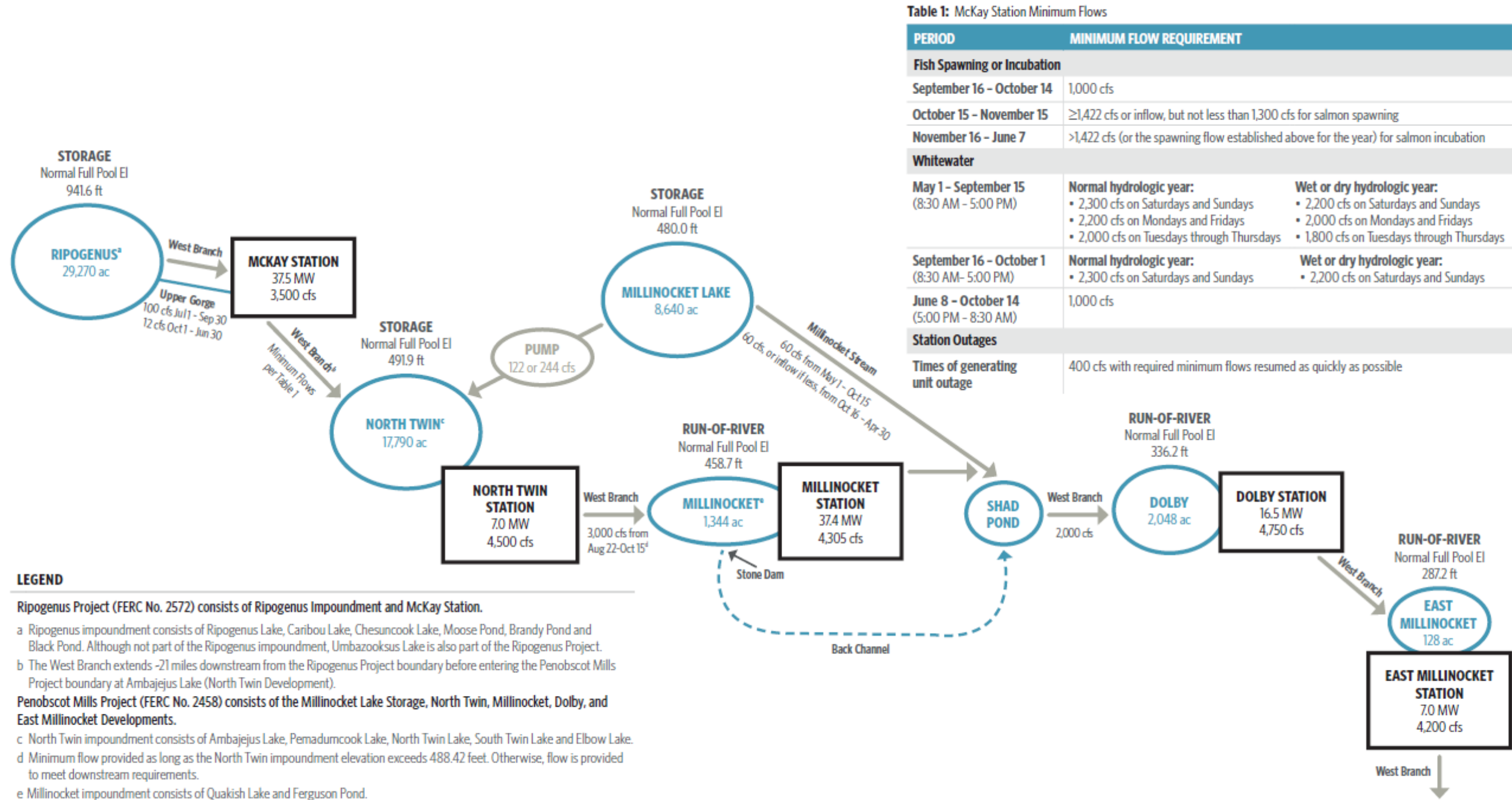
Under the Project's existing license, GLHA is provided the flexibility to provide the required minimum flows in support of aquatic and riverine resources, while providing the tools to help

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reduce the potential impacts (e.g., flooding, public safety, and dam safety) resulting from higher water years.

Pursuant to Article 401 of the existing license, a minimum flow of 100 cfs is released from Ripogenus Dam into the bypassed reach (Upper Gorge) from July 1 through September 30 annually. Consistent with the August 19, 1997 FERC order approving and modifying the Water Management Plan, the minimum flows into the Upper Gorge are released through the sluice gates at the north end of the dam. During the remainder of the year, a minimum flow of 12 cfs is provided through leakage from Ripogenus Dam into the Upper Gorge. Releases from the Ripogenus Project enter the West Branch and flow 21 miles downstream (from McKay Station) into Ambajejus Lake, which is part of the North Twin Development of the Penobscot Mills Project.

Figure 4.4-1
Operational Requirements for the Ripogenus and Penobscot Mills Projects



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Article 402 of the existing license requires minimum flows downstream of McKay Station into the West Branch as specified in Table 4.4-1. These flows may be temporarily modified if required by operating emergencies beyond the control of the Licensee and for short periods upon agreement between the Licensee and the Maine Department of Environmental Protection (MDEP) and Land Use Planning Commission (LUPC). Minimum flows may also be modified (to outflow approximates inflow) if required by hydrologic conditions beyond the control of the Licensee upon mutual agreement between the Licensee, USFWS, MDEP, LUPC, and MDIFW. Consistent with the August 19, 1997 FERC order approving and modifying the Water Management Plan, changes in flows below McKay Station are accomplished through the turbines; however, if necessary, GLHA will open a gate at Ripogenus Dam to augment flows.

Table 4.4-1
Minimum Flow Requirements downstream of McKay Station for the Ripogenus Project¹

Date Range	Minimum Flow Requirement
<i>Fish Spawning or Incubation</i>	
September 16 – October 14	1,000 cfs to facilitate drawdown of the North Twin impoundment (part of the Penobscot Mills Project)
October 15 – November 15	At least 1,422 cfs or inflow, but not less than 1,300 cfs ² for salmon spawning
November 16 – June 7	Greater than 1,422 cfs (or the spawning flow established above for the year) ² for salmon incubation
<i>Whitewater</i>	
May 1 – September 15 (8:30 AM – 5:00 PM)	Normal hydrologic year ³ : • 2,300 cfs on Saturdays and Sundays • 2,200 cfs on Mondays and Fridays • 2,000 cfs on Tuesdays through Thursdays Wet or dry hydrologic year ³ : • 2,200 cfs on Saturdays and Sundays • 2,000 cfs on Mondays and Fridays • 1,800 cfs on Tuesdays through Thursdays
September 16 – October 1 (8:30 AM – 5:00 PM)	Normal hydrologic year ³ : • 2,300 cfs on Saturdays and Sundays Wet or dry hydrologic year ³ : • 2,200 cfs on Saturdays and Sundays
June 8 – October 14 (5:00 PM – 8:30 AM)	1,000 cfs
<i>Station Outages</i>	
Times of generating unit outage	400 cfs with scheduled minimum flows identified above in table to be resumed as quickly as possible by releases from Ripogenus Dam if necessary but in no event in more than three days following the initial outage

¹ Minimum flows shall be the minimum flows for each hourly period measured on the basis of an hourly average.

² Flows to be established each year in consultation with the USFWS and MDIFW.

³ The whitewater flow for each month from May through September is determined on the first day of each month based on an analysis of Total Available Water as described in the Water Use Plan in the application for new license filed with the Commission on December 17, 1991. The determination of “wet,” “normal,” or “dry” shall remain constant during the month based on the first day of the month classification. The range of “normal” available water

represents the expected available water during normal hydrologic conditions. It is defined as the range between $x-s$ and $x+s$, where “ x ” is the mean value and “ s ” is the standard deviation. Based on a statistical analysis, total available water would be expected to be within this “normal” range two-thirds of the time and outside of this range (“wet” or “dry” years) one-third of the time.

Pursuant to the February 20, 2003 FERC order approving the Habitat Improvement Plan under Article 406 of the existing license, GLHA manages flows from the West Branch into the “Holbrook Side Channel.” The Holbrook Side Channel is a 1,400-foot-long channel located approximately 1.7 RM downstream from the Ripogenus Dam in which flow is diverted from the West Branch for landlocked salmon and brook trout spawning and rearing. Flow from the channel re-enters the West Branch approximately 1,000 feet downstream. Flows into the channel are controlled through two pipes, one of which is equipped with a valve that can be opened or closed to increase or reduce flow from the West Branch into the channel. Flows into the channel range from between approximately 35 and 65 cfs during normal operating conditions, depending on the amount of flow in the West Branch. Around June 1, GLHA closes the valve to reduce flow into the channel (for landlocked salmon and brook trout fry emergence and production). Around October 15, GLHA opens the valve to increase flow into the channel (for landlocked salmon and brook trout spawning).

4.4.2 Penobscot Mills Project

The five developments that comprise the Penobscot Mills Project are operated as an integrated system, primarily based on flows received from the Ripogenus Project. The two store-and-release developments (Millinocket Lake Storage and North Twin) are located upstream of the run-of-river developments (Millinocket, Dolby, and East Millinocket). The North Twin impoundment receives flow from the Ripogenus Project. The Millinocket Lake Storage Development is located on Millinocket Stream, which enters the West Branch downstream of the Millinocket Development. Water from Millinocket Lake is either pumped into Ambajejus Lake (part of the North Twin Development), which subsequently passes through the North Twin and Millinocket powerhouses, or it is released into Millinocket Stream, which enters the West Branch downstream of the Millinocket Development.

4.4.2.1 Millinocket Lake Storage Development

The Millinocket Lake Storage Development is solely a storage development with no hydroelectric generation. As discussed in Section 4.4.1, the development is operated as part of the larger West Branch system to manage flows and water levels within the West Branch and the downstream mainstem. When combined with the operational flexibility of the upstream Storage Project, Ripogenus Project, and North Twin Development, the Millinocket Lake Storage Development provides a powerful tool to manage flows and water levels throughout the system and within the larger Penobscot River basin. Essential to this system is the operational flexibility allowed by the current license.

Pursuant to Article 401 of the existing license, GLHA releases a minimum flow of 60 cfs from Millinocket Lake into Millinocket Stream from May 1 through October 15, and a minimum flow of 60 cfs, or inflow if less, from October 16 through April 30, except as temporarily modified by operating emergencies beyond the control of GLHA and for short periods upon mutual agreement between GLHA, the USFWS, and the MDEP. Consistent with the September 3, 1997 FERC order approving and modifying the Water Management Plan, the minimum flows from Millinocket Lake to Millinocket Stream are released through waste gates at the Millinocket Lake Dam. If required flows cannot be maintained because of hydrologic conditions, flows are released that are equal to inflow until conditions improve.

The normal full pond elevation of Millinocket Lake is 480.0 feet. Pursuant to Article 402 of the existing license, the water level in Millinocket Lake is required to be maintained between elevations 470.0 feet and 480.0 feet by either pumping water via the development's pumping station to the North Twin impoundment (typically to maintain required impoundment levels within the North Twin impoundment), or by releasing water into Millinocket Stream. These operations may be temporarily modified during approved maintenance activities, reduced inflows to the Project area, or by operating emergencies beyond GLHA's control. Essential to maintaining the required downstream water elevations (e.g., within the North Twin impoundment) and downstream minimum flows (e.g., from the North Twin Development and downstream of the Millinocket Development at Shad Pond), as well as reducing the downstream effects of high and

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low flow water years (e.g., downstream flooding or reduced flows), is GLHA's operational flexibility to operate the development's pumping station.

4.4.2.2 North Twin Development

Consistent with the operation of the Millinocket Lake Storage Development, and as described in Section 4.4.1, the North Twin Development is an essential resource in support of managing flows and water levels within the West Branch and downstream mainstem of the Penobscot River. In combination with the upstream Storage Project, these impoundments provide the consistent flows typical of the West Branch and downstream mainstem, while reducing the potential flooding, public safety, dam safety, and environmental impacts of higher spring flows. The North Twin Development operates as a store-and-release facility.

Flows from the Ripogenus Project enter the West Branch and subsequently flow 21 miles before entering into Ambajejus Lake of the North Twin impoundment, which has a normal full pond elevation of 491.92 feet.

Pursuant to the July 26, 2012 Order Amending Article 408, from August 22 to October 15, the impoundment is maintained above elevation 488.42 feet (within 3.5 feet from normal full pond elevation)⁵ except as temporarily modified by approved maintenance activities, by inflows to the Project, by the inability to maintain the minimum flow of 2,000 cfs as measured from the outflow at Shad Pond, or by operating emergencies beyond GLHA's control.

From October 15 to the start of the freshet, the impoundment elevation is gradually reduced to a lower target elevation of 479.42 (12 feet from normal full pond elevation) to provide storage for winter thaw and spring flows. However, at times (particularly during periods of high inflows – for example as indicated by snow surveys), GLHA utilizes greater than 12 feet of storage in the North

⁵ Prior to the 2012 Order Amending Article 408 of the License, the North Twin impoundment level was dropped sharply after August 22 (required by Article 408) to accommodate lake trout spawning and incubation in October. Based on periodic lake trout monitoring performed pursuant to Article 409, it was determined that wild lake trout propagation was not occurring, despite water levels being carefully controlled for many years pursuant to Article 408. Additionally, residents and recreationists on North Twin impoundment indicated that the fall impoundment drawdowns reduced boating/fishing access and opportunities in September and October, hurt sporting camp businesses, and caused camp wells and water supplies to run dry in the fall. Therefore, via Order dated July 26, 2012, FERC Amended Article 408 of the License.

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Twin impoundment to absorb flows from the upstream inflows to protect downstream areas and resources from flooding (as the developments downstream of the North Twin Development are operated as run-of-river facilities). From ice out to August 22, the impoundment is refilled and is maintained at a relatively stable target elevation of 490.42 feet (within 1.5 feet from normal full pond elevation) plus or minus 0.5 feet.

A minimum flow of 3,000 cfs from the North Twin Development is provided from August 22 through October 15, so long as the impoundment elevation exceeds 488.42 feet. Otherwise, 2,000 cfs is typically released from the North Twin Development to meet the minimum flow requirement of 2,000 cfs at Shad Pond, which is located downstream of the Millinocket and Millinocket Lake Developments.

The fishway at the North Twin Development allows resident fish that have passed downstream over the dam to move back upstream into the North Twin impoundment. This fishway, which is a pool and weir design, was incorporated into the dam in 1934 and was repaired in 1984 and again in 2013. GLHA maintains a stable impoundment elevation from May 1 through August 22 for recreation purposes, which provides a suitable impoundment elevation for the fishway exit. An attraction flow of 3.5 cfs is provided through an 8-inch gravity pipe that extends from the dam to the fishway entrance. The pipe has a “Y” configuration at its discharge to attract fish to both fishway entrances. Each leg of the “Y” has a control valve and discharges at the surface in line with the entrance flows. The high energy jet surface water discharge provides additional attraction flow and creates acoustic attraction.

4.4.2.3 Millinocket, Dolby, and East Millinocket Developments

Pursuant to Article 403 of the existing license, the Millinocket, Dolby, and East Millinocket developments are operated in a run-of-river mode (with typical impoundment elevation fluctuations of one foot or less from top of flashboards when installed or crest of dam without flashboards) while providing an instantaneous minimum flow of 2,000 cfs to the downstream West Branch and mainstem of the Penobscot River (based on flows from the Millinocket and Millinocket Lake Developments) for the protection of water quality and aquatic habitat).

Consistent with the FERC-approved April 9, 1997 Water Management Plan, run-of-river operations and the release of minimum flows to the West Branch is accomplished primarily through use of the turbines. If the requirements cannot be met through use of the turbines, the Licensee utilizes the rubber dam at Stone Dam at the Millinocket Development and waste gates at the Dolby and East Millinocket Developments to support run-of-river operations.

Run-of-river operation or minimum flows at these developments may be temporarily modified if required by operating emergencies beyond the control of the Licensee and for short periods upon mutual agreement between the Licensee, USFWS, and MDEP.

4.4.3 Transmission System and Battery Storage Assets

The Ripogenus and Penobscot Mills Projects connect to the ISONE power grid at the Point of Interconnection (POI) at the Powersville Substation (115 kV). Millinocket Substation #4 collects power from the North Twin and Millinocket Developments at 34.5 kV, and then it is transformed to 115 kV at the T43 transformer. The transmission line (115 kV) then sends power to the POI at the Powersville Substation. The Powersville Substation collects power from the Dolby and East Millinocket Developments and Weldon Station (Mattaceunk Hydroelectric Project, FERC No. 2520) at 34.5 kV, and then it is transformed to 115 kV at the T500 transformer. Powersville also collects power at 115 kV from the Millinocket Substation #4 as well as from McKay Station (Ripogenus Project). The 115 kV power from the Millinocket Substation #4 and McKay Station connect on the 115 kV side of the T500 transformer.

In 2020, GLHA installed two utility-scale battery energy storage systems (BES system) at the Projects. One BES system is located at the Millinocket Substation #4 and the other is located at the Powersville Substation. The BES systems are connected to the Project's transmission lines and collect power from the Projects at 34.5 kV and deliver it to the grid at 115 kV. The BES systems are connected to the substations by breakers and switches that can isolate the BES systems from the substations at any time. The BES systems will only charge from the existing hydroelectric facilities and not from the ISONE grid. Project operations have not and will not change based on the installation of the BES systems.

4.5 Outflow Records

Table 4.5-1 and Table 4.5-2 provide a summary of the average monthly and average annual outflows for the Projects over the previous five years (2016-2020). There are no flow gages immediately upstream, within, or downstream of the Ripogenus and Penobscot Mills Projects, and therefore, outflow data are based on GLHA-maintained hourly operations records for gated flows and station operations for the Ripogenus Project and the North Twin Development (the Millinocket, Dolby, and East Millinocket Developments located downstream of the North Twin Development are operated in run-of-river mode where outflows approximate inflows provided by the North Twin Development).

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Table 4.5-1
Average Monthly and Average Annual Outflow at the Ripogenus Project, 2016 - 2020

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
2016	2,708	2,691	2,572	2,338	2,336	2,432	2,449	2,575	2,632	1,852	1,852	1,860	2,358
2017	1,888	2,015	1,836	2,252	6,001	2,440	3,559	2,651	2,358	2,153	1,822	2,427	2,617
2018	2,794	2,436	3,307	3,129	2,735	2,432	2,552	2,700	2,057	1,834	1,852	2,025	2,488
2019	2,536	2,917	2,701	3,257	6,888	2,924	2,736	2,306	2,246	1,994	1,828	2,144	2,873
2020	2,548	2,646	2,783	2,755	3,136	2,759	2,886	2,401	2,110	1,488	1,360	1,905	2,398
Average	2,495	2,541	2,640	2,746	4,219	2,598	2,836	2,527	2,280	1,864	1,742	2,072	2,547

Table 4.5-2
Average Monthly and Average Annual Outflow at the Penobscot Mills Project, 2016 - 2020

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec	Annual
2016	4,378	4,518	4,256	3,915	3,509	2,800	2,665	2,646	2,690	2,439	2,666	2,633	3,260
2017	2,781	3,437	3,085	3,409	8,903	3,039	4,122	2,798	3,224	2,532	3,742	3,201	3,689
2018	3,596	3,596	4,534	4,024	5,095	2,704	2,708	2,670	2,941	2,411	2,407	3,167	3,321
2019	3,915	4,085	5,043	5,367	9,458	3,943	3,803	2,878	3,119	3,022	3,122	2,878	4,219
2020	3,931	4,083	3,454	4,049	4,872	2,530	2,752	2,287	2,205	2,309	2,312	3,338	3,177
Average	3,720	3,944	4,074	4,153	6,367	3,003	3,210	2,656	2,836	2,542	2,850	3,043	3,533

4.6 Current License Requirements and Compliance History

4.6.1 Current License Requirements

A summary of the operational license requirements for each Project and the associated status of the requirements is provided below in Table 4.6-1 and Table 4.6-2.

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Table 4.6-1
Summary of Current Operational License Requirements at the Ripogenus Project

Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
401	Licensee to release 100 cfs between July 1 and September 30, and a leakage flow of 12 cfs between October 1 and June 30.	N/A	October 22, 1996 – Order Issuing New License	GLHA continues to provide the required minimum flows via leakage and the sluice gates.
402	Licensee to release specified minimum flows for the following: 1,000 cfs from September 16 through October 14 for North Twin Impoundment drawdown. - At least 1,422 cfs or inflow but not less than 1,300 cfs from October 15 through November 15 for salmon spawning. - Greater than 1,422 cfs (or the spawning flow established for that year) from November 16 through June 7 for salmon incubation. - Whitewater boating – As established in the September 2, 1993 Settlement Agreement between the Licensee and the Maine Professional River Outfitters. 400 cfs during periods of station outage, with required minimum flows resuming as quickly as possible.	September 8, 1993 – Settlement Agreement	October 22, 1996 – Order Issuing New License	GLHA continues to provide the required minimum flows from McKay Station.
403	Licensee to file an Operations Monitoring Plan to monitor minimum flows.	April 9, 1997 – Plan filed	- October 22, 1996 – Order Issuing New License - August 19, 1997 – Order Modifying and Approving Plan for Providing and Monitoring Minimum Flows	GLHA continues to monitor minimum flows pursuant to the FERC-approved plan.

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Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
404	Licensee to file a Mercury Monitoring Plan.	March 12, 1997 – Mercury Contamination Study Plan	- October 22, 1996 – Order Issuing New License - May 2, 1997 – Order Approving Mercury Contamination Study Plan	The study was completed in 1997 and 1998 with results filed with the Commission in 1999. The Commission approved the final study report on October 4, 2000.
405	Licensee to participate in a U.S. Environmental Protection Agency (USEPA) atmospheric mercury deposition study and file annual reports.	Annual reports	October 22, 1996 – Order Issuing New License	GLHA has not been asked to participate in any new USEPA or MDEP monitoring studies at the Ripogenus Project since the 1998 study. GLHA continues to submit annual reports as required.
406	Licensee to file a plan for salmon habitat improvement at the Holbrook site.	- April 21, 1997 – Habitat Improvement Plan - Annual monitoring reports - December 23, 2002 – Final Annual Report	- October 22, 1996 – Order Issuing New License - September 9, 1997 – Order Approving Habitat Improvement Plan - February 20, 2003 – Order Approving Recommendations of Habitat Improvement Plan	GLHA performed biological monitoring in the Holbrook Channel from 1998 through 2002 to evaluate salmon habitat in the channel and filed annual monitoring reports. In consultation with MDIFW and USFWS, it was determined that the habitat improvement project successfully increased salmon spawning and nursery habitat along the West Branch and monitoring is no longer necessary. GLHA continues to manage flows into the channel as required.
407	Reservation of Authority for Fishway Prescription.	N/A	October 22, 1996 – Order Issuing New License	N/A
408	Licensee to file Wetlands Enhancement Plan.	- October 21, 1997 – Wetlands Enhancement Plan - May 31, 2005 – Final Wetlands Monitoring Report	- October 22, 1996 – Order Issuing New License - November 17, 1997 – Order Amending and Approving Wetlands Enhancement Plan	GLHA discontinued storage and release operation in spring 1998 at Umbazooksus Lake by maintaining the outlet gate in a permanently opened position, resulting in a run-of-river regime to lower water levels and enhance wetlands at Umbazooksus Lake. GLHA performed baseline monitoring in 1998 with follow-up monitoring in 2000, 2002, and 2004. Monitoring demonstrated that vegetation density has increased over 350%; the total extent of vegetated wetlands has increased by ~117 acres since 1998;

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Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
				species richness increased from 280% in 1998 to 638% in 2004; and there were 320 acres of recovering wetlands (exceeding the original requirement to enhance ~280 acres). Monitoring was discontinued in 2004 based on the demonstrated success of the initiative. GLHA continues to maintain the outlet gate in a permanently opened position.
409	Licensee to file a Loon Nesting Structure Plan.	- October 22, 1997 – Loon Nesting Plan - October 19, 2010 – Final Loon Nesting Survey Report	- October 22, 1996 – Order Issuing New License - April 15, 1998 – Order Modifying and Approving Common Loon Nesting Plan - February 9, 2011 – Letter Order Accepting Final Loon Nesting Survey Report	Beginning in 2000, GLHA deployed artificial nesting platforms for loons and other aquatic birds in the Ripogenus impoundment. GLHA monitored the loon nesting habitat and success from 1998 through 2010. Although monitoring was discontinued in 2010, GLHA continues to deploy the platforms on Ripogenus impoundment, including increased number of platforms beginning in 2011.
410	Licensee to install specific recreation facilities and enhancements including: - Improvements at Caribou Lake informal boat launch; - Maintenance of trail from Ripogenus Dam along Upper Gorge for pedestrian use; - Modify vehicle gate at McKay Station to allow unrestricted pedestrian access to river 24 hours/day; - Install 2 concrete vault privies at McKay Station parking lot; - Establish telephone message system providing flow conditions in West Branch downstream of McKay;	N/A	- October 22, 1996 – Order Issuing New License - June 17, 1998 – Order Amending Article 410	GLHA completed the installation and enhancement measures of recreation-related facilities and events as required with the exception of the changing rooms at Never's Corner, as it was determined by the commercial rafting outfitters that the changing rooms were not needed. Accordingly, on June 17, 1998, FERC amended Article 410 to remove this requirement.

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Project Location, Facilities, and Operations

Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
	• Attempt to schedule maintenance activities to avoid affecting rafting flows; • Review advisability of whitewater races per information from organizer; and • Construct changing rooms at Never's Corner take-out.			
411	Licensee to monitor and report recreation.	• Periodic monitoring reports	• October 22, 1996 – Order Issuing New License • January 27, 2009 – Order Granting Extension of Time and Amending Licenses	Beginning in 2002 and continuing every 6 years through the term of the existing license, GLHA has performed monitoring of recreation use of Project areas to determine whether existing facilities are meeting recreation needs. Per the 2015 monitoring report, GLHA concluded the existing Project facilities are adequate to meet current and future recreation needs. GLHA received FERC approval to defer the recreation monitoring effort to 2022 one year due to the COVID-19 pandemic, with the report to be filed with the Commission by April 1, 2023.
412	Licensee to file a plan for collecting recreation fees.	• October 6, 1997 – Recreational Facility Fee Plan • October 14, 1997 – Supplemental Information	• October 22, 1996 – Order Issuing New License • August 20, 1999 – Order on Recreational Facility Fee Plan	GLHA does not collect fees for the use of the Project recreational facilities.
413	Licensee shall implement the provisions of the Programmatic Agreement.	• April 25, 1996 – Programmatic Agreement • April 13, 1998 – CRMP	• October 22, 1996 – Order Issuing New License • June 11, 1998 – Order Approving CRMP	GLHA continues to operate the Project pursuant to the requirements of the Programmatic Agreement and CRMP, including submittal of monitoring reports to the Commission.

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Project Location, Facilities, and Operations

Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
414	Licensee to file a Shoreline Management Plan.	- October 20, 1997 – Shoreline Buffer Zone Management Plan - September 26, 2001 – Revised Shoreline Buffer Zone Management Plan	- October 22, 1996 – Order Issuing New License - January 3, 1999 – Order Approving Shoreline Buffer Zone Management Plan - April 2, 2002 – Order Approving Revised Shoreline Buffer Zone Management Plan and Exhibit G Drawing	GLHA continues to implement the FERC-approved Shoreline Management Plan, as required. The plan incorporates a shoreline buffer area extending 200 feet from the normal full pond elevation along portions of the Ripogenus impoundment to protect aesthetics, water quality, wildlife habitat, and recreational opportunities. Additionally, GLHA established a renewable conservation easement (restricting commercial and residential development) with the State of Maine on GLHA-owned shoreline lands within 250 feet of the normal full pond elevation along Chesuncook and Ripogenus Lakes and Brandy and Black Ponds.

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Project Location, Facilities, and Operations

Table 4.6-2
Summary of Current Operational License Requirements at the Penobscot Mills Project

Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
401	Licensee to release a minimum flow of 60 cfs from Millinocket Lake into Millinocket Stream at the <u>Millinocket Lake Storage Development</u> from May 1 to October 15 annually, and a minimum flow of 60 cfs, or inflow if less, during the remainder of the year.	N/A	October 22, 1996 – Order Issuing New License	GLHA continues to provide the required minimum flows.
402	Licensee to maintain the Millinocket Lake reservoir level between elevations 470 and 480 feet at the <u>Millinocket Lake Storage Development</u> while providing water to maintain North Twin impoundment levels.	N/A	October 22, 1996 – Order Issuing New License	GLHA continues to maintain Millinocket Lake elevations as required.
403	Licensee to operate the <u>Millinocket</u> , <u>Dolby</u> , and <u>East Millinocket</u> developments in a run-of-river mode while providing an instantaneous minimum flow of 2,000 cfs to the West Branch Penobscot River as measured downstream of Shad Pond.	N/A	October 22, 1996 – Order Issuing New License	GLHA continues to operate the Millinocket, Dolby, and East Millinocket developments as required.
404	Licensee to file a plan for complying with water levels and stream flows in Articles 401, 402, 403, and 408.	April 9, 1997 – Water Level and Flow Management Plan	- October 22, 1996 – Order Issuing New License - September 3, 1997 – Order Modifying and Approving Plans for Providing and Monitoring Streamflows and Maintaining and Monitoring Reservoir Levels	GLHA continues to manage water levels and minimum flows pursuant to the FERC-approved plan.

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Project Location, Facilities, and Operations

Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
405	Licensee to participate in a USEPA atmospheric mercury deposition study and file annual reports.	Annual reports	- October 22, 1996 – Order Issuing New License - February 5, 1997 – Letter Order Accepting Annual Report on Cooperative Mercury Studies	The study was completed in 1997 and 1998 with results filed with the Commission in 1999. The Commission approved the final study report on October 4, 2000. GLHA has not been asked to participate in any new USEPA or MDEP monitoring studies at the Penobscot Mills Project since the 1998 study. GLHA continues to submit annual reports as required.
406	Licensee to repair and/or modify the <u>North Twin</u> fishway and file a plan for the repairs.	October 22, 1997 – Plan to Repair and Modify the North Twin Fishway	- October 22, 1996 – Order Issuing New License - May 27, 1998 – Order Approving Plan for Repairing and Modifying Upstream Fish Passage Facility at North Twin Dam	The fishway was built in 1934 and subsequently repaired in 1984. Based on an evaluation of the fishway, GLHA modified the fishway in 2013 to increase its effectiveness for attracting and passage of landlocked salmon upstream of the dam. The fishway is operated to provide upstream passage of landlocked salmon that may have passed downstream of the North Twin Dam. GLHA continues to operate the fishway pursuant to applicable requirements.
407	Reservation of Authority for Fishway Prescription.	N/A	October 22, 1996 – Order Issuing New License	N/A
408	Licensee to maintain <u>North Twin</u> impoundment at a relatively stable level from May 1 - August 22 annually, and at a minimum target level of 488.42 feet (3.5-foot drawdown) for the period August 22 through October 15. Licensee shall provide a minimum flow of 3,000 cfs from North Twin Dam from August 22 - October 15, so long as the impoundment water level elevation exceeds 488.42 feet.	April 13, 2012 – Request Amendment of Article 408	- October 22, 1996 – Order Issuing New License - July 26, 2012 – Order Approving Amendment of Article 408	GLHA continues to operate the North Twin Development pursuant to the requirements of Article 408, as amended in 2012. Prior to 2012, the North Twin impoundment level was dropped sharply after August 22 (required by Article 408) to accommodate lake trout spawning and incubation in October. Based on periodic lake trout monitoring performed pursuant to Article 409, it was determined that wild lake trout propagation was not occurring, despite water levels being carefully controlled for many years pursuant to

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Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
				Article 408. Additionally, residents and recreationists on the North Twin impoundment indicated that the impoundment drawdowns reduced boating/fishing access and opportunities in September and October, hurt sporting camp businesses, and caused many camp wells and water supplies to run dry in the fall. Therefore, via Order dated July 26, 2012, FERC Amended Article 408 of the License.
409	Licensee to file a lake trout reproductive monitoring plan for the <u>North Twin</u> impoundment.	- October 22, 1997 – Plan for Evaluating Reproductive Success of Lake Trout in the North Twin Impoundment - January 27, 2011 – Request to Discontinue Monitoring of Lake Trout Reproduction in North Twin impoundment	- October 22, 1996 – Order Issuing New License - December 19, 1997 – Order Modifying and Approving Plan for Monitoring Lake Trout Reproductive Success in North Twin Impoundment - March 30, 2011 – Order Approving Request to Discontinue Monitoring of Lake Trout Reproduction	GLHA performed monitoring over a 10-year period with submittal of the required monitoring reports. In consultation with MDEP and MDIFW, it was agreed that the monitoring results showed that a self-sustaining lake trout population in the North Twin impoundment had not been established despite water level restrictions and monitoring; therefore, monitoring was discontinued.
410	Licensee to file Wetlands Enhancement Plan.	- October 21, 1997 – Wetlands Enhancement Plan - May 31, 2005 – Final Wetlands Monitoring Report	- October 22, 1996 – Order Issuing New License - November 17, 1997 – Order Amending and Approving Wetland Enhancement Plan	Article 410 required the Licensee to enhance wetlands at Deep Cove on the North Twin impoundment. While investigating the feasibility of wetland enhancement at Deep Cove, the Licensee identified and proposed an alternative site (Umbazooksus Lake) that would provide greater opportunities for wetland enhancement, which was approved by the Commission. The wetland mitigation activities performed at Umbazooksus Lake (as described below) satisfied the

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Project Location, Facilities, and Operations

Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
				mitigation requirements for both the Ripogenus Project and the Penobscot Mills Project. Pursuant to the FERC-approved plan, GLHA discontinued storage and release operation in spring 1998 at Umbazooksus Lake by maintaining the outlet gate in a permanently opened position, resulting in a run-of-river regime to lower water levels and enhance wetlands at Umbazooksus Lake. GLHA performed baseline monitoring in 1998 with follow-up monitoring in 2000, 2002, and 2004. Monitoring demonstrated that vegetation density increased over 350%; the total extent of vegetated wetlands increased by ~117 acres since 1998; species richness increased from 280% in 1998 to 638% in 2004; and there were 320 acres of recovering wetlands (exceeding the original requirement to enhance ~280 acres). Monitoring was discontinued in 2004 based on the demonstrated success of the initiative. GLHA continues to maintain the outlet gate in a permanently opened position.
411	Licensee to file a Loon Nesting Structure Plan.	- October 22, 1997 – Loon Nesting Plan - October 19, 2010 – Final Loon Nesting Survey Report	- October 22, 1996 – Order Issuing New License - February 20, 1998 – Order Modifying and Approving Common Loon Nesting Plan - February 9, 2011 – Letter Order Accepting Final Loon Nesting Survey Report and	Beginning in 2000, GLHA deployed artificial nesting platforms for loons and other aquatic birds in Millinocket Lake. GLHA monitored the loon nesting habitat and success from 1998 through 2010. The monitoring indicated that loons successfully nest naturally on Millinocket Lake without artificial nest platforms. As approved by FERC, GLHA discontinued

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Project Location, Facilities, and Operations

Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
			Approving Discontinuation of Loon Platform Deployment	deployment of nesting platforms and the associated monitoring and report in 2011. The artificial nest platforms formerly deployed at Millinocket Lake are now deployed at the Ripogenus impoundment to increase the number of platforms deployed there.
412	Licensee shall file a Wildlife Management plan for the Back Channel for the <u>Millinocket Development</u> .	- April 21, 1997 – Back Channel Wildlife Management Plan - January 14, 1998 – Supplement to the Back Channel Wildlife Management Plan - February 12, 2018 – Back Channel Wildlife Management Report and Request for Amendment	- October 22, 1996 – Order Issuing New License - February 12, 1998 – Order Modifying and Approving Wildlife Management Plan - July 12, 2018 – Order Amending Wildlife Management Plan	GLHA has managed the 2,300-acre Wildlife Management Area by providing wildlife enhancement and management efforts (e.g., forest management techniques, waterfowl nest boxes, maintain seeded roads, etc.) to the Back Channel area, riparian areas, and upland areas surrounding the Project. GLHA filed with the Commission wildlife monitoring reports every 5 years through 2018. The monitoring demonstrated the success of the wildlife activities at the Project, and monitoring was discontinued in 2018. GLHA continues to implement the wildlife management activities as required.
413	Licensee shall implement an upgraded spring and fall brook trout stocking program in Millinocket Stream.	- April 9, 1997 – Plan to Stock and Monitor Brook Trout in Millinocket Stream - February 1, 2000 – Request to Amend Requirements of September 3, 1997 Order - November 16, 2020 – Most Recent Millinocket Stream	- October 22, 1996 – Order Issuing New License - September 3, 1997 – Order Modifying and Approving Plan for Stocking and Monitoring Brook Trout in Millinocket Stream - September 8, 2000 – Order Amending Millinocket Stream Stocking and Monitoring Plan	GLHA filed with the Commission the required Millinocket Stream Fisheries Management Plan, which described the proposed trout stocking and monitoring (to increase angler use and catch). GLHA has implemented the plan, such that in May and September annually, 500 hatchery brook trout generally ranging from 1-3 fish per pound are stocked in Millinocket Stream. GLHA completed 5 years of monitoring of trout stocking as required, which demonstrated that the stocking achieved the goal of increased angler

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Project Location, Facilities, and Operations

Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
		Brook Trout Monitoring Report	January 17, 2021 – Letter Order Accepting Millinocket Brook Trout Stocking Report	use/catch on Millinocket Stream; therefore, monitoring was discontinued in 2003. GLHA continues to perform the May and September trout stocking.
414	Licensee to construct, operate, and maintain recreational facilities including parking at the Dead Man's Curve boat access site and the Route 157 boat access at Dolby Pond, as well as removing shoreline obstructions and providing parking at the Green Bridge access site above Quakish Lake.	N/A	October 22, 1996 – Order Issuing New License	GLHA constructed the required recreational facilities and continues to maintain the facilities as required.
415	Licensee shall monitor recreation and file periodic reports.	Periodic monitoring reports	- October 22, 1996 – Order Issuing New License - January 27, 2009 – Order Granting Extension of Time and Amending Licenses	Beginning in 2002 and continuing every 6 years through the term of the existing license, GLHA has performed monitoring of recreation use of Project areas to determine whether existing facilities are meeting recreation needs. Per the 2015 monitoring report, GLHA concluded the existing Project facilities are adequate to meet current and future recreation needs. GLHA received FERC approval to defer the monitoring effort until 2022 due to the COVID-19 pandemic, with the report to be filed with the Commission by April 1, 2023.
416	Licensee shall file a plan for establishing and collecting fees for recreational facilities	October 6, 1997 – Recreational Facility Fee Plan	- October 22, 1996 – Order Issuing New License - August 20, 1999 – Order on Recreational Facility Fee Plan	GLHA does not collect fees for the use of the Project recreational facilities.

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Project Location, Facilities, and Operations

Article No.	Article Summary	Licensee Filing Date	Associated FERC Orders	Status
417	Licensee shall implement the provisions of the Programmatic Agreement.	- April 25, 1996 – Programmatic Agreement - October 3, 1997 – CRMP - April 13, 1998 – Revised CRMP	- October 22, 1996 – Order Issuing New License - June 11, 1998 – Order Approving CRMP	GLHA continues to operate the Project pursuant to the requirements of the Programmatic Agreement and CRMP, including submittal of monitoring reports to the Commission.
418	Licensee shall file a Shoreline Management Plan for all Project impoundments.	- October 20, 1997 – Shoreline Management Plan - September 26, 2001 – Revised Shoreline Management Plan and Exhibit G Drawings - January 18, 2011 – Amendment Request for Shoreline Management Plan	- October 22, 1996 – Order Issuing New License - January 4, 1999 – Order Approving Shoreline Management Plan - February 12, 2002 – Order Revising Shoreline Management Plan and Approving Exhibit G Drawings - February 16, 2011 – Order Amending Shoreline Management Plan	GLHA continues to implement the FERC-approved Shoreline Management Plan, as required. The plan incorporates a shoreline buffer area extending 200 feet from the normal full pond elevation on GLHA-owned land and a long portions of the Project's impoundments to protect aesthetics, water quality, wildlife habitat, and recreational opportunities. On Millinocket Lake, the shoreline buffer extends 10 feet from the normal full pond elevation and 200 feet from the normal full pond elevation on GLHA-owned land for portions of the shoreline.
420	Licensee to consult with the Maine Department of Conservation regarding the need for a study to mark and remove submerged hazards to recreational navigation in <u>Millinocket Lake</u> and <u>North Twin</u> impoundment.	- March 24, 1997 – Consultation Report and Study Plan - May 2, 2001 – Final Navigational Hazards Report	- October 22, 1996 – Order Issuing New License - April 16, 1998 – Order Modifying and Approving Plan to Study Submerged Hazards - August 24, 2001 – Order Approving Navigational Hazards Report	GLHA collected aerial photographs in October 2000 and subsequently developed navigational hazard maps (instead of removal or marking) for posting at the Millinocket Lake and North Twin impoundments. The maps available to the public upon request.

4.6.2 Compliance History

The Projects are required to comply with the Articles described in the October 22, 1996 Licenses, as amended, the Water Quality Certificates (issued on April 22, 1993, as amended), and the associated FERC-approved operations and management plans as described in Table 4.6-1 and Table 4.6-2. Based on a review of the Projects' compliance history, GLHA has been and continues to be in compliance with the applicable Articles of the existing FERC Licenses, or have been otherwise communicated to FERC and the applicable resource agencies and addressed by GLHA.

4.7 Current Net Investment

GLHA has made significant investments in the Projects over the term of the Projects' existing licenses, including the unit conversions from 40 Hz units to 60 Hz, powerhouse modernization initiatives, dam safety upgrades, and the recent installation of two battery energy storage systems.

The current net investment in the Ripogenus Project is \$35,000,000. The current net investment in the Penobscot Mills Project is \$90,000,000. This should not be interpreted as the fair market value of the Projects.

4.8 Potential for New Project Facilities and/or Operations

GLHA is not proposing any new facilities or changes in operations for the Projects at this time. However, GLHA reserves the right to propose such modifications based on the consultation and potential study activities to be performed. In addition, as economic conditions continue to change, GLHA routinely performs periodic evaluations of the Projects, including potential upgrades, and will continue to do so into the future. Normal routine maintenance will be performed as needed during the remainder of the license terms and during any new license terms.

4.9 PURPA Benefits

In accordance with 18 CFR §5.6(e), GLHA is indicating in this document that GLHA is not seeking rights under Section 210 of the Public Utility Regulatory Policies Act of 1978 (PURPA) for the Projects at this time, and, therefore, no additional information is required. GLHA reserves the right to exercise any rights available to GLHA under PURPA in the future.

Section 5.0

Description of Existing Environment and Resource Impacts

5.1 Description of the River Basin

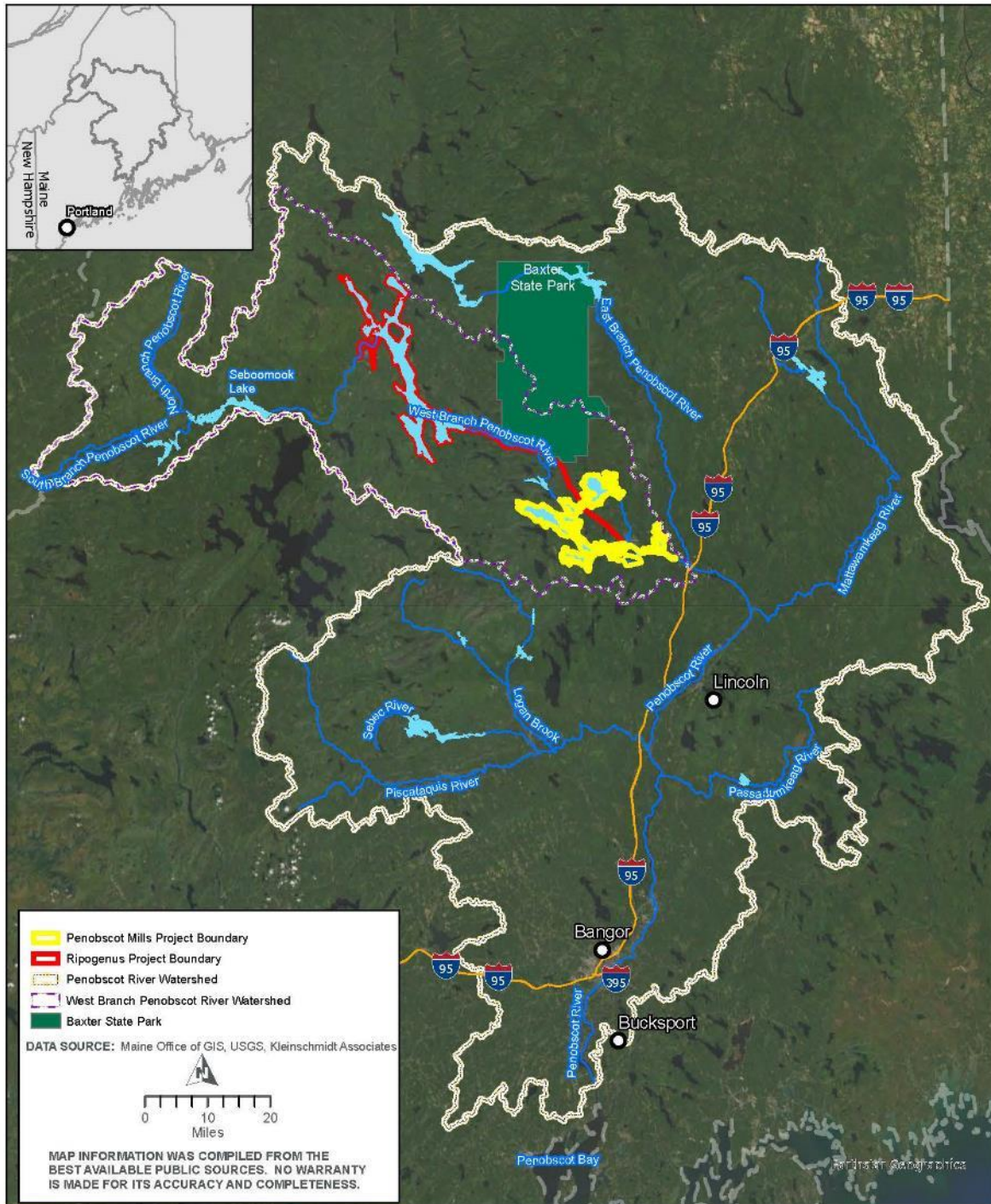
The Penobscot River Basin, which covers 8,750 square miles, is the largest river basin in Maine. The Ripogenus and Penobscot Mills Projects are located on the West Branch of the Penobscot River (Figure 5.1-1). The Penobscot Mills Project is located in the vicinity of Millinocket, Maine. The Ripogenus Project is located upstream of the Penobscot Mills Project. The drainage area at the Ripogenus Project is approximately 1,422 square miles. The drainage area of the Penobscot Mills Project at the East Millinocket Dam is 2,111 square miles. Downstream of the East Millinocket Development, the East and West Branches of the Penobscot River converge to form the Penobscot River mainstem (FERC 1996).

The mainstem of the Penobscot River is nearly 100 miles long with two main branches: the East and West branches. Two smaller branches, the North and South branches of the Penobscot River, combine at Seboomook Lake (part of the Storage Project, FERC No. 2634) in western Maine to form the West Branch Penobscot River (Figure 5.1-1 and Figure 4.2-1) (Maine Rivers 2019). The West Branch flows approximately 100 RMs east through the Seboomook impoundment, the Ripogenus impoundment, Baxter State Park, Penobscot Mills Project impoundments (North Twin, Millinocket, Dolby, and East Millinocket), and the impoundment of the downstream Medway Hydroelectric Project (FERC No. 2666) before joining the East Branch. The East Branch of the Penobscot River originates near Grand Lake Matagamon in northern Piscataquis County, Maine, and flows south-southeast for approximately 70 RMs to converge with the West Branch in Medway, Maine (Figure 5.1-1). The mainstem Penobscot River flows approximately 109 RMs southeast from Medway to Bucksport, Maine, where it empties into Penobscot Bay and eventually into the Gulf of Maine and Atlantic Ocean (Figure 5.1-1) (FERC 1996).

Section 5

Description of Existing Environment and Resource Impacts

Figure 5.1-1
Penobscot River Basin



PENOBSCOT RIVER BASIN
RIPOGENUS HYDROELECTRIC PROJECT (FERC NO. 2572)
PENOBSCOT MILLS HYDROELECTRIC PROJECT (FERC NO. 2458)

PATH: G:\CLINT\DATA\FFRC_PSO\RC1542572\4237385_PMLLS\0000_REFLECTINGRIPROGENUS_REFLECTINGRIPROGENUS_REFLECTINGRIPROGENUS - USER: CHARLES ANDERSON - DATE: 04/09/21

APRIL 2021

5.1.1 Topography

The topography of the Penobscot River watershed is relatively uniform with gentle slopes, low mountains, and rolling hills rising above wide flat valleys (FERC 1986, 2018). There are more than 1,600 miles of streams and rivers and over 625 lakes and ponds throughout the Penobscot River watershed (MDMR and MDIFW 2008). A principal physiographic feature of the northern part of the basin is 5,267-foot-high Mt. Katahdin, the state's highest peak, located in the 200,000-acre Baxter State Park.

5.1.2 Major Land Uses

In the 19th century, land use throughout the Penobscot River watershed was associated with timber operations; dams along the river were constructed to power the timber operations. By the late 1800s, a significant portion of the Penobscot River watershed had been cut for timber. In the early 1900s, pulp and paper production began, which led to the construction of pulp and paper mills from Millinocket to Lincoln, Maine (MDMR and MDIFW 2008).

Throughout the 19th and 20th centuries, the West Branch has been used for lumber and paper-making. These industries used water resources to transport materials and products, and for use in industrial processes. The growth of the towns of Millinocket and East Millinocket paralleled the growth of the mills, and for many years the region's economy was dependent on the lumber and paper industries (Great Northern Nekoosa Corporation [GNNC] 1991a).

Construction of dams, which began on the estuarine tributaries during the late 1700s, has strongly influenced the environmental resources and socioeconomics within the basin. The first Penobscot mainstem dam was built in the mid-1820s in the Old Town-Milford area (GNNC 1991a).

The West Branch of the Penobscot River basin was also developed to support the forest, pulp, and paper industries. It is estimated that 137 dams have been constructed on the West Branch and its tributaries since logging began in 1828 to facilitate the transportation of timber downstream to more populated areas. Construction of dams within the Ripogenus and Penobscot Mills Project areas began in 1846. Stone Dam, the oldest existing dam associated with the Projects, was completed in 1899 (GNNC 1991a).

Today the Penobscot River watershed is covered by forest (approximately 68%), wetlands (woody and emergent herbaceous, 14%), scrub/shrub (7%), and agricultural land (2 %) (Multi-Resolution Land Characteristics Consortium [MRLC] 2019). Pockets of low to high intensity development are dispersed throughout the watershed and constitute approximately one percent of the land cover. The remaining land cover (approximately 3%) is open space, herbaceous, barren, or unclassified. Other than recreation sites and camps, nearly all the developed areas associated with or immediately adjacent to the Projects are located within the town of Millinocket. Most of the land adjacent to the Project impoundments is a mix of forest and wetlands with interspersed shoreline camps and recreational development (MRLC 2019).

5.1.3 Major Water Uses

Current water uses of the West Branch include recreation, storage, flood control, and hydroelectric generation. Several storage impoundments are associated with the Projects, including the Ripogenus impoundment, the Millinocket Lake Storage impoundment, and the North Twin impoundment. In addition, a series of separate storage impoundments (Storage Project, FERC No. 2634) are located upstream of the Ripogenus Project. Downstream of the Penobscot Mills Project is the Medway Project (FERC No. 2666), which is located just upstream from where the East and West Branches converge to form the mainstem Penobscot River. Below Medway, several additional hydroelectric projects operate on the river's mainstem and tributaries (as shown in Table 5.1-1) (FERC 1996).

Recreation is a major use of Project waters at both the Ripogenus and Penobscot Mills Projects. Both Projects support FERC-approved Project recreation sites. In addition, there are numerous non-project and/or informal recreation sites that provide public access to Project lands and waters for recreation. There are also a small number of commercial recreation enterprises that utilize Project waters, including guide services, float plane services, and whitewater rafting outfitters. Recreation sites, facilities, and use of the Projects are discussed in more detail in Section 5.8.

Section 5

Description of Existing Environment and Resource Impacts

Table 5.1-1
Major Hydroelectric and Storage Projects Located in the Penobscot River Basin

Name	FERC Project No.	Licensees*	Capacity (MW)	Water Body
Storage Project - Canada Falls Development - Seboomook Lake Development - Ragged Lake Development - Caucomgomoc Lake Development - Penobscot Lake Development - Loon Lake Development - Dole Pond Development - Long Pond Development - Harrington Lake Development	P-2634	GLHA	Storage	West Branch
Ripogenus Hydroelectric Project	P-2572	GLHA	37.5	West Branch
Penobscot Mills Hydroelectric Project - North Twin Development - Millinocket Development - East Millinocket Development - Dolby Development - Millinocket Lake Storage Development	P-2458	GLHA	67.9	West Branch
Medway Hydroelectric Project	P-2666	BBHP	3.4	West Branch
Mattaceunk Hydroelectric Project	P-2520	GLHA	19.2	Mainstem
West Enfield Hydroelectric Project	P-2600	BPHA	13.0	Mainstem
Milford Hydroelectric Project Gilman Falls	P-2534	BBHP	8.2	Mainstem Stillwater Branch
Stillwater Hydroelectric Project	P-2712	BBHP; BBSO; BBDH	4.2	Stillwater Branch
Orono Hydroelectric Project	P-2710	BBHP; BBSO; BBDH	6.5	Stillwater Branch

Source: MDEP 2013.

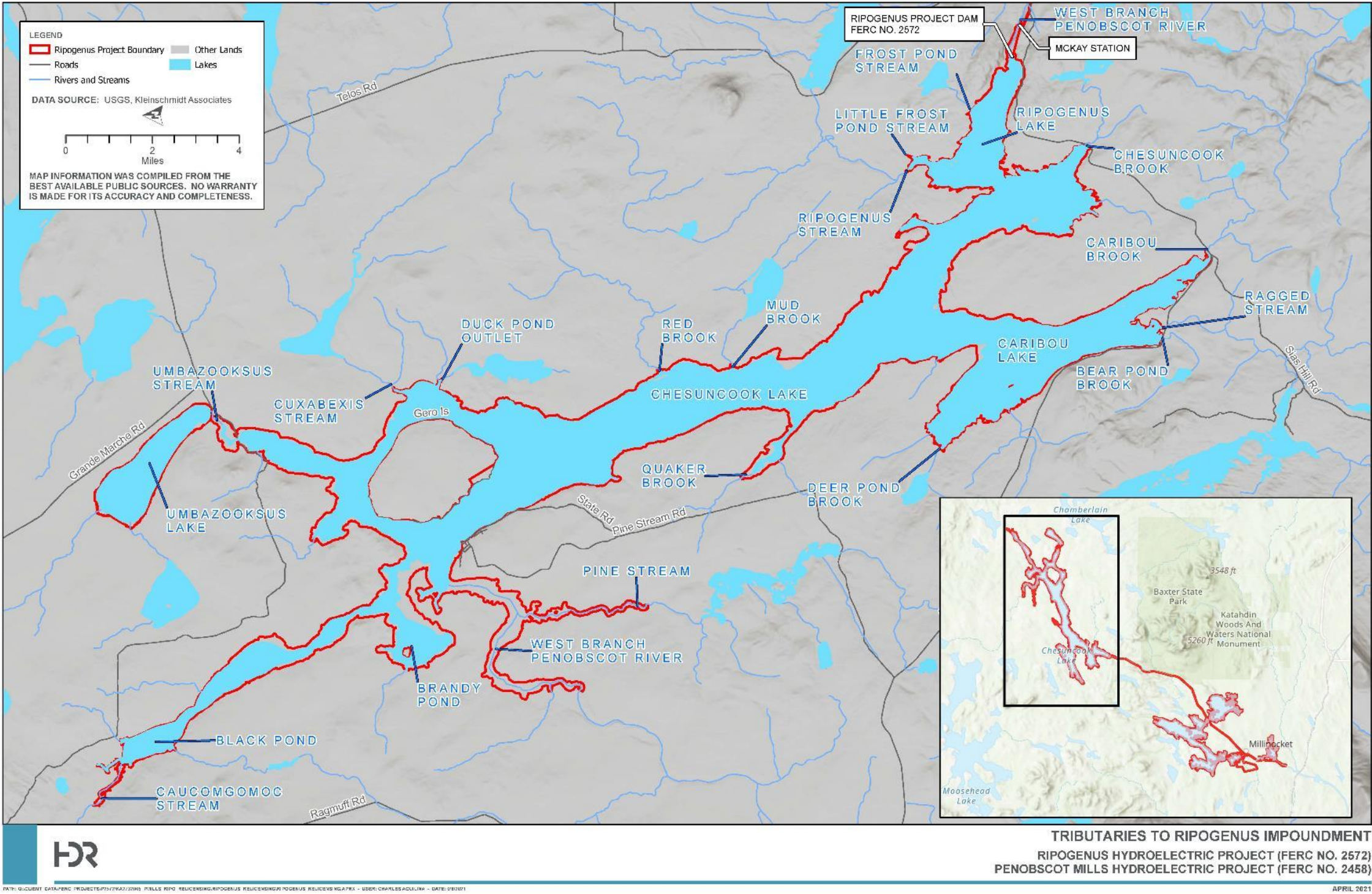
GLHA – Great Lakes Hydro America, LLC; BPHA – Bangor-Pacific Hydro Associates; BBHP – Black Bear Hydro Partners, LLC; BBSO - Black Bear SO, LLC; BBDH - Black Bear Development Holdings, LLC.

5.1.4 Drainage Basin's Tributary Streams

Major tributaries to the West Branch upstream of the Projects include the North and South Branches of the Penobscot River (Figure 5.1-1).

At the Ripogenus Project, nineteen tributaries (i.e., identified and/or named inflows) feed into the Ripogenus impoundment, including Ripogenus Stream, Duck Brook, Cuxabexis Stream, Caucomgomoc Stream, Little Scott Brook, Upper West Branch, and Ragged Stream (see Figure 5.1-2).

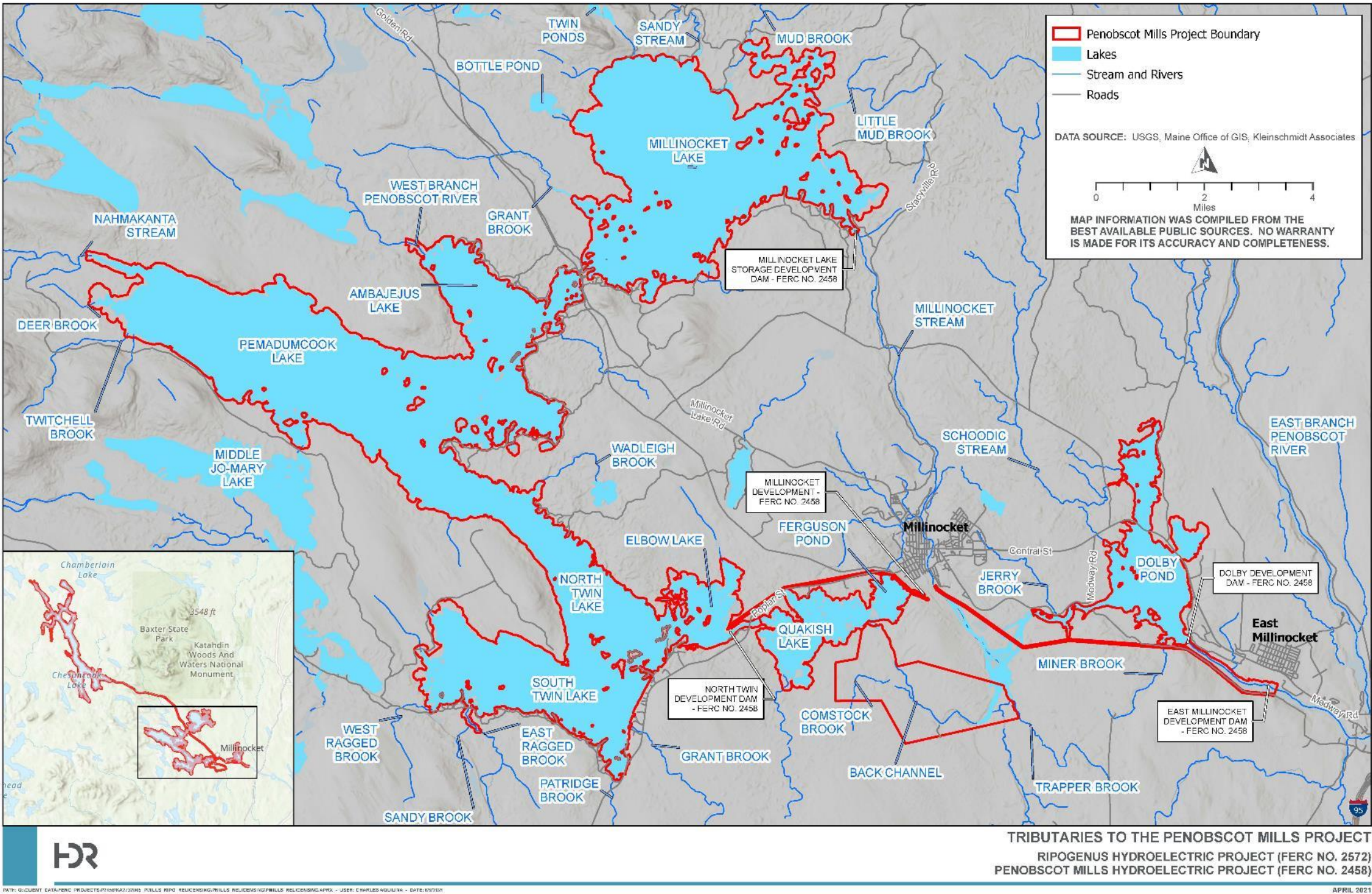
Figure 5.1-2
Tributaries to the Ripogenus Project



Section 5Description of Existing Environment and Resource Impacts

At the Penobscot Mills Project, there are ten inflows to the North Twin impoundment, including the West Branch. There are no tributaries between North Twin and Quakish Lake. Three tributaries flow into the Back Channel below Stone Dam; Comstock Brook, Nollesemic Stream, and Trapper Brook. Two tributaries flow into Shad Pond. Three tributaries enter Millinocket Lake, including Sandy Stream and Mud Brook. One tributary joins Millinocket Stream below the Millinocket Lake Storage Dam. Dolby Pond has three tributaries, and one small tributary flows into the East Millinocket impoundment (see Figure 5.1-3).

Figure 5.1-3
Penobscot Mills Project Tributaries



Section 5

Description of Existing Environment and Resource Impacts

5.1.5 Climate

The Projects are located in the Northern Interior climate zone in the State of Maine. The climate of the Project areas can be categorized as humid, continental with cold, snowy winters and mild, humid summers (Jacobson 2011, Runkle et al. 2017). Overall, precipitation amounts have low seasonal variability while temperatures exhibit strong seasonal variability (Jacobson 2011).

Monthly mean total precipitation and temperature from 2011-2020 and the monthly climate normals for 1991-2020 recorded at the National Weather Service monitoring station at the Millinocket Municipal Airport in Millinocket, Maine, are provided in Table 5.1-2 (Northeast Regional Climate Center [NRCC] 2021); the station is located in close proximity to the Millinocket Development of the Penobscot Mills Project. The mean total precipitation normal ranged from 2.13 inches to 4.55 inches from 1991 to 2020, while the monthly mean precipitation ranged from 2.13 inches to 4.73 inches from 2011 to 2020 (Table 5.1-2). The mean temperature normal ranged from 15.5°F to 68.2°F from 1991 to 2020, while the monthly mean temperature ranged from 17.4 degrees Fahrenheit (°F) to 69.9°F during the 2011-2020 period.

Table 5.1-2
Monthly Mean Precipitation and Temperature from the Millinocket Municipal Airport
from 1991-2020 and from 2011-2020

Month	1991-2020 Climate Normal		2011-2020	
	Mean Total Precipitation (Inches)	Mean Temperature (°F)	Mean Total Precipitation (Inches)	Mean Temperature (°F)
January	2.70	15.5	2.38	17.4
February	2.13	17.6	2.13	18.4
March	2.97	27.6	2.30	27.8
April	3.51	40.4	3.29	40.3
May	3.42	53.2	3.66	54.2
June	4.20	62.6	4.28	62.6
July	4.16	68.2	3.00	69.9
August	3.80	66.5	4.07	67.7
September	3.61	58.2	3.22	59.7
October	4.55	46.0	4.73	47.6
November	4.10	34.6	3.19	34.7
December	3.45	23.0	3.59	23.7

Source: NRCC 2021.

5.2 Geology and Soils

5.2.1 Project Area Geology

The Penobscot River Basin is located in the New England Upland Physiographic region (GNNC 1991a and 1991b). This area is further subdivided into the Aroostook Hills, Central Mountains, Western Foothills, and Eastern Interior Biophysical Regions (MDIFW 2005). The area has gentle slopes interspersed with occasional mountains or monadnocks of resistant rocks composed of metamorphic bedrock (shale, slate, and schist) with igneous intrusions. The mainstem of the Penobscot River is a lower area; hills generally rise 300 to 400 feet. The terrain of the West Branch region is characterized by rolling hills and mountains ranging from 2,000 feet to more than 5,000 feet (Mt. Katahdin) (FERC 1996).

5.2.1.1 Ripogenus Project

The northwestern portion of the Ripogenus Project is located within the Aroostook Hills Biophysical Region. The region is characterized by gently rolling terrain with elevations averaging between 800 and 1,000 feet. Bedrock of this region is almost entirely composed of weakly metamorphosed interbedded pelites, sandstones, and some limestone. Intrusives include a belt of metavolcanic rock that cuts across the central portion of the region and the quartz diorite pluton that underlies Mount Chase. The eastern portion of the region has extensive but scattered deposits of glaciolacustrine sediments on which cedar swamps and peatlands have developed. The western portion of the region is covered with thin drift and pockets of deeper till. Shallow (10-20 inch), excessively drained Thorndike silt loams occur on ridge tops; well to moderately well-drained Plaisted silt loams and Chesuncook loams occur on upper slopes, and finer, poorly drained Aurelie and somewhat poorly drained Daigle soils are typical of valleys in the northern portion of the region. In the southern portion of this region, shallow course-grained Lyman or fine-grained Monson soils are characteristic of higher elevations, with somewhat poorly drained Colonel fine sandy loams and Telos loams below. Deep, poorly drained Monarda loams are widespread throughout the valleys (MDIFW 2005).

The southern portions of the Ripogenus Project, including Ripogenus Dam, are located in the Central Mountains Biophysical Region. The most extensive bedrock outcrops in Maine occur in this region. The Central Mountains Biophysical Region includes the Katahdin group and

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surrounding foothills. It also includes the highlands surrounding Moosehead Lake. The region contains the greatest relief in the state with elevations ranging from 600 to 5,267 feet. Bedrock in this region is dominated by the Katahdin Pluton, which is composed of granite and granodiorite. A series of smaller plutons composed of gabbro and other ultramafic rocks underlies the Whitecap Mountain area. Bedrock of the surrounding hills is composed primarily of weakly metamorphosed pelites and sandstones. The landscape of this region, excluding the bedrock outcrops mentioned above, are covered with thin drift and till with scattered eskers and glaciofluvial deposits. Some of the deepest deposits occur in the ribbed moraine southeast of the Katahdin mountains, where coarse-textured Hermon soils predominate. As in the Western Mountains Biophysical Region, the higher peaks of this region are covered with cryic Saddleback and Enchanted soils, although these are not extensive. Where bedrock is near the surface, fine-textured, somewhat excessively drained Monson loams have developed. At lower elevations, in till derived from metasedimentary rocks, well-drained Elliottsville loams occur. Wetter and deeper Telos and Monarda soils are typical of valleys and flatter areas (MDIFW 2005).

5.2.1.2 Penobscot Mills Project

The majority of the Penobscot Mills Project is located within the Western Foothills Biophysical Region, with only small portions of the area associated with the Project located in the Central Mountains and Eastern Interior Biophysical Regions to the northwest and southeast, respectively. The Western Foothills Biophysical Region parallels the Western and Central Highlands in a 10- to 20-mile-wide band with elevations in the region averaging between 600 and 1,000 feet. The entire region is underlain by metasedimentary rocks except for several small plutons of granite or granodiorite in the southwest. Next to the Aroostook Lowlands, some of the largest calcareous formations occur. The southwest portion is characterized by moderately to strongly metamorphosed pelites, limestones, and dolostones. The northern portion of this region is dominated by the largest ribbed moraine in Maine. The landscape consists of numerous hummocks and short parallel ridges that are most conspicuous in the Millinocket and Pemadumcook Lakes area. Thin drift, occasional bedrock, and till composed of mica schist and phyllite with some granite and gneiss provide the parent material in southern sections. Valley soils north of the moraine are generally deep, somewhat poorly drained Telos and poorly drained Monarda loams, with shallower, better-drained Monson and Elliottsville soils on upper slopes. Soils on the moraine

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tend to be deep, moderately well drained, coarse loamy Dixfield and stony excessively drained Hermon soils, while lower slopes are typically deep, poorly drained Brayton and Daigle soils. Soils in the central and southern portions of the region are generally better-drained silts and fine sandy loams. Ice-contact glaciofluvial deposits and stream alluvium are scattered throughout the region (MDIFW 2005).

As mentioned above, only a small portion of the Penobscot Mills Project is located within the Eastern Interior Biophysical Region in the southeast. This region includes the mainstems and tributaries of the Narraguagus, Pleasant, and Machias Rivers. The topography is gently rolling with elevations averaging between 200 and 400 feet. Small intrusions of gabbro and granodiorite are located along the region's seaward boundary. Wide belts of metasedimentary rocks derived from pelites, calcareous sandstones, and sulfidic quartz sandstone occur in the northern half of the region. Extensive ice-contact deltas and glaciofluvial deposits occur in the western half of the region. The surficial geology of the eastern half of this region is dominated by large deposits of glaciomarine clays and silts. Till and thin drift are most extensive in the northern portion of the region. One of the state's largest examples of an ice-contact glaciomarine delta, Pineo Ridge, is located in the towns of Columbia, Deblois, Cherryfield, and T18MD. Colton gravels and Adams sands are common on outwash plains, with poorly drained Vassalboro peats occurring in small pockets along the delta's margins. Colonel and Brayton fine sandy loams are typical of lower areas, with better-drained Dixfield and Marlow fine sandy loams occurring on upper slopes and ridge tops (MDIFW 2005).

The surficial deposits in the vicinity of the Projects are principally glacial till, swamp, marsh, and bog, ribbed moraine, and some glaciomarine deposits (Thompson and Borns 1985, Maine Department of Agriculture, Conservation and Forestry [MDACF] 2021a). Figure 5.2-1 through Figure 5.2-6 provide the surficial geology in the vicinity of the Projects.

Figure 5.2-1



(Continued)

Surficial Geology of the Ripogenus Project

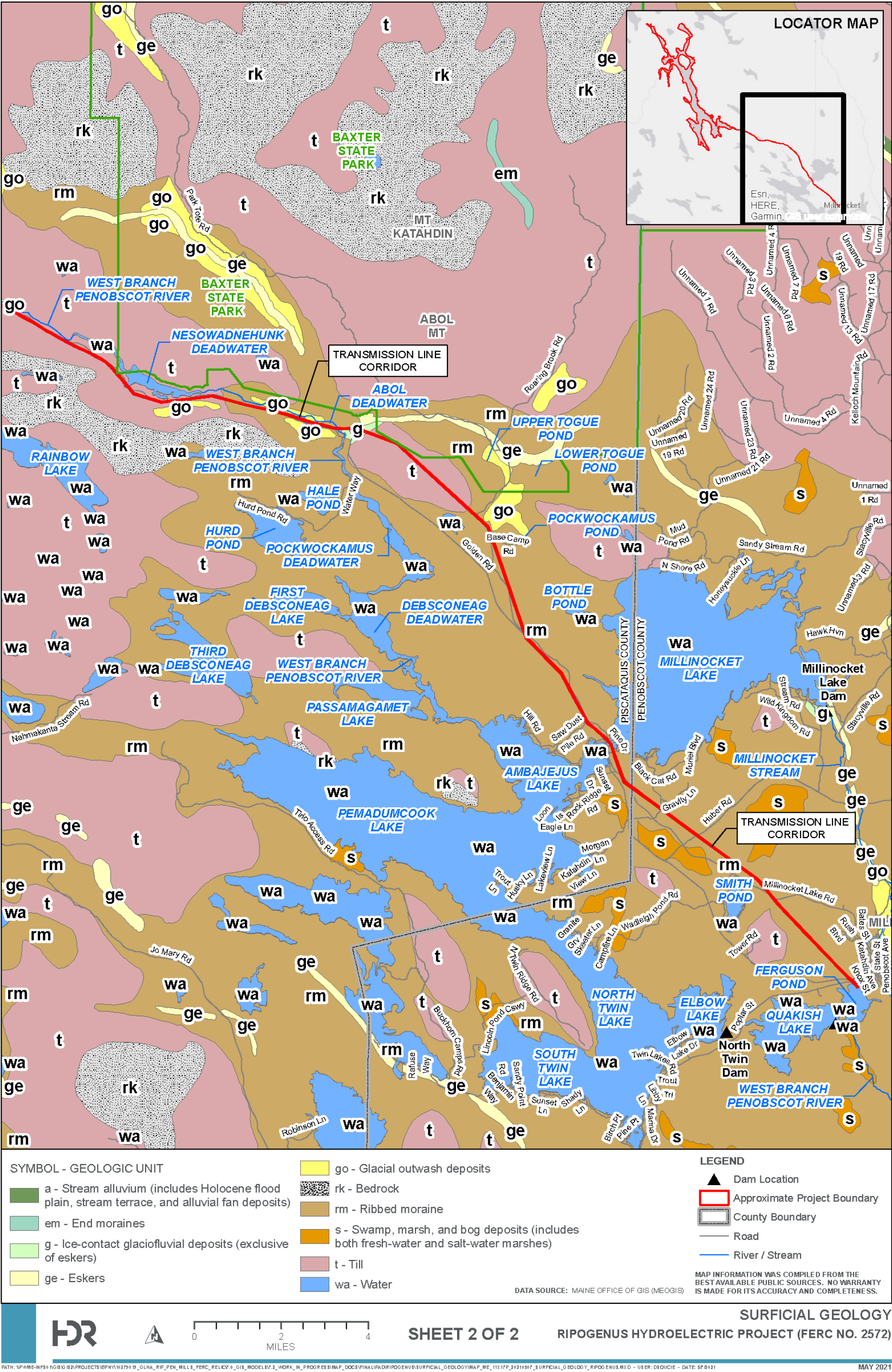


Figure 5.2-2
Surficial Geology of the Millinocket Lake Storage Development

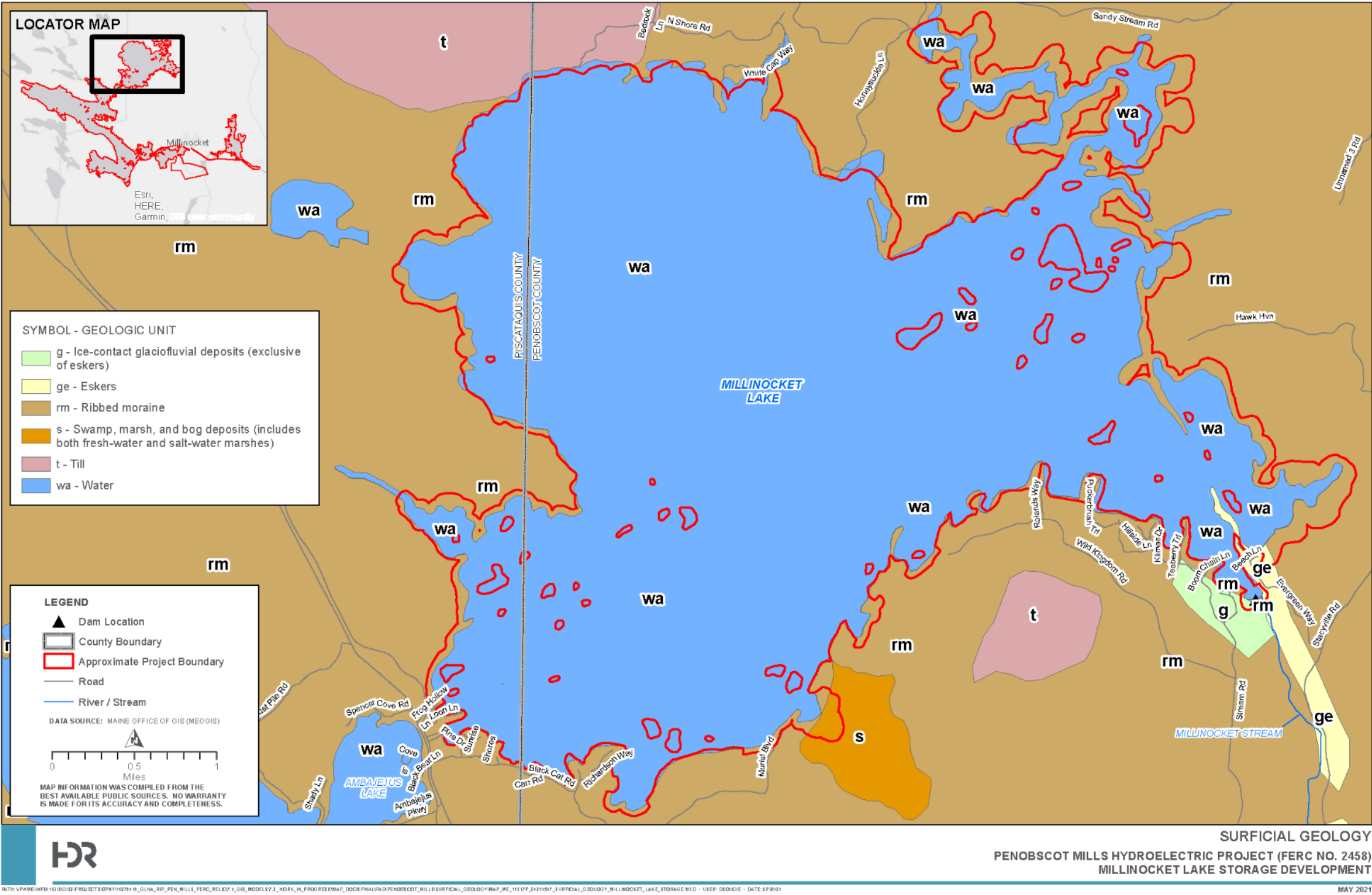


Figure 5.2-3
Surficial Geology of the North Twin Development

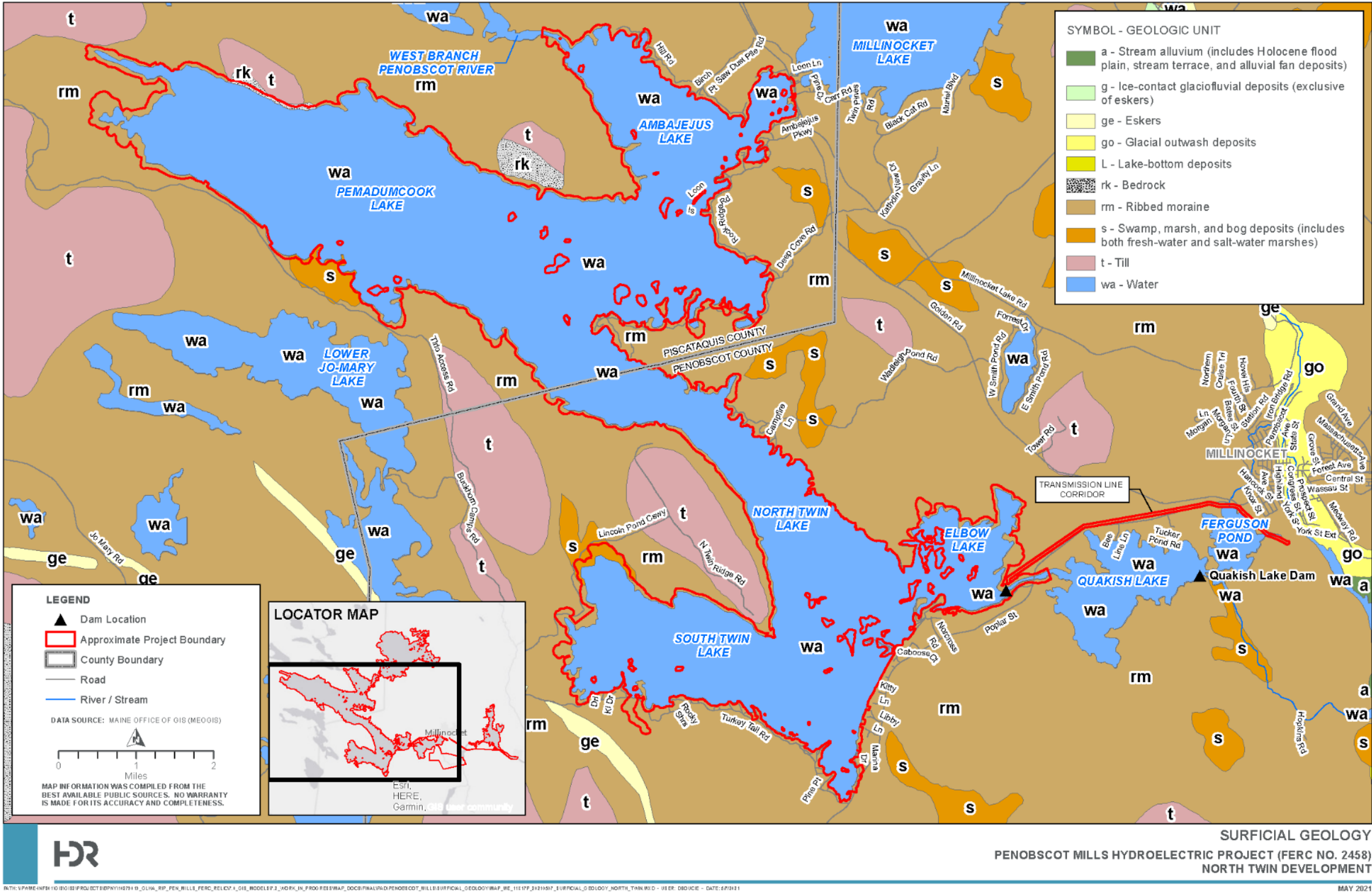
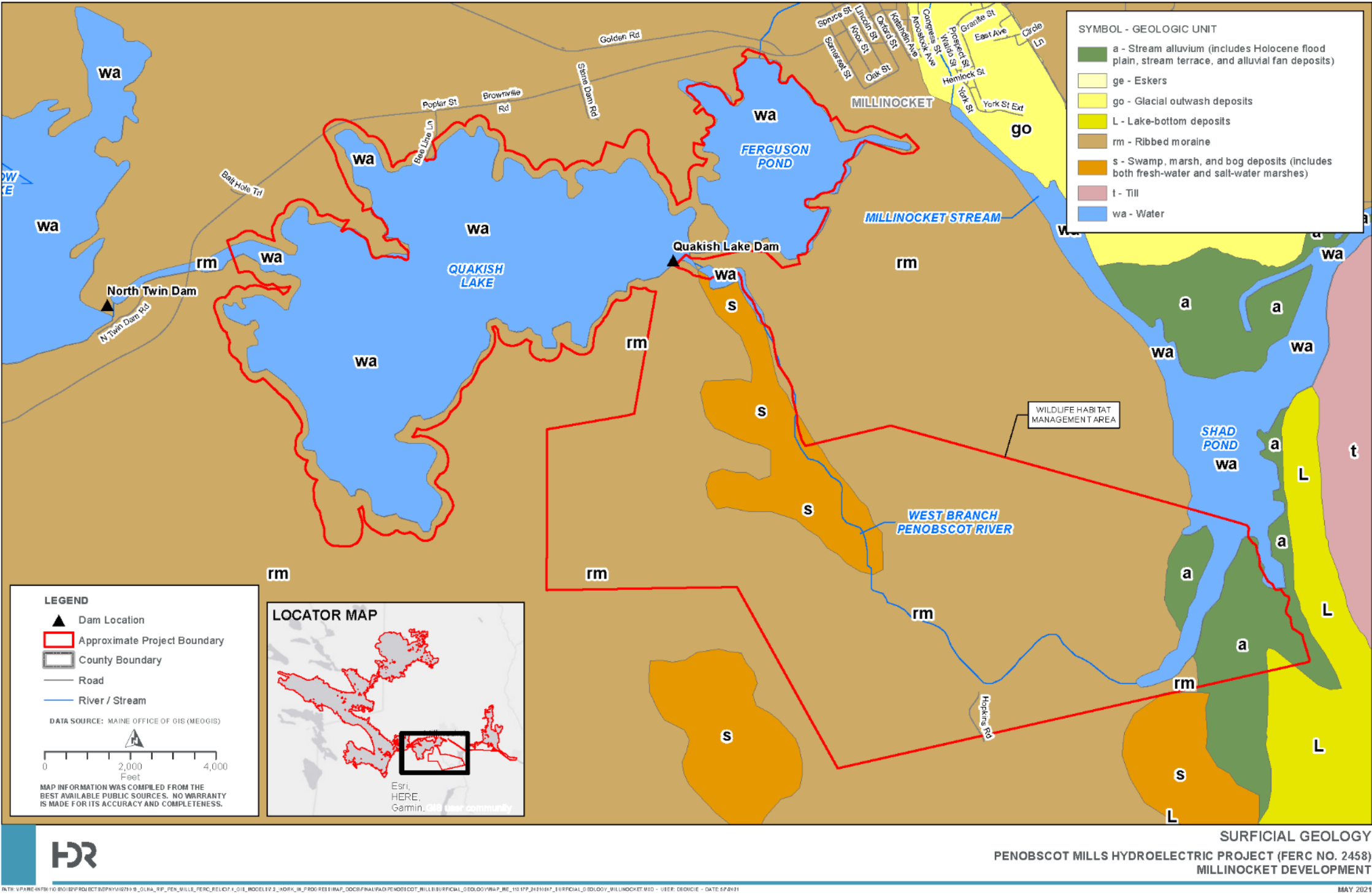


Figure 5.2-4
Surficial Geology of the Millinocket Development



Surficial Geology of the Dolby Development

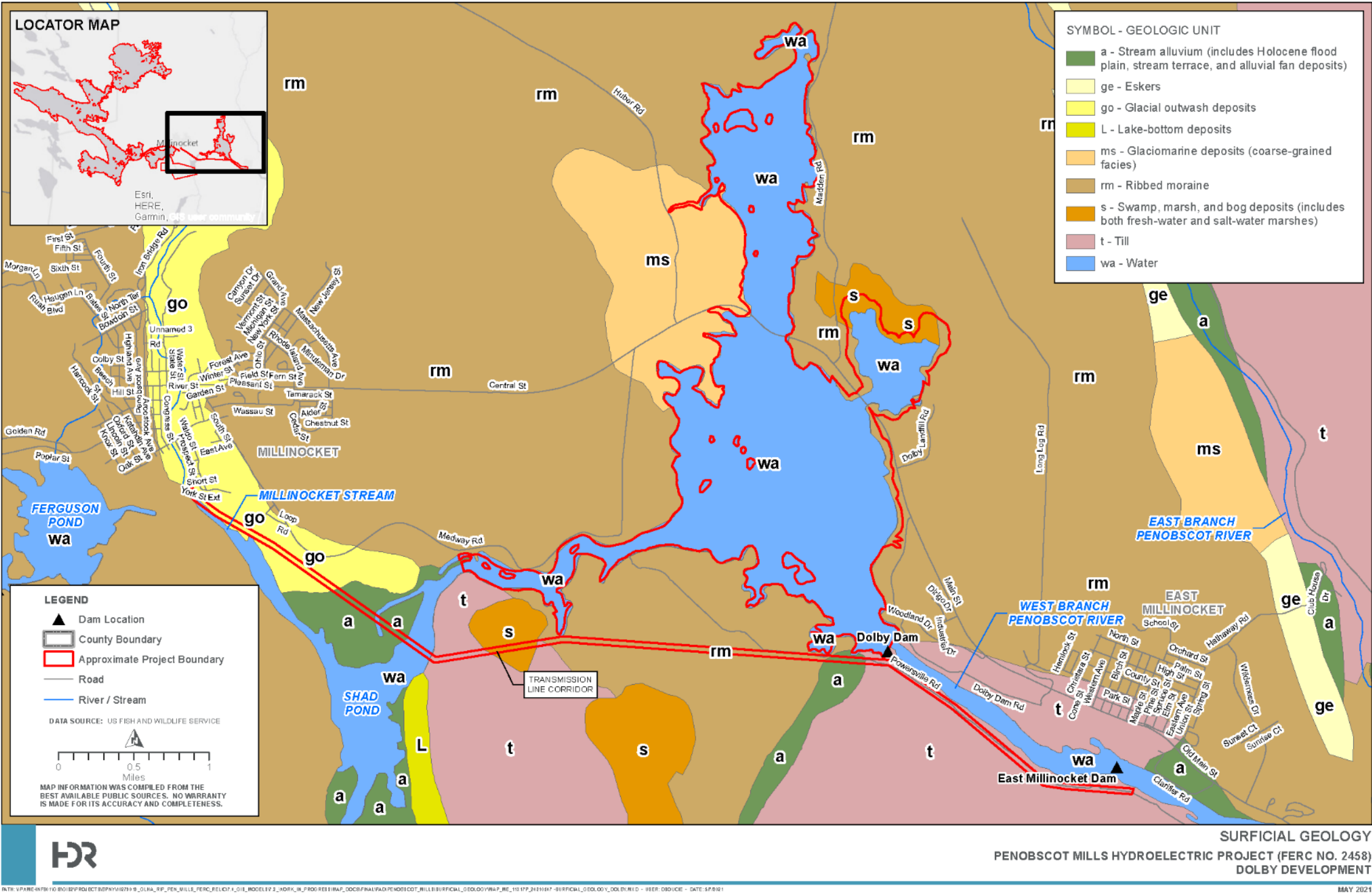
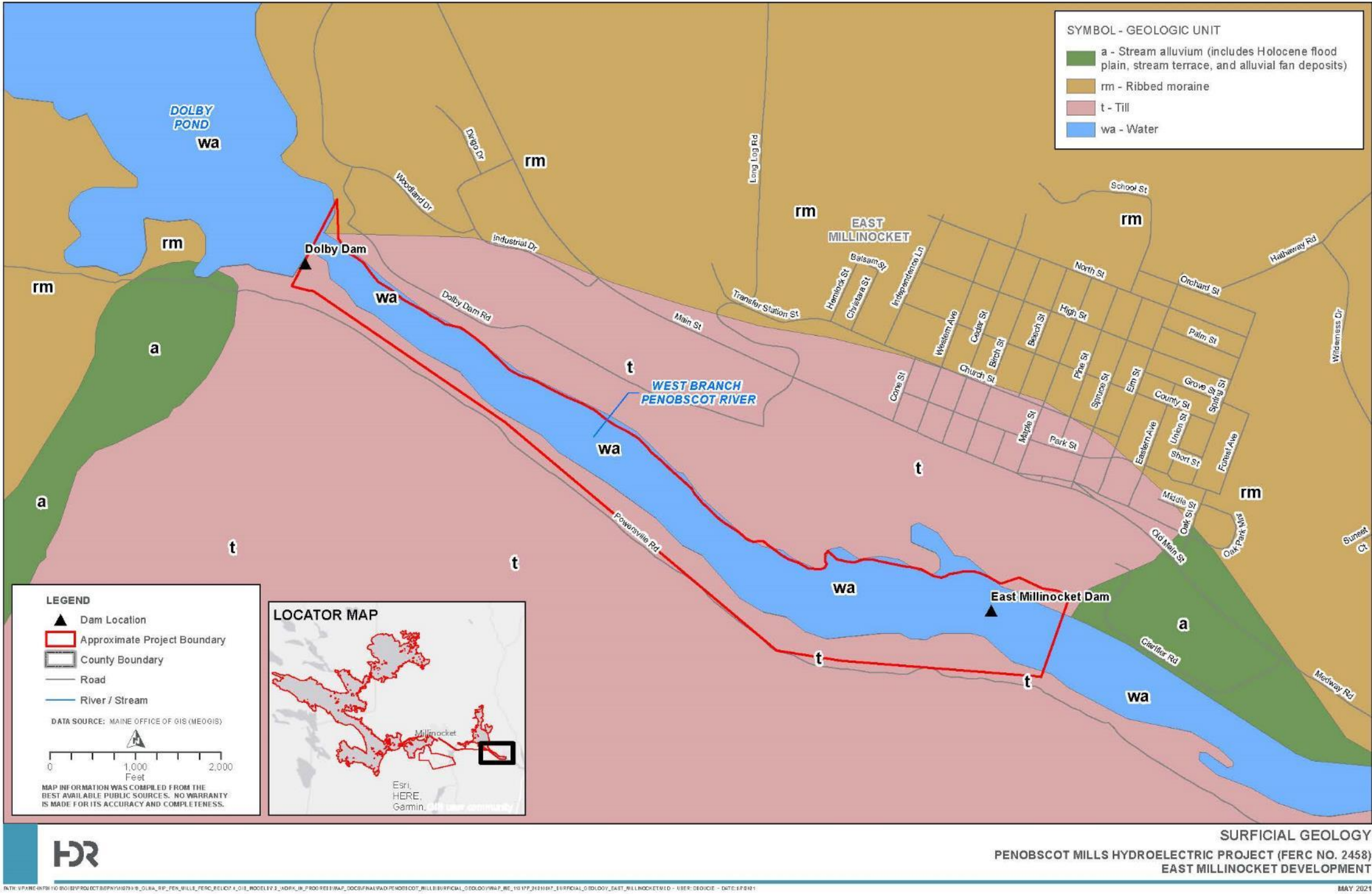


Figure 5.2-6
Surficial Geology of the East Millinocket Development



5.2.2 Topography

The Projects are located on the West Branch of the Penobscot River in northern Maine. The terrain of the West Branch region is characterized by rolling hills and mountains ranging in height from 2,000 to over 5,000 feet. A principal feature in the area of the Projects is the 5,267-foot-high Mt. Katahdin, Maine's highest peak, situated in Baxter State Park. The West Branch and East Branch of the Penobscot River merge at the town of Medway and then flow generally southward, emptying into Penobscot Bay at Bucksport, on the Maine coast (GNNC 1991a and 1991b).

The West Branch flows through the Ripogenus Dam in a southeasterly direction in an elongated, northwest-southeast trending glaciated valley. The valley bottom is approximately 300 feet wide at the Ripogenus Dam. Adjacent valley walls to the west and east rise approximately 150 feet. Physical weathering of the exposed bedrock along hillsides to the north and south of the Ripogenus Project area has resulted in rock fragments being transported downslope and deposited sporadically throughout the area as talus deposits. Surface boulders occur locally over the site; bedrock is exposed upstream and downstream of Ripogenus Dam along both banks of the river and the Ripogenus impoundment (GNNC 1991a).

Downstream of the Ripogenus Project, the West Branch flows through the Penobscot Mills Project in a southeasterly direction. The area associated with the Penobscot Mills Project has gentle slopes interspersed with occasional mountains or monadnocks of resistant rocks which are composed of metamorphic bedrock (shale, slate, and schist) intruded by igneous material.

Downstream of the Penobscot Mills Project, the West Branch merges with the East Branch to form the mainstem of the Penobscot River, which is the lowest area of the basin with hills generally rising 300 to 400 feet (GNNC 1991b).

5.2.3 Project Area Soils

Soil types in the vicinity of the Projects are variable and reflect the diversity of parent materials, the local topography, and the physiographic position of landforms.

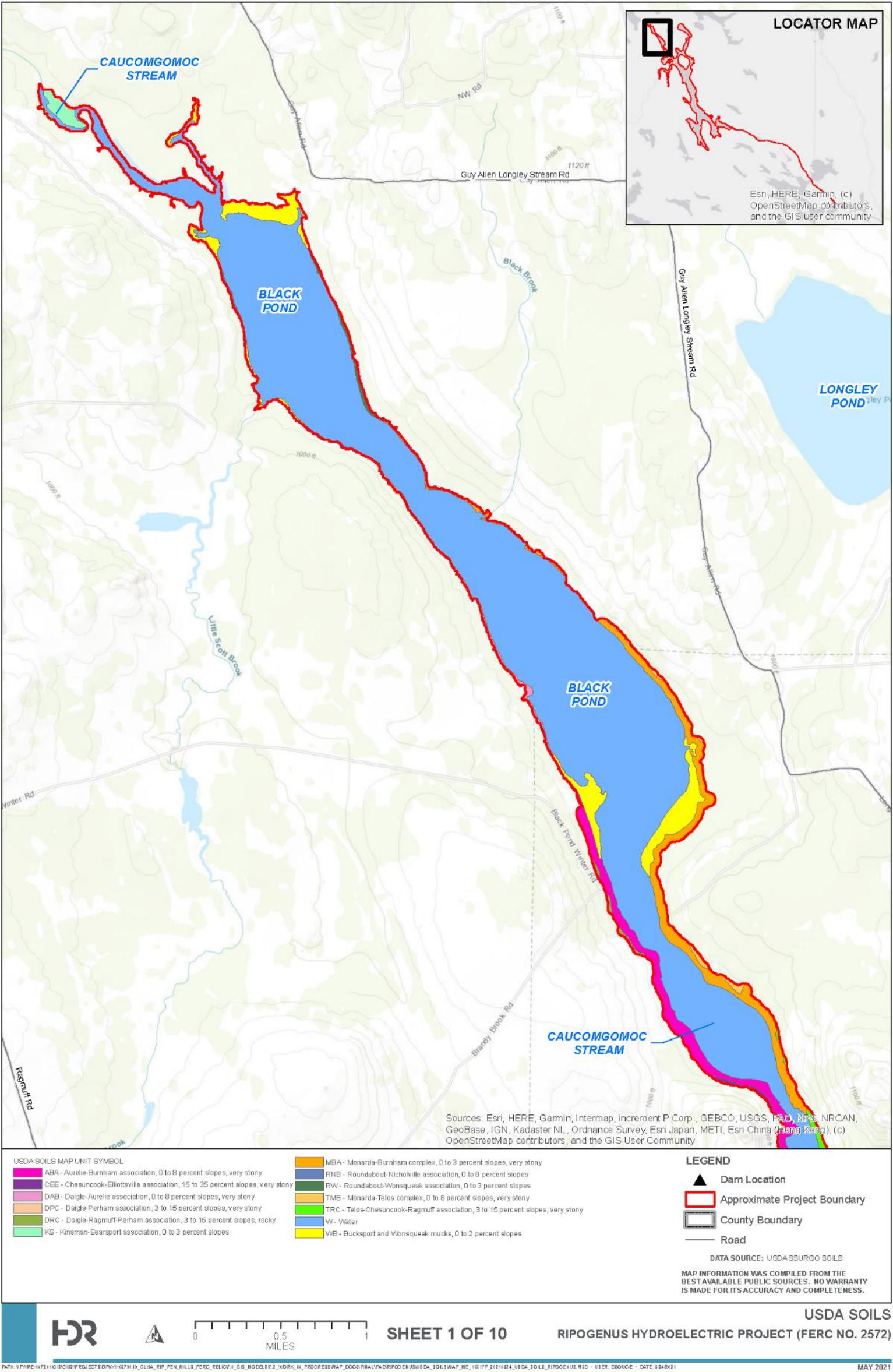
Dominant soil types occurring along the shorelines of the Ripogenus impoundment include Bucksport and Wonsqueak mucks, 0 to 2 percent slopes (WB), Monarda-Burnham complex, 0 to

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3 percent slopes, very stony (MrB), and Telos-Monarda-Monson association, 0 to 8 percent slopes, rocky (TRB).

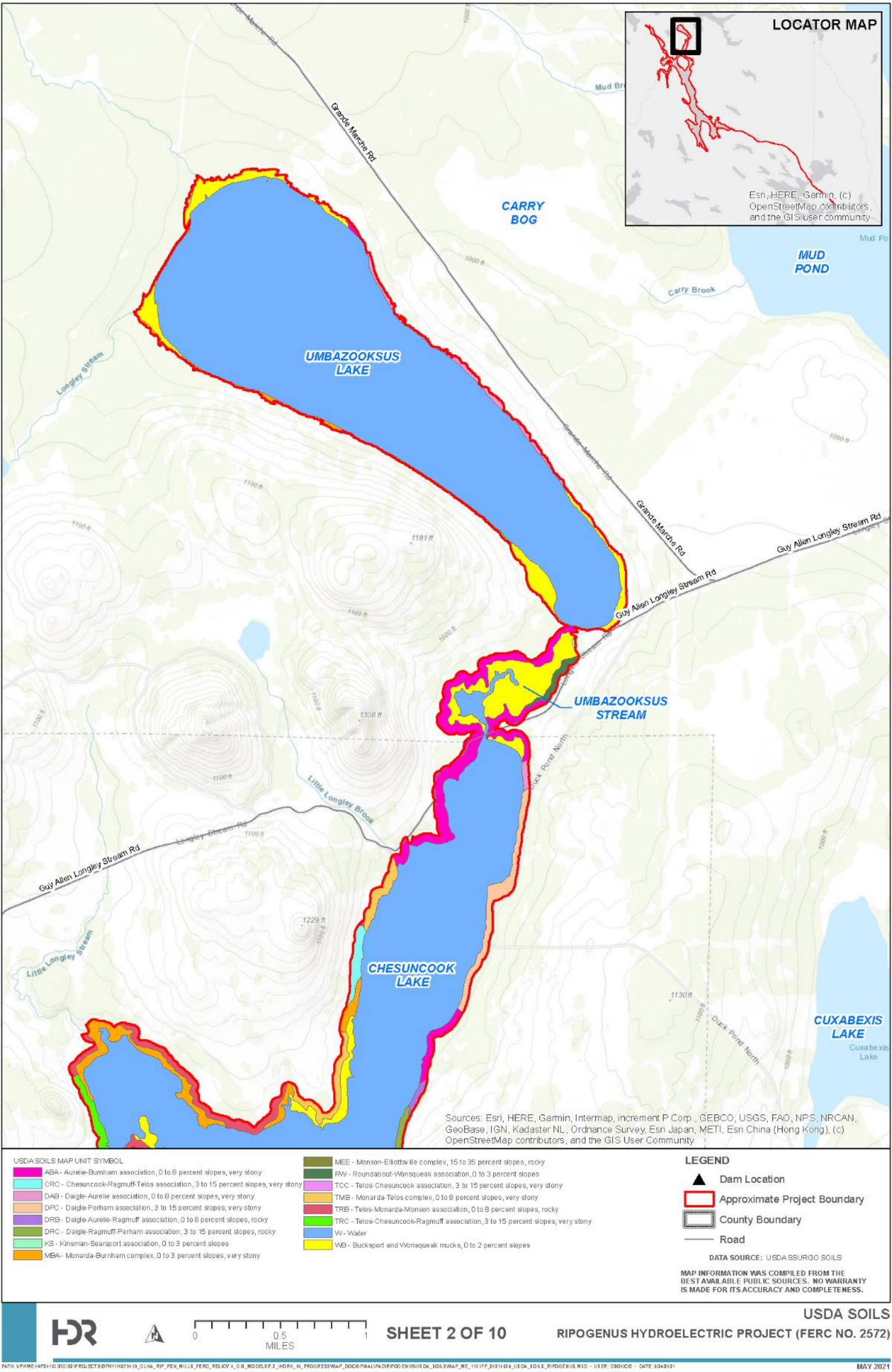
Dominant soil types occurring along the shorelines of the impoundments of the Penobscot Mills Project include Monarda-Burnham complex, 0 to 3 percent slopes, very stony (MrB), Hermon sandy loam, 3 to 15 percent slopes, extremely stony (HhC), and Howland loam, 0 to 8 percent slopes, very stony (HvB). Figure 5.2-7 through Figure 5.2-12 display and describe the soil types within and adjacent to the boundaries of the Projects (U.S. Department of Agriculture [USDA] undated).

Figure 5.2-7
Soils at the Ripogenus Project



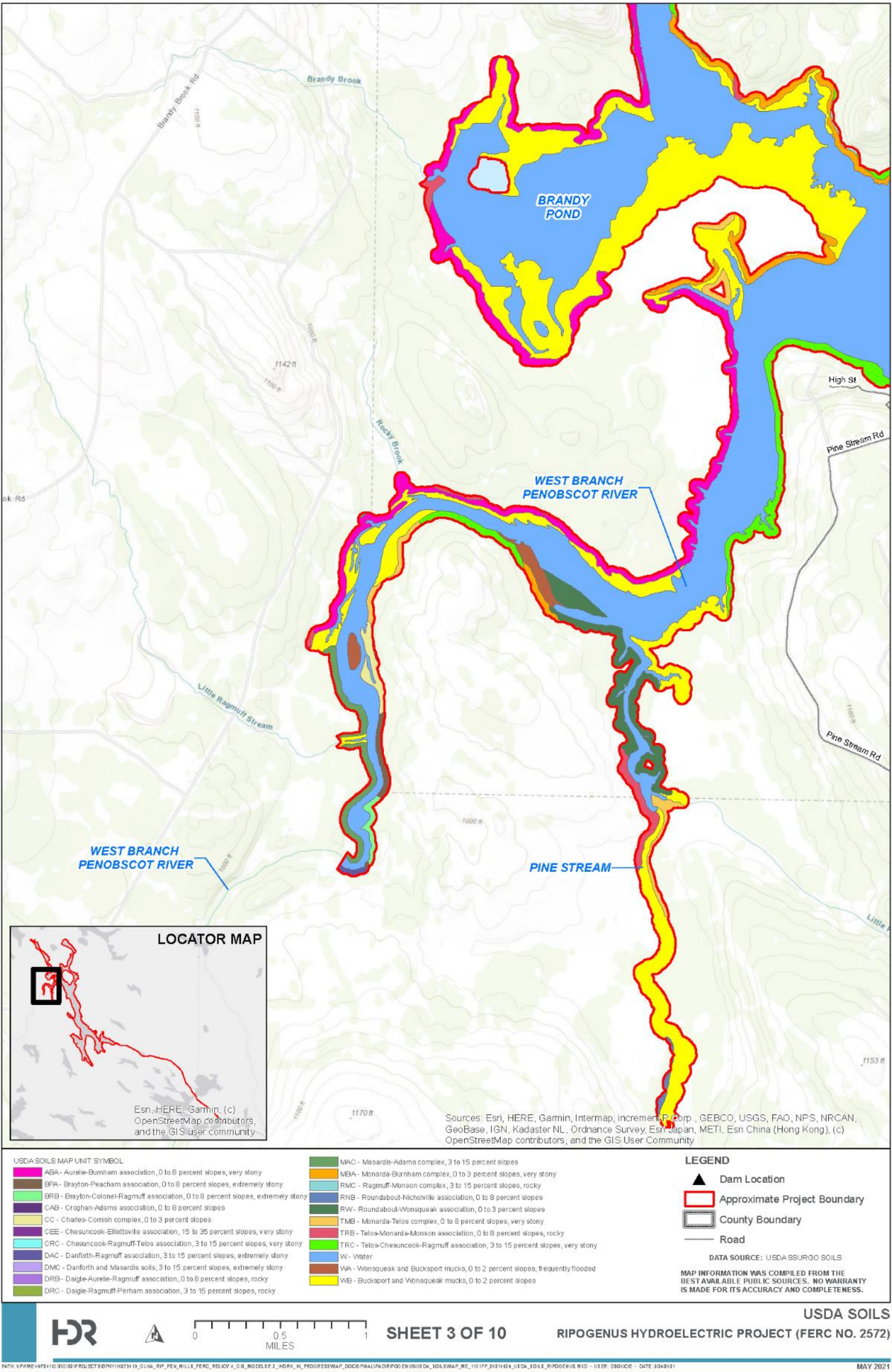
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Soils at the Ripogenus Project

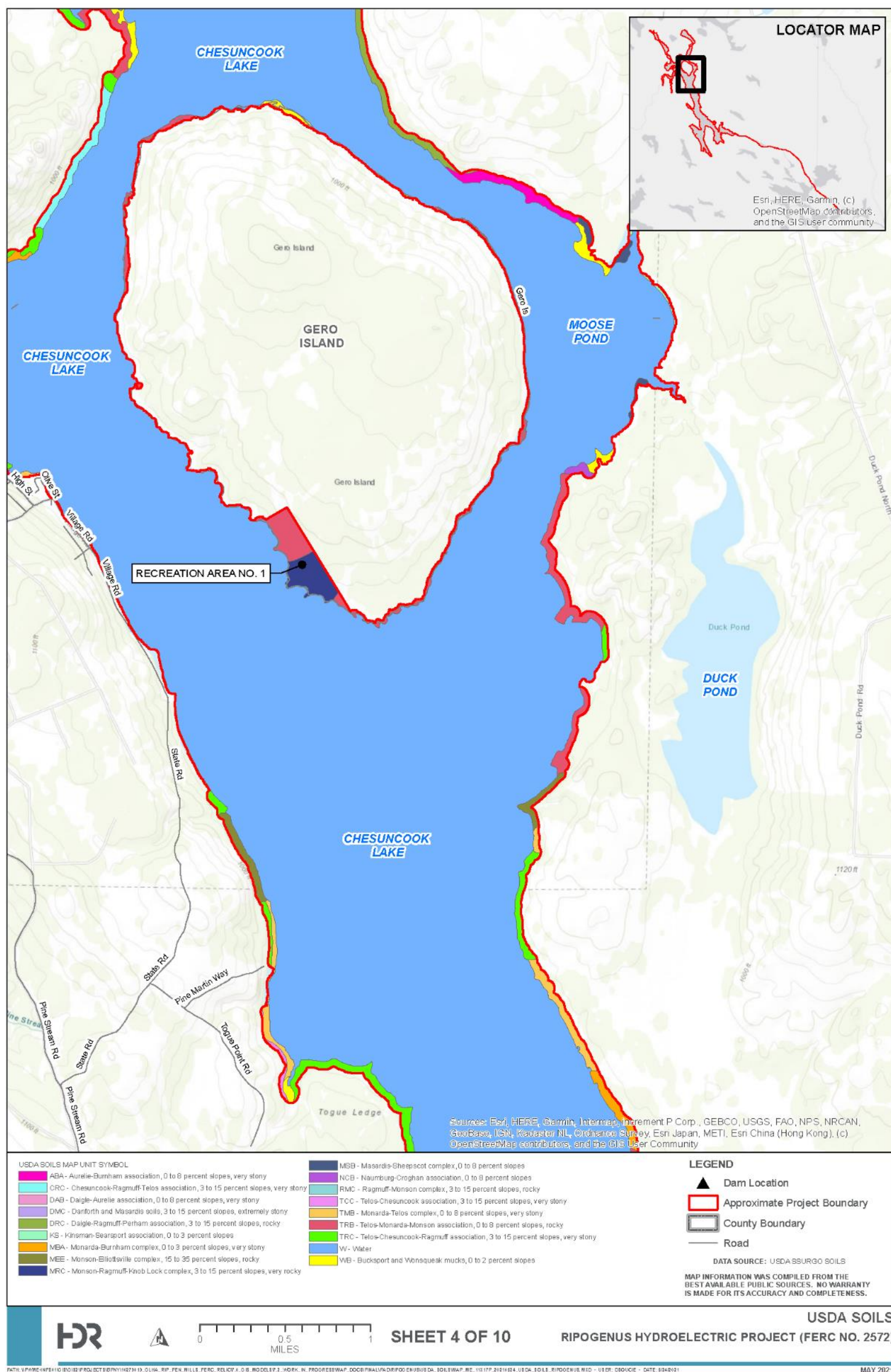


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Soils at the Ripogenus Project

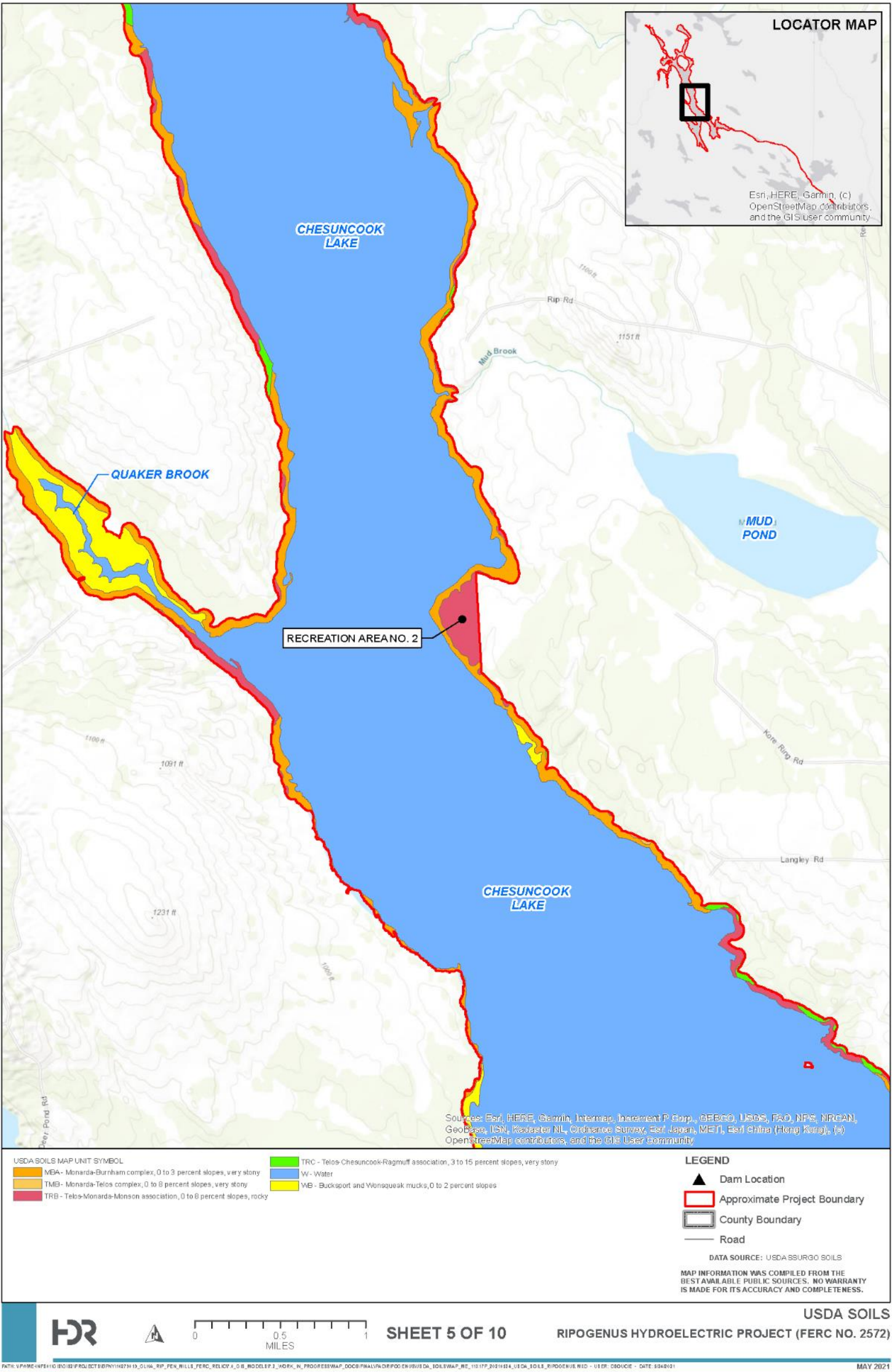


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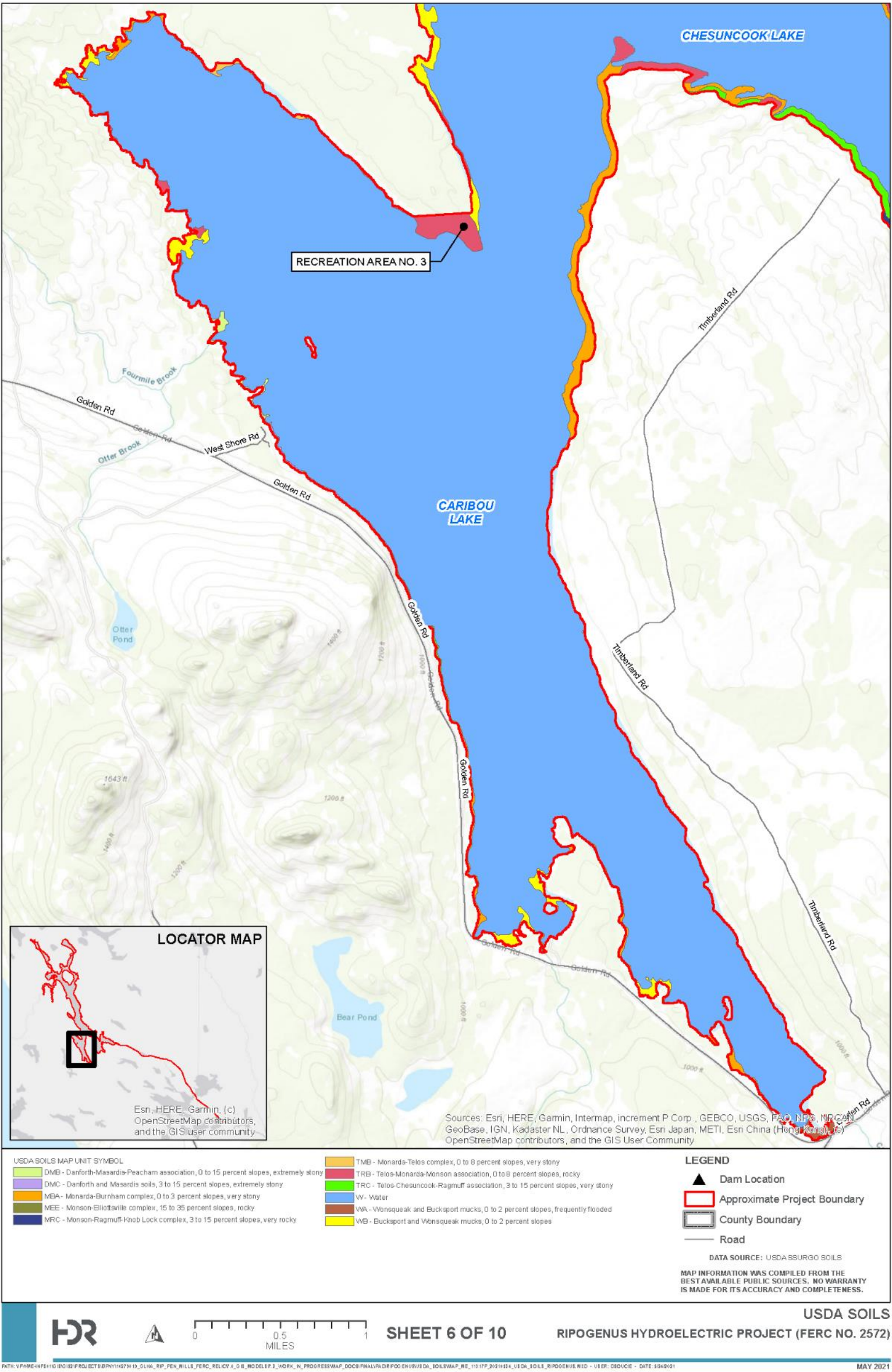


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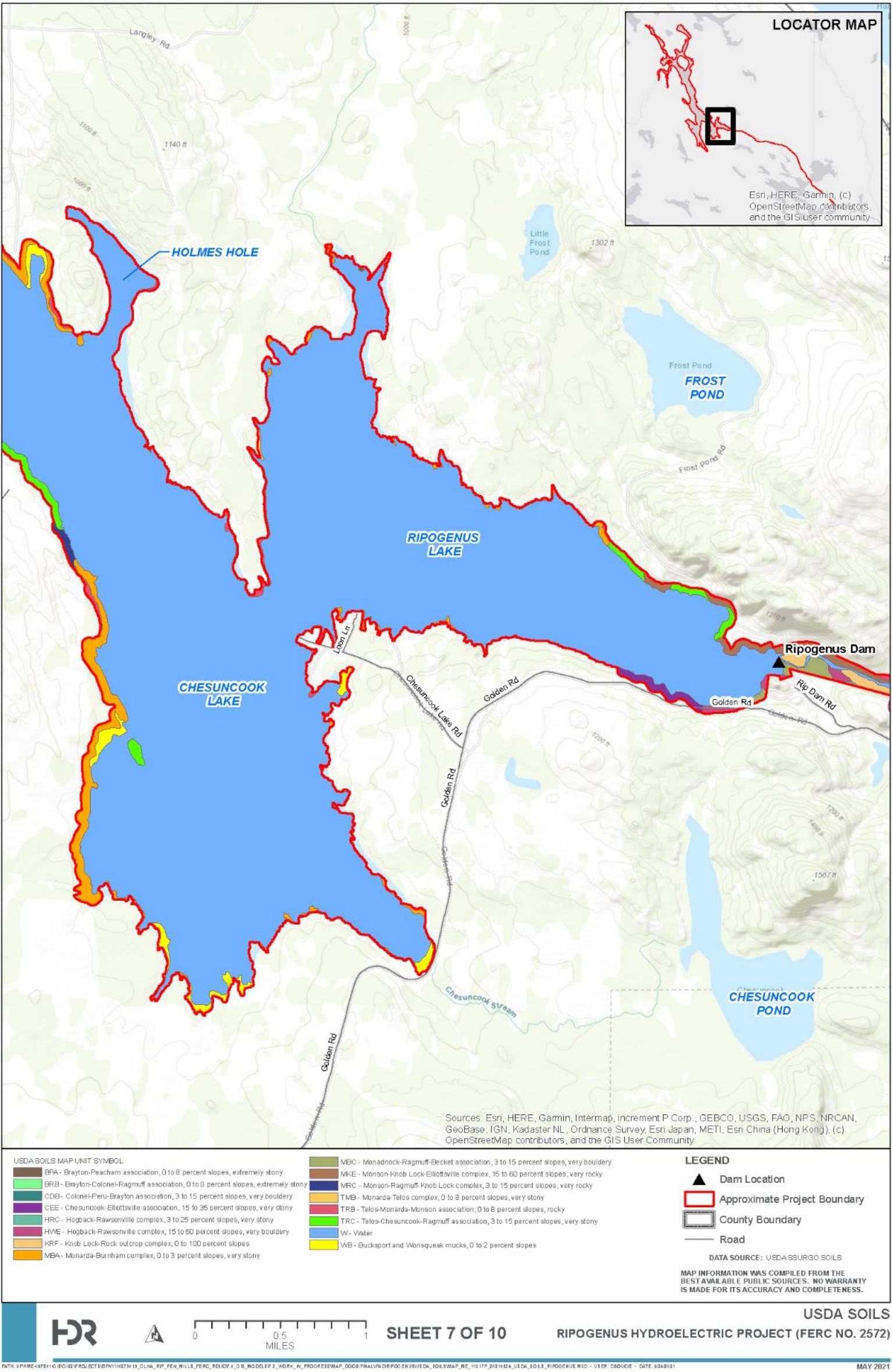
Soils at the Ripogenus Project



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Soils at the Ripogenus Project

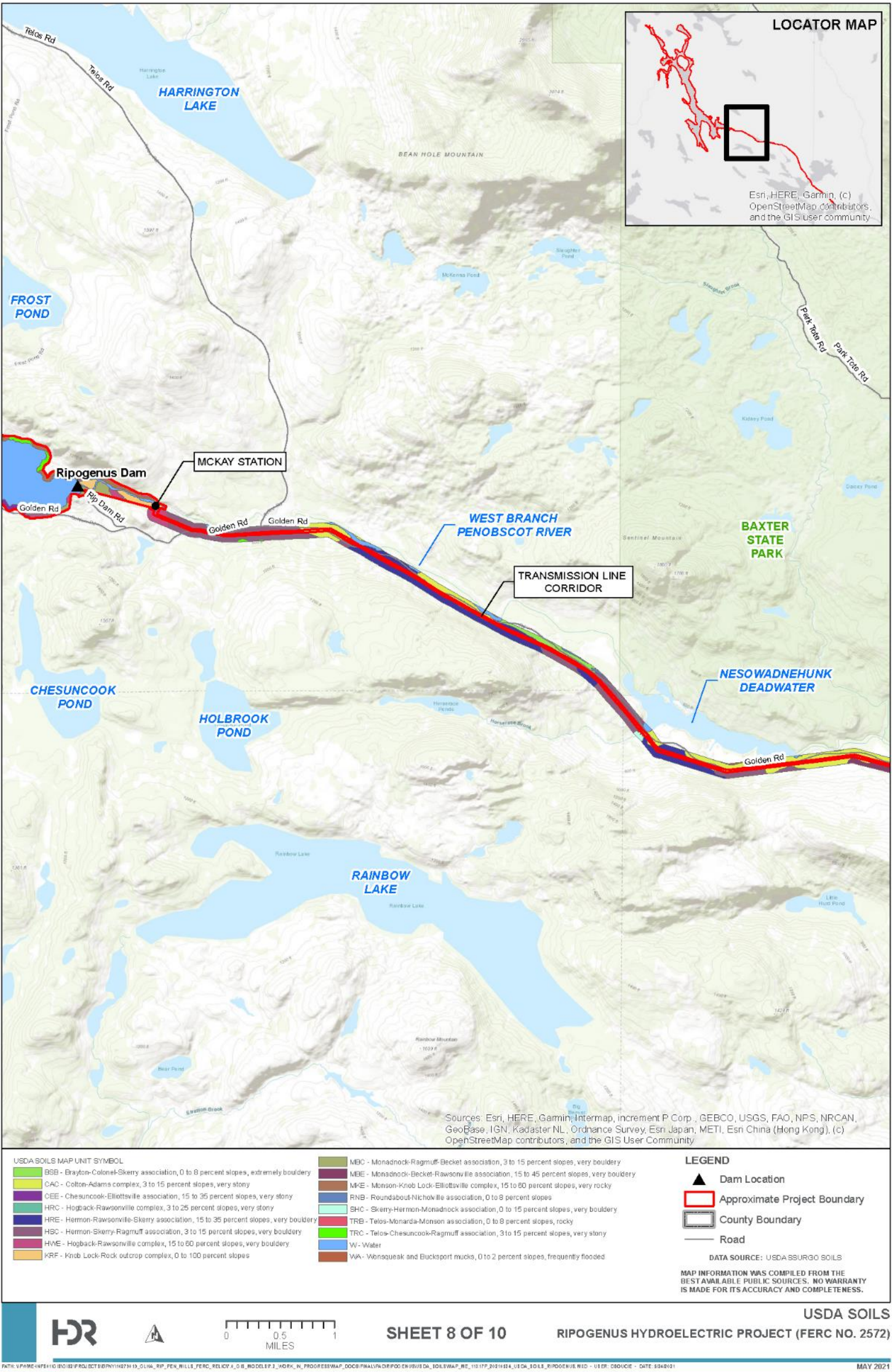


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Soils at the Ripogenus Project

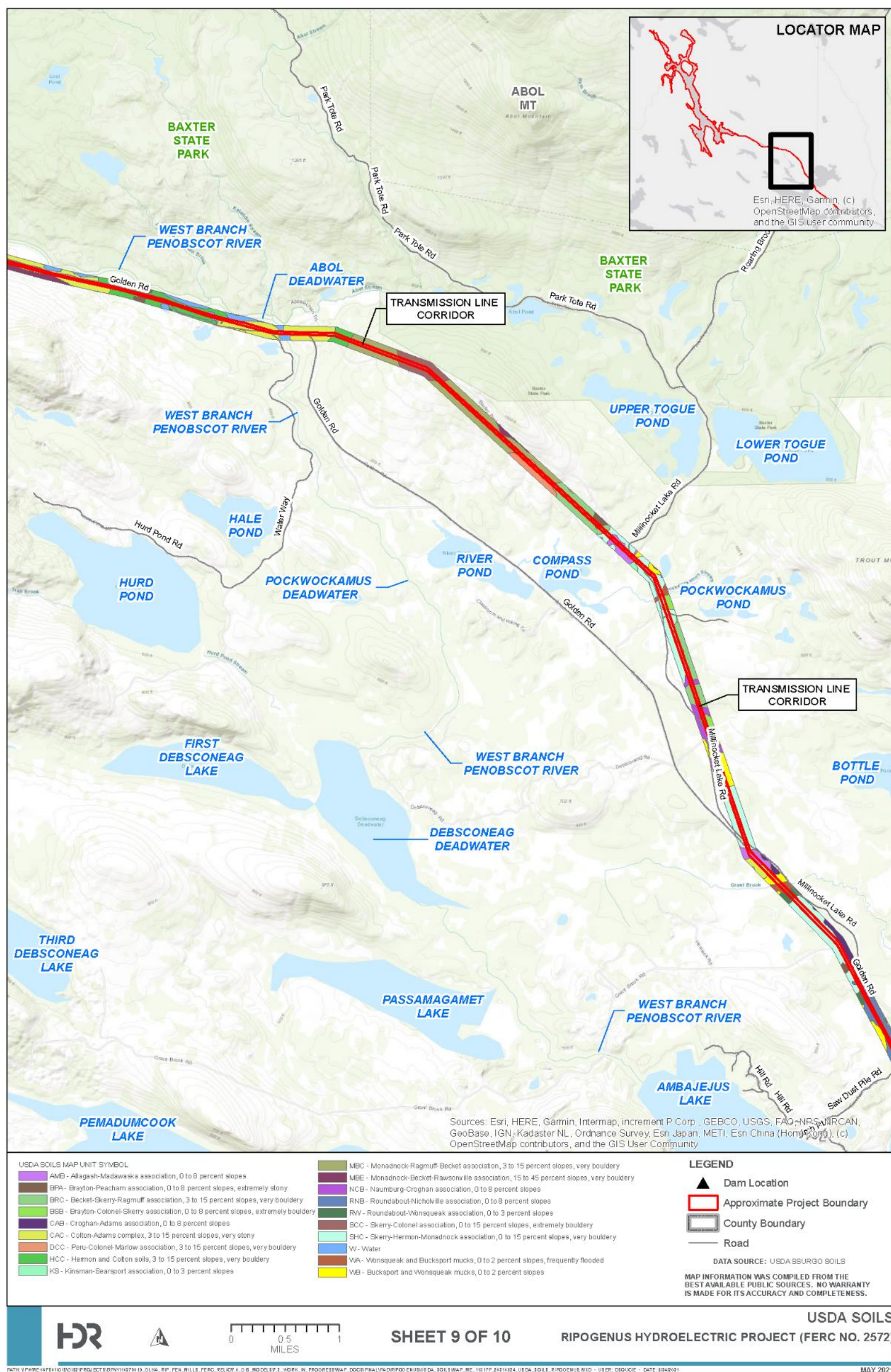


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Soils at the Ripogenus Project



Soils at the Ripogenus Project



(Continued)

Soils at the Ripogenus Project

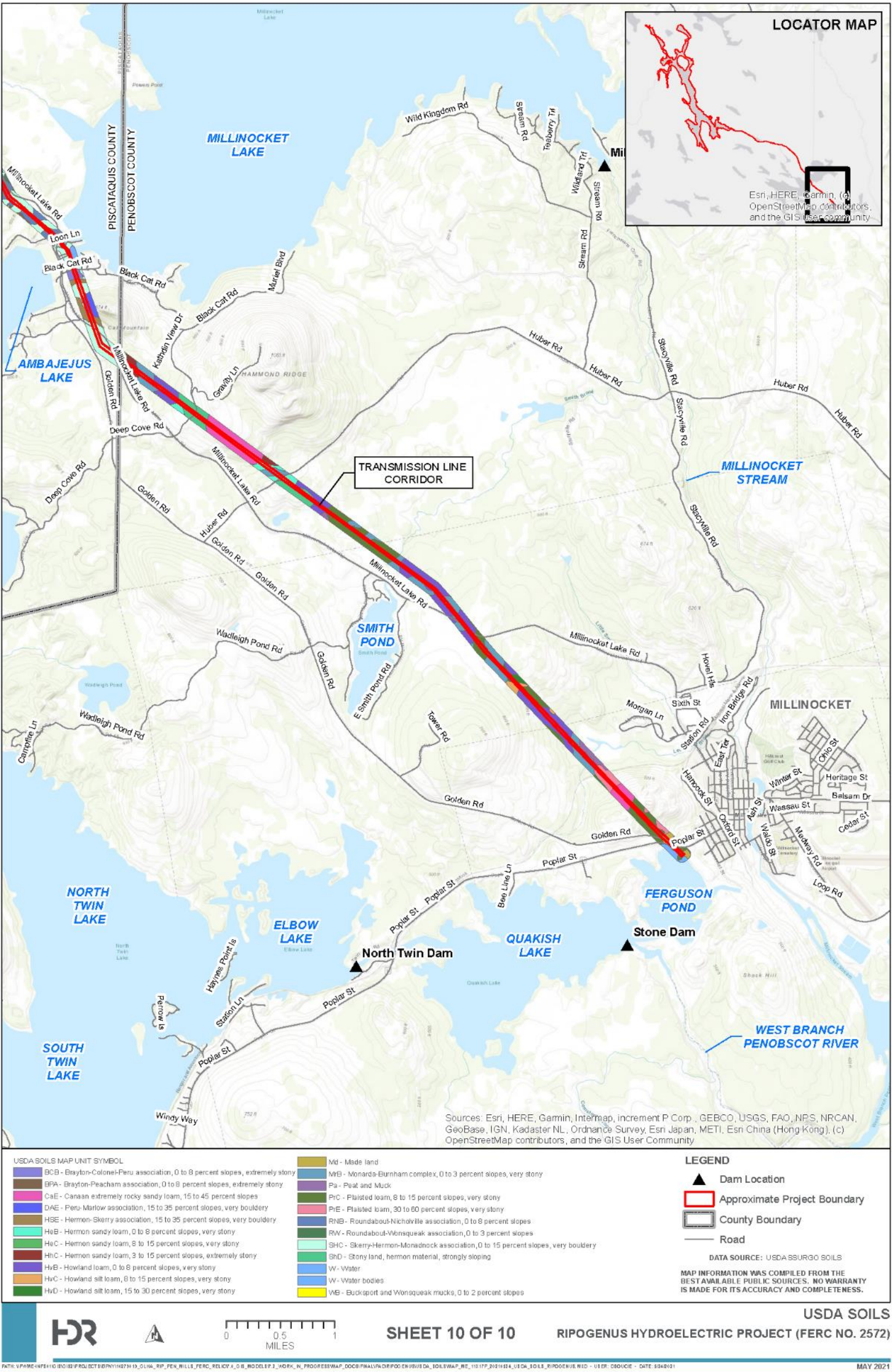


Figure 5.2-8
Soils at the Millinocket Lake Storage Development

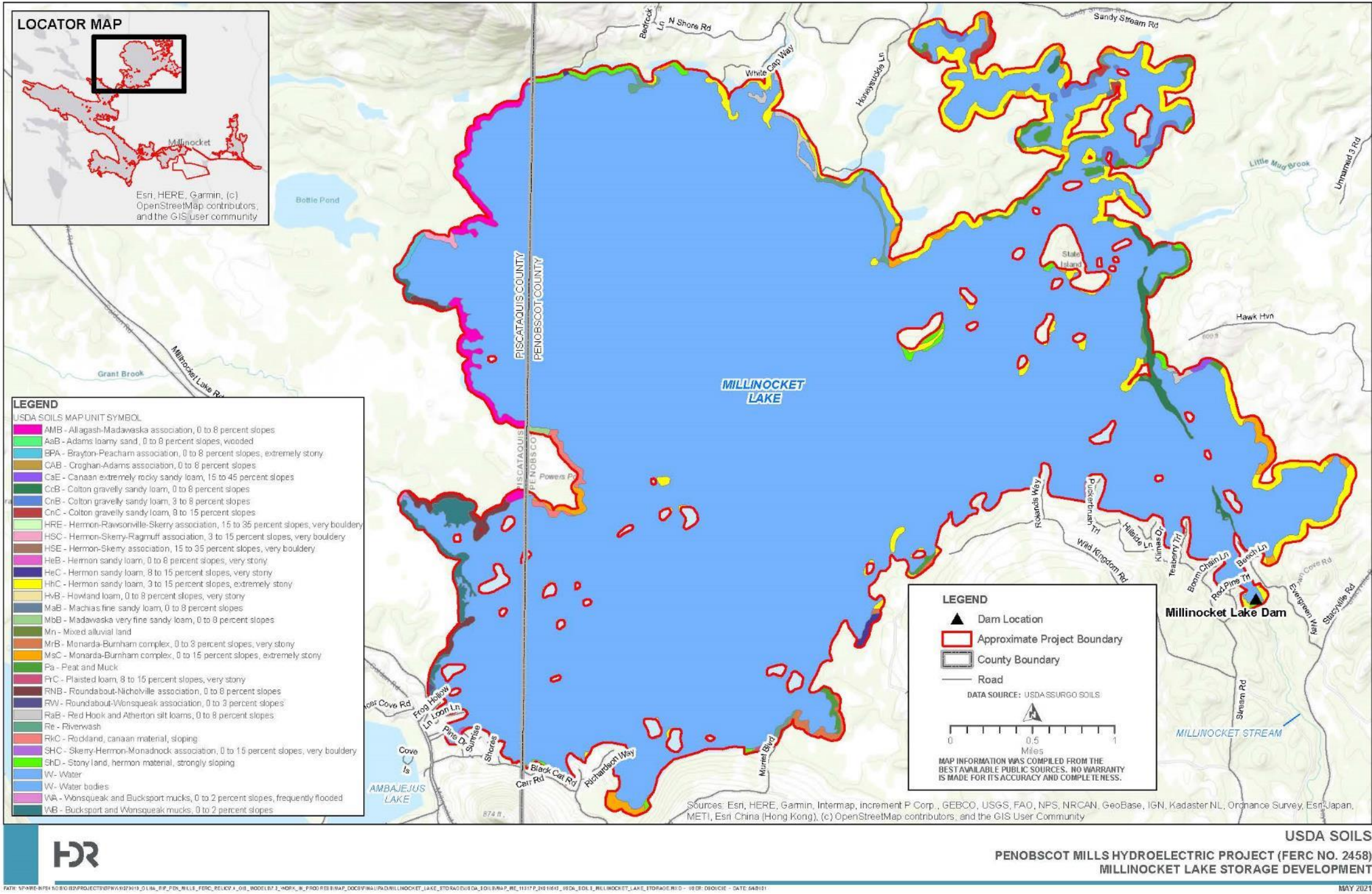
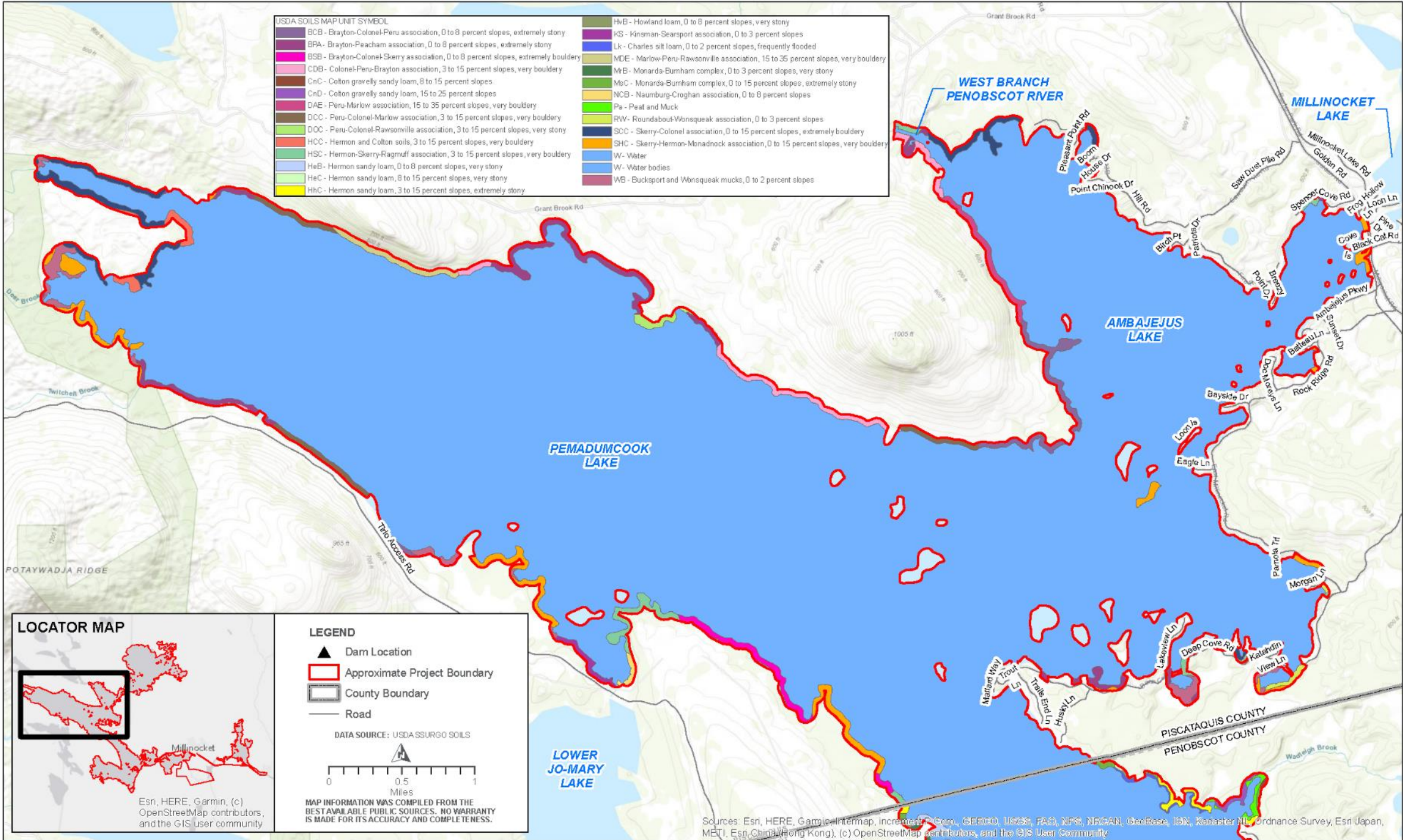


Figure 5.2-9
Soils at the North Twin Development



SHEET 1 OF 2

USDA SOILS
PENOBSCOT MILLS HYDROELECTRIC PROJECT (FERC NO. 2458)
NORTH TWIN DEVELOPMENT

MAY 2021

(Continued)
Soils at the North Twin Development

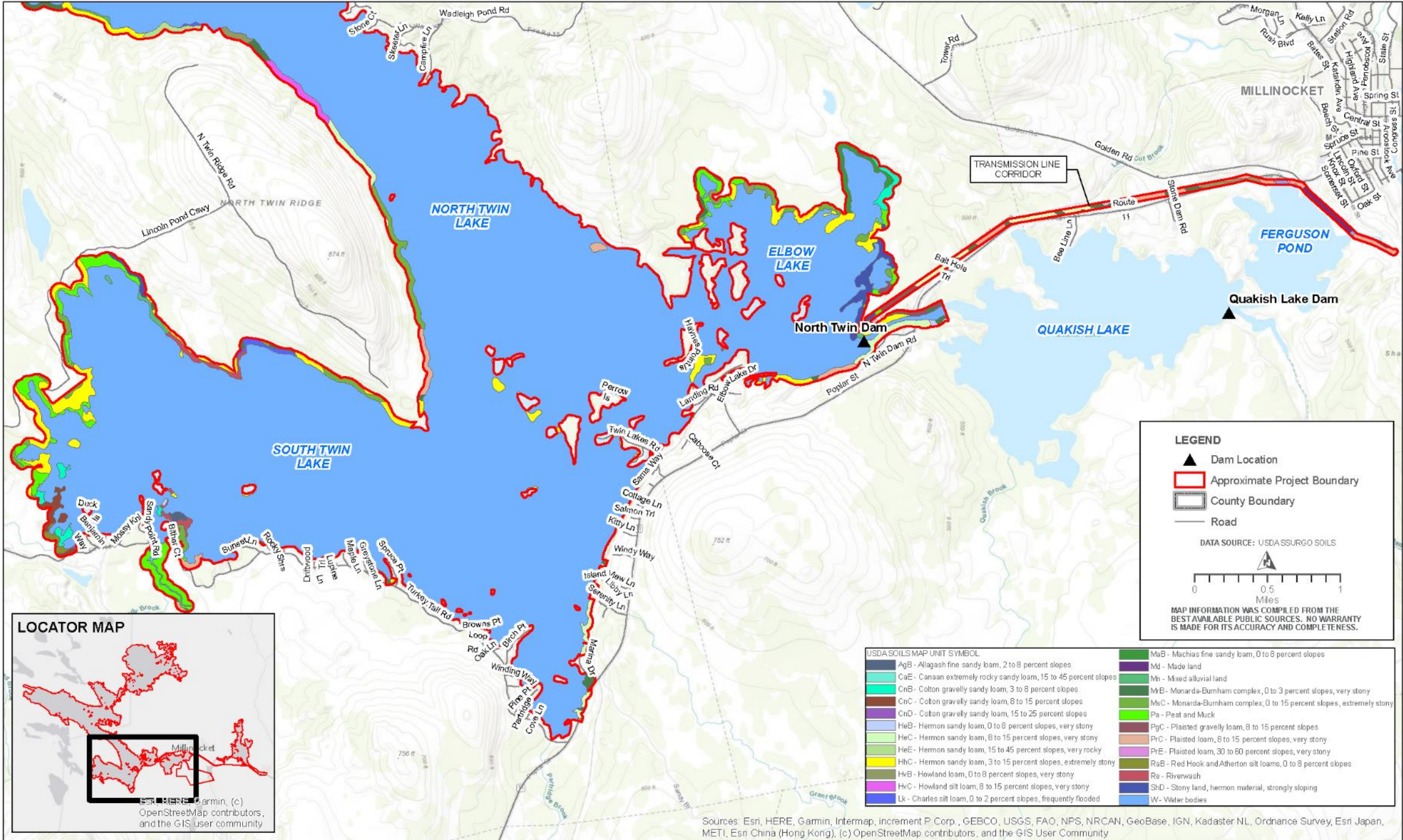


Figure 5.2-10
Soils at the Millinocket Development

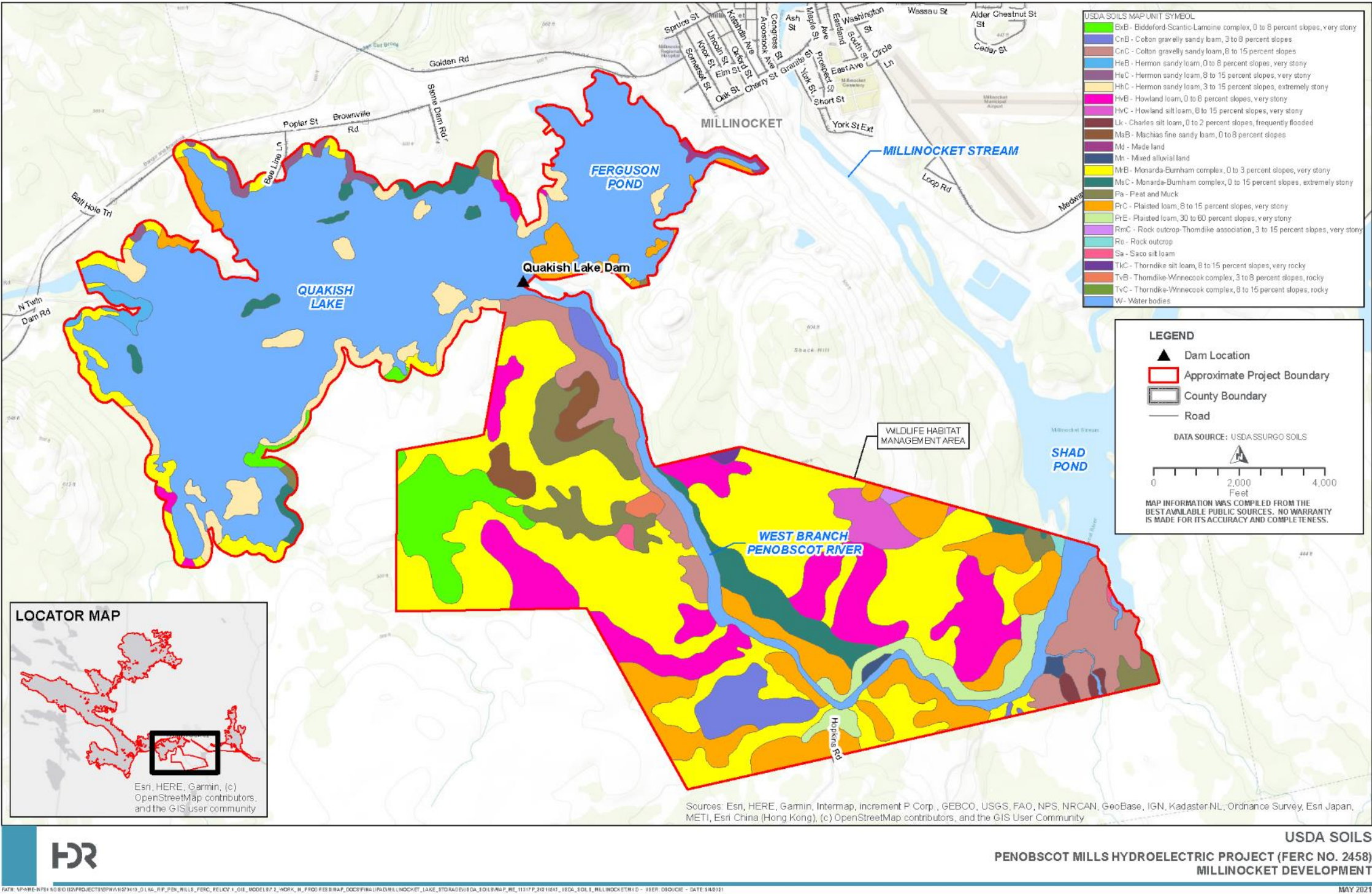


Figure 5.2-11
Soils at the Dolby Development

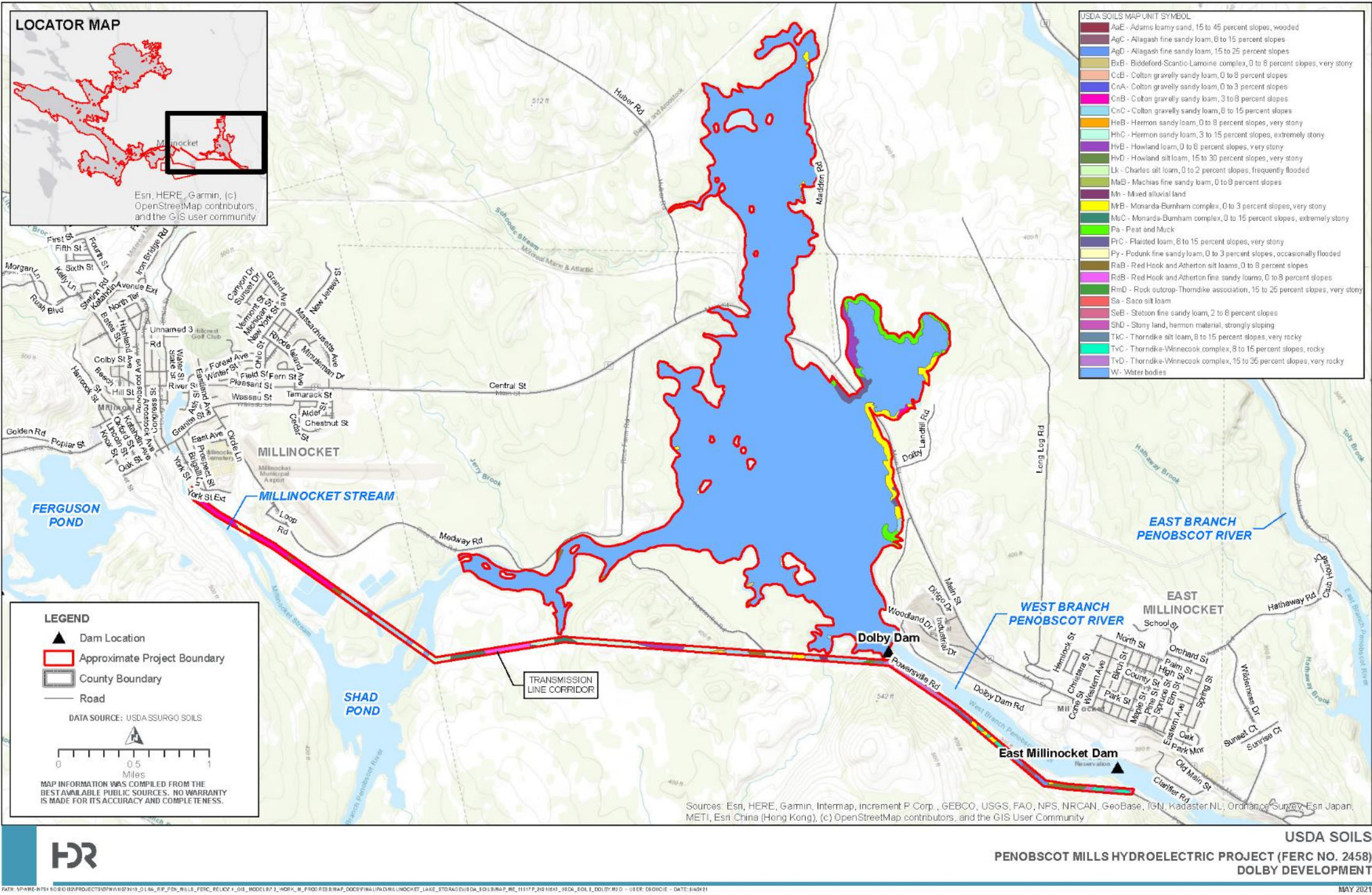
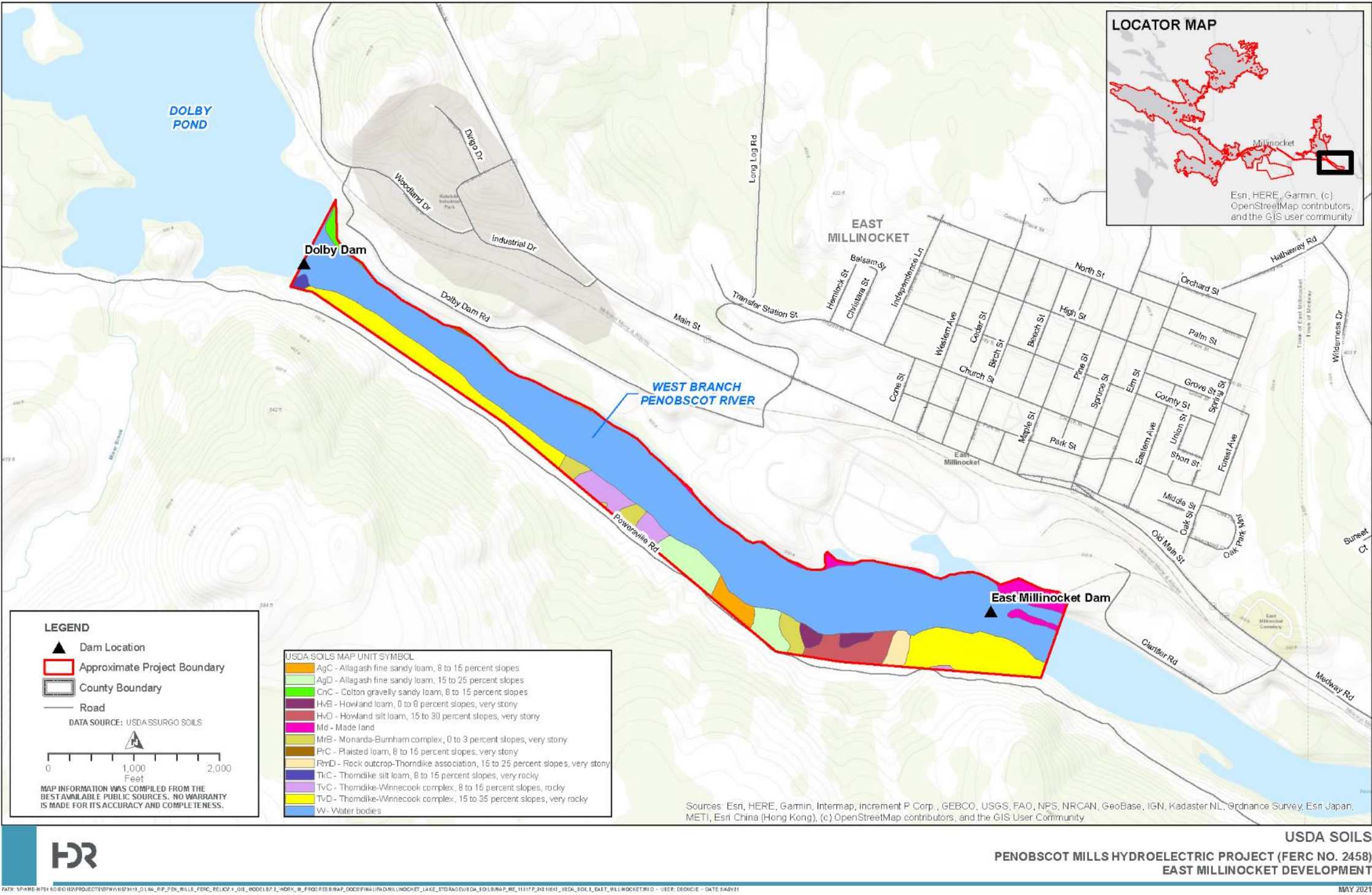


Figure 5.2-12
Soils at the East Millinocket Development



5.2.4 Impoundment Shorelines and Stream Banks

5.2.4.1 Ripogenus Project

The Ripogenus impoundment has six relatively distinct basins: Ripogenus Lake, Caribou Lake, Chesuncook Lake, Black Pond, Brandy Pond, and Moose Pond. The length of the impoundment is approximately 20.8 miles with a surface area of approximately 29,270 acres. The impoundment shoreline is forested and mostly undeveloped, with the exception of scattered camps around the perimeter of the impoundment. Impoundment bank characteristics, including height, slope, substrate, and vegetative cover, vary throughout the impoundment.

The Ripogenus impoundment is bordered by various wetland types and includes a shoreline zone. The shoreline zone is defined as that shoreline area typically exposed during annual drawdown of the impoundment. The width of this zone varies with slope of the shoreline from only a few feet at some locations to more than 100 feet in others. The substrate of the dewatered shoreline zone ranges from ledge and large boulders to smaller rocks and cobbles. In some locations, the rocks and cobbles have undergone further fragmentation to coarse, granular sand. Island shorelines within the impoundment also tend to be rocky (GNNC 1991a).

Umbazooksus Lake is not part of the Ripogenus impoundment but is within the Project boundary. Umbazooksus Lake is located northeast of the Ripogenus impoundment and is connected to the impoundment via Umbazooksus Stream. The length of Umbazooksus Lake is approximately 3.5 miles with a surface area of approximately 1,600 acres. The terrain surrounding both ends of the lake is nearly flat to gently sloping, with steeper slopes on either side of the lake in the midsection. Based on an investigation performed in 1997, substrates underlying the lake primarily consist of soft, fine-textured (i.e., silty to clayey) sediments overlying a firm substratum, probably dense till. Umbazooksus Lake is surrounded by extensive forested cover, including forested wetlands that extend nearly to the water's edge along large portions of the shoreline, especially around the northern perimeter of the lake (GNP 1997a).

The soils within the Ripogenus Project vicinity contain parent material predominated by basil till; Monson-Elliottsville-Ricker-Telos, Telos-Monarda-Monson-Elliottsville, and Aurelie-Daigle-Perham-Burnham map units (Ferwerda et al. 1997). These soils are largely loamy soils formed in

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till derived mainly from slate, phyllite, metasandstone, and schist. Therefore, as mentioned above, large portions of the impoundment shoreline are dominated by coarse substrate (i.e., ledge and large boulders to smaller rocks, cobbles, and stones).

The West Branch flows from the Ripogenus Dam in a southeasterly direction in an elongated, northwest-southeast trending glaciated valley. The valley bottom is approximately 300 feet wide at the dam. Adjacent valley walls to the west and east rise approximately 150 feet. Surface boulders occur locally over the Project vicinity; bedrock is exposed upstream and downstream of the Ripogenus Dam along both banks of the West Branch (GNNC 1991a).

As mentioned above, the majority of the shoreline within the Ripogenus Project boundary is forested. Canopy vegetation, as well as groundcover layers of vegetation (shrubs, small trees, perennials), help to limit the degree of erosion. GLHA is not aware of significant erosion, slumping, or slope instability around the impoundment shoreline. The area below the Ripogenus Dam consists almost entirely of bedrock, with no evidence of erosion. Additionally, no significant shoreline erosion was observed near the Ripogenus Dam abutments or along the visible portions of the reservoir as part of the Tenth Independent Consultant's Safety Inspection performed at the Project on June 21, 2016 (RJ Associates, LLC 2016).

5.2.4.2 Penobscot Mills Project

The Penobscot Mills Project consists of four hydroelectric developments on the West Branch and the Millinocket Lake Storage development located on Millinocket Stream, a tributary to the West Branch. The four hydroelectric developments, listed in order from upstream to downstream, are: North Twin, Millinocket, Dolby, and East Millinocket.

The Millinocket Lake Storage Development contains a single waterbody (Millinocket Lake), has a length of approximately 6.2 miles, and has a surface area of approximately 8,640 acres. The North Twin Development contains five waterbodies (Elbow Lake, North Twin Lake, South Twin Lake, Pemadumcook Lake, and Ambajejus Lake), has a length of approximately 11.8 miles, and has a surface area of approximately 17,790 acres. The Millinocket Development contains two waterbodies (Quakish Lake and Ferguson Pond), has a length of approximately 1.6 miles, and has a surface area of approximately 1,344 acres. The Dolby Development contains a single waterbody

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(Dolby Pond), has a length of approximately 2.3 miles, and has a surface area of approximately 2,048 acres. The East Millinocket Development contains one waterbody (West Branch of the Penobscot River), has a length of approximately 1.9 miles, and has a surface area of approximately 128 acres.

The shorelines of the waterbodies of the Penobscot Mills Project are primarily forested and mostly undeveloped. However, scattered private development, consisting primarily of summer residences and a few commercial establishments, exist along portions of the shores and islands of the upper lakes, such as Ambajetus, North and South Twin, and Millinocket Lakes. Shoreline bank characteristics throughout the Penobscot Mills Project (i.e., height, slope, substrate, and vegetative cover) vary throughout the Project area.

The shoreline of the North Twin Development is irregular, with numerous wind-swept points and exposed shores. Substrates are generally coarse, with boulder fields common along the shoreline. Millinocket Lake has physical characteristics similar to the North Twin impoundment, with predominantly coarse substrates and numerous islands. Both Quakish Lake and Ferguson Pond are relatively shallow, with predominantly fine substrates and large areas of soft bottom materials (e.g., silt). The substrates in Dolby Pond are both coarse and fine, with considerable aquatic vegetation in Upper Dolby Pond and Partridge Brook Flowage (GNNC 1991b).

The soils within the Penobscot Mills Project vicinity contain parent material predominated by basalt and loose till; Monson-Elliottsville-Ricker-Telos, Dixfield-Colonel-Lyman-Brayton, and Hermon-Brayton-Dixfield map units (Ferwerda et al. 1997). These soils are largely loamy soils formed in till derived mainly from slate, phyllite, metasandstone, schist, granite, and gneiss.

As mentioned above, the majority of the shoreline within the Penobscot Mills Project boundary is forested. This canopy vegetation, as well as groundcover layers of vegetation (shrubs, small trees, perennials), helps to limit the degree of erosion. GLHA is not aware of significant erosion, slumping, or slope instability around the shorelines of the impoundments.

5.3 Water Resources

5.3.1 Drainage Area

The Penobscot River Basin, which covers 8,750 square miles, is the largest river basin in Maine. The Ripogenus and Penobscot Mills Projects are located on the West Branch of the Penobscot River (see Figure 5.1-1). The Penobscot Mills Project is located in the vicinity of Millinocket, Maine. The Ripogenus Project lies further upstream on the West Branch. The drainage area at the Ripogenus Project is approximately 1,422 square miles. The drainage area of the Penobscot Mills Project at the East Millinocket Dam is 2,111 square miles. Downstream of the East Millinocket Development, the East and West Branches of the Penobscot River converge to form the Penobscot River mainstem.

5.3.2 River Flows

There are no flow gages located immediately upstream, within, or downstream of the Ripogenus and Penobscot Mills Projects. GLHA maintains operations data indicating daily discharge from the Projects. Monthly and annual average outflow data based on operation of the Projects from 2016 through 2020 are provided in Table 5.3-1 and Table 5.3-2.

Table 5.3-1
Ripogenus Project
Monthly and Annual Average Outflows, 2016-2020¹

Month	Minimum (cfs)	90% Exceedance (cfs)	Median (cfs)	Average (cfs)	10% Exceedance (cfs)	Maximum (cfs)
January	823	1,566	2,934	2,779	3,573	4,526
February	806	1,645	2,917	2,804	3,556	5,041
March	371	1,600	2,660	2,582	3,540	5,973
April	518	874	2,167	2,576	3,571	17,435
May	810	1,913	2,601	3,614	7,396	16,903
June	842	2,022	2,451	2,744	3,400	8,545
July	1,651	2,036	2,500	2,678	3,239	7,908
August	1,351	1,977	2,486	2,622	3,278	7,314

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Month	Minimum (cfs)	90% Exceedance (cfs)	Median (cfs)	Average (cfs)	10% Exceedance (cfs)	Maximum (cfs)
September	800	1,312	2,115	2,247	3,000	7,946
October	800	1,064	1,772	1,755	2,203	5,406
November	800	1,600	1,839	2,193	3,318	11,247
December	819	1,733	2,374	2,499	3,500	10,909
Annual	371	1,618	2,351	2,590	3,500	17,435

¹ Flows are based on daily average flow.

Table 5.3-2
Penobscot Mills Project
Monthly and Annual Average Outflows, 2016-2020^{1,2}

Month	Minimum (cfs)	90% Exceedance (cfs)	Median (cfs)	Average (cfs)	10% Exceedance (cfs)	Maximum (cfs)
January	1,314	2,325	3,912	3,658	4,527	6,924
February	1,116	2,416	3,935	3,870	5,104	6,927
March	983	2,283	3,891	3,772	5,113	7,895
April	664	2,154	3,244	3,890	5,897	26,686
May	640	2,136	3,962	5,303	10,993	24,161
June	529	2,282	3,249	3,519	5,001	12,470
July	2,014	2,307	3,104	3,251	4,089	9,397
August	2,060	2,318	3,045	3,126	3,921	7,782
September	1,966	2,279	3,366	3,467	4,156	11,484
October	1,501	2,168	2,835	2,991	3,998	7,406
November	1,196	2,143	2,461	2,936	3,926	17,659
December	1,559	2,278	3,536	3,503	4,667	14,288
Annual	529	2,208	3,333	3,607	4,918	26,686

¹ Flows are based on daily average flow.

² Data is based on outflows from the North Twin Development.

5.3.3 Flow Duration Curves

Monthly and annual flow duration curves indicating outflows from the Ripogenus and Penobscot Mills Projects, which are based on GLHA operations data from 2016 through 2020 for the McKay Station and North Twin Development, respectively, are provided in Appendix D.

5.3.4 Existing and Proposed Uses of Project Waters

Although licensed as separate projects, water storage used for hydroelectric generation within the Ripogenus and Penobscot Mills Projects is managed as a single coordinated system (FERC 1996). The Ripogenus and Penobscot Mills Projects are located both upstream and downstream from other FERC-licensed projects, including the upstream Storage Project (FERC No. 2634) and the downstream Medway Project (FERC No. 2666), among numerous other projects located further downstream on the mainstem of the Penobscot River.

During the previous relicensing of the Projects, the Licensee identified and prioritized water uses and performed operations modeling to create a plan to meet generation requirements, environmental enhancements, and mitigation measures. Based on the modeling results, the Licensee developed a Water Use Plan (WUP) that identified proposed operations of the Projects and that was designed to balance and manage multiple competing water uses (e.g., power generation, recreation, fisheries, minimum flows, flood control). This WUP was used as the basis for the operational requirements for the Projects as indicated in the 1996 FERC licenses, as amended, and as described previously in Section 4.

5.3.4.1 Ripogenus Project

The Ripogenus Project is used for hydroelectric power generation, recreation, flood control, and wildlife and aquatic habitat. As described in Section 4.4.1, the Ripogenus impoundment is used to store excess runoff from spring snowmelt and rainfall (e.g., flood control) for the release of water downstream at a controlled rate. This creates stable year-round flows downstream to provide a sustained load of energy and provides fish habitat, recreation (e.g., fishing, canoeing, kayaking, whitewater boating), and flood control benefits (GNNC 1991a). The Licensee uses the available storage within the impoundment to capture high-runoff events. As a result of the storage allowances in the upper portion of the West Branch basin, the West Branch has historically contributed limited peak flows during high flow and flood events to the mainstem of the Penobscot River, which has benefited the lower Penobscot River basin during higher flow events. There are no consumptive water uses within the Ripogenus Project waters (GNNC 1991a).

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The Licensee has an active Maine Pollutant Discharge Elimination System (MPDES) permit/Maine Waste Discharge License for non-contact cooling water discharge from the Ripogenus Project (Table 5.3-3). The permit authorizes the discharge of up to 705,600 gallons per day (GPD) of non-contact cooling water, at a temperature not to exceed 95°F, from four outfalls to the West Branch of the Penobscot River (MDEP 2021a). There are no other identified point source discharges to Ripogenus Project waters.

The Ripogenus Project supports a variety of water-based recreation activities. Recreation uses of Project waters are discussed in more detail in Section 5.8.

5.3.4.2 Penobscot Mills Project

The Penobscot Mills Project is used for hydroelectric power generation, recreation, flood control, wildlife and aquatic habitat, and water supply. In addition, the Project historically provided wastewater assimilation during operation of the regional papermills, which have since shuttered (GNNC 1991b). In conjunction with the Ripogenus Project and other upstream storage impoundments (licensed separately as the Storage Project (FERC No. 2634)), the North Twin impoundment and Millinocket Lake are gradually drawn down throughout the year to generate carbon-free electricity and to maintain downstream minimum flows to the lower Penobscot River Basin. The release of water is controlled to minimize peak flows during runoff and to provide a uniform, stable distribution of water to the downstream basin throughout the year.

The North Twin Development is used for water storage and hydroelectric generation. Millinocket Lake is used for water storage only as it does not have hydroelectric generation. Water from the Millinocket Lake is either pumped into Ambajesus Lake of the North Twin impoundment, allowing it to pass through all four downstream developments for hydroelectric power generation, or released into Millinocket Stream to pass through the Dolby and East Millinocket Developments. The Millinocket, Dolby, and East Millinocket Developments are used primarily for hydropower generation and are operated in a run-of-river mode with minimal impoundment fluctuations and negligible storage (GNNC 1991b).

Several active MPDES permits and waste discharge licenses authorize discharges to waters within the Penobscot Mills Project area (Table 5.3-3). The Licensee has four permits to discharge

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non-contact cooling water from the North Twin, Millinocket, Dolby, and East Millinocket Developments (MDEP 2021a). The Towns of Millinocket and East Millinocket have permits for the discharge of treated wastewater (MDEP 2021a). The Town of Millinocket obtains its public water supply from an intake at Ferguson Pond (Public Water System ID ME0090990) (Eastern Maine Development Corporation [EMDC] 2020). There were no restrictions on the volume of the withdrawal, and there had been no problems or limitations in supply under the current Project operations.

**Table 5.3-3
Active Permitted Discharges to the West Branch
in the Ripogenus and Penobscot Mills Project Area**

Licensee	MPDES #	License #	Project/Facility	Authorization
GLHA	ME0036544	W008079-5R-E-R	Ripogenus Hydroelectric Project	Discharge of up to 705,600 GPD of non-contact cooling water, at a temperature not to exceed 95 F, from four outfalls to the West Branch of the Penobscot River
GLHA	ME0036536	W008078-5R-E-R	North Twin Hydroelectric Project	Discharge of up to 423,360 GPD of non-contact cooling water, at a temperature not to exceed 95 F, from seven outfalls to the West Branch of the Penobscot River in T3 Indian Purchase
GLHA	ME0037371	009101-5R-A-N	Millinocket Hydroelectric Project	Discharge of up to 22,000 GPD of non-contact cooling water, at a temperature not to exceed 95 F, and an unspecified quantity of storm water runoff from two roof drains from the station to Millinocket Stream
GLHA	ME0036528	W008077-5R-F-R	Dolby Hydroelectric Project	Discharge of up to 364,320 GPD non-contact cooling water, at a temperature not to exceed 95 F, from nine outfalls to the West Branch of the Penobscot River in East Millinocket
GLHA	ME00336511	W008076-5R-E-R	East Millinocket Hydroelectric Project	Discharge of up to 32,280 GPD non-contact cooling water, at a temperature not to exceed 95 F, from 14 outfalls to the West Branch of the Penobscot River in East Millinocket
Town of Millinocket	ME0100803	002680-6D-I-R	Wastewater Treatment Facility	Discharge of a monthly average of 2.33 million GPD of secondary treated sanitary wastewater from the facility to the West Branch of the Penobscot River in Millinocket, Maine
Town of East Millinocket	ME0102881	W009139-6D-B-M	Publicly Owned Treatment Works	Discharge of up to 2.0 MGD of secondary treated wastewater

Source: MDEP 2021a.

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Various riverine and impounded portions of Penobscot Mills Project waters support a variety of water-based recreation activities. Recreation uses of Project waters are discussed in more detail in Section 5.8.

5.3.5 Existing Instream Flow Uses

5.3.5.1 Ripogenus Project

GLHA provides minimum flows to the Upper Gorge and to the West Branch downstream of the McKay Station for recreation purposes and for the protection of water quality and aquatic habitat. Pursuant to Article 401 of the existing license, a minimum flow of 100 cfs is released from Ripogenus Dam into the Upper Gorge from July 1 through September 30 annually. During the remainder of the year, a minimum flow of 12 cfs is provided through leakage from Ripogenus Dam. A summary of the minimum flows provided downstream of McKay station for fish spawning/incubation and for whitewater recreation are provided in Table 4.4-1 in Section 4.4.1.

5.3.5.2 Penobscot Mills Project

GLHA provides minimum flows to Millinocket Stream and the West Branch for the protection of water quality and aquatic habitat and for recreation purposes. Article 401 requires the Licensee to release a minimum flow of 60 cfs from the Millinocket Lake Storage Dam into Millinocket Stream from May 1 to October 15, except as temporarily modified by conditions beyond GLHA's control (GNP 1997). During the remainder of the year, GLHA provides a minimum flow of 60 cfs, or inflow if less. A minimum flow of 3,000 cfs is provided from North Twin Dam from August 22 through October 15, as long as the North Twin impoundment exceeds elevation 488.42 feet. Article 403 requires the Licensee to operate the Millinocket, Dolby, and East Millinocket developments in a run-of-river mode while providing an instantaneous minimum flow of 2,000 cfs to the West Branch downstream from the Millinocket Development (i.e., from Shad Pond) (GNP 1997b).

5.3.6 Impoundment Information

5.3.6.1 Ripogenus Project

The Ripogenus Project impoundment is comprised of six basins: Ripogenus Lake, Caribou Lake, Chesuncook Lake, Black Pond, Brandy Pond, and Moose Pond. Umbazooksus Lake, which

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discharges to Chesuncook Lake, is included within the Ripogenus Project boundary given the wetland mitigation activities performed following issuance of the Project's existing license; however, GLHA does not control any flows from this lake (Figure 4.2-2). Bathymetry maps of the Ripogenus Project impoundment are provided in Appendix E.

The drainage area at Ripogenus dam is 1,422 square miles. The Ripogenus impoundment has a surface area of 29,270 acres at the normal pond elevation of 941.6 feet (Table 5.3-4). The usable storage capacity of the impoundment, based on a maximum drawdown of 44 feet (El. 897.59 feet), is approximately 688,705 acre-feet (GNNC 1991a), and the gross storage capacity is 710,000 acre-feet. The Ripogenus impoundment provides approximately 51 percent of the usable storage volume of the West Branch System (the total volume of usable storage in the West Branch system is 1,347,600 acre-feet (FERC 1996)). The remaining storage capability is provided by the separately licensed upstream Storage Project (FERC No. 2634) and the downstream North Twin and Millinocket Lake Storage Developments.

The largest of the six basins that comprise the Ripogenus impoundment is the Chesuncook Lake basin, which is 19 miles long. The maximum depth of the Chesuncook Lake basin (115 feet) occurs south of Gero Island (Table 5.3-4). The West Branch, Caucomgomoc Stream, and Umbazooksus Stream discharge into the head of the Chesuncook Lake basin, which provides active water movement (GNNC 1991a). Black and Brandy Ponds are shallow and are considered extensions of Caucomgomoc Stream. Caribou Lake is a side basin to Chesuncook Lake and has a maximum depth of 84 feet. Ragged Stream is the largest single inflow to the Caribou Lake basin. Due to a natural constriction, during periods when the Ripogenus impoundment is significantly drawn down, mixing between the Caribou Lake basin and Chesuncook Lake may be reduced. The Moose Pond basin has a maximum depth of 36 feet (Table 5.3-4).

The Ripogenus Lake basin of the Ripogenus impoundment is located just upstream of the Ripogenus dam. The surface area of the Ripogenus Lake basin is 1,700 acres with a perimeter of 72,200 feet. The maximum depth of the Ripogenus impoundment is 150 feet, located in Ripogenus Lake. The mean depth of the basin is 48.5 feet (GNNC 1991a). The majority of water entering the Ripogenus Lake basin comes from Chesuncook Lake through a wide thoroughfare between the two lakes. In addition, minor inflow comes from Ripogenus Stream to the north.

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**Table 5.3-4
Ripogenus Impoundment Information**

Parameter	Ripogenus Impoundment
Drainage Area (square miles)	1,422
Surface Area (acres)	29,270
Usable storage capacity (acre-feet)	688,705
Gross storage capacity (acre-feet)	710,000
Normal Headpond Elevation (feet)	941.6
Perimeter (feet)	624,600 (118.3 miles)
Mean Depth (feet)	35.8
Maximum Depth (feet)	Ripogenus Lake: 150 Chesuncook Lake: 115 Caribou Lake: 84 Moose Pond: 36
Length (miles)	20.8

Source: GNNC 1991a.

5.3.6.2 Penobscot Mills Project

The Penobscot Mills Project includes five impoundments: Millinocket Lake Storage, North Twin, Millinocket, Dolby Pond, and East Millinocket. Bathymetry maps for the five impoundments are provided in Appendix E. The Penobscot Mills Project provides a usable storage volume of 389,725 acre-feet, which is approximately 29 percent of the total available storage in the West Branch storage system (inclusive of the upstream Storage Project (FERC No. 2634) (FERC 1996).

The North Twin impoundment consists of five lake basins: Elbow Lake, North Twin Lake, South Twin Lake, Pemadumcook Lake, and Ambajejus Lake, which are locally referred to as the “Pemadumcook Chain of Lakes” (Figure 4.2-1 and Figure 4.2-5). The majority of the storage capacity for the Penobscot Mills Project is in the North Twin impoundment (344,355 acre-feet) (Table 5.3-5). The North Twin station controls the outflow to the remainder of the Penobscot Mills Project area. The maximum depth in the North Twin impoundment is found in the Pemadumcook Lake basin (101 feet). Pemadumcook Lake receives the majority of its inflow from the Ambajejus Lake basin. Ambajejus Lake receives the majority of its inflow from the West Branch and a lesser amount from Millinocket Lake Storage impoundment (via the pumping station) (GNNC 1991b). There are 10 tributaries to the North Twin impoundment, including the West Branch (Figure 5.1-3) (FERC 1996).

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The North Twin Lake basin receives inflow from Pemadumcook Lake and some water from South Twin Lake. The maximum depth in North Twin Lake is 63 feet. Three tributaries enter Millinocket Lake: Sandy Stream, East Mud Brook, and Little Mud Brook (FERC 1996). The two tributaries to Millinocket Stream are Ledge Cut Brook and Little Smith Brook (Figure 5.1-3).

Elbow Lake is considered an arm of North Twin Lake. South Twin Lake is hydraulically remote from the main West Branch flow; inflow is primarily from runoff from adjacent lands. Water from South Twin Lake enters North Twin Lake.

The Millinocket Development impoundment includes the Quakish Lake and Ferguson Pond basins (Figure 4.2-1 and Figure 4.2-6). These are two relatively small, connected basins created by Stone Dam and Millinocket Station. They each possess lake-like characteristics based on their morphometry and depth. Flushing times are rapid, and as a result, they have dual riverine-lacustrine hydrological characteristics (GNNC 1991b). The maximum depth is 37 feet in Quakish Lake and 19 feet in Ferguson Pond (Table 5.3-5).

The Dolby impoundment, Dolby Pond, is an irregularly shaped impoundment (Figure 4.2-1 and Figure 4.2-7). Flow restriction caused by the Route 157/railroad causeway separates the impoundment into two basins: Upper Dolby Pond and Lower Dolby Pond. Upper Dolby Pond is largely independent of Lower Dolby Pond and possesses characteristics of a shallow lake (GNNC 1991b). Both the inlet and outlet to the Dolby impoundment are in the southern section (Lower Dolby Pond) of the impoundment. As a result, Lower Dolby Pond has a rapid flushing rate due to flow from the West Branch. The northern portion of Lower Dolby Pond is deeper and exhibits lake-like characteristics. The maximum depth in the Dolby impoundment (Upper and Lower Dolby Ponds) is 46 feet (Table 5.3-5). In addition to the West Branch, two tributaries enter Dolby Pond (Schoodic Stream and Jerry Brook, Figure 5.1-3) (FERC 1996, EMDC 2020).

The East Millinocket Development impounds a 1.9-mile long, narrow section of the West Branch (Figure 4.2-1 and Figure 4.2-8). It is a shallow riverine impoundment with a maximum depth of 24 feet (Table 5.3-5). An unnamed tributary and the West Branch provide inflow to the impoundment (Figure 5.1-3) (FERC 1996).

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The Millinocket Lake Storage impoundment (Figure 4.2-1 and Figure 4.2-4) is used to control flow into Millinocket Stream and has a pumping station to direct water into the Ambajejus Lake basin of the North Twin impoundment. Millinocket Lake is a single basin impoundment, and the deepest areas of Millinocket Lake are in the northwest portion. The maximum depth is 86 feet (Table 5.3-5). Three tributaries enter Millinocket Lake: Sandy Stream, East Mud Brook, and Little Mud Brook (FERC 1996). The two tributaries to Millinocket Stream are Ledge Cut Brook and Little Smith Brook (Figure 5.1-3).

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**Table 5.3-5
Penobscot Mills Project Impoundment Information**

	Millinocket Lake Storage Impoundment	North Twin Impoundment	Millinocket Impoundment		Dolby Impoundment	East Millinocket Impoundment
			Quakish Lake	Ferguson Pond		
Drainage area (square miles)	122	1,877	1,890		2,108	2,111
Surface area (acres)	8,640	17,790	1,344	262	2,048	128
Usable storage capacity (acre-feet)	45,370	344,355	negligible		negligible	negligible
Gross storage capacity (acre-feet)	45,370	346,000	8,100		41,956	1,950
Normal full pond elevation (feet)	480.0	491.92	458.7	457.4	336.2	287.2
Perimeter (feet)	265,100	475,600	58,000	24,600	113,500	20,800
Mean depth (feet)	23.6	27.7	10.5	8.5	20 (lower Dolby Pond basin only)	11
Maximum depth (feet)	86	North Twin: 63 South Twin: 55 Pemadumcook: 101 Ambajejus: 92	37	19	46	24
Length (miles)	6.2	11.8	1.6	0.7	2.3	1.9

Source: GNNC 1991b, FERC 1996.

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5.3.7 Downstream Reach Gradients

The gradient of the downstream reaches below each of the Project developments are provided in Table 5.3-6.

**Table 5.3-6
Downstream Reach Gradients at the Projects**

Reach	Upstream Elevation	Downstream Elevation	Length (feet)	Slope
Upper Gorge – from Ripogenus dam to McKay Station	873	764	4,224	2.5%
West Branch – McKay Station to Telos Bridge	762	713	5,808	0.8%
Millinocket Stream – from dam to railroad/bridge	483	363	29,198	0.4%

5.3.8 Water Quality Standards

State of Maine Water Quality Standards

The State of Maine’s water classification system for surface waters is described in 38 Maine Revised Statutes Annotated (MRSA) §465 (Maine Revised Statutes [MRS] 2017) and 38 MRSA §467 (MRS 2019a). The State of Maine has four standards for the classification of fresh surface waters (AA, A, B, and C) and one class for Great Ponds (GPA). The classifications establish designated uses and the criteria necessary to protect those uses. A Great Pond is defined as any inland body of water, which in a natural state, has a surface area in excess of 10 acres and any inland body of water artificially formed or increased, which has a surface area greater than 30 acres (MRS 1987). The water classifications for the waters within the Ripogenus Project and Penobscot Mills Project are provided in Table 5.3-7 and shown in Figure 5.3-1 and Figure 5.3-2.⁶ The designated uses and water quality standards applicable to each of the Project areas are provided in Table 5.3-8.

⁶ At the time of the previous relicensing, the reach downstream of McKay Station was Class B, and the reach between the outlet of Ferguson Pond to East Millinocket Dam was Class C.

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Table 5.3-7
Water Classifications of the West Branch for the Ripogenus and Penobscot Mills Project Waters

Lake or River Reach	Classification
From its confluence with Chesuncook Lake to Ripogenus Dam	GPA
From Ripogenus Dam through Ripogenus Gorge to McKay Station	B
From McKay Station to its confluence with Ambajejus Lake	A
North Twin Impoundment	GPA
Millinocket Lake impoundment	GPA
From the outlet of Elbow Lake to the outlet of Quakish Lake and Ferguson Pond	B
From the outlet of Quakish Lake and Ferguson Pond to its confluence with Millinocket Stream (includes the Back Channel)	C
From the confluence with Millinocket Stream to its confluence with the East Branch of the Penobscot River, including all impoundments	B
West Branch of the Penobscot River – Tributaries (includes Millinocket Stream)	A
Millinocket Stream, from the railroad bridge near the Millinocket-T3 Indian Purchase boundary to its confluence with the West Branch Canal	B
Millinocket Stream from the confluence of the West Branch Canal to its confluence with the West Branch of the Penobscot River	B

Source: MRS 2017, 2019a.

Figure 5.3-1
Water Classifications for the Ripogenus Project Waters

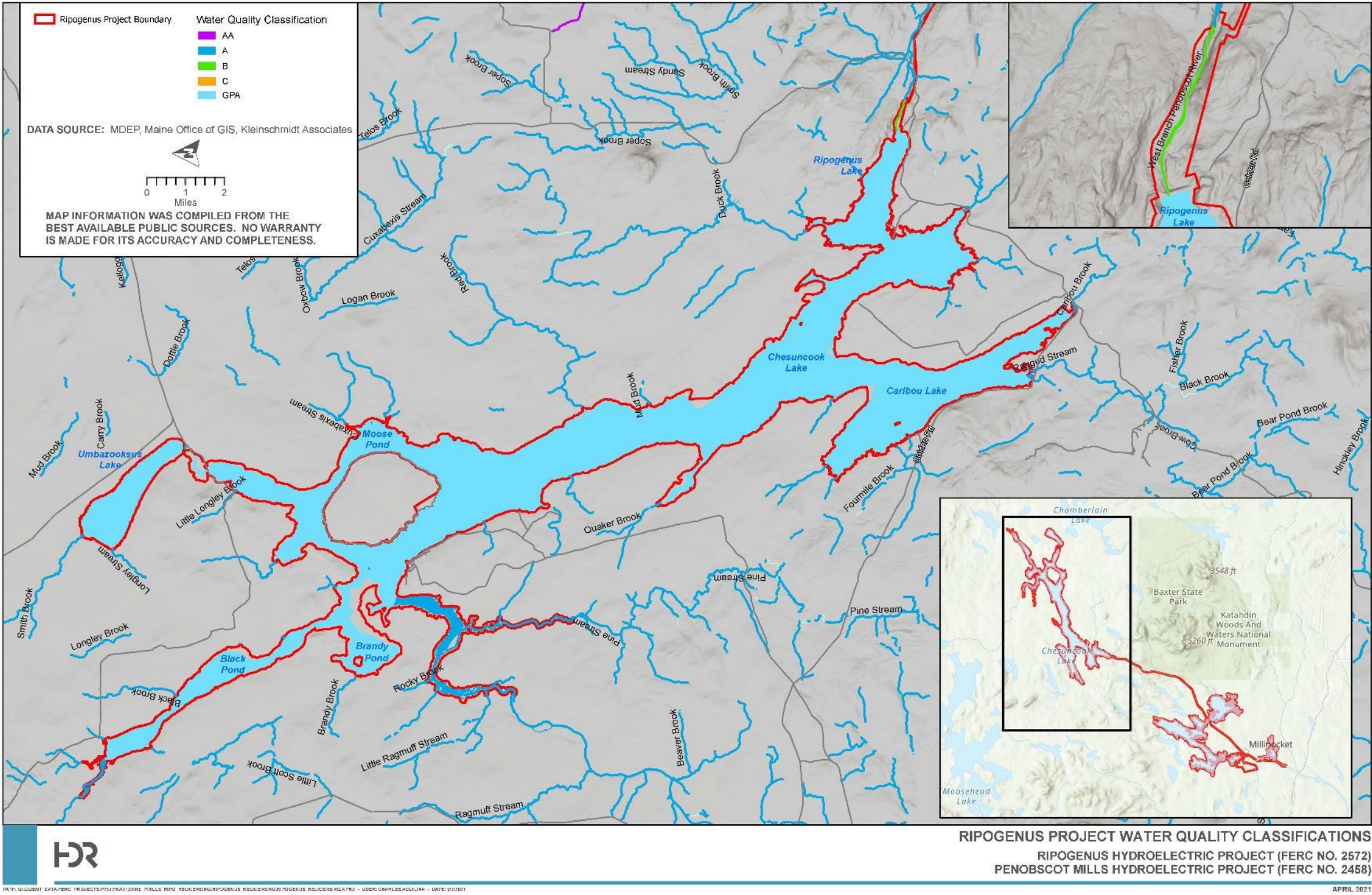
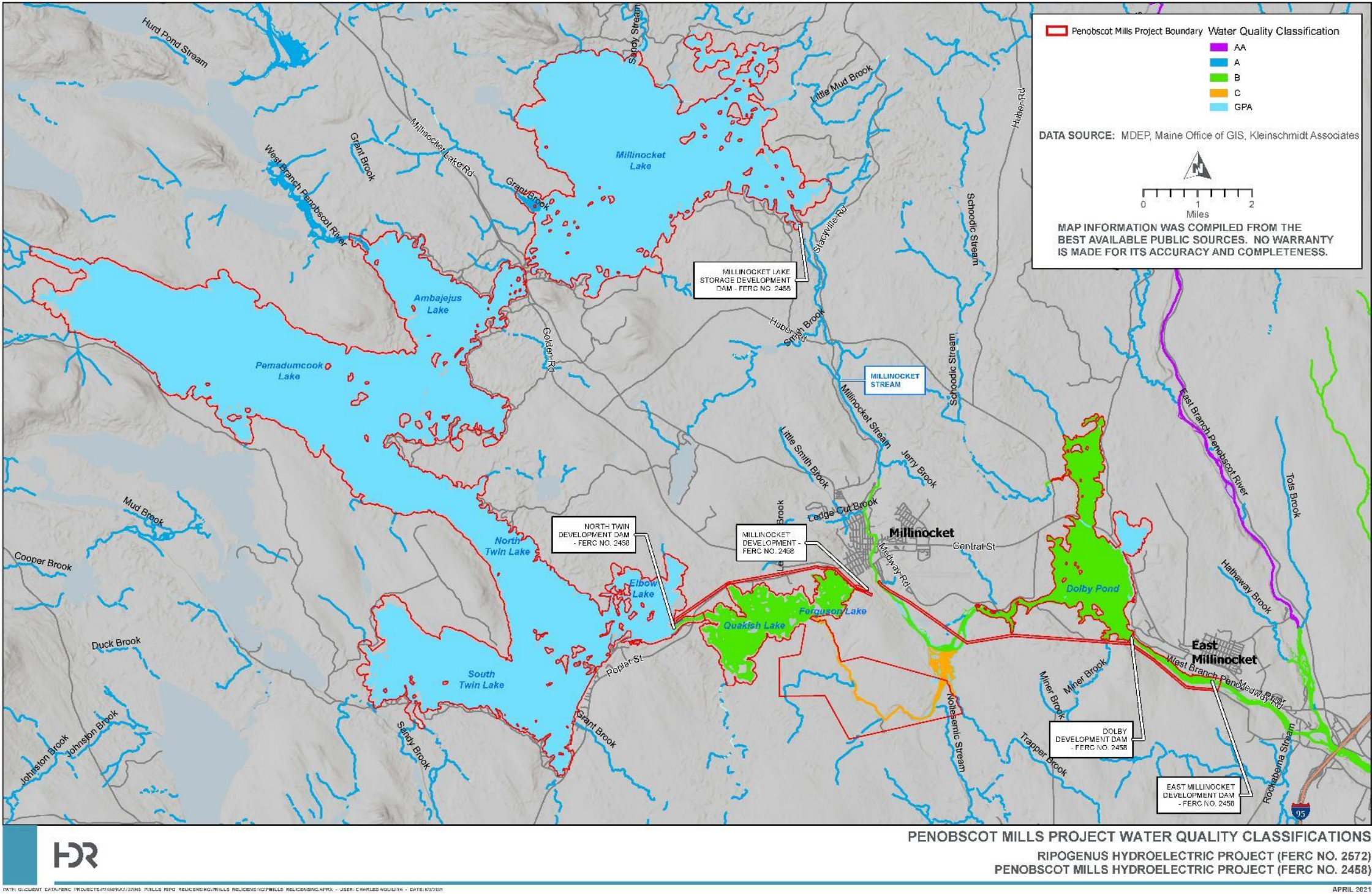


Figure 5.3-2
Water Classifications for the Penobscot Mills Project Waters



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Table 5.3-8
Water Quality Classification Standards and Designated Uses

Class	Designated Uses	Standards
A	Drinking water after disinfection, fishing, agriculture, recreation in and on the water, industrial process and cooling water supply, hydroelectric power generation, navigation, habitat for fish and other aquatic life. The habitat must be characterized as natural.	Dissolved oxygen (DO) > 7 milligrams per liter (mg/L) or 75 % saturation, whichever is higher; From October 1 to May 14, 7-day mean DO > 9.5 mg/L and 1-day minimum > 8 mg/L in identified fish spawning areas Total phosphorus: ≤ 18 micrograms per liter (µg/L) Chlorophyll-a: ≤ 3.5 µg/L (≤ 5 µg/L in impoundments) Secchi Disk Transparency: ≥ 2 m pH: 6.5-9.0 Aquatic life criteria: Direct discharges are allowed but highly restricted; as naturally occur.
B	Drinking water supply after treatment, fishing, agriculture, recreation in and on the water, industrial process and cooling water supply, hydroelectric power generation, navigation, habitat for fish and other aquatic life. The habitat must be characterized as unimpaired.	DO > 7 mg/L or 75 % saturation, whichever is higher; From October 1 to May 14, 7-day mean DO > 9.5 mg/L and 1-day minimum > 8 mg/L in identified fish spawning areas Total phosphorus: ≤ 30 µg/L Chlorophyll-a: ≤ 8.0 µg/L (<10 µg/L in impoundments) Secchi Disk Transparency: ≥ 2 m pH: 6.5-9.0 Aquatic life criteria: Discharges shall not cause adverse impact to aquatic life in that the receiving waters shall be of sufficient quality to support all aquatic species indigenous to the receiving water without detrimental changes to the resident biological community.
C	Drinking water supply after treatment, fishing, agriculture, recreation in and on the water, industrial process and cooling water supply, hydroelectric power generation, navigation, habitat for fish and other aquatic life.	DO > 5 mg/L or 60 % saturation, whichever is higher Total phosphorus: ≤ 40 µg/L Chlorophyll-a: ≤ 8.0 µg/L (<10 µg/L in impoundments) Secchi Disk Transparency: ≥ 2 m pH: 6.5-9.0 Aquatic life criteria: Discharges may cause some changes to aquatic life, provided that receiving waters shall be of sufficient quality to support all species of fish indigenous to the receiving waters and maintain the structure and function of the resident biological community.
GPA	Drinking water after disinfection, fishing, agriculture, recreation in and on the water, industrial process and cooling water supply, hydroelectric power generation, navigation, habitat for fish and other aquatic life. The habitat must be characterized as natural.	No numeric DO standard. Shall be described by their trophic state based on measures of the chlorophyll-a content, Secchi disk transparency, total phosphorus, and other appropriate criteria. Shall have a stable or decreasing trophic state, subject only to natural fluctuations. Shall be free of culturally induced algal blooms, which impair their use and enjoyment.

Source: MRS 2017, 2019a; MDEP 2021b.

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The Ambajejus, Pemadumcook, North Twin, South Twin, Elbow, and Millinocket Lakes are classified as GPA waters. GPA standards are shown in Table 5.3-8. 38 MRS §464-9(D) states that *“Other than those described in paragraphs A, B, and C, all hydropower projects with impoundments in existence on June 30, 1992 that remain classified under section 465-A after June 30, 1992 and that do not attain the habitat and aquatic life criteria of that section must, at a minimum, satisfy the aquatic life criteria contained in section 465, subsection 4, paragraph C.”*

Section 465, subsection 4, paragraph C refers to water quality standards for waters classified as Class C waters. More specifically, 38 MRS §465 (4)(C) states:

“Discharges to Class C waters may cause some changes to aquatic life, except that the receiving waters must be of sufficient quality to support all species of fish indigenous to the receiving waters and maintain the structure and function of the resident biological community...”

A Use Attainment Analysis (UAA) for the Ripogenus impoundment had been previously conducted. As such, the Ripogenus impoundment is classified as a GPA water as modified by 38 MRS §464-9(A) (38 MRS §467-7(C)). More specifically, 38 MRS §464-9(A) states that the Ripogenus impoundment “is deemed to have met the habitat characteristics and aquatic life criteria in the existing impoundment if:”

(1) The project is in existence on June 30, 1992;

(2) The project creates an impoundment that remains classified under section 465-A after June 30, 1992;

(3) The project creates an impoundment that is subject to water level fluctuations that have an effect on the habitat and aquatic life in the littoral zone so that the habitat and aquatic life differ significantly from that found in an unimpounded great pond; and

(4) The existing impounded waters are able to support all species of fish indigenous to those waters and the structure and function of the resident biological community in the impounded waters is maintained.”

The Millinocket impoundment (Quakish Lake and Ferguson Pond), Dolby impoundment (Dolby Pond), and East Millinocket impoundment are classified as riverine (Table 5.3-7), although they have some lacustrine characteristics. In accordance with 38 MRS §464-(13)(B), “*Where mixing is inhibited due to thermal stratification in an existing riverine impoundment, compliance with numeric dissolved oxygen criteria may not be measured below the higher of: (1) the point of thermal stratification when such stratification occurs; or (2) the point proposed by the department as an alternative depth for a specific riverine impoundment based on all factors included in section 466, subsection 11-A and for which a use attainability analysis is conducted if required by the United States Environmental Protection Agency.*”

5.3.9 Existing Water Quality

5.3.9.1 Ripogenus Project

Previous monitoring has shown that water quality at the Ripogenus Project in the impoundment, West Branch downstream of Ripogenus Dam (Upper Gorge), and West Branch downstream of McKay Station is good and meets all applicable water quality standards. Several water quality monitoring studies were conducted prior to and in support of the last FERC relicensing effort to evaluate the water quality conditions in the impoundment, Upper Gorge, and West Branch downstream of McKay Station. The detailed study results are described in the 1991 FERC License Application (GNNC 1991a). Brief summaries of the results are provided below.

1977-1980

The Licensee completed water quality monitoring in the Ripogenus Lake basin and downstream sections of the West Branch in 1977, 1978, and 1980 (GNNC 1991a). The monitoring demonstrated that DO concentrations met state standards, and pH was generally between 6.0 and 7.0. Trace metals, nutrients, chlorophyll-a, biological oxygen demand (BOD), color, total suspended solids, turbidity, and coliform bacteria were low.

1981-1984

The Licensee collected vertical profiles of DO concentrations and water temperature in the Ripogenus Lake basin from 1981 to 1984 (GNNC 1991a). The vertical profiles demonstrated the

lake was thermally stratified⁷ beginning in late May or early June through late October or early November. The epilimnion⁸ extended to depths of 55 to 60 feet with low DO concentrations (< 4 mg/L) and cool temperatures (6-7 degrees Celsius [°C]) in the hypolimnion. Maximum surface water temperatures (> 22°C) occurred in late July or early August.

1986-1988

The Licensee completed comprehensive water quality monitoring to characterize all lake basins in the Ripogenus impoundment, inlets to the Ripogenus impoundment, and waters downstream of Ripogenus Dam. Sampling was conducted at 10 stations once per month from May-November 1986 and 1987 (GNNC 1991a). A less extensive study was completed in June and August 1988. The results of the monitoring demonstrated that operation of the Ripogenus Project did not degrade water quality, that the impoundment met Class GPA standards, and that the West Branch downstream of Ripogenus Dam met Class B standards (GNNC 1991a). Results from the 1986 to 1988 water quality monitoring are further described below for each portion of the Ripogenus Project.

Ripogenus Impoundment:

Caribou Lake basin – Monitoring completed at the deep spot in the Caribou Lake basin demonstrated that class GPA water quality criteria were met (GNNC 1991a). Caribou Lake was thermally stratified by June or July each year and stratification continued through September; the epilimnion extended to a depth of approximately 60 feet. Surface water DO concentrations were 7.4 mg/L or above. The maximum surface water temperatures were 20.0°C in 1986, 23.5°C in 1987, and 22.8°C in 1988. In the hypolimnion during late summer, the DO concentration reached minimum levels of approximately 2 mg/L and 20 percent saturation. Low total phosphorus and chlorophyll-a concentrations suggested that the Caribou Lake basin could be characterized as

⁷ Thermal stratification occurs when there is more than a 1°C difference in temperature per meter of depth.

⁸ The epilimnion is the top layer of a stratified water column; contains warmer, less dense water; and is influenced by mixing at the surface. The hypolimnion is the deepest level of a stratified water column, contains cold and dense water, and is separated from mixing at the surface. The metalimnion is between the epilimnion and hypolimnion and is where temperature changes with depth.

oligotrophic⁹ (i.e., low productivity). Color values (30-50 platinum-cobalt units [PCU]) indicated the presence of dissolved organic compounds. The pH ranged from 6.4 to 7.2.

Chesuncook Lake basin – Three sites throughout the Chesuncook Lake basin, as well as the tributaries to the lake (Caucomgomoc Stream and upper West Branch), were sampled (GNNC 1991a). The monitoring demonstrated that Class GPA criteria were met. Vertical profiles collected at the deep spot in the Chesuncook Lake basin showed that the site stratified throughout the summer. The depth of the epilimnion extended to approximately 55 to 75 feet depending on year. Surface water DO concentrations were greater than 7 mg/L; hypolimnetic DO concentrations were less than 5 mg/L. Water temperatures above the thermocline in July and August ranged from 17°C to 22.4°C. Monitoring at a shallower site (approximately 40 feet deep) indicated there was weak stratification with surface DO concentrations of 7.6 mg/L or greater; mid-summer water temperatures ranged from 16.5°C to 20°C. Chlorophyll-a and total phosphorus concentrations were low indicating the lake could be characterized as oligotrophic. The measurements of color (35-60 PCU) indicated the presence of dissolved organics. The pH ranged from 6.3 to 7.4.

Ripogenus Lake basin – Monitoring at the deep spot in Ripogenus Lake demonstrated that the lake thermally stratified with the epilimnion reaching 50 to 70 feet depending on year (GNNC 1991a). Ripogenus Lake is the deepest basin in the Ripogenus impoundment and remained stratified longer (from June through October) than Caribou Lake and Chesuncook Lake. DO concentrations were above 7 mg/L above the thermocline and were less than 5 mg/L in the hypolimnion. The maximum surface water temperatures were 20.5°C in 1986, 21.5°C in 1987, and 24.7°C in 1988. Chlorophyll-a and nutrient concentrations indicated that Ripogenus Lake had low productivity. The Secchi disk depth ranged from 9.5 feet to 13 feet. The pH ranged from 6.0 to 7.2. The Ripogenus Lake basin met Class GPA water quality criteria.

West Branch (Upper Gorge) – The flow in the Upper Gorge originates from leakage at Ripogenus Dam, releases from Ripogenus Dam (primarily from the sluice gate), from groundwater, and from surface runoff. Water quality sampling at the downstream end of the Upper Gorge (just upstream of the McKay Station Pool) demonstrated attainment with Class B standards

⁹ Mesotrophic waters have an intermediate level of nutrients and productivity compared to oligotrophic (low productivity, low nutrients) and eutrophic (high productivity, high nutrients) waters.

at all times. The maximum water temperature was 18.0°C, and the minimum DO concentration was 7.4 mg/L (GNNC 1991a).

West Branch (McKay Station Tailrace) – Water quality monitoring in the McKay Station tailrace demonstrated that waters met the Class B standards, which was the classification at the time of sampling, and that there was no adverse impact of Project operation on water quality (GNNC 1991a). The DO concentration was 8 mg/L or above, which also indicates attainment with the current Class A standard. The maximum water temperature was 19.0°C. The concentrations of water quality parameters were similar to the Ripogenus Lake epilimnion.

In summary, water quality monitoring completed in 1986-1988 throughout the Ripogenus Project demonstrated that there was no degradation of water quality due to operation of the Ripogenus Project (GNNC 1991a). Water quality met the applicable State of Maine water quality criteria in the impoundment, Upper Gorge, and tailwater areas. The storage system associated with the Ripogenus Project provides a supply of water of uniform and consistent quality to the West Branch downstream of the Project that is comparable to natural lakes and other impoundments. The inflow and outflow patterns of the Ripogenus impoundment and the high energy, wind-driven circulation results in an extensive epilimnetic zone (e.g., to depths of approximately 60 feet or more) (GNNC 1991a). The deep epilimnion allows algal matter to circulate to deeper waters, which likely results in reduced productivity in the lake. The typical pattern of slow drawdown of the Ripogenus impoundment through the summer and fall serves to increase downward mixing and promotes an earlier fall circulation than would occur without the current storage operation regime. The earlier fall circulation may limit the severity of the DO concentration deficit in the hypolimnion and enhances the removal of nutrients from the impoundment, which provides a valuable food source to the West Branch. In addition, the Ripogenus Project intake withdraws water from mid-depth within the epilimnion; thus, water discharged from McKay Station is high in DO concentration and of moderate temperature (usually less than 20°C in summer), which is supportive of a stable and productive fishery resource.

Volunteer Lake Monitoring in Ripogenus Impoundment

The Lake Stewards of Maine (LSM) Volunteer Lake Monitoring group completed sampling in the deep area in the Chesuncook Lake basin on August 22, 2001 (LSM 2021a). The epilimnion

extended to a depth of approximately 32 feet. In the epilimnion, DO was 8.1 mg/L to 8.2 mg/L and well above the state standard. The water temperature ranged from 21.7 °C to 22.7°C. Below the thermocline, DO decreased to 4.1 mg/L and 11.5°C. The total phosphorus concentration was 8 µg/L, chlorophyll-a was 3.5 µg/L, pH was 7.1, and the Secchi disk depth was 4.9 m indicating attainment with riverine water quality standards. Color was 15 PCU, conductivity was 30 microsiemens per centimeter (µS/cm), and alkalinity was 10 mg/L.

5.3.9.2 Penobscot Mills Project

Several water quality monitoring studies were conducted prior to and in support of the last FERC relicensing effort to evaluate the water quality conditions in the Project area. The detailed study results are described in the 1991 FERC License Application (GNNC 1991b). Brief summaries of the results are provided below.

1981-1985

The Licensee conducted summer water quality monitoring from 1981-1985 in relation to their licensed wastewater discharges (GNNC 1991b). Monitoring was completed in Ferguson Pond, in Dolby Pond at Dolby Dam, and in the East Millinocket impoundment at the dam. Monitoring was also completed in Millinocket Stream in 1981 and 1985. In Ferguson Pond, the minimum DO concentration was 7.4 mg/L (83% saturation), which was above the Class B criteria. The maximum water temperature was 23.5°C. Monitoring in the Dolby and East Millinocket impoundments in the vicinity of the dams measured a maximum temperature of 24°C and a minimum DO concentration of 6.0 mg/L (68% saturation) at Dolby and 5.7 mg/L (65% saturation) at East Millinocket; DO concentrations met the Class C criteria, which was the classification at the time of sampling. DO data collected from Millinocket Stream in 1985 upstream and downstream of the railroad bridge were in attainment with the water quality standards. The portions of the West Branch monitored from 1981-1985 had low turbidity (generally 1-5 nephelometric turbidity units [NTU]) and color values ranging from 40-50 PCU (GNNC 1991b).

1984-1985

MDEP monitored water quality in July and August 1984 and 1985 in Ferguson Pond and in the Dolby and East Millinocket impoundments in the vicinity of the dams for effluent discharge

modeling (GNNC 1991b). The DO concentration ranged from 7.5 mg/L to 8.1 mg/L in Ferguson Pond, from 7.3 mg/L to 10.0 mg/L in the Dolby impoundment at Dolby dam, and from 6.7 mg/L to 7.5 mg/L in the East Millinocket impoundment at the dam. The maximum water temperatures were 25.0°C, 24.0°C, and 23.0°C in Ferguson Pond, at Dolby Dam, and at East Millinocket Dam, respectively. The maximum total phosphorus concentrations were 23.0 µg/L, 40.5 µg/L, and 44.5 µg/L at Ferguson Pond, Dolby Dam, and East Millinocket Dam, respectively. The maximum chlorophyll-a concentration in Dolby Pond was 10.04 µg/L, and it was 7.09 µg/L in the East Millinocket impoundment. Based on the 1984 and 1985 monitoring, MDEP reported that sediment accumulation on the bottom of Dolby Pond had little effect on the DO concentrations in the water column (GNNC 1991b).

1986-1988

The Licensee completed comprehensive water quality monitoring in the Penobscot Mills Project impoundments and tailrace areas in support of the last FERC relicensing effort (GNNC 1991b). Monitoring was performed at 17 sites. The sampling frequency was once per month from May to November in 1986 and 1987; supplemental sampling was completed in June and August 1988. Sampling was also conducted in the impoundments through ice cover in March 1987.

North Twin Impoundment:

Ambajejus Lake basin – Monitoring was completed at the deep spot in Ambajejus Lake, which is approximately 92 feet deep and is near the confluence with the West Branch (GNNC 1991b). Ambajejus Lake thermally stratified with the epilimnion extending to a depth of approximately 40 feet each year. The maximum observed surface water temperature was 21°C in 1986 and 24.0°C in 1987. Mid-summer (July and August) water temperatures above the thermocline were above 19°C. At the deep spot in Ambajejus Lake, the minimum DO concentrations in the epilimnion were 7.8 mg/L, 7.9 mg/L, and 7.3 mg/L, in 1986, 1987, and 1988, respectively. Hypolimnetic DO concentrations were less than 3.3 mg/L and 28 percent saturation. The trophic state of Ambajejus Lake was characterized as meso-oligotrophic, or low to moderate productivity. Chlorophyll-a measurements suggested there were no algal blooms. Color ranged from 35 -60 PCU indicating the presence of natural organic compounds. The pH ranged from 6.6 to 7.4. The Secchi disk depth was 10 to 15 feet. Class GPA water quality criteria were met.

Pemadumcook Lake basin – Monitoring was conducted at the deep spot in Pemadumcook Lake (101 feet) (GNNC 1991b). The deep spot thermally stratified in 1986 and 1987 with the epilimnion extending to a depth of approximately 60 feet. The maximum observed surface water temperatures were 21.0°C in 1986 and 24.0°C in July 1987. The minimum DO in the hypolimnion was 3.0 mg/L and 30.4 percent saturation. The pH ranged from 6.5 to 7.2. The water column transparency ranged from 13 to 21 feet. Based on nutrients, Pemadumcook Lake could be characterized as mesotrophic; however, based on chlorophyll-a, Pemadumcook Lake was oligotrophic reflecting low algal productivity. The Pemadumcook Lake basin met Class GPA water quality criteria.

North Twin Lake basin – Monitoring completed at the deep spot in the North Twin Lake basin in 1986, 1987, and 1988 demonstrated that Class GPA standards were met (GNNC 1991b). North Twin Lake is shallower than the Ambajejus Lake and Pemadumcook Lake basins and only exhibited weak stratification with mid-summer bottom water temperatures of 16.5°C or above. Maximum surface water temperatures were 21.0°C, 24.5°C, and 23.2°C in 1986, 1987, and 1988, respectively. The surface water DO concentration was 7.9 mg/L or greater in all three study years. The trophic status of the lake was characterized as meso-oligotrophic based on measurements of chlorophyll-a and nutrients. The pH ranged from 6.7 to 7.5, and color ranged from 25 to 45 PCU. The Secchi disk depth ranged from 11 to 19 feet.

South Twin Lake basin – Water quality sampling at the deep hole (55 feet) in South Twin Lake showed that Class GPA water quality criteria were met (GNNC 1991b). The water quality was similar to North Twin Lake. South Twin Lake experienced weak thermal stratification and was characterized as meso-oligotrophic. Maximum surface water temperatures were 21.0°C to 23.2°C, and the surface water DO concentration was 7.9 mg/L or greater. Mid-summer bottom water temperatures were 17.9°C or greater. Color ranged from 25 to 50 PCU, pH ranged from 6.6 to 7.6, and the Secchi disk depth ranged from 12 to 28 feet.

Millinocket Lake Storage Impoundment (Millinocket Lake) – The deep spot in Millinocket Lake (86 feet) thermally stratified with the epilimnion extending to approximately 20 feet deep in 1986, 1987, and 1988 (GNNC 1991b). The maximum surface water temperatures were 21.0°C, 24.0°C, and 24.8°C in 1986, 1987, and 1988, respectively. The surface water DO concentration was 7.6 mg/L or above each year. The minimum DO concentration in the hypolimnion was

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2.0 mg/L. The lake was characterized as oligotrophic based on the chlorophyll-a and nutrient data. Color ranged from 20-30 PCU. The pH ranged from 6.7 to 7.3. The Secchi disk depth ranged from 10 to 20 feet. Class GPA water quality criteria were met. MDEP concluded that Millinocket Lake was attaining a stable trophic state (MDEP 1993).

Millinocket Impoundment (Quakish Lake and Ferguson Pond) – Water quality was monitored in the center of Quakish Lake (37 feet) and at the outlet of Ferguson Pond (sampling occurred in 1987 and 1988 only) (GNNC 1991b). Class B water quality standards were met at both sites. In general, the water quality of these two basins was similar to other impoundments in the Penobscot Mills Project. Quakish Lake and Ferguson Pond are partially exposed to wind driven circulation. When coupled with the large volume of inflow from the North Twin impoundment, both water bodies are well mixed and exhibit only weak stratification. Quakish Lake was briefly and weakly stratified due to natural conditions; the lake was no longer stratified by September. In July and August 1987, water temperatures above the thermocline were uniform at 22°C and 18.5°C, respectively. In August 1988, the water temperature above the thermocline was uniform at 23.9°C. In Quakish Lake, DO near the surface was 7.6 mg/L or greater. Color ranged from 25 to 50 PCU, pH ranged from 6.2 to 7.2, and the Secchi disk depth ranged from 12 to 17.5 feet. Maximum water temperatures at the Ferguson Pond outlet were 21.0°C in 1986 and 22.5°C in 1987; DO was 8.0 mg/L or 89.4 percent saturation or above. Quakish Lake and Ferguson Pond were characterized as meso-oligotrophic.

Dolby Impoundment:

Upper Dolby Pond – Sampling was completed at a station with a depth of approximately 20 feet. Upper Dolby Pond exhibited brief, weak thermal stratification (lasted approximately 1 month) with low DO concentrations in the near-bottom waters (GNNC 1991b). Maximum surface water temperatures were 22.5°C in 1986 and 23.5°C in 1987. Upper Dolby Pond was characterized as mesotrophic. Chlorophyll-a, turbidity, and color were higher than in other Penobscot Mills Project impoundments, and the Secchi disk depth was lower (6.5 to 10 feet). The pH ranged from 6.2 to 7.3.

Lower Dolby Pond – Water quality was monitored at the deep hole and near Dolby Dam. Maximum surface water temperatures were 22.5°C to 25.1°C in 1986, 1987, and 1988 (GNNC 1991b). Surface water DO concentration was 6.7 mg/L or greater. The water quality in the deep

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hole was similar to Quakish Lake with a brief period of natural thermal stratification (one to two months), and low DO concentrations in the bottom waters. While low DO concentrations were found at the bottom of the Dolby impoundment, there was no evidence that operation of the Project caused or contributed to the low DO concentrations (MDEP 1993, FERC 1996). Similar to Upper Dolby Pond, Lower Dolby Pond was classified as mesotrophic with elevated chlorophyll-a and turbidity. Color ranged from 30 to 70 PCU, and the Secchi disk depth was 7 to 12 feet. The water quality was similar at the station near Dolby dam reflecting the rapid flushing rate of Lower Dolby Pond. Both Upper and Lower Dolby Pond met the Class C water quality standards in place at the time.

East Millinocket Impoundment – Previous monitoring by the Licensee found that the impoundment was well mixed and did not stratify; thus, sampling was conducted from near the surface in 1986 and 1987. The maximum surface water temperature was 23°C, and the lowest DO concentration was 6.5 mg/L (GNNC 1991b). Color ranged from 30 to 45 PCU, and pH ranged from 6.0 to 7.1. Class C water quality standards were met, which was the classification at the time of monitoring.

Riverine Waters:

West Branch – North Twin Tailrace to Quakish Lake – The water quality immediately downstream of North Twin Dam was similar to that measured upstream of the dam in North Twin Lake (GNNC 1991b). The maximum surface water temperature was 23.9°C, and the minimum surface water DO concentration was 7.9 mg/L. Nutrients, chlorophyll-a, pH (6.3 to 7.1), and color (30 to 45 PCU) were similar to the values observed at the inlet to the North Twin impoundment. The water quality criteria in this river reach were met.

West Branch - Millinocket Tailrace to Dolby Pond – Water quality in the Millinocket Station tailrace was similar to that at the outlet of Ferguson Pond (GNNC 1991b). The minimum DO concentration measured was 7.8 mg/L, and the maximum temperature was 22.5°C. The pH ranged from 6.5 to 7.2, and color ranged from 30 to 35 PCU. Water quality criteria were met in this reach of the river.

West Branch – East Millinocket Tailrace – Water quality was monitored downstream of the East Millinocket Dam. Water quality criteria were met at this site. The maximum surface water temperatures were 21.5°C to 24.7°C in 1986, 1987, and 1988, while the minimum DO was 5.7 mg/L to 6.9 mg/L (GNNC 1991b). Color ranged from 30 to 70 PCU, and pH ranged from 5.8 to 7.0. In general, the water quality was similar to that observed in the East Millinocket impoundment.

Millinocket Stream – Water quality was monitored immediately below the Millinocket Lake Dam. Water quality parameters (DO, water temperature, pH, color) were similar to the levels observed in Millinocket Lake and met the water quality standards (GNNC 1991b). Maximum water temperatures were 19.0°C to 25.6°C, and minimum DO concentrations were 7.7 mg/L to 8.5 mg/L. Chlorophyll-a, nutrients, and turbidity were low. The pH ranged from 6.6 to 7.4, and color was 15 to 30 PCU.

Back Channel – A station downstream of Stone Dam was monitored in 1986 and 1987. The minimum DO concentrations were 8.3 mg/L (95.4% saturation) in 1986 and 8.2 mg/L (97.1% saturation) in 1987 (GNNC 1991b). The maximum water temperatures were 21.0°C and 22.5°C in 1986 and 1987, respectively. Nutrients, color, turbidity, and pH (6.4 to 7.2) were similar to that observed in Quakish Lake.

In summary, water quality throughout the Penobscot Mills Project area was consistent with historical observations indicating there was no degradation of water quality due to operation of the Project facilities (GNNC 1991b). All waters met the water quality criteria for their assigned class in place at the time. The good water quality conditions are due to the sustained and consistent flows provided by the storage withdrawals.

The Penobscot Mills Project impoundments upstream of Millinocket were classified as meso-oligotrophic, while impoundments downstream were classified as mesotrophic (GNNC 1991b). Three of the Penobscot Mills Project water bodies (e.g., Quakish Lake, Ferguson Pond, and Dolby Pond) possess some lake-like (lacustrine) characteristics but are assigned flowing-water (riverine) classifications by the State of Maine (GNNC 1991b). Naturally occurring weak thermal stratification was briefly observed in portions of these water bodies due to their lake-like configurations and depths with associated lower DO concentrations in the hypolimnion. These

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near-bottom zones are estimated to be less than 10 percent of each water body's total volume. When this natural thermal stratification is disrupted by wind activity, usually in late August or September, the full water column in each water body is circulated and uniform DO concentrations return throughout the water column. This natural process occurs in the deeper Class GPA Penobscot Mills Project lake basins, but since their stratification period extends into the fall, they possess correspondingly longer periods of DO concentration deficits. The MDEP has recognized that this natural phenomenon can occur in both lacustrine (GPA) and riverine (B, C) waters, and it does not impair the attainment of their classification.

The relatively large volume of inflow and outflow from the North Twin impoundment in combination with wind activity results in a relatively extensive epilimnetic zone. This allows circulation of algal matter from near the surface to deeper epilimnetic waters. This likely results in a reduction in primary productivity in the epilimnion. The drawdowns of the North Twin and Millinocket Lake Storage impoundments likely increase downward mixing. Overall, the increased downward mixing due to drawdowns, large inflow volumes, and wind-driven circulation likely enhances the removal of nutrients and algal material from the Penobscot Mills Project impoundments and likely diminishes any trend toward an increasing trophic state (GNNC 1991b).

The four riverine stations located immediately downstream of the North Twin, Millinocket, East Millinocket, and Millinocket Lake dams reflect the water quality of the epilimnetic zone of the lake or impoundment immediately upstream (GNNC 1991b). DO concentrations and pH values were in attainment with the designated water quality classifications. The operations associated with the Project provide a consistent source of high-quality water to the riverine segments of the West Branch.

The Water Quality Certification issued by MDEP for the Project in 1993 concluded that continued operation of the Penobscot Mills Project would result in affected surface waters being suitable for all Class A, Class B, Class C, and Class GPA designated uses and will meet numeric DO standards and narrative standards for aquatic life provided that the Water Quality Certification conditions are met. The continued operation will comply with the State's antidegradation policy (MDEP 1993).

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Integrated Water Quality Monitoring and Assessment Report

Section 305(b) of the Clean Water Act requires states to submit an integrated report (the 305(b) report) to the USEPA every two years and to assess the ability of waters to meet their designated uses. States are also required to provide the 303(d) list identifying impaired waters that do not meet one or more of their designated uses. The most recent final report prepared by the State of Maine is the 2016 report which indicates that three reaches in the Penobscot Mills Project are listed in Category 4 as impaired or threatened for one or more designated uses, but it does not require development of a Total Maximum Daily Load (TMDL) (MDEP 2018) (Table 5.3-9). It should be noted that the reach in Category 4-B between the confluence of the West Branch and Millinocket Stream to the confluence with the East Branch is expected to be in attainment and to no longer have DO and nutrient eutrophication issues (MDEP 2018) (Table 5.3-9).

**Table 5.3-9
River Reaches in the Penobscot Mills Project listed in Category 4 of the State of Maine
2016 Integrated Report.**

Assessment Unit ID	Segment Name and Length	Category*	Cause	Segment Class	Comment
ME0102000110_205R03	Millinocket Stream-From Ledge Cut Brook to Shad Pond (3.03 miles)	4-A	Escherichia coli	C	9/28/2009: Recreational use impairments now Category 4-A due to approval of statewide bacteria TMDL (ENSR 2009).
ME0102000109_205R01	West Branch Penobscot River below confluence with Millinocket Stream including Dolby Pond, to confluence with East Branch (4.25 miles)	4-B	Nutrient/ Eutrophication Biological Indicators	C	3/4/2015: Recent data from this reach has shown continued attainment. There is no reason to suspect continuing DO/ eutrophication issues. 10/23/2012: 2011 permitting action in Millinocket expected to result in reduced phosphorus loading to river and improvement in DO and nutrient conditions. Expected to attain in 2016.
			DO		
ME0102000109_205R02	West Branch Penobscot River, below outlet of Quakish Lake to confluence with Millinocket Stream (5.1 miles)	4-C	Other flow regime alterations	C	Flow diversion (bypass channel for Quakish Lake/Stone Dam) - modified for hydropower.

Source: MDEP 2018.

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*Category 4-A: Rivers and streams with impaired use other than mercury, TMDL completed but insufficient new data exists to determine that attainment has been achieved. Category 4-B: Rivers and streams impaired by pollutants-pollution control requirements reasonably expected to result in attainment in the near future. Category 4-C: Rivers and streams with impairment not caused by a pollutant. Waters impaired by habitat modification (e.g. a dam) that is a result of human activity.

5.3.9.3 Penobscot Indian Nation Water Quality Monitoring

The Penobscot Indian Nation (PIN) regularly collects water quality data at several riverine and impoundment sites within the Penobscot Mills Project boundary. The objectives of the monitoring are to protect, enhance, and restore water quality and aquatic resources in the Nation's territories and to evaluate whether water quality standards are being met, identify sources of pollution, collect data for regulatory and permitting purposes and water resource planning (PIN 2021). The PIN collects data for water temperature, DO, chlorophyll-a, total phosphorus, turbidity, conductivity, Secchi-disk depth, pH, E-coli, total coliform, and BOD (National Water Quality Monitoring Council [NWQMC] 2021). Vertical profiles of water temperature and the DO concentration are collected at three sites in Dolby Pond (near the inlet, deep hole, and near the dam). Multiple monitoring events are conducted each summer. The monitoring sites are shown in Figure 5.3-3.

Water quality monitoring results from 2012-2019 at sites in the West Branch are shown in Table 5.3-10 to Table 5.3-16 (NWQMC 2021, PIN 2021). The maximum water temperature recorded each year ranged from 22.1°C to 26.4°C. DO was in attainment with the Class B standard with a range of 7.3 mg/L to 10.4 mg/L (86.2 to 103.8%) (Table 5.3-10). Conductivity levels were representative of undisturbed and unpolluted waters with a range of 17.1 µS/cm to 68.4 µS/cm (MDEP 2021c). Turbidity levels were low. Total phosphorus and chlorophyll-a were below the Class B criteria. Similar results were found in Dolby Pond (Table 5.3-11). The Secchi disk depth at the deep hole (site DNR-7-DP2) ranged from 3.7 m to 5.6 m and was above the 2 m standard. The pH results from 2017-2019 (6.5 to 7.3) were also in attainment with the State of Maine standard (Table 5.3-10 and Table 5.3-11).

Water temperature and DO vertical profiles collected in Dolby Pond are shown in Table 5.3-12, Table 5.3-13, and Table 5.3-14 (NWQMC 2021, PIN 2021). At the sites near the inlet to Dolby Pond (DNR-6-DP1) and near the Dolby dam (DNR-76-DP3), DO concentrations were in attainment with the State of Maine standard and ranged from 7.6 mg/L to 9.1 mg/L (87 to 100.8%) and 6.9 mg/L to 10.0 mg/L (78.9 to 103.2%), respectively; the water temperatures ranged from

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16.1°C to 27.3° C and 10.7° C to 27.0°C, respectively. In the epilimnion, DO concentration was above the 7.0 mg/L and 75 percent saturation standards. DO was depleted near the bottom of the impoundment with concentrations less than 4 mg/L observed (NWQMC 2021, PIN 2021).

PIN and MDEP documented algal blooms in the lower West Branch Penobscot River and mainstem Penobscot River in 2001, 2004, and 2007 (PIN 2008, 2021). Chlorophyll-a concentrations of 20 µg/L to 30 µg/L were observed, which are indicative of an algal bloom (PIN 2008). The blooms were thought to originate in Dolby Pond and were caused by discharges from the paper mill in Millinocket, which is no longer in operation. As noted above, the chlorophyll-a concentrations measured in Dolby Pond in 2012 to 2015 (Table 5.3-11) were well below the standard and at values reflective of low algal levels (PIN 2008, 2021).

Figure 5.3-3
Penobscot Indian Nation Water Quality Monitoring Sites

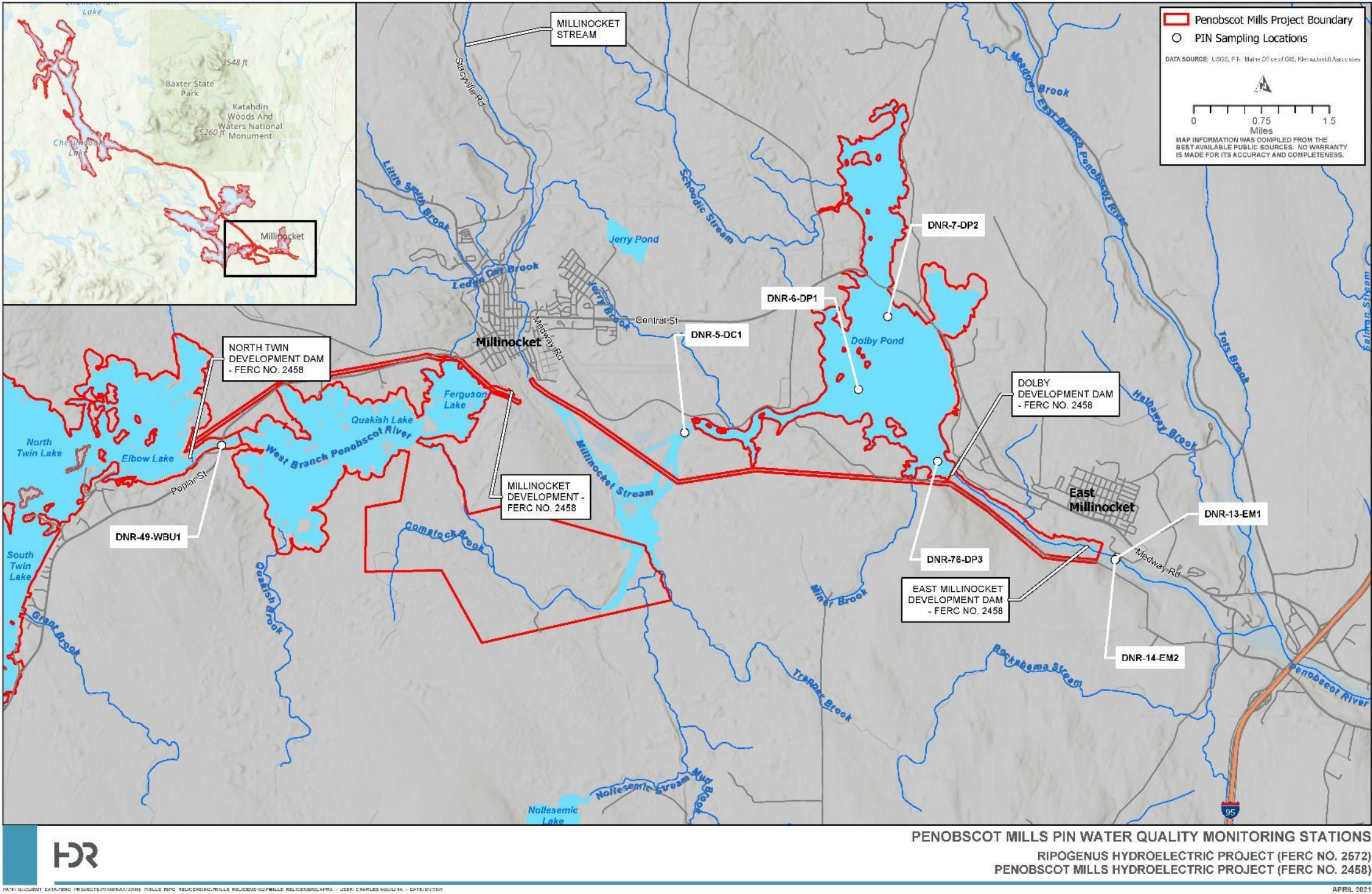


Table 5.3-10
Water Quality Data Collected by PIN from 2012-2019 in the West Branch Penobscot River

Date	Water Temperature (°C)	DO (mg/L) (Percent Saturation)	Conductivity (µS/cm)	Turbidity (NTU)	Total Phosphorus (µg/L)	Chlorophyll-a (µg/L)	BOD (mg/L)	E-coli (MPN)	Total Coliform (MPN)	pH
DNR-49-WBU1 (Route 11 Bridge)										
June-October 2012	11.4-23.8	7.9-9.9 (90.6-96.2)	17.1-27.1	0.37-1.1	5.4-9	1-2.4	0-0.57	1 - 2.4	89-2420	-
June-August 2013	15.0-22.4	8.1-9.4 (92.8-96.8)	25.2-26.5	0.46-0.92	5.4	2.4	0.26-1.1	4 -13	234-2420	-
July-September 2014	17.4-23.7	8.0-8.7 (90.4-95.0)	23.6-25.4	0.38-0.56	5 - 6	1.7-2.3	0.17-0.49	4 - 37	517-2420	-
June-September 2015	17.7-23.1	7.9-9.2 (91.6-96.9)	24.5-28.7	0.36-0.64	7	2	0.31-0.53	2 - 17	219-1553	-
July-September 2016	21.3-22.3	7.9-8.3 (90.3-94.2)	25.1-26.9	0.42-0.56	-	-	0.23-0.48	2 - 9	525-1046	-
June-September 2017	17.2-22.1	8.1-9.6 (91.8-99.8)	22.5-24.5	0.35-0.71	-	-	0.22-0.93	1 - 11	196-1203	6.9-7.1
July-September 2018	20.4-24.4	7.5-8.4 (86.2-98.2)	23.6-26.2	0.35-0.46	-	-		11-49	866-2420	6.9-7.1
July-August 2019	22-24.8	7.9-8.0 (91.4-95.1)	22.3-23.6	0.34-0.57	-	-		4-9	1300-2440	7.0-7.3
DNR-5-DC1 (Dead Man’s Curve)										
June-October 2012	10.8-24.4	8-10.4 (92.1-98.2)	17.3-27.6	0.50-1.3	6.3-11	1-2.2	0-0.72	8- 70	436-2420	-
June-August 2013	15.3-23.2	8.1-9.2 (91.8-98.6)	25.6-26.9	0.48-0.99	-	-	0.21-1.19	22-75	1300-2420	-
July-September 2014	16.9-23.5	7.9-9.6 (92.0-98.6)	23.9-25.4	0.53-0.78	6	1.1-2.2	0-0.5	11 - 93	816-2420	-
June-September 2015	17.9-23	8.0-9.1 (93.1-95.9)	24.6-26.9	0.42-0.85	6	2	0.23-0.43	13-51	770-2420	-
July-September 2016	21.3-22.3	8.3-8.6 (95.8-97.3)	24.4-27.1	0.41-0.44	-	-	0.33-0.53	12 - 44	1120-1414	-
June-September 2017	17.9-22.5	8.2-9.4 (93.6-98.7)	23-25.4	0.32-0.83	-	-	0.22-0.94	4 - 33	313-1553	7.0-7.1
July-September 2018	20.1-24.5	7.8-8.5 (89.6-97.7)	24.5-26.6	0.36-0.58	-	-	0.19-0.56	20-88	816-1553	6.9-7.0
July-August 2019	22.2-25.7	7.8-8.3 (94.8-95.7)	22.3-22.6	0.41-0.52	-	-	0.39-0.47	18-28	770-1120	7.0-7.1
DNR-13-EM1 (1,700 feet downstream from East Millinocket Dam, river left)										
June-September 2012	16.7-23.7	7.6-8.8 (90.1-96.8)	28.1-30.4	0.55-0.81	-	-	0-0.58	1 - 29	579-1986	-
June-August 2013	16.2-23.3	7.6-9.3 (88.8-94.6)	28-29.3	0.70-0.95	-	-	0.62-0.96	22-23	1120-2420	-
September 2014	17	9.5 (98.6)	25.7	0.73	-	-	0.52	5	816	-
June-September 2015	19.2-23.3	7.6-8.8 (88.5-95.7)	25.9-27.7	0.50-0.74	-	-	0.35-0.83	6 - 24	488-1046	-
July-September 2016	22.1-22.8	7.7-8.0 (88.8-92.3)	25.2-27.3	0.47-0.57	-	-	0.45-0.66	10 - 17	548-1046	-
June-September 2017	18.7-23.0	7.9-8.9 (91.4-96.2)	23.8-68.4	0.43-0.93	-	-	0.39-0.76	3 - 28	461-1414	6.8-6.9
July-September 2018	20.1-25.4	7.3-8.7 (87.2-103.8)	24.5-25.8	0.47-0.59	-	-	-	12-108	517-1414	6.8-7.0
July-August 2019	22.4-26.4	7.3-7.7 (89.0-90.1)	23.2-23.4	0.49	-	-	-	5-7	816-980	6.7-6.9
DNR-14-EM2 (1,700 feet downstream from East Millinocket Dam, river right)										
June-September 2012	16.6-23.7	7.8-8.9 (91.1-97.9)	25.9-27	0.59-0.73	-	-	0-0.56	5 -23	328-1986	-
June-August 2013	16.1-23.2	7.7-9.9 (90.1-100.5)	25.6-26.2	0.72-0.86	-	-	0.57-1.11	13-17	866-2420.	-
September 2014	17	9.9 (102.0)	25.8	0.68	-	-	0.30	3.70	570	-
June-September 2015	19.1-23.3	7.6-9.0 (89.0-97.1)	25.4-26.5	0.50-0.66	-	-	0.35-0.73	3 - 22	365-770	-
July-September 2016	22.1-22.8	7.7-8.1 (89.0-92.6)	26.2-27.3	0.53-0.65	-	-	0.26-0.62	5 - 27	548-1203	-
June-September 2017	18.7-22.9	7.9-9.3 (91.3-100.2)	23.6-25.4	0.38-0.92	-	-	0.33-0.80	5 - 23	387-770	6.8-7.0
July-September 2018	20.4-25.3	7.4-8.7 (87.8-103.4)	24.8-26	0.42-0.57	-	-	-	4-108	435-1414	6.8-7.0
July-August 2019	22.5-26.4	7.3-8.0 (90.8-91.8)	22.7-22.7	0.48-0.50	-	-	-	9-10	816-921	6.5-6.8

Source: NWQMC 2021, PIN 2021, personal communication with Dan Kusnierz (PIN), May 26, 2021.
“-” missing data

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Description of Existing Environment and Resource Impacts

Table 5.3-11
Water Quality Data Collected by PIN from 2012-2019 in Dolby Pond.

Date	Conductivity (µS/cm)	Turbidity (NTU)	Total Phosphorus (µg/L)	Chlorophyll-a (µg/L)	BOD (mg/L)	E-coli (MPN)	Total Coliform (MPN)	Secchi Disk (m)	pH
DNR-6-DP1 (Dolby Pond, near inlet)									
June-October 2012	25.7-27.3	0.65-0.93	-	-	0-0.62	2 - 12	133-1300	2.1-2.8	-
June-August 2013	25.9-26.4	0.45-0.75	-	-	0.54-0.97	9 - 36	579-1553	1.8-2.1	-
July-September 2014	24.6-24.9	0.69-0.73	-	-	0.45-0.69	3 - 46	411-1553	1.8-2.0	-
June-September 2015	25.8-28.5	0.46-0.64	-	-	0.55-0.79	6 - 22	727-1203	1.9-2.5	-
July-September 2016	26.7-26.9	0.48-0.59	-	-	0.43-0.60	1 - 7	249-727	-	-
June-September 2017	24-24.5	0.38-0.73	-	-	0.44-0.73	3 - 12	194-1046	2.0-2.2	6.9-7.0
July-September 2018	24.5-25.4	0.41-0.57	-	-	0.36-0.53	8-46	816-1733	-	6.8-6.9
July-August 2019	23-23.2	0.45-0.84	-	-	0.55-0.78	1-5	276-435	-	7.1-7.2
DNR-7-DP2 (Dolby Pond, deep hole)									
June-October 2012	17.4-27.5	0.51-1.86	7.3-11	1.1-4	0-0.89	1 - 12	137-866	3.7-5.3	-
June-August 2013	25.4-26.4	0.58-0.85	-	-	0.54-96.7	1 - 7	178-461	3.9-4.8	-
July-September 2014	24.3-25.7	0.55-1.21	6	2.4-3	0.01-0.7	1 - 17	133-548	4.4-5.6	-
June-September 2015	25-27.2	0.49-0.96	8	4.1	0.42-0.81	1 - 5	69-250	3.9-5.3	-
July-September 2016	25.5-27.9	0.42-0.60	-	-	0.45-0.78	1 - 3	99-228	5.0-5.4	-
June-September 2017	23.7-27.6	0.43-1.18	-	-	0.34-0.73	1 - 8	88-261	3.7-5.3	6.9-7.0
July-September 2018	24.2-25.6	0.43-0.62	-	-	-	1-5	145-387	3.8-5.0	6.8-7.1
July-August 2019	22.6-22.8	0.45-0.53	-	-	-	1	102-107	4.5	7.0-7.1
DNR-76-DP3 (Dolby Pond, near dam)									
June-September 2012	17.5-27.3	0.47-1.13	6.4-9.3	1 - 4.6	0-0.71	2 - 32	344-1986	3.8-5.4	-
June-August 2013	25.5-26.3	0.61-0.91	5.5-9.6	2.2-3.8	0.61-1.24	2 - 32	548-1203	4.0-5.4	-
September 2014	24.7-25.2	0.66-0.87	6	2.3-3.2	0.44-0.63	3 - 35	435-1120	4.9-5.7	-
June-September 2015	25.4-28.2	0.50-0.75	8	3.8	0.48-0.98	3 - 7	194-770	4.3-5.7	-
July-September 2016	26.9-27.8	0.49-0.77	-	-	0.46-0.53	2 - 5	326-613	4.9-5.9	-

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Date	Conductivity (µS/cm)	Turbidity (NTU)	Total Phosphorus (µg/L)	Chlorophyll-a (µg/L)	BOD (mg/L)	E-coli (MPN)	Total Coliform (MPN)	Secchi Disk (m)	pH
June-September 2017	23.6-28.2	0.43-0.84	-	-	0.41-0.58	4 - 12	308-866	3.6-6.0	6.9-7.0
July-September 2018	24.5-25.5	0.42-0.69	-	-	0.48-0.69	2-21	248-816	4.2-5.2	6.9-7.0
July-August 2019	22.3-22.7	0.46-0.54	-	-	0.39-0.63	6	649	4.3-4.9	6.8-6.9

Source: NWQMC 2021, PIN 2021, personal communication with Dan Kusnierz (PIN), May 26, 2021.

“-” missing data.

Table 5.3-12

DO and Water Temperature Profiles at Site DNR-6-DP1 (Dolby Pond, near inlet) Collected by PIN from 2012-2019

	Jun-Sep 2012	Jun-Aug 2013	Jul-Aug 2014	Jun-Sep 2015	Aug-Sep 2016	Jun-Sep 2017	Jul-Sep 2018	Jul-Aug 2019
Depth (m)	DO (mg/L) (percent saturation)							
0	7.8-9.0 (87.9-100.8)	7.7-9.1 (88.9-93.3)	7.8-8.2 (93.4-94.1)	7.7-8.8 (89.9-94.4)	7.7-7.9 (89.2-91.1)	8.0-8.9 (91.6-96.0)	7.5-8.7 (87-101.3)	7.9-8.0 (91.4-100.1)
1	7.8-9.0 (88.9-100.4)	7.7-9.0 (88.9-93.0)	7.8-8.2 (93.1-93.9)	7.7-8.7 (89.4-93.4)	7.6-7.9 (88.5-91.1)	8.0-8.9 (91.5-95.4)	7.8-8.2 (90.6-98.4)	8.0 (99.7)
2	7.7-8.8 (88.9-97.7)	8.0 (92.3)	-	8.1-8.7 (91.3-92.7)	-	-	7.8 (92)	-
Depth (m)	Water Temperature (°C)							
0	16.1-23.3	16.2-23.4	21.6	18.9-23.6	22.3-22.9	18.5-22.1	19.8-25.2	22.5-27.3
1	16.1-23.2	16.3-23.2	21.5-24.6	18.6-23.6	22.3-22.8	18.4-22.1	22.9-24.9	26.8
2	16.1-22.8	22.6	-	18.5-21.4	-	-	23.9	-

Source: NWQMC 2021, PIN 2021, personal communication with Dan Kusnierz (PIN), May 26, 2021.

“-” missing data.

Section 5

Description of Existing Environment and Resource Impacts

Table 5.3-13
DO and Water Temperature Profiles at Site DNR-7-DP2 (Dolby Pond, deep hole) Collected by PIN from 2012-2019

	Jun-Oct 2012	Jun-Oct 2013	Jul-Sep 2014	Jun-Sep 2015	Jul-Sep 2016	Jul-Sep 2017	Jul-Sep 2018	Jul-Aug 2019
Depth (m)	DO (mg/L) (percent saturation)							
0	7.1-9.9 (84.1-102)	7.8-9.4 (89.2-104.5)	7.9-8.3 (85.5-99.1)	7.9-9.0 (90.1-100)	7.7-8.4 (88.8-97.2)	8.2-9.0 (92.7-96.8)	7.7-8.4 (88.4-102.3)	7.9-8.0 (93.3-100.6)
1	7.1-9.9 (83.5-102)	7.8-9.4 (85.4-104.2)	7.9-8.8 (85.2-101)	7.9-8.9 (89.9-99.9)	7.6-8.4 (88.6-97.0)	8.2-9.0 (92.7-96.7)	7.7-8.4 (88.1-101.0)	7.9-8.0 (93.3-100.2)
2	7.1-7.8 (83.1-101)	7.5-9.3 (86.2-102.1)	7.9-8.3 (84.9-98.8)	7.8-8.8 (89.6-99.8)	7.6-8.4 (88.3-96.8)	8.2-8.9 (92-96.4)	7.7-8.3 (87.7-100.4)	7.6 (86.8-95.2)
3	7.0-9.8 (83-100.4)	7.0-9.3 (78.7-97.2)	7.9-8.2 (84.6-95.0)	7.8-8.8 (89.2-99.7)	7.6-8.3 (87.8-96.6)	8.1-8.9 (91.1-96.2)	7.6-8.1 (87.5-95.6)	7.4-7.7 (84.8-94.7)
4	6.9-9.8 (80.8-99.9)	7.0-9.3 (79.3-96.9)	7.7-8.2 (84.4-94.5)	7.6-8.7 (87-98.4)	7.5-8.3 (87.6-95.7)	7.8-8.8 (86.6-94.1)	7.0-7.9 (85.0-94.2)	7.3-7.4 (83.5-88.6)
5	6.7-9.8 (78.5-92.9)	6.7-9.3 (75.6-92.2)	7.1-8.1 (82.6-91.1)	7.6-8.6 (86.5-97.4)	7.5-7.9 (87-90.5)	7.5-8.5 (83.8-92.2)	6.5-7.9 (77.9-94.0)	7.0-7.2 (80.8-83.8)
6	5.6-9.8 (65.4-89.8)	6.3-9.2 (71.9-92.2)	6.4-8.1 (73.9-87.3)	6.9-8.6 (78.5-95.1)	6.9-7.8 (79.6-89.7)	7.4-8.4 (82.5-91.4)	7.1-7.9 (82.3-91.1)	6.0-6.9 (70.7-77.6)
7	4.6-9.8 (51.2-88.7)	0.8-9.2 (7.7-90.7)	5.5-8.1 (61.9-84.7)	6.6-8.5 (73.8-89.1)	6.2-7.5 (71.8-85)	6.1-8.4 (68.1-89.4)	5.8-8.0 (66.5-87.8)	3.7-6.7 (41.6-75.4)
8	0.3-9.7 (3.3-88.5)	0.2-9.3 (2.1-91.0)	0.9-8.1 (9.1-83.7)	3.0-6.7 (33.9-67)	2.7-6.6 (29.9-73.7)	3.0-8.2 (31.2-86.9)	2.5-8.0 (26.7-88.2)	1.5-5.0 (15.1-55.3)
9	0.1-9.7 (0.5-88.3)	0.2-9.4 (1.9-92)	0.1-8.0 (1.3-82.3)	0.4-5.9 (3.7-57.7)	0.3-1.8 (2.7-20)	0.7-7.7 (6.9-80.5)	0.3-5.4 (3.0-59.0)	0.2-0.4 (1.8-3.7)
10	0.0-9.7 (2.9-87.8)	0.1-9.1 (1.1-92)	0.1-1.8 (0.5-16.6)	0.2-4.3 (2.2-41.6)	0.1-0.2 (1.4-1.9)	0.3-6.5 (2.4-68.2)	0.2-0.5 (2.2-5.2)	0.1-0.2 (1.1-2.0)
11	0.0-9.6 (2.8-87.5)	0.1-3.1 (0.6-23.6)	-	-	-	0.2 (1.8)	-	-
12	0.0-0.7 (0.9-6.5)	-	-	-	-	-	-	-
Depth (m)	Water Temperature (°C)							
0	11.0-26.3	14.6-26.0	17.2-24.4	19.2-23.2	22.4-22.8	18.6-22.4	20.2-25.6	22.8-27.6
1	11.0-25.4	14.7-25.9	17.2-24.4	19.0-23.2	22.4-22.8	18.6-22.4	20.2-25.6	22.8-27.3
2	10.9-25.3	14.7-25.5	17.2-24.4	18.6-23.2	22.4-22.8	18.5-22.4	20.1-25.5	22.0-26.9
3	10.9-25.2	14.7-25.5	17.2-24.4	18.5-23.2	22.4-22.8	18.4-22.4	20.1-25.5	21.8-26.1

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Description of Existing Environment and Resource Impacts

	Jun-Oct 2012	Jun-Oct 2013	Jul-Sep 2014	Jun-Sep 2015	Jul-Sep 2016	Jul-Sep 2017	Jul-Sep 2018	Jul-Aug 2019
4	10.8-24.8	14.7-25.4	17.2-24.4	18.4-23.2	22.4-22.8	18.4-22.3	20.1-25.0	21.6-25.3
5	10.7-24.3	14.7-24.2	17.2-23.6	18.3-23.2	21.7-22.8	18.4-22.2	20.1-24.7	21.4-24.7
6	10.6-23.9	14.7-22.6	17.2-22.8	18.2-22.5	21.4-22.5	17.7-22.0	20.0-24.4	21.2-23.6
7	10.6-23.7	14.7-20.8	17.2-21.9	17.9-21.8	21.3-22.3	16.1-21.7	19.9-24.2	21.0-21.7
8	10.5-20.7	12.9-19.9	14.6-19.7	15.6-20.7	18.7-21.0	14.1-20.6	17.5-19.9	17.2-20.0
9	10.5-19.2	12.1-17.0	12.7-17.0	14.4-17.8	16.4-19.8	13.0-19.3	15.4-19.6	14.3-14.4
10	10.5-17.9	11.6-16.4	11.6-14.5	13.9-16.1	15.0-16.3	13.3-17.4	14.7	12.7-13.4
11	10.5-17.9	11.0-11.6	-	-	-	12.5	-	-
12	10.7-13.1	-	-	-	-	-	-	-

Source: NWQMC 2021, PIN 2021, personal communication with Dan Kusnierz (PIN), May 26, 2021.

“-” missing data.

Table 5.3-14

DO and Water Temperature Profiles at Site DNR-76-DP3 (Dolby Pond, near dam) Collected by PIN from 2012-2019

	Jun-Oct 2012	Jun-Oct 2013	Jul-Sep 2014	Jun-Sep 2015	Aug-Sep 2016	Jun-Sep 2017	Jul-Sep 2018	Jul-Aug 2019
Depth (m)	DO (mg/L) (percent saturation)							
0	7.6-10.0 (89.2-99.2)	7.7-9.5 (89.9-103.2)	7.7-8.8 (91.1-96.8)	7.8-9.0 (88.9-98.8)	7.8-8.3 (91-94.7)	8.2-9.0 (94.3-96.8)	7.4-8.4 (86.0-102.3)	7.8-8.0 (91.8-95.8)
1	7.6-10.0 (89.2-98.7)	7.6-9.5 (89.8-100.8)	7.7-8.7 (90.2-96.6)	7.8-9.0 (88.4-98.1)	7.8-8.2 (90.7-94.3)	8.2-9.0 (94-96.7)	7.4-8.4 (85.8-100.9)	7.8-8.0 (91.7-95.3)
2	7.6-9.9 (88.5-98.5)	7.6-9.5 (89.3-97.8)	7.7-8.7 (89.3-96.2)	7.8-9.0 (88.2-97.6)	7.8-8.2 (90.5-93.9)	8.2-8.9 (93.7-96.1)	7.4-8.3 (85.3-99.0)	7.7-8.0 (91.4-94.0)
3	7.6-9.9 (88.1-97.7)	7.4-9.4 (89.1-96.8)	7.7-8.6 (88.9-95.1)	7.7-9.0 (87.2-97.3)	7.8-8.1 (90.3-93.2)	8.2-8.9 (93.2-95.7)	7.6-8.2 (90.9-97.4)	7.6-7.9 (91.0-93.1)
4	7.6-9.9 (88.4-96.6)	7.3-9.4 (89-96.1)	7.7-8.7 (89.2-93.9)	7.7-9.0 (86.9-96.7)	7.7-8.0 (90.2-92)	8.1-8.9 (93-95.5)	7.5-8.2 (90.3-97.0)	7.5-7.9 (90.6-91.4)
5	7.5-9.9 (87-96.4)	7.1-9.4 (84-95.7)	7.7-8.6 (89-93.3)	7.6-9.0 (86.6-96.5)	7.7-8.0 (90-92)	8.1-8.9 (92.8-95.2)	7.5-8.1 (89.0-96.6)	7.4-7.9 (90.4-90.5)
6	7.2-9.9 (85.9-96.3)	7.1-9.3 (87.8-95.3)	7.7-8.6 (88.8-91.9)	7.6-8.9 (86.3-95.7)	7.6-8.0 (88-91.2)	8.1-8.8 (92.6-94.9)	7.5-8.0 (88.2-94.8)	7.4-7.5 (86.1-89.8)

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	Jun-Oct 2012	Jun-Oct 2013	Jul-Sep 2014	Jun-Sep 2015	Aug-Sep 2016	Jun-Sep 2017	Jul-Sep 2018	Jul-Aug 2019
7	-	9.2-9.2 (93.4-95)	7.6-8.7 (88.8-91.7)	7.6-8.1 (86.1-91.4)	7.1-7.8 (82.1-88.6)	8.0-8.8 (91.3-94.7)	7.3-8.0 (86.5-91.4)	7.2-7.4 (84.2-88.1)
8	-	-	-	6.9-7.7 (80.9-88.5)	7.0 (78.9)	7.6-8.7 (87-93.1)	7.4-7.7 (88.9-90.0)	7.1-7.5 (85.0-86.0)
9	-	-	-	-	-	7.3 (83.2)	7.6 (89.5)	-
Depth (m)	Water Temperature (°C)							
0	10.9-25.4	15.4-27.0	17.0-24.3	19.7-23.7	22.2-23.0	18.7-22.2	20.4-25.4	22.2-25.8
1	10.8-24.9	15.1-26.1	16.9-24.3	19.5-23.7	22.2-23.0	18.6-22.2	20.3-25.1	22.2-25.8
2	10.8-24.8	15.0-25.7	16.9-24.3	19.3-23.7	22.2-23.0	18.6-22.2	20.3-25.1	22.1-25.7
3	10.7-24.7	14.9-25.6	16.8-24.3	19.2-23.7	22.2-23.0	18.5-22.2	20.2-25.1	22.1-25.6
4	10.7-24.7	14.8-25.5	16.8-24.2	19.1-23.7	22.1-23.0	18.5-22.2	20.2-25.1	22.1-25.5
5	10.7-24.7	14.8-25.3	16.8-24.2	19.0-23.7	22.0-23.0	18.5-22.2	20.2-25.1	22.1-25.4
6	10.7-24.7	14.8-25.2	16.7-24.2	18.9-23.6	21.9-22.9	18.5-22.2	20.1-25.1	21.9-25.2
7	-	-	16.7-24.2	21.3-23.6	21.9-22.8	18.5-22.1	20.1-25.1	21.9-25.4
8	-	-	-	22.2-23.1	21.6-21.6	18.5-22.0	23.3-25.0	21.8-25.2
9	-	-	-	-	-	21.7	23.3	-

Source: NWQMC 2021, PIN 2021, personal communication with Dan Kusnierz (PIN), May 26, 2021.

“-” missing data.

Toxic Metals

In 1992, the Licensee completed a study to determine if impoundment water level fluctuations were linked to mercury concentrations in fish and aquatic organisms. The Licensee found that the mercury concentrations in sediments from impoundments with drawdowns (e.g., North Twin and Millinocket Lake) and Dolby Pond (does not drawdown) were not statistically different from control lakes. FERC concluded that there was no evidence to suggest that Project operations, including impoundment drawdowns, lead to increased mercury levels or the production of methyl mercury (FERC 1996).

Article 404 required the Licensee to file a plan with the Commission to assess mercury contamination in aquatic life by sampling game fish in the Ripogenus impoundment and the West Branch. In accordance with Article 404 of the Ripogenus license and Articles 405 of the Ripogenus and Penobscot Mills Project licenses, the Licensee cooperated in a study with other stakeholders to assess mercury contamination in aquatic life and to evaluate the inter-relationship and impacts of atmospheric deposition and water level fluctuations on toxic metals, including mercury.

In 1997, the University of Maine and the Licensee collected water and sediment samples and fish tissue samples in Lower Dolby Pond, Chesuncook Lake, and Seboeis Lake (control lake). Vertical profiles of water temperature and DO were also collected. Details of the monitoring methods and study results were provided in Haines and Norton (1999). In summary, the study found that:

- Chemical differences (e.g., pH, alkalinity, major cations and anions) in the three lakes were not sufficiently large to affect the chemical speciation of mercury.
- Chesuncook Lake and Seboeis Lake thermally stratified in the summer; Dolby Pond did not. DO concentrations remained high (>7 mg/L) during the stratification period in Chesuncook Lake. DO concentration was depleted at depth in Dolby Pond and Seboeis Lake.
- Mercury concentrations in the water were similar in the three lakes, did not differ by season, and were typical of water bodies not contaminated by point sources. Mercury was higher in the samples collected near the bottom in deep areas and in Dolby Pond, but the differences were not statistically significant.

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- Concentrations of mercury in sediment cores from each lake were within the range of values for other Maine lakes.
- Construction of Ripogenus dam did not affect sediment mercury accumulation to any significant degree.
- Concentration and accumulation of mercury in sediments was not correlated with any known activities in the basin.
- Mercury concentrations in landlocked salmon were higher in Chesuncook Lake fish than in the West Branch and were above average as compared to other locations in the State of Maine. It was theorized that this was because landlocked salmon were of wild origin and that in general there is some tendency for fish in impoundments to have higher concentrations than fish in river systems (Haines and Norton 1999).

The Licensee continues to file annual reports with FERC in compliance with Article 405 to describe toxic metal study activities in the West Branch.

Every five years (2005, 2010, 2015), the Licensee conducted mercury monitoring studies at the upstream Storage Project (FERC No. 2634) impoundments and analyzed mercury in water, fish, and crayfish. This monitoring was completed in cooperation with MDEP and other stakeholders. During the most recent sampling effort in September 2015, sampling was completed in four Storage Project lakes and one control lake (NAI 2016). The USEPA ambient water quality criteria for the protection of human health from the toxic properties of mercury ingested through water and contaminated aquatic organisms is 1.4 µg/L (1,400 ng/L, acute) and 0.77 µg/L (770 ng/L, chronic) (USEPA 2021). The State of Maine ambient water quality criteria for mercury in freshwater are 1.7 µg/L (1,700 ng/L, acute) and 0.91 µg/L (910 ng/L, chronic) (MRS 2019b). The mean mercury levels in water samples collected in 2015 ranged from 0.0011-0.0017 µg/L (1.1-1.7 ng/L), which were well below the USEPA and State of Maine criteria (Normandeau Associates, Inc. NAI 2016). In addition, the mean mercury levels in the water samples were comparable to the results from the 2005 and 2010 sampling (NAI 2016).

The results of the 2015 monitoring performed at the upstream Storage Project demonstrated that the majority of fish tissue samples collected from salmonid species contained total mercury levels greater than those recommended by the State of Maine Department of Health and Human Services

for children and pregnant women (NAI 2016). There were no salmonid human-health samples collected during 2015 which exceeded the U.S. Food and Drug Administration action level of 1.0 mg/kg (NAI 2016). Mean total mercury levels in crayfish composite samples collected from Canada Falls Lake during 2015 were below both the state and federal action levels.

Total mercury levels observed within salmonid species collected from Project reservoirs during 2015 appear to be consistent with data collected elsewhere in the State of Maine (NAI 2016).

Volunteer Lake Monitoring at the Penobscot Mills Project

The LSM Volunteer Lake Monitoring group has collected several Secchi disk measurements in the southern section of Ambajejus Lake (LSM 2021b). Two to four Secchi disk readings per year between May to September 2007 to 2011 were collected; the Secchi disk depth ranged from 3.5 m to 5.5 m (LSM 2021b). Additional measurements were collected on September 2, 2008, which indicated attainment with state water quality standards. During this sampling event, pH was 7.0, color was 48 PCU, conductivity was 24 μ S/cm, alkalinity was 7 mg/L, and total phosphorus was 6 μ g/L.

The LSM collected a water temperature and DO vertical profile and water samples in the deep area of Millinocket Lake on August 15, 2011, which indicated attainment with state water quality standards (LSM 2021c). The vertical profile demonstrated that the site was stratified with the epilimnion extending to a depth of approximately 10 m. In the epilimnion, DO ranged from 7.3 mg/L to 8.2 mg/L, and the water temperature was 21°C to 23°C. Below the thermocline, DO decreased to 5.0 mg/L and was 0.6 mg/L just above the sediment; the water temperature decreased to 11°C. The Secchi disk depth was 6.0 m, total phosphorus was 5 μ g/L, and chlorophyll-a was 1.8 μ g/L (LSM 2021c).

2007 West Branch and Penobscot River Study

MDEP monitored water quality throughout the West Branch and mainstem Penobscot River at 30 stations located downstream of Ferguson Pond to the confluence with the Atlantic Ocean in Bucksport in summer 2007 (MDEP 2008). The objective was to collect data to be used for calibration and verification of a water quality model. Sampling occurred from July 31 to August 2, 2007. Five sampling locations were in the West Branch: Ferguson Pond outlet, Dolby Pond

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inlet, upstream of Dolby Dam, upstream of the East Millinocket Dam, and downstream of the East Millinocket Dam. The water quality parameters measured included DO, water temperature, chlorophyll-a, and nutrients. Sampling occurred in the morning before 10 AM; DO and water temperature were also sampled in the afternoon. Results from the sampling sites within the Penobscot Mills Project boundary are included in Table 5.3-15 and Table 5.3-16. The DO data indicated attainment with the Class C standard in place at the time (MDEP 2008). The water temperature was 24°C to 28°C (Table 5.3-15). Total phosphorus was low at the Ferguson Pond outlet site, while the sites at the Dolby Pond inlet (Station WBP2) and upstream of the dam (Station WBP3a) indicated some nutrient enrichment (Table 5.3-16). Nitrogen concentrations were low. Chlorophyll-a was low except at the site upstream of Dolby Dam, which indicated the presence of algae.

Table 5.3-15
DO concentration (mg/L), DO percent saturation, and water temperature (°C) data
collected during the MDEP 2007 West Branch and Penobscot River Study

Depth (m)	Station WBP1 - Ferguson Pond Outlet					
	DO (mg/L)	DO % Saturation	Water Temperature (°C)	DO (mg/L)	DO % Saturation	Water Temperature (°C)
	July 31 Morning			July 31 Afternoon		
0	7.2	85.8	24.0	7.7	94.1	25.6
1	7.2	85.2	24.1	7.7	93.6	25.5
2	7.2	86.2	24.1	7.7	94.0	25.6
3	7.2	85.7	24.1	7.7	94.0	25.5
4	7.1	85.0	24.1	7.8	95.5	25.4
	August 1 Morning			August 1 Afternoon		
0	7.1	84.3	24.1	7.5	90.9	25.4
1	7.1	85.0	24.2	7.5	91.0	25.3
2	7.2	85.5	24.5	7.5	90.9	25.2
3	7.2	86.1	24.3	7.6	92.6	25.2
4				7.6	92.6	25.1
	August 2 Morning			August 2 Afternoon		
0	7.2	86.6	24.7	7.3	90.0	25.7
1	7.2	87.1	24.8	7.4	90.2	25.6
2	7.3	88.0	24.8	7.5	91.8	25.7
3	7.3	88.5	24.8	7.5	92.0	25.6
4	7.4	88.6	24.7	7.5	91.8	25.4

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Depth (m)	Station WBP2 - Dolby Pond Inlet					
	DO (mg/L)	DO % Saturation	Water Temperature (°C)	DO (mg/L)	DO % Saturation	Water Temperature (°C)
	July 31 Morning			July 31 Afternoon		
0	6.9	82.5	24.2	7.6	92.6	25.3
1	6.9	82.4	24.2	7.6	91.9	25.1
2	7.0	83.3	24.2	7.6	91.6	24.7
3	6.9	81.9	24.2	7.6	91.3	24.7
	August 1 Morning			August 1 Afternoon		
0	6.8	81.7	24.6	7.5	91.9	25.6
1	6.8	81.8	24.6	7.5	91.3	25.4
2	6.8	81.3	24.6	7.6	92.1	25.2
3	6.6	79.3	24.6	7.5	91.0	25.0
	August 2 Morning			August 2 Afternoon		
0	7.0	84.0	24.8	7.7	93.6	25.4
1	7.0	84.5	24.8	7.8	94.8	25.4
2	7.0	84.1	24.9	7.7	93.2	25.0
3	7.0	84.2	24.8	7.7	93.1	25.0
Depth (m)	WBP3a - Dolby Pond Dam (above)					
	DO (mg/L)	DO % Saturation	Water Temperature (°C)	DO (mg/L)	DO % Saturation	Water Temperature (°C)
	July 31 Morning			July 31 Afternoon		
0	8.9	109.1	25.5	9.8	125.6	28.0
1	8.9	108.6	25.5	9.8	124.7	27.7
2	8.8	107.4	25.4	9.4	111.7	25.7
3	8.8	107.0	25.4	8.4	101.9	25.4
4	8.6	104.6	25.4	8.2	99.4	25.3
5	8.6	105.0	25.3	8.1	98.0	25.2
6	8.2	99.2	25.2	7.7	93.2	25.0
7	7.3	88.4	24.9	7.2	86.6	24.8
8	7.0	83.6	24.6	7.0	84.1	24.5
	August 1 Morning			August 1 Afternoon		
0	8.9	109.4	25.8	10.4	134.2	28.5
1	8.9	108.7	25.8	10.2	126.0	26.2
2	8.7	107.1	25.8	9.0	110.2	25.8
3	8.5	103.9	25.7	8.6	105.2	25.6
4	8.4	102.8	25.7	8.3	101.4	25.5
5	8.2	100.0	25.6	8.2	100.5	25.5
6	7.4	89.7	25.4	7.5	91.6	25.3

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7	7.0	85.4	25.1	7.0	85.0	25.0
8	6.6	78.9	24.7	6.5	78.1	24.6
	August 2 Morning			August 2 Afternoon		
0	7.8	95.3	25.4	8.9	109.6	26.2
1	8.0	97.5	25.4	9.1	111.5	26.0
2	8.0	97.0	25.4	8.9	109.3	25.6
3	7.9	95.5	25.0	8.1	98.1	25.1
4	7.6	92.1	25.2	7.5	90.9	25.0
5	7.2	87.7	25.1	7.4	89.4	24.9
6	7.2	87.0	24.7	7.2	86.5	24.7
7	6.8	81.5	24.5	7.0	83.8	24.5
8	6.5	77.9	24.4	6.7	79.7	24.3
9	6.3	74.9	23.8	-	-	-
	Station WBP3b - Dolby Pond Dam (below)			DO (mg/L)	DO % Saturation	Water Temperature (°C)
Surface	July 31 Afternoon			8.2	99.8	25.2
Surface	August 1 Afternoon			8.0	97.3	25.2
Surface	August 2 Afternoon			7.7	92.7	24.7
Depth (m)	Station WBP4a - East Millinocket Dam (above)					
	DO (mg/L)	DO % Saturation	Water Temperature (°C)	DO (mg/L)	DO % Saturation	Water Temperature (°C)
	July 31 Morning			July 31 Afternoon		
0	8.1	98.3	25.5	8.1	98.4	25.5
1	8.0	97.7	25.5	8.2	99.7	25.5
	August 1 Morning			August 1 Afternoon		
0	8.0	96.7	25.3	8.2	100.8	25.9
1	7.8	95.3	25.3	8.1	99.0	25.8
2	-	-	-	8.1	98.9	25.8
3	-	-	-	8.1	98.7	25.7
	August 2 Morning			August 2 Afternoon		
0	7.5	90.5	24.6	7.8	94.8	25.3
1	7.5	90.5	24.6	7.8	94.9	25.3
2	7.5	89.6	24.6	7.8	94.5	25.2
	Station WBP4b - East Millinocket Dam (below)			DO (mg/L)	DO % Saturation	Water Temperature (°C)
Surface	July 31 Afternoon			8.6	105.0	25.5
Surface	August 1 Afternoon			8.4	103.0	25.9

Source: MDEP 2008.

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Table 5.3-16
Nutrient and chlorophyll-a data collected during the MDEP 2007 West Branch and
Penobscot River Study

Date	Total Phosphorus (µg/L)	Ortho-phosphate (µg/L)	Total Kjeldhal Nitrogen (mg/L)	Ammonia Nitrogen (mg/L)	Nitrite+ Nitrate Nitrogen (mg/L)	Nitrate (mg/L)	Chlorophyll-a (µg/L)
Station WBP1 - Ferguson Pond Outlet							
July 1	5	1	0.2	0.01	0.05	0.11	2.5
August 1	6	1	0.3	0.01	0.06	0.10	3.1
August 2	6	2	0.4	0.01	0.06	0.10	2.3
Station WBP2 - Dolby Pond Inlet							
July 1	23	9	0.3	0.02	0.06	0.13	2.4
August 1	22	2	0.3	0.02	0.06	0.12	3.7
August 2	19	7	0.5	0.02	0.06	0.12	2.0
Station WBP3a - Dolby Pond Dam (above)							
July 1	22	2	0.5	0.01	0.02	0.24	27
August 1	23	2	0.4	0.01	0.02	0.32	32
August 2	22	2	0.7	0.01	0.04	0.20	15

Source: MDEP 2008.

Benthic Macroinvertebrates

The MDEP Biological Monitoring Program monitors benthic macroinvertebrate and algae communities at multiple stations throughout the state to evaluate attainment with aquatic life standards. Several water quality parameters are measured at the time of installation and retrieval of the macroinvertebrate samplers. MDEP has completed benthic macroinvertebrate sampling at several sites in the Ripogenus Project and Penobscot Mills Project areas in the West Branch and in Millinocket Stream (MDEP 2021d).

Benthic macroinvertebrates include aquatic insects (e.g., mayflies, stoneflies), annelids (e.g., worms), arthropods (e.g., crayfish), and mollusks (e.g., freshwater mussels, snails). The abundance of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (EPT) is a useful indicator of water quality, because these species have a low tolerance to pollution; EPT richness values greater than 10 are indicative of excellent water quality. The Hilsenhoff Biotic Index (HBI) is another indicator of the level of pollution-sensitive macroinvertebrates in a surface water body; the HBI ranges from 0 to 10 with lower values indicating a higher abundance of pollution sensitive macroinvertebrates (Hilsenhoff 1987).

All of the benthic macroinvertebrate sampling results from Millinocket Stream (Table 5.3-17) and the West Branch (Table 5.3-18) over the past 30 years demonstrate that the water body was in

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attainment with its statutory class or was determined to meet the classification of a higher statutory class. In addition, DO concentrations and pH met the standards for their statutory class. Conductance was consistent with values for unpolluted/undisturbed waters (MDEP 2021c). EPT richness and HBI values were indicative of good to excellent water quality that supports pollution sensitive macroinvertebrates.

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Table 5.3-17

MDEP benthic macroinvertebrates monitoring results from Millinocket Stream (sites are listed from upstream to downstream)

Station	Location	Date	Statutory Class	Final Determination	Water Temp (°C)	DO (mg/L)	pH	Conductance (µS/cm)	EPT Richness	HBI
970	T01 R08 WELS, 2.5 river miles below Millinocket Lake Dam	7/6/2011	A	A	25.4	8.1	7.1	14	NA	
287	Millinocket (0.8 river miles below railroad)	8/28/1996	B	B	NA					
		7/19/2006	B	A	25.4	8.5		29		
		8/16/2006			21.7	8.7	6.7	24	21	3.55
		7/21/2011	B	A	24.6	8.2	6.6	17		
		9/21/2011			18	8.8	6.9	13	19	3.13
288	Millinocket (0.5 river miles upstream of the Millinocket tailrace)	8/28/1996	B	B	NA					
63	Millinocket (0.3 river miles downstream of the Millinocket tailrace)	8/27/1984	C	B	NA					
279	Millinocket (1.2 river miles downstream of the Millinocket tailrace)	9/27/1995	C	B	NA					

Source: MDEP 2021e.

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Table 5.3-18
MDEP benthic macroinvertebrates monitoring results from the West Branch Penobscot River
(sites are listed from upstream to downstream)

Station	Location	Date	Statutory Class	Final Determination	Water Temp (°C)	DO (mg/L)	pH	Conductance (µS/cm)	EPT Richness	HBI
586	T02 R10 WELS, 5.5 river miles downstream of McKay Station	8/21/2000	A	A	NA					
115	T02 R10 WELS, 7.1 river miles downstream of McKay Station	8/27/1987	B	B	NA					
763	T02 R10 WELS, Downstream of confluence with Nesowadnehunk Stream	8/15/2001	B	A	NA					
277	Millinocket, 1.7 river miles above Dolby Pond	9/29/1995	C	A	NA					
		8/28/1996	C	B	NA					
		7/6/2017	C	B	21.6	8.4 (95.8%)	7	25.8		
		8/2/2017			23.1	8.3 (96.8%)	7.1	25.6	22	4.12
762	Medway 0.8 river miles downstream of East Millinocket dam	7/5/2017	C	B	21.6	8.4 (94.9%)	6.8	25.4		
		8/2/2017			24.3	7.8 (93.6%)	6.9	25.7	16	4.97

Source: MDEP 2021e.

5.4 Fish and Aquatic Resources

5.4.1 Existing Fish and Aquatic Communities

5.4.1.1 Regional Fisheries

Fisheries Management

Fisheries management in most of the Ripogenus and Penobscot Mills Project areas emphasizes the recreationally valuable landlocked salmon fishery. The MDIFW has created a management plan that specifies the goals and objectives of the landlocked salmon fishery through 2022. The current statewide management goals for landlocked salmon are to maintain the current distribution of “principal” fisheries for landlocked salmon, provide for a diversity of fishing opportunities, maintain and where possible expand the contribution of wild salmon to the population, and increase the statewide fishing quality. Each of these goals will be achieved with a combination of harvest regulation, supplemental stocking, and habitat protection objectives (MDIFW 2012).

Except for a small section of the West Branch below Route 11 and Route 157, most of the area in the Ripogenus and Penobscot Mills Projects is considered the North Zone for statewide fishing regulations. The North Zone contains an abundance of wild and native coldwater fisheries and is managed to protect and conserve these resources. The South Zone contains predominantly stocked coldwater fisheries and warmwater fisheries (MDIFW 2021a).

Landlocked salmon fisheries exist in the Project impoundments, chiefly the Ripogenus, North Twin and Millinocket Lake impoundments, most of which are wild and self-sustaining fisheries. Downstream of McKay Station to approximately Abol Bridge, the West Branch is a popular landlocked salmon fishery that is self-sustaining as well. Quakish Lake (part of the Millinocket impoundment) and the Dolby and East Millinocket impoundments are passively managed with a fishery consisting of incidental drop-down landlocked salmon as well as warm water species such as smallmouth bass, pickerel, white perch and yellow perch (Yoder, et al. 2008).

In addition, there are secondary coldwater fisheries for brook trout (including stocking by GLHA and MDIFW in Millinocket Stream), whitefish, and lake trout, the latter of which are stocked by MDIFW on alternate years in the North Twin and Millinocket Lake impoundments. The

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Chesuncook Lake basin of the Ripogenus impoundment was actively managed for lake trout in the past, but was discontinued in 1994 (J Bagley, MDIFW *personal communication*).

Table 5.4-1
Maine Fishing Season Regulations

Lakes and Ponds		Rivers, Streams, Brooks	
North Zone	From April 1 to September 30: open to open water fishing. From October 1 to March 31: closed to all fishing.	North and South Zones	From April 1 to August 15: open to open water fishing. From August 16 to September 30: open to open water fishing using artificial lures or flies only. General law length and bag limits apply, except daily bag limit one landlocked salmon and one brook trout. From October 1 to March 31: closed to all fishing.
South Zone	January 1 to December 31: open to ice and open water fishing		

Source: MDIFW 2021a.

Table 5.4-2 summarizes available stocking information provided by MDIFW for the Penobscot Mills Project. Stocking records date back to as early as 1937 (North Twin and Millinocket Lake impoundments). Stocked species are comprised of landlocked salmon, lake trout and brook trout.

Table 5.4-2
Historic MDIFW fish stocking in the Penobscot Mills Project

Water Body	Years Stocked	Species	Number	Average Length*
Millinocket Lake impoundment	1963-2019	lake trout	215,427	200
Millinocket Lake impoundment	1937-2020	landlocked salmon	448,367	221
Millinocket Stream	1972-2020	brook trout	149,109	NA
North Twin impoundment	2000-2020	brook trout	39,363	282
North Twin impoundment	1976-2020	lake trout	166,804	201
North Twin impoundment	1937-2017	landlocked salmon	441,071	247

* Average length data based on data available from most recent years of stocking and may not reflect early years of stocking practices.

Source: K. Dunham, MDIFW.

In addition to stocking efforts by MDIFW in the Project areas, GLHA annually stocks adult brook trout in Millinocket Stream to provide a seasonal fishery as an enhancement measure pursuant to Article 413 of the 1996 license. GLHA has implemented the 1997 Millinocket Stream Fisheries Management Plan such that in May and September annually, 500 fin-clipped hatchery brook trout generally ranging from 1-3 fish per pound are stocked at 5 locations in Millinocket Stream. GLHA completed 5 years (1998-2002) of monitoring of trout stocking as required, which demonstrated that the stocking has achieved the goal of increased angler use/catch on Millinocket Stream;

therefore, monitoring was discontinued in 2003. GLHA continues to perform the May and September trout stocking.

During the prior relicensing, lake trout were managed as a recreational fishery in the Ripogenus, North Twin, and Millinocket Lake impoundments. Since the 1990s, MDIFW management strategies have shifted due to competition of lake trout with other coldwater species for the lacustrine smelt forage base, and the ultimate adverse effect on the growth and condition of the competing salmonids in some water bodies (MDIFW 2001). Therefore, lake trout are no longer stocked and managed as a fishery in Chesuncook Lake (J. Bagley, MDIFW, personal communication, April 16, 2021).

Key Fish Species in the Project Area

Landlocked Salmon

Landlocked salmon are a freshwater form of the sea-run Atlantic salmon (*Salmo salar*). The landlocked salmon is the most sought-after coldwater game species in the State of Maine after brook trout. Landlocked salmon respond well to recreational management due to their growth rates, longevity, habitat tolerance and ability to be raised in hatcheries (MDIWF 2012).

The life history of landlocked salmon is similar to anadromous sea-run Atlantic Salmon, except that landlocked salmon subadults reside in freshwater impoundments or mainstem rivers rather than in the ocean. The landlocked salmon originated from anadromous Atlantic salmon through physiological adaptation and are not native to the Project waters. Rearing and spawning habitat requirements are similar to anadromous Atlantic salmon (as described below) (FERC 1996).

Landlocked salmon spawn from mid-October to late November in lake inlet, outlets, or shoals if riverine habitat is lacking. The eggs are buried in gravel substrate from 4 to 12 inches deep until they hatch in the spring. Young salmon emerge from the gravel substrate about 6 weeks following hatching. Juvenile salmon spend 1 to 4 years in the stream habitat before moving to a lake. Sexual maturity varies greatly within the species with females typically maturing at a later age than males. Most spawning runs consist of fish between 3 and 5 years of age. Landlocked salmon may be repeat spawners, either in consecutive or alternate years (MDIFW 2012).

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Landlocked salmon use both lacustrine and riverine habitats throughout their life cycle. Salmon smolts move from nursery habitat in their natal rivers to lake habitat where they forage and mature until ready to spawn. Typical lake habitat consists of a clear, cool, deep lake that has rocky shores and well-oxygenated water. Salmon prefer water temperatures of less than 65°F, and thus during the summer when lakes stratify, they seek cooler water where DO levels remain above 8 mg/L. In addition to water quality requirements, forage availability is an important component of the lake habitats. Rainbow smelt (*Osmerus mordax*) is the most important forage species for the landlocked salmon. In habitats where rainbow smelt populations are less than adequate, growth and survival in landlocked salmon will decrease. Lastly, another important habitat requirement of lakes for wild populations is access to a fast-flowing stream inlet or outlet with gravel substrate for spawning. While these requirements describe an optimal habitat for “trophy-size” fish, landlocked salmon fisheries have still been established in lakes with less than optimal water quality conditions (MDIFW 2012).

Landlocked salmon spawning habitat consists of unimbedded gravel areas containing substrate that ranges from 0.5 to 4 inches in diameter. These gravel areas require well-oxygenated water through the redds, because salmon eggs are sometimes deposited up to 12 inches deep. During spawning, water temperatures typically range from 45 to 50°F. The optimal temperature for landlocked salmon egg development is 43°F (MDIFW 2012).

Nursery habitat for juvenile salmon consists of shallow riffles, with a mix of deeper pools and riffles. The substrate in these areas typically ranges from 0.5 to 9 inches. Juvenile salmon can grow at water temperatures below 45°F, but optimal growth is in streams where daily temperature peaks at 72 to 77°F. Water temperatures greater than 83°F are harmful to juvenile salmon (MDIFW 2012).

Adult salmon riverine habitat requires resting and holding areas that offer refuge from strong currents. The pools tend to lack structure and are typically warmer than the rest of the stream. Holding areas are typically close to spawning grounds and typically consist of gravel substrate with nose velocities that are less than 1.6 feet per second. Optimum water temperatures in these holding areas range from 50 to 54°F, but warmer daytime temperatures can be tolerated if temperatures cool significantly at night (FERC 1996).

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Landlocked salmon are native to lakes in the eastern part of North America, in Maine, New Brunswick and Nova Scotia. Before 1868, landlocked salmon only occurred in four Maine river basins, but by 1900 were introduced into new watersheds. Introductions into systems with less than suitable habitat requirements often were unsuccessful, unless supplemented with continuous stockings (MDIFW 2012).

The landlocked salmon population within the Project areas is maintained by both natural reproduction and hatchery stockings. The Ripogenus Project area and portions of the Penobscot Mills Project area consist of naturally reproducing populations. Seven tributaries to the Ripogenus impoundment support landlocked salmon spawning runs, including the upper West Branch. Small spawning tributaries also exist in the West Branch from McKay Station downstream to the North Twin impoundment, but most salmon spawning occurs in the West Branch itself. In addition, pursuant to the 1996 license, the Licensee developed a spawning and nursery habitat improvement project in a side channel upstream of Telos Bridge (Holbrook Side Channel) to further enhance natural reproduction in the river. Annual monitoring performed between 1998-2002 demonstrated that the Holbrook Side Channel provides habitat in support of landlocked salmon spawning and incubation.

Landlocked salmon found in the Penobscot Mills Project area are primarily wild origin fish that may spawn in Nahmakanta Stream or the lower reaches of the West Branch upstream of the North Twin impoundment. This population is supplemented by additional stocking. Between 1988 and 1989, landlocked salmon catch rates by anglers were between 0.38 to 0.40 fish per day (GNNC 1991b). Wild fish found in North Twin or Millinocket Lake impoundments likely originated in the West Branch or tributaries of the impoundments, such as Nahmakanta Stream. Landlocked salmon less frequently occur downstream of the North Twin Dam and are incidental drop-down individuals. There are no tributaries or riverine spawning habitat between North Twin Dam and Quakish Lake. Dolby Pond, Millinocket Stream, Quakish Lake, East Millinocket impoundment, and the remaining riverine reaches of the Penobscot Mills Project area contain small numbers of landlocked salmon, of mostly hatchery origin (FERC 1996).

Brook Trout

Both the Ripogenus and Penobscot Mills Projects are within the native range of the brook trout. The brook trout (*Salvelinus fontinalis*) fishery in the West Branch declined during the 1950s as the landlocked salmon fishery increased in popularity (FERC 1996).

Brook trout are typically found in clear streams, rivers and lakes. They typically exhibit upstream movements in the early spring and later fall. Brook trout feed upon a variety of organisms including macroinvertebrates, terrestrial invertebrates, fishes, and amphibians. Larger lacustrine-dwelling adults prey more on fish such as rainbow smelt. Brook trout require well-oxygenated areas with gravel substrate for spawning. Temperatures of less than 18°C (64.4°F) are optimal for growth; the upper thermal lethal limit for brook trout is reported as 24°C (75°F). Spawning occurs in the fall, typically October or early November. The female digs a redd, and once completed, the male joins and they jointly deposit and fertilize eggs. The female then covers the eggs by sweeping small gravel substrate over the redd (FishBase 2021c). Egg incubation occurs during winter months with fry emerging in the spring.

Brook trout are native to Maine and widely distributed statewide as both natural populations and stocked fisheries. They are stocked in Millinocket Stream downstream of the Millinocket Lake Storage Dam and occur in isolated populations distributed throughout the drainage, primarily in tributaries and other lentic waterbodies with consistently cold and well-oxygenated water (GNNC 1991b).

Lake Trout

Lake trout (*Salvelinus namaycush*) are widely distributed across the northern tier of North America, and the Ripogenus and Penobscot Mills Projects are within this native range. (USFWS 2021b). They are largest of the freshwater charr species and inhabit deep lakes including the Ripogenus, North Twin, and Millinocket Lake impoundments. They have also been found in Quakish Lake, as migrants from upstream populations (FERC 1996).

Lake trout feed upon crustaceans, fishes, plankton, and small mammals. They occasionally occupy freshwater streams but are typically found in deep lakes. In Maine lakes, lake trout feed heavily

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on rainbow smelt, and thus compete with landlocked salmon. Lake trout spawn during the fall and are broadcast spawners (USFWS 2021b). They spawn at depth from 6 inches to 15 feet, and the eggs are deposited between rocky substrate.

Lake trout are distributed throughout the Ripogenus, North Twin and Millinocket Lake impoundments. At the Penobscot Mills Project, in an effort to establish a lake trout fishery, between 1992 and 2008, MDIFW stocked over 54,000 lake trout in the North Twin impoundment. To track the progress of the stocking effort, seven sampling events occurred over the duration of this effort, and no wild lake trout were documented. Thus, the attempt to establish a wild lake trout population in North Twin impoundment was unsuccessful (GLHA 2011). Since then, MDIFW has managed North Twin and Millinocket Lake impoundments as put-and-take fisheries, alternating stockings between these impoundments each year (Kevin Dunham, MDIFW, personal communication, May 5, 2021).

Rainbow Smelt

Rainbow smelt are distributed through North America in the northern Atlantic and Pacific drainages (FishBase 2021b). The smelt occurring in the Project areas are landlocked and spawn in tributaries of the impoundments, as well as in the West Branch. Rainbow smelt are found in all impoundments of the Ripogenus and Penobscot Mills Projects and are an important forage for the landlocked salmon. “Smelt drift” occurs when smelt schools move from one water body to another via connecting stream/river flows, or in the case of the hydropower project dams, via spillage or turbine passage. Regardless, smelt drift provides a critically important source of forage for landlocked salmon residing in the West Branch downstream of McKay Station, and they have been documented at most of the Penobscot Mills Project developments (FERC 1996). Smelt drift is substantial in the West Branch downstream of McKay Station, as well as downstream of the North Twin Dam. Smelt drift is less substantial but has been documented in Millinocket Stream downstream of the Millinocket Lake Storage Dam. In addition, smelt drift potentially occurs in the Back Channel downstream of Stone Dam and below the East Millinocket Dam (GNNC 1991b). A study conducted as part of the last relicensing effort found that total smelt drift averaged 28,085 pounds per year at the Ripogenus Project between 1984 and 1989.

Rainbow smelt are a pelagic species typically found in clear cool lakes, large rivers or coastal waters. There are anadromous populations in coastal areas and landlocked populations inland. Spring spawning migrations occur when water temperatures are between 48 and 65°F, typically lasting three weeks (FishBase 2021b). Rainbow smelt spawn in tributaries to impoundments and mainstem rivers. They migrate into tributaries during the evening and return to the lake during the morning.

Rainbow smelt occur in all of the Ripogenus and Penobscot Mills Project impoundments in various abundance levels, and they use many of the Project tributaries on a seasonal basis during spring spawning migrations. Rainbow smelt populations are substantial in the Ripogenus, North Twin, Millinocket Lake, and Dolby impoundments. Rainbow smelt drift is also believed to occur below all the Project dams, since they are found in the impoundments (MDMR 2021).

Migratory Fish Species

The Penobscot River basin supports a variety of diadromous fish species including Atlantic salmon, American shad, alewife, and blueback herring (collectively referred to as river herring), American eel, and sea lamprey during some portion of their life histories. None of these species currently occur in waters of the Ripogenus or Penobscot Mills Projects, except for the catadromous American eel. The West Branch is not currently managed for anadromous fish. Information including the life histories and temporal and spatial distribution of several key diadromous species is presented in the following sections.

American Eel

American eel (*Anguilla rostrata*) is a catadromous species occurring in the Penobscot River basin. They are widely distributed throughout the Atlantic and Gulf coast tributaries of North America. Adults migrate to the Sargasso Sea to spawn, and the offspring enter freshwater to grow and mature. Immature eels (elvers) migrate into freshwater rivers and lakes where they take up residence and are known as “yellow” eels. Unlike anadromous fish, individual American eels do not have an affinity to a native stream. They may reside in freshwater for up to 40 years prior to emigrating back to the ocean to spawn. The upstream extent of juvenile eels in river habitat may

vary. Density dependent competition forces eels to disperse into upstream habitats when the carrying capacity of yellow eels is exceeded in downstream habitats (USFWS 2015a).

American eel are habitat generalists. Freshwater habitat typically consists of lakes, ponds, or low-gradient low-velocity areas of rivers. They utilize deep pool habitat with boulders and large woody debris or other forms of cover (FishBase 2021a).

American Eel have been found in each of the Project impoundments. Juvenile eels have the ability to ascend damp, rough surfaces of dams, resulting in their distribution above dams in the Project areas (Gulf of Maine Council on the Marine Environment [GMCME] 2007). They also inhabit West Branch riverine habitats and have been documented in fish assemblage catches from the 1980s (FERC 1996) and more recently in 2004 (Yoder, et al. 2008).

American Shad

Adult American shad begin upstream movements into rivers during May or June at northern latitudes, and peak spawning occurs around 18.5°C. Spawning generally occurs at night, beginning at sundown and continuing until after midnight. After hatching, young American shad use riverine habitat for their first growing season, and they outmigrate in schools to the marine environment during the fall. In northern rivers, American shad spawn after spending several years at sea, and individuals can sometimes spawn multiple times (USFWS 2021a).

American shad have a historical range that extends from southeastern Canada to central Florida (USFWS 2021a), and they are indigenous to the Penobscot River. There are no current American shad populations within the Project areas, but the historical upstream extent of American shad in the West Branch was Grand Falls just upstream of Shad Pond.

According to MDMR (2008), the segment of the West Branch between the Mattaceunk Project (FERC No. 2520) Dam and Grand Falls accounts for 1.7 percent of the Penobscot River basin's potential American shad production. There are American shad restoration efforts occurring in the Penobscot River drainage downstream of the Penobscot Mills Project. Maine DMR's Penobscot River Diadromous Strategic Plan for Restoration (MDMR 2008) for American shad calls for "allowing adults to pass upstream and spawn naturally; trucking adults to specific river reaches

and allowing them spawn naturally, stocking hatchery-reared fry or fingerlings in the river or some combination of these measures.”

Atlantic Salmon

In 2009, NMFS listed the Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon as a threatened species under the Endangered Species Act (ESA). Atlantic salmon life history includes spawning and rearing in freshwater rivers and streams, as well as extensive feeding migrations and sexual maturation in the marine environment (Fay et al. 2006). The freshwater juvenile stage of the life cycle can last from one to three years, after which juveniles undergo a physiological transformation (smoltification) and migrate downstream to spend one to three years at sea before returning to freshwater to spawn in their natal rivers. Unlike Pacific salmon, Atlantic salmon do not die after spawning and can return to sea to repeat the migratory cycle.

Although spawning by Atlantic salmon does not occur until late October or November, most adult Atlantic salmon ascend rivers beginning in the spring. In the Penobscot River, the peak upstream migration of adults occurs in June, but may persist until the fall (Fay et al. 2006). Salmon that return early in the spring spend nearly five months in the river before spawning, seeking cool water refuges (e.g., deep pools, springs, and mouths of small cold-water tributaries) during the summer months (Fay et al. 2006). Following spawning, adults (“kelts”) may move downstream in either the fall or the following spring, eventually reaching the estuary and ocean. Once in the marine environment, these salmon resume feeding, and a small percentage may return as repeat spawners one to two years later.

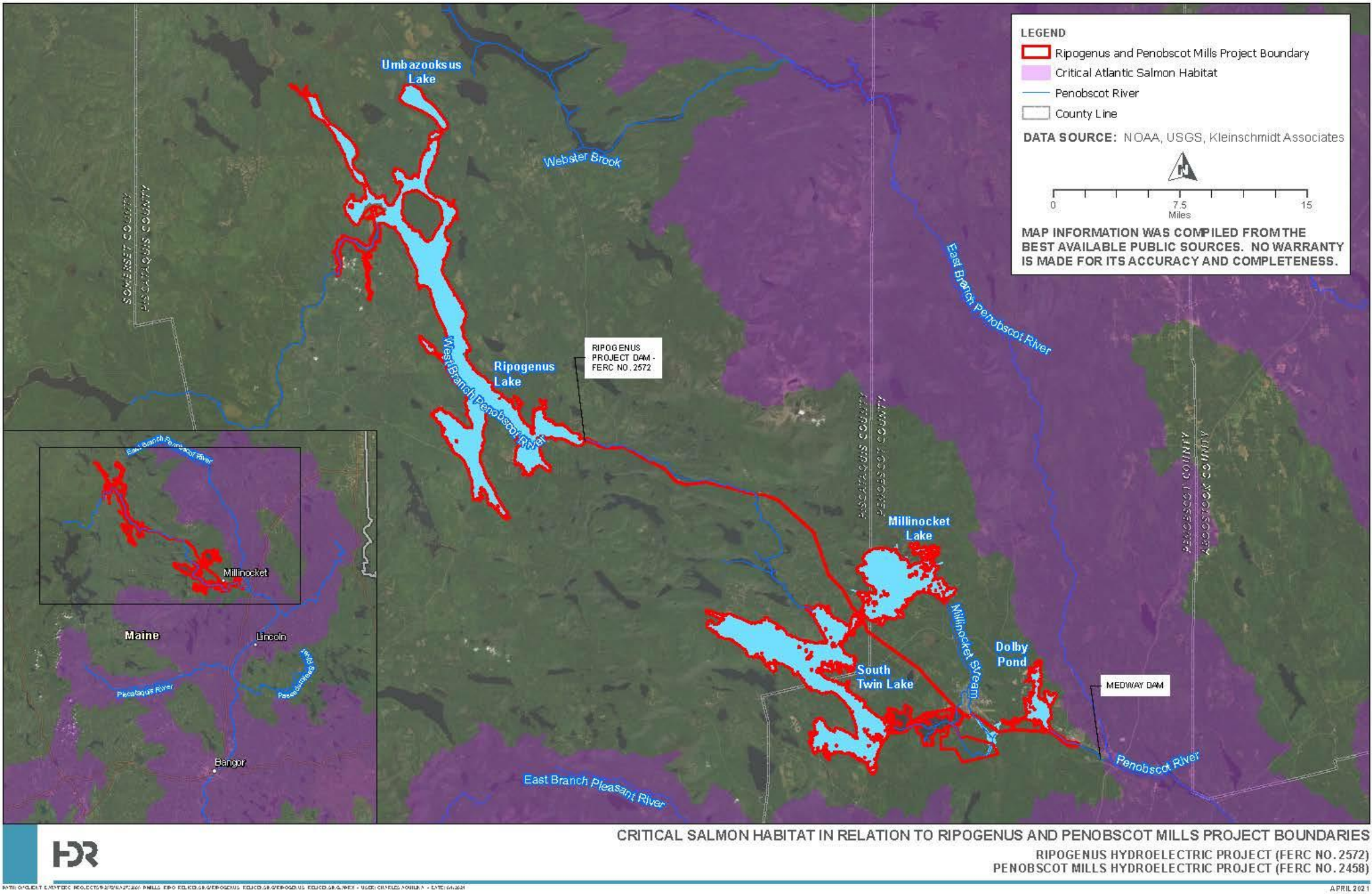
Preferred spawning habitat consists of gravel substrate with adequate water circulation to keep buried eggs well oxygenated. Juvenile salmon (parr) remain in freshwater habitat for one to three years (typically two years in Maine), then undergo a series of physiological, morphological, and behavioral changes in a process called “smoltification.” This transformation occurs in the spring and prepares the juvenile salmon (“smolt”) for its migration from a freshwater to marine environment (Fay et al. 2006). In the Penobscot River, smolts migrate between late April and early June with a peak migration in early May (Fay et al. 2006).

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Atlantic salmon historically occurred throughout the Penobscot River basin, and the upstream extent of their distribution on the West Branch included the North and South branches of the Penobscot River (Dan Kircheis, NOAA, undated document *Atlantic Salmon Gulf of Maine Distinct Population Segment and Critical Habitat Map Book*), including upstream as far as Penobscot Brook on the South Branch (Federal Register / Vol. 74, No. 117). Currently, sea-run Atlantic salmon occupy the mainstem Penobscot and the East Branch of the Penobscot River, but they do not occur in the West Branch.

On June 19, 2009, NMFS and the USFWS expanded the ESA endangered listing range for GOM DPS Atlantic salmon (NMFS 2009a). The GOM DPS of Atlantic salmon is divided into three salmon habitat recovery units (SHRUs) within the range of the GOM DPS. These include the Downeast Coastal SHRU, the Penobscot Bay SHRU, and the Merrymeeting Bay SHRU (NOAA 2009). Coincident with the June 19, 2009 endangered listing, NMFS designated critical habitat for the GOM DPS of Atlantic salmon (NMFS 2009b). Within the Penobscot Bay SHRU, critical habitat for GOM DPS Atlantic salmon includes the mainstem Penobscot River to just downstream of the confluence of the East and West branches, as well as the East Branch (Figure 5.4-1). There is no critical habitat for GOM DPS Atlantic salmon on the West Branch nor within the Project boundaries of the Ripogenus or Penobscot Mills Projects.

Figure 5.4-1
GOM DPS Atlantic Salmon Critical Habitat



Other Fish Species in the Project Area

Impoundment

The Project impoundments support both coldwater and warmwater species depending upon impoundment habitat. Fish species that are known to be present in the Project impoundments are listed below in Table 5.4-3. Warmwater species are generally found in shallower impoundments of the Penobscot Mills Project. Smallmouth bass and chain pickerel are important warmwater species that are found in these habitats. Smallmouth bass spawn in the spring in the littoral zone of the impoundments. Additionally, other recreationally important species known to exist in the Project impoundments include the lake whitefish, burbot, white perch, yellow perch, pumpkinseed and redbreast sunfish. These impoundments also support a typical fisheries assemblage of non-game species including creek chub, fallfish, blacknose dace, white sucker, common shiner, slimy sculpin, banded killifish, and ninespine stickleback (FERC 1996).

Riverine

The riverine sections downstream of the Project dams support a mixture of coldwater and warmwater species. In addition to the key species identified above, other recreationally important species found in the riverine habitat include smallmouth bass, white perch, yellow perch, and brown bullhead (Table 5.4-4). Generally, the warmwater game species are occurring in greater abundance in the riverine habitat within the Penobscot Mills Project area rather than the Ripogenus Project area. Non-game riverine species include white sucker, longnose sucker, fallfish, blacknose dace, common shiner, golden shiner, lake chub, and the slimy sculpin.

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Table 5.4-3
Fish Species Known to Occur in the Ripogenus and Penobscot Mills Project Impoundments

Common Name	Scientific Name	Ripogenus Project	Penobscot Mills Project				
		Ripogenus Impoundment	North Twin	Millinocket Lake	Quakish Lake	Dolby Pond	East Millinocket
Landlocked Salmon	<i>Salmo salar</i>	X	X ²	X ²	X	X ¹	X ¹
Brook Trout	<i>Salvelinus fontinalis</i>	X	X	X	0	X	X
Lake Trout (Togue)	<i>Salvelinus namaycush</i>	X ²	X ²	X ²	X ¹	0	0
Lake Whitefish	<i>Coregonus clupeaformis</i>	X	X	X	0	0	0
Rainbow Smelt	<i>Osmerus mordax</i>	X	X	X	X	X	X ¹
Burbot (Cusk)	<i>Lota lota</i>	X	X	X	0	0	0
Smallmouth Bass	<i>Micropterus dolomieu</i>	0	0	0	0	X	X
Chain Pickerel	<i>Esox niger</i>	0	X	X	X	X	X
White Perch	<i>Marone americana</i>	X	X	X	X	X	X
Yellow Perch	<i>Perea flavescens</i>	X	X	X	X	X	X
Redbreast Sunfish	<i>Lepomis aurltus</i>	0	X	X	X	X	X
Pumpkinseed	<i>Lepomis gibbosus</i>	0	X	X	X	X	X
Brown Bullhead	<i>Ictalurus nebulosus</i>	X	X	X	X	X	X
American Eel	<i>Anguilla rostrata</i>	X	X	X	X	X	X
White Sucker	<i>Catostomus commersoni</i>	X	X	X	X	X	X
Longnose Sucker	<i>Catostomus catostomus</i>	X	X	X	X	X	X
Fallfish	<i>Semotilus corporalis</i>	X	X	X	X	X	X
Pearl Dace	<i>Semotilus margarita</i>	0	0	X	0	0	0
Blacknose Dace	<i>Rhinichthys atratulus</i>	X	X	X	X	X	X
Lake Chub	<i>Couesius plumbeus</i>	X	X	X	X	X	0
Common Shiner	<i>Notropis cornutus</i>	X	X	X	X	X	X
Golden Shiner	<i>Notemigonus crysoleucas</i>	X	X	X	X	X	X
Creek Chub	<i>Semotilus atromaculatus</i>	X	X	X	X	X	X

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Common Name	Scientific Name	Ripogenus Project	Penobscot Mills Project				
		Ripogenus Impoundment	North Twin	Millinocket Lake	Quakish Lake	Dolby Pond	East Millinocket
Fathead Minnow	<i>Pimephales promelas</i>	0	X	0	0	0	0
Ninespine Stickleback	<i>Pungitius pungitius</i>	X	X	X	X	0	0
Slimy Sculpin	<i>Cottus cognatus</i>	X	X	X	X	X	X
Banded Killifish	<i>Fundulus diaphanus</i>	0	X	X	X	X	X

^{1.} Migrants from upstream, downstream, or tributary water only.

^{2.} Stocked.

Table 5.4-4
Fish Species Known to be Present in Rivers within the Ripogenus and Penobscot Mills Project Areas

Common Name	Scientific Name	Ripogenus Project		Penobscot Mills Project								
		West Branch Below McKay Station		West Branch – Upper Gorge	West Branch North Twin Dam to Quakish Lake		West Branch Millinocket Development Tailrace to Dolby Pond		West Branch East Millinocket Development Tailrace	Millinocket Stream		Back Channel
		Historical Data (1991 Exhibit E ³)	IBI Data (2004) - River Mile (43.80, 37.60)	Historical Data (1991 Exhibit E ³)	Historical Data (1991 Exhibit E ³)	IBI Data (2004) - River Mile (11.7)	Historical Data (1991 Exhibit E ³)	IBI Data (2004) - River Mile (5.60, 3.70)	Historical Data (1991 Exhibit E ³)	Historical Data (1991 Exhibit E ³)	IBI Data (2004) - River Mile (1.90, 3.30)	Historical Data (1991 Exhibit E ³)
Landlocked Salmon	<i>Salmo salar</i>	X	X	X	X	X	X ¹	-	X ¹	X	-	X ¹
Brook Trout	<i>Salvelinus fontinalis</i>	X	-	X	X	-	X	-	-	X ²	-	-
Lake Trout (Togue)	<i>Salvelinus namaycush</i>	X	-	X	-	-	-	-	-	X ¹	-	-
Splake	<i>Salvelinus namaycush</i> x <i>Salvelinus fontinalis</i>	X	-	-	-	-	-	-	-	-	-	-
Lake Whitefish	<i>Coregonus clupeaformis</i>	X ²	-	-	-	-	-	-	-	-	-	-
Round Whitefish	<i>Prosopium cylindraceum</i>	X	-	-	-	-	-	-	-	-	-	-
Rainbow Smelt	<i>Osmerus mordax</i>	X ¹	-	X ¹	X ¹	-	X ¹	-	X ¹	X ¹	-	-
Burbot (Cusk)	<i>Lota lota</i>	X	-	-	-	-	-	-	-	X	-	-
Smallmouth Bass	<i>Micropterus dolomieu</i>	-	-	-	-	-	X	X	X	X	X	X ³
Chain Pickerel	<i>Esox niger</i>	X	-	-	X	X	X	X	-	X	X	-
White Perch	<i>Marone americana</i>	X	X	X	X	X	X	X	X	X	X	-
Yellow Perch	<i>Perea flavescens</i>	X	X	X	X	X	X	X	-	X	X	-
Redbreast Sunfish	<i>Lepomis auritus</i>	X	-	-	-	X	-	X	-	X	X	X
Pumpkinseed	<i>Lepomis gibbosus</i>	-	-	-	-	X	-	-	-	-	-	-
Brown Bullhead	<i>Ictalurus nebulosus</i>	X	X	-	-	X	X	X	-	-	-	-
American Eel	<i>Anguilla rostrata</i>	X	X	X	X	-	X	X	X	X	X	-
White Sucker	<i>Catostomus commersoni</i>	X	X	X	X	X	X	X	X	X	X	X
Longnose Sucker	<i>Catostomus catostomus</i>	X	-	X	X	-	X	-	-	X	-	-
Fallfish	<i>Semotilus corporalis</i>	X	-	X	X	X	X	X	-	X	X	-
Pearl Dace	<i>Semotilus margarita</i>	-	-	-	-	-	-	-	-	-	-	-
Blacknose Dace	<i>Rhinichthys atratulus</i>	X	X	X	X	X	X	-	-	X	X	-
Lake Chub	<i>Couesius plumbeus</i>	X	X	-	-	X	-	-	-	-	-	-
Common Shiner	<i>Notropis cornutus</i>	X	X	-	-	X	-	X	-	X	X	X
Golden Shiner	<i>Notemigonus crysoleucas</i>	X	-	-	-	X	-	X	-	-	X	-
Creek Chub	<i>Semotilus atromaculatus</i>	-	-	-	-	-	-	-	-	X	-	X
Fathead Minnow	<i>Pimephales promelas</i>	-	-	-	X	-	-	-	-	-	-	-
Ninespine Stickleback	<i>Pungitilus pungitilus</i>	X	-	-	X	-	X	-	-	-	-	-
Slimy Sculpin	<i>Cottus cognatus</i>	X	X	X	X	X	X	-	-	X	-	X
Banded Killifish	<i>Fundulus diaphanus</i>	-	-	-	-	X	-	-	-	-	-	-

^{1.} Migrants from upstream, downstream, or tributary water only.
^{2.} Stocked.
^{3.} Source: GNP 1991a, 1991b.

5.4.1.2 Ripogenus Project

Ripogenus Impoundment

Aquatic Habitat

Ripogenus Dam creates a 20.8-mile-long, contiguous impoundment that includes different arms of the impoundment and two primary bodies of water: Ripogenus Lake and Chesuncook Lake; Caribou Lake, Black Pond, and Brandy Pond form smaller arms of the impoundment. Ripogenus Lake, Caribou Lake, and Chesuncook Lake are generally oligotrophic, with maximum depths of 150 feet, 84 feet, and 115 feet, respectively (GNNC 1991a). Black and Brandy Ponds are shallower and mesotrophic. At normal full pond elevation, the Ripogenus impoundment has a volume of 710,000 acre-feet and a surface area of 29,270 acres (GNNC 1991a).

Coarse substrates are common throughout much of the shoreline, with sandy areas in localized pockets of shoreline habitat. Shoreline reaches are generally wave-swept, and not conducive to the growth of aquatic vegetation. Approximately 73 miles of shoreline habitat within the Ripogenus Project area is protected by a conservation easement established by GNP and the State of Maine during the previous relicensing (FERC 1996). The conservation easement with the State of Maine was established on GNP-owned shoreline lands within 250 feet of the normal full pond elevation of Chesuncook and Ripogenus Lakes and Brandy and Black Ponds.

The Licensee operates the Ripogenus Project to manage flood flows in the river basin on an annual basis. The impoundment is gradually drawn down throughout the year and reaches its lowest annual level in early spring. This operating regime also allows the Licensee to provide a consistent flow release to meet downstream river flow targets during the rest of the year. Spring runoff then replenishes water in the impoundment, although the impoundment may not refill to its normal full pond elevation during low water years (FERC 1996).

The Ripogenus impoundment is bordered by approximately 1,251 acres of wetlands, of which approximately 80 percent are at least partially hydrologically independent of the impoundment (GNNC 1991a). Approximately 20 percent of the wetlands are hydrologically dependent on impoundment levels. Wetlands that are hydrologically associated with the impoundment contain plant species that are somewhat tolerant of water level fluctuations and are generally not of high

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value to wildlife. The narrow band of affected wetlands occurs around the periphery of the impoundment, and these wetlands do not contain deep, organic substrates or additional sources of inflow independent of the impoundment (FERC 1996).

Positive effects of the impoundment drawdowns include removal of the well-mixed epilimnetic water. This process increases mixing and promotes a somewhat earlier fall circulation. The early mixing can limit the severity of the oxygen deficit in the hypolimnion later in the stratification season. The annual drawdown also enhances removal of nutrients in the form of algal matter and detritus. While this removal likely does little to affect the impoundment, the removal of this productivity introduces valuable food organisms and nutrients to the West Branch through McKay Station discharges (GNNC 1991a).

Nineteen tributaries feed into the Ripogenus impoundment that provide habitat for brook trout, landlocked salmon, rainbow smelt, and other native fishes (Figure 5.1-2). Seven of these tributaries (Ripogenus Stream, Duck Brook, Cuxabaxis Stream, Caucomgomoc Stream, Little Scott Brook, Upper West Branch, and Ragged Stream) have historically produced enough juvenile landlocked salmon to support a wild, self-sustaining fishery. As part of the last relicensing, rainbow smelt spawning assessments were conducted to assess the status of smelt access to tributaries. Surveys by boat and foot were used to verify stream access during late April and early May. Barriers (i.e., small falls) were documented at most streams, but only Caucomgomoc Stream had a barrier that would be expected to fully impede smelt access, even during periods of increased flow and higher water levels (GNNC 1991a).

The Upper West Branch of the Penobscot River is the most important and productive of the Ripogenus impoundment tributaries with regards to spawning and adult habitat (GNNC 1991a). The salmonid fisheries in the Upper West Branch reach are primarily supported by fish from the Ripogenus impoundment population, as opposed to upstream water bodies. The reach provides spawning opportunities for salmon, but also supports its own robust fishery. The river fishery in this reach tends to reflect the status of both populations (river fishery and impoundment fishery) with regards to health and abundance (GNNC 1991a, FERC 1996).

Fish Assemblage

The Ripogenus impoundment supports major recreational fisheries for landlocked salmon, rainbow smelt, burbot, and white perch (GNNC 1991a). The landlocked salmon fishery in the West Branch and Ripogenus impoundment is a high-quality and important fishery in Maine, and a primary source of recreation in the area; brook trout angling is also popular (GNNC 1991a). These wild fisheries are self-sustaining because of the amount of spawning habitat available in tributaries and in the mainstem of the West Branch. Large pools in the West Branch downstream of McKay Station at Little Eddy, Big Eddy, Highbank Pool, and below Nesowadnehunk Falls, Abol Falls, and Pockwockamus Falls all provide excellent adult habitat. Other areas with suitable adult habitat include Little Ambejackmockamus Deadwater and the reach between Point Pool and Abol Ledges. Isolated boulders scattered throughout the reach also provide suitable habitat, with large deadwater areas also providing low-velocity conditions that the fish utilize.

A smelt population distributed throughout the Ripogenus impoundment is an important forage source for landlocked salmon and other fish species. Factors that provide for the self-sustaining landlocked salmon fishery in Chesuncook and Ripogenus lakes include favorable year-round river flows, abundant forage (e.g., rainbow smelt), suitable habitat for all life stages, favorable year-round water temperatures, numerous public access points for anglers, and the lack of non-native, predatory fish species such as smallmouth bass and northern pike. Smallmouth bass have been documented as far upstream as Abol Bridge in the West Branch, and cool water discharged from McKay Station likely impedes their continued upstream expansion (GNNC 1991a). The introduction and establishment of non-native fish species, including smallmouth bass or northern pike, could potentially harm the robust landlocked salmon fishery through increased competition and predation.

Angler effort in the impoundment was collected via creel surveys during winter, spring, and summer months in advance of the previous relicensing. Anglers pursued white perch, yellow perch, burbot, lake trout, landlocked salmon, and brook trout in Caribou Lake, Ripogenus Lake, and Chesuncook Lake. Landlocked salmon were the most common sportfish pursued. A total of 51,749 angler hours were assessed in 1986. Over 3,000 landlocked salmon (6,044 pounds) were harvested by surveyed anglers from January to September. Caribou Lake and Chesuncook Lake

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received the most angling pressure on landlocked salmon, with less effort occurring in Ripogenus Lake. An additional 4,581 pounds of salmon were harvested in 1989 (GNNC 1991 a). While the State of Maine's general landlocked salmon limit is two fish per day with a 14-inch minimum, there are currently no size or bag limits for landlocked salmon on the Ripogenus impoundment for fish less than 16 inches long, but there is a 1 fish daily bag limit for landlocked salmon longer than 16 inches. The MDIFW also holds annual fishing derbies to encourage harvest of smaller landlocked salmon to increase the size structure.

In addition to the salmonid fishery, the Ripogenus impoundment supports a mix of coldwater and warmwater resident species. Fish sampling has been conducted over the years, which has demonstrated that the assemblage is composed of native fish species that are typical of northern Maine. GNP has documented 24 warmwater and coldwater species within Chesuncook and Ripogenus Lakes. The assemblage includes landlocked salmon, brook trout, lake whitefish, burbot, smelt, white perch, yellow perch, and several nongame species (GNNC 1991 a). Gill netting efforts documented populations of landlocked salmon, brook trout, lake whitefish, burbot, white perch, yellow perch, white sucker, and longnose sucker in the Ripogenus impoundment. Landlocked salmon, lake whitefish, burbot, white perch, yellow perch, white sucker, and longnose sucker were the most common species collected during open water gill netting efforts. Fish species collected during boat electrofishing surveys in littoral habitats included predominantly white sucker and white perch (GNNC 1991 a).

Non-native species such as northern pike and smallmouth bass have not been documented in the Ripogenus Project area, although they have been documented in more downstream reaches of the Penobscot River Basin. There are no anadromous fish populations present in the Ripogenus Project area. A fish species list is provided in Table 5.4-4.

West Branch – Below McKay Station*Aquatic Habitat*

The West Branch flows approximately 21 miles from McKay Station before entering the North Twin impoundment at Ambajetus Lake. This reach of the river and its tributaries provide high-quality habitat for spawning, nursery, and adult lifestages for a variety of fish species. Habitat is

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especially suitable for landlocked salmon and brook trout. Almost all wild landlocked salmon in this reach complete their entire life cycle in the river. This life history is unusual in that landlocked salmon generally spawn in tributaries but rear and grow in larger lakes. The West Branch, however, provides lacustrine adult habitat in the large deadwater areas and pools, and ample spawning and parr nursery habitat in flowing reaches. Necessary forage opportunities are provided to this reach via smelt drift from Ripogenus impoundment. The discharge of plankton-rich waters from the Ripogenus impoundment influences the diversity and abundance of aquatic populations in the West Branch (GNNC 1991a).

Previous relicensing studies of aquatic communities at the Ripogenus Project include assessments of periphyton, phytoplankton, zooplankton, and benthic macroinvertebrates. Benthic macroinvertebrate communities are described in Section 5.3.9. Periphyton accumulators (vertical slide racks suspended below tethered floats) were placed in open water and littoral habitat within Ripogenus Lake and in pool habitats in the West Branch. Periphyton was sampled during ice free months. The periphyton community was represented by 32 taxa in littoral habitat, with 9 of the 32 taxa not found in other areas. A total of 21 taxa were found in open water reaches, and riverine and tributary habitats had a total of 22 periphyton taxa documented. Diatoms and green algae dominated taxon richness at littoral and tributary stations. Diatoms and blue-green algae were most abundant at limnetic stations. The same periphyton taxa were abundant across sampling events, suggesting that the community is relatively stable in its seasonal cycle with regards to abundance and composition. An assessment of periphyton density and biomass suggested that periphyton productivity was higher in the West Branch than in Ripogenus Lake. This likely reflects the stimulatory effect that river currents can have on periphyton productivity (GNNC 1991a).

Water samples were taken during the previous relicensing from the impoundment and the West Branch in open water, tributary inlets, and littoral habitats in the impoundment and multiple West Branch locations. Phytoplankton were identified to the lowest practical taxonomic unit and enumerated. Samples were also scanned for microzooplankton. Phytoplankton biomass and overall primary productivity were also assessed. At least 75 species of phytoplankton taxa were present in water samples across sites, with 66 taxa documented in the West Branch. There was a similarity in the number of species (species richness) between Ripogenus Lake and the West Branch, suggesting that Ripogenus Lake is an important source of river phytoplankton. Phytoplankton

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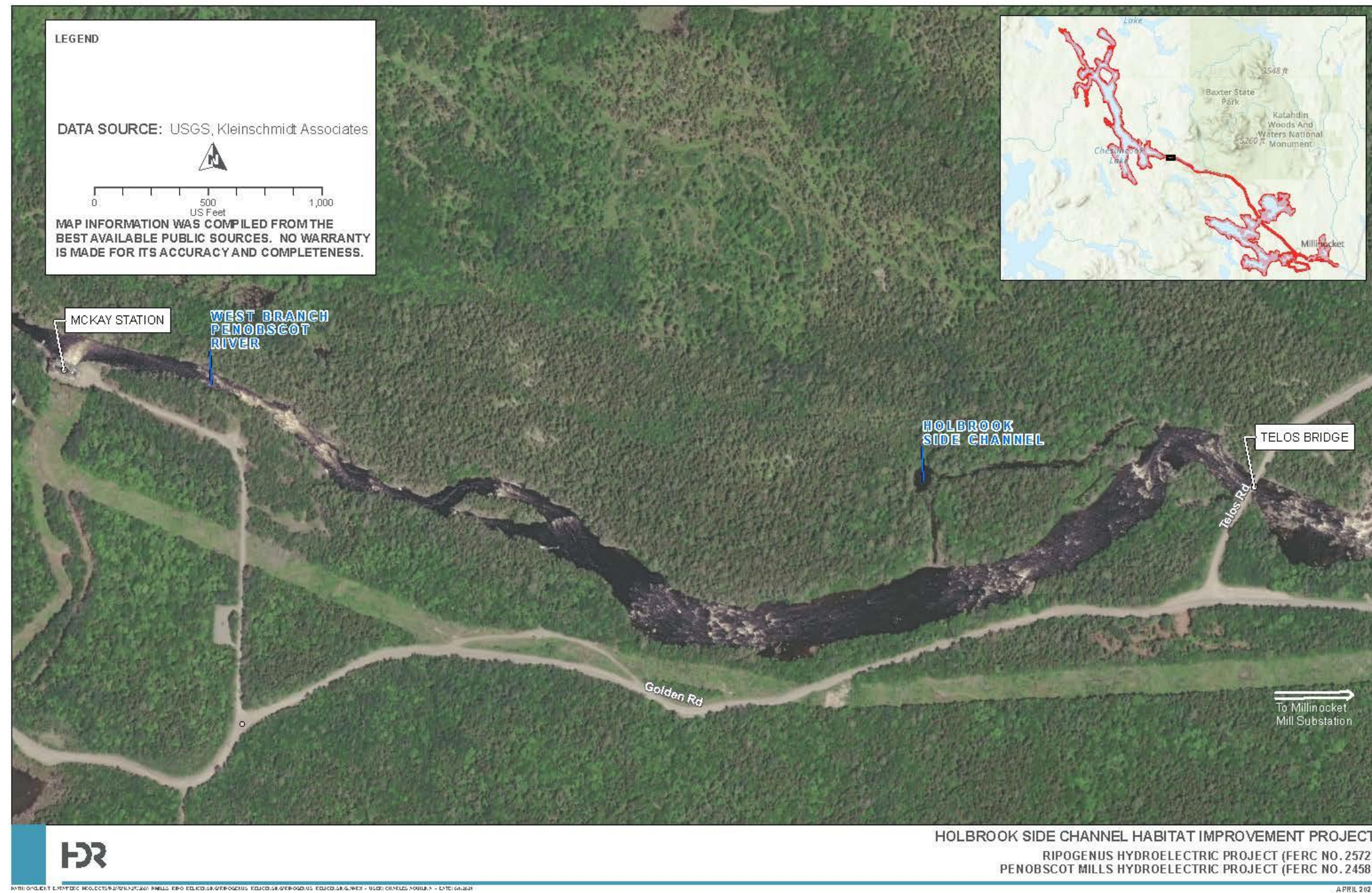
density and species richness in Ripogenus Lake were similar over time and were comparable to other upper oligotrophic Maine lakes (GNNC 1991a).

Zooplankton samples were collected during May, July, and September 1981 via tows of a 153-micrometer mesh hoop net. Impoundment samples were taken by dragging the net via boat, and samples in the West Branch were taken by allowing nets to sit in ambient flow. A subsample from each zooplankton samples was identified to the lowest practical taxonomic unit and enumerated under a dissecting microscope. *Kellicottia longispina* (Rotifera), soft-bodied Rotifera, and *Conochilus* sp (Rotifera) were numerically most abundant across sampling areas. Ripogenus Lake stations had higher zooplankton densities than the sampling reaches in the West Branch. Total zooplankton abundance was greatest in Ripogenus Lake, and lowest at the West Branch's inlet to the impoundment (GNNC 1991a).

During the previous relicensing effort, the Licensee proposed to provide stable minimum flows from McKay Station into the West Branch to promote landlocked salmon spawning and egg incubation. As such, pursuant to License Article 402, GLHA provides landlocked salmon spawning flows of at least 1,422 cfs (or inflow, but not less than 1,300 cfs) from October 15 to November 15 and incubation flows greater than 1,422 cfs (or the spawning flow established for that year) from November 16 through June 7. These flows were developed to prevent exposure and desiccation of salmon redds and enhance overall reproductive success (FERC 1996). Further, GLHA implements automatic, short-term "outage" flows of 400 cfs downstream of McKay Station during station outages as a temporary means for protecting aquatic habitat in downstream reaches of the West Branch. Stable flows resulting from water management at McKay Station help to maintain constant, high quality flow conditions downstream. Specifically, the water management regime provides high quality habitat, abundant smelt drift, and above average water quality.

As part of the flow improvements made in the West Branch during the previous relicensing, GLHA developed and constructed landlocked salmon nursery and spawning habitat at the Holbrook Side Channel, which is about 0.8 miles downstream of McKay Station. The project created approximately 14.5 acres of stream habitat for landlocked salmon and other fishes in the Holbrook Side Channel, which was historically blocked off during the log-driving era. The Holbrook Side Channel, which is approximately 1,500 feet long, discharges back into the West Branch near Telos Bridge (Figure 5.4-2).

Figure 5.4-2
Holbrook Side Channel Habitat Enhancement Area



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The habitat improvements were completed in September 1998. These included the installation of two 30-inch diameter pipes and an associated flow control valve to divert 35 to 65 cfs (depending on flow conditions in the West Branch) into the Holbrook Side Channel through a rock berm. Conveyance of water from the pipes to the side channel is through a small, constructed channel. In-river channel bed modifications were made at the outlet of the Holbrook Side Channel where it discharges back to the mainstem of the West Branch and within the large pool in the middle of the side channel. These modifications to the channel bed were made to create a more defined and reliable stream outlet from the pool and provide unobstructed access to the side channel on the downstream side for spawning landlocked salmon.

The Licensee monitored the success of the Holbrook Side Channel habitat enhancement project for 5 years from 1998 to 2002. Monitoring included annual spawning redd counts and electrofishing surveys in the Holbrook Side Channel. Results of the monitoring demonstrated that landlocked salmon were using the side channel for spawning and rearing and that the number of redds and juvenile salmon increased substantially after the project was completed (Table 5.4-5). Monitoring reports were provided to the USFWS, PIN, and MDIFW prior to submittal to FERC. In consultation with the agencies, it was agreed to cease monitoring after 2002, but to continue maintaining the Holbrook Side Channel habitat.

Table 5.4-5
Number of landlocked salmon redds and juvenile salmonids collected prior to and after
Holbrook Side Channel habitat improvements

Sample Date	No. Redds Observed	No. Salmon Collected	No. Brook Trout Collected
2002	22	44	14
2001	28	210	19
2000	39	27	8
1999	28	14	7
1998	29	<i>1</i>	<i>13</i>
1997	<i>0</i>	<i>1</i>	<i>25</i>

* bold, italic, shaded cells indicate sampling occurred prior to completion of habitat improvements.

Source: GNP's annual monitoring reports filed with FERC from 1997 through 2002.

Fish Assemblage

GNP documented that the fish assemblage in the West Branch below McKay Station is similar to that found in the Ripogenus impoundment, although the West Branch provides habitat for several riverine species (e.g., round whitefish and redbreast sunfish) (Table 5.4-4). Self-sustaining populations of native lake whitefish and round whitefish occur in the West Branch. White sucker and longnose sucker, two native riverine sucker species, are also distributed throughout the drainage; suckers were the dominant fish with regards to biomass and numbers, representing a potential source of competition with other species for food (GNNC 1991a).

Brook trout are common throughout the West Branch, although they are less abundant than landlocked salmon. GNP's redd observations and young-of-year sampling via electrofishing suggested that most brook trout spawning occurs in West Branch tributaries (GNNC 1991a). Stomach content analyses suggested that insects comprise a large portion of the brook trout diet, and that brook trout begin feeding on smelt once they are approximately 9 inches long. Larger individuals may feed exclusively on smelt. American eel have occasionally been collected as bycatch during trap netting efforts for other species in the West Branch between Big Eddy and Ambajekus Lake (GNNC 1991a) and in electrofishing surveys (Midwest Biodiversity Institute & Center for Applied Bioassessment and Criteria [MBI] 2005).

Landlocked salmon is the dominant gamefish in the West Branch. Large numbers of smelt may discharge from McKay Station and drift downstream (GNNC 1991a). When this occurs, landlocked salmon actively feed on smelt; live smelt have been documented in numerous downstream reaches and are abundant and well distributed throughout all basins of the impoundment (GNNC 1991a). Some smelt are moribund during the drifts, while others survive, as evidenced by observations of smelt in downstream reaches (GNNC 1991a). Smelt are the primary forage for salmon throughout much of the year.

GNP sampled smelt drift from 1981 to 1991 using 4-foot-wide, small, mesh bag nets in shallow water to strain the water column at numerous sites in the West Branch. Sampling sites included Holbrook Pool, Big Eddy, Little Ambejackmockamus Deadwater, the Horserace, and Nesowadnehunk, Abol, and Pockwockamus, and Debsconeag Deadwaters (Figure 5.4-3). Volume estimates were determined by extrapolating drift estimates at Holbrook Pool (0.7 miles

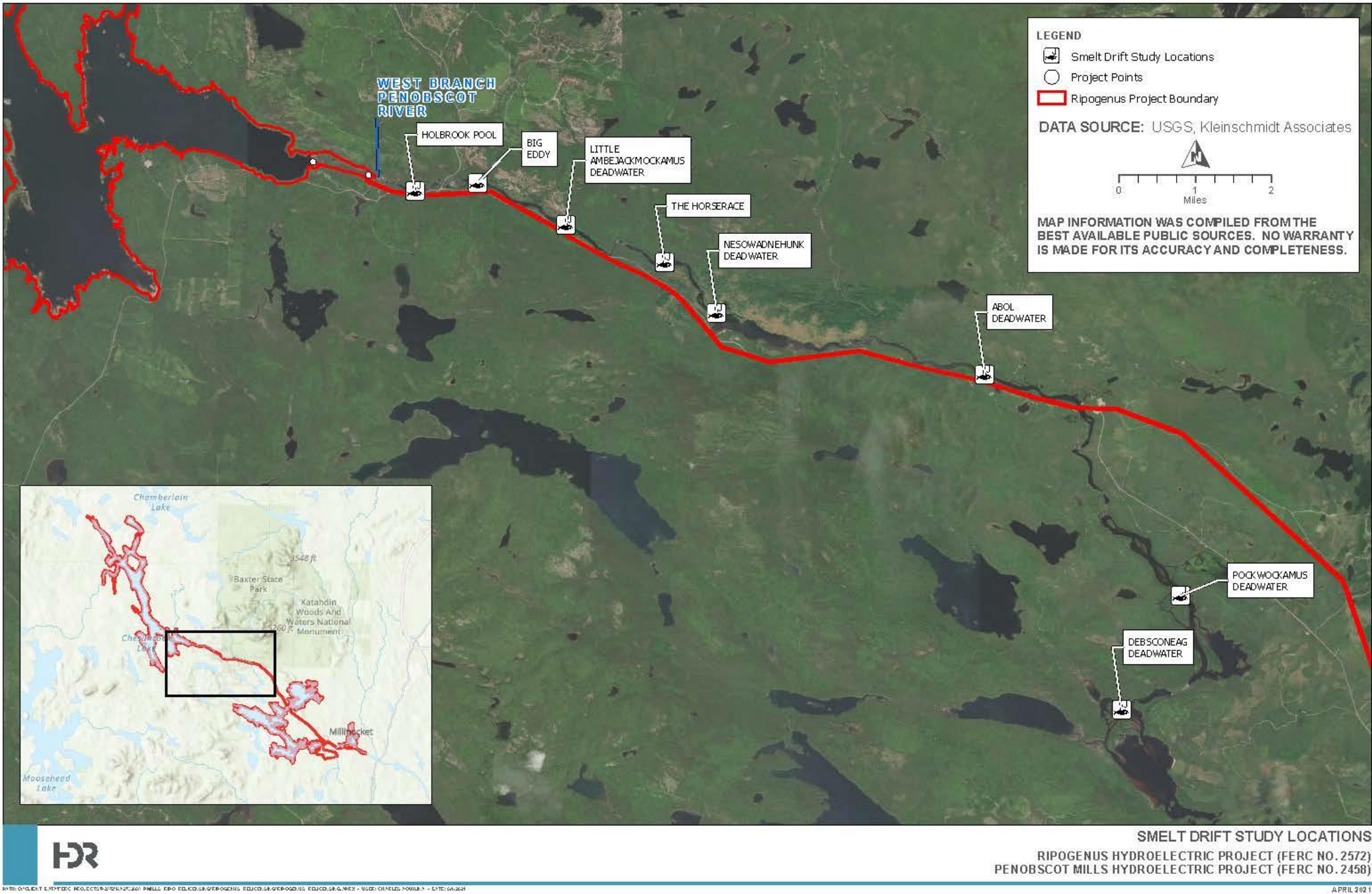
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downstream of McKay Station) and the Horserace (5.3 miles downstream of McKay Station). A correction factor was computed by comparing Holbrook Pool and Horserace drift volumes and assuming a direct relationship between reduction in drift and distance from McKay Station (GNNC 1991a).

Overall, smelt drift timing was predictable throughout the study period, with some variation in magnitude and across seasons. Estimates of annual smelt drift ranged from 10,597 pounds to 49,292 pounds across the sampling period (1981 to 1991). The average annual drift was estimated to be 28,085 pounds. The largest daily drift was estimated at 11,670 pounds. A majority of smelt observed in the drift events were young-of-year and age-1 fish, suggesting that relatively few mature, spawning smelt pass through McKay Station. Smelt drift volume decreased with distance below McKay Station. The decrease in drift volume from McKay Station to Holbrook Pool (a distance of 0.7 mile) was estimated to be approximately 10 to 12 percent across age groups. The decrease between Holbrook Pool and the Horserace (a distance of 4.6 miles) was estimated to be 77 to 89 percent across age groups. Smelt drift was documented as far downstream as Debsconeag Deadwater during peak drift abundance, although smelt drift was only considered to be reliable in reaches upstream of Pockwockamus Deadwater. Additionally, movement of landlocked salmon was linked to smelt drift timing in the system, with upstream movement occurring during periods when smelt drift began to decrease (GNNC 1991a). Thus, upstream movement generally occurred earlier for salmon in more downstream reaches where smelt drift was less abundant (GNNC 1991a).

Landlocked salmon of all lifestages were collected for gut content analyses as part of the smelt drift study. Macroinvertebrates were the most abundant food source for young-of-year salmon, and springtime collections showed that smelt were the primary prey source for adult salmon. Growth data collected by GNP for landlocked salmon suggested that West Branch wild landlocked salmon have higher than average growth rates as compared to other Maine lakes because of smelt drift from the Ripogenus impoundment. Insects are a more important and reliable food source in downstream reaches where smelt drift can be more intermittent (GNNC 1991a).

Figure 5.4-3
Rainbow smelt drift monitoring locations in the West Branch of the Penobscot River



Tagging studies conducted by GNP during 1979 to 1983 documented landlocked salmon movement in the West Branch reach below McKay Station. Salmon spent the winter months in deep areas of the river and tended to remain sedentary until late-May. A late-spring and early-summer period of upstream movement occurred when water temperatures began to increase, and upstream movement peaked into June and continued into July. The exact timing of downstream movements was not fully documented, as the fishing season closure date of September 30 limited fall recapture data. Salmon in the West Branch spawn in the fall, generally during late October and into November (FERC 1996).

GNP previously completed spawning assessments (redd surveys) for landlocked salmon in the West Branch (GNNC 1991a). Redd surveys were conducted in the mainstem West Branch during intentionally reduced river flows at the end of the fall spawning season across a ten-year timeframe (1979-1989). McKay Station discharge was reduced to 400-500 cfs for several hours prior to the start of surveys to allow for accessible conditions in suitable spawning areas. Observations were made from boat and shore in the reach between McKay Station and Ambajejus Lake, with extra effort occurring in areas that were believed to have suitable spawning habitat. An average of 566 redds were documented annually during 1979-1989. Reaches in which redds were observed during all ten years include Little Ambejackmockamus Falls, Little Ambejackmockamus Deadwater, Line Pool, Head of Nesowadnehunk Deadwater, Abol Deadwater, and Robinson's Run. Results of the studies suggested that spawning habitat availability is not a limiting factor in the West Branch, with numerous reaches providing ample spawning habitat during some or all years that surveys were conducted (GNNC 1991a).

West Branch – Upper Gorge (reach between Ripogenus Dam and McKay Station)

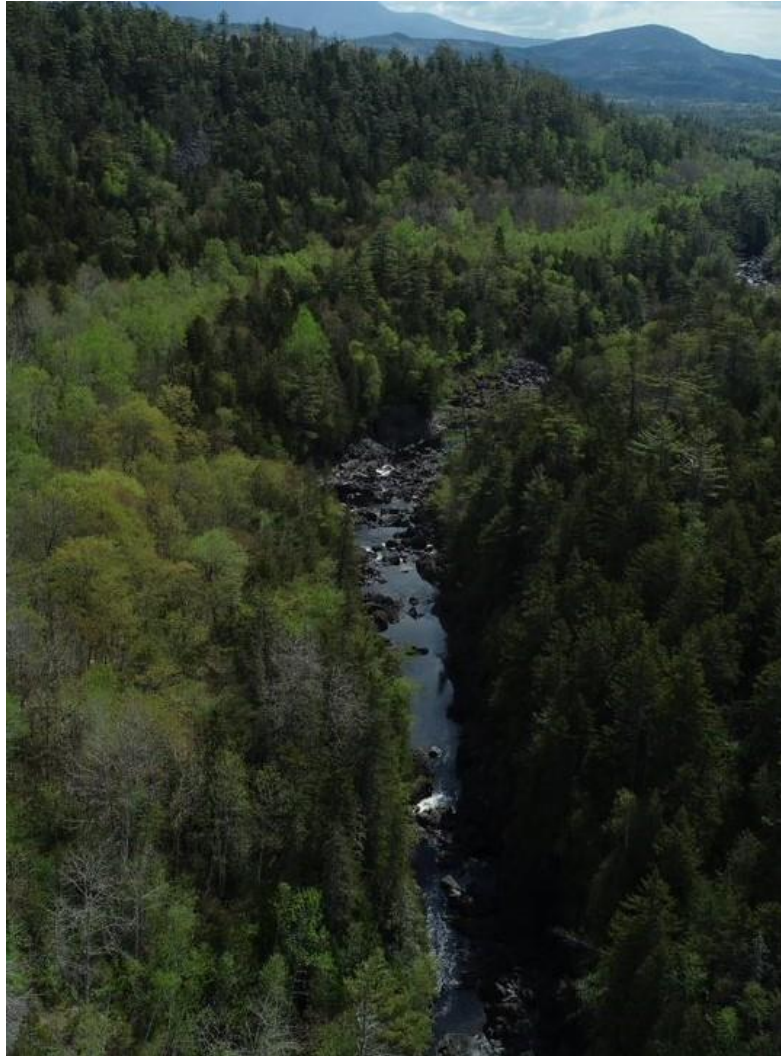
Aquatic Habitat

The reach between the Ripogenus Dam and McKay Station is a high-gradient, bedrock dominated gorge. The reach is largely inaccessible to the public, given its steep ravine-like riverbanks. Substrates are primarily bedrock, along with some smaller areas of cobble and boulder. The reach is comprised of deep pools, high-gradient riffles, and deep runs. The Licensee provides a minimum flow of 100 cfs from July 1 to September 30 to attract adult salmon and increase angling opportunities in the summer months. A minimum flow of approximately 12 cfs is provided during

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the rest of the year as leakage from the dam. The 12 cfs flow maintains interconnected aquatic, riverine habitats, and adequate water depths (e.g., > 1 foot) to allow for volitional movements of fish that may enter the gorge (Photo 5.4-1).

Photo 5.4-1
Upper Gorge flow of 12 cfs (taken May 18, 2021)



During the previous relicensing of the Project, the Licensee completed an instream flow study in the Upper Gorge to assess the relationship between river flow and aquatic habitat. Results of the assessment demonstrated that flows up to 100 cfs increased the amount of adult salmon habitat in the reach from approximately 42,000 to over 71,000 square feet. Although moderately higher flows (50 to 100 cfs) were shown to improve habitat for landlocked salmon, GNP documented that high, scouring flows through the gorge during spill events negated these positive effects. Further

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the study demonstrated that no overwintering or spawning habitat (e.g., low-gradient gravel beds) exists in the Upper Gorge. GNP documented no brook trout spawning activity during redd surveys, although the presence of young-of-year and older brook trout suggests that brook trout reproduction may occur in the lower gradient portions of the Upper Gorge.

Fish Assemblage

GNP documented 12 species of fish in the Upper Gorge, including landlocked salmon, brook trout, fallfish, rainbow smelt, sculpin, and other cool and cold water species (Table 5.4-6) (GNNC 1991a). The lack of spawning and quality rearing habitat suggests that individuals found in this reach are likely transient and enter the reach during periods of spill from Ripogenus Dam. For example, lake trout caught by anglers in the Upper Gorge had been stocked in the Ripogenus impoundment.

The presence of adult salmon in the Upper Gorge, and associated angling opportunities, are seasonal and dependent upon sufficient flow to attract fish upstream from McKay Station. Landlocked salmon and brook trout are known to be year-round residents in the Upper Gorge. Electrofishing surveys have documented high growth rates of juvenile landlocked salmon and brook trout in this reach, suggesting that an abundant macroinvertebrate community provides a reliable food source for these species and lifestages.

Table 5.4-6
Fish Species Documented in the Ripogenus Impoundment and West Branch Downstream of the Ripogenus Dam during 1986-1989 Fish Assemblage Surveys

Common Name	Scientific Name	Ripogenus Impoundment	West Branch below McKay Station	West Branch below Ripogenus Dam (Upper Gorge)
Landlocked Salmon	<i>Salmo salar</i>	X	X	X
Brook Trout	<i>Salvelinus fontinalis</i>	X	X	X
Splake	<i>Salvelinus namaycush</i> x <i>Salvelinus fontinalis</i>	-	X	-
Lake Trout (Togue)	<i>Salvelinus namaycush</i>	X	X	X
Lake Whitefish	<i>Coregonus clupeaformis</i>	X	X	-
Round Whitefish	<i>Prosopium cylindraceum</i>	-	X	-
Rainbow Smelt	<i>Osmerus mordax</i>	X	X	X
Burbot (Cusk)	<i>Lota lota</i>	X	X	

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Common Name	Scientific Name	Ripogenus Impoundment	West Branch below McKay Station	West Branch below Ripogenus Dam (Upper Gorge)
Chain Pickerel	<i>Esox niger</i>	-	X	-
White Perch	<i>Marone americana</i>	X	X	X
Yellow Perch	<i>Perea flavescens</i>	X	X	X
Redbreast Sunfish	<i>Lepomis aurltus</i>	-	X	-
Brown Bullhead	<i>Ictalurus nebulosus</i>	X	X	-
American Eel	<i>Anguilla rostrata</i>	X	X	X
White Sucker	<i>Catostomus commersoni</i>	X	X	X
Longnose Sucker	<i>Catostomus catostomus</i>	X	X	X
Fallfish	<i>Semotilus corporalis</i>	X	X	X
Blacknose Dace	<i>Rhinichthys atratulus</i>	X	X	X
Lake Chub	<i>Couesius plumbeus</i>	X	X	-
Common Shiner	<i>Notropis cornutus</i>	X	X	-
Golden Shiner	<i>Notemigonus crysoleucas</i>	X	X	-
Creek Chub	<i>Semotilus atromaculatus</i>	X	-	-
Ninespine Stickleback	<i>Pungitius pungitius</i>	X	X	-
Slimy Sculpin	<i>Cottus cognatus</i>	X	X	X

Source: GNNC 1991a, MBI2005.

5.4.1.3 Penobscot Mills Project

North Twin Impoundment

Aquatic Habitat

North Twin impoundment has a surface area of 17,790 acres and is comprised of 5 lake basins (Ambajejus, Pemadumcook, North Twin, South Twin, and Elbow Lakes). The impoundment is oligotrophic, and most of the maximum basin depths range from 55 to 101 feet. Elbow Lake is shallower than the other lake basins. The mean depth of the impoundment is 27.7 feet. The shoreline consists of wind-swept points with irregular, exposed shores. The littoral substrate consists of coarse substrates and boulder fields and boulder reefs. Reaches of finer substrates are interspersed within the sections of boulder areas. There are also numerous wooded islands on the North Twin impoundment. There are 10 tributaries to the impoundment, including the West Branch. Some of these tributaries, such as Nahmakanta Stream, provide spawning habitat for landlocked salmon, brook trout, and rainbow smelt (FERC 1996).

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Fish Assemblage

The fish assemblage of North Twin impoundment is a mix of coldwater and warmwater fish species. North Twin impoundment has several game species, such as landlocked salmon, brook trout, whitefish, and lake trout (Table 5.4-7). In addition to the game species, the impoundment contains a typical assemblage of suckers and minnows. There is also a population of rainbow smelt that provides the forage base to support landlocked salmon and brook trout. Brook trout are found within the tributaries of North Twin impoundment, but not in great abundance. Landlocked salmon in the North Twin impoundment mostly consist of stocked individuals (FERC 1996). There are recent reports that smallmouth bass have become illegally introduced to the impoundment (*Kevin Dunham, MDIFW, personal communication, May 2021*).

Lake trout are managed as a recreational species in the North Twin impoundment by MDIFW. Pursuant to Article 409 of the current license, for over ten years, lake trout monitoring was performed consisting of biannual sampling and reporting on the success of wild lake trout populations in the North Twin impoundment. MDIFW has stocked over 166,804 lake trout in the North Twin impoundment between 1976 and 2020. Despite the management for lake trout and operations of the impoundment levels in support of lake trout (per Article 408 of the Project license), no wild lake trout were observed over seven sampling periods from 1998 to 2008 (GLHA 2011). The management objective for lake trout in the North Twin Impoundment has shifted from a wild fishery to now being managed as a stocked fishery. The North Twin impoundment is currently stocked every other year with lake trout; therefore, any lake trout observed in the North Twin impoundment are likely hatchery origin fish (*Kevin Dunham, MDIFW, personal communication*).

Table 5.4-7
Fish Assemblage Data from North Twin Impoundment (2016-2017)

Species	Method	Year	Total ¹⁰
Brook Trout	Gill Net	2016	20
	Winter Creel	2017	3
Burbot	Gill Net	2016	3
	Winter Creel	2017	1
Lake Trout	Gill Net	2016	9

¹⁰ MDIFW unpublished sampling data from 2016 and 2017.

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Species	Method	Year	Total ¹⁰
Landlocked Salmon	Gill Net	2016	6
	Winter Creel	2017	49
Lake Whitefish	Gill Net	2016	4
Rainbow Smelt	Gill Net	2016	2
White Perch	Gill Net	2016	1

Millinocket Lake*Aquatic Habitat*

Millinocket Lake has a surface area of 8,640 acres at normal pond elevation, with an average depth of 23.6 and a maximum depth of 86 feet (FERC 1996). Three streams provide the predominant inflow into Millinocket Lake, and the main outlet is at the dam where water is discharged into Millinocket Stream. Additionally, water from Millinocket Lake may also be directed to Ambajejus Lake (part of the North Twin impoundment) via the pumping station located at Millinocket Lake.

Millinocket Lake is oligotrophic and contains various coarse littoral substrates. Additionally, the impoundment contains many islands. The tributary Sandy Stream offers spawning habitat for both landlocked salmon and brook trout, while Mud Brook offers brook trout spawning habitat (FERC 1996).

Fish Assemblage

The fish assemblage of Millinocket Lake is similar to that of the North Twin impoundment. The lake supports a mixed coldwater and warmwater fishery that is naturally reproducing, except for landlocked salmon and lake trout. The wild landlocked salmon and lake trout populations are supplemented with stocking to support the fishery (FERC 1996). The lake contains an open water and ice fishery that includes landlocked salmon, lake trout, rainbow smelt, burbot, white perch, and pickerel. In addition to these game fish species, Millinocket Lake also supports a typical Maine assemblage of non-game fish species such as suckers and minnows (GNNC 1991b).

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**Table 5.4-8
Fish Assemblage Data from Millinocket Lake (2017 – 2018)**

Species	Method	Year	Total ¹¹
Lake Trout	Gillnet	2018	6
	Winter Creel	2017	2
Landlocked Salmon	Gillnet	2018	4
Burbot	Winter Creel	2017	4
Landlocked Salmon	Winter Creel	2017	4
Pickarel	Winter Creel	2017	2
White Perch	Winter Creel	2017	9

Millinocket Impoundment (Quakish Lake and Ferguson Pond)

Aquatic Habitat

Quakish Lake is a shallow lake that has a surface area of 1,344 acres. The lake was formed in 1899 by the construction of Stone Dam and a dike system. Additionally, Ferguson Pond (262 acres) is a sub-basin that lies directly east of Quakish Lake. The mean depth of Ferguson Pond is 8.5 feet and the maximum depth is 19 feet, while the mean depth of Quakish Lake is 10.5 feet and the maximum depth is 37 feet. These lakes are both shallow compared to the other Project impoundments. They have numerous stumps and submerged pulpwood. The substrate is fine and silty, with organic rich bottoms (FERC 1996).

Fish Assemblage

The fish assemblage within Quakish Lake and Ferguson Pond is typical of Maine mesotrophic lakes and includes a mix of warmwater and coldwater species. Landlocked salmon and lake trout within Quakish Lake are likely fish that dropped down from upstream waterbodies. The fish assemblage is dominated by warmwater predator species such as pickerel and white perch (FERC 1996).

¹¹ MDIFW unpublished sampling data from 2017 and 2018.

Dolby Impoundment (Dolby Pond)*Aquatic Habitat*

Dolby Pond is approximately 2,048 acres and a shallow mesotrophic lake. The upper Dolby Pond is separated by State Route 157 from the lower Dolby Pond. The pond has three tributaries which offer additional habitat. There is an abundance of stumps and accumulations of pulpwood. The substrate type is variable with an abundance of aquatic vegetation (FERC 1996).

Fish Assemblage

Dolby Pond primarily supports a warmwater fishery which consists of game species including smallmouth bass, pickerel, and white perch. Additionally, Dolby Pond supports a large rainbow smelt population that serves as a forage base for the predator species. A few landlocked salmon have been documented in Dolby Pond, likely fish that dropped downstream from upstream waterbodies (GNNC 1991b).

East Millinocket Impoundment*Aquatic Habitat*

The East Millinocket impoundment is a small riverine impoundment with a surface area of 128 acres, mean depth of 11 feet, and maximum depth of 24 feet. The impoundment is mesotrophic and has a relatively constant flow of water because it and the upstream Dolby Dam are operated as run-of-river facilities (FERC 1996). The impoundment has steep banks and is greatly wooded on both banks (GNNC 1991b). Fish Brook, which is the only tributary stream to this impoundment, also supports a small brook trout population.

Fish Assemblage

The East Millinocket impoundment fish assemblage receives minimal fishing pressure. There is a small fishery below the East Millinocket tailrace for drop-down landlocked salmon and smallmouth bass. Other species found in the impoundment are those known to be upstream of the East Millinocket impoundment and which transition through the impoundment (GNNC 1991b).

West Branch (North Twin Dam to Quakish Lake)*Aquatic Habitat*

The section of the West Branch downstream of the North Twin dam to Quakish Lake is less than one mile in length and contains various fish habitat and substrates. This section of the West Branch can best be described by four separate reaches. The 650-foot reach immediately below the North Twin powerhouse tailrace is a long deep run with riffles on either side. There is a pool and weir fishway that is incorporated into the dam that allows upstream passage of resident species to the North Twin impoundment. The next reach (1,600 feet long) consists of a moderate velocity, deep run with boulder and large substrate. This reach ends below the Route 11 bridge. Below the Route 11 bridge, there is a 400-foot-long reach comprised of a short high velocity deep riffle, which is followed by a 2,000-foot-long deep run of lower velocity. This final run transitions into Quakish Lake and contains emergent vegetation along the banks. Substrate in these reaches is mostly coarse and suited to adult landlocked salmon (GNNC 1991b).

Fish Assemblage

Table 5.4-9 outlines the species that are present in this reach of the West Branch. Landlocked salmon that occur in this section mostly originate from the upstream North Twin impoundment. The white perch and pickerel populations in this reach are small but offer some local fishing opportunities (GNNC 1991b).

During a 2004 boat electrofishing survey, a total of 385 fish of 15 various species were sampled in the lower portion of this reach of the West Branch. The most commonly occurring species were pumpkinseed sunfish (89), redbreast sunfish (60), and common shiner (51). Additional species occurring in this reach during the survey included chain pickerel, fallfish, brown bullhead, white sucker, and slimy sculpin (Yoder et al. 2008).

Table 5.4-9
Fish Assemblage Data from 2004 IBI Sampling in
West Branch from North Twin Dam to Quakish Lake

Species	Number of Fish	Percentage
Pumpkinseed Sunfish	89	23.12
Redbreast Sunfish	60	15.58
Common Shiner	51	13.25

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Species	Number of Fish	Percentage
White Sucker	44	11.43
Fallfish	39	10.13
Slimy Sculpin	38	9.87
Yellow Perch	22	5.71
Lake Chub	11	2.86
Golden Shiner	8	2.08
Eastern Banded Killifish	8	2.08
Brown Bullhead	5	1.3
Landlocked Salmon	4	1.04
Blacknose Dace	3	0.78
Chain Pickerel	2	0.52
White Perch	1	0.26
Total	385	100

Source: Yoder et al. 2008.

Lower Millinocket Stream and West Branch (Millinocket Tailrace to Dolby Pond)

Aquatic Habitat

The Millinocket powerhouse discharges into Millinocket Stream and flows approximately 1.7 miles downstream into Shad Pond, a shallow lacustrine area at the confluence of Millinocket Stream and the Back Channel. Habitat in Millinocket Stream between the Millinocket powerhouse tailrace and Shad Pond consists of a continuous low velocity run, with small gravel and fine substrates. Young-of-year and parr habitat is poor in this reach due to the lack of instream cover and warm ambient summer temperatures. There are no tributaries in this 1.7-mile-long stretch of Millinocket Stream. Shad Pond contains shallow marshy habitat with fine substrates, divided by the thalweg from the Back Channel. Two tributaries flow into the southeast portion of Shad Pond. The stretch from Shad Pond to Dolby Pond is the West Branch and consists of deadwater, fine substrates, woody debris, and aquatic vegetation. This reach of river only supports warmwater species (GNNC 1991b).

Fish Assemblage

The fish assemblage in the lower portion of Millinocket Stream and the West Branch between Shad Pond and Dolby Pond is similar to that of the West Branch between North Twin Dam and Quakish Lake with the addition of smallmouth bass. There is a small coldwater fishery in the

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spring for landlocked salmon and stocked trout below the Millinocket powerhouse (GNNC 1991b). The landlocked salmon that are caught in this section are drop-down fish from Millinocket Lake or Quakish Lake. Between 1986 and 1989, anglers caught a total of 7 to 47 landlocked salmon per year in this section. There is also rainbow smelt drift below the Millinocket powerhouse tailrace. The smelt drift is smaller in volume than at other tailraces of the Penobscot Mills Project. Additionally, there is a smallmouth bass and white perch fishery at the Millinocket Stream confluence during the summer months.

The Shad Pond fish assemblage is a typical Maine warmwater fisheries assemblage. During a 2004 electrofishing survey, a total of 146 fish of 11 various species were sampled in Shad Pond (Table 5.4-10). The most commonly occurring species were the common shiner (42), redbreast sunfish (40), and the smallmouth bass (29). Additional species that were occurring in Shad Pond during the survey included chain pickerel, fallfish, American eel, white sucker, and white perch (Yoder et al. 2008). This electrofishing sample supports the historical data that Shad Pond is a warmwater fishery and supports small recreational fisheries for smallmouth bass and chain pickerel.

Table 5.4-10
Fish Assemblage Data from 2004 IBI Sampling in Shad Pond

Species	Number of Fish	Percentage
Common Shiner	42	28.77
Redbreast Sunfish	40	27.4
Smallmouth Bass	29	19.86
Yellow Perch	13	8.9
Chain Pickerel	6	4.11
Fallfish	6	4.11
American Eel	4	2.74
White Sucker	3	2.05
Golden Shiner	1	0.68
Brown Bullhead	1	0.68
White Perch	1	0.68
Total	146	100

Source: Yoder et al. 2008.

Millinocket Stream (Millinocket Lake Storage Dam to Millinocket Development)*Aquatic Habitat*

Millinocket Stream extends approximately 7.9 miles from Millinocket Lake Storage Dam until it joins the Back Channel at Shad Pond. Upstream of the Millinocket station tailrace, Millinocket Stream consists primarily of riffle-run and pool habitat, except for two deadwater sections (Smith Brook Deadwater and Bernier's Barrens Deadwater). The substrate in this reach ranges from coarse to fine, with abundant habitat for juvenile landlocked salmon and brook trout. Adult landlocked salmon and brook trout habitat is limited by the depth of the pools. The one tributary in this reach of Millinocket Stream is Little Smith Brook (GNNC 1991b).

The current minimum flow in the stream was derived through an Instream Flow Incremental Methodology (IFIM) study conducted by the Licensee in 1987 and 1988 in consultation with MDIFW and USFWS to evaluate habitat-based minimum flow alternatives. The IFIM study modeled flows of 20 cfs to 80 cfs. Habitat suitability was rated using Weighted Useable Area (WUA) for both landlocked salmon and smallmouth bass at various life stages. WUA increased as flows increased for juvenile, adult, and spawning stages of landlocked salmon. WUA decreased for fry stages of landlocked salmon as flow increased. At the current minimum flow of 60 cfs, there is an abundance of spawning habitat for landlocked salmon in the riffle-run sections of Millinocket Stream. The IFIM study demonstrated that 30 cfs offered maximum WUA for all non-spawning life stages of smallmouth bass. Maximum WUA for spawning smallmouth bass was shown to occur at 50 cfs. Smallmouth bass spawning habitat mostly occurs in the lower reaches of Millinocket Stream (GNNC 1991b).

An additional IFIM study was conducted on the "deadwater" sections of Millinocket Stream to compliment the initial IFIM study. A "deadwater" habitat is defined as a reach of river longer than 100 yards in length where channel constriction creates a backwater effect. Landlocked salmon WUA was not greatly impacted by the addition of the deadwaters due to poor substrate in the "deadwater" areas, as there is very little spawning habitat for landlocked salmon in these sections. Smallmouth bass WUA greatly increased when deadwater areas were included in the model, because juvenile and adult smallmouth bass generally prefer the slower and deeper habitats found in the "deadwater" reaches (GNNC 1991b).

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Fish Assemblage

Millinocket Stream contains a mixed fisheries assemblage of coldwater and warmwater species (Table 5.4-11). Smallmouth bass, brook trout, and landlocked salmon are important recreational game species in this reach. MDIFW and GLHA stock brook trout in Millinocket Stream to support a spring and fall fishery. Studies by the Licensee as part of the prior relicensing documented a small population of wild landlocked salmon in Millinocket Stream, with additional landlocked salmon that drop-down from Millinocket Lake with spillage. Smelt drift from Millinocket Lake provides forage for the fishery. Most anglers fish for landlocked salmon directly below the Millinocket Lake Storage Dam, but there is access to the upper section of Millinocket Stream on both banks of the stream. Smallmouth bass are commonly found in the pool and lower “deadwater” habitats of Millinocket Stream, but they are rarely found in sizes greater than 10 inches (GNNC 1991b).

During a 2004 electrofishing survey, a total of 491 fish of 11 various species were sampled in the lower portion between RM 3.3 and 1.9 of Millinocket Stream. The most commonly occurring species were common shiner (160), fallfish (119), and white sucker (106). Additional species that occurred in Millinocket Stream during the survey included smallmouth bass, American eel, and chain pickerel (Yoder et al. 2008).

Table 5.4-11
Fish Assemblage Data from 2004 IBI Sampling in Millinocket Stream

Species	Number of Fish	Percentage
Common Shiner	160	32.59
Fallfish	119	24.24
White Sucker	106	21.59
Smallmouth Bass	74	15.07
Redbreast Sunfish	11	2.24
Chain Pickerel	6	1.22
American Eel	6	1.22
Golden Shiner	5	1.02
Yellow Perch	2	0.41
Blacknose Dace	1	0.2
White Perch	1	0.2
Total	491	100

Source: Yoder et al. 2008.

Back Channel

Aquatic Habitat

The Back Channel is a 4.5-mile-long reach downstream of Stone Dam (Millinocket impoundment) that flows into Shad Pond. The Back Channel is bracketed by Stone Dam and Grand Falls, which is a natural falls located approximately 2.7 miles below Stone Dam and a barrier to upstream movement of warmwater species, sea run alosines (shad and river herring), and juvenile salmon (GNNC 1991b) (Photo 5.4-2). The reach receives inflow from various tributaries as well as from Quakish Lake, which in the summer is composed of warm limnetic surface water spill at Stone Dam.

Photo 5.4-2
View of Back Channel looking upstream at Grand Falls (taken May 20, 2021)



Back Channel geomorphology is varied, but includes alluvial and bedrock-controlled areas, making for non-uniform channel characteristics; however, it has never been mapped. Parts of the Back Channel exhibit evidence of erosion with poorly defined channels, over-widened banks, and braided channels, while other more bedrock-controlled portions are narrower and better defined. The surrounding land is forested. Mesohabitats above Grand Falls consist of riffles, runs, braided

channels, backwaters, and pools. Substrates are comprised predominantly of large cobble and boulder. Below Grand Falls, the Back Channel is dominated by low gradient run-pool mesohabitats and is at least partially backwatered by the Shad Pond flowage (Photo 5.4-3). Nollesmic Brook and Trapper Stream are two tributaries that enter this portion of the Back Channel.

Photo 5.4-3
View of Back Channel looking downstream toward
Shad Pond (distant) from below Grand Falls (taken May 20, 2021)



Current leakage flows from Stone Dam are estimated to range from 2 to 5 cfs; however, during spillage, flows can exceed 29,000 cfs and, as a result, the substrates in the upper reach are predominantly highly scoured and coarse. Small trees, shrubs, and emergent vegetation are interspersed through the upper reach margins. The Back Channel has three primary tributaries (Comstock Brook, Nollesmic Stream, and Trapper Brook) that offer limited aquatic habitat and inflow. Smaller substrates such as gravel in the upper reach are limited to the stream margins where they are embedded by root systems, therefore limiting spawning habitat for salmonids.

Back Channel fisheries management potential is limited, because it is separated from contiguous segments of the river system by Stone Dam, Grand Falls, and the Dolby impoundment. In addition,

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inflow to the reach is warm in the summer, as most flow emanates from Quakish Lake, which is shallow and warm during the open water season.

Water quality in the Back Channel was found to be nearly the same as that of Quakish Lake (GNNC 1991b). Although at the time of the last relicensing there was initial interest in exploring habitat suitability for landlocked salmon, this reach is not specifically managed for coldwater species. An IFIM study was conducted using a transect-based Physical Habitat Simulation (PHABSIM) hydraulic model at 2 sites: one site located above Grand Falls and another located below the falls. (GNNC 1991b). Subsequent to the IFIM study, it was concluded that the reach would not support self-sustaining coldwater fish due to the lack of spawning habitat, warm water temperatures during summer months, and isolation from other contiguous riverine reaches. As an alternative to maintaining a habitat-based flow in the Back Channel, the Licensee established 2,300 acres of forested land surrounding the Back Channel as a Wildlife Management Area, which is open to the public and is managed by GLHA for the enhancement and protection of wildlife habitat (See Section 5.5 for more details).

Fish Assemblage

The fish assemblage of the Back Channel consists of warmwater species and cyprinid minnows. There is a very small landlocked salmon fishery below Stone Dam for fish that drop-down during spill periods. There is limited angler access, and creel surveys have documented that angler usage is essentially nonexistent. Smallmouth bass are present below Grand Falls, which is a natural upstream barrier for that species (GNNC 1991b).

Comstock Brook, Nollesemic Stream, and Trapper Brook are the only significant tributaries. Comstock Brook has a population of small brook trout based on historic electrofishing surveys totaling 325 feet of stream (GNNC 1991b). Blacknose dace, creek chub, and stickleback were also taken in this brook. Nollesemic Stream electrofishing took only young-of-year smallmouth bass. Trapper Brook does not support any significant fish populations.

The Back Channel discharges to Shad Pond below Grand Falls. The fish assemblage below Shad Pond was surveyed in 2004 and was composed of warmwater species such as common shiners, smallmouth bass, and redbreast sunfish (Yoder, et al. 2008).

West Branch (downstream of East Millinocket Development)*Aquatic Habitat*

The Project boundary for the East Millinocket Development extends 300 yards downstream from East Millinocket tailrace, where it enters the Medway Project impoundment (FERC Project No. 2666). This stream reach is predominantly high velocity with coarse substrates such as boulders and large cobbles. This habitat is mostly suitable for adult landlocked salmon and offers little habitat for young-of-year or parr stage landlocked salmon (FERC 1996).

Fish Assemblage

There are no creel or fisheries data for this reach of the West Branch because angler usage on this section is extremely low. During the span of 1986 to 1989, only one angler was observed fishing in this section of the West Branch (FERC 1996).

5.4.2 Macroinvertebrates**5.4.2.1 Ripogenus Project**

The 21-mile-long reach of the West Branch below McKay Station provides suitable water quality and multiple substrate types to support abundant populations of aquatic macroinvertebrates. This reach is indicative of conditions across the Penobscot River watershed, as conditions within this reach are determined by factors that affect the watershed as a whole. The West Branch has a benthic macroinvertebrate population similar to those observed in other flow-managed rivers and impoundments. Changes in macroinvertebrate composition are related to distance downstream from the Ripogenus Dam, likely due to a diminishing supply of plankton and other particulate material in water discharged from McKay Station.

Benthic macroinvertebrate collections in the West Branch are dominated by mayflies, caddisflies, true flies, and stone flies. Density estimates for macroinvertebrates were obtained during 1981-1984 in Ripogenus Lake and in selected riffle areas of the West Branch. At least 197 taxa of benthic macroinvertebrates were found in the Ripogenus Project study area (Ripogenus impoundment and downstream in the West Branch) from 1981-1984, and 123 taxa were found specifically in the West Branch during this timeframe. The benthic macroinvertebrate community exhibited

relatively stable composition and abundance across years, suggesting that conditions were maintained at an equilibrium. Species diversity was higher in more upstream reaches of the West Branch, with an increasing number of taxa in stations closer to the McKay Station (GNNC 1991a).

5.4.2.2 Penobscot Mills Project

Riverine habitat in the Penobscot Mills Project contained 142 taxa, and the macroinvertebrate communities consisted primarily of mayflies, caddisflies, true flies, and worms. Surber samples were taken in the Back Channel at Stone Dam and in Millinocket Stream. The Back Channel was numerically dominated by worms, caddisflies, and chironomid midges. Millinocket Stream was numerically dominated by mayflies, caddisflies and chironomid midges (GNNC, 1991b).

5.4.3 Freshwater Mussels

New England exhibits a relatively depauperate assemblage of freshwater mussels when compared to other nearby regions. Approximately 10 species are known to occur in Maine, whereas places as close as New York support much more diverse assemblages with as many as 50 species (Nedeau et al. 2000). The lack of mussel diversity in Maine results from the effects of the last ice age, which displaced many species, including freshwater mussels (Nedeau et al. 2000).

In Maine, species diversity varies by region. The Penobscot and Kennebec Rivers of the mid-coast and central Maine exhibit the greatest diversity; however, species diversity is less in the various branches (North, South, Upper East, and West) of the Penobscot River when compared to the mainstem. A natural mainstem barrier (waterfall) to most fishes is believed to limit the range in the system (Swartz and Nedeau 2007). Southern Maine and eastern Maine exhibit less diverse mussel assemblages, with northwestern and northern Maine containing the state's lowest diversity.

The MDIFW has compiled information on the distribution of freshwater mussels in Maine. The database includes information from 1,824 survey sites investigated between 1985 and 2009 (MDIFW 2021b). Between 1996 and 2009, MDIFW performed mussel surveys in the West Branch basin. Survey areas are shown on Figure 5.4-4 and identified mussels at each of the survey locations are indicated in Table 5.4-12.

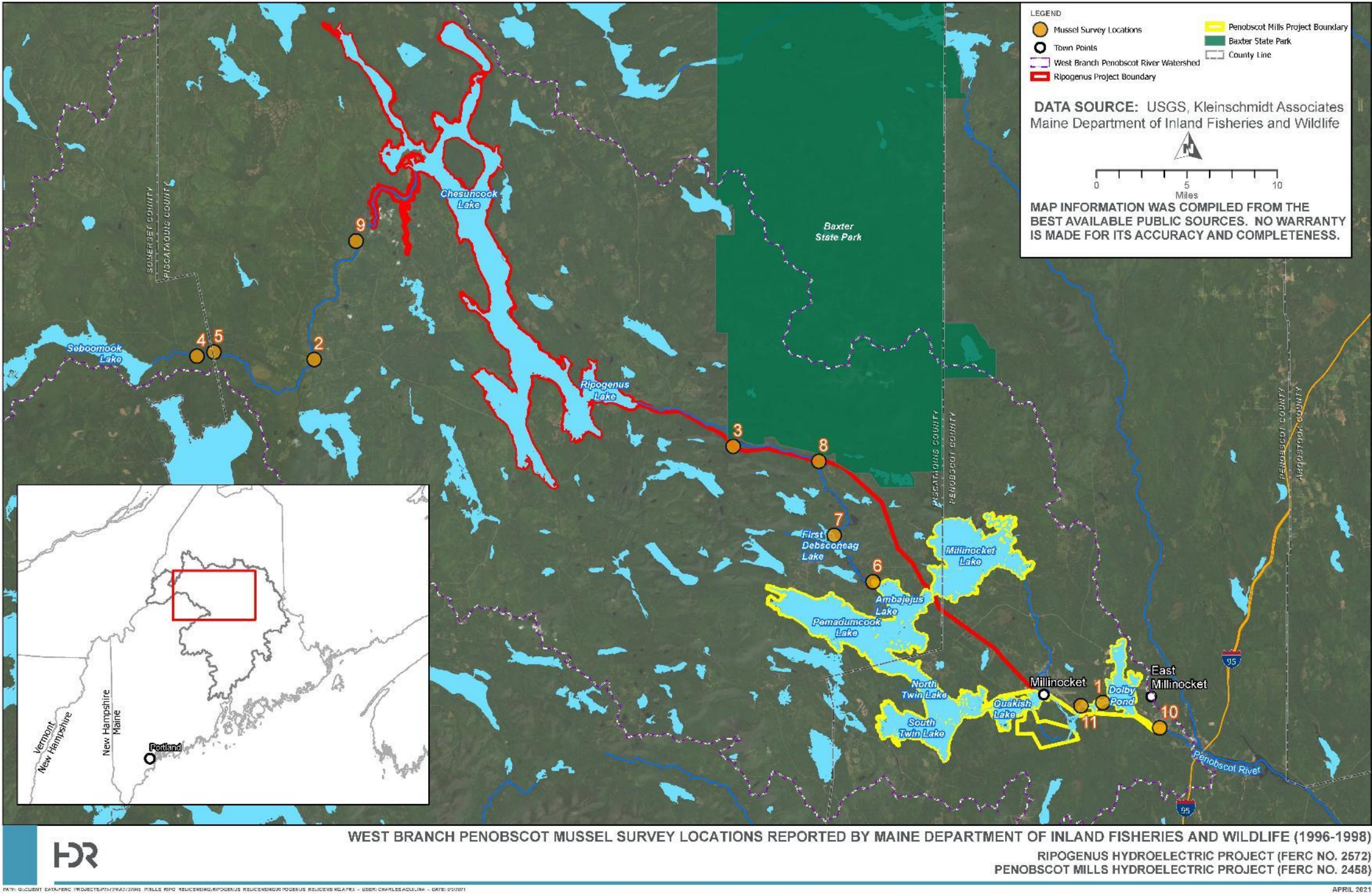
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Maine is home to ten species of freshwater mussels; the four rarest species include the tidewater mucket, yellow lampmussel, brook floater, and creeper, believed to occur in the West Branch. Other species known to occur in the West Branch include more common mussels including the: triangle floater, eastern floater, eastern elliptio, and eastern lampmussel. Table 5.4-13 lists the freshwater mussel species known to occur in Maine, their habitat preferences, ecological status, and if they occur in the Project areas. In all, seven of the ten species found in Maine are known to occur in the West Branch, including the Project areas (Table 5.4-13).

Of the seven species found in the Project areas, the creeper, tidewater mucket and the yellow lampmussel are the rarest, with the tidewater mucket and yellow lampmussel state-listed as threatened. The creeper is a state species of special concern. The yellow lampmussel has been found in the West Branch, Dolby Pond, Millinocket Stream, Pemadumcook Chain Lakes, Millinocket Lake, Passamagamet Lake, Upper, Middle and Lower Jo-Mary Lake, First and Third Debsconeag Lake, and Debsconeag Deadwater (Swartz 2007). Its host fishes (and suspected host fishes*) include white perch, yellow perch, largemouth bass, banded killifish*, chain pickerel*, white sucker*, and smallmouth bass*. The tidewater mucket has been found in Dolby Pond, Millinocket Lake, Passamagamet Lake, and Lower Jo-Mary Lake. Its host fishes (and suspected host fishes*) include the white perch, banded killifish* and alewife*(Swartz and Nedeau 2007). Both the yellow lampmussel and tidewater mucket have been declining throughout their range, prompting many states to list them as endangered or threatened species. In Maine, occurrences of these species are often limited and fragmented in distribution (Swartz and Nedeau 2007).

The creeper is one of the most widely distributed mussel species in North America, occurring as far west as Texas and along the Atlantic coastal drainages, St. Lawrence River system, Great Lakes basin, and the Ohio and Mississippi River systems (Swartz and Nedeau 2007). In Maine, it is found in most major watersheds, including the West Branch, but is sparsely distributed in low abundance. Its host fishes include largemouth bass, creek chub, fathead minnow, bluegill, longnose dace, blacknose dace, fallfish, golden shiner, common shiner, yellow perch, slimy sculpin, Atlantic salmon, and Atlantic sturgeon.

Figure 5.4-4
MDIFW Freshwater Mussel Survey Locations in the West Branch



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Table 5.4-12
MDIFW Freshwater Mussel Survey Results in the West Branch

Mussel Monitoring Site	Drainage	Year	Source	MM - Eastern Pearlshell	EC - Eastern Elliptio	AU - Triangle Floater	AV - Brook Floater	PC - Eastern Floater	AI - Alewife Floater	SU - Creeper	LO - Leptodea ochracea	LC - Yellow Lampmussel	LR - Eastern Lampmussel
1	West Branch Penobscot	1996	MDIFW	-	S	S	-	X	-	-	-	-	-
2	West Branch Penobscot	1996	MDIFW	-	X	-	-	-	-	-	-	-	-
3	West Branch Penobscot	1996	MDIFW	-	X	X	-	X	-	-	-	-	-
4	West Branch Penobscot	1996	MDIFW	-	X	X	-	X	-	X	-	-	-
5	West Branch Penobscot	1996	MDIFW	-	X	X	-	X	-	X	-	-	-
6	West Branch Penobscot	1996	MDIFW	-	X	X	-	-	-	-	-	X	X
7	West Branch Penobscot	1996	MDIFW	-	X	X	-	X	-	-	-	X	X
8	West Branch Penobscot	1996	MDIFW	-	X	X	-	-	-	-	-	-	X
9	West Branch Penobscot	1997	MDIFW	-	X	-	-	-	-	-	-	-	-
10	West Branch Penobscot	1997	MDIFW	-	-	-	-	X	-	-	-	-	-
11	West Branch Penobscot	1998	MDIFW	-	X	X	-	X	-	-	-	X	X
*	West Branch Penobscot	2009	MDIFW	-	X	-	-	-	-	-	-	X	X
*	West Branch Penobscot	2009	MDIFW	-	X	S	-	-	-	-	X	X	X
*	West Branch Penobscot	2009	MDIFW	-	X	X	-	-	-	-	-	-	-
*	West Branch Penobscot	2009	MDIFW	-	X	X	-	X	-	-	-	-	-
*	West Branch Penobscot	2009	MDIFW	-	X	X	-	-	-	-	-	X	X

* = Specific location unknown.

Note: X=live mussel; S=relic (shell); - = not found

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Table 5.4-13
Freshwater Mussel Species Known to Occur in Maine, Habitat Preference, and Status

Species	Scientific Name	Habitat Preference	Status*	Known to Occur in the West Branch (<i>Project Waters</i>)
Eastern Pearlshell	<i>Margaritifera margaritifera</i>	Occurs in cold-water streams and rivers tolerating a wide range of flow velocities including high gradient reaches with swift currents. Preferred substrates include firm sand, gravel and cobble and can tolerate soft (acidic) waters with low calcium.	Common	No
Brook Floater	<i>Alasmodonta varicosa</i>	Inhabits flowing water, in a range of water of moderate and low gradient from small streams to large rivers. Prefers coarse stable substrates including sand and gravel. Often associated with rooted aquatic vegetation.	State-listed <i>Threatened</i>	Yes (Penobscot Mills Project)
Triangle Floater	<i>Alasmodonta undulata</i>	Occurring in streams and rivers, and in lower abundance in lakes and ponds, exhibiting little substrate preference, but is frequently encountered in sand and gravel.	Common	Yes
Creeper	<i>Strophitus undulatus</i>	Typically occurs in streams, rivers, and impoundments in Maine but is known to occur in lakes in other parts of its range. Can tolerate a variety of flow velocities but prefers the slower waters of lower gradient reaches in sand and small gravel substrates.	Special Concern	Yes
Eastern Floater	<i>Pyganodon cataracta</i>	Occurs in most freshwater habitats, including small streams, rivers, ponds, and lakes. It usually is confined to slow-moving portions of riverine environments in sandy or muddy substrates. It is one of the few species that can tolerate deep silt substrates found in the deeper water of most lakes and ponds.	Common	Yes

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Species	Scientific Name	Habitat Preference	Status*	Known to Occur in the West Branch (<i>Project Waters</i>)
Alewife Floater	<i>Anodonta implicata</i>	Occurs in streams, rivers, and lakes that support runs of its diadromous fish host in a variety of substrates including silt, sand, and gravel.	Common	No
Eastern Elliptio	<i>Elliptio complanata</i>	Occurs in a variety of habitats, including small streams, large rivers, freshwater tidal waters, ponds and lakes. Found in various substrates including clay, mud, sand, gravel, and cobble.	Common	Yes
Tidewater Mucket	<i>Leptodea ochracea</i>	Inhabits lakes, ponds, slow moving portions of rivers and impoundments, occurring over a variety of substrates including sand, silt, gravel, cobble and clay.	State-listed <i>Threatened</i>	Yes (Penobscot Mills Project)
Yellow Lampmussel	<i>Lampsilis cariosa</i>	Typically prefers medium and large sized rivers but in Maine also inhabits lakes, ponds and impoundment in a variety of substrates including silt, sand, gravel and cobble.	State-listed <i>Threatened</i>	Yes (Penobscot Mills Project)
Eastern Lampmussel	<i>Lampsilis r. radiata</i>	Inhabits a variety of aquatic habitats, including small streams, large rivers, ponds, and lakes, occurring in a variety of substrates, though most often it is encountered in sand or gravel.	Common	Yes

*Status designation source: MDIFW 2021c.

5.4.4 Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act requires the eight regional fishery management councils to describe and identify EFH in their respective regions, to specify actions to conserve and enhance that EFH, and to minimize the adverse effects of fishing on EFH (National Oceanographic and Atmospheric Administration [NOAA] 2021). EFH is defined as "those waters and substrates necessary to fish for spawning, breeding, feeding or growth to maturity", where "*necessary*" refers to "the habitat required to support a sustainable fishery and the managed species contribution to a healthy ecosystem" (NOAA 2021). In Maine, as well as four other New England states, the New England Fishery Management Councils have designated 28 managed species in the Greater Atlantic Region. Most designated species occur in marine habitats; however, the anadromous Atlantic salmon is among these species and is known to historically occur in the Project areas. Currently, Atlantic salmon are present downstream of the Penobscot Mills Project in the East Branch and mainstem of the Penobscot River, but they are not currently present in Project waters. This designation does not extend to landlocked salmon known to occur in the Project areas.

According to NMFS (1998), Atlantic salmon EFH includes all aquatic habitats in the watersheds of the identified rivers, including all tributaries, to the extent that they are currently or were historically accessible for Atlantic salmon migration. Based on NMFS's 1998 description of EFH for Atlantic salmon, the West Branch of the Penobscot River is EFH.

5.4.5 Aquatic Invasive Species

The non-native smallmouth bass is well established throughout the Penobscot River basin, including downstream reaches of the West Branch where it has recently expanded its upstream range. The species has reportedly colonized the West Branch as far upstream as Abol Bridge (Kevin Dunham, MDIFW, *personal communication*, May 2021). The cooler water temperatures that are discharged from McKay Station may keep this species from establishing itself further upstream. Current biological studies conducted during the 1980s and 1990s do not describe the presence of any aquatic invasive plant species.

5.5 Wildlife and Botanical Resources

Terrestrial land within the Ripogenus Project is generally limited to the land associated with the 29.4-mile transmission line corridor from McKay Station to Millinocket, Maine; shoreline management; and Project facilities (e.g., powerhouse). Terrestrial land within the Penobscot Mills Project is generally limited to the land associated with transmission line corridors, the Wildlife Management Area located in the vicinity of the Back Channel, shoreline management, and Project facilities.

As part of the studies conducted in the late 1980s and early 1990s for the previous relicensing of the Projects, several resource investigations were conducted to gather information necessary to understand the potential effects of the Projects on wildlife and botanical resources. These studies and investigations included, but were not limited to, those described below.

- Investigations of the wildlife resources of the area of the Projects to characterize existing wildlife communities and habitats in the surrounding region on lands bordering the Projects.
- Characterization of wildlife resources of the shoreline/wetland environments bordering the Project impoundments and associated streams and rivers.
- Shoreline and wetland surveys for common loons (*Gavia immer*).
- Surveys of wetland habitat and littoral areas affected by impoundment fluctuations associated with the Projects to characterize existing habitat for wetlands-oriented shorebirds, waterfowl, and aquatic furbearers.
- Detailed botanical resource investigations.

Wildlife Management Area Habitat Enhancements and Management

In addition to the aforementioned studies, since 1997 GLHA has implemented measures to enhance habitat diversity and value to wildlife in the Wildlife Management Area, comprised of approximately 2,300 acres of land adjacent to the Back Channel (downstream from Quakish Lake). Pursuant to Article 412, a Wildlife Management Plan was filed with FERC on April 21, 1997,

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supplemented on January 14, 1998, and approved by FERC via order dated February 12, 1998. The area targeted for wildlife enhancement consists of the Back Channel (upper, middle, and lower sections), the riparian area along the Back Channel, and the upland area adjacent to the Back Channel, as described below.

Pursuant to the FERC-approved plan, GLHA has monitored the enhancement measures since implementation in 1998 and filed monitoring reports (subsequent to consultation with USFWS and MDIFW) with the Commission every five years. Pursuant to the monitoring report filed with the Commission on February 12, 2018, along with the associated FERC Order Amending the Wildlife Plan issued by the Commission on July 12, 2018, the Commission determined that the 20-year wildlife monitoring of the Wildlife Management Area demonstrated the success of GLHA's wildlife management activities. Therefore, GLHA discontinued monitoring activities in 2018, but continues to implement the required enhancement measures within the Wildlife Management Area as further described below.

Back Channel Area Habitat Management

Based on initial consultation with MDIFW personnel, a variety of enhancement measures have been deployed and maintained within the upper, middle, and lower sections of the Back Channel Wildlife Management Area. The upper section of the Back Channel was enhanced through riparian management in order to ensure that sufficient snags are available within the area; forest harvesting to enhance beaver habitat; the placement of waterfowl nest boxes; nesting banks that were created to enhance habitat for the belted kingfisher population; and tree swallow boxes that were placed in the wetland area. The middle section was enhanced through riparian management to ensure that sufficient snags occur and that continuous cover trees exist to serve as a wildlife travel corridor, and a bank was created for kingfisher nesting. The lower section was enhanced through riparian management to ensure that sufficient snags occur and that continuous cover trees exist to serve as a wildlife travel corridor; the placement of waterfowl nest boxes; and nesting banks were created to enhance habitat for the belted kingfisher population.

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Riparian Area Habitat Management

Within the riparian habitat along the Back Channel, forest harvesting within 100 feet of the Back Channel is prohibited except to release mast producing species or enhance an area utilized by beaver. This management strategy minimizes disturbance to amphibians and reptiles that use the 100-foot buffer area along the channel. Forest harvesting is permitted in the remainder of the riparian area, but it is limited to 20 percent removal of trees over 4.6 inches diameter breast height (DBH) at harvest intervals of not less than 20 years, unless dictated otherwise by forest conditions (e.g., insect infestation, windthrow). Red oak and American beech are not to be harvested in the riparian area, and snags are maintained. Eastern white pine in the riparian area are retained for perch and/or potential nest trees for bald eagle and osprey. Nesting banks for kingfisher habitat were created along the old road that parallels the Back Channel on the west side. During kingfisher nesting bank creation, small forest openings (1/4 to 1/2 acre in size) were also created and were seeded and maintained by mowing and fertilizing, as necessary. Additional sections of the old road were also seeded to maintain an herbaceous area.

Upland Area Habitat Management

In the upland area adjacent to the Back Channel, the overall forest area is divided into management blocks based on existing forest types and natural features. The area is managed to maintain and increase the existing forest diversity by using both even-aged and uneven-aged management systems throughout the area.

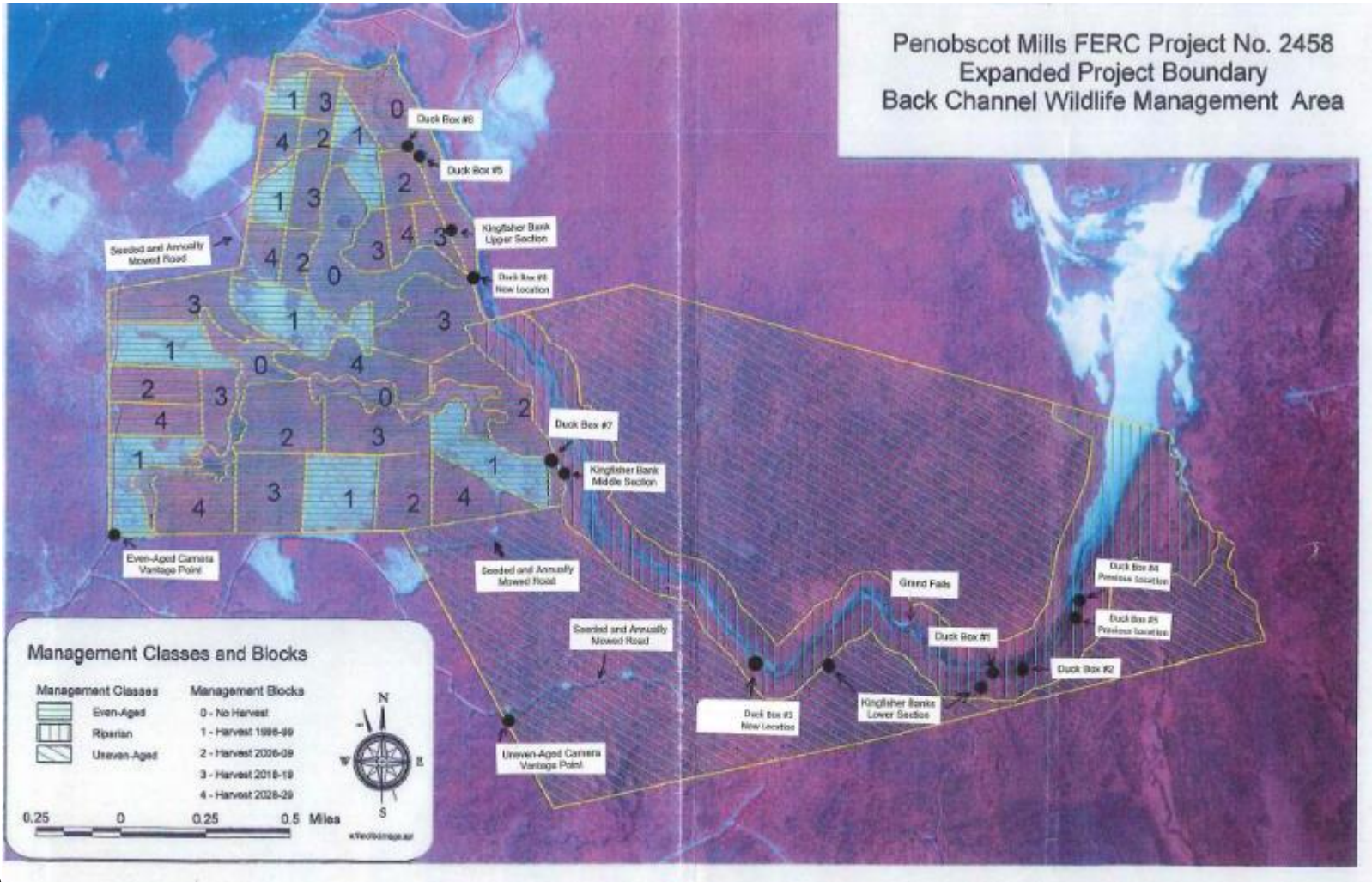
The uneven-aged area is managed such that slash is allowed to remain on site or be returned to the site for woody debris habitat. Snags are managed in the uneven-aged management blocks to provide habitat for wood duck, hooded merganser, pileated woodpecker, little brown myotis, and weasel. Important vernal pools in the upland area have been identified and continue to be protected. Log landings and winter roads were seeded with herbaceous mixture designed to provide wildlife use. The zoned white-tailed deer wintering area is managed for wintering deer habitat such that 50 percent of the softwood area is maintained in softwood cover, with 70 percent crown closure in softwood trees 35 feet tall at all times.

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The even-aged area is managed to regenerate aspen and other intolerant hardwoods to enhance beaver and ruffed grouse habitat, which also benefits wood duck, American black duck, muskrat, river otter, mink, and wading birds. The even-aged area is managed to provide habitat for song-bird species that utilize early successional forest.

A map of the Back Channel showing the Wildlife Management Area and associated enhancements is provided as Figure 5.5-1, as excerpted from the Final Wildlife Management Area Monitoring Report filed with FERC on February 12, 2018.

Figure 5.5-1
Wildlife Management Area at the Penobscot Mills Project



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5.5.1 Wildlife

5.5.1.1 Mammals

Table 5.5-1 provides a list of mammals that may exist or utilize habitat in the vicinity of the Projects. Since the Projects include limited terrestrial areas, it is likely that many of the species identified in Table 5.5-1 may not occur within the boundaries of the Projects. Species observed during prior wildlife-related field studies are indicated with an asterisk (*)¹².

Table 5.5-1
List of Mammals Potentially Occurring in the Vicinity of the Projects

Species	Scientific Name	Habitat Preference
Masked Shrew	<i>Sorex cinereus</i>	Damp woodlands with structures
Water Shrew	<i>Sorex palustris</i>	Riparian and wetland areas in coniferous areas
Smoky Shrew	<i>Sorex fumeus</i>	Moist, bouldery upland areas with moss, clear cuts
Long-tailed Shrew	<i>Sorex dispar</i>	Deep coniferous/mixed forests, with moss covered rocks
Northern Short-tailed Shrew*	<i>Blarina brevicauda</i>	Variety of open wooded habitats
Pygmy Shrew	<i>Sorex minutus</i>	Variety of wooded habitats
Hairy-tailed Mole	<i>Parascalops breweri</i>	Open wooded areas, fields
Star-nosed Mole	<i>Condylura cristata</i>	Moist, open areas
Little Brown Bat	<i>Myotis lucifugus</i>	Near waterbodies and wetlands, tree cavities
Northern Long-eared Bat	<i>Myotis septentrionalis</i>	Mixed forested landscapes
Silver-haired Bat	<i>Lasionycteris noctivagans</i>	Wooded areas with loose bark near watercourses
Keen's Myotis	<i>Myotis keenii</i>	Wooded areas, under bark
Eastern Small-footed Bat	<i>Myotis leibii</i>	In or near woodland in caves, mine tunnels, buildings, crevices in rocks
Tri-colored Bat	<i>Perimyotis subflavus</i>	Open woods near water, crevices in cliffs, buildings, caves
Big Brown Bat	<i>Eptesicus fuscus</i>	Wooded areas, tree cavities
Red Bat	<i>Lasiurus borealis</i>	Edge of wooded areas
Hoary Bat	<i>Lasiurus cinereus</i>	Wooded coniferous areas
New England Cottontail	<i>Sylvilagus transitionalis</i>	Brushy areas, open woodlands, swamps, mountains
Snowshoe Hare*	<i>Lepus americanus</i>	Woodlands with dense cover, clear cuts, regeneration
Eastern Chipmunk	<i>Tamias striatus</i>	Deciduous woodlands, right-of-way (ROW) edge
Woodchuck	<i>Marmota monax</i>	Woodland edges, open areas
Gray Squirrel	<i>Sciurus carolinensis</i>	Deciduous and mixed forest

¹² Prior wildlife-related field studies conducted at the Projects consisted of general observations conducted during various relicensing studies, as well as small mammal trapping efforts.

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Species	Scientific Name	Habitat Preference
Red Squirrel*	<i>Sciurus vulgaris</i>	Coniferous forests
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>	Deciduous and mixed forest above 1,000 feet
Beaver*	<i>Castor canadensis</i>	Slow moving waterbodies, wetlands
Deer Mouse*	<i>Peromyscus maniculatus</i>	Coniferous or mixed forests, edges, and clear cuts
Southern Red-backed Vole*	<i>Myodes gapperi</i>	Cool, moist forest with mossy rocks, clear cuts
Meadow Vole*	<i>Microtus pennsylvanicus</i>	Open areas such as fields, marshes, and clear cuts
Rock Vole	<i>Microtus chrotorrhinus</i>	Coniferous and mixed forests at higher elevations
Muskrat*	<i>Ondatra zibethicus</i>	Marshes and slow waterbodies with cattail
Southern Bog Lemming	<i>Synaptomys cooperi</i>	Marshes, meadows, and mixed woodlands with duff
Northern Bog Lemming	<i>Synaptomys borealis</i>	Sphagnum bogs, black spruce, and hemlock areas
Norway Rat	<i>Rattus norvegicus</i>	Industrial, farm, and residential areas
House Mouse	<i>Mus musculus</i>	Buildings, fields, corncribs
Meadow Jumping Mouse*	<i>Zapus hudsonius</i>	Moist, open meadows, shrub swamps, and wooded uplands
Woodland Jumping Mouse*	<i>Napaeozapus insignis</i>	Meadows, marshes, clear cuts, and wooded areas
Porcupine	<i>Hystricomorph</i> <i>Hystricidae</i>	Mixed or coniferous forest
Coyote*	<i>Canis latrans</i>	Forest edge, existing ROW
Red Fox*	<i>Vulpes Vulpes</i>	Forest edge, existing ROW, meadows
Gray Fox	<i>Urocyon cinereoargenteus</i>	Dense northern hardwood or mixed forests
Black Bear*	<i>Ursus americanus</i>	Mixed Forest and swamps
Raccoon*	<i>Procyon lotor</i>	Wooded areas along waterbodies
Marten*	<i>Martes americana</i>	Deciduous and coniferous forest
Fisher	<i>Martes pennanti</i>	Mixed and coniferous forest
Ermine	<i>Mustela erminea</i>	Variety of brushy, wooded habitats, close to waterbodies
Long-tailed Weasel	<i>Mustela frenata</i>	Open areas, forest edge, existing ROW
Mink*	<i>Neovison vison</i>	Riparian and wetland areas
Striped Skunk*	<i>Mephitis mephitis</i>	Open woodlands, meadows
River Otter*	<i>Lontra canadensis</i>	Riparian areas and wetlands
Lynx	<i>Felis lynx</i>	Extensive forest
Bobcat*	<i>Lynx rufus</i>	Mixed and deciduous forest, brushy fields, swamps
White-tailed Deer*	<i>Odocoileus virginianus</i>	Forest edge, coniferous swamps
Moose*	<i>Alces alces</i>	Emergent wetlands, waterbodies edges, forest

Sources: Devine Tarbell and Associates, Inc. (DTA) 2002, DeGraaf and Yamasaki 2001, GNNC 1991a and 1991b.

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According to the MDIFW's *Wildlife Habitat Data Web Mapping Application* (MDIFW 2021d), there are no mapped Deer Wintering Areas¹³ (DWAs) located within the Ripogenus Project boundary and two DWAs located towards the downstream end of the Penobscot Mills Project boundary. One DWA is located west of Millinocket, and another is located to the east of Dolby Pond. The DWA located west of Millinocket is located outside of the Penobscot Mills Project boundary, while portions of the DWA located east of Dolby Pond are located within the Penobscot Mills Project boundary.

5.5.1.2 Birds

A wide range of bird species, including both resident and migratory species, may occur in the vicinity of the Projects. Table 5.5-2 provides a list of bird species that may exist or may utilize habitat in the vicinity of the Projects. Species observed during prior field studies are indicated with an asterisk (*).

Table 5.5-2
List of Bird Species Potentially Occurring in
the Vicinity of the Projects

Species	Scientific Name	Habitat Preference
Common Loon*	<i>Gavia immer</i>	Large waterbodies
Double-crested Cormorant*	<i>Phalacrocorax auritus</i>	Rivers and lakes as well as in coastal areas
Pied-billed Grebe	<i>Podilymbus podiceps</i>	Ponds, marshes with heavy emergent vegetation
American Bittern	<i>Botaurus lentiginosus</i>	Marshes, bogs, and waterbodies
Great Blue Heron*	<i>Ardea herodias</i>	Shallow shores of marshes and waterbodies
Green Heron	<i>Butorides virescens</i>	Swamps, marshes, lakes, ponds, impoundments, and other wet habitats with trees and shrubs
Canada Goose	<i>Branta canadensis</i>	Many habitats near water, grassy fields, and grain fields
Wood Duck	<i>Aix sponsa</i>	Shallow water ponds, lakes, and wetlands near wooded areas
American Black Duck*	<i>Anas rubripes</i>	Emergent and shrub wetlands, flowages, rivers, and lakes
Green-winged Teal	<i>Anas crecca</i>	Isolated river deltas, forested wetlands, beaver flowages, sedge meadows, streams, and lakes

¹³ A DWA is defined as a forested area used by deer when snow depth in the open/hardwoods exceeds 12 inches, deer sinking depth in the open/hardwoods exceeds 8 inches, and mean daily temperatures are below 32°F (Maine ArcGIS 2018).

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Species	Scientific Name	Habitat Preference
Blue-winged Teal	<i>Spatula discors</i>	Marshes, vegetated wetlands around lakes, and shallow ponds or pond-marsh mixes
Mallard*	<i>Anas platyrhynchos</i>	Emergent and shrub wetlands, rivers, and lakes
Ring-necked Duck	<i>Aythya collaris</i>	Marshes, bogs, and flowages
Common Goldeneye	<i>Bucephala clangula</i>	Ponds, lakes, and rivers near wooded areas
Hooded Merganser	<i>Lophodytes cucullatus</i>	Wooded ponds, lakes, and rivers
Common Merganser*	<i>Mergus merganser</i>	Rivers and lakes
Red-breasted Merganser*	<i>Mergus serrator</i>	Rivers and lakes
Osprey*	<i>Pandion haliaetus</i>	Near large waterbodies
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Near large waterbodies
Northern Harrier*	<i>Circus cyaneus</i>	Meadows, emergent wetlands, bogs
Sharp-shinned Hawk	<i>Accipiter striatus</i>	Isolated forested areas, edges
Cooper's Hawk*	<i>Accipiter cooperii</i>	Extensive forests
Northern Goshawk	<i>Accipiter gentilis</i>	Extensive forests
Red-shouldered Hawk	<i>Buteo lineatus</i>	Woodlands, forested wetlands
Broad-winged Hawk*	<i>Buteo platypterus</i>	Woodlands, forested wetlands
Red-tailed Hawk*	<i>Buteo jamaicensis</i>	Woodlands, ROW corridors, old fields
Rough-legged Hawk	<i>Buteo lagopus</i>	Open fields, marshes
American Kestrel*	<i>Falco sparverius</i>	ROW edges, old fields near tree cavities
Ruffed Grouse*	<i>Bonasa umbellus</i>	Forested areas with herbaceous openings, ROW edges
Semipalmated Plover*	<i>Charadrius semipalmatus</i>	Shores, tideflats, favors open habitats on migration, including broad mudflats, sandy beaches, lake shores; sometimes in flooded fields or even plowed fields with other shorebirds
Spruce Grouse	<i>Falcipennis canadensis</i>	Dense interior coniferous forest, cedar bogs
Virginia Rail	<i>Rallus limicola</i>	Shallow freshwater wetlands with tall stands of cattails and rushes
Sora	<i>Porzana carolina</i>	Marshes, ponds, swamps, bogs, wet grassy meadows, sloughs having abundant and dense vegetation
Spotted Sandpiper*	<i>Actitis macularius</i>	Edges of lakes and rivers
Killdeer*	<i>Charadrius vociferus</i>	Barren areas, pastures, gravel pits
Common Snipe*	<i>Gallinago gallinago</i>	Marshes, emergent bogs
American Woodcock*	<i>Scolopax minor</i>	Nest in young, shrubby, deciduous forests, old fields, and mixed forest-agricultural-urban areas
Herring Gull*	<i>Larus argentatus</i>	Large waterbodies
Ring-billed Gull*	<i>Larus delawarensis</i>	Found in and around urban, suburban, and agricultural areas as well as reservoirs, lakes,

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Species	Scientific Name	Habitat Preference
		ponds, streams, landfills, parking lots, and shopping malls
Great black-backed Gull*	<i>Larus marinus</i>	Can be found in inland wetland habitats, such as lakes, ponds, rivers, wet fields
Common Tern*	<i>Sterna hirundo</i>	Lakes, ocean, bays, beaches; wide range of aquatic habitats in summer
Belted Kingfisher*	<i>Megasceryle alcyon</i>	Streams, lakes, bays, coasts; nests in banks
Northern Flicker*	<i>Colaptes auratus</i>	Open forests, woodlots, groves, towns, semi-open country
Rock Dove	<i>Columba livia</i>	Near human dwellings
Mourning Dove	<i>Zenaidura macroura</i>	Open country, scattered trees, and woodland edges
Eastern Screech Owl	<i>Otus asio</i>	Shade trees in towns, orchards, small woodlots, and open woodlands
Great Horned Owl	<i>Bubo virginianus</i>	Interior woodlands, forest edges, wetlands
Barred Owl	<i>Strix varia</i>	Forested wetlands, bottomlands
Long-eared Owl	<i>Asio otus</i>	Dense (usually coniferous) forests or groves
Boreal Owl	<i>Aegolius funereus</i>	Dense coniferous and mixed hardwood forests
Northern Saw-whet Owl	<i>Aegolius acadicus</i>	Woodlands, edges
Common Nighthawk	<i>Chordeiles minor</i>	Open woodlands, railroad beds, clearings
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	Woodlands, edges, swamps
Hairy Woodpecker*	<i>Picoides villosus</i>	Forests
Three-toed Woodpecker	<i>Picoides dorsalis</i>	Coniferous forest, clear cuts with dead timber
Black-backed Woodpecker	<i>Picoides arcticus</i>	Coniferous forest, clear cuts with dead timber
Pileated Woodpecker*	<i>Dryocopus pileatus</i>	Interior second growth forest, forested wetlands
Downy Woodpecker*	<i>Dryobates pubescens</i>	Forests, woodlots, willows, river groves, orchards, shade trees
Yellow-bellied Sapsucker*	<i>Sphyrapicus varius</i>	Woodlands, aspen groves; in winter, also orchards, other trees. In summer mostly in mixed coniferous and deciduous woods, especially around aspens
Eastern Wood Pewee*	<i>Contopus virens</i>	Forest interior
Alder Flycatcher	<i>Empidonax alnorum</i>	Shrub wetlands with openings
Least Flycatcher*	<i>Empidonax minimus</i>	Deciduous woodlands, edges, forested wetlands
Eastern Phoebe	<i>Sayornis phoebe</i>	Wooded or shrub areas near waterbodies
Great crested Flycatcher*	<i>Myiarchus crinitus</i>	Woodlands, forested swamps
Eastern Kingbird	<i>Tyrannus tyrannus</i>	Open woodlands, shrub wetlands
Horned Lark	<i>Eremophila alpestris</i>	Open areas, fields, pastures
Tree Swallow*	<i>Tachycineta bicolor</i>	Open areas near water, beaver flowages
Bank Swallow*	<i>Riparia riparia</i>	Riverbanks, gravel pits

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Species	Scientific Name	Habitat Preference
Cliff Swallow	<i>Hirundo pyrrhonota</i>	Farmlands, villages, cliffs, bridges, dams, fresh or saltwater areas, open forests
Blue Jay*	<i>Cyanocitta cristata</i>	Woodlands, towns
Raven*	<i>Corvus corax</i>	Boreal and mountain forests, coastal cliffs, tundra, desert; often in heavily forested country
Gray Jay	<i>Perisoreus canadensis</i>	Coniferous forest, cedar bogs
American Crow*	<i>Corvus brachyrhynchos</i>	Woodlands, ROW corridors
Black-capped Chickadee*	<i>Poecile atricapillus</i>	Woodlands, towns
Boreal Chickadee	<i>Poecile hudsonicus</i>	Coniferous forest, spruce bogs
White-breasted Nuthatch*	<i>Sitta carolinensis</i>	Deciduous woodlands
Red-breasted Nuthatch*	<i>Sitta canadensis</i>	Coniferous Forest
Brown Creeper	<i>Certhia americana</i>	Dense woodlands
House Wren	<i>Troglodytes aedon</i>	Near human dwellings, brushy clearings
Winter Wren*	<i>Troglodytes hiemalis</i>	Dense coniferous undergrowth, bog edges
Sedge Wren	<i>Cistothorus platensis</i>	Sedge meadows, shallow sedge marshes with scattered shrubs and little or no standing water, coastal brackish marshes
Marsh Wren	<i>Cistothorus palustris</i>	Marshes
Golden-crowned Kinglet	<i>Regulus satrapa</i>	Coniferous forest
Ruby-crowned Kinglet*	<i>Regulus calendula</i>	Coniferous forest, edges
Eastern Bluebird	<i>Sialia sialis</i>	Open woodlands, clearings, edges
Veery*	<i>Catharus fuscescens</i>	Moist deciduous woodlands
Swainson's Thrush*	<i>Catharus ustulatus</i>	Coniferous forest, near water
Hermit Thrush*	<i>Catharus guttatus</i>	Wooded swamps, coniferous edges
Wood Thrush*	<i>Hylocichla mustelina</i>	Mature lowland forests, shady, cool, mature upland forests, often near a swamp, pond, stream, or lake
American Robin*	<i>Turdus migratorius</i>	Open woodlands, clearings pastures
Gray Catbird*	<i>Dumetella carolinensis</i>	Brushy edges, shrub wetlands, clear cuts
Brown Thrasher	<i>Toxostoma rufum</i>	Bushes, low trees, tangle of vines in open pastures or woodland edges and clearings in early stages of second growth
Bohemian Waxwing	<i>Bombycilla garrulus</i>	Unreported
Cedar Waxwing*	<i>Bombycilla cedrorum</i>	Open woodlands, open orchards, towns
Northern Shrike	<i>Lanius excubitor</i>	Open woodlands, brushy areas
Loggerhead Shrike	<i>Lanius ludovicianus</i>	Open country with scattered trees, shrubs, roadside hedges
European Starling	<i>Sturnus vulgaris</i>	Towns, farms, and fields
Solitary Vireo*	<i>Vireo solitarius</i>	Mixed woodlands with dense understory

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Species	Scientific Name	Habitat Preference
Yellow-throated Vireo	<i>Vireo flavifrons</i>	Tall deciduous trees in woodlands with partially opened canopy, seldom in dense forests, rarely in conifers
Philadelphia Vireo	<i>Vireo philadelphicus</i>	Forests, edges, ROW corridors
Red-eyed Vireo*	<i>Vireo olivaceus</i>	Open deciduous forest
Nashville Warbler*	<i>Vermivora ruficapilla</i>	Moist deciduous forest, edges
Northern Parula*	<i>Setophaga americana</i>	Mix forest with old man's beard, forested wetlands
Yellow-rumped Warbler*	<i>Dendroica coronata</i>	Coniferous forest, edges
Black-throated Green Warbler*	<i>Dendroica virens</i>	Mixed forest, forested wetlands
Blackburnian Warbler*	<i>Dendroica fusca</i>	Deep coniferous woods or swampy woods
Palm Warbler	<i>Dendroica palmarum</i>	Bogs and bog edges
Bay-breasted Warbler*	<i>Dendroica castanea</i>	Coniferous forest, coniferous shrub areas
Blackpoll Warbler*	<i>Setophaga striata</i>	Wet areas with evergreen trees, scrubby thickets, and mature evergreen and deciduous forests
Ovenbird*	<i>Seiurus aurocapilla</i>	Broadleaf or mixed forests
Yellow Warbler*	<i>Setophaga petechia</i>	Bushes, swamp edges, streams, gardens
Chestnut-sided Warbler*	<i>Setophaga pensylvanica</i>	Slashings, bushy pastures; breeds in second-growth deciduous woods, overgrown fields, and edge habitat
Black-and-white Warbler*	<i>Mniotilta varia</i>	Forest and second growth
American Redstart*	<i>Setophaga ruticilla</i>	Deciduous woodlands, forested wetlands
Northern Waterthrush*	<i>Parkesia noveboracensis</i>	Forested wetlands near waterbodies
Mourning Warbler	<i>Oporornis philadelphia</i>	ROW corridors, clear-cuts
Common Yellowthroat*	<i>Geothlypis trichas</i>	Shrub wetlands, brushy areas
Wilson's Warbler	<i>Wilsonia pusilla</i>	Bogs, shrub wetlands
Canada Warbler*	<i>Wilsonia canadensis</i>	Moist forest with undergrowth, forested wetlands
Tennessee Warbler*	<i>Leiothlypis peregrina</i>	Deciduous and mixed forests; breeds in bogs, swamps, and forests
Magnolia Warbler*	<i>Setophaga magnolia</i>	Low conifers; breeds most commonly in areas of short young spruce; also in young hemlocks and pines and in dense understory of taller coniferous forest
Cape May Warbler*	<i>Setophaga tigrina</i>	Spruce forest; breeds in spruce forest, either in pure stands or mixed with firs or other trees, generally in more open woods or near the forest edge
Black-throated blue Warbler*	<i>Setophaga caerulescens</i>	Interior of hardwood and mixed deciduous-coniferous forests; breeds in large areas of relatively undisturbed forests of maple, birch, beech, eastern hemlock, spruce, and fir

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Species	Scientific Name	Habitat Preference
Scarlet Tanager*	<i>Piranga olicacea</i>	Mature deciduous and mixed wood lands, roadside shade trees
Chipping Sparrow	<i>Spizella passerina</i>	Towns, farms, fields
Savannah Sparrow*	<i>Passerculus sandwichensis</i>	Open fields, meadows, salt marshes, prairies, dunes, shores
White-throated Sparrow*	<i>Zonotrichia albicollis</i>	Brushy areas, clear-cuts, bogs
Dark-eyed Junco*	<i>Junco hyemalis</i>	Forest, clearings, ROW edges
Song Sparrow*	<i>Melospiza melodia</i>	Thickets, brush, marshes, roadsides, gardens
Swamp Sparrow*	<i>Melospiza georgiana</i>	Fresh marshes with tussocks, bushes, or cattails; sedgy swamps
Red-winged Blackbird*	<i>Agelaius phoeniceus</i>	Breeds in marshes, brushy swamps, hay fields; forages also in cultivated land and along edges of water
Lapland Longspur	<i>Calcarius lapponicus</i>	Cultivated fields, open weedy meadows, beaches, sandy waste places with sparse vegetation
Snow Bunting	<i>Plectrophenax nivalis</i>	Lake shores, salt marshes, open beaches, cultivated fields and windswept grasslands
Bobolink	<i>Dolichonyx oryzivorus</i>	Hayfields, meadows, marshes, fallow fields
Eastern Meadowlark	<i>Sturnella magna</i>	Open farmlands, especially pastures, hayfields, and grassy meadows
Common Grackle*	<i>Quiscalus quiscula</i>	Farmlands, suburbs, marshes, swamps, meadows at low elevations
Pine Grosbeak	<i>Pinicola enucleator</i>	Northern spruce-fir forests
Purple Finch*	<i>Carpodacus purpureus</i>	Edges of coniferous forests, evergreen plantations, ornamental conifers in residential areas, parks, open mixed woodlands
Red Crossbill	<i>Loxia curvirostra</i>	Coniferous forests from wooded marine islands to mountain tops
Common Redpoll*	<i>Carduelis flammea</i>	Near alders and birches
Hoary Redpoll	<i>Carduelis hornemanni</i>	Old fields, pastures, and birch or alder swamps
Pine Siskin*	<i>Carduelis pinus</i>	Coniferous forests, natural conifer stands or evergreen plantations, alder thickets, weed patches adjacent to forests
American Goldfinch*	<i>Carduelis tristis</i>	Open weedy fields, pastures with scattered trees near villages and farms, forest edges, open swamps
Evening Grosbeak*	<i>Coccothraustes vespertinus</i>	Coniferous forests
Rose-breasted Grosbeak*	<i>Pheucticus ludovicianus</i>	Deciduous woods, orchards, groves
House Sparrow	<i>Passer domesticus</i>	Villages, farms, cities, parks

Sources: DTA 2002, DeGraaf and Yamasaki 2001, GNNC 1991a and 1991b, Audubon Undated.

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Bald eagles (*Haliaeetus leucocephalus*) are known to nest at several locations within the vicinity of the Projects (GNNC 1991a and 1991b). The MDIFW has been monitoring the occurrence of nesting bald eagles for many years and maintains a comprehensive database of known bald eagle nest sites in Maine. This database, available through the Maine Office of GIS, indicates that there are six bald eagle nest sites located in the Ripogenus Project vicinity. These are identified as nest sites 441A, 730B, 186B, 186C, 264B, and 120B. Most of these nests appear to be located within or just slightly outside of the Ripogenus Project boundary. Within the Penobscot Mills Project vicinity, the database indicates there are 13 bald eagle nest sites. These are identified as nest sites 439A, 285A, 461A, 383C, 141C, 613A, 236D, 098D, 289D, 816A, 214D, 498D, and 628B. The majority of the nests appear to be located near the outer edge of the Penobscot Mills Project boundary with several occurring within the Project boundary. Although the bald eagle is no longer listed as federally threatened or endangered, protection continues under the Bald and Golden Eagle Protection Act, the Migratory Bird Treaty Act, and the Lacey Act (MDIFW 2008). The bald eagle was delisted by the State of Maine in 2009.

According to the MDIFW's *Wildlife Habitat Data Web Mapping Application* (MDIFW 2021d), several Inland Waterfowl/Wading Bird Habitats (IWWH)¹⁴ are located within the boundaries of the Projects. Table 5.5-3 provides mapped IWWHs that are located within the approximate boundaries of the Projects. These habitats typically include nesting and feeding areas for waterfowl and wading birds.

Table 5.5-3
Summary of IWWH Within the Project Boundaries

IWWH ID	IWWH Rating ¹
<i>Ripogenus Project</i>	
3695	H
4020	H
4210	M
4281	M
4271	M
4562	M
5159	M

¹⁴ MDIFW has identified significant inland habitats for ducks, geese, herons, and similar species of waterfowl and wading birds throughout the state, rating them as having high to moderate value. A high to moderate value inland bird habitat is a complex of freshwater wetland and open water areas plus a 250-foot wide area surrounding the complex itself where inland species of waterfowl and wading birds nest (MDEP 2019a).

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IWWH ID	IWWH Rating¹
5485	M
5582	M
5373	M
5321	M
4285	M
4193	M
4243	M
3985	M
3687	M
4135	M
4184	M
4201	M
4050	H
<i>Ripogenus Project Transmission Line</i>	
5445	M
5613	M
5807	M
5834	M
6000	M
6035	M
<i>Millinocket Lake Storage Development</i>	
5935	M
5841	M
5761	M
5728	M
5706	M
5759	M
474	H
5834	M
6065	M
<i>North Twin Development</i>	
6463	M
6304	H
6315	M
6264	M
6164	M
6335	M
6015	M
6120	M
6227	M
6261	H
6485	H
6626	M
6698	M
6715	M
6736	M
6660	M
6662	H

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IWWH ID	IWWH Rating ¹
<i>Millinocket Development</i>	
203443	M
203359	M
6713	M
6683	M
<i>Dolby Development</i>	
110724	H
6646	M

Source: MDIFW2021d.

No Essential Habitats are known to exist within the boundaries of the Projects or vicinity. Essential Habitats are defined as “areas currently or historically providing physical or biological features essential to the conservation of an endangered or threatened species in Maine and which may require special management considerations” (MDIFW 2021e).

5.5.1.3 Amphibians and Reptiles

A wide range of amphibian and reptile species may occur in the vicinity of the Projects. For example, the blue and spotted salamanders, *Ambystoma laterale* and *A. maculatum*, respectively, make use of temporary forested pools (e.g., vernal pools) for reproduction in early spring before returning to terrestrial habitats to forage and over-winter underground (Hunter et al. 1999). Table 5.5-4 provides the amphibian and reptile species that may exist or utilize habitat in the vicinity of the Projects. Species observed during prior field studies are indicated with an asterisk (*).

Table 5.5-4
List of Amphibians and Reptiles Potentially Occurring
in the Vicinity of the Projects

Species	Scientific Name	Habitat Preference
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	Terrestrial, undisturbed damp, shady deciduous or mixed woods, bottomlands, swamps, ravines, moist pastures, or lakeshores
Blue-spotted Salamander	<i>Ambystoma laterale</i>	Moist areas such as vernal pools and forested wetlands
Spotted Salamander*	<i>Ambystoma maculatum</i>	Moist forested areas, vernal pools, marshy areas, mixed woods
Red-spotted Newt	<i>Notophthalmus viridescens</i>	Juveniles (red efts) in moist forested areas, adults in slow-moving waters
Northern Dusky Salamander*	<i>Desmognathys fuscus</i>	Cool running waters at forest margin

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Species	Scientific Name	Habitat Preference
Redback Salamander*	<i>Plethodon cinereus</i>	Mixed deciduous woodlands; under decaying logs, rocks, and litter
Four-toed Salamander	<i>Hemidactylium scutatum</i>	Wet forested areas with sphagnum moss, bogs
Northern Spring Salamander	<i>Gyrinophilus porphyriticus</i>	Forested areas with clear, cold water, springs, mountain streams, creeks, boggy areas
Northern Two-lined Salamander	<i>Eurycea bislineata</i>	Floodplains, moist forests near seeps
Eastern American Toad*	<i>Bufo a. americanus</i>	Forested habitats, existing ROW
Northern Spring Peeper*	<i>Hyla crucifer</i>	Wetlands such as emergent and scrub-shrub, edges of waterbodies
Gray Treefrog	<i>Hyla versicolor</i>	Forested areas, scrub-shrub swamps
Bullfrog*	<i>Rana catesbeiana</i>	Shorelines of large waterbodies
Green Frog*	<i>Rana clamitans melanota</i>	Riparian areas along waterbodies and shallow pools
Mink Frog	<i>Rana septentrionalis</i>	Margins of ponds, waterbodies
Wood Frog*	<i>Rana sylvatica</i>	Forested areas, vernal pools
Northern Leopard Frog*	<i>Rana pipiens</i>	Wet open fields, emergent wetlands
Pickerel Frog*	<i>Rana palustris</i>	Wet open areas, waterbodies, and pond margins
Common Snapping Turtle	<i>Chelydra serpentina</i>	Permanent waterbodies
Wood Turtle	<i>Glyptemys insculpta</i>	Slow-moving sandy/gravel bottom waterbodies, fields, and woods
Eastern Painted Turtle	<i>Chrysemys picta</i>	Slow, quiet waterbodies
Midland Painted Turtle	<i>Chrysemys picta marginata</i>	Quiet water, preferably shallow areas with dense vegetation
Northern Water Snake	<i>Nerodia sipedon</i>	Permanently flooded wetlands, waterbodies
Northern Redbelly Snake	<i>Storeria occipitomaculata occipitomaculata</i>	Moist woodlands, bogs with sphagnum
Eastern Garter Snake*	<i>Thamnophis sirtalis</i>	Variety of terrestrial habitats
Maritime Garter Snake	<i>Thamnophis sirtalis pallidula</i>	Mature hardwood stands and fir stands with mixed understory
Northern Ribbon Snake	<i>Thamnophis sauritus septentrionalis</i>	Sunny areas with low dense vegetation near bodies of shallow quiet water
Northern Ringneck Snake	<i>Diadophis punctatus edwardsii</i>	Shady woodlands and under logs, rocks
Eastern Smooth Green Snake	<i>Opheodrys vernalis vernalis</i>	Upland areas, scrublands, existing ROW
Eastern Milk Snake	<i>Lampropeltis tiangulum</i>	Variety of habitats such as scrublands, woodlands, and ROW edge

Sources: DeGraaf and Yamasaki 2001, GNNC 1991a and 1991b, Hunter et al. 2009.

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There are no MDIFW vernal pools or Significant Vernal Pools (SVP) mapped within the approximate boundaries of the Projects according to the MDIFW's *Wildlife Habitat Data Web Mapping Application* (MDIFW 2021d). Pursuant to the 1997 Back Channel Wildlife Management Plan and subsequent monitoring reports filed with FERC, and as part of the upland area habitat management, vernal pools are identified in the spring or early summer for protection during subsequent timber harvest activities. Several vernal pools and two SVPs are located southeast of Ferguson Pond, but outside of the Project boundary.

5.5.1.4 Invasive Wildlife Species

The Wildlife Society (TWS) defines an invasive species as an established plant or animal species that causes direct or indirect economic or environmental harm within an ecosystem, or a species that would likely cause such harm if introduced to an ecosystem in which it is non-indigenous as determined through objective, scientific risk assessment tools and analyses (TWS 2020). According to the University of Maine, Maine Invasive Species Network (University of Maine 2021), there are nine invasive insect species currently known to occur in Maine. Table 5.5-5 lists invasive insect species that are currently known to occur in Maine, with the majority of these species occurring in central and coastal Maine, outside of the area associated with the Projects.

**Table 5.5-5
Invasive Insect Species Currently Known to Occur in Maine**

Common Name	Scientific Name	Notes
European fire Ant	<i>Myrmica rubra</i>	Established in many communities along the Maine coast
Gypsy Moth	<i>Lymantria dispar</i>	Infestations are heaviest in central and southern Maine
Spotted wing Drosophila	<i>Drosophila suzukii</i>	
Emerald ash Borer	<i>Agrilus planipennis</i>	Emerald ash borer was first found in Aroostook County and York County, ME, in 2018. It was detected in Cumberland County in September 2019
Asian longhorned Beetle	<i>Anoplophora glabripennis</i>	Hosts include hardwood trees, especially maples
Brown spruce longhorn Beetle	<i>Tetropium fuscum</i>	Pest from Europe currently found in parts of Nova Scotia and New Brunswick Canada

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Common Name	Scientific Name	Notes
Hemlock woolly Adelgid	<i>Adelges tsugae</i>	As of 2018, hemlock woolly adelgid has been found in forests of more than 40 southern and coastal Maine towns
Winter Moth	<i>Operophtera brumata</i>	Currently only known to occur in coastal Maine from Kittery to Bar Harbor
Browntail Moth	<i>Euproctis chrysorrhoea</i>	The greatest concentrations of this species are known to occur in mid-coastal Maine and the capitol region.

Source: MDACF 2021b.

5.5.2 Botanical Resources

Approximately 95 percent of the Penobscot River Basin is forested (Pierce et al. 1993 *as cited in* FERC 1996). Historically, the predominant vegetation type throughout northern Maine, including the Penobscot River Basin, was spruce-fir forest (FERC 1996). Lands adjacent to the boundaries of the Projects are largely forested. Both hardwoods and softwoods are present, with primarily softwoods along the shorelines of the impoundments. Deciduous species in the vicinity include yellow birch (*Betula alleghaniensis*), American beech (*Fagus grandifolia*), and sugar maple (*Acer saccharum*). The most common coniferous species in the vicinity of the Projects are eastern hemlock (*Tsuga canadensis*), red spruce (*Picea rubens*), and white pine (*Pinus strobus*). Based on previous field investigations conducted in the late 1980s and early 1990s to identify the predominant and characteristic species of trees, shrubs, and herbs present in each dominant cover type within the Projects, the following two major communities within the Projects were identified: 1) softwood-dominated mixed forest; and 2) hardwood-dominated mixed forest (GNNC 1991a and 1991b). Appendix F, Botanical Data, lists the vascular plant species found in the dominant cover types as a result of previous relicensing investigations.

5.5.2.1 Invasive Botanical Species

The MDACF Advisory List of Invasive Plants (Advisory List) is a list of non-native plants found to pose a threat to habitats and natural resources in Maine. The Advisory List is an informal tool for landowners, wildlife biologists, foresters, land stewards, conservation commissions, and others interested in controlling invasive plants and preventing their spread (MDACF 2021c). Overall, the abundance and distribution of invasive plant species within the State are much less severe than in

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other New England states, due to the effects of climate and the isolation of a majority of Maine watersheds (Maine Natural Areas Program [MNAP] 2000 *as cited in* FPL Energy 2012). Table 5.5-6 lists plant species considered to be severely invasive and very invasive within the State of Maine. According to the MDEP (2019b), no infestation of aquatic invasive species is known to occur within the boundaries of the Projects.

Table 5.5-6
Invasive Botanical Species Considered to be Severely Invasive and Very Invasive within the State of Maine

Common Name	Scientific Name	Ranking
American water lotus	<i>Nelumbo lutea</i>	Severely invasive
Amur honeysuckle*	<i>Lonicera maackii</i>	Severely invasive
Asiatic bittersweet*	<i>Celastrus orbiculatus</i>	Severely invasive
Bella honeysuckle*	<i>Lonicera x bella</i>	Severely invasive
Black locust*	<i>Robinia pseudoacacia</i>	Severely invasive
Black swallowwort	<i>Cynanchum louiseae</i>	Severely invasive
Bohemian knotweed	<i>Fallopia x bohémica</i>	Severely invasive
Brazilian waterweed**	<i>Egeria densa</i>	Severely invasive
Canada thistle	<i>Cirsium arvense</i>	Severely invasive
Chinese yam	<i>Dioscorea polystachya</i>	Severely invasive
Chocolate vine; five-leaf akebia	<i>Akebia quinata</i>	Severely invasive
Common buckthorn	<i>Rhamnus cathartica</i>	Severely invasive
Common reed	<i>Phragmites australis</i>	Severely invasive
Curly pondweed**	<i>Potamogeton crispus</i>	Severely invasive
Eurasian milfoil**	<i>Myriophyllum spicatum</i>	Severely invasive
European alder	<i>Alnus glutinosa</i>	Severely invasive
European frog's bit**	<i>Hydrocharis morsus-ranae</i>	Severely invasive
False indigo*	<i>Amorpha fruticosa</i>	Severely invasive
Fanwort**	<i>Cabomba caroliniana</i>	Severely invasive
Flowering rush	<i>Butomus umbellatus</i>	Severely invasive
Garlic mustard*	<i>Alliaria petiolata</i>	Severely invasive
Giant knotweed	<i>Fallopia sachalinensis</i>	Severely invasive
Glossy buckthorn*	<i>Frangula alnus</i>	Severely invasive
Goutweed*	<i>Aegopodium podagraria</i>	Severely invasive
Hydrilla**	<i>Hydrilla verticillata</i>	Severely invasive
Inflated bladderwort	<i>Utricularia inflata</i>	Severely invasive
Japanese barberry*	<i>Berberis thunbergii</i>	Severely invasive
Japanese honeysuckle*	<i>Lonicera japonica</i>	Severely invasive

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Common Name	Scientific Name	Ranking
Japanese knotweed*	<i>Fallopia japonica</i>	Severely invasive
Japanese stilt grass*	<i>Microstegium vimineum</i>	Severely invasive
Morrow's honeysuckle*	<i>Lonicera morrowii</i>	Severely invasive
Ornamental jewelweed*	<i>Impatiens glandulifera</i>	Severely invasive
Pale swallowwort	<i>Cynanchum rossicum</i>	Severely invasive
Parrot feather**	<i>Myriophyllum aquaticum</i>	Severely invasive
Porcelainberry*	<i>Ampelopsis glandulosa</i>	Severely invasive
Reed canary grass	<i>Phalaris arundinacea</i>	Severely invasive
Slender-leaved naiad**	<i>Najas minor</i>	Severely invasive
Starry stonewort	<i>Nitellopsis obtusa</i>	Severely invasive
Starwort	<i>Callitriche stagnalis</i>	Severely invasive
Tall pepperwort	<i>Lepidium latifolium</i>	Severely invasive
Tartarian honeysuckle*	<i>Lonicera tatarica</i>	Severely invasive
Tree of heaven*	<i>Ailanthus altissima</i>	Severely invasive
Variable milfoil**	<i>Myriophyllum heterophyllum</i>	Severely invasive
Water chestnut**	<i>Trapa natans</i>	Severely invasive
Water lettuce	<i>Pistia stratiotes</i>	Severely invasive
Water soldier	<i>Stratiotes aloides</i>	Severely invasive
Wavy leaf basketgrass	<i>Oplismenus hirtellus ssp. undulatifolius</i>	Severely invasive
White cottonwood*	<i>Populus alba</i>	Severely invasive
Wineberry	<i>Rubus phoenicolasias</i>	Severely invasive
Winged euonymus*	<i>Euonymus alatus</i>	Severely invasive
Yellow floating heart**	<i>Nymphoides peltata</i>	Severely invasive
Yellow iris*	<i>Iris pseudacorus</i>	Severely invasive
Amur cork tree*	<i>Phellodendron amurense</i>	Very invasive
Amur maple*	<i>Acer ginnala</i>	Very invasive
Autumn olive*	<i>Elaeagnus umbellata</i>	Very invasive
Black jetbead	<i>Rhodotypos scandens</i>	Very invasive
Border privet	<i>Ligustrum obtusifolium</i>	Very invasive
California privet	<i>Ligustrum ovalifolium</i>	Very invasive
Callery ("Bradford") pear	<i>Pyrus calleryana</i>	Very invasive
Common barberry*	<i>Berberis vulgaris</i>	Very invasive
Creeping buttercup	<i>Ranunculus repens</i>	Very invasive
Dame's rocket*	<i>Hesperis matronalis</i>	Very invasive
English water grass	<i>Glyceria maxima</i>	Very invasive
European blackberry	<i>Rubus fruticosus</i>	Very invasive
Giant hogweed	<i>Heracleum mantegazzianum</i>	Very invasive

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Common Name	Scientific Name	Ranking
Hairy willow-herb	<i>Epilobium hirsutum</i>	Very invasive
Hardy kiwi	<i>Actinidia arguta</i>	Very invasive
Japanese hops	<i>Humulus japonicus</i>	Very invasive
Kudzu	<i>Pueraria lobata</i>	Very invasive
Leafy spurge	<i>Euphorbia esula</i>	Very invasive
Lesser celandine	<i>Ficaria verna</i>	Very invasive
Linden arrowwood	<i>Viburnum dilatatum</i>	Very invasive
Mile-a-minute vine*	<i>Persicaria perfoliata</i>	Very invasive
Multiflora rose*	<i>Rosa multiflora</i>	Very invasive
Narrowleaf bittercress	<i>Cardamine impatiens</i>	Very invasive
Norway maple*	<i>Acer platanoides</i>	Very invasive
Oriental photinia	<i>Photinia villosa</i>	Very invasive
Privet*	<i>Ligustrum vulgare</i>	Very invasive
Purple loosestrife*	<i>Lythrum salicaria</i>	Very invasive
Rugosa rose	<i>Rosa rugosa</i>	Very invasive
Water forget-me-not	<i>Myosotis scorpioides</i>	Very invasive
Wintercreeper	<i>Euonymus fortunei</i>	Very invasive
Yam-leaved virgin's bower	<i>Clematis terniflora</i>	Very invasive

Source: MDACF 2021c.

Notes:

*Plant regulated by the Do Not Sell list, Horticulture Program, MDACF.

**Aquatic plant regulated by the MDEP.

The Projects have not experienced operational or other issues related to any of the species listed above.

5.6 Wetlands, Riparian, and Littoral Habitat

Wetlands are generally defined as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support vegetation typically adapted for life in saturated soil conditions. Most formal wetland definitions emphasize three primary components that define wetlands: the presence of water, unique soils, and hydrophytic vegetation. The USFWS (Cowardin et al. 1979) defines wetlands as follows:

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have one or more of the following three attributes: (1) at least

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periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year.

MDEP's wetland definition is consistent with the USFWS. The USFWS, MDEP, and the U.S. Army Corps of Engineers (USACE) each has jurisdiction over wetlands within the State of Maine and within the vicinity of the Projects.

Riparian habitats are areas that support vegetation found along waterways such as lakes, reservoirs, rivers, and streams. The boundary of the riparian area and the adjoining uplands is gradual and not always well defined. However, riparian areas differ from the uplands because of their high levels of soil moisture, frequency of flooding, and unique assemblage of plant and animal communities (Virginia State University 2000). These habitats can range from mature forests to areas covered by emergent vegetation and shrubs. Riparian habitats are unique because of the linear form and processing of large fluxes of energy and materials from upstream systems (Mitsch and Gosselink 1993). Riparian areas and associated vegetation provide important habitat for wildlife and often contain a higher number of species, both plant and animal, than surrounding upland areas due to proximity to water. These areas are also important avian habitats for resident and migratory birds. Riparian habitat also functions as travel corridors for wildlife species.

5.6.1 Wetland, Riparian, and Littoral Vegetation

Since the beginning of the 19th century, wetlands throughout the Penobscot River Basin have been altered or inundated to some degree through development such as dams for the logging industry, water storage, and hydroelectric generation. Predominant wetlands types within the Penobscot River Basin are palustrine emergent marsh (primarily bogs), palustrine scrub/shrub, and wetland floodplain forests (Tiner 1984 *as cited in* FERC 1996).

As part of the studies conducted in the late 1980s and early 1990s for the previous relicensing of the Projects, investigations were conducted to gather information necessary to understand the potential effects of the Projects on wetland, riparian, and littoral resources. These studies and investigations included a detailed botanical resources investigation.

5.6.1.1 Ripogenus Project

The study area for botanical resource investigations performed for the previous relicensing for the Ripogenus Project included the Ripogenus impoundment (Ripogenus, Chesuncook, and Caribou Lakes, and Black, Brandy, and Moose Ponds), the Upper Gorge (between the Ripogenus dam and McKay Station), the approximately 21-mile-long segment of the West Branch from McKay Station to Ambajejus Lake (North Twin impoundment), and the approximately 29.4-mile-long transmission line corridor from McKay Station to the town of Millinocket. In addition, field investigations were performed in 1981, 1986, 1987, 1989, and 1991. Additionally, desk-top investigations included examining forest cover maps and recent aerial photographs of the Ripogenus impoundment, the West Branch, and the transmission line corridor.

Investigations of the botanical resources of the Project study area were designed to fulfill two primary objectives: 1) characterization of vegetation communities in the lands bordering the Project study area; and 2) characterization of the immediate shoreline environments of the impoundment and West Branch to address resource agency concerns regarding effects of annual drawdowns in water levels. The primary focal points for the shoreline investigations were: 1) effects of the drawdowns on existing wetlands bordering the impoundment as well as those bordering the West Branch; and 2) impacts and enhancements relative to wetland and shoreline vegetation presently occurring and that would be expected in the absence of drawdowns.

Based on field surveys conducted for the previous relicensing in the late 1980s and early 1990s, several categories of wetlands were identified at the Ripogenus Project, including: 1) alder thickets; 2) conifer swamp/wet forest; 3) wet meadow/emergent marsh and wet meadow/open water; and 4) open bog/wet meadow. In addition, in quiet waters 2 to 10 feet deep with sufficient fine substrate, deep marsh/aquatic bed is found in the Project study area (GNNC 1991a). Appendix F, Botanical Data, provides lists of plant species occurring in these principle wetland types within the Project area.

More than 1,251 acres of wetlands border the Ripogenus impoundment (GNNC 1991a). Alder thicket constitutes 118 acres, wet meadow/emergent marsh constitutes 282 acres, wet meadow/open water constitutes 66 acres, and open bog/wet meadow constitutes 785 acres (FERC

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1996). Areas of conifer swamp/wet forest and deep marsh/aquatic bed were not previously measured or estimated. The following are brief descriptions of the principal wetland types:

- Alder thickets, composed primarily of dense stands of speckled alder (*Alnus incana* ssp. *rugosa*), occur as discontinuous bands along the shoreline of the Project impoundment and in deadwaters¹⁵ of the West Branch (FERC 1996). Other common vegetation occurring in alder thickets includes red maple (*Acer rubrum*), meadowsweet (*Spiraea latifolia*), various sedge (*Carex*) species, and sensitive fern (*Onoclea sensibilis*) (GNNC 1991a and 1991b).
- Wet meadow/emergent marsh and wet meadow/open water occur along the shorelines of the Ripogenus impoundment and West Branch deadwaters, often in association with beaver dams. Common vegetation occurring in these wetland types included various willow species (*Salix* spp.), steplebush (*Spiraea tomentosa*), three-way sedge (*Dulichium arundinaceum*), swamp candles (*Lysimachia terrestris*), and blue flag (*Iris versicolor*) (GNNC 1991a and 1991b).
- Open bog/wet meadow occurs on the periphery of the impoundments and in association with streams and beaver ponds. The most common plants include the shrubs leatherleaf (*Chamaedaphne calyculata*), Labrador tea (*Ledum groenlandicum*), bog rosemary (*Andromeda glaucophylla*), and bog laurel (*Kalmia polifolia*) (FERC 1996).
- Conifer swamp/wet forest is found primarily in the deadwater areas along the shorelines of the West Branch at the Ripogenus Project. Principal tree species include northern white cedar (*Thuja occidentalis*), black spruce (*Picea mariana*), green ash (*Fraxinus pennsylvanica*), yellow birch (*Betula alleghaniensis*), and red maple (FERC 1996).
- Deep marsh/aquatic bed is found in still waters of ponds and lake embayments with water depths of 2 to 10 feet, when sufficient fine substrates are present. Predominant plants include manna grass (*Glyceria borealis*), pond lily (*Nymphaea odorata*), pondweed (*Potamogeton epiphydrus*), and bur-reed (*Sparganium* sp.) (FERC 1996).

¹⁵ Deadwaters are backwaters, coves, or other sheltered environments where wetlands are often present.

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The following major systems represent wetlands around the Ripogenus impoundment:

- The 437-acre Brandy Pond wetland system is located at the confluence of the Upper West Branch, Caucomgomoc Stream, and Umbazooksus Stream. It is a large open bog/wet meadow, grading outward (towards the Ripogenus impoundment) to wet meadow/emergent marsh (FERC 1996).
- The Quaker Brook system is approximately 183 acres and is located north of Caribou Lake on the west side of Chesuncook Lake. The lower half of the system is wet meadow/emergent marsh along both banks of Quaker Brook, and it is inundated at normal high-water level for part of the year. The upper half of the system is open bog/wet meadow, where surface water is present most of the year (FERC 1996).
- The shoreline zone of the Ripogenus impoundment includes the area directly above the water line that is exposed during annual drawdowns of the impoundment. The substrate ranges from ledge and large boulders to small rocks and cobbles, with a few areas of coarse granular sand. Predominant plants within the shoreline zone are typical of those adapted to fluctuating water regime and disturbance. Many areas are dominated by “weedy” plant species. There are some scattered areas of submerged aquatic vegetation and emergent plants in the lower end of the dewatered zone. These areas are believed to be most affected by drawdowns (FERC 1996).
- The Upper Gorge area between Ripogenus dam and McKay Station contains predominantly very rocky substrate with high, steep-sided rock walls, which has restricted wetlands development. Vegetation is very sparse in general in the Upper Gorge (FERC 1996).

Of the 528 acres of riparian wetlands bordering the West Branch in the vicinity of the Ripogenus Project, most are associated with dead waters. These deadwaters consist primarily of alder thickets, conifer swamp/wet forest, wet meadow/emergent marsh, wet meadow/open water, and open bog/wet meadow. These wetlands closely resemble those in unregulated lakes in remote parts of Maine (GNNC 1991a). The riparian zone wetlands between McKay Station and Ambajejus Lake

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are characterized by alder thickets and open patches of grasses and sedges. Drier riparian sites at slightly higher elevations are dominated by hardwood and softwood mixed forests (FERC 1996).

In addition to the studies performed during the previous relicensing, GNP performed additional studies associated with wetland mitigation pursuant to the requirements of Article 408 of the Ripogenus Project and Article 410 of the Penobscot Mills Project. Specifically, Article 408 required the Licensee to file a plan to enhance wetlands at the Black Pond site on the Ripogenus impoundment.

On October 21, 1997, the former Licensee (GNP) filed a wetland enhancement plan, pursuant to Article 408 of the Ripogenus Project. Based on consultation with resource agencies during development of the plan, GNP evaluated wetland enhancement at Umbazooksus Lake as an alternative to the Black Pond site. Umbazooksus Lake is a 1,600-acre former storage impoundment located less than one mile upstream of the Ripogenus impoundment via Umbazooksus Stream. Umbazooksus Lake had a dam operated by GNP that could be used to control lake levels for wetland enhancements with less impacts than would occur with a new dam at Black Pond. The objective of the plan was to substantially increase the extent, density, and species diversity of wetland vegetation cover within the zone from the full pond elevation down to approximately six feet below ordinary low water within Umbazooksus Lake. The plan also established a more consistent hydrologic regime and reduced the variability of water levels during the growing season.

As further described in the periodic monitoring reports and the final monitoring report filed with FERC on June 1, 2005, baseline monitoring of Umbazooksus Lake was performed in 1998 with follow-up monitoring performed in 2002 and 2004. Based on the results of monitoring, 320 acres of wetlands were undergoing recovery based on the enhancements. Vegetation cover (i.e., density) increased in all vegetation zones, including a substantial increase in the E/F zones between 1998 and 2004. Overall, vegetation cover increased over 350 percent. The 320 acres of recovering wetlands at Umbazooksus Lake exceeds the original license requirements to enhance approximately 250 acres at Black Pond for the Ripogenus Project and 30 acres at Deep Cover for the Penobscot Mills Project.

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In addition, the wetlands at Umbazooksus Lake had increased by 117 acres (between 1998 and 2004) and substantial progress had been made towards the enhancement objectives of substantially increasing the extent, vegetation density, and plant species richness of Umbazooksus Lake's wetlands. A total of 62 plant species were identified in sample plots within each vegetation zone located along transects, including 11 species of trees and shrubs, 20 herbaceous plants, 24 graminoids, 4 floating-leaved aquatic plants, and 3 bryophytes (GLHA 2005) (see Appendix F, Botanical Data, Table 2 Relative Abundance of Plant Species in Four Wetland Cover Classes Sampled at Umbazooksus Lake, August 16, 17, and 18, 2004).

5.6.1.2 Penobscot Mills Project

The study area for botanical resource investigations performed for the previous relicensing for the Penobscot Mills Project included the North Twin impoundment (Ambajejus, Pemadumcook, North Twin, South Twin, and Elbow Lakes), the Millinocket impoundment (Quakish Lake and Ferguson Pond), the Dolby impoundment (Dolby Pond), the East Millinocket impoundment, Millinocket Lake impoundment, Millinocket Stream, segments of the West Branch, the Back Channel, and the transmission line corridors. Field investigations were performed in 1986, 1987, 1989, and 1991. Additionally, desk-top investigations included examining forest cover maps and recent aerial photographs of the Project study area.

Investigations of the botanical resources of the Project study area were designed to fulfill two primary objectives: 1) characterization of vegetation communities in the lands bordering the Project study area; and 2) characterization of the immediate shoreline environments to address resource agency concerns regarding effects of annual drawdowns in water level of the Project's two storage impoundments (North Twin and Millinocket Lake). The primary focal points for the shoreline investigations were: 1) effects on the existing wetlands bordering the Project's two storage impoundments (North Twin and Millinocket Lake); and 2) impacts and enhancements relative to wetland and shoreline vegetation presently occurring and that would be expected in the absence of drawdowns.

Based on field surveys conducted for the previous relicensing of the Projects in the late 1980s and early 1990s, several categories of wetlands were identified at the Penobscot Mills Project, including: 1) alder thickets; 2) conifer swamp/wet forest; 3) wet meadow/emergent marsh and wet

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meadow/open water; 4) open bog/wet meadow; and 5) deep marsh/aquatic bed (GNNC 1991a). Appendix F, Botanical Data, provides lists of plant species occurring in these principle wetland types within the Project area.

A total of 296 acres of wetlands border the North Twin impoundment. The principal types of wetlands at North Twin are wet meadow/emergent marsh (180 acres), open bog/wet meadow (114 acres), and wet meadow/open water (2 acres) (FERC 1996). The three principal wetland systems in the vicinity of the North Twin impoundment are the following:

- White Horse Island wetland complex, which is wet meadow/emergent marsh, with open water east and south of the island.
- Stephenson's Landing wetlands, which consists of two distinct types, wet meadow/emergent marsh and open bog/wet meadow. The wetlands are flooded during high water.
- Impoundment shoreline wetlands, which are characterized by plants tolerant of fluctuating water levels during drawdowns and human disturbance. The substrate of the dewatered shoreline zone ranges from ledge and large boulders to smaller rocks and cobbles and coarse, granular sand (FERC 1996).

Millinocket Lake encompasses approximately 709 acres of wetlands (FERC 1996). Wetland types include wet meadow/emergent marsh (383 acres), open bog/wet meadow (316 acres), alder thickets (8 acres), and wet meadow/open water (2 acres). There are three major wetland systems at Millinocket Lake:

- Pickerel Cove wetlands consists of two wet meadow/emergent marshes.
- The Grant Brook wetlands complex consists of open bog/wet meadow.
- Impoundment shoreline wetlands that are characterized by plants found in constantly wet soils (FERC 1996).

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A total of 159 acres of wetlands were identified at Quakish Lake, predominantly consisting of wet meadow/emergent marsh (FERC 1996). These wetlands are primarily herbaceous with occasional scattered shrubs. Shoreline zones are absent around Quakish Lake, Ferguson Pond, Dolby Pond, and East Millinocket impoundment because water levels are stable.

A total of 219 acres of wetlands were identified at Dolby Pond, most of which were wet meadow/emergent marsh. These wetlands are predominantly herbaceous.

The East Millinocket impoundment area encompasses very few wetlands because of the past development of the Millinocket Mill complex and the associated mill yards on its eastern shore (FERC 1996).

Riverine wetlands border Millinocket Stream and sections of the West Branch in the vicinity of the Penobscot Mills Project, including the following:

- Millinocket Stream has small areas of emergent marsh with scattered shrubs along the shoreline. Areas of emergent and scrub/shrub wetlands occur in several small deadwaters that have developed along the stream (FERC 1996).
- Sections of the West Branch from North Twin impoundment to Quakish Lake and from the Millinocket tailrace to Dolby Pond contain the same wetland types as Millinocket Stream. Shad Pond supports abundant emergent and deep marsh wetlands (FERC 1996).
- The Back Channel consists of a main channel and an overflow channel. Three tributary streams flow into the main channel. The substrate of the main channel is predominantly large cobbles and boulders, but silt and sand have accumulated in a few sections, allowing development of small areas of wetlands. Narrow areas of riparian scrub/shrub wetlands occur in narrow margins along both the main channel and the overflow channel (FERC 1996).

In addition to the studies performed during the previous relicensing, GNP performed additional studies associated with wetland mitigation pursuant to the requirements of Article 408 of the Ripogenus Project and Article 410 of the Penobscot Mills Project. Specifically, Article 410

required the Licensee to file a plan to enhance wetlands at the Deep Cove site on the North Twin impoundment.

As presented above for the Ripogenus Project, GNP evaluated wetland enhancement at Umbazooksus Lake as an alternative to the Deep Cove site. Umbazooksus Lake is a 1,600-acre former storage impoundment located less than one mile upstream of the Ripogenus impoundment via Umbazooksus Stream. Umbazooksus Lake had a dam operated by GNP that could be used to control lake levels for wetland enhancements with less impacts than would occur with a new dam at Deep Cove. Based on the enhancements performed at Umbazooksus Lake, 320 acres of wetlands underwent recovery, and vegetation cover (i.e., density) increased in all vegetation zones, including a substantial increase in the E/F zones between 1998 and 2004. Overall, vegetation cover increased over 350 percent. The 320 acres of recovering wetlands at Umbazooksus Lake exceeds the original license requirements to enhance approximately 250 acres at Black Pond for the Ripogenus Project and 30 acres at Deep Cove for the Penobscot Mills Project.

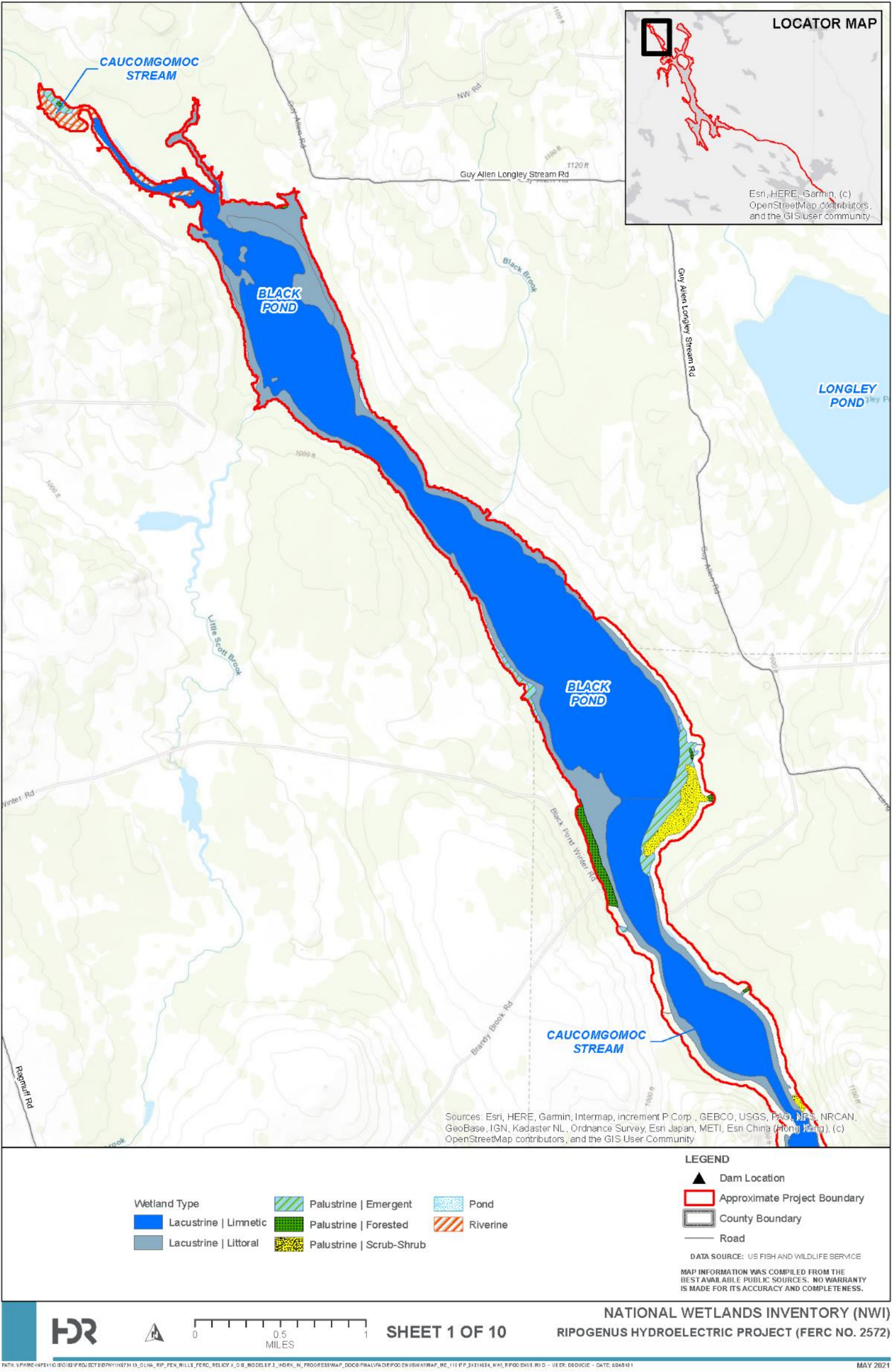
5.6.2 Wetland, Riparian, and Littoral Wildlife

Lists of wildlife specifically known to occur in wetland, riparian, and littoral habitats in the vicinity of the Projects are limited; however, many of the species likely to occur in the Project vicinities typically use these habitats at some time during their lives. Many of the amphibians and reptiles described in Section 5.5.1 may occur in the vicinity of the Projects. Other wildlife likely to occur in the wetland habitats of the Projects include mammals listed in Table 5.5-1 and birds listed in Table 5.5-2.

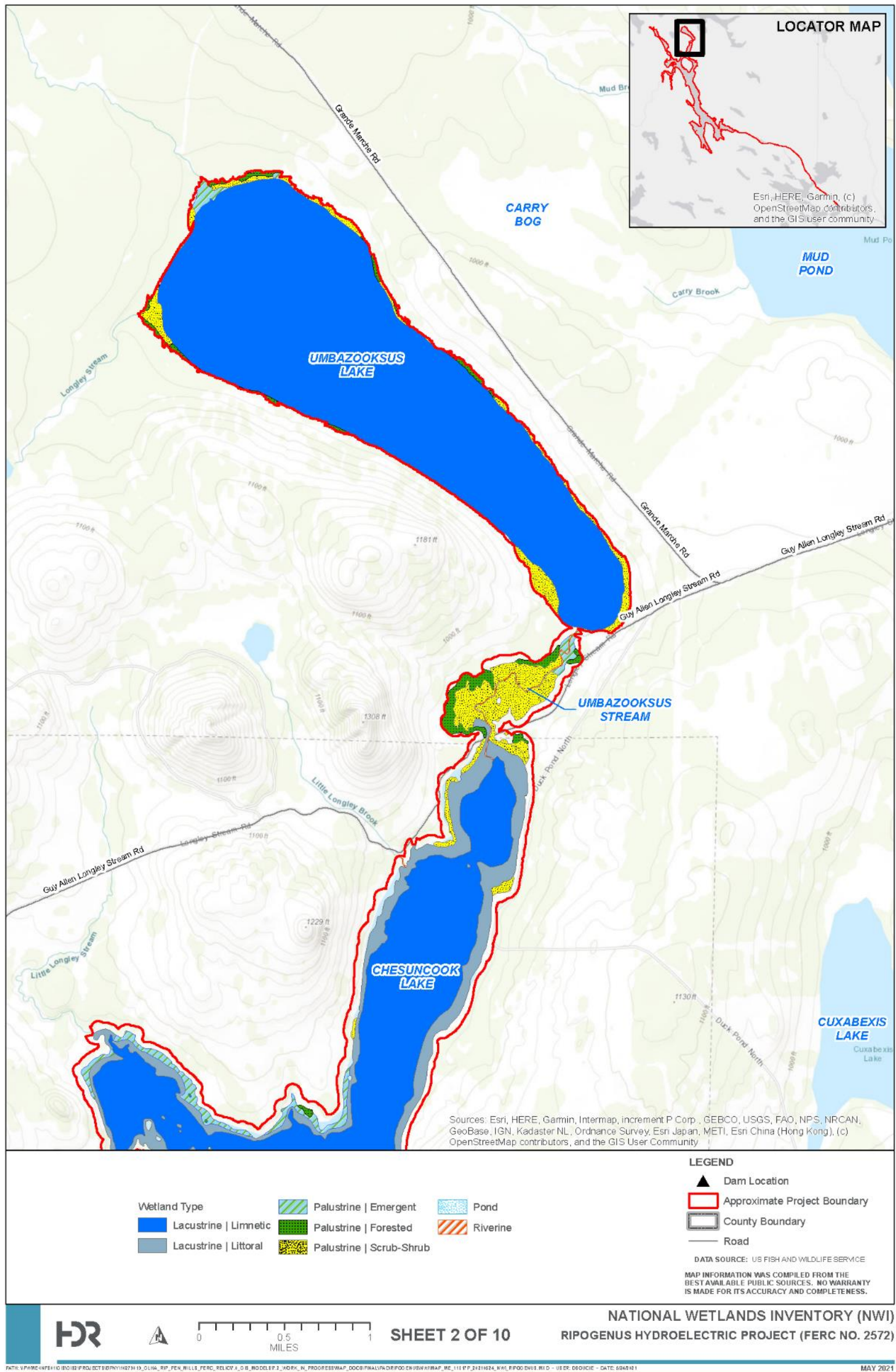
5.6.3 Wetland, Riparian, and Littoral Habitat Mapping

Maps showing wetland habitats in the vicinity of the Projects are presented in Figure 5.6-1 through Figure 5.6-6. Table 5.6-1 includes a summary of wetland habitats occurring within the approximate boundaries of the Projects based on the USFWS' National Wetland Inventory (NWI) (USFWS 2021c). There are approximately 63,784.5 acres of NWI-mapped wetlands within the boundaries of the Projects. Of this area, approximately 54,467.7 acres are lacustrine, limnetic, unconsolidated bottom, and/or permanently flooded.

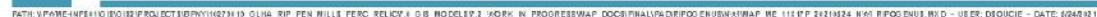
Figure 5.6-1
Wetlands at the Ripogenus Project



Wetlands at the Ripogenus Project

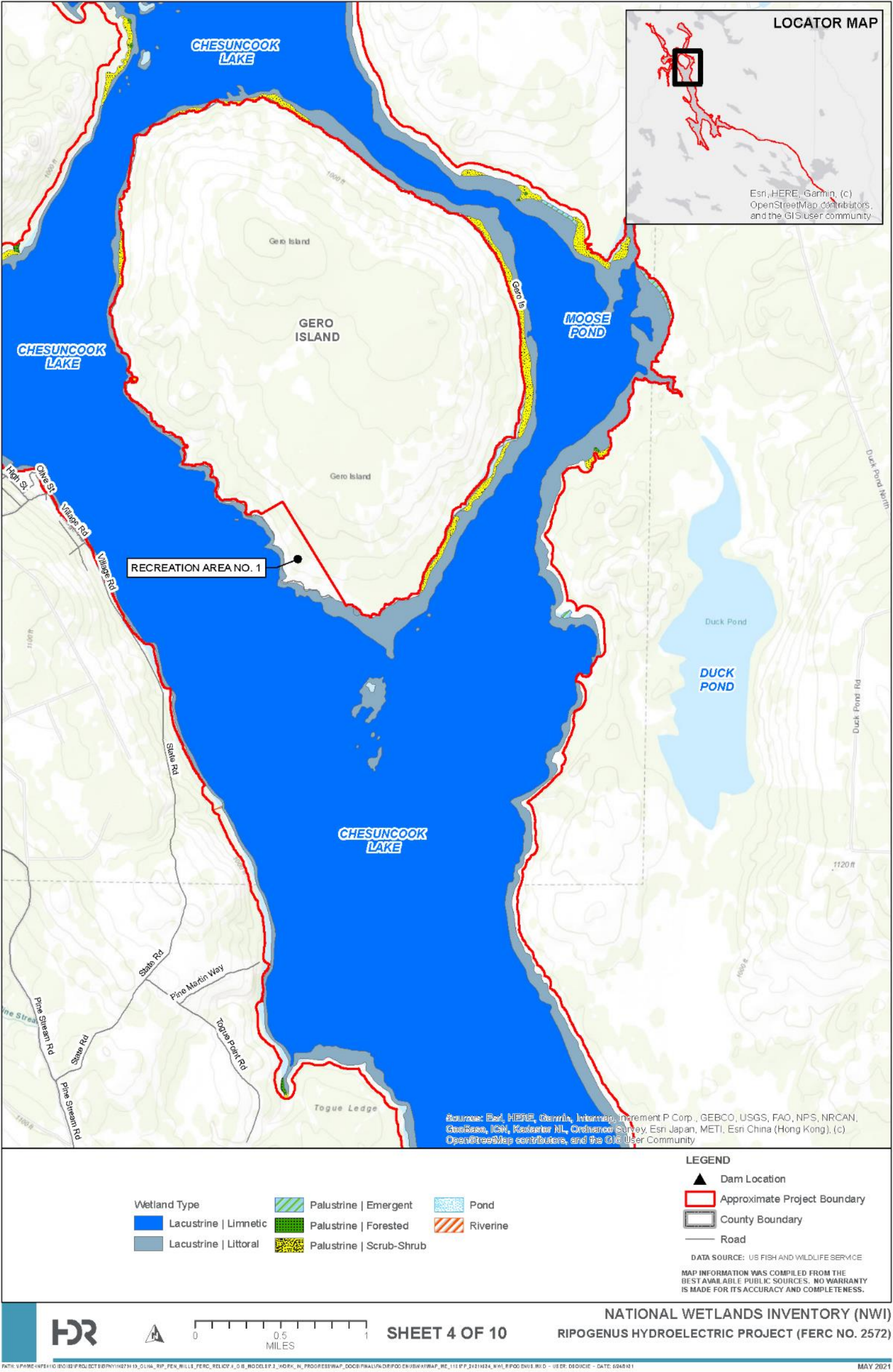


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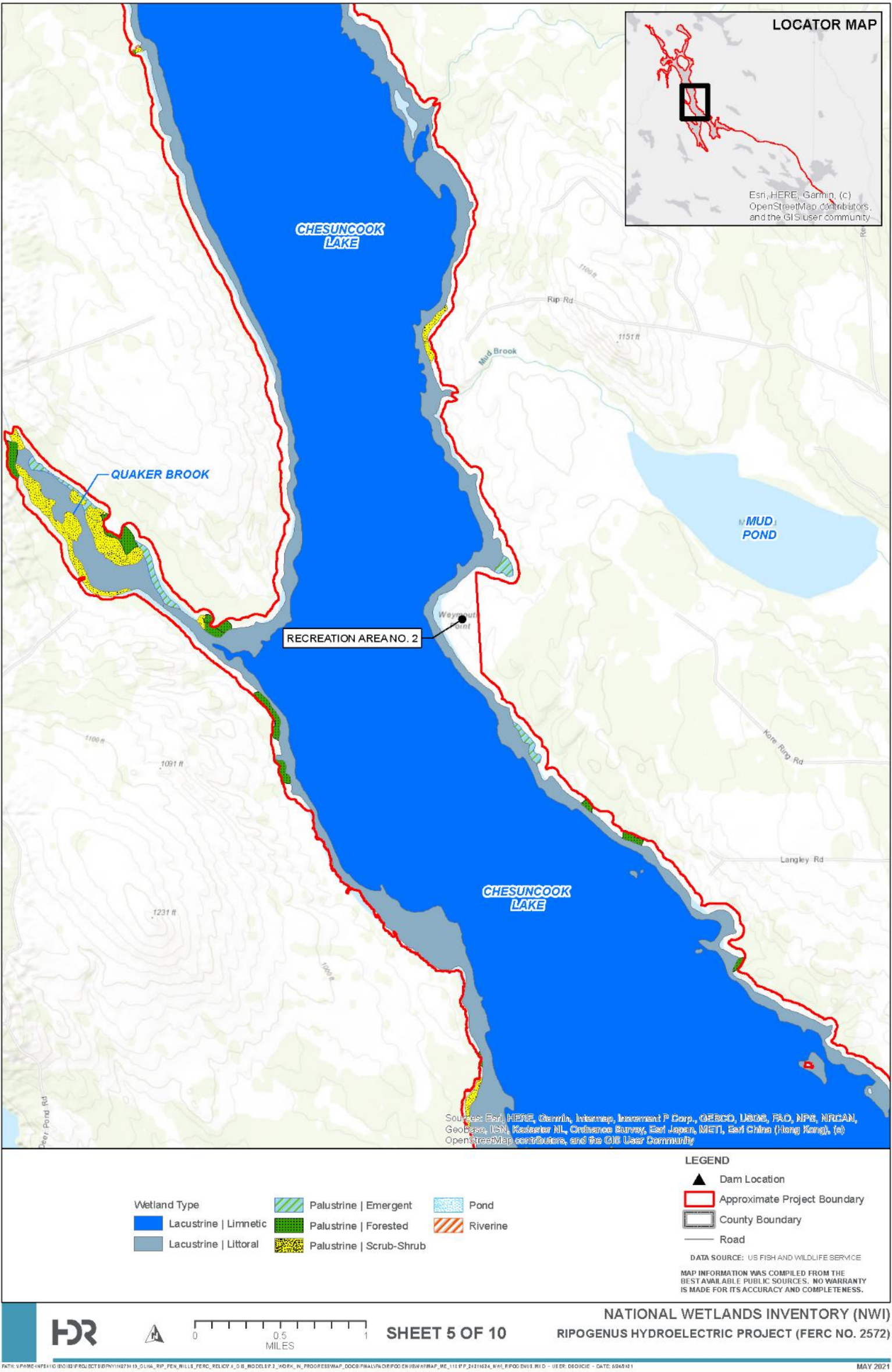


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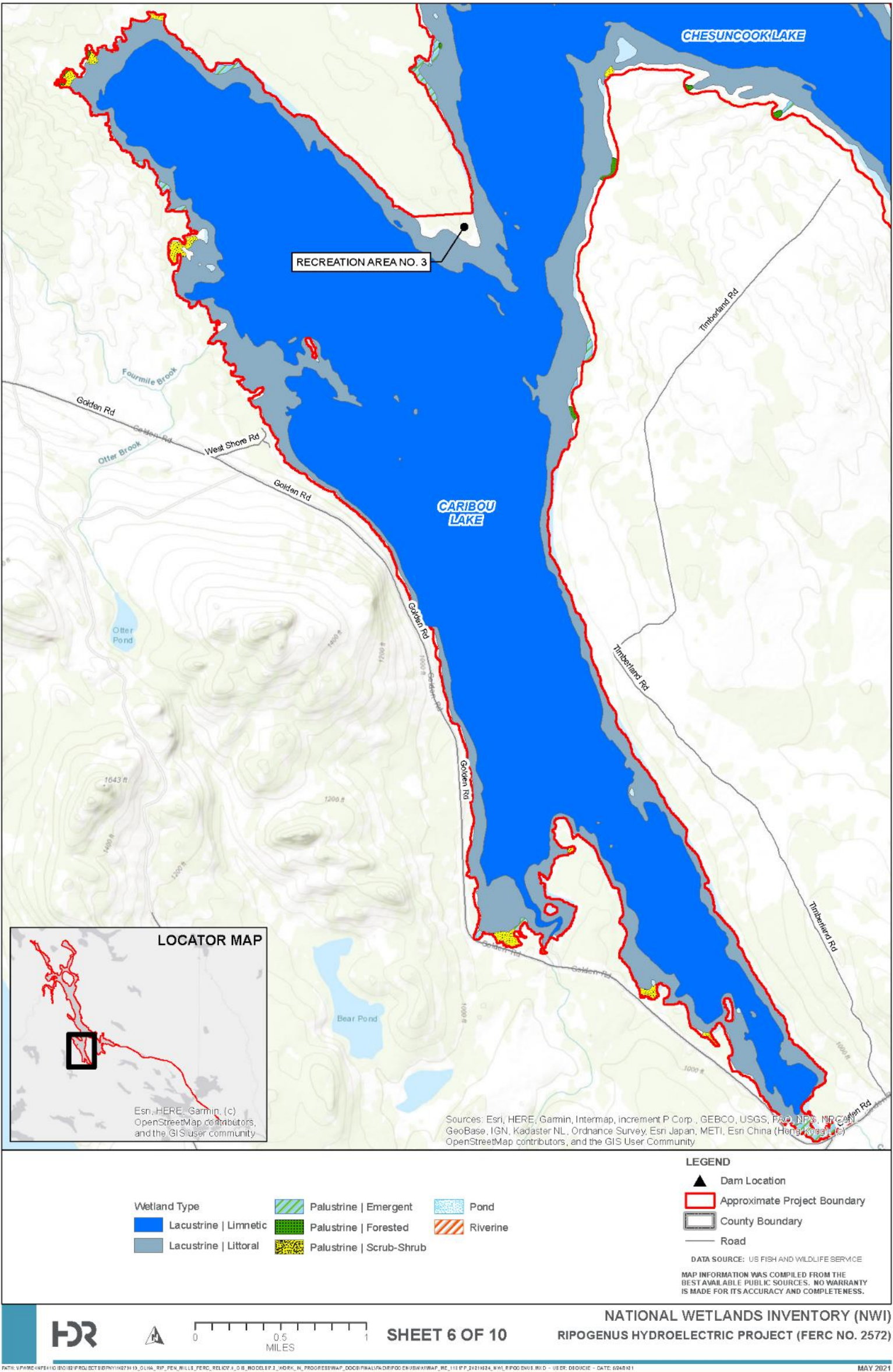


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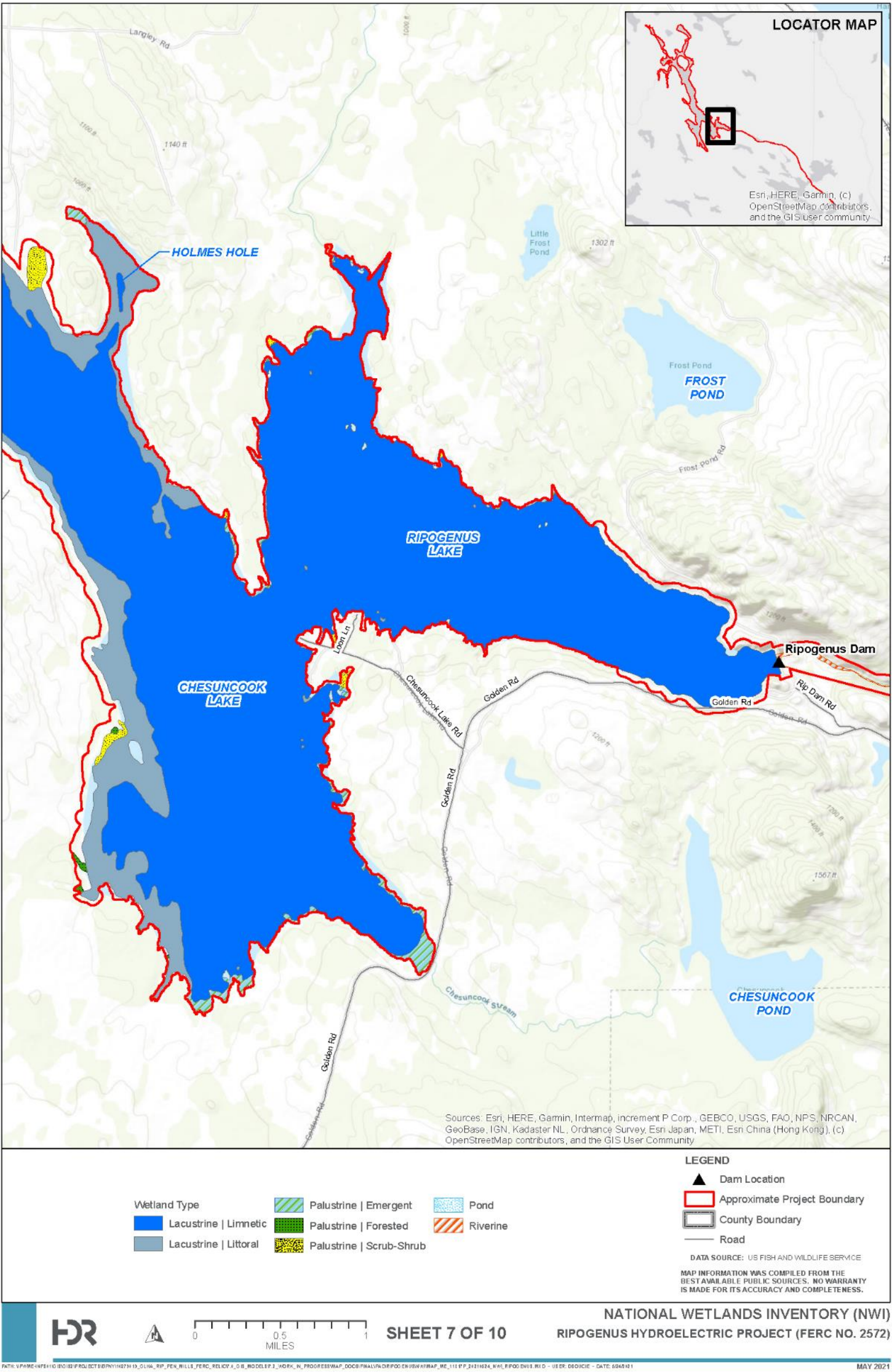


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Wetlands at the Ripogenus Project



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Wetlands at the Ripogenus Project



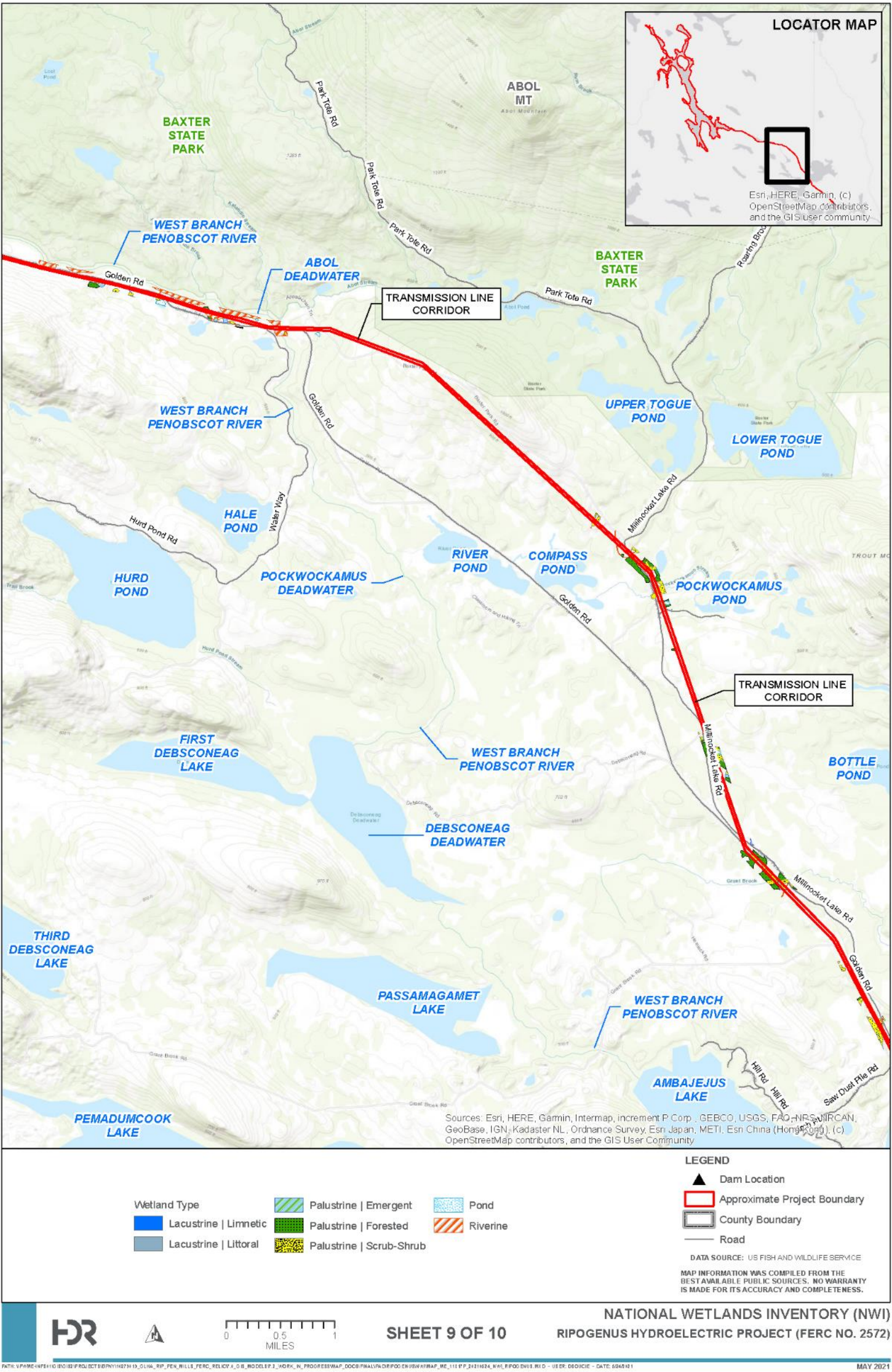
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Wetlands at the Ripogenus Project



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Wetlands at the Ripogenus Project



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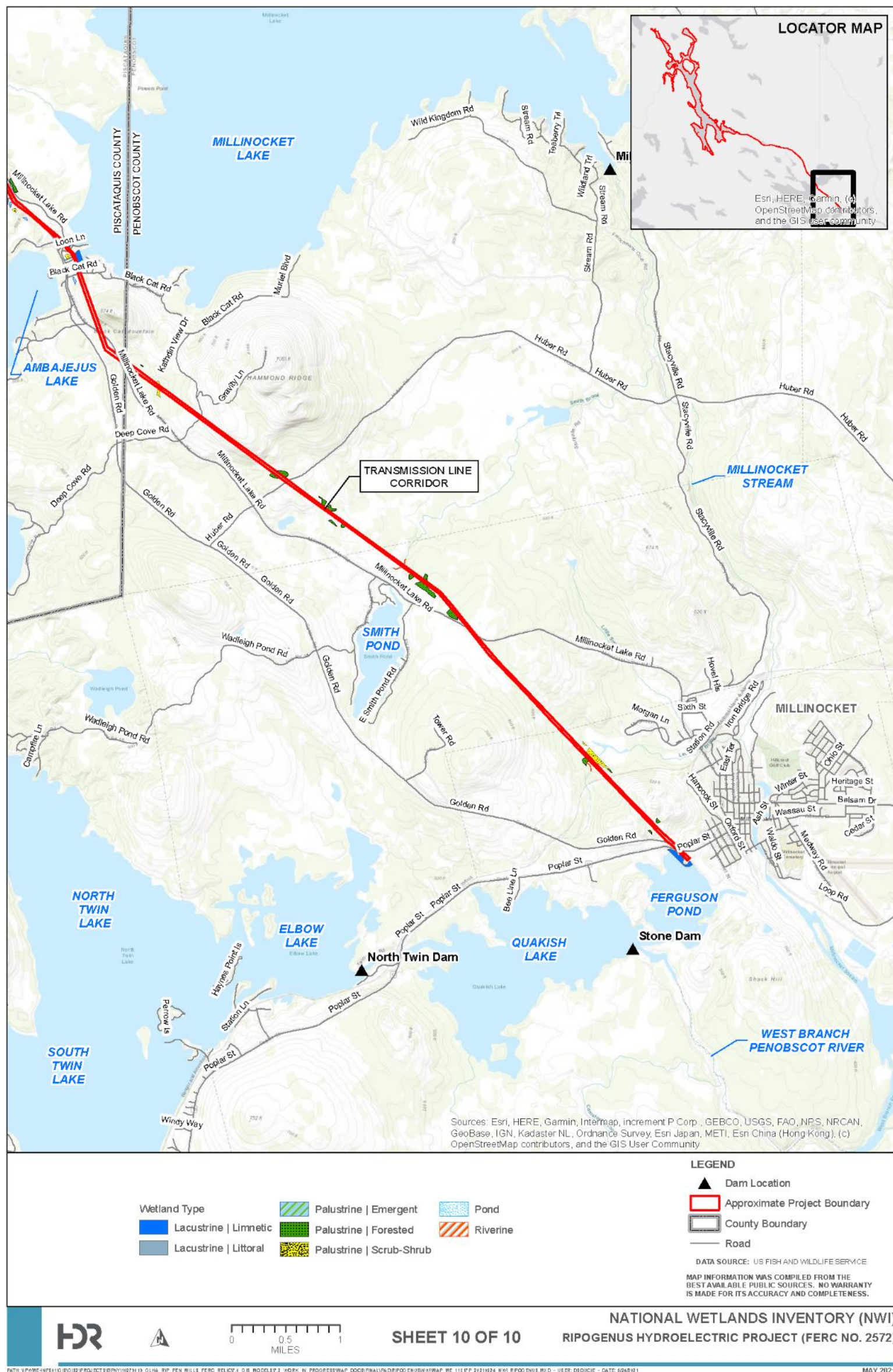


Figure 5.6-2
Wetlands at the Millinocket Lake Storage Development

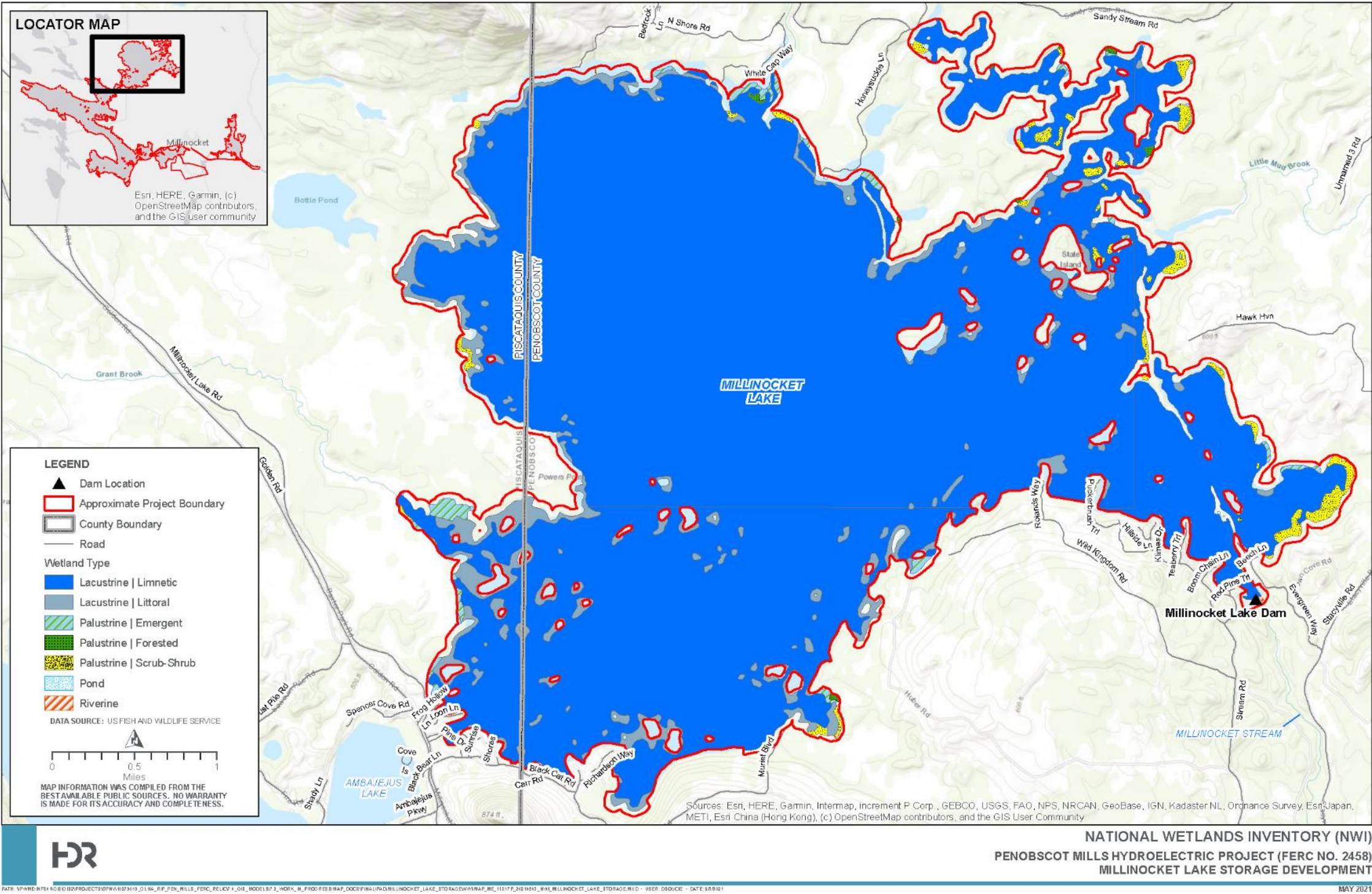
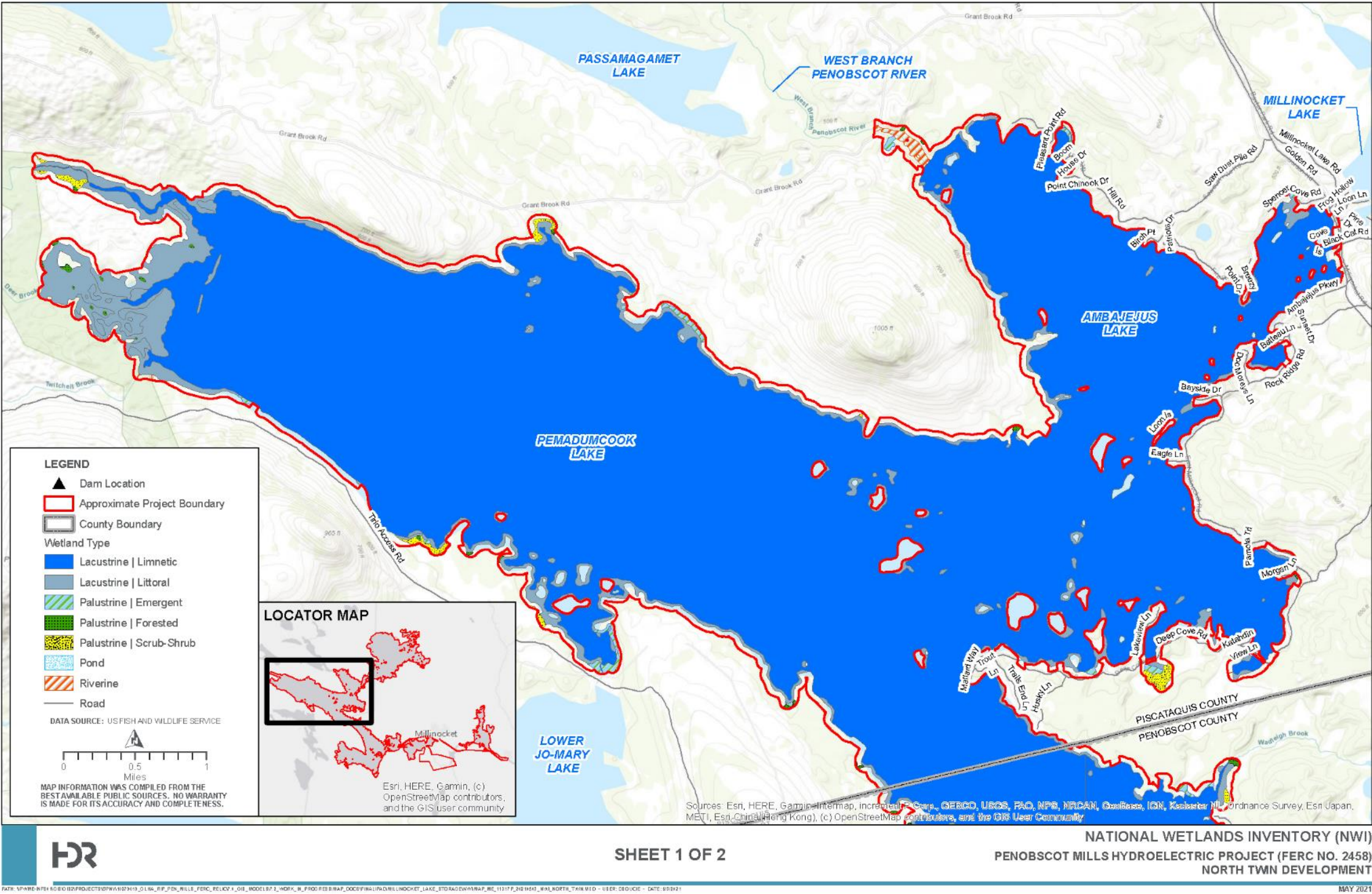


Figure 5.6-3
Wetlands at the North Twin Development



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Wetlands at the North Twin Development

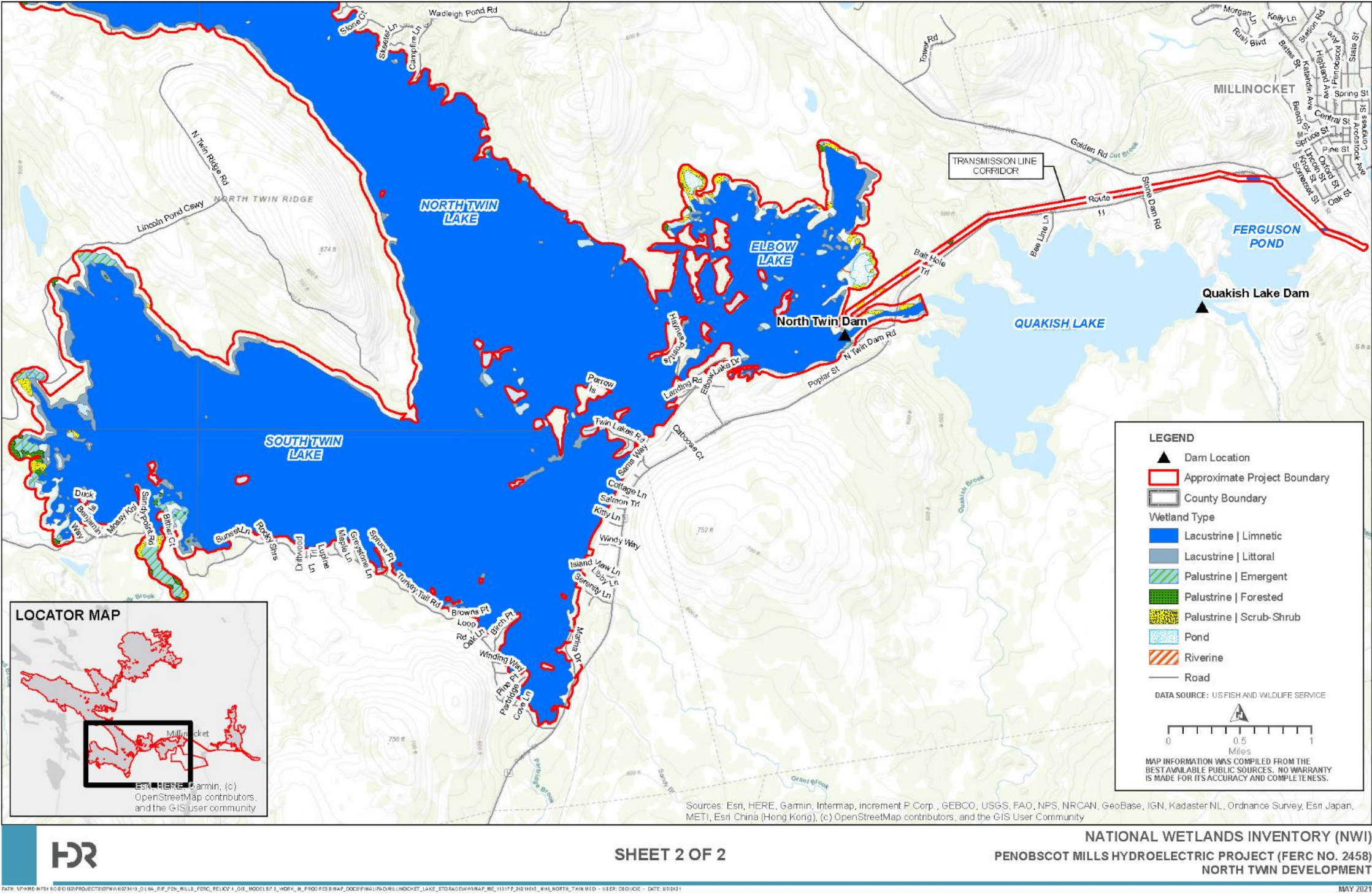


Figure 5.6-4
Wetlands at the Millinocket Development

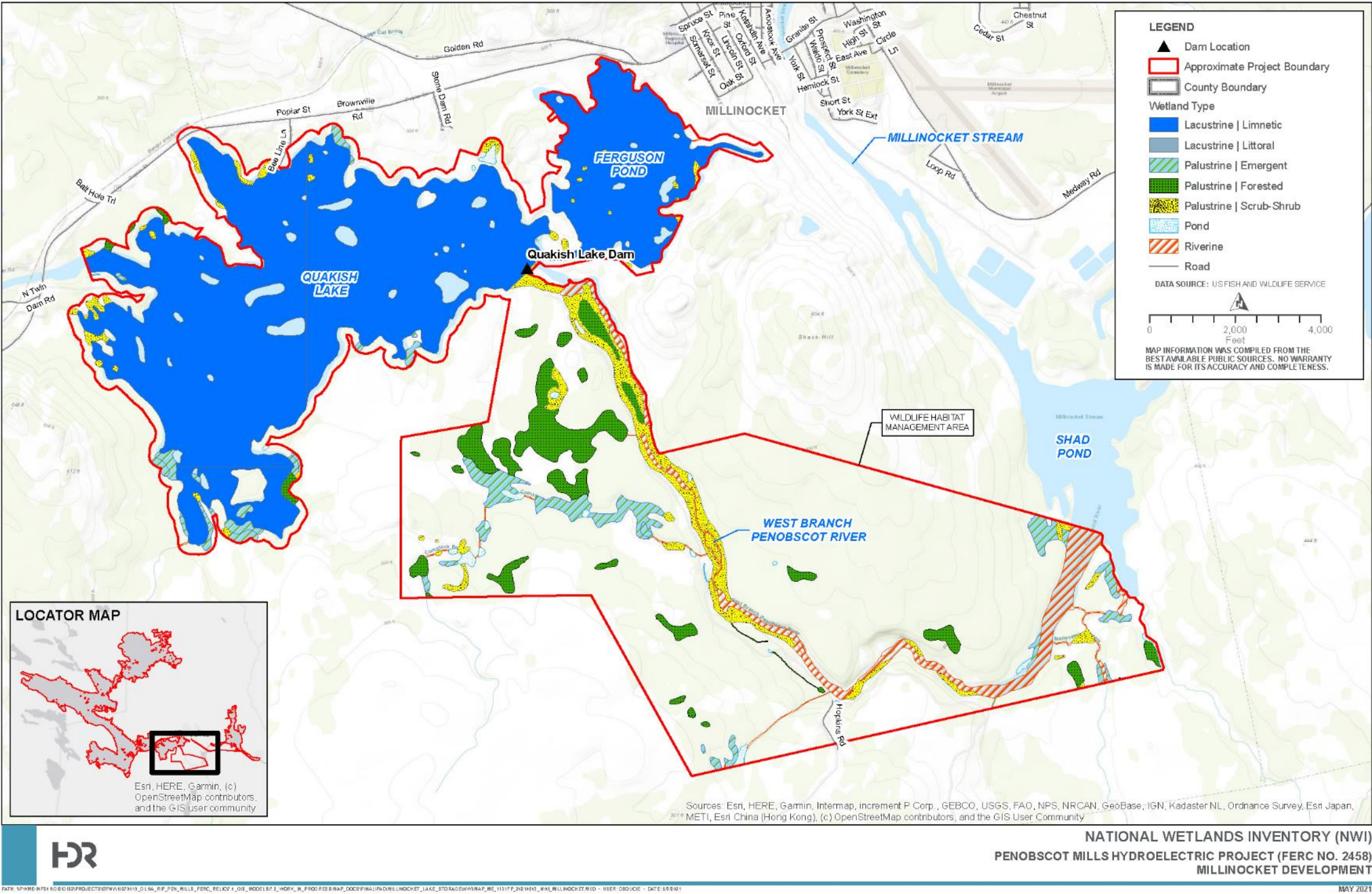


Figure 5.6-5
Wetlands at the Dolby Development

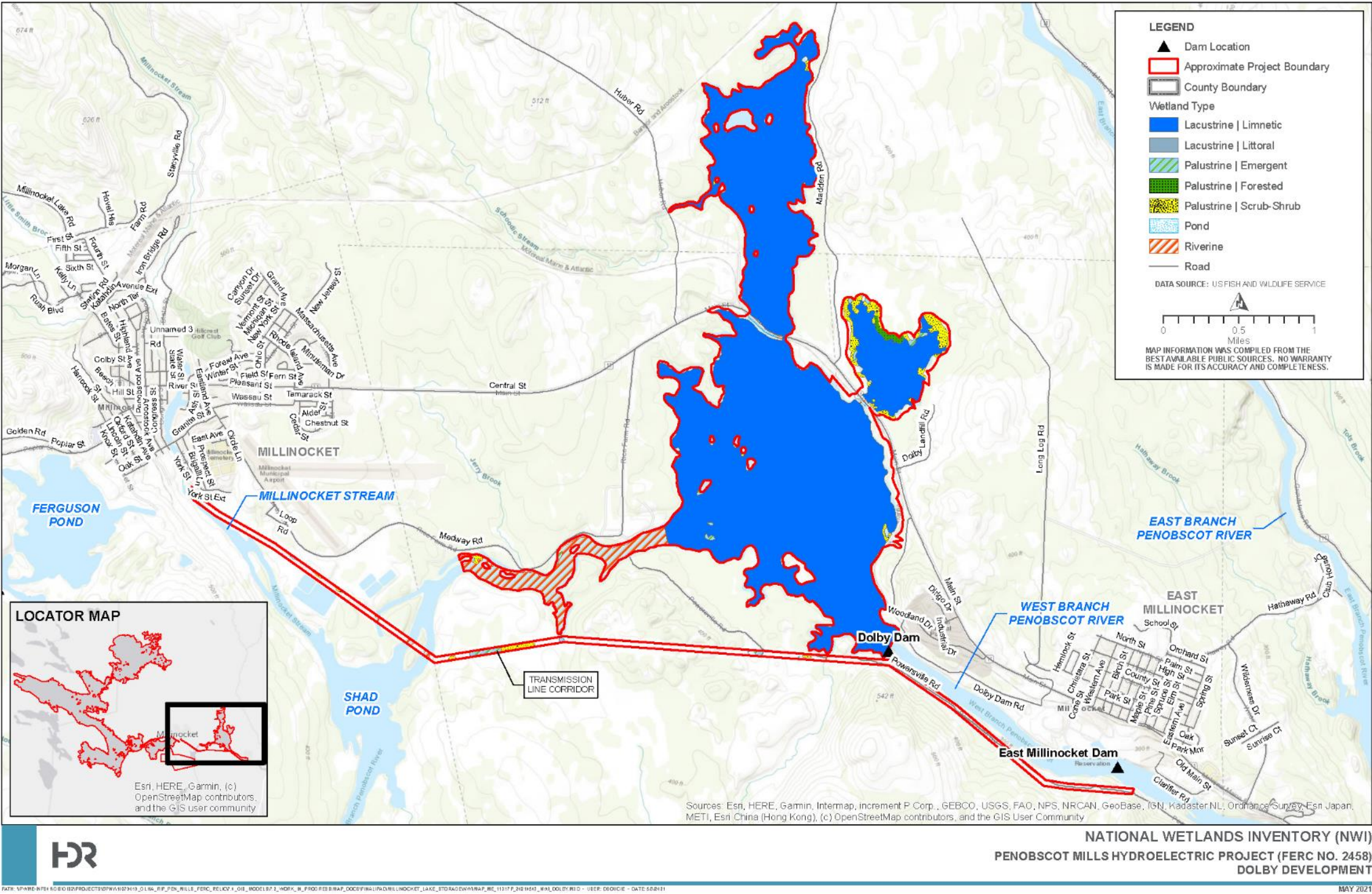
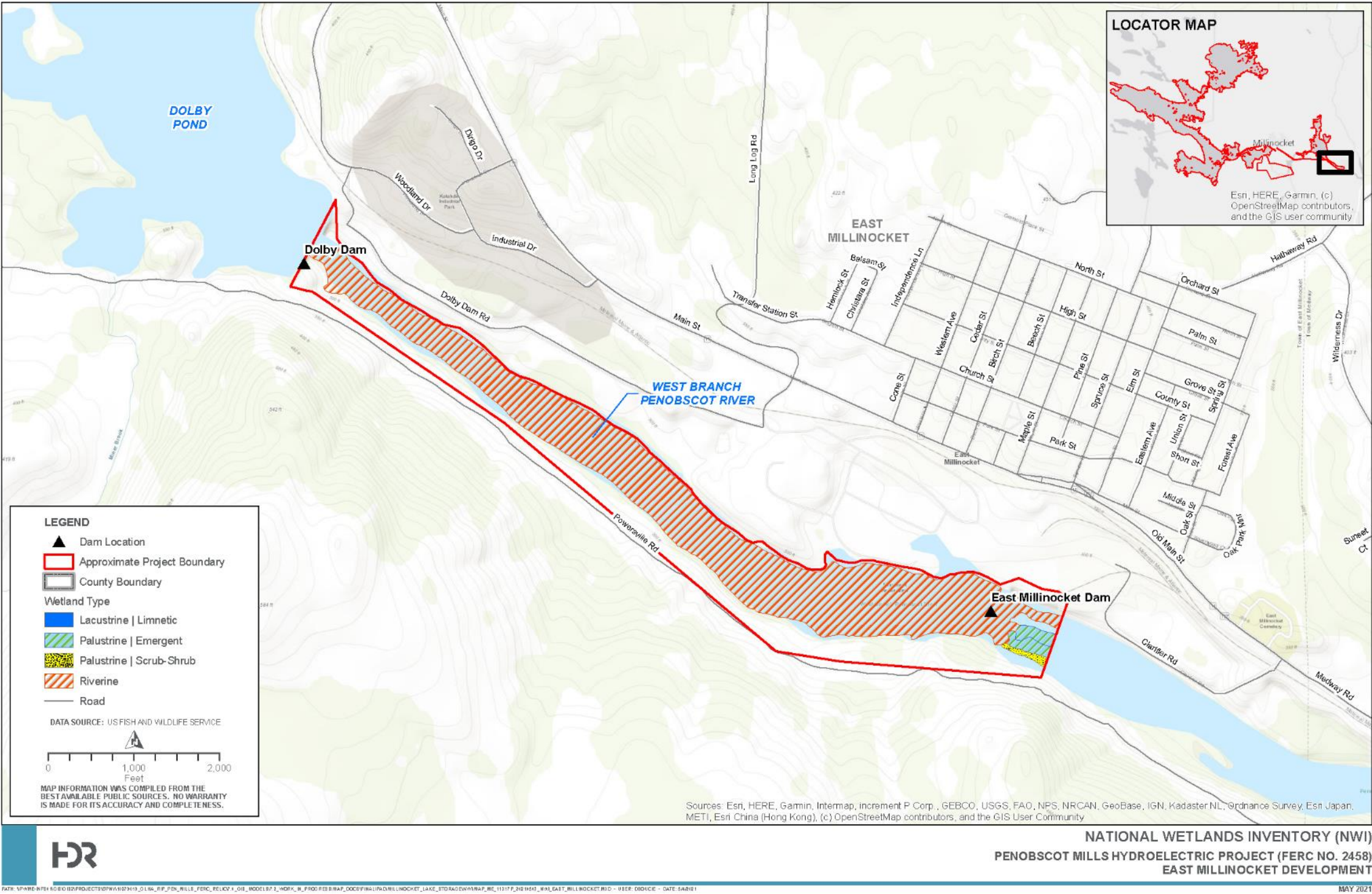


Figure 5.6-6
Wetlands at the East Millinocket Development



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Table 5.6-1
Summary of Wetland Acreage Within the Project Approximate Boundaries

Project/Development	Wetland Type (Acres)							Total (Acres)
	Lacustrine Limnetic	Lacustrine Littoral	Palustrine Emergent	Palustrine Forested	Palustrine Scrub-Shrub	Pond	Riverine	
Ripogenus Project	25,385.5	4,912.2	385.8	428.1	790.1	2.1	73.2	31,977
Penobscot Mills Project								
Millinocket Lake Storage Development	8,075.8	463.3	65.6	7.6	101.3	0.9	1.1	8,715.6
North Twin Development	17,714.4	983.9	122.8	40.5	101.2	24.4	18.7	19,005.9
Millinocket Development	1,267.6	N/A	98.3	138.8	124.3	16.1	95.4	472.9
Dolby Development	2,024.3	N/A	16.2	7.1	52.2	2.8	121.2	199.5
East Millinocket Development	0.1	N/A	3.3	N/A	0.9	N/A	117.4	117.4
Total	54,467.7	6,359.4	692.0	622.1	1,170.0	46.3	427.0	63,784.5

Source: USFWS 2021c.

5.7 Rare, Threatened, and Endangered Species

5.7.1 Overview

The area associated with the Projects includes a variety of terrestrial and aquatic habitat that may be utilized by federally and/or state-listed rare, threatened, or endangered (RTE) species. The State of Maine also identifies State Species of Special Concern. A Species of Special Concern is any species of fish or wildlife that does not meet the criteria of an endangered or threatened species but is particularly vulnerable, and could easily become an endangered, threatened, or extirpated species due to restricted distribution, low or declining numbers, specialized habitat needs or limits, or other factors. State designation as a Species of Special Concern is administrative and has no legal standing under Maine's Endangered Species statutes (MDIFW 2021f). To assess the potential occurrence of RTE species, information requests were made to the USFWS, MNAP and the MDIFW. In addition, the State of Maine's Natural Heritage Database was utilized to assess whether these species have the potential to occur in the vicinity of the Projects. A determination was based on the known distribution of these species and whether it overlaps with the area associated with the Projects.

To assess the potential occurrence of federally-listed species or candidate species within the vicinity of the Projects, information was requested from the USFWS Information for Planning and Consultation (IPaC) database. The IPaC database generates a list of species and other resources under USFWS jurisdiction that are known or expected to be on or near the Project area (USFWS 2021d and 2021e). Based on a search of the USFWS IPaC system for ESA-listed or candidate species, two mammals and one fish species were identified: northern long-eared bat (*Myotis septentrionalis*), Canada lynx (*Lynx canadensis*), and Atlantic salmon (*Salmo salar*) as potentially occurring within the area associated with the Projects (Table 5.7-1).

On January 5 and 14, 2021, HDR, on behalf of GLHA, requested information on threatened, endangered, and special concern species and habitats from the MDIFW and MNAP, respectively (Appendix B). On February 3, 2021, MDIFW responded to the request for information on RTE species and habitats with a list of species that may occur in the vicinity of the Projects. Additionally, specific to the Penobscot Mills Project, MDIFW indicated that rare species occur in

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the vicinity of the Project, including one reptile and three species of freshwater mussels. On February 5, 2021, MNAP responded to the request for information on RTE species and habitats and indicated the area associated with the Projects includes mapped rare plants and mapped rare or exemplary natural community types. MDIFW and MNAP indicated that the species listed in Table 5.7-1 have been documented in the general vicinity of the Projects.

Table 5.7-1
Rare, Threatened, and Endangered Species that Have the Potential to Occur in the Vicinity of the Projects

Project(s)	Common Name	Scientific Name	Status	Documented Occurrence/Critical Habitat in the Project Boundary(s)
<i>Fish</i>				
Penobscot Mills Project	Atlantic Salmon	<i>Salmo salar</i>	Federally Endangered	Atlantic salmon have been documented as a species potentially occurring downstream of the Projects (e.g., downstream of the Medway Project [FERC No. 2666]). No critical habitat has been designated within the boundaries of the Projects.
<i>Mammals</i>				
Ripogenus Project & Penobscot Mills Project	Canada Lynx	<i>Lynx canadensis</i>	Federally Threatened	Canada lynx has been documented as a species potentially occurring in the vicinity of the Projects. Critical habitat for this species has been designated within the boundaries of the Projects.
Ripogenus Project & Penobscot Mills Project	Northern Long-eared Bat	<i>Myotis septentrionalis</i>	Federally Threatened	Northern long-eared bat has been documented as a species potentially occurring in the vicinity of the Projects. No critical habitat has been designated within the boundaries of the Projects.
Ripogenus Project & Penobscot Mills Project	Little Brown Bat	<i>Myotis lucifugus</i>	State Endangered	Based on historical evidence, MDIFW indicated that this species may potentially occur within the area associated with the Projects during migration and/or the breeding season.
Ripogenus Project & Penobscot Mills Project	Eastern Small-footed Bat	<i>Myotis leibii</i>	State Threatened	Based on historical evidence, MDIFW indicated that this species may potentially occur within the area associated with the Projects during migration and/or the breeding season.

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Project(s)	Common Name	Scientific Name	Status	Documented Occurrence/Critical Habitat in the Project Boundary(s)
Ripogenus Project & Penobscot Mills Project	Big Brown Bat	<i>Eptesicus fuscus</i>	State Species of Special Concern	Based on historical evidence, MDIFW indicated that this species may potentially occur within the area associated with the Projects during migration and/or the breeding season.
Ripogenus Project & Penobscot Mills Project	Eastern Red Bat	<i>Lasiurus borealis</i>	State Species of Special Concern	Based on historical evidence, MDIFW indicated that this species may potentially occur within the area associated with the Projects during migration and/or the breeding season.
Ripogenus Project & Penobscot Mills Project	Hoary Bat	<i>Lasiurus cinereus</i>	State Species of Special Concern	Based on historical evidence, MDIFW indicated that this species may potentially occur within the area associated with the Projects during migration and/or the breeding season.
Ripogenus Project & Penobscot Mills Project	Silver-haired Bat	<i>Lasionycteris noctivagans</i>	State Species of Special Concern	Based on historical evidence, MDIFW indicated that this species may potentially occur within the area associated with the Projects during migration and/or the breeding season.
Ripogenus Project & Penobscot Mills Project	Tri-colored Bat	<i>Perimyotis subflavus</i>	State Species of Special Concern	Based on historical evidence, MDIFW indicated that this species may potentially occur within the area associated with the Projects during migration and/or the breeding season.
Birds				
Ripogenus Project & Penobscot Mills Project	Bald Eagle	<i>Haliaeetus leucocephalus</i>	State Species of Special Concern	According to the MDIFW database of known bald eagle nest sites in Maine, there are several mapped bald eagle nests located along some of the impoundments associated with the Projects.
Invertebrates				
Penobscot Mills Project	Brook Floater	<i>Alasmidonta varicosa</i>	State Threatened	MDIFW indicated that this species is likely to occur in the vicinity of the Penobscot Mills Project.
Penobscot Mills Project	Yellow Lampmussel	<i>Lampsilis cariosa</i>	State Threatened	MDIFW indicated that this species is likely to occur in the vicinity of the Penobscot Mills Project.
Penobscot Mills Project	Tidewater Mucket	<i>Leptodea ochracea</i>	State Threatened	MDIFW indicated that this species is likely to occur in the vicinity of the Penobscot Mills Project.

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Project(s)	Common Name	Scientific Name	Status	Documented Occurrence/Critical Habitat in the Project Boundary(s)
Reptiles				
Penobscot Mills Project	Wood Turtle	<i>Glyptemys insculpta</i>	State Species of Special Concern	Wood turtle has been documented as a species potentially occurring in the vicinity of the Penobscot Mills Project.
Plants				
Ripogenus Project	Swamp Birch	<i>Betula pumila</i>	State Species of Special Concern	Swamp birch has been documented by MNAP as occurring in the vicinity of the Ripogenus Project in Ellis Bog and Carry Bog.
Ripogenus Project	Slender Rush	<i>Juncus subtilis</i>	State Endangered	Slender rush has been documented by MNAP as occurring in the Ripogenus Project vicinity on Gero Island.
Ripogenus Project	Purple Clematis	<i>Clematis occidentalis</i> ssp. <i>occidentalis</i>	State Species of Special Concern	Purple clematis has been documented by MNAP as occurring in the vicinity of Ripogenus Dam and Ripogenus Gorge.
Ripogenus Project	Fragrant Wood Fern	<i>Dryopteris fragrans</i>	State Species of Special Concern	Fragrant wood fern has been documented by MNAP as occurring in the vicinity of Ripogenus Gorge.
Ripogenus Project	Slender Cliff Brake	<i>Cryptogramma stelleri</i>	State Threatened	Slender cliff brake has been documented by MNAP as occurring in the vicinity of Ripogenus Gorge.
Ripogenus Project	Hornemann's Willow-Herb	<i>Epilobium hornemannii</i>	State Threatened	Hornemann's willow-herb has been documented by MNAP as occurring in the vicinity of Ripogenus Gorge.
Ripogenus Project	Smooth Woodsia	<i>Woodsia glabella</i>	State Threatened	Smooth woodsia has been documented by MNAP as occurring in the vicinity of Ripogenus Gorge.
Ripogenus Project	Rock Whitlow-Grass	<i>Draba arabisans</i>	State Threatened	Rock whitlow-grass has been documented by MNAP as occurring in the vicinity of Ripogenus Gorge.
Ripogenus Project	Northern Woodsia	<i>Woodsia alpina</i>	State Threatened	Northern woodsia has been documented by MNAP as occurring in the vicinity of Ripogenus Gorge.
Penobscot Mills Project	Moor Rush	<i>Juncus stygius</i> ssp. <i>americanus</i>	State Species of Special Concern	Moor rush has been documented by MNAP as occurring in Millinocket Lake wetlands.
Penobscot Mills Project	Orono Sedge	<i>Carex oronensis</i>	State Threatened	Orono sedge has been documented by MNAP as occurring in the vicinity of North Twin Lake and along a powerline corridor in TA R7 WELS.

Sources: USFWS IPaC consultation (USFWS 2021d and 2021e), MDIFW 2021c, MNAP 2021.

5.7.2 Rare, Threatened, and Endangered Aquatic Species

The Atlantic salmon is the only federally-protected aquatic species in the area associated with the Projects (USFWS 2021d and 2021e). Additionally, three state-threatened aquatic species (brook floater, yellow lampmussel, and tidewater mucket) and one aquatic species of special concern (wood turtle) may occur in the vicinity of the Penobscot Mills Project as their known distribution overlaps with the Project area (Table 5.7-1).

5.7.2.1 Rare, Threatened, and Endangered Aquatic Species Temporal/Life History Information

Atlantic Salmon – Anadromous Atlantic salmon have a complex life history that includes spawning and rearing in freshwater rivers and streams, as well as extensive feeding migrations and sexual maturation in the marine environment (Fay et al. 2006). The freshwater juvenile stage of the life cycle can last from one to three years, after which juveniles undergo a physiological transformation (called smoltification) and migrate downstream to spend one to three years at sea before returning to freshwater to spawn in their natal rivers. Unlike Pacific salmon, Atlantic salmon do not die after spawning and can return to sea to repeat the migratory cycle.

Brook Floater – The brook floater inhabits flowing-water habitats from small streams to large rivers. It is found in a range of flow conditions but does not typically inhabit high-gradient streams with very fast water flow, nor is it typically found in slow moving water. In general, the brook floater prefers stable habitats such as coarse sand and gravel. In Maine, it is often found in association with rooted aquatic vegetation (Neddeau et al. 2000).

Yellow Lampmussel – The yellow lampmussel seems to prefer medium to large rivers, although in Maine it is also found in lakes and ponds and seems to do well in impounded sections of rivers. This mussel species exists in a variety of substrate types, including silt, sand, gravel, and cobble (Neddeau et al. 2000).

Tidewater Mucket – The tidewater mucket is found in Atlantic coastal drainages from Georgia to Nova Scotia. In Maine, the tidewater mucket is known only from Merrymeeting Bay and the St. George, Penobscot, lower Kennebec, and lower Androscoggin River drainages. Its distribution is very similar to that of the yellow lampmussel, particularly in ponds and lakes. Despite its common

name, it is found quite far inland — as far as Millinocket Lake in the Mount Katahdin region. The tidewater mucket seems to prefer coastal lakes, ponds, and slow-moving portions of rivers, including artificial impoundments. It is found in a variety of substrates, including silt, sand, gravel, cobble, and occasionally clay (Neddeau et al. 2000).

Wood Turtle – According to MDIFW (undated), no other Maine turtle species makes such extensive use of both aquatic and terrestrial habitats. For much of the year, wood turtles are found in slow-moving, clear-water streams with a predominantly sand or gravel substrate. During late spring and summer, they utilize the surrounding upland areas including forests, floodplains, meadows, and hayfields. From late fall to early spring, wood turtles hibernate underwater in sheltered areas of rivers, including pool bottoms, under riverbanks, or under woody debris.

5.7.3 Rare, Threatened, and Endangered Wildlife Species

The Canada lynx and the northern long-eared bat are the only federally protected wildlife species in the area associated with the Projects (USFWS 2021d and 2021e). Additionally, one state endangered mammal species (little brown bat), one state threatened mammal species (eastern small-footed bat), and six state species of special concern (big brown bat, eastern red bat, hoary bat, silver-haired bat, tri-colored bat, and the bald eagle) may occur in the vicinity of the Projects, as their known distribution overlaps with the area associated with the Projects (Table 5.7-1).

5.7.3.1 Temporal and Spatial Distribution of Rare, Threatened, and Endangered Wildlife Species

Canada Lynx – The Canada lynx is a secretive forest-dwelling cat of northern latitudes and high mountains. Lynx dens in Maine consist of a bed under thick regenerating fir or elevated downed logs. Lynx are highly specialized to hunt snowshoe hare, which comprise over 75 percent of their diet. When hares are abundant, lynx may consume one or two a day. In the summer, the diet is more varied and may include grouse, small mammals, and squirrels. In winter, carrion (dead animals) may supplement the diet (USFWS 2018). Lynx are often found at higher densities in boreal mixed wood forests than in boreal coniferous forests and favor swamps, bogs, or rocky areas (DeGraff and Yamasaki 2001).

Northern Long-eared Bat - The range for the northern long-eared bat covers 37 states, much of which is in the eastern and north central United States including Maine, as well as several Canadian provinces. The National Park Service documented northern long-eared bats in Acadia National Park in the summers of 2012 and 2014 (USFWS 2015b). During the summer, they roost singly or in colonies underneath bark and in cavities or crevices of both living and dead trees. Breeding begins in late summer or early fall and fertilization is delayed until spring. Pregnant females roost in small colonies (generally 30 to 60 females and young) and give birth in the summer. In the winter, northern long-eared bats hibernate in caves or mines with constant temperatures, high humidity, and no air currents. This species overwinters in local or regional hibernacula and does not migrate extensive distances; therefore, it does not have significant temporal distribution. Northern long-eared bats primarily feed in the understory of forested areas on moths, flies, leafhoppers, caddisflies, and beetles, which they catch in flight with echolocation. They also glean insects from vegetation (USFWS 2015b).

Little Brown Bat - The little brown bat is a migratory bat that is found throughout New England. Its habitat depends on the season and the setting. During the winter they hibernate in caves and abandoned mines or hydroelectric dams. The pregnant females require warm areas such as barns and attics in the spring for rapid embryo growth (DeGraaf and Yamasaki, 2001). The diet of this bat consists of insects.

Eastern Small-footed Bat – The habitat for the eastern small-footed bat is mostly hilly or mountainous, generally in or near deciduous or coniferous forest. Like many other bat species, this one often forages over ponds and streams; foraging habitat also includes riparian forests, upland forests, clearings, stripmines, and ridgetops. Foraging flights tend to be slow and often within a few meters of the ground or water surface. Warm-season roosts may be primarily in cracks or crevices of rocky outcrops or talus slopes but also have been found in buildings (including the slate roof of a house), bridges (e.g., in expansion joints, guardrail crevices), towers, hollow trees, spaces beneath the loose bark of trees, road cuts, rocky dams, caves, and mines. The species relies heavily on rock roosts or similar man-made structures during the summer months. Roosts often are exposed to the sun but also may be under moderate to extensive canopy cover. Recaptures of

marked individuals in successive years indicate that the bats exhibit fidelity to their summer roosts (NatureServe Explorer 2021a).

Big Brown Bat - The big brown bat is found in virtually every American habitat ranging from timberline meadows to lowland deserts, though it is most abundant in deciduous forest areas. This species is often abundant in suburban areas of mixed agricultural use. Traditionally, these bats have formed maternity colonies beneath loose bark and in small cavities of pine, oak, beech, and other trees. Common maternity roosts today can be found in buildings, barns, bridges, and even bat houses. Small beetles are their most frequent prey, yet big brown bats will consume prodigious quantities of a wide variety of night-flying insects. They are generalists in their foraging behavior and habitat selections, seemingly showing little preference for feeding over water vs. land, or in forests vs. clearings (Bat Conservation International 2021a).

Eastern Red Bat - Eastern red bats are North America's most abundant "tree bats." They are found wherever there are trees east of the Rocky Mountains from Canada to as far south as central Florida. Eastern red bats roost right out in the foliage of deciduous or sometimes evergreen trees. For the most part, red bats are solitary, coming together only to mate and to migrate. Females even roost singly when rearing young. Unlike most bats, Eastern red bats often give birth to twins and can have litters of up to five young, though three young are average. In the summertime, red bats are among the earliest evening fliers, typically feeding around forest edges, in clearings, or around street lights where they consume predominantly moths. In the fall they perform long-distance migrations using the same migratory routes along the Atlantic seaboard as many bird species (Bat Conservation International 2021b).

Hoary Bat - Humans rarely get the chance to see these bats; they are not attracted to houses or other human structures, and they stay well-hidden in foliage throughout the day. They typically roost 10-15 feet up in trees along forest borders. In the summer, hoary bats don't emerge to feed until after dark, but during migration, they may be seen soon after sundown. They sometimes make round trips of up to 24 miles on the first foraging flight of the night, then make several shorter trips, returning to the day roost about an hour before sunrise. Between late summer and early fall, they start their long journey south, migrating to subtropical and possibly even tropical areas to spend the winter (Bat Conservation International 2021c).

Silver-haired Bat - This bat is a summer resident throughout New England and the home range is unknown. Habitat requirements for the bat are hardwood clear-cuts, coniferous and mixed wood forests near lakes, streams, or ponds. The silver-haired bat forages over forest clearing, ponds, and streams for a diet of emerging aquatic insects (DeGraaf and Yamasaki, 2001).

Tri-colored Bat - These bats are associated with forested landscapes, where they forage near trees (including forest perimeters) and along waterways. In many areas, most foraging occurs in riparian areas. In Nova Scotia, they appeared to use primarily areas with intact, unfragmented forest cover. In spring and summer in deciduous forests in western North Carolina, nonreproductive individuals selected mature stands or buffer zones near perennial streams, and they tended to roost near openings (perhaps to minimize commuting costs when openings comprise a small proportion of a densely forested landscape) (NatureServe Explorer 2021b).

Bald Eagle - Bald eagles thrive around bodies of water where adequate food exists and human disturbance is limited (Wakeley and Wakeley 1983). Nesting eagles are particularly sensitive to human intrusions or disturbances, and such activities can compel eagles to abandon a nest. Bald eagles are wholly North American and currently are found in every state except Hawaii, as well as throughout Canada. Eagles prefer undisturbed areas near large lakes and reservoirs, marshes, and swamps, or stretches along rivers where they can find open water and their primary food, fish. The breeding habitats of bald eagles can perhaps be summarized simply; they require an adequate supply of moderate-sized to large fish, nearby nesting sites, and a reasonable degree of freedom from disturbance during the nesting period (Johnsgard 1990).

The MDIFW has been monitoring the occurrence of nesting bald eagles for many years and maintains a comprehensive database of known bald eagle nest sites in Maine. This database, available through the Maine Office of GIS, indicates that there are five bald eagle nest sites located in the Ripogenus Project vicinity. These are identified as nest sites 441A, 730B, 186C, 264B, and 120B. Within the Penobscot Mills Project vicinity, the database indicates there are 13 bald eagle nest sites. These are identified as nest sites 439A, 285A, 461A, 383C, 141C, 613A, 236D, 098D, 289D, 816A, 214D, 498D, and 628B.

In June 2007, the bald eagle was removed from the federal list and in May 2009 delisted in the State of Maine. Though the eagle is no longer protected on the federal or Maine ESA, it does fall under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (Eagle Act), the Lacey Act, and associated regulations (USFWS 2017).

5.7.4 Rare, Threatened, and Endangered Botanical Species

The Project areas and immediate vicinities include a wide variety of upland and wetland habitat associated with the shoreline of the West Branch Penobscot River and the shorelines of the impoundments within the Projects. A request was made on January 14, 2021, to MNAP to determine the presence of RTE botanical resources known to occur within the vicinity of the Projects. The MNAP indicated that there were rare botanical resource features within the Project areas and provided a list of species and natural communities potentially occurring in the vicinity of the Projects (Table 5.7-1 and Appendix F). The habitat requirements and distributions for MNAP-identified species contained in Table 5.7-1 are provided in MNAP's species profiles provided in Appendix F. Of note, the MNAP stated in their response that, provided that the relicensing of the Projects did not result in changes in water management or flows, there should be no adverse impacts to these features (Appendix B).

Based on field surveys conducted for the previous relicensing of the Projects in the late 1980s and early 1990s, two rare plant species were found in the Ripogenus Project: purple clematis (*Clematis occidentalis* ssp. *occidentalis*), and northern woodsia (*Woodsia alpina*). The purple clematis, a vine with showy purple flowers, occurred at several locations along the banks of the West Branch between McKay Station and Ambajejus Lake. The northern woodsia, a small fern, was also found at several locations on the walls of the Upper Gorge (between Ripogenus Dam and McKay Station), and also on the wall of the lower end of the Upper Gorge (GNNC 1991a). According to GNNC (1991b), no federally or state listed threatened or endangered plant species were observed in the Penobscot Mills Project area during searches for such species in the late summers of 1986 and 1987.

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5.7.4.1 Ecological Reserves

Ecological Reserves are public lands set aside to protect and monitor the State of Maine's natural habitats. The MNAP oversees the long-term ecological monitoring plans for these lands managed by the Bureau of Parks and Lands. As of 2013, Maine has designated more than 90,000 acres of Ecological Reserves on 17 public land units (MDACF 2021d). Gero Island, located in Chesuncook Lake (Ripogenus Project), is identified as an Ecological Reserve (MDACF 2021d). Gero Island is a 3,175-acre island located in the northwestern section of Chesuncook Lake. Most of the island's timber was harvested in the 1920s, and the southeast side of the island was cut again following a spruce-budworm outbreak in the 1980s. Gero Island is known to contain two exemplary natural communities (Lower Elevation Spruce-Fir Forest and White Pine Forest), as well as a rare plant species (slender rush [*Juncus subtilis*]) (MDACF 2021d).

5.7.5 Biological Opinions, Status Reports, and Recovery Plans for Listed Species

Several biological opinions have been developed for the northern long-eared bat; however, none of them are specific to the vicinity of the Projects.

Several biological opinions, status reports, and recovery plans have been developed for Atlantic salmon; however, Atlantic salmon are not found within the Project waters, as they are concentrated in the mainstem Penobscot River, East Branch Penobscot River, and other tributaries downstream of the Projects.

In 2005, USFWS published a recovery outline for the contiguous United States distinct population segment of the Canada lynx. This document was designed to serve as an interim strategy to guide recovery efforts and inform the critical habitat designation process for the contiguous United States population of the Canada lynx until a draft recovery plan has been completed. To date, a draft recovery plan has not been completed.

5.7.6 Federally-Designated Critical Habitat for Listed Species

When a species is proposed for listing as endangered or threatened under the ESA, the USFWS or NMFS must consider whether there are areas of habitat believed to be essential to the species' conservation. Those areas may be proposed for designation as critical habitat. Critical habitat is a

specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. Based on a review of USFWS' IPaC reports, critical habitat has been designated within the Ripogenus and Penobscot Mills Project boundaries (but not within the Penobscot Mills Project Wildlife Management Area) for Canada lynx (USFWS 2021d and 2021e). This critical habitat was designated by USFWS in 2009 to include 6.4 million acres in northern Maine (MDIFW 2021g).

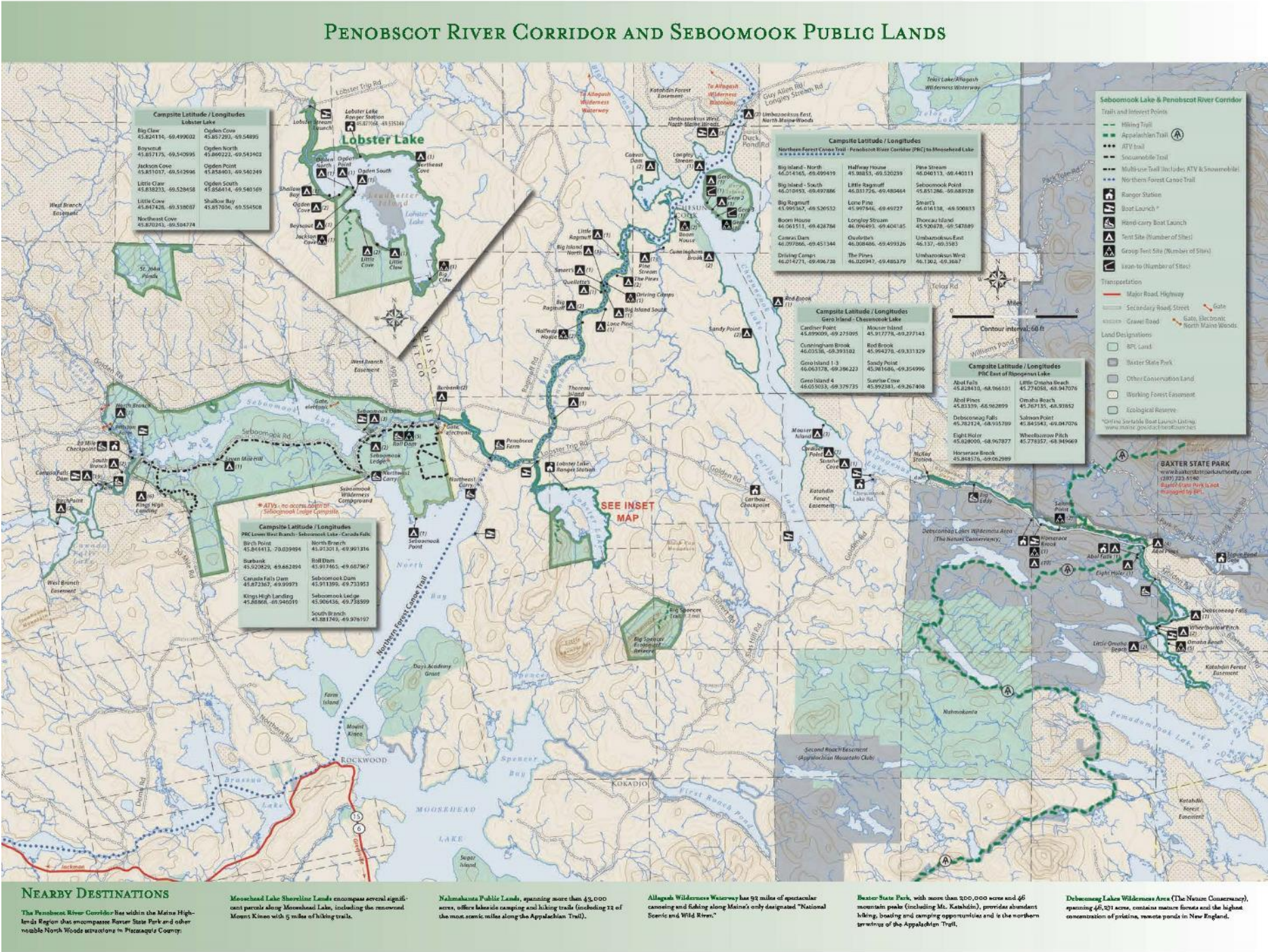
In 2009, NMFS listed the GOM DPS of Atlantic salmon as a threatened species under the ESA. The GOM DPS of Atlantic salmon is divided into three SHRUs within the range of the GOM DPS: the Downeast Coastal SHRU, the Penobscot Bay SHRU, and the Merrymeeting Bay SHRU. Critical habitat for ESA-listed Atlantic salmon includes the mainstem Penobscot River to just below the confluence of the East and West Branches, as well as the East Branch (Figure 5.4-1). There is no critical habitat for GOM DPS within the Project boundaries for the Ripogenus or Penobscot Mills Projects.

5.8 Recreation and Land Management

5.8.1 Regional Recreation Opportunities

The Ripogenus and Penobscot Mills Projects are located in the Katahdin/Moosehead Travel Region, the largest of the eight travel regions in Maine. This area is rich in natural resources and offers abundant outdoor recreation opportunities. Recreation represents one of the most important economic drivers for the region. The Projects are located within the North Maine Woods area and are surrounded by thousands of acres of forest, lakes, rivers, and mountains. Baxter State Park, northwest of Millinocket where the Penobscot Mills Project is located, offers over 200,000 acres for public recreation with 46 mountain peaks, the highest being Mount Katahdin at 5,270 feet. There are more than 200 miles of hiking trails and ten campgrounds in this renowned state park (Baxter State Park 2021). There are also numerous individual backcountry sites for backpackers. An illustration of the various recreation opportunities in the Project region is provided in Figure 5.8-1.

Figure 5.8-1
Penobscot River Corridor and Seboomook Public Lands: Regional Recreation



Source: MDACF 2021e.

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The West Branch of the Penobscot River and other recreation facilities within the Project areas provide additional recreation opportunities for visitors. GNP once owned much of the land outside of Baxter State Park and allowed public access for recreation. Since then, these lands have been sold multiple times to multiple entities who generally still allow public access and recreation throughout the area.

Also nearby is the Katahdin Woods and Waters National Monument, another popular outdoor recreation destination. This monument was created in 2016 when 87,500 acres were donated to the United States Government (Natural Resources Council of Maine [NRCM] 2021). This national designation of land helps to preserve natural features of cultural, historic, and scientific value outside of the Baxter State Park. Recreation opportunities available within the monument include hiking, hunting, camping, biking, snowmobiling, and fishing (National Park Service [NPS] 2021a).

The Town of Millinocket, Maine, where a portion of the Penobscot Mills Project is located, is transitioning to a four-season destination for people wanting to fish, hike, camp, and paddle. Recreation opportunities in the Millinocket area include paddling, whitewater rafting on the West Branch, or fishing in many of the region's lakes and streams in the warmer months and cross-country skiing, snowmobiling, snowshoeing, and skiing in the winter. Snowmobiling is especially popular in the area. The Millinocket region has its own snowmobile trail system that is groomed by volunteers from local clubs and provides access to hundreds of miles of regional trails, some of which pass through the Project areas.

The Ripogenus Project area supports abundant recreation opportunities. Chesuncook Lake (Ripogenus impoundment) is Maine's third-largest lake. The lake covers 26,200 acres and is very popular with anglers primarily for its landlocked salmon. Primary public boat access to Chesuncook Lake is located off the Golden Road that connects Greenville and Moosehead Lake to Ripogenus Dam. There are numerous wilderness campsites located along the lake, many of which are managed by the Bureau of Parks and Lands (Maine Office of Tourism 2021).

The Golden Road parallels the western shoreline of Chesuncook Lake for approximately four miles, providing easy access to a small community of private camps (seasonal homes) at the

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midpoint of the lake. While most of the private camps are on the western shoreline, a few are located on the opposite side of the lake, accessed by gravel roads off the Golden Road.

The West Branch below McKay Station is best known as a starting point for whitewater rafting. Whitewater rafting and other forms of whitewater boating are an important recreation activity in the region (FERC 1996). With long stretches of river available for paddling, both private and commercial whitewater opportunities exist in abundance along the West Branch. An agreement made in 1993 between the Maine Professional River Outfitters and the Ripogenus Project Licensee addressed whitewater boating fees and facility needs and established a schedule for whitewater boating flow releases from McKay Station that has allowed commercial rafting and whitewater boating industries to become established in the region. The whitewater release schedule established by the agreement remains in effect today.

The West Branch provides a world class whitewater boating and rafting opportunity along a 15-mile-long reach of Class III-V whitewater (American Whitewater 2021). Discharges from McKay Station provide dependable flows throughout the paddling season. The section from McKay Station to Chewonki's Big Eddy Campground (about 2 miles) is considered a Class IV-V run. Just below the put-in is the Exterminator (Class IV), followed by other named rapids including Staircase (Class IV) and Cribworks (Class V). Throughout the 15-mile reach, the river alternates between long stretches of flatwater and sudden large drops. Figure 5.8-2 is a depiction of the major whitewater rapids on the West Branch.

Figure 5.8-2
Whitewater Boating Features of the West Branch Below McKay Station



Source: Whitewater Rafting Maine | Penobscot River | Northeast Whitewater.

There are other whitewater boating opportunities in the region. Weekly dam releases (July through September) below Canada Falls Lake on the South Branch Penobscot River (located between Canada Falls Lake and Seboomook Lake, west of the Projects) generate 3.5 miles of challenging Class IV-Class V whitewater. Additionally, between Seboomook Dam and Roll Dam, paddlers enjoy Class III whitewater through much of the season (at flows from 350 to over 3,000 cfs). Below Roll Dam, the Upper West Branch offers a mix of quiet water and gentle quick water (typically a 3 to 4-day trip to Chesuncook Village). Paddlers can take out at Umbazooksus Stream (a trip of 35 miles), continue to the eastern end of Chesuncook Lake (another 17 miles), or head into the Allagash Wilderness Waterway via either Umbazooksus Stream and the Mud Pond

Portage or Caucomgomoc Stream and Round Pond (both require substantial portages) (MDACF 2021f).

Fishing is also an important part of the recreation industry in the Project areas. The West Branch downstream of Ripogenus Dam is renowned for its popular landlocked salmon fishery and is considered one of the very best landlocked salmon rivers in the Northeast (The Perfect Fly Store 2021). This section of river also holds wild brook trout. Both coldwater fisheries are supported by cold water releases from Ripogenus Dam, which help maintain a productive coldwater fishery throughout the summer. Although many sections of the West Branch are popular with anglers, the most popular reach is from McKay Station downstream to Abol Bridge.

The Northern Forest Canoe Trail is a 700-mile-long water trail completed in 2006 that starts in New York and ends in Maine. The Northern Forest Canoe Trail follows the West Branch of the Penobscot river from Moosehead Lake to Chesuncook Lake (Penobscot River Trails 2021). Section 11 of the Northern Forest Canoe Trail includes the historic Northeast Carry route that connects the Kennebec River and Penobscot River drainages via a 1.9-mile-long portage between Moosehead Lake and the West Branch (Chesuncook Lake).

Penobscot River Trails is a privately-owned nature reserve that offers year-round recreation opportunities along the East Branch of the Penobscot River. With 16 miles of maintained trails and rental equipment, this area supports biking, hiking, and kayaking in the summer with snowshoeing and cross-country skiing in the winter (Penobscot River Trails 2021).

The Appalachian Trail crosses the West Branch of the Penobscot River at Abol Bridge (approximately 11 miles downstream of Ripogenus Dam). From there, the Appalachian Trail follows Nesowadnehunk Stream to its northern terminus in Baxter State Park (NPS 2021b).

5.8.2 Existing Project Recreation Facilities and Opportunities

There are both formal and informal public recreation sites and facilities at the Ripogenus and Penobscot Mills Projects that provide access to Project lands and waters.

A site is considered a formal site if it has been improved or facilities and/or amenities have been added specifically to enhance public recreation use. Formal recreation sites include both Project

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and non-project recreation sites. Project recreation sites are those that have been approved by FERC, are located within the Project boundary, and are managed pursuant to the FERC license.

Non-project recreation sites are improved sites that provide public or private access to Project lands or waters, but which are not considered part of the FERC-licensed Project and are generally operated and managed by others. A municipal facility that provides public access to Project lands or waters is a good example of a non-project recreation site.

Informal sites are those where public recreation can and does occur, but where there have been no improvements made to the site. Rather, the site has been used traditionally or informally to access Project lands or waters. Unimproved pathways down to the shoreline and shoreline fishing areas are good examples of informal recreation sites. Additionally, a boat launch is defined as a formal launching facility with parking for trailered vehicles, while boat put-ins are defined as unimproved lake or river access with limited parking for the purpose of this document.

5.8.2.1 Ripogenus Project

Project Recreation Sites

The Ripogenus Project has several formal FERC-approved Project recreation sites which provide opportunities for fishing, swimming, boating, hunting, ice fishing, camping, hiking, snowmobiling, canoeing, cross-country skiing, waterskiing, sailing, and sightseeing. These include one boat launch, one boat put-in, several campsites, rafting put-in facilities at McKay Station, and one trail (Table 5.8-1 and Figure 5.8-3).

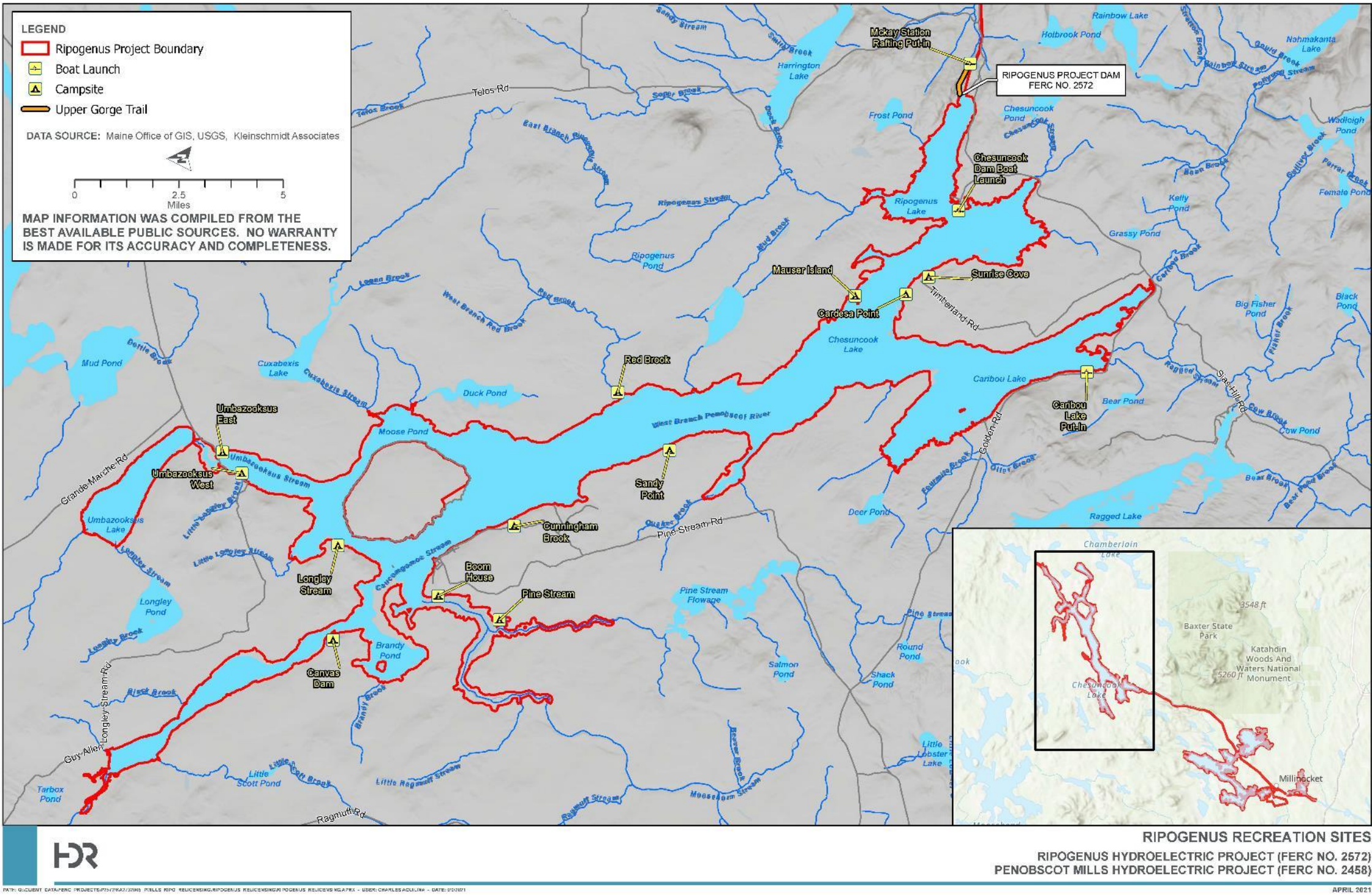
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Table 5.8-1
Formal FERC-Approved Project Recreation Sites at the Ripogenus Project

Recreation Site Name	Development/Location	Recreation Facilities	Notes
Caribou Lake Put-in	Ripogenus impoundment: Western Shore of Caribou Lake basin on the Golden Road	• Primitive gravel boat put in	Managed by GLHA
Chesuncook Dam Point Boat Launch	Ripogenus impoundment (Chesuncook Lake basin) on Chesuncook Lake Road off the Golden Road	• Single lane gravel boat launch. • Parking for multiple trailered vehicles • Informational kiosk • Restroom	Managed by Penobscot River Corridor
Chesuncook Lake Remote Campsites	Ripogenus impoundment: 10 campsites at various locations around Chesuncook Lake	• Cleared tent site • Fire pit (at some)	Managed by Penobscot River Corridor
Umbazooksus Stream Campsites	Ripogenus impoundment: Northeast end of Umbazooksus Cove	• 2 campsites • Cleared tent sites	Managed by North Maine Woods
Upper Gorge Trail	Ripogenus: East side of the West Branch starting just north of Ripogenus Dam	• Hiking trail following the Upper Gorge from Ripogenus Dam down to McKay Station, on east side of river	Managed by GLHA
McKay Station Rafting Put-in Site	Ripogenus: Located at McKay Station	• Whitewater boating put-in. Ample parking, restrooms, and access to put-in site	Managed by GLHA

Figure 5.8-3
FERC-Approved Project Recreation Sites at the Ripogenus Project



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The Caribou Lake Put-in is a primitive gravel put-in on the western shoreline of the Caribou Lake basin near the Golden Road that provides water and boat access to the lake. This site has limited parking for multiple trailered vehicles. The Chesuncook Dam Point Boat Launch is located off Chesuncook Lake Road and directly adjacent to the Chesuncook Boom House. Facilities at this site include an improved gravel boat launch, informational kiosk, and outhouse (Photo 5.8-1, Photo 5.8-2, and Photo 5.8-3). This facility also has ample parking for trailered and non-trailered vehicles. Both of these facilities provide year-round access to Ripogenus impoundment for various recreation activities including boating, fishing, snowmobiling, and more. The Caribou Lake Boat Launch is managed by GLHA while the Chesuncook Dam Point Boat Launch is managed by the Penobscot River Corridor (PRC) ¹⁶.

Photo 5.8-1
Chesuncook Dam Point Boat Launch



¹⁶ The PRC is an entity of MDACF specifically tasked with managing the PRC and many of the recreation facilities along the river.

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Photo 5.8-2
Chesuncook Dam Point Boat Launch Informational Kiosk



Photo 5.8-3
Chesuncook Dam Point Boat Launch Outhouse



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There are 10 remote campsites on Chesuncook Lake, some of which are water access only. These campsites are primarily accessible via boat and are located around Chesuncook Lake and on Gero Island. These sites are managed by the PRC. These campsites are classified as either Authorized or Permitted. Authorized campsites are allowed to have fires without a permit, while the permitted campsites require users to obtain a fire permit from the Maine Forest Service. These campsites are primarily used in the summer months and enable recreational users to camp out on and along the shores of the lake to fish, hunt, swim, and generally recreate within the Project area.

There are two other remote campsites further north in Umbazooksus Cove managed by North Maine Woods. These campsites also provide boat access to the northeastern end of Chesuncook Lake and the Upper West Branch, which enters the lake just north of Chesuncook Village. These are permitted campsites that require a fire permit. These campsites are primarily used in the summer months and enable recreational users to camp on and along the shores of the lake to fish, hunt, swim, and generally recreate within the Project area.

The Upper Gorge Trail extends from Ripogenus Dam to McKay Station along the eastern shore of the West Branch and is maintained by GLHA. The trail extends along the top of the sheer vertical walls, rising fifty feet or more from the riverbed. This foot trail heads in an easterly direction from the dam, following the old log sluiceway for 0.75 miles above the Upper Gorge to a point opposite McKay Station. This area also provides views of the Ripogenus Dam. The bridge deck atop the dam is also used to access Frost Pond and a set of sporting camps 2.5 miles to the north (Photo 5.8-4 and Photo 5.8-5).

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Photo 5.8-4
Head of the Upper Gorge Trail



Photo 5.8-5
View of Ripogenus Dam from the Upper Gorge Trail



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The McKay Rafting Put-In recreation site is adjacent to McKay Station. The site includes a gravel parking lot (approximately 100 feet x 175 feet in size), which is located between McKay Station and the Golden Road to accommodate the buses and other vehicles used by the commercial rafting companies and their clientele, as well as private boaters. A gravel staging area is located outside the gates to McKay Station to give the rafting companies a location to orient their parties and to make last minute preparations. Two portable toilets are located at the site, one at the parking area and one adjacent to McKay Station. A sign outlining the rules for use of the rafting/whitewater put-in is mounted on the security gate at McKay Station. The put-in is comprised of a wide gravel path that leads around the powerhouse and into the West Branch at a quiet pool above the McKay Station tailrace.

Under the existing agreement with the Maine Professional River Outfitters, GLHA provides whitewater flow releases on a set schedule. Typically, releases are made daily from May 1 through September 16 annually; weekend whitewater flows are provided from September 16 to October 1. These flows are available to boaters for much of the day running from 8:30 AM to 5:00 PM. Table 5.8-2 and Photo 5.8-6 below depict the scheduled whitewater flow releases from McKay Station.

Whitewater boaters and rafts put in at McKay Station. From this point, the boaters travel down the West Branch through Class III- V rapids. Whitewater boaters have multiple opportunities to take out along the river; however, the most common takeout is approximately 14 miles downstream at Never's Corner takeout. Figure 5.8-2 depicts the notable rapids and white-water features on the river.

Table 5.8-2
Minimum Whitewater Flow Release (cfs) Requirements for
Ripogenus Project (McKay Station) 8:30 AM – 5:00 PM

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
May 1 to September 15							
CFS-Normal Year	2,300	2,200	2,000	2,000	2,000	2,200	2,300
CFS-Wet/Dry Year	2,200	2,000	1,800	1,800	1,800	2,000	2,200
September 15 to October 1							
CFS Normal Year	2,300	-	-	-	-	-	2,300
CFS Wet/Dry Year	2,200	-	-	-	-	-	2,200

Photo 5.8-6
McKay Station Whitewater Put-In Area



Current whitewater boating flow levels for rafting were determined through a 1990 Whitewater Rafting and Boating Survey as part of a larger survey regarding “Recreational Activities in the Ripogenus Project.” The focus of these surveys was to capture basic information on recreational users and how much they enjoyed the activity. This survey explored whitewater rafters’ and boaters’ experiences at different flow levels and put-in locations. The run enjoys continued popularity for whitewater rafters under the current flow levels.

Non-project Recreation Sites

The Project and surrounding areas provide vast amounts of recreational opportunities utilizing both formal and informal non-project recreation sites. Along the Golden Road, which follows the Ripogenus impoundment (Chesuncook Lake), there are many informal recreation sites and pull-offs that provide public access to Project lands and waters. This is also true for the impoundment itself. With vast areas of undeveloped lake and riverfront, recreational users within the Project area frequently utilize informal recreation sites along the shoreline and within the drawdown zone, and they use informal beach areas for swimming, picnicking, fishing and camping. Wintertime

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activities are more limited due to the remote location, weather conditions, and heavy snow. However, snowmobiling, cross-country skiing, and ice fishing are enjoyed throughout the Chesuncook Lake areas, primarily in the vicinity of Chesuncook Village, or from one of the formal boat launch facilities (Katahdin Snowmobile Trail Map 2021, FERC 1996).

Additionally, there are multiple commercial recreational opportunities outside of the rafting industry. The Big Eddy Campground (formerly known as Pray's Cottages) provides fee-based camping and lodging options along the West Branch downstream of McKay Station. The Allagash Gateway campsite is a sporting camp located near the Chesuncook Dam Point Boat Launch that offers a private boat launch, canoeing, campsites, lodging, guide services and a small store. Chesuncook Village at the western end of Chesuncook Lake is a historic logging village typically accessed by boat floatplane or snowmobile. Snowmobile access to the village is via snowmobile trail 3A, which is groomed by a local trail club (Katahdin Snowmobile Trail Map 2021). This village has lodging and guide services.

Gero Island, a non-project 3,000-acre island directly opposite Chesuncook Village, is designated as a Maine Public Reserve Land and maintained by the Maine Bureau of Parks and Lands (MDACF 2021f).

5.8.2.2 Penobscot Mills Project

There are both formal and informal public recreation sites and facilities at the Penobscot Mills Project that provide access to Project lands and waters. Recreational use at the Project includes boating, fishing, sailing, water skiing, hiking, sightseeing, swimming, hunting, camping, canoeing, ice fishing, snowmobiling, and cross-country skiing. Table 5.8-3 provides a summary of the Penobscot Mills Project recreation sites. The sites found at each of the Project developments are discussed in more detail in the following sections.

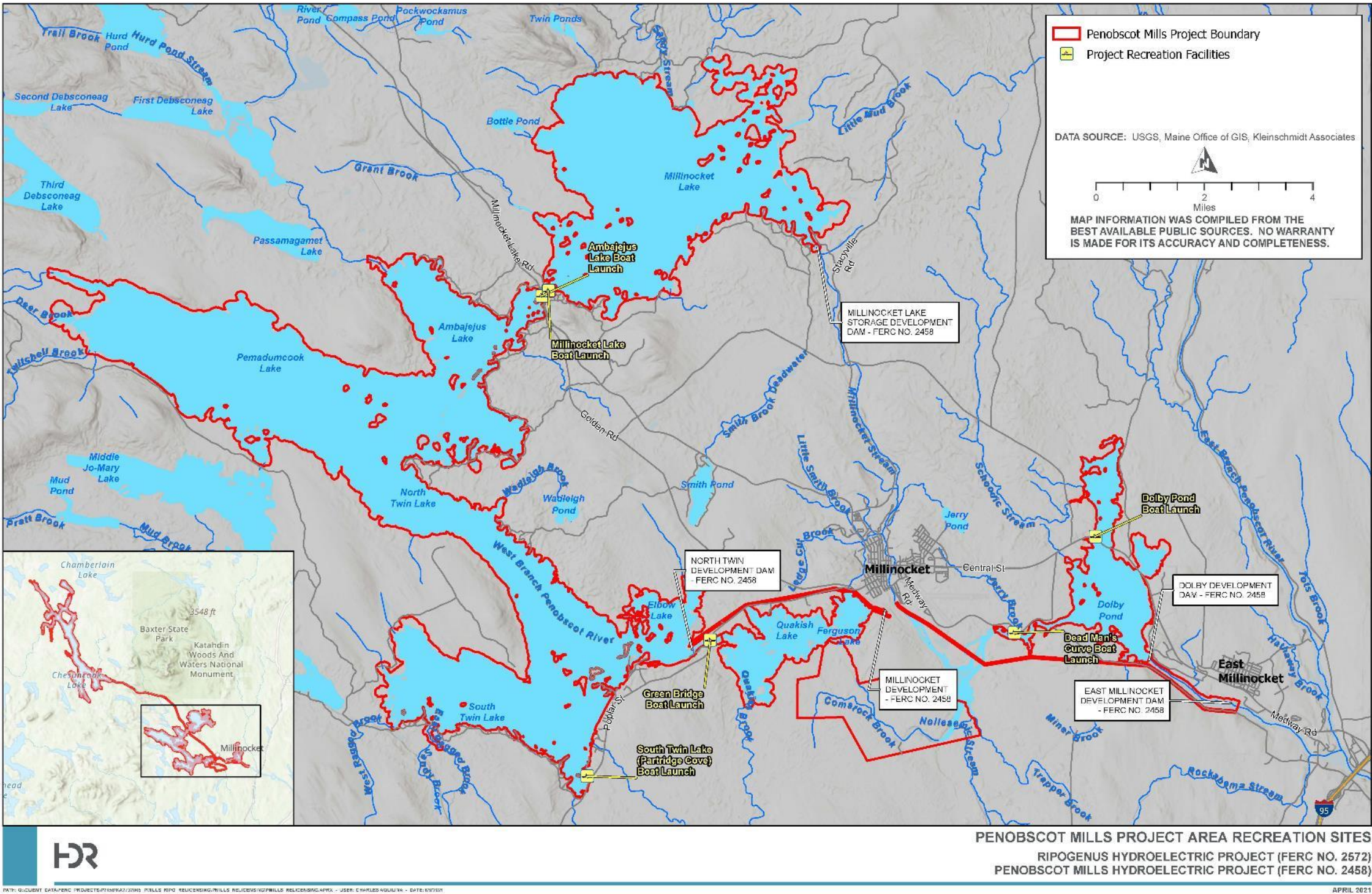
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Table 5.8-3
Formal FERC-Approved Project Recreation Sites at the Penobscot Mills Project

Recreation Site Name	Development/Location	Recreation Facilities	Notes
Millinocket Lake Public Boat Launch	Millinocket Lake Storage Development: Located off Baxter Park Road in southwest portion of lake.	- Boat launch - Parking area	Managed by GLHA
Ambajejus Lake Boat Launch	North Twin Development (within Spencer Cove of Ambajejus Lake). Located off Golden Road in northeast portion of lake.	- Boat launch - Parking area	Managed by GLHA
South Twin Lake (Partridge Cove) Boat Launch	North Twin Development (within Partridge Cove of South Twin Lake). Located off ME-11 in southeast portion of lake.	- Boat launch - Parking area	Managed by GLHA
Green Bridge Boat Launch	Millinocket Development (Quakish Lake). Located on West Branch below North Twin Dam, off ME-11.	- Boat Launch - Parking Area	Managed by GLHA
Dead Man's Curve Boat Launch	Dolby Pond at mouth of Jerry Brook). Located off Rice Farm Road.	- Boat Launch - Parking area	Managed by GLHA
Dolby Pond (Flowage) Boat Launch	Dolby Pond. Located off ME-157 in northwest portion of pond.	- Boat Launch - Parking area	Managed by GLHA

Figure 5.8-4
FERC-Approved Project Recreation Sites at the Penobscot Mills Project



Millinocket Lake Storage Development*Project Recreation Sites*

The Millinocket Lake Boat Launch is located off Baxter Park Road near the southwestern area of the lake. This boat launch is also adjacent to a public parking area. In 2008, the Millinocket Lake Boat Launch received the most usage out of eight surveyed recreation facilities at Penobscot Mills. Most recreationists were boaters seeking angling opportunities or traveling to their camps (GLHA 2009).

Photo 5.8-7
Millinocket Lake Boat Launch



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Non-project Recreation Sites

Millinocket Lake is accessible from the State Road and is most heavily developed at the southwestern end. Millinocket Lake has a fair amount of private development and a couple commercial properties on the lake. The commercial properties include a store, campground, restaurant, and several sporting camps. There is a private boat launch and informal boat put-in located at the New England Outdoor Center, which is a year-round private campground located on the southwest shore of the lake. An informal fishing spot is located at the Millinocket Dam. There are two informal beach/swimming areas located on the northern shore of the lake. One is near the mouth of Sandy Creek and the other on a landmass known as Eagle Point. Picnic sites are also found within the vicinity of each of the two swimming sites.

A primitive campsite is located adjacent to the access road to the dam, providing rudimentary accommodations for those fishing and canoeing the river. A groomed snowmobile trail, part of a large network between Millinocket and Millinocket Lake on the north side of the State Road, crosses the stream near the campsite.

North Twin Development*Project Recreation Sites*

There are two public boat launches within the North Twin impoundment: Ambajejus Lake Boat Launch and South Twin Lake Boat Launch. The Ambajejus Lake Boat Launch is in Spencer Cove in the northern portion of the impoundment. The boat launch is most often used by boaters who are going fishing or traveling to their camps. However, given its proximity to a beach, store, campground, and floatplane facility, it often is used for non-boating purposes by swimmers, sightseers, photographers, and sunbathers. The South Twin Lake Boat Launch is in Partridge Cove in South Twin Lake, in the southern portion of the impoundment. Most recreationists at the South Twin Lake Boat Launch are boaters seeking angling opportunities or traveling to their camps.

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Photo 5.8-8
Ambajejus Lake Boat Launch Approach



Photo 5.8-9
Ambajejus Lake Boat Launch



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Photo 5.8-10
South Twin Lake Boat Launch Parking Area



Photo 5.8-11
South Twin Lake Boat Launch



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Non-project Recreation Sites

There are a number of non-project recreation sites on the North Twin impoundment. The North Woods Trading Post maintains a private boat launch on Spencer Cove in Ambajejus Lake. Parking for boaters is available on the opposite side of the dike adjacent to the North Woods Trading Post. The Ambajejus Lake basin of the North Twin impoundment is accessible from the State Road and is one of the more popular recreation destinations within the Penobscot Mills Project. Ambajejus Lake has a large amount of private development and two commercial developments, most of which are located near the State Road dike on the eastern side of the lake. There is a public beach and a commercial flying service located near the dike that separates Ambajejus Lake from Millinocket Lake.

Ambajejus Lake has the greatest number of private campsites in the project area. These camps are located along most of the lake's northern and eastern shoreline. Camp owners and the general public use the waters for fishing, boating, canoeing, sailboating, water skiing, swimming, and sightseeing. Camping, fishing, and smelt dip net fishing are popular on the western end of the lake at the point where the West Branch enters the lake. Snowmobiling, cross-country skiing, and ice fishing are major winter activities. There are two major ice fishing sites and a section of the Maine Interconnected Trail System (ITS) 86 snowmobile trail is nearby.

The Pemadumcook Lake basin of the North Twin impoundment has a small amount of private development concentrated at the south-easterly end. There is a year-round sporting camp located at White House Landing at the northwesterly end of the lake near Nahmakanta Stream. Camp owners and the general public use the waters for fishing, boating, water skiing, and swimming.

While Pemadumcook Lake is the largest basin within the North Twin Impoundment, it has one of the lowest patterns of recreational use, due mainly to its remote location. The lack of roads along the shoreline restricts access to Pemadumcook to boats, snowmobiles, or float planes. The primary open water activities are boating and fishing. Camping occurs at Moose Cove on the northerly shore, and at the outlet of Nahmakanta Stream at the western end. Snowmobiling is an important winter activity, with a segment of the Maine ITS known as the Pemadumcook Freeway following its northerly shore. Ice fishing occurs to a major degree at one site on the eastern end and to a minor degree at two mid-lake locations.

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The "AMC River Guide" describes the five-mile-long segment of Nahmakanta Stream, between Nahmakanta Lake and Pemadumcook Lake, as having high water in May and a series of mostly Class I and II rapids. The scenery is characterized as "wild," which is defined as having long sections of semi-wilderness, with no more than a few isolated camps and only occasional road access. While Nahmakanta Stream is outside the Project boundary, the campsites on Pemadumcook Lake provide overnight facilities for recreational users of the stream.

The South Twin Lake, North Twin Lake, and Elbow Lake basins in the North Twin impoundment are located seven miles west of Millinocket and are accessible from Route 11. The southerly shore of South Twin Lake and the eastern end of North Twin Lake are two of the most heavily developed areas within the Project area. These lakes have one commercial development and a large number of private developments. There is a non-project, state-operated picnic area on the shore of South Twin Lake adjacent to Route 11. There is also a commercially operated marina (with boat launch) and general store adjacent to the public boat launch. Camp owners and the general public use the waters for fishing, boating, water skiing, sightseeing, picnicking, canoeing, and swimming. Wintertime use includes ice fishing, with a major ice fishing colony established at the southerly end of the lake, along with snowmobiling and cross-country skiing.

Ambajejus, North Twin, and Elbow Lakes are important components of the 83 -mile-long canoe route from Seboomook Lake through Chesuncook Lake and the Ripogenus impoundment and down to the North Twin impoundment basin. There are many formal and informal campsites along this route primarily managed by the PRC.

Snowmobiling is a popular winter recreation activity around the Penobscot Mills Project developments. Over the years, the Licensee has cooperated with the local snowmobile clubs and private individuals in establishing an extensive network of trails on their property. Several hundred miles of groomed trails are located in or adjacent to the Project area. Two sections of the Maine ITS are located within the Project area at Pemadumcook Lake. A segment of the ITS known as the Pemadumcook Freeway follows its north shore. Approximately 40 miles of maintained snowmobile trails are available in the area between Millinocket Lake and Elbow Lake. Additionally, a section of the ITS 86 snowmobile trail runs through the area of Ambajejus Lake.

Section 5Description of Existing Environment and Resource Impacts**Millinocket Development***Project Recreation Sites*

The Green Bridge Boat Launch and associated parking area is located off Route 11 on the West Branch between North Twin Dam and Quakish Lake. The site includes a paved boat launch and parking area. The site is used by boaters, hikers, and anglers.

Photo 5.8-12
Green Bridge Boat Launch Parking Area



Photo 5.8-13
Green Bridge Boat Launch



Note: Photograph taken prior to formal opening of the boat launch.

Non-project Recreation Sites

Next to the Green Bridge Boat Launch site is a suspension footbridge that provides passage across the West Branch for hikers, pedestrians, and snowmobilers. Additionally, a non-project recreation trail begins at the Green Bridge boat launch parking area and leads to the North Twin Dam.

Quakish Lake (Millinocket Development) is a relatively small body of water with limited recreational value, located adjacent to Route 11. The lake can be accessed at two informal locations: at the end of a dirt road off Route 11 and directly off the highway on the southwesterly side of Route 11 at the Green Bridge. The latter point also provides access into the West Branch riverine segment below North Twin Dam, 0.5 mile above Quakish Lake. Recreational uses include fishing, canoeing, and ice fishing.

Dolby Development*Project Recreation Sites*

There are two public boat launches on Dolby impoundment: Dead Man's Curve Boat Launch and Dolby Pond Boat Launch. The Dead Man's Curve Boat Launch and parking area is located at the entrance to Jerry Brook along the Rice Farm Road (Photo 5.8-14). This site is most often used by shore anglers but is also used for launching boats and as a parking area by hikers. The Dolby Pond Boat Launch and parking area is located on the western shore of Dolby Pond where Route 157 crosses the pond (Photo 5.8-15).

Photo 5.8-14
Dead Man's Curve Boat Launch (Dolby Pond)



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Photo 5.8-15
Dolby Pond Boat Launch

*Non-project Recreation Sites*

There is an informal boat put-in in the southeastern portion of Dolby Pond. The 3-mile-long section of the West Branch between the Millinocket Development and Dolby Pond is primarily used by anglers in the springtime, with a concentration at Shad Pond. Route 157 crosses Dolby Pond on a causeway between Millinocket and East Millinocket. A non-project Maine Department of Transportation picnic and rest area (the Dolby Flowage Rest Area) is located on the north side of the road, adjacent to the northerly portion of the pond. This area, with picnic shelters and rest rooms, affords a convenient place to fish, watch birds, or appreciate the view to Mount Katahdin. The primary recreational activities on the pond are fishing, ice fishing, and canoeing.

East Millinocket Development*Project Recreation Sites*

There are no Project recreation sites at the East Millinocket Development.

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Non-project Recreation Sites

Recreational use of the East Millinocket impoundment is limited by the impoundment's proximity to the former mill site and limited public access along the north side of the impoundment. The tailwater of Dolby dam at the upper end of the impoundment provides the primary fishing opportunity in this reach. The impoundment gets some use by paddlers passing through as they travel down the West Branch to the mainstem Penobscot River (FERC 1996). Both Dolby and East Millinocket Development dams have informal portage trails around them on the south-west side of the river.

5.8.3 Project Recreation Use

5.8.3.1 Ripogenus Project

Article 411 of the Ripogenus Project license requires GLHA to monitor recreation use at the Project every six years and to evaluate whether existing facilities meet the recreation needs of the public. Recreation monitoring surveys were completed in 2001, 2008, and 2014; the next monitoring study is planned for 2022¹⁷. Most recently, in 2014, GLHA performed user spot counts at the Project recreation sites on weekdays, weekends, and holiday weekend days from late-spring to early-fall to estimate annual and peak usage. The user spot counts recorded the number of vehicles, boats, and people, and observed activities at the site. In 2001 and 2008, total recreationists were counted on each survey day. Recreational use information from state agencies and other organizations were also obtained. Recreation use information is discussed generally below.

The Project recreation sites and facilities around the Ripogenus impoundment receive regular use. The Chesuncook Lake campsites were used a minimum of 1,320 camper nights in 2001 and 2,482 nights in 2008 (GLHA 2002, 2009). The Chesuncook Dam Point boat launch received more use than the Caribou Lake boat put-in and access areas at the Umbazooksus Stream West and East campsites. Umbazooksus West is used more the Umbazooksus East.

In 2014, there were an estimated 19,645 recreation days at the Ripogenus Project recreation sites. This was comprised of 13,270 whitewater rafting days (68% of use); other use days (19% of use);

¹⁷ The survey planned for 2021 was delayed due to the ongoing COVID-19 pandemic.

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1,400 fishing days (7% of use); 545 camping days (3% of use), and 460 boating days (2% of use); remaining use included sightseeing and hunting (GLHA 2015). Whitewater boating was the primary activity at the Ripogenus Project in 2014 followed by fishing. This stretch of the West Branch downstream of the Ripogenus Project is well known for its landlocked salmon fishery and is its own tourist destination for that purpose. These fisheries support local guides and bait and tackle shops throughout the region.

In 2014, use at the Ripogenus Project recreation facilities was used under capacity. The whitewater boating site was used at 50 percent capacity. The Project campsites and access areas were used at about 25 percent capacity, with trail (Upper Gorge Trail) use at only about 1 percent capacity (GLHA 2015). In response to the filing of the periodic recreation monitoring reports, FERC concluded that the facilities at the Ripogenus Project are meeting the needs of the public and that the Project does not require additional recreation facilities (FERC 2002, 2009, 2015).

Whitewater rafting and boating remains the most popular recreation use of the Ripogenus Project. A total of 14,171 and 21,776 whitewater rafting customers were counted using the McKay Station Whitewater Rafting put-in site in 2001 and 2008, respectively (GLHA 2002, 2009). The majority of rafting use (approximately 70%) occurs in July and August. In 2020, the West Branch of the Penobscot River saw 5,942 commercial whitewater rafters (MDIFW 2020). This accounted for approximately 22 percent of all commercial rafting in the State of Maine and was the second most popular commercial rafting destination in the state only behind the Kennebec River. The MDIFW charges outfitters \$2.00 per commercial customer. These funds are divided between the county the river is located in, which receives 10 percent, the MDACF receives 25 percent, and the MDIFW receives 65 percent of these funds. In 2019, this program received a total revenue of \$120,202. Between 2016 and 2019, this program averaged approximately \$132,847 (MDIFW 2020).

5.8.3.2 Penobscot Mills Project

Article 415 of the Penobscot Mills Project license requires GLHA to monitor recreation use at the Project every six years and to evaluate whether existing facilities meet the recreation needs of the public. Recreation monitoring studies were completed in 2001, 2008, and 2014; the next monitoring study is planned for 2022 (delayed due to the ongoing COVID-19 pandemic). In 2014, GLHA performed user spot counts at commonly used formal recreation sites on weekdays,

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weekends, and holiday weekend days from late-spring to early-fall to estimate annual and peak usage. The user spot counts recorded the number of vehicles, boats, and people, along with the observed activities at the site. In 2001 and 2008, total recreationists were counted on each survey day. Recreational use information from state agencies and other organizations were also obtained. Recreation use information is discussed generally below.

The 2001 and 2008 studies assessed use at eight Project recreation sites within the Penobscot Mills Project area including the: Millinocket Lake Boat Launch, Ambajejus Lake Boat Launch, South Twin Lake Boat Launch, Green Bridge Boat Launch, Dead Man's Curve Boat Launch, and the Dolby Pond Boat Launch (GLHA 2002, 2009). In both study years, the Ambajejus Lake Boat Launch, South Twin Lake Boat Launch, and the Millinocket Lake Boat Launch received the most use (each site received 20 to 30% of the total use each year). The most popular activities were boating, canoeing, angling, and accessing camps. The Ambajejus Lake Boat Launch area was also used for swimming, sightseeing, and sunbathing. The other recreation sites each received 10 percent or less of the total recreation use for angling, boating, sightseeing, picnicking, hiking, walking dogs, or resting. Based on the routine recreation survey monitoring reports filed with FERC, both GLHA and FERC concluded that the available recreation facilities within the Penobscot Mills Project area were meeting the needs of recreationists and were adequate to accommodate current and future recreational needs (FERC 2002, 2009).

In 2014, the majority of recreation use occurred at the North Twin Development (approximately 48% of total recreational use at the Penobscot Mills Project); recreationists participated in activities such as walking the dog, swimming, wading, fishing, boating, picnicking, sightseeing, and camping (GLHA 2015). The Dolby Development received 30 percent of the total recreation use with users participating in fishing, sightseeing, picnicking, and walking. The Millinocket Lake Storage Development (activities included fishing, boating, and other) and the Millinocket Development (the only observed activity was fishing) received 17 percent and 5 percent of the total recreation use, respectively. The least amount of use occurred at the East Millinocket Development (less than 1% of total recreational use). Overall recreational use was low, and the facilities at the Penobscot Mills Project were used under capacity (40% or less). While some facilities were at or over capacity during occasional three-day holiday weekends and special events

(such as fishing tournaments), recreationists were still able to use the facilities without any problems (GLHA 2015). In response to the most recent recreation monitoring report filed by GLHA with FERC, FERC concluded that the recreation facilities were meeting the needs of the public and additional facilities were not needed (FERC 2015).

5.8.4 Recreation Needs Identified in Management Plans

During the previous relicensing, a number of recreation facility and flow enhancements were identified and incorporated into the 1996 FERC licenses; all were completed and continue to be maintained by the GLHA pursuant to the Project licenses.

2020-2024 Maine State Comprehensive Outdoor Recreation Plan

The Maine State Comprehensive Outdoor Recreation Plan (MSCORP) provides information on the supply and demand for outdoor recreation opportunities in Maine, assesses recreation issues, provides an implementation plan, and serves to qualify Maine for funding from the federal Land and Water Conservation Fund to acquire or develop lands for public outdoor recreation. There are no recommendations specific to the Ripogenus or Penobscot Mills Projects. Recreation priorities outlined in the MSCORP that may bear relevance to the Projects are the following (MDACF 2020):

- To connect Mainers with the health and wellness benefits of outdoor recreation;
- To support regionally connected trail systems in less developed regions to increase access and enhance economic development;
- To connect to future tourism markets through recreation interests; and
- To increase access to and awareness of local and regional recreation opportunities through effective communication and collaboration between the public, municipal, and private landowners.

The 2020 MSCORP identified several outdoor recreation activities in which Maine residents participate at higher than national levels and for which there is growing demand throughout the state. These include primitive camping, big-game hunting, snow/ice activities (any type),

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snowmobiling, boating and canoeing, coldwater fishing, viewing and/or photographing other wildlife besides birds, and gathering mushrooms, berries, etc. As discussed previously, both Project and non-project public recreation sites and facilities provided at the Ripogenus and Penobscot Mills Projects provide ample opportunity for Project lands and waters to be used for all of these forms of outdoor recreation.

5.8.5 Specially Designated Recreation Areas in or Adjacent to the Projects or in the Vicinity of the Projects

5.8.5.1 National Wild and Scenic River System

The West Branch of the Penobscot River within the Project boundaries has not been designated as a National Wild and Scenic River. The state of Maine has not requested federal designation of the river as a wild, scenic, or recreational river (National Wild and Scenic River System [NWSRS] 2021).

5.8.5.2 Nationwide Rivers Inventory

The Ripogenus and Penobscot Mills Projects are hydrologically connected to and within the vicinity of a stretch of the West Branch Penobscot River which is classified in the National Rivers Inventory as having “Outstanding Remarkable Value”. Listed in 1982, the segment of river is approximately 22 miles and extends from the Ripogenus Dam to Ambajejus Lake of the North Twin Development. The National Park Service website illustrates that the river segment “includes a spectacular, narrow, impassible gorge and regionally unique views to Mt. Katahdin, a rare open low mountain area”. The classification values of this river segment are “scenic” and “recreational.” A “scenic river” is defined as “those rivers or sections of rivers that are free of impoundments, with shorelines or watersheds still largely primitive and shorelines largely undeveloped, but accessible in places by roads”. A “recreational river” is defined as “those rivers or sections of rivers that are readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past” (NPS 2021b).

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5.8.5.3 National Trails System and Wilderness Areas

The Appalachian National Scenic Trail, a part of the National Trails System, crosses the Ripogenus Project transmission line corridor (part of the Ripogenus Project boundary) at Abol Bridge. A short segment of the Maine ITS snowmobile trail is located along the northern shore of Pemadumcook Lake, a popular snowmobile route (NPS 2021c). No National Wilderness Areas or National Natural Landmarks are located within the Project areas.

5.8.5.4 North Maine Woods

The North Maine Woods is a large area of northern Maine that is mostly in private ownership but that is available for certain types of public recreation use including hunting, fishing, and camping. The region is overseen by a combination of private individual and private industrial owners and state government agencies, and it is divided into 155 unincorporated townships within the North Maine Woods management area. There are no towns or paved roads (North Maine Woods 2021).

The North Maine Woods covers more than 3.5 million acres (14,000 km²) of forest land bordered by Canada to the west and north and by the early 20th century transportation corridors of the Canadian Pacific International Railway of Maine to the south and the Bangor and Aroostook Railroad Ashland branch to the east. It includes western Aroostook and northern Somerset, Penobscot, and Piscataquis counties. Much of the woods is currently owned by timber corporations, including Seven Islands Land Company, Plum Creek, Maibec, Orion Timberlands, and JD Irving timber corporations (North Maine Woods 2021).

Much of the North Maine Woods is managed as commercial timber for wood products, pulp, and lumber, as well as hunting and outdoor recreation. Included within its boundaries are two wild rivers of the Northeastern United States: the Saint John and the Allagash Rivers. The North Maine Woods completely surrounds the Allagash Wilderness Waterway. Portions of the West Branch of the Penobscot River, including the northern end of Chesuncook Lake, lie within the area designated as the North Maine Woods (North Maine Woods 2021).

North Maine Woods, Inc. operates a system of gated access roads and campsites, which are available for public recreation use. The organization charges land use and camping fees for those using its private roads and recreation facilities. Fees are charged to cover operational expenses

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related to maintaining checkpoints and camp sites. North Maine Woods, Inc. is a non-profit corporation and none of the user fees are shared with landowners or any other group.

5.8.5.5 Scenic Byways

A National Scenic Byway is a road recognized by the U.S. Department of Transportation for one or more of six "intrinsic qualities": archeological, cultural, historic, natural, recreational, and scenic. The program was established in 1991 to preserve and protect the nation's scenic but often less-traveled roads and promote tourism and economic development. The National Scenic Byways Program (NSBP) is administered by the Federal Highway Administration (Federal Highway Administration 2021).

The Katahdin Woods and Water National Scenic Byway passes through the Penobscot Mills Project area. The byway begins at the southern entrance of Baxter State Park and winds its way through Millinocket along Route 11 and the Penobscot River to Patten, Maine ending at Baxter State Park's northern entrance at Grand Lake Matagamon (Figure 5.8-5) (Katahdin Woods and Waters 2021). The byway crosses through the Penobscot Mills Project along the Route 11 bridge over Dolby Pond, and along the Baxter State Road on the Ambajejus dike between the North Twin and Millinocket Lake Storage development impoundments.

Figure 5.8-5
Katahdin Woods and Waters National Scenic Byway Route



Source: Katahdin Woods and Waters 2021.

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5.8.6 Land Use

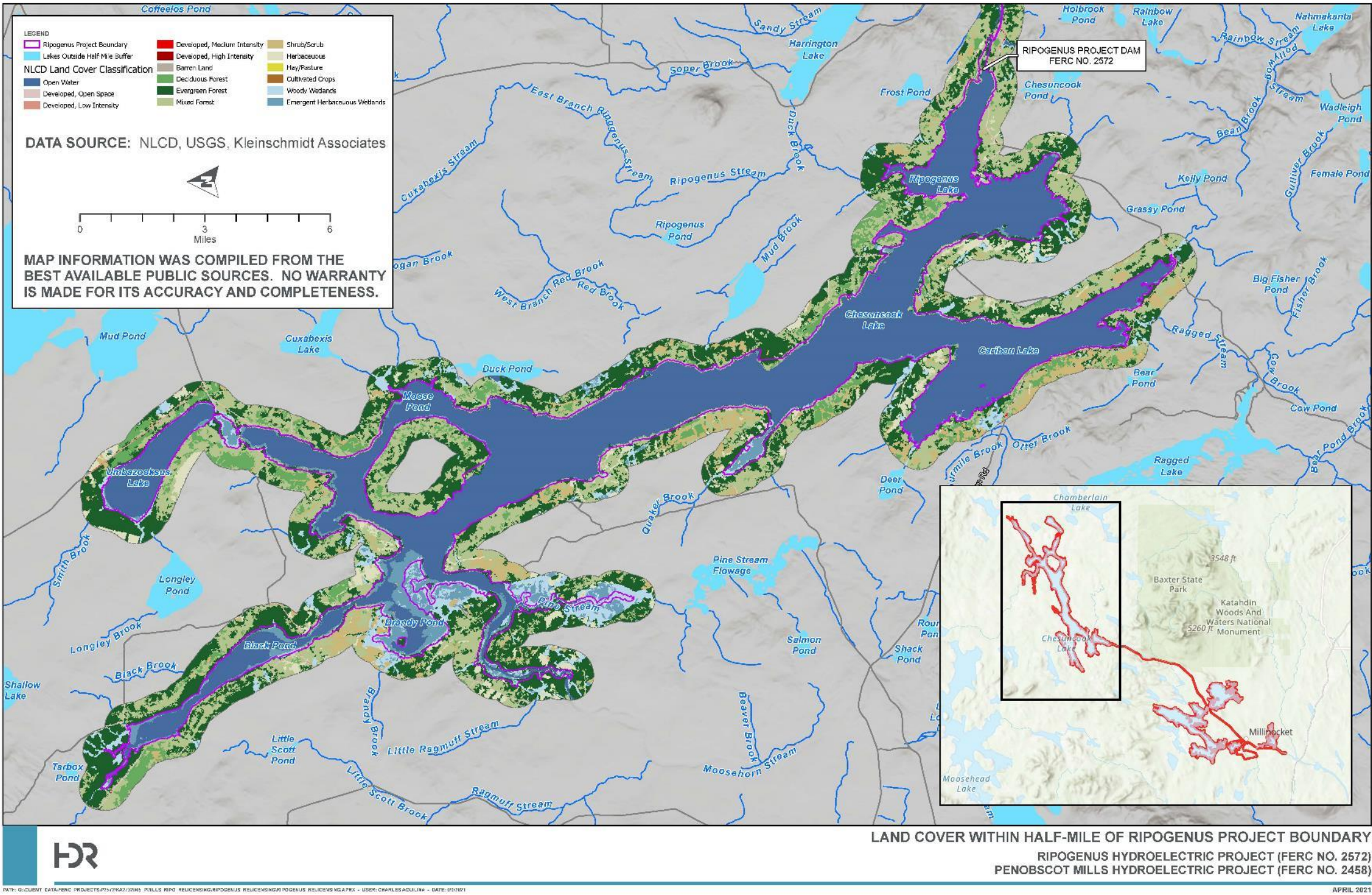
5.8.6.1 Ripogenus Project

Land use in the vicinity of the Ripogenus Project is primarily undeveloped forested lands. Table 5.8-4 provides a breakdown of the land use cover types for lands within the Project boundary available from the National Land Use Cover Dataset (NLCD). With the exception of open water (accounting for approximately 84% of land cover within the Project boundary), forested lands of various types account for the majority of Project lands. Developed lands account for less than 1 percent of Project lands. Figure 5.8-6 shows NLCD cover types within 0.5 mile of the Project boundary. Based on a review of the reports and publications from the Maine LUPC for the 2020 season, no specific recommendations associated with the Ripogenus Project were identified (MDACF 2021g).

Table 5.8-4
Land Use Cover Types Within the Ripogenus Project Boundary

NLCD Land Cover Class	Area Acres	% Area
Open Water	27118.8	84.1
Developed, Open Space	1.1	0.0
Developed, Low Intensity	1.8	0.0
Developed, Medium Intensity	4.4	0.0
Developed, High Intensity	1.3	0.0
Deciduous Forest	199.9	0.6
Evergreen Forest	1131.3	3.5
Mixed Forest	1275.7	4
Shrub/Scrub	15.3	0.04
Herbaceous	19.8	0.06
Woody Wetlands	315.4	1
Emergent Herbaceous Wetlands	2158.6	6.7

Figure 5.8-6
Land Use Cover Types Within One-Half Mile of the Ripogenus Project Boundary.



Source: National Land Cover Database 2021.

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5.8.6.2 Penobscot Mills Project

Land use in the vicinity of the Penobscot Mills Project includes a mix of cover types. Table 5.8-5 provides a breakdown of the land use cover types for lands within the Project boundary available from NLCD. Open water accounts for approximately 85 percent of the land cover; forested lands of various types account for 9.3 percent of Project lands. Developed lands account less than one percent of Project lands. Figure 5.8-7 shows NLCD cover types within 0.5 mile of the Project boundary. Based on a review of the reports and publications from the Maine LUPC for the 2020 season, no specific recommendations associated with the Penobscot Mills Project were identified (MDACF 2021f).

Table 5.8-5
Land Use Cover Types Within the Penobscot Mills Project Boundary

Cover Type	Area (mi ²)	Percent (%)
Open Water	30,767.2	84.6
Developed, Open Space	113.0	0.3
Developed, Low Intensity	30.0	0.1
Developed, Medium Intensity	19.8	0.1
Developed, High Intensity	6.9	0.0
Barren Land	154.8	0.4
Deciduous Forest	62.5	0.2
Evergreen Forest	2,512.6	6.9
Mixed Forest	798.4	2.2
Shrub/Scrub	198.8	0.5
Herbaceous	84.7	0.2
Woody Wetlands	1,381.7	3.8
Emergent Herbaceous Wetlands	244.6	0.7

5.8.7 Existing Shoreline Buffer Zones within the Project Boundary

GLHA manages Project lands and shorelines (within the Project boundaries) in accordance with the FERC-approved Shoreline Management Plans (SMP) for each Project. The SMPs were developed during the last relicensing of the Projects, as required under License Articles 414 and 418 for the Ripogenus and Penobscot Mills Projects, respectively.

The objectives of the SMPs are to protect water quality and quantity; to provide for the continued protection of natural and recreational resources; to manage or prohibit additional commercial and residential structures within areas of the Project shorelines; to prohibit timber harvests within near-shore areas, and manage timber harvests on other Project lands; and to establish conservation easements in certain areas and grant the State of Maine the ability to manage recreational activity on the easement lands. Since their initial development and approval, the SMPs have been updated as needed to reflect changes in Project conditions or the FERC Project boundary.

5.8.7.1 Ripogenus Project

Prior to issuance of the 1996 FERC license, the designated Project boundary around the Ripogenus impoundment was at or near the normal full pond elevation. During relicensing, an expansion of the Project boundary along the impoundment shoreline to protect aesthetic resources, water quality, wildlife habitat, and recreational opportunity was discussed among FERC, GNP, resource agencies, and stakeholders. FERC and GNP agreed to expand the Ripogenus Project boundary 200 feet from the normal full pond elevation on GNP-owned lands around the Ripogenus impoundment but excluding existing leased lots.

Pursuant to Article 414 of the Project license, GNP developed a SMP for the lands that are within the expanded Project boundary. The SMP was filed with FERC on October 17, 1997 (GNP 1997b) and approved by FERC via order issued January 4, 1999. A revised SMP was filed with FERC on September 26, 2001, which was approved by FERC via order issued April 2, 2002.

In total, the 200-foot Shoreline Buffer Zone (within the Project boundary) protects approximately 73 miles of shoreline (62% of the 118 miles of shoreline at normal full pond elevation of 941.59 feet) around the Ripogenus impoundment encompassing approximately 1,815 acres of land. The

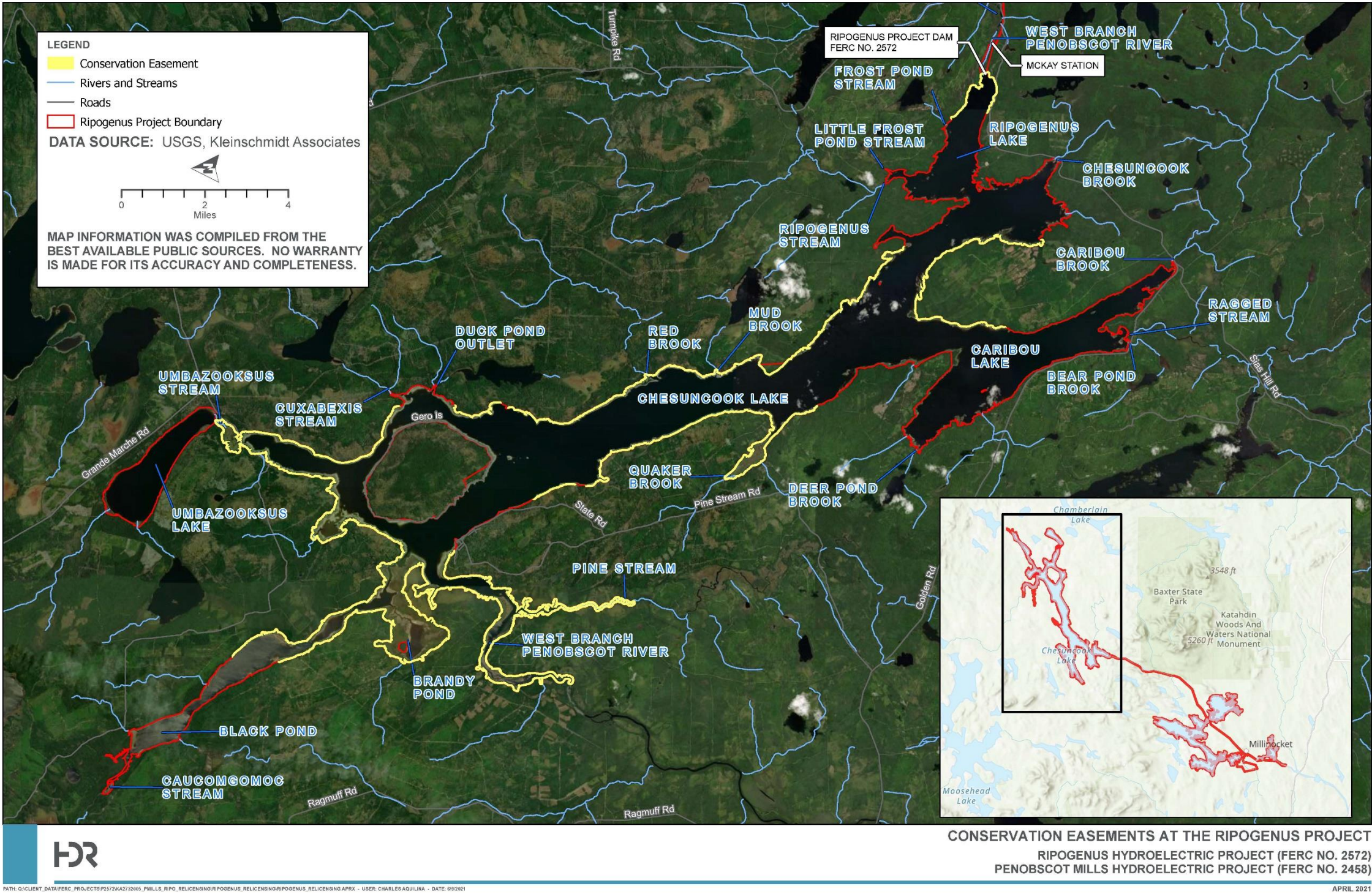
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Shoreline Buffer Zone excludes privately-owned lands and campsites that are currently managed by the PRC.

Within the Shoreline Buffer Zone, the SMP generally requires a 200-foot building setback, and a 100-foot vegetative buffer (Vegetative Buffer Zone), within which no timber harvesting can occur. The SMP establishes other management practices for the Vegetative Buffer Zone, including timber management practices. The SMP also establishes timber management practices for areas outside of the Vegetative Buffer Zone.

In addition to the 200-foot Shoreline Buffer Zone around Ripogenus impoundment (included within the Project boundary), a renewable conservation easement with the State of Maine was also established on Licensee-owned shoreline lands within 250 feet of the normal full pond elevation of Chesuncook and Ripogenus Lakes and Brandy and Black Ponds. This easement was generally for the same GNP-owned shoreline lands, except that the easement would extend beyond the Project boundary by going 250 feet landward from the normal full pond elevation, and that certain campsite areas leased by the State of Maine excluded from the Project boundary are included within the easement. Through granting of the conservation easement, GNP gave up the right to develop for commercial or residential purposes the land it owns within 250 feet of the normal full pond elevation on the specified lakes, except as specifically allowed under the FERC license and the easement, and granted the State of Maine the ability to manage recreation activities on these lands consistent with the requirements of GNP's FERC license. In total, the easement covers approximately 2,365 acres of shorefront land owned by the Licensee around Chesuncook and Ripogenus Lakes and Brandy and Black Ponds as seen in Figure 5.8-8.

Figure 5.8-8
Conservation Easement Lands at Ripogenus Impoundment.



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Within the 250-foot conservation easement, additional development is prohibited, though the State of Maine may seek to enter into a lease with the Licensee to allow for construction of certain administrative structures for the purpose of management of recreational use on conservation easement lands.

The SMP also includes procedures for complying with the buffer zone requirements, and provisions for enforcement. The SMP makes it clear that, in all cases, in addition to complying with the requirements of the SMP, any land management or development activities undertaken on Project lands must also be allowable under and in conformance with the standard land use article and other provisions of the FERC Project license.

In addition to the conservation easement lands identified at the Ripogenus Project through the SMP, there are also three areas at the Ripogenus impoundment, identified as Recreation Areas 1, 2, and 3 on the Exhibit G drawings (provided in Appendix C), that were reserved for potential future recreation use/development during both previous relicensings of the Project (1968 and 1996). Although these areas have not been developed, and GLHA currently foresees no need for their development, GLHA is proposing to continue maintaining these areas (which are located within the Ripogenus Project boundary) for possible future recreation use or development considering the anticipated term for a new Project license.

5.8.7.2 Penobscot Mills Project

Prior issuance of the 1996 FERC license, the designated Project boundary around the Penobscot Mills Project shoreline was at or near the normal full pond elevation for each of the Penobscot Mills Project impoundments. During relicensing, an expansion of the Penobscot Mills Project boundary along the shoreline to protect aesthetic resources, water quality, wildlife habitat, and recreational opportunity was discussed among FERC, GNP, resource agencies, and stakeholders. FERC and GNP agreed to expand the Penobscot Mills Project boundary 200 feet from the normal full pond elevation on GNP-owned lands on each of the Project's impoundments, excluding existing leased lots.

Pursuant to Article 418 of the Project license, GNP developed a SMP for the lands that are within the expanded Project boundary, which was filed with FERC on October 17, 1997 (GNP 1997c)

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and approved by FERC via order issued January 4, 1999. A revised SMP was filed with FERC in September 2001, which was approved by FERC via order issued February 12, 2002. The SMP was again revised in 2011 and approved by FERC via order issued February 16, 2011.

There are approximately 2,700 acres of protected Project shoreline, excluding highly developed shoreline areas and former mill properties. Out of those 2,700 acres, 385 acres were reserved for future development as requested by the Town of Millinocket. This provides approximately 2,300 acres of Project lands for recreational use and aesthetic values. Minor revisions were made to this plan in 2002 and 2011 to adjust future development areas, the Project boundary, and non-project recreation areas. The 2011 revision removed two small parcels (0.6 acres and 0.1 acres) of lands in the expanded FERC Project boundary. These parcels were developed and had been leased for years and, therefore, were not supposed to be included in the Project boundary.

The Project boundary at the Millinocket Lake Storage Development includes the bed of Millinocket Lake up to the normal full pond elevation, at elevation 480 feet, plus an additional 10 feet buffer from this elevation. In addition, on the western side of Millinocket Lake and the entire southern shore, the Project boundary was expanded 200 feet from the normal full pond elevation on GNP-owned lands, excluding existing leased lots, consistent with the other Project impoundments. On the south shore of the lake, starting from the pumping station and extending east to about 0.5 mile north of the Millinocket Lake Dam, there are lands that are developed or reserved for future development, which are excluded from the Project boundary (as indicated on the Exhibit G drawings provided in Appendix C).

The SMP also includes procedures for complying with the buffer zone requirements, and provisions for enforcement. The SMP makes it clear that in all cases in addition to complying with the requirements of the SMP, any land management or development activities undertaken on Project lands must also be allowable under and in conformance with the standard land use article and other provisions of the FERC Project license.

In addition to the shoreline buffer lands identified at the Penobscot Mills Project through the SMP, there are also five recreation areas (Recreation Areas 1 through 5) that were set aside in 1966 at the North Twin impoundment for future recreation needs. In 2002, Recreation Area 3 was removed

from the Project boundary due to the large number of existing leases. Currently, there are four recreation areas located within the Project boundary, identified as Recreation Areas 1, 2, 4, and 5 on the Exhibit G drawings (provided in Appendix C), that were reserved for future recreation use/development. Although these areas have not been developed, and GLHA currently foresees no need for their development, GLHA is proposing to continue maintaining these areas (which are located within the Penobscot Mills Project boundary) for possible future recreation use or development considering the anticipated term for a new Project license.

5.8.8 Licensee's Shoreline Management Policies

GLHA manages shorelines in accordance with the current FERC-approved SMPs for the Projects as described in the previous section. Stakeholders are allowed to access Project waters for recreation, including swimming, fishing, boating, etc., and to deploy temporary seasonal docks without GLHA's authorization. However, stakeholder uses of Project lands and waters that require a permit (and therefore landowner permission), such as installation of rip rap, moving or breaking rocks, and installation of permanent docks, require prior authorization from GLHA (LUPC 2017). For these types of activities, a user will request authorization from GLHA, who will then provide a permit in accordance with Article 419 of the Penobscot Mills Project and Article 415 of the Ripogenus Project licenses. Articles 419 and 415 require the Licensee to grant permissions for certain types of use and occupancy of Project lands and waters. For lands outside of the Project boundaries, private landowners must follow local and state regulations for development and land use in accordance with the LUPC.

5.8.9 Non-Recreational Land Use and Management within the Project Boundary

Primary land uses within the Ripogenus Project boundary include hydroelectric generation and recreation-related activities (recreation sites and camps). There are a very limited number of roads in and around the Ripogenus Project, and most roads are unpaved. There are some seasonal camps on the Ripogenus impoundment, primarily off the Golden Road on the western side of the impoundment. There is also a small residential village on the northwestern end of the lake called Chesuncook Village, which is partially within the Project boundary. Project-related development is limited to the Ripogenus Dam, and the area around McKay Station. As described in

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Section 5.8.2, there are also several public recreation sites at the Ripogenus Project, including two boat launches on the impoundment and scattered remote campsites.

Article 408 of the existing Ripogenus Project license required the Licensee to develop wetland enhancement measures for the Ripogenus impoundment. The goal of the enhancement plan was to substantially increase the extent, vegetation density and plant species richness of the Umbazooksus Lake wetlands. The most recent and final monitoring report in 2005 showed that those goals had been met and monitoring has since been discontinued.

The Penobscot Mills Project has significantly more development than the Ripogenus Project. There are many seasonal camps and some year-round residences around several of the Project's impoundments, primarily the Millinocket Lake and North Twin impoundments. There are a small number of commercial properties around the Project's impoundments as well. Several of the Project developments are in the town of Millinocket, and portions of the former mill operations remain a development feature associated with both the East Millinocket and Millinocket developments.

During the previous FERC relicensing effort, there were several measures undertaken to manage use of Project lands and to enhance wetlands and wildlife habitat. Article 410 of the existing Penobscot Mills Project license required the Licensee to develop wetland enhancement measures for the Deep Cove East and the Deep Cove West sites on the North Twin impoundment. These are discussed in more detail in Section 5.6.1.

Article 412 of the existing Penobscot Mills Project license required the Licensee to develop a Wildlife Management Plan to enhance and manage wildlife habitat in the area surrounding the Back Channel of the Millinocket Development. The Wildlife Management Area consists of 2,300 acres area managed for wildlife use through a variety of management prescriptions. Timber harvesting is still allowed in this area, but it is done in such a way to increase forest diversity and vertical stratification. A 330-foot riparian zone was created around the majority of the Back Channel itself to protect riparian habitat in the area.

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Current goals for the wildlife management area include:

- maintaining sufficient snags for cavity nesters;
- maintaining wildlife nest boxes;
- maintaining a nesting bank for the belted kingfisher;
- preserving existing old growth areas;
- retaining mast producing trees;
- mapping and avoiding vernal pools when cutting timber;
- managing the upper (northern) Back Channel area for beaver
- maintaining several roads in a herbaceous (grassy) condition

5.9 Aesthetic Resources

5.9.1 Regional

The aesthetic resources of the Project region include diverse water, landform, and vegetative patterns. The area provides numerous opportunities for viewing wildlife in vast forested lands of diverse vegetation. Visual resources include large, mostly undeveloped lakes, small ponds, small streams, the West Branch, recreation areas, islands, sandy beaches, shorelines, and mountains. Distant views include Mount Katahdin and other peaks within Baxter State Park. Structures within both Project areas are primarily limited to seasonal camp buildings and Project structures, including dams, powerhouses, pumping stations, and (former, non-project) paper mills. Several national historic structures, such as the Ambajejus Boom House and Chesuncook Village, are noted historic and visual landmarks of the region.

Shoreline development within the region consists primarily of seasonal private and commercial camps. The type and extent of development vary considerably (Dewan & Assoc., 1990a, 1990b). The shorelines of the most heavily developed areas are irregular with many inlets and peninsulas. Forestry clear cutting practices often have visual impacts within the region. The Maine LUPC and the Maine Forest Service regulate forestry practices within the Ripogenus Project and Penobscot Mills Project areas. Timber harvesting regulations define the size and location of allowable clear cutting and provide measures for limiting the visual impacts related to forestry practices.

The flow in the West Branch is relatively uniform year-round because of the storage in the Ripogenus, North Twin, and Millinocket Lake impoundments, along with additional headwater storage impoundments. This consistent flow is essential to maintaining the visual and aesthetic environment as well as the recreational activities in the Project areas.

5.9.2 Ripogenus Project

Significant visual elements within the Ripogenus Project area include the Ripogenus impoundment, Ripogenus Dam, McKay Station, and the transmission line from McKay station to Millinocket. Ripogenus Dam creates a 29,270-acre impoundment consisting of three lakes and three ponds. The shorelines of these lakes and ponds are largely undeveloped, and the primary uses of the surrounding land are forestry (timber production and transportation) and recreation. Development along the impoundment occurs in three primary areas: Chesuncook Dam Point (at the confluence of Ripogenus Lake and Chesuncook Lake), Chesuncook Village at the western end of Chesuncook Lake, and along the western shoreline of Caribou Lake (GNNC 1991a). Development consists of private and commercial camps, most of which are seasonal camps. Structures are diverse and located primarily along the shorelines where road access is nearby.

The transmission line between McKay Station and Millinocket is supported primarily by wooden structures that blend into the surrounding forest. The Ripogenus Dam itself is visually significant within the region. The Ripogenus Dam is a monolithic concrete structure with numerous gates and a former log sluice. Visitors can view the dam from the Upper Gorge Trail. The Upper Gorge itself is very scenic with stretches containing sheer vertical walls that rise 75 feet above the riverbed (Photo 5.9-1). The Gorge can be viewed from the Upper Gorge Trail. McKay Station is constructed of concrete and brick and is visible from the rafting put-in recreation site (Photo 5.9-2). Because of the limited land area, the substation and transformers are located on the roof. Motorists can view the West Branch below McKay Station, including several waterfalls, from several points along the Golden Road between Abol Bridge and McKay Station (Dewan & Assoc., 1990b, GNNC 1991a).

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Photo 5.9-1
View of the Upper Gorge from Ripogenus Dam



Photo 5.9-2
View of McKay Station



The Maine Land Use Regulation Commission (LURC, now LUPC) completed the Maine Wildlands Lake Assessment in 1986 to help inform decisions regarding land management activities within the unorganized territory. Seven natural resource characteristics were evaluated (fish, wildlife, scenic quality, shoreline character, botanic features, cultural and historic features, and physical features (geology and hydrology)) and categorized as outstanding (statewide importance due to unique or otherwise noteworthy characteristics), significant (met a predetermined minimum standard of significance) or no rating (no resource value or no information available). The Ripogenus impoundment was given the highest classification (1A) because it contains multiple outstanding natural values (fishing, wildlife, botanic, cultural and historic, and physical features) (GNNC 1991a).

5.9.3 Penobscot Mills Project

The Penobscot Mills Project area contains great year-round visual diversity with unique combinations of landforms, water, and vegetation. Significant visual resources of the Penobscot Mills Project include the five impoundments and associated structures. Most of the Project structures are positioned in inconspicuous locations and are screened from major public roadways. The exteriors of Project structures are compatible with their surroundings and do not intrude upon or diminish the visual characteristics of the Project area. The principal access to the Project area, State Route 11, offers periodic views of the lakes, ponds, and surrounding distant hills.

Views of the Penobscot Mills Project features are more abundant than at the Ripogenus Project. Portions of the Millinocket and East Millinocket developments are visible from those respective towns. The Millinocket and East Millinocket powerhouses are integral with the former paper mills. Route 157 crosses Dolby Pond and provides views of both the north and south basins of the pond. Route 11 passes close to Ferguson Pond, and crosses the West Branch between Quakish Lake and the North Twin impoundment. The Golden Road and the Baxter State Park Road cross at the pump station location between Millinocket Lake and Ambajejus Lake (North Twin impoundment), providing views of both water bodies, as well as the pump station.

In 1990, as a component of the Maine Wildland Lakes Assessment, LURC conducted a Scenic Lakes Evaluation in Maine's unorganized towns using a multistep procedure to identify lakes with the greatest scenic value (LURC 2010). The rating criteria included elevation changes in areas

surrounding the lakes, shoreline configuration, foreground and background relief, vegetation diversity along the shoreline, presence of inharmonious development, and presence of special features (such as extreme water clarity or wildlife viewing). The lakes in the North Twin impoundment, except for Ambajejus Lake, were rated as "outstanding scenic resources" because of numerous islands, shorelines and beaches, diverse vegetation, and views of Mount Katahdin. Ambajejus Lake and Millinocket Lake were rated as "significant scenic resources" because of dramatic relief, islands, beaches, boulders and rock ledges, wildlife viewing, and diverse vegetation (Dewan & Assoc. 1990a, GNNC 1991b). Although this assessment is somewhat dated, it is likely that the assessment results remain valid today due to the very limited development in this region of Maine.

The two most developed areas within the Project area are the south shore of South Twin Lake and the eastern end of North Twin Lake. The typical development around the Projects consists of seasonal camps. The typical camp is a one-story structure of modest design and often includes outside storage areas for recreational equipment, household items, or firewood (Dewan & Assoc., 1990a). Views of the lakes are available from the South Twin Lake boat launch. Pemadumcook Lake is less developed and is open and expansive; the bordering land is generally rolling to steeply sloping.

The area surrounding the Millinocket Lake boat launch is heavily developed with camps, transmission lines, and the pumping station. The visual resources around Millinocket Lake are diverse consisting of open water, islands, boulders and rocks, coves and inlets, peninsulas, beaches, vegetation, and views of Mount Katahdin.

5.10 Cultural Resources

In issuing a new license for the Projects, the Commission is the lead agency for compliance with applicable federal laws, regulations, and policies pertaining to historic properties, including the National Historic Preservation Act, as amended (NHPA). Section 106 of the NHPA (Section 106) directs federal agencies to take into account the effects of their undertakings on historic properties and to afford the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment.

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The regulations implementing Section 106 (36 CFR Part 800) define “historic properties” as any precontact or historic period district, site, building, structure, or individual object included in or eligible for inclusion in the National Register of Historic Places (“NRHP” or “National Register”). This term includes artifacts, records, and remains that are related to and located within historic properties, as well as properties of traditional religious and cultural importance (often referred to as “traditional cultural properties” [TCP]) that meet the National Register criteria.

The Secretary of the Interior has established the criteria for evaluating properties for inclusion in the NRHP (36 CFR Part 60). In accordance with the criteria, properties are eligible if they are significant in American history, architecture, archaeology, engineering, or culture. The quality of significance is present in historic properties that (a) possess integrity of location, design, setting, materials, workmanship, feeling, or association and (b) meet one or more of the National Register criteria:

- Criterion A: Are associated with events that have made a significant contribution to the broad patterns of our history; or
- Criterion B: Are associated with the lives of persons of significance in our past; or
- Criterion C: That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components could lack individual distinction; or
- Criterion D: That have yielded, or could be likely to yield, information important in prehistory or history.

The implementing regulations of Section 106 are intended to accommodate historic preservation concerns with the needs of federal undertakings through a process of consultation among agency officials, federally recognized Native American Tribes, State Historic Preservation Officers, Tribal Historic Preservation Officers, and other parties, including the public, as appropriate.

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This section of the PAD describes the known cultural and historic resources in the vicinity of the Projects' proposed area of potential effects (APE). The APE is defined in 36 CFR §800.16(d) as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different types of effects caused by the undertaking.

For the purposes of this discussion, the proposed APE is defined as all lands and waters within the Project Boundary (see Figure 4.2-1 through Figure 4.2-8). This includes the area where Project operations or Project-related recreation activities or other enhancements may cause changes in the character or use of historic properties.

5.10.1 Cultural Context

5.10.1.1 Precontact Period

Previous site discoveries indicate that Paleo-Indians camped and hunted large game within the region, specifically within the Ripogenus and Penobscot Mills Project areas, around 9,000 to 7,000 B.C. Evidence of the archaic period occupations, typically hunter-gatherer groups, is more common than evidence of the Paleo-Indian in the Penobscot drainage. These populations range from early archaic (ca. 7,000 to 5,500 B.C.), to middle archaic (ca. 5,500 to 4,000 B.C.), and late archaic (4,000 to 1,000 B.C.). Late archaic period sites, the most common sites identified in the Project region, are found along the lower Penobscot River (GNNC 1991a, 1991b).

Woodland era populations (ca. 1,000 B.C. to 1,550 A.D.) occupied the entire Penobscot River drainage basin and nearby waterways. The woodland culture of this era continued earlier hunter-gatherer patterns of subsistence. The Penobscot Indians, whose population numbered as many as 3,300 in the early 1600s, were reduced to 200 people by the late 1700s. Various aboriginal groups remained widespread in the region until the late 18th century, when they gathered along the main stretch of the lower Penobscot River (GNNC 1991a, 1991b).

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5.10.1.2 Historic Period

As settlers came into the area, tribal areas were reduced and the lumber industry in the area rapidly expanded to meet industrial needs. During the 18th century, the Penobscot River basin was largely used for exploration, trapping, and trade routes. The vast potential of the surrounding forests was identified early, and logging activity began early in the 19th century. The first recorded logging history of activity on the West Branch was recorded on July 5, 1828 (GNNC 1991a, 1991b). Shortly thereafter, the river was rapidly developed as a means of conveying the timber harvested from the forests along its many tributaries. Early harvests of timber were primarily for saw logs and ships' masts, which were floated downriver to mills in the Bangor and Old Town areas. Subsequently, pulpwood was also floated down the rivers. Log drives occurred in the spring and early summer of each year, while timber harvesting operations took place during the preceding winter. Since logging and log driving were seasonal activities, lumber camps and small outposts were the only settlements on the West Branch at that time.

The intensity of log-driving activity increased throughout the 19th century. Navigational dams and log booms were constructed throughout the century. The earliest log-driving dam constructed on the West Branch was built on Chesuncook Lake in 1840; approximately 137 dams were constructed on the West Branch and its tributaries (GNNC 1991a, 1991b). After 1846, the increased traffic in logs, as well as the necessity for organizing log-driving activities, produced a series of cooperative companies, many of which were organized around the dams or booms and their potential revenues. The dams allowed flooding in areas of steep falls that were previously impassable, making navigation possible. Logs were floated through the impoundments behind such dams, and then sluiced through the dams. Dam owners collected tolls based on the tally of logs made at the head of the sluice. Further downstream, near the various mills to which the logs were driven, log booms were established that collected and directed the logs past points at which agents for the many drivers identified and tallied the logs by characteristic markings.

Numerous small communities were established along the Penobscot River in the areas of sawmills. These communities grew as the prosperity of the mills grew but were essentially limited to the areas of the lower ends of the river. The upper reaches of the river and its tributaries above the

confluence of the East and West Branches remained largely unsettled throughout the 19th century (GNNC 1991a, 1991b)

GNP was organized in 1899 (GNNC 1991a, 1991b). It consolidated many of the log-driving companies in existence until that time. In the same year, GNP began construction of its Millinocket Mill, located in Millinocket, Maine, approximately ten miles upstream of the confluence of the East and West Branches in Medway, Maine. GNP recognized the advantage of locating its papermaking operations adjacent to the river and the forests, which would provide the opportunity for expanded operations over a period of time. The company subsequently developed a number of hydroelectric and water storage dams throughout the West Branch basin. More than 62 dams were built in the years between 1899 and 1936. The construction of the first mill (Millinocket Mill) in 1899 began a history of extensive economic developing of the West Branch and surrounding area (GNNC 1991a, 1991b).

GNP's operation of the pulp and paper mills at Millinocket and East Millinocket led to coordinated management of the West Branch as an integrated resource for flood control, process water for industry, energy for generation of hydroelectric power, recreational use, and maintenance of water quality. By 1971, log driving had ceased, and the extensive water storage system that had been developed over the past century became regulated solely for the generation of hydroelectric and hydromechanical power (GNNC 1991a, 1991b). This flow regulation essentially replaced the highly variable seasonal flows of the river with the relatively stable flows that exist today.

5.10.2 Previous Surveys and Consultation for Archeological Resources

Initial archaeological studies were performed at the Projects in 1981 and 1985. In addition, extensive archaeological investigations and consultation with the Maine State Historic Preservation Officer (MSHPO) have occurred for both Projects (as listed below), the results of which are further described in the following subsections of this PAD:

- Petersen, James B., David E. Putnam, and Thomas R. Baker. 1988. Phase "0" Cultural Resources Assessment of the Penobscot Mills Project (FERC No. 2458), Penobscot Piscataquis Counties, Maine. University of Maine at Farmington Archaeology Research Center.

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- Petersen, James B., David E. Putnam, and Thomas R. Baker. 1988. Phase “0” Cultural Resources Assessment of the Ripogenus Project (FERC No. 2572), Piscataquis County, Maine. University of Maine at Farmington Archaeology Research Center.
- Bartone, Robert N., Mark E. Petersen, Catherine A. Quinn, Thomas R. Buchanan, and James B. Petersen. 1989. Archaeological Phase I Survey and Phase II Testing of the Penobscot Mills Project (FERC No. 2458), Penobscot and Piscataquis Counties, Maine. University of Maine at Farmington Archaeology Research Center.
- Bartone, Robert N., Mark E. Petersen, Catherine A. Quinn, Thomas R. Buchanan, and James B. Petersen. 1989. Archaeological Phase I Survey and Phase II Testing of the Ripogenus Project (FERC No. 2572), Piscataquis County, Maine. University of Maine at Farmington Archaeology Research Center.
- Quinn, Catherine A., and James B. Persen. 1991. Supplemental Archaeological Phase II Testing of the Penobscot Mills Project (FERC No. 2458), Penobscot and Piscataquis Counties, Maine. University of Maine at Farmington Archaeology Research Center.
- Quinn, Catherine A., and James B. Persen. 1991. Supplemental Archaeological Phase II Testing of the Ripogenus Project (FERC No. 2572), Piscataquis County, Maine. University of Maine at Farmington Archaeology Research Center.
- 1995 – Identified Sites at Ripogenus and Penobscot Mills Projects listed in NRHP.
- 1996 Programmatic Agreement issued by FERC for each Project.
- 1996 Order Issuing New License for each Project.
- 1998 Cultural Resources Management Plan (including Phase III Mitigation Plan consisting of data recovery via excavation for NRHP-listed sites).
- 1998 to Current – Performance of data recovery via excavation of identified sites at the Projects.

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In support of issuing the Projects' existing licenses, in March 1987 GNP initiated formal consultation with the Project relicensing stakeholders. In response, the MSHPO recommended that sufficient studies be undertaken to find, assess the significance of, and, if necessary, mitigate any effect to significant archaeological sites that are being damaged by erosion around the full-pool-level shoreline. The MSHPO further recommended that work start with a "Phase 0" survey, based on existing collections and aerial photography, to discern and map any landforms and ancient shorelines likely to contain archaeological sites, and requested that scopes of work by consulting archaeologists be submitted for review for sufficiency of methodology.

On June 19, 1987, GNP submitted the "Phase 0" scope of work prepared by the consulting archaeologist, and on July 1, 1987, the MSHPO stated that the proposed work was reasonable and sufficient. The subsequent archaeological survey and testing were conducted in 1987 and 1988.

A scope of work for Phase I work was prepared following a review of "Phase 0" results with the MSHPO on September 3, 1987. The Phase I scope was submitted to the MSHPO on September 16, 1987 and was approved by letter dated November 10, 1987. On June 10, 1988, the final "Phase 0" report was submitted to the MSHPO and was approved on June 14, 1988. Because of the constraints of a limited field season and the vast amount of territory to be covered, the consulting archaeologist, with agreement from GNP and the MSHPO, proposed to initiate Phase II work without issuing a final report for Phase I work; one final report including the results of both Phases of work was proposed. Upon completion of Phase I fieldwork, a meeting was held on July 18, 1988, with the consulting archaeologist, the MSHPO, and representatives from GNP. Phase I data were reviewed and a scope of work for Phase II was discussed. By letter dated July 22, 1988, the MSHPO approved the Phase II scope and fieldwork began immediately.

Phase II fieldwork continued through late fall in 1988. By letters dated January 31, 1990, (Penobscot Mills Project) and February 6, 1990 (Ripogenus Project), GNP submitted the draft report on Phases I and II to the MSHPO.

In the spring of 1990, the MSHPO provided technical and editorial comments and substantive management comments on the Phase II report. The substantive management comments included the MSHPO's preliminary recommendation that some 44 sites at the Ripogenus Project and 20

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sites at the Penobscot Mills Project were significant and in need of a Phase III Mitigation Plan. By letter dated August 8, 1990, the MSHPO modified his preliminary recommendation by requesting further Phase II investigation at four sites at the Ripogenus Project, deleting one site originally listed, and adding another site that was not originally listed for potential significance. For the Penobscot Mills Project, several other sites were later determined not significant following further input from the MSHPO.

The MSHPO stated that the four sites at the Ripogenus Project that were added as potentially significant were not significant and indicated that a total of 36 sites were considered eligible for listing. Similarly, for the Penobscot Mills Project, the MSHPO indicated that a total of 12 sites were considered significant; however, additional consultation with the MSHPO was needed for the Penobscot Mills Project concerning several unresolved issues (at the time).

On October 25, 1991, final Phase I and II reports were provided to the MSHPO for comment. Details of the Archaeological Phase I Survey and Phase II Testing of the Ripogenus Project are provided in Bartone et al. (1990), and details for the Penobscot Mills Project are provided in Nelson et al 1990. The final Phase I and II reports were submitted during a meeting held with the MSHPO to discuss GNP's plans to develop a Phase III CRMP.

By letter dated November 14, 1990, the Penobscot Indian Nation requested a copy of the CRMP to manage the archaeological resources associated with the Ripogenus Project and stated that they would support decisions made by the MSHPO regarding the excavation of priority sites.

Article 413 of the Ripogenus Project license and Article 417 of the Penobscot Mills Project license required the Licensee (now GLHA) to implement the provisions of the Programmatic Agreement for managing historic properties. The Programmatic Agreement required that the Licensee file a CRMP specifying how historic properties will be managed within the Project areas during the terms of the licenses. The CRMPs for both Projects require that a report be filed with the Commission and the MSHPO by the Licensee on every anniversary of the license issuance date (October 22) on activities conducted under the implemented CRMPs.

5.10.3 Summary of Existing Discovery Measures and Identified Cultural Resources

5.10.3.1 Ripogenus Project

Archaeological Resources

The earliest professional archaeological survey of the West Branch was conducted by Warren K. Moorehead in 1915 (Morehead 1922). This survey discovered sites at Medway and Chesuncook Lake and also mentioned finding several Indian encampments on the West Branch between Millinocket and Chesuncook Lake; however, no exact locations were provided.

During the 1987-1988 Phase I survey and Phase II testing work, 17 sites received Phase I survey evaluation and a total of 113 unequivocal aboriginal sites received Phase I survey and Phase II testing. On the basis of diagnostic artifacts and radio-carbon dates, this portion of the Penobscot River drainage was determined to have been occupied by aboriginal populations during the Early Paleoindian period and throughout much, if not all, of the remaining sub-periods of prehistory and early history, ca. 9,000 B.C. to A.D. 1,750 and later. Many thousands of aboriginal artifacts were recovered, including lithic, ceramic, and organic remains. While some of the sites proved rich in cultural remains, many produced relatively few artifacts, possibly due to their small ephemeral nature at the time of occupation and/or the high degree of destruction through erosion and historical artifact collecting activities.

A total of 15 of the 130 archaeological sites that were discovered or re-identified were deemed significant and eligible for nomination to the NRHP and were formally listed in the NRHP in October 1995. It was determined that all the NRHP-listed sites were undergoing erosion, in part, attributable to the existence and operation of the Ripogenus Project. Therefore, in consultation with the MSHPO, four alternative plans were considered for mitigating the adverse effects of the operation of the Project on the 15 sites: (1) stabilization without data recovery, (2) long-term erosion monitoring, (3) data recovery with stabilization, and (4) data recovery excavation without stabilization. In consideration of the 30-year operating license, GNP chose the fourth alternative.

A CRMP for mitigating effects of the operation of the Ripogenus Project on 15 prehistoric archaeological sites was filed with FERC on April 13, 1998. The CRMP was based on consultation

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with the MSHPO, ACHP, and FERC (Archeological Research Center 1998a). The CRMP, in part, established the Phase III study for the data recovery via excavation of the 15 NRHP-listed sites.

A list of the 15 sites in the Phase III study for the Ripogenus Project, the cultural affiliation, setting, size, and area for the data recovery plan are provided in Table 5.10-1. Site locations within the Project area are described relative to reservoir zones. Details and methods of site-specific data recovery plans in which research goals were framed within the context of research-significant themes developed by Spiess (1990) are included in the Ripogenus CRMP (Archeological Research Center 1998a).

Table 5.10-1
Characteristics of Archaeological Sites in the Phase III Study at the Ripogenus Project

Site No.	Cultural Affiliation	Setting	Size (m ²)	Depth (cm)	Data Recovery Excavation (m ²)
<i>Caucomgomoc Stream and Black Pond</i>					
142.05	A, C/W	SF, UF	1,500	40	10
142.06	A, C/W	SF, UF	5,625	90	20
142.08	A, C/W	SF	32,640	40	100
142.12	W	SF	100	20	4
142.13	A, C/W, C	SF	8,820	20	20
142.14	A, C/W	SF	2,525	20	20
143.05	P, A, C/W, C	SF	4,400	20	4
143.12	A, C/W	SF, UF	7,500	40	16
143.15	P, A, C/W	SF	35,000	20	120
143.16	C/W, C	SF	12,150	20	20
143.23	A, C/W	SF	37,000	20	25
<i>West Branch and Pine Stream</i>					
143.52	A, C/W	SF, UF, BS	2,275	70	25
143.53	A, C/W	SF	214,000	40	500
143.57	A, C/W	SF, UF	1,610	20	15
<i>Chesuncook</i>					
143.79	A, C/W	SF, UF, BS	1,600	120	25

Notes: P = Paleoindian, A=Archaic, C/W= Ceramic/Woodland, C=Contact, SF=shoreline fluctuation zone, UF=upper floodpool zone, and BS=backshore zone. Source: Bartone et al. 1990, Archeological Research Center 1998b.

As required by the CRMP, annual reports are submitted by GLHA to the FERC and the MSHPO by October 22nd of each year describing the overall current conditions of the site and any data recovery work done during the previous year. To date, Historic Management Reports have been filed annually with FERC from 1999 through 2020. A summary of the status of the data recovery work at the 15 NRHP-listed sites is provided in Table 5.10-2 and Table 5.10-3.

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Table 5.10-2
Summary of Annual Phase III Study Activities at the Ripogenus Project

Year	Summary of Activities
1999	- Each of the sites was visited in September 1999 and a grid system was laid in place. - Work was initiated at sites 142.05 and 142.06 but could not be completed due to rapidly rising impoundment elevations. - Work was initiated at sites 143.79 and 133.52. - Archaeological materials collected from the sites were cleaned, catalogued, and analyzed.
2000	- Continued cataloging and analysis of archaeological materials collected in 1999 from sites 143.05, 143.79, and 133.52. - Work was initiated at sites 142.12, 143.12, 143.15, 143.16, and 143.53. - Work focused on site 143.53 at locus 9 and 13. Work indicated that features may have been secondarily deposited by ice and that moose trampling plays a major role in site destruction at this Project.
2001	Continued analyses and reporting of materials collected from sites 142.05, 142.06, 142.16, and 143.52.
2002	- Investigations indicated many of the NRHP-eligible sites appear to be surficial deposits in nature such that many of the exposed artifacts on sites such as 142.05, 142.06, 143.14, and 143.52 appear to be redeposited contexts. - Evaluation of these sites, along with field observations at several other sites, indicates the existing scope of work for large-scale excavation may not be necessary. - GLHA recommends a re-evaluation of the scope of work.
2003	- Continued evaluations to understand the dynamic processes that are occurring (and have occurred) at the Project and the influence of these processes on the preservation of historic properties. - A report was completed on sites 142.05, 142.06, 142.14, and 143.52. These sites have no subsurface or very shallow subsurface archaeological deposits. - Work was performed at sites 143.57 and 143.05, with results indicating these sites largely were surface scatters with no cultural materials occurring in subsurface deposits. - Hearths were constructed in 2000 in an experiment to understand how they might be affected by sediment deposition and removal. Field reconnaissance of these sites in 2003 showed that both sediment deposition and removal can account for changes observed in historic properties. The experiment demonstrates that these processes have been ongoing for a long period of time.
2004	- Fieldwork and analysis of sites 142.05, 142.06, 142.14, and 143.52 were completed with reports on these sites sent to the MSHPO for review and comment. - The MSHPO concurred with all the findings from this work, including a need to reconsider previous scopes of work as a result of field studies that suggest some sites either have no subsurface or very shallow subsurface archaeological deposits. - Sites where scope of mitigation work is being reassessed and adapted to contemporary field conditions are 142.08, 142.13, 143.12, 143.15, and 143.23. - Work was performed at sites 142.12, 143.05, and 143.16. - Analyses and reporting are underway for sites 143.53, 143.57, and 143.79.

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Year	Summary of Activities
2005	- Analyses underway of materials recovered from sites 142.12, 143.05, and 143.16. - Reporting underway for sites 143.53, 143.57, and 143.79. - Fieldwork could not be performed in 2005 due to unsuitable field and weather conditions.
2006	- Analyses and reporting for sites 142.12, 143.16, and 143.05 nearly complete. - Fieldwork could not be performed in 2006 due to unsuitable field and weather conditions.
2007	- Fieldwork complete at sites 142.12, 143.16, 143.05, 143.53, 143.57, and 143.79 but analyses and reporting are still underway. - Revised data recovery plan under development for sites 142.08, 142.13, 143.12, 143.15, and 143.23 (to better accommodate field conditions observed at these sites in 2007).
2008 - 2020	- Sites 142.08¹⁸, 142.13, 143.12, 143.15, and 143.23 are precontact period archaeological sites located low in the drawdown zone of the Ripogenus impoundment. Fieldwork has not been able to be performed at these sites due to water levels that do not allow site access. These sites have been difficult to access due to extremely limited access, which is only possible during very low impoundment water levels. Unusually low impoundment levels occurred in 2018 and 2020, but access to these sites were impracticable when the upper reaches of the impoundment and the exposed old wooden dam at the outlet of Black Pond could not be portaged in a safe manner due to soft sediments and mucky terrain. GLHA is currently investigating alternative strategies for accessing these areas when allowed by low impoundment elevations that occur in the future. - Continued analyses and reporting on sites 142.12, 143.16, 143.05, 143.53, and 143.57.

¹⁸ Annual reports filed between 2008 and 2020 incorrectly refer to this site as 142.03.

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Table 5.10-3
Status of Phase III Study Activities at the Ripogenus Project

Site No.	Fieldwork	Analyses & Reporting	Comment
<i>Caucomgomoc Stream and Black Pond</i>			
142.05	Complete	Complete	MSHPO concurred with findings
142.06	Complete	Complete	MSHPO concurred with findings
142.08	Not Complete	Not Complete	Difficulty accessing site
142.12	Complete	In Progress	--
142.13	Not Complete	Not Complete	Difficulty accessing site
142.14	Complete	Complete	MSHPO concurred with findings
143.05	Complete	In Progress	--
143.12	Not Complete	Not Complete	Difficulty accessing site
143.15	Not Complete	Not Complete	Difficulty accessing site
143.16	Complete	In Progress	--
143.23	Not Complete	Not Complete	Difficulty accessing site
<i>West Branch and Pine Stream</i>			
143.52	Complete	Complete	MSHPO concurred with findings
143.53	Complete	In Progress	--
143.57	Complete	In Progress	--
<i>Chesuncook</i>			
143.79	Complete	In Progress	--

As indicated above, on October 31, 1995, the 15 archaeological sites identified above were listed on the NRHP as prehistoric areas of significance. The specific location of these sites is restricted and, therefore, not provided on a map in relation to the Project boundary.

Historic Architectural Resources

There is one historic structure (Ripogenus Dam) and one cultural resources district (Chesuncook Village) within or partially within the Ripogenus Project Boundary (Figure 5.10-1).

On October 15, 1990, the MSHPO notified GNP that the Ripogenus Dam is eligible for listing in the NRHP, since it represents a significant achievement in the control of water resources in Maine. The MSHPO specifically limited the consideration of eligibility to Ripogenus Dam only. In 1992, GNP submitted to the MSHPO a draft NRHP Registration Form nominating Ripogenus Dam for the NRHP. Via letter dated November 3, 1992 to GNP, MSHPO indicated the draft nomination was under review. Currently, Ripogenus Dam is not listed on the NRHP.

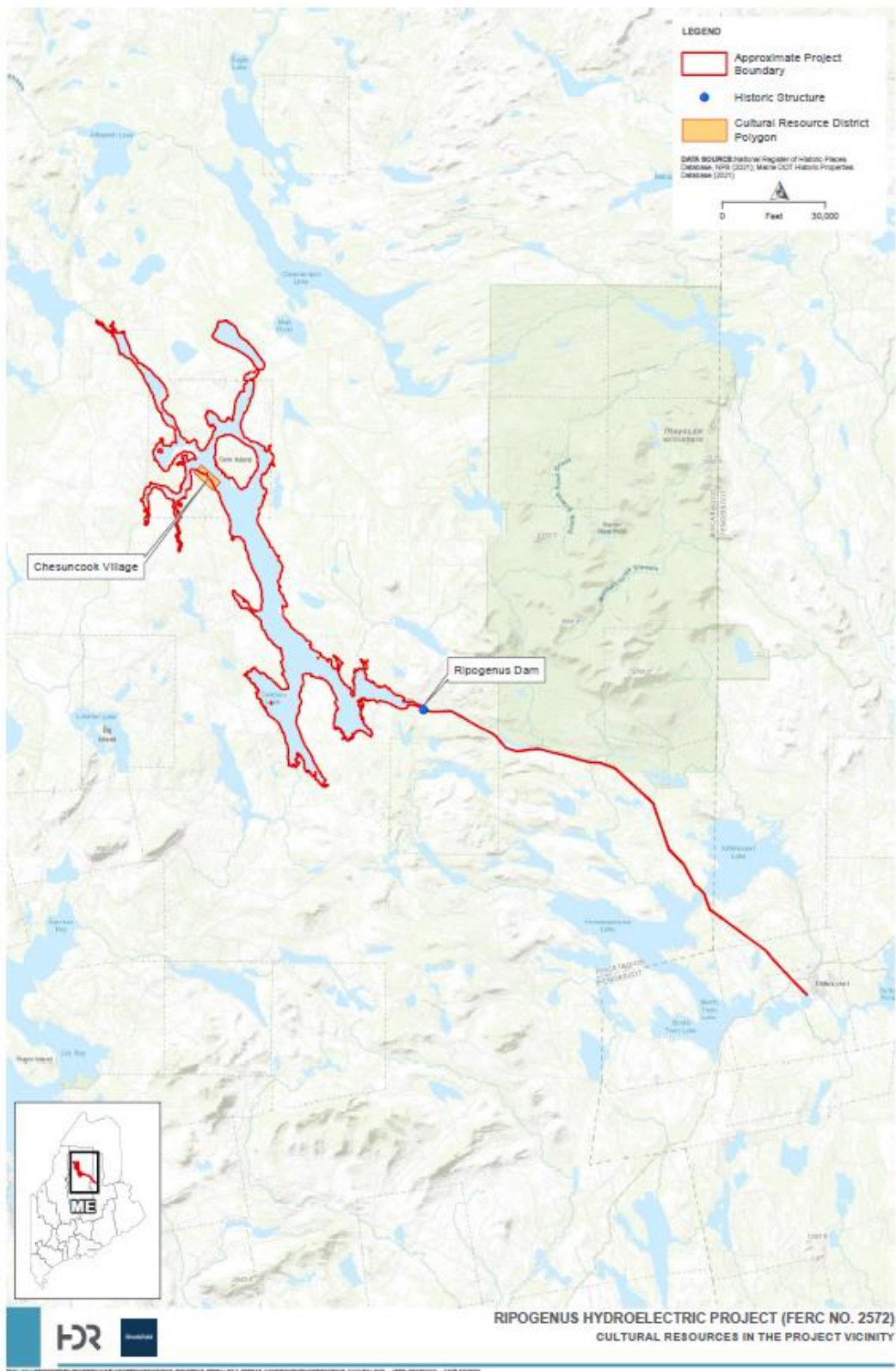
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Chesuncook Village, which lies partially within the Project Boundary, is located on the northwest side of the Ripogenus impoundment and was a frontier settlement considered as a socializing area for lumbermen during times of heavy logging activity in the vicinity of Chesuncook Lake. The original log shanty at Chesuncook Village was constructed in 1849. According to historical documents, the log shanty was a building measuring approximately 80 feet in length, with many apartments, large stone chimneys, and a roof of spruce bark. On one end of the building there was the regulation loggers' camp for the boarders. It wasn't until 1863 that the house known as the Chesuncook House was constructed. Later, in 1911, a boom house with accommodations for 24 men was constructed at the head of Chesuncook Lake. In 1923, this building was moved and converted into a church and was presented to the village by GNP. In 1916, eleven years after its original construction, a separate boom house known as the Chesuncook Dam Boom House was moved to the landing above Chesuncook Village. The Chesuncook Dam Boom House consisted of one and one-half stories and had a bunk room for 20 men.

Several buildings at Chesuncook Village were used until 1971 by GNP in connection with the West Branch log drive. On a hill overlooking the village, a church/schoolhouse was built by GNP and was once the social center of the community.

On April 11, 1973, Chesuncook Village was listed on the NRHP as an area of significance for industry, entertainment/recreation, and architecture.

**Figure 5.10-1
Ripogenus Project Cultural Resources**



5.10.3.2 Penobscot Mills Project

Archeological Resources

The Penobscot Mills Project consists of four developments located between RM 2 and 15 of the West Branch and one development located on Millinocket Stream. The dam sites that comprise the Penobscot Mills Project have been utilized since as early as 1846 when the first timber crib structure was built at the North Twin Development.

Investigations were performed in 1987 and 1988 at the Project, and results are documented in an archaeological Phase I survey and Phase II testing report prepared by the University of Maine at Farmington Archeology research Center (Nelson et al. 1990). The MSHPO issued formal comment letters on the identified and variably-evaluated cultural resources in 1990, 1991, and 1992. During the 1987 and 1988 investigations, a total of 7 of the 124 archaeological sites that were discovered or re-identified were deemed significant and eligible for nomination to the NRHP and were formally listed in the NRHP in October 1995.

It was determined that all the NRHP-listed sites were undergoing erosion, in part, attributable to the existence and operation of the Penobscot Mills Project. Therefore, in consultation with the MSHPO, four alternative plans were considered for mitigating the adverse effects of the operation of the Project on the 15 sites: (1) stabilization without data recovery, (2) long-term erosion monitoring, (3) data recovery with stabilization, and (4) data recovery excavation without stabilization. In consideration of the 30-year operating license, GNP chose the fourth alternative.

A CRMP for mitigating effects of the operation of the Penobscot Mills Project on the 7 archaeological sites was filed with FERC on April 13, 1998, after consultation with the MSHPO, ACHP, and FERC (Archeological Research Center 1998a). The CRMP, in part, established the Phase III study for the data recovery via excavation of the 7 NRHP-listed sites.

A list of the 7 sites in the Phase III study for the Penobscot Mills Project, the cultural affiliation, setting, size, and area proposed under the data recovery plan are provided in Table 5.10-4. Site locations within the Project area are described relative to reservoir zones. Details and methods of site-specific data recovery plans in which research goals were framed within the context of

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research-significant themes developed by Spiess (1990) are included in the Penobscot Mills CRMP (Archeological Research Center 1998a).

Table 5.10-4
Characteristics of Phase III Archaeological Sites in the Penobscot Mills Project

Site No.	Cultural Affiliation	Setting	Size (m ²)	Depth (cm)	Data Recovery Excavation (m ²)
<i>Millinocket Lake</i>					
122.14	P, A, C/W	SF, UF	16,500	40	16
122.16	A, C/W, C	SF, UF	4,125	40	30
134.08	P, A, C/W	SF, BS	28,000	90	82
134.09	P, A, C/W	SF	24,000	20	16
<i>North Twin</i>					
121.59	A, C/W	SF, UF	10,500	70	38
<i>West Branch Ambajejus</i>					
121.52a	C/W, E	SF, BS	48+	60	15
121.52b	A, C/W, E	SF, UF, BS	875	120	92

Notes: P = Paleoindian, A=Archaic, C/W= Ceramic/Woodland, C=Contact, E=Ethnographic, SF=shoreline fluctuation zone, UF=upper flood pool zone, and BS=backshore zone. Source: Nelson et al. 1990, Archeological Research Center 1998b.

As required by the CRMP, annual reports are submitted by GLHA to the FERC and the MSHPO by October 22nd of each year describing the overall current conditions of the site and any data recovery work done during the previous year. To date, annual Historic Management Reports are available from 1999 through 2020. A summary of the status of the data recovery work at the 7 NRHP-listed sites is provided in Table 5.10-5 and Table 5.10-6.

Table 5.10-5
Summary of Annual Phase III Study Activities at the Penobscot Mills Project

Year	Summary of Activities
1999	Fieldwork performed (detailed information not available on FERC's eLibrary)
2000	- Cataloging and analyses of archaeological materials collected in 1999. - Reconnaissance survey conducted to relocate sites 121.52a and 121.5b in support of scheduling fieldwork in 2001. - Fieldwork performed at site 134.08.
2001	- Fieldwork performed at site 122.52b. - Fieldwork completed at site 134.08. - Analyses and reporting completed for site 134.08.

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Year	Summary of Activities
2002	- Fieldwork completed at site 122.52a and 122.52b. - Fieldwork completed at site 122.16. Very few artifacts were recovered from site 122.16. The artifact scatter at this location was so low and discovered in such a questionable stratigraphic context that initial analyses indicate this site is likely not eligible for listing in the NRHP. - Laboratory analyses completed for sites 122.52b and 134.08 and reports in progress.
2003	- Analysis and reporting completed for sites 122.52a and 122.52b. - Report under development for site 134.08.
2004	- Reports for sites 122.52a and 122.52b were submitted to the MSHPO for review and comments. The MSHPO concurred with the findings. - Analyses and reporting nearly complete for sites 122.16 and 134.08. - Field reconnaissance for site 121.59 resulted in the discovery of a few stone artifacts on the shore but very little backshore area for archaeological testing. The scope of mitigation work at this location is being reconsidered as a result of the field reconnaissance. A similar situation was noted at site 134.09.
2005	Analysis and reporting were completed for sites 122.16 and 134.08.
2006	- Fieldwork was not performed in 2006 due to unsuitable field and weather conditions. - Report for site 134.08 was submitted to the MSHPO for review and comment.
2007	- Analysis and reporting for site 122.16 were completed and developed into a journal article to be published in fall 2007 in the <i>Bulletin of the Maine Archaeological Society</i>. - Field reconnaissance at site 121.59 indicates field study is not required at this site because past reporting failed to consider the lack of context for the site.
2008 – 2020	- Remaining cultural resource work includes mitigation data recovery at sites 122.14 and 134.09, both of which are precontact period archaeological sites. - Site 122.14 is a multi-component site where previous work identified evidence for human occupation during the Paleoindian, Archaic, and Ceramic periods. The site requires landowner permission in order to reassess it for possible data recovery mitigation. - Site 134.09 also contains archaeological evidence for three precontact archaeological periods, but most archaeological materials collected there have been from the fluctuation zone during low impoundment elevations. Review of records and field observations indicate that site 134.09 appears to largely consist of reworked archaeological materials from a site that has largely eroded away, thus, its physical location has been difficult to determine. A field reconnaissance site visit to relocate the site, assess erosion, and make recommendations for data recovery mitigation (if warranted) is planned for future efforts.

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Table 5.10-6
Status of Phase III Study Activities at the Penobscot Mills Project

Site No.	Fieldwork	Analyses & Reporting	Comment
<i>Millinocket Lake</i>			
122.14	In Progress	Not Complete	Requires landowner permission
122.16	Complete	Complete	MSHPO concurred with findings
134.08	Complete	Complete	MSHPO concurred with findings
134.09	In Progress	Not Complete	Requires field reconnaissance
<i>North Twin</i>			
121.59	Not Required	Not Required	Lack of context for site
<i>West Branch Ambajejus</i>			
121.52a	Complete	Complete	MSHPO concurred with findings
121.52b	Complete	Complete	MSHPO concurred with findings

As indicated above, on October 31, 1995, the archaeological sites identified above (with the exception of Site No. 121.59) were listed on the NRHP as prehistoric areas of significance. The specific location of these sites is restricted and, therefore, not provided on a map in relation to the Project boundary.

Historic Architectural Resources

The Ambajejus Boom House, which was listed on the NRHP on April 2, 1973, is one of the most significant remaining sites connected with lumbering on the West Branch. It was used by GNP until 1971 when the West Branch log drive was discontinued. The Ambajejus Boom House was built in 1907 and is located on an island at the head of Ambajejus Lake. This boom house was the site of offices and dormitories associated with the boom that crossed the West Branch at this site.

In August 2015, GLHA and the West Branch Historical Preservation Committee executed a donation agreement to transfer the 2.5-acre island on which the Ambajejus Boom House is located from GLHA to the Historical Preservation Committee. In the agreement, the West Branch Historical Preservation Committee would give the Maine Historic Preservation Commission the preservation interest in the area of the “grounds, collateral or appurtenant improvements, and the Ambajejus Boom House” as further described in the NRHP. The agreement provides stipulations to ensure that the Ambajejus Boom House and the surrounding area are maintained to retain the architectural, historical, and/or archaeological integrity of the property, by requiring any work that may alter the integrity of the area to be approved by the State of Maine through the Director of the

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Maine Historic Preservation Commission. Via Order Amending License to Remove Land from the Project boundary issued August 18, 2016, FERC approved removal of the 2.5-acre island, including the Ambajejus Boom House from the Project boundary.

GNP supplied various documents and materials to the MSHPO to aid in the consideration of potential eligibility for the Penobscot Mills Project facilities; however, by letter dated October 15, 1990, the MSHPO determined that none of the Project structures or features were eligible for nomination.

Several structures within the Project vicinity have been included as eligible for listing on the NRHP in more recent years. These include the Millinocket Historic District, which includes six eligible historic properties (see Table 5.10-7), the West Branch Bridge (87168) and the Bangor & Aroostook Railroad (No. 87166) (North Twin Development), and two other sites associated with the Bangor & Aroostook Railroad on Dolby Pond (see Table 5.10-7 and Figure 5.10-2.)

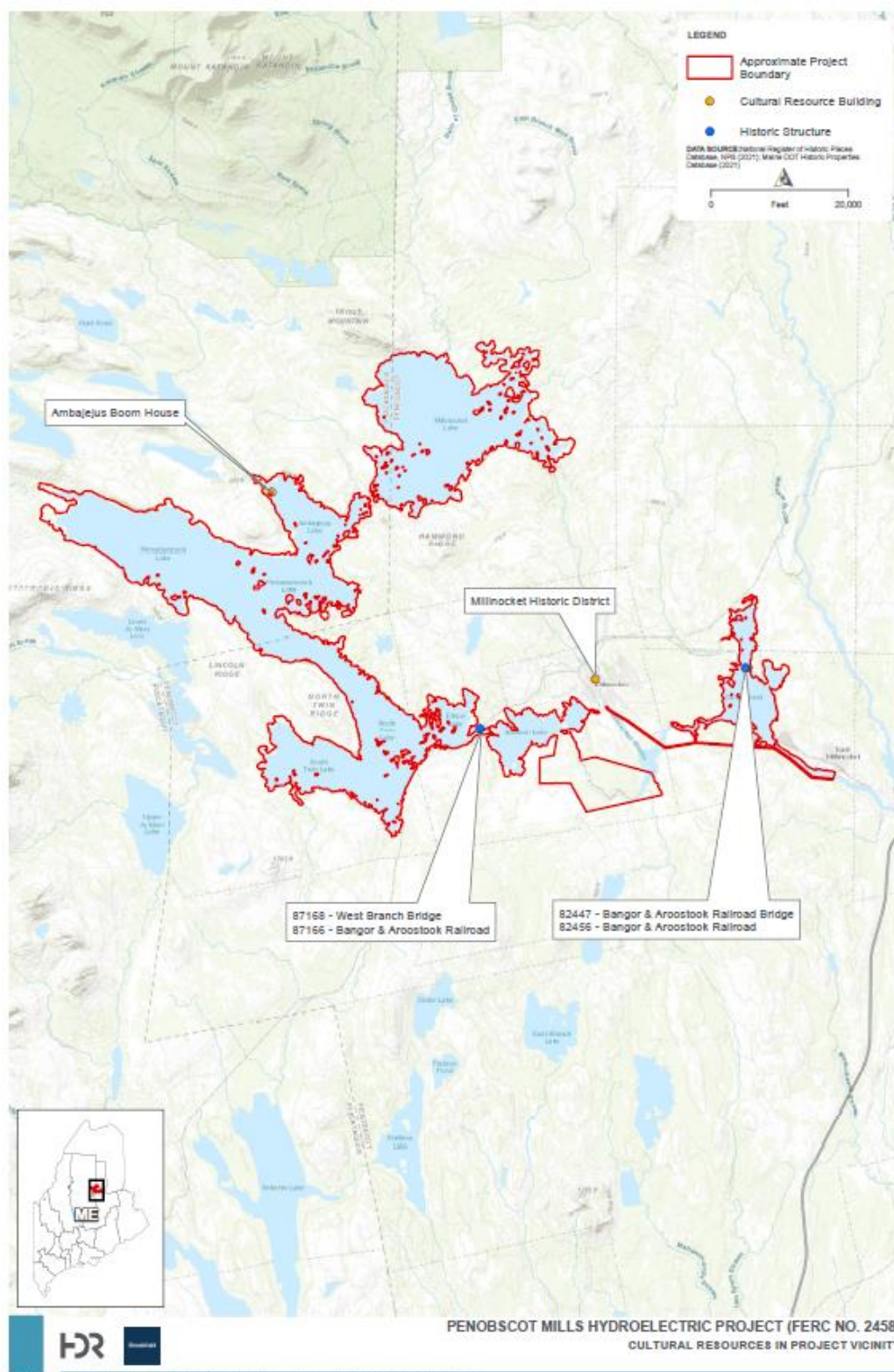
Table 5.10-7
Eligible Historic Structures in the Project Vicinity

ID	Historic Property	Description	Relationship to Project Boundary
53791	George W. Stearns High School	Millinocket Historic District	~ 1 mile from boundary
87473	U.S. Post Office	Millinocket Historic District	~0.5 mile from boundary
87490	102 Penobscot Avenue – Dry Goods Store	Millinocket Historic District	~0.5 mile from boundary
52970	13 Poplar Street	Millinocket Historic District	~0.5 mile from boundary
86671	Great Northern Paper Engineering & Research Building	Millinocket Historic District	~0.5 mile from boundary
86673	Great Northern Paper Administration Building	Millinocket Historic District	~0.3 mile from boundary
87168	West Branch Bridge	Constructed in 1948; Spans West Branch Penobscot River carrying Poplar Street	Within boundary
87166	Bangor & Aroostook Bridge (North Twin Development)	Constructed ca. 1929	Within boundary
82447	Bangor & Aroostook Railroad Bridge	Constructed ca. 1910; Spans Dolby Pond carrying Bangor & Aroostook Railroad	Within boundary
82456	Bangor & Aroostook Railroad	Constructed ca. 1899-1910; Rail first proposed in 1893 after taking over Katahdin Iron Works tracks	Within boundary

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Figure 5.10-2
Cultural Resources in the Penobscot Mills Project Vicinity



5.11 Socioeconomic Resources

The Ripogenus and Penobscot Mills Projects are located in Piscataquis and Penobscot Counties, Maine. Both counties are primarily rural and forested. Piscataquis County has a population of 17,535 people according to the 2010 census (U.S. Census Bureau [USCB] 2019). The estimated 2019 population of Piscataquis County was 16,785 people, reflecting a 4.3 percent decrease over the nine-year period between 2010 and 2019. The 2010 census reported that Penobscot County has a population of 153,923. The estimated 2019 population of Penobscot County was 152,148 people, reflecting a 1.2 percent decrease over the nine-year period between 2010 and 2019. Both counties have a relatively large geographic area, with 3,961 square miles in Piscataquis County and 3,397 square miles in Penobscot County. The population density in 2010 was 4.4 people per square mile in Piscataquis County and 45.3 people per square mile in Penobscot County.

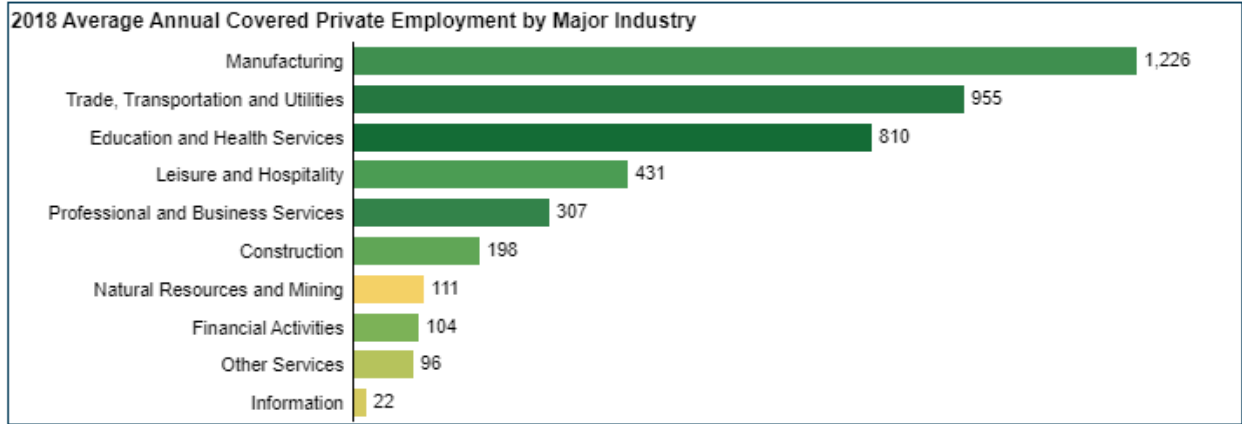
In the Katahdin region (specifically the towns of Millinocket and East Millinocket), the economy has historically been focused on the paper, pulp, and forest industry. The growth of the industry in the 19th and 20th centuries led to a rapid influx of French, Italian, Anglo, and other ethnic groups to work the mills. However, closure of papermills in the region and throughout the State caused by a decline in the national paper and pulp industry has hindered the stable growth and prosperity in the region. While the population has decreased in the Katahdin region since the mill closures, there has been a recent increase in tourism and recreation. Populations in the towns of Millinocket and East Millinocket are expected to continue to decrease by approximately 44 percent between 1970 and 2036, compared to an expected increase in population by 35 percent at the state level (EMDC 2020).

The mean household income in 2019 was \$40,890 for Piscataquis County and \$50,808 for Penobscot County, compared to \$57,918 for the state in 2019 (USCB 2019). The unemployment rates in Piscataquis and Penobscot Counties as of March 2021 were 5.9 percent and 5.3 percent, respectively (Maine Department of Labor 2021). The unemployment rate at the same time in the state of Maine was 5.4 percent and in the United States was 6.0 percent. All counties in Maine experienced increases in unemployment between March 2020 and March 2021.

In 2018, the largest employment sectors in Piscataquis County included manufacturing, trade, transportation and utilities, and education and health services (Maine Department of Labor 2021,

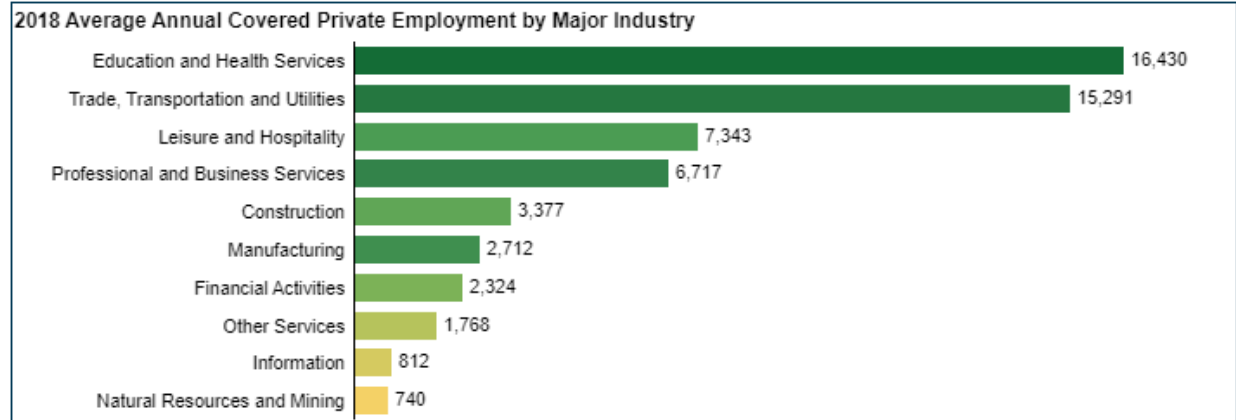
Figure 5.11-1). In the same year, the largest employment sectors in Penobscot County included education and health services, trade, transportation, and utilities, and leisure and hospitality (Maine Department of Labor 2021, Figure 5.11-2). In the Katahdin region, small businesses are common and approximately 55 percent of businesses employ less than 5 people (EMDC 2020). The top ten employers in each county are presented in Table 5.11-1.

**Figure 5.11-1
Piscataquis County Employment Sectors**



Source: Maine Department of Labor 2021.

**Figure 5.11-2
Penobscot County Employment Sectors**



Source: Maine Department of Labor 2021.

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**Table 5.11-1
Top Ten Employers in Penobscot and Piscataquis Counties in 2020**

Rank	Employer	Employment Range	Industry Description
Penobscot County			
1	Eastern Maine Medical Center	4,001 to 4,500	General medical and surgical hospitals
2	Northern Light Health	1,001 to 1,500	Office administrative services
3	Hannaford Bros Co	1,001 to 1,500	Supermarkets and other grocery stores
4	St Joseph Hospital Inc	1,001 to 1,500	General medical and surgical hospitals
5	Walmart / Sam's Club	501 to 1,000	Warehouse Clubs and Supercenters
6	Penobscot Community Health Care	501 to 1,000	Offices of physicians, except mental health
7	Husson University	501 to 1,000	Colleges and universities
8	Acadia Hospital Corp	501 to 1,000	Psychiatric and substance abuse hospitals
9	Bangor Savings Bank	501 to 1,000	Savings institutions
10	Penquis C.A.P., Inc.	1 to 500	Other individual and family services
Piscataquis County			
1	Hardwood Products Co	501 to 1,000	Surgical appliance and supplies manufacturing
2	Duvaltex US Inc	1 to 500	Broadwoven fabric mills
3	JSI Store Fixtures	1 to 500	Showcases, partitions, shelving, and lockers
4	Penquis C.A.P., Inc.	1 to 500	Other individual and family services
5	C A Dean Memorial Hospital	1 to 500	General medical and surgical hospitals
6	A E Robinson Oil Co Inc	1 to 500	Gasoline stations with convenience stores
7	Pleasant River Lumber Company	1 to 500	Sawmills
8	Hibbard Skilled Nursing Center	1 to 500	Nursing care facilities, skilled nursing
9	Country Pride Cleaning Service Inc	1 to 500	Janitorial services
10	Shaws Supermarkets Inc.	1 to 500	Supermarkets and other grocery stores

Source: Maine Department of Labor 2020.

As described previously, a variety of outdoor recreation opportunities exist in Piscataquis and Penobscot Counties, particularly in the vicinity of the Projects. Such activities include whitewater rafting on the West Branch downstream of the Ripogenus Project, along with hiking, camping, and fishing throughout the Katahdin region.

The Projects are an important employer in the region by directly employing approximately 20 full-time employees as well as numerous local contractors and vendors who routinely provide services at the Projects, as well as contractors and vendors who travel to the region to provide specialty services. Additionally, the Projects provide various recreation opportunities, which directly correlate to tourism in the area.

Hydropower represents a valuable carbon-free, renewable energy resource that provides reliable baseload electricity. These attributes can attract new industry and employers, such as data centers and high-tech developers, to a geographic region. Given the Projects' combination of run-of-river operations and storage, the Projects provide the region with a valuable socioeconomic resource that has the potential to be a driver for economic development over the term of the Projects' new license.

5.12 Tribal Resources

The Penobscot Indian Nation is a federally recognized Indian Tribe in Maine. Their traditional homeland is the 8,500-square-mile Penobscot River Basin. The Penobscot River is important to the Penobscot people, as it has been the center of the Tribe's existence for many years. The Tribe continues to use the lands and waters for hunting, fishing, trapping, gathering, transportation (boating), and ceremonial purposes. The Penobscot Indian Nation's land holdings consist of approximately 123,000 acres in numerous parcels throughout the state, which include Reservation, Trust, and Fee Lands. Approximately 4,866 acres of these land holdings extend across 146 islands in the Penobscot River (USEPA 2007). There are no tribal lands located in the Project boundaries. However, GLHA has worked closely with the Penobscot Indian Nation in regards to traditional uses of Project waters, most notably the tribe's annual spiritual pilgrimage from Indian Island to Mount Katahdin. GLHA will continue to coordinate with the Penobscot Indian Nation during and following the relicensing process.

Section 5Description of Existing Environment and Resource Impacts

The Aroostook Band of Micmacs historically occupied the land south and east of the Gulf of Saint Lawrence, the Maritime Provinces, and other regions along the Atlantic Seaboard of Northeastern America. The Micmac Nation today is composed of seven districts with 29 bands and a population of approximately 30,000 members. The Aroostook Band of Micmacs has tribal land holdings within Aroostook County in northern Maine (Aroostook Band of Micmacs 2012). None of the tribal land holdings of the Aroostook Band of Micmacs are within the vicinity of the Projects. Continued operation of the Projects is not expected to impact the Aroostook Band of Micmacs.

The Maliseet Indians historically occupied much of what is now considered the eastern border line of the U.S. and Canada in northern New England. The Maliseets consider themselves river people who have traditionally been hunters and gatherers in the St. John River basin. The Houlton Band of Maliseet Indians is comprised of approximately 800 members. The Houlton Band of Maliseet Indians has commercial land holdings in Aroostook County, with much of the land bordering the Meduxnekeag River (Houlton Band of Maliseet Indians undated). None of the land holdings of the Houlton Band of Maliseet Indians are within the vicinity of the Projects. Continued operation of the Projects is not expected to impact the Maliseet Indians.

The Passamaquoddy Tribe historically inhabited Maine and western New Brunswick, Canada. Passamaquoddy Indians traditionally relied on hunting, fishing, and gathering for subsistence and relocated between family band camps seasonally (Passamaquoddy Tribe undated). The Passamaquoddy Tribe now has 200,000 acres of land holdings in central Maine from east to west across Franklin, Somerset, Penobscot, Hancock, and Washington Counties (Passamaquoddy Tribe undated, Penobscot Nation undated). Most Passamaquoddies currently reside at Pleasant Point on Passamaquoddy Bay or Indian Township near the St. Croix River (Passamaquoddy Tribe undated).

The Licensee distributed a PAD questionnaire to the Penobscot Indian Nation, Aroostook Band of Micmacs, Passamaquoddy Tribe, and the Houlton Band of Maliseet Indians, and requested information for this PAD. Chris Sockalexis, the Tribal Historic Preservation Officer for the Penobscot Nation provided a response via email on May 31, 2021 detailing potential resources of interest to his office. No other responses have been received to date. Additionally, FERC invited the same Tribes to participate in the relicensing for the Projects by letter dated April 15, 2021. To date, no responses have been filed with FERC. Per 18 CFR §5.7, FERC will hold an initial tribal consultation meeting no later than 30 days of filing of the NOI and PAD.

Section 6.0

Preliminary Issues, Project Effects, and Potential Studies List

6.1 Potential Project Effects Pertaining to the Identified Resources

GLHA has conducted research and initial consultation activities for the purpose of identifying stakeholder and agency interests relative to the resources in the Project area. A summary of responses resource areas of interest communicated to GLHA by stakeholders is provided in Table 6.1-1.

Table 6.1-1
Stakeholder Communicated Resource Areas of Interest

Organization	Resource Areas of Interest	Description
U.S. Bureau of Indian Affairs	Cultural Resources	Project area is of historic interest to PIN
Maine Department of Environmental Protection	Water Resources	Water quality in the Back Channel
Maine Department of Inland Fisheries and Wildlife	Water Resources Wetlands Wildlife and Botanical Protected Species Recreation	- Flows related to water quality (temperature) in the Upper Gorge and fisheries habitat downstream of McKay Station - Water quality in Caribou Lake basin - Ripogenus impoundment elevations related to public access - Public access - Wildlife: - Common loon productivity - Bald eagle nests - Significant wildlife habitats - Wetlands - State-listed species: - Three bat species - Little brown bat - Northern long-eared bat - Eastern small-footed bat - Three mussel species - Brook floater - Yellow lampmussel - Tidewater mucket - Species of special concern: - Five bat species - Wood turtle - Others
American Whitewater	Recreation	Recreation flows and access
Appalachian Mountain Club	Recreation	Recreation flows and access

Section 6

Preliminary Issues, Project Effects, and Potential Studies List

Organization	Resource Areas of Interest	Description
Maine Council of Trout Unlimited	Water Resources Recreation	Ripogenus: 1. Minimum flows/need to use sluiceway – specifies water temperature impacts in bypass reach need to be investigated and lake levels in Ripogenus and Chesuncook Lakes needs to be considered 2. Shutdowns/dewatering during thunderstorms – results in dewatering and impacts to aquatic life 3. Water access needs to be incorporated into the license Penobscot Mills: 4. Dewatered back channel of Quakish Lake Dam – minimum flows need to be established 5. Fish passage for river herring needs to be provided at all dams. Increased spawning habitat would increase alewife stocks and improve subsistence fishery for the PIN 6. PIN cultural impacts due to dewatered back channel at Quakish Lake Dam and fish passage
Penobscot Indian Nation	Geology and Soils Water Resources Fish and Aquatics Wetlands Habitat Recreation Use Cultural Resources	Not specified.

Based on input received, GLHA has categorized the potential issues and developed a matrix of potential additional information needs where applicable. These items are summarized below.

This section identifies preliminary issues pertaining to the continued operation of the Projects based upon existing information summarized in Section 5 of this PAD and the initial PAD questionnaire responses provided by resource agencies and stakeholders, as summarized for each Project in Table 6.1-2 and Table 6.1-3.

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Preliminary Issues, Project Effects, and Potential Studies List

Table 6.1-2
Preliminary List of Potential Project Effects Pertaining to the Ripogenus Project

Resource Area	Potential Effect	GLHA Comment
Geology and Soils	Potential effect of Project operation on shoreline stabilization	No adverse effects to geology and soils from Project operations and maintenance have been identified, nor are any anticipated.
Water Resources		
Water Quality - Impoundment Trophic State	Potential effect of Project operation on impoundment water quality (trophic state) – ensure applicable water quality standards are met.	- Water Quality data collected during the previous relicensing indicated that the Ripogenus impoundment met applicable water quality standards. - The hydraulic connection between the Caribou Lake and Chesuncook Lake basins may be reduced at lower water levels. During previous relicensing, the Caribou Lake basin was found to meet applicable water quality standards. - As there have been no changes to Project operations, it is expected that applicable water quality standards are still being met in both the Caribou Lake basin, as well as in the Ripogenus impoundment. - Collection of updated water quality data will confirm that applicable water quality standards are still being met.
Water Quality – Project Tailwater	Potential effect of Project operation on McKay Station tailwater water quality	- Water quality data collected during the previous relicensing indicated that the Ripogenus Project discharge (McKay Station) met applicable water quality standards. - As there have been no changes to Project operations, it is expected that applicable water quality standards are still being met. - Collection of updated water quality data will confirm that applicable water quality standards are still being met.
Water Quality – Upper Gorge	Potential effect of Project operation on DO/temperature of Upper Gorge	- Establishment of Upper Gorge minimum flow through previous relicensing enhanced DO/temperature conditions in the Upper Gorge. - As there have been no changes to Project operations and minimum flow continues to be provided, it is expected that DO/temperature conditions in the Upper Gorge meet applicable water quality standards. - Collection of updated DO/temperature data in the Upper Gorge will confirm that applicable water quality standards are still being met.

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Resource Area	Potential Effect	GLHA Comment
Water Quality - Impoundment Aquatic Life	Potential effect of Project operation on impoundment aquatic life – ensure applicable water quality standards for aquatic life are met.	• Applicable water standard for Ripogenus impoundment aquatic life is to maintain the structure and function of the resident biological community and support all species of indigenous fish (Title 38, Section 465 (4)(c)). • Based on fish and aquatic habitat studies during the previous relicensing, it was determined that the Ripogenus impoundment met the applicable water quality standards for aquatic life. • As there have been no changes to Project operations, it is expected that the applicable water quality standards for aquatic life are still being met.
Water Quality – Project Tailwater Aquatic Life	Potential effect of Project operation on McKay Station tailwater aquatic life – ensure applicable water quality standards for aquatic life are met.	• Establishment of minimum flow regime for McKay Station through the previous relicensing enhanced aquatic habitat in the Project tailwater area. • As there have been no changes to Project operations and minimum flows continue to be provided, it is expected that aquatic life standards in the Project tailwater are still being met. • Collection of updated macroinvertebrate data for the tailwater area will confirm that applicable water quality standards for aquatic life are still being met.
Water Quality – Upper Gorge Aquatic Life	Potential effect of Project operation on aquatic life and aquatic habitat in the Upper Gorge – ensure applicable water quality standards for aquatic life are met.	• Establishment of Upper Gorge minimum flow through previous relicensing enhanced aquatic habitat in the Upper Gorge. • As there have been no changes to Project operations and minimum flows continue to be provided, it is expected that aquatic life conditions in the Upper Gorge meet the applicable water quality standards. • If there are remaining questions about aquatic habitat conditions, re-evaluation of aquatic habitat should focus on zone of passage conditions for salmonids.
Fish and Aquatic Resources		
Baseline Fisheries - West Branch (below McKay Station)	Potential effect of Project operations on West Branch fisheries – current baseline	• Significant amounts of information/data on West Branch fisheries already exist, as fisheries data were collected during the last relicensing and has continued to be collected by the GLHA and MDIFW. • The existing fisheries data are sufficient to characterize the existing West Branch fishery. • As there have been no changes to Project operations, there are no expected changes or impacts to West Branch fisheries.

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Resource Area	Potential Effect	GLHA Comment
Instream Flows – Ripogenus Upper Gorge	Potential effect of Project operations and stream flows on fish habitat in Upper Gorge.	- An instream flow study was conducted as part of previous relicensing effort. - Study results demonstrated that the current minimum flow supports fishery management objectives for the Upper Gorge. - Establishment of the minimum flow regime for the Upper Gorge through the previous relicensing enhanced fish and aquatic habitat in the reach and has benefitted the coldwater fishery. - As there have been no changes to Project operations and minimum flows continue to be provided, it is expected that the existing flow regime into the Upper Gorge will continue to support the existing fishery.
Instream Flows - West Branch (below McKay Station)	Potential effect of project operations and stream flows on fish habitat in the West Branch below McKay Station.	- Establishment of minimum flow regime for McKay Station through the previous relicensing enhanced fish and aquatic habitat in the West Branch, including spawning and rearing habitat for landlocked salmon. - As there have been no changes to Project operations and minimum flows continue to be provided, it is expected that the existing flow regime from McKay Station will continue to support the existing West Branch fishery.
Fish Habitat – West Branch - Holbrook Side Channel	Potential effect of continued project operations on Holbrook Side Channel salmonid spawning habitat	- The Holbrook Side Channel salmonid habitat area was established during the last relicensing to provide premium spawning and rearing habitat for landlocked salmon along the West Branch. - Sufficient monitoring was conducted after the habitat enhancement measures were completed in the channel to demonstrate its use by salmon. - GLHA continues to maintain and operate the Holbrook Side Channel and is proposing no changes to its operation. - As there have been no changes to Project operations, the side channel will continue to provide salmon spawning habitat.
Baseline Fisheries - Ripogenus Impoundment	Potential effect of Project operations on Ripogenus impoundment fisheries – current baseline	- Significant amounts of information/data on the Ripogenus impoundment fisheries already exist, as fisheries data were collected during the last relicensing, and has continued to be collected by the Licensee and MDIFW. - The existing fisheries data are sufficient to characterize the existing Ripogenus impoundment fishery.

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Preliminary Issues, Project Effects, and Potential Studies List

Resource Area	Potential Effect	GLHA Comment
		As there have been no changes to Project operations, there are no expected changes or impacts to Ripogenus impoundment fisheries.
Fish Habitat – Ripogenus Impoundment Tributary Access	Potential effect of Project operations on tributary access around the Ripogenus impoundment	- Existing data/information on the status of the salmonid fishery in the Ripogenus impoundment indicates that the salmonid and smelt fisheries are healthy and self-sustaining and therefore successfully gain access to tributaries for spawning. - As there have been no changes to Project operations and none are proposed, there will be no change to the tributary access that is currently available for spawning salmonids and rainbow smelt.
Fish Entrainment – McKay Station	Potential effect of Project operations on fish entrainment at McKay Station.	- Historically, entrainment has not been an issue at McKay Station. Rather, the landlocked salmon fishery in the West Branch is known to benefit from “smelt drift” as a significant forage base. Thus, smelt entrainment and passage downstream of McKay Station benefits the existing landlocked salmon fishery. - The Ripogenus impoundment is very large and is separated into several distinct subbasins, so the potential for entrainment impacts to populations of other fish species is very low. - As there have been no changes to Project operations and none are proposed, there will be no change to existing smelt drift, which bolsters the West Branch salmon fishery, and continued very low risk of entrainment of other fish species that may occur at McKay Station.
Diadromous Fish – West Branch and Ripogenus Dam	Potential effect of Project operations on diadromous fish species.	- There are no anadromous fish species currently in the West Branch, although sea-run Atlantic salmon historically ascended the river. The historical upstream extent of sea-run alewives (American shad; river herring) was likely to Grand Falls near Millinocket. There is no critical habitat for federally listed Atlantic salmon within the Project boundary. - Catadromous American eels have been documented in the West Branch above the Penobscot Mills Project, but they are thought to occur in very small numbers due to the Project’s location in the watershed. - As there have been no changes to Project operations and none are proposed, there will be no effect of continued Project operations on diadromous fish use of the West Branch.

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Resource Area	Potential Effect	GLHA Comment
Aquatic Habitat - Freshwater Mussels Ripogenus	Potential effect of Project operations on freshwater mussels	- MDIFW has relatively recent information on the status of freshwater mussels in the West Branch. Seven of the ten species found in Maine are known to occur in the West Branch, including the Project area - Establishment of the minimum flow regime for the West Branch through the previous relicensing enhanced fish and aquatic habitat in the West Branch and is supporting existing freshwater mussel species. - As there have been no changes to Project operations and minimum flows continue to be provided, it is expected that the existing flow regime from the Project will continue to support the existing West Branch population of freshwater mussels.
Wildlife and Botanical Resources	Potential effect of Project operation on wildlife and botanical resources	- In response to the PAD Questionnaire, the MDIFW indicated interest in common loon productivity, bald eagle nests, and significant wildlife habitats. - Beginning in 2000, GLHA has annually deployed artificial nesting platforms for loons and other aquatic birds in the Ripogenus impoundment. GLHA monitored the loon nesting habitat and success from 1998 through 2010. Although monitoring was discontinued in 2010, GLHA continues to deploy the platforms on Ripogenus impoundment, including increased number of platforms beginning in 2011.
Wetland, Riparian, and Littoral Habitat	Potential effect of Project operation on wetlands, riparian, and littoral habitat	- In response to the PAD Questionnaire, the MDIFW indicated interest in wetlands. - Extensive wetlands surveys were performed during the previous relicensing in the vicinity of the Ripogenus impoundment, West Branch, and the Project's transmission line corridor. The surveys identified a total of 1,251 acres of wetlands bordering the Ripogenus impoundment, a portion of which may be affected by impoundment fluctuation. - Wetland enhancement was performed by altering operation of the existing outlet gates at Umbazooksus Lake, located northeast of the Ripogenus impoundment. Enhancement activities and subsequent monitoring demonstrated that vegetation density increased over 350%; the total extent of vegetated wetlands increased by ~117 acres since 1998; species richness increased from 280% in 1998 to 638% in 2004; and there were 320 acres of recovering wetlands (exceeding the original requirement to enhance ~280 acres).

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Resource Area	Potential Effect	GLHA Comment
RTE Species		
Terrestrial Species	Potential effect of Project operation on RTE terrestrial species	- Based on the information from the USFWS IPaC database, the federal listed Canada lynx and northern long-eared bat may occur in the Project vicinity. Additionally, critical habitat for Canada lynx occurs within the Project boundary. - In response to the PAD Questionnaire, the MDIFW indicated interest in three state-listed bat species (little brown bat, northern long-eared bat, and eastern small-footed bat) as well as five bat species of special concern. The MDIFW indicated that they do not anticipate significant impacts to any of the bat species as a result of the Project. - No adverse effects to listed or protected terrestrial species are anticipated, as GLHA is not proposing modifications or new construction to the Project.
Aquatic Species	Potential effect of Project operation on RTE aquatic species	- In response to the PAD questionnaire, the MDIFW indicated several rare species occur in the Project vicinity including wood turtle (Special Concern) and three species of fresh water mussel (brook floater, yellow lampmussel, and tidewater mucket). - No adverse effects to listed or protected aquatic species are anticipated, as GLHA is not proposing modifications to the Project and continued minimum flows into the downstream reaches will protect aquatic species.
Recreation and Land Management		
Recreation Facility Inventory – Ripogenus Project	Potential effects of Project operations on existing Project recreation sites and facilities.	- The Licensee is responsible for ensuring the operation and maintenance of a number of FERC-approved Project recreation sites, with associated facilities and amenities. - An updated Project Recreation Plan is required for the Project's FERC license application including an updated description of the Project recreation sites and an accurate inventory of facilities and amenities. - Storage operations at the Project result in seasonal changes in impoundment water levels which may affect the usability of certain recreation sites/facilities.
Recreation Use Survey - Ripogenus Project	Potential effects of Project operations on existing Project recreation sites and facilities.	- The Licensee currently collects recreation use information for the Project recreation sites/facilities every 6 years. - Recreation use monitoring at the Project recreation sites will next occur in 2022. Use data gathered during the next 6-year assessment will be sufficient to evaluate current use and to assess the adequacy of the existing sites to meet current and future recreation demand.

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Preliminary Issues, Project Effects, and Potential Studies List

Resource Area	Potential Effect	GLHA Comment
Whitewater Boating Flow Assessment– Ripogenus and Penobscot Mills Projects.	Potential effects of Project operations on whitewater boat opportunities.	The West Branch below McKay Station is a 15-mile Class III-V whitewater boating reach. Sufficient existing information including study results, video, user surveys, and use records exist to demonstrate that the existing whitewater boating flow regime and facilities are world class and meeting current demand.
Cultural Resources	Potential effect of Project operation on cultural resources in the region	- In 1973, Chesuncook Village was listed on the NRHP, and consultation performed during the previous relicensing determined that Project operations and maintenance are not anticipated to have an adverse effect on this site. - Between 1988 and 1991, comprehensive Phase 0 and I cultural resources assessments and Phase II testing were performed. - In 1992, Ripogenus Dam was determined to be eligible for the NRHP. - Via letter dated October 20, 1992, MSHPO determined that the licensing of the Project would have no adverse effects on the identified historic properties, if the CRMP was implemented as a condition of the license. - In 1995, identified archaeological sites were listed in the NRHP. - In 1996, FERC issued a Programmatic Agreement. - In 1998, based on consultation with MSHPO and FERC, GLHA filed a CRMP describing the Phase III mitigation and data recovery activities, which was approved by the Commission. - Since, 1998, Phase III mitigation and data recovery activities via excavation have been performed at identified archaeological sites based on the results of the assessments and testing and comprehensive consultation with the MSHPO. - GLHA proposes to develop an updated HPMP for the Project for the continued protection and management of identified cultural resources/historic properties at the Project. - Based on the cultural resources assessments and activities performed to date at the Project, as well as the proposal to develop an updated HPMP for the Project, no adverse effects to cultural resources are anticipated from the continued operation and maintenance of the Project.

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Resource Area	Potential Effect	GLHA Comment
Socioeconomic Resources	Potential effect of Project operation on socioeconomic resources in the region	• No adverse effects to socioeconomics from Project operations and maintenance have been identified, nor are any anticipated. • To the contrary, the Project provides important employment opportunities both for direct employees of GLHA and for numerous contractors and vendors who routinely provide services at the Project. • Whitewater releases from McKay Station support commercial rafting outfitters in the Project vicinity. • Overall, Project operations continue to have an economic benefit that supports the tourism and recreation industries in Piscataquis and Penobscot Counties, including river outfitters, guides, and ancillary services such as hotels, restaurants, and campgrounds. • Existing Project operations are part of the current socioeconomic context of the Project vicinity.
Tribal Resources	Potential effect of Project operations on tribal resources in the region	• No adverse effects to tribal resources from Project operations and maintenance have been identified.

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Table 6.1-3
Preliminary List of Resource Issues Pertaining to the Penobscot Mills Project

Resource Area	Potential Effect	GLHA Comment
Geology and Soils	Potential effect of Project operation on shoreline stabilization	No adverse effects to geology and soils from Project operations and maintenance have been identified, nor are any anticipated.
Water Resources		
Water Quality – Penobscot Mills Impoundment Trophic State	Potential effect of Project operation on impoundment water quality	- Water quality data collected during the previous relicensing indicated that Penobscot Mills impoundments met applicable water quality standards. - As there have been no substantial changes to Project operations, it is expected that applicable water quality standards are still being met. - Collection of updated water quality data will confirm that applicable water quality standards are still being met.
Water Quality – Penobscot Mills Project Tailwater	Potential effect of Project operation on tailwater water quality	- Water quality data collected during the previous relicensing indicated that the Penobscot Mills Project discharges met water quality standards. - As there have been no changes to Project operations, it is expected that applicable water quality standards are still being met. - Collection of updated water quality data will confirm that applicable water quality standards are still being met.
Water Quality – Penobscot Mills Impoundment Aquatic Life	Potential effect of Project operation on impoundment aquatic life	- Based on fish and aquatic habitat studies conducted during the previous relicensing, it was determined that Penobscot Mills Project impoundments met applicable water quality standards for aquatic life. - As there have been no changes to Project operations, it is expected that applicable water quality standards for aquatic life are still being met.
Water Quality – Penobscot Mills Project Tailwater Aquatic Life	Potential effect of Project operation on tailwater aquatic life	- As there have been no changes to Project operations and minimum flows continue to be provided, it is expected that aquatic life standards in the Project tailwaters are still being met. - Collection of updated macroinvertebrate data for the tailwater areas will confirm that applicable water quality standards for aquatic life are still being met.

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Resource Area	Potential Effect	GLHA Comment
Fish and Aquatic Resources		
Baseline Fisheries – Penobscot Mills Project Impoundments	Potential effect of Project operations on Penobscot Mills Project impoundment fisheries – current baseline	- Sufficient information/data exist on fisheries in the five major impoundments that comprise the Penobscot Mills Project: Millinocket Lake, North Twin, Millinocket, Dolby, and East Millinocket. Fisheries data were collected during the last relicensing and has continued to be collected by the Licensee and MDIFW. - Available fisheries data are sufficient to characterize the existing impoundment fisheries throughout the Project. - Although there have been some modest changes to the operation of the Project impoundments (North Twin), the anticipated effect of those modifications on the lake trout fishery has been reviewed by MDIFW. No other changes in Project operations have occurred and no new changes are proposed.
Penobscot Mills - Back Channel Instream Flows	Potential effect of Project operations and flows on fish habitat in the Back Channel.	- River flow was diverted around the Back Channel over 120 years ago, and the channel currently supports a warmwater fishery. - The Back Channel is difficult to access, and angler use is minimal. - As there have been no changes to Project operations, and the Back Channel has existed in its current condition for over 120 years, it is expected that current operations will continue to support the Back Channel's existing fish and aquatic community and meet current fisheries management objectives for the area.
Penobscot Mills - Back Channel mesohabitat survey	Potential effect of Project operations and stream flows on aquatic habitat in the Back Channel.	- River flow was diverted around the Back Channel over 120 years ago and fundamentally changed the aquatic habitat characteristics of the reach. - The Back Channel is difficult to access, and little is known about the current distribution and function of aquatic habitat in the reach under existing Project operations.
Instream Flows – Millinocket Stream	Potential effect of project operations and stream flows on fish habitat in Millinocket Stream.	- An instream flow study of Millinocket Stream was conducted as part of previous relicensing effort. - Study results were used to establish current minimum flows and demonstrated that the minimum flows would support fishery management objectives for the stream. - Establishment of a minimum flow regime for Millinocket Stream through the previous relicensing enhanced fish and aquatic habitat in the stream. - As there have been no changes to Project operations and minimum flows continue to be provided, it is expected that the existing flow regime for Millinocket Stream will continue to support the existing fishery and fishery management objectives.
Impoundment fluctuation – Millinocket Lake and North Twin Impoundment	Potential effect of project operations and resulting impoundment fluctuations on fisheries in Millinocket Lake and North Twin Impoundment.	- Millinocket Lake and North Twin impoundment are operated as part of the Project's storage system, resulting in some impoundment fluctuations. - The effects of the current operating regime on the fisheries in these two impoundments is well understood.

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Resource Area	Potential Effect	GLHA Comment
		Although there have been some modest changes to the operation of the Project impoundments (North Twin), the anticipated effect of those modifications on the impoundment fishery has been reviewed by MDIFW. No other changes in Project operations have occurred and no new changes are proposed, so there will be no effects on impoundment fisheries.
Fish Habitat – Penobscot Mills Project Impoundment Tributary Access	Potential effect of Project operations on tributary access around the Penobscot Mills Project impoundments.	- The Millinocket, Dolby and East Millinocket developments are all operated in a run-of-river mode and, therefore, operations would have no impact on tributary access. - Millinocket Lake and North Twin impoundment are operated as part of the Project's storage system, resulting in some impoundment fluctuations. - Existing data/information on the status of the fisheries in Millinocket Lake and the North Twin impoundment indicate that the fisheries are healthy; therefore, tributary access is likely not an issue for salmonids or smelt. - As there have been no changes to Project operations and none are proposed, there will be no change to the tributary access that is currently available.
Diadromous Fish – Penobscot Mills Project	Potential effect of Project operations on diadromous fish species.	- There are no anadromous fish species currently in the West Branch, although sea-run Atlantic salmon historically ascended the river. The historical upstream extent of sea-run alewives (American shad; river herring) was likely to Grand Falls in the Back Channel near Millinocket. There is no critical habitat for listed Atlantic salmon within the Project boundary. - Catadromous American eels have been documented in Project waters, but they are thought to occur in very small numbers due to the Project's location in the watershed. - As there have been no changes to Project operations and none are proposed, there will be no effect of continued Project operations on diadromous fish use of the West Branch.
Fish Entrainment – Penobscot Mills Project	Potential effect of Project operations on fish entrainment at the Penobscot Mills Project developments.	- Historically, entrainment has not been an issue at the Penobscot Mills Project. "Smelt drift" through project facilities may provide a significant forage base to downstream fisheries. - The North Twin impoundment is very large and is separated into several distinct subbasins, so the potential for entrainment impacts to populations of other fish species is very low. - As there have been no changes to Project operations and none are proposed, there will be no change to existing smelt drift or potential entrainment of other fish species at the Project.
Aquatic Habitat - Freshwater Mussels Penobscot Mills	Potential effect of Project operations on freshwater mussels	- MDIFW has relatively recent information on the status of freshwater mussels in the West Branch. Seven of the ten species found in Maine are known to occur in the West Branch drainage, including Millinocket Stream and several of the Project impoundments. - As there have been no changes to Project operations and none are proposed, it is expected that existing freshwater mussel populations will continue to be supported.

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Resource Area	Potential Effect	GLHA Comment
Wildlife and Botanical Resources	Potential effect of Project operation on wildlife and botanical resources	- Potential effects to wildlife and botanical resources from Project operations are limited to the small areas of land within the Project boundary in the vicinity of the Project facilities, transmission line corridors, and the Wildlife Management Area adjacent to the Back Channel. - Implementation and maintenance of wildlife enhancement measures in the Wildlife Management Area since 1998 were determined effective based on 20 years of monitoring (1998-2018). - No adverse effects to wildlife and botanical resources from Project operations and maintenance have been identified, nor are any anticipated.
Wetland, Riparian, and Littoral Habitat	Potential effect of Project operation on wetlands, riparian, and littoral habitat	- In response to the PAD Questionnaire, the MDIFW indicated interest in wetlands. - Extensive wetlands surveys were performed during the previous relicensing in the vicinity of the Penobscot Mills Project impoundments, West Branch, and the Project's transmission line corridor. The surveys indicated the following: - Wetlands around the periphery of Quakish Lake, Ferguson Pond, Dolby Pond, and the East Millinocket impoundment were not affected by Project operations, because water levels at these impoundments do not fluctuate significantly due to their run-of-river operations. - A total of 709 acres of wetlands were identified around Millinocket Lake, most of which are hydrologically independent of the impoundment levels due to the deep organic substrates and the independent sources of inflow in these wetlands (even during a dry period experienced in August 1993). - A total of 296 acres of wetlands were identified around the North Twin impoundment, of which approximately 75% (222 acres) were at least partially hydrologically independent of the impoundment levels. The 25% of wetlands that are hydrologically dependent on North Twin impoundment levels are generally small and composed of plant species that are somewhat tolerant of fluctuating impoundment levels. - Wetland enhancement (to mitigate Project effects at the North Twin Development) was performed by altering operation of the existing outlet gates at Umbazooksus Lake, located northeast of the Ripogenus impoundment. Enhancement activities and subsequent monitoring demonstrated that vegetation density increased over 350%; the total extent of vegetated wetlands increased by ~117 acres since 1998; species richness increased from 280% in 1998 to 638% in 2004; and there are 320 acres of recovering wetlands (exceeding the original requirement to enhance ~280 acres).

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Preliminary Issues, Project Effects, and Potential Studies List

Resource Area	Potential Effect	GLHA Comment
RTE Species		
Terrestrial Species	Potential effect of Project operation on RTE terrestrial species	- Based on the information from the USFWS IPaC database, the federal listed Canada lynx and northern long-eared bat may occur in the Project vicinity. Additionally, critical habitat for Canada lynx occurs within the Project boundary but is not located within Wildlife Management Area surrounding the Back Channel. - In response to the PAD Questionnaire, the MDIFW indicated interest in three state-listed bat species (little brown bat, northern long-eared bat, and eastern small-footed bat) as well as five bat species of special concern. The MDIFW indicated that they do not anticipate significant impacts to any of the bat species as a result of the Project. - No adverse effects to listed or protected terrestrial species are anticipated, as GLHA is not proposing modifications or new construction to the Project.
Aquatic Species	Potential effect of Project operation on RTE aquatic species	- Based on the information from the USFWS IPaC database, the federal-listed Atlantic salmon may occur in the Project vicinity; however, the species is anticipated to occur downstream of the Project. There is no critical habitat for this species in the West Branch, as critical habitat is limited to the East Branch and mainstem Penobscot River. - In response to the PAD questionnaire, the MDIFW indicated several rare species occur in the Project vicinity including wood turtle (Special Concern) and three species of freshwater mussel (brook floater, yellow lampmussel, and tidewater mucket). - No adverse effects to listed or protected aquatic species are anticipated, as GLHA is not proposing modifications to the Project and continued minimum flows into the downstream reaches will protect aquatic species.
Recreation and Land Use Resources		
Recreation Facility Inventory – Penobscot Mills Project	Potential effects of Project operations on existing Project recreation sites and facilities.	- The Licensee is responsible for ensuring the operation and maintenance of a number of FERC-approved Project recreation sites, with associated facilities and amenities. - An updated Project Recreation Plan is required for the Project's FERC license application, including an updated description of the Project recreation sites and an accurate inventory of facilities and amenities. - Storage operations at the Project result in seasonal changes in impoundment water levels which may affect the usability of certain recreation sites/facilities.

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Preliminary Issues, Project Effects, and Potential Studies List

Resource Area	Potential Effect	GLHA Comment
Recreation Use Survey – Penobscot Mills Project	Potential effects of Project operations on existing Project recreation sites and facilities.	- The Licensee currently collects recreation use information for the Project recreation sites/facilities every 6 years. - Recreation use monitoring at the Project recreation sites will next occur in 2022. Use data gathered during the next 6-year assessment will be sufficient to evaluate current use and to assess the adequacy of the existing sites to meet current and future recreation demand.
Cultural Resources	Potential effect of Project operation on cultural resources in the region	- Between 1988 and 1991, comprehensive Phase 0 and I cultural resources assessments and Phase II testing were performed. - Via letter dated October 15, 1990, the MSHPO determined that none of the Penobscot Mills Project structures or features were eligible for nomination for the NRHP. - Via letter dated October 20, 1992, MSHPO determined that the licensing of the Project would have no adverse effects on the identified historic properties, if the CRMP was implemented as a condition of the license. - In 1995, identified archaeological sites were listed in the NRHP. - In 1996, FERC issued a Programmatic Agreement. - In 1998, based on consultation with MSHPO and FERC, GLHA filed a CRMP describing the Phase III mitigation and data recovery activities, which was approved by the Commission. - Since, 1998, Phase III mitigation and data recovery activities via excavation have been performed at identified archaeological sites based on the results of the assessments and testing and comprehensive consultation with the MSHPO. - GLHA proposes to develop an updated HPMP for the Project for the continued protection and management of identified cultural resources/historic properties at the Project. - Based on the cultural resource assessments and activities performed to date at the Project, as well as the proposal to develop an updated HPMP for the Project, no adverse effects to cultural resources are anticipated from the continued operation and maintenance of the Project.

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Preliminary Issues, Project Effects, and Potential Studies List

Resource Area	Potential Effect	GLHA Comment
Socioeconomic Resources	Potential effect of Project operation on socioeconomic resources in the region	• No adverse effects to socioeconomics from Project operations and maintenance have been identified. • To the contrary, the Project provides important employment opportunities both for direct employees of GLHA and for the numerous contractors and vendors who routinely provide services at the Project. • Overall, Project operations continue to have an economic benefit that supports the tourism and recreation industries in Piscataquis and Penobscot Counties, including for river outfitters, guides, and ancillary services such as hotels, restaurants, and campgrounds. • Existing Project operations are part of the current socioeconomic context of the Project vicinity.
Tribal Resources	Potential effect of Project operations on tribal resources in the region	• No adverse effects to tribal resources from Project operations and maintenance have been identified.

6.2 Proposed Studies and Information Gathering Associated with Identified Issues

A significant body of information presently exists relative to the Ripogenus and Penobscot Mills Projects; even so, GLHA understands that some level of additional study or information gathering may be necessary in support of the application for new licenses. Accordingly, potential studies or information gathering activities commensurate with this framework are outlined for each Project in Table 6.2-1 and Table 6.2-2. GLHA notes that this listing is preliminary and will likely be subject to change based on additional consultation with resource agencies and stakeholders pursuant to the ILP study scoping process. Subsequently, GLHA will prepare and present a set of refined studies in the Proposed Study Plan.

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Preliminary Issues, Project Effects, and Potential Studies List

Table 6.2-1
Potential Study and Information Gathering Activities Pertaining to the Ripogenus Project

Resource Area	Potential Study	Study Objective	Study Framework
Water Resources	Water Quality Study	Collect baseline water quality information to appropriately inform FERC relicensing and the MDEP 401 Water Quality Certification processes.	Potential/relevant study methods (consistent with MDEP protocols) may include: • Lake Trophic sampling twice a month between June and October: ○ Collect water quality data at one location in Ripogenus impoundment (~150 feet upstream of Ripogenus dam representative of water entering intake) and one location in the deep part of the Caribou Lake basin. ○ Water quality data collection will include vertical profiles of water temperature and DO, Secchi disk readings, and sample collection for lake trophic parameters. • Tailwater/riverine sampling between July and August: ○ Perform continuous monitoring of DO and water temperature at one location in the Upper Gorge (between Ripogenus dam and McKay Station) ○ Perform continuous monitoring of DO and water temperature at one location in the West Branch downstream of McKay Station.
Fish and Aquatic Resources	Macroinvertebrate Survey	Survey and analyses to characterize the macroinvertebrate community downstream of McKay Station	Potential/relevant study methods (following MDEP protocols) may include: • Collect macroinvertebrate samples at select locations downstream of McKay Station using methods employed by the MDEP for assessing the condition of macroinvertebrate communities in Maine streams. • Conduct laboratory analyses of macroinvertebrate samples.
Recreation and Land Management	Recreation Facility Inventory and Condition Assessment	Characterize existing Project recreational facilities and conditions	Potential/relevant study methods may include: • Field inventory and documentation of existing Project recreational facilities. • Desktop research and inventory of regional recreational facilities, opportunities, and management plans. • Identify gaps, improvements, or use needs within the Project boundary.

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Table 6.2-2
Potential Study and Information Gathering Activities Pertaining to the Penobscot Mills Project

Resource Area	Potential Study	Study Objective	Study Framework
Water Resources	Water Quality Study	Collect baseline water quality information to appropriately inform FERC relicensing and the MDEP 401 Water Quality Certification processes.	Potential/relevant study methods (consistent with MDEP protocols) may include: • Lake Trophic sampling twice a month between June and October: ○ Collect water quality data at one location in each of the impoundments: Millinocket Lake (deep area upstream of dam), North Twin impoundment (deep area of Elbow Lake), Millinocket impoundment (deep area of Ferguson Pond), Dolby impoundment (deep area upstream of dam), and East Millinocket impoundment (deep area upstream of dam). ○ Water quality data collections will include vertical profiles of water temperature and DO, Secchi disk readings, and sample collection for lake trophic parameters. • Tailwater/riverine sampling between July and August: ○ Perform continuous monitoring of DO and water temperature at one location in each of the riverine/tailwater areas: Millinocket Stream downstream of the Millinocket Lake Dam and West Branch in the North Twin tailrace, downstream of Stone Dam, Millinocket tailrace, Dolby tailrace, and the East Millinocket tailrace.
Fish and Aquatic Resources	Macroinvertebrate Survey	Survey and analyses to characterize the macroinvertebrate community in each of the tailwater and riverine reaches.	Potential/relevant study methods (following MDEP protocols) may include: • Collect macroinvertebrate samples at select locations using methods employed by the MDEP for assessing the condition of macroinvertebrate communities in Maine streams. • Conduct laboratory analyses of macroinvertebrate samples. • Conduct sampling at the following locations: Millinocket Stream downstream of the dam, North Twin tailrace, Millinocket tailrace, Dolby tailrace, and the East Millinocket tailrace.

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Preliminary Issues, Project Effects, and Potential Studies List

Resource Area	Potential Study	Study Objective	Study Framework
Fish and Aquatic Resources	Back Channel Mesohabitat Survey	Map and characterize aquatic and riparian mesohabitat types found in the Back Channel under existing flow regime.	Potential/relevant study methods may include: • Use aerial imagery/videography (collected by drone) to identify the distribution and relative abundance of mesohabitat types and boundaries found in the Back Channel from Stone Dam to Shad Pond. • Conduct videography under existing minimum flow (leakage) conditions. • Create a map of mesohabitat types within the channel. • Characterize aquatic habitat and use of the Back Channel based on mesohabitat mapping.
Recreation and Land Management	Recreation Facility Inventory and Condition Assessment	Characterize existing Project recreational facilities and conditions	Potential/relevant study methods may include: • Field inventory and documentation of existing Project recreational facilities. • Desktop research and inventory of regional recreational facilities, opportunities, and management plans. • Identify gaps, improvements, or use needs within the Project boundary.

Section 7.0

Comprehensive Plans and Resource Management Plans

GLHA reviewed FERC's March 2021 List of Comprehensive Plans applicable to Maine and adopted by FERC under Section 10(a)(2)(A) of the Federal Power Act, 16 U.S.C. §803(a)(2)(A). Of the 38 comprehensive plans relevant to Maine, 18 are considered potentially applicable to the Projects. GLHA also identified 9 additional relevant qualifying resource management plans considered potentially applicable to the Projects. Based on a review of the 18 potentially relevant comprehensive plans, GLHA believes that the Projects, as currently operated, are consistent with each of the plans listed below.

FERC's List of Comprehensive Plans

Federal Plans

1. Atlantic States Marine Fisheries Commission. 1999. Amendment 1 to the Interstate Fishery Management Plan for shad and river herring. (Report No. 35). April 1999.
2. Atlantic States Marine Fisheries Commission. 2000. Interstate Fishery Management Plan for American eel (*Anguilla rostrata*). (Report No. 36). April 2000.
3. Atlantic States Marine Fisheries Commission. 2000. Technical Addendum 1 to Amendment 1 of the Interstate Fishery Management Plan for shad and river herring. February 9, 2000.
4. Atlantic States Marine Fisheries Commission. 2008. Amendment 2 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. October 2008.
5. Atlantic States Marine Fisheries Commission. 2009. Amendment 2 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. May 2009.
6. Atlantic States Marine Fisheries Commission. 2010. Amendment 3 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. February 2010.
7. Atlantic States Marine Fisheries Commission. 2013. Amendment 3 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. August 2013.
8. Atlantic States Marine Fisheries Commission. 2014. Amendment 4 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. October 2014.

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9. National Marine Fisheries Service. 2018. Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon. Hadley, Massachusetts. January 2019.
10. National Park Service. 1993. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C.
11. U.S. Fish and Wildlife Service. 1989. Atlantic salmon restoration in New England: Final environmental impact statement 1989-2021. Department of the Interior, Newton Corner, Massachusetts. May 1989.
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13. U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986.

Maine Plans

14. Maine Atlantic Sea-Run Salmon Commission. 1984. Strategic plan for management of Atlantic salmon in the State of Maine. Augusta, Maine. July 1984.
15. Maine Department of Agriculture, Conservation, & Forestry. Maine State Comprehensive Outdoor Recreation Plan (SCORP): 2014-2019. Augusta, Maine.
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17. Maine State Planning Office. 1987. Maine Comprehensive Rivers Management Plan Vols 1-3. Augusta, Maine. May 1987.
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Section 8.0

Summary of Contacts

8.1 Summary of Contacts used to Prepare the PAD

In support of preparing this PAD, GLHA distributed a PAD questionnaire to help identify sources of existing, relevant, and reasonably available information pertinent to the Projects that are not currently in the possession of GLHA. The PAD questionnaires were mailed on January 6, 2021, to the parties identified in the PAD questionnaire distribution list, which included 104 federal and state agencies, local government officials, and Indian Tribes, among others. A total of 15 responses to the PAD questionnaire were received. The PAD questionnaire and the associated responses are provided in Appendix B of this PAD.

Consultation with the Maine Coastal Program was conducted to confirm the Project is not located in the Maine Coastal Zone as identified by the State's coastal zone management plan. A copy of this consultation record is provided in Appendix B of this PAD.

Notice of the filing of the NOIs and this PAD has been provided to representatives of state and federal resource agencies, local government officials, Indian Tribes, NGOs, and members of the public that may have an interest in participating in the relicensing of the Projects. These stakeholders are identified in the PAD distribution list.

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