U.S. Army Corps of Engineers (USACE)

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT

For use of this form, see 33 CFR 325. The proponent agency is CECW-COR.

Form Approved - OMB No. 0710-0003
Expires: 2027-10-31

The public reporting burden for this collection of information, OMB Control Number 0710-0003, is estimated to average 11 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or burden reduction suggestions to the Department of Defense, Washington Headquarters Services, at whs.mc-alex.esd.mbx.dd-dod-information-collections@mail.mil. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. PLEASE DO NOT RETURN YOUR APPLICATION TO THE ABOVE EMAIL.

PRIVACY ACT STATEMENT

Authorities: Rivers and Harbors Act, Section 10, 33 USC 403; Clean Water Act, Section 404, 33 USC 1344; Marine Protection, Research, and Sanctuaries Act, Section 103, 33 USC 1413; Regulatory Programs of the Corps of Engineers; Final Rule 33 CFR 320-332. Principal Purpose: Information provided on this form will be used in evaluating the application for a permit. Routine Uses: This information may be shared with the Department of Justice and other federal, state, and local government agencies, and the public and may be made available as part of a public notice as required by Federal law. Submission of requested information is voluntary, however, if information is not provided the permit application cannot be evaluated nor can a permit be issued. One set of original drawings or good reproducible copies which show the location and character of the proposed activity must be attached to this application (see sample drawings and/or instructions) and be submitted to the District Engineer having jurisdiction over the location of the proposed activity. An application that is not completed in full will be returned. System of Record Notice (SORN). The information received is entered into our permit tracking database and a SORN has been completed (SORN #A1145b) and may be accessed at the following website: http://dpcld.defense.gov/Privacy/SORNsIndex/DOD-wide-SORN-Article-View/Article/570115/a1145b-ce.aspx

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED 02/12/2026	4. DATE APPLICATION COMPLETE

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME	8. AUTHORIZED AGENT'S NAME AND TITLE (agent is not required)
First – Dwayne Middle – Last – Shaw Company – E-mail Address – ellie@mainesalmonrivers.org	First – Kaylee Middle – Last – Faltys Company – Inter-Fluve E-mail Address – kfaltys@interfluve.com
6. APPLICANT'S ADDRESS:	**9. AGENT'S ADDRESS:**
Address – 187 Main St City – Columbia Falls State – ME Zip - 04623 Country – US	Address – 113 S. Main Street Unit 107 City – Lodi State – WI Zip – 53555 Country – US
7. APPLICANT'S PHONE NOs. w/AREA CODE	**10. AGENTS PHONE NOs. w/AREA CODE**
a. Business b. c. Fax +12076644189	a. Primary b. c. Fax +6086085092711

STATEMENT OF AUTHORIZATION

11. I hereby authorize, Kaylee Faltys to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

/s/ - provided on authorized agent form — 02/12/2026

SIGNATURE OF APPLICANT — Date

NAME, LOCATION, AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

Cherryfield Ice Dam Fish Passage Project

13. NAME OF WATERBODY, IF KNOWN (if applicable)

14. PROJECT STREET ADDRESS (if applicable)

Address -- Unionville Rd

City -- Cherryfield

State -- ME

Zip – 04622

15. LOCATION OF PROJECT

Latitude: ◦N 44.6077786 Longitude: ◦W -67.938842

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN (see instructions)

Section – Township – Range –

County – Washington County Project Area – 9.090601 Acres State Tax Parcel ID –

17. DIRECTIONS TO THE SITE

18. Nature of Activity (Description of project, include all features)

The proposed activity involves modification of the existing Cherryfield Ice Dam to replace the current Denil fishway with a bank-to-bank, nature-like fishway to improve upstream fish passage in the Narraguagus River while maintaining ice dam functions. The purpose of the project is to provide effective, volitional passage for migratory fish species, particularly federally endangered Atlantic salmon, by addressing deficiencies in the existing fish passage structure, which currently provides only limited upstream passage under a narrow range of flow conditions. The intended use of the project is to restore access to critical upstream habitat within the Narraguagus River watershed for Atlantic salmon, American shad, alewife, and other migratory fish species.

The proposed nature-like fishway has been designed to convey required flows across a wide range of river conditions throughout the migration season, with emphasis on peak adult migration periods. The fishway footprint was designed to minimize the overall project area and associated impacts to waters of the United States while maintaining the functional integrity of an ice dam. Best management practices will be implemented during construction to avoid and minimize impacts to aquatic and riparian resources to the maximum extent practicable.

Direct adverse environmental effects associated with the project include limited tree clearing (less than two acres) to provide equipment access and the permanent impact of approximately 1.16 acres of riverine waters to construct the nature-like fishway. Indirect effects are expected to be minimal and temporary, primarily associated with short-term construction disturbance. Overall, the project will result in a net environmental benefit by substantially improving fish passage and access to upstream habitats. A Biological Assessment was completed to evaluate direct and indirect effects to Atlantic salmon in accordance with Section 7 of the

Endangered Species Act.

Construction of the nature-like fishway will utilize natural materials, including boulders, gravel, and cobble, to create stable channel features and roughness elements. Bank stabilization will be accomplished using biodegradable woven coir fabric and wood stakes. Modifications to the existing grade control dam will include the use of sheet pile, fill material, and boulders. Construction activities will be conducted using excavators and means of the Contractor.
The proposed project consists of construction of a bank-to-bank nature-like fishway at the existing dam facility, along with associated site improvements to support maintenance access and public use. The nature-like fishway will be constructed using natural materials arranged to mimic step-pool morphology and a roughened rock ramp.
The nature-like fishway will extend approximately 270 feet in length, with a width varying from approximately 150 feet to 300 feet. The maximum excavation depth will be approximately 7 feet, tapering to zero at the upstream and downstream tie-ins. Subgrade excavation will occur primarily at the downstream end of the project to allow placement of natural substrate materials required to create a stable channel and fish passage structure.
Secondary project elements include site improvements and access features to facilitate operation and maintenance of the fishway and to improve existing public facilities. These features will be designed to minimize disturbance to surrounding natural resources.
The proposed use of the nature-like fishway is to provide volitional upstream and downstream passage for aquatic organisms at the dam site. No filled, pile-supported, or float-supported platforms are proposed as part of the project, and no structures will be erected on fill beyond the fishway and associated access features.

19. Project Purpose (Describe the reason or purpose of the project, see instructions)

The purpose of this project is to improve fish passage at the site of the Cherryfield Ice Dam while maintaining the dams original purpose of mitigating ice-related flooding, a consistent documented challenge for the Town of Cherryfield since the 1800s. The existing Denil fishway at the Cherryfield Ice Dam, while providing nominal upstream passage for various species, has many deficiencies and is especially inadequate at passing critically endangered Atlantic salmon attempting to access critical upstream habitat in the Narraguagus River watershed. While efficiency of the existing fishway remains unknown, poor attraction flows, narrow orientation of entrance, and steep slope likely combine to limit upstream passage for fish under a range of flow conditions. Removing and replacing the current ice dam with a channel-spanning, nature-like fishway will provide many different flow pathways for fish to utilize while migrating upstream through the project area under a range of different flows, improving passage for Atlantic salmon, alewife, blueback herring, Eastern brook trout, and other native diadromous species. The fishway is designed to maintain current upstream conditions, including the existing head pond elevation and ice dam functions.

The proposed action also includes bank stabilization and creation measures, partial removal of artificial earthen embankments on the left and right banks to increase flow conveyance through the site during high flows, and a robust native planting and revegetation plan. DSF also proposes to construct upland, terrestrial improvements to enhance an existing community gathering place and facilitate safe public access to the stream.

USE BLOCKS 20-23 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

The project involves both temporary and permanent discharges of fill material into the river channel. Temporary placement of bulk bags and sheet pile will be used to construct cofferdams within the river channel. The specific purpose of these temporary structures is to isolate work areas, divert river flows, and allow in-water construction activities to be conducted in the dry. Use of cofferdams will minimize turbidity, reduce the extent and duration of in-water disturbance, and limit potential adverse effects to aquatic organisms during construction. All temporary materials will be removed upon completion of in-water work, and affected areas will be restored to pre-construction conditions.

Permanent discharge of fill material, including boulders, fill, and sheet pile, will occur within the river channel as part of modifications to the existing weir for ice mitigation and construction of the nature-like fishway. The purpose of this permanent material placement is to create a stable channel structure that conveys required flows and provides effective, volitional upstream fish passage. The nature-like fishway is intended to improve access to upstream habitat for migratory fish species within the Narraguagus River, including federally endangered Atlantic salmon and maintain the functionality of the ice dam.

21. Type(s) of Material Being Discharged and the Amount of Each Type:

See Appendix C

22. Surface Area in Acres of Wetlands or Other Waters Filled (see instructions)

See Appendix C

23. Description of Avoidance, Minimization, and Compensation (see instructions)

There are unavoidable direct impacts to existing wetlands due to the proposed project. These impacts are minimized due to the placement of the nature-like fishway in a location where wetlands are the narrowest, least complex, and provide the least function. More complex and functionally important wetlands upstream and downstream of the project site are not impacted. Additionally, because the proposed project will maintain typical impoundment levels, no indirect impacts to wetlands upstream of the project are anticipated. The project includes a robust revegetation plan designed to replicate and replace the impacted wetlands. These designed revegetated areas consider the anticipated changes in hydrology at the project site, and prescribe native wetland plant species that will provide long term ecological function. For detailed information and analysis, see the Wetland Delineation and Functional Assessment.
For Federally listed species, see Biological Assessment Report. All construction elements of the project will be conducted in compliance with the NMFS and Federal Highway Administrations (FHWA) Best Management Practices (BMP) to avoid and minimize effects to endangered species. BMPs can include precautionary, avoidance, or protection procedures such as timing restrictions or buffers around sensitive habitats and habitat features that are important to listed species. BMPs may also include methods, facilities, built elements, and techniques implemented or installed during project construction to prevent or reduce project impacts on natural resources, such as water quality, soil, and animal habitats. BMPs are measures that are considered part of each proposed activity that will be implemented throughout the project. A fish evacuation plan will be performed in isolated areas. Maine Dept. of Marine Resources will be on call and available during construction activities in the event any life stage of Atlantic salmon is observed behind the turbidity curtains or within areas cofferdam excluded areas.

24. Is Any Portion of the Work Already Complete? ☐ Yes ☑ No

If Yes, describe the completed work:

25. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (if more than can be entered here, please attach a supplemental list).

a. Address – 6 Penny Lane
0R4-001-000

City – Saco State – ME Zip – 04072

b. Address – 12 Municipal Way
0U6-012-000

City – Cherryfield State – ME Zip – 04622

c. Address – 203 Blackswoods Rd
0U7-015-000

City – Cherryfield State – ME Zip – 04622

d. Address – 182 Blacks Woods Rd
0U7-016-000

City – Cherryfield State – ME Zip – 04622

e. Address – 12 Municipal Way
0U6-011-000

City – Cherryfield State – ME Zip – 04622

f. Address – 12 Municipal Way
0R4-002-000

City – Cherryfield State – ME Zip – 04622

g. Address – 118 Stillwater Rd

City – Cherryfield State – ME Zip – 04622

26. List of Other Certificates or Approvals/Denials received from other Federal, State, or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
National Oceanic Atmospheric Association	Biological Opinion (ESA Sec. 7)	Unknown	01/05/2026		
Maine Department of Environmental Protection	Natural Resources Protection Act Permit by Rule (In-Stream)	HQJ-JX79-QMQ2Q	02/12/2026		
Town of Cherryfield	Land Use and Building Permit	Unknown	02/12/2026		
Town of Cherryfield	Demolition Permit	Unknown	02/12/2026		
Maine Department of Environmental Protection	Natural Resources Protection Act Permit by Rule (Park)	HQK-4Z18-TGVK0	02/12/2026		

* Would include but is not restricted to zoning, building, and flood plain permits

27. Application is hereby made for permit or permits to authorize the work described in this application. I certify that this information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

/s/ - provided on authorized agent form		Kaylee Faltys	02/12/2026
SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

The Application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

U.S. Army Corps of Engineers (USACE)

STANDARD PERMIT PROJECT INFORMATION SHEET

(ITEMS 1 THRU 3 TO BE FILLED OUT BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED
		02/12/2026

(ITEMS BELOW TO BE FILLED OUT BY APPLICANT)

4. SELECT THE TYPE OF PERMIT YOU'RE REQUESTING

☑ Standard ☐ Letter Of Permission ☐ General Permit

5. SELECT A DEVELOPMENT TYPE

☐ Commercial ☐ Non-commercial ☑ Government/Tribal

6. APPLICABLE STATUTORY AUTHORITY

☑ Section 404 Clean Water Act ☐ Section 10 Rivers and Harbors Act ☐ Section 103 of the Marine Protection, Research, and Sanctuaries Act

ENDANGERED AND THREATENED SPECIES

7. DESCRIBE YOUR CURRENT KNOWLEDGE OF ENDANGERED SPECIES THAT MAY BE AFFECTED BY ACTIVITIES OCCURRING WITHIN THE PROJECT OR ACTION AREA

Atlantic salmon,Northern Long-Eared Bat

ADDITIONAL AFFECTED SPECIES:

Federally endangered Atlantic salmon are found in the Narraguagus River watershed throughout the year. During the proposed summer work window (July 15 to October 14), it is very unlikely that juvenile Atlantic salmon will be present in the vicinity of the action area due to high water temperatures, lack of suitable habitat within the impoundment, limited function of the rearing habitat below the dam, lack of documented spawning in the action area, and timing of the work. Out-migrating smolts begin downstream movement in the spring and generally exit the system by the first week of June (communication with Ernie Atkinson of MDMR, May 2025) which is prior to the start of in-water work (July 15). The vast majority of adult Atlantic salmon return to rivers to spawn by mid-June. All known spawning in the Narraguagus River occurs above the impoundment and no redds or spawning habitat are documented downstream of the dam (verbal communication with Ernie Atkinson of MDMR, May 2025). Therefore, adults are expected to utilize the action area for migration only. Based on 4 years of data at the Cherryfield fish trap, the vast majority of adults ascend the fishway at the Cherryfield dam between early June and early July. However, a small number of individuals stray into the system in August or late September occasionally. It is possible that a small number of adult Atlantic salmon individuals may attempt to migrate through the action area during the in-water work window. However, the majority of adults are expected to vacate the action area by mid-July.

Maine Department of Marine Resources has mapped suitable Atlantic rearing habitat above and below the dam. Upstream of the Cherryfield Ice Dam, surveyed rearing habitat on the main stem Narraguagus River begins near the upstream extent of the impoundment and continues beyond the project action area. Most of the surveyed rearing habitat is located outside the project action area, however approximately 0.66 acres occur within the action area at the northern limit of the impoundment. The limited rearing habitat within the impoundment is not expected to be adversely affected by construction activities due to its substantial proximity from the dam. Below the dam, a small amount of rearing habitat (fewer than 10 total habitat units) occurs with the project action area. An additional mile of mapped rearing habitat is present in the reach downstream of the current dam. The mapped critical habitat is based on physical stream characteristics thus does contain elements of the PCEs including limited substrate, depth, and velocity that support rearing development. However, the mapped habitat does not take into account the biological function. The rearing habitat that is present below the dam has limited function due to warm water temperatures, a straightened river channel that lacks sinuosity, and a lack of diversity in habitat. The substrate below the dam is generally gravel-

cobble, but contains artificial fill from the failure of several dam structures over the years
Please see the Biological Assessment for Atlantic salmon for full details.

Northern long-eared bats were identified as potentially present within the project area using the U.S. Fish and Wildlife Service Information for Planning and Consultation (IPaC) tool, however, no designated critical habitat occurs within the project area. Consultation with the U.S. Fish and Wildlife Service is ongoing at the time of this application.

HISTORIC PROPERTIES

8. DESCRIBE YOUR CURRENT KNOWLEDGE OF HISTORIC PROPERTIES THAT WOULD HAVE THE POTENTIAL TO BE IMPACTED BY ACTIVITIES OCCURRING WITHIN THE AREA OF POTENTIAL EFFECT/PERMIT AREA

Following receipt of letter of inquiry, the Maine Historic Preservation Commission determined that there will be no historic properties affected by the project under Section 106 of the National Historic Preservation Act of 1966.

NATIONAL WILD AND SCENIC RIVERS

9. IF THE PROPOSED ACTIVITY WOULD OCCUR IN A NATIONAL WILD AND SCENIC RIVER SYSTEM OR IN AN OFFICIALLY DESIGNATED STUDY RIVER, LIST THE RIVER OR STUDY RIVER

SECTION 408 USACE CIVIL WORKS PROJECTS

10. WILL THE PROPOSED ACTIVITY REQUIRES PERMISSION FROM THE USACE PURSUANT TO 33 U.S.C. 408 BECAUSE IT WILL ALTER OR TEMPORARILY OR PERMANENTLY OCCUPY OR USE A U.S. ARMY CORPS OF ENGINEERS FEDERALLY AUTHORIZED CIVIL WORKS PROJECT?

☐ Yes ☑ No ☐ I'm not sure

11. IF BLOCK 10 IS YES, HAVE YOU SUBMITTED A WRITTEN REQUEST FOR SECTION 408 PERMISSION FROM THE USACE DISTRICT HAVING JURISDICTION OVER THAT PROJECT?	12. IF BLOCK 11 IS YES, PROVIDE THE DATE YOUR REQUEST WAS SUBMITTED TO THE DISTRICT
☐ Yes ☑ No	

SECTION 103 OF THE MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

13. HAS THE PROPOSED DISPOSAL SITE BEEN DESIGNATED FOR USE BY THE ADMINISTRATOR, EPA, PURSUANT TO SECTION 102(C) OF THE MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT OF 1972, AS AMENDED (33 U.S.C. 1413)?

14. IF BLOCK 13 IS NO, DESCRIBE THE CHARACTERISTICS OF THE PROPOSED DISPOSAL SITE AND AN EXPLANATION AS TO WHY NO PREVIOUSLY DESIGNATED DISPOSAL SITE IS FEASIBLE

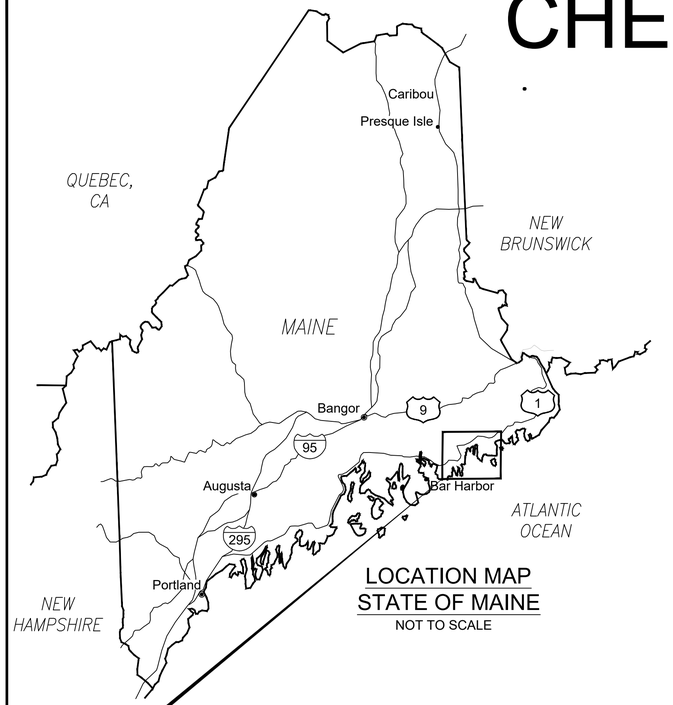
15. DESCRIBE KNOWN DREDGED MATERIAL DISCHARGES AT THE PROPOSED DISPOSAL SITE	
16. PROVIDE THE EXISTENCE AND DOCUMENTED EFFECTS OF OTHER AUTHORIZED DISPOSALS THAT HAVE BEEN MADE IN THE DISPOSAL AREA (E.G., HEAVY METAL BACKGROUND READING AND ORGANIC CARBON CONTENT)	
17. PROVIDE THE ESTIMATED LENGTH OF TIME DURING WHICH THE DISPOSAL WOULD CONTINUE AT THE PROPOSED SITE (in months)	18. PROVIDE THE SOURCE OF THE MATERIAL
19. DESCRIBE THE TYPE AND COMPOSITION OF THE MATERIAL	20. DESCRIBE THE METHOD OF TRANSPORTATION AND DISPOAL OF THE MATERIAL

CHERRYFIELD ICE DAM FISH PASSAGE PROJECT

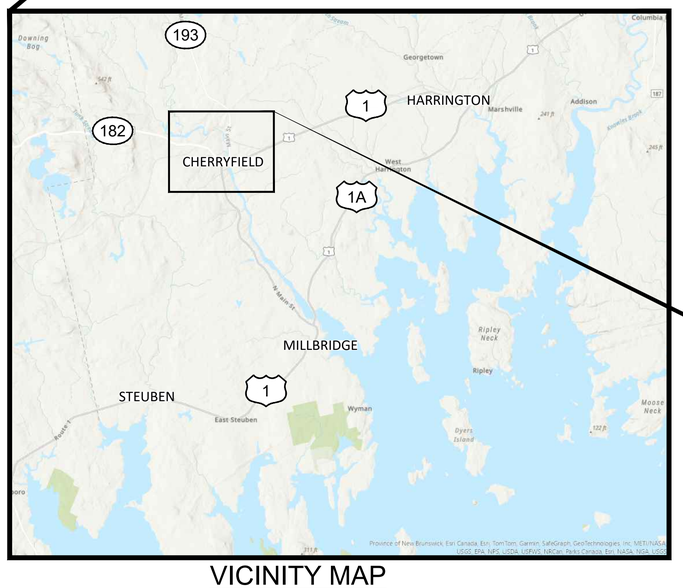
NARRAGUAGUS RIVER, CHERRYFIELD, ME

FINAL DESIGN

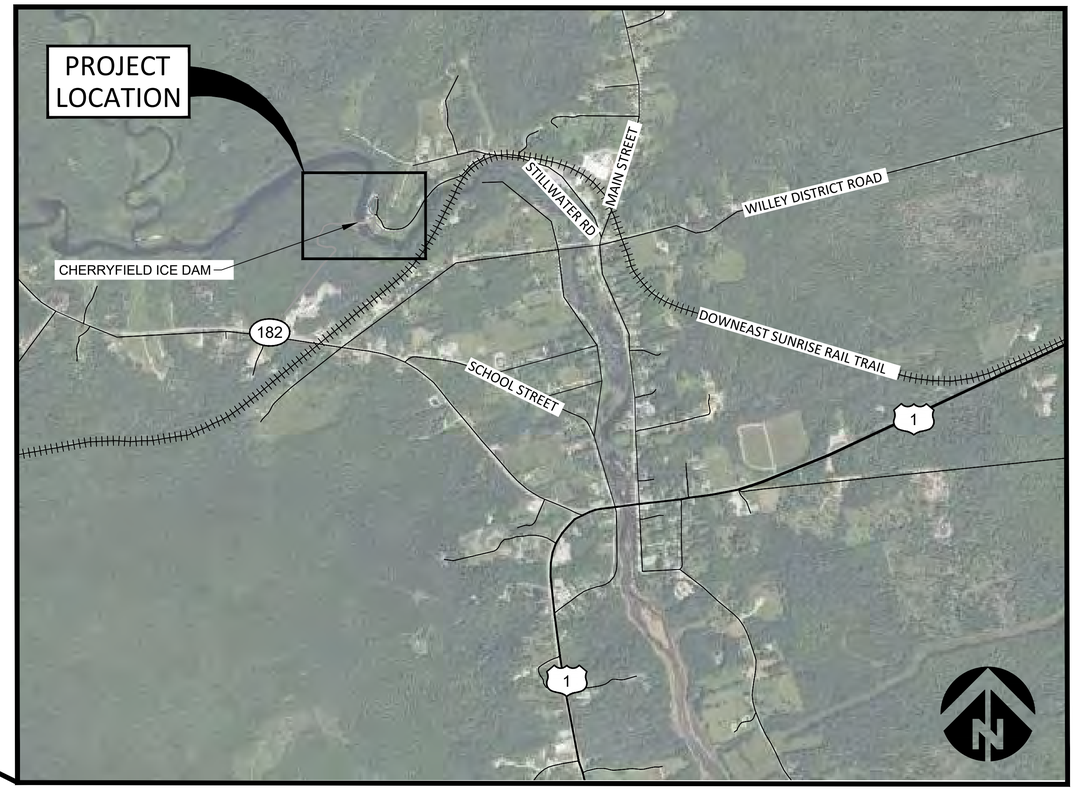
NOVEMBER 2025



LOCATION MAP
STATE OF MAINE
NOT TO SCALE



VICINITY MAP
1' = 10,000'



SITE MAP
1' = 1,000'

SHEET INDEX

1	COVER, LOCATION MAPS, AND SHEET INDEX
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5	ACCESS, STAGING, SEQUENCING AND EROSION CONTROL (2 OF 4)
6	ACCESS, STAGING, SEQUENCING AND EROSION CONTROL (3 OF 4)
7	ACCESS, STAGING, SEQUENCING AND EROSION CONTROL (4 OF 4)
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9	DEMOLITION AND REMOVAL PLAN
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11	REACH PROFILE
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16	PRIMARY CHANNEL GRADING SECTIONS (1 OF 2)
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18	CHANNEL TYPICAL SECTIONS AND DETAILS (1 OF 3)
19	STEP POOL CONSTRUCTION SEQUENCE
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22	FES LIFTS AND SURFACE FABRIC DETAILS (1 OF 2)
23	FES LIFTS AND SURFACE FABRIC DETAIL (2 OF 2)
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25	REVEGETATION TYPICAL DETAILS
26	REVEGETATION SCHEDULE
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SS-102	BORING LOGS
SS-103	HISTORICAL DRAWINGS: DAM PROFILE AND SECTION
SS-104	HISTORICAL DRAWINGS: DAM SECTIONS
SS-105	HISTORICAL DRAWINGS: CRIB AND SLUICEWAY DETAILS
SD-101	STRUCTURAL DETAILS I
CS-101	SITE IMPROVEMENT PLAN
CS-102	SITE IMPROVEMENT PLAN ENLARGEMENT
CS-103	SITE IMPROVEMENT- OVERLOOK PLAN ENLARGEMENT
CG-101	GRADING PLAN - RIVER LEFT
CG-102	GRADING PLAN - RIVER RIGHT
LP-101	LANDSCAPE PLAN
CD-101	CIVIL DETAILS
CD-102	CIVIL DETAILS
CD-103	CIVIL DETAILS
CD-104	CIVIL DETAILS

COORDINATES:

LATITUDE: 44°36'30.42" N
LONGITUDE: 67°56'04.07" W

WATERBODY: NARRAGUAGUS RIVER

DIG SAFE: STATE LAW REQUIRES ANY PERSON PERFORMING EXCAVATION ON PRIVATE OR PUBLIC PROPERTY TO CALL DIG SAFE AT 1-888-DIG-SAFE OR 8-1-1. ALL EXCAVATIONS SHALL BE ACCOMPLISHED IN ACCORDANCE WITH MAINE DIG SAFE LAW.

STATE OF MAINE
MARCEL YOUNG-SCIACCA
No. 16803
LICENSED
PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISION DESCRIPTION
1	MYS	11/2025	RELEASED FOR BIDDING

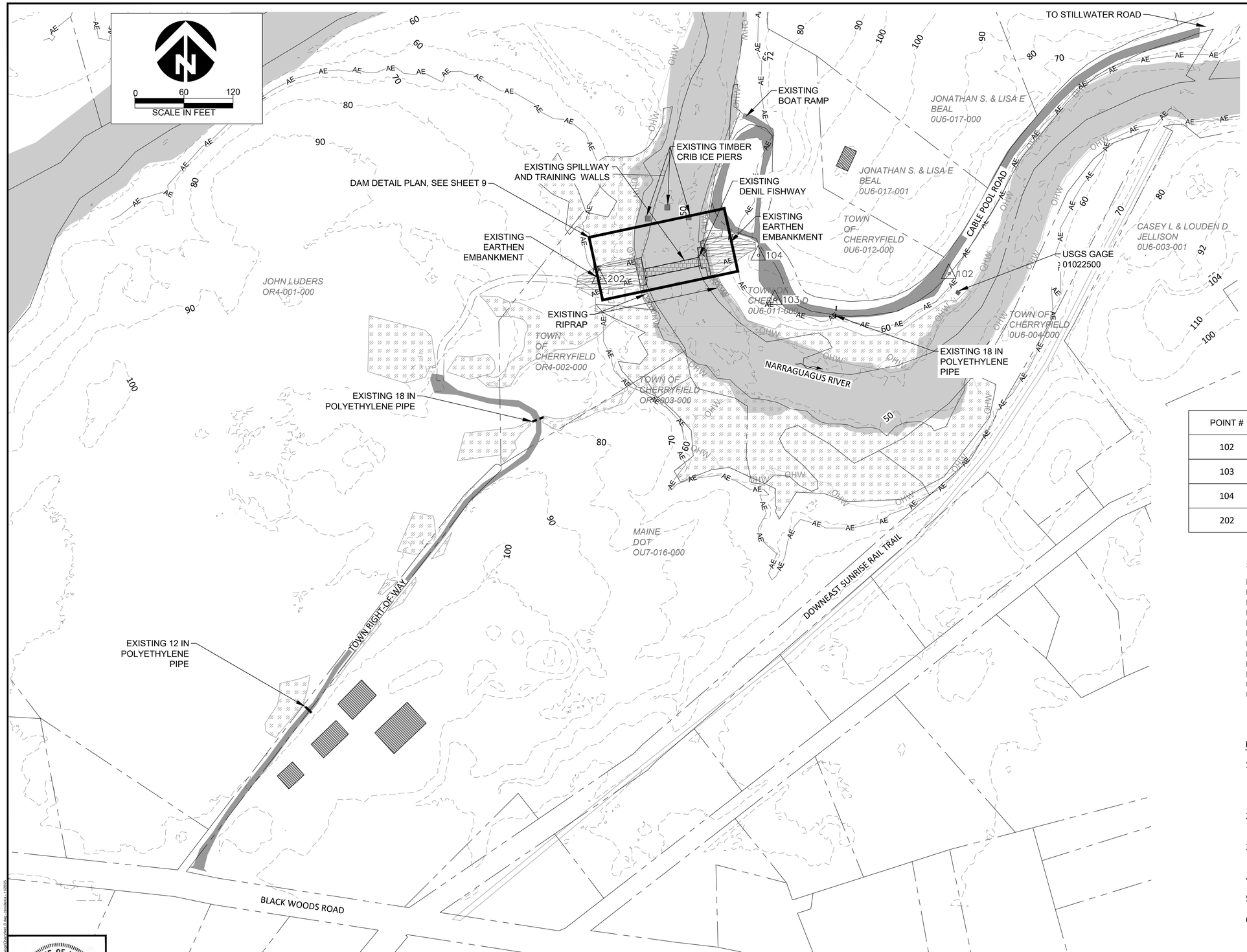
BB	MYS, SS	MB, MM
DRAWN	DESIGNED	CHECKED
MYS	11/25	23-05-14
APPROVED	DATE	PROJECT

CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

inter-fluve
181 Main Street, 2nd Floor
P.O. Box 236
Damariscotta, ME 04543
207.315.7014
www.interfluve.com

COVER, LOCATION MAPS, AND SHEET INDEX

SHEET
1 OF 45



LEGEND

- EXISTING 10 FT CONTOUR
- 100 CONTROL POINT
- OHW EXISTING ORDINARY HIGH WATER
- APPROXIMATE PARCEL LINES
- DELINEATED WETLAND
- EXISTING CHANNEL
- EXISTING DAM
- EXISTING EMBANKMENTS
- EXISTING BUILDINGS
- EXISTING ROAD
- AE AE FEMA ZONE AE

SURVEY CONTROL

POINT #	NORTHING	EASTING	ELEVATION	DESCRIPTION
102	343683.78	1131147.41	62.86	CAPPED REBAR
103	343620.18	1130722.05	64.06	CAPPED REBAR
104	343729.10	1130681.26	71.63	CAPPED REBAR
202	343672.05	1130293.08	71.75	CAPPED REBAR

ABBREVIATIONS

NOAA	NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NAD	NORTH AMERICAN DATUM
NAVD	NORTH AMERICAN VERTICAL DATUM
MEGIS	MAINE OFFICE OF GIS
PWS	PROFESSIONAL WETLAND SCIENTIST
FEMA	FEDERAL EMERGENCY MANAGEMENT AGENCY
MEDOT	MAINE DEPARTMENT OF TRANSPORTATION
ME DEP	MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION
ME DIFW	MAINE DEPARTMENT OF INLAND FISHERIES AND WILDLIFE
ME DMR	MAINE DEPARTMENT OF MARINE RESOURCES
USACE	UNITED STATES ARMY CORPS OF ENGINEERS
USFWS	UNITED STATES FISH AND WILDLIFE SERVICE

NOTES:

1. EXISTING TOPOGRAPHIC AND BATHYMETRIC CONTOURS BASED ON SURVEY COLLECTED BY WOOD ENGINEERING AUGUST AND SEPTEMBER 2018, AND SURVEY COLLECTED BY INTERFLUVE JULY 2023, NOVEMBER 2024, AND MAY 2025. BATHYMETRIC CONTOURS SHOULD BE CONSIDERED APPROXIMATE.
2. LIDAR DATA OBTAINED FROM NOAA DIGITAL COAST, DATE OF ACQUISITION 2017, PROVIDES SUPPLEMENTAL TOPOGRAPHY OUTSIDE THE LIMITS OF THE TOPOGRAPHIC AND BATHYMETRIC SURVEY.
3. HORIZONTAL COORDINATES ARE REFERENCED TO MAINE STATE PLANE, EAST ZONE, NAD 83, US SURVEY FEET. ELEVATIONS ARE REFERENCED TO NAVD 1988, FEET.
4. PARCEL LINES OBTAINED FROM STATE OF MAINE GIS DATABASE AND SHOULD BE CONSIDERED APPROXIMATE.
5. WETLAND DELINEATION WAS CONDUCTED BY ALAN HABERSTOCK, PWS, MAY AND AUGUST 2025.
6. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) ZONE AE LINEWORK OBTAINED FROM THE FLOOD MAP SERVICE CENTER EFFECTIVE JULY 18, 2017.

STATE OF MAINE — MARCEL YOUNG-SZACKI — No. 16803 — LICENSED PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISION DESCRIPTION

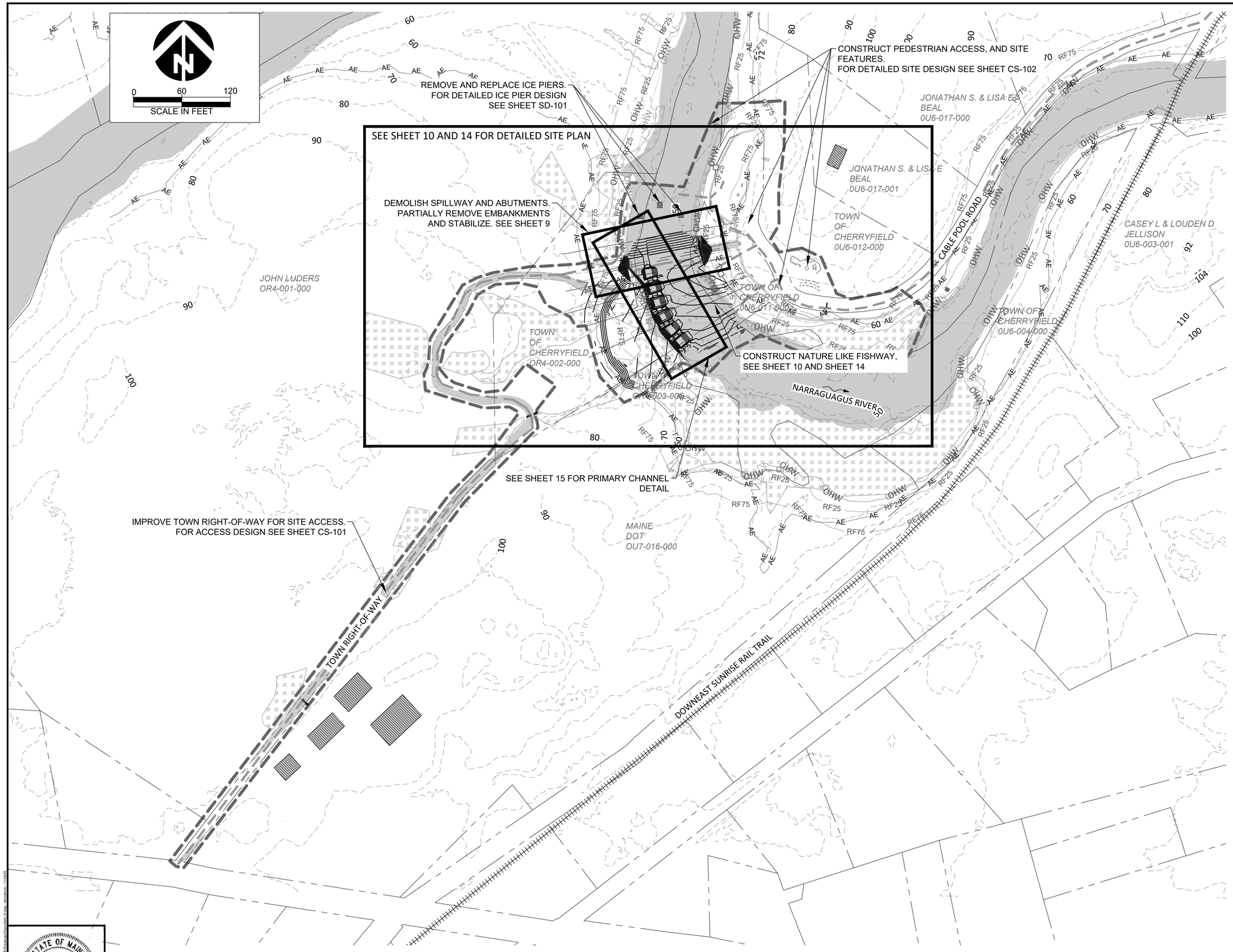
BB	MYS, SS	MB, MM
DRAWN	DESIGNED	CHECKED
MYS	11/25	23-05-14
APPROVED	DATE	PROJECT

CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

inter·fluve
181 Main Street, 2nd Floor
P.O. Box 236
Damariscotta, ME 04543
207.315.7014
www.interfluve.com

EXISTING CONDITIONS AND SURVEY CONTROL

SHEET 2 OF 45



STATE OF MAINE
MARCEL YOUNG-SPAGGS
No. 16803
LICENSED PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISION DESCRIPTION

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SITE PLAN & SHEET KEY

SHEET
3 OF 45

0 40 80
SCALE IN FEET

EROSION CONTROL NOTES

1. ALL SPECIFIC EROSION CONTROL BEST MANAGEMENT PRACTICES, INCLUDING WORK AREA ISOLATION, SEDIMENT CONTAINMENT, AND POLLUTION PREVENTION MEASURES SHALL COMPLY WITH ALL PROJECT PERMITS, PROJECT SPECIFICATIONS, THE MAINE DOT BEST MANAGEMENT PRACTICES FOR EROSION CONTROL AND SEDIMENTATION CONTROL MANUAL (MEDOT 2008), AND THE MAINE DEP EROSION AND SEDIMENT CONTROL PRACTICES FIELD GUIDE FOR CONTRACTORS (MEDEP 2014).
2. THE CONTRACTOR SHALL SUBMIT A PROJECT SPECIFIC SOIL EROSION AND WATER POLLUTION CONTROL PLAN TO ENGINEER FOR REVIEW. PLAN MUST BE ACCEPTED PRIOR TO MOBILIZATION TO THE PROJECT SITE.
3. ALL AREAS OF EXPOSED SOIL SHALL BE SEEDED WITH NATIVE VEGETATIVE SPECIES UPON COMPLETION OF FINISHED GRADING IN EACH AREA OF THE PROJECT SITE.
4. LOCATIONS OF TEMPORARY ACCESS INDICATE GENERAL CORRIDORS, FINAL ALIGNMENTS AND CONFIGURATION TO BE CONFIRMED IN THE FIELD AT THE TIME OF CONSTRUCTION.
5. LIMITS OF CLEARING TO BE CONFIRMED IN THE FIELD AT THE TIME OF CONSTRUCTION.

LEGEND
- EXISTING 2 FT CONTOUR
- OHW — EXISTING ORDINARY HIGH WATER
- STAGING AREA
- SILT FENCE
- CONSTRUCTION ACCESS
- APPROXIMATE PARCEL LINES
- LIMITS OF DISTURBANCE
- EXISTING CULVERT
- DELINEATED WETLAND
- EXISTING DAM
- EXISTING EMBANKMENT
- EXISTING CHANNEL
- EXISTING BUILDING
- EXISTING ROAD
- AE — AE — FEMA ZONE AE
- ② — CONSTRUCTION SEQUENCE IDENTIFIERS

STAGING AREA, SURROUND WITH SILT FENCING, TYP.

ACCESS ROUTE

INGRESS/EGRESS

TO STILLWATER ROAD

CABLE POOL ROAD

TOWN OF CHERRYFIELD OR4-002-000

TOWN OF CHERRYFIELD OR4-003-000

TOWN OF CHERRYFIELD 0U6-012-000

ACCESS ROUTE, TYP.

TO BLACK WOODS ROAD

INGRESS/EGRESS

NARRAGUAGUS RIVER

SUGGESTED CONSTRUCTION SEQUENCING (1 OF 4)

PROJECT INITIATION

1. MOBILIZATION
2. IDENTIFY AND PREPARE STAGING AREAS AND SITE ACCESS ROUTES
3. INSTALL EROSION AND SEDIMENT CONTROL MEASURES
4. COMMENCE PROJECT CLEARING.
   NOTE: NO TREE GREATER THAN 3 INCHES DBH SHALL BE REMOVED BETWEEN APRIL 15 AND SEPTEMBER 20. SCHEDULE PROJECT CLEARING TO OCCUR BETWEEN OCTOBER 1 AND APRIL 14, INCLUSIVE.
5. DEMOLISH TIMBER CRIB ABUTMENTS
6. BREACH DAM, PARTIAL DRAWDOWN OF IMPOUNDMENT.
   NOTE: ALL IN-WATER WORK SHALL BE COMPLETED WITHIN THE IN-WATER WORK WINDOW BETWEEN JULY 15 AND OCTOBER 14. ANY IN-WATER WORK OUTSIDE OF THE IN-WATER WORK WINDOW REQUIRES COORDINATION AND APPROVAL FROM USACE, NOAA, USFWS, AND MEDEP, ME DIFW AND ME DMR. CONTRACTOR MAY DRAW DOWN THE IMPOUNDMENT PARTIALLY TO AID PROJECT CONSTRUCTION. MINIMUM IMPOUNDMENT WATER SURFACE ELEVATION = 53.0 FT. NORMAL MINIMUM POOL ELEVATION = 57.0 FT. DRAWDOWN RATE SHALL NOT EXCEED 2 FT PER DAY OR 6-IN PER HOUR.

STATE OF MAINE — MARCEL YOUNG-SCIGLIO — No. 16803 — LICENSED PROFESSIONAL ENGINEER

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ACCESS, STAGING, SEQUENCING AND EROSION CONTROL (1 OF 4)

0 40 80
SCALE IN FEET

EROSION CONTROL NOTES

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LEGEND
- EXISTING 2 FT CONTOUR
- PROPOSED 1 FT CONTOUR
- OHW — EXISTING ORDINARY HIGH WATER
- OHW — PROPOSED ORDINARY HIGH WATER
- STAGING AREA
- WORK AREA EXCLUSION 1
- SILT FENCE
- CONSTRUCTION ACCESS
- APPROXIMATE PARCEL LINES
- LIMITS OF DISTURBANCE
- EXISTING CULVERT
- DELINEATED WETLAND
- EXISTING CHANNEL
- EXISTING STRUCTURE
- EXISTING ROAD
- FISH PASSAGE ZONE
- EXISTING RIPRAP
- AE — AE — FEMA ZONE AE
- ② CONSTRUCTION SEQUENCE IDENTIFIERS

STAGING AREA, SURROUND WITH SILT FENCING, TYP.

ANTICIPATED RUN-OF-RIVER/FISH PASSAGE ZONE

ACCESS ROUTE

INGRESS/EGRESS

TO STILLWATER ROAD

CABLE POOL ROAD

TOWN OF CHERRYFIELD OR4-002-000

TOWN OF CHERRYFIELD OR4-003-000

NARRAGUAGUS RIVER

ACCESS ROUTE, TYP.

TO BLACK WOODS ROAD

INGRESS/EGRESS

SUGGESTED CONSTRUCTION SEQUENCING (2 OF 4)

PHASE 1

7. IMPLEMENT PHASE 1 WORK AREA ISOLATION AND WATER CONTROL MEASURES.
   - A. FISH REMOVAL SHALL OCCUR IN ISOLATED AREAS BEFORE WORK MAY COMMENCE. COORDINATION WITH THE PROJECT ENGINEER AND MAINE DEPARTMENT OF MARINE RESOURCES REQUIRED.
   - B. CONTRACTOR SHALL INSTALL WATER CONTROL MEASURES IN A MANNER THAT MAINTAINS A FISH MIGRATION CORRIDOR THROUGH THE PROJECT SITE. THE FISH MIGRATION CORRIDOR CAN BE USED TO MAINTAIN RUN OF RIVER FLOW THROUGH THE PROJECT SITE.
8. DEMOLISH EXISTING ICE PIERS
9. INSTALL PROPOSED ICE PIERS
10. PARTIALLY DEMOLISH EXISTING SPILLWAY
11. CONSTRUCT PRIMARY CHANNEL OF FISHWAY
12. BEGIN CONSTRUCTION OF ROUGHENED CHANNEL AND OVERBANK
13. GRADE RIVER RIGHT EMBANKMENT AND INSTALL HEAVY RIPRAP

STATE OF MAINE — MARCEL YOUNG-SCIACCA — No. 16803 — LICENSED PROFESSIONAL ENGINEER

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ACCESS, STAGING, SEQUENCING AND EROSION CONTROL (2 OF 4)

SHEET 5 OF 45

0 40 80
SCALE IN FEET

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LEGEND
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- PROPOSED 1 FT CONTOUR
- OHW — EXISTING ORDINARY HIGH WATER
- OHW — PROPOSED ORDINARY HIGH WATER
- STAGING AREA
- WORK AREA EXCLUSION 2
- SILT FENCE
- CONSTRUCTION ACCESS
- APPROXIMATE PARCEL LINES
- LIMITS OF DISTURBANCE
- EXISTING CULVERT
- DELINEATED WETLAND
- EXISTING CHANNEL
- EXISTING STRUCTURE
- EXISTING ROAD
- FISH PASSAGE ZONE
- EXISTING RIPRAP
- AE — AE — FEMA ZONE AE
- (2) CONSTRUCTION SEQUENCE IDENTIFIERS

STAGING AREA, SURROUND WITH SILT FENCING, TYP.

ACCESS ROUTE

INGRESS/EGRESS

TO STILLWATER ROAD

CABLE POOL ROAD

TOWN OF CHERRYFIELD 0U6-012-000

TOWN OF CHERRYFIELD OR4-002-000

ANTICIPATED RUN-OF-RIVER/FISH PASSAGE ZONE

TOWN OF CHERRYFIELD OR4-003-000

NARRAGUAGUS RIVER

ACCESS ROUTE, TYP.

TO BLACK WOODS ROAD

INGRESS/EGRESS

SUGGESTED CONSTRUCTION SEQUENCING (3 OF 4)

PHASE 2

14. IMPLEMENT PHASE 2 WORK AREA ISOLATION AND WATER CONTROL.
    A. IF CONTRACTOR ELECTS TO PARTIALLY DRAW DOWN THE IMPOUNDMENT, THE CONTRACTOR MAY NEED TO REFILL THE IMPOUNDMENT BEFORE INITIATING PHASE 2 WATER CONTROL MEASURES. WHILE REFILLING THE IMPOUNDMENT, THE CONTRACTOR SHALL PROVIDE AT LEAST 10 CFS THROUGH THE PROJECT SITE TO MAINTAIN DOWNSTREAM RIVERINE HABITAT.
    B. FISH REMOVAL SHALL OCCUR IN ISOLATED AREAS BEFORE WORK MAY COMMENCE. COORDINATION WITH THE PROJECT ENGINEER AND MAINE DEPARTMENT OF MARINE RESOURCES REQUIRED.
    C. CONTRACTOR SHALL INSTALL WATER CONTROL MEASURES IN A MANNER THAT MAINTAINS A FISH MIGRATION CORRIDOR THROUGH THE PROJECT SITE. THE FISH MIGRATION CORRIDOR CAN BE USED TO MAINTAIN RUN OF RIVER FLOW THROUGH THE PROJECT SITE.
15. DEMOLISH REMAINING PIER
16. INSTALL STONE ICE PIER
17. DEMOLISH REMAINING PORTIONS OF THE EXISTING SPILLWAY
18. FINISH CONSTRUCTION OF PRIMARY CHANNEL AND ROUGHENED CHANNEL
19. GRADE RIVER LEFT EMBANKMENT AND INSTALL HEAVY RIPRAP
20. INSTALL BANK PROTECTION ON RIVER LEFT

STATE OF MAINE
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LICENSED PROFESSIONAL ENGINEER

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ACCESS, STAGING, SEQUENCING AND EROSION CONTROL (3 OF 4)

SHEET
6 OF 45

0 40 80
SCALE IN FEET

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- EXISTING ROAD
- FISH PASSAGE ZONE
- SITE IMPROVEMENTS
- AE — AE — FEMA ZONE AE
- (2) CONSTRUCTION SEQUENCE IDENTIFIERS

STAGING AREA, SURROUND WITH SILT FENCING, TYP.

ACCESS ROUTE

INGRESS/EGRESS

TO STILLWATER ROAD

CABLE POOL ROAD

TOWN OF CHERRYFIELD OR4-002.000

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ANTICIPATED RUN-OF-RIVER/FISH PASSAGE ZONE

NARRAGUAGUS RIVER

TOWN OF CHERRYFIELD OR4-003.000

ACCESS ROUTE, TYP.

TO BLACK WOODS ROAD

INGRESS/EGRESS

CONSTRUCTION SEQUENCE IDENTIFIERS

SUGGESTED CONSTRUCTION SEQUENCING (4 OF 4)

PHASE 3

21. PHASE 3 WORK AREA SHOULD OCCUR OUT OF WATER.
22. CONSTRUCT PROPOSED OVERBANK ON RIVER RIGHT
23. CONSTRUCT NEW BANK ON RIVER RIGHT
24. COMPLETE UPLAND CONSTRUCTION INCLUDING ALL PROPOSED PARK FEATURES
25. PLANTING AND REVEGETATION
26. RESTORE ALL AREA TO PRE-PROJECT CONDITION OR BETTER
27. DEMOBILIZATION

STATE OF MAINE
MARCEL YOUNG-STACCHI
No. 16803
LICENSED PROFESSIONAL ENGINEER

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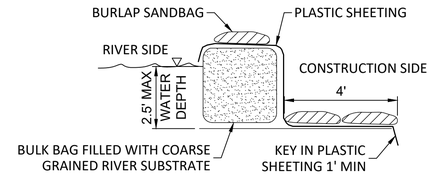
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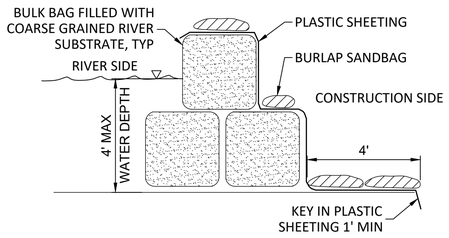
ACCESS, STAGING, SEQUENCING AND EROSION CONTROL (4 OF 4)

SHEET
7 OF 45



SINGLE LAYER COFFERDAM

(WATER DEPTH LESS THAN 2.5')



STACKED BULK BAG COFFERDAM

(WATER DEPTH GREATER THAN 2.5')

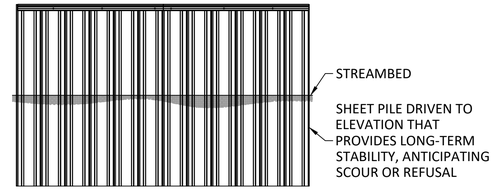
BULK BAG NOTES:

1. DETAIL PROVIDED FOR GENERAL REPRESENTATION. LOCATIONS AND DESIGN DETAILS TO BE DETERMINED BY THE CONTRACTOR IF SELECTED FOR USE IN CONTROL OF WATER PLAN.
2. BULK BAG COFFERDAM SHALL BE CONSTRUCTED OF SEVERAL UNITS OF BULK BAGS FILLED WITH WASHED COBBLE, AND ABUTTED SIDE BY SIDE TO CREATE A ROW THAT ISOLATES THE CONSTRUCTION SITE.
3. IF WATER DEPTH EXCEEDS 85% OF THE BULK BAG HEIGHT, AN ADDITIONAL TOP ROW OF BULK BAGS SHALL BE INSTALLED, SUPPORTED BY TWO BOTTOM ROWS OF BULK BAGS. BULK BAG COFFERDAM SHALL BE SEALED BY COVERING THE COFFERDAM WITH PLASTIC SHEETING HELD IN PLACE BY STANDARD SANDBAGS PLACED IN ROWS ON TOP OF COFFERDAM, AND AT TOE OF COFFERDAM.
4. THE PLASTIC SHEETING SHALL BE DRAPED ALONG THE CHANNEL BOTTOM ON THE RIVER SIDE OF THE COFFERDAM WITH OUTWARD EDGE OF SHEETING MINIMUM 4-FEET FROM TOE OF COFFERDAM. THE DRAPED PORTION OF PLASTIC SHEETING SHALL BE PINNED TO THE CHANNEL BED BY MINIMUM TWO ROWS OF STANDARD SANDBAGS. ALL SANDBAGS SHALL BE FILLED WITH WASHED PEA GRAVEL.
5. THE TERMINAL ENDS OF BULK BAG COFFERDAM, WHERE IT CONNECTS TO CHANNEL BANK OR HIGH GROUND, SHALL BE SEALED WITH PLASTIC SHEETING AND STANDARD SANDBAGS.
6. BULK BAGS SHALL BE CUBE-SHAPED POLYPROPYLENE WOVEN FABRIC BAGS WITH FULLY OPEN TOP, FLAT BOTTOM, FOUR LOOPS, MINIMUM 2-TON WEIGHT CAPACITY, MINIMUM 5:1 SAFETY FACTOR.
7. PLASTIC SHEETING SHALL BE MINIMUM 6-MIL THICKNESS. ROLL LENGTH SHALL BE LONG ENOUGH TO ENSURE THAT ENTIRE LENGTH OF COFFERDAM WILL BE COVERED WITHOUT A SEAM. MINIMUM 12-FT WIDE ROLL SHALL BE USED FOR SINGLE LAYER BULK BAG COFFERDAM. MINIMUM 16-FT WIDE ROLL SHALL BE USED FOR 2-LAYER STACKED BULK BAG COFFERDAM.
8. ALTERNATE COFFERDAM MATERIALS AND CONFIGURATIONS MAY BE ALLOWED BUT SHALL NOT BE IMPLEMENTED WITHOUT REVIEW AND APPROVAL BY THE OWNER'S REPRESENTATIVE. CONTRACTOR SHALL PROVIDE SHOP DRAWINGS AND/OR VENDOR CUT SHEETS FOR SUBSTITUTIONS.
9. IF FLOW CONDITIONS ENCOUNTERED ON SITE DURING CONSTRUCTION DO NOT ALLOW FOR SUCCESSFUL DEWATERING USING THIS METHOD, SHEETPILE COFFERDAM (HIGH FLOWS) OR SAND BAG COFFERDAM (LOW FLOWS) MAY BE CONSIDERED.

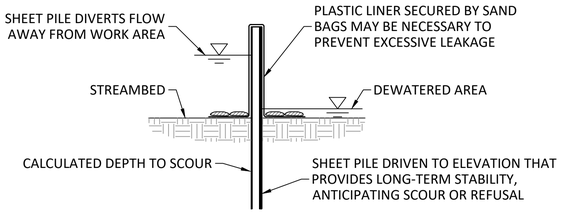
1/8 TYPICAL SECTION - BULK BAG COFFERDAM
NOT TO SCALE

NOTES:

1. DETAIL PROVIDED FOR GENERAL REPRESENTATION. LOCATIONS AND DESIGN DETAILS TO BE DETERMINED BY THE CONTRACTOR IF SELECTED FOR USE IN CONTROL OF WATER PLAN.



ELEVATION

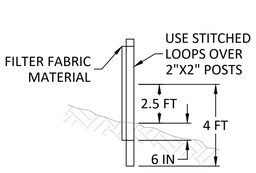


SECTION

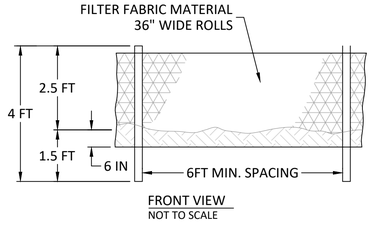
2/8 TYPICAL SECTION - TEMPORARY SHEET PILE COFFERDAM
NOT TO SCALE

SILT FENCE NOTES

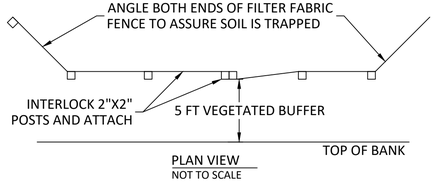
1. DETAIL PROVIDED FOR GENERAL REPRESENTATION. LOCATIONS AND DESIGN DETAILS TO BE DETERMINED BY THE CONTRACTOR IF SELECTED FOR USE IN CONTROL OF WATER PLAN.
2. THE FILTER FABRIC SHALL BE PURCHASED IN A CONTINUOUS ROLL CUT TO THE LENGTH OF THE BARRIER TO AVOID USE OF JOINTS. WHEN JOINTS ARE NECESSARY, FILTER CLOTH SHALL BE SPLICED TOGETHER ONLY AT A SUPPORT POST, WITH A MINIMUM 6 INCH OVERLAP, AND BOTH ENDS SECURELY FASTENED TO THE POST. ALTERNATIVELY, OVERLAP AND INTERLOCK TWO POSTS WITH ATTACHED FABRIC AS APPROVED BY THE OWNER'S REPRESENTATIVE.
3. THE SILT FENCE IS TO BE INSTALLED AT LOCATIONS SHOWN ON THE PLAN ALONG THE DOWNHILL PERIMETER OF DISTURBED AREAS. THE FENCE POST SHALL BE SPACED A MAXIMUM OF 6 FEET APART AND DRIVEN SECURELY INTO THE GROUND A MINIMUM OF 24 INCHES APART.
4. THE FILTER FABRIC SHALL HAVE A MINIMUM VERTICAL BURIAL OF 6 INCHES. ALL EXCAVATED MATERIAL FROM SILT FENCE INSTALLATION SHALL BE BACK-FILLED AND COMPACTED ALONG THE ENTIRE DISTURBED AREA.
5. STANDARD OR HEAVY DUTY SILT FENCE SHALL HAVE MANUFACTURED STITCHED LOOPS FOR 2 INCHES X 2 INCHES POST INSTALLATION.
6. SILT FENCES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE, BUT NOT BEFORE THE UPSLOPE AREA HAS BEEN PERMANENTLY PROTECTED AND STABILIZED, OR AS DIRECTED BY THE OWNER'S REPRESENTATIVE.



SIDE VIEW
NOT TO SCALE



FRONT VIEW
NOT TO SCALE

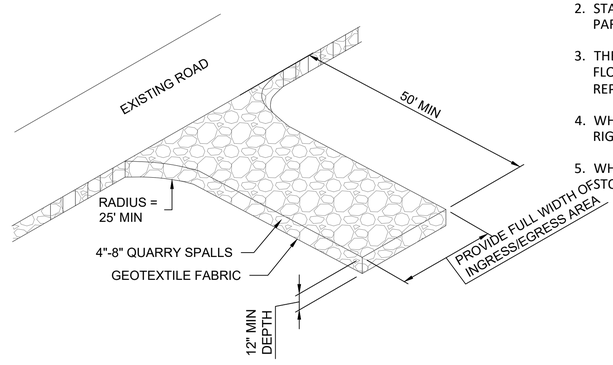


PLAN VIEW
NOT TO SCALE

3/8 TYPICAL SECTION - SILT FENCE
NOT TO SCALE

CONSTRUCTION ENTRANCE NOTES:

1. DETAIL PROVIDED FOR GENERAL REPRESENTATION. LOCATION AND DESIGN DETAILS TO BE DETERMINED BY THE CONRACTOR IF SELECTED FOR USE IN CONTROL OF WATER PLAN.
2. STABILIZED ACCESS MUST BE USED IN ALL AREAS OF THE SITE WITH VEHICLE TRAFFIC AND PARKING.
3. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
4. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
5. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.



4/8 TYPICAL DETAIL - CONSTRUCTION ENTRANCE
NOT TO SCALE

STATE OF MAINE
MARCEL YOUNG-SAGGESE
No. 16803
LICENSED PROFESSIONAL ENGINEER
February 2014

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EROSION CONTROL DETAILS

SHEET
8 OF 45

0 10 20
SCALE IN FEET

DEMOLISH, REMOVE, AND REPLACE EXISTING ICE PIERS. REMOVE DEBRIS TO PRE-PIER RIVERBED. SALVAGED ROCK FILL TO BE INCORPORATED IN THE NATURE-LIKE FISHWAY. FOR PROPOSED ICE PIER DESIGN SEE SHEET SD-101

EXISTING TIMBER CRIB ABUTMENT

EXISTING TIMBER CRIB ABUTMENT AND DENIL FISHWAY

NARRAGUAGUS RIVER

EXISTING TIMBER CRIB SIPLLWAY

PORTION OF THE EXISTING EMBANKMENT TO REMAIN

PARTIALLY REMOVE THE EMBANKMENT AND GRADE AS INDICATED

DEMOLISH AND REMOVE EXISTING DAM SPILLWAY AND ABUTMENTS. REMOVE DEBRIS TO NATIVE MATERIAL. SEE SHEETS SS104-SS106 FOR HISTORICAL DAM DRAWINGS. SALVAGE EXISTING ROCK FILL TO BE INCORPORATED IN THE PROJECT.

PORTION OF THE EXISTING EMBANKMENT TO REMAIN

SALVAGE EXISTING RIPRAP

SALVAGE EXISTING RIPRAP

LEGEND

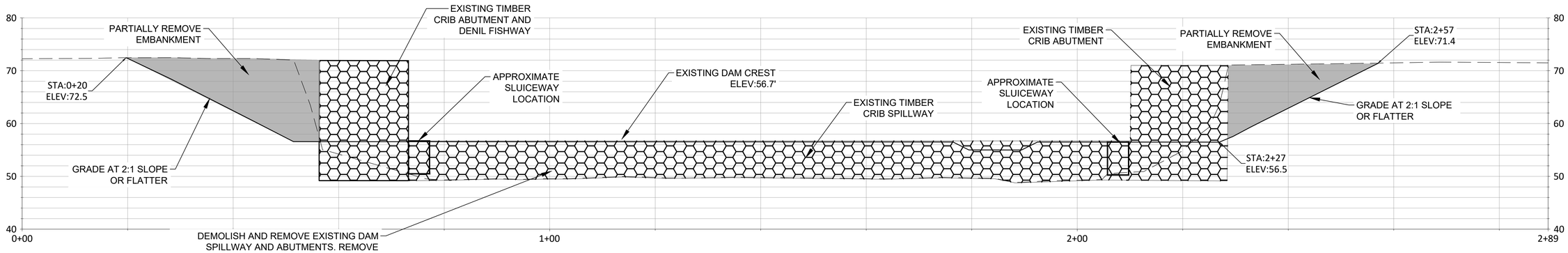
- EXISTING 2 FT. CONTOUR
- EXISTING ORDINARY HIGH WATER
- LIMITS OF DISTURBANCE
- APPROXIMATE PARCEL LINES
- STRUCTURE REMOVAL
- EMBANKMENT REMOVAL
- DELINEATED WETLAND
- AE——AE FEMA ZONE AE

NOTE: EXACT DAM AND PIER FOUNDATION EXTENTS ARE NOT FIELD VERIFIED AND SHOULD BE CONSIDERED APPROXIMATE. THE CONTRACTOR SHALL FIELD VERIFY THE ACTUAL EXTENTS OF STRUCTURE FOUNDATIONS DURING CONSTRUCTION.

SECTION LEGEND

- EXISTING GRADE
- STRUCTURE REMOVAL
- EMBANKMENT REMOVAL

1x VERTICAL EXAGGERATION
10'
10'



1/9 DEMOLITION SECTION

STATE OF MAINE
MARCEL YOUNG-SEAGER
No. 16803
LICENSED PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISION DESCRIPTION

BB	MYS, SS	MB, MM
DRAWN	DESIGNED	CHECKED
MYS	11/25	23-05-14
APPROVED	DATE	PROJECT

CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

inter·fluve
181 Main Street, 2nd Floor
P.O. Box 236
Damariscotta, ME 04543
207.315.7014
www.interfluve.com

DEMOLITION AND REMOVAL PLAN

SHEET
9 OF 45

0 50 100
SCALE IN FEET

FOR ICE PIER DESIGN SEE SHEET SD-101

GRADE CONTROL, SEE SHEET 20

FOR SITE IMPROVEMENTS SEE SHEET CS-101

POOL, TYP.

STEP, TYP.

ROUGHNESS BOULDER TYP., SEE DETAILS 1/21 2/21

FOR SITE IMPROVEMENTS SEE SHEET CS-102

FIELD FIT TIE-IN TO EXISTING GRADE TO ENHANCE FISH PASSAGE PER ENGINEER GUIDANCE

PRIMARY CHANNEL ALIGNMENT, SEE PROFILE SHEET 11

NARRAGUAGUS RIVER

1009+00 1008+00 1007+00 1006+00 1005+00 1004+00 1003+00 1002+00

71.39 55.00 72.33

LEGEND

- EXISTING 2 FT. CONTOUR
- PROPOSED 1 FT. CONTOUR
- OHW EXISTING ORDINARY HIGH WATER
- OHW PROPOSED ORDINARY HIGH WATER
- 20+00 PROPOSED ALIGNMENT
- LIMITS OF DISTURBANCE
- APPROXIMATE PARCEL LINES
- REPLACED ICE PIERS
- POOLS
- DELINEATED WETLANDS
- SITE IMPROVEMENTS
- AE FEMA ZONE AE
- RF25 RIVERFRONT BUFFER 25'
- RF75 RIVERFRONT BUFFER 75'

STATE OF MAINE
MARCEL YOUNG-SCIACCA
No. 16803
LICENSED PROFESSIONAL ENGINEER

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CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
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NATURE-LIKE FISHWAY GRADING PLAN

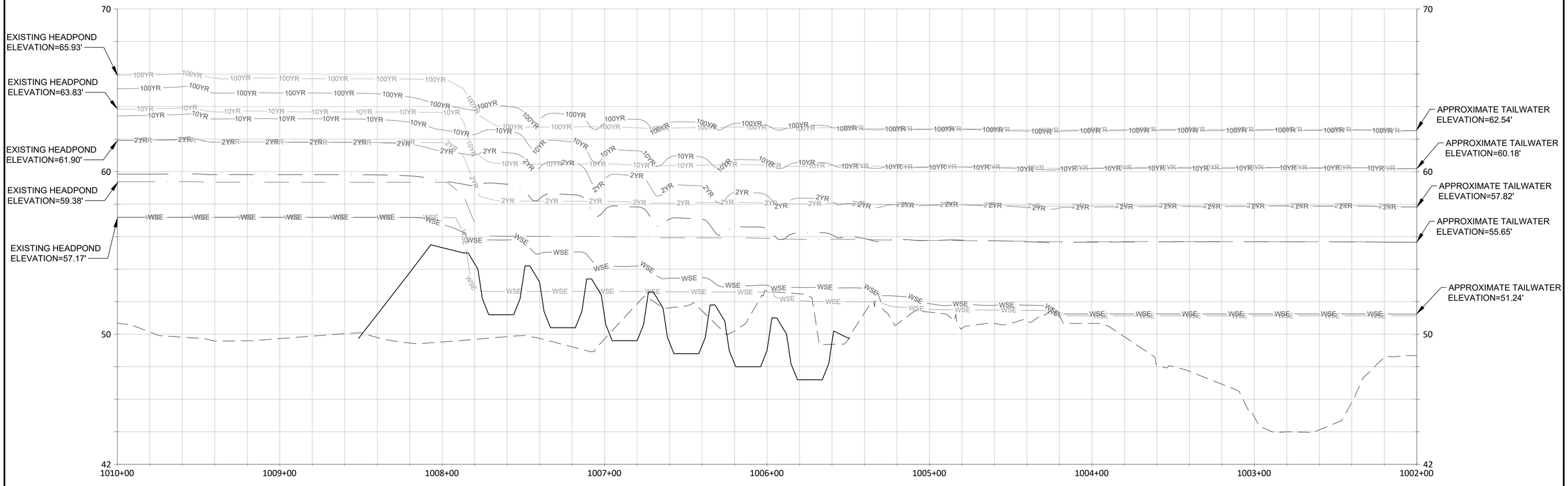
PROFILE LEGEND

- EXISTING GRADE
- PROPOSED GRADE
- WSE — EXISTING LOW FISH PASSAGE WSE
- WSE — PROPOSED LOW FISH PASSAGE WSE
- EXISTING HIGH FISH PASSAGE WSE
- PROPOSED HIGH FISH PASSAGE WSE
- 2YR — EXISTING 2-YEAR WSE
- 2YR — PROPOSED 2-YEAR WSE
- 10YR — EXISTING 10-YEAR WSE
- 10YR — PROPOSED 10-YEAR WSE
- 100YR — EXISTING 100-YEAR WSE
- 100YR — PROPOSED 100-YEAR WSE

10x VERTICAL EXAGGERATION

3'

30'



REACH PROFILE - PRIMARY CHANNEL

SEE SHEET 15 FOR PRIMARY CHANNEL DETAILED PROFILE

NOTE:

LOW FISH PASSAGE FLOW=106 CFS
HIGH FISH PASSAGE FLOW=1528 CFS
2-YEAR FLOW= 4120 CFS
10-YEAR FLOW= 6590 CFS
100-YEAR FLOW= 9630 CFS

STATE OF MAINE
MARCEL YOUNG-SCIACCA
No. 16803
LICENSED PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISION DESCRIPTION

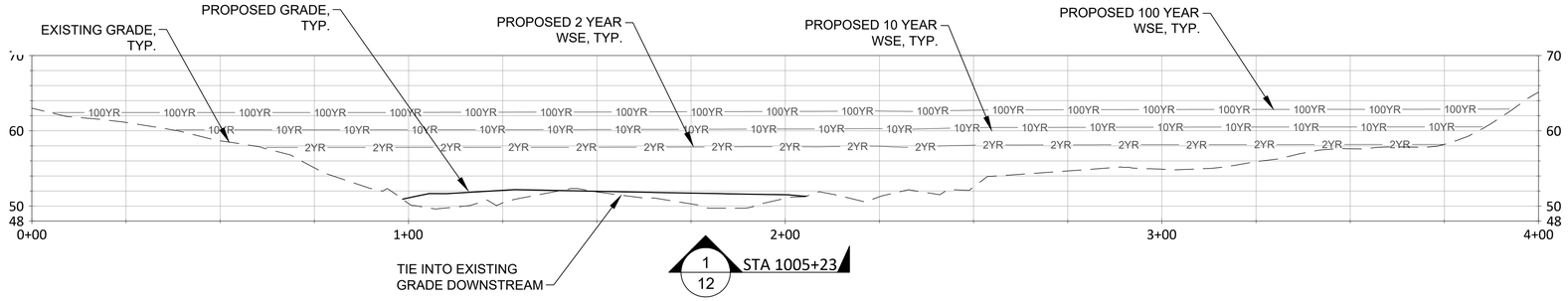
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APPROVED	DATE	PROJECT

CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

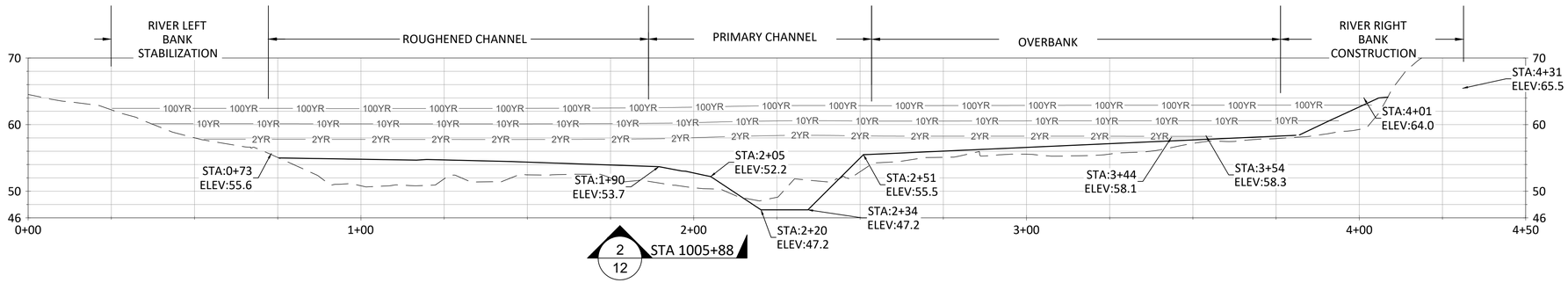
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REACH PROFILE

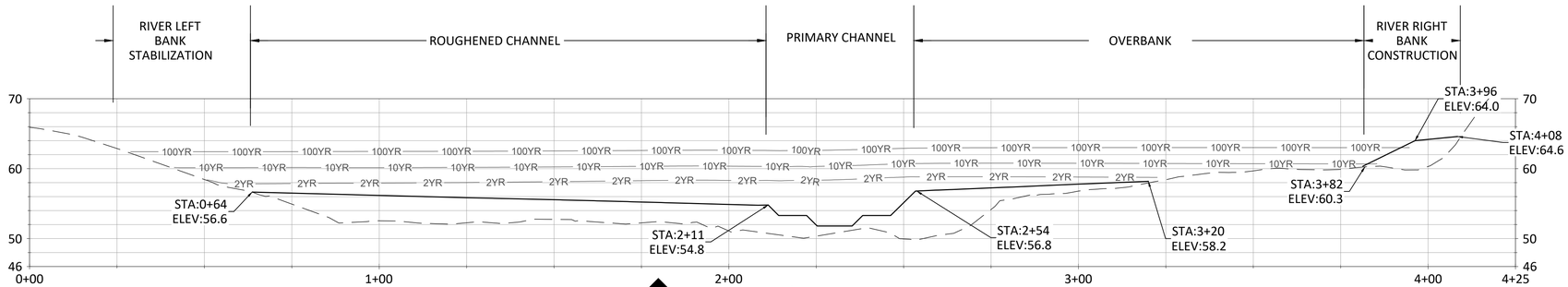
SHEET
11 OF 45



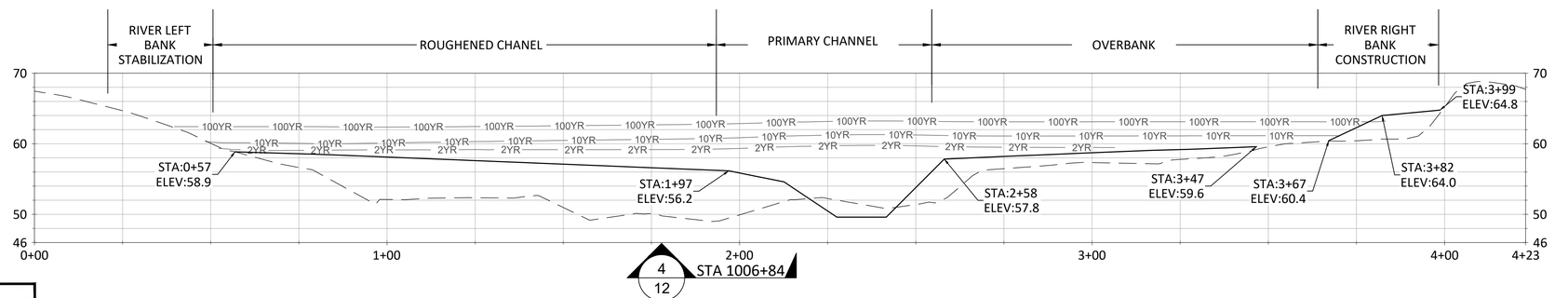
1
12
STA 1005+23



2
12
STA 1005+88



3
12
STA 1006+33



4
12
STA 1006+84

LEGEND

- EXISTING GRADE
- PROPOSED GRADE
- 2YR — PROPOSED 2 YEAR WSE
- 10YR — PROPOSED 10 YEAR WSE
- 100YR — PROPOSED 100 YEAR WSE

NOTE: SECTIONS ARE ORIENTED FACING DOWNSTREAM

STATE OF MAINE
MARCEL YOUNG-SEAGUST
No. 16803
LICENSED PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISION DESCRIPTION

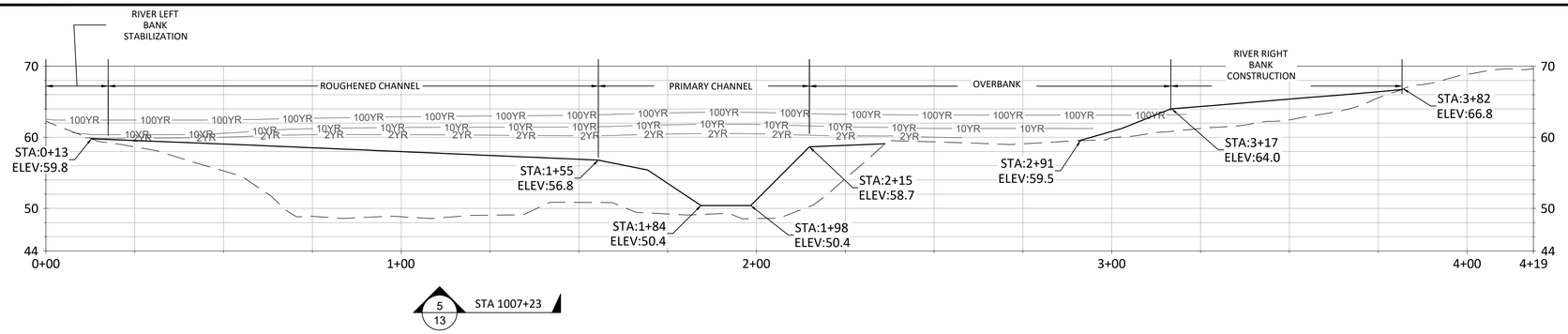
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DRAWN	DESIGNED	CHECKED
MYS	11/25	23-05-14
APPROVED	DATE	PROJECT

CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

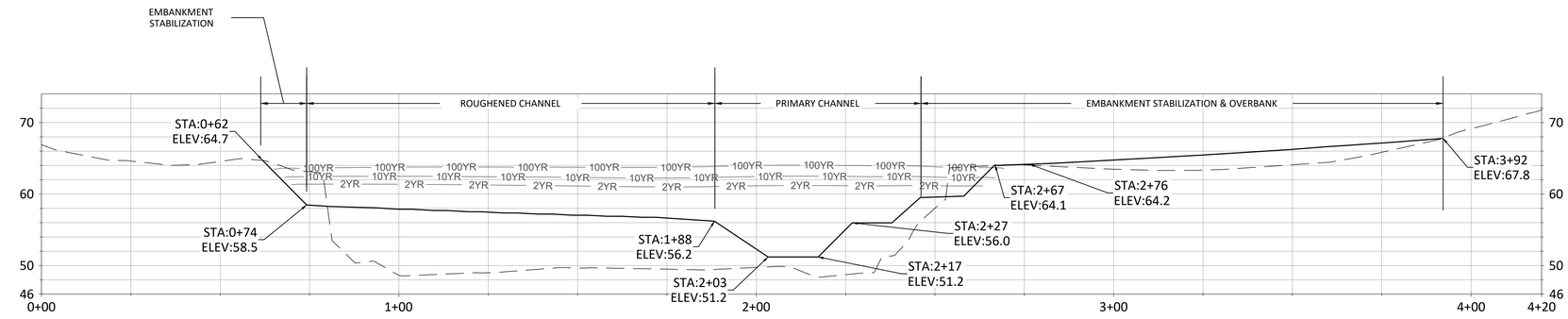
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GRADING SECTIONS (1 OF 2)

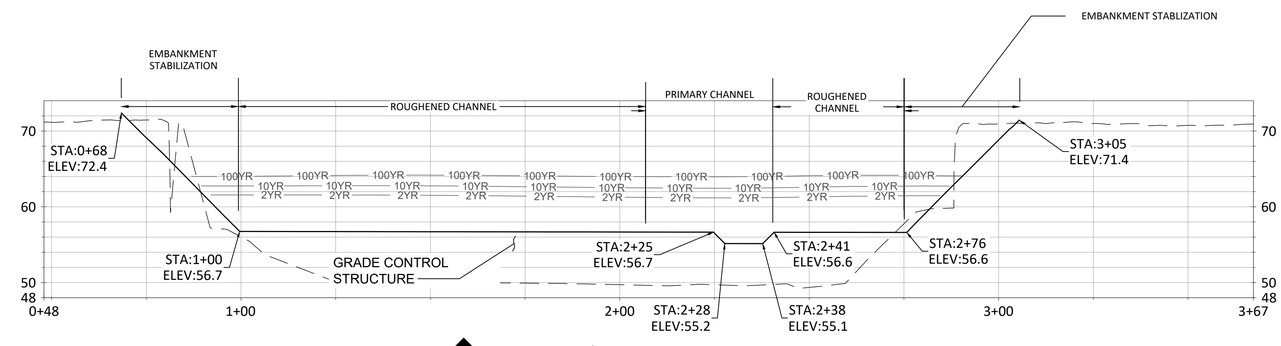
SHEET
12 OF 45



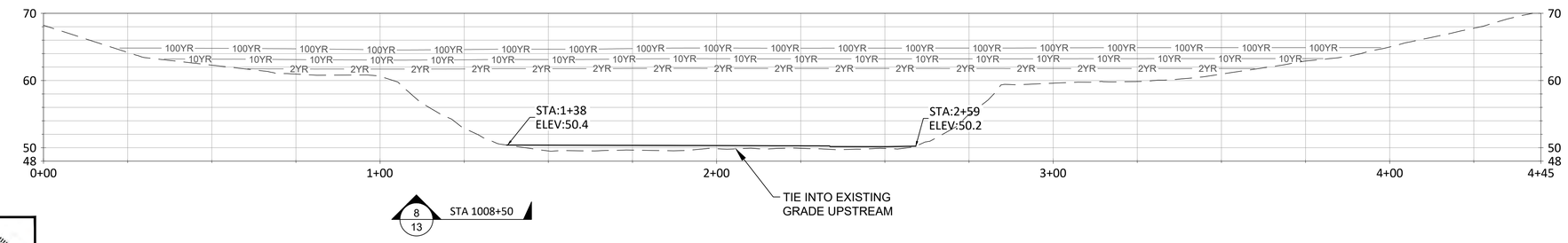
5 / 13 STA 1007+23



6 / 13 STA 1007+62



7 / 13 STA 1007+93



8 / 13 STA 1008+50

LEGEND

- EXISTING GRADE
- PROPOSED GRADE
- 2YR PROPOSED 2 YEAR WSE
- 10YR PROPOSED 10 YEAR WSE
- 100YR PROPOSED 100 YEAR WSE

1X VERTICAL EXAGGERATION
20'
20'

NOTE: SECTIONS ARE ORIENTED FACING DOWNSTREAM

STATE OF MAINE
MARCEL YOUNG-SEAGUST
No. 16803
LICENSED PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISION DESCRIPTION

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CHERRYFIELD ICE DAM
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GRADING SECTIONS (2 OF 2)

SHEET
13 OF 45

0 50 100
SCALE IN FEET

GRADE CONTROL STRUCTURE WITH SHEET PILE CUTOFF, SEE DETAILS 1/20 2/20 3/20

EMBANKMENT STABLIZATION, SEE DETAIL 1/20

PRIMARY CHANNEL ALIGNMENT, SEE SHEET 15 FOR DETAILS

EMBANKMENT STABILIZATION, SEE DETAIL 1/20

ROUGHENED CHANNEL, SEE DETAILS 1/18 2/18 2/18

BOULDER CLUSTERS, SEE DETAILS

RIVER LEFT BANK STABILIZATION. MAINTAIN EXISTING GRADE. SEE DETAIL 4/18

OVERBANK, SEE DETAIL 3/18

RIVER RIGHT BANK CONSTRUCTION, SEE DETAIL 3/18

PRIMARY CHANNEL ALIGNMENT, SEE PROFILE SHEET 11, 15

NARRAGUAGUS RIVER

1009+00 1008+00 1007+00 1006+00 1005+00 1004+00 1003+00 1002+00

71.39 55.00 72.33

LEGEND

- EXISTING 2 FT. CONTOUR
- PROPOSED 1 FT. CONTOUR
- OHW EXISTING ORDINARY HIGH WATER
- OHW PROPOSED ORDINARY HIGH WATER
- 20+00 PROPOSED ALIGNMENT
- LIMITS OF DISTURBANCE
- GRADE CONTROL STRUCTURE
- SALVAGED RIPRAP
- RIVER SUBSTRATE TYPE A
- RIVER SUBSTRATE TYPE B
- RIVER SUBSTRATE TYPE C
- OVERBANK MATERIAL
- FES LIFTS
- FABRIC SLOPE PROTECTION
- DELINEATED WETLAND
- AE FLOOD ZONE AE
- RF25 RIVERFRONT BUFFER 25'
- RF75 RIVERFRONT BUFFER 75'
- (H) HIGH PROFILE BOULDER CLUSTER
- (L) LOW PROFILE BOULDER CLUSTER
- MEDIUM PROFILE BOULDER CLUSTER

FOR BOULDER CLUSTER DETAILS SEE 1/21 2/21

STATE OF MAINE
MARCEL YOUNG-SPAGGIST
No. 16803
LICENSED PROFESSIONAL ENGINEER

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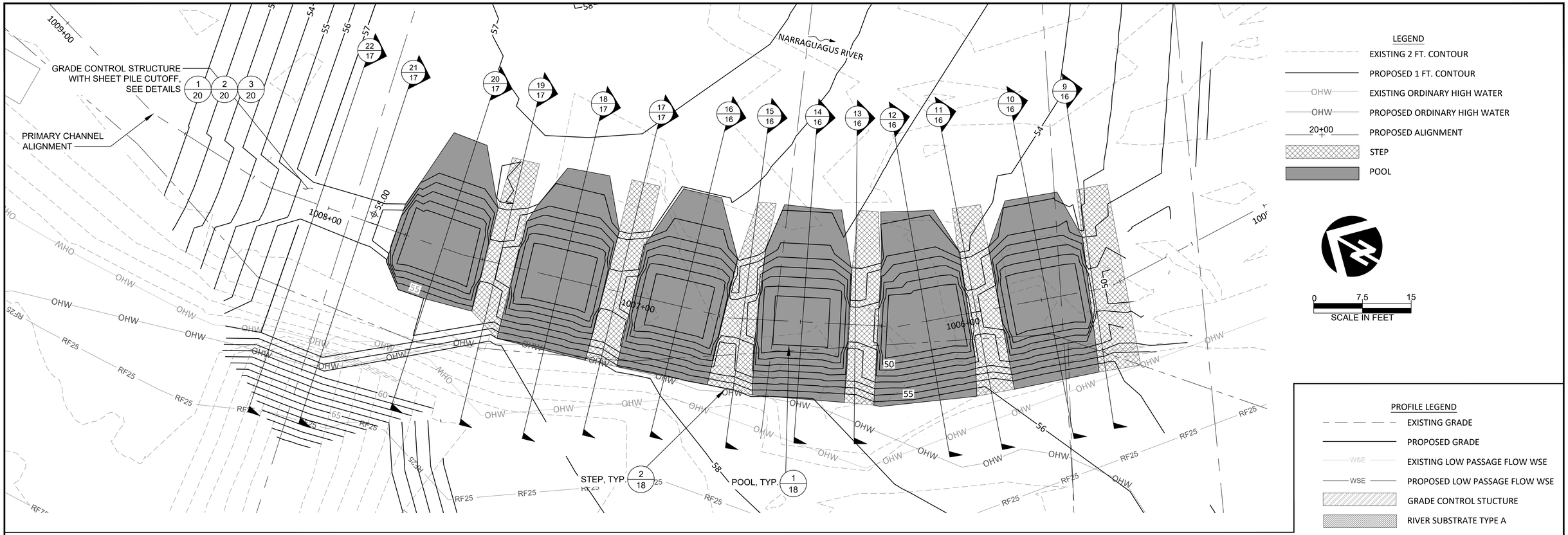
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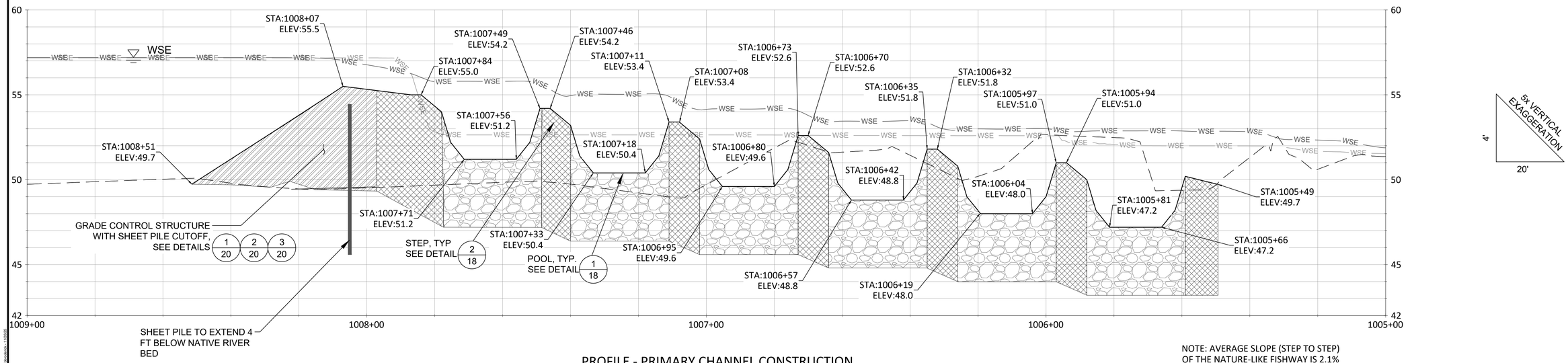
CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

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NATURE-LIKE FISHWAY TREATMENT PLAN

SHEET
14 OF 45





PROFILE - PRIMARY CHANNEL CONSTRUCTION

NOTE: AVERAGE SLOPE (STEP TO STEP) OF THE NATURE-LIKE FISHWAY IS 2.1%

STATE OF MAINE
MARCEL YOUNG-SCIACCA
No. 16803
LICENSED
PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISION DESCRIPTION

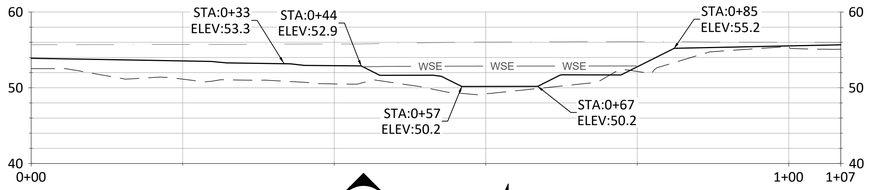
BB	MYS, SS	MB, MM
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CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

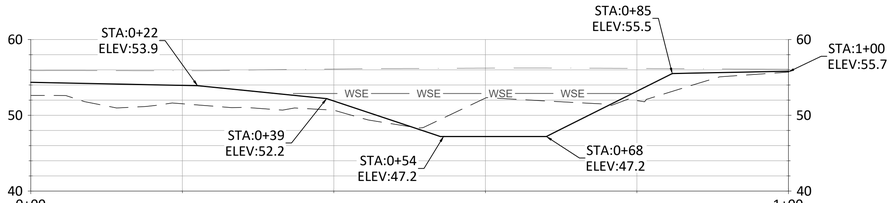
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PRIMARY CHANNEL PLAN AND PROFILE

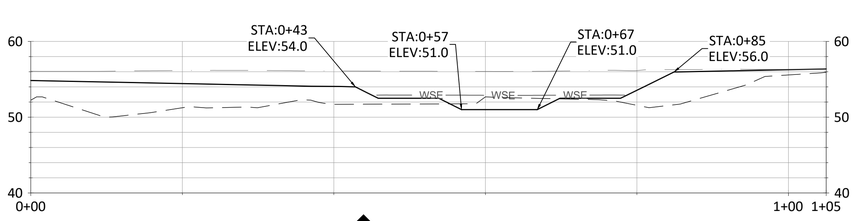
SHEET
15 OF 45



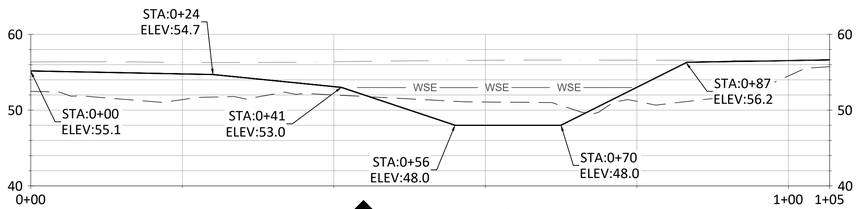
9/16 STA 1005+62
STEP SECTION



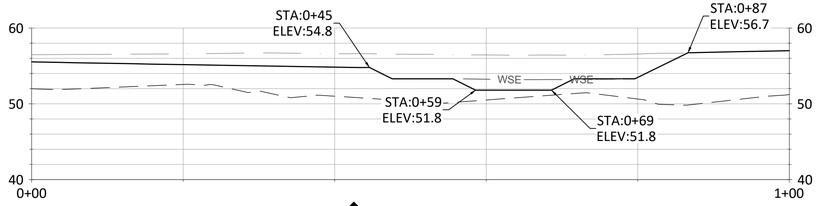
10/16 STA 1005+73
POOL SECTION



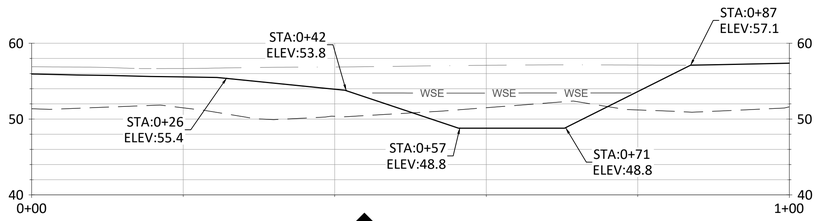
11/16 STA 1005+95
STEP SECTION



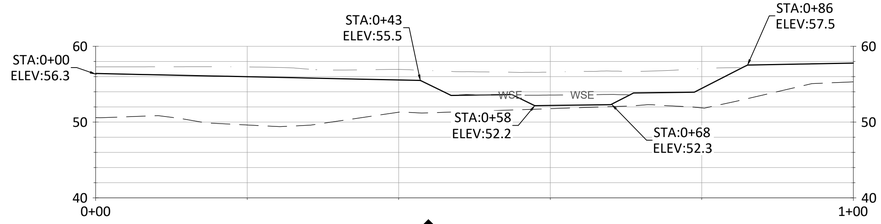
12/16 STA 1006+11
POOL SECTION



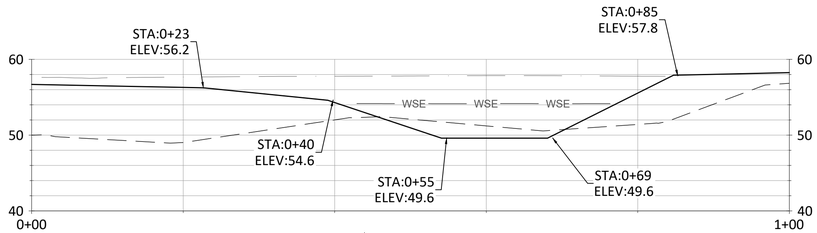
13/16 STA 1006+33
STEP SECTION



14/16 STA 1006+49
POOL SECTION

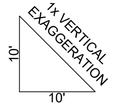


15/16 STA 1006+65
STEP SECTION



16/16 STA 1006+87
POOL SECTION

LEGEND
- EXISTING GRADE
- PROPOSED GRADE
- WSE PROPOSED LOW FISH PASSAGE WSE
- PROPOSED HIGH FISH PASSAGE WSE



STATE OF MAINE
MARCEL YOUNG-SCIACCHITANO
No. 16803
LICENSED PROFESSIONAL ENGINEER

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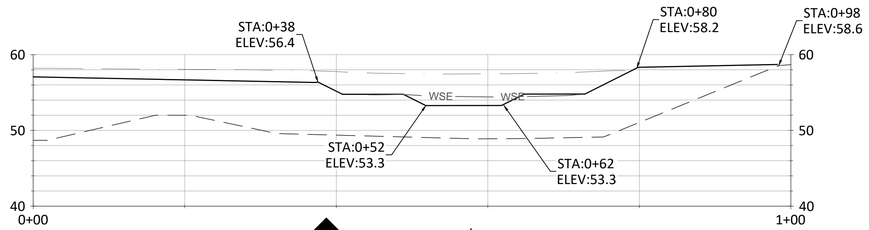
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MYS	11/25	23-05-14
APPROVED	DATE	PROJECT

CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

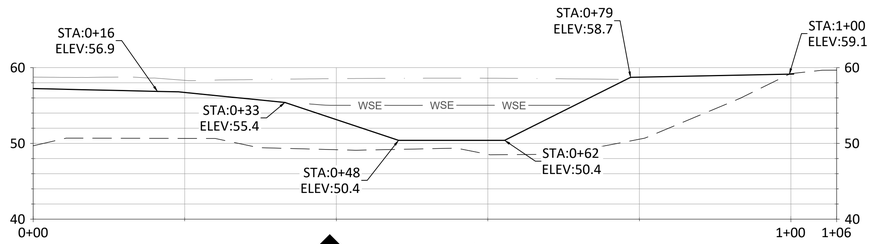
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PRIMARY CHANNEL GRADING SECTIONS (1 OF 2)

SHEET
16 OF 45

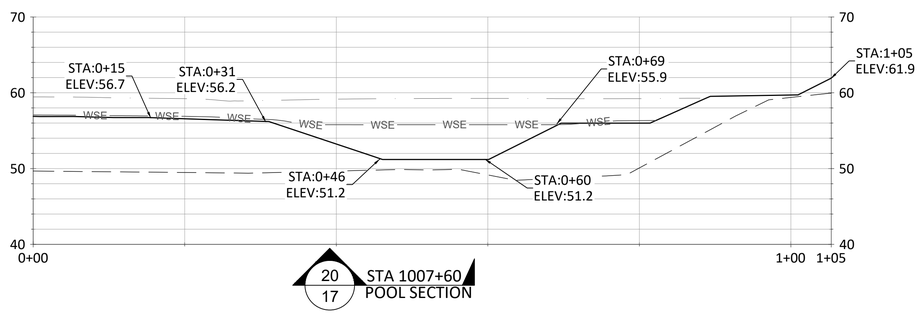


17 / ## STA 1007+03
STEP SECTION

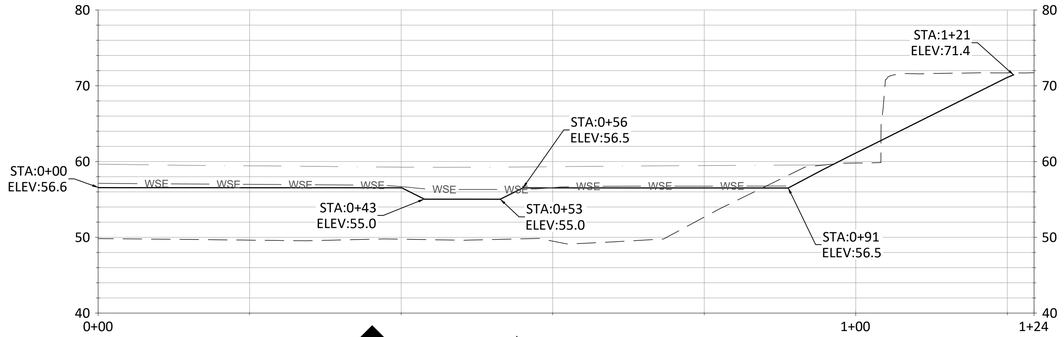


18 / 17 STA 1007+23
POOL SECTION

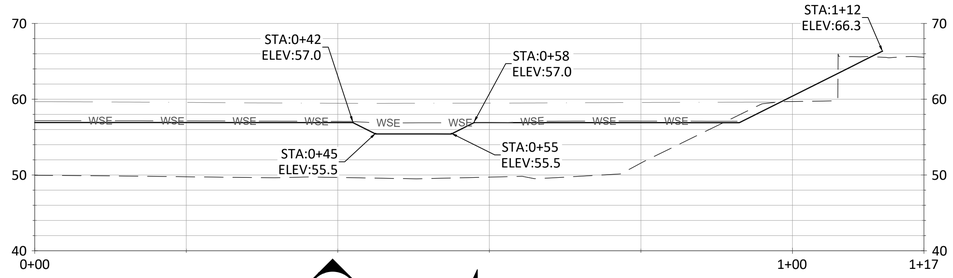
19 / 17 STA 1007+41
STEP SECTION



20 / 17 STA 1007+60
POOL SECTION



21 / 17 STA 1007+88
GRADE CONTROL



22 / 17 STA 1008+03
GRADE CONTROL STRUCTURE

LEGEND

- EXISTING GRADE
- PROPOSED GRADE
- WSE — PROPOSED LOW FISH PASSAGE WSE
- PROPOSED HIGH FISH PASSAGE WSE

1X VERTICAL EXAGGERATION
10' / 10'

STATE OF MAINE
MARCEL YOUNG-SAGGIO
No. 16803
LICENSED PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISION DESCRIPTION

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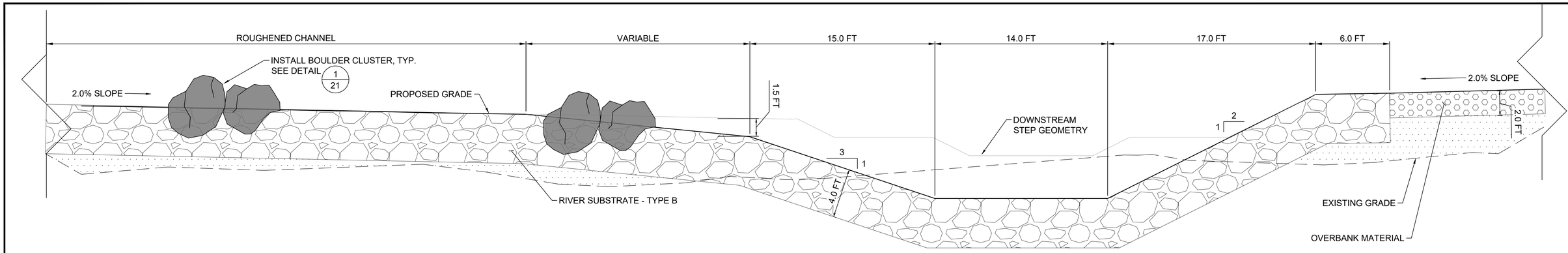
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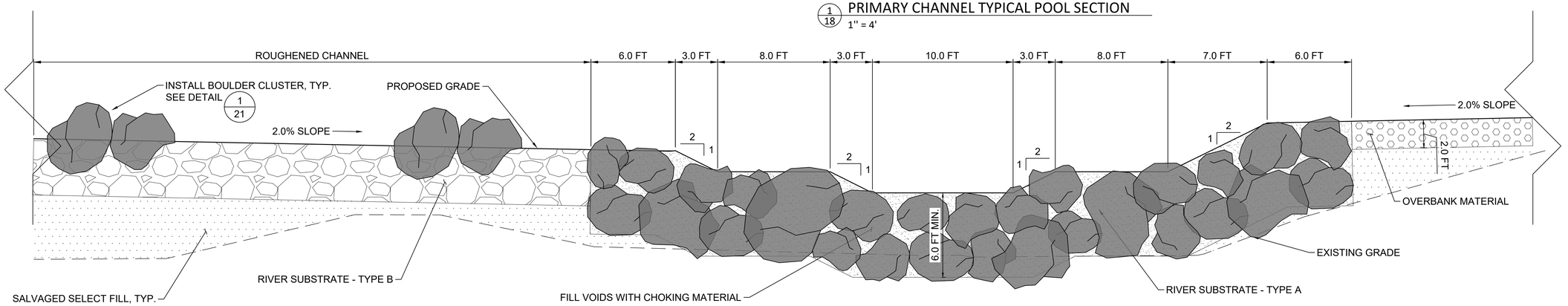
PRIMARY CHANNEL GRADING
SECTIONS (2 OF 2)

SHEET
17 OF 45

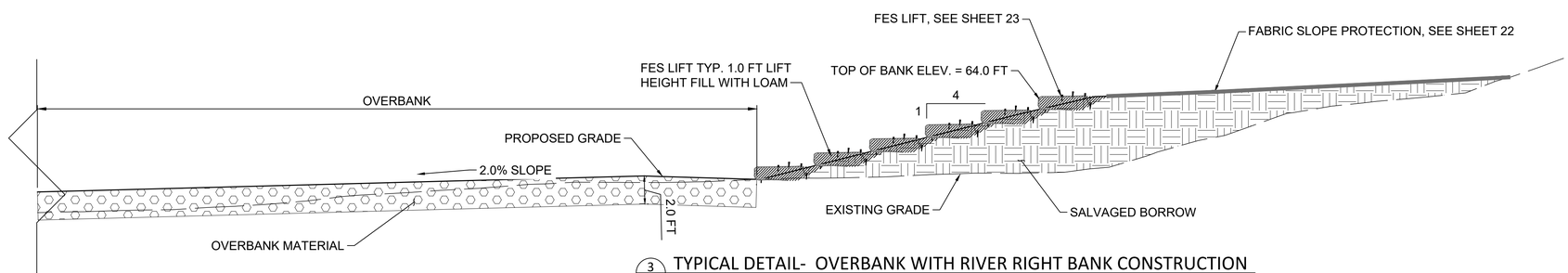
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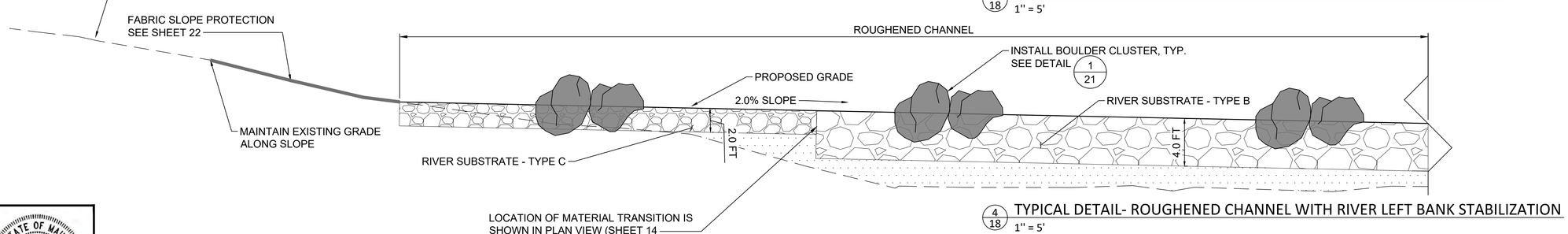
1/18 PRIMARY CHANNEL TYPICAL POOL SECTION
1" = 4'



2/18 PRIMARY CHANNEL TYPICAL STEP SECTION
1" = 4'



3/18 TYPICAL DETAIL- OVERBANK WITH RIVER RIGHT BANK CONSTRUCTION
1" = 5'



4/18 TYPICAL DETAIL- ROUGHENED CHANNEL WITH RIVER LEFT BANK STABILIZATION
1" = 5'

STATE OF MAINE
MARCEL YOUNG-SZACZSZ
No. 16803
LICENSED
PROFESSIONAL ENGINEER

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DRAWN	DESIGNED	CHECKED
MYS	11/25	23-05-14
APPROVED	DATE	PROJECT

CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

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CHANNEL TYPICAL SECTIONS AND DETAILS (1 OF 3)

SHEET
18 OF 45

S:\Projects_Active\Cherryfield_to_Dam_MD\Drawings\Cad_Files_Working\18_11/25/25

STEP 1

A. PREPARE SITE
B. ESTABLISH SUBGRADE



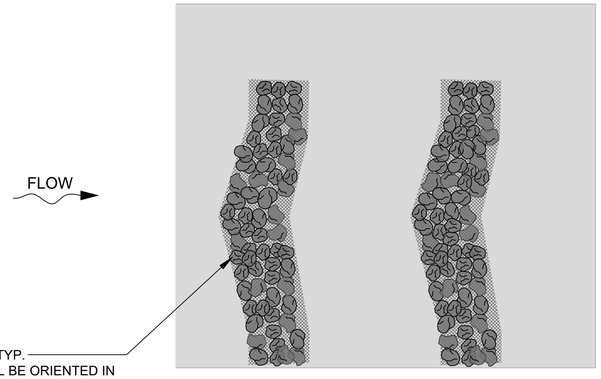
PLAN



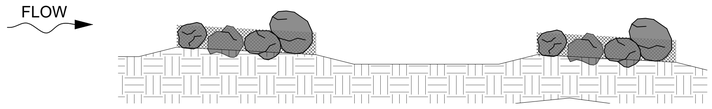
PROFILE

STEP 2

A. PLACE INITIAL LAYER OF BOULDERS
B. ENSURE FIRM BOULDER TO BOULDER CONTACT AND EMBEDMENT OF AT LEAST 1 FT
C. BACKFILL/WASH IN CHOKING MATERIAL



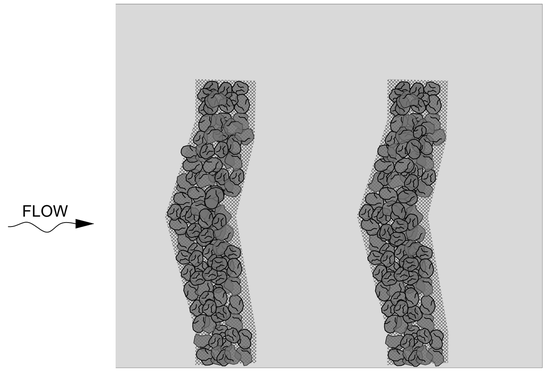
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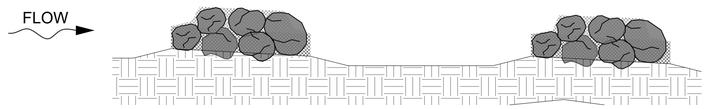
PROFILE

STEP 3

A. PLACE NEXT LAYER OF BOULDERS
B. ENSURE FIRM BOULDER TO BOULDER CONTACT AND EMBEDMENT OF AT LEAST 1 FT
C. BACKFILL/WASH-IN CHOKING MATERIAL



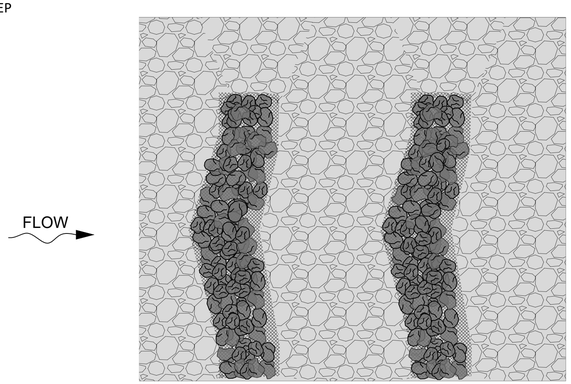
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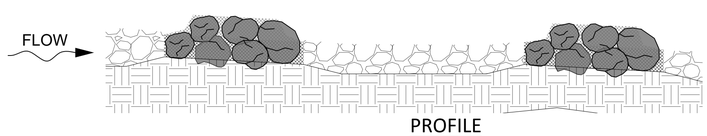
PROFILE

STEP 4

A. PLACE RIVER SUBSTRATE UPSTREAM AND DOWNSTREAM OF STEP



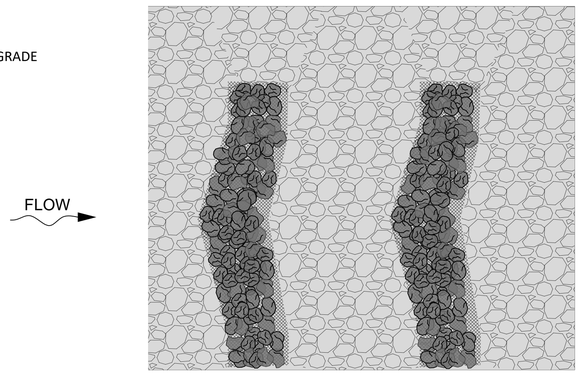
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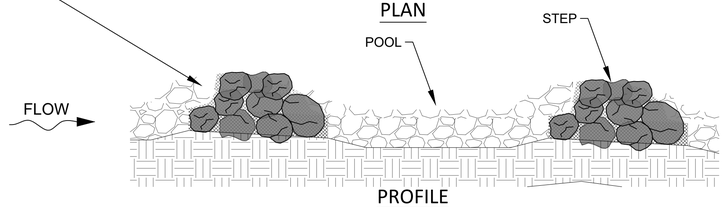
PROFILE

STEP 5

A. PLACE FINAL LAYER OF BOULDERS AS NEEDED AND BACKING MATERIAL ALONG UPSTREAM FACE OF THE BOULDER STEP
B. ENSURE FIRM BOULDER TO BOULDER CONNECTION AND EMBEDMENT OF AT LEAST 1 FT
C. BACKFILL/WASH IN CHOKING MATERIAL
D. CHOKING MATERIAL MAY NOT BE USED TO REACH DESIGN GRADE



PLAN



PROFILE

1/19 STEP POOL CONSTRUCTION SEQUENCING

STATE OF MAINE
MARCEL YOUNG-SZACKAT
No. 16803
LICENSED PROFESSIONAL ENGINEER

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APPROVED	DATE	PROJECT

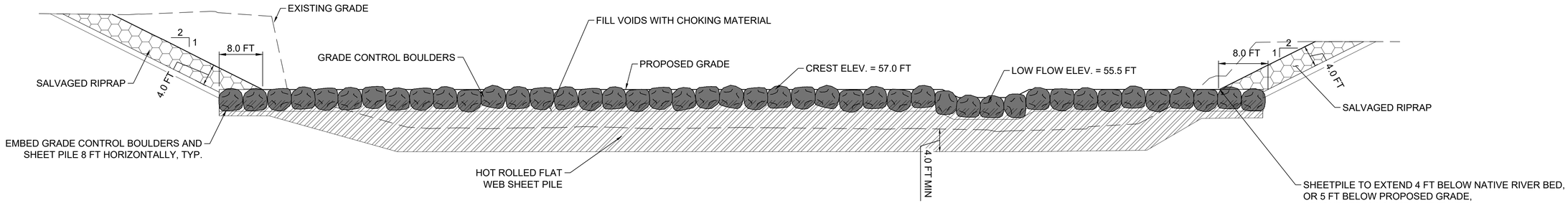
CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

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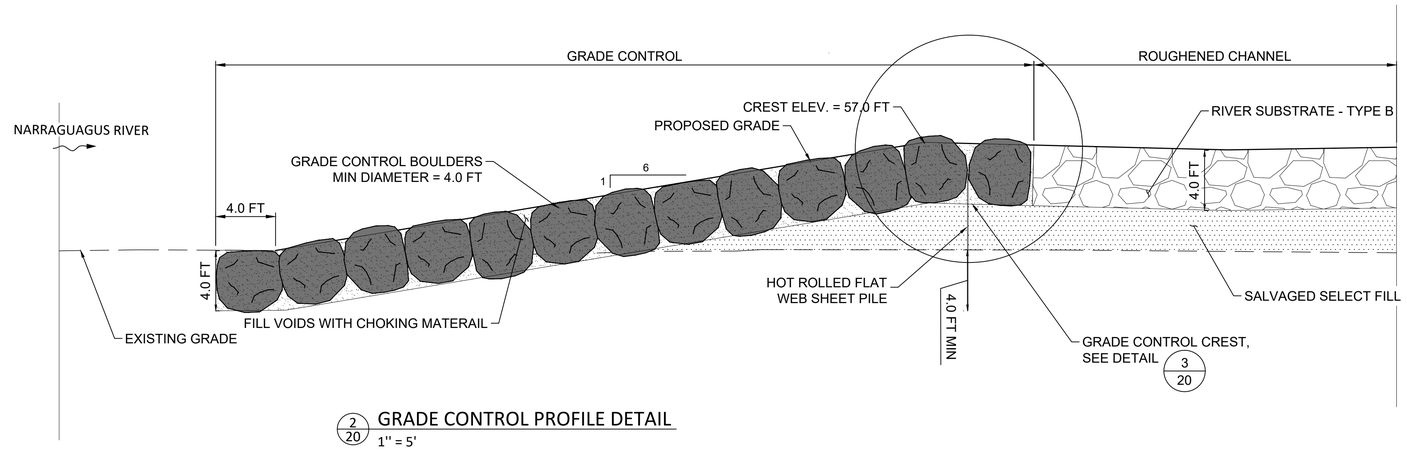
STEP POOL CONSTRUCTION SEQUENCE

SHEET
19 OF 45

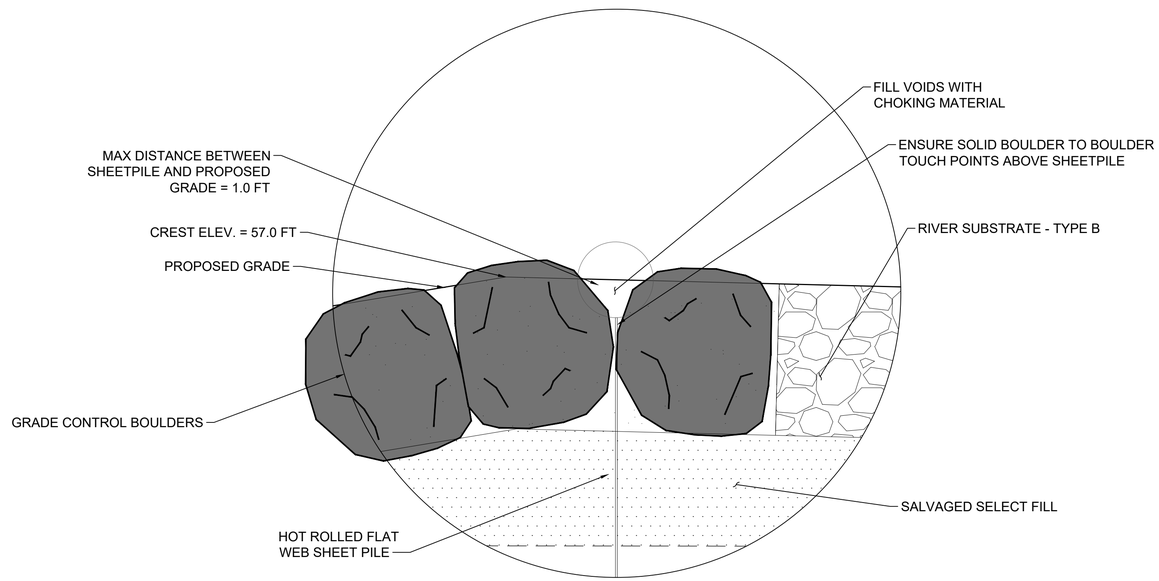
Y:\Projects\...\Attachments\...\Step_MDDamariscotta_Plate_Mockup_111925



1/20 GRADE CONTROL STRUCTURE DETAIL WITH EMBANKMENT STABILIZATION
1" = 10'



2/20 GRADE CONTROL PROFILE DETAIL
1" = 5'



3/20 GRADE CONTROL STRUCTURE CREST DETAIL
1" = 2'

STATE OF MAINE
MARCEL YOUNG-SEAGRAVES
No. 16803
LICENSED PROFESSIONAL ENGINEER

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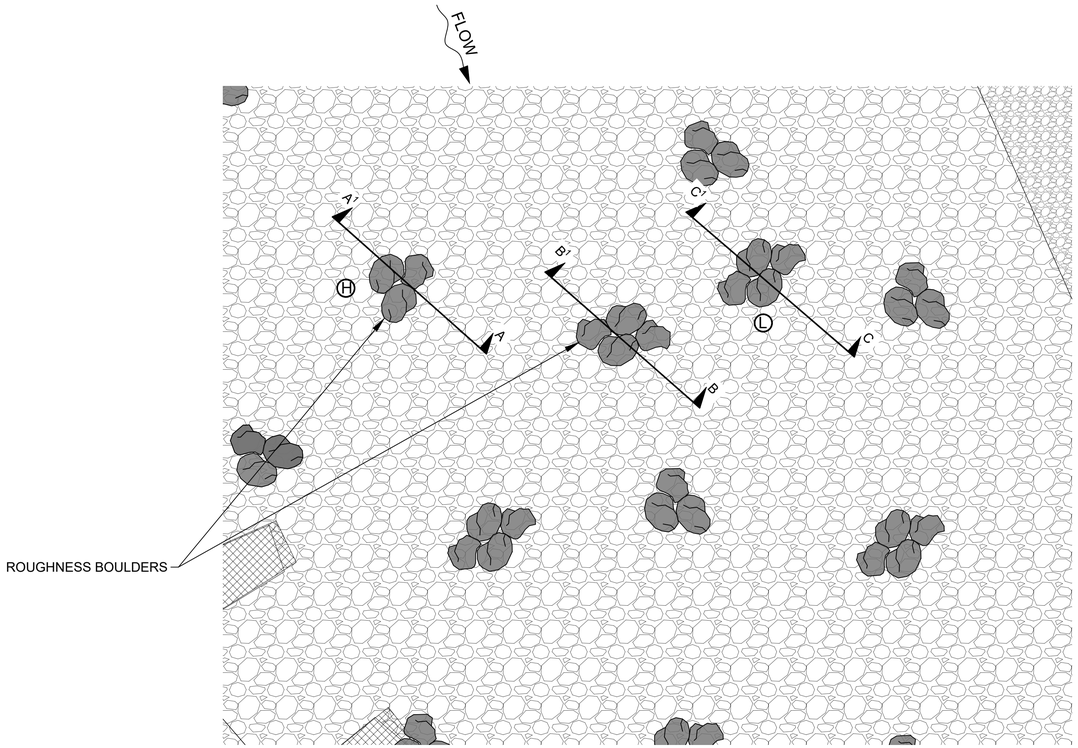
BB	MYS, SS	MB, MM
DRAWN	DESIGNED	CHECKED
MYS	11/25	23-05-14
APPROVED	DATE	PROJECT

CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

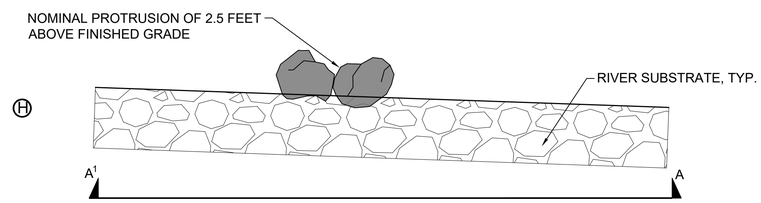
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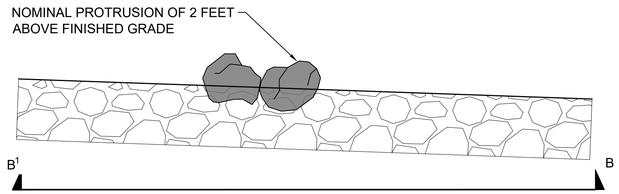
GRADE CONTROL AND SHEETPILE CUTOFF DETAILS (2 OF 3)

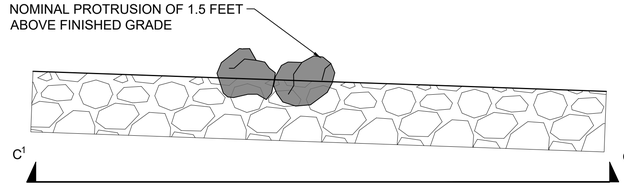
SHEET
20 OF 45



1/21 ROUGHNESS BOULDERS TYPICAL DETAIL
1" = 50'







2/21 ROUGHNESS BOULDERS PROFILE
1" = 20'

STATE OF MAINE
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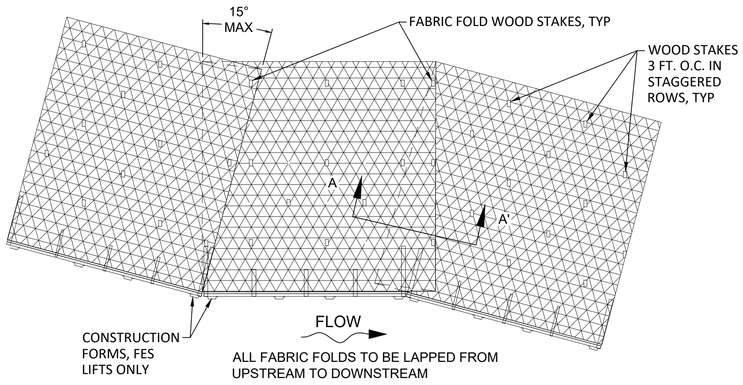
BB	MYS, SS	MB, MM
DRAWN	DESIGNED	CHECKED
MYS	11/25	23-05-14
APPROVED	DATE	PROJECT

CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

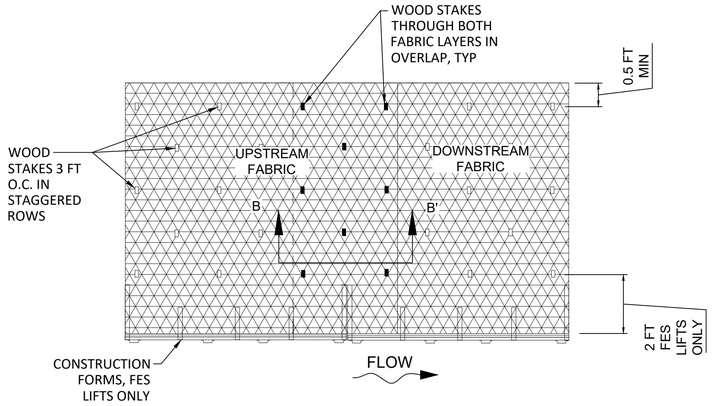
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TYPICAL DETAILS (3 OF 3)

SHEET
21 OF 45



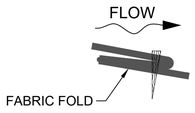
PLAN



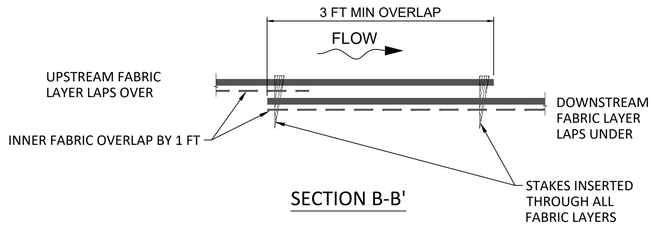
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NOTES:

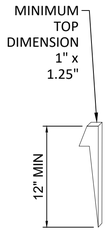
1. INSERT AND DRIVE WOOD STAKES BETWEEN THE FIBERS OF THE WOVEN COIR FABRIC. FIBERS AT WOOD STAKE LOCATION SHALL BE MANUALLY STRETCHED TO ACCOMMODATE THE WOOD STAKE WITHOUT BREAKING THE FABRIC FIBERS. STAKING SHALL NOT BE FACILITATED BY PRE-CUTTING OF THE COIR FABRICS.
2. FORMS MAY BE ANGLED TO CREATE BENDS IN THE LIFTS AS NEEDED. FABRIC SHALL BE FOLDED AS SHOWN. STAKE THE FOLDS AS SHOWN.
3. OUTER FABRIC ENDS SHALL BE JOINED BY LAPPING THE UPSTREAM PIECE OF FABRIC OVER THE DOWNSTREAM PIECE AS SHOWN.



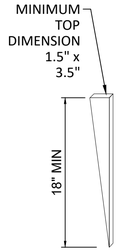
SECTION A-A'



SECTION B-B'

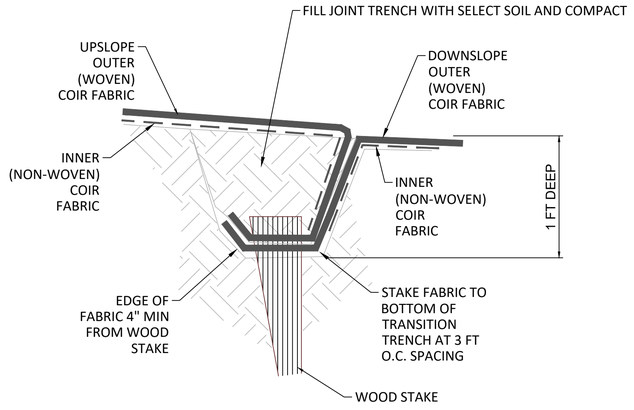


WOOD STAPLE



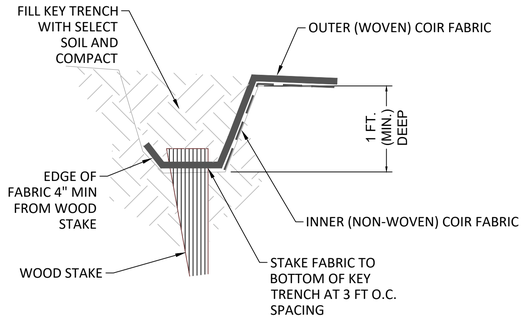
WOOD STAKE

TYPICAL DETAIL -
1/22 FOLDING OF CONTINUOUS OUTER COIR FABRIC AT BENDS
NOT TO SCALE



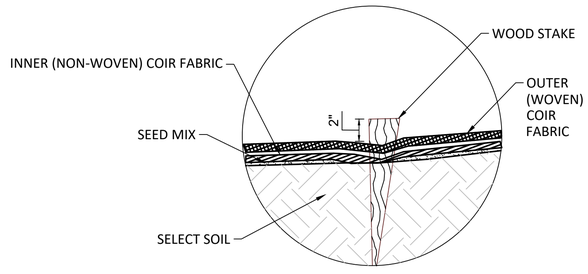
4/22 TYPICAL DETAIL - JOINT TRENCH
NOT TO SCALE

2/22 TYPICAL DETAIL - OUTER FABRIC JOINING
NOT TO SCALE



5/22 TYPICAL DETAIL - KEY TRENCH
NOT TO SCALE

3/22 TYPICAL DETAIL - WOOD STAKE FABRICATION
NOT TO SCALE



6/22 BIODEGRADABLE FABRICS AND WOOD STAKES
NOT TO SCALE

STATE OF MAINE
MARCEL YOUNG-SAGGESE
No. 16803
LICENSED
PROFESSIONAL ENGINEER
February 2014

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FES LIFTS AND FABRIC SLOPE PROTECTION DETAILS (1 OF 2)

SHEET
22 OF 45

FIG A.

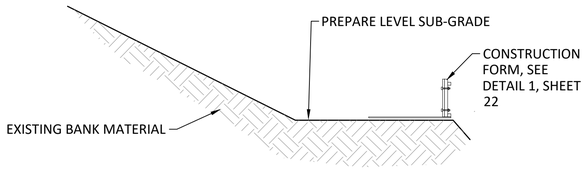
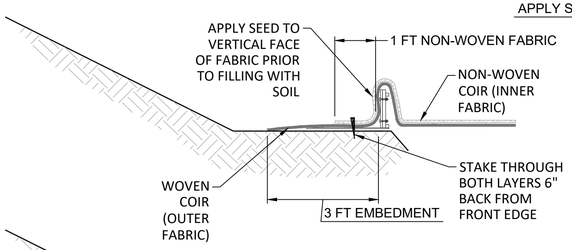


FIG B.



NOTE:
INSERT WOOD STAKES WITHOUT BREAKING FABRIC (MANUALLY STRETCH HOLE SO THAT STAKE CAN ENTER WITHOUT BREAKING FABRIC).

FIG C.

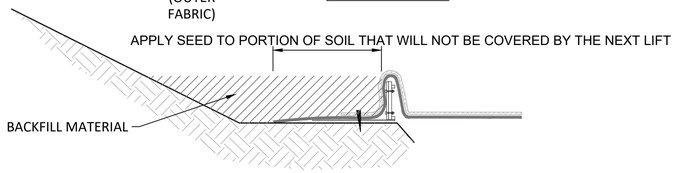


FIG D.

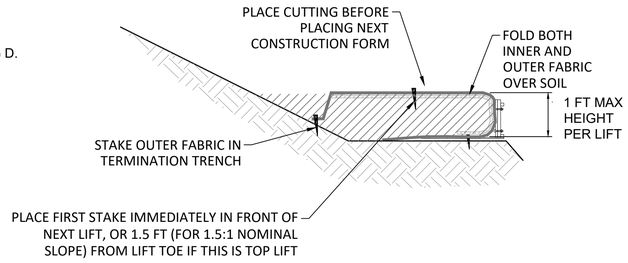
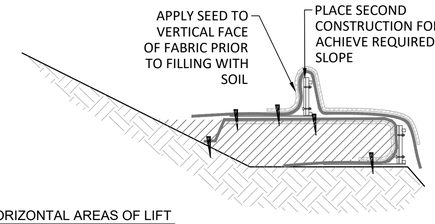


FIG E.



APPLY SEED TO EXPOSED VERICAL AND HORIZONTAL AREAS OF LIFT

FIG F.

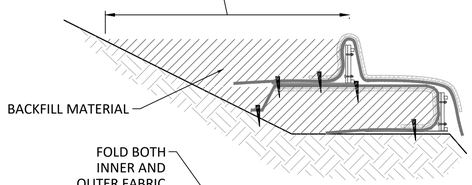


FIG G.

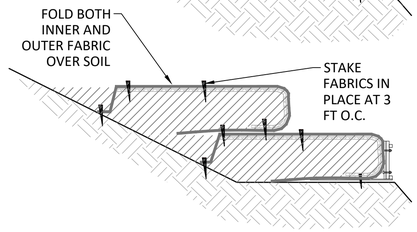
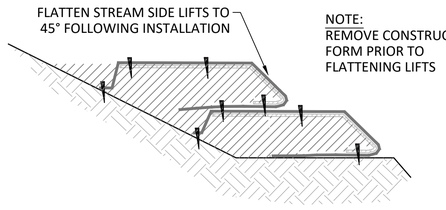


FIG H.



NOTE:
REMOVE CONSTRUCTION FORM PRIOR TO FLATTENING LIFTS

SEQUENCING NOTES:

1. LIFTS SHALL USE 13 FT WIDE WOVEN COIR FOR THE OUTER FABRIC.
2. FES LIFTS MAY BE CONSTRUCTED IN EITHER AN UPSTREAM OR DOWNSTREAM DIRECTION, AS LONG AS THE FABRIC IS OVERLAPPED IN THE PROPER DIRECTION.
3. EACH LIFT MAY HAVE A UNIQUE FILL COMPOSITION AND VARYING PLACEMENT OF CUTTINGS. SEE TYPICAL SECTIONS.
4. PLACE A SERIES OF THREE OR MORE FORMS ON THE GROUND SO THAT THE FORMS FOLLOW THE PROPOSED STREAM BANK ALIGNMENT. BUTT THE ENDS OF THE FORMS TIGHTLY TOGETHER.
5. UNROLL THE OUTER FABRIC PARALLEL TO THE LONG AXIS OF THE CHANNEL AND POSITION IT SO THAT 3 FT EXTENDS FOR EMBEDMENT ON THE BANK SIDE OF THE FORMS (FIG B), AND A MINIMUM 3 FT EXTENDS LENGTHWISE BEYOND THE LAST FORM FOR OVERLAP. DRAPE THE REMAINDER OF THE FABRIC OVER THE TOP OF THE FORMS ON THE STREAM SIDE (FIG B).
6. UNROLL THE INNER FABRIC OVER THE TOP OF THE WOVEN COIR FABRIC (FIG B) AND POSITION IT SO THAT AT LEAST 1 FT OF THE INNER FABRIC EXTENDS AS AN EMBEDMENT LENGTH ON THE BANK SIDE OF THE FORMS (FIG C). DRAPE THE REMAINDER OF THE FABRIC OVER THE TOP OF THE FORMS ON THE STREAM SIDE AND ALIGN THE LONG EDGES OF THE FABRICS. STRETCH AND PULL THE FABRIC LAYERS TO REMOVE WRINKLES.
7. APPLY SEED MIX TO INNER FABRIC ALONG VERTICAL EDGE OF LIFT (FIG C). PLACE SPECIFIED FILL OVER THE FABRIC ON THE BANK SIDE OF THE FORMS. LEVEL THE FILL AND COMPACT TO 85 PERCENT OF MAXIMUM DENSITY (FIG C).
8. APPLY SEED MIX TO TOP OF FILL FROM THE FRONT OF THE LIFT TO THE POINT AT WHICH THE ABOVE LIFT WILL OVERLAP (FIG C).
9. FOLD THE LOOSE ENDS OF THE TWO COIR FABRIC LAYERS BACK OVER THE COMPACTED FILL MATERIAL AND STRETCH TIGHTLY TO REMOVE WRINKLES (FIG D). SECURE WITH WOOD STAKES AT 3 FT ON CENTER ALONG THE BACK EDGE AND INTO UNDISTURBED SOIL.
10. REMOVE THE FORMS FROM THE FRONT OF THE COMPLETED LIFTS (FIG. G). LEAVE THE LAST FORM IN PLACE AT THE END OF THE NEWLY CONSTRUCTED LIFT (FIG. G).
11. WHERE THE TOP OF THE LIFT MEETS THE GROUND SURFACE, EXCAVATE A KEY TRENCH 1.5 FT WIDE AND 1 FT DEEP ALONG THE EDGE OF THE OUTER FABRIC LAYER, PARALLEL TO THE FORMS. SEED ENTIRE AREA OF TOP LIFT. SECURE FABRIC IN THE KEY TRENCH WITH WOOD STAKES AT 3 FT ON CENTER.
12. BACKFILL THE KEY TRENCH AND CONTINUE TO BACKFILL AND COMPACT TO SMOOTHLY MERGE WITH THE ADJACENT FINISHED GRADE. APPLY SEED MIX TO KEY TRENCH AREA.

1/22 TYPICAL SECTION - CONSTRUCTION SEQUENCE FOR FES LIFTS
NOT TO SCALE

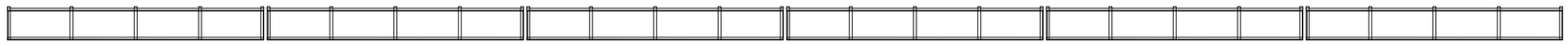


FIG 1. PLACE A ROW OF CONSTRUCTION FORMS ALONG DESIRED CHANNEL ALIGNMENT FOR FIRST LIFT.

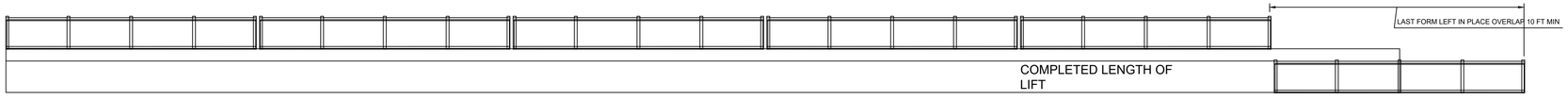


FIG 2. CONSTRUCT FABRIC ENCAPSULATED LIFTS ALONG THE LENGTH OF THE FIRST SET OF FORMS AND THEN BEGIN PLACEMENT OF FORMS AND CONSTRUCTION OF SECOND LIFT.

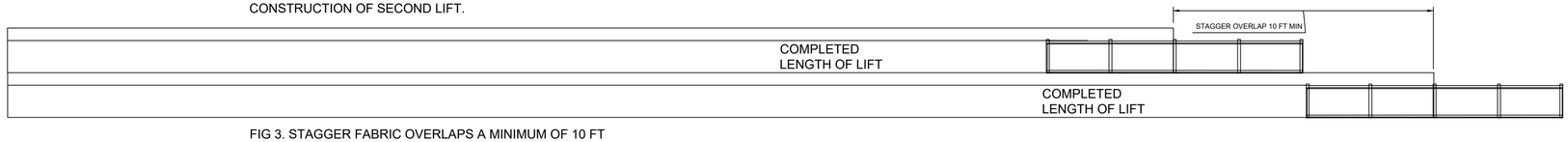


FIG 3. STAGGER FABRIC OVERLAPS A MINIMUM OF 10 FT BETWEEN LIFTS

2/22 TYPICAL ELEVATION VIEW- CONSTRUCTION SEQUENCE FOR FES LIFTS
NOT TO SCALE

STATE OF MAINE
MARCEL YOUNG-SCIACCA
No. 16803
LICENSED PROFESSIONAL ENGINEER

NO.	BY	DATE	REVISION DESCRIPTION

BB	MYS, SS	MB, MM
DRAWN	DESIGNED	CHECKED
MYS	11/25	23-05-14
APPROVED	DATE	PROJECT

CHERRYFIELD ICE DAM
NARRAGUAGUS RIVER
DOWNEAST SALMON FEDERATION

inter·fluve
181 Main Street, 2nd Floor
P.O. Box 236
Damariscotta, ME 04543
207.315.7014
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FES LIFTS AND FABRIC SLOPE PROTECTION DETAILS (2 OF 2)

SHEET
23 OF 45

X:\Projects\Active\Cherryfield_Ice_Dam_MB\Drawings\Cherryfield_ICE_DAM_Sheets.dwg, Damariscotta, 11/25/25

0 150 300
SCALE IN FEET

LEGEND
- EXISTING 2 FT CONTOUR
- PROPOSED 1 FT CONTOUR
- APPROXIMATE PARCEL LINES
- OHW — PROPOSED OHW
- RIPARIAN PLANTING/ WET SEED MIX ZONE
- TRANSITIONAL PLANTING/ DRY SEED MIX ZONE
- RIPARIAN STAKING
- UPLAND PLANTING/ DRY SEED MIX ZONE
- SITE IMPROVEMENTS

UPLAND PLANTING ZONE

RIPARIAN STAKING ZONE

RIPARIAN PLANTING ZONE

TRANSITIONAL PLANTING ZONE

SEE SHEET LP-101 FOR PARK PLANTING AND REVEGETATATION

JONATHAN S. & LIS BEAL 0U6-017-001

TOWN OF CHERRYFIELD 0U6-012-000

TOWN OF CHERRYFIELD 0U6-011-000

TOWN OF CHERRYFIELD OR4-002-000

TOWN OF CHERRYFIELD OR4-003-000

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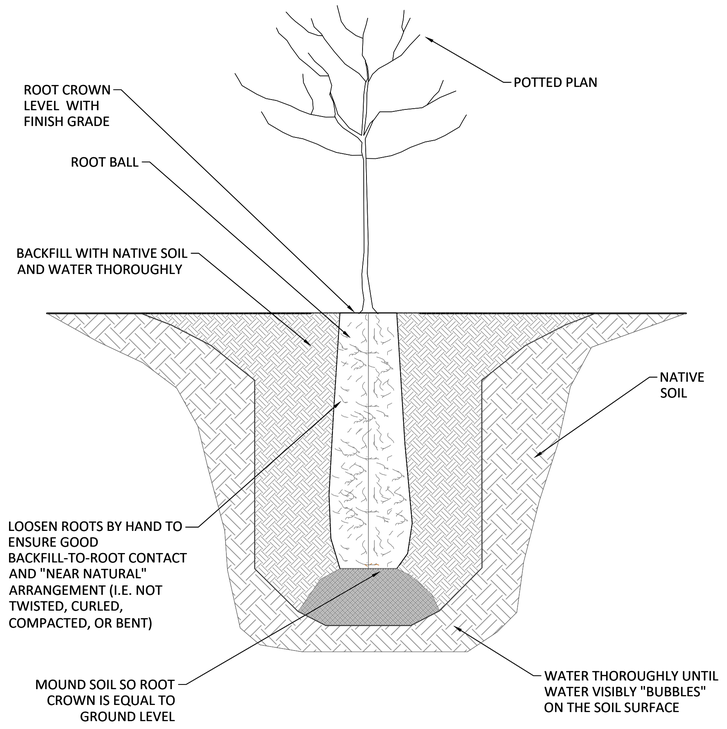
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CHERRYFIELD ICE DAM
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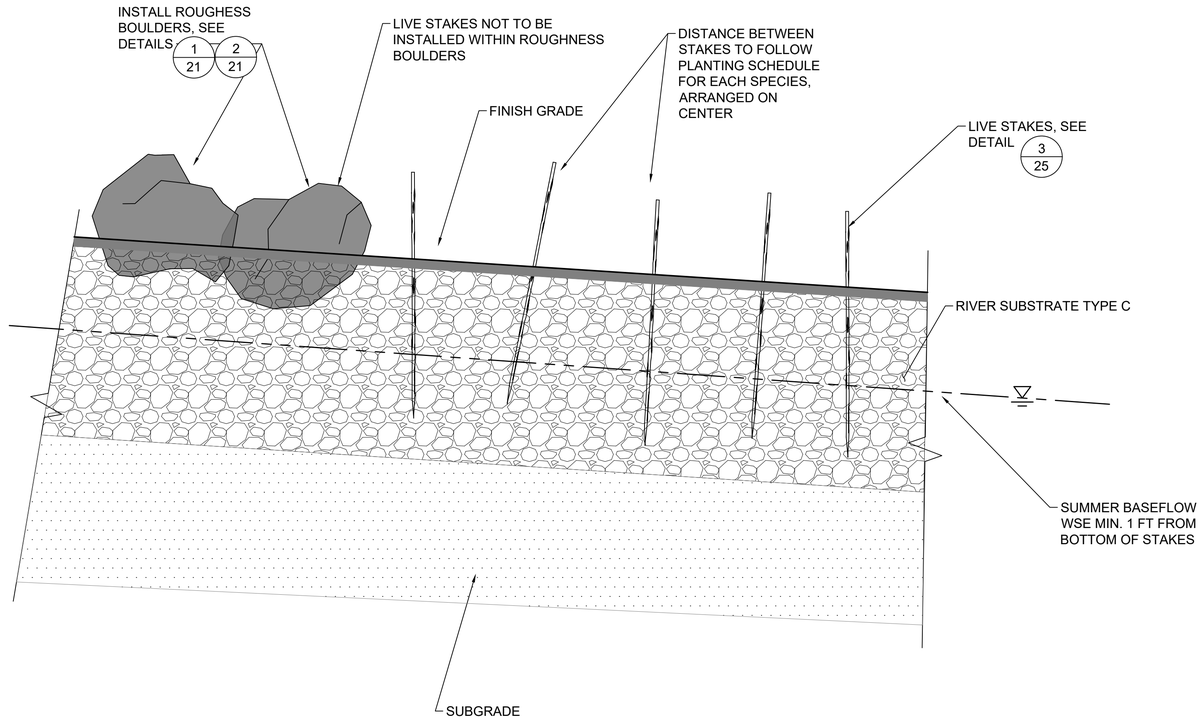
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REVEGETATION PLAN

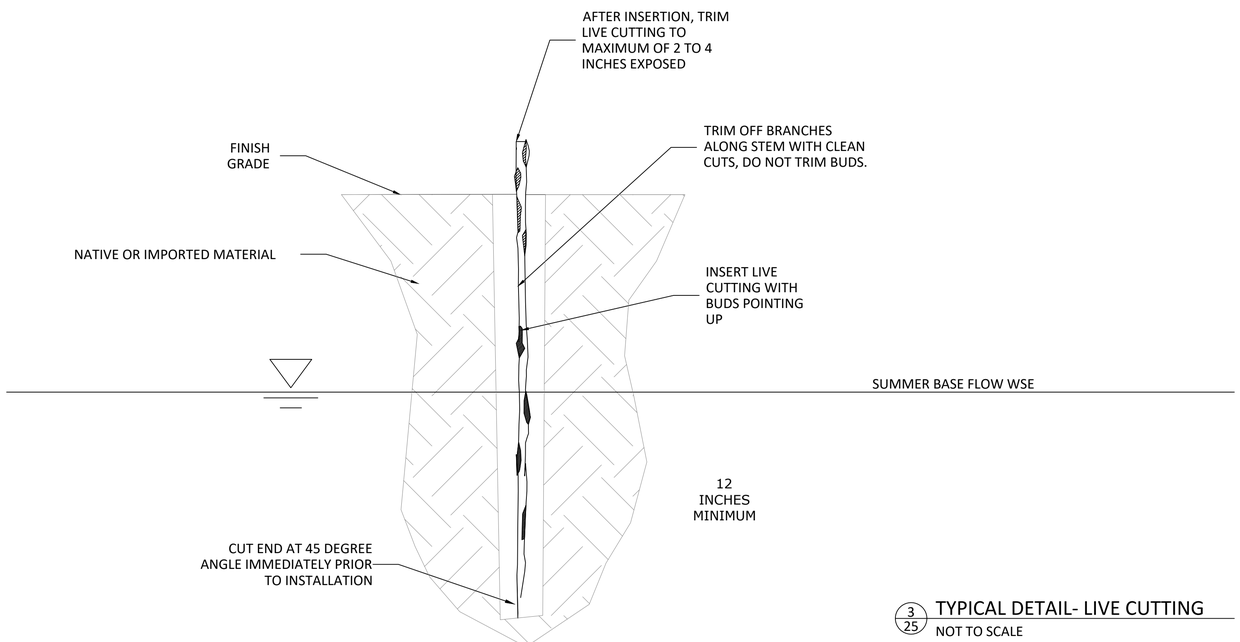
SHEET
24 OF 45



1/25 TYPICAL DETAIL- POTTED PLANT/TUBELING
NOT TO SCALE



2/25 TYPICAL DETAIL- RIPARIAN STAKING
NOT TO SCALE



3/25 TYPICAL DETAIL- LIVE CUTTING
NOT TO SCALE

NOTES:

1. CUTTINGS HELD FOR GREATER THAN 24 HOURS FROM FIELD CUT MUST BE SOAKED IN WATER UNTIL INSTALLATION. IF PLACED IN NATIVE CHANNELS, CONTRACTOR IS RESPONSIBLE FOR PROTECTING CUTTINGS FROM BEAVER AND UNGULATE HERBIVORY.
2. CUTTINGS MUST BE PLACED WITH A MINIMUM OF 1 FT LENGTH IN LOW WATER TABLE, AND WHERE DEPTH TO GROUNDWATER BELOW FINISHED GRADE IS NO GREATER THAN 1 FT. OF CUTTING SHOULD EXTEND ABOVE FINISH GRADE WITH 2-4 LIVE AUXILIARY BUDS. WITH MAXIMUM 2 TO 4 INCHES EXPOSED
3. DEVELOP PILOT HOLE TO 1 FT BELOW WATER TABLE DEPTH. LIVE CUTTINGS SHALL NOT BE USED TO DEVELOP PILOT HOLE. PUMP WATER INTO HOLE. INSTALL LIVE CUTTINGS WITH ANGULAR CUT ENDS DOWN AND BLUNT ENDS UP. INSERTION SHALL NOT SPLIT THE STAKE, BRUISE OR STRIP BARK, OR REMOVE STEM NODES, OR OTHERWISE DAMAGE THE LIVE CUTTING.
4. CONTINUE TO PUMP WATER INTO HOLE AND COMPACT SOIL AND BACKFILL IN LIFTS TO IMPROVE STEM TO SOIL CONTACT.
5. TAMP IN MATERIAL AT GROUND SURFACE AROUND LIVE STAKE TO REMOVE AIR POCKETS AND IMPROVE STEM TO SOIL CONTACT.
6. WATER IN FINISHED CUTTING UNTIL WATER VISIBLY “BUBBLES” ON SURFACE

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REVEGETATION TYPICAL DETAILS

SHEET
25 OF 45

Riparian Staking (0.1 Acre)						
Common Name	**Scientific Name**	**Type**	**Stock**	**Size**	**Spacing**	**Quantity**
Silky Dogwood	*Cornus amomum*	Shrub	Live Stake	4 - 6 ft, 0.5-1.5" diameter	5 feet o.c.	40
Pussy Willow	*Salix discolor*	Shrub	Live Stake	4 - 6 ft, 0.5-1.5" diameter	5 feet o.c.	40
American Black Elderberry	*Sambucus nigra ssp. canadensis*	Shrub	Live Stake	4 - 6 ft, 0.5-1.5" diameter	5 feet o.c.	40
White Meadowsweet	*Spiraea latifolia*	Shrub	Live Stake	4 - 6 ft, 0.5-1.5" diameter	5 feet o.c.	40
Arrowwood	*Viburnum dentatum*	Shrub	Live Stake	4 - 6 ft, 0.5-1.5" diameter	5 feet o.c.	40
Bebb Willow	*Salix bebbiana*	Tree	Live Stake	4 - 6 ft, 0.5-1.5" diameter	10 feet o.c.	45

Riparian (1 Acre)						
Common Name	**Scientific Name**	**Type**	**Stock**	**Size**	**Spacing**	**Quantity**
Silky Dogwood	*Cornus amomum*	Shrub	Live Stake	4 - 6 ft, 0.5-1.5" diameter	10 feet o.c.	50
Pussy Willow	*Salix discolor*	Shrub	Live Stake	4 - 6 ft, 0.5-1.5" diameter	10 feet o.c.	50
American Black Elderberry	*Sambucus nigra ssp. canadensis*	Shrub	Live Stake	4 - 6 ft, 0.5-1.5" diameter	10 feet o.c.	50
Bebb Willow	*Salix bebbiana*	Tree	Live Stake	4 - 6 ft, 0.5-1.5" diameter	20 feet o.c.	15
White Meadowsweet	*Spiraea latifolia*	Shrub	Potted	1 gallon	10 feet o.c.	63
Steeplebush	*Spirea tomentosa*	Shrub	Potted	1 gallon	10 feet o.c.	62
Arrowwood	*Viburnum dentatum*	Shrub	Potted	1 gallon	10 feet o.c.	63
Balsam Fir	*Abies balsamifera*	Tree	Potted	1 gallon	20 feet o.c.	15
Red Maple	*Acer rubrum*	Tree	Potted	1 gallon	20 feet o.c.	15
Gray Alder	*Alnus incana*	Tree	Potted	1 gallon	20 feet o.c.	15
Yellow Birch	*Betula alleghaniensis*	Tree	Potted	1 gallon	20 feet o.c.	15
Gray Birch	*Betula populifolia*	Tree	Potted	1 gallon	20 feet o.c.	15
Black Spruce	*Picea mariana*	Tree	Potted	1 gallon	20 feet o.c.	15
American Elm	*Ulmus americana*	Tree	Potted	1 gallon	20 feet o.c.	15

Transitional (0.55 Acres)						
Common Name	**Scientific Name**	**Type**	**Stock**	**Size**	**Spacing**	**Quantity**
Sweet-fern	*Comptonia peregrina*	Shrub	Potted	1 gallon	10 feet o.c.	45
Virginia Rose	*Rosa virginiana*	Shrub	Potted	1 gallon	10 feet o.c.	45
Steeplebush	*Spirea tomentosa*	Shrub	Potted	1 gallon	10 feet o.c.	45
Arrowwood	*Viburnum dentatum*	Shrub	Potted	1 gallon	10 feet o.c.	45
Balsam Fir	*Abies balsamifera*	Tree	Potted	1 gallon	20 feet o.c.	9
Red Maple	*Acer rubrum*	Tree	Potted	1 gallon	20 feet o.c.	9
Gray Alder	*Alnus incana*	Tree	Potted	1 gallon	20 feet o.c.	9
Yellow Birch	*Betula alleghaniensis*	Tree	Potted	1 gallon	20 feet o.c.	9
Paper Birch	*Betula papyrifera*	Tree	Potted	1 gallon	20 feet o.c.	9
Gray Birch	*Betula populifolia*	Tree	Potted	1 gallon	20 feet o.c.	9
Black Spruce	*Picea mariana*	Tree	Potted	1 gallon	20 feet o.c.	10

Upland (0.49 Acres)						
Common Name	**Scientific Name**	**Type**	**Stock**	**Size**	**Spacing**	**Quantity**
Sweet-fern	*Comptonia peregrina*	Shrub	Potted	1 gallon	10 feet o.c.	42
Bush-Honesuckle	*Diervilla lonicera*	Shrub	Potted	1 gallon	10 feet o.c.	41
Creeping Juniper	*Juniperus horizontalis*	Shrub	Potted	1 gallon	10 feet o.c.	41
Common Red Raspberry	*Rubus ideaus*	Shrub	Potted	1 gallon	10 feet o.c.	41
Sugar Maple	*Acer saccharum*	Tree	Potted	1 gallon	20 feet o.c.	14
Paper Birch	*Betula papyrifera*	Tree	Potted	1 gallon	20 feet o.c.	14
Eastern White Pine	*Pinus strobus*	Tree	Potted	1 gallon	20 feet o.c.	14
Eastern Hemlock	*Tsuga canadensis*	Tree	Potted	1 gallon	20 feet o.c.	14

Wet Seed Mix (Riparian Zone)
40 Lbs / Acre, 1 Acre Total

Common Name	***Scientific Name***	**Percent of Mix**
Upland Bentgrass	Agrostis perenans	1%
Big Bluestem	Andropogon gerardii	16%
Devil's Beggartick	Bidens frondosa	8%
Riverbank Wildrye	Elymus riparius	37%
Common Boneset	Eupatrorium perfoliatum	1%
Spotted Joe Pye Weed	Eutrochium maculatum	2%
Red Fesuce	Festuca rubra ssp. Rubra	6%
Common Rush	Juncus effusus	1%
Switchgrass	Panicum virgatum	6%
Little Bluestem	Schizachryium scoparium	8%
Woolgrass	Scirpus cyperinus	1%
New England Aster	Symphotrichum novae-angilae	2%
New York Ironweed	Vernonia noveboracensis	12%
		100%

Dry Seed Mix (Transitional and Upland Zones)
40 Lbs / Acre, 1.04 Acres Total

Common Name	***Scientific Name***	**Percent of Mix**
Upland Bentgrass	Agrostis perennans	2%
Canada Wilrye	Elymus canadensis	27%
Virginia Wildrye	Elymus virginicus	15%
Red Fescue	Festuca rubra ssp. rubra	22%
Poverty Rush	Juncus tenuis	1%
Switchgrass	Panicum virgatum	14%
Little Bluestem	Schizachryium scoparium	12%
Indian Grass	Sorghastrum nutans	7%

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NARRAGUAGUS RIVER
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REVEGETATION SCHEDULE

SHEET
26 OF 45

CHERRYFIELD ICE DAM REMOVAL

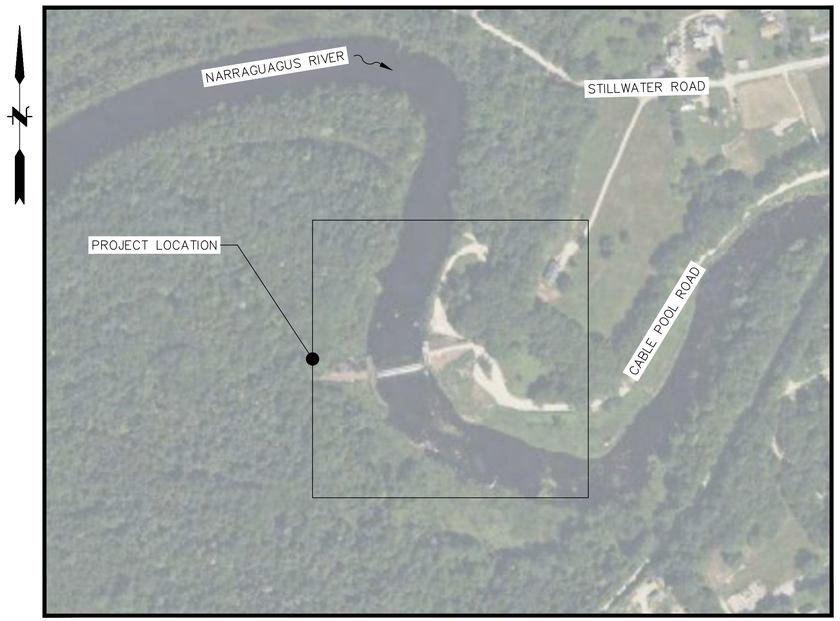
CABLE POOL PARK · CHERRYFIELD · MAINE

100% PLAN SET

November 26, 2025

SHEET INDEX

Sheet no.	Sheet Title
GI-001	Cover Sheet
GA-002	General and Structural Notes
C-101	Existing Conditions
SS-101	Dam Overview
SS-102	Boring Logs
SS-103	Historical Drawings: Dam Profile and Sections
SS-104	Historical Drawings: Dam Sections
SS-105	Historical Drawings: Crib and Sluiceway Details
SD-101	Structural Details - I
CS-101	Site Improvement Plan
CS-102	Site Improvement Plan Enlargement
CS-103	Site Improvement - Overlook Plan Enlargement
CG-101	Grading Plan - River Left
CG-102	Grading Plan - River Right
LP-101	Landscape Plan
CD-101	Civil Details
CD-102	Civil Details
CD-103	Civil Details
CD-104	Civil Details



LOCATION MAP

SCALE: 1" = 200'

PREPARED BY

FUSS & O'NEILL

300 CORNERSTONE DR, SUITE 335
WILLISTON, VT 05495
603.222.3488
www.fando.com

PREPARED FOR

DOWNEAST SALMON FEDERATION

13 WILLOW STREET,
EAST MACHIAS, ME 04630

PROJ. No.: 20230407.A11
DATE: 11/26/2025

GI-001

100% PLANS FOR CONSTRUCTION

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GENERAL NOTES:

GENERAL

1. SYMBOLS AND LEGENDS OF PROJECT FEATURES ARE GRAPHIC REPRESENTATIONS AND ARE NOT NECESSARILY SHOWN ON THE DRAWINGS TO SCALE OR TO THEIR ACTUAL DIMENSION OR LOCATION. COORDINATE DETAIL SHEET DIMENSIONS, MANUFACTURERS' LITERATURE, SHOP DRAWINGS AND FIELD MEASUREMENTS OF SUPPLIED PRODUCTS FOR LAYOUT OF THE PROJECT FEATURES.
2. DO NOT RELY SOLELY ON ELECTRONIC VERSIONS OF DRAWINGS, SPECIFICATIONS, AND DATA FILES THAT ARE PROVIDED BY THE ENGINEER. FIELD VERIFY LOCATION OF PROJECT FEATURES.
3. PERFORM NECESSARY CONSTRUCTION NOTIFICATIONS, APPLY FOR AND OBTAIN NECESSARY PERMITS, PAY FEES, AND POST BONDS ASSOCIATED WITH THE WORK AS REQUIRED BY THE CONTRACT DOCUMENTS.
4. BASE PLAN: THE PROPERTY LINES SHOWN ARE FROM PUBLICLY AVAILABLE GIS DATA AND ARE FOR DISPLAY PURPOSES ONLY. THE TOPOGRAPHY AND PHYSICAL FEATURES ARE BASED ON AN ACTUAL FIELD SURVEY PERFORMED ON 03/21/2024.
6. TOPOGRAPHIC ELEVATIONS ARE BASED ON NAVD88. HORIZONTAL COORDINATE ARE NAD 83 MAINE EAST.
7. GEOTECHNICAL DATA INCLUDING TEST PIT AND BORING LOCATIONS AND ELEVATIONS PROVIDED BY SWCOLE/SEABOARD DRILLING.
8. WETLANDS WERE DELINEATED BY ALAN HABERSTOCK PWS IN MAY 2025.

CONSTRUCTION LAYOUT

1. PROVIDE PROPER TRANSITIONS BETWEEN EXISTING AND PROPOSED SITE IMPROVEMENTS. FIELD VERIFY EXISTING GROUND ELEVATIONS BEFORE START OF CONSTRUCTION.
2. PRIOR TO ORDERING MATERIALS AND BEGINNING CONSTRUCTION, FIELD VERIFY PROPOSED UTILITY ROUTES AND IDENTIFY ANY INTERFERENCES OR OBSTRUCTIONS WITH EXISTING UTILITIES OR PUBLIC RIGHTS-OF-WAY.
3. IMMEDIATELY INFORM THE ENGINEER IN WRITING IF EXISTING UTILITY CONDITIONS CONFLICT OR DIFFER FROM THAT INDICATED AND IF THE WORK CANNOT BE COMPLETED AS INDICATED.
4. BOUNDS OR MONUMENTATION DISTURBED DURING CONSTRUCTION SHALL BE SET OR RESET BY A PROFESSIONAL LICENSED SURVEYOR.

EARTHWORK

1. NOTIFY UTILITY LOCATOR SERVICE AT LEAST 72 HOURS BEFORE STARTING EXCAVATION. "DIG SAFE" AT 811 OR AT 1-888-344-7233.
2. STOP WORK IN THE VICINITY OF SUSPECTED CONTAMINATED SOIL, GROUNDWATER OR OTHER MEDIA. IMMEDIATELY NOTIFY THE ENGINEER SO THAT APPROPRIATE TESTING AND SUBSEQUENT ACTION CAN BE TAKEN. RESUME WORK IN THE IMMEDIATE VICINITY ONLY UPON DIRECTION BY THE ENGINEER.

UTILITIES

1. TERMINATE EXISTING UTILITIES IN CONFORMANCE WITH LOCAL, STATE AND INDIVIDUAL UTILITY COMPANY STANDARD SPECIFICATIONS AND DETAILS. COORDINATE UTILITY SERVICE DISCONNECTS WITH UTILITY REPRESENTATIVES.
2. THE TYPE, SIZE AND LOCATION OF DEPICTED UNDERGROUND UTILITIES ARE APPROXIMATE REPRESENTATIONS OF INFORMATION OBTAINED FROM FIELD LOCATIONS OF VISIBLE FEATURES, EXISTING MAPS AND PLANS OF RECORD, UTILITY MAPPING, AND OTHER SOURCES OF INFORMATION OBTAINED BY THE ENGINEER. ASSUME NO GUARANTEE AS TO THE COMPLETENESS, SERVICEABILITY, EXISTENCE, OR ACCURACY OF UNDERGROUND FACILITIES. FIELD VERIFY THE EXACT LOCATIONS, SIZES, AND ELEVATIONS OF THE POINTS OF CONNECTIONS TO EXISTING UTILITIES.
3. PAY ALL FEES AND COSTS ASSOCIATED WITH UTILITY MODIFICATIONS AND CONNECTIONS, REGARDLESS OF THE ENTITY THAT PERFORMS THE WORK.
4. COORDINATE THE WORK AND WORK SCHEDULE WITH UTILITY COMPANIES. PROVIDE ADEQUATE NOTICE TO UTILITIES TO PREVENT DELAYS IN CONSTRUCTION.

SITE RESTORATION

1. PROVIDE 6 INCHES OF TOPSOIL AND SEED TO AREAS DISTURBED DURING CONSTRUCTION AND NOT DESIGNATED TO BE RESTORED IN ANOTHER MANNER, UNLESS OTHERWISE NOTED.
2. REPAIR DAMAGES RESULTING FROM CONSTRUCTION LOADS, AT NO ADDITIONAL COST TO OWNER.
3. RESTORE AREAS DISTURBED BY CONSTRUCTION OPERATIONS TO THEIR ORIGINAL CONDITION OR BETTER, AT NO ADDITIONAL COST TO OWNER.

STRUCTURAL GENERAL NOTES:

SPECIFICATIONS

1. DESIGN: LOAD AND RESISTANCE FACTOR DESIGN PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, NINTH EDITION 2020, WITH CURRENT INTERIM SPECIFICATIONS.
2. ICE LOADING: MAINE DOT BRIDGE DESIGN GUIDE, 2003 EDITION, WITH JULY 2004 UPDATE.
3. PEDESTRIAN LOAD: LRFD GUIDE SPECIFICATIONS FOR THE DESIGN OF PEDESTRIAN BRIDGES, SECOND EDITION 2009.
4. CONSTRUCTION SHALL BE DONE USING THE SPECIAL PROVISIONS PROVIDED.

FOUNDATIONS

1. FOUNDATIONS MAY BE ALTERED, IF NECESSARY, TO SUIT CONDITIONS ENCOUNTERED DURING CONSTRUCTION, WITH THE APPROVAL OF THE ENGINEER. DESIGN OF FOUNDATIONS IS BASED ON BORING LOGS NOT TAKEN DIRECTLY AT THE PIER LOCATIONS. CONTRACTOR SHALL CONFIRM BEDROCK ELEVATION BEFORE CONSTRUCTING NEW PIERS.
2. FOUNDATION PREPARATION, PILE AND PILE CAP INSTALLATION SHALL BE PERFORMED IN A DRY CONDITION. COFFERDAM AND DEWATERING WILL BE REQUIRED. SEE SPECIAL PROVISIONS FOR DETAILS.

WASTE MATERIAL

1. ALL WASTE MATERIAL NOT USED ON THE PROJECT SHALL BE DISPOSED OF OFF THE PROJECT IN ACCEPTABLE WASTE AREAS REVIEWED BY THE RESIDENT. GRADING, SEEDING, AND MULCHING OF WASTE AREAS SHALL BE CONSIDERED INCIDENTAL.

CONSTRUCTION REQUIREMENTS AND PROCEDURES

1. THE EXISTING DAM IS TO BE REMOVED AND EXISTING ICE PIERS TO BE REPLACED. THE CONTRACTOR SHALL TAKE THE PROPER PRECAUTIONS TO ENSURE THE STABILITY AND SAFE PERFORMANCE OF ALL STRUCTURAL ELEMENTS DURING DEMOLITION AND CONSTRUCTION. REFER TO APPROVED DEMOLITION/ ERECTION PLANS.
2. ALL DAM REMOVAL AND ICE PIER REPLACEMENT SHALL BE PERFORMED IN A DRY CONDITION. COFFERDAM AND DEWATERING WILL BE REQUIRED. SEE SPECIAL PROVISIONS FOR DETAILS.

EXISTING CONSTRUCTION

1. DIMENSIONS SHOWN ARE TAKEN FROM SURVEY AND VARIOUS FIELD MEASUREMENTS AND ORIGINAL CONTRACT DOCUMENTS AND ARE NOT GUARANTEED. THE CONTRACTOR SHALL DETERMINE AND ESTABLISH ALL DIMENSIONS AND DETAILS NECESSARY FOR COMPLETION OF ALL WORK BY FIELD MEASUREMENT AND SURVEY. THE CONTRACTOR SHALL BE RESPONSIBLE AND NOT ORDER ANY MATERIAL OR COMMENCE ANY FABRICATION UNTIL THEY HAVE MADE THE REQUIRED MEASUREMENTS ON THE ACTUAL STRUCTURE AND THE EXTENT OF THE PROPOSED WORK HAS BEEN APPROVED BY THE ENGINEER.

STRUCTURAL ADDITIONAL NOTES:

MATERIALS

CONCRETE:	CLASS "A"
REINFORCING STEEL:	ASTM A615, GRADE 60
STEEL FASTENERS:	
LAG SCREWS:	ASTM A307, GRADE A
TIMBER HEX SCREWS:	ASTM A307, GRADE A
ANCHOR BOLTS:	ASTM F1554, GRADE 55
ANCHOR BOLT NUTS:	ASTM A563, GRADE A
STEEL H-PILES:	ASTM A572, GRADE 50

1. ALL SCREWS, BOLTS, NUTS, AND WASHERS SHALL BE HOT DIP GALVANIZED IN ACCORDANCE WITH ASTM A153.

CONCRETE

1. THE USE OF REMAIN-IN-PLACE FORMS ON THIS STRUCTURE IS NOT ALLOWED.

REINFORCEMENT

1. REINFORCING STEEL SHALL BE EPOXY COATED.
2. ALL REINFORCING STEEL SHALL HAVE A MINIMUM CONCRETE COVER OF 3 INCHES TO REINFORCING ℄ UNLESS OTHERWISE NOTED.

PILE NOTES

1. HEAVY DUTY PILE SHOES SHALL BE INSTALLED ON THE TIPS OF ALL PILES. PREFABRICATED PILE SHOES MAY BE USED IF APPROVED BY THE ENGINEER.
2. ALL PILE SPLICES SHALL BE EITHER BUTT JOINTS MADE USING COMPLETE JOINT PENETRATION WELDS OR MECHANICAL TYPE SPLICERS INSTALLED IN ACCORDANCE WITH THE APPROVED INSTALLATION NOTES. ALL SPLICE WELDS WITHIN 26 FEET FROM THE TOP OF THE PILE SHALL BE 100% INSPECTED USING UT.
3. FACTORED AXIAL DESIGN LOAD PER PILE PER AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS.
   - 3.1. STRENGTH I LIMIT STATE
     FACTORED AXIAL DESIGN LOAD = 24.4 KIPS.
   - 3.2. EXTREME II LIMIT STATE
     FACTORED AXIAL DESIGN LOAD = 40.1 KIPS.
4. PILES SHALL BE DRIVEN TO BEDROCK WITH THE ESTIMATED TIP ELEVATION AT EL. 14.83. THE FACTORED STRUCTURAL RESISTANCE PER PILE IS 335.0 KIPS AND IS THE PRODUCT OF THE NOMINAL STRUCTURAL RESISTANCE OF 372.2 KIPS AND A RESISTANCE FACTOR OF 0.90.
5. DETERMINATION OF THE DRIVEN PILE RESISTANCE, PILE DRIVING CRITERIA, AND PILE INTEGRITY SHALL BE PERFORMED ON AT LEAST 1 PILE PER PIER USING WAVE EQUATION ANALYSIS WITH A RESISTANCE FACTOR OF 0.50. PILES SHALL BE INSTALLED TO ACHIEVE A FACTORED DRIVEN RESISTANCE EQUAL TO OR GREATER THAN THE FACTORED AXIAL DESIGN LOAD NEGLECTING AN ESTIMATED 8 KIPS OF SIDE RESISTANCE THAT WILL BE LOST DUE TO 14.5 FEET OF DESIGN SCOUR.
6. THE CONTRACTOR SHALL SUBMIT A PILE SCHEDULE, PILE INSTALLATION, AND PILE DRIVING/TESTING PLAN FOR REVIEW AND APPROVAL BY THE ENGINEER.
7. AFTER PILE DRIVING IS COMPLETE THE CONTRACTOR SHALL SUBMIT PILE DRIVING LOGS INCLUDING THE FINAL TIP ELEVATIONS AND THE RESULTS OF ANY DYNAMIC OR STATIC LOAD TESTING. SIGNIFICANT DEVIATIONS SHALL BE NOTED AS REVISIONS ON THE CONSTRUCTION DRAWINGS.

GEOTECHNICAL NOTES

1. SEE EXPLORATION AND BORING LOGS, DATED FEBRUARY 19, 2025.
2. NATIONAL VERTICAL DATUM NAVD 88 FEET IS USED THROUGHOUT.

CONSTRUCTION JOINTS

1. CONSTRUCTION JOINTS, OTHER THAN THOSE SHOWN ON THE PLANS, WILL NOT BE PERMITTED WITHOUT PRIOR APPROVAL OF THE ENGINEER.

100% PLANS FOR CONSTRUCTION

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LAYER STATE:
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No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: NOT TO SCALE
VERT.:
DATUM:
HORZ.: -
VERT.: -

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603.222.3488
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ICE DAM AT CABLE POOL PARK

GENERAL AND STRUCTURAL NOTES

NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

GA-002

NOTE:
TAX PARCEL BOUNDARIES ACCESSED FROM MAINE GEOLIBRARY PARCEL PROJECT (ACCESSED FEBRUARY 2025).

THE PROPERTY LINES SHOWN ARE FROM PUBLICLY AVAILABLE GIS DATA (ACCESSED MAY 2025) AND ARE FOR DISPLAY PURPOSES ONLY. TOPOGRAPHY AND PHYSICAL FEATURES ARE BASED ON AN ON-SITE FIELD SURVEY (PERFORMED ON 03/21/2024).

LOCATION OF EXISTING BOAT RAMP

TO STILLWATER ROAD

PARCEL ID: 0U6-017-000
OWNER:
PAUL AND ANITA MERRITT

PARCEL ID: 0U6-017-001
OWNER:
JONATHAN AND LISA BEAL

LOCATION OF EXISTING ICE PIERS

LOCATION OF EXISTING DAM

PARCEL ID: 0R4-001-000
OWNER:
MARY E. WESTON AND JOHN LUDERS

PARCEL ID: 0U6-012-000
OWNER:
TOWN OF CHERRYFIELD

EXISTING ACCESS ROAD

LOCATION OF EXISTING PAVILION/GAZEBO

CABLE POOL ROAD

PARCEL ID: 0U6-003-001
OWNER:
JOSEPH SPROUL

NARRAGUAGUS RIVER

PARCEL ID: 0U6-011-000
OWNER:
TOWN OF CHERRYFIELD

PARCEL ID: 0R4-002-000
OWNER:
TOWN OF CHERRYFIELD

PARCEL ID: 0R4-003-000
OWNER:
NORMA V. JOHNS

PARCEL ID: 0U6-004-000
OWNER:
TOWN OF CHERRYFIELD

EXISTING TOWN RIGHT OF WAY

PARCEL ID: 0U7-016-000
OWNER:
STATE OF MAINE DEPARTMENT OF TRANSPORTATION

PARCEL ID: 0U6-001-000
OWNER:
WILLIAM THOMPSON

TO ROUTE 182 / BLACK HILLS ROAD

LEGEND

- EXISTING 2-FT CONTOURS
- EXISTING 10-FT CONTOURS
- WETLAND DELINEATION
- APPROXIMATE TREE LINE
- EXISTING TREES
- APPROXIMATE WATER EDGE LINE
- OHW — OHW — ORDINARY HIGH WATER LINE
- RF25 — RF25 — 25' OHW BUFFER
- RF75 — RF75 — 75' OHW BUFFER
- FEMA AE - FEMA AE - FEMA AE - FEMA AE — FEMA FLOODZONE
- APPROXIMATE TAX PARCEL LOTS
- EXISTING ROAD EDGE
- EXISTING CULVERT
- EXISTING DAM & ICE PIERS

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: 1" = 70'
VERT.: -
DATUM:
HORZ.: -
VERT.: -
0 35' 70' 140'
GRAPHIC SCALE

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WILLISTON, VT 05495
603.222.3488
www.fando.com

ICE DAM AT CABLE POOL PARK

EXISTING CONDITIONS

NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

C-101

File: J:\DWG\P2023\0407\A11\Civil\Plan\20230407A11_EXC01.dwg Layout: C-101 Plotted: 2025-11-26 8:22 PM Saved: 2025-11-26 8:21 PM User: Dora.Bean
PC3: AUTOCAD PDF (GENERAL DOCUMENTATION).PC3 STB/CTB: FO.STB
LAYER STATE:
MS VIEW:

B-1
SOIL BORING #1
B-2
SOIL BORING #2
EXISTING CABLE POOL RD
DEMOLISH AND REBUILD ICE PIERS. SEE SHEET SD-101 FOR DETAILS.
LIMIT OF DISTURBANCE (TYP.)
CONSTRUCTION ACCESS VIA ACCESS ROAD EXTENSION.
NARRAGUAGUS RIVER
PARTIALLY REMOVE DAM. SEE SHEETS SS-103, 104, AND 105 FOR DETAILS OF EXISTING STRUCTURE. SEE SHEET IF-9 FOR LIMITS OF REMOVAL.
A SS-103
D SS-105
F SS-104
C SS-104
E SS-104

LEGEND

- EXISTING 2-FT CONTOURS
- EXISTING 10-FT CONTOURS
- WETLAND DELINEATION
- APPROXIMATE TREE LINE
- EXISTING TREES & ROCK OUTCROPPINGS
- APPROXIMATE WATER EDGE LINE
- OHW — ORDINARY HIGH WATER LINE DELINEATION
- RF25 — 25' OHW BUFFER
- RF75 — 75' OHW BUFFER
- FEMA AE — FEMA FLOODZONE
- APPROXIMATE TAX PARCEL LOTS
- EXISTING ROAD EDGE
- LOD — LIMIT OF DISTURBANCE
- PROPOSED ACCESS ROAD ALIGNMENT
- PROPOSED ACCESS ROAD LIMITS
- DAM SPILLWAY, ABUTMENTS, AND ICE PIERS

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: 1" = 20'
VERT.: -
DATUM:
HORZ.: -
VERT.: -
0 10' 20' 40'
GRAPHIC SCALE

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WILLISTON, VT 05495
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ICE DAM AT CABLE POOL PARK

DAM OVERVIEW

NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

SS-101

File: J:\DWG\P2023\20407\A11\Civil\Plan\20230407A11_STR01.dwg Layout: SS-101 Plotted: 2025-11-26 8:23 PM Saved: 2025-11-26 10:31 AM User: Nathan.Unruh
PC3: AUTOCAD PDF (GENERAL DOCUMENTATION).PC3 STB/CTB: FO.STB
LAYER STATE:
MS VIEW:

BORING LOG

BORING NO.: B-1
SHEET: 1 of 1
PROJECT NO. 25-0024
DATE START: 2/10/2025
DATE FINISH: 2/10/2025

CLIENT: Inter-Fluve, Inc.
PROJECT: Proposed Ice Piers
LOCATION: Cherryfield Dam, Cherryfield, Maine

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): N/A
TOTAL DEPTH (FT): 43.0
LOGGED BY: Alex Allen
DRILLING CO.: Seaboard Drilling, LLC
DRILLER: Ryan Hackett
DRILLING METHOD: Cased Boring
RIG TYPE: Track Mounted Diedrich D-50
AUGER ID/OD: N/A / N/A
SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic
HAMMER WEIGHT (lbs): 140 / 140
CASING ID/OD: 4 in / 4 1/2 in
CORE BARREL: NQ2
HAMMER CORRECTION FACTOR: 1.47
HAMMER DROP (inch): 30 / 30
WATER LEVEL DEPTHS (ft): Soils wet below 5 feet +/-
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level; ∇ At time of Drilling; ⧩ At Completion of Drilling; ⧩ After Drilling; D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear; Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot; WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		2-4	24/0	3-4-6-7			Loose, brown silty gravelly SAND (Fill)		
	5		2D		5-7	24/8	1-3-5-6			5.0 Loose, gray gravelly silty SAND (Probable Fill)		
	10		3D		10-12	24/6	8-21-19-19			10.0 Dense, brown gravelly SAND, some silt with frequent cobbles		
	15		4D		15-17	24/12	10-11-16-22					
	20		5D		20-21.8	22/18	11-28-31-50/4"			21.8 Probable cobbles		
	25		6D		25-27	24/16	18-29-41-36			23.2 Dense to very dense, brown silty gravelly SAND with frequent cobbles		
	30		7D		30-31.4	17/8	16-26-50/5"			31.4 Probable Bedrock, advanced to 33 feet by rollercone		
			1R		33-38	60/56	93			33.0 Bedrock; Gabbro-Diorite, fresh, hard, joints moderately spaced		
	35											
			2R		38-43	60/60	100					
	40									Bottom of Exploration at 43.0 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-1

BORING / WELL 10-12-2022 25-0024.GPJ SWCE TEMPLATE.GDT 2/19/25

BORING LOG

BORING NO.: B-2
SHEET: 1 of 1
PROJECT NO. 25-0024
DATE START: 2/11/2025
DATE FINISH: 2/12/2025

CLIENT: Inter-Fluve, Inc.
PROJECT: Proposed Ice Piers
LOCATION: Cherryfield Dam, Cherryfield, Maine

Drilling Information

LOCATION: See Exploration Location Plan
ELEVATION (FT): N/A
TOTAL DEPTH (FT): 45.4
LOGGED BY: Nate Strout
DRILLING CO.: Seaboard Drilling, LLC
DRILLER: Ryan Hackett
DRILLING METHOD: Cased Boring
RIG TYPE: Track Mounted Diedrich D-50
AUGER ID/OD: N/A / N/A
SAMPLER: Standard Split-Spoon
HAMMER TYPE: Automatic / Automatic
HAMMER WEIGHT (lbs): 140 / 140
CASING ID/OD: 4 in / 4 1/2 in
CORE BARREL: NQ2
HAMMER CORRECTION FACTOR: 1.47
HAMMER DROP (inch): 30 / 30
WATER LEVEL DEPTHS (ft): Soils wet below 5 feet +/-
GENERAL NOTES:

KEY TO NOTES AND SYMBOLS: Water Level; ∇ At time of Drilling; ⧩ At Completion of Drilling; ⧩ After Drilling; D = Split Spoon Sample; U = Thin Walled Tube Sample; R = Rock Core Sample; V = Field Vane Shear; Pen. = Penetration Length; Rec. = Recovery Length; bpf = Blows per Foot; mpf = Minute per Foot; WOR = Weight of Rods; WOH = Weight of Hammer; RQD = Rock Quality Designation; PID = Photoionization Detector; S_v = Field Vane Shear Strength, kips/sq.ft.; q_u = Unconfined Compressive Strength, kips/sq.ft.; Ø = Friction Angle (Estimated); N/A = Not Applicable

Elev. (ft)	Depth (ft)	Casing Pen. (bpf)	SAMPLE INFORMATION: Sample No.	Type	Depth (ft)	Pen./ Rec. (in)	Blow Count or RQD	Field / Lab Test Data	Graphic Log	Sample Description & Classification	H_2O Depth	Remarks
			1D		2-4	24/17	48-14-16-22			Dense, brown silty gravelly SAND, with frequent cobbles (Fill)		
	5		2D		5-7	24/20	14-17-17-20			5.0 Dense to very dense, brown gravelly SAND, some silt with frequent cobbles		
	10		3D		10-12	24/18	12-22-33-37					
	15		4D		15-17	24/15	30-36-26-22			15.0 Very dense, brown silty gravelly SAND with occasional cobbles		
	20		5D		20-22	24/4	30-36-46-41					
	25		6D		25-27	24/5	29-39-37-36					
	30		7D		30-32	24/16	39-36-32-31					
			1R		35.1-39.1	48				Cobbles; cored through stacked cobbles from 35.1 to 39.1 feet		
	35											
			2R		40.4-45.4	60/60	55			40.4 Bedrock; Gabbro-Diorite, fresh, hard, joints moderately spaced		
	40											
	45									Bottom of Exploration at 45.4 feet		

Stratification lines represent approximate boundary between soil types, transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to other factors than those present at the time measurements were made.

BORING NO.: B-2

BORING / WELL 10-12-2022 25-0024.GPJ SWCE TEMPLATE.GDT 2/19/25

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: AS NOTED
VERT.:
DATUM:
HORZ.: -
VERT.: -

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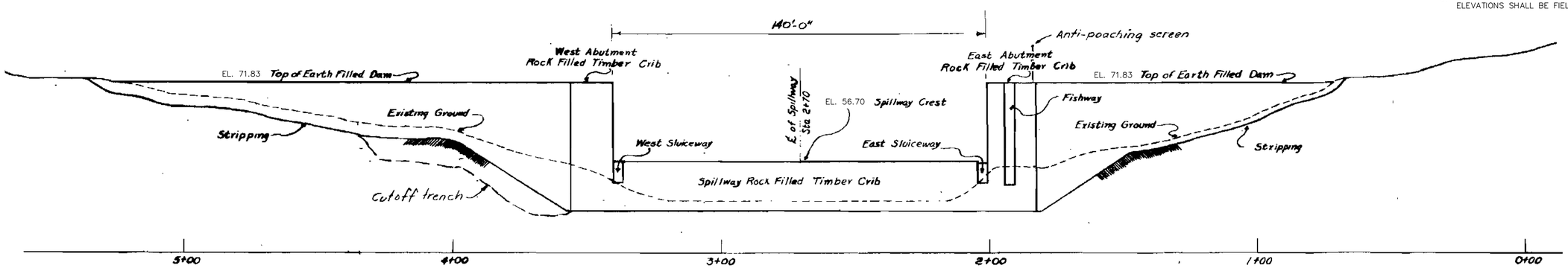
ICE DAM AT CABLE POOL PARK
BORING LOGS
NARRAGUAGUS RIVER
CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

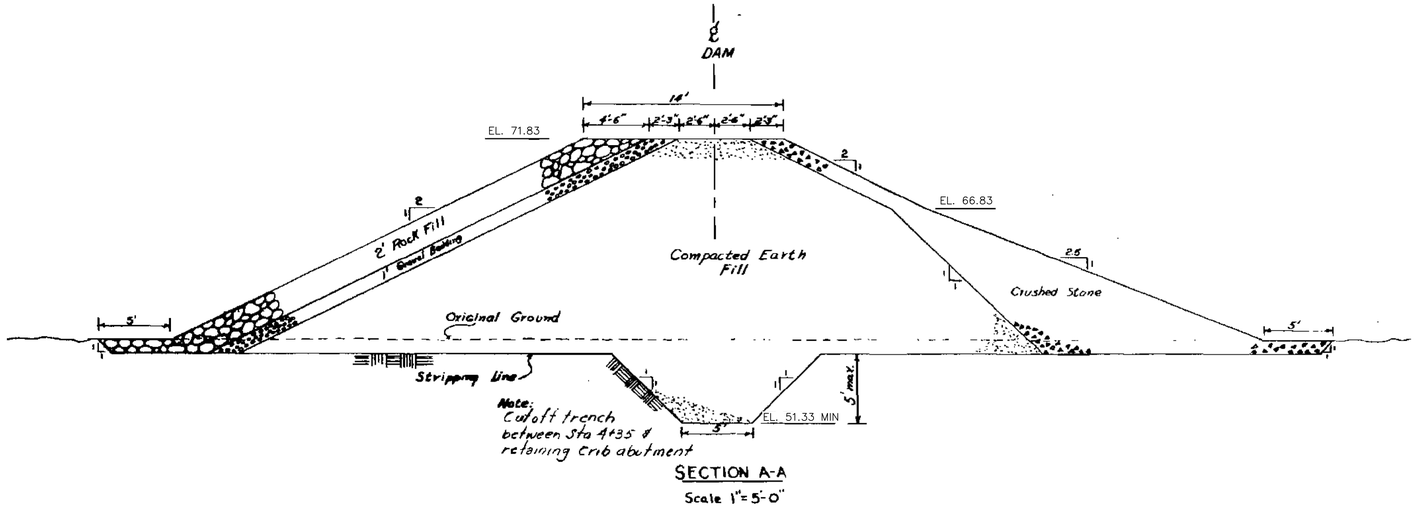
SS-102

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MS VIEW:

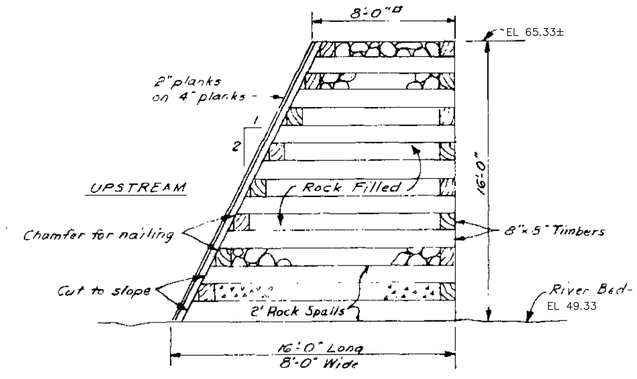
NOTES:
1. HISTORIC DRAWINGS TITLED NARRAGAUGUS RIVER FLOOD CONTROL BY U.S. ARMY ENGINEER DIVISION, NEW ENGLAND DATED APRIL 1960, SUPPLIED BY INTERFLUVE FOR REFERENCE ONLY.
2. ELEVATIONS HAVE BEEN CONVERTED FROM NGVD29 TO SURVEY DATUM (NAVD88).
3. ALL HISTORICAL INFORMATION AND CONVERTED ELEVATIONS SHALL BE FIELD VERIFIED.



℄ PROFILE OF DAM
Scale: 1"=20' Hor
1"=10' Vert



SECTION A-A
Scale 1"=5'-0"



TIMBER ICE-HOLDING CRIB
SCALE: 1/4"=1'-0"

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: NOT TO SCALE
VERT.:
DATUM:
HORZ.: -
VERT.: -

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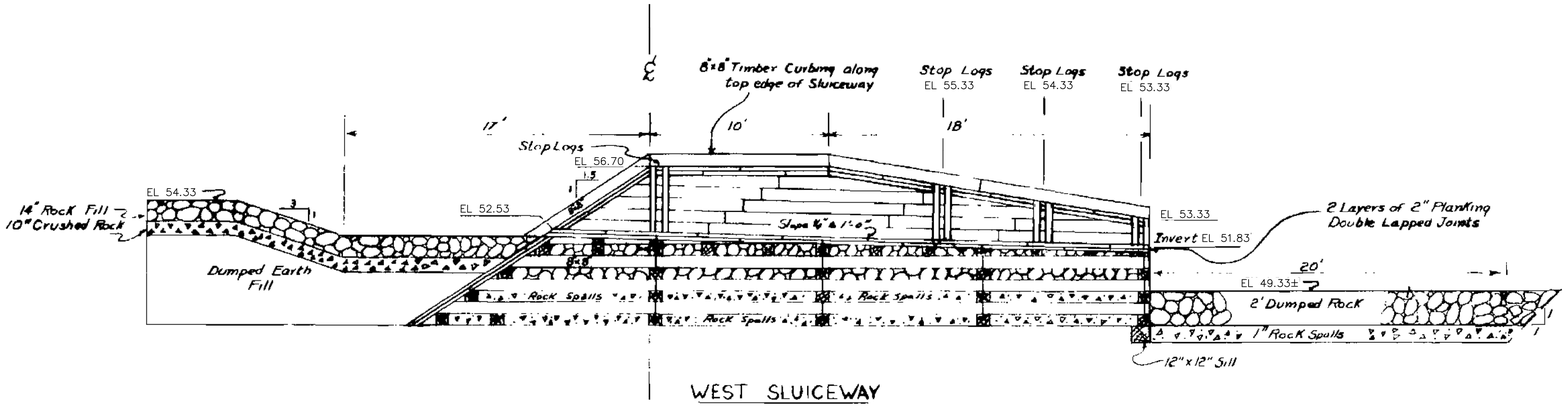
ICE DAM AT CABLE POOL PARK
HISTORICAL DRAWINGS:
DAM PROFILE AND SECTIONS
NARRAGUAGUS RIVER
CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

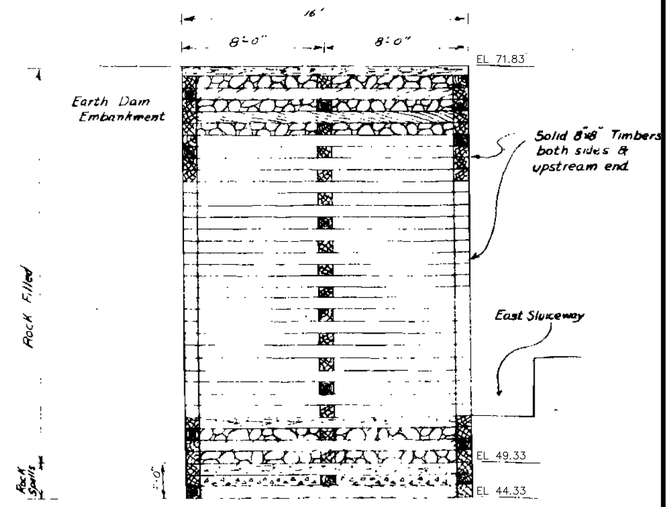
SS-103

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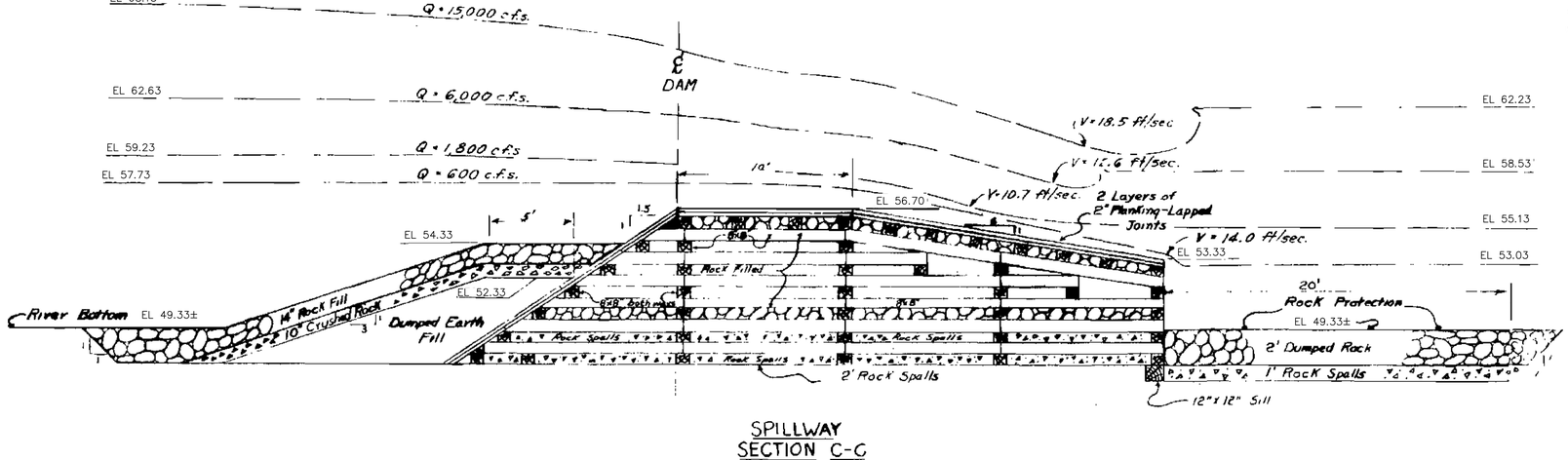
NOTES:
1. HISTORIC DRAWINGS TITLED NARRAGAUGUS RIVER FLOOD CONTROL BY U.S. ARMY ENGINEER DIVISION, NEW ENGLAND DATED APRIL 1960, SUPPLIED BY INTERFLUVE FOR REFERENCE ONLY.
2. ELEVATIONS HAVE BEEN CONVERTED FROM NGVD29 TO SURVEY DATUM (NAVD88).
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WEST SLUICEWAY
SECTION F-F



SECTION E-E



SPILLWAY
SECTION C-G

100% DRAFT - NOT FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: NOT TO SCALE
VERT.:
DATUM:
HORZ.: -
VERT.: -

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WILLISTON, VT 05495
603.222.3488
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ICE DAM AT CABLE POOL PARK

HISTORICAL DRAWINGS: DAM SECTIONS

NARRAGUAGUS RIVER

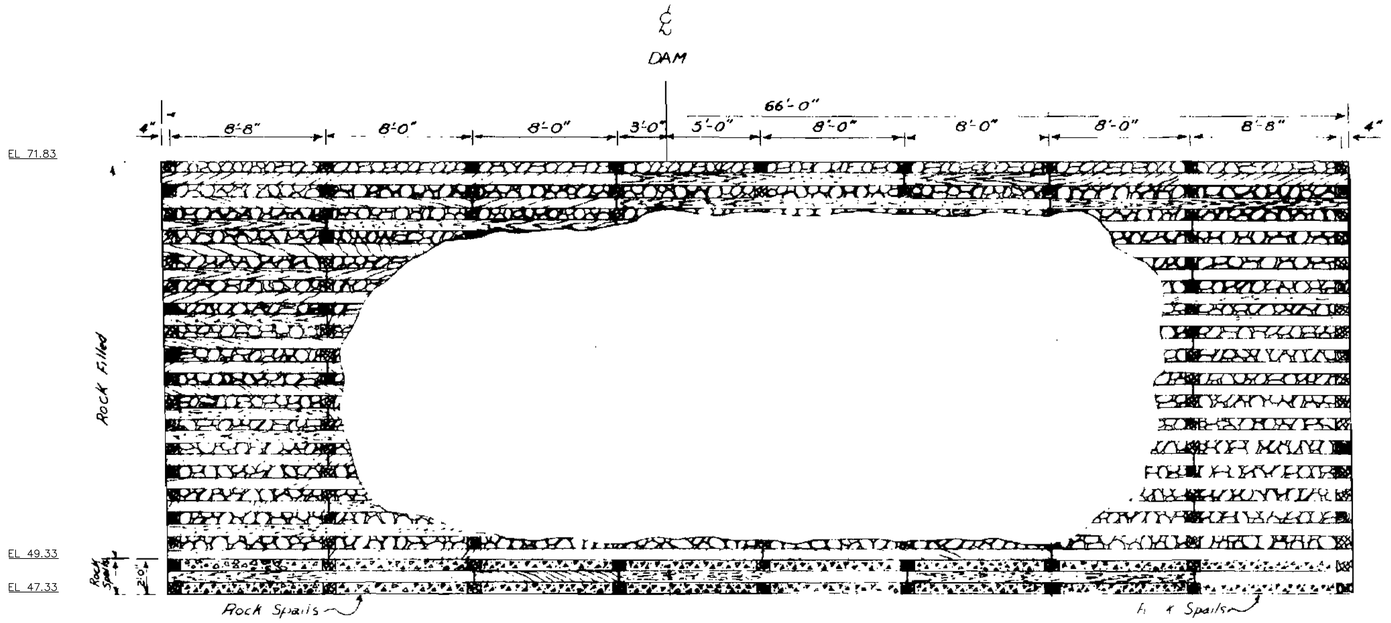
CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 10/17/2025

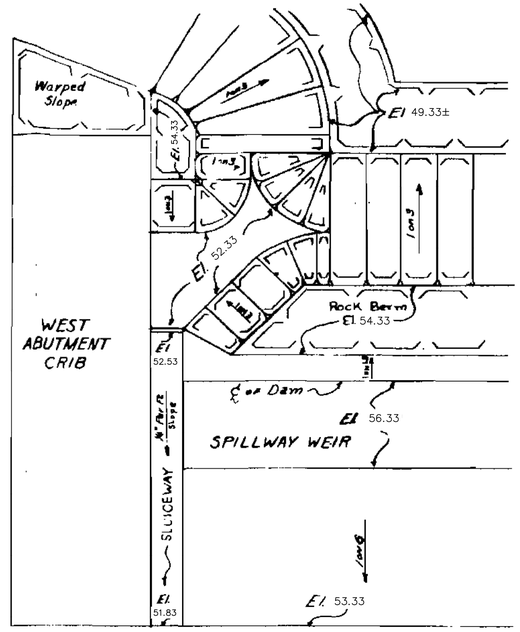
SS-104

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PC3: AUTOCAD PDF (GENERAL DOCUMENTATION).PC3 STB/CTB: FO.STB
MS VIEW: LAYER STATE:

NOTES:
1. HISTORIC DRAWINGS TITLED NARRAGAUGUS RIVER FLOOD CONTROL BY U.S. ARMY ENGINEER DIVISION, NEW ENGLAND DATED APRIL 1960, SUPPLIED BY INTERFLUVE FOR REFERENCE ONLY.
2. ELEVATIONS HAVE BEEN CONVERTED FROM NGVD29 TO SURVEY DATUM (NAVD88).
3. ALL HISTORICAL INFORMATION AND CONVERTED ELEVATIONS SHALL BE FIELD VERIFIED.



WEST ABUTMENT CRIB
SECTION D-D



PLAN - WEST SLUICEWAY
East Sluiceway opposite ~~North~~
Scale 1/8" = 1'-0"

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: AS NOTED
VERT.:
DATUM:
HORZ.: -
VERT.: -

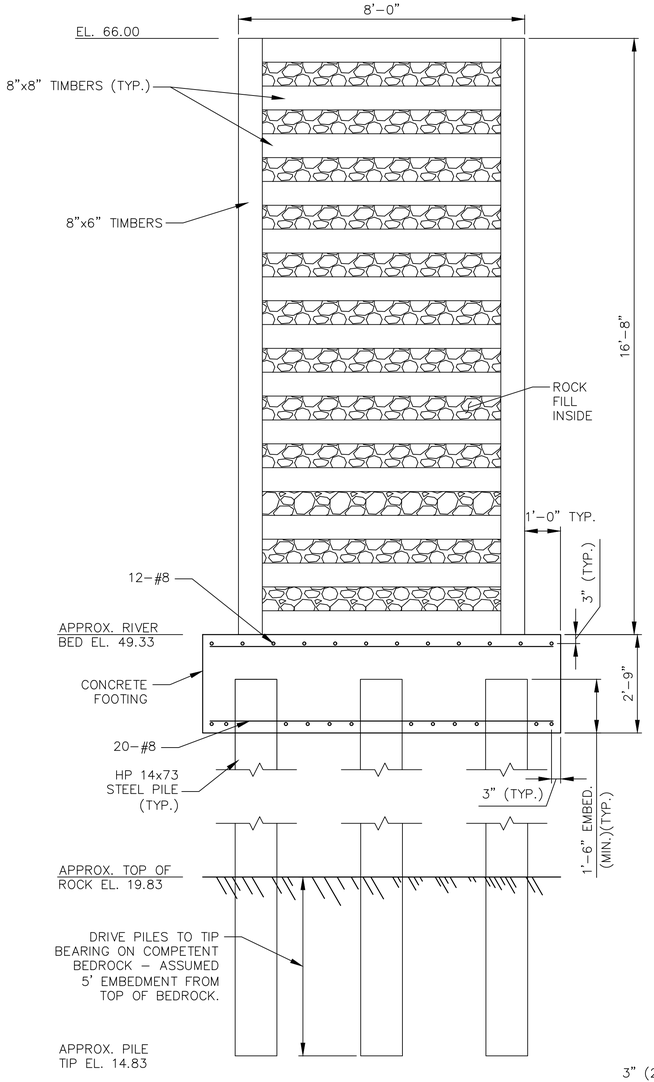
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ICE DAM AT CABLE POOL PARK
HISTORICAL DRAWINGS:
CRIB AND SLUICEWAY DETAILS
NARRAGUAGUS RIVER
CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

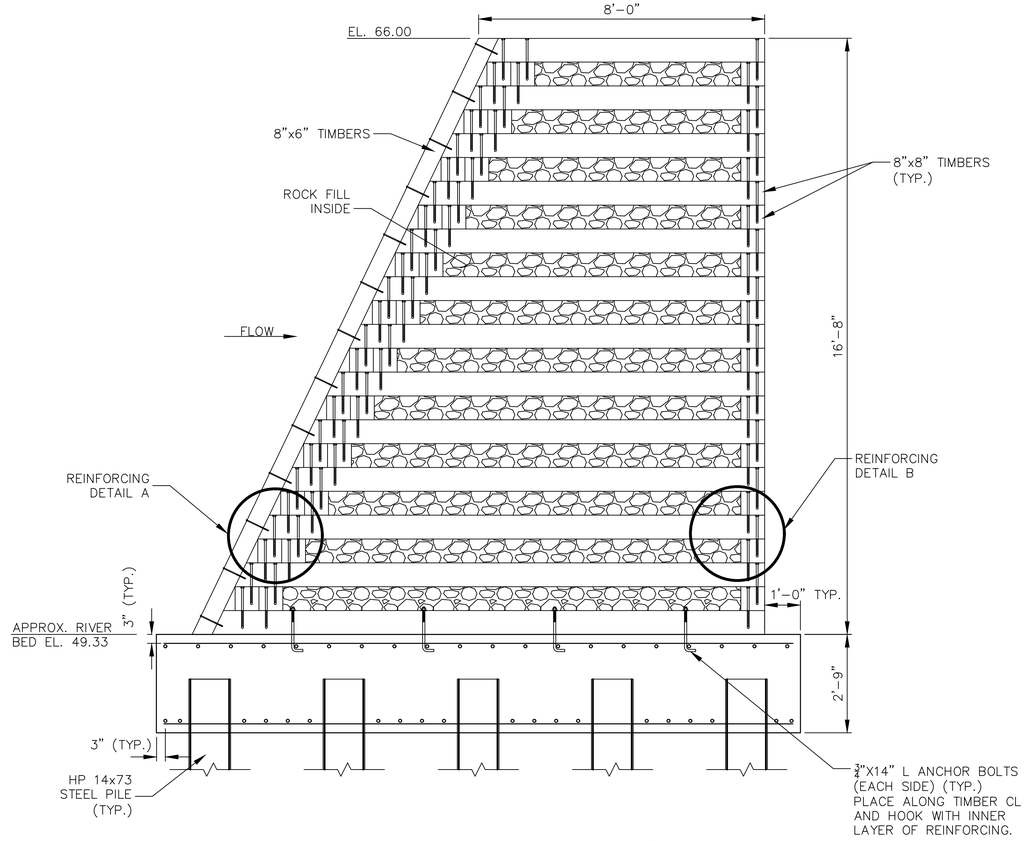
SS-105

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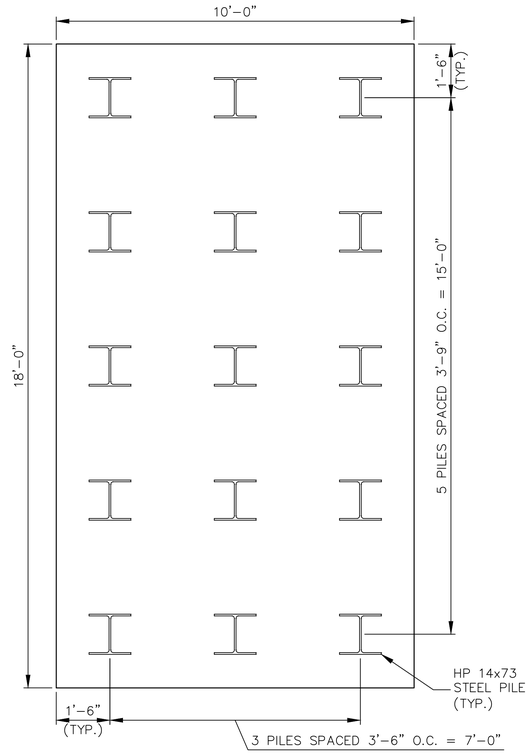
TYPICAL ICE PIER (FRONT ELEVATION)

SCALE: 1/2" = 1'–0"



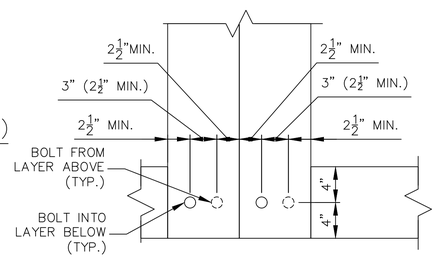
TYPICAL ICE PIER (SIDE ELEVATION)

SCALE: 1/2" = 1'–0"



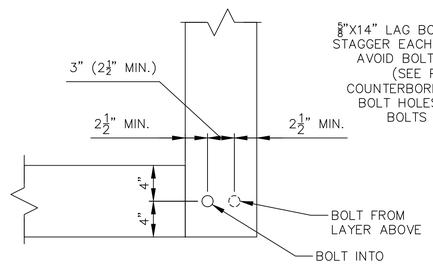
PILE LAYOUT PLAN

SCALE: 1/2" = 1'–0"



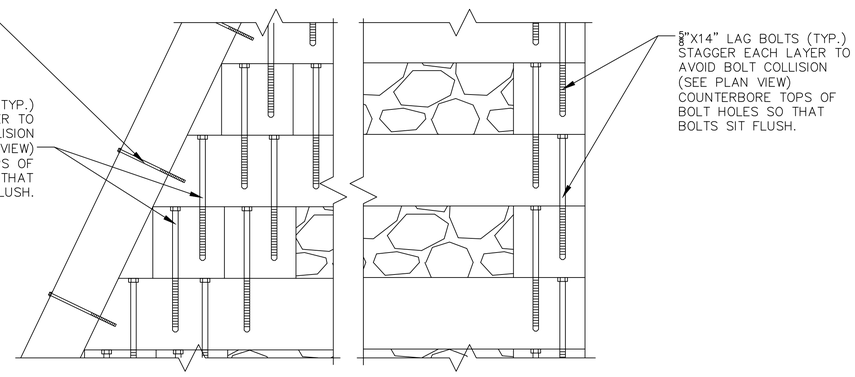
REINFORCING DETAIL A – PLAN VIEW OF BOLT LOCATIONS

SCALE: 1 1/2" = 1'–0"



REINFORCING DETAIL B – PLAN VIEW OF BOLT LOCATIONS

SCALE: 1 1/2" = 1'–0"



REINFORCING DETAIL A

SCALE: 1 1/2" = 1'–0"

REINFORCING DETAIL B

SCALE: 1 1/2" = 1'–0"

NOTES:
1. PIERS SHALL BE FILLED WITH EXISTING ICE PIER AND DAM CRIBBING STONES.
2. SPACE TOP LAYER OF REINFORCING BARS EQUALLY. SPACE BOTTOM LAYER AROUND PILES AS NECESSARY.
3. SEE SHEET SI–002 FOR PILE NOTES.

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: AS NOTED
VERT.:
DATUM:
HORZ.: -
VERT.: -

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300 CORNERSTONE DR, SUITE 335
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ICE DAM AT CABLE POOL PARK

STRUCTURAL DETAILS - I

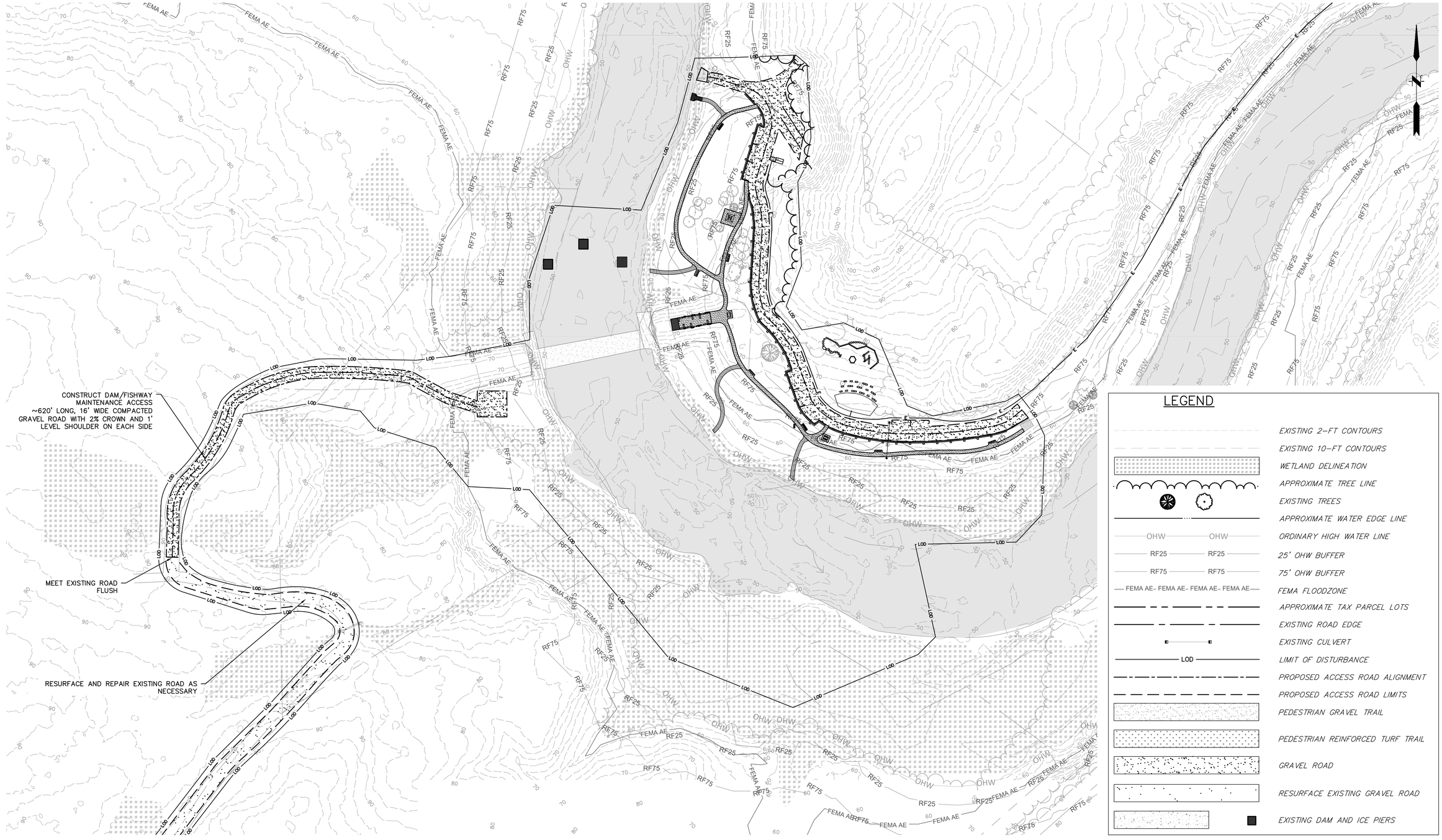
NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

SD-101

File: J:\DWG\P2023\0407\A11\Civil\Plan\20230407A11_STR01.dwg Layout: SD-101 Plotted: 2025-11-26 8:25 PM Saved: 2025-11-26 10:31 AM User: Nathan.Unruh
PC3: AUTOCAD PDF (GENERAL DOCUMENTATION).PC3 STB/CTB: FO.STB
LAYER STATE:
MS VIEW:



100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: 1" = 60'
VERT.: -
DATUM:
HORZ.: -
VERT.: -
0 30' 60' 120'
GRAPHIC SCALE

FUSS & O'NEILL
300 CORNERSTONE DR, SUITE 335
WILLISTON, VT 05495
603.222.3488
www.fando.com

ICE DAM AT CABLE POOL PARK

SITE IMPROVEMENT PLAN

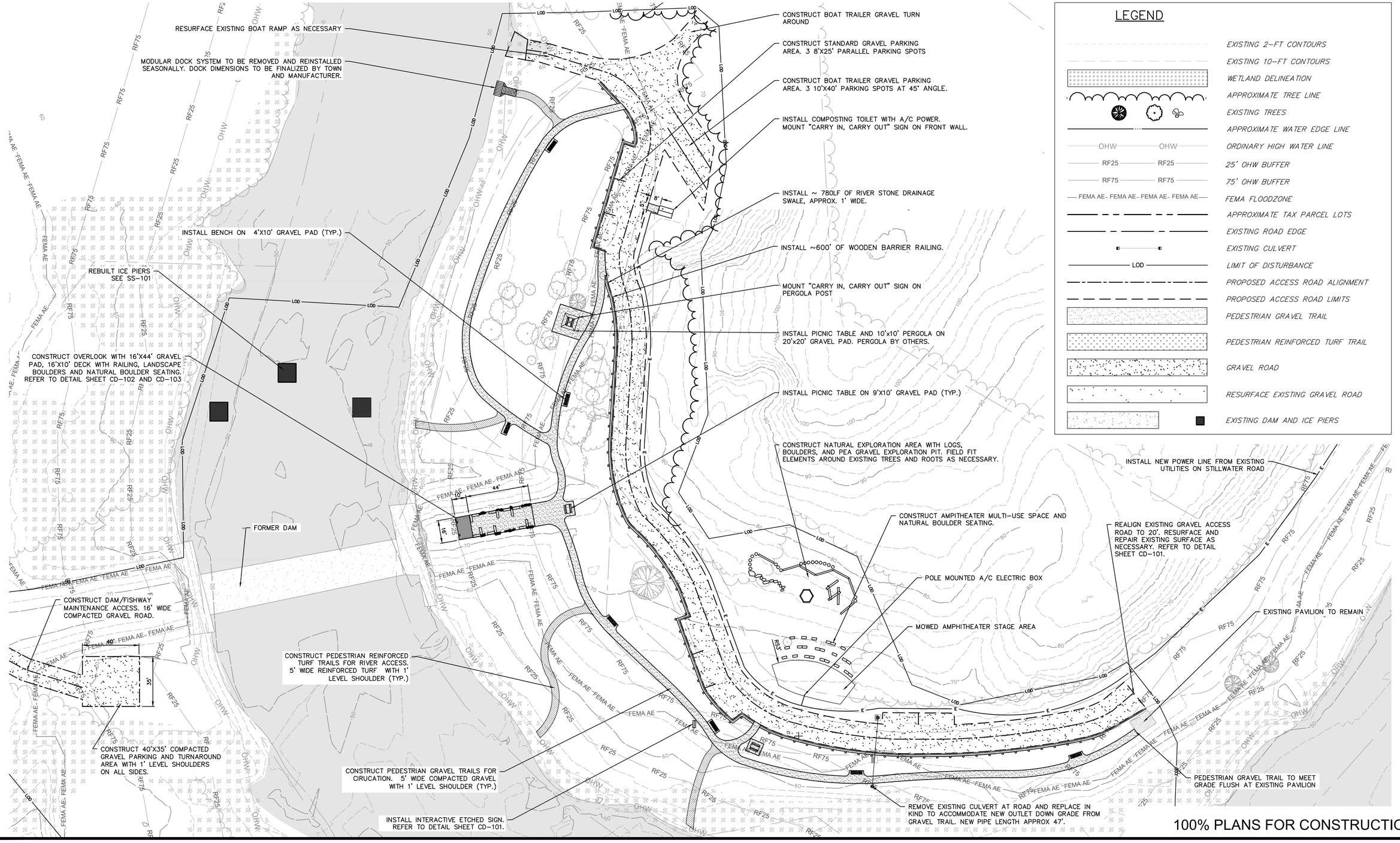
NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

CS-101

File: J:\DWG\P2023\0407A11\Civil\Plan\20230407A11_STP01.dwg Layout: CS-101 Plotted: 2025-11-26 8:25 PM Saved: 2025-11-26 8:14 PM User: Dora.Bean
PC3: AUTOCAD PDF (GENERAL DOCUMENTATION).PC3 STB/CTB: FO.STB
LAYER STATE:
MS VIEW:



100% PLANS FOR CONSTRUCTION

File: J:\DWG\P20230407\A11\Civil\Plan\20230407A11_STP01.dwg Layout: CS-102 Plotted: 2025-11-26 8:25 PM Saved: 2025-11-26 8:14 PM User: Dora.Bean
PC3: AUTOCAD PDF (GENERAL DOCUMENTATION).PC3 STB/CTB: FO.STB
LAYER STATE:
MS VIEW:

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: 1" = 30'
VERT.: -
DATUM:
HORZ.: -
VERT.: -
0 15' 30' 60'
GRAPHIC SCALE

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WILLISTON, VT 05495
603.222.3488
www.fando.com

ICE DAM AT CABLE POOL PARK

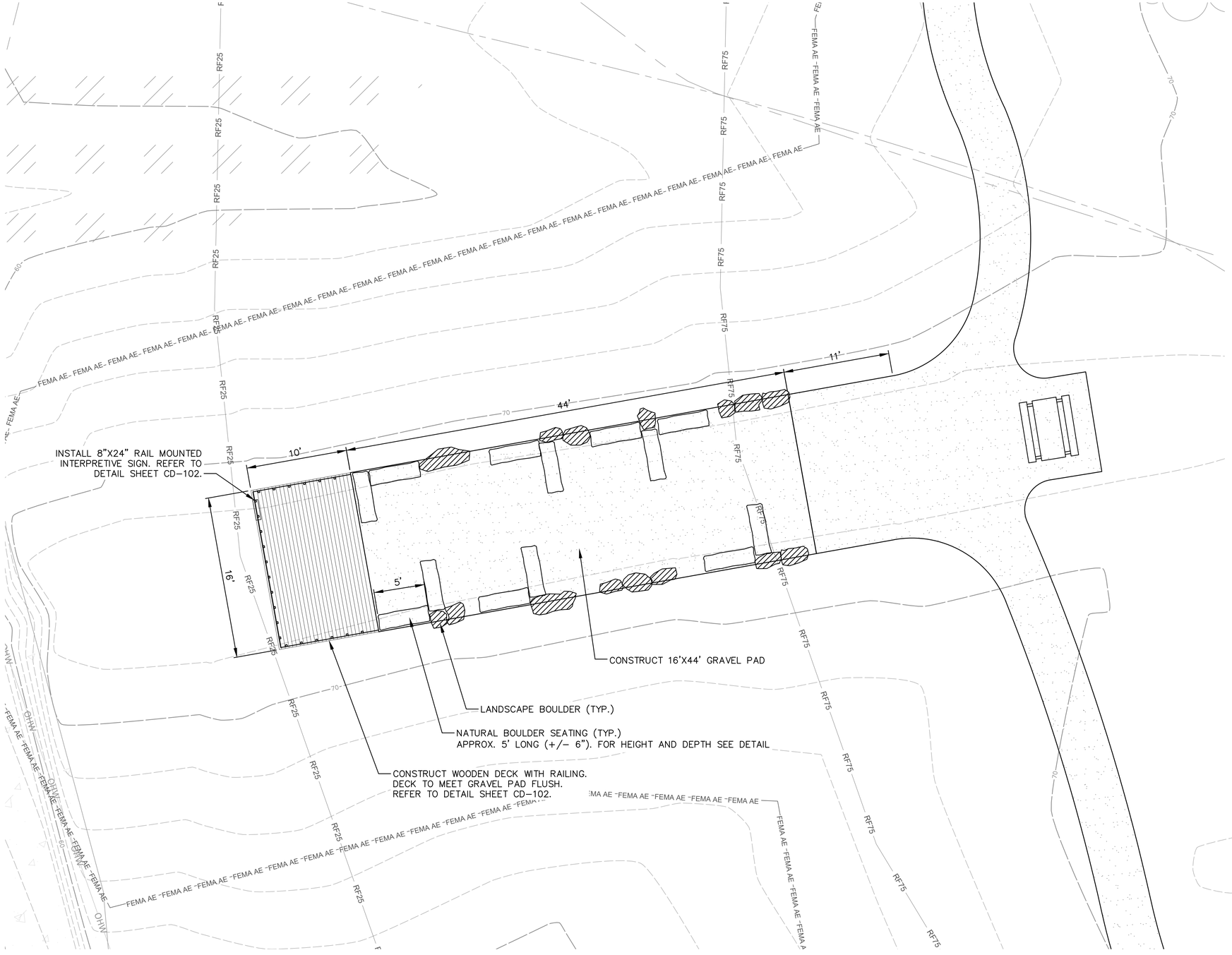
SITE IMPROVEMENT PLAN ENLARGEMENT

NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

CS-102



LEGEND

- EXISTING 2-FT CONTOURS
- EXISTING 10-FT CONTOURS
- WETLAND DELINEATION
- APPROXIMATE TREE LINE
- EXISTING TREES
- APPROXIMATE WATER EDGE LINE
- ORDINARY HIGH WATER LINE
- 25' OHW BUFFER
- 75' OHW BUFFER
- FEMA FLOODZONE
- APPROXIMATE TAX PARCEL LOTS
- EXISTING ROAD EDGE
- EXISTING CULVERT
- LIMIT OF DISTURBANCE
- PROPOSED ACCESS ROAD ALIGNMENT
- PROPOSED ACCESS ROAD LIMITS
- PEDESTRIAN GRAVEL TRAIL
- PEDESTRIAN REINFORCED TURF TRAIL
- GRAVEL ROAD
- RESURFACE EXISTING GRAVEL ROAD
- EXISTING DAM AND ICE PIERS

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: 1" = 5'
VERT.: -
DATUM:
HORZ.: -
VERT.: -
0 2.5' 5' 10'
GRAPHIC SCALE

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300 CORNERSTONE DR, SUITE 335
WILLISTON, VT 05495
603.222.3488
www.fando.com

ICE DAM AT CABLE POOL PARK

SITE IMPROVEMENT - OVERLOOK PLAN ENLARGEMENT

NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

CS-103

File: J:\DWG\P2023\20407A11\Civil\Plan\20230407A11_STP01.dwg Layout: CS-103 Plotted: 2025-11-26 8:26 PM Saved: 2025-11-26 8:14 PM User: Dora.Bean
PC3: AUTOCAD PDF (GENERAL DOCUMENTATION).PC3 STB/CTB: FO.STB
LAYER STATE:
MS VIEW:

NOTES:
- ALL SIDE SLOPES GRADED AT MAXIMUM 2:1 SLOPE
- CABLE POOL ROAD REALIGNMENT AND RESURFACING GRADING TO INCLUDE 2% CROSS SLOPE PITCH DOWNHILL TOWARD RIVER STONE SWALE
- PEDESTRIAN PATHS RUNNING PARALLEL TO EXISTING SLOPE TO INCLUDE 2% CROSS SLOPE DOWNHILL
- PEDESTRIAN PATHS RUNNING PERPENDICULAR TO EXISTING SLOPE TO INCLUDE 2% CROWN

ADJUSTED TREELINE TO ACCOMMODATE GRADING EXTENTS AND REMOVALS

GRADE AT 2:1 SLOPE MAXIMUM. INSTALL TREE PROTECTION AND MINIMIZE IMPACTS TO TREES.

APPROXIMATE LOCATION OF 18" DIA. HDPE CULVERT TO BE FIELD FIT TO DRAIN

CONSTRUCT 40'X35' COMPACTED GRAVEL PARKING AND TURNAROUND AREA WITH 1' LEVEL SHOULDERS ON ALL SIDES.

REMOVE EXISTING CULVERT AT ROAD AND REPLACE IN KIND TO ACCOMMODATE NEW OUTLET DOWN GRADE FROM GRAVEL TRAIL. NEW PIPE LENGTH APPROX 47'.

LEGEND

- EXISTING 2-FT CONTOURS
- EXISTING 10-FT CONTOURS
- PROPOSED 2-FT CONTOURS
- PROPOSED 10-FT CONTOURS
- WETLAND DELINEATION
- APPROXIMATE TREE LINE
- EXISTING TREES
- APPROXIMATE WATER EDGE LINE
- ORDINARY HIGH WATER LINE
- 25' OHW BUFFER
- 75' OHW BUFFER
- FEMA FLOODZONE
- APPROXIMATE TAX PARCEL LOTS
- EXISTING ROAD EDGE
- EXISTING CULVERT
- LIMIT OF DISTURBANCE
- PROPOSED ACCESS ROAD ALIGNMENT
- PROPOSED ACCESS ROAD LIMITS
- PEDESTRIAN GRAVEL TRAIL
- PEDESTRIAN REINFORCED TURF TRAIL
- PEDESTRIAN GRAVEL TRAIL
- PEDESTRIAN GRAVEL TRAIL
- DAM AND ICE PIERS

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: 1" = 30'
VERT.: -
DATUM:
HORZ.: -
VERT.: -
0 15' 30' 60'
GRAPHIC SCALE

FUSS & O'NEILL
300 CORNERSTONE DR, SUITE 335
WILLISTON, VT 05495
603.222.3488
www.fando.com

ICE DAM AT CABLE POOL PARK

GRADING PLAN - RIVER LEFT

NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

CG-101

File: J:\DWG\P2023\04\07\A11\Civil\Plan\20230407A11_GRD01.dwg Layout: CG-101 Plotted: 2025-11-26 8:26 PM Saved: 2025-11-21 5:17 PM User: Nathan.Unruh
PC3: AUTOCAD PDF (GENERAL DOCUMENTATION).PC3 STB/CTB: FO.STB
LAYER STATE:
MS VIEW:

NOTES:
– ALL SIDE SLOPES GRADED AT MAXIMUM 2:1 SLOPE

APPROXIMATE LOCATION OF 18" DIA. HDPE CULVERT TO BE FIELD FIT TO DRAIN

EXISTING ACCESS ROAD

CONSTRUCT DPW MAINTENANCE ACCESS ROAD EXTENSION ALONG EXISTING PRIVATE CAMP ROAD
~620' LONG, 16' WIDE COMPACTED GRAVEL ROAD WITH 2% CROWN AND 2' LEVEL SHOULDER ON EACH SIDE

APPROXIMATE LOCATION OF 18" DIA. HDPE CULVERT TO BE FIELD FIT TO DRAIN

MEET EXISTING CAMP ROAD FLUSH

CONSTRUCT 40'X35' COMPACTED GRAVEL PARKING AND TURNAROUND AREA WITH 1' LEVEL SHOULDERS ON ALL SIDES.

NARRAGUAGUS

LEGEND

- EXISTING 2–FT CONTOURS
- EXISTING 10–FT CONTOURS
- PROPOSED 2–FT CONTOURS
- PROPOSED 10–FT CONTOURS
- WETLAND DELINEATION
- APPROXIMATE TREE LINE
- EXISTING TREES
- APPROXIMATE WATER EDGE LINE
- ORDINARY HIGH WATER LINE
- 25' OHW BUFFER
- 75' OHW BUFFER
- FEMA FLOODZONE
- APPROXIMATE TAX PARCEL LOTS
- EXISTING ROAD EDGE
- EXISTING CULVERT
- LIMIT OF DISTURBANCE
- PROPOSED ACCESS ROAD ALIGNMENT
- PROPOSED ACCESS ROAD LIMITS
- PEDESTRIAN GRAVEL TRAIL
- PEDESTRIAN REINFORCED TURF TRAIL
- PEDESTRIAN GRAVEL TRAIL
- PEDESTRIAN GRAVEL TRAIL
- DAM AND ICE PIERS

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: 1" = 30'
VERT.: -
DATUM:
HORZ.: -
VERT.: -
0 15' 30' 60'
GRAPHIC SCALE

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300 CORNERSTONE DR, SUITE 335
WILLISTON, VT 05495
603.222.3488
www.fando.com

ICE DAM AT CABLE POOL PARK

GRADING PLAN - RIVER RIGHT

NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

CG-102

File: J:\DWG\P2023\20407A11\Civil\Plan\20230407A11_GRD01.dwg Layout: CG-102 Plotted: 2025-11-26 8:26 PM Saved: 2025-11-21 5:17 PM User: Nathan.Unruh
MS VIEW: LAYER STATE: PC3: AUTOCAD PDF (GENERAL DOCUMENTATION).PC3 STB/CTB: FO.STB

NOTE: ALL DISTURBED AREAS TO BE RESEEDED WITH NATIVE SEED MIX.

3' WIDE MOWED TURF AREA ALONG UPHILL SIDE OF PATHS AND AROUND SEATING AREAS (TYP.)

APPROX. 5 EXISTING TREES TO REMOVE (TYP.) ALL EFFORTS TO PROTECT AND RETAIN OTHER TREES SHALL BE TAKEN

PROTECT EXISTING TREES TO MAXIMUM EXTENT POSSIBLE

ADJUSTED TREE LINE TO ACCOMMODATE GRADING AND REMOVALS

APPROX. 4,670 SF AREA DISTURBED BY GRADING. REMOVE TREES AS NECESSARY. RESEED WITH NATVE SEED MIX TO STABILIZE SLOPE.

APPROX. 9,000 SF TURF SEED AREA INCLUDING AMPHITHEATER AND NATURAL EXPLORATION AREA TO BE CLEARED AND GRUBBED OF ALL INVASIVE PLANTS, VINES, AND WOODY SHRUBS. ALL EXISTING TREES TO REMAIN.

12,819.84 sf

4,673.88 sf

10,942.36 sf

10,761.05 sf

2,966.14 sf

PLANT SCHEDULE

SYMBOL	CODE	BOTANICAL / COMMON NAME	SIZE	CONTAINER	QTY
TREES					
	AR	ACER RUBRUM / RED MAPLE	2" CAL.	B&B	6
	BN	BETULA NIGRA / RIVER BIRCH MULTI-TRUNK	2" CAL.	B&B	6
	NS	NYSSA SYLVATICA / TUPELO / BLACK GUM	2" CAL.	B&B	13
	PS	PRUNUS SEROTINA / BLACK CHERRY	2" CAL.	B&B	7
	QA	QUERCUS ALBA / WHITE OAK	2" CAL.	B&B	6
	QB	QUERCUS BICOLOR / SWAMP WHITE OAK	2" CAL.	B&B	11
	SN	SALIX NIGRA / BLACK WILLOW	2" CAL.	B&B	5
SHRUBS					
	CP	COMPTONIA PEREGRINA / SWEET FERN	1 GAL.	POT	21
	CG	CORNUS RACEMOSA / GRAY DOGWOOD	1 GAL.	POT	8
	HV	HAMAMELIS VIRGINIANA / COMMON WITCH HAZEL	1 GAL.	POT	12
	VA	VIBURNUM ACERIFOLIUM / MAPLELEAF VIBURNUM	1 GAL.	POT	5
	VD	VIBURNUM DENTATUM / ARROWWOOD VIBURNUM	1 GAL.	POT	8

SEED SCHEDULE

SYMBOL	CODE	BOTANICAL / COMMON NAME	AREA	SIZE	QTY	REMARKS
		CONSERVATION TURF SEED MIX (OR EQUAL)	17,000 SF	SEED	26 LBS	SEED AT 3 LBS / 1,000 SF
		NEW ENGLAND CONSERVATION / WILDLIFE SEED MIX (OR EQUAL)	60,000 SF	SEED	16 LBS	SEED AT 1 LB / 1,750 SF

LEGEND

- EXISTING 2-FT CONTOURS
- EXISTING 10-FT CONTOURS
- WETLAND DELINEATION
- APPROXIMATE TREE LINE
- EXISTING TREES
- APPROXIMATE WATER EDGE LINE
- OHW — ORDINARY HIGH WATER LINE
- RF25 — 25' OHW BUFFER
- RF75 — 75' OHW BUFFER
- FEMA AE — FEMA FLOODZONE
- APPROXIMATE TAX PARCEL LOTS
- EXISTING ROAD EDGE
- EXISTING CULVERT
- LOD — LIMIT OF DISTURBANCE
- PROPOSED ACCESS ROAD ALIGNMENT
- PROPOSED ACCESS ROAD LIMITS
- PEDESTRIAN TRAIL
- EXISTING IMPOUNDMENT AND ICE PIERS
- PLANTING AREAS

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: 1" = 30'
VERT.: -
DATUM:
HORZ.: -
VERT.: -
0 15' 30' 60'
GRAPHIC SCALE

FUSS & O'NEILL
300 CORNERSTONE DR, SUITE 335
WILLISTON, VT 05495
603.222.3488
www.fando.com

ICE DAM AT CABLE POOL PARK

LANDSCAPE PLAN

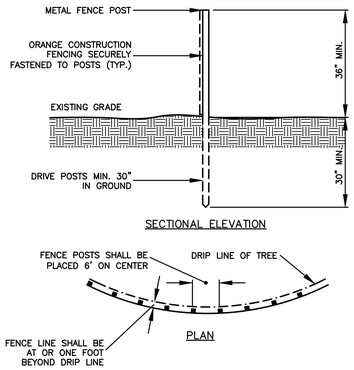
NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

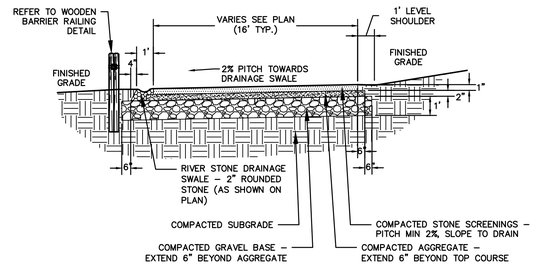
LP-101

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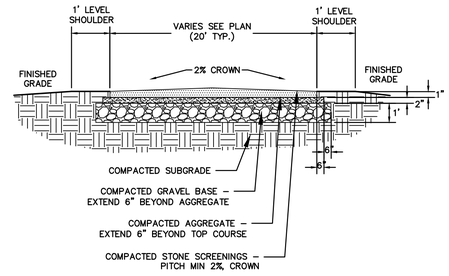
TREE PROTECTION FENCING

SCALE: N.T.S.



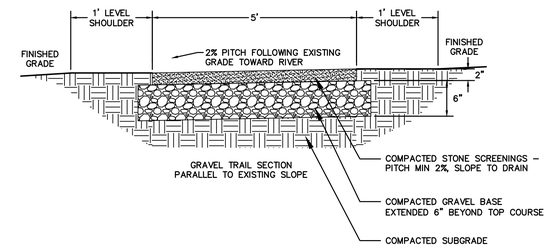
GRAVEL ACCESS ROAD TYPICAL SECTION

SCALE: N.T.S.



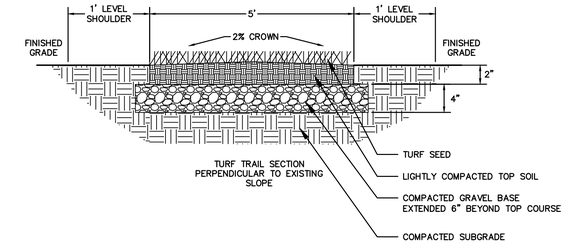
DPW MAINTENANCE ACCESS ROAD EXTENSION TYPICAL SECTION

SCALE: N.T.S.



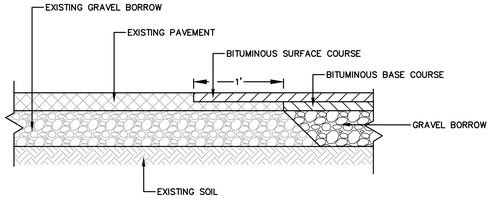
PEDESTRIAN GRAVEL TRAIL TYPICAL SECTION

SCALE: N.T.S.



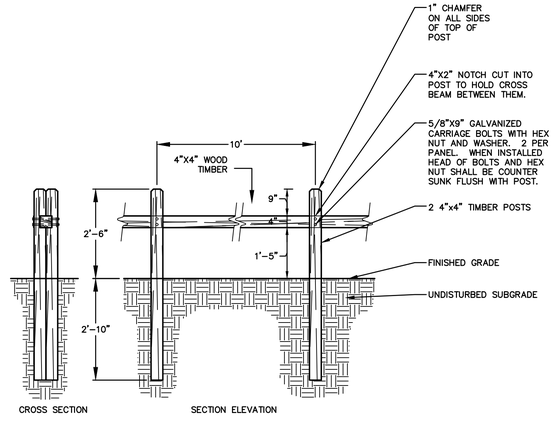
PEDESTRIAN REINFORCED TURF TRAIL TYPICAL SECTION

SCALE: N.T.S.



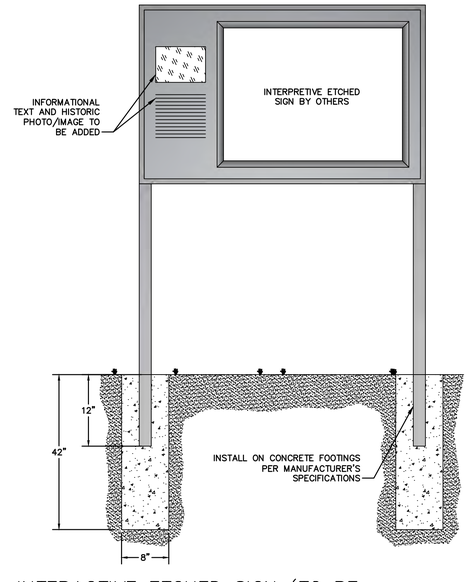
SAWCUT AND MATCH PAVEMENT

SCALE: N.T.S.



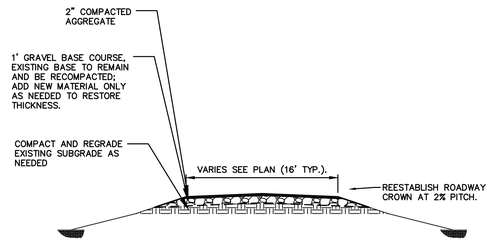
WOODEN BARRIER RAILING

SCALE: N.T.S.



INTERACTIVE ETCHED SIGN (TO BE CUSTOMIZED)

SCALE: N.T.S.



TYPICAL GRAVEL ACCESS ROAD RESURFACING SECTION

SCALE: N.T.S.

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

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VERT.:
DATUM:
HORZ.: -
VERT.: -

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ICE DAM AT CABLE POOL PARK

CIVIL DETAILS

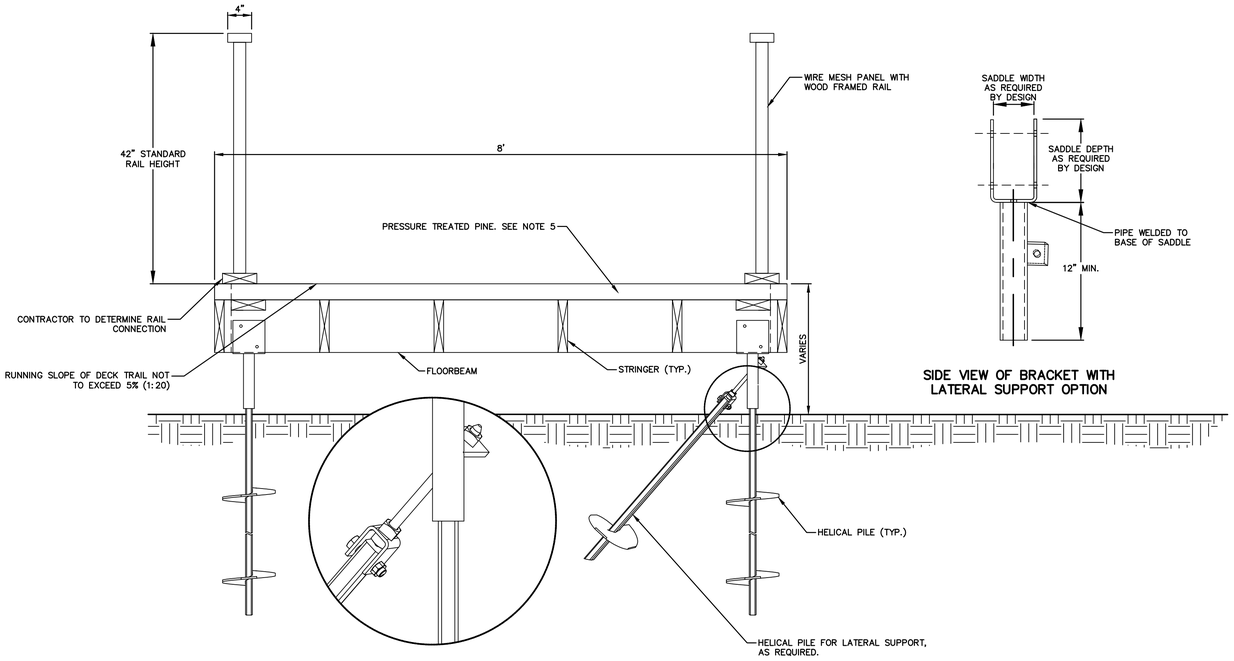
NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

CD-101

File: J:\DWG\P2023\0407\A11\Civil\Plan\20230407A11_DET01.dwg Layout: CD-101 Plotted: 2025-11-26 8:27 PM Saved: 2025-11-26 8:17 PM User: Dora.Bean
PC3: AUTOCAD PDF (GENERAL DOCUMENTATION).PC3 STB/CTB: FO.STB
LAYER STATE:
MS VIEW:



SIDE VIEW OF BRACKET WITH LATERAL SUPPORT OPTION

NOTES:
1. HELICAL PIERS CAN BE EITHER SINGLE OR MULTI-HELIX, THE NUMBER AND SIZE OF HELIX PLATES TO BE DESIGNED BY CONTRACTOR DEPENDING ON PIER LOAD AND SOIL CONDITIONS.

2. HELICAL PIERS ARE INSTALLED (SCREWED) TO A MINIMUM DEPTH AND TORQUE AS REQUIRED ON THE APPROVED BOARDWALK DESIGN PLANS AND CALCULATIONS.

3. DECK AND SUPPORTING MEMBERS, INCLUDING THE HELICAL PILES AND RAILINGS, TO BE DESIGNED BY THE CONTRACTOR. CONSTRUCTION DRAWINGS AND DESIGN CALCULATIONS TO BE STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF MAINE, AND SUBMITTED FOR REVIEW AND APPROVAL.

4. DECKS TO BE DESIGNED FOR A 90 PSF PEDESTRIAN LIVE LOADING.

5. DECKING MATERIAL SHALL BE PRESSURE TREATED PINE. DECK SUPPORTING ELEMENTS SHALL BE PRESSURE TREATED TIMBER IN ACCORDANCE WITH THE AMERICAN WOOD PRESERVERS ASSOCIATION (AWPA) UC5A.
   A. ACCEPTABLE PRESERVATIVE CHEMICALS: ALKALINE COPPER QUATERNARY (ACQ-D)
   B. IF REQUIRED DUE TO LOAD REQUIREMENTS, FLOOR BEAMS MAY BE HOT-DIP GALVANIZED STEEL.

6. STEEL PLATES AND MATERIAL TO MEET THE REQUIREMENTS OF ASTM A36 AND BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A123. ALL STEEL HARDWARE TO BE STAINLESS OR GALVANIZED IN ACCORDANCE WITH ASTM A153.

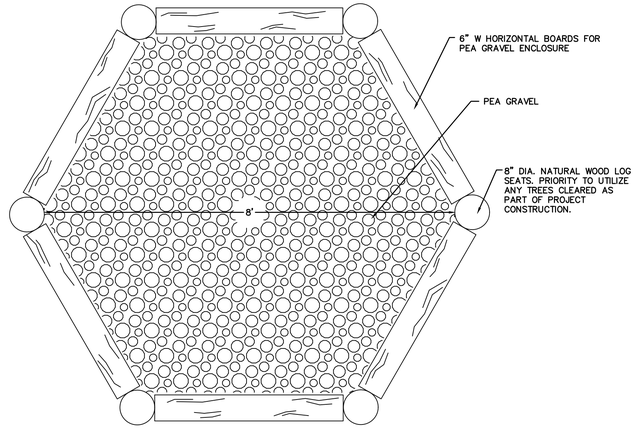
7. HELICAL PILES SHALL BE DESIGNED FOR EXPOSURE TO SEVERE CONDITIONS AND SHALL BE EITHER RESISTANT TO CORROSION OR INCORPORATE A SACRIFICIAL DESIGN TO ACCOMMODATE A GIVEN SERVICE LIFE.

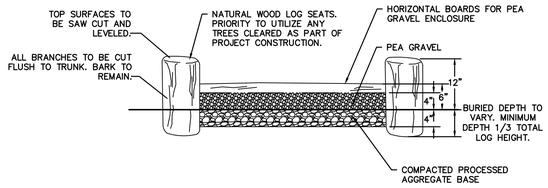
8. DESIGN CODES
   A. AASHTO LRFD GUIDE SPECIFICATIONS FOR DESIGN OF PEDESTRIAN BRIDGES. 2009.
   B. AASHTO LRFD 9TH EDITION. 2020 WITH LATEST INTERIMS FOR TIMBER FRAMING DESIGN.



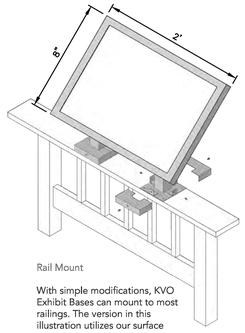
GENERAL CONFIGURATION AND STYLE OF DECK WITH RAILING

DECK WITH RAILING
SCALE: N.T.S.





PEA GRAVEL EXPLORATION PIT
SCALE: N.T.S.



Rail Mount

With simple modifications, KVO Exhibit Bases can mount to most railings. The version in this illustration utilizes our surface mount option although numerous custom installation ideas are possible.

NOTES:

1. BASIS OF DESIGN KVO OUTLINE OR APPROVED EQUAL.
2. CONTRACTOR TO SUBMIT SHOP DRAWING.
2. GRAPHIC TO BE APPROVED BY DESIGNER.
3. GRAPHIC TO BE APPROVED BY OWNER BEFORE INSTALLATION.
3. SEE LAYOUT PLAN FOR LOCATION.

RAIL MOUNTED INTERPRETIVE SIGN
SCALE: N.T.S.



NOTES:

1. ATTACH TO EXISTING UTILITY POLES, FENCE, STRUCTURE, ETC.

"CARRY IN CARRY OUT" SIGN (OR SIMILAR)
SCALE: N.T.S.

100% PLANS FOR CONSTRUCTION

No.	DATE	DESCRIPTION	DESIGNER	REVIEWER

SEAL

SEAL

SCALE:
HORZ.: NOT TO SCALE
VERT.:
DATUM:
HORZ.: -
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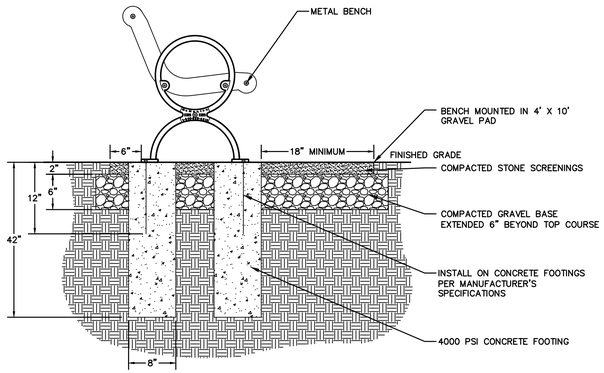
NARRAGUAGUS RIVER

CHERRYFIELD MAINE

PROJ. No.: 20230407.A11
DATE: 11/26/2025

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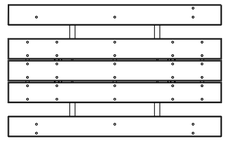
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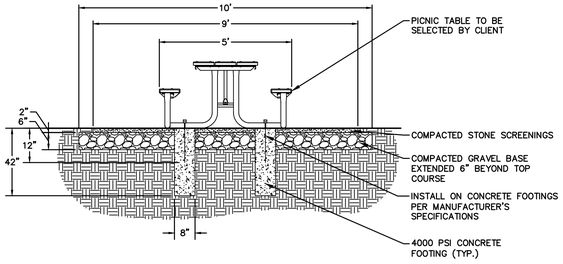
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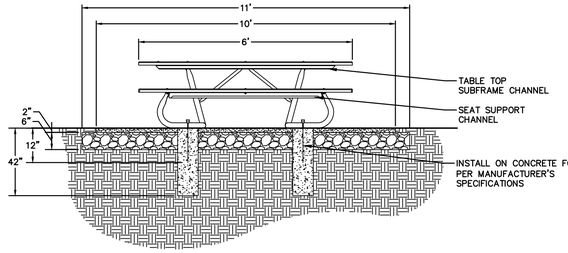
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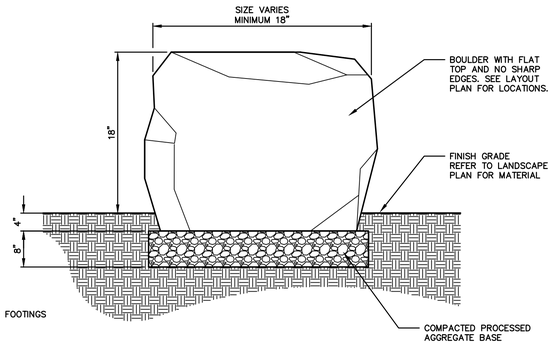
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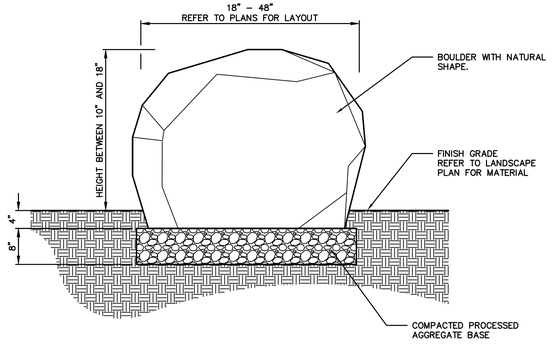


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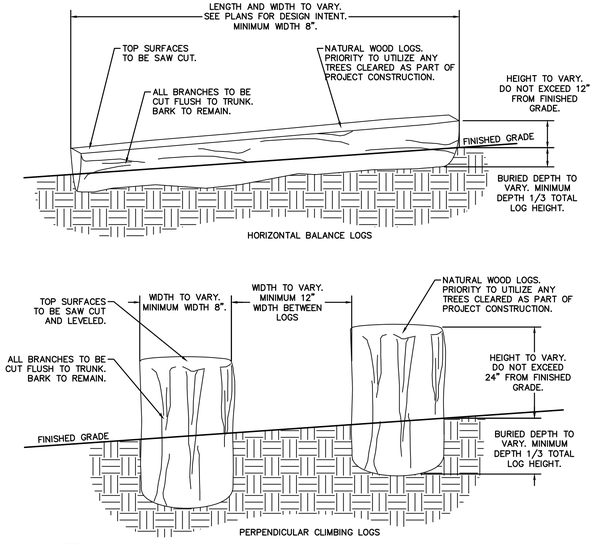


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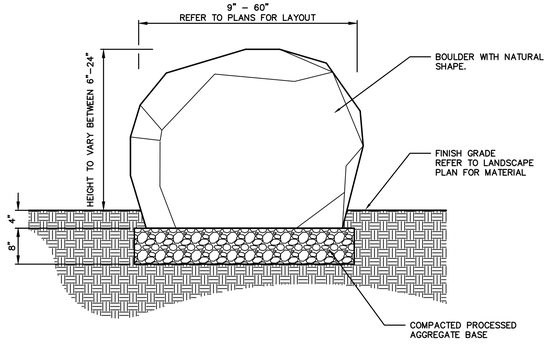


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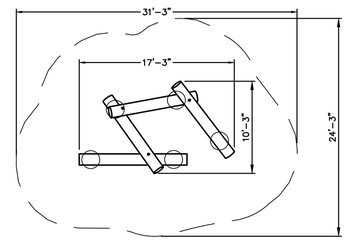


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LOG PILE IN NATURAL EXPLORATION AREA

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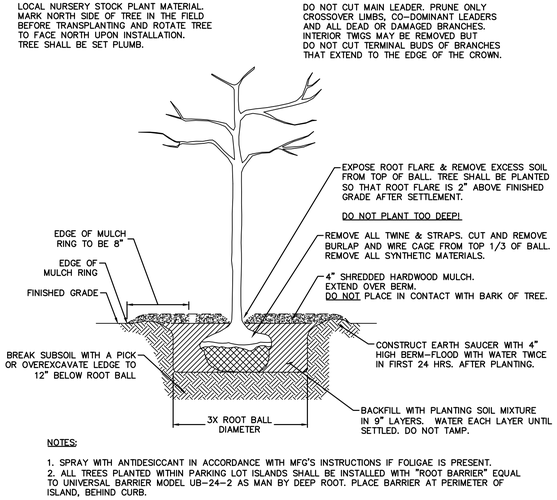
NARRAGUAGUS RIVER

CHERRYFIELD MAINE

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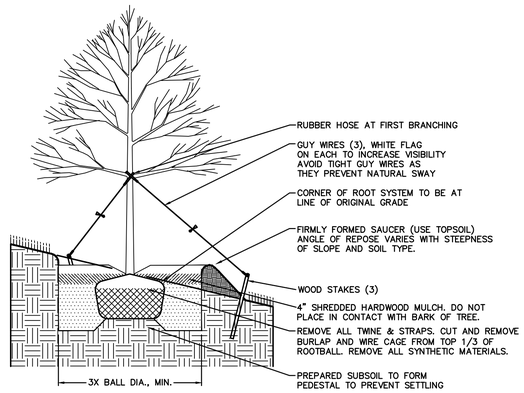
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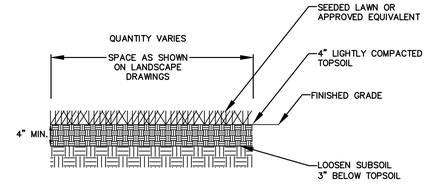
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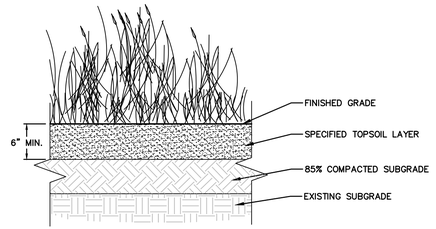
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TYPICAL LAWN

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NATIVE SEEDING AREAS

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clivusmultrum INCORPORATED

Model M54W
Specification Sheet

NSF Certification

The Clivus Model M54W is certified by the National Sanitation Foundation under Standard 41 (day-use, park).

Capacity

M54W Volume

Solids storage capacity: 78 cubic feet; 580 US gallons

Liquid storage capacity: 49 cubic feet; 365 US gallons

Daily capacity at average temp. >65°F: 60 visits

Annual capacity at average temp. >65°F: 22,000 visits

Specifications and Materials

Dimensions

Pre-fabricated Shipping Dimensions (2 pcs):

Length: 121"; Width: 76.5"; Height: 48"

Building: Length: 108"; Width: 85.5"; Height: 114"

Kit Shipping Dimensions:

Length: 240" (20'); Width: 85.5"; Height: 72"

Pre-fabricated Shipping Weight:

Base: 1,000 lbs, Building: 1,400 lbs

Kit Shipping Weight: 2,400 lbs

Assembled Building Dimensions:

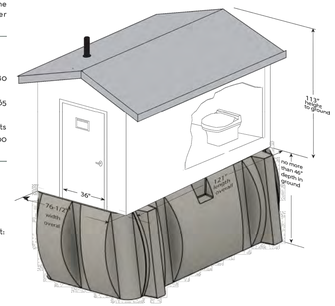
Outside Length: 108"; Width: 85.5"; Height: 114"

Building Enclosure (inside)

Inside Length: 82"; Inside Width: 61"

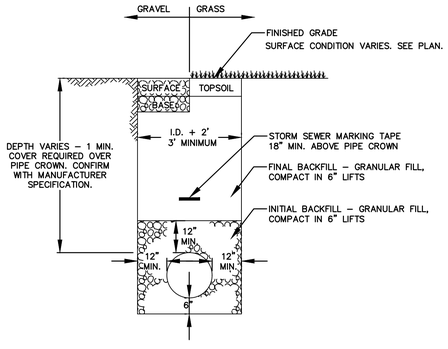
Composter Base

Length: 121"; Width: 76.5"; Height: 48"



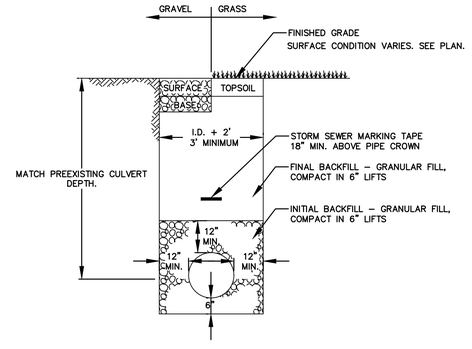
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Ernst Conservation Seeds
8884 Mercer Pike
Meadville, PA 16335
(800) 873-3321 Fax (814) 336-5191
www.ernstseed.com

Date: February 27, 2025

Contractor's Lakeview Conservation Mix - ERNMX-116

	Botanical Name	Common Name	Price/Lb
45.00 %	*Lolium perenne, Green Supreme +*	Perennial Ryegrass, Green Supreme +	3.38
30.00 %	*Lolium multiflorum*	Annual Ryegrass	1.30
12.00 %	*Festuca rubra*	Creeping Red Fescue	3.58
11.00 %	*Poa pratensis, 'Volt'*	Kentucky Bluegrass, 'Volt'	4.10
2.00 %	*Trifolium repens, Dutch*	White Clover, Dutch	9.10
100.00 %		**Mix Price/Lb Bulk:**	**$2.97**

Seeding Rate: 75-150 lb per acre, or 3 lb per 1,000 sq ft

Grasses & Grass-like Species - Herbaceous Perennial; Lawn & Turfgrass Sites

The mix diversity is designed for varying soil conditions and nutrients. A great mix for around a pond; withstands traffic. Seed in full sun. Mix formulations are subject to change without notice depending on the availability of existing and new products. While the formula may change, the guiding philosophy and function of the mix will not.

CONSERVATION TURF SEED MIX (OR APPROVED EQUAL)

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NEW ENGLAND WETLAND PLANTS, INC
14 Pearl Lane South Hadley, MA 01075
PHONE: 413-548-8000 FAX 413-549-4000
EMAIL: INFO@NEWP.COM WEB ADDRESS: WWW.NEWP.COM

New England Conservation/Wildlife Mix

Botanical Name	Common Name	Indicator
Elymus virginicus	Virginia Wild Rye	FACW-
Schizachyrium scoparium	Little Bluestem	FACU
Andropogon gerardii	Big Bluestem	FAC
Festuca rubra	Red Fescue	FACU
Sorghastrum nutans	Indian Grass	UPL
Panicum virgatum	Switch Grass	FAC
Chamaecrista fasciculata	Partridge Pea	FACU
Desmodium canadense	Showy Tick Trefoil	FAC
Asclepias tuberosa	Butterfly Milkweed	NI
Bidens frondosa	Beggar Ticks	FACW
Eupatorium purpureum (Eutrochium maculatum)	Purple Joe Pye Weed	FAC
Rudbeckia hirta	Black Eyed Susan	FACU-
Aster pilosus (Symphyotrichium pilosum)	Heath (or Hairy) Aster	UPL
Solidago juncea	Early Goldenrod	

APPLY: 25 LBS/ACRE :1750 sq ft/lb

The New England Conservation/Wildlife Mix provides a permanent cover of grasses, wildflowers, and legumes
For both good erosion control and wildlife habitat value. The mix is designed to be a no maintenance seeding, and is appropriate for cut and fill slopes, detention basin side slopes, and disturbed areas adjacent to commercial and residential projects.
New England Wetland Plants, Inc. may modify seed mixes at any time depending upon seed availability. The design criteria and ecological function of the mix will remain unchanged. Price is $/bulk pound, FOB warehouse, Plus SH and applicable taxes.

NEW ENGLAND CONSERVATION/WILDLIFE SEED MIX (OR APPROVED EQUAL)

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SEAL

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Applicant Prepared Biological Assessment for Cherryfield Ice Dam Fish Passage Project

Prepared for:

Downeast Salmon Federation and
NOAA Fisheries Restoration Center

Prepared by:

Inter-Fluve
181 Main St 2nd Floor
PO Box 236
Damariscotta, ME 04543

Finalized by:

NOAA Restoration Center
January 5, 2025

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1. Executive Summary

The Downeast Salmon Federation (DSF), in partnership with the Town of Cherryfield (the town), is proposing to replace the Cherryfield Ice Dam with a channel-spanning, nature-like fishway to improve passage for anadromous species within the Narraguagus River. The dam is owned by the town and located seven miles upstream of Narraguagus Bay in Cherryfield, Maine.

The National Oceanic and Atmospheric Administration Restoration Center (NOAA RC) is providing funding and technical assistance for this project and is required to review project impacts pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 USC 1531 *et seq*.), and its implementing regulations (50 CFR Part 402). The project also requires federal permits pursuant to Section 404 of the Clean Water Act as administered by the U.S. Army Corps of Engineers (USACE).

The proposed project is within the geographic range of three endangered species and one designated critical habitat (Table 1), all afforded protection under the ESA and within NOAA Fisheries (NMFS) jurisdiction. Section 7 of the ESA requires that, through consultation with the NMFS, Federal actions do not jeopardize the continued existence of any threatened, endangered, or proposed species, or result in the destruction or adverse modification of their critical habitat. If a federally listed endangered or threatened species or their designated critical habitat occurs in the vicinity of a major construction activity, and the proposed action may affect the listed species or critical habitat, a Biological Assessment (BA) must be prepared to determine whether the proposed federal action will adversely affect the species. This Biological Assessment is for Endangered and Threatened species within jurisdiction of the NMFS.

The project also overlaps with habitat for the Northern Long Eared Bat (*Myoptis septentrionalis*) and Monarch Butterfly (*Danaus plexippus*), a listed and proposed species under jurisdiction of the US Fish & Wildlife Service. The preliminary determination of the project action is Not Likely to Adversely Affect the Northen Long-Eared Bat. The project action is anticipated to have no effect on the Monarch Butterfly, a proposed Threatened species with final determination ruling projected in May 2026. Listed species which USFWS has jurisdiction over are addressed in a separate process, and this BA is for Endangered and Threatened species within jurisdiction of NOAA-NMFS. Thus, the Northern Long-Eared bat and Monarch Butterfly are not considered further in this BA.

Downeast Salmon Federation has suggested that the proposed project is **not likely to adversely affect shortnose sturgeon and Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic sturgeon**. The project **is likely to adversely affect GOM DPS of Atlantic salmon, is likely to adversely affect designated critical rearing habitat for Atlantic salmon, and is likely to adversely affect critical migratory habitat for Atlantic salmon**. However, the project outcomes are likely to have an overall net benefit to the species and their critical habitat.

Downeast Salmon Federation is requesting formal consultation with the NOAA-NMFS under Section 7 of the ESA. We certify that the best scientific and commercial data available were used to complete this Biological Assessment.

Table 1. Federally listed species and federally designated critical habitat within the jurisdiction of NOAA fisheries with potential to occur in the project area.

Species	**Distinct Population Segment**	**Federal Listing Status**	**Effect Determination**
Shortnose sturgeon *Acipenser brevirostrum*	N/A	Endangered	Not likely to adversely affect
Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus*	Gulf of Maine	Threatened	Not likely to adversely affect
Atlantic salmon *Salmo salar*	Gulf of Maine	Endangered	Likely to adversely affect
Critical rearing habitat for Atlantic salmon	Gulf of Maine	N/A	Likely to adversely affect
Critical migratory habitat for Atlantic salmon	Gulf of Maine	N/A	Likely to adversely affect

2. Proposed Project Overview and Description

Downeast Salmon Federation, in cooperation with the Town of Cherryfield (dam owner) and conservation partners, proposes to replace the existing dam with a channel-spanning nature-like fishway and improve upland public use facilities in the town of Cherryfield, Washington County, Maine. The purpose of the project is to facilitate the upstream and downstream passage of diadromous fish, primarily Atlantic salmon, which are currently prevented or delayed while accessing 515 miles of river habitat in the Narraguagus River and tributaries above the dam. The Cherryfield Ice Dam is the only fish passage barrier on the main stem of the Narraguagus River. The project area falls within the distribution of listed Gulf of Maine Distinct Population Segment (GOM DPS) of Atlantic salmon (Endangered) and contains designated Critical Habitat. Habitat connectivity will be vastly enhanced for the 5,700 units of salmon habitat above the Cherryfield Ice Dam. Improving fish passage at this location is identified as a top priority in the Atlantic Salmon Collaborative Management Strategy 5-year work plan. This project would provide the Downeast Coastal Salmon Habitat Recovery Unit (SHRU) with approximately 72% of the total habitat units required under the biological conditions for reclassification listed in the 2019 Recovery Plan.

The project actions align with Program Priorities by achieving consistency with Recovery Plan for the GOM DPS of Atlantic Salmon and the Species in the Spotlight Priority Actions 2016-2020 5-year action plan: The proposed Connectivity Recovery Actions to create connectivity and fish passage improvements to ensure access to habitats are consistent with the following recovery actions outlined in the Recovery Plan: Part IV. Connectivity C categories C1.2, C3.3, C5.1, C6.2, C6.3 and C6.4. The proposed recovery actions leverage years of progress made by DSF and in collaboration with its project partners in other Recovery Actions Connectivity Actions including: C2.3, C3.3, C.4.0, C.5.0 and C6.0; Freshwater Actions F1.0, F2.0 and portions of F.3.0; Outreach and Education Actions O.1.0, O.2.0 and O.3.O; Federal/Tribal Coordination Actions T.1.2; Conservation Hatchery Actions H.1.1, H.1.4, H.1.5 and H.1.6; G.1.2 and Genetics Actions G.1.3 and G.1.5.

The proposed project design improves passage for all species of fish compared to current conditions, effectively eliminates the likelihood that a hazardous hydraulic roller will form at the site, and enhances flood resiliency by improving an aging structure. The design also maintains the ability to mitigate the impacts of ice jam flooding, enhancing public safety, and sustaining the original purpose of the Cherryfield Ice Dam.

2.1 PURPOSE OF THE PROJECT

The purpose of this project is to improve fish passage at the site of the Cherryfield Ice Dam while maintaining the dam's original purpose of mitigating ice-related flooding, a consistent documented challenge for the Town of Cherryfield since the 1800's. The existing Denil fishway at the Cherryfield Ice Dam, while providing nominal upstream passage for various species, has many deficiencies and is especially inadequate at passing critically endangered Atlantic salmon attempting to access critical upstream habitat in the Narraguagus River watershed. While efficiency of the existing fishway remains unknown, poor attraction flows, narrow orientation of entrance, and steep slope likely combine to limit upstream passage for fish under a range of flow conditions. Removing and replacing the current dam with a channel-spanning, nature-like fishway will provide many different flow pathways for fish to utilize while migrating upstream through the project area under a range of different flows, improving passage for Atlantic salmon, alewife, blueback herring, Eastern brook trout, and other native diadromous species. The fishway is designed to maintain current upstream conditions, including the existing head pond elevation (Inter-Fluve, Inc., 2025).

The proposed action also includes bank stabilization, partial removal of artificial earthen embankments on the left and right banks to increase flow conveyance through the site during high flows, and a robust native planting and revegetation plan. The revegetation plan includes four different types of planting treatments: riparian planting zone, transitional planting zone, riparian staking planting zone, and upland planting zone. The planting treatments consider grading, substrate, hydrology, and the relationship between the existing wetlands and hydrology. The planting palette in each zone includes plants with a range of wetland indicator with diverse growth forms to increase the likelihood of successful plant establishment across variable conditions, intending to center on the proposed hydrologic conditions. All zones include both creeping shrubs and upright trees to provide erosion control, habitat diversity, and shade (see sheet pages 24-26 of Appendix B. 100% Design Drawings). The revegetation plan is expected to return the limit of disturbance to natural wetland condition, resulting in a net-zero loss of wetland area.

DSF also proposes to construct upland, terrestrial improvements to enhance an existing community gathering place and facilitate safe public access to the stream.

2.2 LOCATION AND EXISTING FACILITY

The Cherryfield Fish Passage Project is located in the Town of Cherryfield within Washington County, Maine. The site is located along the lower portion of the Narraguagus River, a coastal tributary to the Gulf of Maine. The site is within the Downeast Coastal SHRU. The Cherryfield Ice Dam is the only barrier on the main stem of the Narraguagus River. The Narraguagus River and its tributaries are listed as Critical Habitat for the endangered population of Atlantic salmon under the Endangered Species Act as part of the GOM DPS. The river supports one of seven remaining genetic stocks of Atlantic salmon that make up this DPS (FR, June 19, 2009, 29344).

2.3 CONSULTATION HISTORY

Federal actions include: NOAA's Restoration Center (RC) is providing funding to Downeast Salmon Federation (Award # NA24NMFX463C0037) for the proposed project and is acting as the lead federal agency for the purposes of this Section 7 consultation. Downeast Salmon Federation is also obtaining a permit from the U.S. Army Corps of Engineers (USACE), New England District for the proposed work.

On March 31, 2025 staff from NOAA RC, NOAA PRD, and Downeast Salmon Federation met to discuss the potential effects of the project to Atlantic salmon and Atlantic salmon critical habitat and reviewed the consultation process. The group agreed that the action area is an occupied migration corridor, there is rearing habitat below the dam, and that the project needs adequately sized flow conveyance throughout construction. On August 27, 2025, Downeast Salmon Federation hosted an on-site interagency meeting between federal agencies (United State Fish and Wildlife Service [USFWS], NOAA, USACE), state agencies (Maine Department of Environmental Protection [MDEP], Maine Department of Inland Fish and Wildlife [MDIFW], Maine Department of Marine Resources [MDMR]), municipal officials (Town of Cherryfield Planning Board chair), and Project Partners. Federal agencies were in agreement that NOAA RC would be the lead action agency for this consultation.

Between July and December 2025, Downeast Salmon Federation drafted and finalized the Biological Assessment with technical assistance from NOAA (Maranda Nemeth, Matt Bernier, Dave Bean, and Rory Saunders). Downeast Salmon Federation completed a pre-application with the USACE on December 9, 2025. NOAA RC

provided the final draft Biological Assessment to the USACE on December 23, 2025. USACE provided input and concurrence with these BMPs and determinations on December 30. NOAA RC provided the final Biological Assessment to NOAA PRD and requested to initiate formal consultation on January 5.

NOAA's Restoration Center (RC) is cooperative agreement Downeast Salmon Federation (Award # NA24NMFX463C0037) includes conditions that all Federal, state, and local permits and consultations will be completed and verified by the NOAA's Restoration Center (RC) prior to implementation of any activities that are federally funded.

Conservation actions and permit conditions:

- DSF will implement the following conservation actions, in addition to the Best Management Practices summarized in Section 4.2 of this report.
- No tree clearing shall occur during the Summer Occupancy period (April 15 – September 30) of the Northern Long Eared Bat, in a given year.
- All in-water work will be completed between July 15 to October 14. This extended in-water work window was granted by the USACE, NOAA, MDIFW and MDMR.
- All work shall be conducted "in-the-dry" behind a cofferdam to avoid impacts to federally listed species between July 15 to October 14 in a given year with the exception of the notching of the dam to facilitate a drawdown, if that is elected. Any in-water work after October 14 shall not occur without coordination between and written approval from the USACE and NOAA.
- A zone of passage will be maintained throughout the project, which will allow fish to pass through the project area without a meaningful delay. (see Section 4.2). Exceptions include period of impoundment drawdown, and period of impoundment refill.
- All cofferdams used during construction must completely isolate the construction area so as to allow equipment to work in dry conditions, and to prevent turbidity from reaching the stream channel outside the enclosed construction area.
- Any bypass or dewatering pump required for the initial dewatering and maintenance of the cofferdams shall prevent entrainment and impingement of Atlantic salmon juveniles throughout the duration of the project. The permittee or their contractors shall use a screen on each pump intake sufficiently large enough so that the approach velocity does not exceed 6.10 meters per second (0.20 feet per second). Square or round screen face openings are not to exceed 2.38 millimeters (approximately 3/32 inch) and slotted face openings will not exceed 1.75 millimeters (approximately 1/16 inch) in the narrow direction. Intake hoses shall be regularly monitored while pumping to minimize adverse effects to Atlantic salmon.
- Approved Standing protocol (see Section 4.2) shall be followed for the duration of the project.
- A Soil Erosion and Water Pollution Control Plan (SEWPCP), designed to avoid and minimize the effects of erosion and pollution on aquatic organisms and habitats, will be provided. As a component of the SEWPCP, the Contractor must develop and properly implement a Spill Prevention Control and Countermeasure Plan (SPCCP) designed to avoid stream impacts from hazardous chemicals, such as diesel fuel, oil, lubricants, and other hazardous materials
- If ESA-listed species are observed or otherwise determined to be within the project area, at any point during construction, all activities below the ordinary water line will cease, and the Contractor shall contact USACE, NOAA, and MDMR who will coordinate the needed response. The USACE point of

contact is Zachary Normile (Zachary.M.Normile@usace.army.mil) at 978-318-8496. The NOAA point of contact is Ryan Bernstein (ryan.bernstein@noaa.gov) at 978-281-9174 or Rory Saunders (rory.saunders@noaa.gov) at 207-866-4049. The MDMR point of contact is Casey Clark (casey.clark@maine.gov) at 207-350-9791.

3. Definition of Action Area

A project's action area is defined as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area (project area) involved in the proposed action" (50 CFR 402.02). The action area for this consultation includes the area affected by the removal of the dam and associated structures, construction (earthen embankments, primary timber-crib spillway, two sluiceways, Denil type fishway) deconstruction and reconstruction of three ice piers and the nature-like fishway, and the area temporarily and permanently affected by the project, both during and after completion. Therefore, the action area includes the area affected by underwater noise, sedimentation and turbidity, and temporary and permanent modification of critical habitat.

The action area for this project is within the Narraguagus River and extends approximately 3.5 miles upstream of the current dam and 1,000 feet downstream of the current dam. The area is expected to encompass all the direct and indirect effects of the proposed activity and is displayed in Figure 1.

3.1 SUSPENDED SEDIMENT AND TURBIDITY

The project area is likely to experience temporary increases in suspended sediment (ie, turbid water discharges) from the drawdown, cofferdam and sheet pile installation and removal, and upland activities. Using available information collected from a project in the Hudson River, we expect pile driving activities to produce total suspended sediment (TSS) concentrations of approximately 5.0 to 10.0 mg/L above background levels within approximately 300 feet (91 meters) of the pile being driven (Federal Highway Administration (FHWA) 2012, NOAA Fisheries 2025). Any increase in turbidity from these activities will be contained within the area around construction activities by project specific construction best management practices. The maximum extent where a temporary increase in turbidity is expected to occur from pile driving is approximately 300 feet upstream and 300 feet downstream from the site of nature-like fishway construction.

The project area is also likely to experience a temporary increase in the release of impounded sediment during dam demolition. However, as described in Section 7.1.1, the amount of sediment stored behind the dam is nominal and it is anticipated that any increase in sedimentation and turbidity throughout the project will be temporary and mitigated by sediment and erosion control Best Management Practices. The maximum extent where any temporary increase in turbidity or sedimentation is expected to occur from the dam demolition is approximately 1,000 feet downstream of the current dam. These estimated distances are based on observations of turbidity releases during similar projects by Inter-Fluve engineering staff.

3.2 UNDERWATER NOISE

During construction, the project area is likely to experience a temporary increase in sound pressure from sheet pile driving with a vibratory hammer attached to an excavator. The greatest increase is expected to occur in association with sheet pile driving for work area isolation. Unattenuated vibratory hammer installation of 24-

inch AZ sheet pile is capable of inducing physiological and behavioral effects to salmon and sturgeon up to 131 feet (at 165 dBs SEL) from the pile driving activity. Depending on the location of the pile, the ensonified area could extend approximately 131 feet from the project footprint, upstream and downstream.

3.3 COFFERDAM AREA

The project area will be temporarily isolated within cofferdams during construction. There will be potential for fish to become entrapped within the enclosed areas at the site of the nature-like fishway construction and structure demolition.

3.4 MODIFICATION OF SENSITIVE AND CRITICAL HABITAT

Actions associated with dam removal and construction of the nature-like fishway may include a partial drawdown of the approximately 3.5-mile long and 328-acre impoundment upstream of the current dam. Therefore, the estimated temporary action area of the project extends approximately 3.5 miles upstream of the current dam in the mainstem and West Branch Narraguagus River.

Construction of the nature-like fishway involves permanent impacts to wetland habitat and critical rearing habitat within the immediate project area. The permanent action area associated with the dam removal and nature-like fishway construction includes approximately 73,000 square feet (1.67 acres) of permanent direct impacts to wetlands around the current dam and associated ice jam mitigation structures. This includes approximately 9,270 cubic yards of permanent fill for the nature-like fishway. The nature-like fishway also includes a channel-spanning grade control structure with an embedded sheet pile cutoff. Approximately 150 feet of sheet pile will be permanently installed at the crest of the nature-like fishway as part of the permanent structure.

3.5 TERRESTRIAL ACTIVITIES

The action area on the terrestrial upland is confined to the footprint of road improvements, public park and access improvements and construction stockpiling areas.

3.6 SUMMARY

The action area for this project is within the Narraguagus River. The permanent action area associated with the dam removal and nature-like fishway construction includes approximately 73,000 square feet (1.67 acres) around the current dam. If the impoundment is partially drawn down during construction, the temporary action area associated with these actions extends approximately 3.5 miles upstream of the current dam, which is the modeled extent of the drawdown effects influence, throughout the approximate 328-acre impoundment in the mainstem and West Branch Narraguagus River. The maximum extent where any increase in turbidity or sedimentation is expected to occur is 1,000 feet downstream of the current dam. The action area on the terrestrial upland is confined to the footprint of road improvements, public park and access improvements and construction stockpiling areas. The area is expected to encompass all the effects of the proposed activity (Figure 1).

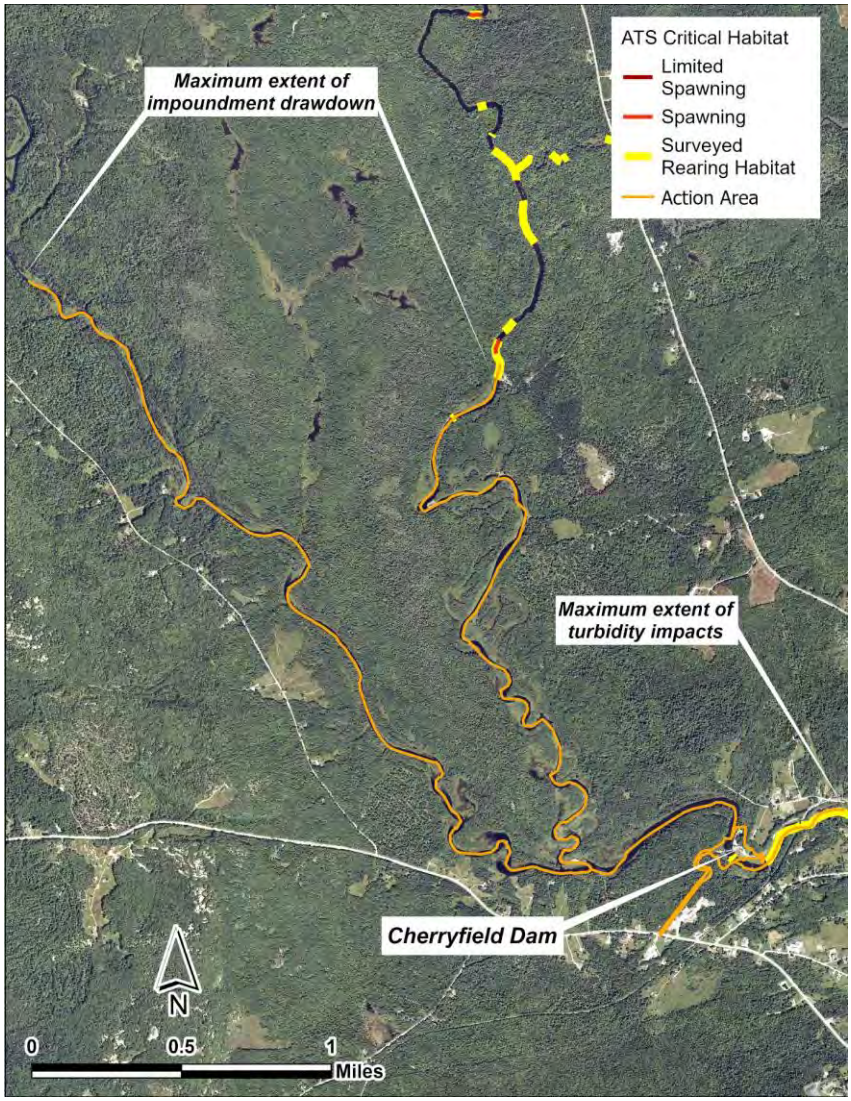


Figure 1. Maximum extent of project action area and Atlantic salmon critical habitat.

4. Proposed Actions

Downeast Salmon Federation is proposing to improve fish passage at the existing Cherryfield Ice Dam and associated structures by installing a channel-spanning nature-like fishway that maintains similar typical head pond elevations (See Appendix B) and ice jam flood mitigation capabilities as the current dam and associated structures. Proposed actions include removing the existing dam spillway, which is approximately 140 feet long and 7 feet high, and associated dam structures (training walls, ice piers), all of which are made from creosote-treated timber cribbing and rock fill. Proposed actions also include partial removal of artificial earthen embankments adjacent to the spillway and construction of a channel-spanning nature-like fishway. Deconstructed ice piers are proposed to be replaced in the same location with structures of similar shape and size as the existing piers to retain the ice jam flood mitigation capabilities of the existing ice piers. Terrestrial actions associated with the project include improvements to existing access roads and public use facilities.

The following paragraphs provide an overview of the anticipated approach to project construction. The actual and final approach will be negotiated and finalized once a contractor has been selected to construct the project. See Appendix B for site drawings. The final approach will be approved by the project engineer in consultation (Inter-Fluve) with NOAA Restoration Center (Maranda Nemeth, Matt Bernier) and will comply with all applicable laws, regulations and permits.

4.1 CONSTRUCTION

All construction elements of the project will be conducted in compliance with the NMFS and Federal Highway Administration's (FHWA) Best Management Practices (BMP) to avoid and minimize effects to endangered species (NMFS/FHWA, 2018). BMPs can include precautionary, avoidance, or protection procedures such as timing restrictions or buffers around sensitive habitats and habitat features that are important to listed species. BMPs may also include methods, facilities, built elements, and techniques implemented or installed during project construction to prevent or reduce project impacts on natural resources, such as water quality, soil, and animal habitats. BMPs are measures that are considered part of each proposed activity that will be implemented throughout the project. They are not recommendations, guidelines, or suggestions. BMPs and avoidance and mitigation measures are mentioned with each associated project action and further detailed in Section 4.2.

4.1.1 Project Overview

The three primary components of the project actions include the removal of the existing Cherryfield Ice Dam and associated structures, construction of the nature-like fishway and ice piers, and terrestrial and upland improvements.

Removal of the Cherryfield Ice Dam and associate structures includes removal of the entire spillway down to the original, pre-dam channel bed. The creosote-treated timber crib and rockfill training walls, as well as the Denil fishway, will also be removed. Creosote-treated timber crib ice piers will be removed completely down to the original, pre-pier channel bed and replaced with structures of similar shape. The creosote-treated timbers will be disposed of off-site at an appropriate facility, likely a regulated site for contaminated waste disposal. The existing rock fill will be salvaged for reuse on-site. Reuse of existing rock fill material will only be allowed if the existing material fits the needs of the site and will be at the discretion of the engineer.

The proposed design includes partial removal of the existing earthen embankments. Both embankments will be cut back at a 2H:1V slope beginning at the top of the proposed grade control and extending to the existing grade. This slope will be protected by riprap installation, continuing the existing riprap treatment on the upstream face of the embankments along the newly exposed portion of the embankment. The proposed nature-like fishway spans the full width of the river, beginning at the location of the existing dam and extending approximately 250 feet downstream, where it ties into the existing riverbed. The nature-like fishway generally follows the Federal Interagency Nature-like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes (Turek et al., 2016). Through redundant design and optimization of fishway geometry, many different pathways are available for fish to utilize while migrating upstream through the project area under a range of different flows. It is designed to maintain current typical head pond elevations and is divided into five main elements:

• Controlling Weir

The grade control weir is designed to maintain existing predicted water levels. The grade control constructed of boulders with a minimum 4-foot diameter and the voids will be filled engineered fill labeled as 'chocking material;' on the plans. The choking material shall consist of a well graded mix of small gravel, sand, and fines used to fill voids and seal the surface of the Grade Control Structure. It shall have enough fines as determined by visual inspection of installation, so that water will pool on the surface of the constructed streambed. Choking material shall be free from organic matter and other unsuitable material, and shall not contain material larger than 4 inches. Choking Material may be imported or may be salvaged from earth borrow pits, dredge, or other sources approved by Engineer.

The front face of the weir will have a slope of 6H:1V from the existing bed to the crest. See Sheet 20 of the plan set in Appendix B for details. The primary elevation of the weir is set at elevation 57.0 feet, with a low flow channel located at elevation 55.5 feet. This low flow channel is positioned to optimize head pond elevation and fish passage. The grade control weir contains a sheet pile cutoff established to help keep water from travelling through interstitial spaces in the nature-like fishway, especially during low flows. The sheet pile cut off will supplement the engineered fill and placed substrate to promote surficial flow through the nature-like fishway. Although not its primary function, the sheet pile cutoff will also help prevent seepage around the nature-like fishway.

• Primary Channel

The primary channel of the nature-like fishway acts as the low flow conveyance of the river, as well as the primary fish passage zone. The average slope of the proposed primary channel is 2.1%. The thalweg of the primary channel is designed to have vertical variation along the longitudinal profile, emulating step-pool channel morphology found in natural systems. Each step is intended to increase the grade of the low flow channel by 0.8 feet while the pools provide up to 3 feet of residual depth below each controlling step. Within the step sections, the channel has a compound configuration, with a low elevation channel with a 10-foot bottom width and 2H:1V bank slopes, and a high elevation channel with an additional 16-foot bottom width. The low flow channel ties into the roughened channel at a 2H:1V bank slope, resulting in a top width of 42 feet and a variable depth step control. This configuration optimizes passage conditions at low and moderate passage flows. Within pool sections, the channel has a bottom width of 14 feet and a variable top width. The left bank slope is 3H:1V and the right bank slope is 2H:1V.

• Roughened Channel

The roughened channel occupies the area on river left, immediately adjacent to the primary channel. The roughened channel is designed to be dry during periods of low flow, and progressively wetted as flows increase. The roughened channel provides passage redundancy, when there are high flow periods during the fish passage season, creating a space that fish can utilize as needed and providing options for passage if other areas become more difficult to pass. This feature mimics a natural channel and provides variability and complexity in flow depths and velocities both along the river profile and along the river cross section. The roughened channel has a cross-slope of approximately 2.0%, providing positive drainage towards the primary channel within each section. The longitudinal slope of the roughened channel varies, with a shallow gradient at the upstream end (approximately 0.1%), and a steeper gradient at the downstream end (approximately 2.4%). At

the upstream end, it ties into the grade control weir, and at the downstream end, the roughened channel blends into the existing river bed.

As part of the design of the roughened channel, the design includes 120 boulder clusters to mimic the natural bed downstream of the dam (see Sheet 14 for the layout and Sheet 21 for details in Appendix B). These boulders are designed to be partially submerged during high passage flows. The roughness boulders for the boulder clusters will be individual stones, having a minimum dimension of 4.0 feet when measured on the median axis, that are hard, durable, resistant to weathering and to water action, and be free from overburden, spoil, shale, limestone, structural defects and organic material. Boulders shall be sub-angular or rounded with a maximum allowable length to width ratio of 2:1. Flat or thin boulders will not be allowed.

The roughness boulders provide aesthetic and performance benefits, creating a more natural looking channel and providing refugia for migrating fish. Roughness boulders generate macro eddies and areas of reduced velocity, aiding weaker swimmers and offering a more natural flow pattern that aligns with fish intuition.

- Overbank

The overbank occupies the area on river right, immediately adjacent to the primary channel. The overbank is designed to concentrate passage flows in the primary channel and in the roughened channel, and to provide stable flood conveyance. Set at an elevation approximately 2-feet higher than the roughened channel, the high elevation overbank conveys flow at 2-year and larger events. The relative frequency of flooding in the high elevation overbank will promote vegetative growth over time. The design includes the placement of an erosion resistant growing medium with plantings that will eventually create a diversely vegetated bank that mimics the existing banks upstream and downstream of the project area. The high elevation overbank has a cross slope of 2.0%, providing positive cross drainage. The longitudinal slope of the high elevation overbank follows the average slope of the primary channel.

- Bank Stabilization/Construction

Bank stabilization and creation measures include a combination of fabric-encapsulated soil (FES) lifts and fabric slope protection to provide near-term stability where indicated. On the river-left bank, adjacent to the roughened channel, the proposed design provides fabric slope protection that is installed following the existing grade (approximately 6H:1V Slope). Fabric slope protection is planted with seed and riparian trees and shrubs. On the river-right, adjacent to the overbank, a new channel bank is formed with layers of 1-foot thick FES lifts applied at a 4H:1V slope. The FES lifts are backfilled with loam and planted with seed and native riparian/upland shrubs.

4.1.2 Project Schedule and Sequencing

Conceptual schedules are a part of the planning process to aid in the assessment of timeframes for minimizing effects to resources, i.e., biological, physical, and economic. Project construction will likely take approximately 10 months to complete including terrestrial activities. The schedule may be impacted by unpredictable external circumstances such as extreme weather events throughout the course of the project. The Construction Contractor will be required to submit workplans that describe the schedule, sequence, and means and methods for their construction activities. The workplans will be reviewed for acceptance by the contracted project engineer (Inter-Fluve) before the Construction Contractor begins work.

The potential occurrence of listed species in the action area is explained in Section 6.0 NMFS Listed Species and Designated Critical Habitat in the Action Area. The period in which listed species are least likely to occur in the proposed action area is during the in-water work window (July 15 – October 14). Review of project schedules by Inter-Fluve engineers experienced with project construction has suggested that restricting in-water work activities to this period does not allow for interference of unforeseen external circumstances that could delay the project, such as extreme weather events. For this reason, DSF will have a 2-week extension of the in-water work window for the project. In-water work for the project is proposed to begin on July 15, 2026, with completion anticipated by October 14, 2026. This 2-week extension of the in-water work window allows a buffer to ensure that all proposed in-water work can be completed within one season. The in-water work timing and specific conditions were reviewed and approved by all resource agencies including Maine Inland Fisheries and Wildlife, Maine Department of Marine Resources, NOAA Fisheries, and United States Army Corp of Engineers. If the project is delayed a year, the same timeline for construction would occur in 2027.

Terrestrial activities for the project, including tree clearing to comply with USFWS Section 7 requirements and the necessary staging and access improvements to complete tree clearing, are scheduled to begin as early as March 2026, pending isolated approval from federal agencies. The remainder of the proposed sequence and all federally funded work will begin when all local, state, and federal permits are in hand. Terrestrial activities may occur throughout the duration of the project with substantial completion anticipated by November 30, 2026 may continue through December 2026, but no tree removal will occur between October 1 - April 15 to mitigate impacts to the Northern Long-Eared Bat. The installation of native plantings and revegetation for upland site restoration is anticipated to be completed by June 1, 2027 and ongoing monitoring for planting survival through October 1, 2029.

Inter-Fluve staff experienced with dam removal, natural channel design, and natural channel construction recommend the following construction sequence for the project, which may be modified by the Construction Contractor pending approval. In-water activities are specified in bold and described further in Table 2. Timing of in-water work activities specific to the Cherryfield Ice Dam Fish Passage Project. and subsequent sections:

1) Mobilization and staging
2) Flagging limits of disturbance and installation of erosion and sediment control measures
3) Tree clearing and access improvements by April 15
4) Partial Demolition of Timber crib abutments, and Embankment Removal
5) **Installation of in-water BMP controls including turbidity curtain starting July 15**
6) **Optional partial dam breach and partial impoundment drawdown**
7) **Implement Phase 1 Water Control to Isolate River Right (sheet pile/bulk bag/earthen cofferdam)**
    a) **Fish removal in isolated work areas**
    b) **Demolish existing ice piers and construct new piers**
    c) **Partially demolish of timber crib spillway and abutments**
    d) **Begin construction of nature-like fishway primary and roughened channel**
    e) **Grade river right embankment and install rip rap protection**

f) Construct proposed overbank on river right (may occur out of the water)

8) **Remove Phase 1 Water Control**

9) Impoundment Refill

10) **Implement Phase 2 Water Control to isolate River Left (sheet pile/bulk bag cofferdam)**

a) **Fish removal in isolated work areas**

b) **Demolish remaining piers and construction of new piers**

c) **Demolish remaining portions of spillway**

d) Complete construction of nature-like fishway primary and secondary channel

11) Remove Phase 2 Water Control by October 14

12) Upland Construction and substantial Completion is anticipated to be completed by November 30, 2026

13) Planting and Revegetation for upland Site Restoration is anticipated to be completed June 1, 2027

14) Demobilization

15) Ongoing monitoring for planting survival through October 1, 2029

Table 2. Timing of in-water work activities specific to the Cherryfield Ice Dam Fish Passage Project.

Activity	**Duration**	**Timing**
Optional Impoundment Drawdown	2-5 days	July 15
Phase 1 Water Control (River Right)	**7 weeks**	**July 15 – September**
Cofferdam installation and fish evacuation	2-3 days	July 15
Demolition of ice piers and partial demolition of timber crib spillway	1-2 weeks	July 15
Reconstruction of ice piers	Ongoing throughout Phase 1	July 15- August
Permanent sheet pile installation for controlling weir	2-3 days	July 15 - August
Construction of nature-like fishway primary and roughened channel	Ongoing throughout Phase 1	July 15 - August
Embankment grading and rip rap protection	Ongoing throughout Phase 1	July 15 - August
Construction of Overbank	Ongoing throughout Phase 1	July 15 - August
Remove Phase 1 cofferdam	2-3 days	August – September
Impoundment Refill (if Optional Impoundment Drawdown)	1 week	August - September
Phase 2 Water Control (River Left)	**4 weeks**	**September – October 14**
Cofferdam installation and fish evacuation	2-3 days	September 1 –30
Demolition of remaining ice piers and spillway	1 week	September
Reconstruction of ice piers	Ongoing throughout Phase 2	September – October 14
Permanent sheet pile installation for controlling weir	2-3 days	September – October 14
Complete construction of nature-like fishway primary and secondary channel	Ongoing throughout Phase 2	September – October 14
Remove Phase 2 cofferdam	2-3 days	October 14

The Contractor will be required to submit workplans that describe the schedule, sequence, and means and methods of their construction activities. These workplans will be reviewed for acceptance by the project engineer (Inter-Fluve) before the Contractor begins work. The Contractor is responsible for performing the work in the manner required to protect the public and natural resources. See Appendix B, Sheets 5-8 for full details on the suggested construction sequencing and proposed locations of all activities.

4.1.3 Mobilization, Staging, Access Road Improvements, and Tree Clearing

The project site can be accessed via public rights of way located on either side of the river. Access to the site from the east is via Cable Pool Road, the primary access point to the site in current conditions. Access to the site from the west is via Stillwater Road, a town right-of-way that is not regularly maintained. Improvement of Stillwater Road will be required before heavy machinery can utilize it for access, and site preparation will initiate with tree clearing and road improvements in March 2026. Additional access improvements on river left include an extension of the existing Stillwater Road right-of-way for approximately 600 feet. The vehicular access road will start adjacent to the Department of Transportation lot, southwest of the dam, on Route 182. A partial road currently exists and will be temporarily improved to provide access just north of the western dam embankment. Following road improvements, site preparation will continue with the establishment staging areas to facilitate work at the project site. The existing parking and overall property area on river left will be utilized for equipment, vehicular, crew and materials movements and staging, and onsite maintenance, as necessary. The project disturbance area will be restricted and limit of disturbance and will be clearly marked before any site operations begin. All work will occur in the uplands and at no time shall construction vehicles be allowed to enter areas outside the limit of disturbance boundaries shown on the plan maps. These areas will be returned to pre-project or better condition following project completion. Appropriate BMPs will be in place to prevent environmental damages associated with all construction activities. See Appendix B. 100% Design Drawings for further explanation of proposed access, staging and mobilization areas.

Erosion control and sediment control measures will be installed during this stage in accordance with applicable permits and project specifications prior to ground disturbance. Typical erosion control measures include, but are not limited to installation of silt fencing, construction entrances, erosion control mulch, and silt bags. Clearing for the project shall be in accordance with applicable permits, and project specifications. All project clearing shall take place between October 1 and April 15 to comply with Section 7 requirements for species under USFWS jurisdiction.

4.1.4 Demolition of Timber Crib Abutments and Embankment Removal

Prior to in-water work, the rock-filled creosote-treated timber crib abutments on both banks may be demolished down to water level with an excavator, and the embankments may be partially removed. (see Appendix B) Rock fill that is suitable for the nature-like fishway design will be salvaged and reused on-site. All creosote-treated timbers will be hauled off site and disposed of at an off-site licensed disposal facility. Disposal of the creosote-treated timbers are the responsibility of the Contractor. The approved disposal locations will be the Waste Management Facility in Norridgewock, ME or Bangor, ME. Transportation of contaminated materials will follow established trucking routes from Cherryfield, ME to the selected disposal facility. The route will be determined by the contractor in coordination with the disposal facility operator and local authorities to ensure safety, compliance, and minimization of off-site impacts. We estimate 150 trips from the project site to the offsite disposal facility.

4.1.5 Optional Partial Impoundment Drawdown

The Construction Contractor may elect to install a cofferdam barrier (combination of sheet pile, bulk bag, and clean fill) and begin in-stream construction without drawing down the impoundment (see Section 4.1.6). Although not required, a partial drawdown of the impoundment is recommended. A partial drawdown will

decrease the water surface differential between isolated work areas and the river, which will increase flexibility for the contractor, decrease overall cost, allow for a more uniform construction of the nature-like fishway, and provide additional safety for personnel and the public. If the Construction Contractor elects a partial impoundment drawdown, the drawdown will be limited to no more than 6 inches per hour and no more than 2 feet per day. The impoundment will be limited to a partial drawdown to an elevation of 53.0 feet (NAVD88). Impacts to critical habitat associated with the partial drawdown are temporary and limited to the period associated with the drawdown. The drawdown may impede fish passage during a two to five day period when the Denil fishway may not be flowing, because the water levels are too low to supply flow to the Denil fishway entrance. However, this potential passage delay should consider the limited existing passage through the Denil fishway under typical summer flow conditions (see more detailed explanation in Section 6.4.1.2). After the drawdown is complete, fish passage will be restored on river left, potentially a more feasible passageway than the existing Denil fishway that would remain the passage if a partial drawdown were not completed. At the onset of the temporary drawdown and continuing until the water level reaches the required drawdown elevation of 53.0 feet, any previously wetted areas upstream of the dam will be monitored for the presence of stranded fish and native freshwater mussels. Efforts will be made to remove any remaining fish from these areas should they become isolated from the main flow of the river channel during drawdown The fish evacuation efforts will be completed by qualified personnel using the stranding protocol (Section 4.2). Similarly, any remaining fish and freshwater mussels in the project area will be removed prior to construction activities under the direction of DSF, following the stranding protocol (Section 4.2). Any Atlantic salmon captured will be appropriately handled and enumerated as described in Section 4.2 supporting the permit application and subsequent ESA consultation with NOAA.

The existing structures at the Cherryfield Ice Dam, including the two sluiceways and Denil fishway, will be utilized to drawdown the reservoir. These structures are not sufficient to effectively draw down the impoundment within a reasonable timeline to the desired water surface elevation, therefore, the impoundment drawdown may be achieved by modifying the existing dam. A notch may be constructed into the existing dam at the location of the Denil fishway and east sluiceway. The notch will be sized such that the reservoir would be drawn down efficiently while following the drawdown rate limitations stated above.

To better understand notch size requirements and drawdown conditions, Inter-Fluve performed an analysis using a 1D hydraulic model. Initial water surface elevations during each of the flow events were determined using the 1D hydraulic model. A representative notch size of 35 feet was determined based on the July 50% flow and the maximum allowable days to drawdown the reservoir. For example, the drawdown depth to elevation 53.0 feet during the July 50% flow is approximately 3.86 feet, which would require a minimum of approximately 1.93 days to drawdown at a maximum of 2 feet per day. A notch width of 35 feet with a sill elevation of 52 feet allows for the reservoir to maintain a water surface elevation of approximately 53.0 feet while all flow is discharged through the notch (i.e. inflow equals outflow).

Table 3. Anticipated time for impoundment drawdown based on expected conditions.

Month	50% Exceedance Probability Flow (cfs)	Initial WSE (ft, NAVD88)	Target Draw down WSE (ft, NAVD88)	Simulated Drawdown WSE (ft, NAVD88)	Drawdown Depth (ft)	Minimum Days to Drawdown
July	140	56.9	53	53.2	3.6	1.8
August	99	56.8		53.0	3.8	1.9

Based on the hydrologic conditions shown in Table 3 and 35-foot notch at a sill elevation of 52 feet, it is anticipated that the impoundment will take approximately 2 days to draw down. During the same hydrologic and physical conditions, and after the impoundment if drawn down, hydraulic modelling shows a maximum drop height of 1.1 feet and a maximum velocity of 1.9 feet/sec through a fish passage corridor. This fish passage corridor would be the primary passage corridor during phase 1 water control in the event of a partial impoundment drawdown. Turek et al (2016) provides guidelines for conditions for fish passage, which the Contractor should follow to ensure adequate fish passage through the site.

If the Contractor does not elect a partial drawdown before installation of the water control methods described in Section 4.1.6, then fish passage will remain feasible through the existing Denil fishway during Phase 1.

4.1.6 Sheet Pile and Cofferdam Installation

Exact means and methods of how the Contractor will control water during project construction is still unknown. Control of water features may vary depending on conditions, available materials, and contractor experience. Typical methods of water control include utilizing placed fill, large bags filled with alluvium, or installation of sheet pile. It is anticipated that sheet pile, bulk bag cofferdams, and temporary fill will be used throughout the course of this project. Work area isolation will occur in three phases, described in Section 4.1.2 and Appendix B, Sheets 6-8. MDMR staff have committed to support fish removal efforts for the project (Ernie Atkinson and Colby Bruchs of MDMR, verbal commitment by Casey Clark and Ernie Atkinson of MDMR at Interagency Meeting, August 27, 2025). For each phase, fish removal shall occur in isolated areas before sheet pile cofferdam installation in coordination with the Project Engineer and MDMR staff. The Contractor shall install water control measures (Appendix B) in a manner that maintains a fish migration corridor through the project site. The fish migration corridor can be used to maintain run of river flow through the project site during construction.

Phase 1 consists of in-stream construction activities on river right including river right spillway demolition, construction of the primary nature-like fishway channel and partial construction of the permanent sheet pile and controlling weir on river right, partial construction of the roughened channel, demolition and rebuilding of the two western-most ice piers, and embankment grading and overbank construction and bank stabilization measures on river right. Phase 2 consists of in-stream construction activities on river left including spillway demolition, completion of the sheet pile controlling weir (which is part of the sheet pile installation on river left), completion of the nature-like fishway primary and roughened channels, demolition and rebuild of remaining, eastern ice pier, and embankment grading. The remaining work is in the upland areas on both river right and river left. A channel of active flow will be maintained throughout construction during each of these phases as

detailed in Appendix B, Sheets 6-8. This channel flow was selected to maintain downstream pool habitat for Atlantic salmon holding.

For Phase 1 and Phase 2, the permanent sheet pile will consist of hot rolled flat web steel sheet piles. It is anticipated that portions of the temporary cofferdams will likely consist of 24-inch AZ steel sheet piles installed upstream of the current dam. If sheet pile is utilized, approximately 250 feet of sheet piling will be installed for each of these phases of water control. Sheet pile cofferdams will be installed with a vibratory hammer mounted on an excavator. It is estimated that installing the cofferdam is anticipated to take 3 days per phase. Each 250-foot section will require approximately 15-60 minutes of vibratory hammer operation, followed by approximately 15 minutes between each section. In total, this activity results in approximately 60 hours of total time, of which, approximately 45 hours (2700 minutes) will be active vibratory hammer use. In conjunction with sheet pile installation upstream of the existing structure, either bulk bag cofferdams or temporary fill cofferdams may be installed downstream of the current dam. The Contractor may elect to only use bulk bags and/or temporary clean fill to isolate work areas. This method of work area isolation would generate the maximum volume of temporary fill needed for isolation measures. Volume of fill shown in Table 4 represents this scenario.

Table 4. Extent of temporary structures for in-stream work area isolation for the Cherryfield Ice Dam Fish Passage Project.

Water Control Phase	Temporary Fill
Phase 1 (River Right)	~750 cubic yard
Phase 2 (River Left)	~750 cubic yards
Total	~1500 CY

The Construction Contractor shall make the final decision on cofferdam sizing and specifications and submit these specifications to the project engineer (Inter-Fluve) in their work plan.

Full details of suggested sheet pile and cofferdam installation, including suggested BMP's and location of cofferdams, can be found in Appendix B, Sheets 5-8.

4.1.7 Dam Demolition and Nature-Like Fishway Construction

The demolition of the dam and associated structures will occur in three phases, as described below.

4.1.7.1 Phase 1 Water Control: Dam / Structure Demolition, Pier construction, and nature-like fishway Construction (River Right) – Sheet 5

Following installation of cofferdams (sheet pile, bulk bag, and/or temporary fill), the isolated work areas (estimated 46,800 square feet) will be dewatered. Screened intakes on dewatering pumps and fish evacuation will follow exclusion barrier construction. The isolated work areas will then be pumped dry with screened dewatering. Water removed from the isolated areas will be discharged to a temporary sediment basin or other outlet filter (i.e., silt bag). at a location that has limited impacts and disturbances, as determined in the field with the Project Engineer. River flow will be maintained on river left for the duration of Phase 1 project work Prior to demolition activities, a turbidity curtain will be installed downstream of the dam to moderate the delivery of

sediment and turbid water to the downstream river while construction occurs. Phase 1 in-water work activities include permanent installation of sheet pile at the grade control weir, construction of the nature-like fishway primary channel, demolition of two existing ice piers and construction of two new ice piers, partial construction of the nature-like fishway roughened channel, embankment grading of river right overbank, and rip rap installation. If a partial drawdown is not elected, the Denil fishway will remain as the feasible fish passage throughout Phase 1 activities. All demolition and construction work in the riverbed will occur in the dry.

4.1.7.2 Impoundment Refill

If the Contractor previously elected to partially drawdown the impoundment per Section 4.1.5, the following sequence will occur after finalization of Phase 1 activities described in Section 4.1.7.1. Upon completion of the primary channel of the nature like fishway, the water surface elevation will be raised and the impoundment refilled to allow for flow into the primary channel of the nature like fishway. The impoundment will be refilled to allow flow through the primary channel. As the reservoir is refilling from the drawdown elevation of 53 feet, the notch will be incrementally blocked while ensuring a minimum flow of 10 cfs through all conveyances (7Q10 flow is 29 csf). Table 5 summarizes the expected conditions to refill the impoundment at incremental water surface elevations and modifications made to a 35-foot notch. Once the primary channel flow exceeds flow of 10 cfs, the notch can be blocked completely.

While flow will not be interrupted, there will not be fish passage through the project area while the impoundment refills. However, it is necessary to refill the impoundment to provide adequate uninterrupted fish passage throughout the remainder of the in-water work. While refill occurs, the Contractor shall provide at least 10 cfs of river flow through the project site to maintain downstream riverine habitat.

This phase of the project may be variable, and is dependent on hydrological conditions at the site during construction. Table 5 shows the anticipated conditions of the site during refilling of the impoundment. The table assumes 50% exceedance flows along the Narraguagus River, and assumes the contractor is allowing a flow of 30 cfs to bypass the construction zone. If the contractor allows the minimum flow of 10 cfs to bypass the construction zone, the time to re-fill the impoundment will decrease. If the Narraguagus River is experiencing flow conditions lower than normal, the time to refill the impoundment may increase.

While the minimum allowable downstream bypass flow is 10cfs, the Contractor should only reduce flow to this minimum level when absolutely necessary to maintain a similar time to refill the impoundments as shown in Table 5. If no impoundment refill is needed, the Contractor shall maintain run of river flow through the project site, and shall not obstruct flow.

Table 5. Anticipated conditions during impoundment refill if scenario is elected by Contractor.

Refill to Water Surface Elevation 54 feet NAVD88				
Event	**Exceedance Probability Flow (cfs)**	**Incremental Refill Time (day)**	**Notch Flow (cfs)**	**Primary Channel Flow (cfs)**
July 50%	140	1.5	82	0
August 50%	99	2.7	82	0
Refill to Water Surface Elevation 55 feet NAVD88				
Event	**Exceedance Probability Flow (cfs)**	**Incremental Refill Time (day)**	**Notch Flow (cfs)**	**Primary Channel Flow (cfs)**
July 50%	140	0.8	49	0
August 50%	99	1.2	49	0
Refill to Water Surface Elevation 56 feet NAVD88				
Event	**Exceedance Probability Flow (cfs)**	**Incremental Refill Time (day)**	**Notch Flow (cfs)**	**Primary Channel Flow (cfs)**
July 50%	140	0.5	49	47.2
August 50%	99	0.6	49	47.2
Total Time to Refill (days)				
July 50%	2.8			
August 50%	4.5			

4.1.7.3 Phase 2 Water Control: Dam / Structure Demolition, Pier Rebuild, and nature-like fishway Construction (River Left) – Sheet 6

When there is adequate flow within the impoundment to allow for an unobstructed channel on river right during Phase 2 activities, cofferdams (sheet pile, bulk bag, and/or temporary fill) will be installed to isolate areas on river left, and the isolated work areas will be dewatered. Screened intakes on dewatering pumps and fish evacuation will follow exclusion barrier construction. The isolated work area will then be pumped dry with screened dewatering. Water removed from the isolated areas will be discharged through to a temporary sediment basin or other outlet filter (i.e., silt bag)., at a location that has limited impacts and disturbances, as determined in the field with the Project Engineer. Phase 2 in-water work activities include completion of the permanent sheet pile installation and the grade control weir, completion of the nature-like fishway roughened channel, removal of the remaining ice pier and construction of a new ice pier, removal of the existing portions of the remaining spillway, embankment grading, rip rap installation, and bank protection. If a partial impoundment drawdown is elected by the Contractor, Phase 2 will also include demolition of the existing portions of the Denil fishway. If a partial drawdown is not elected, Phase 2 will also include the full demolition of the Denil fishway. River flow will be maintained on river right, in the previously constructed primary passage channel, throughout these construction activities. All demolition and construction work in the riverbed will occur in the dry. Prior to demolition activities, a turbidity curtain will be installed downstream of the dam to moderate the delivery of sediment and turbid water to the downstream river while construction occurs. Following completion of this phase of construction, any remaining sheet pile used to create a cofferdam barrier will be removed.

4.1.8 Access, Upland and Park Improvements

Proposed access improvements to the upland area include the addition of a truck/trailer turn-around in an existing flat area northeast of the existing boat launch on the eastern side of the river (river left), the addition of 5 parking spots in the existing park and roadway on the eastern side of the river (river left), and the addition of a new 40-foot x 40-foot gravel parking area on the western side of the river (river right). It is anticipated that the western parking lot will be utilized as a maintenance lot for the nature-like fishway and that most recreational traffic will park within the main existing Cable Pool Park on river left. The new 40' x 40' parking area is outside of the 25-foot shoreland zoning buffer, and is adjacent to, but outside of delineated wetlands on river left. The proposed roadway footprint is primarily on an existing right-of-way, but crosses into adjacent property. The proposed park improvements on the eastern side of the river (river left) include the addition of three new designated footpaths on river left, the addition of a removable floating dock at the existing boat launch, and the addition of benches, picnic tables, and kiosks installed at various locations along the new pedestrian footpaths. A total of 4 new permanent structures including an informational kiosk and overlook, a pergola, an ADA compliant composting toilet, and a small, open-air amphitheater will be constructed in Cable Pool Park on river left. All new structures will comply with state permits and applicable shoreland zoning laws.

4.1.9 Remaining Site Improvements

Remaining site improvements include a robust revegetation plan adjacent to the nature-like fishway (see Appendix B, Sheets 24-25). Revegetation plans include Riparian Staking extending from river left at the nature-like fishway to the existing slope break. This zone is mostly within the ordinary high water (OHW) and the substrate in this zone has a median diameter of 12-inches. This zone is comprised of facultative wetland species that can be installed as live stakes in rows perpendicular to the main flow direction in the rock substrate. The Riparian zone extends from the edge of the Riparian Staking or low flow inundation boundary to the approximate edge of the two-year flood event footprint. This zone is comprised of a mixture of facultative wetland and facultative species that tolerate regular flooding, including the same species as the Riparian Staking with the addition of potted plants. Upslope is the Transitional zone, located above the two-year flood event footprint. The species in this zone range from facultative wetland to facultative upland. The Upland zone is the highest and driest, comprised of facultative upland and upland species.

4.2 BEST MANAGEMENT PRACTICES

The majority of the construction elements of the project will be conducted in compliance with the NMFS and Federal Highway Administration's (FHWA) Best Management Practices (BMP) to avoid and minimize effects to endangered species (NMFS/FHWA, 2018) as well as the NOAA Restoration Center Mitigating Measures from the Programmatic Environmental Impact Statement (NOAA RC, 2015). BMPs can include precautionary, avoidance, or protection procedures such as timing restrictions or buffers around sensitive habitats and habitat features that are important to listed species. BMPs may also include methods, facilities, built elements, and techniques implemented or installed during project construction to prevent or reduce project impacts on natural resources, such as water quality, soil, and animal habitats. BMPs are measures that are considered part of each proposed activity that will be implemented throughout the project. They are not recommendations, guidelines,

or suggestions. BMPs and avoidance and mitigation measures are mentioned with each associated project action and further summarized here.

Many of the proposed actions (see Sections 4.1) will occur during the low water level season between July 15 and September 30. The requested extension to the in-water work window, July 15 to October 14, is beyond the standardized in-water work window but is still within the period of low water. DSF and Inter-Fluve has consulted with state agencies (MDMR and MDIFW) regarding the proposed extension to the in-water work window, both agencies have provided their approval (see Appendix D). Prior to construction activities, site preparation will begin with the establishment of an ingress, egress, and staging area for construction equipment. Site disturbance will be controlled by using extra care in doing the demolition and excavation work and by properly locating controls and staging of earthwork. River flows will be maintained throughout the duration of in-water activities of the project as described in Sections 4.1.5 and 4.1.6, which is expected to maintain fish passage capabilities during all construction phases, with the exception of an optional impoundment drawdown period of 2-5 days (see Section 4.1.5) and a subsequent impoundment refill period of 2-5 days (See Section 4.1.7.2). Prior to any in-water work, fish removal will occur (see Section 4.1.6) and active monitoring for stranded fish will be conducted (see stranding protocol below). Water diversions will redirect all active flow of water to allow work to occur in the dry to reduce sedimentation and turbidity. Any active river flow isolated will be pumped with a screened pump to reduce any fish isolation entrapment. All discharge will be to a temporary sediment basin or other outlet filter (i.e., silt bag)., to reduce downstream sedimentation and turbidity. Cofferdams and the temporary access will be sized in height to adequately handle a 2-year flood event to reduce risk of failure.

<u>On-site Pollution Controls</u>

- Properly confine, remove, and dispose of construction waste, including every type of debris, discharge water, concrete, cement, grout, washout facility, welding slag, petroleum product, or other hazardous materials generated, used, or stored on-site.
- All vehicles and other heavy equipment would be (a) operated in a safe manner; (b) stored, fueled, and maintained in a vehicle staging area set back from any natural waterbody or wetland; (c) inspected daily for fluid leaks before leaving the vehicle staging area.
- Generators, cranes, and any other stationary equipment operated within 150 feet of any natural or wetland would be maintained as necessary to prevent leaks and spills from entering the water.
- Use procedures to contain and control a spill of any hazardous material generated, used or stored on-site, including notification of proper authorities.
- Heavy equipment can also leak oil and fluids. Equipment is always refueled away from stream corridors, and operators are required to have a spill response plan in place in case of a leak

<u>Invasive Species Spread Prevention</u>

- Vehicles or equipment used to manage invasive plants should be cleaned of all debris before removing it from the treatment site to prevent the unintended spread of seeds, rhizomes or plant fragments to other areas. Biofouled debris bearing non-native species should be appropriately treated before moving to reduce the likelihood of introducing or spreading of invasive species.

- Implementation of prevention measures, such as application of Hazard Analysis and Critical Control Point (HACCP) planning, can be used to identify and minimize the risks introducing non- native organisms during restoration activities.

Erosion Control

- Temporary erosion controls would be in place before any significant alteration of the action site and would be monitored during construction to ensure proper function. Any number of erosion control structures or approaches may be used: turbidity curtains, hay bales, and erosion mats may be used where appropriate. When possible, stream flow would be diverted from work areas to prevent excess turbidity.
- Confine vegetation and soil disturbance to the minimum area, and minimum length of time, as necessary to complete the action, and otherwise prevent or minimize erosion associated with the action.
- Anticipate erosion and head cuts through grade control structures or bank recontouring;
- Cease work under high flows or seasonal conditions that threaten to disturb turbidity reduction measures, except for efforts to avoid or minimize resource damage.
- Exposed areas would be mulched and seeded after ground-disturbing activities are complete.
- Site restoration - Any woody debris, mature native vegetation, topsoil, and native channel material displaced by construction would be stockpiled for use during site restoration. When construction is finished, all streambanks, soils, and vegetation would be cleaned up and restored as necessary to renew ecosystem processes that form and maintain productive fish habitats.

Methods to Reduce Soil Compaction

- Existing access ways would be used whenever possible. Temporary access roads would not be built on slopes greater than 50%, where grade, soil, or other features suggest a likelihood of excessive erosion or failure. Soil disturbance and compaction would be minimized within 150 feet of a natural waterbody or wetland. All temporary access roads would be obliterated when the action is completed, the soil would be stabilized, and the site would be revegetated. Temporary roads in wet or flooded areas would be restored shortly after the work period is complete.
- Heavy equipment would be selected and operated in a manner that minimizes adverse effects to the environment (e.g., minimally-sized, low pressure tires, and minimal hard tum paths for tracked vehicles,).
- Any work with heavy equipment in jurisdictional resource (wetlands and below OHWM) will require the use of construction matting
- To the extent feasible, heavy equipment would work from the top of the bank, unless work from another location would result in less habitat disturbance.

Planting or installing vegetation

- The use of an appropriate assemblage of species native to the action area or region, including trees, shrubs, and herbaceous species will be followed.
- Adequate Training of Volunteers - Training should be provided to ensure minimal impact to the restoration site by volunteers. Volunteers shall be trained in the use of low-impact techniques for planting, equipment handling, and moving around the restoration site to avoid unnecessary impacts on native flora and fauna.

Flagging sensitive areas

- Sensitive resource areas adjacent to the action area, such as buffers, archeological sites, and wetlands will be flagged prior to mobilization to avoid accidental impacts.

Adequate Training of Volunteers

- Training should be provided to ensure minimal impact to the restoration site by volunteers. Volunteers shall be trained in the use of low-impact techniques for planting, equipment handling, and moving around the restoration site to avoid unnecessary impacts on native flora and fauna.

A fish evacuation plan will be performed in isolated areas (see Sections 4.1.7.1, 4.1.7.3, **Error! Reference source not found.**). MDMR will be on call and available during construction activities in the event any life stage of Atlantic salmon is observed behind the turbidity curtains or within areas cofferdam excluded areas. Isolated waters will be dewatered with a screened pumped to ensure no entrainment of individuals. If Atlantic salmon are detected at any point, construction activities will cease and the Contractor will contact the oversight engineer and the Downeast Salmon Federation. DSF will coordinate with NMFS and MDMR on the removal of ESA listed Atlantic salmon. The following Standing protocol and fish evacuation procedures will be applied as allowed by fish handling personnel:

Stranding Protocol:

- Purpose: The potential exists for Atlantic salmon at any life stage to be stranded in areas below the Cherryfield Ice Dam when construction is underway during the times of extreme low flow; 1) a drawdown is commenced and subsequent refill is needed and 2) during times the river right or river left are isolated (referred to under Phase 1 and 2 in the construction sequence) under differing flow regimes
- Scheduling: Dates of importance are noted below, but this stranding protocol should apply to any times in which water flow through the project site is impacted enough to cause reasonable concern for a fish stranding to occur.
    - July 15: If the Contractor elects a partial impoundment drawdown, there may not be a temporary bypass channel through the construction area for 2 – 5 days during the active drawdown and fish passage may be delayed during this portion of Phase 1

  - July 15 – October 14: At any point while river right or river left is isolated (referred to under Phase 1 and 2 in the construction sequence) under differing flow regimes, the passage zone adjacent to the isolated work channel may cause fish stranding.
  - August: During the refill period, there may not be a passable channel through the construction area for a period of 2 – 5 days, and fish passage may be delayed during this phase of the project.

- If this situation occurs, these areas below the dam need to be visually checked regularly/daily during low flows and as soon as possible following drawdown for the presence of Atlantic salmon and the following protocol shall be followed:
  - 1. Designated personnel from the Downeast Salmon Federation must perform visual checks to monitor any isolated pools below the Dam while the drawdown and refill occurs as well as during any time flow direction is alternated throughout the summer work window. The designated DSF personnel will keep a log sheet noting the date, time, observer, weather, and notes of fish presence.
    - Vantage points include the timber abutment on river left and river right (until demolition) and walk through the downstream area All vantage points shall be visited by the Designated personnel to complete the visual survey.
    - The Designated DSF personnel shall follow all contractor safety protocols while on site including wearing high-vis clothing and checking in with the foreman. In some areas close to the dam, crews may be required to wear personal flotation devices and a hard hat. The Designated personnel shall be equipped with appropriate foot wear to decrease the potential of slipping on wet rocks and polarized sunglasses to increase their ability to see into the water to locate stranded fish. The Designated personnel should also carry personal supplies of water, mobile phone with the appropriate contact list, a notebook, and pencil.
    - If exceptions need to be made for other outside operational factors and crew safety constraints, visual surveys will be conducted as soon as it is reasonably safe to do so, and those conditions will be documented and reported.
  - 2. If a stranding event occurs, all Atlantic salmon seen by Designated DSF personnel should be left untouched until the MDMR has arrived on scene if they are not in immediate danger. The Designated DSF personnel will alert the foreman, work will stop, and DSF shall follow the contact procedure outlined below to notify MDMR that Atlantic Salmon are present and follow the 'Fish Evacuation' protocol, described in further detail below.
  - 3. For each fish removed, the DSF shall ensure photos are taken and the recording of the life stage, and condition of the fish as well as the approximate location of the stranded fish, river flow, bypass reach minimum flow, and water temperature will be recorded. All relevant information will be recorded and subsequently reported.

- 4. If any injured Atlantic salmon are found, the DSF shall report immediately to NOAA Fisheries (see contact information below) the data collected in step 3. Injured fish must be photographed and measured, if possible, and the reporting sheet must be submitted to NOAA Fisheries within 24 hours. If the fish is badly injured, the fish should be retained by the DSF and its partners, if possible, until obtained by a NOAA Fisheries recommended facility for potential rehabilitation.
- 5. The DSF shall report any dead fish immediately to NOAA Fisheries (see contact information below) and MDMR. Any dead specimens or body parts should be photographed, measured, retained and preserved by MDMR with support from DSF, until they can be obtained by NOAA Fisheries for analysis.
- Contact Information:
  - Within 24 hours of any stranding event, contact with an injured or dead Atlantic salmon: contact NOAA Fisheries Northeast Regional Office –Julie Crocker (978-281-9328 x6530) and fax any reporting sheets to 978-2819394. Messages should be left on voice mail or email (Julie.Crocker@noaa.gov) if unable to access by phone.
  - Subsequently within 48 hours, contact U.S. Army Corp - Zach Normile (978-318-8496) and scan any reporting sheets via email (Zachary.M.Normile@usace.army.mil).

Fish Evacuation Protocol -

- Electrofishing shall be conducted using the following guidelines: "Maine Department of Marine Resources Bureau of Sea-run Fisheries and Habitat Standard Operating Procedure for Juvenile Atlantic salmon Sampling by Electrofishing in Wadeable Streams-2025."
- Fish shall be excluded and evacuated from the worksite before any instream work is started (with the exception of cofferdam installation and dewatering). This work will be performed by MDMR in accordance with MDMR Adult Atlantic salmon fish handling SOP, ensuring the fish evacuation is supervised by a fisheries scientist experienced with work area isolation and safe handling of Atlantic salmon.
- All Atlantic salmon trapped within the isolated work area shall be captured using techniques to minimize the risk of injury, then transported to a safe release site, preferably upstream of the isolated reach in a pool or other area that provides cover and flow refuge. The transport equipment must provide appropriate conditions that would allow the fish to recover, rest and be relocated without further stress. The transport needs to be in a designated salmon transport truck with cool well oxygenated water to allow immediate recovery while being relocated. MDMR will provide this transportation vehicle that is equipped with a Xactic tank, and oxygen and aeration transport capabilities and will utilize transport protocols as outlined in Appendix F "Adult Salmon Transport Procedure" of MDMR's Atlantic Salmon Trap Operating and Fish Handling Protocols.

- The fish will be released in an area of quiet flow, and with sufficient depth and egress to the main flow of the river to provide the fish a safe opportunity to swim off. This area will be in the river, with a first preference of relocation to Schoodic Brook if possible.
- Fish evacuation may be conducted by electrofishing and may also include one or a combination of the following methods: herding, hand netting, seining, or trapping prior to electrofishing. Fish will be captured via nets, buckets, seines, or similar gear as appropriate to the area. Crews will use good handling practice for fish if possible, such as using nets with soft mesh, large fish handling rubber "sock", not overcrowding buckets, and releasing fish promptly. All Atlantic salmon shall be handled with extreme care and kept in water the maximum extent possible during transfer procedures.
- If the river temperatures exceed 23^{o}C all stranded fish observed need to be removed as quickly as possible and transported to a designated suitable area (e.g., cold water refugia) where the fish can recover and rest. The transport needs to be in a designated salmon transport truck with cool well oxygenated water to allow immediate recovery while being relocated. MDMR will provide this transportation vehicle that is equipped with a Xactic tank, and oxygen and aeration transport capabilities.
- Fish evacuation shall be supervised by MDMR fisheries scientists experienced with work area isolation and safe handling of Atlantic salmon. All Atlantic salmon that are relocated during the fish evacuation process shall be documented, including information on injuries or mortalities.
- Electrofishing shall be conducted using the following guidelines: "Maine Department of Marine Resources Bureau of Sea-run Fisheries and Habitat Standard Operating Procedure for Juvenile Atlantic salmon Sampling by Electrofishing in Wadeable Streams-2025."
- If there are any changes in the project and fishway operations, head pond elevation changes or bypass flow regimes that differ from the previously described conditions, DSF will notify NOAA NFMS and MDMR points of contact (listed below).
- If ESA-listed species are observed or otherwise determined to be within the project area, at any point during construction, all activities below the ordinary water line will cease, and the Contractor shall contact USACE, USFWS, NOAA, and MDMR who will coordinate the needed response. USFWS point of contact is Wende Mahaney (wende_mahaney@fws.gov) at 207-902-1569. The USACE point of contact is Jeremy Lessard (Jeremy.S.Lessard@usace.army.mil) at 978-318-8789. The NOAA point of contact is Julie Crocker (julie.crocker@noaa.gove) at 978-281-9328 x6530. The MDMR point of contact is Casey Clark (casey.clark@maine.gov) at 207-350-9791.

5. Environmental Baseline

5.1 PROJECT SETTING

The Cherryfield Ice Dam (the dam), part of the Cherryfield Local Protection Project (LPP), is located on the Narraguagus River in the town of Cherryfield, ME, approximately seven miles north of the confluence with Narraguagus Bay and one mile north of the Cherryfield town center and head of tide. The dam is approximately .8 miles downstream from the confluence with the West Branch and mainstem Narraguagus River. The project site is entirely freshwater and the farthest extent of Highest Astronomical Tide (HAsT) is 1.2 miles below the dam (MGS, 2022).

The entire watershed area, from the headwaters of the Narraguagus River at Eagle Lake in Hancock County, ME to the confluence with Narraguagus Bay in Milbridge, ME, encompasses 244 square miles (Figure 2). The watershed includes approximately 2,609 acres of alewife spawning habitat across seven lakes north of the dam (Schoodic, Spruce Mountain, West Beddington, Narraguagus, and Eagle Lakes, Myrick Pond, and Bog Brook Flowage). The watershed is largely undeveloped with 69% forested cover (Dewitz, 2019). The remaining area consists of wetlands (6.5%), open water (2%), agricultural fields (4%), headwater streams, and limited developed space concentrated in the towns of Cherryfield and Milbridge below the dam (Inter-Fluve, Inc, 2025).

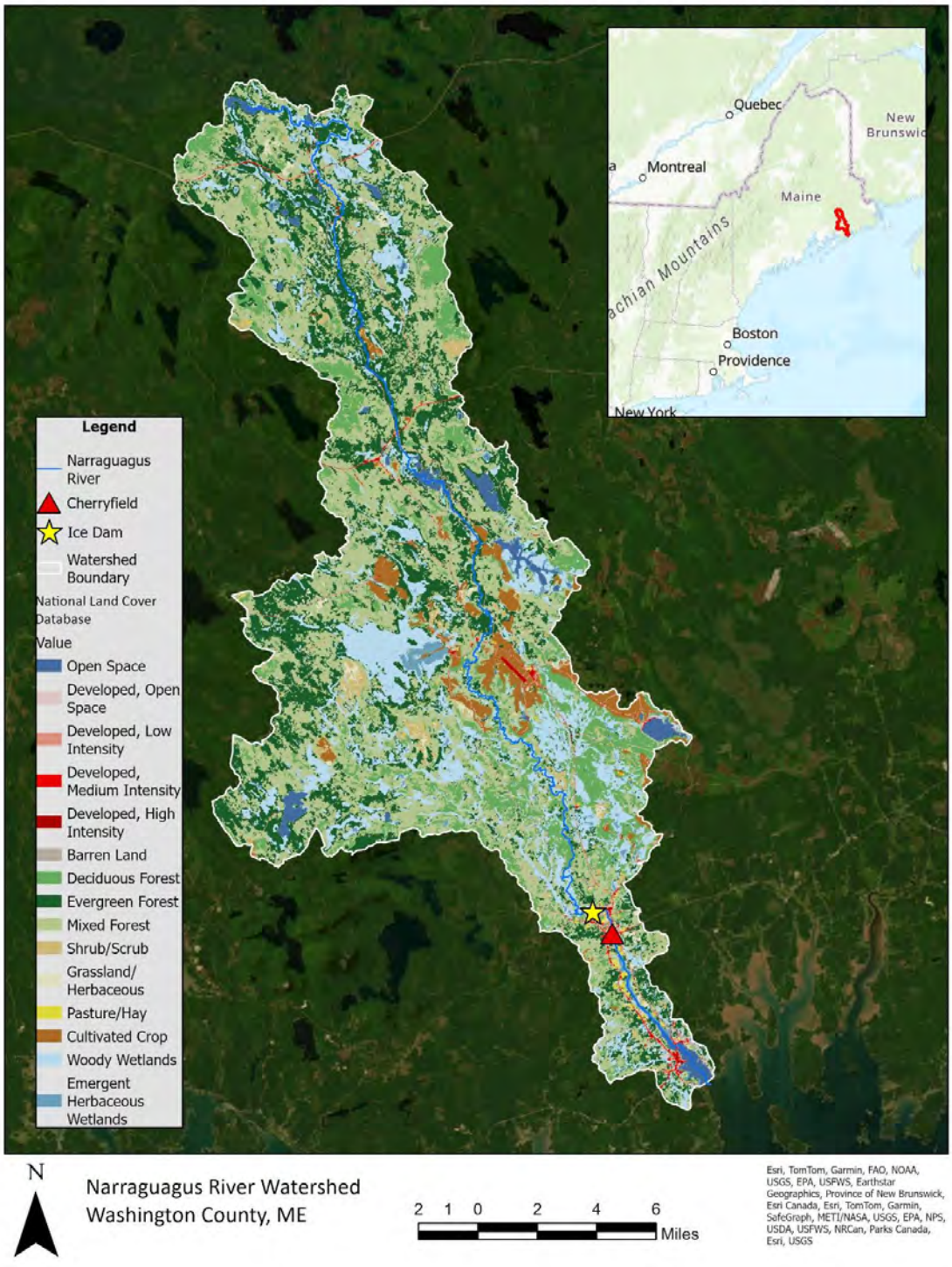


Figure 2. Narraguagus Watershed Map with National Land Classification Data (NLCD) and locations of the Town of Cherryfield and the Ice Dam. Source: Inter-Fluve, Inc (2025).

5.2 ACTIONS IMPACTING THE ENVIRONMENT WITHIN THE ACTION AREA

5.2.1 Historic Actions within the action area

The approximate one-mile section of the Narraguagus River between the head of tide and the project site was heavily dammed throughout the 1800's and 1900's, blocking or impeding passage for native diadromous fish species for more than a century. During this period, five dams were constructed between the town center and the current project site to support timber harvesting and other industries in the Town of Cherryfield. Above the current dam site, widespread channel widening during the log drive era significantly altered the river's morphology and exacerbated existing natural sediment deficiency. Log drives, which persisted into the early 20th century, resulted in the removal of in-channel obstructions, including natural sediment storage features like large wood and boulders, leading to straightened and widened channels in many reaches. This historic modification further reduced sediment retention within the system, leaving the modern Narraguagus River and the action area above the dam largely starved of sediment. The combination of natural low sediment availability and simplified channels resulted in a static riverscape with limited ability to evolve over time (Inter-Fluve, Inc, 2025).

Many iterations of dam construction and rebuilding took place at the current project site between 1836 and 1961, resulting in consistently interrupted fish passage at the site for over a century. Stillwater Dam was first constructed at the site in 1836. This dam was partially destroyed by fire and rebuilt in 1875, partially destroyed by flooding in 1901, and further damaged by flooding in 1923. It failed completely in 1936 due to an ice jam flood (Cherryfield Historic Society, 2024). The remains of the structure were washed out by another ice jam flood event in 1942, which caused significant property damage to the town of Cherryfield and destroyed three additional downstream dams. Following the destruction of Stillwater Dam, four additional ice jam flood events resulted in significant property damage to the town of Cherryfield in 1950, 1953, 1954, and 1959. The last dam on the lower section of the Narraguagus River, which was completely impassable to diadromous fish, failed in 1951 (USACE, 2016).

In response to the apparent increase in frequency of significant ice jam flood events that followed the destruction of Stillwater Dam, the USACE constructed the current Cherryfield LPP at the site in 1961. The dam has negatively impacted upstream and downstream migratory fish movement since its construction. Today, it remains the only barrier to fish passage on the mainstem Narraguagus River.

5.2.2 Current Actions within the action area

5.2.2.1 Cherryfield Ice Control Dam

The Cherryfield Ice Dam is the primary component of the Cherryfield Ice Dam LPP. The LPP functions to mitigate ice jam-related flooding on the Narraguagus River to protect property in Cherryfield. The dam is an approximately 500-foot-long earthen embankment dam with a timber crib fixed crest spillway. It has an approximate structural height of 24.5 feet and a hydraulic height

of 7 feet (Rocks et al., 2021). The dam consists of five main components including an earthen embankment, a primary timber-crib spillway, two sluiceways on the right and left sides of the spillway between the spillway and training walls, a Denil type fishway, and three ice piers (**Error! Reference source not found.**). The sluiceways provide a means to partially draw the impoundment down below the spillway level for maintenance purposes. The dam is owned by the Town of Cherryfield, Maine.

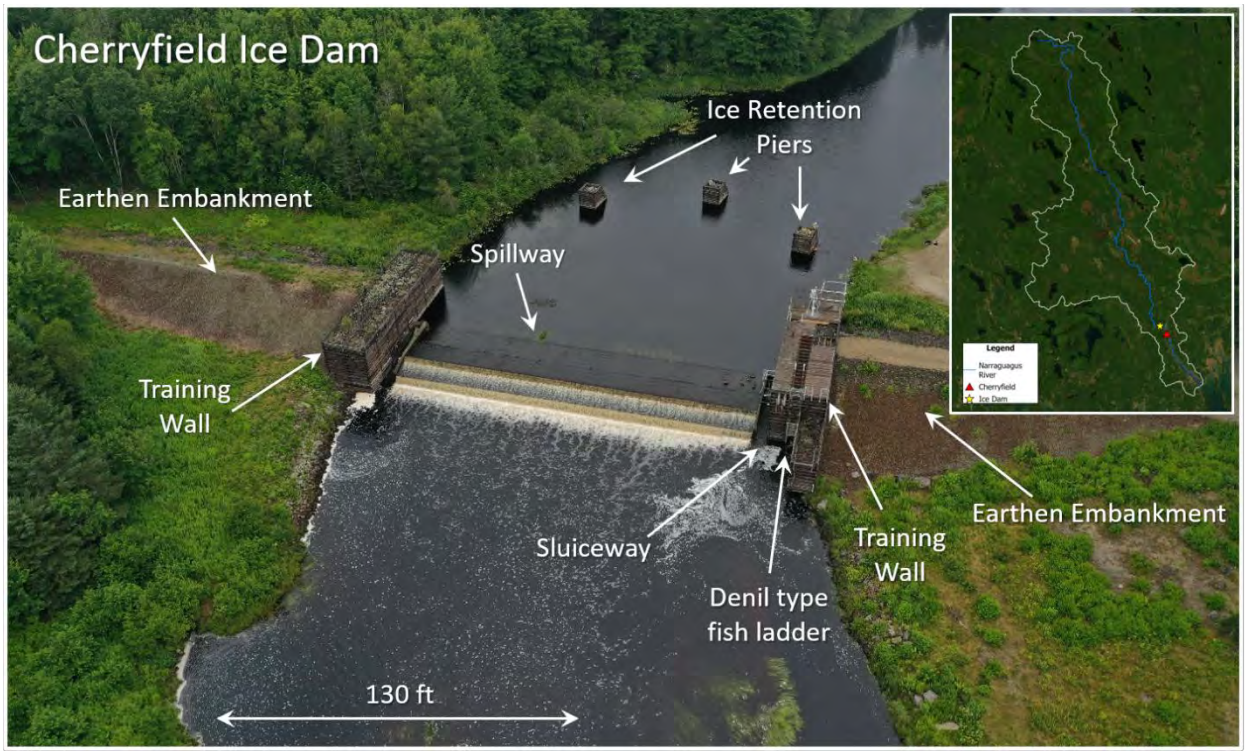


Figure 3. Cherryfield LPP highlighting key infrastructure details. Source: Inter-Fluve, Inc (2025).

The earthen and timber crib Cherryfield Ice Dam was constructed to create an artificial reservoir for the purpose of ice retention (USACE, 2016) so that the reservoir would retain ice jams until they melted, delaying movement downstream. As stated in the USACE CRREL report from 2021, "the surface ice cover that forms upstream of the Cherryfield dam allows for the retention of breakup ice from upstream...likely mitigat[ing] the severity of ice jams that occur downstream of the existing dam." The ice piers appear to have been included to improve the ability of the reservoir to hold/immobilize the ice sheet and delay the arrival of broken ice to the vulnerable downstream areas between Cherryfield and Millbridge (USACE, 2016).

The dam contains a 3.5-ft wide wooden Denil fishway with 17 wooden baffles built into its east abutment (**Error! Reference source not found.**). The slope of the fishway is relatively steep (1V:6H). The existing Denil fishway at the Cherryfield Ice Dam, while providing nominal upstream passage for various species, has many deficiencies and is especially inadequate at passing critically endangered Atlantic salmon attempting to access critical upstream habitat in the Narraguagus River watershed. While efficiency of the existing fishway remains unknown, poor attraction flows, narrow

orientation of entrance, and steep slope likely combine to limit upstream passage for fish under a range of flow conditions. The fishway is also a confined channel that especially excludes deeper-bodied fish such as American shad and Atlantic salmon (USACE, 2016). Atlantic salmon have been observed attempting to jump over the spillway rather than pass through the fishway (USACE, 2016), though a sill was installed in the early 2000's to prevent this. Overall, Denil fishways have relatively lower passage efficiencies compared to other designs (USACE, 2016). Therefore, the dam is a barrier that delays migration for Atlantic salmon and native diadromous fish including American shad, alewife, blueback herring, and Eastern brook trout, especially during low flows.



Figure 4. Denil fishway and wooden baffles on East Abutment of Cherryfield Dam LPP. Source: USACE (2016).

5.2.2.2 Fish Trap and Alewife Harvest

The Town of Cherryfield operates a commercial alewife harvest at the project site (**Error! Reference source not found.**) which has resulted in annual revenues of approximately $30,000 - $60,000 since 1996 (USACE, 2016 and data shared from the Town of Cherryfield in an email communication with Jacob van de Sande of MCHT, May 2025). A metal fish trap which operates in conjunction with the Denil fishway is connected to the upstream side of the fishway (USACE, 2016). All fish passage is restricted to the Denil fishway in the current configuration, which forces all migrating species into the trap facility. The bars of the trap retain larger-bodied fish (American shad >40 cm FL, adult Atlantic salmon) and allow alewife and smaller shad to pass through (email communication with Colby Bruchs of MDMR, May 21, 2025). MDMR monitors the fish trap daily and releases larger-bodied shad and Atlantic salmon upstream. The metal trap prevents adult Atlantic salmon and large shad from comingling with the alewife harvest, but occasionally results in Atlantic salmon mortalities and regularly causes American shad mortalities (Figure 6). According to MDMR data, Atlantic salmon trap mortality reached 4% in 2008 (1 mortality out of 26 trapped) and 2019 (3 mortalities out of 81 trapped), and 1% in 2020 (1 out of 109 trapped). Mortality of American shad generally ranged from 4% – 14% from 2005 to 2024, with higher mortality rates in 2005 (24%) and lower mortality rates in 2008, 2014, and 2020 (2%, 1%, and .25%, respectively). Returns and mortalities recorded by MDMR for Atlantic salmon and American shad are not indicative of the total

run or total mortalities (email communication with Colby Bruchs of MDMR, May 2025). All existing structures will remain intact for the regularly scheduled 2026 Alewife harvest.



Figure 5. Fish trap at the Cherryfield Dam, alewife harvest facility upstream of the left spillway training wall. Source: Inter-Fluve, Inc (2025).

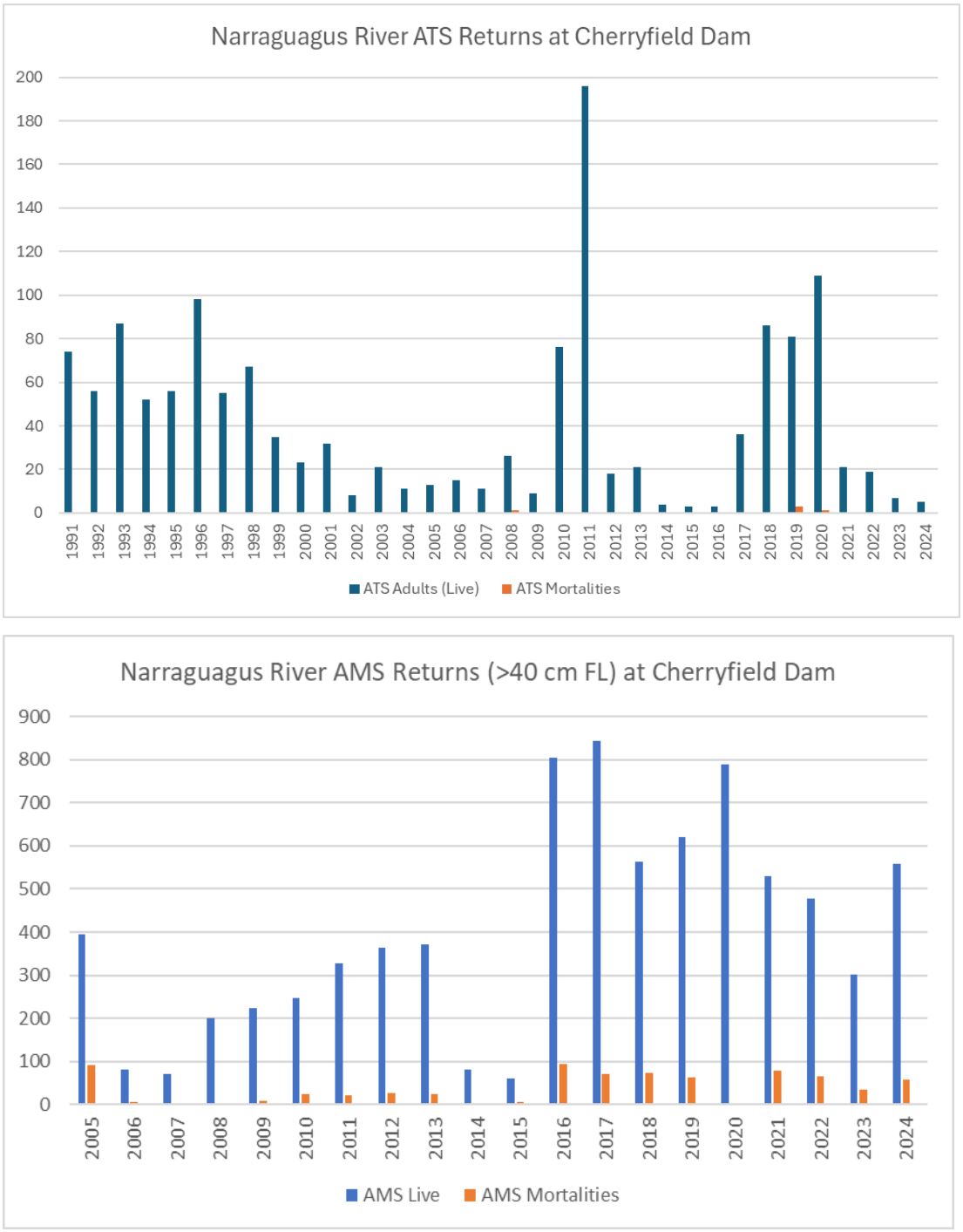


Figure 6. Recent counts of returning adult Atlantic salmon (ATS, top) and American shad (AMS, bottom) and mortalities at the Cherryfield Dam fish trap, 1991 - 2024. Data from MDMR, figures by Inter-Fluve, Inc.

5.3 AQUATIC HABITAT

The Narraguagus River and its tributaries are listed as Critical Habitat for the endangered population of Atlantic salmon under the Endangered Species Act as part of the GOM DPS. The Narraguagus River is one of eight Maine rivers that hosts a distinct population segment of federally endangered Gulf of Maine Atlantic salmon [(FR, June 19, 2009, 29344). Whiting et al, 2008]. The Narraguagus also hosts robust populations of native diadromous fish including alewife, blueback herring, American eel, American shad, sea lamprey, and Eastern brook trout. Atlantic and shortnose sturgeon, both present in Narraguagus Bay, may also sporadically utilize the lower reaches of the Narraguagus River as foraging habitat for brief periods during the spring and fall, while migrating to and from spawning grounds.

The Cherryfield LPP forms a 3.5 mile long, shallow, narrow impoundment upstream of the dam along the mainstem and the West Branch of the Narraguagus River (USACE, 2016). Impoundment depths vary with flow, but are generally between 7 and 14 feet deep at normal water levels (Inter-Fluve, Inc, 2025). The entire impounded area contains approximately 28 acres of freshwater emergent wetland (PEM), 437 acres of forested shrub/scrub wetland (PFO and PSS), 7.5 acres of freshwater pond (PUB) wetland, and 328 acres of riverine habitat according to the National Wetlands Inventory (Figure 7). The vegetated riparian wetlands above the dam provide habitat for aquatic species and important ecosystem functions including nutrient filtration, bank stabilization, and water quality improvements. The impounded area above the dam also contains exemplary natural wetland communities identified by the Maine Natural Areas Program (MNAP) including Streamshore Ecosystem, Grassy Shrub Marsh, and Tall Grass Meadow (Table 6, Figure 8). There is no spawning or rearing habitat for Atlantic salmon within the impoundment (Maine Stream Habitat Viewer, confirmed by verbal communication with Ernie Atkinson of MDMR, May 8, 2025). The immediate project footprint around the current dam contains 0.79 acres of palustrine emergent wetland, 5.44 acres of palustrine forested wetland, and 1.37 acres of mixed palustrine shrub-scrub and palustrine emergent wetland.

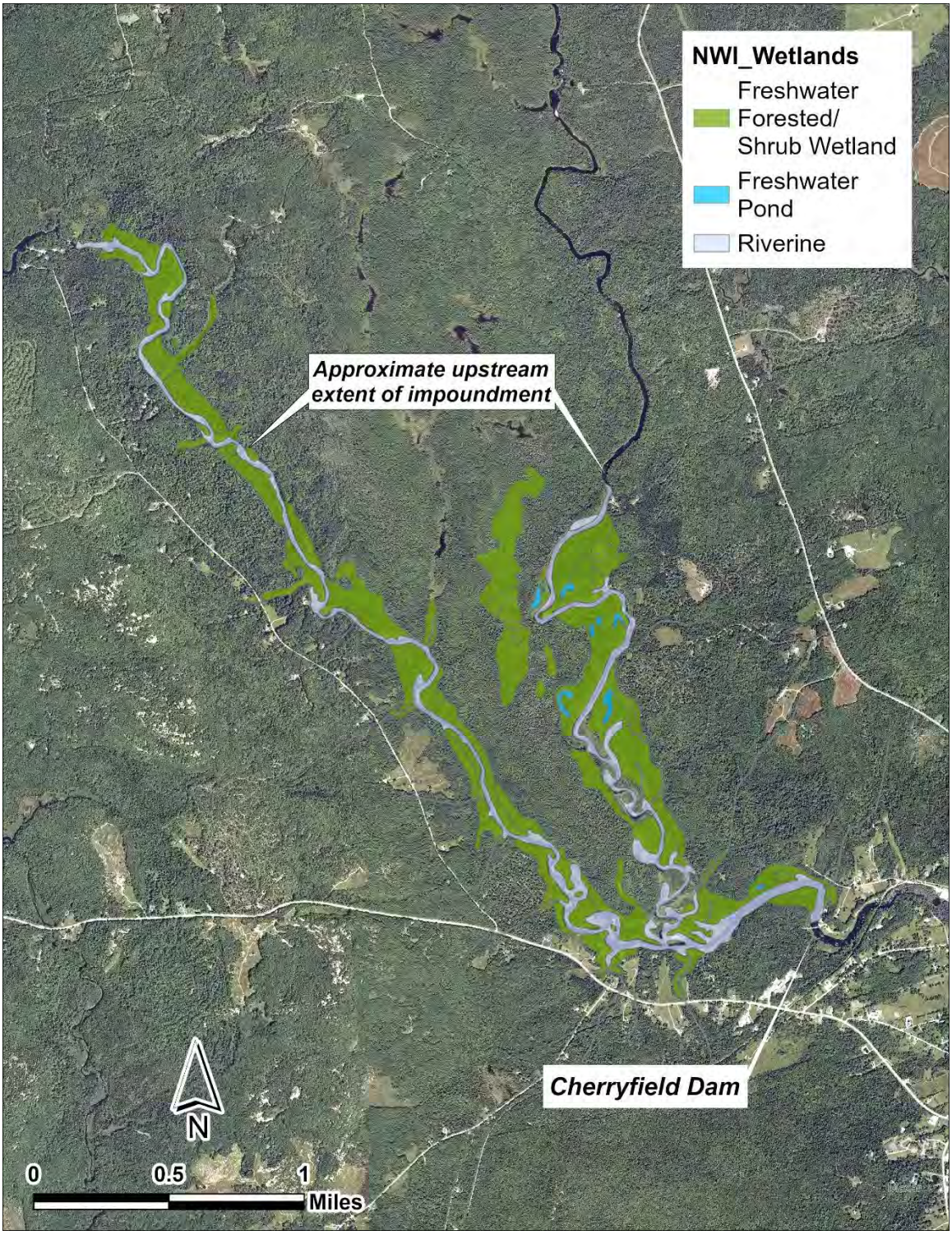


Figure 7. Wetland habitat above the Cherryfield Dam in impounded area. Data by NWI, figure by Inter-Fluve, Inc.

Table 6. Exemplary wetland natural communities identified by MNAP above the dam. Source: MNAP (2025).

Feature	State Status	State Rank	Global Rank	Occurrence Rank	Site
Streamshore Ecosystem	---	S4	GNR	B - Good	Narraguagus Confluence
Grassy Shrub Marsh	---	S5	GNR	H - Historical	Narraguagus Confluence
Tall Grass Meadow	---	S4	G4G5	B - Good	Narraguagus Confluence
Tall Grass Meadow	---	S4	G4G5	H - Historical	Mahanon Branch

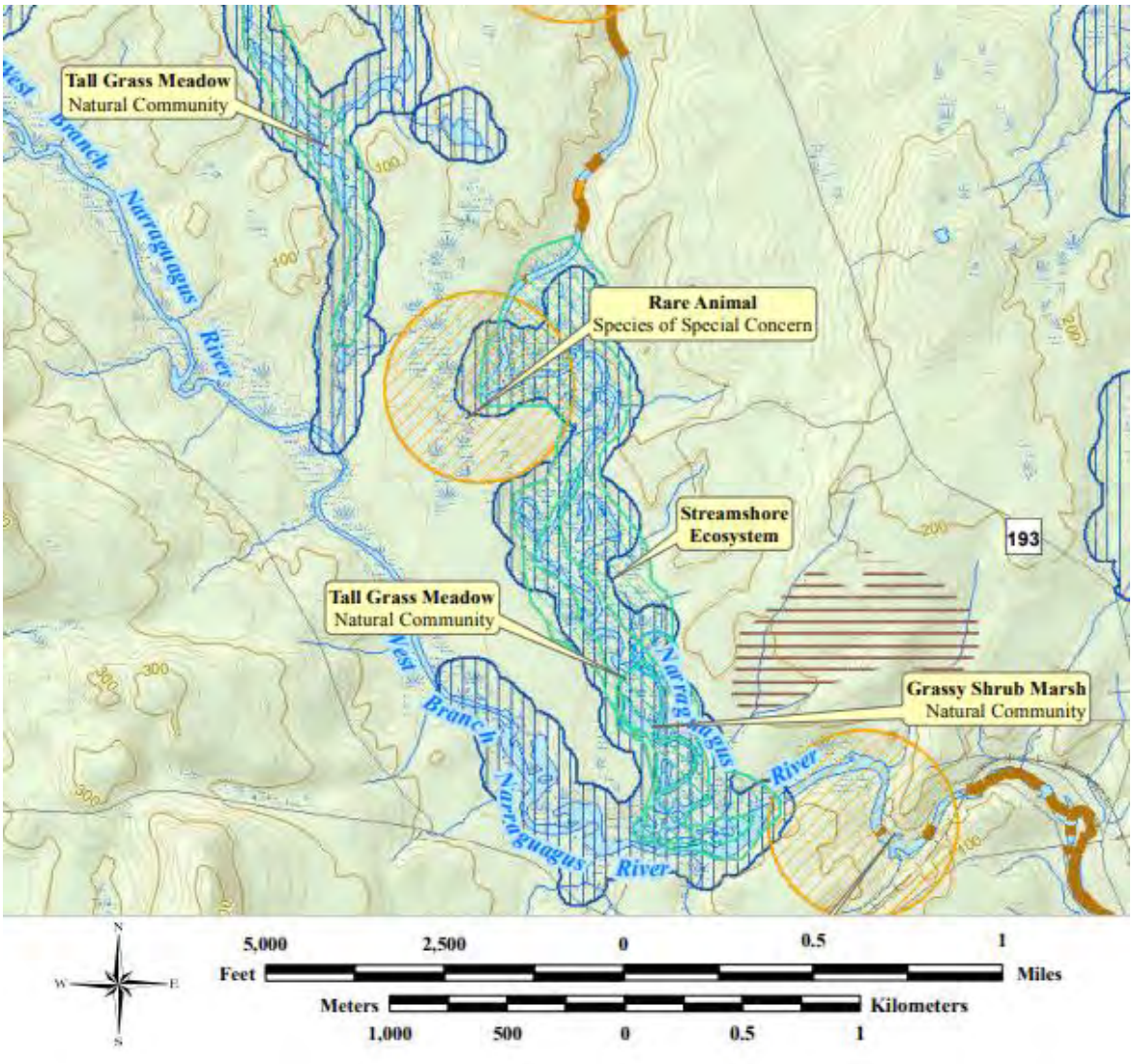


Figure 8. Natural plant communities above and below Cherryfield Ice Dam, mapped by MNAP. "Rare animals" and species of special concern include alewife, American shad, and endangered Atlantic salmon. Source: MNAP (2025).

A wetland delineation was conducted at the project site in May 2025 using methods outlined by the USACE Wetlands Delineation Manual (USACE, 2025). Palustrine Emergent Marsh (PEM), Palustrine Forested Wetland (PFO), and Palustrine Shrub-Scrub (PSS) wetlands were all identified in the immediate project area (Figure 9). The wetlands in the vicinity of the dam were dominated by native plant species, though a few purple loosestrife (*Lythrum salicaria*, an invasive wetland plant) were observed (Haberstock, 2025). The wetlands immediately adjacent to the existing dam on both banks were narrow with limited complexity. Soils in these wetlands were comprised mostly of historic fill. Wetlands downstream of the dam were broader, more complex, and overall more functionally important (Haberstock, 2025). Since no permanent changes were proposed to typical upstream conditions in the project design, wetlands were only delineated within the immediate project footprint including road improvements on river right and public use facility improvements on river left (Figure 9) and the proposed in-stream action area for construction of the nature-like fishway (Figure 10).

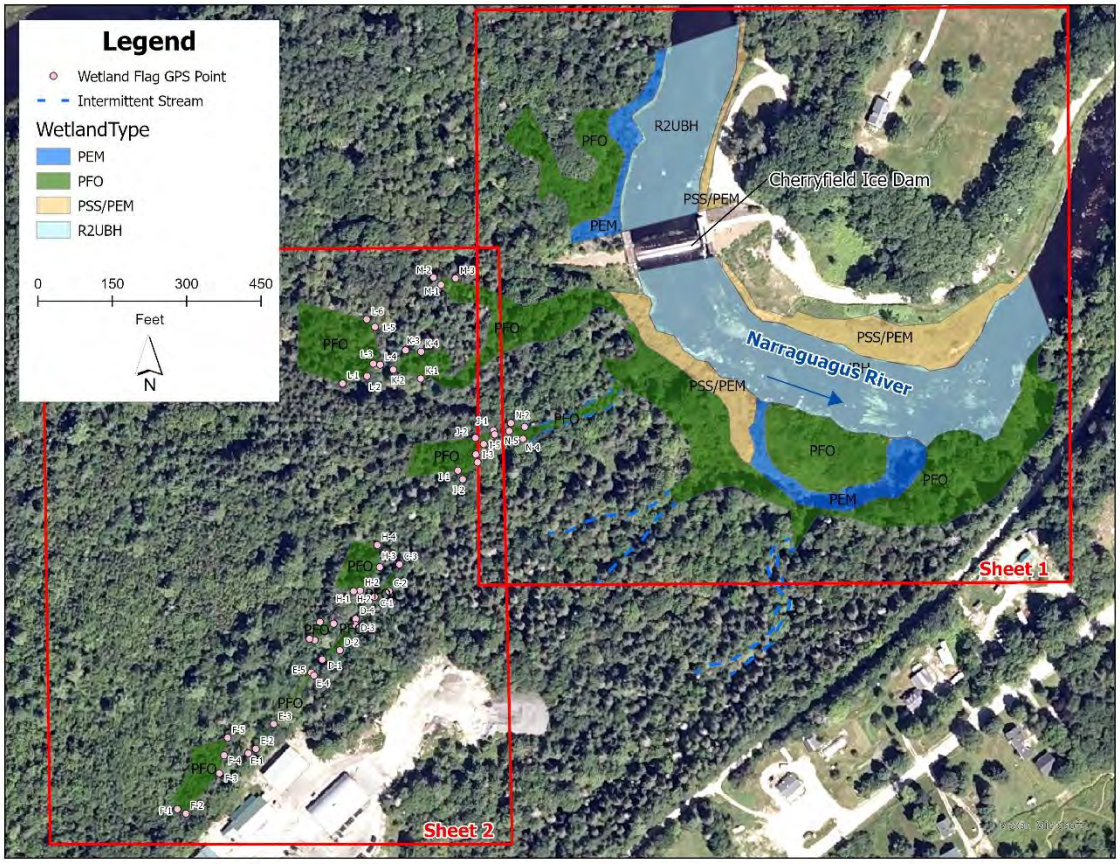


Figure 9. Wetland zones delineated in the project action area including road/park improvements and proposed naturelike fishway by PWS Alan Haberstock, 2025.

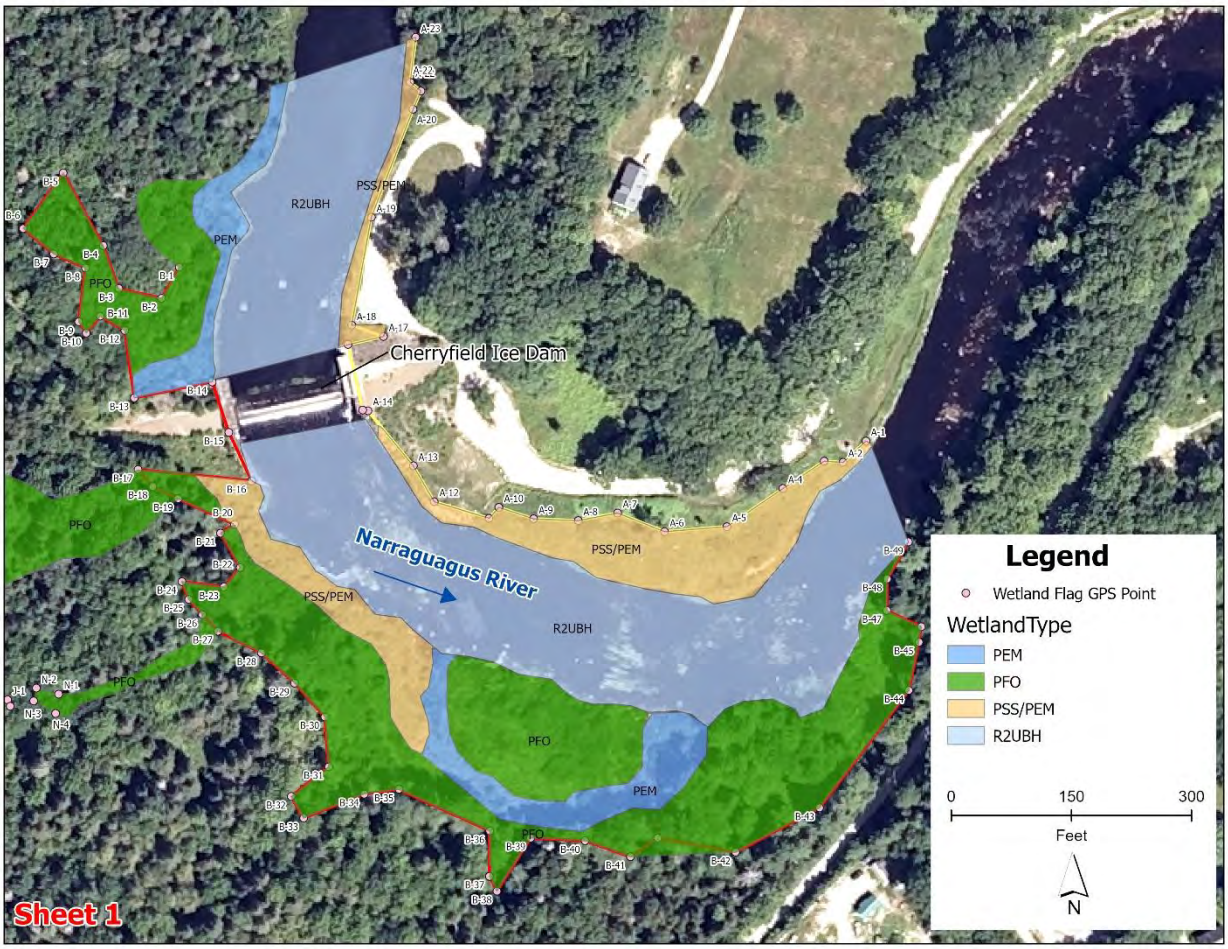


Figure 10. Wetlands delineated in the permanent action area of the proposed nature-like fishway construction.

There are no manmade barriers to fish passage between the dam site and the headwaters of the Narraguagus River at Eagle Lake in Hancock County, Maine. Although portions of the West Branch and mainstem Narraguagus channels have been straightened from past use, overall the river habitat between the headwaters of Eagle Lake and the Cherryfield Dam is complex, with very limited development, vegetated riparian areas, multiple tributaries and lakes, and overall high sinuosity. Comparatively, the channel below the dam is straighter, with low sinuosity and higher concentrated development in the towns of Cherryfield and Milbridge. The approximate one mile of channel between the existing dam and the Route 193 bridge contains some complexity, with higher sinuosity than the straightened channel and a mix of riffles, runs, and shallow pools.

5.4 WATER TEMPERATURE

EcoSHEDS, a web-based stream temperature database developed by USGS for the Northeast United States, contains publicly available temperature timeseries data at 66 locations throughout the HUC10 Narraguagus watershed (EcoSHEDS, 2022). However, records of recent, directly comparable timeseries data within and above the impoundment are limited. No recent temperature timeseries data are available in the head pond immediately above the impoundment through EcoSHEDS, and sampling periods and duration are widely variable across the watershed. For this reason, the USGS Interactive Catchment Explorer and Coldwater Refugia tools were employed to examine temperature patterns across the Narraguagus watershed (ICE, 2023) instead of timeseries data. The Interactive Catchment Explorer utilizes temperature timeseries data on EcoSHEDS and a stream temperature model published by Lecher et al (2016) to predict mean summer temperatures across catchments in northeastern streams. The Coldwater Refugia tool takes these predictions a step further to estimate the percent of catchments within a HUC12 that are likely to contain coldwater refugia (EcoSHEDS, 2022).

Generally, the Interactive Catchment Explorer shows cooler modeled temperatures with higher percentage coldwater refugia in tributaries (Schoodic Brook) and northern regions of the watershed (Beddington Lake) at the HUC12 level outside of the action area, compared to the lower reaches of the Narraguagus River inside the temporary and permanent action area (**Error! Reference source not found.**). At the catchment level, the Interactive Catchment Explorer shows pockets of potential groundwater refugia in the northern reaches of the watershed outside of the action area (Beddington Lake), with modeled mean summer temperatures ranging from 15.25 – 16.5 degrees Celsius. Modeled mean summer temperatures in the mainstem Narraguagus River within the temporary and permanent action area is 17-18 degrees Celsius (EcoSHEDS, 2022).

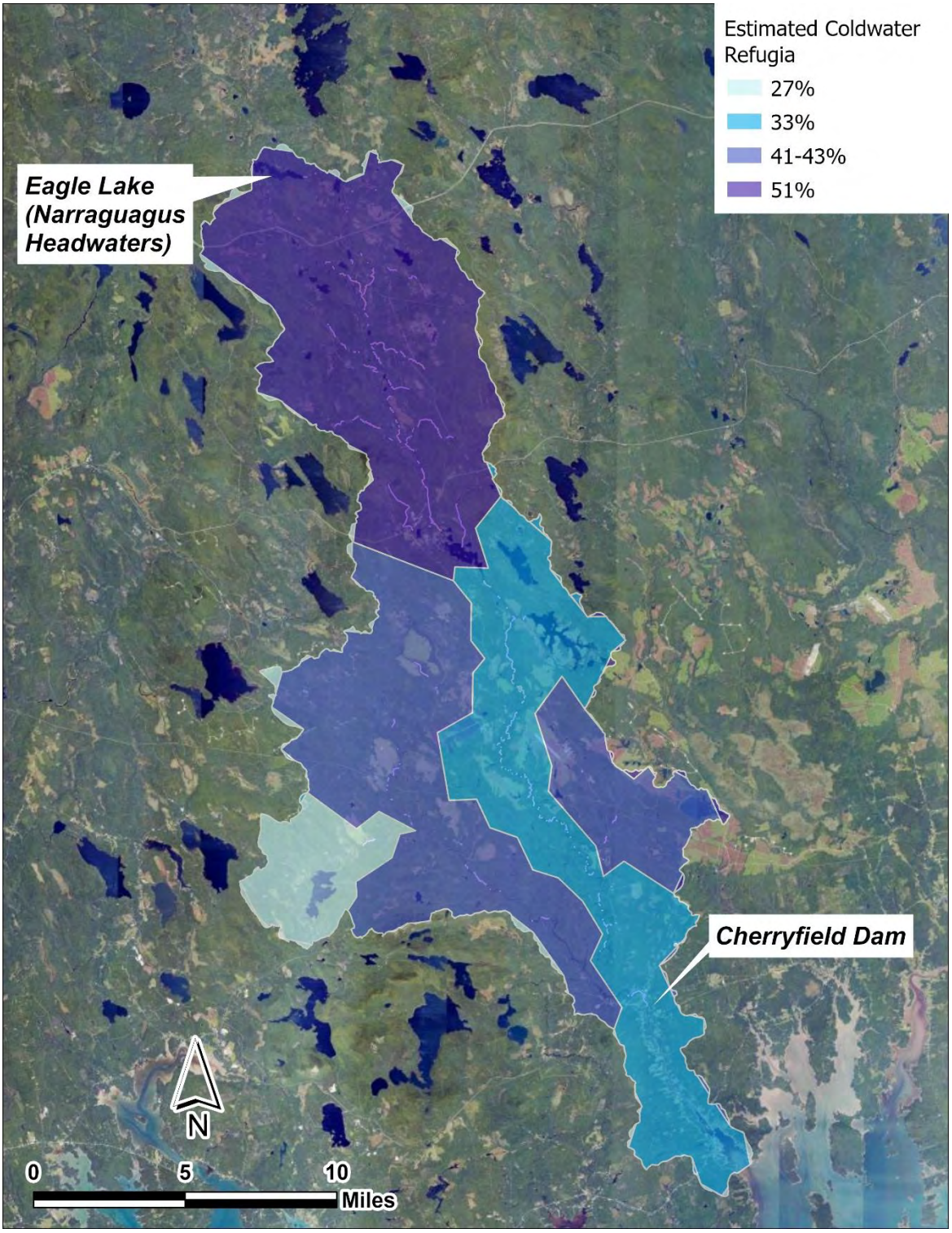


Figure 11. Estimated percent of each HUC12 drainage basin containing catchments that provide coldwater refugia. Data from EcoSHEDS (2022), figure created by Inter-Fluve, Inc.

The U.S. Geological Survey (USGS) operates a flow and temperature gauge (site number 01022500) approximately 900 feet below the dam, adjacent to Cable Pool Park. Based on 38 years of consecutive temperature data from 1977-2015, average daily temperatures in the downstream area of the dam range between 20.4 and 23.6 degrees Celsius in July and August and between 14.1 and 20.4 Celsius degrees in September, with cooler temperatures at the middle and end of the month (USGS Water Resources, 2025). Maximum daily temperatures range from 25.8 to 26.7 degrees Celsius in July and August, and from 17.4 to 22.4 degrees Celsius throughout September. See Appendix A for the full mean timeseries data from USGS.

Temperature thresholds for Atlantic salmon are 14.5 degrees Celsius for preferred, 22.5 degrees Celsius for feeding cessation, and 27.8 degrees Celsisus for survival. These thresholds are based on the Habitat Suitability Models that are referenced and utilized by the MDMR (Stanley and Trial, 1995).

Comparing the USGS data the Stanley and Trial Habitat Suitability thresholds, average daily temperatures below the dam exceed the preferred temperature threshold for 91 out of 93 days from July 15 – September 30, only reaching the preferred threshold (14.5 degrees Celsius) for the last two days of September. Average daily temperatures exceed the feeding cessation threshold for 19 days throughout July and August. Maximum daily temperatures exceed the preferred threshold throughout the entire period from July 15 – September 30. Between October 1-14, all days for average daily temperatures are within the preferred threshold, indicating potential functionality, however the maximum daily temperatures have 8 of the 14 days in October exceeding the preferred temperature.

Although recent time series data is not readily available in the head pond immediately above the dam, nor immediately below the dam, it is likely that temperature ranges within the impoundment are similar to the USGS gauge, based on the proximity of the USGS gauge and experience of Inter-Fluve biologists with temperature monitoring for similar projects.

6. NMFS Listed Species and Designated Critical Habitat in the Action Area

The federally listed endangered species and designated critical habitat addressed in this BA are briefly discussed below. The following information focuses largely on the species and critical habitats associated within the Gulf of Maine.

The NOAA ESA Mapper and USFWS IPaC (Information for Planning and Consultation) tool were employed to review potential presence of NMFS listed species and their critical habitats within the action area. Shortnose and Atlantic sturgeon were not included on the species list generated by IPaC, but their potential presence in the action area was indicated on the NOAA ESA Mapper.

Species	Life Stage	Behavior	Times of Year
Atlantic salmon	Adult	Migrating, foraging	4/1 – 12/31
Atlantic salmon	Juvenile	Migrating and foraging	4/1 – 7/1
Atlantic sturgeon	Subadult	Migrating and foraging	1/1 – 12/31
Shortnose sturgeon	Adult	Limited foraging	4/1 – 11/30

6.1 ATLANTIC STURGEON

6.1.1 Status and Conservation

As of February 6, 2012, NOAA Fisheries listed the New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs as endangered and the GOM DPS as threatened (NOAA Fisheries 2012a). NOAA Fisheries determined the GOM DPS is threatened throughout its range due to significant declines in population sizes, limited amounts of current spawning, the protracted period during which sturgeon populations have been depressed, and the impacts and threats that continue to prevent population recovery.

Numbers of Atlantic sturgeon in the GOM DPS are significantly lower than historical levels and have remained so for more than 100 years. Currently, there are only two known spawning subpopulations within the GOM DPS, in the Kennebec and Androscoggin Rivers. There are no abundance estimates for either subpopulation within the GOM DPS (ASSRT, 2007; Wippelhauser et al., 2015, 2017). The Atlantic States Marine Fisheries Commission (ASMFC) benchmark stock assessment concluded there was a 51% probability that abundance of the GOM DPS increased since implementation of the 1998 fishing moratorium here in the U.S. However, there was a 74% probability that mortality exceeded the mortality threshold used for the assessment (ASMFC, 2017).

6.1.1.1 Recovery Efforts

Threats to Atlantic sturgeon include habitat changes, impeded access to historical habitat by dams and reservoirs, degraded water quality, reduced water quantity, vessel strikes, and bycatch in commercial fisheries (NOAA Fisheries, 2012a).

6.1.2 Critical Habitat

In September 2017, NOAA Fisheries designated critical habitat for each of the DPSs, i.e., the GOM, New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs (82 Federal Register 39160–39274; NOAA Fisheries 2017). Specific occupied areas designated as critical habitat for the GOM DPS included approximately 152 miles of aquatic habitat in the Penobscot, Kennebec, Androscoggin, Piscataqua, Cocheco, Salmon Falls, and Merrimack rivers.

NOAA Fisheries (2017) identified the following physical and biological features (PBFs) essential to the survival of Atlantic sturgeon in the GOM, New York Bight, and Chesapeake Bay DPSs:

- Hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0–0.5 ppt range) for settlement of fertilized eggs, refuge, growth, and development of early life stages.
- Aquatic habitat with a gradual downstream salinity gradient of 0.5 ppt up to as high as 30 ppt and soft substrate (e.g., sand, mud) between the river mouth and spawning sites for juvenile foraging and physiological development.
- Water of appropriate depth and absent physical barriers to passage (e.g., locks, dams, thermal plumes, turbidity, sound, reservoirs, gear, etc.) between the river mouth and spawning sites.
- Unimpeded movement of adults to and from spawning sites; unimpeded movement of spawning condition adults or subadults to staging, resting, or holding areas; and unimpeded seasonal and physiologically dependent movement of juvenile Atlantic sturgeon to appropriate salinity zones within the river estuary.
- Sufficient water depths in main river channels to ensure continuous flow in the main channel at all times to support all sturgeon life stages (e.g., at least 1.2 meters), and
- Water with temperature, salinity, and oxygen values between the river mouth and spawning sites that support: Spawning (annual and interannual adult); survival (subadult, larval, and juvenile stages); and larval, juvenile, and subadult growth, development, and recruitment (e.g., 30° C for spawning habitat and 13-26° C for rearing habitat).

6.1.3 Distribution and General Habitat Use

Atlantic sturgeon inhabit rivers and coastal waters from New Brunswick and Nova Scotia, Canada to Florida, spending most of their adult life in the marine environment (ASSRT 2007). The GOM DPS is defined as "all Atlantic sturgeon that are spawned in the watersheds from the Maine-Canadian border, extending southward to include all associated watersheds draining into the Gulf of Maine as

far south as Chatham, MA. . .[and] wherever these fish occur in coastal bays and estuaries and the marine environment" (NOAA Fisheries, 2012a). They have been documented in the Penobscot, Kennebec, Androscoggin, Sheepscot, Saco, Pemaquid, Piscataqua, and Merrimack Rivers in the GOM. Atlantic sturgeon spawn in the Kennebec River, and they potentially spawn in other rivers (ASSRT 2007, Damon-Randall et al. 2013). Exact spawning locations in the Kennebec River are not known, but spawning is inferred based on substrates, salinity, and water depths, and on tracking of adults and capture of eggs, larvae, and young-of-year.

In Canada, Atlantic sturgeon are commonly caught in the upper Bay of Fundy and Minas Basin in western Nova Scotia (Dadswell 2006, Taylor et al. 2016). The next closest known population occurs in the Saint John River in New Brunswick.

6.1.4 Life History

6.1.4.1 Spawning and Larval Development

Evidence from genetic studies indicates that Atlantic sturgeon return to their natal river to spawn. In Maine, adults migrate upriver from coastal areas in the spring (March to May). Spawning usually occurs in early- to mid-summer (Wippelhauser and Squiers, 2015; Wippelhauser et al., 2017). Atlantic sturgeon spawn in freshwater reaches of estuaries, in flowing water between the salt front and fall line of large rivers or estuarine tributaries (ASSRT, 2007; Greene et al., 2009). Silt-free hard bottom substrates such as boulder, bedrock, cobble-gravel, hard clay, or coarse sand are required to spawn adhesive eggs (Collette and Klein-MacPhee, 2002; Greene et al., 2009). The depth at which spawning occurs is highly variable. Eggs, larvae, and young-of-the-year do not tolerate high salinities, with mortalities documented at salinities as low as 5-10 ppt (Green et al., 2009).

6.1.4.2 Juveniles

The juvenile stage lasts from months to years in brackish waters. Juvenile Atlantic sturgeon are found in water bodies with sand, mud, cobble, rocks, and transitional substrates, and remain in their natal estuaries for up to six years before migrating out to sea. Juveniles move further downstream into brackish waters, and eventually become residents in estuarine waters for months to years. Subadults may move to coastal waters (Smith, 1985), where populations may undertake long range seasonal migrations (Dovel and Berggren, 1983; Bain, 1997). Juveniles overwinter in brackish water near the mouths of estuaries.

6.1.4.3 Adults

Atlantic sturgeon adults spend most of their lives in offshore marine waters. During winter months (November – March), Atlantic sturgeon primarily occupy water at depths greater than 20 meters (66 feet). Shallower waters are inhabited in summer and early fall, May – September (Erickson et al., 2011). Adult Atlantic sturgeon frequently aggregate in upper estuary habitats around the saltwater interface (Greene et al., 2009). Adults have been documented in moderately shallow nearshore sand and gravel habitats (7-50 meters deep, Stein et al., 2004; Laney et al., 2007; Greene et al., 2009). Prey include polychaetes, amphipods, isopods, decapods, mollusks, and sand lance (*Ammodytes* spp.) (Scott and Scott, 1988; Johnson et al., 1997).

6.1.5 Atlantic Sturgeon in the Action Area

While the NOAA ESA Mapper includes the Narraguagus River as part of the range of Atlantic sturgeon up to and including the dam, Atlantic sturgeon have not been documented or tracked in the Narraguagus River (NOAA Fisheries GARFO 2023). Atlantic sturgeon do not use the Narraguagus River for important life strategies, and the closest known population occurs in the Kennebec River. Atlantic sturgeon use the Penobscot & Kennebec Rivers and their estuaries (Johnston 2016; Wippelhauser et al. 2017), both of which are more than 70 miles west of Narraguagus Bay

Atlantic sturgeon are known to enter coastal streams to forage opportunistically year-round during their coastal migrations. However, if sturgeon did enter the Narraguagus River to forage, it is extremely unlikely that they would travel all the way upstream from Narraguagus Bay to the dam. The reach immediately below the dam is does not contain suitable habitat with the river being shallow, rocky, and steep and the dam is located approximately one mile upstream from the head of tide. MDMR biologists have indicated that sturgeon have not been observed or documented however may opportunistically enter the lower reaches of the Narraguagus River to forage near the confluence with Narraguagus Bay, but are not likely to ascend all the way to the dam (personal communication with Colby Bruchs and Ernie Atkinson of MDMR, June 2025). The action area is not within designated critical habitat given the lack of documented presence.

6.2 SHORTNOSE STURGEON

6.2.1 Status and Conservation

The Department of Interior listed shortnose sturgeon as an endangered species in 1967 (USDOI, 1967) under the Endangered Species Preservation Act. Shortnose sturgeon remained on the endangered species list with the enactment of the ESA. The most significant threats to the species are dams that block access to spawning areas or lower parts of rivers, poor water quality, dredging, and water withdrawals from rivers, and unintended bycatch in some commercial fisheries.

6.2.1.1 Recovery Efforts

In 1998, NOAA Fisheries approved the shortnose sturgeon recovery plan (NOAA Fisheries, 1998). The recovery plan sought to recover shortnose sturgeon populations to levels of abundance at which they would no longer require protection under the ESA. Since publication of the recovery plan, researchers have completed a number of studies (Walsh et al. 2001; Grunwald et al. 2002; Wirgin et al. 2005, 2010; and others) and revised population assessments. The findings are summarized in the Shortnose Sturgeon Status Review Team's (SSSRT) biological assessment of the species (SSSRT, 2010).

NOAA Fisheries has worked with conservation organizations, energy companies, states, tribes, and citizens to evaluate manmade barriers to improve fish passage and migration. Shortnose sturgeon are bred in captivity and housed at research facilities in accordance with specific permits to provide

important information on the physical, chemical, and biological parameters necessary for optimal growth, survival, and reproduction in the wild. These captive-bred sturgeon are also used to promote public awareness of the species.

6.2.2 Distribution and General Habitat Use

Shortnose sturgeon occur on the east coast of North America in rivers, estuaries, and marine waters. Their current riverine distribution extends from the Saint John River, New Brunswick, Canada, to the St. Johns River, Florida. Recent information indicates that their marine range extends into the Minas Basin, Nova Scotia (Dadswell et al., 2014). Despite this relatively broad range for the species, there are currently no known reproducing populations in the river systems between Chesapeake Bay and the southern boundary of North Carolina, a gap of roughly 250 miles. As a result of this distribution and apparent reproductive isolation, researchers' group shortnose sturgeon into three metapopulations: Acadian Province (northern), Virginian Province (mid-Atlantic), and Carolinian Province (southern).

Shortnose sturgeon are born in freshwater, and juveniles primarily live in the estuarine and freshwater habitats of their natal river. Adults may make short feeding or migratory trips into salt water and return to freshwater to feed and escape predation.

Adults prefer slow-moving riverine, estuarine, and nearshore marine habitats of large river systems, migrating occasionally into faster moving freshwater areas to spawn. In Maine, shortnose sturgeon are known to occur in the estuarine complex formed by the Sheepscot, Kennebec, and Androscoggin rivers (SSSRT, 2010). Feeding and overwintering occur in either freshwater or saltwater areas (NOAA Fisheries, 1998). In general, foraging habitat for shortnose sturgeon and Atlantic sturgeon overlap; however, shortnose sturgeon typically spawn farther upriver than Atlantic sturgeon (SSSRT, 2010).

6.2.3 Life History

6.2.3.1 Spawning and Larval Development

Spawning typically occurs in the farthest accessible upstream reach of an undammed natal river, near the base of a dam or in the tailrace of a dammed river. Spawning may occur in areas with gravel, rubble, timber, scoured clay, cobble, and large rocks (Dadswell, 1979; Taubert, 1980; Dadswell et al., 1984; Kynard, 1997). Spawning occurs in mid- to late-spring when water temperatures reach 8–9° Celsius (46-48° Fahrenheit) (SSSRT, 2010). Once they reach a length of two centimeters, larvae migrate downstream where they typically reside in deep, freshwater channels for a year or more before migrating to the estuary (Dadswell et al., 1984; Richmond and Kynard, 1995; Kynard, 1997).

6.2.3.2 Juveniles

Juveniles up to 10 years of age live in the estuary of their natal rivers, where they move back and forth within the low-salinity portion of the salt wedge at depths of 10-20 meters (33–66 feet) (NOAA Fisheries, 1998). Salinity tolerance increases with age (Dadswell et al., 1984; Kynard, 1997).

6.2.3.3 Adults

Adult shortnose sturgeon have been found at temperatures ranging from 2–34° Celsius (36-93° Fahrenheit). They occur at a wide range of depths from 0.6–30 meters (2–98 feet), but generally occur at depths of 20 meters (66 feet) or less in the river or estuary with suitable oxygen values (Dadswell, 1979). Shortnose sturgeon tolerate a wide range of salinities from freshwater (0 ppt) to seawater (32 ppt; Holland and Yeverton, 1973, Dadswell, 1979).

Adult migrations include spring movement from overwintering sites to upriver spawning sites, late-spring downstream movements to feeding areas lower in the river, and directed movements in the fall to overwintering sites (Fernandes et al., 2010; SSSRT, 2010). In the northern part of their range, shortnose sturgeon are seldom found in shallow water once temperatures exceed 22° Celsius (72° Fahrenheit) (Dadswell et al., 1984). Individuals seem to remain in their natal river or estuary (Dadswell, 1979), but recent research has shown that shortnose sturgeon occasionally leave their natal streams and migrate long distances. Wippelhauser et al. (2015) discovered that shortnose sturgeon travel long distances in coastal waters to known spawning sites or historical spawning habitat throughout Maine's Kennebec River system and enter small coastal rivers to forage opportunistically such as the Saco River in Maine and the Merrimack River in New Hampshire.

Typically, adult shortnose sturgeon in the northern part of their range spawn and forage during spring/summer in upper river reaches, and over-winter in deeper channels in the lower estuary (Kynard, 1997). Overwintering occurs in deep river segments and deep depressions at depths of 10–30 meters (33–98 feet) (Dadswell et al., 1984). In northern rivers, overwintering juvenile and adult shortnose sturgeon form tight aggregations in specific, relatively deep sandy segments of freshwater or saline reaches of the river with little movement or foraging (Dadswell, 1979; SSSRT, 2010). Between spring and fall, shortnose sturgeon forage in shallow water (1–15 meters [3-50 feet] deep) on sand-mud bottoms covered with aquatic plants, feeding on a variety of benthic and epibenthic animals including insects, mollusks, crustaceans, worms, and small fishes (Dadswell, 1979; Dadswell et al., 1984; Kynard et al., 2000).

Shortnose sturgeon leave their natal estuaries, make coastal migrations, and use other river systems (Zydlewski, et al. 2011; Dionne et al., 2013; Wipplehauser et al., 2015). Within the Gulf of Maine, adults have been observed migrating along the coast, traveling between the Penobscot, Kennebec, and Merrimack rivers and making stops in smaller coastal rivers along this route (Zydlewski et al., 2011). Outside of the Gulf of Maine, marine migrations have only rarely been documented. Shortnose sturgeon overwinter in rivers, and coastal migrations occur from April 1–November 30 according to the NOAA ESA Mapper. Coastal migrations are likely to occur within the 50-meter (164-foot) depth contour.

6.2.4 Shortnose Sturgeon in Maine

Table 7 summarizes known important habitats for shortnose sturgeon in the Gulf of Maine. Individuals have been observed or captured in other Maine rivers, but so far, researchers have not indicated that shortnose sturgeon use these rivers for important life strategies.

Table 7. Important habitat sites for shortnose sturgeon in the Gulf of Maine. Source: summarized by Wippelhause et al (2015).

River System	Location	Habitats
Merrimack	Estuary	Spawning, Wintering, Foraging
Androscoggin	Androscoggin River below Brunswick Dam	Spawning
Kennebec	Kennebec River below site of former Edwards Dam	Spawning
Kennebec	Merrymeeting Bay	Wintering
Kennebec	Lower Kennebec estuary and Sagadahoc Bay	Foraging
Penobscot	Upper estuary	Foraging
Penobscot	Middle and lower estuary	Wintering
Saint John	Estuary	Spawning, Wintering

6.2.5 Shortose Sturgeon in the Action Area

The best available information on shortnose sturgeon presence indicate that shortnose sturgeon do not utilize the Narraguagus River for important life strategies (see Table 7; NOAA Fisheries GARFO 2025). The nearest known occupied habitats are in the Saint John River estuary in New Brunswick, which is more than 90 miles east of Narraguagus Bay. Shortnose sturgeon use the Penobscot River (more than 60 miles west of Narraguagus Bay) for foraging and wintering, but no spawning sites have been located to date. Out of sixty-eight shortnose sturgeon that were captured in the Penobscot Estuary and tagged with coded acoustic transmitters from 2006 – 2009, only one sturgeon was ever detected on the Narraguagus River (Dionne et al, 2013). It is possible, but reasonably unlikely that shortnose sturgeon from the Penobscot River, Union River, Saint John River or Bay of Fundy would occur in the lower reaches of the Narraguagus River during the low flows of the in-water work window. The action area is not within designated critical habitat given the lack of documented presence.

6.3 GULF OF MAINE DISTINCT POPULATION SEGMENT OF ATLANTIC SALMON

6.3.1 Status and Conservation

The project is located within the range of the federally endangered GOM DPS of Atlantic salmon that was originally listed as endangered in December 2000 (65 FR 69459) by NOAA Fisheries and USFWS.

The 2000 listing included all naturally reproducing wild populations and hatchery populations with historical river specific characteristics found north of the Kennebec River. Subsequently, new data

led to expansion of the GOM DPS to include populations in larger river systems covering a more extensive geographic area. The final rule for the expanded DPS was published on 19 June 2009 (74 FR 29344). USFWS and NOAA Fisheries provided an updated draft recovery plan for the species in 2016 (NOAA & USFWS, 2019).

6.3.1.1 Trends

Atlantic salmon populations have been declining in the US and the GOM DPS since the early 1800s, and present population estimates are significantly lower than historic numbers (Fay et al, 2006). Returning adult records show that totals in the GOM DPS have somewhat stabilized at very low numbers since the late 1990s (Fay et al 2006). Recent (10-year) adult return estimates in Maine rivers are shown in Figure 12 andFigure 13. Adult salmon return numbers have been steadily declining throughout the US since the early 1980s, and appear to have stabilized at very low levels in recent years with a moderate increase in 2009, 2010, 2011 and 2023 (Figure 14).

Contemporary abundance levels of Atlantic salmon within the GOM DPS are significantly lower than historical abundance estimates. For example, Atkins and Foster (1867, as cited in Schmitt and Anderson 2012) estimated that roughly 100,000 adult salmon returned to the Penobscot River alone before the river was dammed. Since 1967, contemporary estimates of abundance for the entire GOM DPS exceeded 5,000 individuals only in 1986 (USASAC 2025). According to Faye et al (2006), dams remain "the greatest impediment to self-sustaining Atlantic salmon populations in Maine". Dams alter natural hydrologic processes and thermal regimes, impede fish migration, and interrupt natural river processes such as sediment transport (Fay et al, 2006).

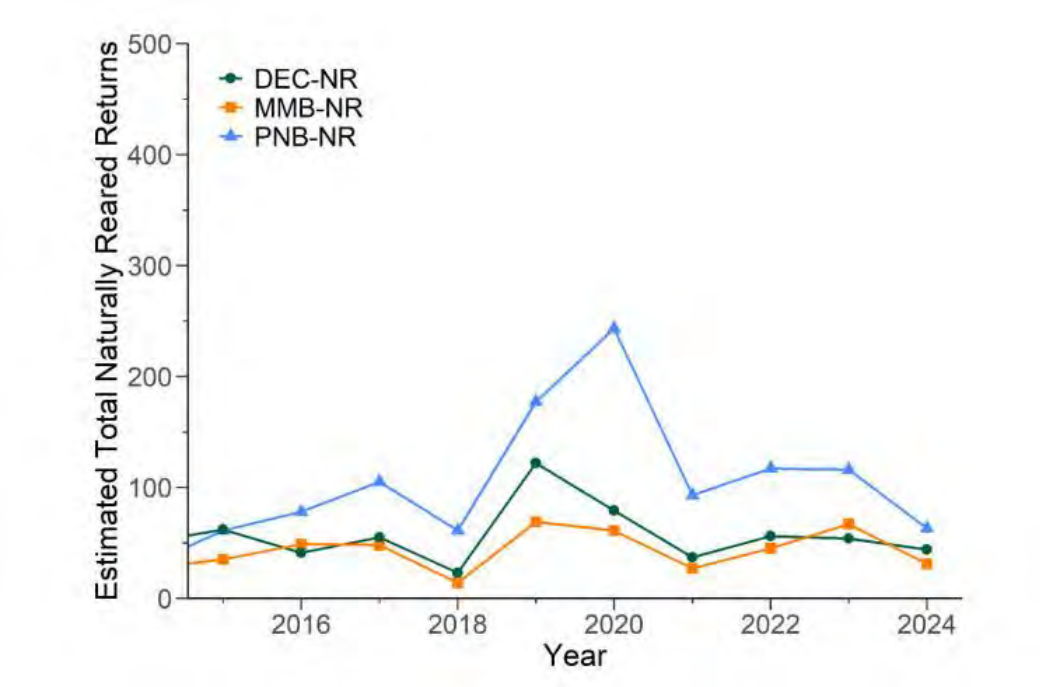


Figure 12. Recent 10-year time-series of all naturally-reared (NR) adult returns to all GOM DPS rivers in the Downeast Coastal (DEC-green), Merrymeeting Bay (MMB-orange), and Penobscot (PNB-blue) Salmon Habitat Recovery Units. Source: USASAC (2025).

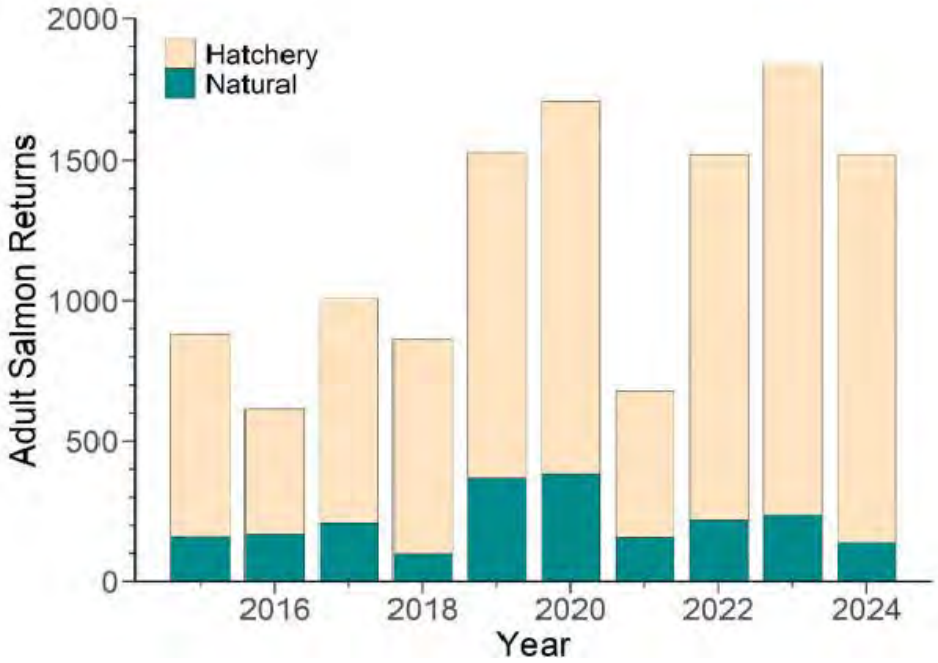


Figure 13. Combined total estimate of natural (green) and hatchery-reared (peach) Atlantic salmon adult returns to all GOM DPS rivers, 2015-2024. Source: USASAC (2025).

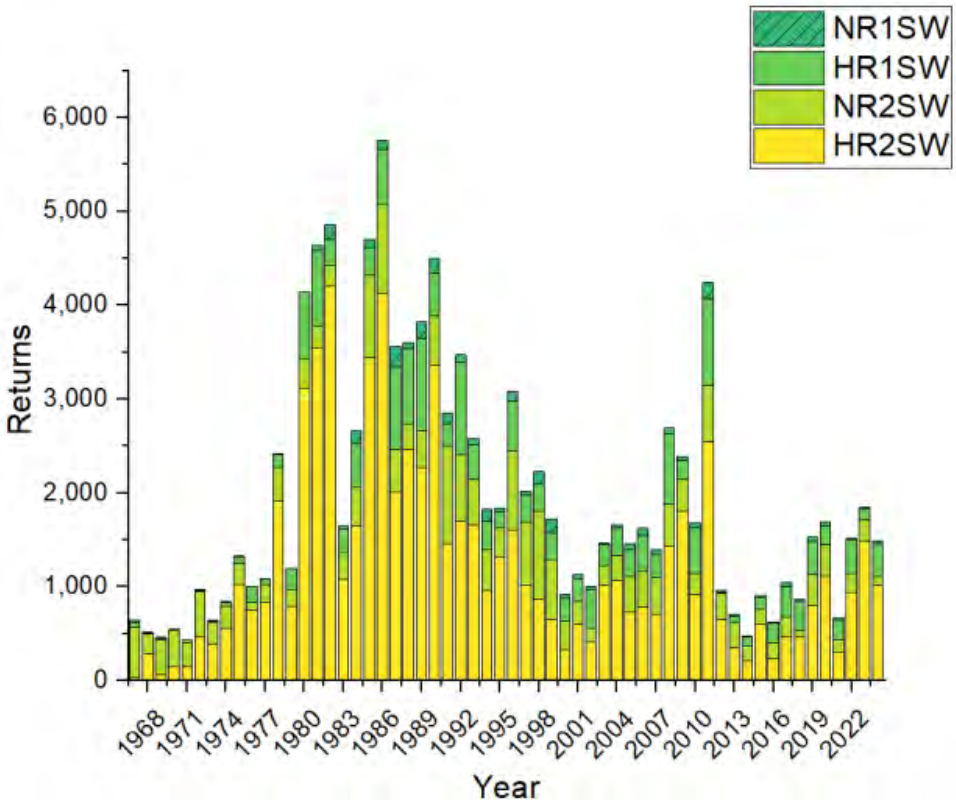


Figure 14. Atlantic salmon returns to all US rivers including the GOM DPS, 1967-2024. NR1SW = Naturally Reared One Sea Winter; HR1SW = Hatchery Reared One Sea Winter; NR2SW = Naturally Reared Two Sea Winter; HR2SW = Hatchery Reared Two Sea Winter. Source: USASAC (2025).

NOAA Fisheries established a threshold of 2,000 wild Atlantic salmon spawners per SHRU in the GOM DPS as a target recovery number for delisting (USASAC, 2025). Only naturally-reared (NR) fish are considered in the target number, since the goal for recovery is a wild and self-sustaining population (USASAC, 2025). The target recovery number for downlisting from endangered to threatened is 500 wild spawners per SHRU (USASAC, 2025). Actual documented adult returns for each SHRU in 2024 compared to target numbers are shown in Table 8. Approximately 23% of total NR spawners in the Downeast Coastal SHRU were counted in the Narraguagus River in 2024 (USASAC, 2025).

Table 8. Documented returns from trap and redd counts for the GOM DPS Atlantic salmon by SHRU for 2024 and % of naturally reared (NR) fish relative to target. Source: USASAC (2025).

SHRU	Hatchery	Natural	Sub Totals	% NR of 500
Downeast Coastal	3	44	47	8.8%
Penobscot Bay	1,321	63	1,384	12.6%
Merrymeeting Bay	62	24	86	4.8%
GOM DPS	**1386**	**131**	**1517**	**--**

6.3.1.2 Recovery Efforts

Efforts to conserve and restore Atlantic salmon populations have been in place for nearly 200 years. Sharp declines in the commercial fishery for Atlantic salmon were first recorded in the late 1800's. The commercial fishery for Atlantic salmon was closed in 1948 (Fay et al, 2006). Other conservation measures have included water quality improvements, fish culture programs, habitat connectivity improvements, targeted habitat restoration in occupied rivers, genetics research, and international collaborative restoration efforts. Conservation hatcheries, brood stocking, fish passage improvements, and habitat connectivity efforts play a major role in Atlantic salmon recovery strategies in the Downeast Coastal SHRU.

To date, most of the dams and major barriers to aquatic connectivity have been removed in the Downeast Coastal SHRU. The Cherryfield Dam, part of the Cherryfield LPP, remains the only anthropogenic migration barrier to adult and juvenile Atlantic salmon on the mainstem Narraguagus River.

6.3.2 Description and General Habitat Use

Atlantic salmon are diadromous fish that use freshwater rivers and streams for spawning and rearing, and ocean environments for periods of rapid growth in adulthood. Atlantic salmon have a complex life history that ranges from territorial rearing in rivers to extensive feeding migrations on the high seas. During their life cycle, Atlantic salmon go through several distinct phases that are distinguished by specific changes in behavior, physiology, morphology, and habitat requirements. These phases occur at various times of the year and require specific habitat features, or Primary Constituent Elements (PCE), within watersheds.

6.3.3 Life History

6.3.3.1 Spawning and Larval Development

In the fall, female Atlantic salmon select sites for spawning. Spawning sites are positioned in flowing water, particularly where upwelling of groundwater occurs, allowing for percolation of water through the gravel (Danie et al., 1984). These sites are most often positioned at the head of a riffle (Beland et al., 1982), at the tail of a pool, or at the upstream edge of a gravel bar where water depth decreases and velocity increases (White, 1942; McLaughlin and Knight, 1987) and hydraulic head allows for permeation of water through the redd (a gravel depression where eggs are deposited). Female salmon dig redds and deposit eggs that are then fertilized by the males (Jordan and Beland, 1981). A single female may create several redds before depositing all of her eggs. Upstream of the last deposition site, the female continues digging which buries the fertilized eggs with clean gravel.

After spawning, Atlantic salmon may either return to sea immediately in late fall or remain in freshwater until the following spring before returning to the sea (Fay et al., 2006). Embryos develop in the redd for a period of 175 to 195 days and hatch in late-March or April (Danie et al., 1984). Newly hatched salmon (referred to as larval fry, alevin, or sac fry) remain in the redd for approximately 6 weeks after hatching and are nourished by their own yolk sac (Gustafson-Greenwood and Moring, 1991).

6.3.3.2 Juveniles

Once alevin emerge from the gravel and begin active feeding, they are referred to as fry. When fry reach approximately 4 centimeters (1.6 inches) in length, the young salmon are referred to as parr (Danie et al., 1984). Parr remain in the river for 2 to 3 years before undergoing a physiological transformation called smoltification that prepares them for life in a marine habitat. For parr to undergo smoltification, they must reach a critical size of 10 centimeters (4 inches) in length at the end of the previous growing season (Hoar, 1988). The transition of smolts into seawater is usually gradual as they pass through a zone of the river's estuary.

When smolts migrate from the river and into the ocean they are referred to as "post-smolts". The spring migration of post-smolts out of the coastal environment is generally rapid and follows a direct route (Hyvarinen et al., 2006, Lacroix and McCurdy, 1996, Lacroix et al., 2004). Parr transitioning to smolts are signaled to start their move downstream during higher flow conditions in the spring, and most smolts enter the sea by the end of May to begin their first ocean migration (Fay et al., 2006).

6.3.3.3 Adults

Some salmon may remain at sea for another year or more before maturing. After their first or second winter at sea (1SW and 2SW, respectively), the salmon return to their natal rivers to spawn (Reddin and Shearer, 1987). Adults ascend their natal rivers beginning in the spring, typically during the last week of May, with the peak influx of adults usually occurring in mid- to late June. Although spawning does not occur until late fall, most Atlantic salmon in Maine enter freshwater between May and mid-July (Meister, 1958; Baum, 1997). Rarely, individuals may stray into July, August, and

September or later in the fall. Salmon that return in early spring spend nearly five months in the river before spawning, often seeking cool water refuge (e.g., deep pools, springs, and mouths of smaller tributaries) during the summer months.

6.3.1 Atlantic Salmon Within the Action Area

According to MDMR, all life stages of Atlantic salmon are found in the Narraguagus River watershed throughout the year. However, water temperature and flow limit habitat functionality and fish migration during the proposed summer work window (July 15 – October 14).

6.3.1.1 Juvenile Atlantic Salmon

During the proposed summer work window (July 15 to October 14), it is very unlikely that juvenile Atlantic salmon will be present in the vicinity of the action area due to high water temperatures, lack of suitable habitat within the impoundment, limited function of the rearing habitat below the dam (see 6.1.2 Critical Habitat section), lack of documented spawning in the action area, and timing of the work. Out-migrating smolts begin downstream movement in the spring (see Section 6.3.3.2) and generally exit the system by the first week of June (see Figure 17 and communication with Ernie Atkinson of MDMR, May 2025) which is prior to the start of in-water work (July 15) .

Conservation stocking efforts have occurred on the Narraguagus River to supplement naturally-reared Atlantic salmon populations since 1970. In 2022, 71,600 fry and 89,677 parr (YOY) were stocked in the Narraguagus watershed (USASAC Database, 2025). In 2023 and 2024, 16,418 and 306,197 Atlantic salmon fry were stocked in the Narraguagus watershed, respectively (USASAC Database, 2025). Smolts from these stocking efforts are expected to exit the system before the in-water work window in 2026. MDMR confirmed that stocking did not occur in the action area or anywhere near the dam in 2024 or 2025 (Figure 15). Stocking locations did occur near the dam in 2022 and 2023, see Figure 15. Recent (2024 and 2025) stocking locations, labeled as 1 and 2 in Figure 15, are within two miles of the upstream extent of the Action Area. Fish stocked in 2024 may travel downstream to the ocean because parr typically remain in the river for 2 to 3 years before smoltification begins. This downstream smolt migration is expected to be complete by May, before any in-water work begins. The upstream extent of the impoundment, shown in Figure 15, is the maximum extent of the channel that would be temporarily impacted by the proposed project actions. There is no surveyed spawning habitat and there are no redds or stocking locations in the impoundment (Figure 16). MDMR has confirmed that the closet redd (based on 2024-2025 data) is more than 9 miles upstream of the furthest upstream extent of the action area (personal communication, Ernie Atkinson, MDMR, 2025) (Figure 18). Less than 10 out of 6,197 habitat rearing units in the Narraguagus and West Branch Narraguagus River are located within the action area

upstream and downstream of the dam (Figure 16). MDMR has also confirmed that no stocking will occur near the dam in 2026 (personal communication with Ernie Atkinson of MDMR, May 2025).

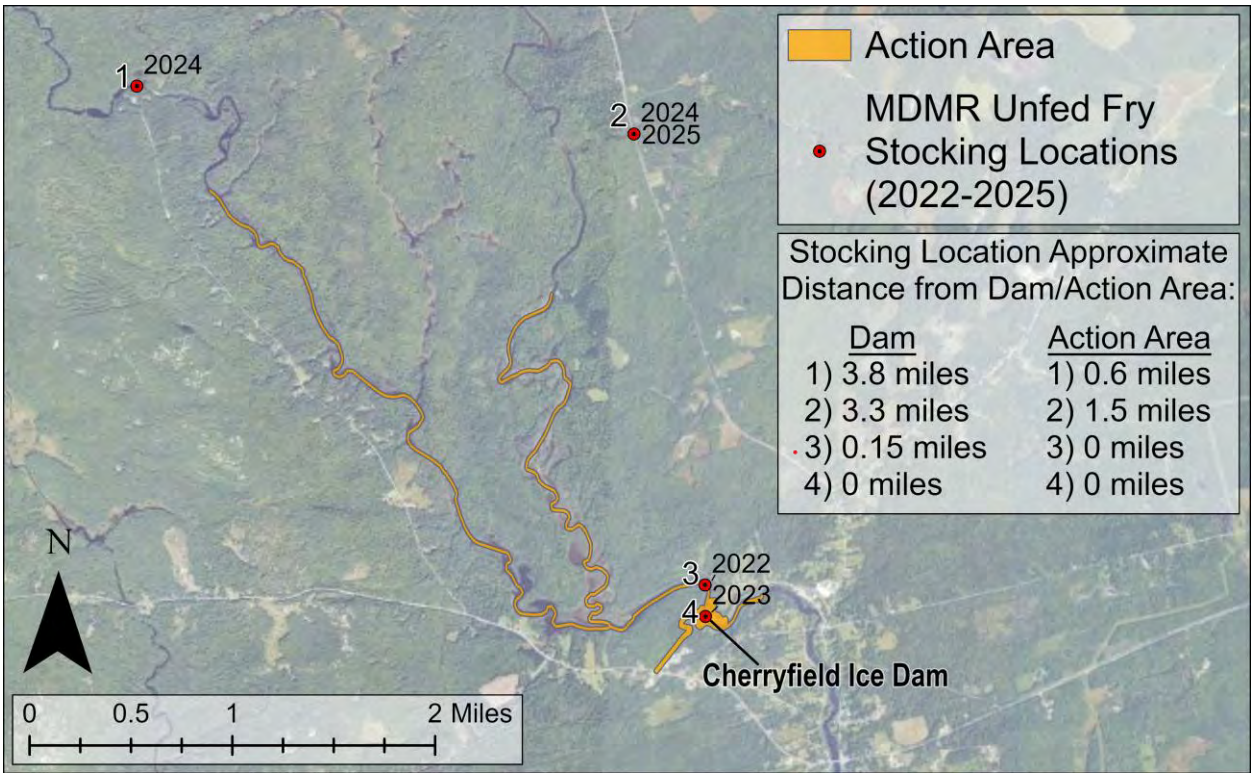


Figure 15. Closest MDMR stocking locations to the Cherryfield Dam with years stocked with unfed fry and approximate distance from the dam and the upstream extents of the Action Area. Data from MDMR (2025), figure by Inter-Fluve, Inc.

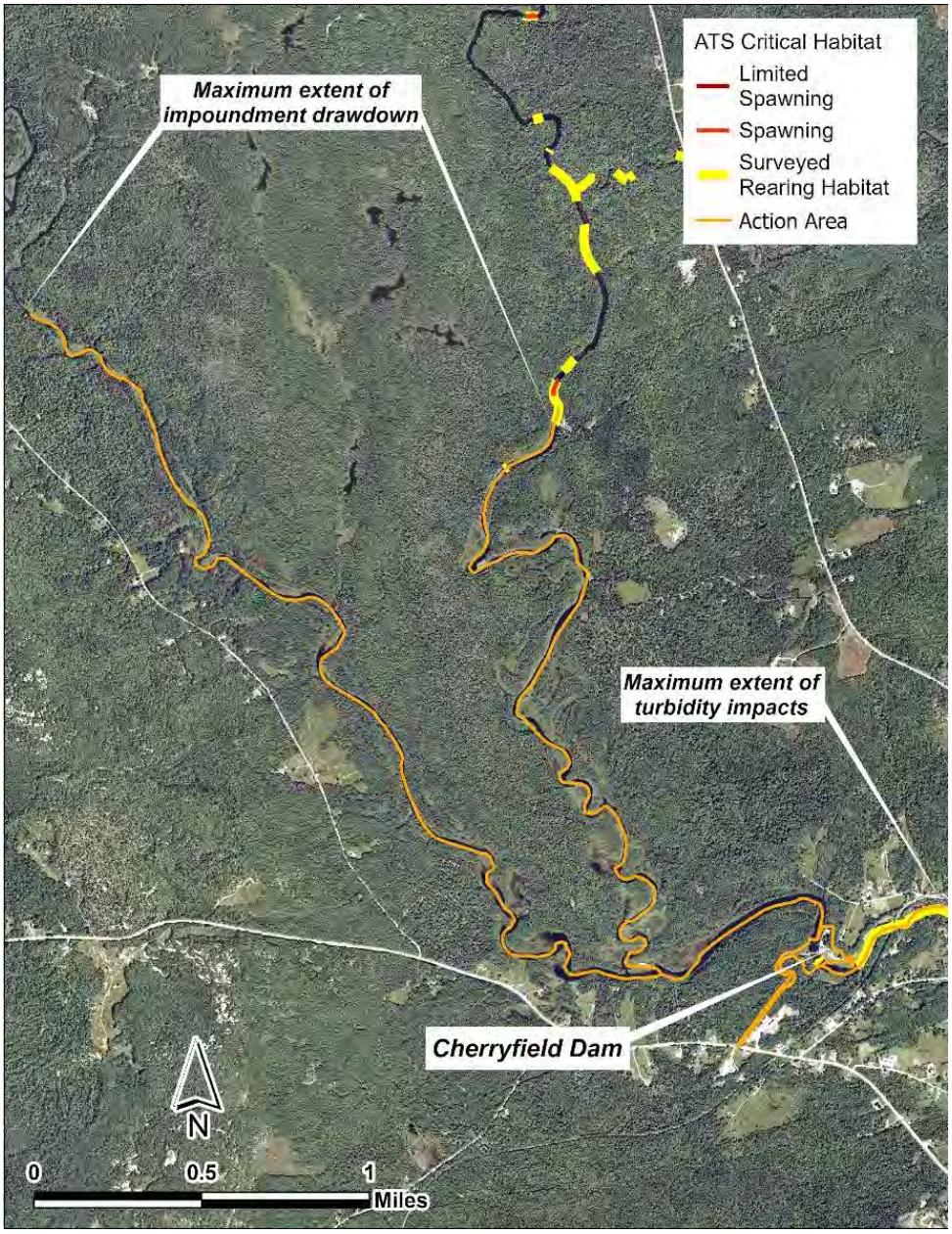


Figure 16. Atlantic salmon critical habitat within the temporary and permanent action area. Figure by Inter-Fluve, Inc.

The MDMR operates a rotary screw trap at two locations on the Narraguagus River (an upper and lower site) to conduct annual mark-recapture population estimates of smolts exiting the system. A total estimated 1,550 smolts (541 naturally reared and 1,015 hatchery origin) exited the system in 2024 based on trap counts and extrapolated mark-recapture population estimates (USASAC, 2025). All smolts exited the system by the first week of June (**Error! Reference source not found.**).

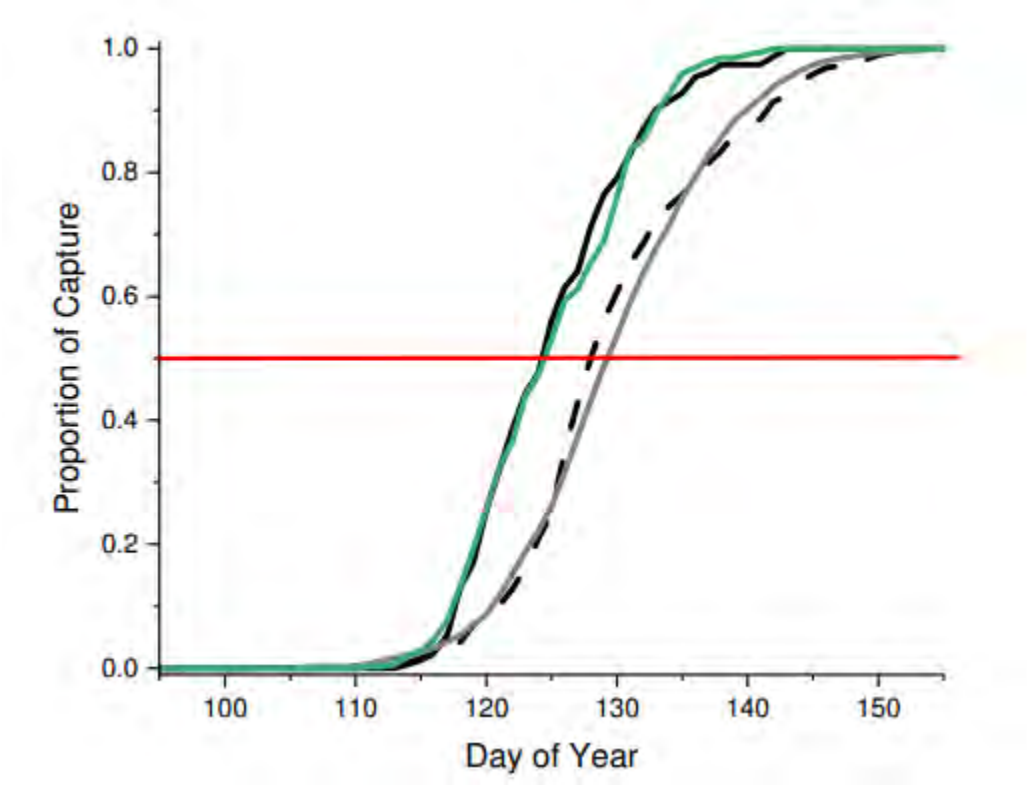


Figure 17. Proportion of naturally reared smolt capture on the Narraguagus River. Timing of capture for naturally reared smolts within the Narraguagus River is present year (2024) = black line, five-year mean = black dashed line and time series = grey line. Additionally, the 2024 capture of hatchery smolts are represented by the green line. Where the red line and catch curve bisect indicates median (50%) capture. Figure provided by MDMR (Ernie Atkinson and Colby Bruchs) using preliminary data subject to revision. MDMR requests that this figure is cited only with permission by the authors.

Juvenile Atlantic salmon that do not exit the system in the spring (young-of-the-year (YOY) and first-year parr) are known to swim upstream from stocking locations and spend the summer month in regions outside of the action area, including Beddington Lake and Deblois (communication with Ernie Atkinson of MDMR, May 2025). As noted in Section 5, the habitat above the impoundment is vast and complex compared to the habitat below and immediately around the dam, and Atlantic salmon are much more likely to utilize this habitat than the impoundment or the project area adjacent to the dam, as shown in **Error! Reference source not found.**.

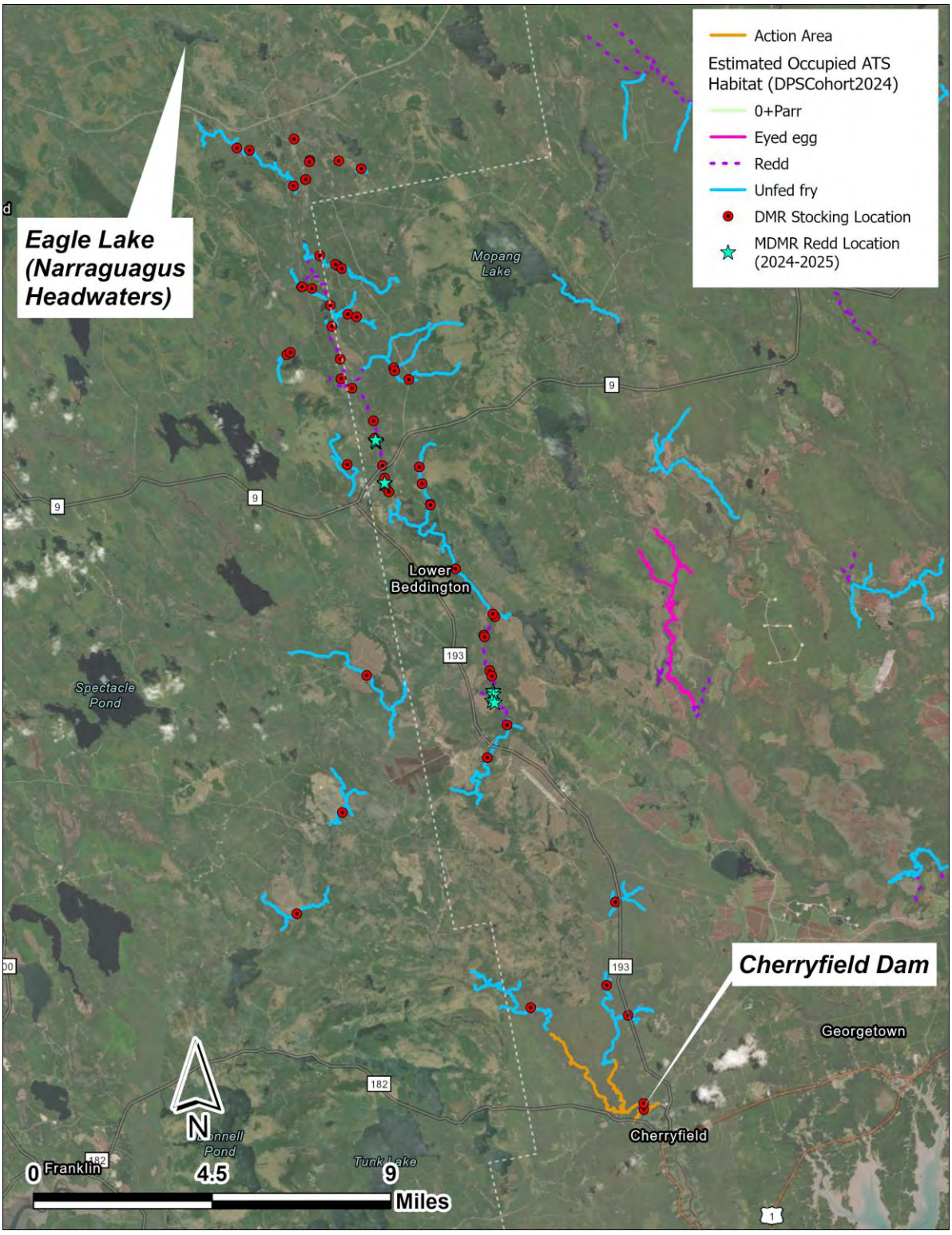


Figure 18. Estimated occupancy of salmon habitat within the Narraguagus watershed (2024 DPS cohort) and stocking locations from 2022-2025. See Figure 15 for dates of stocking at locations closest to the dam. Redds data shows 2024-2025 redd locations. Data from MDMR (2025), figure by Inter-Fluve, Inc.

6.3.1.2 Adult Atlantic Salmon

Adult Atlantic salmon return to their natal rivers to spawn after spending one or two winters at sea. These returning adults are referred to as 1SW (one sea winter) and 2SW (two sea winters) and may be naturally- or hatchery-reared (USASAC, 2025). Smolt-to-adult return rates have ranged from 0% (2011-2015) to 1.99% (2018) for 1SW adults on the Narraguagus River from 1997-2023, and from .17% (2000) to 3.31% (2018) for 2SW adults (**Error! Reference source not found.**, USASAC, 2025).

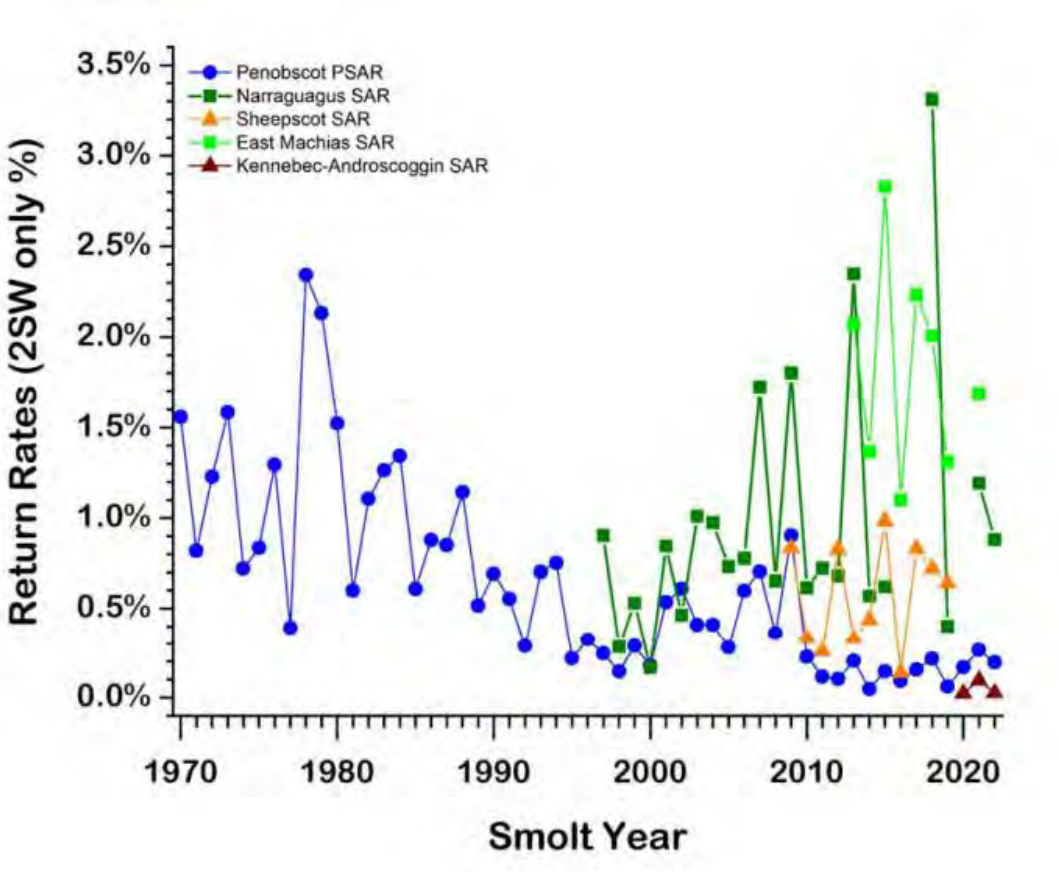


Figure 19. Time series of adult 2SW return rates for Penobscot River hatchery smolts (PSAR) and naturally-reared smolt-to-adult return rates for other watersheds in the GOM DPS. Source: USASAC (2025).

As stated in Section 5.2, the vast majority of adult Atlantic salmon return to rivers to spawn by mid-June. All known spawning in the Narraguagus River occurs above the impoundment and no redds or spawning habitat are documented downstream of the dam (verbal communication with Ernie Atkinson of MDMR, May 2025). Therefore, adults are expected to utilize the action area for migration only. Based on 4 years of data at the Cherryfield fish trap, the vast majority of adults ascend the fishway at the Cherryfield dam between early June and early July (**Error! Reference source not found.**). However, a small number of individuals stray into the system in August or late September occasionally. It is possible that a small number of adult Atlantic salmon individuals may attempt to migrate through the action area during the in-water work window. However, the majority of adults are expected to vacate the action area by mid-July.

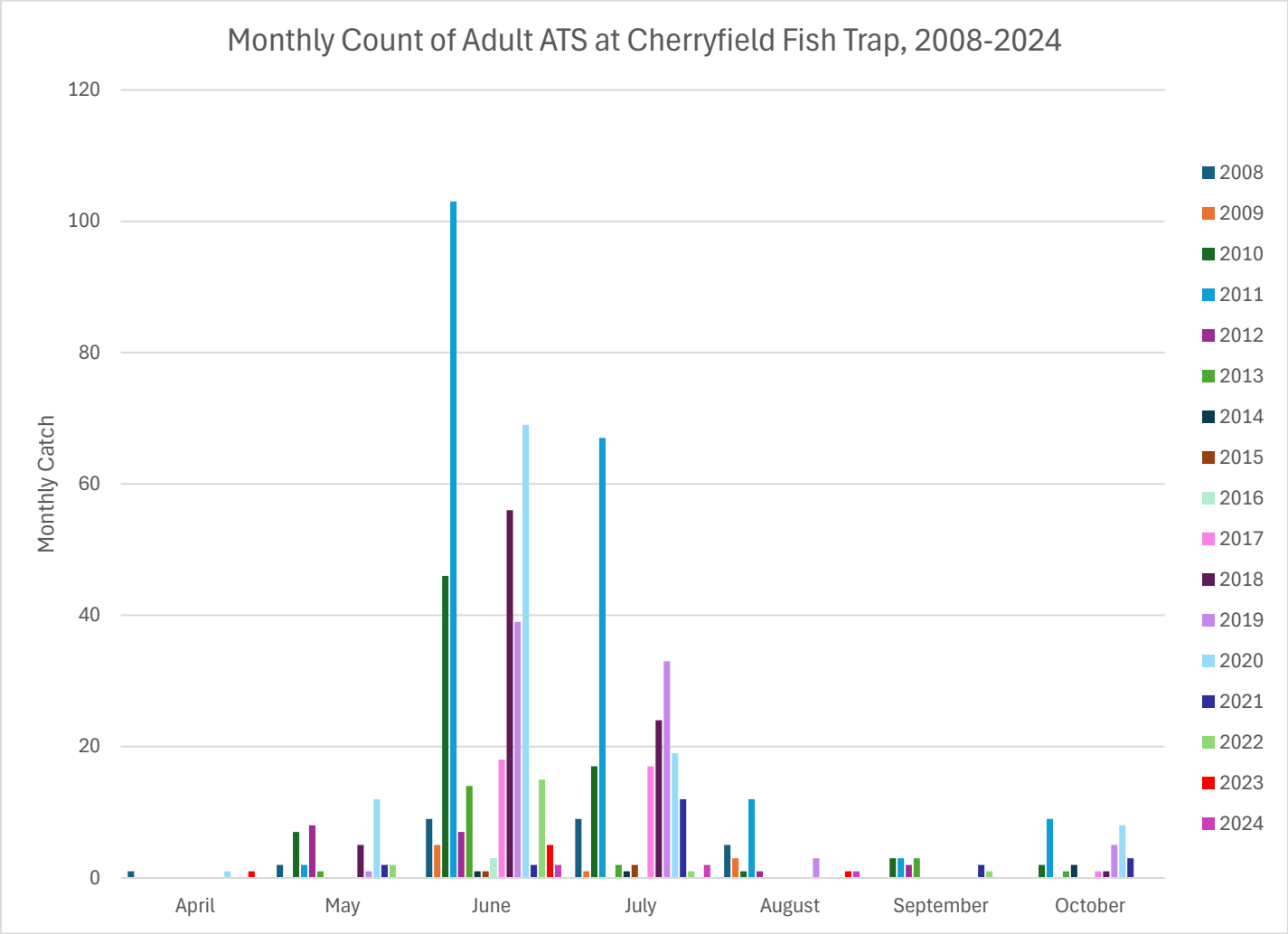


Figure 20. Monthly count of adult Atlantic salmon captured at the Cherryfield fish trap from 2008-2024.

6.4 DESIGNATED CRITICAL HABITAT FOR GOM DPS OF ATLANTIC SALMON

Coincident with the June 19, 2009 endangered listing, NMFS designated critical habitat for the GOM DPS of Atlantic salmon (74 FR 29300). The final rule was revised on August 10, 2009 to exclude trust and fee holdings for the Penobscot Indian Nation and a table was corrected (74 FR 29300). Critical habitat has been designated for HUC 10 watersheds occupied by Atlantic salmon at the time of listing. These areas comprise approximately 19,751 square kilometers (7,626 square miles) of perennial river, stream, and estuary habitat and 799 square kilometers (308 square miles) of lake habitat.

Critical habitat is focused primarily on the known Primary Constituent Elements (PCEs) within the occupied areas of a listed species that are deemed essential to the conservation of the species. Within the GOM GPS, the PCEs are: 1) sites for spawning and rearing, and 2) sites for migration.

The physical and biological features (PBF's) for the two PCEs for Atlantic salmon critical habitat in the GOM DPS are as follows:

Features of the Spawning and Rearing PCEs

- SR 1. Deep, oxygenated pools and cover (e.g., boulders, woody debris, vegetation, etc.), near freshwater spawning sites, necessary to support adult migrants during the summer while they await spawning in the fall.
- SR 2. Freshwater spawning sites that contain clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support spawning activity, egg incubation, and larval development.
- SR 3. Freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support emergence, territorial development and feeding activities of Atlantic salmon fry.
- SR 4. Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr.
- SR 5. Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate parr's ability to occupy many niches and maximize parr production.
- SR 6. Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr.
- SR 7. Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr.

Features of the Migration PCE

- M 1. Freshwater and estuary migratory sites free from physical and biological barriers that delay or prevent access of adult salmon seeking spawning grounds needed to support recovered populations.

- M 2. Freshwater and estuary migration sites with pool, lake, and in-stream habitat that provide cool, oxygenated water and cover items (e.g., boulders, woody debris, and vegetation) to serve as temporary holding and resting areas during upstream migration of adult salmon.
- M 3. Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation.
- M 4. Freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment.
- M 5. Freshwater and estuary migration sites with sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration.
- M 6. Freshwater migration sites with water chemistry needed to support sea water adaptation of smolts.

All 244 square miles of the Narraguagus HUC10 watershed are designated as critical habitat for Atlantic salmon in the Downeast Coastal SHRU (**Error! Reference source not found.**). Critical spawning, rearing, and migration habitat within the project action area is discussed in Section 6.4.1.

6.4.1 Critical Habitat in the Action Area

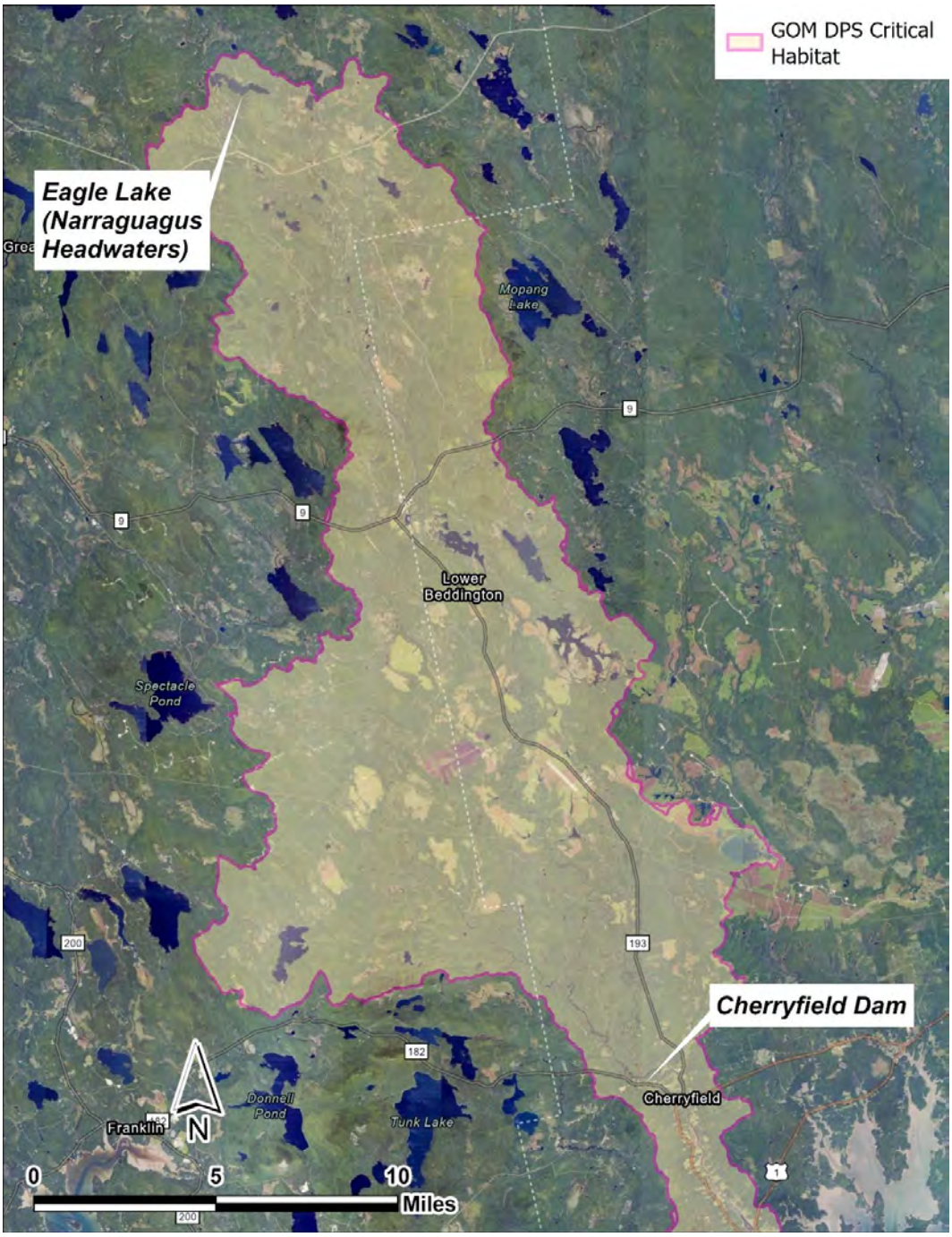


Figure 21. Designated critical habitat for GOM DPS Atlantic salmon in the Narraguagus watershed (Downeast Coastal SHRU).

6.4.1.1 Spawning and Rearing Habitat within the Action Area

Features of the Spawning and Rearing PCEs in the Action Area

- SR 1. Deep, oxygenated pools and cover (e.g., boulders, woody debris, vegetation, etc.), near freshwater spawning sites, necessary to support adult migrants during the summer while they await spawning in the fall.
- SR 3. Freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support emergence, territorial development and feeding activities of Atlantic salmon fry.
- SR 4. Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr.
- SR 5. Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate parr's ability to occupy many niches and maximize parr production.
- SR 6. Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr.
- SR 7. Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr.

These features are present in the action area however each are with limited function due to various existing conditions. MDMR has mapped suitable Atlantic rearing habitat above and below the dam. Upstream of the Cherryfield Ice Dam, surveyed rearing habitat on the main stem Narraguagus River begins near the upstream extent of the impoundment and continues beyond the project action area (see Figure 1) Most of the surveyed rearing habitat is located outside the project action area, however approximately 0.66 acres occur within the action area at the northern limit of the impoundment. The limited rearing habitat within the impoundment is not expected to be adversely affected by construction activities due to its substantial proximity from the dam. Below the dam, a small amount of rearing habitat (fewer than 10 total habitat units) occurs with the project action area (see Section 7.1.6). An additional mile of mapped rearing habitat is present in the reach downstream of the current dam. The mapped critical habitat is based on physical stream characteristics thus does contain elements of the PCE's including limited substrate, depth, and velocity that support rearing development. However, the mapped habitat does not take into account the biological function.

The rearing habitat that is present below the dam has limited function due to warm water temperatures, a straightened river channel that lacks sinuosity, and a lack of diversity in habitat. The substrate below the dam is generally gravel-cobble, but contains artificial fill from the failure of several dam structures over the years as referenced in Section 5.2.1 (phone communication with Ernie Atkinson of MDMR, September 5, 2025). See Figure 22 - Figure 25 for examples of artificial

substrate within the area mapped as rearing habitat below the Cherryfield Dam. Therefore, the action area does not contain sufficient and functional PCE's for rearing habitat.



Figure 22. Artificial fill (large rectangular slabs) below the dam within the vicinity of mapped rearing habitat.



Figure 23. Artificial fill, likely the remains of the old Stillwater Dam, in the vicinity of mapped rearing habitat below the dam.



Figure 24. Gravel bar comprised of potentially artificial fill below the Cherryfield Dam, within the vicinity of mapped rearing habitat.



Figure 25. Artificial fill, potentially from the remains of the old Stillwater Dam, within the vicinity of mapped rearing habitat below the Cherryfield Dam.

Additionally, only about 8% of the mapped rearing habitat in the HUC10 Narraguagus watershed is located downstream of the dam (557 out of 6,197 total habitat rearing units, email communication with Ernie Atkinson, May 2025). The rearing habitat within the permanent action area immediately below the dam, within the area of direct impact of the nature-like fishway, accounts for less than 1%

of the total rearing habitat downstream of the dam, and a tiny fraction of the total rearing habitat in the HUC10 Narraguagus watershed (Figure 26).

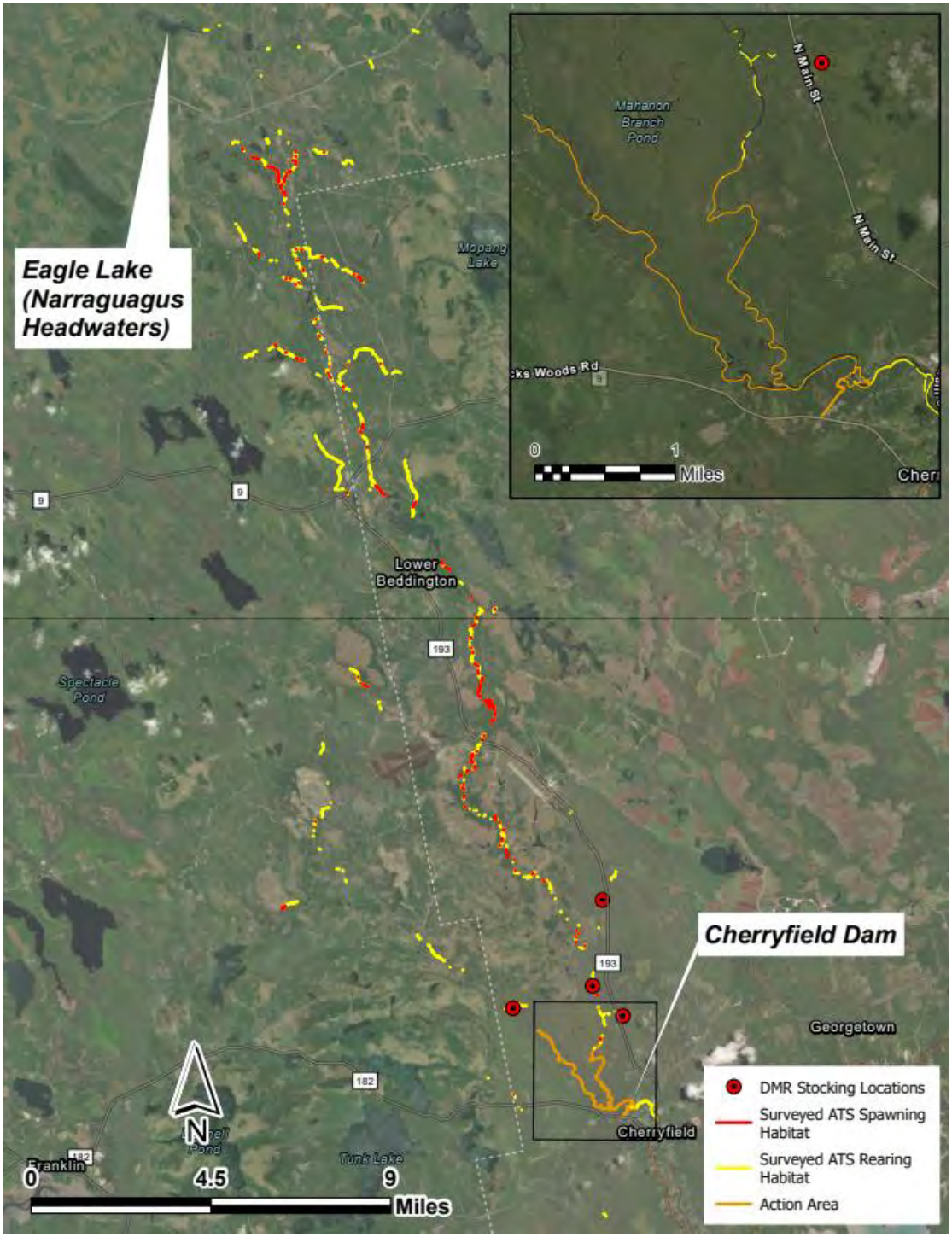


Figure 26. Mapped Atlantic salmon spawning (red) and rearing (yellow) habitat above and below Cherryfield Dam. Data from MDMR, figure by Inter-Fluve, Inc.

Adult Atlantic salmon spawn in freshwater habitats. There is no documented spawning habitat downstream of the dam in the approximate one mile between the dam and head of tide (MDMR, 2025). All recent (2023-2025) documented redds occur upstream of the dam (Figure 27, Figure 18) outside of the action area. There is no reason to expect that adult salmon would spawn during the anticipated in-water work window in the action area where there is no spawning habitat and no documented redds. The lack of suitable spawning habitat within the action area has been confirmed by an MDMR biologist with over 20 years of experience conducting habitat surveys in the watershed (verbal communication with Ernie Atkinson of MDMR, May 2025). The distance from the nearest surveyed redd in 2023 to the top of the action area was over 6 miles. Furthermore, during the anticipated in water work window the PCE's for rearing would not be fully functional due to reduced water levels, flows, and increased summer temperatures and would have a decreased ability to provide adequate cover and food to sustain any juveniles that would be in the action area. Therefore, the action area does not contain sufficient and functional PCE's for rearing habitat.

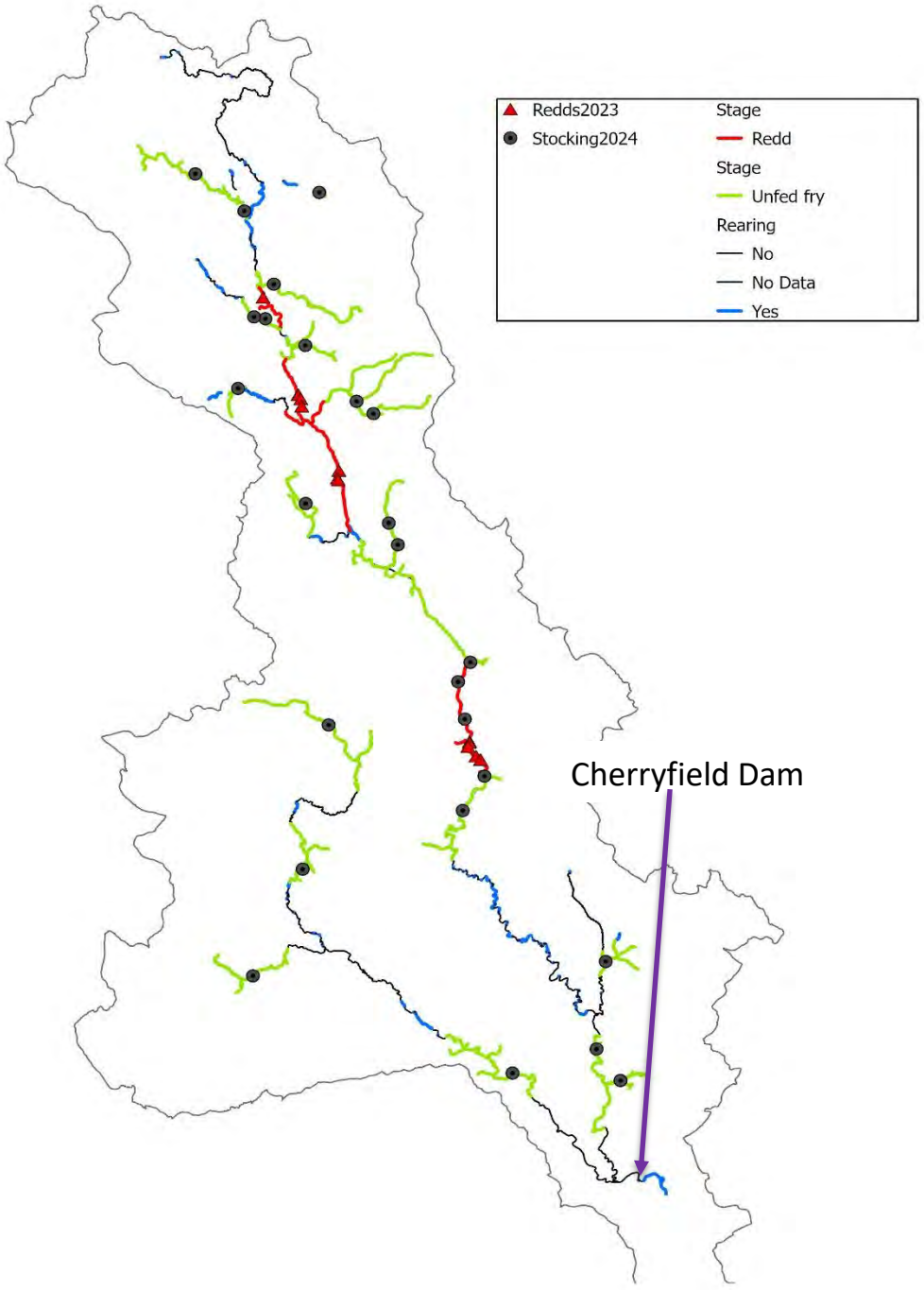


Figure 27. All 2024stocking location, 2023redds, and estimated occupied salmon habitat in the HUC10 Narraguagus watershed, with approximate location of Cherryfield Dam shown. Source: MDMR (2025).

6.4.1.2 Migratory Critical Habitat within the Action Area

The existing critical habitat within the action area does not contain fully functional Features of the Migration PCE's. The migratory habitat exhibits limited function or not properly functioning essential features due to a physical barrier (the Cherryfield Dam) that delays passage of adult and juvenile salmon at all flows and restricts access of adult and juvenile salmon at very low and very high flows. The presence of dam and its fishway configuration is also known to cause mortality of adults during migration between April 15th- December 14th, demonstrating that the migratory critical habitat within the action area is not properly functioning.

(PCE M 1) The site is not free from physical and biological barriers. The Cherryfield Dam in its existing conditions does delay or prevent access of adult salmon seeking spawning grounds needed to support recovered populations. As noted in the Environmental Baseline section, all fish passage is restricted to the Denil fishway in the current configuration, which forces all migrating species into the trap facility. The bars of the trap retain adult Atlantic salmon and allow alewife and smaller shad to pass through (email communication with Colby Bruchs of MDMR, May 21, 2025). MDMR monitors the fish trap daily and releases Atlantic salmon upstream. The metal trap prevents adult salmon and large shad from comingling with the alewife harvest, but occasionally results in Atlantic salmon mortalities (Figure 6). According to MDMR data, Atlantic salmon trap mortality reached 4% in 2008 (1 mortality out of 26 trapped) and 2019 (3 mortalities out of 81 trapped), and 1% in 2020 (1 out of 109 trapped).

Because of its high slope and narrow width, the Denil fishway does not pass adult or juvenile salmon efficiently. Adult and juvenile salmon may expend significant amounts of energy ascending and descending the fishway, especially at very low or very high flows. During high spring flows, juveniles migrating downstream have the chance to pass through the spillway at the dam. All adults migrating upstream on alewife trapping days must first pass through the fish trap at the upstream side of the fishway, further delaying migration.

As noted in the Environmental Baseline section, all fish passage is restricted to the Denil fishway in the current configuration, which forces all migrating species into the trap facility. The bars of the trap retain adult Atlantic salmon and allow alewife and smaller shad to pass through (email communication with Colby Bruchs of MDMR, May 21, 2025). MDMR monitors the fish trap daily and releases Atlantic salmon upstream. The metal trap prevents adult Atlantic salmon and large shad from comingling with the alewife harvest, but occasionally results in Atlantic salmon mortalities (Figure 6). According to MDMR data, Atlantic salmon trap mortality reached 4% in 2008 (1 mortality out of 26 trapped) and 2019 (3 mortalities out of 81 trapped), and 1% in 2020 (1 out of 109 trapped).

(PCE M 2) The action area does contain limited pools that could serve as temporary holding and resting areas during upstream migration of adult salmon. There are 2 large pools present downstream of the dam with maximum depths of 7.8 feet and 5.0 feet. See Figure 30 under Section

7.1.5. These pools are outside of the immediate action area where the dam demolition and work area isolation is occurring. The pools are within the indirect areas of the action area

The pools lack sufficient cover and water quality data has not been collected for the pools themselves, therefore its unknown if the pools have oxygenated water and functional dissolved oxygen levels nor specific temperatures. The closest best available temperature data in close vicinity of these pools is at the USUS gauge approximately 900 feet below the dam, as noted in the Environmental Baseline, Section 5.4. Comparing the USGS data the Stanley and Trial Habitat Suitability thresholds, average daily temperatures below the dam exceed the preferred temperature threshold for 91 out of 93 days from July 15 – September 30, only reaching the preferred threshold (14.5 degrees Celsius) for the last two days of September. Average daily temperatures exceed the feeding cessation threshold for 19 days throughout July and August. Maximum daily temperatures exceed the preferred threshold throughout the entire period from July 15 – September 30. Between October 1-14, all days for average daily temperatures are within the preferred threshold, indicating potential functionality, however the maximum daily temperatures have 8 of the 14 days in October exceeding the preferred temperature. Migration is also flow river depth dependent. Overall, based on best available data, the pools are functioning limitedly. Further discussion on the effects of the action are under 7.1.5.

(PCE M 3) The migratory habitat does not contain abundant, diverse native fish communities to serve as a protective buffer against predation. The Narraguagus river, like all rivers in New England, have suffered from centuries of impacts from logging, industrialization, commercial fishing, and other developments that have the native fish populations at low populations.

During the proposed working window, the Contractor will be required to maintain run-of-river flow through the project area. During the impoundment refill, this flow may be limited to 10 to facilitate refill. During Phase 1 of the project, the existing Denil fishway will continue to be used to provide both flow and fish passage. As described above, this structure provides only limited and inefficient passage for both adults and juvenile Atlantic salmon, particularly at low flows (which are anticipated during the in-water work window) and high flows, therefore, already causes delays in upstream passage migration under baseline conditions. Temporary changes in flow distribution during Phase 1 associated with maintaining run-of-river conditions and refilling the impoundment may further reduce the hydraulic efficiency of the Denil fishway and incrementally increase passage delays. These effects are expected to be short-term and minor relative to the existing delay and partial barrier created by the existing Denil fishway and dam and will be offset in the long term by the substantial improvement in passage conditions following dam removal and construction of the nature-like fishway.

The Cherryfield Ice Dam also currently blocks the downstream movement of natural debris and sediments throughout the lowest section of the Narraguagus River. Although the proposed nature-like fishway is expected to maintain the same level of the head pond at normal flows and drop only nominally during low flows, a channel-spanning nature-like fishway is expected to improve flow and natural sediment transport processes as well as water quality by removing a channel-spanning

physical barrier with one designated flow channel (through the Denil fishway) and replacing the dam with a nature-like fishway with multiple flow channels.

Therefore, the action area does contain limited functional migratory habitat, however, not sufficient and functional PCE's for migratory habitat.

7. Effects Analysis

The Cherryfield Dam is within the known and expected range of Atlantic salmon and Atlantic salmon critical habitat. Atlantic salmon are potentially susceptible to direct project impacts from removal including excessive turbidity, sedimentation and/or stranding. Accordingly, in the unlikely event that fish are present in the action area, individuals may be exposed to these stressors during deconstruction or construction activities which may result in an adverse impact. However, by using the proposed BMPs, maintaining sufficient passage through the work area, and conducting work during specified in-water work windows, most project activities should result in discountable impacts to Atlantic salmon. Furthermore, beneficial direct effects of the action include improvement of migratory passage that would increase species distribution and potentially abundance within the Narraguagus River and greater Narraguagus watershed.

The ESA Consultation Handbook (USFWS and NOAA Fisheries 1998) identifies six factors that should be examined (as appropriate for the proposed action under consideration) to assess the direct and indirect effects of a proposed action. These factors include the following:

1) Proximity of the proposed action to the species, management units, or designated critical habitat units.

2) Geographic areas where the proposed action-induced disturbance occurs.

3) Timing of the proposed action in relation to the sensitive period of a species' life cycle.

4) Nature of the effects of the proposed action on elements of a species life cycle, population size or variability, or distribution; or on the primary constituent elements of the critical habitat.

5) Duration of the effects (i.e., pulse effect – short-term event whose effects are relaxed almost immediately; press effect - sustained, long-term, or chronic event whose effects are not relaxed; and threshold effect - permanent event that sets a new threshold for some feature of a species' environment).

6) Disturbance frequency of the effects resulting from the proposed action (USFWS and NOAA Fisheries 1998).

The factors described above are to be evaluated, as appropriate, to determine if the proposed action is likely to adversely affect listed species or critical habitat.

The direct effects on a protected species at the individual level and on critical habitat should be thoroughly evaluated when determining the extent of the adverse effect. The potential effects of the action to the listed species and to each PBF of critical habitat needs to be evaluated and a

determination made regarding whether the effects will be beneficial, extremely unlikely, insignificant, or may result in adverse effects. The six factors identified above were used to assess the consequences of the action on the listed species and whether the proposed activities would adversely affect listed species or critical habitat. In turn, this information is used to select the appropriate ESA determination for the proposed action.

The occurrence and timing of each species' life stage in the action area, in-water work window, and the approximate timing of each potential project-related effect were considered when reaching an ESA determination. The following sections present the potential project-related effects on Atlantic sturgeon, shortnose sturgeon, Atlantic salmon, and Atlantic salmon designated critical habitat and the subsequent determination for each.

Table 9. Summary of in water construction activities and species exposure.

Activity	Duration	Timing	Stressor
Mobilization and staging, tree clearing and access improvements, upland improvements	4 months prior to in-water work and throughout duration of project	March 2025 – December 2026	Spills, limited turbidity release
Optional Impoundment Drawdown	2-5 days	July 15	Modification to critical migratory habitat
Phase 1 Water Control (River Right)	**6 weeks**	**July – September**	Temporary modification to critical migratory habitat, limited turbidity release, cofferdams, and hydroacoustic
Cofferdam installation and fish evacuation	2-3 days	July	
Demolition of ice piers and partial demolition of timber crib spillway	1-2 weeks	July	
Reconstruction of ice piers	Ongoing throughout Phase 1	July - August	
Permanent sheetpile installation for controlling weir	2-3 days	July - August	
Construction of nature-like fishway primary and secondary channel	Ongoing throughout Phase 1	July - August	
Embankment grading and rip rap protection	Ongoing throughout Phase 1	July - August	
Remove Phase 1 cofferdam	2-3 days	August - September	
Impoundment Refill	1 week	August - September	Temporary modification to critical migratory habitat
Phase 2 Water Control (River Left)	**4 weeks**	**September – October**	
Cofferdam installation and fish evacuation	2-3 days	September 1 - 30	

Demolition of remaining ice piers and spillway	1 week	September	Temporary modification to critical migratory habitat, limited turbidity release, cofferdams, and hydroacoustic
Reconstruction of ice piers	Ongoing throughout Phase 2	September - October	
Permanent sheet pile cutoff installation for controlling weir	2-3 days	September - October	
Complete construction of nature-like fishway primary and secondary channel	Ongoing throughout Phase 2	September - October	
Remove Phase 2 cofferdam	2-3 days	October	

7.1 CONSTRUCTION EFFECTS

7.1.1 Turbidity and Sedimentation

Construction activities associated with this project, including cofferdam construction and removal and access road construction and removal, placing and removing cofferdams, placing riprap, and demolishing the dam and associated structures, may temporarily introduce sediment and increase turbidity downstream of the current dam. A turbidity curtain will be installed downstream of the work area at the start of in-water work, including the potential drawdown, and will remain in place throughout the duration of construction. The notching of the dam will occur in the wet. All other in-stream work will be conducted in the dry, within the confines of dewatered cofferdams. The proposed actions will occur within a low flow time of the year when fish utilization is lowest.

Cofferdams, turbidity curtains, silt fencing, construction entrances, and other BMPs will be used throughout project work to minimize sediment disturbance, transport, and exposure of dry sediment to stream flow. The turbidity curtain will be in place and functional prior to the notching of the dam (if drawdown is elected), the placement of sheet pile cofferdam and the dam demolition sequence to reduce any generated turbidity. Flooding and failure of all stream barriers will be minimized by sizing all barriers to heights that accommodate expected rain events. This measure is to ensure minimal overtopping during a high flow event and therefore, will minimize sedimentation and turbidity effects. The Contractor is responsible for sizing cofferdams to prevent failure or overtopping up to the 2-year event.

Before each cofferdam is dismantled, contractors will slowly dewater with a screened pump, discharge to a temporary sediment basin or other outlet filter (i.e. silt bag)., and remove any remaining sediment or construction debris from within the cofferdam. The close-out procedure described above may cause temporary effects to water quality in the action area, but any generated turbidity will subside within 12-24 hours. The duration of elevated turbidity effects in areas of the work site as the cofferdams are decommissioned will vary with the size of the cofferdam or work exclusion zone. When the primary cofferdams are decommissioned, it can be expected that elevated turbidity may be experienced for several hours but should subside in less than 24 hours. For smaller cofferdams that may be used to isolate localized work areas, periods of elevated turbidity will be

shorter in duration lasting 1 to 2 hours, or less. In general, because there is minimal accumulated sediment in the impoundment, generation of turbidity will be modest. A continuous flow channel will be maintained throughout the project except for the impoundment refill period (if a drawdown is elected).

Dams create backwater environments, known as impoundments, that are wider, deeper, with slower flow velocities than the stream upstream of the impoundment or downstream of the dam. This flow reduction lowers the sediment transport capacity of a stream, resulting in conditions with the potential for trapping sediment that under natural conditions would be transported downstream. Management of impounded sediment is an important consideration when contemplating dam management activities, in which the quantity, distribution and composition of impounded sediment are key factors.

Downstream transport of sediment is a natural process, important for sustaining rivers and floodplains, estuaries, and coastal areas. In some instances, passive release of accumulated sediment associated with dam removal or modification may be planned when the net benefit to the downstream river facilitates restoration while avoiding risks. In other instances, a passive release of sediment can impact sensitive aquatic habitat or accumulate in downstream depositional areas where it would be viewed problematically.

To characterize accumulated sediment distributions in the impoundment, Inter-Fluve performed a Depth of Refusal (DOR) survey on November 12th, 2024. DOR measurements were mapped within the surveyed area (Figure 28**Error! Reference source not found.**). The sediment thickness map shows fairly uniform deposition in the upstream portions of the impoundment, with typical depths of 1.5–2 feet and localized depths up to 3 feet. Downstream, where the river bends, sediment is more heavily accumulated along the river-right bank (2–3 feet) and thins toward the channel center (0–1 foot). Near the river-left bank and immediately upstream of the dam, there is negligible sediment accumulation. This sediment
distribution reflects differences in river bathymetry where water depths shallow in the area immediately upstream of the dam, compared to areas further upstream where greater water depths provide more accommodation space for sediment to accumulate.

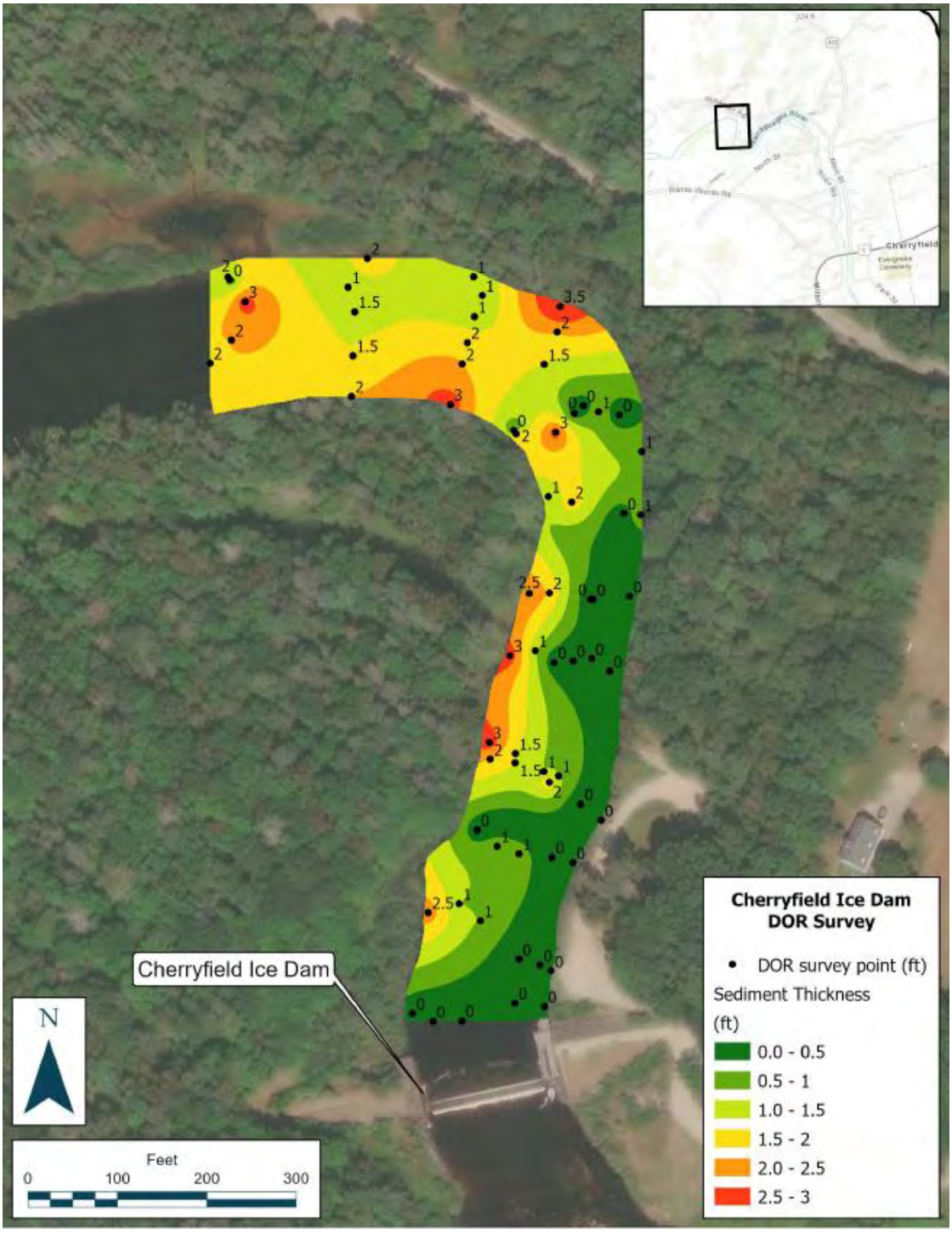


Figure 28. Surveyed depth of refusal and sediment thickness above Cherryfield Ice Dam.

Due to minimal sediment occurring immediately upstream of the dam as documented in the surveyed bathymetry and depth to refusal data, and the temporary nature of impacts at the site, we anticipate there will insignificant and unmeasurable sediment that releases due to construction of the proposed project. The sediment that does mobilize will be mitigated by Contractor BMPs. Cofferdams and turbidity curtains will be actively used throughout project work to minimize sediment disturbance, transport, and exposure of dry sediment to stream flow. Sediment that does travel past the project site will likely in settle large pools immediately downstream of the site adjacent to the USGS gaging station and transport downstream up to 1,000 feet beyond the dam. The amount of sediment deposition is unlikely to exceed normal sediment transport processes in the Narraguagus River. Sedimentation impacts during demolition and construction and following project completion are therefore anticipated to be discountable.

7.1.1.1 Species Determinations

Implementation of the BMPs will reduce the likelihood and severity of temporary increases of turbidity in the Narraguagus River. During any of the activities with potential to create turbidity, TSS level will be below those shown to have adverse effect on fish (typically up to 1,000 mg/L) with the use of BMPs as described in subsequent sections. Although the potential exists for juvenile and adult Atlantic salmon to occur in the action area during the in-water work window, the likelihood of presence is extremely low due to the time of year, low water temperatures, and lack of suitable habitat within the action area. Atlantic sturgeon and shortnose sturgeon are unlikely to occupy the action area at any time of year, as described above, although the potential exists for them to occur. During any of the activities with potential to create turbidity, TSS level will be below those shown to have adverse effect on fish (typically up to 1,000 mg/L). Based on the above considerations, the turbidity effects to migrating Atlantic salmon adults and smolts are likely to be too small to be meaningfully measured or detected when added to the baseline and, therefore, will be insignificant.

7.1.1.2 Critical Habitat Determinations

Based on the limited sediment storage above the dam, limited anticipated release of sediment during dam demolition, and the limited amount of mapped critical habitat within the action area (less than 1 critical rearing habitat unit within the action area below the dam with no spawning habitat, and negligible amounts of rearing habitat over three river miles upstream of the dam), any effects to Atlantic salmon critical habitat are anticipated to be minimal and discountable. Existing mapped rearing critical habitat within the turbidity action area has limited function. Any anticipated increases in turbidity or sedimentation are anticipated to be temporary and insignificant to critical rearing habitat in the action area and adjacent areas above and below the dam site. Although a small amount of sediment may travel past the project site and settle in large pools immediately downstream of the current dam adjacent to the USGS gaging station that are a feature of migratory habitat, the amount of sediment deposition is unlikely to exceed normal sediment transport processes in the Narraguagus River. Long term impacts from sedimentation loads are not expected due to minimal sediment accumulation upstream of the dam. Most sedimentation impacts will be mitigated by BMPs as described in subsequent sections. Sedimentation impacts to critical rearing

and migratory habitat during demolition and construction and following project completion are therefore anticipated to be discountable.

The temporary and minor adverse effects on water quality in the river described above will not create physical or biological barriers to migration, or measurably affect characteristics such as water temperature, oxygen levels, abundance of prey, or other physical characteristics of the habitat. Impacts to critical migratory habitat within the action area are therefore anticipated to be discountable.

7.1.2 Cofferdams, Dewatering, and Fish Stranding

Throughout the course of the project, work area isolation measures will be in place to conduct in-water work in the dry and minimize impacts to endangered species and habitats within the action area. Isolation of a stream work area within a cofferdam is a conservation measure intended to minimize the overall adverse effects of construction activities on Atlantic salmon and their habitat. When a portion of the river is isolated from the active flow, the remaining water confined behind the cofferdam is removed with mechanical pumps, this drawdown equipment will be screened to reduce entrainment of juvenile fish during dewatering operations.

Fish stranding and fish evacuation protocol (see Section 4.2) will be followed throughout the duration of the project. The protocols indicate the time period, and related construction activities where fish are in the greatest danger for stranding. Further discussion in regards to stranding potential can be found in Section 7.1.5.

7.1.2.1 Species Determinations

Juvenile and adult endangered Atlantic salmon are anticipated to be in the action area during certain times of the year, as described in Section 5 Environmental Baseline. The approved in-water work window to maximize avoidance and mitigation measures for Atlantic salmon is July 15 – September 30. However, warm water temperatures and low flows generally begin in late June on the Narraguagus River (personal communication with Ernie Atkinson, May 2025). During the proposed demolition and construction period between July 15 and October 14, juvenile salmon are unlikely to be present given the time of year with warmer water temperatures, a low likelihood of juveniles present given the small amount of rearing habitat that is present below the dam (92% of the rearing habitat in the watershed is located above the dam outside of the extent of the temporary action area), and general lack of preferred and functional habitat in the action area as described above. Based on available trap data from MDMR over the last decade, warm water temperatures, and low flows, adult Atlantic salmon are also unlikely to be migrating through the action area during demolition and construction activities. Therefore, the likelihood of encountering and entrapping any juvenile or adult Atlantic salmon inside a cofferdam during construction is very low. Sturgeon are unlikely to occur in the action area at any time of year as described in subsequent sections and effects are therefore considered discountable.

While unlikely, there may be juvenile or adult Atlantic salmon in the action area that need to be removed over the duration of the project. These individuals would be exposed to electrofishing and subsequent handling while being captured for removal from inside the cofferdam. Additionally, since the flow of water will be somewhat altered but remain uninterrupted/unobstructed (with the exception of a possible 2-5 day temporary partial impoundment drawdown, and 2-5 day period to re-fill the impoundment) within the action area during construction, fish will continue to have an opportunity to pass through the action area. Daily observations will be made to ensure no juveniles or adults are in the action area during construction and therefore, none will be exposed to the effects of the construction.

Atlantic salmon may be killed or more likely temporarily disturbed, displaced, or injured by instream work activities. There is also a chance fish can enter the isolated areas during higher flows which overtop the sandbag barriers. Future isolation as a result of high flows from flooding will be minimized within the cofferdam areas by sizing all barriers to heights that accommodate expected rain events. However, in the unlikely event re-isolation occurs, special precautions for fish removal and relocation procedures involving MDMR staff as described previously will be followed. Dewatering of stream habitat inside a cofferdam could have a lethal effect on any fish within the enclosed area. Therefore, all fish will be removed from all cofferdams as directed by the MDMR. To avoid the death of fish caught inside a cofferdam as a result of dewatering, qualified biologists will capture and remove all Atlantic salmon and other fish species. Capturing and handling salmon can cause physiological stress and lead to physical injury or death, including cardiac or respiratory failure from electrofishing (Snyder 2003). Studies have shown that all aspects of fish handling are stressful and can lead to immediate or delayed mortality (Murphy and Willis 1996). Direct mortality may occur when fish are handled roughly, not properly restrained, sedated during handling, or kept out of the water for extended periods.

Despite precautions, some mortality is possible during the removal of fish from within cofferdams. The MDMR annually reports juvenile salmon mortality rates associated with electrofishing activities in GOM DPS waters. While the MDMR usually handles a few thousand juvenile salmon each year during electrofishing, mortalities are usually less than two percent of total fish captured. From 2001-2009, MDMR's electrofishing mortality during YOY and parr population estimation and broodstock collection has ranged from 3.33% (2001) to 0.82% (2006) with an average mortality rate of 1.70% for both life stages combined over that period. It is assumed that for this project all juvenile salmon within the cofferdam would be subject to some level of stress during the capture and relocation process. The number of injuries or mortalities can be quantified based on SHRU-specific estimates of juvenile densities, as well as the estimated mortality that may occur during capture and relocation. It is assumed that no more than 1.70% of the fish that are captured will suffer injury or death.

The MDMR has committed to providing qualified staffing to take the lead on fish collections and relocations (Ernie Atkinson and Colby Bruchs of MDMR, verbal commitment by Casey Clark and Ernie Atkinson of MDMR at Interagency Meeting, August 27, 2025). If juvenile or adult salmon are present, MDMR will follow all protocols to safely capture and handle all individual fish as described in the Electro-Fishing Wadable Stream guidelines (MDMR2025). The MDMR will be available

during construction to remove fish from the project should flows become isolated from the main flow potentially stranding fish. All captured fish will be documented/reported and immediately returned to suitable habitat outside of the action area.

7.1.2.2 Critical Habitat Determinations

Temporary cofferdams are anticipated to have no effects on critical habitat within the action area.

7.1.3 Noise

Noise will be generated by the equipment (excavators, vibratory hammers, trucks, etc.) operating within the construction area for demolition of dam, construction of bank stabilization, and reconstruction of the viewing platform and by vehicles operating on temporary access roads, as described above. All construction work areas within the river channel will be conducted in the dry and cofferdams will remain functionally active to ensure separation between the work area and the active stream. In areas where hammering is required, every reasonable measure will be taken to ensure that the hammering does not occur in the active stream and in a location that is not hydrologically connected to the active stream, to prevent migration of vibration and sound effects through the water to areas where fish may be present. Cofferdams will be employed to isolate the work area from the active river.

Under certain conditions, underwater sound generated from construction activities such as sheet pile driving may cause behavioral or physiological changes to aquatic organisms. Behavioral changes often include avoidance of the action area, disruption of foraging attempts, or interruption of reproduction. Physiological effects vary depending on the duration and intensity of sound produced during construction. Aquatic organisms could suffer temporary or permanent hearing loss, or percussion-type injuries such as bruising, ruptures to capillaries, hemorrhaging of organ systems, damage to the swim bladder and internal organs, or death (Halvorsen et al. 2011). The types of effect on and response from fishes to a sound source will depend on distance. The potential for effects declines as distance increases between the individual and the source. Very close to the source, effects may range from behavioral changes to mortality. Farther from the source mortality is no longer an issue, and effects range from behavioral to physiological. The nature of effects depends on several other factors, such as fish hearing sensitivity, source level, sounds propagation and resultant sound level at the fish, whether the fish stays near the source, and motivation level of the fish. Generally speaking, species are thought to have different tolerances to sound levels and may exhibit different responses to the same sound source. The following are commonly used measures of sound:

- Peak sound pressure level (SPL): the maximum sound pressure level (highest level of sound) in a signal measured in dB re 1 μPa.
- Sound exposure level (SEL): the integral of the squared sound pressure over the duration of the pulse (e.g., a full pile driving strike). SEL is the integration over time of the square of the

acoustic pressure in the signal and is thus an indication of the total acoustic energy received by an organism from a particular source (such as pile strikes). Measured in dB re 1μPa2-s.

- Single Strike SEL: the amount of energy in 1 strike of a pile.
- Cumulative SEL (cSEL or SELcum): the energy accumulated over multiple strikes. cSEL indicates the full energy to which an animal is exposed during any kind of signal. The rapidity with which the cSEL accumulates depends on the level of the single strike SEL. The actual level of accumulated energy (cSEL) is the logarithmic sum of the total number of single strike SELs. Thus, cSEL (dB) = Single-strike SEL + 10log10(N); where N is the number of strikes.
- Root Mean Square (RMS): the average level of a sound signal over a specific period of time. NOAA Fisheries generally uses 150 dB RMS as the threshold for behavioral effects to listed fish species (Buehler et al. 2015). For the State Route 197 Bridge in Richmond, Maine, NOAA Fisheries used 150 dB re 1 μPa RMS as a conservative indicator of the sound level at which there is the potential for behavioral effects (NOAA Fisheries 2012b). Exposure to sound levels of 150 dB re 1 μPa RMS will not always result in behavioral modifications, and behavioral modifications will not always result in adverse effects (i.e., harm or harassment to listed species), but that there is the potential for behavioral response upon exposure to 150 dB re 1 μPa RMS (NOAA Fisheries 2012b).

In 2008, the Fisheries Habitat Working Group (FHWG) developed the Agreement in Principal for Interim Criteria for Injury to Fish from Pile Driving Activities, which identifies the following thresholds for onset of physical injury to fish (FHWG 2008):

- Peak SPL: 206 decibels relative to 1 micro-Pascal (dB re 1 μPa) [for fish of any size].
- cSEL of 187 decibels relative to 1 micro-Pascal-squared second (dB re 1μPa2-s) for fishes above 2 grams (0.07 ounces).
- cSEL of 183 dB re 1μPa2-s for fishes below 2 grams (0.07 ounces).

These are criteria for the onset of physiological effects and not levels at which fish are necessarily mortally damaged. These criteria apply to green sturgeon and Pacific salmon, and both USFWS and NOAA Fisheries have assumed the criteria can be applied to Atlantic salmon and sturgeon (FHWG 2008). NOAA Fisheries has relied on these criteria in determining the potential for physiological effects in ESA Section 7 consultations. At this time, they represent the best available information on the thresholds at which physiological effects to salmon and sturgeon are likely to occur. Physiological effects may range from minor injuries, resulting in complete recovery, to death. The severity of injury is related to the distance from the pile being installed and the duration of exposure. The closer to the source and the greater the duration of the exposure, the higher likelihood of significant injury.

For the Cherryfield Ice Dam Fish Passage Project construction work, the activities that could result in elevated underwater sound pressure during construction are potential sheet pile cofferdam

installation (see Section 4.1) which is anticipated to be completed for 2-3 days starting July 15 and 2-3 days in September, no later than September 30 (see Table 2 under Section 4.1.2). The specific activity of concern is vibratory driving of sheet piles in the wetted channel. We anticipate having to use a vibratory hammer to seat the 24- inch AZ sheet piles for work area isolation. Unattenuated vibratory hammer installation of 24-inch steel bent piles is capable of inducing injury (at 150 dBs SEL [surrogate for 187 dB cSEL]) to salmon and sturgeon up to 152 feet and behavior modification (at 150 dB RMS) to salmon and sturgeon up to 300 feet from the pile driving activity. Depending on the location of the pile, the ensonified area could extend approximately 152-300 feet from the project footprint, upstream and downstream (Figure 29).

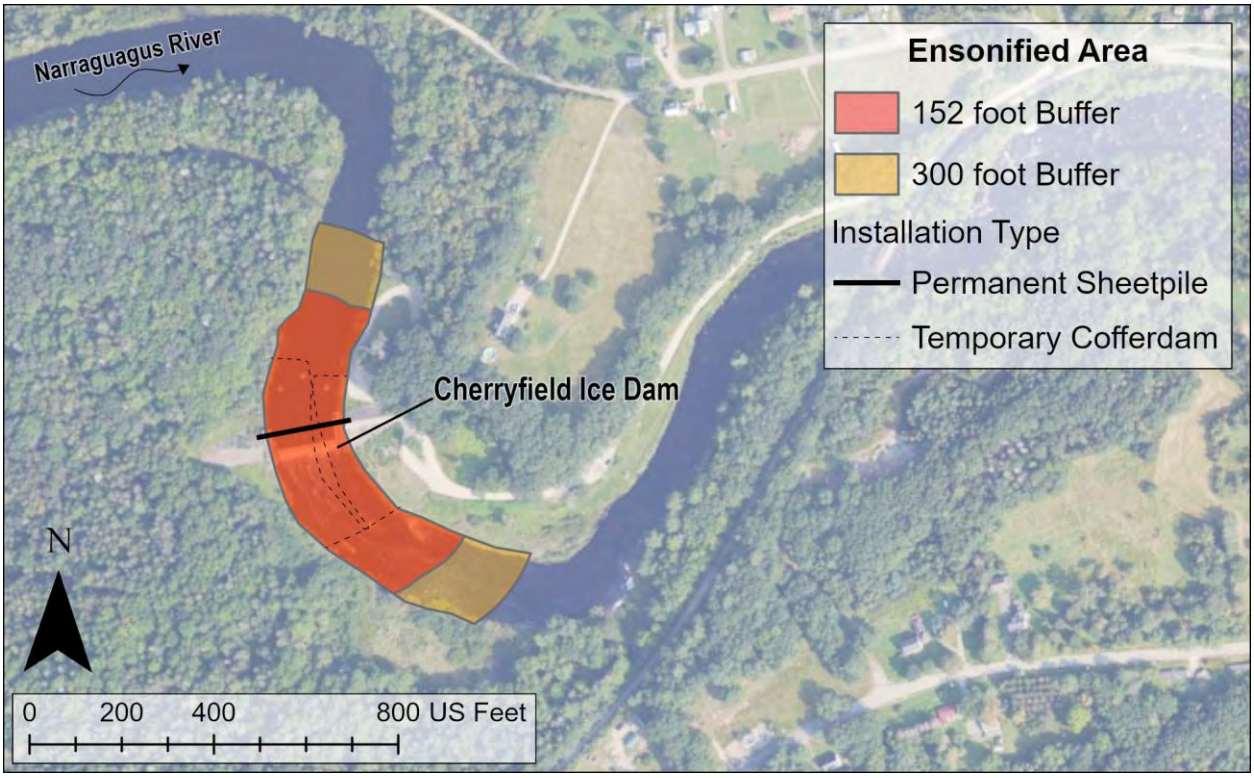


Figure 29. Noise radius buffers around installation activities capable of altering behavior in Atlantic salmon and sturgeon. Figure by Inter-Fluve, Inc.

Phase 1 and Phase 2 work area isolation measures may involve the installation of 24-inch steel bent AZ piles that will be driven using a vibratory hammer which is anticipated to be completed for 2-3 days starting July 15 and 2-3 days in September, no later than September 30 (see Table 2 under Section 4.1.2). Cofferdam construction will entail the use of a vibratory hammer to install a series of interlocking 24-inch-wide steel sheets. The substrate that the sheets are being driven into will determine the duration of the driving event for each pair of sheets. Existing substrate is characterized as dense sand with cobbles, which may prove to be difficult for driving sheetpile. A pair of sheets that are driven into finer material will take approximately 15 minutes. A pair of sheets driven into material with larger rocks and firmer substrate can take up to 1 hour. Based on the substrates in the Narraguagus River, Inter-Fluve estimates that each cofferdam in each phase of

water control (phase 1 and 2) will take approximately 2-5 days to install. Each 250-foot section will require approximately 15-60 minutes of vibratory hammer operation, followed by approximately 15 minutes between each section. In total, this activity results in approximately 60 hours of total time, of which, approximately 45 hours (2700 minutes) will be active vibratory hammer use. This is the equivalent of approximately 8 hours of pile driving per day during the duration of sheet pile coffer dam installation.

If Bulk Bags are used, then there are no noise effects. Installation of H pile foundations for the proposed ice piers and installation of permanent flat webbed sheet pile for the proposed nature-like fishway will occur in the dry, behind cofferdams, which will mitigate the effects of dangerous sounds pressure sound exposure travelling through the water column.

Caltrans (2009) summarized records from numerous construction projects in the Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish (Caltrans 2009 accessed within NOAA Fisheries 2021) and presented the expected noise levels for steel sheet piles and steel bent piles shown in **Error! Not a valid bookmark self-reference.** - Table 11. Additionally, MaineDOT et al. (2016) summarized records from construction activities in the State of Maine, and these values are included in the tables below as applicable. The tables below were developed using the acoustics tool developed for use by the Greater Atlantic Region and Office of Protected Resources (NOAA Fisheries 2025).

Table 10. Estimates for underwater noise for the Cherryfield project based on using the Multi-Species Pile Driving Calculator developed by NOAA Fisheries Office of Protected Resources and with data from Caltrans (2009) and MaineDOT et al. (2016).

Type of Pile	Hammer Type	Estimated Peak Noise Level (dB)	Estimated Pressure Level	Estimated Single Strike Sound Exposure Level
24-inch AZ Steel Sheet (coffer dam Installation)	Impact	182	165	165

Table 11. Estimated distances to sturgeon/salmon injury and behavioral thresholds for the Cherryfield project based on using the Multi-Species Pile Driving Calculator developed by NOAA Fisheries Office of Protected Resources and with data from Caltrans (2009) and MaineDOT et al. (2016).

Type of Pile	Hammer Type	Distance (m) to 206dBPeak (injury)	Distance (ft) to 150 dBsSEL (surrogate for 187 dBcSEL injury)	Distance (ft) to Behavioral Disturbance Threshold (150 dBRMS)
24-inch AZ Steel Sheet	Impact	NA	152	300

Based on this information, installation of the 24-inch AZ steel bent piles with a vibratory hammer is likely to generate peak SPL of 182 dB. This level exceeds the peak SPL of 150 dB that is the threshold

for the onset of physiological effects at 152 feet. Installation of the 24-inch AZ piles with a vibratory hammer is likely to exceed the behavioral distance threshold of 150 dBRMS out to 300 feet beyond the project site.

7.1.3.1 Species Determinations

Installation of steel bent piles and sheet piles for cofferdams using a vibratory hammer could result in behavioral responses for the adult life stages of the listed species out to 152 feet beyond the site of pile driving, however the effects will be insignificant for adult life stages and discountable for juvenile life stages. It is unlikely that these temporary behavioral responses (avoidance) will have long-term consequences to any listed species that may encounter and subsequently avoid the sound field, and effects to the long-term survival of the species will be discountable. Adults may be present downstream of the dam occupying migratory habitat in the holding pools, however the likelihood is low because the temperatures during the time of year the work with noise effects is proposed to be completed (July 15 – September 30) exceed the temperature thresholds for Atlantic salmon. Between July 16 and 23, when the Phase 1 cofferdam installation is scheduled to occur, in particular, the maximum daily mean exceeds 26 degrees Celsius, very close to the threshold for survival that is 27.8 degrees. While the temperatures downstream do lower after October, the cofferdam installation of pile driving will be completed prior to September 30. See Section the Water Temperature Section of the Environmental Baseline (5.4) and Appendix A for more details. Additionally, the baseline passage potential in the summer is low for existing conditions (see Sections 6.4.1.2 and 7.1.5), further indicating that generally, at this time of year, the likelihood of adult presence is low. The proposed project is committed to several BMPS for mitigation including the permeant sheet pile driving will occur in the dry, behind cofferdams. Combining these factors, while there will likely be an effect, this effect is minimized due to typical fish behavior, existing conditions at the project site, and BMPs, and therefore, insignificant. The absence of listed species early life stages (eggs/larvae) in the action area due to the time of year and extremely limited mapped rearing habitat make the noise effects to those life stages highly unlikely, and therefore discountable.

7.1.3.2 Critical Habitat Determinations

It is anticipated that a vibratory hammer will be used in the installation and removal of piles. Installation of sheet piles will be scheduled outside of the critical migration period from April 15 through June 15 to minimize effects to out-migrating salmon smolts and up-river migrating adult salmon, and within the low-water work window to minimize effects to juvenile salmon in the nominal amount of rearing habitat that is mapped within the action area. Sheet pile installation or removal is anticipated during timeframes as shown in Table 2 (July 15 – August for Phase 1and by September 30 for Phase 2). Once pile installation and removal is completed, noise conditions will return to those that occurred before the work started. Pile installation may temporarily affect the action area's ability to provide unimpeded movements of salmon smolts and adults. However, the action area is already the site of impeded movement due to the inefficiency of the existing denil fishway, and characteristic of the river upstream and downstream of the action area. The effects of

temporary underwater noise generated during sheet pile installation and removal will likely temporarily impact critical habitat during the duration of pile installation however will not permanently alter the critical habitat and therefore are, insignificant.

7.1.4 Spills

As a component of the Soil Erosion and Water Pollution Control Plan (SEWPCP), the contractor will develop and properly implement a Spill Prevention Control and Countermeasure Plan (SPCCP) designed to avoid stream impacts from hazardous chemicals, such as diesel fuel, oil, lubricants, and other hazardous materials. By implementing BMPs, the potential for contaminants to enter the waterway is significantly reduced. BMPs include no equipment or machinery stored, cleaned, or fueled within the waterway, dumping of contaminants on the ground is forbidden, all contaminant material will be disposed of properly, and any spills will be reported immediately.

Furthermore, removing the existing creosote-treated timber structures (crib, training walls, Denil fishway, ice piers) from the water will eliminate contaminant leaching from these materials, representing a clear benefit of the project.

7.1.4.1 Species Determinations

With the appropriate implementation of BMPs as described above, the release of contaminants into the action area is extremely unlikely and effects to Atlantic salmon and sturgeon are therefore, discountable.

7.1.4.2 Critical Habitat Determinations

With the appropriate implementation of BMPs as described above, the release of contaminants into the action area is extremely unlikely and effects to Atlantic salmon critical habitat are therefore discountable.

7.1.5 Fish Passage

The proposed action includes removing the Cherryfield Ice Dam, an existing barrier to fish passage, and replacing it with a channel-spanning nature-like fishway which is expected to improve fish passage for Atlantic salmon and other diadromous fish species. The anticipated work window for instream work will take place during periods of low discharge and reduced migration for Atlantic salmon. While work is proceeding, the river flow will be uninterrupted and bypassed through the temporary access alignment around the cofferdam barrier, as described in previous sections.

In-water work will be completed in phases and may not require an impoundment drawdown, as described in previous sections. Although not required, however, a partial drawdown of the impoundment is recommended. A partial drawdown will decrease the water surface differential between isolated work areas and the river, which will increase flexibility for the contractor, decrease overall cost, allow for more uniform construction of the nature-like fishway, and provide additional

safety for personnel, and the public. If the Contractor elects a partial impoundment drawdown, there may not be a temporary bypass channel through the construction area for up to 12 days throughout the course of the project (approximately 13% of the total 92 days in the approved work window.

The 12 days total breaks downs between Phase 1 and 2 in the construction sequence. If the Contractor elects a partial impoundment drawdown, there may not be a temporary bypass channel through the construction area for 2 – 5 days during the active drawdown and fish passage may be delayed during this portion of Phase 1. As described in Section 6.1.4.3, peak Atlantic salmon migration at the Cherryfield dam is early June through early July. Therefore, in-water work is not expected to delay the primary passage window for adults.

After completion of Phase 1, if the impoundment was drawn down, the impoundment will be allowed to refill, during which, fish passage is interrupted. The refill is necessary to ensure that enough water is available to create a fish bypass channel for the remainder of the project along the previously constructed portion of the nature-like fishway. During the refill period, there may not be a passable channel through the construction area for a period of 2 – 5 days, and fish passage may be delayed during this phase of the project. While refill occurs, the Contractor shall provide at least 10 cfs of river flow through the project site to maintain downstream riverine habitat.

Figure 30 shows modelled depth of flow of the existing site conditions at the downstream reach of the project site with 50 cfs of flow in the channel. This flow represents the 80% Exceedance flow for the month of September. This is representative of typical base flow in the Narraguagus River during the summer, a natural condition of the river that may occur every year. There are 2 large pools present downstream of the dam with maximum depths of 7.8 feet and 5.0 feet. Further downstream, the model shows depth of flow that is limited to approximately 1.0 feet deep. Additionally upstream of the pools and downstream of the dam, there are areas where depths are lower, and not optimal for fish passage. Under these typical existing conditions, while there are large pools present for fish to hold, there is limited depth of flow to support fish passage through the lower project reach.

Figure 31 shows modelled depth of flow of the existing site conditions at the downstream reach of the project site with 10 cfs of flow in the channel. This flow is the minimum flow the contractor must allow downstream of the project site in the event of an impoundment refill period. The 2 existing large pools are still present downstream of the project with minor reductions in overall depth (7.2 feet and 4.4 feet respectively). This suggests the despite the reduction of flow, the holding areas for fish in the river are still present and will function similarly under reduced flow. In this scenario, depth of flow along areas downstream of the 2 holding pools is further reduced from approximately 1.0 feet in the 50cfs scenario to approximately 0.7 feet. This reduction further limits passage potential along the downstream project reach, however the passage potential in this reach is already anticipated to be minimal based on communications with knowledgeable staff (see Section 7.1.5.1) and hydraulic modelling of typical existing conditions.

Passage will be provided via an unobstructed flow channel throughout the remainder of the project.

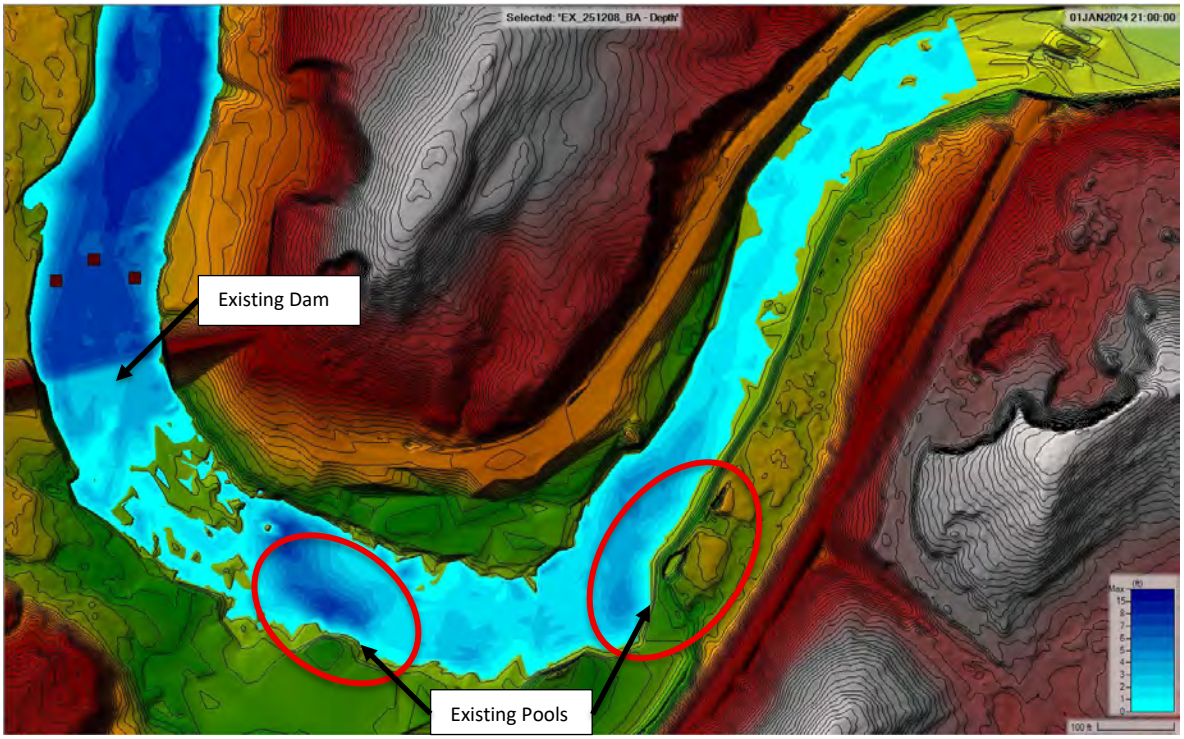


Figure 30: Existing conditions water depth downstream at the project site at 50cfs. Existing maximum pool depths of 7.8ft and 5.0ft

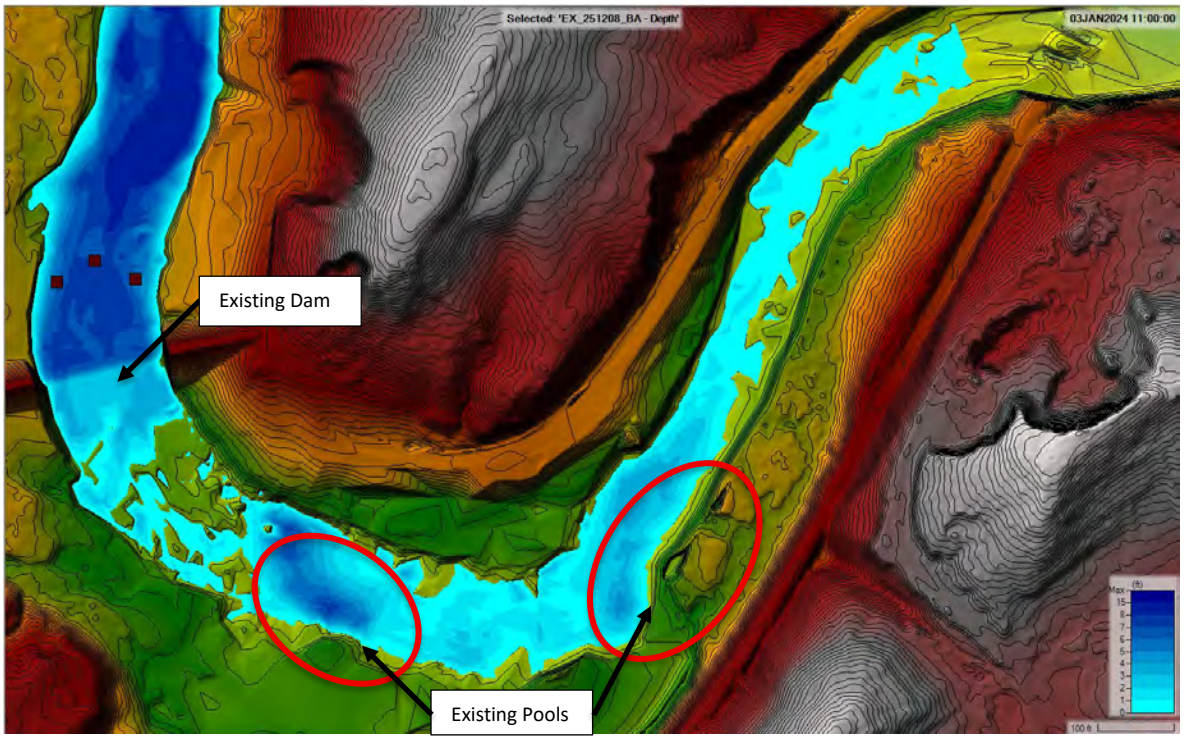


Figure 31: Existing conditions water depth downstream at the project site at 10cfs. Existing maximum pool depths of 7.2ft and 4.4ft

7.1.5.1 Species Determinations

In the current condition, fish passage is consistently delayed at the project site during low flows. The existing Denil fishway at the Cherryfield Ice Dam has many deficiencies and is especially inadequate at passing critically endangered Atlantic salmon attempting to access critical upstream habitat in the Narraguagus River watershed. Poor attraction flows, narrow orientation of entrance, and steep slope limit upstream passage for fish, in particular during periods of low flow commonly experienced during the summer months. Under typical summer flows, Atlantic salmon typically do not migrate upstream and have difficulty passing through the existing denil fishway (personal communication with Colby Bruchs, MDMR, December 2025). Hydraulic modelling shown above in Figure 30 corroborates difficult passage conditions downstream of the existing dam. Although fish passage is estimated to be delayed for up to 12 days throughout the course of the project (approximately 13% of the total 92 days in the approved work window), the delay will occur during the approved low flow in-water work window between July 15 – October 14, when Atlantic salmon are unlikely to be present in the action area. The delay will also occur during a time window in which fish already experience consistent delays migrating through the project site in the current condition due to inefficiency of the existing Denil fishway. Sturgeon are unlikely to be present in the action area. Additionally, the proposed action to replace the Cherryfield Ice Dam with a channel-spanning nature-like fishway is expected to permanently improve migration and passage at the site compared to the current condition. Additionally, the project is committed to employing a stranding protocol

during the drawdown, subsequent refill, and during times the river right or river left are isolated (referred to under Phase 1 and 2 in the construction sequence) between July 15 through August. See Section 4.2 for details on the stranding protocol. These BMPs will mitigate the potentially effects to adult Atlantic salmon.

The effect of the proposed activity to fish passage is minimal during the project period and as a result of the project, fish passage upstream and downstream will be improved.

7.1.5.2 Critical Habitat Determinations

The existing dam and Denil fishway is an existing physical barrier that currently impacts the function of migratory critical habitat within the action area. The dam has limited fish passage and delays upstream movement, especially during low flows. The dam and associated impoundment limit the essential features required for migration critical habitat by warmer temperatures, lower dissolved oxygen, less native fish abundance, and a reduced natural flow regime. Although migratory critical habitat may be delayed by 12 days during construction if a partial impoundment drawdown occurs, it is unlikely that this delay exceeds current migration delays at the dam site during low flows. Furthermore, the impoundment refill is necessary to ensure that enough flow exists in the channel to provide an unobstructed flow channel throughout the project area for the remaining duration of the project. The Contractor is required to minimally provide flow of 10 CFS to downstream areas during the period of impoundment refill to avoid any impacts to critical rearing habitat or river conditions downstream. Additionally, approved stranding protocol (See Section 4.2) will be in place to mitigate the effects of possible fish stranding for the duration of the project. Figure 30 and Figure 31 suggest that during periods of restricted flow, or periods of low flow, there will generally be good connectivity to primary channel flow. During periods of work area isolation, and differing flow paths around the construction site, the pools downstream of the construction zones act to reset the natural distribution of flow, preventing large area of the river from drying out during normal construction operations. Therefore, the impacts to critical habitat caused by the impoundment drawdown, flow diversion, and refill during construction are temporary and anticipated to be discountable. The proposed action is expected to permanently improve migration critical habitat at the site compared to the current condition.

7.1.6 Permanent Modification to Critical Habitat

Dam demolition and construction of the nature-like fishway will result in permanent impacts to the project area. The dam will be removed and replaced with a channel-spanning nature-like fishway that maintains similar permanent upstream elevations as the current condition, with a nominal lowering of these elevations during extremely low flow periods (Haberstock, 2025). Construction of the nature-like fishway involves permanent impacts to 1.67 acres of wetland habitat and surveyed rearing habitat within the immediate project area (Figure 32) including the addition of 7,460 cubic yards of permanent fill in the primary river channel. The surveyed rearing habitat within the red, permanent impacts zone in Figure 32, will be the only critical habitat directly impacted as it is within the footprint of the proposed nature-like fishway (***Table 12***).

Table 12. *Estimated quantities of sensitive and critical habitat and associated direct permanent impacts by nature-like fishway construction within the permanent action area.*

Wetland Type	**Area (Acres)**	**Direct Impacts (Acres)**
R2UBH	4.27	1.16
Habitat Type	**# of Habitat Units**	**Direct Impacts (# Habitat Units)**
Critical rearing habitat	.7	.7

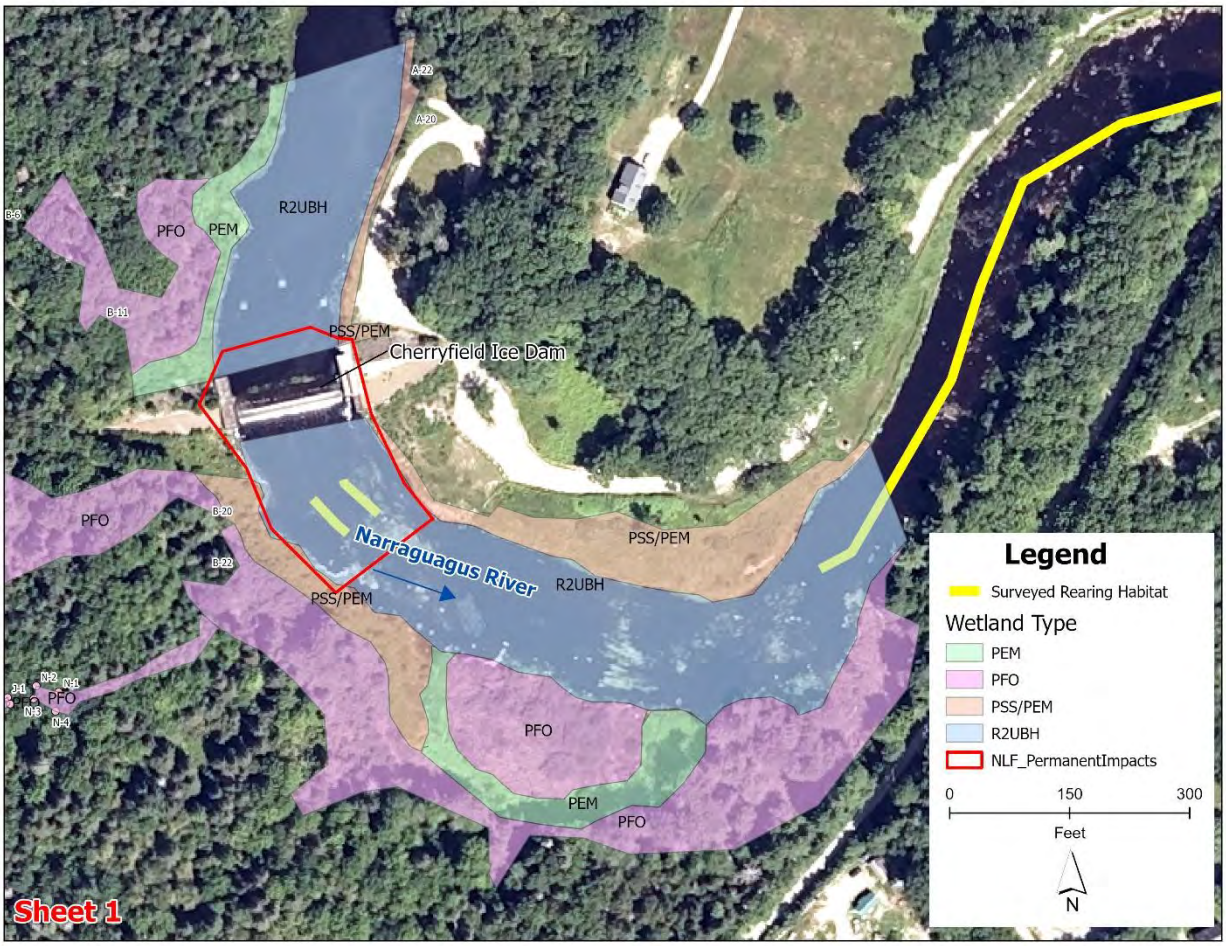


Figure 32. Map of the permanent action area of the proposed nature-like fishway outlined in red, critical habitat, and wetland habitat.

nature-like fishway construction includes the placement of a permanent channel-spanning controlling weir at the fishway crest. The controlling weir contains a sheet pile cutoff established to prevent water from traveling through interstitial spaces in the nature-like fishway, especially during low flows. The sheet pile cut off will supplement the engineered and placed substrate to promote surficial flow through the nature-like fishway. Although not its primary function, the sheet pile

cutoff will also help prevent seepage around the nature-like fishway. It will be embedded 4 feet vertically into the river bed, and 8 feet horizontally into each embankment. This will likely create permanent impacts to hyporheic flow at the project site, although the existing spillway and dam likely already impact hyporheic flow in the current condition.

The nature-like fishway will also include placement of rock fill in the river channel to construct a primary and secondary/low flow channel as described in previous sections. The rock fill will be placed directly over .8 mapped units of critical rearing habitat and permanently impact the habitat.

7.1.6.1 Species Determinations

During demolition and construction between July 15 and October 14, juvenile salmon are unlikely to be present given the time of year with warmer water temperatures, a low likelihood of juveniles present, and general lack of preferred habitat as described above. The mapped critical rearing habitat within the permanent action area serves limited function, as discussed in subsequent sections. The likelihood of encountering any juvenile Atlantic salmon in the mapped rearing habitat during nature-like fishway construction is therefore unlikely. The likelihood of encountering adult Atlantic salmon in the action area is also unlikely due to the time of year, warm water temperatures, and lack of suitable habitat. While unlikely, there may be some juvenile or adult salmon in the action area that need to be removed over the duration of the project. These individuals would be exposed to electrofishing and subsequent handling while being captured for removal from inside the cofferdam. Daily observations will be made to ensure no juveniles or adults are in the action area during construction and therefore, none will be exposed to the effects of the construction. Sturgeon are extremely unlikely to be present in the action area as discussed above and impacts to these species are expected to be discountable.

The placement of the fishway is expected to overall improve the chance of recovery for the species, since the nature-like fishway will improve fish passage and increase adult escapement to the drainage.

7.1.6.2 Critical Habitat Determinations

Construction of the nature-like fishway includes permanent direct impacts to approximately 1.16 acres of riverine habitat at the project site and .8 habitat units of critical rearing habitat mapped within the permanent project footprint. The critical rearing habitat in the action area does not currently function properly for spawning, rearing, or migration due to the dam itself and high-water temperatures during the summer upstream and downstream of the dam. However, within the action area, the PCEs for Atlantic salmon include limited migratory habitat and limited habitat for spawning and rearing downstream of the dam. Construction of the nature-like fishway may temporarily degrade Atlantic salmon critical habitat as a result of clearing, excavating, and grading, filling, or other construction activities. Additionally, these activities could temporarily degrade water quality by increasing turbidity and siltation, potentially altering spawning and rearing habitat. Following completion of the project, the downstream critical rearing habitat PCEs will remain and the project is expected to improve critical migratory habitat. However, the

approximately .8 units of critical rearing habitat within the permanent action area will be adversely impacted and will be converted to migratory critical habitat following project completion. The critical rearing habitat will be adversely impacted, though construction of the nature-like fishway will facilitate passage to an addition 5,700 critical habitat rearing units upstream.

8. Conclusions

By using the proposed BMPs, limiting construction activities to the immediate vicinity of the dam, interrupting passage at the site for no more than five days during the in-water work window, maintaining unobstructed passage through the work area throughout the remainder of the project, and working within a low flow summer work window throughout the entire course of the project, most project activities should result in insignificant impact to Atlantic salmon critical habitat. Following construction, the nature-like fishway will improve connectivity and improve timely migration and access to 5,197 critical habitat units for spawning, incubation, and rearing above the dam. These features are essential to the conservation and recovery of the species. Additionally, the nature-like fishway will improve timely migration and access to approximately 515 total miles of river habitat above the dam, resulting in an overall net benefit to the species.

8.1 SPECIES & CRITICAL HABITAT CONCLUSIONS

Downeast Salmon Federation has analyzed the effects of the Cherryfield Ice Dam Fish Passage Project on the endangered shortnose sturgeon, threatened GOM DPS of Atlantic sturgeon, endangered GOM DPS Atlantic salmon, and designated critical habitat for the GOM DPS Atlantic salmon. DSF certifies that the effects analysis used the best scientific and commercial data available.

DSF proposes that, when added to baseline conditions, effects from the stressors including in-water work, construction of the nature-like fishway, underwater noise, cofferdam entrapment, and sedimentation and turbidity are either insignificant or unlikely to occur (Table 13). The project, as proposed, is **not likely to adversely affect Atlantic sturgeon or shortnose sturgeon.** The project **is likely to adversely affect, Atlantic salmon.** In addition, the nature-like fishway construction is **likely to adversely affect designated critical rearing habitat for Atlantic salmon** and is **likely to adversely affect critical migratory habitat within the action area**. The nature-like fishway will provide an overall net benefit to the species by improving migratory critical habitat and increasing adult escapement to the watershed.

Table 13. Summary of effect determinations for endangered species and their critical habitats in the action area for the Cherryfield Fish Passage Project.

Species	**Life Stage or Habitat**	**Turbidity and Sedimentation**	**Cofferdam Entrapment**	**Noise**	**Spills**	**Passage**	**Permanent Modification to Critical Habitat**
Atlantic salmon	Adult	Discountable	May affect	Insignificant	Discountable	May affect	Discountable
Atlantic salmon	Eggs	Discountable	Insignificant	Discountable	Discountable	NA	Discountable
Atlantic salmon	Fry	Discountable	Insignificant	Discountable	Discountable	NA	Discountable
Atlantic salmon	Parr	Discountable	Insignificant	Discountable	Discountable	Discountable	May affect
Atlantic salmon	Smolt	Discountable	May affect	Discountable	Discountable	Discountable	Discountable
Atlantic sturgeon	all	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Shortnose sturgeon	all	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant

Table 14. Summary of critical habitat effects in the action area on each PBF.

PBF	Description	Existing Function of the PBF in the action area	Effects of the action
Spawning and rearing 1 (SR1)	Deep, oxygenated pools and cover (e.g., boulders, woody debris, vegetation, etc.), near freshwater spawning sites, necessary to support adult migrants during the summer while they await spawning in the fall.	Limited function	Maintain limited function
Spawning and rearing 2 (SR2)	Freshwater spawning sites that contain clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support spawning activity, egg incubation, and larval development.	Not present	N/A
Spawning and rearing 3 (SR3)	Freshwater spawning and rearing sites with clean, permeable gravel and cobble substrate with oxygenated water and cool water temperatures to support emergence, territorial development and feeding activities of Atlantic salmon fry.	Not present	N/A
Spawning and rearing 4 (SR4)	Freshwater rearing sites with space to accommodate growth and survival of Atlantic salmon parr.	Limited function	Maintain limited function
Spawning and rearing 5 (SR5)	Freshwater rearing sites with a combination of river, stream, and lake habitats that accommodate parr's ability to occupy many niches and maximize parr production.	Limited function	Maintain limited function
Spawning and rearing 6 (SR6)	Freshwater rearing sites with cool, oxygenated water to support growth and survival of Atlantic salmon parr.	Limited function	Maintain limited function
Spawning and rearing 7 (SR7)	Freshwater rearing sites with diverse food resources to support growth and survival of Atlantic salmon parr.	Limited function	Maintain limited function
Migration 1 (M1)	Freshwater and estuary migratory sites free from physical and biological barriers that delay or prevent access of adult salmon seeking spawning grounds needed to support recovered populations.	Not properly functioning with Denil fishway/dam causes delay	Fully functional

Migration 2 (M2)	Freshwater and estuary migration sites with pool, lake, and in-stream habitat that provide cool, oxygenated water and cover items (e.g., boulders, woody debris, and vegetation) to serve as temporary holding and resting areas during upstream migration of adult salmon.	Limited function	No change
Migration 3 (M3)	Freshwater and estuary migration sites with abundant, diverse native fish communities to serve as a protective buffer against predation.	Limited function	No change
Migration 4 (M4)	Freshwater and estuary migration sites free from physical and biological barriers that delay or prevent emigration of smolts to the marine environment	Not properly functioning	Fully functional
Migration 5 (M5)	Freshwater and estuary migration sites with sufficiently cool water temperatures and water flows that coincide with diurnal cues to stimulate smolt migration.	Limited function	No change
Migration 6 (M6)	Freshwater migration sites with water chemistry needed to support sea water adaptation of smolts.	Not present	N/A

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Appendix A: Water Temperature Data

Washington County, Maine Hydrologic Unit Code 01050002 Latitude 44°36'29", Longitude 67°56'07" NAD83 Drainage area 227 square miles Contributing drainage area 227 square miles Gage datum 43.89 feet above NAVD88	**Output formats** HTML table of all data Tab-separated data Reselect output format

00010, Temperature, water, degrees Celsius,												
Day of month	**Mean of daily mean values for each day for water year of record in, deg C (Calculation Period 1977-10-01 -> 2015-09-30)**											
	Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	0.1	0.	0.2	3.2	10.2	17.1	20.6	22.9	20.4	14.3	7.1	2.1
2	0.1	0.	0.3	3.2	10.3	17.3	20.6	22.8	20.3	14.5	6.9	2.1
3	0.1	0.	0.2	3.2	10.7	16.8	21.2	22.8	20.2	14.3	6.5	2
4	0.	0.1	0.2	3.4	11.2	16.4	21.8	22.8	20.2	14	6.3	1.9
5	0.	0.1	0.2	3.4	11.5	16.5	21.7	22.9	20.1	13.8	6.5	1.7
6	0.	0.1	0.3	3.4	12.1	16.9	21.4	22.7	19.8	13.4	6.4	1.8
7	0.	0.1	0.3	3.4	12.8	17.2	21.8	22.4	19.6	13.2	6.3	1.7
8	0.	0.	0.4	3.7	13.1	17.4	22.3	22.2	19.4	12.8	6.2	1.3
9	0.	0.	0.5	4.1	13	17.4	22.2	22.3	19.1	11.9	5.8	0.8
10	0.	0.	0.5	4.5	13	17.8	22.1	22.4	18.8	11.2	5.8	0.7
11	0.1	0.	0.7	4.9	13.4	18.3	22.4	21.9	17.9	10.9	5.7	0.7
12	0.1	0.	0.8	5.2	13.8	18.5	22.8	21.6	17.5	10.6	5.4	0.6
13	0.1	0.	1	5.3	13.8	18.5	23	21.2	17.4	10.4	5	0.7
14	0.1	0.	0.9	5.7	13.7	18.3	23	20.9	17.6	10.2	4.8	0.8
15	0.1	0.	0.6	6.1	13.7	17.8	22.9	20.8	17.6	10.5	4.5	0.7
16	0.1	0.	0.6	5.9	13.9	17.9	22.9	20.9	17.4	10.7	4.2	0.7
17	0.1	0.	0.6	6.1	13.7	18.7	22.9	20.8	17.3	10.6	4.2	0.6
18	0.1	0.	0.9	6.6	13.7	19.3	23.3	21.1	17.2	10.5	4.3	0.3
19	0.1	0.	1.1	7.2	13.9	19.3	23.5	21.2	16.7	10.3	3.6	0.2
20	0.1	0.1	1	7.4	14.6	19.4	23.6	21.1	16.1	10.2	2.9	0.2
21	0.1	0.1	1.3	7.4	14.9	19.6	23.6	21.1	15.9	10.1	2.6	0.3
22	0.1	0.1	1.8	7.5	14.8	19.5	23.6	21.1	15.8	9.9	2.3	0.5
23	0.	0.1	2.1	7.6	14.7	19.4	23.5	21.3	15.7	9.7	2.5	0.4
24	0.1	0.1	2.4	7.8	14.8	19.5	23	21	15.3	9.4	2.4	0.3
25	0.1	0.2	2.2	8.1	15.1	19.5	22.5	20.6	15.1	8.9	2.6	0.4
26	0.1	0.2	2.1	8.7	15.4	19.5	22.2	20.6	14.9	8.7	2.2	0.4
27	0.1	0.2	2	9.2	16.2	19.3	22	20.6	14.9	8.7	2	0.3
28	0.	0.1	2	9.1	16.9	20	22	20.6	14.9	8.4	2.2	0.3
29	0.1	0.2	2.4	9.3	17	20.3	22.1	20.4	14.5	8.1	2.1	0.3
30	0.1		3	9.9	17.2	20.6	22.3	20.4	14.1	7.6	1.9	0.1
31	0.1		3.2		17.6		22.6	20.4		7.2		0.

Figure A 1. Average daily stream temperature below the Cherryfield Dam at USGS gauge site (1977 - 2015). Source: USGS.

Washington County, Maine Hydrologic Unit Code 01050002 Latitude 44°36'29", Longitude 67°56'07" NAD83 Drainage area 227 square miles Contributing drainage area 227 square miles Gage datum 43.89 feet above NAVD88	**Output formats** HTML table of all data Tab-separated data Reselect output format

00010, Temperature, water, degrees Celsius,												
Day of month	Maximum of daily mean values for each day for water year of record in, deg C (Calculation Period 1977-10-01 -> 2015-09-30)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.4	0.2	1.6	8.7	14.0	20.9	23.9	24.4	22.4	18.5	12.2	5.9
2	1.0	0.2	2.0	9.0	14.4	21.7	25.2	24.7	22.6	18.2	10.9	6.3
3	0.5	0.3	1.8	8.6	14.5	21.7	25.9	25.3	22.7	16.3	11.0	4.8
4	0.4	0.9	0.9	8.3	14.9	20.3	26.1	25.2	22.2	15.8	10.5	3.7
5	0.4	1.3	1.1	7.1	14.9	19.5	24.8	24.7	22.1	16.4	9.4	4.0
6	0.4	1.1	1.8	6.4	15.2	19.7	26.5	25.0	22.1	17.0	9.3	4.9
7	0.4	0.6	2.1	6.0	16.2	19.2	26.8	25.0	22.2	17.8	8.3	5.6
8	0.4	0.2	2.0	6.3	17.8	19.5	26.4	24.9	22.7	17.5	7.6	4.8
9	0.4	0.2	2.0	8.1	18.3	21.0	24.4	24.9	22.6	13.7	7.7	3.3
10	0.4	0.1	2.4	9.1	17.4	22.0	24.4	25.0	22.9	14.3	8.0	3.7
11	0.4	0.1	3.1	8.4	17.1	21.6	24.7	25.3	21.7	14.2	8.7	2.5
12	0.4	0.0	3.2	8.9	15.5	22.0	24.7	24.7	20.0	13.0	7.6	1.6
13	0.4	0.1	3.0	9.3	15.1	22.6	25.1	24.6	19.5	12.3	6.9	2.0
14	0.8	0.1	2.8	9.7	14.9	21.9	25.0	24.2	19.5	12.7	6.8	3.9
15	0.6	0.1	2.0	10.7	15.3	21.3	25.8	24.8	19.9	13.9	8.1	2.6
16	0.4	0.1	1.6	12.1	15.6	20.0	26.7	23.9	20.1	13.5	7.8	3.1
17	0.4	0.2	2.5	13.3	16.2	21.2	26.7	24.5	21.0	15.0	7.7	2.4
18	0.4	0.3	3.9	14.0	16.1	21.6	26.6	25.0	21.4	15.3	7.5	1.6
19	0.5	0.1	4.7	13.7	16.0	20.5	26.4	25.1	21.4	14.4	5.8	1.2
20	0.5	0.2	5.0	13.9	17.5	20.5	26.7	25.0	21.2	12.5	5.2	0.9
21	1.0	0.2	5.9	13.6	18.6	22.3	26.6	24.6	20.1	12.7	5.4	1.2
22	0.5	0.2	7.1	12.1	18.9	23.5	26.0	24.1	18.7	12.0	5.8	2.2
23	0.4	0.3	7.8	10.7	19.0	22.7	26.5	24.1	18.4	11.6	6.6	1.2
24	0.4	0.3	6.5	10.6	19.1	21.4	26.2	24.4	17.8	12.6	5.4	1.7
25	0.6	1.0	5.2	10.1	18.2	23.4	25.3	24.2	18.4	11.9	6.4	3.3
26	0.6	1.4	4.7	10.4	18.2	24.0	24.0	23.0	19.3	10.7	6.7	3.3
27	0.4	1.6	4.9	10.9	19.2	23.6	24.0	22.9	19.4	10.6	7.5	2.3
28	0.4	0.8	5.8	11.7	20.7	22.9	24.4	22.9	18.5	11.7	6.6	2.4
29	0.4	0.4	6.5	12.5	21.7	23.4	24.4	22.4	17.5	11.2	5.6	2.3
30	0.4		7.3	13.3	22.3	23.9	24.0	22.0	17.4	11.9	6.0	0.6
31	0.3		8.3		22.6		24.3	22.2		13.1		0.4

Figure A 2. Average maximum daily stream temperature below Cherryfield Dam at USGS gauge site (1977-2015). Source: USGS.

Appendix B. 100% Design Drawings

See attached sheets 1 – 45, dated November 2025 and entitled “Cherryfield Ice Dam Fish Passage Project”



Cherryfield Ice Dam Fish Passage Project
100% Design Report

SUBMITTED TO

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November 2025

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1. Introduction

The Narraguagus River flows approximately 50 miles from its headwaters at Eagle Lake to Milbridge, Maine, where it drains into Narraguagus Bay. Approximately one mile north of the Town of Cherryfield stands the Cherryfield Ice Dam, owned by the Town, which is the last remaining dam on the mainstem Narraguagus River (Figure 1). The Cherryfield Ice Dam was built in 1961 and is intended to mitigate ice jam-related flooding in Cherryfield, a consistent challenge for the Town of Cherryfield, recorded since the 1800's. The Cherryfield Ice Dam consists of five main components including an earthen embankment, a primary spillway, two sluiceways, a Denil type fishway, and ice retention piers and was built on the site of the Stillwater Dam, which was originally built in 1836, but was destroyed by ice jam floods in 1936 and 1942. The dam impedes passage to an estimated 515 total miles of river habitat in the watershed, including 47 miles in the mainstem channel to the outlet at Eagle Lake, and an additional 25 miles in the West Branch tributary. Both channels contain documented and modeled Atlantic Salmon spawning and rearing habitat. The dam also impedes access to 2,609 acres of Alewife spawning habitat (Myrick Pond, Bog Brook Flowage; Schoodic, Spruce Mountain, West Beddington, Narraguagus and Eagle Lakes).

The existing Denil fishway at the Cherryfield Ice Dam, while providing nominal upstream passage for various species, has many deficiencies and is especially inadequate at passing critically endangered Atlantic Salmon attempting to access critical upstream habitat in the Narraguagus River watershed. While efficiency of the existing fishway remains unknown, poor attraction flows, narrow orientation of entrance, and steep slope likely combine to limit upstream passage for fish under a range of flow conditions.

The United States Army Corps of Engineering (USACE) and the Cold Regions Research & Engineering Lab (CRREL) completed a feasibility study in 2023 to evaluate alternatives to improve fish passage while maintaining the dam's original purpose of mitigating ice-related flooding. Through this analysis, a channel-spanning, nature-like fishway was chosen as the preferred alternative. However, the rough order of magnitude cost estimate for the fishway exceeded the maximum limit allowed by the study authority (Section 1135), and the project was therefore terminated (USACE, 2023).

In 2023, the town of Cherryfield voted unanimously to deauthorize the dam from USACE jurisdiction and improve fish passage at the dam through construction of a channel-spanning nature-like fishway. Following the vote, the dam was deauthorized by an act of Congress through the 2024 Water Resources Development Act (WRDA) bill.

Inter-Fluve completed the preliminary (30%) designs for replacing the Cherryfield Ice Dam with a nature-like fishway in August 2024, updated the designs to 60% level in April 2025 and 90% level in August 2025, and finalized project design (100%) in October 2025. The purpose of this report and the accompanying 100% design plans, is to expand previous submittals to and progress designs and cost estimates to the present 100% design level.

This project is being led by the Downeast Salmon Federation (DSF), and is supported by a diverse, multidisciplinary team of project partners which include:

- The Town of Cherryfield
- The National Oceanic and Atmospheric Administration (NOAA)
- The Nature Conservancy (TNC)
- The Atlantic Salmon Federation (ASF)
- Maine Coast Heritage Trust (MCHT)
- Maine Department of Marine Resources (MDMR)

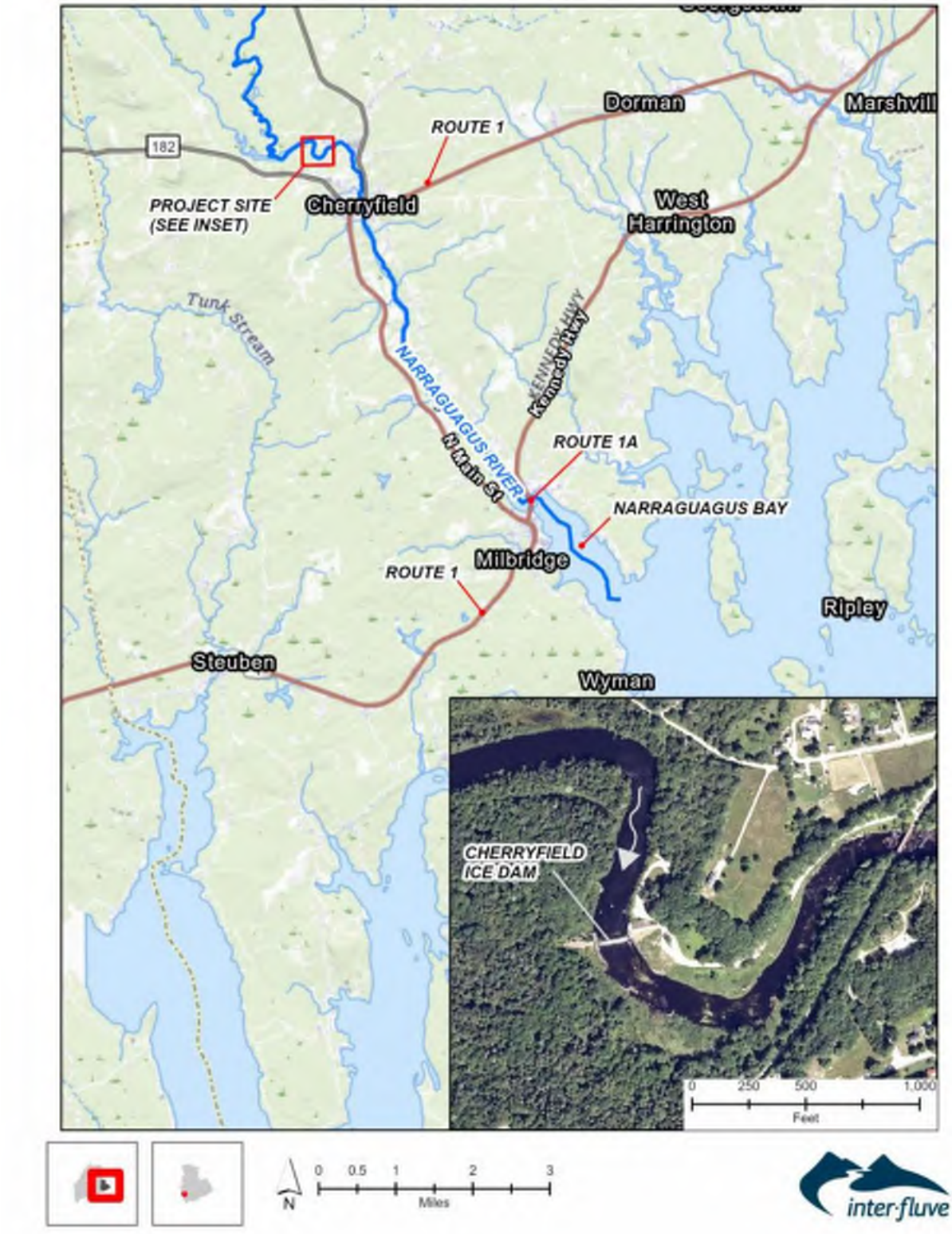


Figure 1: Project Overview Map.

1.1 PROJECT GOALS AND OBJECTIVES

The Town of Cherryfield and project partners developed project goals and objectives to help guide the alternatives analysis, project selection, and detailed design. The project goals and objectives were developed over the course of many years, and finalized for this project in February of 2024. The primary goal of the project is to modify the Cherryfield Ice Dam to provide volitional upstream passage for native sea-run and resident fish species on the Narraguagus River, while continuing to mitigate ice-related flooding downstream. The key project objectives include:

- Providing optimized fish passage by means of a bank-to-bank nature-like fishway for native sea-run fish, especially critically endangered Atlantic Salmon, Alewife, and American Shad.
- Maintaining or mimicking structures that mitigate ice jam related flooding
- Maintaining seasonal impoundment elevations
- Maintaining the Town's alewife harvest
- Improving public use facilities at the Project Site

2. Site History

For generations, the Narraguagus River has held deep cultural and economic importance for the Wabanaki Nations, including the Passamaquoddy Tribe, who rely on its abundant diadromous fish and other natural resources for sustenance and cultural practices along the Maine coast. Prior to European settlement, diadromous fish runs, as well as native wildlife and flora, were central to the lifestyles of Indigenous peoples in the region. Over time, the increasing presence of settlers profoundly impacted the Passamaquoddy Tribe's land and resources.

In 1757, European settlers, Ichabod Willey and Samuel Colson, arrived in the region, calling it "Narraguagus," an Abenaki word meaning "above the boggy place." Cherryfield was officially incorporated in 1816 in Washington County and later annexed land from nearby Steuben in 1826 and Columbia in 1881.

The history and early success of Cherryfield was due, primarily, to the availability of natural resources, which, in addition to timber, included wild blueberries and Atlantic Salmon (Mitchell, 1905). These resources drove successful lumber, shipbuilding, farming, and fishing industries. In the late 1800s, between 12 to 15 million board feet of lumber were shipped annually from Cherryfield (Varney, 1881).

Historically, many dams were built along the Narraguagus River, controlling flows for the various industries located in the town. A profile of the Narraguagus River from the 1960 USACE report shows five dams along the reach of the river from the confluence of the West Branch and the Main Stem of the Narraguagus River to the head of tide and the route 1 bridge in Cherryfield (Figure 2).

The present-day Cherryfield Ice Dam (also known as the Cherryfield Ice Dam Local Protection Project, or LPP) was constructed in 1961 by the USACE under Section 205 of the Continuing Authorities Program (USACE, 1960), in response to a series of ice jam-induced flooding events. Table 1 lists major ice jam floods prior to the construction of the current dam in 1961. Modeled after the Stillwater Dam, which was destroyed in 1942, the new dam was designed to mitigate ice jam flooding by stopping upstream breakup ice before it could reach the tidally influenced reach of the Narraguagus River (USACE, 1960). Historical imagery of the area captures changes to the river channel at the time the Stillwater Dam was washed out and after the construction of the Cherryfield Ice Dam (Figure 3, Figure 4, and Figure 5).

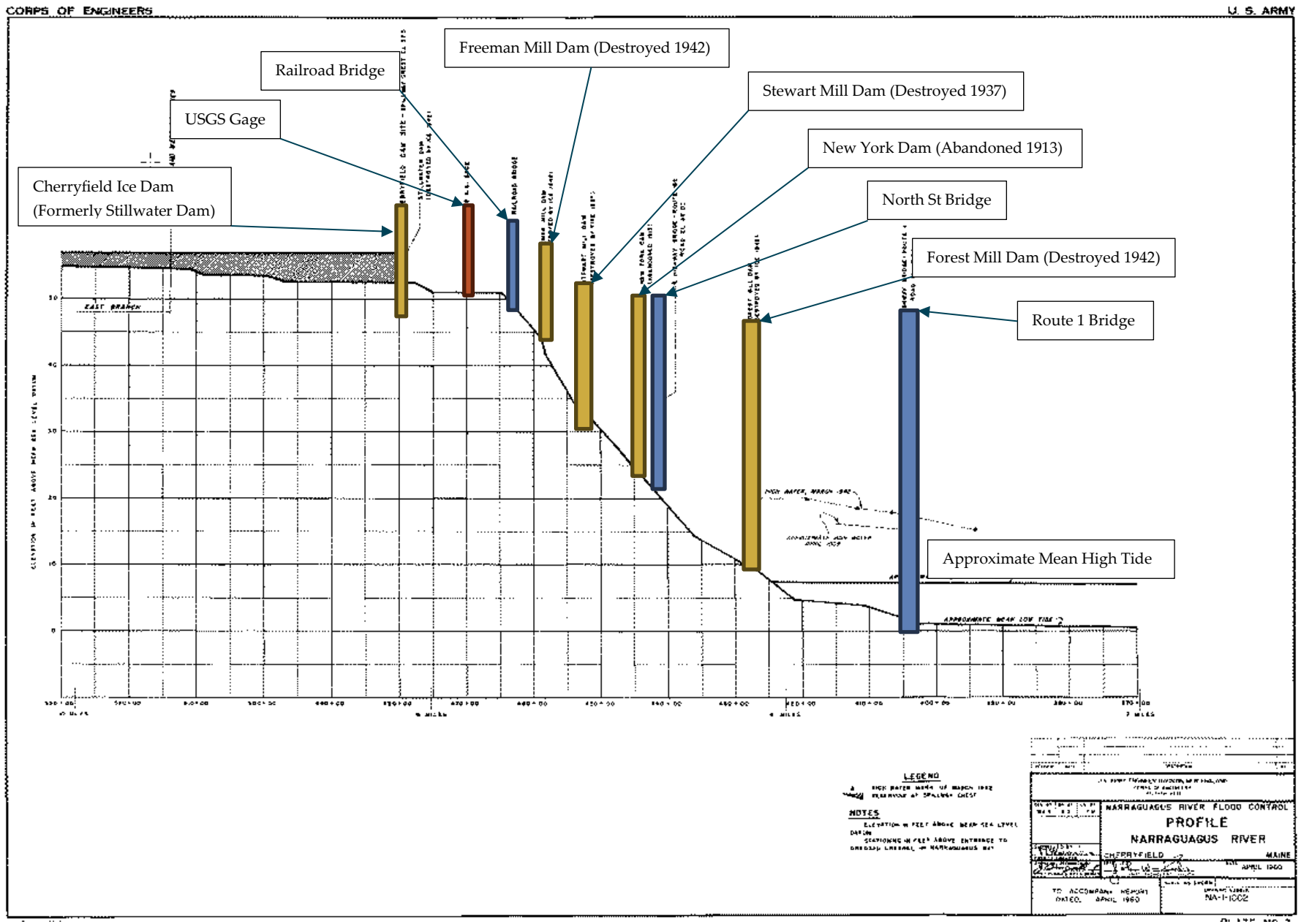


Figure 2: Profile of the Narraguagus River with locations of historic dams, and dates of destruction/abandonment (USACE, 1960) , Callouts by Inter-Fluve

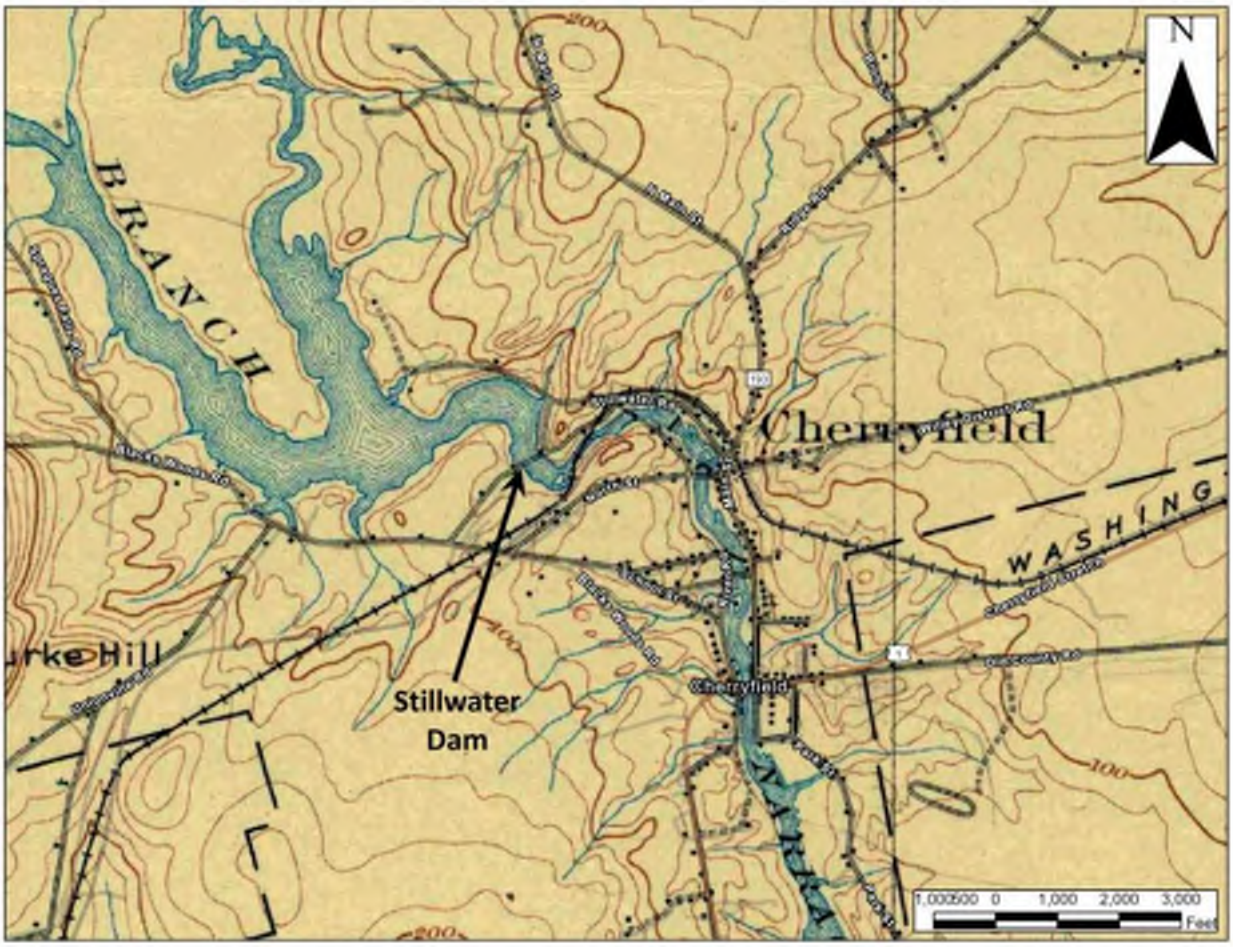


Figure 3: Cherryfield, Maine, 1902 USGS topographical map with Stillwater Dam upstream of the downtown area.

Table 1: Documented Ice Jam Flood Occurrences from CRREL's Ice Jam Database *(Rocks et al., 2021).*

Date	Estimated flow (cfs)	Experienced stage (ft MSL)	Likely type of Ice Jam	Remarks
March 1936	5000	14.5	Breakup	Stillwater Dam damage
March 1942	4600	17.7	Breakup	Stillwater Dam washed out
January 1945	N/A	10.0-11.0	N/A	Used dynamite
January 1949	3600	10.5	Breakup	
January 1951	3140	11.0	Unknown	
January 1953	5800	11.0	Unknown	
January 1954	6900	11.5	Unknown	
April 1959	6550	15.5	Breakup	
February 1968	1100	N/A	Breakup	Caused by break up of ice downstream of CD
December 1977	2650	13.3	Breakup	Ice jam reported at USGS 01022500 gage
March 2005	1720	N/A	Breakup	Ice jam at North Street Bridge caused by ice breakup downstream of Cherryfield Ice Dam.
March 2007	3970	13.7	Breakup	Ice jam caused by break up of ice located downstream of Cherryfield Ice Dam. Flooding reported along Patty Lane



Figure 4: Aerial Imagery from 1951. The red circle highlights the remaining material from the Stillwater dam that washed out in 1942.



Figure 5: Aerial Imagery from 1975 after construction of the Ice Dam in 1961 (circled in red).

3. Existing Conditions

3.1 NARRAGUAGUS RIVER

The Narraguagus River drains a 244-square-mile watershed that extends from its headwaters in Eagle Lake in Hancock County, ME, through the towns of Beddington and Deblois before winding through Cherryfield toward the coastal town of Milbridge and into Narraguagus Bay (Figure 6). Elevations within the watershed range from sea level to 1,378 feet (NAVD88). The region receives an average of 49.5 inches of precipitation annually (PRISM, 2024). Land cover is predominantly forested, with deciduous, coniferous, or mixed forest accounting for 69% of the watershed (Dewitz, 2019; Figure 6). Open water, including Beddington, Tunk, and Schoodic Lakes, along with smaller ponds, covers approximately five square miles (~2%), while wetlands make up about 16 square miles (~6.5%). The remaining area consists of headwater streams, fields, and limited developed space concentrated around Cherryfield and Milbridge.

The watershed is underlain by erosion-resistant Devonian-aged granites, with small occurrences of the Ordovician-Cambrian Penobscot Formation, composed of carbonaceous pelites, and the Bucksport Formation, and a Devonian-Ordovician gneiss (Osberg et al., 1985). This bedrock was scraped and molded during the last ice age by the Laurentide ice sheet (ending approximately 13,000 years ago). The ice sheet left behind thin and patchy deposits of glacial till and outwash that sit atop the bedrock. As a result, the Narraguagus, like many other rivers in the region, is bedrock controlled with limited sediment availability. Sediment inputs in the steeper headwaters are deposited in the watershed's many lakes and wetlands.

Widespread channel widening during the log drive era significantly altered the river’s morphology and exacerbated the sediment deficiency. Log drives, which persisted into the early 20th century, resulted in the removal of in-channel obstructions, including natural sediment storage features like large wood and boulders, leading to straightened and widened channels in many reaches. This historic modification further reduced sediment retention within the system, leaving the modern Narraguagus River largely starved of sediment. The combination of low sediment availability and simplified channels results in a static riverscape that has limited ability to evolve over time.

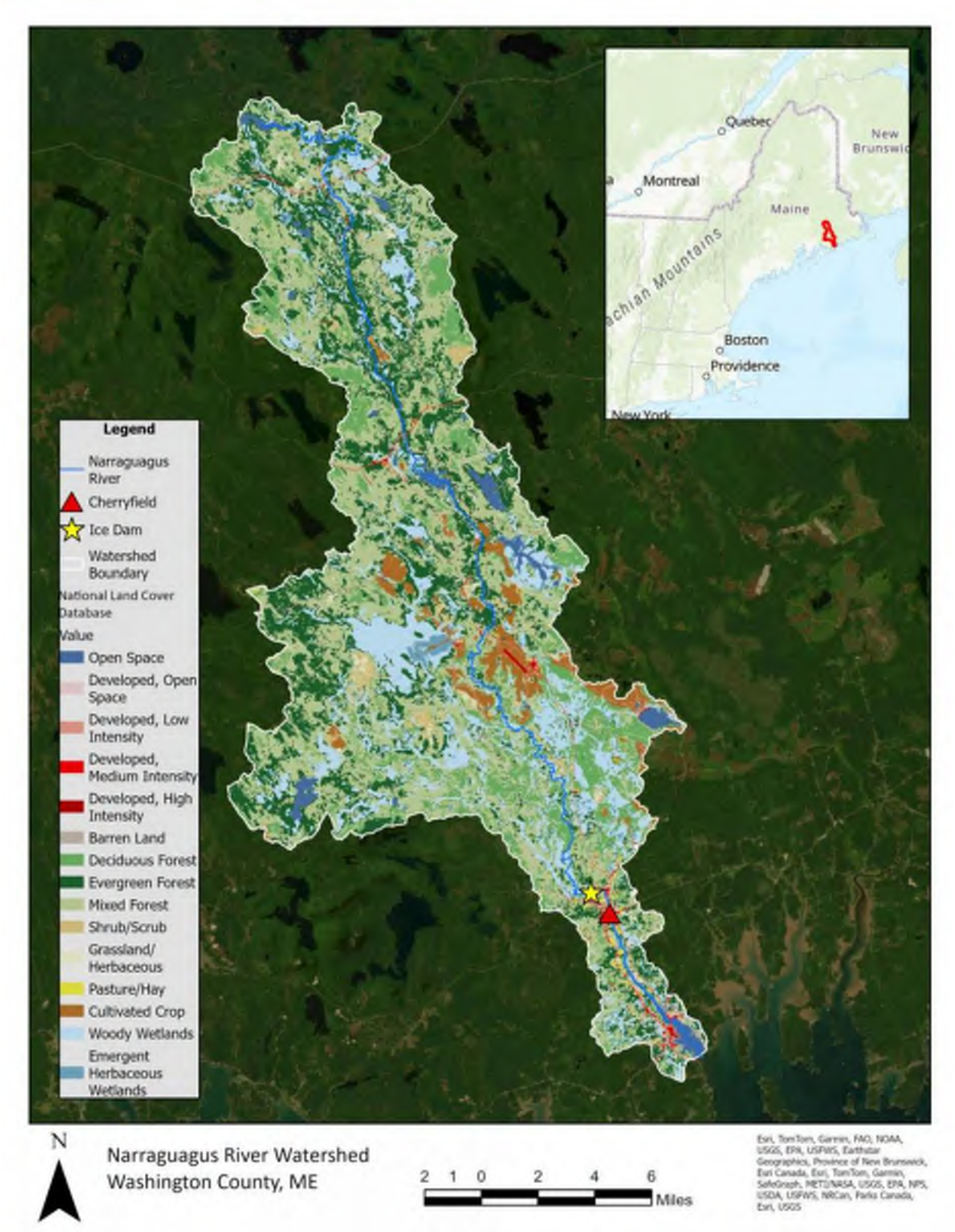


Figure 6: Narraguagus River Watershed Map with National Land Classification Data (NLCD) and locations of the Town of Cherryfield and the Ice Dam. Inset Map showing location of the watershed in New England.

3.2 FISHERIES OVERVIEW

The fish community of the Narraguagus River is typical of Downeast Maine rivers and comprises resident and migratory species (Table 2). The new fish passage structure will provide effective passage for resident and migratory species.

Table 2: List of fishes typical of the Narraguagus River, Maine.

Common Name	Family	Scientific Name	Native (N) or Introduced (I); Resident (R) or Migratory (M)
Sea Lamprey	Petromyzontidae	*Petromyzon marinus*	N/M
Shortnose Sturgeon*	Acipenseridae	*Acipenser brevirostrum*	N/M
American Eel	Anguillidae	*Anguilla rostrata*	N/M
American Shad	Clupeidae	*Alosa sapidissima*	N/M
Alewife	Clupeidae	*Alosa pseudoharengus*	N/M
Atlantic sturgeon*	Acipenseridae	*Acipenser oxyrinchus*	N/M
Blueback Herring	Clupeidae	*Alosa aestivalis*	N/M
Various minnow species	Cyprinidae	Minnow species	N/R
White Sucker	Catostomidae	*Catostomus commersonii*	N/R
Brown Bullhead	Ictaluridae	*Ameiurus sp.*	N/R
Rainbow smelt	Osmeridae	*Osmerus mordax*	N/M
Atlantic Salmon	Salmonidae	*Salmo salar*	N/M
Brown Trout	Salmonidae	*Salmo trutta*	I/R
Brook Trout	Salmonidae	*Salvelinus fontinalis*	N/R/M
Chain Pickerel	Esocidae	*Esox niger*	I/R
Ninespine Stickleback	Gasterosteidae	*Pungitius pungitius*	N/R
Striped Bass	Moronidae	*Morone saxatilis*	N/M
Various sunfishes/bass	Centrarchidae	Sunfish/bass species	I/R

*Species may enter the Narraguagus River from time to time but likely not to spawn.

Of primary focus for passage are the migratory species. Six taxonomic families comprise the suite of migratory fishes of the Narraguagus River that are most likely to utilize the upstream reaches of the river (Table 2). These six families include nine[1] anadromous[2] and one catadromous[3] species (together they are called diadromous[4]). All migratory species populations are managed by Maine Department of Marine Resources, and jointly managed by state and federal agencies. The Atlantic States Marine

[1] Includes sea lamprey, American shad, alewife, blueback herring, rainbow smelt, Atlantic salmon, striped bass, and sea-run Brook Trout and Brown Trout. Does not include Atlantic or Shortnose sturgeon (unlikely to utilize upstream reaches).
[2]Anadramous = breeding/reproducing in freshwater
[3]Catadramous = breeding/reproducing in salt water/marine
[4]Diadramous = life cycle includes presence in both fresh and salt water

Fisheries Commission, a joint organization of the 12 coastal states and Pennsylvania and the federal agencies, coordinates the management of species that move across state borders during migrations. Maine also includes various towns as co-managers of some migratory species when harvest by the town has been authorized by the state. Cherryfield is one such town that has harvest rights for Alewife.

Three endangered fish species may enter the Narraguagus River. Since two of them (Atlantic Sturgeon, Shortnose Sturgeon) are unlikely to move upriver to any significant extent, they are not considered as important with respect to fish passage design details for this 100% design. Atlantic Salmon is the third endangered species and one of great importance in the Narraguagus River; the proposed fish passage design will have elements specific to improving the passage for Atlantic Salmon.

Other key migratory species include the alosine species American Shad and Alewife. Currently Blueback Herring are not abundant in the Narraguagus River, however they may be present. Blueback Herring is a congener of Alewife (and American Shad) and similar morphometrically so passage that is suitable for Alewife will also pass Blueback Herring[2]. Passage numbers of American Shad to date have been low so improvement in shad passage is a key consideration for the new passage design. While Alewife have passed through the existing Denil fishway, the new passage design will likely be significantly more effective at passing herring.

American Eel is the sole catadromous species present in North America. As with the other migratory species, the new passage design should greatly improve the upstream movement of young eels as they seek rearing and feeding areas.

Considering all the migratory species in the river, the migration period spans much of a year from spring through fall (Figure 7). Although not included in this figure, the upstream migration of young catadromous American Eel typically occurs from spring through summer; emigration of adult American Eels that will spawn in that year occurs in fall and typically is initiated through a combination of decreasing river temperatures and increasing river flows, among other potential factors ((Haro et al., 2000)). Thus, fishway design features will consider a range of river flows to cover the full migration season, with particular focus on the peak adult immigration period for Atlantic Salmon, American Shad, and Alewife. All species of fish that utilize the Narraguagus River will have better access to reaches of the Narraguagus River drainage than afforded with the existing fish passage structure.

[2] 'River herring' is a common term used for both Alewife and Blueback Herring. To an untrained person, distinguishing between the two species can be difficult, particularly when both species are abundant in a given river. The migratory periods of these species overlap to some degree so in many rivers both species can be present at the same time.

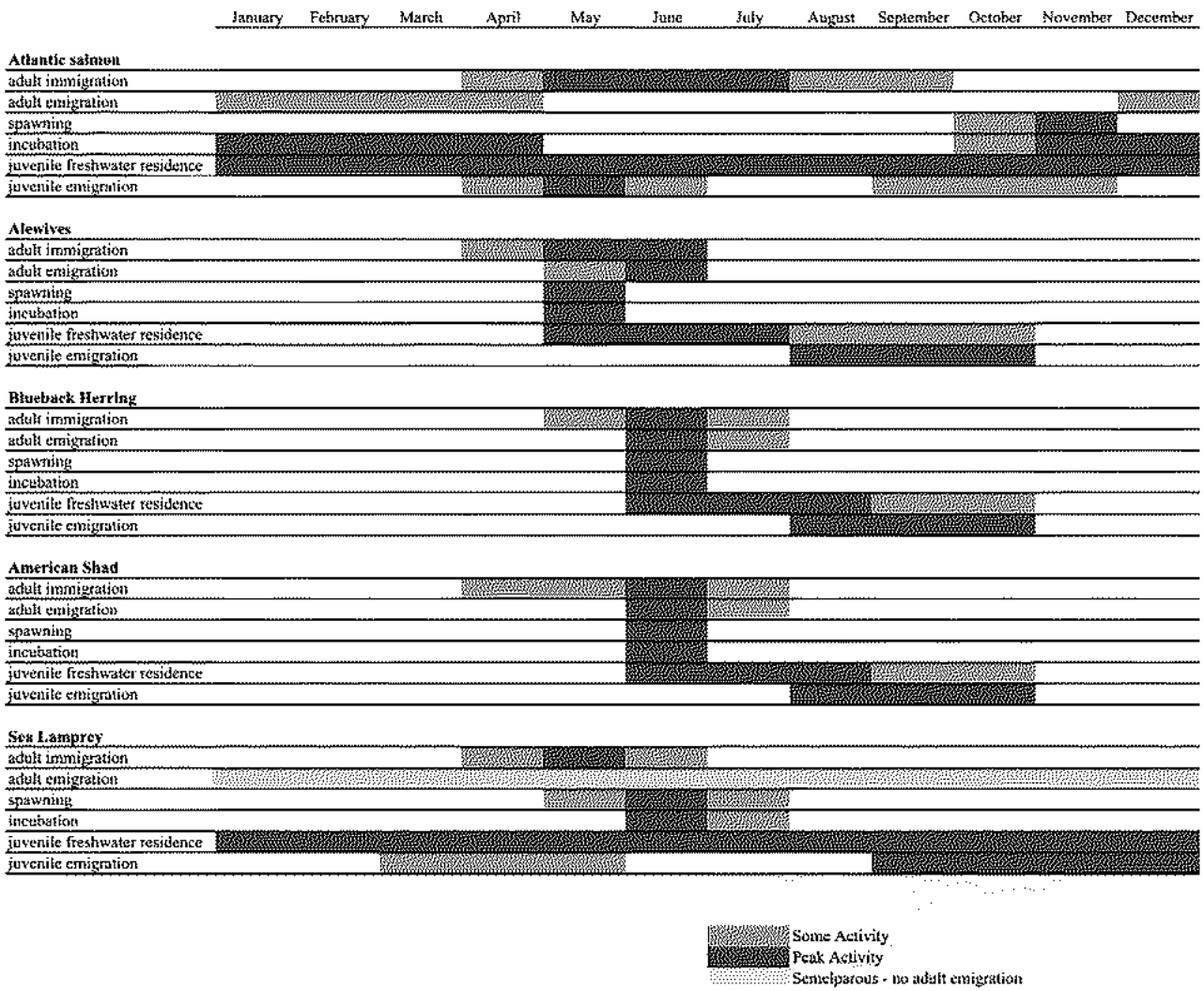


Figure 7. Typical migration periods by species and life stage for diadromous species of the Narraguagus River, Maine (*Saunders et al., 2006****).***

3.3 PROJECT SITE

The Cherryfield Ice Dam is the primary component of the Cherryfield Ice Dam LPP. The LPP functions to mitigate ice jam formation and therefore mitigate flooding on the Narraguagus River to protect property in Cherryfield. The dam is an approximately 500-foot-long earthen embankment dam with a timber crib fixed crest spillway (Figure 8) and has an approximate structural height of 24.5 feet and a hydraulic height of 7 feet (Rocks et al., 2021). The dam consists of five main components, including two earthen embankments, a primary timber-crib spillway, two sluiceways, a Denil type fishway, and three ice piers. The dam is owned by the Town of Cherryfield, Maine. The dam is approximately 0.8 miles downstream of the confluence of the West Branch Narraguagus River and the Narraguagus River.

3.3.1 Intended Dam and Ice Pier Function

The earthen and timber crib Cherryfield Ice Dam was constructed to create an artificial reservoir for the purpose of ice retention (USACE, 2016) whereby the reservoir would retain ice jams until they melted and delay the movement of ice jams downstream. The dam was supplemented with the three rock-filled timber crib ice piers, each about 12 feet wide and 20 feet long located just upstream of the dam. As stated in the USACE CRREL report from 2021, "the surface ice cover that forms upstream of the Cherryfield dam allows for the retention of breakup ice from upstream...likely mitigat[ing] the severity of ice jams that occur downstream of the existing dam."

Less specific information is known regarding the function of the ice piers. The ice piers appear to have been included to improve the ability of the reservoir to hold/immobilize the ice sheet (USACE, 2023) and delay the arrival of broken ice to the vulnerable downstream areas between Cherryfield and Millbridge (USACE, 2016). A study published in *Cold Regions Science and Technology* (Morse et al., 2006), briefly documented the use of ice piers in this manner by stating that "ice piers were often located on top of a weir in order to raise water levels upstream and thereby reduce current velocities sufficiently to form a stable ice cover upstream of the structure." The study goes on to suggest the same ice retention mechanism stated in the CRREL research, essentially that this stable ice cover reduces the transport of any incoming ice from upstream by effectively increasing the surface area reach of the piers.

With the different pieces of information from these studies, we understand that the intent of the Cherryfield Ice Dam ice piers was to serve the following purposes, listed in order of occurrence during the winter season:

1. During the formation of the winter ice sheet, provide a structure on which reservoir ice can freeze to increase the strength of the ice sheet, immobilizing the ice sheet upstream of the dam.

2. During the formation of the winter ice sheet, provide a collection point for any early mobilization of large ice pieces from upstream.

3. During melt periods, provide a collection point for any early mobilization of large ice pieces from upstream.
4. During ice-out, slow the breakup of the ice sheet to increase the time required for ice to mobilize to tidal areas downstream.

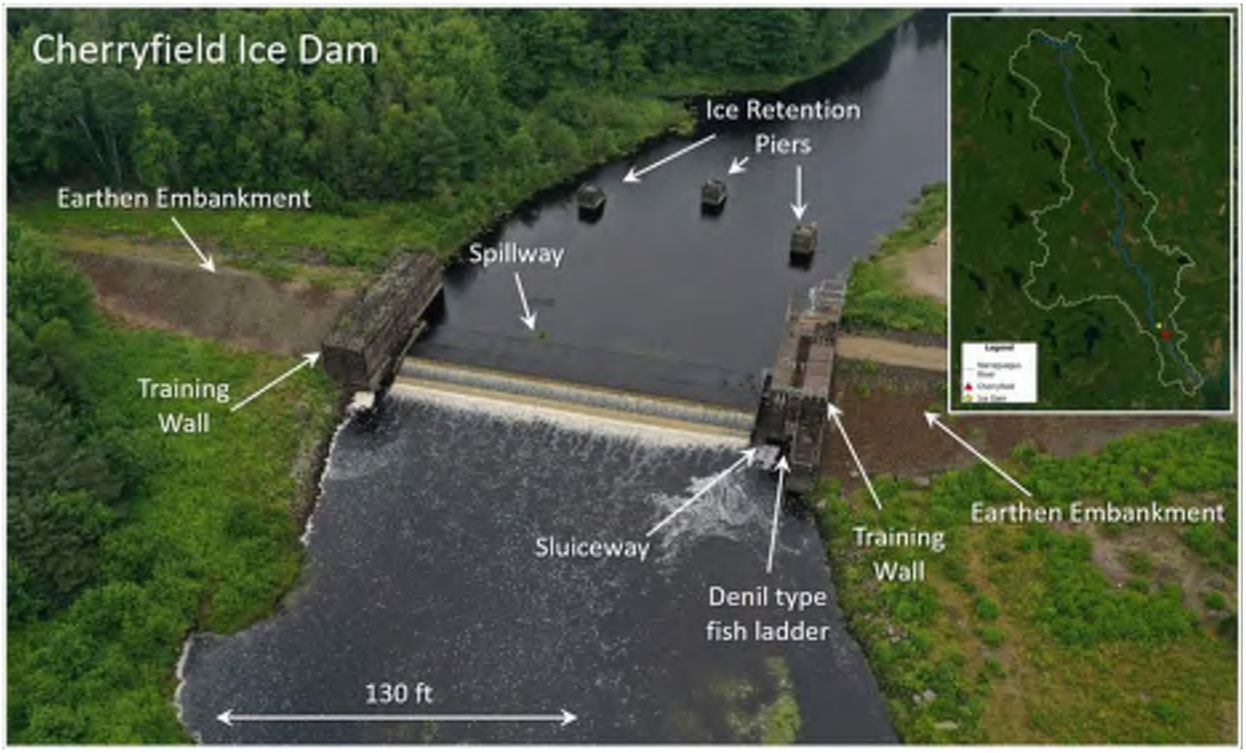


Figure 8: Cherryfield Ice Dam Drone footage highlighting key infrastructure details.

3.3.2 Earthen Embankment

The earthen embankments extend from the left and right sides of the spillway and tie into the valley slopes. As-built plans indicate that the earthen embankment is constructed primarily of compacted earth fill with upstream and downstream stone armoring. The upstream slope is approximately 2H:1V and armored with rock fill overlying gravel bedding stone. The downstream slope is approximately 2.5H:1V and armored with a crushed stone buttress varying in thickness. The crest of the embankment is approximately 14 feet wide. The surface of the crest consists of exposed compacted earth fill and stone armor at the edges of the crest. As-built plans indicate that the embankment is homogeneous with a 5-foot wide by 5-foot-deep earthen cutoff trench in the foundation soils.



Figure 9: Earthen embankment and training wall on right river bank.

3.3.3 Primary Spillway

The primary spillway consists of a 140-foot-long fixed crest, broad crested weir. The spillway is constructed of creosote treated timber cribbing with rock fill. The timber crib spillway structure is approximately 10 feet wide and covered with timber shiplap planks. The as-built plans indicate that there is a dumped earth fill buttress with a stone armored approach apron upstream of the dam. Creosote treated timber crib and rockfill training walls support the earthen embankments at the left and right sides of the spillway.



Figure 10: Cherryfield Ice Dam spillway from above.



Figure 11: Left: River right Training wall. Right: Rockfill timber crib training wall from above.

3.3.4 Fishway

The Denil fishway on the left side of the spillway is 3.5 feet wide with 17 timber baffles. The fishway is sloped at 6H:1V (USACE, 2023). Flow through the fishway is regulated by a sluice gate at the upstream side of the fishway. The Denil fishway is the only passage structure at the Cherryfield Ice Dam and as such, any fish passage that occurs upstream past the dam utilizes this fishway.



Figure 12: Denil fishway in river left training wall

3.3.5 Sluiceways

Timber plank lined sluiceways are present on the right and left sides of the spillway between the spillway and the training walls (Figure 12). The sluiceways provide a means to partially draw the impoundment down below the spillway level for maintenance purposes. The sluiceways are controlled by timber stoplogs that can be manually removed to divert flow from the primary spillway.

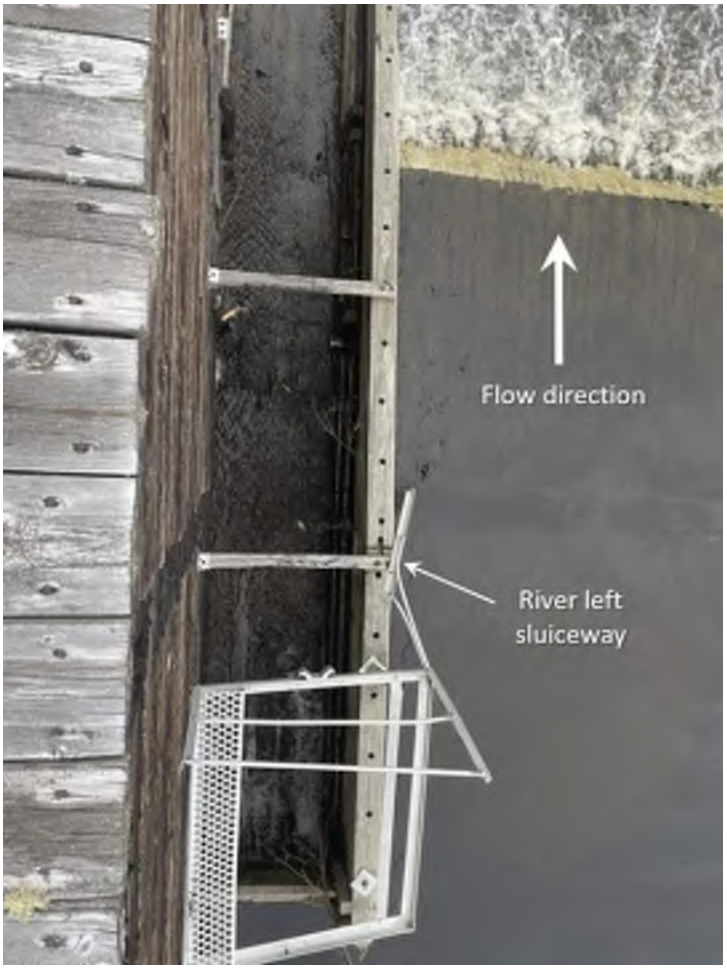


Figure 13. River left sluiceway from above with flow direction indicated by large arrow.

3.3.6 Ice Piers

Three creosote treated timber crib and rockfill ice piers are located approximately 120 to 140 feet upstream of the spillway (Figure 14). The piers are approximately 12 feet wide and 20 feet in length at the base.



Figure 14: Looking upstream of the dam at the three timber crib and rockfill ice piers.

3.3.7 Miscellaneous Site Features

Other site features include public access and temporary alewife harvest facilities on the left bank of the river. The site is accessible by vehicle via gravel drive from Cable Pool Road (Figure 15). The access drive terminates in a loop upstream of the dam. The left riverbank upstream and downstream of the dam is vegetated with mowed grass turf extending from the gravel drive to the river edge. A narrow buffer of un-mowed grass was maintained at the river bank at the time of the field survey. A boat ramp is located upstream of the dam on the river left bank.



Figure 15: Cable Pool Road access to the boat ramp on left bank of river.

The existing temporary alewife harvest facility is located at the left upstream spillway training wall (Figure 16). The harvest facility augments the existing river left abutment and ice piers to create temporary harvest facility that is erected during the harvest season and is removed once the harvest is over.



Figure 16: Alewife harvest facility upstream of the left spillway training wall.

3.3.8 Cherryfield Ice Dam Impoundment

Cherryfield Ice Dam forms a 3.5 mile long, shallow, narrow impoundment upstream of the dam along the main stem and the west branch of the Narraguagus River. Impoundment depths vary with flow, but during normal water levels are between 7 and 14 feet deep. The riverbanks throughout the impoundment are gradually sloped, undeveloped, and forested. Approximately 800 feet upstream from the dam, there is a large bend in the river alignment with the outer bend on the river's left bank (Figure 17). Above this bend, the river straightens out, and farther upstream, the West Branch of the Narraguagus joins the main stem.



Figure 17: Cherryfield Ice Dam impoundment upstream of the dam.

3.3.9 Impounded Sediment and Depth of Refusal

Dams create backwater environments, known as impoundments, that are wider, deeper, with slower flow velocities than the stream upstream of the impoundment or downstream of the dam. This flow reduction lowers the sediment transport capacity of a stream, resulting in conditions with the potential for trapping sediment that under natural conditions would be transported downstream. Management of impounded sediment is an important consideration when contemplating dam management activities, in which the quantity, distribution and composition of impounded sediment are key factors.

Downstream transport of sediment is a natural process, important for sustaining rivers and floodplains, estuaries, and coastal areas. In some instances, passive release of accumulated sediment associated with dam removal or modification may be planned when the net benefit to the downstream river facilitates restoration while avoiding risks. In other instances, a passive release of sediment can impact sensitive aquatic habitat or accumulate in downstream depositional areas where it would be viewed problematically.

To characterize accumulated sediment distributions in the impoundment, Inter-Fluve performed a Depth of Refusal (DOR) survey on November 12th, 2024. The survey extended from approximately 70 feet to 1,200 feet upstream of the dam spillway.

Measurements of sediment thickness were collected from a canoe using a metal probe rod paired with an RTK-GPS antenna for position tracking. These measurements were taken systematically along transects at approximately equal intervals to accurately characterize sediment distribution throughout the impoundment.

After confirming data quality, the DOR measurements were mapped within the surveyed area (Figure 18). The sediment thickness map shows fairly uniform deposition in the upstream portions of the impoundment, with typical depths of 1.5–2 feet and localized depths up to 3 feet. Downstream, where the river bends, sediment is more heavily accumulated along the river-right bank (2–3 feet) and thins toward the channel center (0–1 foot). Near the river-left bank and immediately upstream of the dam, there is negligible sediment accumulation. This sediment distribution reflects differences in river bathymetry, where water depths decrease in the area immediately upstream of the dam, compared to areas further upstream where greater water depths provide more accommodation space for sediment to accumulate.

Due to minimal sediment occurring immediately upstream of the dam, and the temporary nature of impacts at the site, we anticipate there will be very little sediment that releases due to construction of the proposed project. The sediment that does mobilized will likely be mitigated by contractor BMPs. Sediment that does travel past the project site will likely settle large pools immediately downstream of the site adjacent to the USGS gaging station.

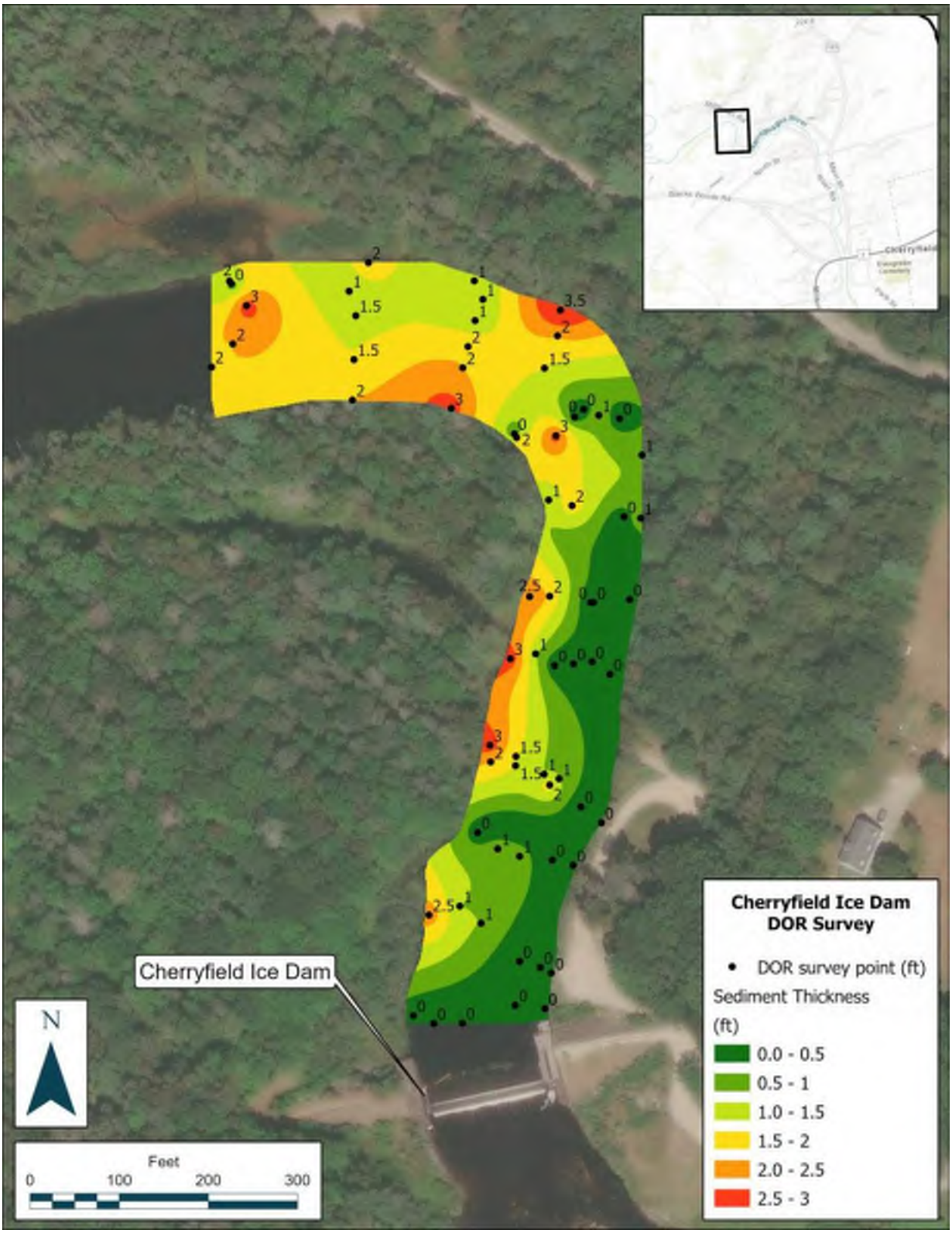


Figure 18: Surveyed depth of refusal, and sediment thickness

3.3.10 Downstream Reach

The downstream reach is characterized by a relatively steeper average slope (approximately 0.9%) that extends downstream of the dam and steadily flattens as the river approaches the head of tide, approximately 800 feet upstream of the Route 1 bridge. Portions of the river are much steeper than the average slope, including a small reach at the railway crossing and another reach just upstream of the North Street bridge. These small steeper reaches have average slopes that are 2% and higher. Infrastructure downstream of the dam includes the town center of Cherryfield. River crossings downstream of the dam include the Sunrise Trail (Figure 19), North Street, and Route 1 (Figure 20) bridges. A food processing facility is located on the left river bank approximately 0.5 miles downstream of the dam. The riverfront area is moderately developed within the town center and sparsely developed outside of the town center, which is roughly bound by North Street and Route 1. Narraguagus Bay is approximately 7 miles downstream of the Cherryfield Ice Dam. The dam is the first impediment that spans the river channel upstream of the mouth of the river.



Figure 19: Sunrise Trail bridge approximately 1,800 ft downstream of the Cherryfield Ice Dam.



Figure 20: Rt. 1 bridge in Cherryfield approximately 1.5 miles downstream of Cherryfield Ice Dam.

4. Studies

As part of this effort, the project team conducted detailed studies that support the project design. Brief summaries of the studies follow, and full reports are included in the attached appendices:

- Alewife Harvest Feasibility Study by Inter-Fluve (Appendix B)
- Dam Assessment by Fuss and O'Neill (Appendix C)
- Alternatives Analysis by Inter-Fluve and Fuss and O'Neill (Appendix D)
- Wetland Delineation and Functional Analysis by Alan Haberstock, PWS (Appendix G)
- Hydrologic study of the Narraguagus River by Inter-Fluve (Section 4.5)
- Hydraulic study of the Narraguagus River by Inter-Fluve (Section 4.6)

4.1 ALEWIFE HARVEST FEASIBILITY STUDY

Given the importance of the Alewife harvest to the Town of Cherryfield and the potential impacts of the proposed designs, Inter-Fluve performed an assessment of how the harvest might proceed once the proposed nature-like fishway is constructed. This assessment was finalized in August 2024. The study determined that, while some changes to the harvest method may be required, the harvest would be feasible in conjunction with the proposed design. Possible changes to the mechanism of harvest could vary in complexity depending on the chosen harvest method. Further analysis, design, and construction of alewife harvest facilities are not part of the scope of this project, and the Alewife Harvest Feasibility Study is included for informational purposes only. Additional information can be found in Appendix B.

4.2 DAM ASSESSMENT

To support the alternative selection and design, Fuss & O'Neill, Inc. performed a visual inspection of the dam's structural elements to document the physical conditions at the time of the site visit. The site visit was performed in August 2023, and the dam assessment was finalized in April 2024. The findings of the visual inspection are detailed as a standalone report in Appendix C. Structural elements of the dam, including the spillway and training walls were found to be in fair condition. Several localized concerns were identified including the sluiceway walls and planking and the ice pier on river right. The sluiceway wall appeared to be leaning, which may indicate instability or undermining of the wall. The above water portions of the ice pier on river right appeared to be leaning, which may indicate instability or undermining. During the February 2024 Alternatives Analysis meeting, the Town reported that a local diver observed broken segments of timber cribbing below the water line. Loss of timber cribbing could reduce the lateral restraint for the stone armor, increasing instability at the pier under extreme loading conditions.

The 2019 USACE System Inspection Report (USACE, 2019) classified the flood protection system condition as "Unacceptable" due to the presence of unwanted woody vegetation within 50 feet of the dam embankments and valves deemed inoperable because of corroded gate stems.

4.3 ALTERNATIVES ANALYSIS

4.3.1 Prior (USACE) Alternatives Analysis

An alternatives analysis was performed by the USACE (USACE, 2023) to assess potential options to address dam safety concerns at the Cherryfield Ice Dam. The alternatives included non-structural, structural, and nature-based solutions. Dam removal was not considered as a viable option in the analysis because the USACE could not consider the de-authorization of the dam. Three alternatives were selected for further evaluation past the initial screening. The three selected alternatives were a rock-ramp step-pool, a rock-ramp boulder bar, and a nature-like bypass channel.

The USACE feasibility report concluded that none of the alternatives evaluated were feasible for them to carry to detailed design and construction due to the constraints of Section 1135 of the Water Resources Development Act of 1986, under which the study was authorized.

4.3.2 Supplemental Alternatives Analysis

Following the completion of the USACE (2023) study, Inter-Fluve completed a supplemental alternatives analysis focused on the rock-ramp step pool alternative. To further evaluate alternatives, baseline components of the project were identified. These baseline components act as building blocks and are the key elements of design that dictate the shape and constraints of the proposed fishway and infrastructure. These building blocks are generally not mutually exclusive and can be combined to meet the project goals. The baseline components considered in the alternatives analysis include:

- Fishway slope
- Fishway exit location
- Morphological configuration of the fishway
- Spillway, abutment and embankment retention/removal
- Ice pier options

The alternatives were qualitatively compared in relation to the analysis criteria based on existing technical material, past project experience, and engineering judgement. The analysis criteria include fish passage effectiveness, public access improvements on land and water, longitudinal floodplain connectivity, flooding and resilience, natural resource impacts, engineering design complexity, constructability, construction and long-term maintenance costs. Completed in February of 2024, the detailed alternatives analysis and summary memorandum is provided in Appendix D.

In addition to the alternatives considered in detail, a "no action" alternative would involve capital expenditures to perform on-going maintenance and maintaining USACE authorization at the structure without enhancing fish passage. Since this alternative does not meet the critical goal of enhancing fish passage, this alternative was not further evaluated in detail.

Through a collaborative feedback process with the project partners, the selected alternative was identified to include the following elements.

- Average Fishway Slope of 2.5%
- Fishway exit location at the current spillway crest/existing dam location
- Step-Pool Low Flow Channel with Roughened High Flow Conveyance
- Full replacement of the spillway and abutments with the nature-like fishway
- Partial embankment retention
- Remove and reconstruct ice piers in the current location and similar configuration and shape

4.4 WETLAND DELINEATION AND FUNCTIONAL ASSESSMENT

A wetland delineation and functional assessment was performed by Alan Haberstock, PWS to delineate and document existing wetland locations, and to evaluate potential direct and indirect project impacts to existing resources. There are unavoidable direct impacts to existing wetlands due to the proposed project. These impacts are minimized due to the placement of the nature-like fishway in a location where wetlands are the narrowest, least complex, and provide the least function. More complex and functionally important wetlands upstream and downstream of the project site are not impacted. Additionally, because the proposed project will maintain typical impoundment levels, no indirect impacts to wetlands upstream of the project are anticipated. The project includes a robust revegetation plan (Section 5.3), designed to replicate and replace the impacted wetlands. These designed revegetated areas consider the anticipated changes in hydrology at the project site, and prescribe native wetland plant species that will provide long term ecological function. For detailed information and analysis, see Appendix G.

4.5 HYDROLOGY

4.5.1 Historical Hydrologic Studies

4.5.1.1 FEMA Study

A Flood Insurance Study (FIS) for Washington County was completed by the Federal Emergency Management Agency (FEMA), effective July 18, 2017 (FEMA, 2017). This 2017 FIS study supersedes a previous study completed for the Town of Cherryfield by FEMA in 1990 (FEMA, 1990). The Project area is located within a designated FEMA flood hazard area (FIRM Numbers 23029C1752E and 23029C1756E). The FIS report indicates that the historical hydrologic analysis was performed in 1986 using the United States Geological Survey (USGS) Regional Formula and the hydraulic analysis was completed the same year using the Federal Highway Administration HY-7 model, which utilizes

USGS step-backwater calculations (Shearman et al., 1986). The FEMA FIS only provided a peak flood estimate for the 100-year (1% annual exceedance probability) event for the Narraguagus River, estimated at 11,300 cfs at the USGS gage, and no other peak discharge scenarios. Further detail on the hydraulic analysis conducted by FEMA is provided in Section 4.6.

4.5.1.2 USACE Study

The U.S. Army Corps of Engineers (USACE) New England District conducted a feasibility study of alternatives to improve diadromous fish passage at the dam (USACE, 2023). The study utilized data from the USGS streamgage station located in Cherryfield for their hydrologic analysis. In association with the USACE feasibility study, a hydraulic analysis of impacts of the alternatives on ice control was conducted by the Cold Regions Research and Engineering Laboratory (CRREL) in 2021 (Rocks et al., 2021). CRREL conducted hydraulic modeling of the selected alternatives using the USACE Hydraulic Engineering Center River Analysis System (HEC-RAS) software.

4.5.2 Climate Change

In Maine, climate change is altering long-established patterns of temperature, precipitation, and river flow. Since 1895, the state's average annual air temperature has risen by about 3.2°F, annual precipitation has increased by nearly six inches, and winter temperatures have warmed, decreasing snowpack (Fernandez et al., 2020).

Streamflow Impacts

The Narraguagus River, like most Maine rivers, exhibits high flows in the spring due to snowmelt and rain, lower flows in late summer, and a resurgence of flows in the autumn rainy season. Ongoing climate shifts are causing more variable flow conditions, with observations of higher early-spring flows and lower late-spring flows, largely because snow is melting earlier (Dudley et al., 2020; Hodgkins G.A. et al., 2017). While summer low-flow magnitudes have not shown significant changes, the duration of low-flow periods may be increasing (MCC STS, 2020).

Moderate flood events (e.g., 2- and 10-year floods) appear to be more frequent because of greater precipitation intensity and winter rainfall. The effect of climate change on larger, less frequent floods (e.g., 100-year events) remains uncertain because few data records include 100 years of data and the events that cause these floods are influenced by many different global processes (Hodgkins & Dudley, 2013; MCC STS, 2020).

Fish Migration and Habitat Impacts

Shifts in streamflow timing and magnitude driven by climate change can significantly disrupt fish migration periods and critical habitat conditions. Lower flows during the peak runs in May and June can impede upstream movement, while altered seasonal water temperatures can shift migration windows, both of which may lead to declines in fish populations. At the same time, more intense flood events can scour streambeds and flush away aquatic insects, further degrading habitat and reducing food sources. Additionally, rising water temperatures can stress coldwater species such as Atlantic Salmon and Eastern Brook Trout, potentially limiting their distribution and survival (MCC STS, 2020).

Sea Level Rise Impacts

Currently, the Narraguagus River is tidally influenced to a point upstream of Route 1, and downstream of the North Street Bridge. While projected sea level rise is not anticipated to affect the Cherryfield Ice Dam, rising seas could eventually impact downstream infrastructure, including the Route 1 Bridge that crosses the river. Storm surges coinciding with high tides and higher baseline sea levels may further increase the risk of coastal and tidal flooding (MCC STS, 2020).

4.5.3 Statistical Analyses

To support design development, Inter-Fluve performed hydrologic analyses to estimate peak flood flows and seasonal fish passage flows for the Narraguagus River at Cherryfield, Maine. We used the estimates in the subsequent hydraulic modeling to inform the project designs. The historical hydrologic evaluations published in the flood insurance studies described above were reviewed and were compared the results of the historical evaluations to our results. The data, methods, and results are described below.

USGS Streamgage

The USGS maintains a streamgage on the Narraguagus River at Cherryfield (01022500). The gage is located approximately 1,000 feet downstream of the Project Site. The contributing watershed to the gage is approximately 227 square miles. Inter-Fluve used the available daily average discharge data at this gage to inform the statistical analysis of streamflow at the Project Site. Additionally, Inter-Fluve used stage data collected at the gage to inform model performance and model calibration efforts. Since the gage location is so close to the dam and their respective watershed areas are nearly identical, no scaling of the gage data was necessary for the hydrologic analyses.

The USGS gage period of record (POR) begins on February 5, 1948 and continues through the present day (Figure 21). The flood of record at this gage (instantaneous peak of 10,400 cfs) was recorded in May 1961.

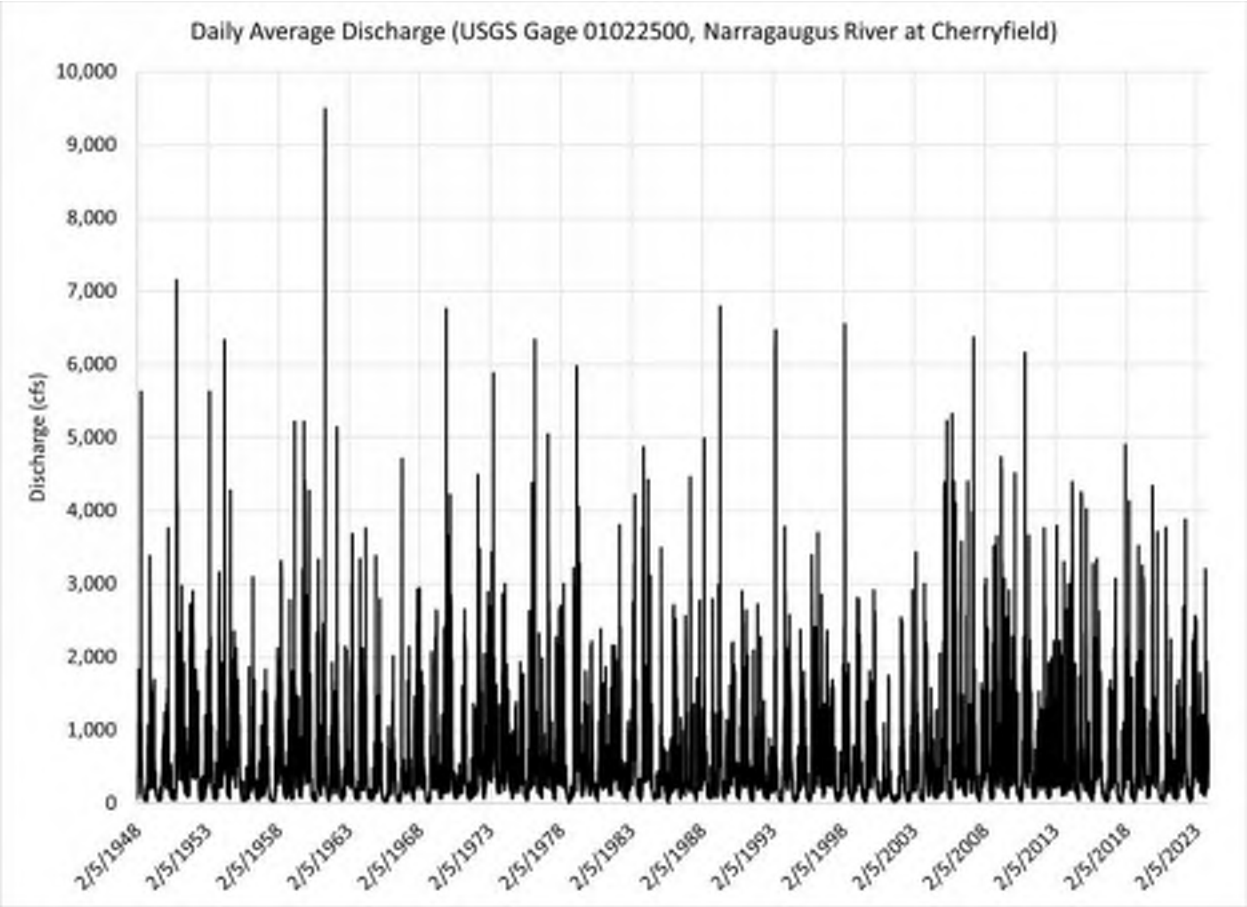


Figure 21: Daily average discharge at the USGS streamgage on the Narraguagus River at Cherryfield (01022500). From February 1948 to December 2023.

Peak Flow Statistics

Inter-Fluve used several methods to evaluate the peak flood flow statistics for the Narraguagus River at the Project Site including (1) a statistical analysis of streamflow measurements (a gage record analysis), (2) a statistical analysis of watershed characteristics, also known as a regional regression analysis (Lombard & Hodgkins, 2020) and, (3) the peak flow estimate published in the FEMA FIS for the Town of Cherryfield, Maine (FEMA, 1990). A comparison of the estimated peak flood flow statistics is shown in Figure 22. The 5% and 95% confidence intervals as calculated during the gage record analysis are also shown on Figure 22. Confidence intervals provide a measure of the uncertainty of the discharge at a selected exceedance probability.

Inter-Fluve performed a statistical analysis of gage records by applying the methods described in USGS Water Resources Bulletins 17B (USGS, 1982) and 17C (England et al., 2018) to the data collected at the USGS gage at Cherryfield. The 17B and 17C analysis were completed using the USACE Statistical Software Package (HEC-SSP). These methods use the historical record of annual

peak flows to estimate a frequency-discharge relationship for high-flow events. Estimates from the 17B and 17C analysis were nearly identical, so estimates from the more recent methods of 17C were advanced for further analysis.

Inter-Fluve performed the gage record analysis on two periods of time including (1) the full period of record and (2) the record post-1970. Figure 22 compares the frequency-discharge relationship for high-flow events for the full period of record at the gaged site to the same relationship for a period post-1970. Contrary to the common trends in the Northeast region that show increases in peak annual floods post-1970, the record post-1970 at the Cherryfield gage showed lower peak discharges than the full record starting in 1948. The hydraulic study performed for this project utilizes peak discharge estimates as calculated from the full period of record from the gage, since it is the more conservative estimate. The FEMA estimate of flow for the 100-year event is also included on Figure 22. The shaded values in Table 3 were selected to be used in the hydraulic analysis.

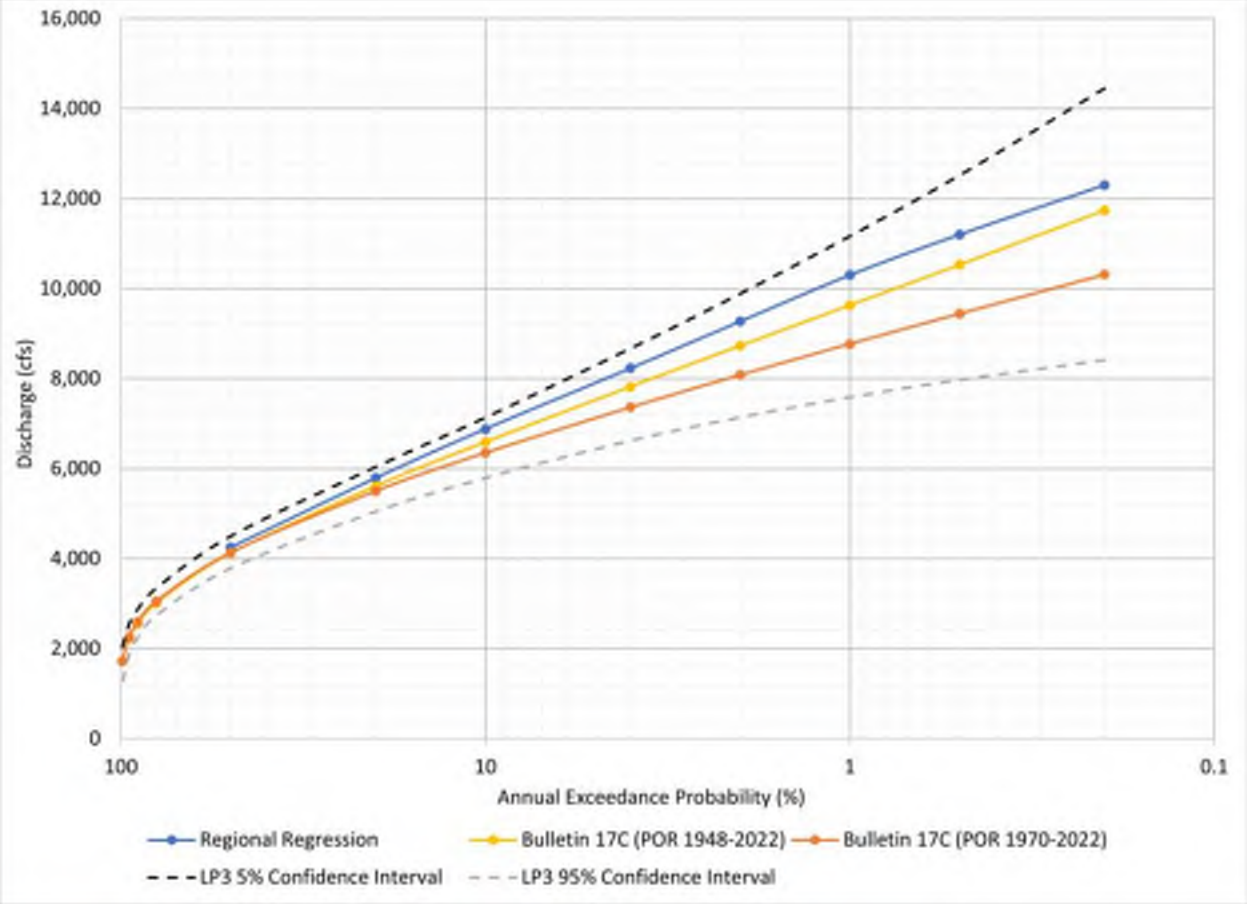


Figure 22. Discharge-frequency relationships evaluated in the hydrologic analysis.

Table 3. Peak flood flow frequency estimates for the Narraguagus River.

Return Period ***Years***	***Annual Exceedance Probability*** ***%***	***Regional Regression Equations*** ***cfs***	***USGS Gage 01022500 (1948-2023)*** ***cfs***	***USGS Gage 01022500 (1970 - 2023)*** ***cfs***	***FEMA FIS*** ***cfs***
2	50	4250	4120	4130	--
5	20	5790	5610	5500	--
10	10	6880	6590	6350	--
25	4	8230	7820	7360	--
50	2	9270	8730	8080	--
100	1	10300	9630	8770	11300
200	0.5	11200	10530	9440	--
500	0.2	12300	11740	10310	--

Monthly Statistics

In addition to the peak flood flow estimates, seasonal flow estimates were determined for non-flood periods. Inter-Fluve performed a statistical analysis on the mean daily flow record at the USGS gage to evaluate the discharge-frequency relationship for flows on a monthly basis. Additionally, monthly flows estimated using regional regression equations were evaluated (Dudley, 2015). Figure 23 presents the results of this analysis. Since flow estimates using USGS gage data and regional regression equations were similar, estimates based on the observed gage data were selected for use in the hydraulic analysis. Inter-Fluve has selected the design flows, summarized in Table 4 for use in subsequent habitat continuity and fish passage design analyses.

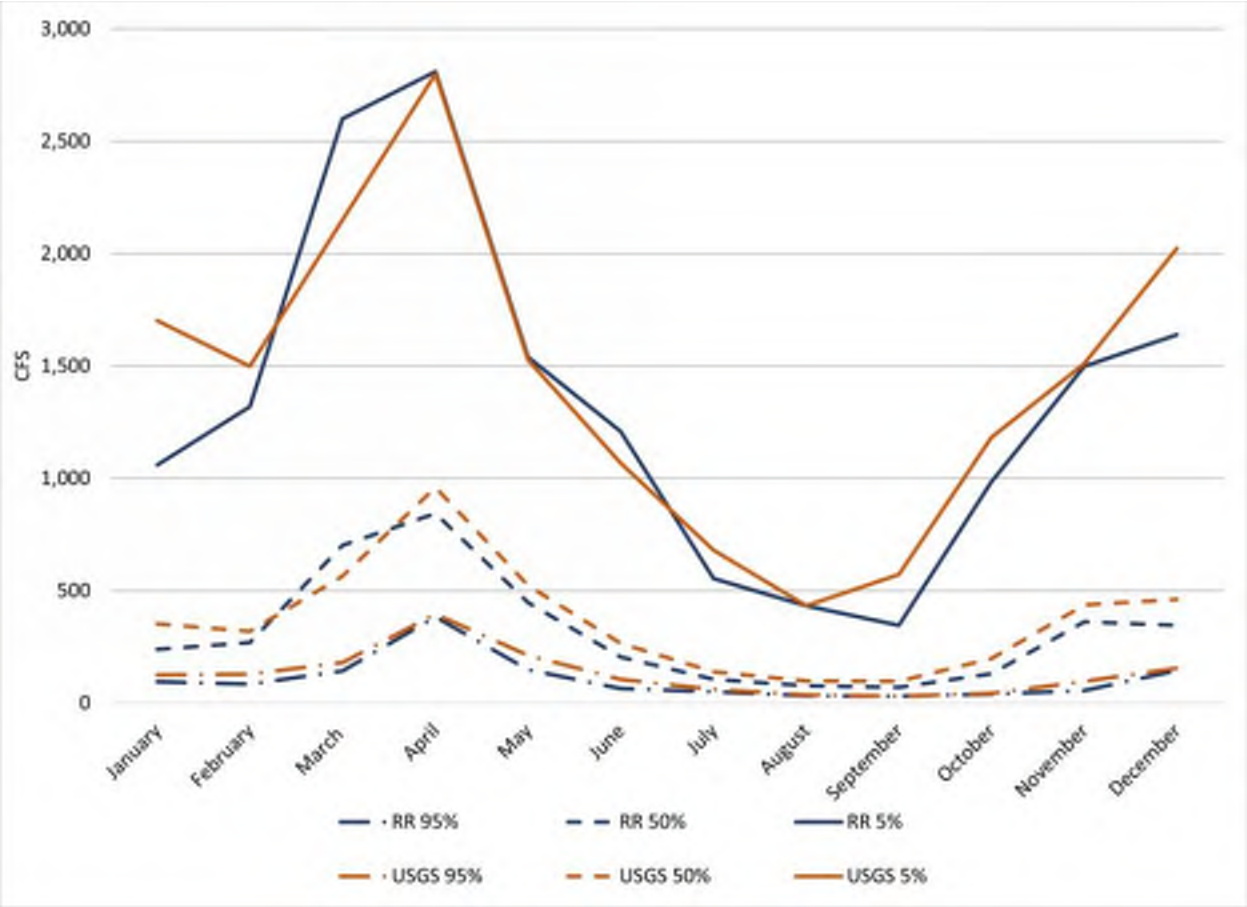


Figure 23: Monthly discharge-frequency estimates using USGS gage data and regional regression (RR) equations.

Table 4: Monthly flows (cubic feet per second) estimated using data from the USGS gage on the Narraguagus River at Cherryfield (01022500). Shaded values were used in hydraulic analysis.

Month	95% Exceedance Probability Flow (cfs)	50% Exceedance Probability Flow (cfs)	5% Exceedance Probability Flow (cfs)
January	125	353	1703
February	129	320	1500
March	180	566	2150
April	397	960	2800
May	213	524	1528
June	106	267	1070
July	62	140	682
August	37	99	434
September	32	97	572
October	44	199	1183
November	97	437	1512
December	155	462	2024

4.6 HYDRAULICS

As part of this work, Inter-Fluve developed an unsteady-flow, two-dimensional (2D hydraulic model of the Project Site using USACE's Hydrologic Engineering Center's River Analysis System (HEC-RAS) Version 6.6. The numerical model, once calibrated and validated, allows for a wide array of potential topographic changes to be evaluated to assist in making design decisions. HEC-RAS 2D, a public domain modeling software, was selected, as it is both computationally efficient and widely accepted in the scientific and engineering community. The model was referenced to the NAD83 State Plane Maine East FIPS 1801 (feet) horizontal coordinate system and NAVD88 vertical datum. All model units are given in feet.

4.6.1 Model Geometry

Inter-Fluve created the model geometry using HEC-RAS geometry tools. Three versions were developed: one representing existing conditions and two representing proposed conditions. The key difference between the geometries is that the existing conditions geometry includes the Cherryfield Ice Dam as a SA/2D connection, while the proposed conditions geometries removes the dam. A SA/2D connection is used as a hydraulic connection between storage areas and/or 2D flow areas (mesh) within a 2D HEC-RAS geometry. It is also used as a hydraulic connection within a 2D flow area.

4.6.2 Model Terrain

Inter-Fluve developed a digital elevation model (DEM) of the Narraguagus River and floodplain using high-resolution topographic data from various sources including publicly available LiDAR data (USGS, 2017) and site-specific field survey performed by Wood Environmental and Infrastructure Solutions in 2018 and Inter-Fluve in 2023-2025.

Within the HEC-RAS model, three terrains were used – one which defines the existing conditions and two which define the proposed conditions. The proposed conditions terrain incorporates the proposed nature-like fishway, which was developed in AutoCAD Civil 3D, and merged into the base terrain. One proposed conditions model terrain incorporates terrain modifications and Mannings "n" value adjustments that simulated proposed roughness boulders, while the other proposed conditions model terrain does not include terrain modifications to simulate roughness boulders. Additionally, both the existing conditions and proposed conditions terrain were modified to include the three ice piers located upstream of the Cherryfield Ice Dam. Dimensions and elevations of the ice piers were based on available drawings and positioned based on collected aerial imagery.

4.6.3 Model Extent

The hydraulic model domain begins approximately 1,000 feet upstream of the Cherryfield Ice Dam and extends approximately 1,800 feet downstream of the Cherryfield Ice Dam. The 2D flow area covered approximately 35.5 acres and is shown in Figure 24.



Figure 24. 2D Model Extent.

4.6.4 Structures

The Cherryfield Ice Dam is the only structure included within the model extent. The Cherryfield Ice Dam is operated as a run-of-river structure and is included within the existing conditions model as a SA/2D connection, allowing water to flow through the 2D mesh from the upstream reach to the downstream reach. Dimensions and elevations of the Cherryfield Ice Dam reflect survey collected by Inter-Fluve November 2024. As described above, the Cherryfield Ice Dam is included in the existing conditions model and removed for the proposed conditions model.

4.6.5 Computational Mesh

A 2 dimensional flow area is a region within a HEC-RAS model in which flow through that region is computed with the HEC-RAS 2D flow computation algorithms. 2D flow areas are defined by a polygon that represents the outer boundary of the 2D flow area. Within the 2D flow area the user must define the computational mesh. The area of interest is a relatively small area with detailed characteristics included within the river bathymetry and the proposed nature-like fishway. The base mesh cell size is selected as 10-feet by 10-feet within the floodplain for both the existing conditions and proposed conditions geometry. The existing conditions used the base mesh cell size throughout the flow area, including the river channel. The proposed conditions geometry further refined the mesh cells around the nature-like fishway to 3-feet by 3-feet to capture the detail within the fishway. Breaklines were used to align the mesh with the river channel, river banks, and along the weirs separating the fishway pools.

4.6.6 Roughness Coefficients

We assigned hydraulic roughness values (Manning's "n") for the channel and floodplain based on field observations and thorough consideration of published reference materials (e.g., Arcement & Schneider, 1986). We developed discrete polygons based on the observed characteristics of different regions of the site during site visits and available aerial imagery. We developed four Manning's "n" value datasets which represented (1) the existing conditions for low and passage flows, (2) the existing conditions for flood flows, (3) the proposed conditions for low and passage flows, and (4) the proposed conditions for flood flows. The proposed conditions datasets included additional refinements to the Manning's "n" values in the area of the proposed nature-like fishway. Table 5 summarizes the Manning's "n" values used in the existing and proposed conditions. Figure 25 shows the Manning's "n" values polygons overlain on an aerial.

Table 5. Summary of Manning's "n" values used in the hydraulic model.

Location	Manning's "n" Value	Description
Channel (above Cherryfield Ice Dam)	0.035	Main river channel that is absent of debris winding with areas of shallow pools and some weeds and stones.
Channel (below Cherryfield Ice Dam, Low Flow)	0.065	Main river channel where large boulders and rocks constrict the river channel with areas of shallow pools. Low Flow.
Channel (below Cherryfield Ice Dam, High Flow)	0.04	Main river channel where large boulders and rocks litter the river channel with areas of shallow pools. High Flow.
Step Pool	0.06	Nature-like fishway primary channel with step-pool morphology, large cobble to large boulder material
Nature-Like Fishway Overbank Areas	0.08	Overbanks of the nature-like fishway, Vegetated soil and cobble, and roughened cobble and boulder material
Deciduous Forest	0.10	Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover.
Woody Wetlands	0.07	Areas where forest or shrubland vegetation accounts for greater than 20% of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
Scrub-Shrub	0.05	Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation.
Developed Medium Intensity	0.025	Areas with a mixture of constructed materials and vegetation.

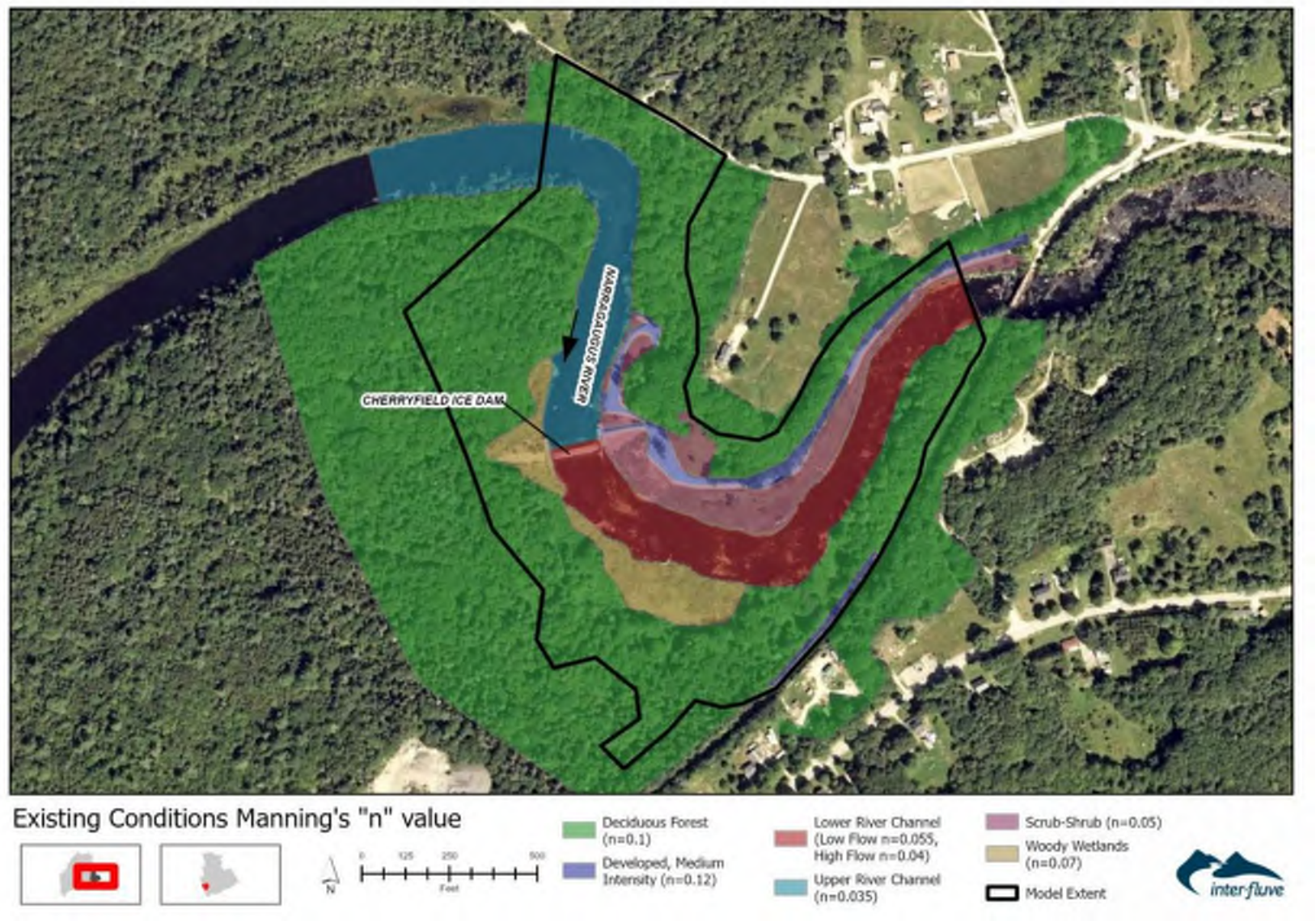


Figure 25. Existing Conditions Manning's "n" values

We further refined the Manning's "n" value in the reach below Cherryfield Ice Dam based on field observations and model calibration/validation efforts discussed in further detail in Section 4.6.9. Within the downstream reach extent, the channel slope is generally shallow with areas of deeper pools. Boulders and large stones occupy the downstream reach creating a rough channel surface. Figure 26, Figure 27, and Figure 28 show sections of the reaches upstream and downstream of the Cherryfield Ice Dam.



Figure 26. River channel upstream of Cherryfield Ice Dam (looking downstream).



Figure 27. Channel downstream of Cherryfield Ice Dam (looking downstream).



Figure 28. Channel approximately 300 feet upstream from model downstream extent (looking downstream).

4.6.7 Boundary Conditions

Upstream boundary: We applied the hydrologic inflows across the entire width of the Narraguagus River channel including the floodplain on the right side of the river. We set the energy slope for distributing the flow along the line to 0.001 feet/feet, a relatively flat value which represents the generalized slope of the upstream river channel which is in an impounded condition.

Downstream boundary: We set the downstream boundary condition to normal depth with a value of 0.001 ft/ft for final simulations, which is generally consistent with the average channel slope of the Narraguagus River at the downstream limit of the model domain. Inter-Fluve performed a sensitivity analysis to determine the effect of this downstream boundary condition and is discussed in further detail in Section 4.6.9.

4.6.8 Inflow Hydrographs

Inter-Fluve simulated inflows to the HEC-RAS model using a suite of flows which ranged from 32 cfs to 11,300 cfs (see Section 4.5.3). Table 6 summarizes the flows which we used as inflow to the HEC-RAS model.

Table 6. Summary of simulated inflows.

Event	Flow (cfs)
September 95%	32
September 50%	97
June 95%	106
May 95%	213
June 50%	267
May 50%	524
June 5%	1,070
May 5%	1,528
2-Year	4,120
5-Year	5,610
10-Year	6,590
25-Year	7,820
50-Year	8,730
100-Year	9,630

4.6.9 Model Calibration

Calibration of the existing conditions HEC-RAS model was performed using available flow and water surface data collected during site visits and at the USGS gage located downstream of Cherryfield Ice Dam for a range of flows. Table 7 summarizes the events which were selected for model calibration.

Table 7. Calibration flow events recorded at USGS Gage Narraguagus River at Cherryfield (01022500).

Date	Observed Flow (cfs)	Observed Water Surface Elevation (ft, NAVD88)	Approximate Return Frequency or statistic
September 16, 2020	32	51.0	September 95%
November 12, 2024	46.5	51.3	
August 22, 2018	97	51.6	September 50%
March 28, 2018	381	52.7	June 50%
September 12, 2021	1,310	54.5	May 5%
April 1, 2010	4,050	57.3	2-Year
December 14, 2010	6,160	58.9	10-Year

To validate the model, each of the flow events was simulated and results were compared to the recorded water surface elevation at the gage location. Incremental adjustments to the Manning's "n" value were made to better understand the effect of adjustment of the Manning's "n" value on modeled results and in attempt to align the resulting water surface elevations to the observed water surface elevations. Results of calibration efforts are summarized in Table 8.

Table 8. Comparison of recorded water surface elevations at the USGS gage to simulated water surface elevations at varying Manning's "n" values at the USGS gage location.

Date	Recorded Flow (cfs)	Recorded WSE (ft, NAVD88)	Manning's "n" value							
			0.04		0.045		0.055		0.065	
			Modeled WSE (ft, NAVD88)	Difference from Recorded WSE (ft)	Modeled WSE (ft, NAVD88)	Difference from Recorded WSE (ft)	Modeled WSE (ft, NAVD88)	Difference from Recorded WSE (ft)	Modeled WSE (ft, NAVD88)	Difference from Recorded WSE (ft)
Low Flow										
Sept 16, 2020	32	51.0	50.3	-0.73	50.3	-0.69	50.4	-0.61	50.5	-0.54
Nov 12, 2024	46.5	51.3	50.4	-0.87	50.5	-0.83	50.6	-0.74	50.6	-0.66
Aug 22, 2018	97	51.6	50.84	-0.71	50.9	-0.66	51.0	-0.54	51.1	-0.45
Mar 28, 2018	381	52.7	*52.0*	-0.75	52.1	-0.64	52.3	-0.44	52.5	-0.24
High Flow										
Sept 12, 2021	1,310	54.5	53.9	-0.57	54.1	-0.39	54.5	0.06	54.9	0.48
April 1, 2010	4,050	57.3	*57.3*	-0.02	57.7	0.37			59.2	1.88
Dec 14, 2010	6,160	58.9	59.2	0.30	59.6	0.66	60.5	1.57	61.5	2.60

Initial simulations used a Manning's "n" value of 0.045 in the downstream, which falls in range of a boulder channel as defined in Manning's base values in Arcement & Schneider (1986). A 0.045 Manning's "n" value in the downstream reach resulted in simulated water surface elevations which fell below the recorded USGS water surface elevations during lower flows and above recorded USGS water surface elevations at higher flows. Increasing the Manning's "n" value to 0.065 resulted in good correlation to the recorded USGS water surface elevations during low flows, however the simulated water surface elevations during high flows differed significantly from the recorded water surface elevations.

Further sensitivity analysis was conducted which considered the effect of the downstream boundary condition. Two additional calibration sensitivity scenarios were simulated which adjusted the downstream boundary condition normal slope from 0.001 to 0.0001 and simulated a 0.045 and 0.055 Manning's "n" value in the downstream reach. Table 9 summarizes the results of the downstream boundary condition sensitivity simulations as compared to corresponding Manning's "n" values.

Table 9. Comparison of recorded water surface elevations to simulated water surface elevations at varying Manning's "n" values and varying normal depth downstream boundary conditions.

Date	Recorded Flow (cfs)	Recorded WSE (ft, NAVD88)	Manning's "n" value				Manning's "n" value			
			0.045				0.055			
			DSBC=0.001		DSBC=0.0001		DSBC=0.001		DSBC=0.0001	
			Modeled WSE (ft, NAVD88)	Difference from Recorded WSE (ft)	Modeled WSE (ft, NAVD88)	Difference from Recorded WSE (ft)	Modeled WSE (ft, NAVD88)	Difference from Recorded WSE (ft)	Modeled WSE (ft, NAVD88)	Difference from Recorded WSE (ft)
Low Flow										
Sept 16, 2020	32	51.0	50.3	-0.69	50.3	-0.69	50.4	-0.61	50.4	-0.61
Nov 12, 2024	46.5	51.3	50.5	-0.83	50.5	-0.82	50.6	-0.74	50.6	-0.72
Aug 22, 2018	97	51.6	50.9	-0.66	51.0	-0.58	51.0	-0.54	51.1	-0.41
Mar 28, 2018	381	52.7	52.1	-0.64			52.3	-0.44		
High Flow										
Sept 12, 2021	1,310	54.5	54.1	-0.39	56.7	2.27	54.5	0.06	57.6	3.10
April 1, 2010	4,050	57.3	57.7	0.37						
Dec 14, 2010	6,160	58.9	59.6	0.66	67.2	8.29	60.5	1.57	68.2	9.32

Results of the downstream boundary condition simulations show that there is negligible impact at lower flows, however at higher flows differences in resulting modeled water surface elevations deviate significantly, suggesting that at higher flows the 0.0001 normal depth downstream boundary conditions results in excessive backwatering of the channel and increases the water surface elevation significantly.

Verification results indicate that a normal depth of 0.001 and a Manning's "n" value (Downstream reach) of 0.065 at low flows and 0.04 at high flows results in good correlation to observed water surface elevations and provide reasonable confidence in model results.

Two final verification scenarios were simulated which utilized the downstream boundary condition normal depth of 0.001 and Manning's "n" value of 0.04. These scenarios included events which occurred on March 15, 2024 and December 12, 2023. The March 2024 event observed a peak flow of approximately 3,850 cfs which approximately aligns with a 2-year return frequency event. The December 2023 event observed a peak flow of approximately 7,130 cfs which approximately aligns with a 10-year return frequency event. Figure 29 and Figure 30 shows the resulting simulated water surface elevation at the USGS gage compared to the recorded water surface elevation.

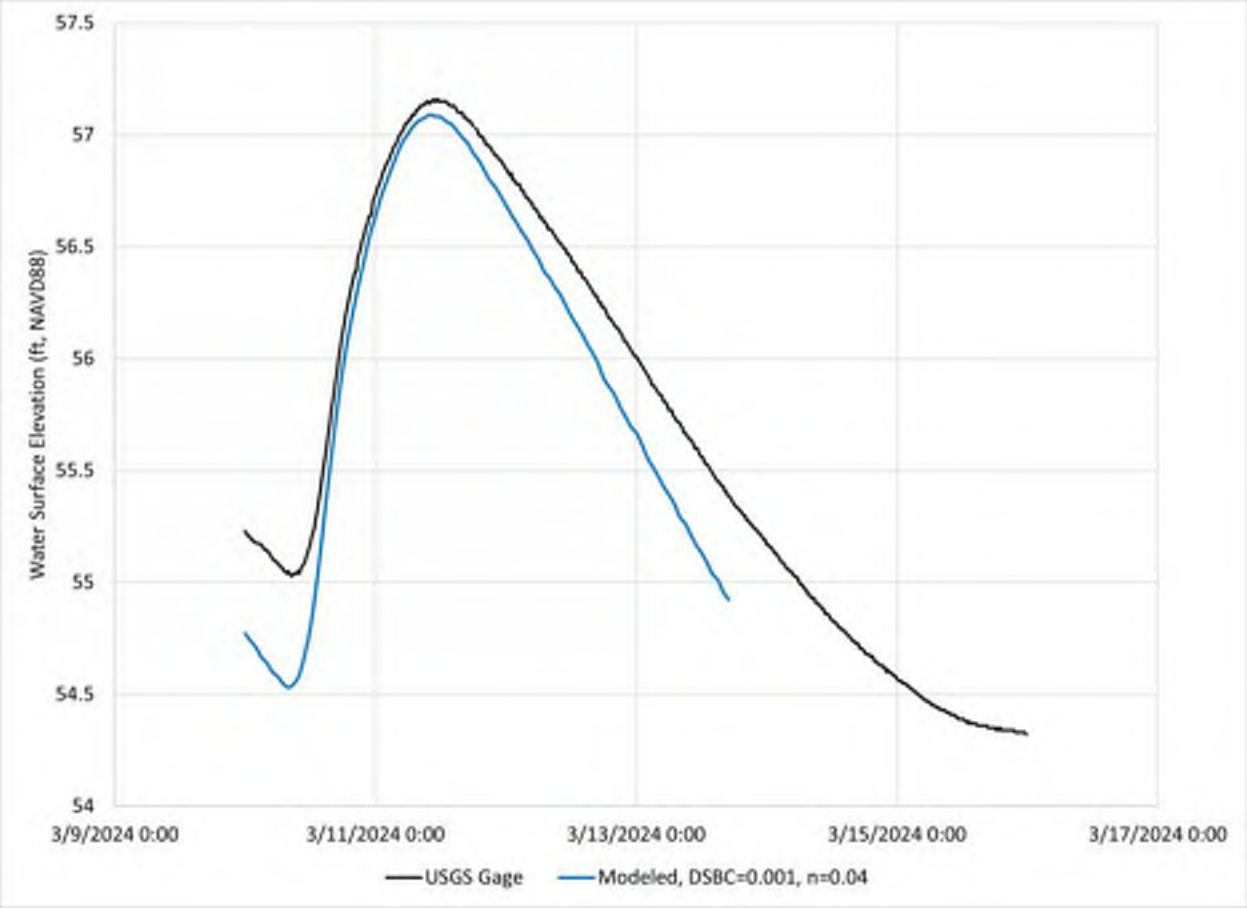


Figure 29. Comparison of recorded and modeled water surface elevation during the approximate 2-year return frequency event using a Manning's "n" value of 0.04 and downstream boundary condition of 0.001.

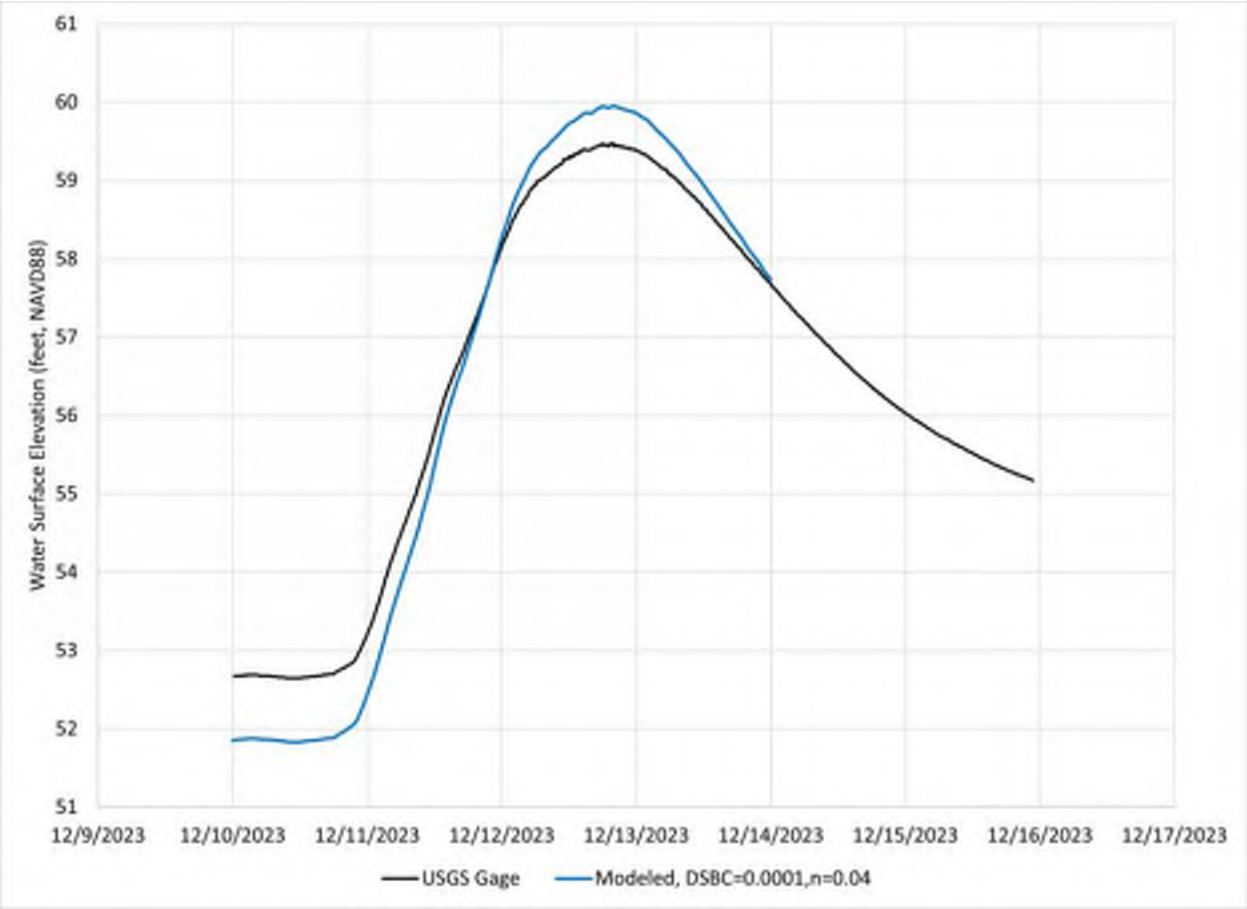


Figure 30. Comparison of recorded and modeled water surface elevation during the approximate 10-year return frequency event using a Manning's "n" value of 0.04 and downstream boundary condition of 0.001.

5. Proposed Design

This section of the report provides a narrative description of the proposed design presented in detail in the Final 100% Design Drawings included in Appendix A. The proposed design follows the selected alternative as presented in the Alternative Analysis memorandum, which is included in Appendix D, and builds upon the 90% designs previously completed in August of 2025. The design team roles and responsibilities are presented in Table 10.

Table 10: Design Team Roles and Responsibilities

Firm	Project Role/Responsibility
Inter-Fluve	Lead technical consultant, river science and engineering, river ecology and restoration, structure demolition, and water control
Fuss & O'Neill	Structural and site civil infrastructure coordination and design

5.1 REMOVALS

The proposed designs include removal of the entire Cherryfield Ice Dam spillway down to the original, pre-dam channel bed. The creosote-treated timber crib and rockfill training walls, as well as the Denil fishway, will also be removed. The proposed design includes removal of the existing creosote-treated timber crib ice piers. These ice piers will be replaced with a structure of similar shape as described in Section 5.6. The existing ice piers will be removed completely to the original, pre-pier channel bed. The creosote-treated timbers will be disposed of at an appropriate site, likely a regulated site for contaminated waste disposal. The existing rock fill will be salvaged for reuse on-site. Rock fill may be reused as salvaged riprap, or as portions of select fill. Reuse of existing rock fill material will only be allowed if the existing material fits the needs of the site and will be at the discretion of the engineer.

The proposed design includes partial removal of the existing earthen embankments. This removal provides additional flow conveyance through the project site during periods of flooding, decreasing the impact of the proposed nature-like fishway to flooding upstream. Both embankments will be cut back at a 2H:1V slope beginning at the top of the proposed grade control and extending to the existing grade. This slope will be protected with salvaged riprap, continuing the existing treatment on the upstream face of the embankments along the newly exposed section.

5.2 NATURE-LIKE FISHWAY

In place of the dam, the project proposes to construct a nature-like fishway. The proposed nature-like fishway spans the full width of the river, beginning at the location of the existing dam and extending about 250 feet downstream, where it ties into the existing riverbed. It is designed to maintain current typical head pond elevations and is divided into five main elements:

- Grade Control Structure
- Primary Channel
- Roughened Channel

- Overbank
- Bank Creation/Stabilization

The primary channel, located on the river-right side of the existing channel, conveys low flows. The roughened channel on the river-left side of the existing channel, conveys seasonal flows. The entire nature-like fishway is designed to convey flood flows.

Grade Control Structure

The grade control structure is a broad-crested weir that includes a low-flow section and will be constructed with boulders, fill, and sheet pile. It is designed to maintain existing water levels and for stability with considerations for both hydraulic forces and ice forces. The front (upstream) face of the grade control structure will be constructed of 4-foot-diameter boulders and engineered fill and will have a slope of 6H:1V from the existing bed to the crest. The primary control elevation of the grade control structure will be set at elevation 57.0 feet, with a low flow channel located at elevation 55.5 feet. This low flow channel will be positioned to optimize head pond elevation and fish passage.

The grade control structure will contain a sheet pile cutoff established to help keep water from travelling through interstitial spaces in the nature-like fishway, especially during low flows. The sheet pile cut off will supplement engineered and placed substrate to promote surficial flow through the nature-like fishway. Although not its primary function, the sheet pile cutoff will also help prevent seepage around the nature-like fishway.

A variety of ice force induced failure modes for the grade control structure are considered and factored into the design. Anchor ice can form on the grade control structure and destabilize it through floatation of placed material. Ice rafts may move downstream and forcefully impact the controlling weir. Ice can build up on the weir and push material up and over the controlling weir. Ice Jams can create an increase in velocity and roughness. Lastly, ice cover can increase the effective tractive force imposed by the stream on the river (Vaughan et al., 2002;) (CRREL, 2006).

Available literature suggests that analyzing stability based solely on typical riverine forces without accounting for impacts due to ice may not be adequate for long term stability. Applying adequate factors of safety and optimizing the geometry of the controlling weir work to create a stable structure able to withstand potential ice forces encountered. Quantitative analysis suggests that implementation of a conservative factor of safety when sizing substrate placed in a riverine setting works to counteract any additional forces due to ice impacts (Vaughan et al., 2002). Additionally, sizing material so that it is at least twice the size of the anticipated ice cover and configuring material to a 3H:1V slope or flatter is recommended (CRREL, 2006) (Tuthill, 2008). The design of the controlling weir incorporates these elements to provide a robust, appropriately shaped structure for long term stability.

Primary Channel

The primary channel of the nature-like fishway acts as the low flow conveyance of the river, as well as the primary fish passage zone. The average slope of the proposed primary channel is 2.1%. The thalweg of the primary channel is designed to have vertical variation along the longitudinal profile,

emulating step-pool channel morphology found in natural systems. Each step is intended to increase the grade of the low flow channel by 0.8 feet while the pools provide up to 3 feet of residual depth below each controlling step. Within the step sections, the channel has a compound configuration, with a low elevation channel with a 10-foot bottom width and 2H:1V bank slopes, and a high elevation channel with an additional 16-foot bottom width. The low flow channel ties into the roughened channel at a 2H:1V bank slope, resulting in a top width of 42 feet and a variable depth step control. This configuration optimizes passage conditions at low and moderate passage flows. Within pool sections, the channel has a bottom width of 14 feet and a variable top width. The left bank slope is 3H:1V and the right bank slope is 2H:1V.

Material sizing for the steps is determined using spherical moment calculations that assume a 0.5-foot embedded boulder depth and result in a stability ratio of 1.55 during the 100-year event. Each step is built using rock with a minimum diameter of 3 feet. These rocks are formed to create a step that has a material thickness of 6-feet. The void spaces between boulders are filled with choking material designed to pack all available interstitial space, and to prevent piping of flow through the step matrix. Material sizing for the pools was primarily determined using the USACE Maynord Method (Maynord, 1993) and moment stability methods (Julien, 2010). Material in the pools has a median diameter of 2-feet with a material thickness of 4-feet.

Roughened Channel

The roughened channel occupies the area on river left, immediately adjacent to the primary channel. The roughened channel is designed to be dry during periods of low flow, and progressively wetted as flows increase. The roughened channel provides passage redundancy when there are high flow periods during the fish passage season, creating a space that fish can utilize as needed, and providing options for passage if other areas become more difficult to pass. This feature mimics a natural river channel and provides variability and complexity in flow depths and velocities both along the river profile and along the river cross section.

The roughened channel has a cross-slope of approximately 2.0%, providing positive drainage towards the primary channel within each section. The longitudinal slope of the roughened overbank varies, with a shallow gradient at the upstream end (approximately 0.1%), and a steeper gradient at the downstream end (approximately 2.4%). At the upstream end, it ties into the controlling weir, and at the downstream end, the roughened overbank blends into the existing river bed.

As part of the design of the roughened channel, we explored adding boulder clusters to mimic the natural bed downstream of the dam. These boulders are designed to be partially submerged during high passage flows. The roughness boulders provide performance benefits, creating a more natural-looking channel and providing refugia for migrating fish. Roughness boulders generate macro eddies and areas of reduced velocity, aiding weaker swimmers and offering a more natural flow pattern that aligns with fish intuition.

Positioning boulders within the nature-like fishway forms interconnected micro channels, so it is essential to understand the resulting hydraulics and confirm that the boulders do not concentrate flow and raise velocities above passable levels for migrating fish (Acharya et al., 2004). The two-

dimensional HEC-RAS model examined three center to center spacings, 30-foot, 40-foot, and 50-foot, across the full range of migration flows. Each cluster was represented by three four-foot boulders embedded two feet into the bed. The goal was to maximize cluster density while keeping local velocities below the six feet per second swimming threshold for river herring. Modeling showed that a 30-foot spacing provides the desired velocity reduction without sacrificing conveyance, giving the best balance between habitat complexity and hydraulic performance.

Material sizing for the roughened channel is primarily determined using the USACE Maynord Method (Maynord, 1993), and moment stability methods (Julien, 2010). Material in the roughened channel has a median diameter of 2-feet with a material depth of 4-feet. The roughness boulder sizing and embedment criteria is determined using spherical moment calculations and employing a variety of assumptions related to size and position.

Overbank

The overbank occupies the area on river right, immediately adjacent to the primary channel. The overbank is designed to concentrate passage flows in the primary channel and in the roughened channel, and to provide stable flood conveyance. Set at an elevation approximately 2-feet higher than the roughened overbank, the high elevation overbank conveys flow at 2-year and larger events. The relative frequency of flooding in the high elevation overbank will promote vegetative growth over time. The design includes the placement of an erosion resistant growing medium with plantings that will eventually create a diversely vegetated bank that mimics the existing banks upstream and downstream of the project area. The high elevation overbank has a cross slope of 2.0%, providing positive cross drainage. The longitudinal slope of the high elevation overbank follows the average slope of the primary channel. Material in the high elevation overbank consists of a 50/50 mix of 6-inch cobble and loam, providing stability and sufficient growth media for abundant vegetative growth. This material is placed with a thickness of 2 feet.

Bank Stabilization/Construction

Bank stabilization and creation measures include a combination of fabric-encapsulated soil (FES) lifts, and fabric slope protection to provide near-term stability where indicated. Seed is applied during installation of these soil and fabric structures, and container plantings are included, ensuring long-term stability through vegetative cover where FES lifts and fabric-covered slopes are utilized.

FES lifts are typically constructed out of soil (or a soil-cobble mix) and biodegradable coconut fabric. The fabric is a near-term measure to hold the soil in place during the vegetation establishment period. The strength of the fabric diminishes over a period of approximately 2 years. After 2 years, the stability of the bank is dependent primarily on vegetation and the soil structure.

Fabric slope protection is typically constructed out of soil and biodegradable fabric. Fabric slope protection is suitable for use in locations where there is need to stabilize a relatively flat earthen slope, with low hydraulic forces. The fabric is a near-term measure to hold the soil in place during the vegetation establishment period. The strength of the fabric diminishes over a period of

approximately 2 years. After 2 years, the stability of the ground surface is dependent primarily on vegetation and soil structure.

On the river-left bank, adjacent to the roughened channel, the proposed design provides fabric slope protection that is installed on the existing grade (approximately 6H:1V Slope). Fabric slope protection is planted with seed and riparian trees and shrubs.

On the river-right, adjacent to the overbank, a new channel bank is formed with layers of 1-foot thick FES lifts applied at a 4H:1V slope. The FES lifts are backfilled with loam and planted with seed and native riparian/upland shrubs. Surface fabric extends from the top layer of FES lifts to the existing grade, stabilizing the newly constructed slope. Surface fabric is planted with seed and native upland trees and shrubs.

5.3 REVEGETATION

The restoration planting plan includes four different types of planting treatments:

- Riparian planting zone
- Transitional planting zone
- Riparian staking planting zone
- Upland planting zone

The planting treatments consider grading, substrate, hydrology, and the relationship between the existing wetlands and hydrology. The planting palette in each zone includes plants with a range of wetland indicator statuses (Table 11) with diverse growth forms to increase the likelihood of successful plant establishment across variable conditions, intending to center on the proposed hydrologic conditions. All zones include both creeping shrubs and upright trees to provide erosion control, habitat diversity, and shade.

Riparian Staking is the wettest zone. This zone extends from river left at the nature-like fishway to the existing slope break. This zone is mostly within the OHW and the substrate in this zone has a median diameter of 12-inches. This zone is comprised of facultative wetland species that can be installed as live stakes in this rocky substrate. The substrate in the other zones will support the planting of potted plants.

The Riparian zone extends from the edge of the Riparian Staking or low flow inundation boundary to the approximate edge of the two-year flood event footprint. This zone is comprised of a mixture of facultative wetland and facultative species that tolerate regular flooding, including the same species as the Riparian Staking with the addition of potted plants.

Upslope is the Transitional zone, located above the two-year flood event footprint. The species in this zone range from facultative wetland to facultative upland.

The Upland zone is the highest and driest, comprised of facultative upland and upland species. Seeding is planned in all zones with the exception of the Riparian Staking. The Riparian zone will

have a wet seed mix, and the Transitional and Upland zones will have a drier seed mix. The species composition is herbaceous and follows the wetland indicator status of the live plant zones.

Table 11. United States Army Corps of Engineers Wetland Indicator Status Definitions. Arranged from most likely to least likely to occur in wetlands.

Status	Abbreviation	Description
Obligate Wetland	OBL	Almost always occurs in wetlands
Facultative Wetland	FACW	Usually occurs in wetlands, but may occur in non-wetlands
Facultative	FAC	Occur in wetlands and non-wetlands
Facultative Wetland	FACU	Usually occur in non-wetlands, but may occur in wetlands
Upland	UPL	Almost always occur in non-wetlands

5.4 FISH PASSAGE DESIGN

The nature-like fishway generally follows the Federal Interagency Nature-like Fishway Passage Design Guidelines for Atlantic Coast Diadromous Fishes (Turek et al., 2016). Through redundant design, and optimization of fishway geometry, many different pathways are available for fish to utilize while migrating upstream through the project area under a range of different flows. Designing for multiple species, with varying sizes and swimming abilities is difficult, and although the proposed design endeavors to accomplish this task, there are areas where the design falls short of the interagency design guidelines. However, by utilizing natural design elements and natural features, the proposed nature-like fishway enables an intuitive response from fish improving their ability to pass through the project site. These elements, in combination, provide a system by which fish are more likely to exceed assumed capabilities presented in the regional passage criteria. Table 12 provides a detailed comparison of the proposed geometric design with relevant regional passage guidelines. Velocity and depth criteria are discussed in detail below.

Table 12: Proposed Design compared to regional passage criteria for select sea run species** (Turek et al., 2016)**. Deviations from the published passage criteria are highlighted in orange.

	Minimum Pool Width (ft)	Minimum Pool Depth (ft)	Minimum Pool Length (ft)	Minimum Weir Opening Width (ft)	Maximum Fishway Channel Slope
Proposed Design	45.5	4.0	38.0	16.0	2.1%
Atlantic Salmon	20.0	3.75	40.0	6.25	5.0%
American Shad	20.0	4.0	30.0	5.0	3.33%
Alewife	5.0	2.0	10.0	2.5	5.0%

Sea Lamprey	10.0	2.0	20.0	0.75	3.33%
Sea Run Brook Trout	5.0	2.5	10.0	1.5	5.0%

The recommended maximum fishway weir opening velocities in the nature-like fishway design guidelines for Alewife, American Shad, Atlantic Salmon, and Sea Run Brook Trout are 6 feet per second (ft/s), 8.25 ft/s, 13.75 ft/s, and 3.25 ft/s respectively (Turek et al., 2016). In practice, no single threshold velocity prevents fish from being able to pass. Several other factors should be considered when determining if predicted velocities are suitable for fish passage. The guidelines cited above indicate velocities that fish can swim against for intermittent periods of elevated effort, rather than excessive distances. Providing a diversity of flow conditions within the channel over a range of anticipated design flows allows migrating fish opportunities for rest and is an important consideration (USFWS, 2019). The proposed channel morphology for the nature-like fishway includes step-pool morphology with a roughened channel during high flows that will provide diverse flow conditions for fish passage. Pools provide areas for fish to rest between short sections of higher velocity that occur over step-crests.

The relationship between flow velocity and the distance required for fish passage was explored using a computer model developed by the U.S. Fish and Wildlife Service (USFWS, 2016) which estimates a proportion of alewife successfully passing a high velocity zone of a given length. The 'survivorship' function that the model implements was originally presented in Haro et al. (2004) and summarizes the ability of fish to ascend a high velocity zone before having to fall back to slower waters due to fatigue. Because the empirical data that the Haro study reported was based on fish that had been handled repeatedly in the experiment, common practice uses the 60% survivorship range as an approximate threshold for fish passage potential (USFWS, 2018). The model was executed for river herring assuming a range of lengths and velocities to result in the series of curves organized by velocity barrier length (Figure 31).

The model suggests that alewife can reasonably be expected to traverse a velocity barrier of 2.4 m/s (7.9 ft/s) for a distance of 4.6 m (15.1 ft). Similar research has shown that American Shad and Sea Run Brook Trout are able to outperform the regional passage criteria over shorter distances (Haro et al., 2004) (Castro-Santos et al., 2012).

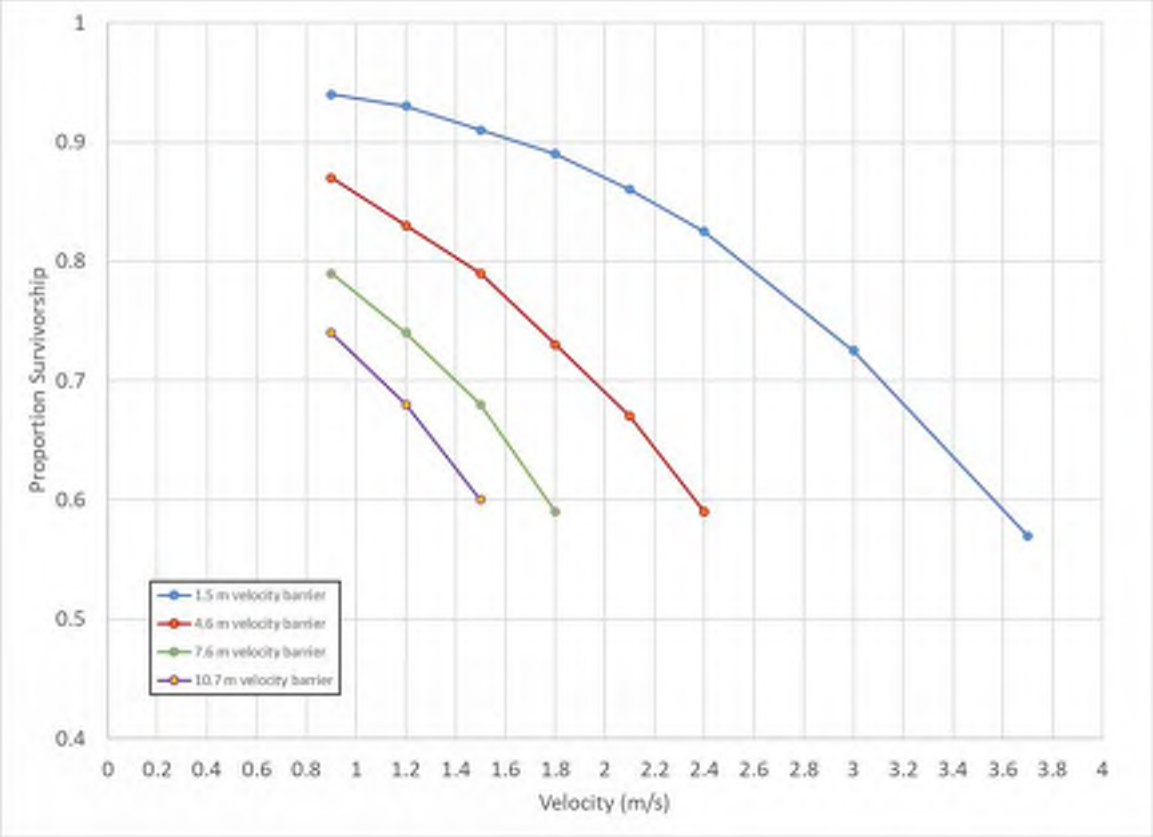


Figure 31. Proportion of survivorship of 22 cm Alewife for velocity barriers of varying lengths. Assumed water temperature of 18 degrees Celsius.

The recommended minimum weir opening depth in the nature-like fishway design guidelines for Alewife, American Shad, Atlantic Salmon, and Sea Run Brook Trout is 1.0-ft, 2.25-ft, 2.0-ft, and 1.25-ft respectively (Turek et al., 2016). The design criteria for depth is based on typical body morphology with multipliers and buffers included, presenting a conservative approach for fish passage. While these depth values are preferred and will optimize fish passage through a system, not meeting these requirements does not inherently create a barrier to passage. The nature-like fishway design guidelines set the value for minimum weir opening depth at three times the body depth of the largest sized individual.

Review of fish passage guidelines and research, combined with the morphology and complexity of the proposed nature-like fishway suggest utilization of non-binary design criteria for depth and velocity requirements. The non-binary design criteria allows for greater nuance when attempting to determine if fish passage can be achieved at a project site. Two-dimensional hydraulic modelling results, in combination with non-binary design criteria allow a user to more readily visualize potential passage routes and assess overall passage potential through the project for a range of flows. For this analysis, we created four classifications of passage that each have specific, and unique velocity and depth criteria for species of interest. The passage classifications are named “Favorable”, “Optimal”, “Sub-Optimal”, and “Not Anticipated”. “Favorable” conditions exceed the regional fish

passage guidelines, "Optimal" conditions meet the reginal fish passage guidelines, "Sub-Optimal" conditions do not meet the regional fish passage but are likely still passable under many conditions, and "Not Anticipated" conditions do not meet any of the design criteria. Depth criteria for "Sub-Optimal" classification are based on a depth that is equal to 1.5 times the body depth of the largest individual documented in Turek et al. (2016). Velocity criteria for "Sub-Optimal" classifications are based on available survivorship models for passage of a velocity barrier of 3 meters (9.8 feet) (Haro et al., 2004) (Castro-Santos et al., 2012) (Katopodis & Gervais, 2016). Results of this analysis are provided in Figure 32, Figure 33, Figure 34, Figure 35, Figure 36, and Figure 37.

Table 13: Non-Binary design criteria, and corresponding passage classifications for Alewife, American Shad, Atlantic Salmon, and Sea Run Brook Trout.

Passage Classification	Alewife	American Shad	Atlantic Salmon	Sea Run Brook Trout
Favorable	Depth > 2.0 ft Vel < 3.0 ft/s	Depth > 4.0 ft Vel < 4.0 ft/s	Depth > 3.75 ft Vel < 4.0 ft/s	Depth > 2.5 ft Vel < 2.0 ft/s
Optimal	Depth > 1.0 ft Vel < 6.0 ft/s	Depth > 2.25 ft Vel < 8.25 ft/s	Depth > 2.25 ft Vel < 13.75 ft/s	Depth > 2.25 ft Vel < 3.25 ft/s
Sub-Optimal	Depth > 0.5 ft Vel < 8.0 ft/s	Depth > 1.1 ft Vel < 13.0 ft/s	Depth > 1.0 ft Vel < 13.75 ft/s	Depth > 0.6 ft Vel < 6.0 ft/s
Not Anticipated	Depth < 0.5 ft Vel > 8.0 ft/s	Depth < 1.1 ft Vel > 13.0 ft/s	Depth < 1.0 ft Vel > 13.75 ft/s	Depth < 0.6 ft Vel > 6.0 ft/s

Based on hydraulic model results, Alewife are expected to be able to utilize the proposed nature-like fishway for the majority of the peak adult immigration period. Passage potential for alewife is particularly high during lower flows (June 95% exceedance, June 50% exceedance, May 95% exceedance, May 50% exceedance), with clear a clear pathway upstream along the primary channel of the nature-like fishway. Passage potential remains high during higher flows (June 5% exceedance, May 5% exceedance), but with a less discrete corridor of passage. During higher fish passage flows, modelling indicates potential increased usage of the roughened channel for alewife passage with the primary channel proving too hydraulically intense.

American Shad and Atlantic Salmon have very similar design criteria, and hydraulic model results show equally similar passage potential through the proposed nature-like fishway. During lower flows, (June 95% exceedance, June 50% exceedance, May 95% exceedance) depth and velocity are more than adequate for passage in the pools, however depth of flow over the steps fall below the regional fish passage design criteria (Turek et al., 2016). There is sufficient depth flow over the steps to place it in the "Sub-Optimal" passage classification. During higher flows (June 5% exceedance, May 50% Exceedance, May 5% exceedance) Passage potential improves within the primary channel of the nature-like fishway, and the model indicates potential use of the roughened channel for passage during the highest flows.

Sea Run Brook Trout are not a primary species of interest for this project, but as a species of fish that has co-evolved with Atlantic Salmon, it is important culturally, and efforts to restore native Brook

Trout fisheries across the state of Maine are ongoing. Thus, it is important to assess the effect of the proposed nature-like fishway on this species. Passage potential for Brook Trout is not as high as for Alewife, American Shad, or Atlantic Salmon. Hydraulic modelling indicates that at lower flows passage potential is highest along the primary channel of the fishway, with the steps creating sub-optimal conditions for passage due to velocity. The fishway does however provide large pools with high resting potential to give ascending Brook Trout space to rest as needed. Passage potential during the highest flows (June 5% exceedance, May 5% exceedance) becomes marginal with no discrete areas of passage and large areas of sub-optimal passage potential. Roughness elements in the fishway could provide additional areas for passage that are not represented in the model results.

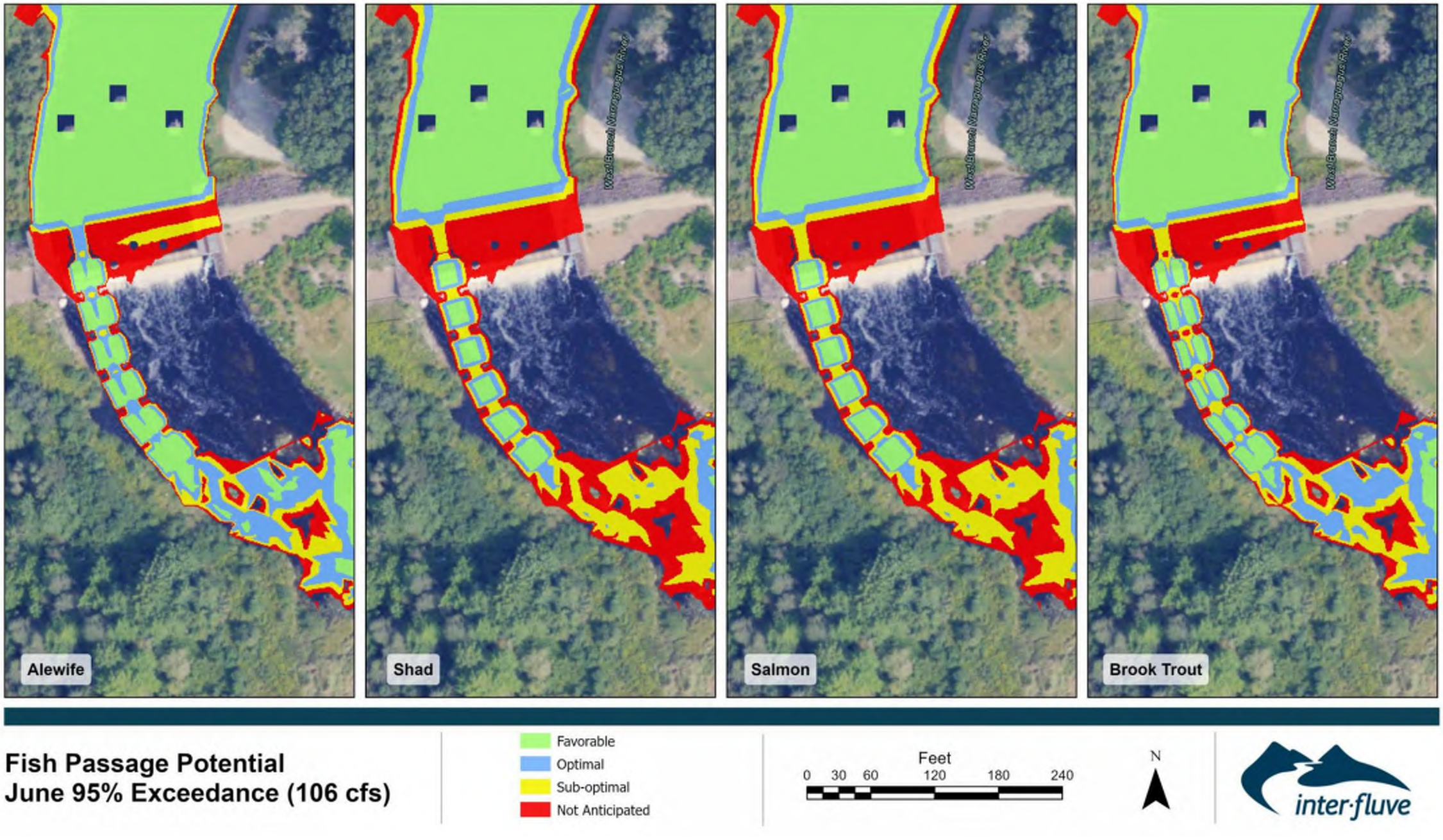


Figure 32. Fish passage potential at June 95% exceedance.

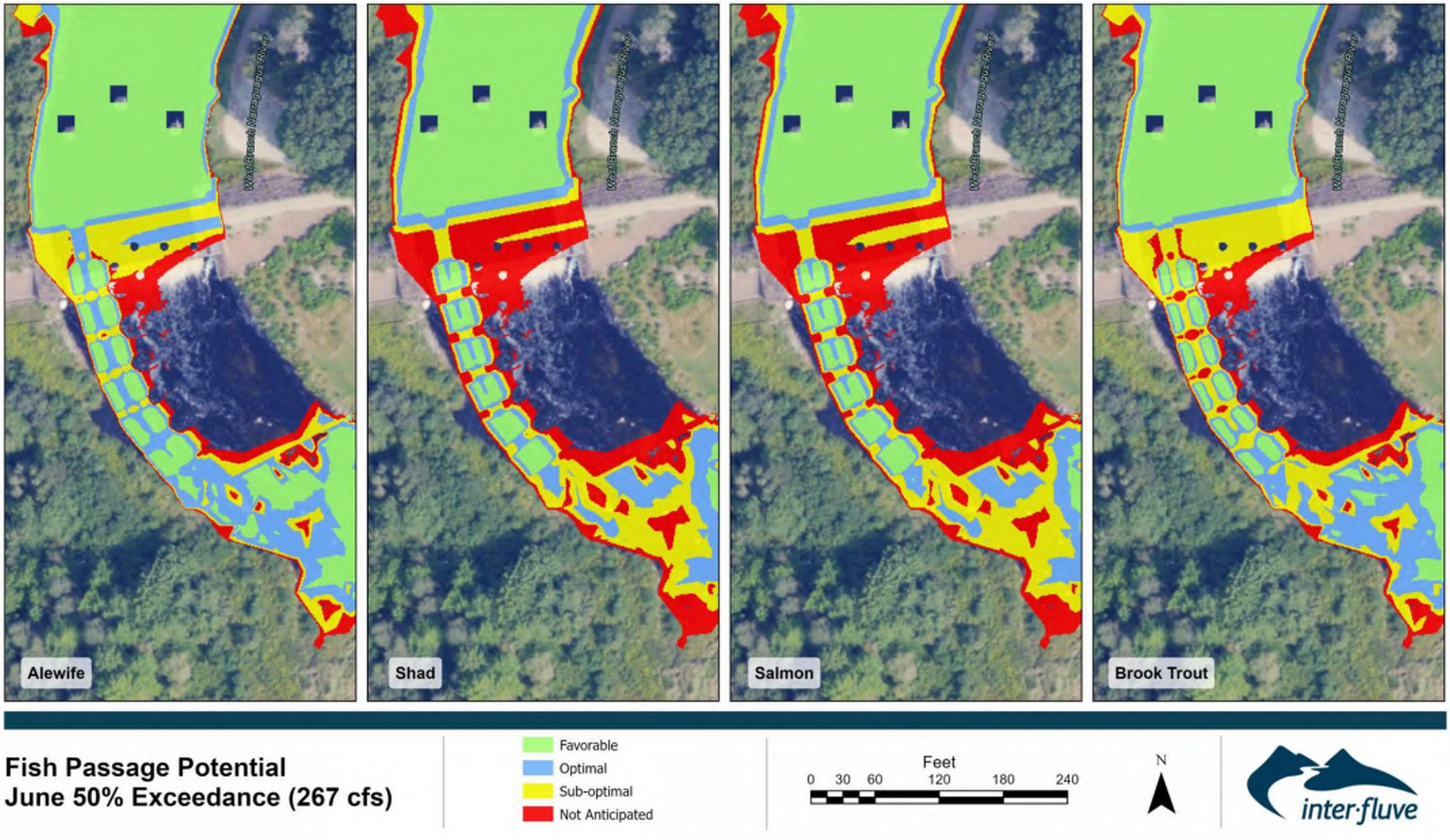


Figure 33. Fish passage potential at June 50% exceedance.

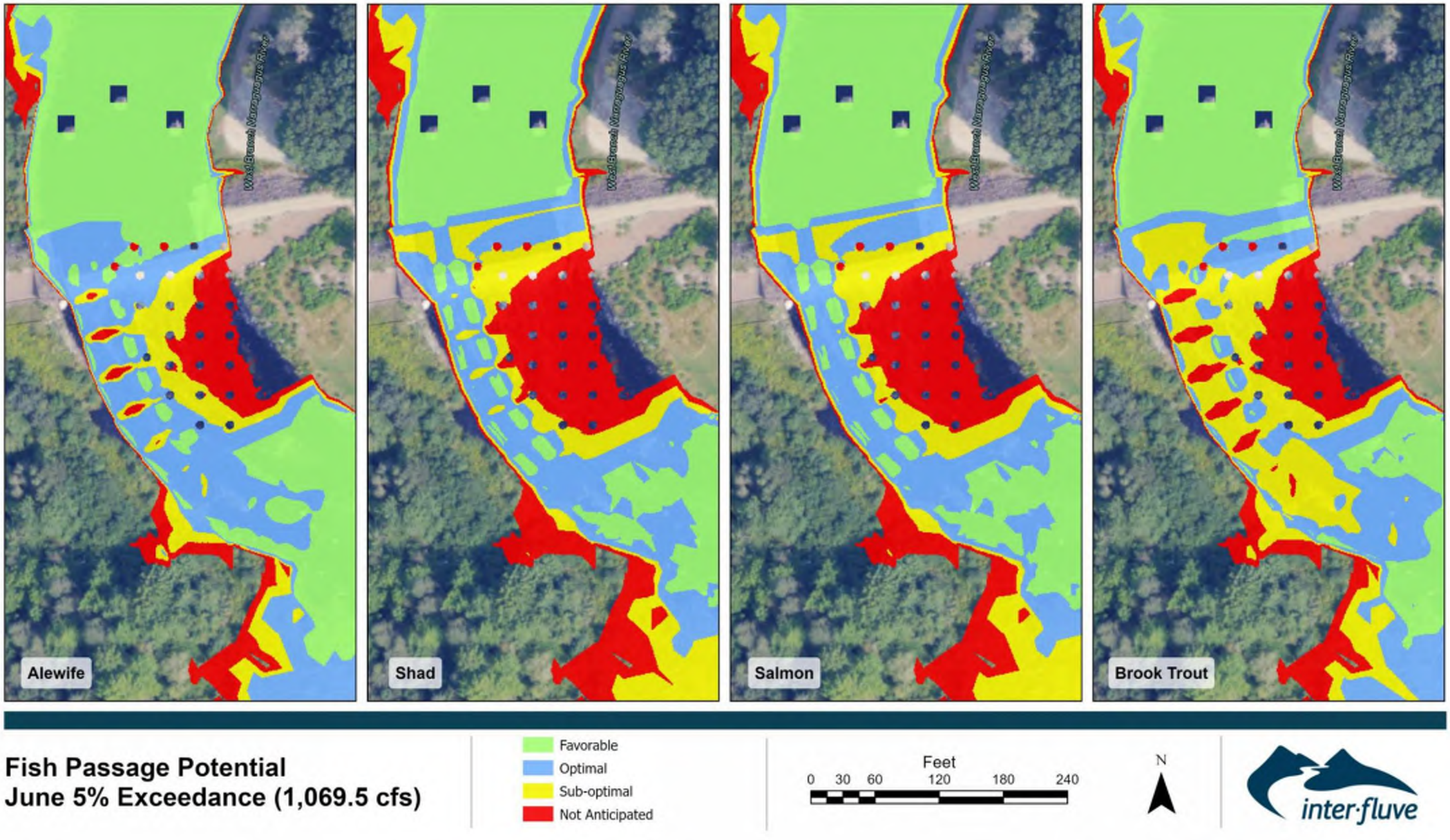


Figure 34. Fish passage potential at June 5% exceedance.

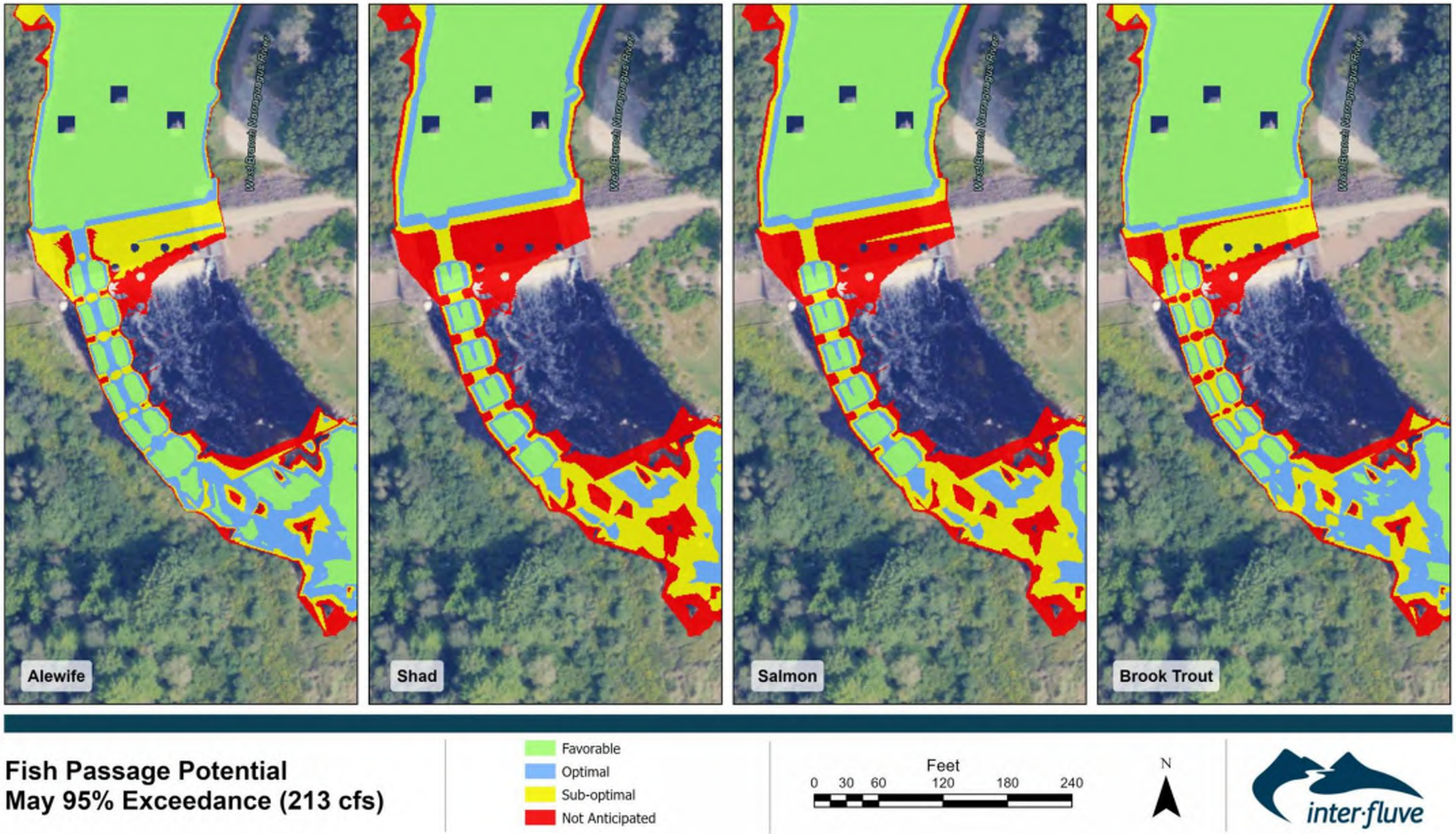


Figure 35. Fish passage potential at May 95% exceedance.

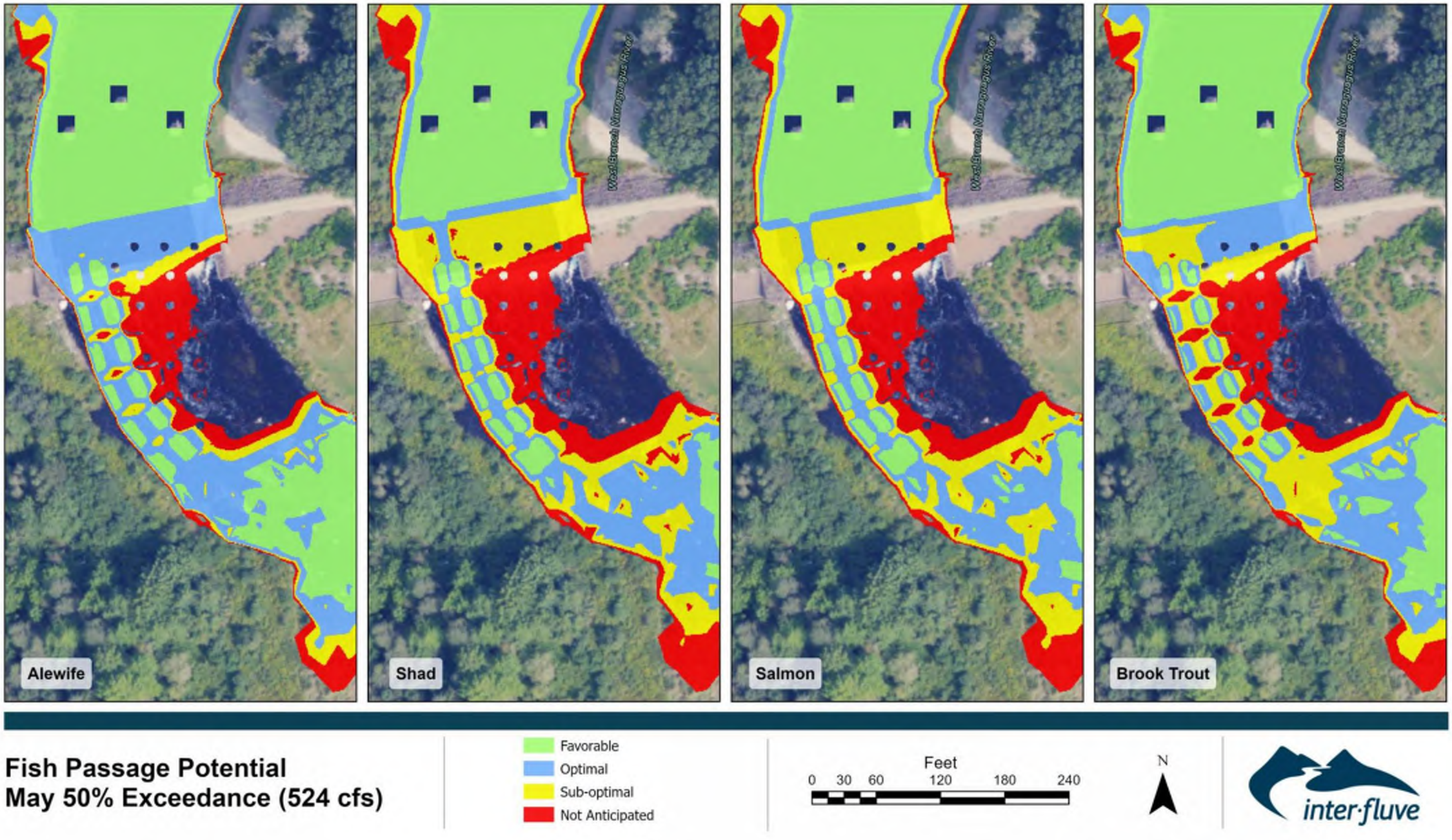


Figure 36. Fish passage potential at May 50% exceedance.

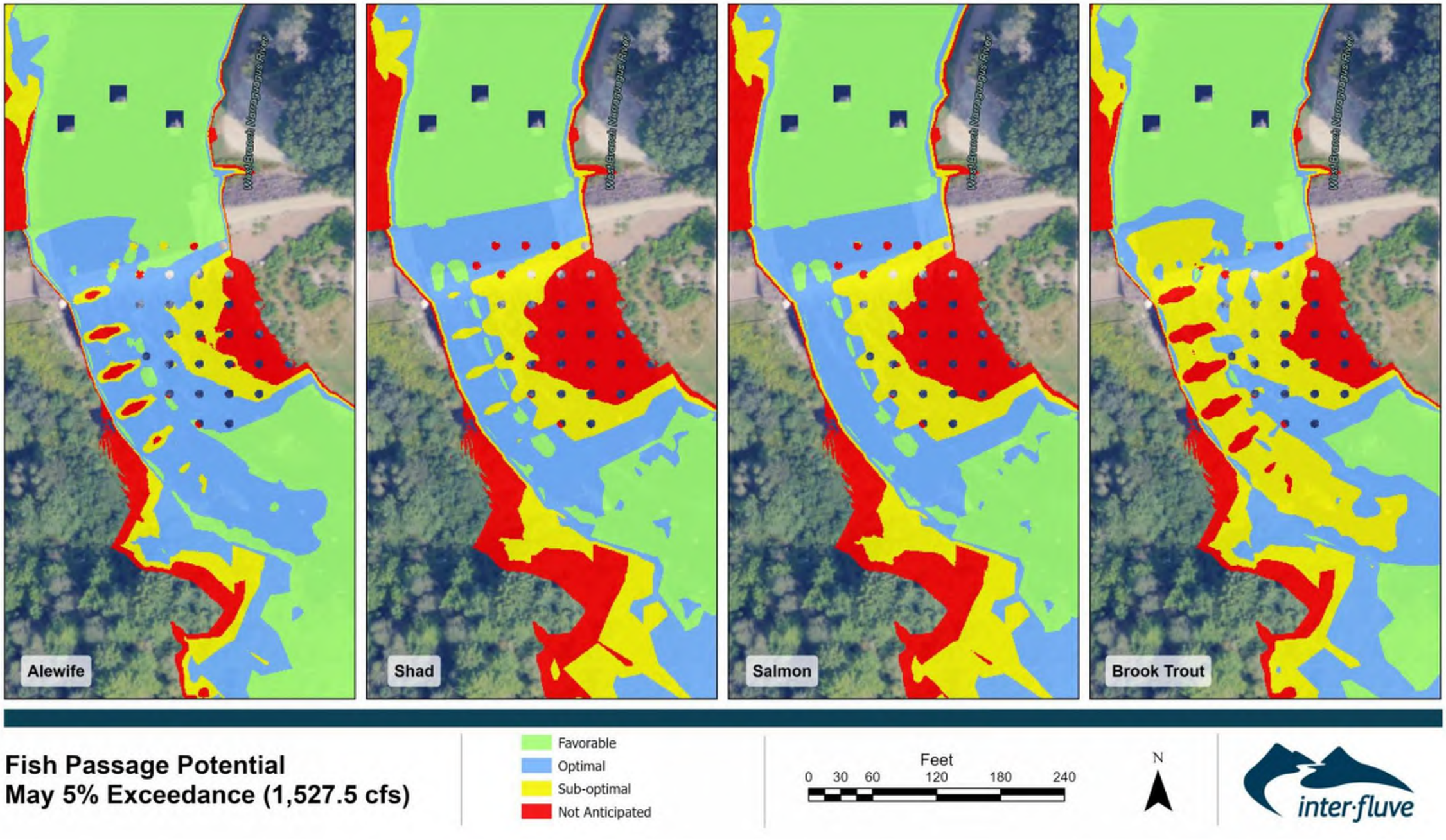


Figure 37. Fish passage potential at May 5% exceedance.

5.5 HYDRAULICS OF THE PROPOSED DESIGN

This section of the report summarizes selected model results for existing and proposed conditions. Additional model results are included in Appendix F.

5.5.1 Energy Dissipation Factor (EDF)

The design of the proposed fishway was evaluated for energy dissipation in the pools through calculation of the Energy Dissipation Factor (EDF). Often, desired reduction in velocities results in increased roughness in the water column, and excessive dissipation rates can result in unwanted turbulence and air entrainment (USFWS, 2019). The results for the EDF calculations are summarized in Table 15. Target EDF values vary for different fish species ranging from 5.0 for adult salmonids to 2.0 for juvenile salmonids (USFWS, 2019). Due to the configuration of the proposed nature-like fishway, all the river flow will not occupy the proposed pools during certain events, with flow being distributed along the roughened channel as well. A received discharge value was determined to more accurately represent flow within the pools of the primary channel during high fish passage flows. Calculated EDF values indicate that values will remain sufficiently low through the passage season for lower flows. While presented with relatively elevated EDF values for the highest passage flows (June 5% exceedance, May 5% Exceedance) it is anticipated that non-salmonids will utilize portions of the nature-like fishway outside the pools, or adjacent to pools which may minimize exposure to excessive turbulence. In addition, it should be noted that relatively higher EDF values may be more tolerable in nature-like fishways due to the complexity of flow and the natural refugia that develops in these systems.

Table 14: Calculated EDF Values for Selected Flow Conditions During the Upstream Fish Passage Period

Flow	Discharge (cfs)	Received Discharge (cfs)	EDF (ft-lb/ft^3/s)
June 95% Exceedance	106	106	1.16
June 50% Exceedance	267	267	1.94
June 5% Exceedance	1070	1022	3.97
May 95% Exceedance	213	213	1.80
May 50% Exceedance	524	524	2.78
May 5% Exceedance	1528	1361	4.51

5.5.2 Water Surface Elevation

Figure 38 through Figure 40 show the resulting simulated water surface profile along the centerline of the primary channel for the entire length of the model domain for the existing (EX) and proposed (PR) conditions during each of the events. The bed profile of the existing and proposed conditions is also included in the figures.

Figure 38 shows model results that indicate that proposed conditions create a small reduction (0.39 feet) in upstream water surface elevation during extreme annual low flows. Figure 39 shows model results that indicate this reduction is no longer present during average yearly low flows. Figure 40 shows model results that indicate a reduction in upstream flooding during the 10-year, 100-year, and FEMA 100-year flow events for proposed conditions, and no significant changes upstream during the 2-year flow event. There is a short zone of increased water surface elevations that occurs where the river traverses the proposed nature-like fishway. Immediately downstream of the proposed work, the flood water surface elevations converge to match existing conditions.

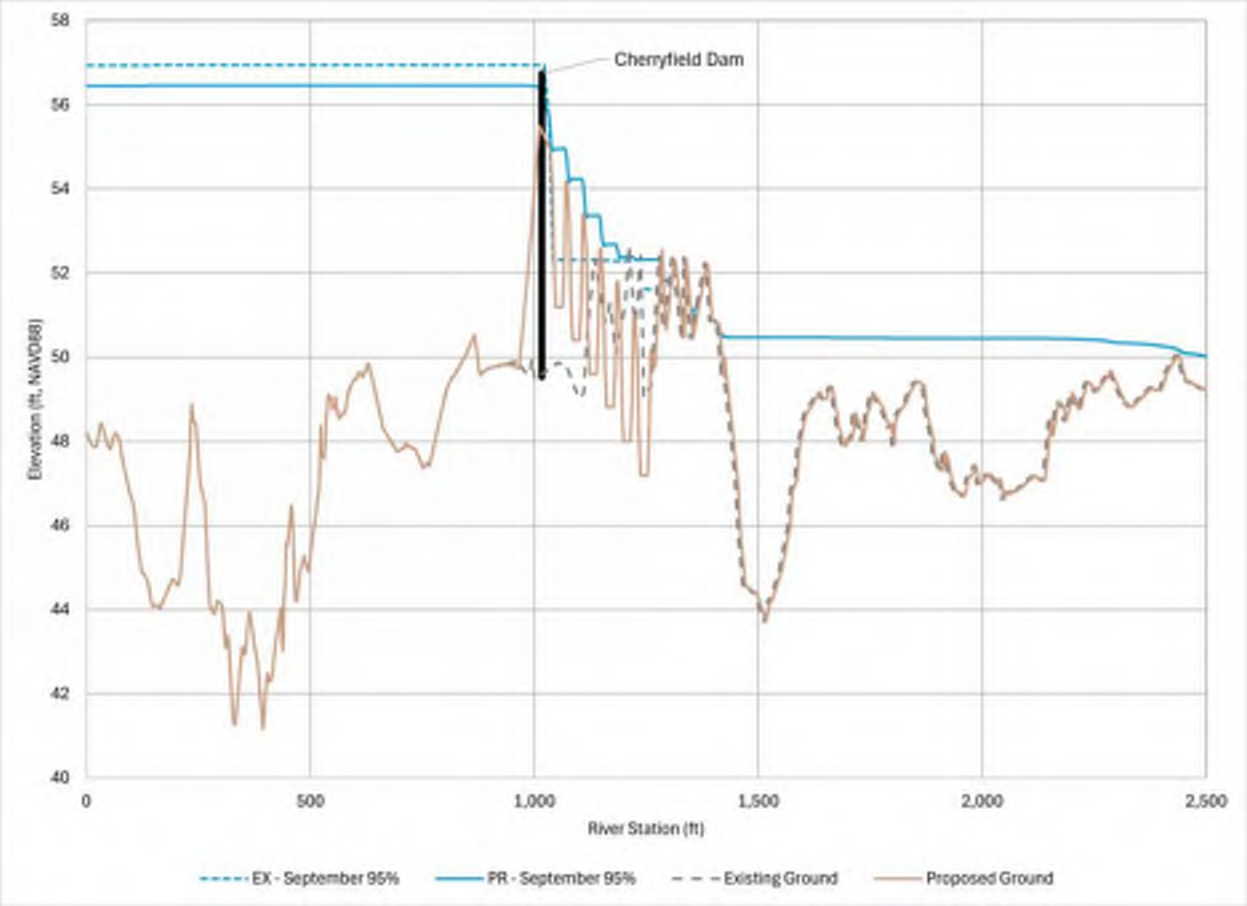


Figure 38. Existing and proposed water surface elevation profile during the September 95% (32 cfs) flow.

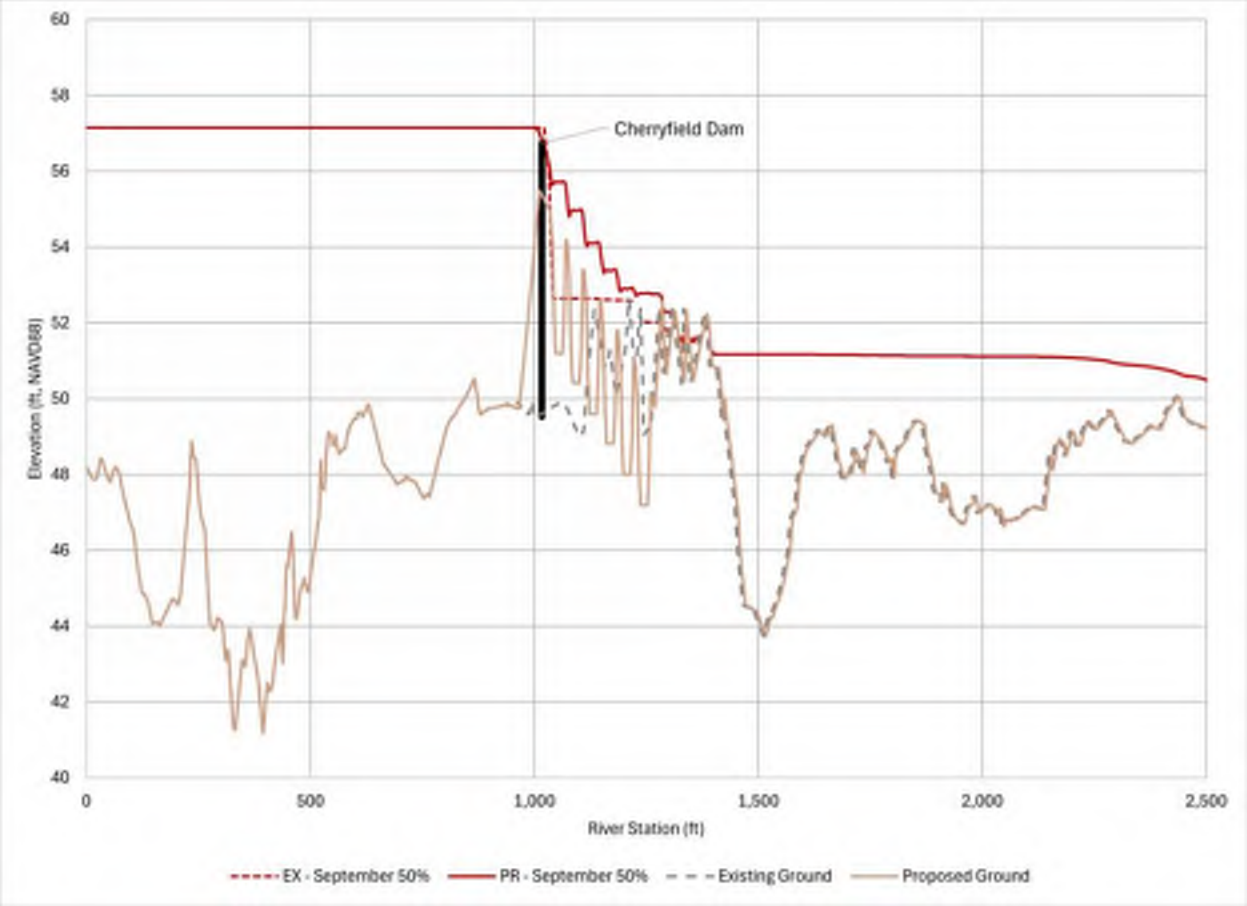


Figure 39. Existing and proposed water surface profile during the September 50% (97 cfs) flow.

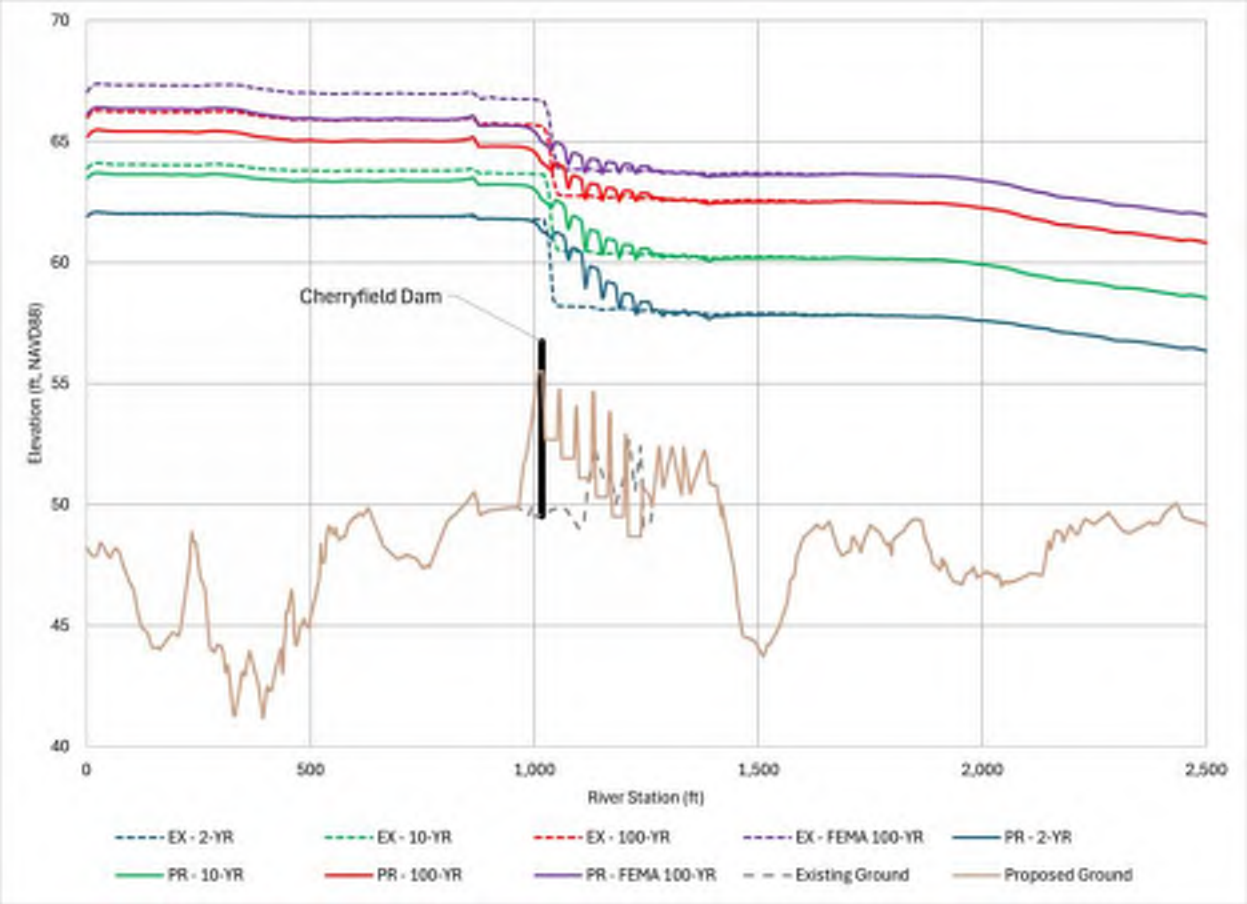


Figure 40. Existing and proposed water surface profile during the 2-year (4,120 cfs), 10-year (6,590 cfs), 100-year (9,630 cfs) and FEMA 100-year (11,300 cfs) flow.

5.5.3 Velocity

The hydraulic model predicts that the proposed project will result in a modest increase in velocity upstream of the project area for most flood events. Velocity upstream of the project area will remain unchanged for typical seasonal and annual events. Velocity increases at the project site for all events, before matching the existing conditions downstream of the project site. Figure 41 and Figure 42 show modeled velocities for existing and proposed conditions during a 100-year event.

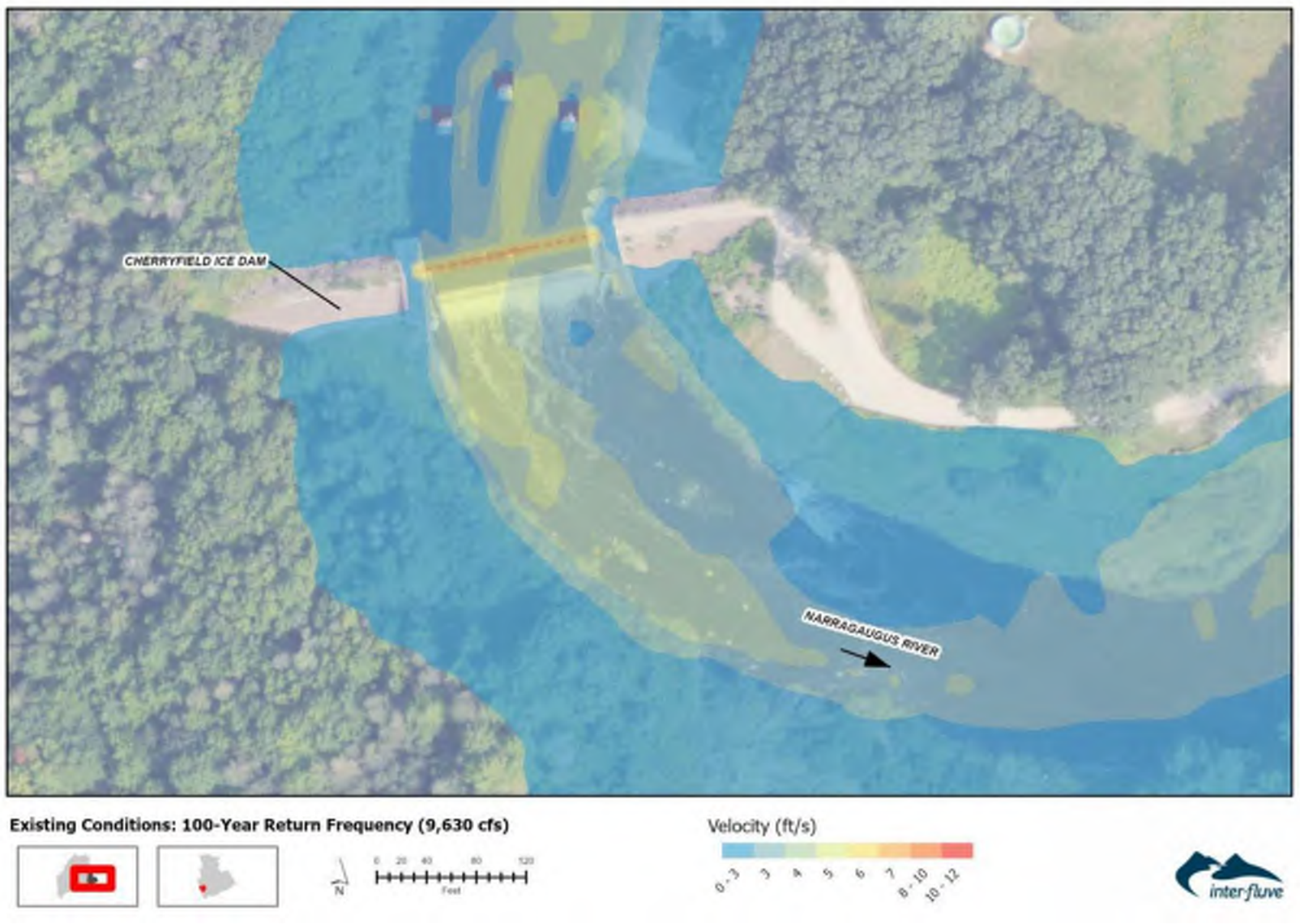


Figure 41: Existing condition velocity at the 100-year return interval.

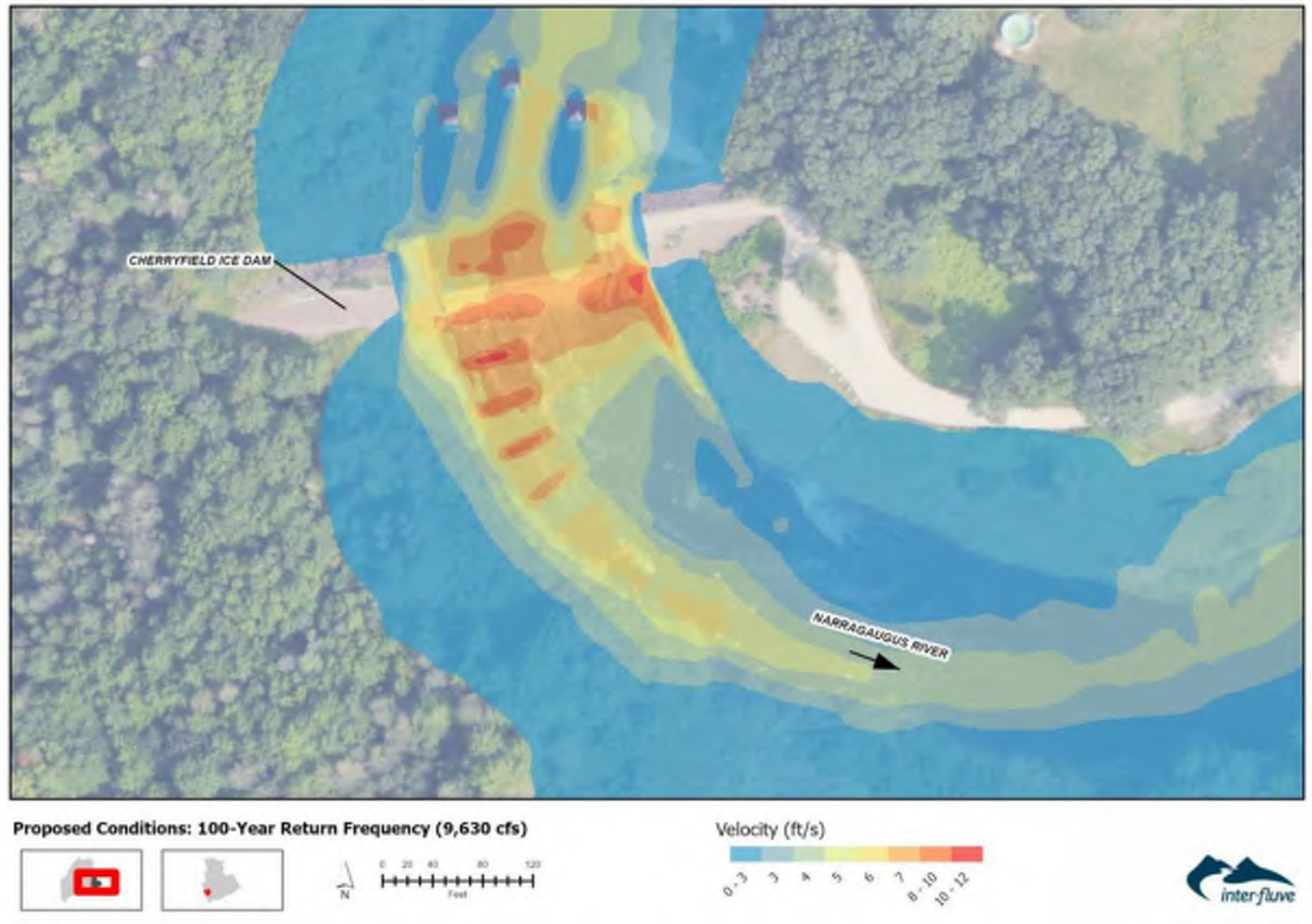


Figure 42: Proposed condition velocity at the 100-year return interval.

5.5.4 Shear Stress

The hydraulic model predicts that the upstream and the downstream reaches of the Narraguagus River will experience similar shear stresses under proposed conditions as under existing conditions. Shear stresses are predicted to increase at the location of the nature-like fishway, in line with the increases seen in velocity. These increases are isolated to the location of the proposed project. Downstream, the proposed shear stresses converge to match the existing shear stresses. Figure 43 and Figure 44 show modeled shear stresses for existing and proposed conditions during a 100-year event.



Figure 43: Existing condition shear stress at the 100-year return interval.

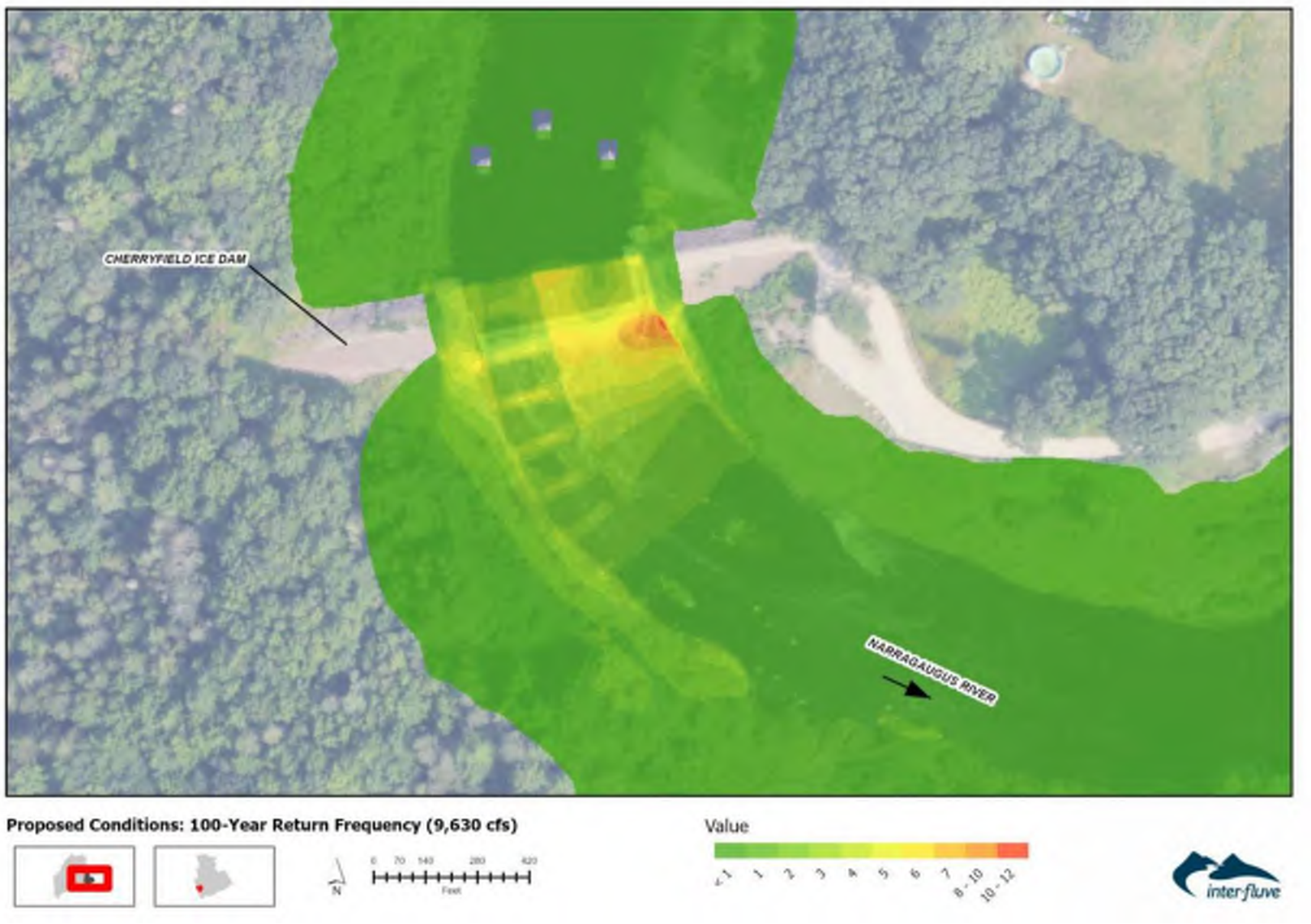


Figure 44: Proposed condition shear stress at the 100-year return interval.

5.5.5 Inundation Extents

Inundation extents of the Narraguagus river are expected to vary from existing conditions at the project site for low flows, while maintaining similar inundation extents for flood events. For existing conditions, the dam spillway evenly distributes flow across the river at all flows, including low flows, creating a typical wetted width of 140 feet. The geometry of the proposed nature-like fishway concentrates flow towards the primary channel on the right side of the river during lower flows, creating narrower wetted width through the fishway. For high seasonal, annual, and peak flood events, the inundation extents at the project site match existing conditions. Figure 45 and Figure 46 show the inundation extents for existing and proposed conditions for the modeled 2-year, 10, year, 100-year, and FEMA 100-year events. While there is a decrease in flood water surface elevation for these events, the inundation extents are not anticipated to change appreciably.

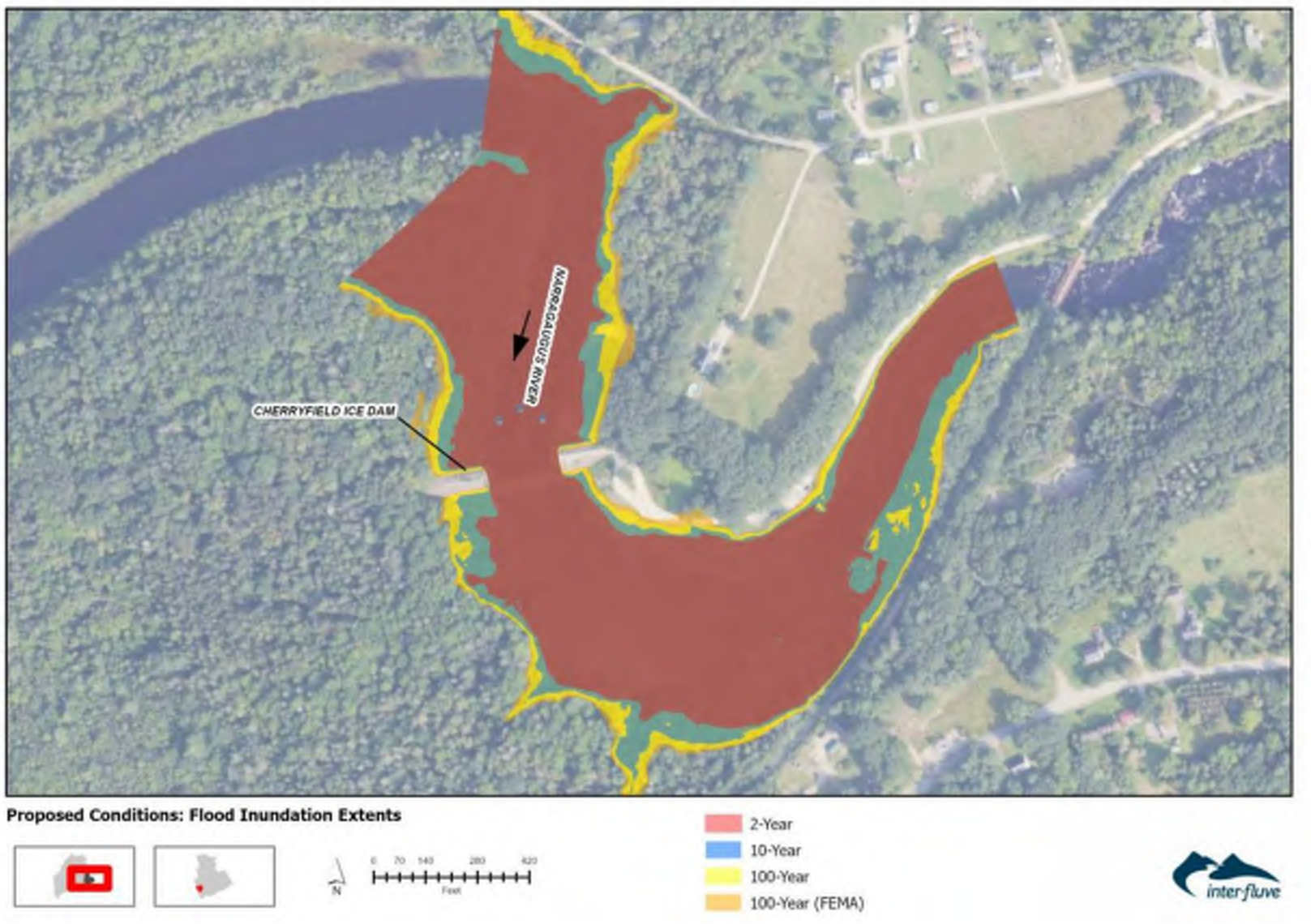


Figure 45: Existing conditions flood inundation extents at 2-year, 10-year, 100-year and FEMA 100-year return frequency.

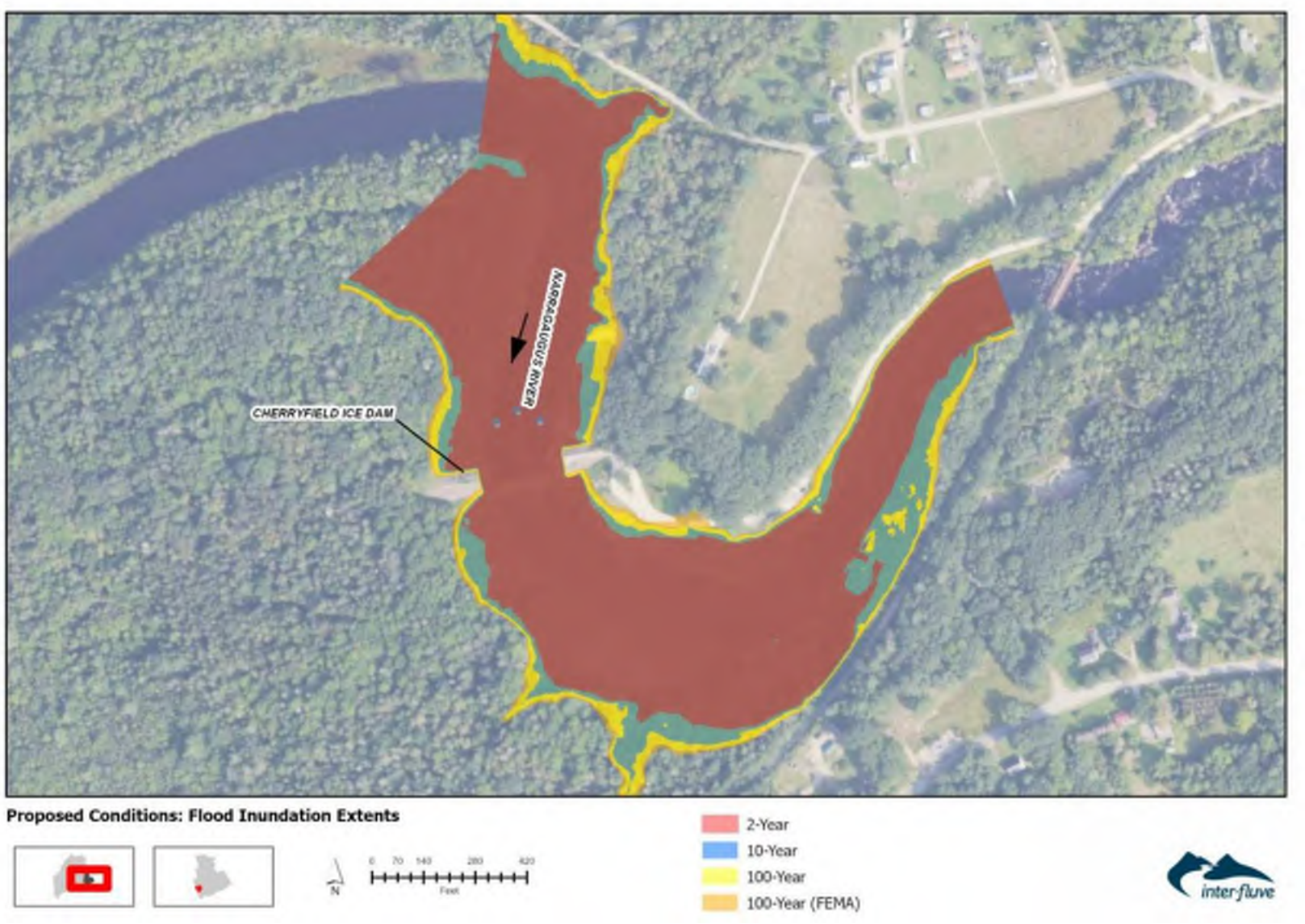


Figure 46: Proposed conditions flood inundation extents at 2-year, 10-year, 100-year and FEMA 100-year return frequency.

5.6 ICE PIERS

The three existing ice piers are each comprised of an 8-feet by 16-feet creosote-treated timber base frame standing 16 feet in height. The leading face of the timber frame angles from upstream to downstream. The timber frame structure is backfilled with rock such that the structure remains porous to flow and can provide ample surface area for ice buildup. These ice piers have generally remained stable for the past 60 years, although the westernmost ice pier no longer stands plumb. It is currently unknown if this is due to a broken timber beneath the water surface or an issue with the pier foundation. To increase their longevity, all three piers will be fully rebuilt in their existing locations.

The new pier design aims to provide the same structural functions (ample surface area, porous interior, etc.) as the existing piers while changing the primary material from creosote-treated timbers to stackable stone blocks. This shift should increase the longevity of the structures and avoid the use of hazardous materials (e.g., creosote). The new pier design is comprised of stacks of blasted stone blocks, presumably granite, with each block approximately 3-feet by 10-inch by 10-inch and connected to the next layer by a WT5x24.5 metal T-plate with grouted anchor bolts. Each successive layer of blocks will be grouted to the previous layer to add to the overall structural stability of the pier. Each layer of stone will be rotated 90 degrees to create an alternating void space allowing flow through the center of the piers. The piers will no longer have a taper and will instead be fully rectangular with an 8-foot by 16-foot frame. This design will provide enough surface area along each side for the buildup of ice and will allow water to flow through, alleviating concerns associated with solid-poured concrete walls. The footer/foundation design currently includes a concrete foundation with fifteen evenly spaced micropiles driven into the riverbed; the total foundation footprint for this plan is 10-feet by 18-feet. The use of the pile foundation will enhance the long term resilience of the ice pier structures and will reduce the risk of tipping and other failure mechanisms. A pile foundation is also resilient with respect to riverine pier scour.

5.7 CIVIL/SITE UPGRADES

5.7.1 Parking Upgrades

The current park access road and parking setup includes a roadway “loop” near the boat launch. This loop allows trucks with trailers to back into the boat launch but does not provide simple parking options that are out of the way of additional incoming truck/trailer traffic. Further south, park visitors can park cars along a smaller roadway loop to the south of the dam on Cable Pool Road, but this area again lacks formal parking spaces. Feedback from members of the public centered around including enough parking without excess, and on developing “organic pods” of parking spaces rather than large parking lots.

The new parking design includes a truck/trailer turn-around to the northeast of the boat launch in an existing small, flat area. The western portion of the existing roadway loop will be abandoned and converted into a pedestrian pathway; more details are provided in a later section. The proposed

design adds three parallel parking spaces for cars along the western edge of the roadway, and three formalized truck/trailer spaces to the east of the existing loop in a flat area at the north end of the park. Further south, the secondary loop will be eliminated to create three formal parallel parking spots near the current eastern dam embankment. Two additional parallel parking spaces will be added to the north of Cable Pool Road near the park entrance and proposed amphitheater. The entire length of Cable Pool Road through the park, including the perimeter of these new parking areas, will feature a wooden barrier (similar to a guardrail, but not rated for crash safety) to restrict traffic to roadways and to enhance roadway aesthetics. It is anticipated that this wooden barrier will be constructed primarily of recycled timber. Where possible, any timber from the dam/abutments that does not contain creosote will be re-used for the wooden barriers.

An additional parking area will be established on the western side of the river (river right) at the end of the Stillwater Road/DOT Access Road extension. This area will include a 40-foot by 40-foot compacted gravel parking and turnaround area, large enough to accommodate two to three cars with turnaround space. It is anticipated that this parking will be utilized primarily during the alewife harvest and that most traffic will park within the main Cable Pool Park area.

5.7.2 Rain Buffer Plantings and Filter Strip

The western side of the existing truck/trailer loop is located along the western top bank of the Narraguagus River, leaving approximately 15-feet or less of buffer between the roadway and the river. The center of this loop is primarily mowed grass with trees. Further south along the car parking area, there is an approximately 80-feet wide area of mowed grass between Cable Pool Road and the river.

The new design includes linear roadway buffer plantings between all roadways/parking areas and the river to intercept stormwater, reduce erosion, and reduce sediment/nutrient loading to the river. To benefit pollinators and re-naturalize the riverbanks, the buffer plantings will include a selection of grasses and wildflowers native to New England. At the northern end of the project area, a ~12,500 square foot buffer planting area will border the parallel parking, occupying much of the former mowed grass loop center; the roadway has been rerouted to keep existing trees to the maximum extent practicable. Further south near the second car parking area, a variable width buffer planting will border the length of Cable Pool Road within the park. The roadway buffer planting will include a 1’ wide gravel filter strip between the roadway and the plantings to intercept sediment runoff.

5.7.3 Access Roads and Pathways

The park is situated nearby the Sunrise Trail, a major multi-use recreational pathway that crosses the Narraguagus River via bridge and intersects with Cable Pool Road to the east of the park. Aside from the Sunrise Trail, the park has limited recreational trails and pedestrian footpaths. There are no designated footpaths leading from the parking lot to the river and no access roads or footpaths to the western bank of the river, limiting pedestrian access to the river. Social trails have been developed for fishing and swimming leaving certain areas of the riverbanks susceptible to erosion.

The proposed design aims to improve connectivity and significantly enhance recreational access to the Narraguagus River. This will be accomplished through a new network of pedestrian footpaths and an extension of a current vehicular access road to the southwest of the dam.

To improve access from Cable Pool Road and the parking areas to the river, new footpaths will be established. One proposed path will be located north of the existing eastern dam embankment, reoccupying the footprint of the existing loop road, and will provide access to a new prefabricated floating dock for swimmers and boaters during the summer. Another new footpath will be located south of the eastern dam embankment, offering multiple spurs to provide recreational access to the riverbank. These two paths join via a proposed footpath running parallel to Cable Pool Road. All entrances to footpaths will be fit with timber bollards and/or stone barriers to preclude vehicular traffic, including ATVs.

Near the existing western dam embankment, an extension of the existing Stillwater Road right-of-way will allow vehicular access to the western bank of the river. The vehicular access road will start behind the Department of Transportation lot, southwest of the dam, on Route 182. A partial road currently exists and will be refinished and extended to provide access just north of the western dam embankment. The proposed roadway footprint is primarily on an existing right-of-way, but crosses into adjacent property. There is an existing clearing/partial road leading to a camp on adjacent property; preliminary arrangements have been discussed where that road will be reoccupied and improved as part of this project in exchange for public access. It is anticipated that this road will primarily be used during the alewife harvest and may otherwise be gated off to restrict vehicular access.

Previous design concepts included additional access and connectivity to the Sunrise Trail. Natural resource delineations (i.e. wetland and stream delineations) elucidated the significant natural resource impacts that would be required to implement such connectivity. Much of the western bank of the river is comprised of quality wetland habitat in which disturbance should be limited. Multiple inflowing streams exist in this area, each of which is large enough to require a bridge or other significantly improved crossing. These natural resources create both impact and cost barriers to connecting the Sunrise Trail to the current dam site; this improvement was therefore removed from consideration at this time.

5.7.4 Park Amenities

Currently, the park offers limited public recreation amenities. As previously mentioned, the park does not directly connect to the Sunrise Trail, except at Cable Pool Road to the northeast. Approximately 450 feet east of the existing dam, there is a small pavilion and bench overlooking the river. There is an existing boat ramp at the north end of the park. All of these existing park features will be preserved and/or improved.

As previously noted, north of the existing eastern dam embankment, a small, prefabricated floating dock will be available for swimmers during the summer. The dock will be located at the end of a new footpath near the existing boat ramp at the north end of the park. This location is currently used for swimming and launching of non-motorized boats; both activities will be enhanced by this formal

dock structure. The dock is anticipated to be a prefabricated floating structure (EZ Dock or equivalent) anchored to driven piers or permanent ballast. The Town of Cherryfield will manage the input/removal of the dock during large storms and off-seasons, maintenance of the dock, and off-season storage.

Benches, picnic tables, and signage/kiosks will be installed at various locations along the new pedestrian footpaths. To provide visitors with shade and additional gathering space, an additional pergola/pavilion will be constructed on the western side of the former loop road north of the former dam embankment. The proposed structure will be a simple canopy mounted on four posts with a gravel pad below. The structure is proposed to be 10′ by 10′ and the gravel pad will be 20′ by 20′. Proposed signage, kiosks, and other structures will be constructed of recycled dam timber (if available and non-contaminated by creosote) or similar timbers to create a rustic and durable design. The information kiosk in the center of the park will feature educational materials highlighting the natural landscape, the benefits of the dam removal, and the park enhancement project. The kiosk may be made of recycled timber, if possible, or will otherwise be similarly rustic in design to mimic the current park features. Picnic tables will be a mix of wood and metal for improved durability, and each table will be set and anchored down onto a 9′x10′ gravel pad. Benches will be painted metal to match the aesthetic of the existing park bench, and all benches will be set and anchored onto a 4′ by 10′ gravel pad.

Just beyond the central informational kiosk and picnic table, an overlook will be constructed atop the existing dam embankment. The overlook will be connected to the new trail network and will provide visitors an area to gather and view the scenic Narraguagus River. The overlook will rest on concrete footings and gravel, overlaid with a recycled timber deck, recycled timber barrier rails (or similar timber if dam timbers cannot be reused), and several stone benches for sightseers to rest on while enjoying the landscape. The overlook footings will be concealed with native grasses and wildflowers.

The proposed design establishes a new recreation and gathering area on the north side of Cable Pool Road in what is currently a meadow offering low quality vegetation and habitat. This area will feature a small, open-air amphitheater with stone bench seating and a natural play area incorporating log climbers and steps, boulders, and a pea gravel sensory pit. The amphitheater seating will center around a flat, mowed grass “stage” area to be maintained for small gatherings, and the south side of the stage area will be lined with trees for privacy and shading. Where feasible, boulders for the play-area will be repurposed from the existing dam embankment or other locations on-site. The new design incorporates these materials for their sustainability, durability, and ability to blend visually with the natural surroundings.

At the northern end of the park near the boat and trailer parking area, an ADA compliant self-contained composting toilet building will be available for visitors (Clivus New England M54W Trailhead Restroom or equivalent). The toilet is estimated to be able to accommodate 60 restroom visits per day. The restroom is anticipated to be constructed of structural panel wood building with board-and-batten exterior, white fiberglass reinforced panels on the inside finished walls, and a steel

door. A ventilation fan will be installed on the top of the building, to improve airflow in the restroom.

The above toilet building will require electricity to run the fan. Other park features (the "stage" in the amphitheater and monitoring equipment for the alewife harvest) may also require electricity. A buried electrical conduit will be run from Stillwater Road to the northeast along Cable Pool Road into Cable Pool Park. A pole-mounted A/C electric box will be installed near the amphitheater stage so that the public may have access to electricity as needed. It is anticipated that this box will remain locked and that access will be managed by the Town.

6. Construction Considerations

6.1 SITE ACCESS AND STAGING

The project site can be accessed via public rights of way located on either side of the river. Access to the site from the east is via Cable Pool Road, the primary access point to the site in current conditions. Access to the site from the west is via Stillwater Road, a town right-of-way that is not regularly maintained. Improvement of Stillwater Road will be required before heavy machinery can utilize it for access. Potential staging areas are included in the design drawings. Final access and staging areas will be determined by the contractor with prior approval by the project team.

6.2 CONSTRUCTION SEQUENCE

The Project Team recommends the following construction sequence, which may be modified by the Construction Contractor as they refine their project implementation plan. The Contractor will be required to submit workplans that describe the schedule, sequence, and means and methods of their construction activities. These workplans will be reviewed for acceptance by the Project Team before the Contractor begins work. The Contractor is responsible for performing the work in the manner required to protect the public and the natural resources.

Project Initiation

1. Mobilization
    a. Identify and construct site access/egress including construction entrances and security fencing. Ingress and egress will adhere to best management practices for sediment control and will be properly marked so that the public can clearly determine where the construction entrance is.
2. Staging
    a. Identify and prepare staging areas. Potential staging areas are indicated in the design drawings. Other alternative staging locations can be arranged by the Contractor, with review for acceptance needed from the Project Partners before use.
3. Erosion Control
    a. Install erosion and sediment control measures in accordance with applicable permits and project specifications prior to ground disturbance.
    b. Typical erosion control measures include, but are not limited to installation of silt fencing, construction entrances, erosion control mulch, and silt bags We anticipate that erosion control measures will need to be adapted, and methods may need to change throughout the project timeline depending on work progress, weather, and project coordination.
4. Clearing

a. Clearing for the project shall be in accordance with applicable permits, and project specifications. All project clearing shall take place between October 1 and April 14. Trees greater than 3-inches diameter at breast height shall not be removed between April 15 and September 30.

5. Demolition of Timber Crib Abutments

    a. Demolish timber crib abutments down to water level, ensure proper disposal of creosote treated timbers. Salvage existing rock fill.

    b. Demolition of the abutments should be done in a controlled manner, with care to prevent material from falling or wasting into the active river flow.

6. Dam Breach and Partial Impoundment Drawdown

    a. Breach the dam and draw down the impoundment. This will initially entail removing stop logs from the existing gate on river left. When additional drainage through the small gate has ceased, adjacent areas of the spillway will be incrementally breached to increase drawdown capacity. Drawdown will be monitored closely, proceeding at a maximum rate of up to 6 inches per hour, and 2 feet per day to a minimum impoundment water surface elevation of 53.0 feet

    b. All in-water work shall be completed within the in-water work window between July 15 and September 30. Any in-water work outside of the in-water work window requires coordination and approval from USACE, NOAA, USFWS, and Maine DEP.

Phase 1

7. Implement Phase 1 Water Control

    a. Control of water features may vary depending on conditions, available materials, and contractor experience. Typical methods of water control include utilizing placed fill, large bags filled with alluvium, or installation of sheet pile.

    b. Fish removal shall occur in isolated areas before work may commence. Coordination with the Project Engineer and Maine DMR is required.

    c. The Contractor shall install water control measures in a manner that maintains a fish migration corridor through the project site. The fish migration corridor can be used to maintain run of river flow through the project site during construction.

8. Perform work tasks, including:

    a. Demolition of existing piers and construction of new piers

    b. Partial demolition of existing timber crib spillway focusing on portions on river right

    c. Construction of nature-like fishway primary channel

    d. Begin construction of nature-like fishway roughened channel, focusing on portions on river right

e. Grade existing river right embankment and install heavy riprap protection

Phase 2

9. Implement Phase 2 Water Control
    a. Control of water features may vary depending on conditions, available materials, and contractor experience. Typical methods of water control include utilizing placed fill, large bags filled with alluvium, or installation of sheet pile.
    b. The contractor may need to refill the impoundment before initiating phase 2 water control measures. While refilling the impoundment, the contractor shall provide at least 30 cfs of river flow through the project site to maintain downstream riverine habitat.
    c. Fish removal shall occur in isolated areas before work may commence. Coordination with the Project Engineer and Maine DMR is required.
    d. The Contractor shall install water control measures in a manner that maintains a fish migration corridor through the project site. The fish migration corridor can be used to maintain run of river flow through the project site during construction.
10. Perform work tasks, including:
    a. Demolition of remaining piers, and construction of new piers
    b. Demolition of the remaining portions of the spillway, primarily on river left
    c. Finish construction of the primary channel and roughened channel of the nature-like fishway on river left
    d. Grade existing river left embankment and install heavy riprap protection
    e. Install bank protection on river left

Phase 3

11. Implement Phase 3 Water Control
    a. It is anticipated that at this point in construction, The river flow will be primarily located in the primary channel of the nature-like fishway, and it is anticipated that work will occur out of water. Water control should be installed as needed to complete work but may not be necessary depending on conditions.
    b. Fish Removal shall occur in isolated areas before work may commence. Coordination with the Project Engineer and Maine DMR is required.
    c. The Contractor shall install water control measures in a manner that maintains a fish migration corridor through the project site during construction.
12. Perform work tasks, including:
    a. Construct proposed overbank on river right

b. Construct new bank on river right

13. Upland Construction
    a. Construct overlooks, trails, access, and other park features at the Cable Pool Park
    b. Construct access and parking, and other features on the west side of the river.
14. Planting and Revegetation
15. Demobilization
    a. Restore staging areas as delineated on the plans
    b. Remove sedimentation and erosion control measures
    c. Remove construction entrances and security fencing

6.3 IMPOUNDMENT DRAWDOWN AND REFILL

Although not required, a partial drawdown of the impoundment is recommended. A partial drawdown will decrease the water surface differential between isolated work areas and the river, which will increase flexibility for the contractor, decrease overall cost, allow for more uniform construction of the nature-like fishway, and provide additional safety for personnel, and the public. The following has been prepared to provide the Town of Cherryfield, Project Partners, and regulatory agencies with a general description of the proposed drawdown sequence, as well as anticipated conditions during drawdown, and refilling of the impoundment.

It is important to note that a variety of assumptions have been made in this analysis. Field conditions at the commencement of construction will guide the sizing of the notch and the drawdown and refill period. Close coordination between the Project Engineer and the contractor will be maintained throughout construction to ensure requirements are fulfilled.

6.3.1 Background

As stated above, The Cherryfield Ice Dam consists of a 140-foot primary spillway, a 3.5-foot-wide Denil fishway on the left side of the spillway, and two 3.5-wide-sluiceways, oneon the east (left) and one on the west (right) sides of the spillway. During normal operations, the Denil fishway is regulated by a gate and the two sluiceways are closed. Therefore, during normal operations, flow is over the primary spillway and through the Denil fishway.

During the 30 percent design phase of the project, Inter-Fluve developed a one-dimensional (1D), steady-flow hydraulic model of the Narraguagus River. This model uses cross sectional data, which includes field survey bathymetric data collected by Inter-Fluve in 2023 and Wood Environmental and Infrastructure Solutions in 2018 and Federal Emergency Management Agency (FEMA) Flood Insurance Study (FIS) cross sectional data. The domain of the 1D model includes the entirety of the Cherryfield Ice Dam impoundment and extends approximately 52,500 feet upstream of the Cherryfield Ice Dam and approximately 31,550 feet upstream of the West Branch of Narraguagus

River from the confluence of the main stem. Subsequent modeling of the Cherryfield Ice Dam has migrated from a 1D model to a two-dimensional (2D) hydraulic model, as described in Section 4.6. The 2D model domain is limited to focus primarily on the Cherryfield Ice Dam and therefore does not include the entirety of the impoundment. Therefore, use of the 1D hydraulic model is appropriate to understand the influence of the drawdown through the impoundment. Figure 47 shows the extent of the 1D hydraulic model cross sections with the river stationing labeled on select cross sections.

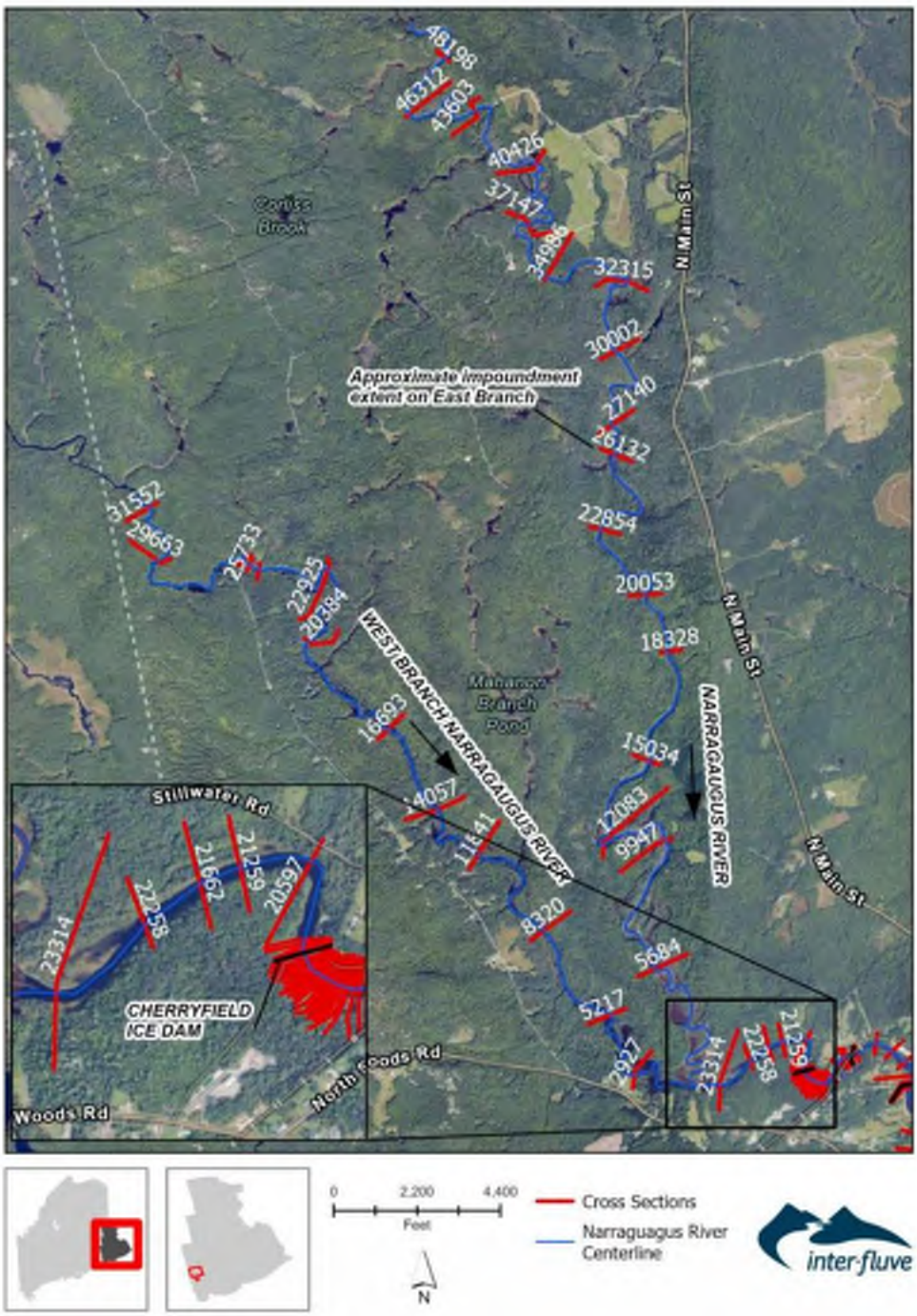


Figure 47: 1D Model Extent

As summarized in Section 4.5, Inter-Fluve performed a statistical analysis on the mean daily flow record at the USGS gage located approximately 1,000 feet downstream of the Cherryfield Ice Dam (USGS 01022500 Narragaugus River at Cherryfield) to evaluate the discharge-frequency relationship for flows on a monthly basis. Several key flow rates calculated during the drawdown period are shown below in Table 15.

Table 15: Estimated monthly flows and exceedance probabilities at USGS gage 01022500 Narraguagus River at Cherryfield

Month	95% Exceedance Probability Flow (cfs)	50% Exceedance Probability Flow (cfs)	5% Exceedance Probability Flow (cfs)
June	106	267	1070
July	62	140	682
August	37	99	434
September	32	97	572

6.3.2 Drawdown of the Impoundment

Drawdown of the impoundment will be limited to no more than 6 inches per hour and no more than 2 feet per day. The impoundment will be limited to a partial drawdown to an elevation of 53.0 feet (NAVD88).

To drawdown the impoundment, the existing structures at the Cherryfield Ice Dam, including the two sluiceways and Denil fishway, could be utilized, however these structures do not have sufficient hydraulic capacity to effectively drawdown the impoundment to the desired water surface elevation. Therefore, the impoundment drawdown may be achieved by modifying the existing dam. A notch may be constructed into the existing dam at the location of the Denil fishway and east sluiceway. The notch would be sized such that the reservoir would be drawn down efficiently while following the drawdown rate limitations stated above.

To better understand notch size requirements and drawdown conditions, Inter-Fluve performed an analysis using the 1D hydraulic model. Initial water surface elevations during each of the flow events were determined using the 1D hydraulic model. A representative notch size of 35 feet was determined based on model iteration at the July 50% flow. A notch width of 35 feet in combination with a sill elevation of 52 feet allows for the reservoir to maintain a water surface elevation of approximately 53.0 feet while all flow is discharged through the notch (i.e. inflow equals outflow).

Table 16 summarizes the conditions that are anticipated during a drawdown, including drawdown depth, and minimum time to achieve draw down conditions given regulatory limitations on drawdown speed.

Table 16: Anticipated conditions during drawdown.

Month	50% Exceedance Probability Flow (cfs)	Initial WSE (ft, NAVD88)	Target Draw down WSE (ft, NAVD88)	Simulated Drawdown WSE (ft, NAVD88)	Drawdown Depth (ft)	Minimum Days to Drawdown
July	140	56.9	53	53.2	3.6	1.8
August	99	56.8		53.0	3.8	1.9

Based on the configured 35-foot notch, the 1D hydraulic model geometry was updated to better understand the impact of the drawdown on the extent of the reservoir impoundment. A comparison of the existing conditions and the drawdown conditions throughout the Cherryfield Ice Dam impoundment is shown in Table 17. Figure 48 and Figure 49 also shows a profile of the existing conditions and the drawdown conditions along the Narraguagus main stem, East branch and West branch ("EX" denotes "existing" conditions and "DRDN" denotes "drawdown" conditions).

Table 17: Existing Conditions versus Drawn Down Conditions Water Surface Elevations.

Reach	River Station (ft)	July 50% (140 cfs)			August 50% (99 cfs)		
		Existing WSE (ft, NAVD88)	Drawdown WSE (ft, NAVD88)	Difference in WSE (ft)	Existing WSE (ft, NAVD88)	Drawdown WSE (ft, NAVD88)	Difference in WSE (ft)
West Branch	31552	75.8	75.8	0.0	75.5	75.5	0.0
	29663	74.6	74.6	0.0	74.3	74.3	0.0
	25928	71.7	71.7	0.0	71.3	71.3	0.0
	25733	68.9	68.9	0.0	68.6	68.6	0.0
	25469	66.4	66.4	0.0	66.3	66.3	0.0
	22925	57.0	54.9	-2.1	56.8	54.5	-2.3
	20384	56.9	53.9	-3.0	56.8	53.5	-3.3
	16693	56.9	53.6	-3.3	56.8	53.3	-3.5
	14057	56.9	53.4	-3.5	56.8	53.1	-3.7
	11841	56.9	53.4	-3.5	56.8	53.1	-3.7
	8320	56.9	53.3	-3.5	56.8	53.0	-3.7
	5217	56.9	53.3	-3.6	56.8	53.0	-3.7
	2927	56.9	53.3	-3.6	56.8	53.0	-3.8
East Branch	48198	81.3	81.3	0.0	80.9	80.9	0.0
	46312	80.4	80.4	0.0	80.0	80.0	0.0
	43603	79.2	79.2	0.0	78.8	78.8	0.0
	40426	77.9	77.9	0.0	77.5	77.5	0.0
	37147	76.3	76.3	0.0	76.0	76.0	0.0
	34986	74.9	74.9	0.0	74.4	74.4	0.0
	32315	73.3	73.3	0.0	72.9	72.9	0.0
	30002	72.6	72.6	0.0	72.2	72.2	0.0
	27140	70.1	70.1	0.0	70.0	70.0	0.0
	26132	65.9	65.9	0.0	65.6	65.6	0.0
	22854	65.0	64.9	-0.2	64.7	64.6	-0.2
	20053	64.3	63.5	-0.9	64.1	63.2	-0.9
	18328	59.8	60.9	1.1	59.7	60.6	1.0
	15034	57.0	55.3	-1.7	56.8	54.9	-2.0
	12083	56.9	54.0	-2.9	56.8	53.6	-3.2
	9947	56.9	53.3	-3.5	56.8	53.0	-3.7
	5684	56.9	53.3	-3.6	56.8	53.0	-3.8

Reach	River Station (ft)	July 50% (140 cfs)			August 50% (99 cfs)		
		Existing WSE (ft, NAVD88)	Drawdown WSE (ft, NAVD88)	Difference in WSE (ft)	Existing WSE (ft, NAVD88)	Drawdown WSE (ft, NAVD88)	Difference in WSE (ft)
Main Stem	23314	56.9	53.3	-3.6	56.8	53.0	-3.8
	22258	56.9	53.2	-3.6	56.8	53.0	-3.8
	21662	56.9	53.2	-3.6	56.8	53.0	-3.8
	21259	56.9	53.2	-3.6	56.8	53.0	-3.8
	20597	56.9	53.2	-3.6	56.8	53.0	-3.8
	19822	56.9	53.2	-3.6	56.8	53.0	-3.8
	19776	56.9	53.2	-3.6	56.8	53.0	-3.8
	19739	56.9	53.2	-3.6	56.8	53.0	-3.8
	19725	56.9	53.2	-3.6	56.8	53.0	-3.8
	19688	Cherryfield Ice Dam			Cherryfield Ice Dam		
	19650	52.1	52.1	0.0	51.9	51.9	0.0
	19618	52.1	52.1	0.0	51.9	51.9	0.0
	19597	52.1	52.1	0.0	51.9	51.9	0.0
	19573	52.1	52.1	0.0	51.9	51.9	0.0
	19551	52.1	52.1	0.0	51.8	51.8	0.0

Note: A negative value indicates a lower water surface elevation in the drawn down condition.

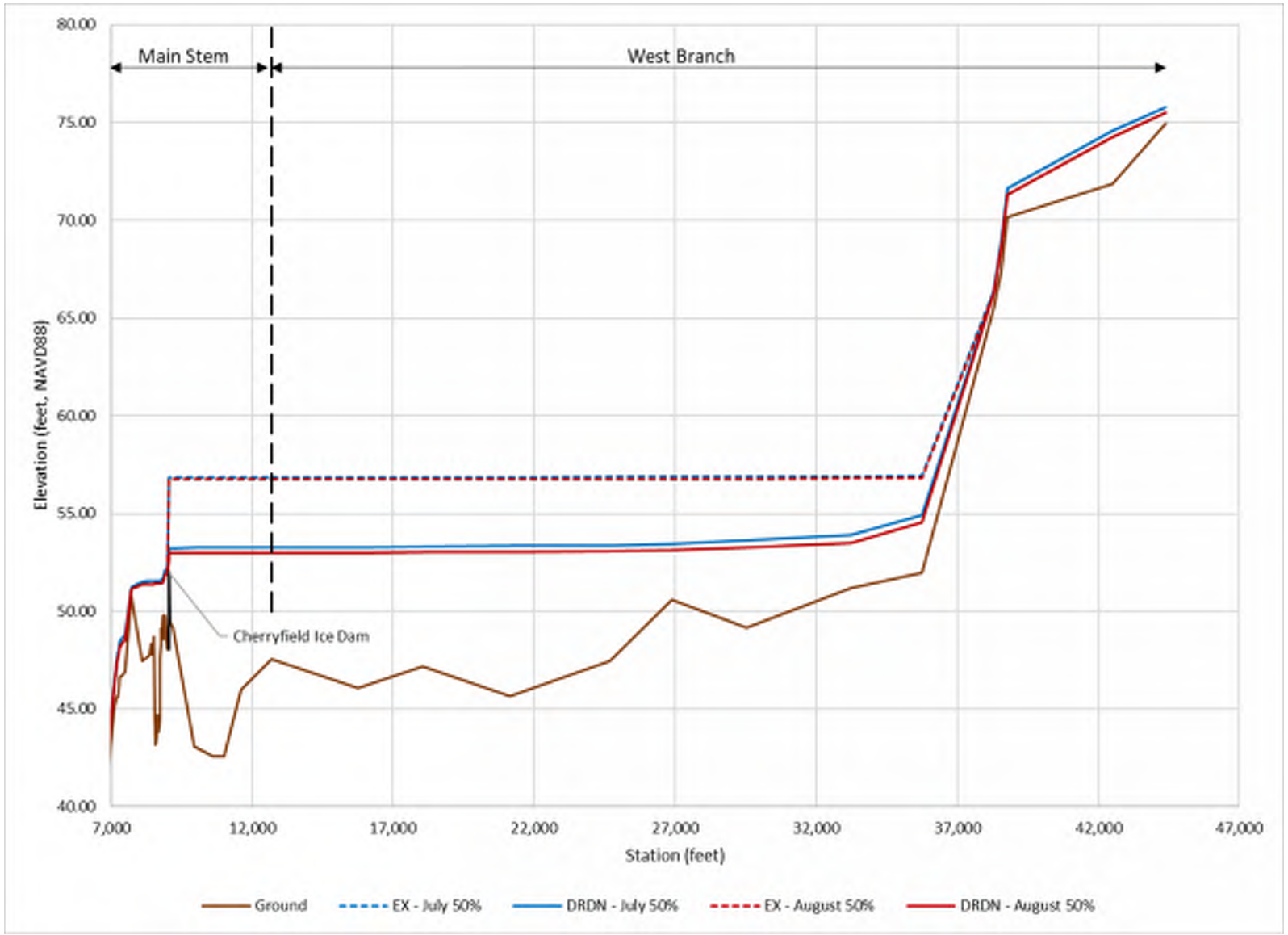


Figure 48: Existing conditions versus draw down conditions water surface elevations of the Narraguagus Main Stem and West Branch

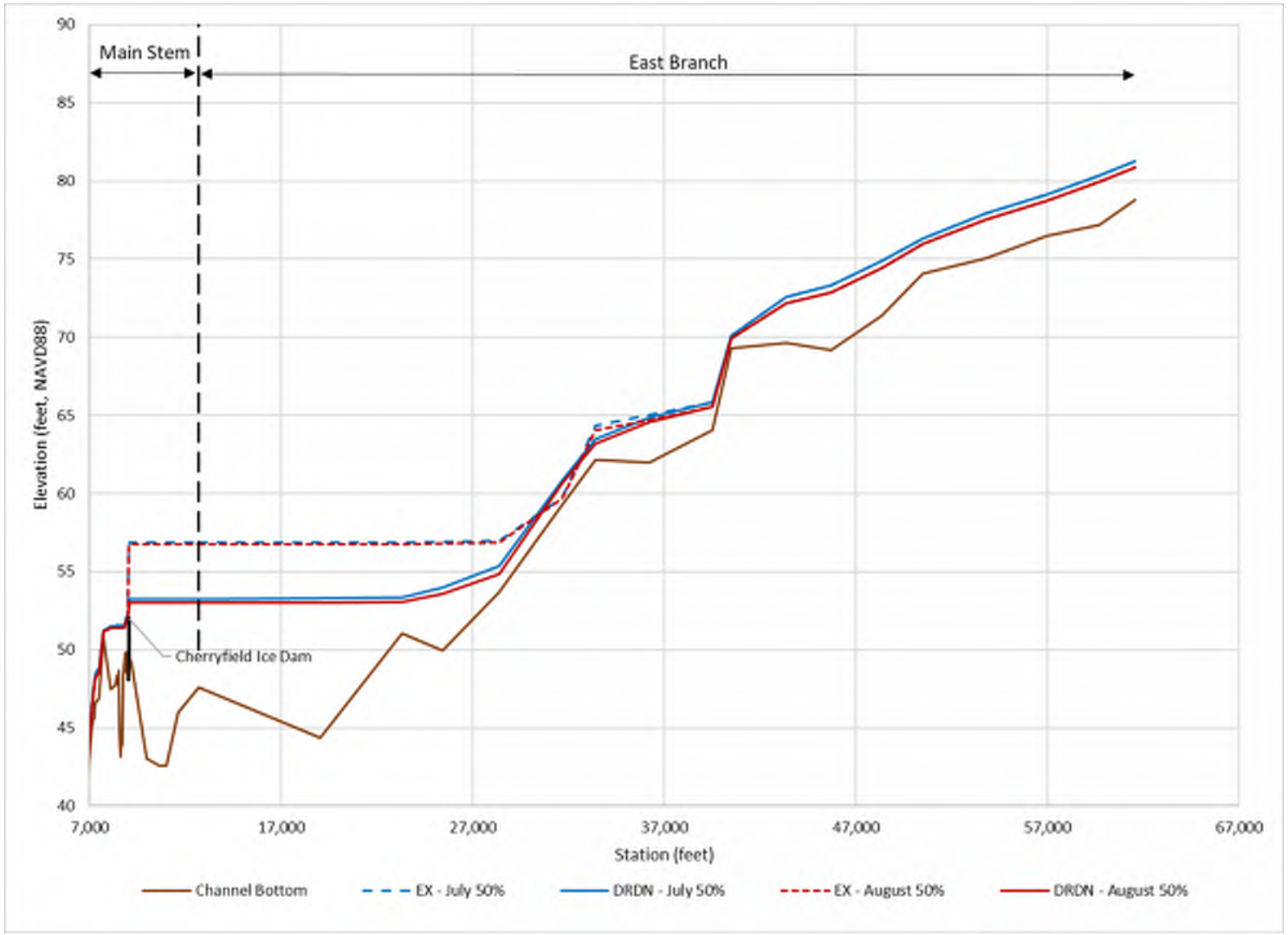


Figure 49: Existing conditions versus drawn down conditions water surface elevations of the Narragaugus main stem and East Branch.

6.3.1 Impoundment Refill

Upon completion of the construction of the primary channel of the nature-like fishway, the water surface elevation will be raised and the impoundment refilled to allow for flow into the primary channel of the nature-like fishway. The refill elevation will be a minimum of 55.5 feet (crest elevation of the primary channel) and be high enough to allow a minimum flow of 30 cfs for base flow through the primary channel. As the reservoir is refilling to this elevation from the drawdown elevation of 53 feet, the notch will be incrementally blocked while ensuring a minimum flow of 30 cfs through all conveyances. Table 18 summarizes the expected conditions to refill the impoundment at incremental water surface elevations and modifications made to the 35-foot notch. Once the primary channel flow exceeds the required minimum base flow of 30 cfs, the notch can be blocked completely.

Table 18: Anticipated conditions during impoundment refill.

Refill to Water Surface Elevation 54 feet NAVD88				
Event	**Exceedance Probability Flow (cfs)**	**Incremental Refill Time (day)**	**Notch Flow (cfs)**	**Primary Channel Flow (cfs)**
July 50%	140	1.5	82	0
August 50%	99	2.7	82	0
Refill to Water Surface Elevation 55 feet NAVD88				
Event	**Exceedance Probability Flow (cfs)**	**Incremental Refill Time (day)**	**Notch Flow (cfs)**	**Primary Channel Flow (cfs)**
July 50%	140	0.8	49	0
August 50%	99	1.2	49	0
Refill to Water Surface Elevation 56 feet NAVD88				
Event	**Exceedance Probability Flow (cfs)**	**Incremental Refill Time (day)**	**Notch Flow (cfs)**	**Primary Channel Flow (cfs)**
July 50%	140	0.5	49	47.2
August 50%	99	0.6	49	47.2
Total Time to Refill (days)				
July 50%	2.8			
August 50%	4.5			

7. Additional Project Considerations

7.1 PROPERTY OWNERSHIP

As part of continued coordination with project partners and the Town of Cherryfield, property owners whose land will be impacted by the proposed design should be notified and coordinated with. Access permissions, and potentially-required right of way, easement, or purchase agreements should be evaluated and secured if necessary.

The Town of Cherryfield owns all the impacted property on the river left bank and much of the impacted property on the river right bank. This includes a small parcel on river right which is heavily impacted by the proposed design. The 0.15-acre property was owned by Norma Johns of Hampstead, Maryland per the Town of Cherryfield's 2020 tax commitment book. However, the Town of Cherryfield has indicated that this parcel now belongs to the town and is no longer under private ownership. Additionally, access to the site through, and permanent improvement of, the currently defunct Stillwater Road will need to be confirmed by the Town of Cherryfield and adjacent property owners.

7.2 PERMITTING AND OUTREACH

Dam removal, while net beneficial to existing infrastructure and ecosystems, can impose short term impacts on the environment during the construction phase of the project and disrupt species that have adapted to presence of the dam. Dam removals can also have cultural impacts if the dam or impoundment is adjacent to historically significant features. The proposed project will require regulatory review by local, state, and federal agencies. The Project Team has initiated outreach and/or consultation with the following agencies:

- U.S. Fish and Wildlife Service (USFWS)
- NOAA Fisheries (NMFS)
- United States Army Corps of Engineers (USACE)
- Maine Department of Environmental Protection (DEP)
- Maine Department of Inland Fisheries and Wildlife (MDIFW)
- Maine Natural Areas Program (MNAP)
- Maine Historic Preservation Commission (MHPC)
- Tribal Historic Preservation Officers (THPO)
- Aroostook Band of Micmacs
- Houlton Band of Maliseet
- Penobscot Indian Nation
- Passamaquoddy Tribe of Indians

Table 19 summarizes the status of engagement with each entity. Additional relevant notes are detailed in subsequent sub-sections.

Table** 19**: Status of Consultation with regulatory Agencies** **Agency	**Contact Initiated**	**Response Received***	**Notes**
USFWS	Yes	Yes	• Section 7 consultation initiated through Information for Planning and Consultation (iPac) tool and determination key • Northern Long-Eared Bat (NLEB) and Atlantic Salmon occur within the project area • Preliminary determination of Not Likely to Adversely Affect (NLAA) – subject to change with agency review
NOAA-NMFS	Yes	Yes	• Section 7 pre-consultation meeting complete • Draft Biological Assessment in progress, anticipated first draft completion by September 2025
USACE	Yes	---	• Contact initiated through letter of inquiry and preliminary meeting with USACE regulatory staff and Project Partners in May 2025 • Permitting pathway to be determined at Inter-Agency Meeting (August 27, 2025)
MDIFW	Yes	Yes	• LOI submitted (February 2025) • MDIFW response received (March 2025) • Consultation meeting with Project Partners and MDIFW regulatory staff (April 2025) • Follow-up actions (mussel survey, wetland delineation, vernal pool survey) complete (August 2025) • No state sensitive species present in project area • Additional follow-up to be determined following submittal of wetland/vernal pool report and Inter-Agency Meeting (August 27, 2025)
MNAP	Yes	Yes	• LOI submitted (February 2025) • Additional information exchanged through email (March 2025) • NLAA determination received (April 2025) • Additional consultation may be required following submittal of wetland assessment report and 90% design plans
MHPC	Yes	Yes	• LOI submitted (February 2025) • Response received (March 2025) • No anticipated impacts to historic properties and no additional consultation anticipated

Table Continued

Agency	**Contact Initiated**	**Response Received***	**Notes**
Town of Cherryfield	Yes	----Yes	• Coordination/communication with town selectboard ongoing since 2022 • 3 design charrettes held fall 2024 – spring 2025 for park designCoordination required • Permitting coordination with town planning board required Planning board member to attend Inter-Agency Meeting (August 27, 2025)
DEP	Yes	Yes	• LOI sent (February 2025) • 2 followup meetings with Project Partners and MDEP Permit-By-Rule (PBR) and regulatory NRPA staff (March – April 2025) • Permit-by-Rule anticipated under Sections 2 and 13, with MDMR as sponsoring agency • Additional followup required after submission of wetland assessment report and 90% design plans • Individual permit may be required under NRPA for select elements of park design
Aroostook Band of Micmacs	Yes	No	• Contacted LOI submitted to THPO Jennifer Gaenzle on (February 5, 2025). • Contact reinitiated/LOI re-submitted in April 2025
Houlton Band of Maliseet	Yes	Yes	• Contacted THPO Isaac St John on February 5, 2025LOI submitted to THPO Isaac St John (February 2025) • No anticipated impacts or immediate concerns
Penobscot Indian Nation	Yes	No	• Contacted LOI submitted to THPO Chris Sockalexis on (February 5, 2025) • Contact reinitiated/LOI resubmitted (April 2025)
Passamaquoddy Tribe of Indians	Yes	Yes	• THPO Donald Soctomah reviewed our request and identified no impact with Passamaquoddy cultural concerns if no archaeological work occurs at the site. If any artifacts or human remains are uncovered during construction, the THPO must be contacted.LOI submitted to THPO Donald Soctomah (February 2025) • No anticipated impacts with Passamaquoddy cultural concerns if no archaeological work

7.2.1 U.S. Fish and Wildlife Service

The project is in the vicinity of Northern Long-eared Bat (NLEB), a species protected and regulated under the Endangered Species Act (ESA) by the USFWS. Current conservation measures to prevent impacts to NLEB include limiting tree removal to the inactive season (April 15 – October 31) and removing no more than two acres of trees throughout the project area.

At this stage, Inter-Fluve has completed the first step of Section 7 consultation for NLEB by creating a new project in the USFWS Information for Planning and Consultation tool (iPac), filling out a determination key, and generating a technical assistance letter for the lead Federal Action Agency to review. Based on the determination key, the project actions are considered Not Likely to Adversely Affect (NLAA) NLEB. This NLAA determination is preliminary until the lead Federal Action Agency reviews the determination key, concurs with answers submitted by Inter-Fluve, and generates a concurrence letter. NOAA has requested final designs before reviewing answers to the determination key, providing feedback, and initiating concurrence.

The project also overlaps with Atlantic Salmon Habitat. Atlantic salmon are protected under the Endangered Species Act and regulated by multiple federal agencies including NOAA, USFWS, and USACE. Progress on Section 7 consultation for Atlantic salmon and other protected marine species is further detailed below.

7.2.2 NOAA Fisheries (NOAA-NMFS)

Inter-Fluve has reviewed the spatial and temporal ranges of species protected by the ESA in the project area with the NOAA ESA Critical Habitat Mapper. Atlantic sturgeon, shortnose sturgeon, and Atlantic salmon are all protected species with the potential to occur in the project area at various times of year. There is documented Atlantic salmon spawning habitat above the dam, and documented rearing habitat above and below the dam.

Inter-Fluve coordinated a pre-consultation meeting with Downeast Salmon Federation, NOAA, and Project Partners in May 2025 to discuss Section 7 consultation needs for these protected species under jurisdiction of NOAA-NMFS in the project area. Formal Section 7 consultation is required.

At the time of reporting, Inter-Fluve and Downeast Salmon Federation have submitted a draft Environmental Baseline section of a Biological Assessment (BA) for NOAA-NMFS for review. Inter-Fluve is currently working on remaining sections of the BA (Proposed Actions, Definition of Action Area, and Effects Determination) and is completing these sections in concurrence with 90% designs. It is anticipated that Inter-Fluve and Downeast Salmon Federation will complete and submit the first draft of the remaining BA sections to NOAA by September 2025, and a complete revised document by the end of year in 2025.

7.2.3 United States Army Corps of Engineers (USACE)

Inter-Fluve and non-governmental Project Partners initiated outreach and held a preliminary meeting with USACE in late May 2025. The purpose was to introduce the project, discuss permitting needs, and discuss anticipated timelines for implementation of new Nationwide Permits (NWPs) for the state of Maine following expiration of the Maine General Permits (GPs) in October 2025. The new NWPs are anticipated to take effect by March 2026. If a GP application has been submitted on or after October 25th (but before March 2026), and if a project has received a GP after October 2025 (but before March 2026), the GP will remain active throughout the 2026 construction period if the project is under contract by March 2026.

The USACE regulates activities "in, over, or under navigable waters of the Unites States" under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 403) and the "discharge of dredged or fill material into water of the United States to include wetlands" under Section 404 of the Clean Water Act of 1972 (33 U.S.C. 1344). Aside from riverine habitat (R2UBH) confined to the river channel, no wetlands are mapped by the National Wetlands Inventory (NWI) in the permanently impacted project area.

At the time of initial outreach with USACE, wetlands had not been delineated within the permanent action area. Based on NWI mapping, it seemed probable that the project could be permitted under a Maine General Permit (Maine GP). However, after wetlands were delineated in the permanent action area (June – July 2025), potential impacts became apparent.

At this stage, the final USACE permitting pathway is yet to be determined. If an Individual Permit (IP) is required instead of a GP, then public notice, Coastal Zone Management Concurrence, and a Water Quality certification will also be required.

Inter-Fluve will assist Downeast Salmon Federation with coordination of preapplication meetings between NOAA and USACE in August and September, beginning with an inter-agency meeting at the site on August 27, 2025.

7.2.4 Maine Department of Inland Fisheries and Wildlife (MDIFW)

MDIFW submitted a response to Inter-Fluve's letter of inquiry in April 2025. Project partners and Inter-Fluve met with MDIFW in May 2025 to review state sensitive species in the project area. A mussel survey was completed in June 2025 which determined that no state-endangered mussels were present in the project area. MDIFW determined that the impoundment drawdown was unlikely to negatively impact nesting waterfowl during the anticipated drawdown window (July 15 – Sept 30). MDIFW also requested a wetland delineation and vernal pool survey in the immediate project area. A Professional Wetland Surveyor (PWS) completed a wetland delineation and vernal pool survey in August 2025.

Additional followup may be required to discuss riparian buffer areas and vernal pool impacts with MDIFW following review of the wetland assessment report and 90% design plans. Inter-Fluve will submit final wetland and mussel reports to MDIFW by late August 2025.

7.2.5 Maine Natural Area Program (MNAP)

Inter-Fluve submitted an initial letter of inquiry to MNAP in February 2025 and responded to additional requests for information through email in March 2025.

According to MNAP, no rare botanical features are documented at the dam site. There are documented exemplary wetland natural communities just upstream of the dam along the Narraguagus River and the West Branch. MNAP has determined that long-term project actions are Not Likely to Adversely Affect (NLAA) these exemplary communities, as no long-term changes to current water levels above the dam are anticipated.

Inter-Fluve will submit a complete wetland assessment report and 90% design plans to MNAP in August to determine if further consultation is necessary.

7.2.6 Maine Historic Preservation Commission (MHPC)

Following receipt of letter of inquiry, the MHPC determined that there will be no historic properties affected by the project under Section 106 of the NHPA. No further consultation is anticipated.

7.2.7 Town of Cherryfield

Outreach with the Town Selectboard has been led by Project Partners and ongoing since 2022. Most recently, Downeast Salmon Federation and Project Partners hosted a series of design charrettes in the town of Cherryfield with the design team, where community members provided input into the park design.

Coordination is required for town permitting. A member of the Cherryfield Planning Board is scheduled to attend the inter-agency site meeting in August 2025 to kick off this process.

7.2.8 Maine Department of Environmental Protection (MDEP)

Inter-Fluve and Project Partners met with MDEP regulatory and permit-by-rule (PBR) staff to review preliminary and 60% design plans in March and April 2025. It is likely that the nature-like fishway can be permitted by rule under Section 13 (habitat creation or enhancement and water quality improvement activities) and that the park improvements can be permitted by rule under Section 2 (activities adjacent to protected natural resources). MDMR has agreed to serve as a sponsoring agency under the PBR permitting pathway. An individual permit may be required under the Natural Resources Protection Act (NRPA) for construction of an overlook within the shoreland zone, a 25-foot buffer adjacent to the river channel.

Followup coordination is scheduled with MDEP in August 2025 to review 90% design plans and the complete wetland assessment report.

7.2.9 Tribal Historic Preservation Officers (THPO's)

Letters of inquiry were submitted to THPO's for the Aroostook Band of Micmac Indians, the Houlton Band of Maliseet Indians, Penobscot Indian Nation, and Passamaquoddy Tribe of Indians in February 2025. At the time reporting, responses have not been received by Jennifer Gaenzle (THPO of Aroostook Band of MicMacs) or Chris Sockalexis (THPO for Penobscot Indian Nation).

THPO for the Passamaquoddy Tribe of Indians, Donald Soctomah, reviewed our request and identified no impacts with Passamaquoddy cultural concerns if no archaeological work occurs at the site. If any artifacts or human remains are uncovered during construction, the project must stop and the THPO must be contacted.

THPO for the Houlton Band of Maliseet Indians, Isaac St John, identified a lack of resources to fully investigate the project or project site but no immediate concerns. If any artifacts or human remains are unearthed during the project, the project must stop and findings reported to the THPO and other authorities.

7.3 DAM CLASSIFICATION

The Cherryfield Ice Dam (NID ID: ME00061) is one of 75 high hazard dams located in the State of Maine. The existing dam is regulated by the Maine Emergency Management Agency (MEMA) and has no known federal agency involvement. The National Inventory of Dams indicates that an Emergency Action Plan (EAP) was last submitted to MEMA Dam Safety Office in June 2025.

Per Maine State Law, the definition of a dam is as follows:

> "any artificial barrier, including appurtenant work, the site, on which it is located and appurtenant rights of flowage and access, that impounds or diverts water, and that: A. Is 25 feet or more in height from the natural bed of the watercourse measured at the downstream toe of the barrier or from the lowest elevation of the outside limit of the barrier to the maximum water storage elevation and impounds at least 15 acre-feet of water; or B. Is 6 feet or more in height from the natural bed of the watercourse measured at the downstream toe of the barrier or from the lowest elevation of the outside limit of the barrier to the maximum water storage elevation and has an impounding capacity at maximum water storage elevation of 50 acre-feet or more (MRS Title 37-B, 2023)."

The proposed fish passage design, although constructed of natural materials and not a discrete structure, will likely continue to be classified as a dam per the state statute, and may retain its high hazard designation. The retained embankments create a dam height that is 25 feet, and the proposed fish passage structure will maintain a normal storage of approximately 9,720 ac-ft, well above the threshold to be defined as a dam.

Continued coordination with MEMA and other state agencies as design continues. This may include a future evaluation to facilitate determination by the State whether the proposed structure will be designated as a dam, and whether the dam will retain a high hazard classification.

8. Opinion of Probable Construction Costs

An opinion of probable cost was developed for the final (100%) proposed project design and assumes the site-specific approaches discussed above in Section 5. According to the definitions developed by the American Association of Cost Engineering, the cost analysis is estimated to fall within the range of Class 1 estimates (AACE International, 2020). Pricing is based on 2025 dollars and does not include long-term maintenance costs, or construction period project management.

The cost opinion has been developed based on review of construction costs for similar items in past projects, consultation with construction contractors and material suppliers, and applicable reference cost data. The actual cost to implement the Project may vary from the cost opinions due to high variability in the construction market, price fluctuations, and other unforeseen factors. Recent bid results, in particular between 2018 and 2023, have seen substantial escalation in bid pricing due to labor shortages in the state of Maine and in the broader region, continued market volatility post-COVID Pandemic, and supply chain pressures for materials and equipment.

The following assumptions apply to the development of the opinion of probable cost:

- Pricing is developed based on project construction in 2026
- The base cost includes a 15% construction contingency.
- The disposal costs associated with the creosote treated lumber are based on hazardous materials disposal costs from past projects, and general pricing at Crossroads Landfill in Norridgewock Maine.
- All excavated soil and timber crib rock fill will be re-used on-site.
- Nature-like fishway material required for construction will be imported. However, an objective during construction will be to reuse excavated materials to the extent possible to reduce project costs.
- Does not include long-term operation and maintenance costs.
- Does not include the cost of easement agreements.

8.1.1 Cost Analysis Summary

The results of the cost analysis can be found in Appendix E and are summarized in Table 20.

Table 20: Opinion of Cost Summary

Description	*Cost*
Construction Subtotal	$5,748,000
Contingency (15%)	$863,000
Project Construction Total	**$6,611,000**

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Appendix A | 100% Design Drawings

Inter-Fluve, and Fuss & O'Neill Inc.

Appendix B| Cherryfield Alewife Harvest Considerations

Inter-Fluve

1. UNDERSTANDING OF ASSIGNMENT

The natural resources associated with the Narraguagus River are well recognized for their value to the town of Cherryfield (Williams et al. 2019). We understand that the Alewife harvest is a valuable source of revenue for Cherryfield and that a key goal of this fish passage design and implementation project is to allow for an ongoing harvest by the town, even while the specifics of the harvest gear and practices may necessarily be modified. An overreaching goal of this project is to improve fish passage overall at the site. Alewife (Alosa pseudoharengus) passage is expected to be improved through the removal of the Denil fish ladder and construction of alternative passage for fish that may provide passage over a wider portion of the river width. An *a priori* estimate of how many, or what proportion of, Alewife will pass the new fishway is impossible, but we are confident that the number of Alewife that pass upstream will be greater than it has been through the Denil fish ladder. Following are potential harvest options to continue the annual harvest practices. The favored option, or combination of options, may be best arrived through ongoing dialogue from the town representatives, harvesters, agencies and special interest group professionals that have first-hand experience at this site (or similar sites in Maine).

2. ALEWIFE HABITAT CONNECTIVITY

Instream impediments are one of the factors limiting river herring populations along the east coast so improving habitat connectivity is a primary objective of resource management agencies (German et al. 2023). Alewife generally home to natal streams although some straying may occur (Loesch 1987), so it is important that the Alewife population from a particular river have sufficient access to and from spawning habitat to complete its life cycle. Flagg (2007) reported declines in herring numbers in the St. Croix River after each of several fishways was closed thus eliminating access to spawning habitat. His analysis further demonstrated that Alewife must be able to ascend to specific spawning habitats. The Atlantic States Marine Fisheries Commission's (ASMFC) primary role with respect to Alewife is to assure that adequate measures are implemented coast wide to protect and to increase Alewife (and other species) abundance. ASMFC has the authority to regulate migratory species fisheries along the Atlantic Coast. Multiple entities have responsibility for river herring management within each state.

3. MANAGEMENT RESPONSIBILITIES AND CHERRYFIELD'S HARVEST

For a given state to have an open fishery for Alewife, the state must provide an assessment report and management plan that demonstrates that the Alewife population is sustainable with a particular harvest strategy in play. MDMR has satisfied the ASMFC requirements for maintaining an Alewife harvest. Towns must develop and submit an annual Harvest Management Plan to MDMR to be eligible for a harvest. If approved, that town may conduct a harvest for that year within the regulations and requirements set by Maine DMR. Cherryfield has developed Harvest Management Plans and has harvested Alewife in at least 15 years since the mid-1990's based on information provided by the Town.

Alewife harvest records were provided by the Town of Cherryfield for most of the years from 1996 through 2023; all years from 2015 to 2023 were included. Harvests ranged between 47 bushels (2005) and 2,011 bushels (2018) during this period of record (Figure 50).

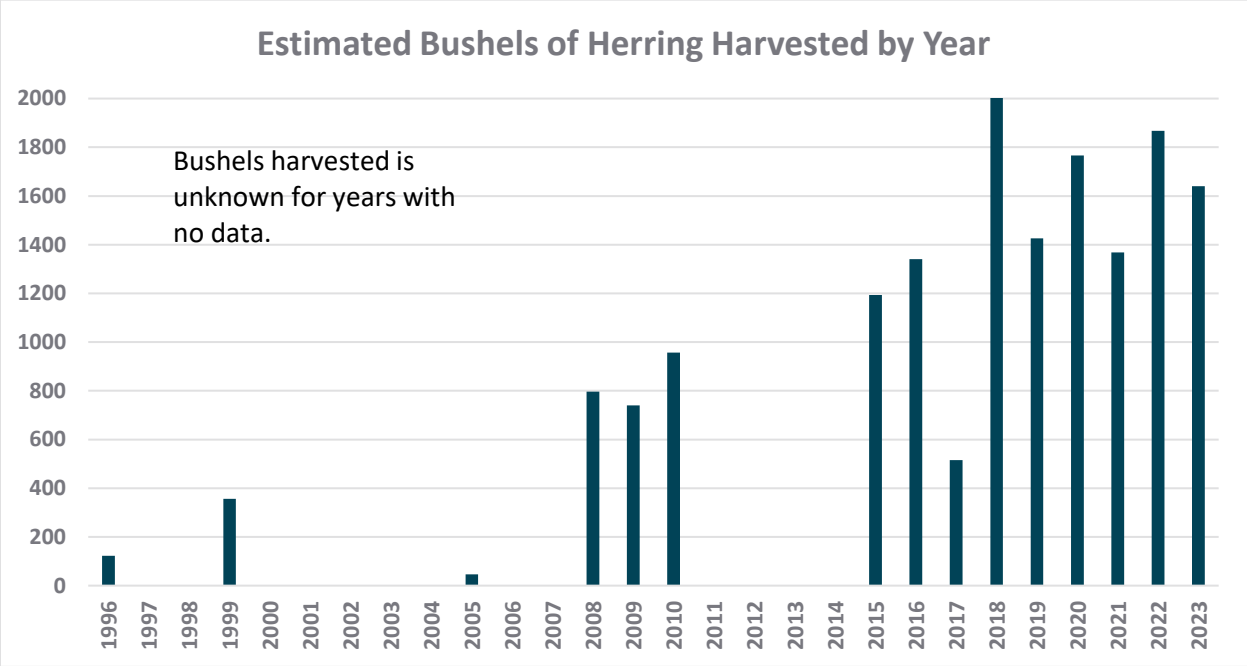


Figure 50: Estimated Alewife harvest in the Narraguagus River at Cherryfield by year. Data provided by Town of Cherryfield, Maine

Harvest quantities have increased since the mid-1990's though the reason(s) for the increase are not certain. Possible explanations include an increase in the herring population that has utilized the Narraguagus River, an increase in fishing effort over the years, more effective use of collection gear resulting in an increase in harvest efficiency, better data collection and reporting of harvest data. One or any combination of these factors could explain the increase in harvest quantities. Harvest has been variable but trending upward over the past 25 years in other regional rivers as well (Hayden *et al*. 2019).

4. MAINE'S APPROACH TO ESTIMATING HABITAT CAPACITY

Estimating habitat carrying capacity is a difficult task particularly for migratory species that are transitory and temporary inhabitants of a given habitat. Intuitively, habitat carrying capacity can vary widely among systems, but Gibson and Myers (2003) found a relative constancy in maximum lifetime reproductive rates of Alewife among populations. One approach used for estimating the capacity of a system for alosines develops a number of spawners per unit area of spawning habitat, then multiplies the spawners per unit area by the available suitable spawning area. This approach has been used for American Shad in the Susquehanna, Connecticut, and Santee Cooper river basins. In Maine, for river herring, the approach to estimating system capacity is based on 235 herring spawners per acre of spawning habitat (Flagg 2007; Hayden et al. 2019; Brown 2024). Hayden et al. (2019) reported that the estimated capacity of the Narraguagus system is 970,000 Alewife; Brown (2024) stated that the Narraguagus Alewife production is estimated at 419,475 fish. If the capacity

estimation approach is sound, the Narraguagus system can support more than two times the number of Alewife spawners than currently use the system. The new nature-like fishway should facilitate population growth assuming no other population limiting factors (e.g., ocean mortality) impact population growth, and therefore support an annual Alewife harvest at current or greater levels. Annual coordination with Maine DMR will be important to set harvest levels on an ongoing basis.

5. CONSIDERATIONS FOR ALEWIFE HARVESTS WITH NEW NATURE-LIFE FISHWAY

5.1. HABITAT CONNECTIVITY IS KEY

Boreman and Friedland (2003) conducted an analysis of factors that may limit reproductive potential of American Shad (*A. sapidissima*), a congener of Alewife. One conclusion was that a strategy of improving habitat connectivity may be more beneficial than reducing fishing mortality. Flagg (2007) documented dramatic drops in Alewife abundance after access to spawning habitat was eliminated when fishways were closed. These previous analyses support the concept that greater access to spawning habitat provided by the new nature-like fishway should facilitate and support future Cherryfield harvests at current (or greater) levels.

5.2. HARVEST LOCATION OPTIONS

The proposed nature-like fishway design will move most fish passage to the river right (west) side of the river, perhaps from the right bank to approximately the middle of the river. How close to the right bank immigrating Alewife will travel may depend on river flows on a given day. We propose the harvest location be moved to the right side of the river (west) as well. Access to the harvest facilities will be included in the design and implementation of the new fish passage facilities. We anticipate two alternatives as described below.

5.2.1. ALTERNATIVE 1

The first harvest location alternative suggests that the harvest facilities be similar to what have been used in recent years, including the holding and lifting gear, but be located on the opposite bank from where they have been, and tied into the ice pier similar to what was done on the left (east) side of the river. To guide Alewife into the trap box, a guide net (or picketed weir, or similar) will run from a point near the crest of the fishway toward the collection/holding box. A series of anchor points for the guide net will be installed across the fishway crest to intercept upstream migrating fish. At least several anchor points will be installed so that the leading edge of the guide net can be moved across the crest of the fishway to adjust the fish catch as appropriate (Figure 51). For example, if too few Alewife are being collected, the leading edge of the guide net could be moved out to intercept more of the upstream moving fish. Also, if too many non-target species are being collected, the leading edge of the guide net could be moved closer to shore to intercept fewer of the fish using the fishway. It is possible, if not likely, that non-target fish will be collected. . The design features a notch (approximately 12”-18” wide) in one wall of the collection box that may help to reduce Atlantic Salmon capture. Water would be pumped over the weir to attract salmon. The weir will be high enough that a fish would need to jump to get over it, thus it would allow salmon to

escape but not alosine fishes. provisions to release non-target fish timely should be incorporated into the harvest operations until there is sufficient experience to predict which species and how many may be collected. Harvesters should communicate, and work closely, with Maine DMR to adjust fishing effort and guide net locations appropriately. Provisions will be included so no fish are collected on the 'off days' when harvesting is not allowed. Further design work will need to consider the provision of safe access to the guide net anchoring points if the potential to move the guide net within a season is an attractive feature of the system.

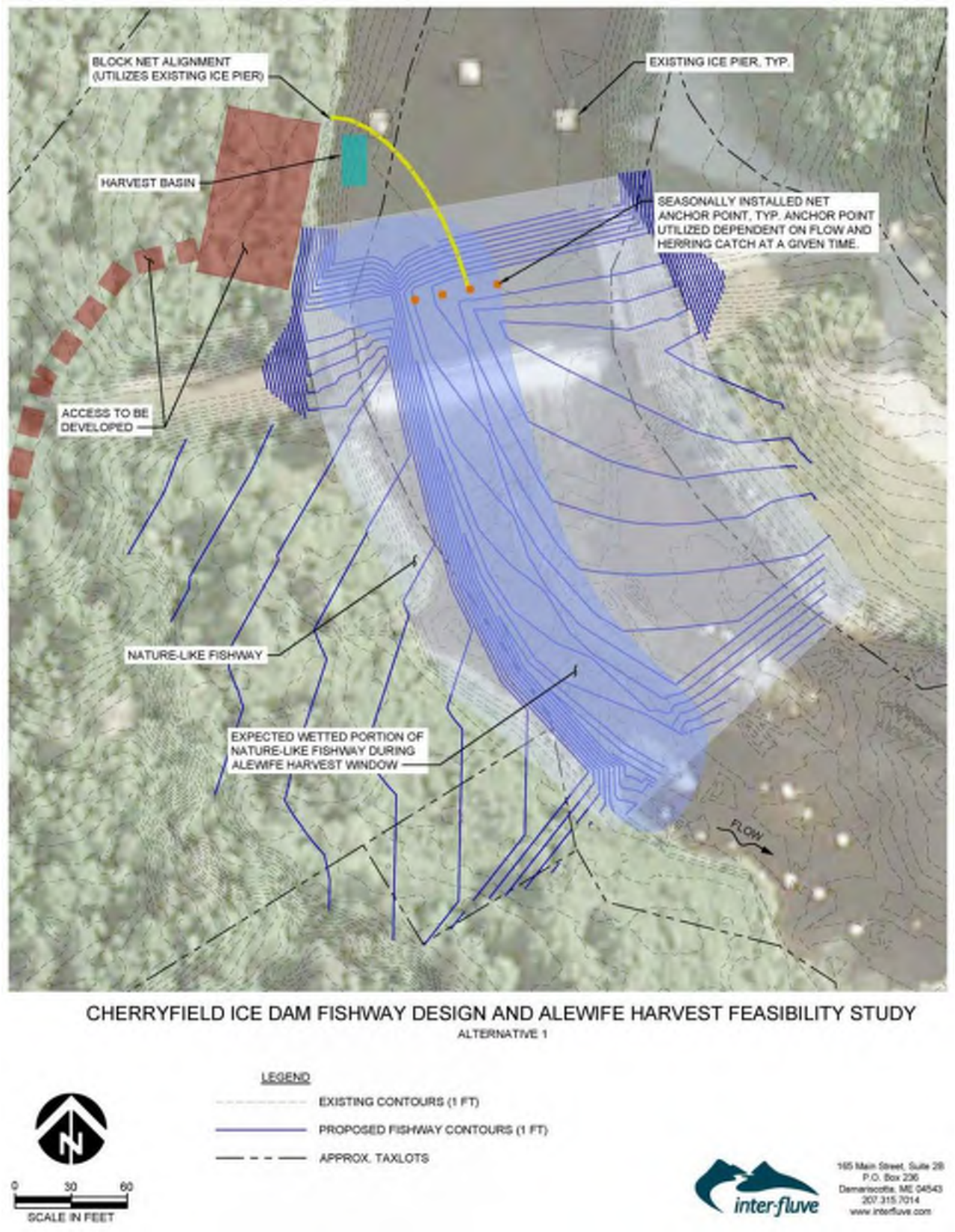


Figure 51: Alewife Harvest Alternative 1.

5.2.2. ALTERNATIVE 2

The second alternative considers a concept put forth by Project Partners (Figure 52) who suggested that a channel be installed on the right bank with the entrance near the lower end of the nature-like fishway. The channel would lead to a collection/harvest box from which Alewife (and other species) could be removed; a fish return pipe will be included to return non-target species to the river. The entrance channel would be supplied with an attraction flow via an attraction flow pipe. The attraction flow will be supplied by gravity feed from the impoundment just upstream of the nature-like fishway. A gate near the top end of the attraction flow pipe will allow for closing off the attraction flow when not in use. A screen to exclude Atlantic Salmon and American Shad (and other larger fish) will be installed near the downstream end of the entrance channel. The entrance channel will include sufficient depth and roughened surface or baffles to facilitate Alewife movement through the channel into the collection/harvest box. Access to the area will be included as part of the fishway construction project.

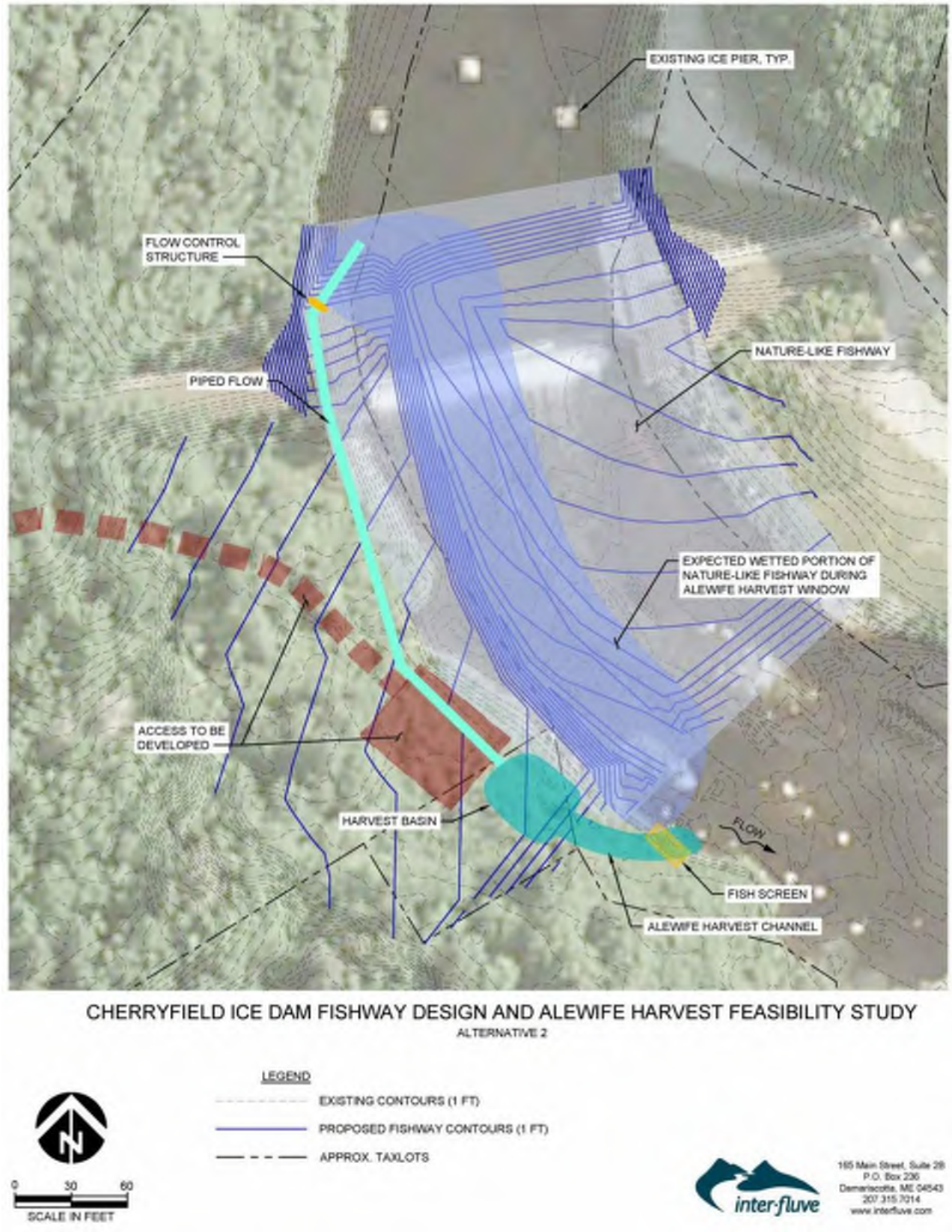


Figure 52: Alewife Harvest Alternative 2

5.3. GEAR/TECHNIQUE OPTIONS

With Alternative 1, Alewife should be able to be harvested in the same manner as they have been in recent years by using a herring lift to remove Alewife from the holding pen. The existing lifting gear can likely be used by installing it on the river's right side. The holding/trapping box may need to be re-designed and built, but it would be designed to accommodate the lifting mechanism that already exists. There may be a requirement to sort and release non-target species. The trapping/holding box will include a gate of dimensions approved by DMR for the pass through of fish during days when fishing is not conducted.

If Alternative 2 is selected, the trapping/holding box would be off-channel (i.e., on the bank) and supplied with water from a gravity fed pipe. A crowding and lifting mechanism will be designed to fit in the new trapping/holding box to facilitate removal of Alewife. The entrance channel will include an exclusion screen with bar spacing to exclude larger fish such as Atlantic Salmon, American Shad, and other non-target species. However, even with the exclusion screen, there may be a need to sort and return some non-target fish (e.g., small 'buck' shad can be similar in size to herring and could conceivably pass through the screen bars). A non-target fish return pipe will be installed to facilitate the return of non-target fish to the river. The return pipe will be supplied with water from a small pump, or perhaps a feed off the gravity fed attraction flow pipe. During days when fishing is not conducted, the attraction flow will be turned off so that fish will not enter the fish collection system.

As previously stated, it is impossible to estimate what the harvest quantities will be in future years. However:

- Given that the nature-like fishway is expected to improve overall passage for Alewife (and all species);
- Given that the annual harvest quantities have trended upward since 2008 (see Figure 31), and;
- Assuming no extraneous population limiting factors unrelated to this nature-like fishway design project will significantly reduce the annual abundance of Narraguagus River run Alewife, then,

we anticipate annual harvest levels will be at least as great as have been realized over the past several years. If the Alewife population increases due to improved fish passage and has access to underutilized spawning and rearing habitat, it is quite possible that harvest levels could be increased in the future. It may require multiple seasons of experience with the new harvest gear and procedures, and it may take two or more Alewife life cycles for any population increases to be observed, but the likelihood of maintaining the current harvest levels or increasing them is high.

6. RECOMMENDATIONS

Assuming the current recommended nature-like fishway design, located on the right side of the river (Figure 32), is implemented, we recommend that the existing harvest gear (i.e., the lift mechanism) continue to be utilized on the right side of the river. Access and trapping/holding

facilities similar to those used to date should be able to be used. A guide net or screen will likely need to be installed seasonally to intercept a portion of the immigrating Alewife and guide them into the trapping/holding facilities. Multiple anchor points will be available near the crest of the fishway so that the guide net/screen can be moved to intercept a larger or smaller proportion of the upstream migrating fish, as appropriate to maintain harvest numbers. Non-target species may be collected so harvesters will need to return those fish safely and in a timely manner to the river. Details on those aspects will need to be coordinated with Maine DMR.

Inter-Fluve's alternative recommendation is the collection system with an entrance downstream of the new fishway (Figure 33). We surmise that this alternative will be less productive with respect to harvest numbers than Alternative 1 because it relies on the attractiveness of the entrance channel. Flows cascading through the new fishway will compete with the attraction flow from the entrance channel, and the design includes an exclusion screen for larger non-target fish (primarily to exclude Atlantic Salmon and American Shad). While Alewife will be able to pass through the screen, the fact that it is there may be a visual/behavioral deterrent when open water provided by the new fishway is adjacent and readily available.

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Appendix C| Dam Assessment

Fuss & O'Neill, Inc.

Appendix D| Alternatives Analysis

Inter-Fluve

Appendix E| Opinion of Cost

Inter-Fluve and Fuss & O'Neill, Inc.

Appendix F| Additional HEC-RAS Results

Inter-Fluve

Appendix G| Wetland Delineation and Functional Assessment

Alan Haberstock, PWS

Appendix C. Wetland Assessment

See attached report with 39 pages, dated June 8, 2025 and updated August 11, 2025 and entitled “Cherryfield Ice Dam - Nature-Like Fishway and Dam Removal Wetland Delineation and Wetland Functional Assessment”

Cherryfield Ice Dam - Nature-Like Fishway and Dam Removal

Wetland Delineation and Wetland Functional Assessment

Narraguagus River

Town of Cherryfield, Washington County, Maine



Prepared for: Inter-Fluve and the Downeast Salmon Federation

By: Alan Haberstock, PWS

June 8, 2025

(updated August 11, 2025 to reflect delineation of wetlands along the western access)

Cover Photo: View of the Narraguagus River looking downstream about 1,000 ft upstream of the dam. A fringe of palustrine emergent marsh is visible in the background at the shoreline. Riparian forest (both upland and palustrine forested wetland) is wide and unfragmented above the dam. At and below the dam the riparian forest is more fragmented.

Introduction and Background

The Downeast Salmon Federation (DSF) contracted with Inter-Fluve to design and permit a nature-like fishway (NLF) to replace the Cherryfield Ice Dam on the Narraguagus River in Cherryfield, ME. Inter-Fluve sub-contracted Alan Haberstock, PWS to conduct a wetland delineation and assessment to evaluate potential project impacts and alternatives, and inform designers seeking to avoid and minimize wetland impacts.

The project will restore and enhance fish passage while providing a more natural, riverine habitat in place of the existing dam and technical fishway. Little to no direct wetland impacts form the NLF development would occur upstream of the existing dam. Downstream impacts are unavoidable as the natural rock design with step pools and weirs needs to tie-in to the adjacent banks, which are fringed by riparian wetlands. Impacts, however, can be avoided and minimized, as detailed later in this report, and a native wetland and riparian planting plan would be implemented in areas of unavoidable impact along the margins of the NLF. The natural rock material of the NLF is designed to replicate in-stream habitat features such as riffles and pools and can also accommodate native riparian plantings along the margins as long as fines (sand, silt, clay, and organic matter) are available for rooting below the rock mantle.

Methods

The wetlands above the dam and below the pond outlet were delineated on May 19, 2025 using the U.S. Army Corps of Engineers Wetlands Delineation Manual (Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0) (https://www.mvp.usace.army.mil/Portals/57/docs/regulatory/Website%20Organization/Northcentral%20and%20Northeast%20Regional%20Supplement.pdf). This method uses three factors (soils, hydrology, and vegetation) to determine the wetland/upland boundary. On May 19, the growing season had begun, and vegetation was readily identifiable. Signs of hydrology such as sediment deposits, drift wracks, and saturated soils were also readily apparent in the field. Hydric soils indicators for the Northeast Region were determined using a spade and examining the soil profile for hydric soils characteristics such as depleted mineral soil horizon or organic soils.

A "Descriptive Approach" to wetland functions and values known as the “Highway Methodology Workbook Supplement: Wetland Functions and Values – A Descriptive Approach” published by the United States Army Corps of Engineers (USACE) was used for the wetland functional assessment. This method incorporates both wetland science and human judgment. The evaluator first determines if a wetland is suitable for particular functions and values and why, followed by a determination of what functions and values are principal and why. The purpose of designating a principal function and value assists regulators and professionals in assessing impacts and net functional lift or impact. Functions and values can be principal if they are a significant component of a wetland ecosystem (function only) and/or are considered of special value to society, from a local, regional, and/or national perspective.

Field work was completed by Alan Haberstock, PWS, Mercedes Valdez, PE (Inter-Fluve) and Project Engineer Marcel Young-Scaggs, PE (Inter-Fluve) on May 19th and by Alan Haberstock and Marcel Young-Scaggs on August 6th. Sequentially numbered “wetland boundary” ribbon was hung along the wetland boundary. Inter-Fluve used a GPS to geo-locate the flagging within sub-meter accuracy.

Results

Wetland Delineation

The wetland boundary was delineated using the following flagging sequences:

May Field Work (river and NLF construction area):

Flag #s A-1 through A-23:	northeast side of river (beginning with flag #A-1 downstream and ending with flag #A-23 above the dam, just beyond the boat launch)
Flag #s B-1 through B-49:	southwest side of river (beginning with flag #B-1 several-hundred feet upstream of the dam and ending with flag #B-49 about 750 feet below the dam)

August Field Work (western access road):

Flag #s C-1 through C-3:	east side of shared road
Flag #s D-1 through D-4:	east side of shared road
Flag #s E-1 through E-5:	east side of shared road
Flag #s F-1 through F-5:	west side of shared road
Flag #s G-1 through G-4:	west side of shared road
Flag #s H-1 through H-4:	west side of shared road
Flag #s I-1 through I-6:	west side of shared road
J Sequence:	not used
Flag #s K-1 through K-4:	east side of road turnoff to dam
Flag #s L-1 through L-6:	west side of road turnoff to dam
Flag #s M-1 through M-3:	east side of road turnoff to dam
Flag #s N-1 through N-4:	east side of shared road at intermittent stream near intersection with road turnoff to dam

USACE data sheets are included in Appendix A. Paired plots (one wetland; one upland) were established perpendicular to the wetland boundary, approximately 15 feet either side of Wetland Boundary Flags A-6 and B-1. The upland/wetland boundary was clear and abrupt as wetlands mostly occupied a flat, floodplain shelf along the river and transitioned to upland at slopes/banks. Normal conditions were present throughout.

Figures 1-3 show the upland/wetland boundary as well as palustrine wetland habitat types (using the USFWS Cowardin system) within the wetland system. Representative photos are included in Appendix B.

Wetlands A and B along the Narraguagus River in the vicinity of the NLF

Wetlands on the northeast side of the Narraguagus River (Wetland A) occur as a narrow strip of riparian wetland between the shoreline of the river and the road bank below the dam. Above the dam, a narrow wetland margin was delineated from the dam upstream to the vicinity of the boat launch. Wetland soils are derived from a mix of fill and alluvium on this shoreline and are primarily palustrine scrub-shrub (PSS) and palustrine emergent (PEM) intermingled.

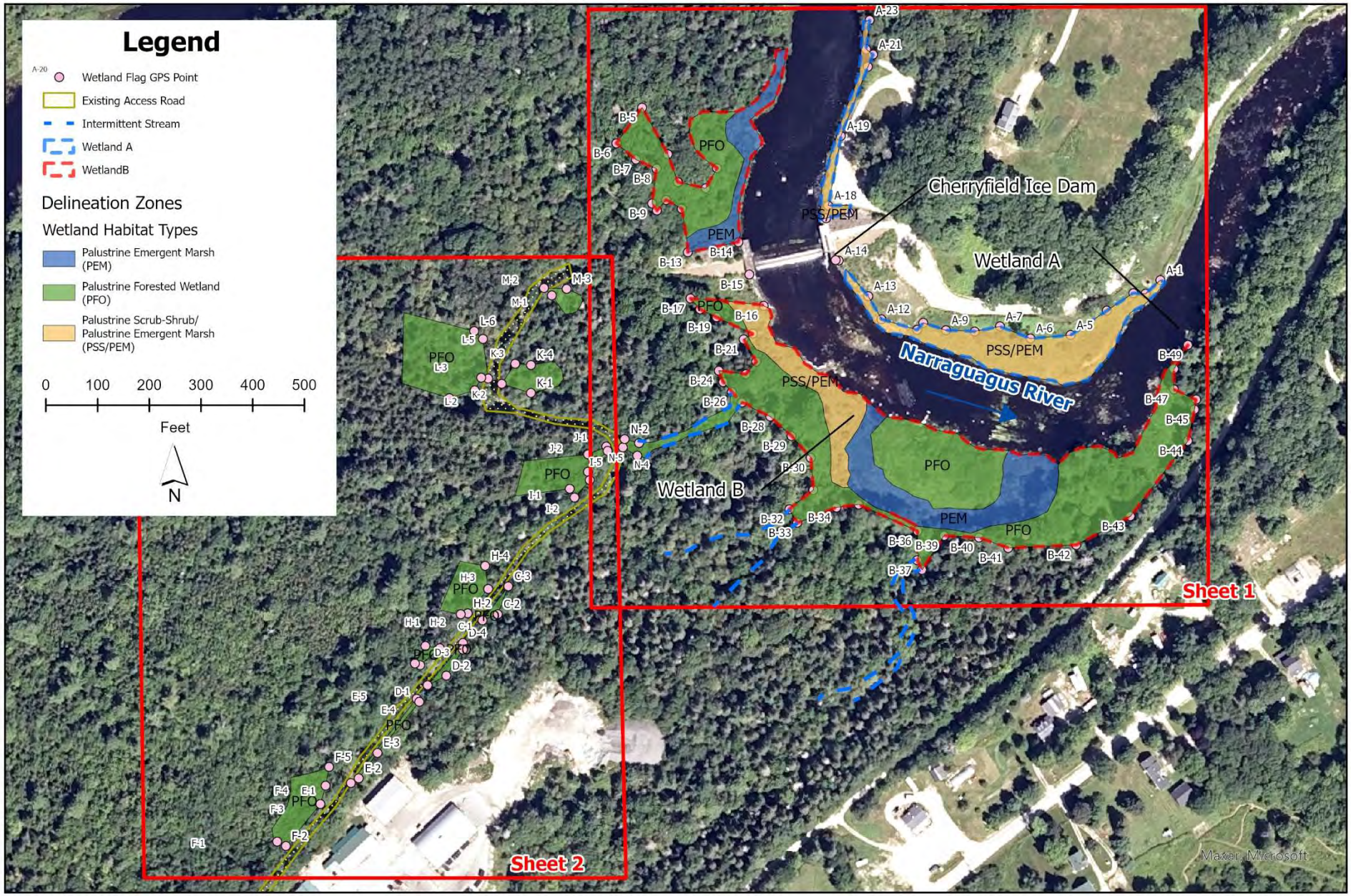


Figure 1. Overview of Wetland Delineation with palustrine wetland habitat types identified.

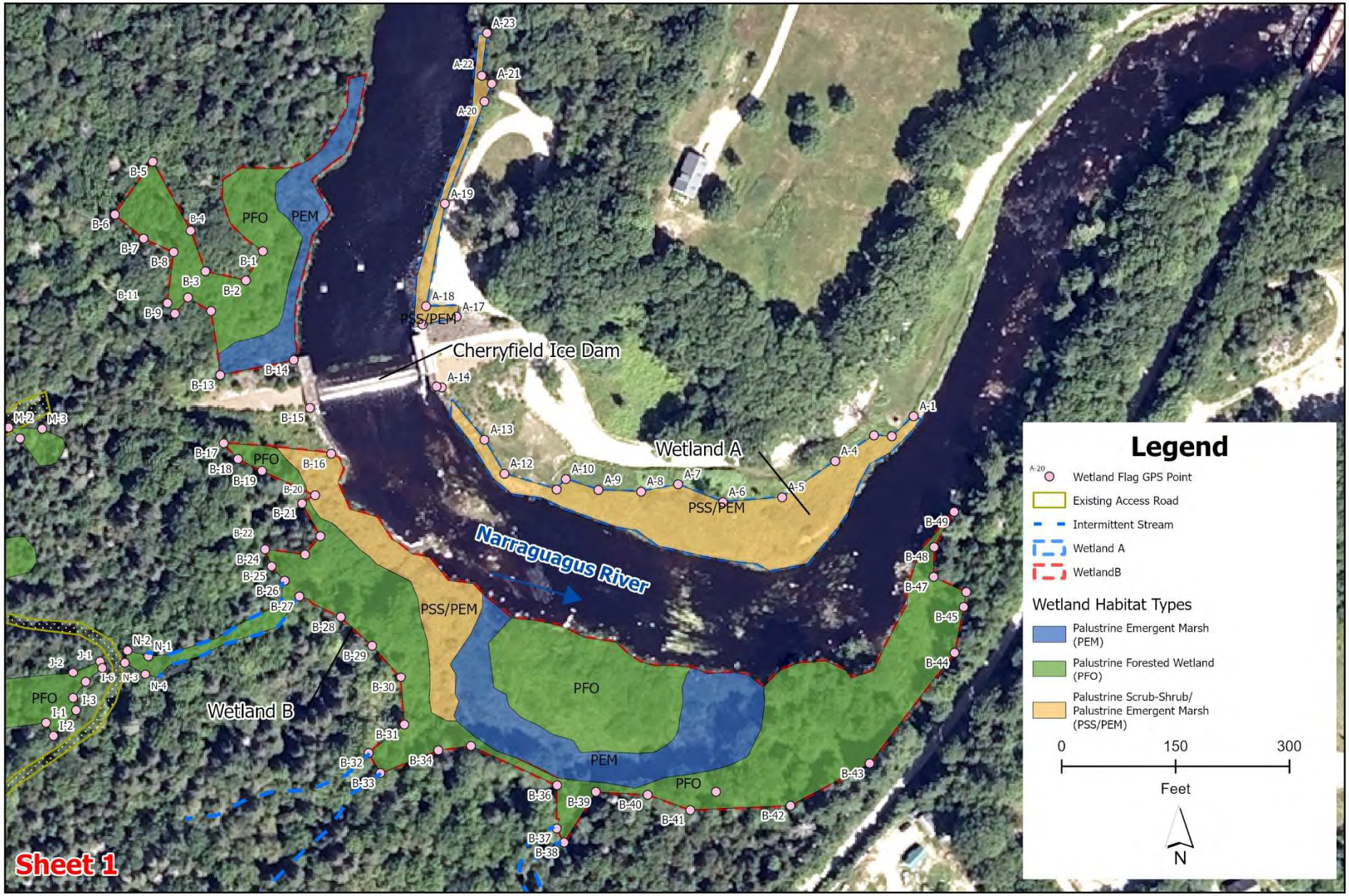


Figure 2. Wetland delineation (Sheet 1).

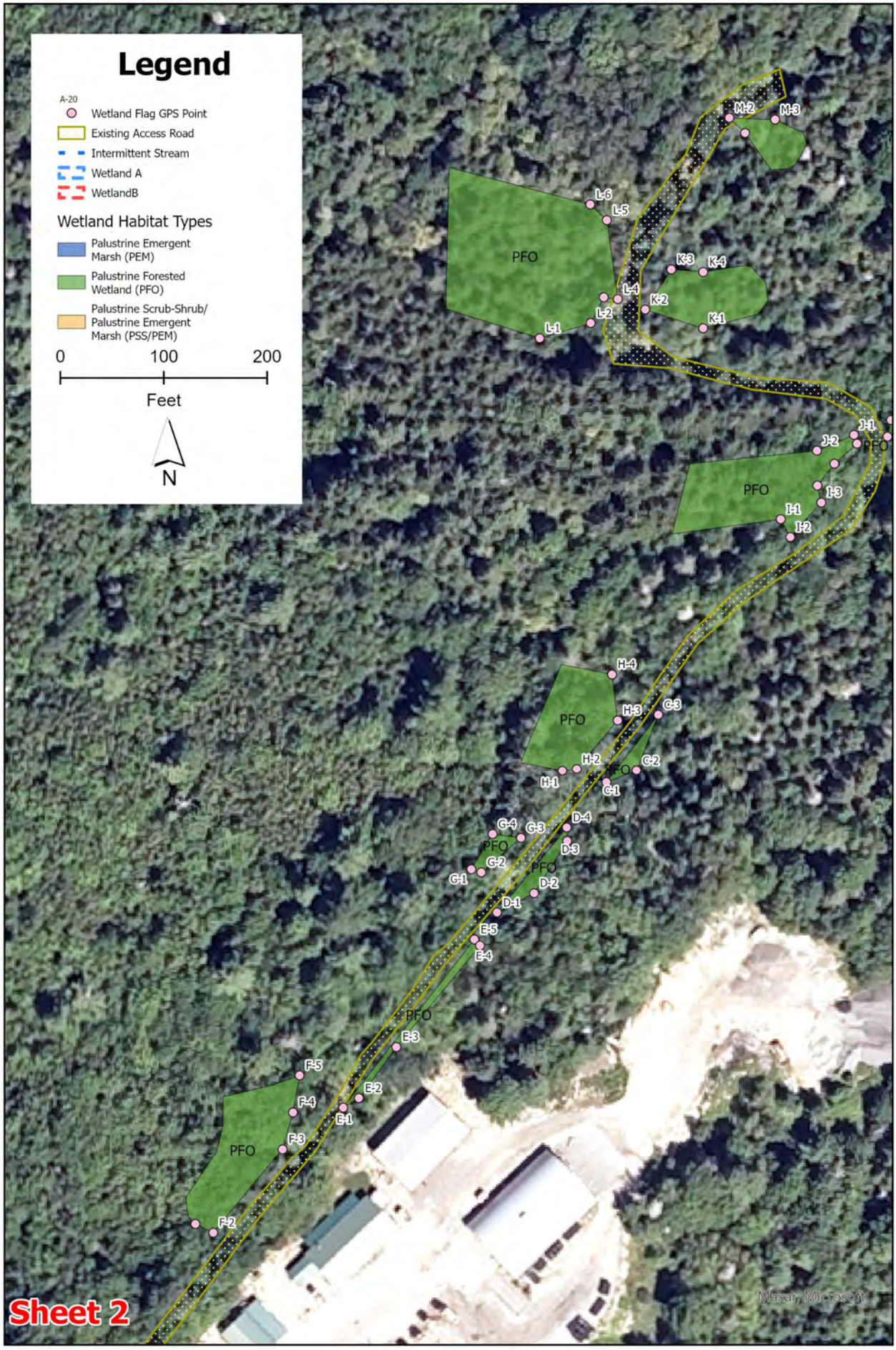


Figure 3. Wetland delineation (Sheet 2).

On the southwest side of the river (Wetland B), wetlands are broader and more diverse including palustrine forested wetland (PFO) as well as PSS/PEM well interspersed. The most diverse area in terms of habitat complexity and interspersion, as well as plant diversity, occurs furthest downstream of the dam, downstream of the proposed NLF. This portion of the wetland complex includes a small hardwood floodplain forest (PFO) as well as areas of standing water including a small pool and a secondary flow channel. This wetland complex receives hydrologic input from intermittent streams entering from the adjacent forested hillside as well as periodic overbank flows from the Narraguagus River. Beaver have constructed small dams where channels would drain the open water in this wetland complex towards the river. Wetlands on the southwest side of the river above the dam are PEM along the river shoreline and PFO adjacent to the upland/wetland boundary.

The PEM occurs in in the wetter areas adjacent to the Narraguagus River and in micro-habitat lows like swales and back-channels. Dominant species include tussock sedge (*Carex stricta*), woolgrass (*Scirpus cyperinus*), sensitive fern (*Onoclea sensibilis*), and rough rough bedstraw (*Galium asprellum*) on the northeast bank. In the PEM portion of the wetland complex on the southwest side, a more diverse community occurred with several additional species present: Canada bluejoint (*Calamagrostis canadensis*), blue-flag (*Iris versicolor*), sweetflag (*Acorus calamus*), soft rush (Juncus effusus), needle spikerush (*Eleocharis acicularis)*, annual water bulrush (*Schoenoplectus subterminalis*), rattlesnake manna grass (*Glyceria canadensis*), tall meadow rue (*Thalictrum polygamum*), American bur-reed (*Sparganium americanum*), cattail (*Typha latifolia*), three-way sedge (*Dulichium arundinaceum*), Canada rush (*Juncus canadensis*), smooth saw-sedge (*Cladium mariscoides*), northern long sedge (*Carex folliculate*), brown beaksedge (*Rhynchospora fusca)*, New York aster (*Symphiotrichum novi-belgii*), and jewelweed (*Impatiens capensis*).

The PSS occurs intermingled with the PEM such that it is impractical to map separately as individual polygons. In addition to the emergent species listed above for the PEM community, a few more shade tolerant herbaceous layer species were found such as dewberry (*Rubus hispidus*), stinging nettle (*Urtica dioica*), royal fern (*Osmunda regalis*), and cinnamon fern (Os*munda cinnamomea*). Dominant shrubs are speckled alder (*Alnus incana*), green alder (*Anus viridis*), silky dogwood (*Cornus amomum*), red osier dogwood (*Cornus sericea*), arrowwood (*Viburnum dentatum*), withe-rod (*Viburnum nudum*), elderberry (*Sambucus canadensis*), willow species (*Salix discolor and S. bebbiana*), meadowsweet (*Spiraea latifolia*), and steeplebush (*Spiraea tomentosa*).

Forested wetlands (PFO) were dominated by a tree stratum of red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), black spruce (*Picea mariana*), American elm (*Ulmus americana*), and balsam fir (*Abies balsamifera*). The sapling/shrub stratum was dominated by winterberry and saplings of overstory trees. The herbaceous layer included cinnamon fern, sensitive fern, starflower, and spinulose wood fern.

The wetlands in the vicinity of the dam were dominated by native species though a few purple loosestrife (*Lythrum salicaria*), an invasive wetland plant) were observed. Some invasive honeysuckle (*Lonicera*, spp) and multiflora rose (*Rosa multiflora*) were also observed near the upland/wetland boundary in the shrub stratum. The entire wetland system, however, generally lacks large monocultures of noxious species like common reed (*Phragmites australis*) and Japanese knotweed (*Fallopia japonica*).

Parent material was a complex mix. Presumpscot formation marine clays were found at 2-3 ft depths. Recent (modern) alluvium was often found above the marine clays. Near the dam and on the entire northeast shoreline, some fill material was found. Organic matter, including histic epipedons and thick,

dark A horizons were found in micro-lows and in PEM habitats below the dam. Above the dam there was more alluvial deposition. Low chroma matrix colors (chroma 2 and less) as well as mottling (redoximporphic concentrations) and oxidized root channels were typical signs of hydric conditions in the mineral horizons where intermittent saturation and inundation results in anaerobic conditions.

Riparian uplands adjacent to the wetlands were characterized by Spodosol soils that had a leached (low chroma, iron and other minerals removed) E horizon and sandy loam to loamy sand textures in many places. Other places had a clay loam subsoils (Presumpscot formation clays as parent material) but were still well drained or moderately well drained on the gently sloping riparian hillsides. Dominant trees were typical of mixed hardwood/softwood forests in Maine with white pine, balsam fir, white, gray and yellow birch, red and sugar maple, hemlock, red spruce and beech in the canopy and sapling/shrub strata. Typical species such as starflower, bunchberry, Canada mayflower and Indian cucumber dominated the herb stratum.

Wetlands C through N

Wetlands C through N were all palustrine forested wetlands (PFO) along the access road for the west side of the dam. Wetlands C-E were part of narrow roadside ditches confined between the existing road on the west side and an upland slope near the MDOT facility on the east side. The lack of culverts in this area basically impounds these wetlands and directs drainage to the north along roadside ditches. Wetlands F-N were connected to more extensive forested wetlands that we delineated away from the road for a distance of ~20-25 ft. None of these wetlands were within the floodplain or hydrologic influence of the Narraguagus River. However, because improvements will be needed to the access road, the wetlands were delineated in order to assess unavoidable impacts.

The PFO wetlands were dominated by a tree stratum of red maple, green ash, black and red spruce, balsam fir, gray birch and yellow birch. The shrub stratum was dominated by saplings of the same species as the tree stratum. The herbaceous stratum was dominated by fowl manna grass (*Glyceria striata*), Canada bluejoint (*Calamagrostis canadensis*), sensitive fern, cinnamon fern, interrupted fern (*Osmunda claytonia*), starflower (*Trientalis borealis*), and tussock sedge.

Soils were mineral (both glacial till-derived as well as glacio-marine-derived). No organic or alluvial soils were present near the road. Low chroma colors (2 or less) near the surface indicated reducing conditions in the upper portion of the soil profiles. In some areas, dense subsoils with high clay content (glacial marine parent material) were present.

Wetland Functional Analysis

Wetlands A and B along the Narraguagus River

The completed Functions and Values Evaluation data sheets (Appendix C) summarize the six (6) principal functions/values provided by the wetland complex on the southwest side of the river (Wetland B) and the single principal function provided by the wetlands on the northeast side of the river (Wetland A).

Neither wetland provides important groundwater discharge or recharge functions; there are no sand and gravel deposits (unlike upstream portions of the watershed, which have coarse-grained, sandy outwash deposits such as deltas and outwash plains) or community wells near the wetlands. The wetland complex (Wetland B) on the southwest side does accommodate floodwater and can store a modest amount of it.

Wetland A on the northeast side, however, is immediately connected to the main stream channel. There is little opportunity for long term storage in this wetland as there are no swales or back channels.

Fish and shellfish habitat is provided in the Narraguagus River itself. The wetlands provide shade, water quality protection and other important functions indirectly but do not provide important fish and shellfish habitat in and of themselves (*e.g.,* fry are not utilizing back channels). There is no modeled, surveyed or mapped Atlantic salmon spawning or rearing habitat in the wetlands.

Sediment/toxicant retention and nutrient removal are provided at the principal level for the wetland complex on the southwest side of the river (Wetland B), but not by Wetland A on the northeast side. Wetland B is characterized by dense, low vegetation, broad areas, and micro-topographic heterogeneity. This lends itself to trapping and storing sediment and associated pollutants/nutrients. Wetland A is less complex, more narrow, and lacks characteristics that would allow for significant sediment storage and nutrient conversion. Similarly, Wetland B can provide floodflow alteration at the principal level because of its larger size, micro-topographic complexity and dense low vegetation, whereas Wetland A is more narrow and flat (little to no storage capacity). The dense, low vegetation and topographic complexity of Wetland B allows it to slow flood waters and allow sediments and associated nutrients to settle-out providing important sediment/toxicant retention and nutrient removal functions. The diverse native, wetland plant community adjacent to the steam is productive and provides important production export functions (e.g., robust macroinvertebrate community) to the adjacent stream and downstream areas.

Wetland B also provides wildlife habitat at the principal level. It has areas of standing water (swales and back channels) as well as a high degree of interspersion (complex edges) between PEM, PSS and PFO. It is also bordered by a wide forested riparian buffer. We observed Bald Eagle using the trees in and around this wetland complex to view the river. There was beaver sign (dams, feeding, channels, bank den). Passerines including Common Yellowthroat, Chestnut-sided Warbler, Kingfisher, and Yellow Warbler were observed or heard in and adjacent to Wetland B. Pickerel frog were observed using Wetland B.

The downstream portion of Wetland B, in particular, offers a high degree of habitat interspersion and optimal juxtapositions. For example, the emergent marsh and aquatic habitats are very well interspersed with complex edges and a high degree of micro-topographic diversity. This habitat is ideal for many species of wading birds and waterfowl. The diversity of berry-producing shrubs and nutritious emergent marsh plants also contribute to the high-quality wildlife habitat function. The wetland complex is also part of the larger forested corridor of the Narraguagus River though it is broken (fragmented) by the dam.

Wetland A is more narrow and less complex. It is also sandwiched between the road to the boat launch and the river.

Cormorants were fishing from rocks in the river channel below the dam. The alewife were moving upstream. Lobstermen were catching them as bait just above the dam. The anadromous fish runs and piscivores that utilize the food resource are less concerned with specific wetland and buffer characteristics than are aquatic and semi-aquatic furbearers like muskrat, beaver and otter, waterfowl and wading birds, passerines and herptiles. The wetland delineation area was evaluated for vernal pools and, although there were areas of standing water, no egg masses of vernal pool obligates were found, perhaps because such features were in the flood zone of the Narraguagus River as opposed to isolated woodland depressions.

Sediment/shoreline stabilization is a function provided by the wetlands on both sides of the river at a principal level. The dense vegetation and associated root mass help stabilize shoreline soils during ice floes and flooding.

The endangered Atlantic salmon utilizes the Narraguagus River and any wetland along the margins of the river is therefore important with respect to providing indirect habitat function for Atlantic salmon (water quality functions, etc.). Cold-water fish species (brook trout, salmon), warm-water fish species (bass and sunfish) and abundant aquatic macroinvertebrates inhabit the Narraguagus River.

We paddled from the dam to the confluence of the West Branch Narraguagus River and the main stem Narraguagus River, about 0.5 miles upstream of the dam. Extensive wetlands occur in this area and upstream including old meander scars that create complex edges between open water and PEM, PSS and PFO wetlands. These wetlands provide important inland waterfowl and wading bird habitat (IWWBH) including high value IWWBH mapped by the Maine DIFW. Ice scarring was occasionally observed as high as 3-4 ft above the water level above the dam.

Throughout the remainder of the impoundment (approximately 3.5 miles above the dam), the National Wetlands Inventory identifies primarily freshwater forested shrub/scrub and riverine wetlands along the West Branch and mainstem Narraguagus River. A few small pockets of freshwater pond wetlands are also mapped along the mainstem.

Wetlands C-N along the Access Road to the West Side of the Dam

Forested wetlands C-N drain to Wetland B and the Narraguagus River via intermittent streams, and surface and shallow groundwater runoff. They provide several important functions including water quality functions. Specifically, these forested wetlands retain sediment and remove nutrients, protecting water quality in the Narraguagus River. The wetlands are particularly well suited to removing nitrogen because the soils are intermittently saturated and aerated, facilitating denitrification. The soils were saturated to the surface with some areas of ponding or surface runoff in May. In August soils were unsaturated down to two feet in depth.

The high degree of microtopography or surface roughness helps the wetlands filter sediment and slowly infiltrate runoff. The diverse micropography also helps these forested wetlands alter floodflows, slowing and storing surface and subsurface drainage towards the river. The importance to the Narraguagus River is that this enhances baseflows and attenuates peak flows.

These forested wetlands also provide important wildlife habitat. They are part of a riparian corridor that connects to the intact forested riparian corridor to the north. They also provide important forest interior habitat for species that prefer dense, unfragmented forest like wood thrush and ovenbird. The high degree of dead-and-downed wood and standing snags enhance habitat for amphibians as well as species like owls and flying squirrels that use cavities.

No potential vernal pools were identified. Wetlands C-E do have standing water in the spring, but they are artificially impounded by the gravel road and drained by roadside ditches. In contrast to isolated woodland depressions, these wetlands drain via intermittent streams towards the Narraguagus River. No wood frog or salamander egg masses were observed.

Wetland values such as recreation and uniqueness/heritage are not served at a Principal level by these forested wetlands.

Exemplary Natural Communities and Rare Species

The Maine Natural Areas Program (MNAP) identified three exemplary natural communities upstream of the dam, primarily in the vicinity of the major confluence. The communities are: 1) Streamshore Ecosystem, 2) Grassy Shrub Marsh, and 3) Tall Grass Meadow (Table 1, Figure 1).

Table 1. Exemplary wetland natural communities identified by MNAP above the dam. Source: MNAP (2025).

Feature	State Status	State Rank	Global Rank	Occurrence Rank	Site
Streamshore Ecosystem	---	S4	GNR	B - Good	Narraguagus Confluence
Grassy Shrub Marsh	---	S5	GNR	H - Historical	Narraguagus Confluence
Tall Grass Meadow	---	S4	G4G5	B - Good	Narraguagus Confluence
Tall Grass Meadow	---	S4	G4G5	H - Historical	Mahanon Branch

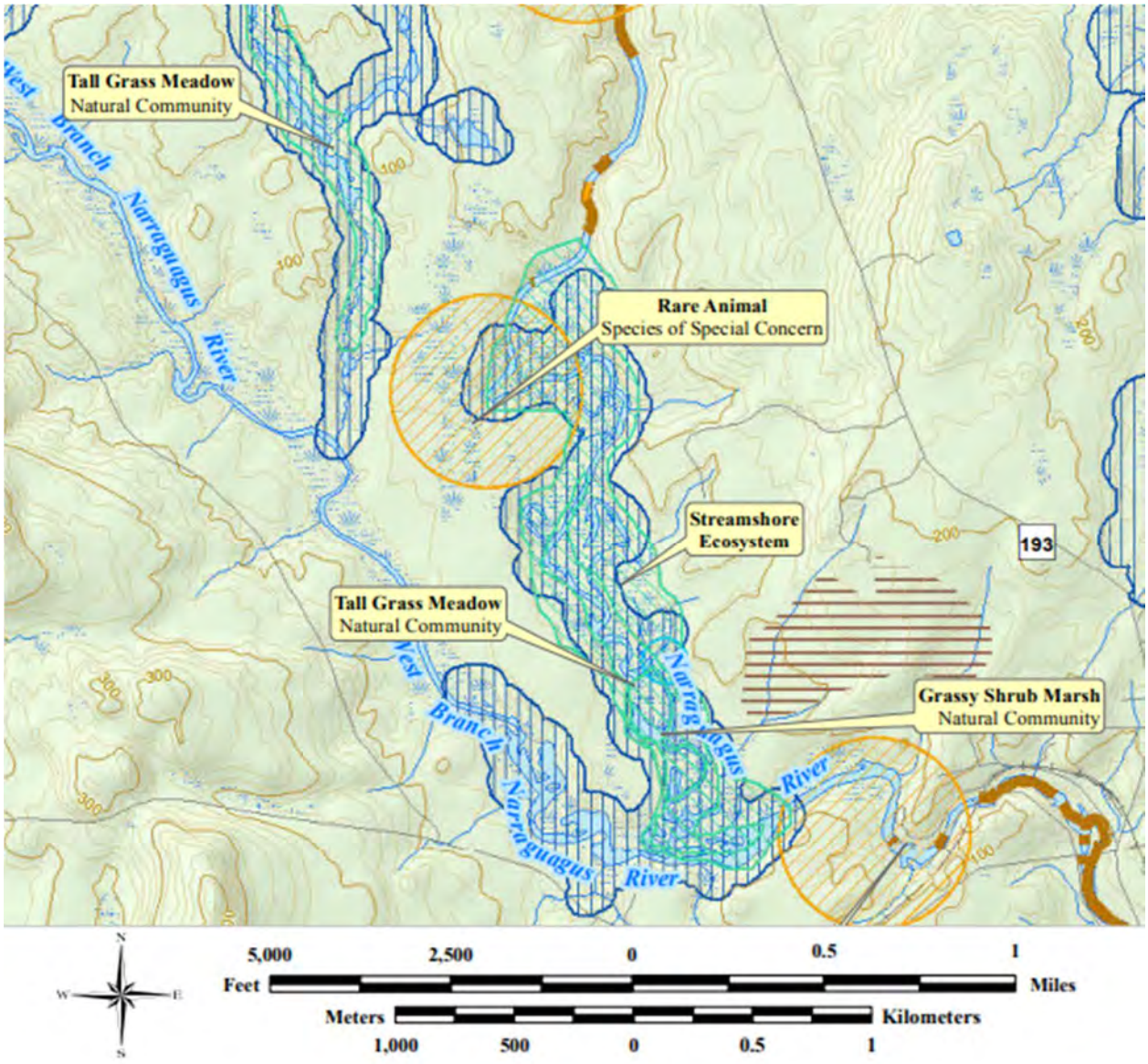


Figure 4. Natural plant communities above and below Cherryfield Ice Dam, mapped by MNAP. "Rare animals" and species of special concern include alewife, American shad, and endangered Atlantic salmon. Source: MNAP (2025).

Discussion and Impact Considerations

The NLF design will unavoidably result in direct wetland fill on both banks of the Narraguagus River immediately at and below the existing dam. Importantly, this is the narrowest, least complex (as far as habitat types and micro-topography) and provides the least function of the wetland system on both sides of the river. Much of the soil in the vicinity of the existing dam and proposed NLF is historic fill. As such, potential wetland loss of both functions and area are minimized. The broader, more complex, and more functionally important wetlands downstream of the proposed NLF would not be directly or indirectly impacted. Additionally, because the goal of the project is to maintain the level of the current head pond, the wetlands upstream of the dam throughout the impoundment are unlikely to be permanently impacted. The wetlands upstream of the dam throughout the impoundment are only likely to be

temporarily impacted if the impoundment is partially drawn down during the in-water work window, from July 15 – September 30.

All three of the exemplary wetland community types identified by the Maine Natural Areas Program (Streamshore Ecosystem, Grassy Shrub Marsh, and Tall Grass Meadow) rely heavily on annual disturbance. Specifically, overbank flooding, ice formation (still ice at the shoreline), ice floes, and wave action favor graminoids such as Canada bluejoint and tussock sedge. The disturbance regime prevents woody species such as speckled alder and red maple from taking over and out-competing and shading the graminoids. Even in the grassy shrub community, where in fact some shrubs do establish, the shrub stratum is thin and sporadic because of the riverine disturbances. In the proposed condition, these disturbances will continue long term. The temporary drawdown that would occur during the summer of construction would not negatively affect the communities because the flood flows and ice floes would normalize in the fall and not a single season of these disturbances would be dampened. There would be a permanent lowering of the very lowest flows (those that only occur about every 10 years on average) but that is a subtle hydrologic change that would not alter the communities, which rely on the high flows and the ice disturbance, not the low flows. Base flow would generally remain similar (just the lowest of low flows that would change slightly).

The design would utilize bioengineering in the outer zones of the NLF to ensure that wetland functions are retained in the floodplain. Armoring will be needed in the outer margins of the NLF to ensure that river flows are not able to erode around the outer margins of the NLF during flood events. The NLF will benefit from a native planting plan that will ensure that a native plant community (and associated functions) replaces unavoidably filled wetlands. Live stakes would be utilized. They would be driven between rocks and into the soil matrix below the rock mantle during the dormant season to create a living shoreline (as opposed to simply exposed rock). In addition, native wetland and riparian seed mixes would be utilized on disturbed soil areas adjacent to the NLF to ensure the long-term function and ecological integrity of the system persists. Shrub species that would be best suited to live staking above the shoreline (base flow) of the NLF are summarized in Table 1. These are species that seek to meet the following criteria: present in the immediate vicinity and in the watershed, generally commercially available, perform well as live stakes in flood zones, native, and functionally useful.

Table 1. Woody Species Recommended for Bio-stabilization of the Floodplain Zone of the NLF

Species	Notes
Long-beaked willow (*Salix bebbiana*)	Willows perform well in rocky shorelines subject to ice and flooding and provide excellent wildlife habitat and shoreline stabilization functions. Most common species used in living shoreline projects.
Pussy willow (*Salix discolor*)	See above.
Elderberry (*Sambucus canadensis or nigra*)	Valuable for wildlife and establishes well from live staking.
Silky dogwood (*Cornus amomum*)	Commercially available and suitable as a native for this watershed; dogwoods are great wildlife habitat (flowers and berries) and very good at establishing in flood zones as live stake plantings. A very similar and appropriate substitute is red osier dogwood (*Cornus sericea*).
Arrowwood (*Viburnum dentatum*)	Fantastic wildlife habitat. Good native for this watershed.
Speckled alder (*Alnus incana*)	Most common native shrub in the immediate vicinity of the proposed NLF. Great at removing nutrients and protecting water quality. Easy to salvage from the unavoidable impact zone if timed correctly (cut and installed during dormant period).

Meadowsweet (*Spiraea latifolia*)	Very common and beneficial native. May be difficult to find stout enough stems to drive into the soils between rocks.

The wetland complex has a high degree of ecological integrity (lack of invasive plants) both above and below the dam. As such it will be important to ensure that invasive species such as common reed and Japanese knotweed are not brought into the site or spread by construction equipment. As possible, any invasives found during and after construction should be controlled before they have a chance to spread.

Overall functional lift of the wetland and aquatic habitat is expected from the Inter-Fluve design. In place of the dam, which fragments the aquatic and riparian habitat, the proposed NLF would provide a step pool morphology that would provide high quality in-stream habitat as well as aquatic connectivity and dissolved oxygen (DO) enhancement from the steps. Incorporation of a living shoreline with native species, in place of the unavoidably impacted wetlands, would ensure that important functions such as wildlife habitat, nutrient removal, shoreline stabilization and sediment filtering are maintained.

References

U.S. Army Corps of Engineers. 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region*, ed. J.S. Wakeley, R.W. Lichvar, and C.V. Noble. ERDC/EL TR-09-19. Vicksburg, MS: U.S. Army Engineers Research and Development Center. URL: http://www.usace.army.mil/Portals/2/docs/civilworks/regulatory/reg_supp/NCNE_suppv2.pdf

Appendix A. Wetland Delineation Data Sheets

Appendix B. Photographs



Photo 1. Typical view of wetland A on the northeast side of the Narraguagus River downstream of the dam, facing downstream. This wetland has areas of fill (historically disturbed soils) and lacks habitat complexity. The wetland plant community is dominated by alder, meadowsweet and steeplebush in the shrub stratum and species such as sensitive fern, tussock sedge and rough bedstraw in the herb stratum. The upstream (foreground) portion of this wetland would be directly impacted by the proposed NLF.



Photo 2. Photo facing upstream with dam in background. Silky dogwood and speckled alder visible near spade in wetland. The topography is flat with pockets of fill material. The shoreline wetlands on the right side of the photo between the spade and the dam would be unavoidably impacted by the NLF.



Photo 3. View of downstream portion of Wetland B, below the area that would be directly impacted by the proposed NLF. This pool is about 100 feet from the Narraguagus River. Micro-topography is complex and wetland plant diversity is greater than in Wetland A.



Photo 4. PFO, PSS and PEM is well interspersed in the downstream portion of Wetland B. This part of Wetland B is downstream of the proposed direct impact area.



Photo 5. View of the secondary flow channel (lower left) in Wetland B, downstream of the proposed NLF. The NLF would be constructed along the shoreline in the far upper right of this photo where the NArraguagus River is visible. A classic Maine hardwood floodplain forest is visible between the secondary flow channel and the river. Red maple and grey birch are typical tree species in this habitat.



Photo 6. View of the downstream portion of Wetland B. Hummocks of tussock sedge, shrub islands, and inundated swales exemplify this portion of the wetland, which is downstream of the proposed NLF direct impact area.



Photo 7. Ice scarring about 3-3.5 feet above the surface elevation on a grey birch, just upstream of the boat launch.



Photo 8. Alewife harvested by lobstermen just above the ice dam.



Photo 9. A videographer that was working on the project and Marcel Young-Scaggs, PE with GPS equipment. Wetland A is located between Marcel and the river in the background.



Photo 10. Wetland D, typical of Wetlands C-E. These are narrow bands of PFO along the east side of the road. Red maple, cinnamon and interrupted fern, fowl manna grass and Canada bluejoint are typical species.



Photo 11. Wetland H. Red maple and balsam fir dominate the tree and sapling/shrub strata. Starflower is dominant in the herbaceous stratum. These soils were dry in August but showed signs of seasonal saturation (low chroma matrix colors within the upper horizons, oxidized root channels, redoximorphic concentrations or mottles).



Photo 12. Wetland I. Note the dense herbaceous layer, which helps filter sediments.



Photo 13. The abundance of dead-and-down wood and snags in these forested wetlands contributes to wildlife habitat. The high degree of microtopography helps slow and store stormwater and allow sediments to settle-out.



Photo 14. Wetland B facing downstream on west side of Narraguagus River. Notice the upstream part (where the NLF will be) is separated from the river by a steep bank. This area has historic fill. The downstream part of this wetland is better connected to the river and has natural soil profiles.

Appendix C. Wetland Functional Analysis Data Sheets

Appendix D: In-water Work Extension: State Agency Approvals

See attached .pdf of email correspondence with Maine DMR (response dated December 23, 2025) and Maine IFW (response dated September 30, 2025).