Restoration of Riverine Process and Habitat Suitability In the Upper Narraguagus River and Northern Stream Focus Areas (Maine)

Project Location (State, County, Town): Maine, Washington and Hancock, unorganized townships

Congressional District of Project: Maine 2nd

Congressional District of Applicant: Maine 2nd

NFHP/EBTJV Funding Request: $38,000

Total of Other Federal Funding Contributions: $74,082

Total of Non-Federal Funding Contributions: $43,655

Total Project Cost: $155,737

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USFWS FONS Database Project Number: Not Applicable. See Letter of Support

Coordination Completed with Sponsoring U.S. Fish and Wildlife Service Office (Check One):

__X____Yes **__10/2017_____Date Coordination Began**

_____No

I. PROJECT DESCRIPTION, SCOPE OF WORK, AND PARTNER INFORMATION

A. Project Goal:

Goal #1 is to increase in-stream habitat complexity and suitability and restore river–riparian interactions by adding large wood and creating log jams in high priority Brook Trout watersheds.

Goal #2 is to remove remnant dams that result in artificial impoundments, reduced current velocities, disrupted sediment transport and river warming.

Goal #3 is to increase resiliency of brook trout and Atlantic salmon populations by improving habitat suitability as described above.

B. Project Description:

Project SHARE has created habitat restoration focus areas in the upper Narraguagus River (80 mi^2) and Northern Stream (50 mi^2; East Machias River) sub-watersheds. Phase 1 of our holistic approach to restoration involves reconnecting habitat by replacing undersized culverts on tributaries with AOP crossings has been ongoing and will be completed in 2019 with other sources of funding. This project involves Phase 2: implementing habitat suitability enhancement and restoring natural stream processes in the focus areas by adding wood complexity and removing remnant dams.

The rivers and streams of Maine have experienced a long history of impacts from the log drive era of the 1700's to the early 1900's. Dams were built, streams channelized, logs and boulders were removed to enhance the log drives. For decades each spring, logs were driven down the Narraguagus River and Northern Stream to mills located downstream. The forest along the riparian buffer was harvested, river bank stability was decreased, and the channel became over-widened. Fluvial geomorphologists have assessed reaches in the Narraguagus River, determining that the river bed is too stable and high-water events no longer mobilize the bed due to loss of complexity elements and over-widened channels. As a result, pools are absent, and interstitial spaces are embedded with fine sediments. This same field assessment by fluvial geomorphologists, also identified a loss of connectivity between the river and its riparian buffer, another legacy effect of the log drive era due to the historic removal of wood and boulder complexity elements. Adding complexity provides a way to catalyze the restoration of river/riparian interaction processes.

Scott Craig (USFWS) has conducted extensive temperature monitoring in these focus areas documenting elevated water temperatures for increasingly longer time periods in summer months [personal communication]. In addition, cold water refugia and areas of colder

ground water input have been identified. Habitat restoration actions will target the availability of colder water as one of the design criteria.

Several remains of dams are evident in the focus areas. Historically dams were not removed in the same sense as a modern dam removal and restoration action. They were either breached by man or natural events and then left with remnants still in place. As a result, the remnants create an unnatural hydraulic/gradient check creating a backwater upstream of the former dam site. The remnant dams do not pose a barrier to fish passage; however, current velocities are reduced upstream, disrupting sediment transport, and over-widening the channels even more. The above-mentioned legacy impacts contribute to a loss of habitat complexity and reduced habitat suitability that is detrimental to both Eastern brook trout and Atlantic salmon.

Project SHARE intends to concentrate on implementing Phase 2 of habitat restoration efforts in the Upper Narraguagus River and Northern Stream focus areas. We will add large wood (LW) as a river complexity element to several miles of mainstem habitat. Several remnant dam sites have been identified in mainstem reaches of the focus areas that do not present barriers to fish passage; however, they are unnatural hydraulic and gradient checks that negatively impact current velocities and riverine process. We intend to breach them to the natural elevation of the river channel.

Large wood has been shown to help enact geomorphic change in riverine systems [Gurnell et al. 2002, Montgomery et al. 2003]. This geomorphic complexity provides a variety of different habitat types that can be utilized by a multitude of organisms throughout their lifecycles [Gurnell et al. 2002]. Geomorphic changes will be documented using the HDLWD Effectiveness App [Camp 2015].

Although Project SHARE has been involved with LW additions (typically trees felled using a Griphoist) for many years there has not been an efficient and effective method to treat long stretches of streams. Post-assisted wood structures (PALS) have shown great promise in this capacity. The structures are constructed of dead-and-down wood from the riparian area and/or from remotely harvested areas. The structures are then secured to the streambed using wooden posts driven into the streambed [see Camp 2015, Wheaton et al. 2012]. The Griphoist method involves pulling living (or dead) trees over into the stream channel. Some of the roots are cut to ease felling but most are left intact to help anchor the tree to the bank [see Naumann 2011]. This method is very labor intensive and inevitably thins the canopy cover over the stream. SHARE has recently begun only using this method in reaches with extensive canopy cover shading the stream or to add large key logs as a foundation for log-jam formation. SHARE has just recently started using self-placing wood additions as a treatment option. Whole trees are harvested off-site and

transported to the top of the treatment reach [see MacCartney et al. 2014]. The trees are then strategically added into the stream to be passively dispersed throughout the reach by high flow events. This process is repeated multiple times to achieve the desired wood loading rate. SHARE intends on using self-placing wood in conjunction with key pieces added with the Griphoist and/or PALS.

Returning streams to a more natural state is believed to have a positive impact on native fish populations. Brook trout and juvenile Atlantic salmon populations will be assessed by means of electrofishing. Many of the treatment reaches have extensive historical electrofishing data associated with them. Those with historical data will be able to have a pre- and post-treatment comparison done. Those without historical data will be compared to nearby untreated reaches. It is the hope of this project to be able to detect a positive impact upon both brook trout and juvenile Atlantic salmon populations.

C. Project Methods/Design (Max Characters: 350):

A variety of LW addition methods will be used in this project. In areas that contain long reaches of contiguous habitat PALS will be used. In remote areas, or areas previously treated, self-placing wood additions will be used to passively treat the reach. In areas with dense canopy cover, trees will be felled into the river using a Griphoist winch. The Griphoist will be used to add very large key trees to the reaches.

D. Project Timeline:

2014:	-Upper Narraguagus and Northern Stream focus areas established
2015:	-Extensive tributary connectivity projects in focus areas completed -Griphoist wood additions begun in Barrows Stream (Northern Stream sub-watershed)
2016:	-Extensive tributary connectivity projects in focus areas completed
2017:	-Extensive tributary connectivity projects in focus areas completed -Pilot PALS wood addition project at 28 Pond Reach (Narraguagus River) -Pre-treatment geomorphic monitoring begun (Narraguagus River)
2018:	-Extensive tributary connectivity projects in focus areas completed -PALS wood additions begun in Narraguagus River -Griphoist wood additions in Barrows Stream continue -Self-placing wood additions begin in Narraguagus River -Create a low flow channel through remnant base of Hemlock Dam (Narraguagus River)

2019: (6/15-9/30)	-Complete remaining tributary connectivity projects in focus areas -PALS and self-placing wood additions continue in Narraguagus River -Griphoist wood additions begin in Narraguagus River -Griphoist wood additions in Barrows Stream continue -Griphoist and self-placing wood additions begin in Northern Stream -Continue creating low flow channel through remnant base of Hemlock Dam -Remove remnant dam in Creamer Brook (Northern Stream sub-watershed)
2020: (6/15-9/30)	-PALS, Griphoist, and self-placing wood additions continue in Narraguagus River -Griphoist wood additions continue in Barrows Stream -Griphoist and self-placing wood additions continue in Northern Stream - Continue creating low flow channel through remnant base of Hemlock Dam (if needed)

E. Describe the Problem and Specific Cause of the Problem (Max Characters: 350):

Legacy impacts of the log drive era impair stream process and habitat suitability. Dams were built, streams channelized, logs and boulders were removed. The riparian buffer was harvested, river banks destabilized, and channels over-widened. Legacy reservoirs contribute to dead waters. Homogeneous habitat is normal; pools are scarce, interstitial spaces are embedded, and water temperature is elevated.

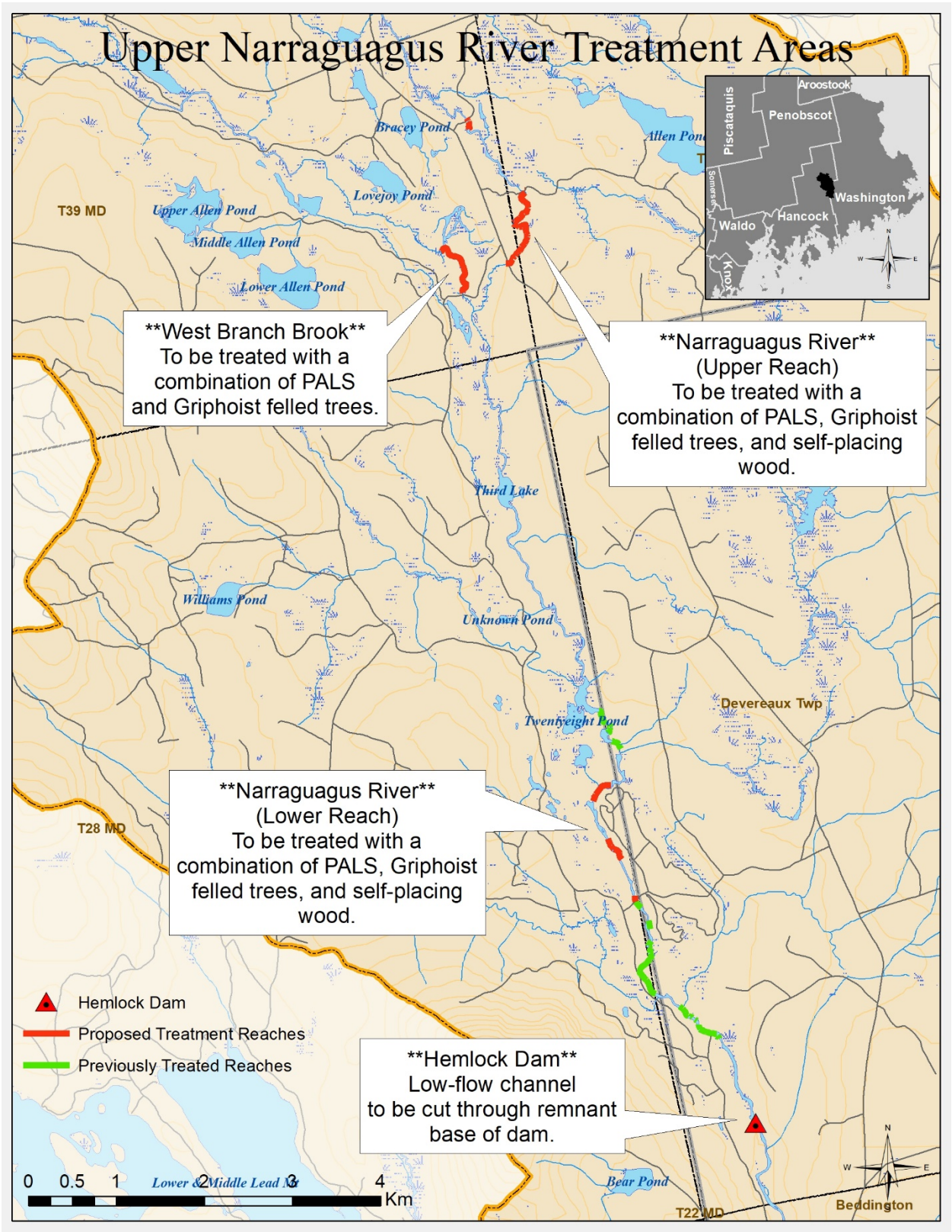
F. Summarize the Project's Expected Outcomes (Max Characters: 350):

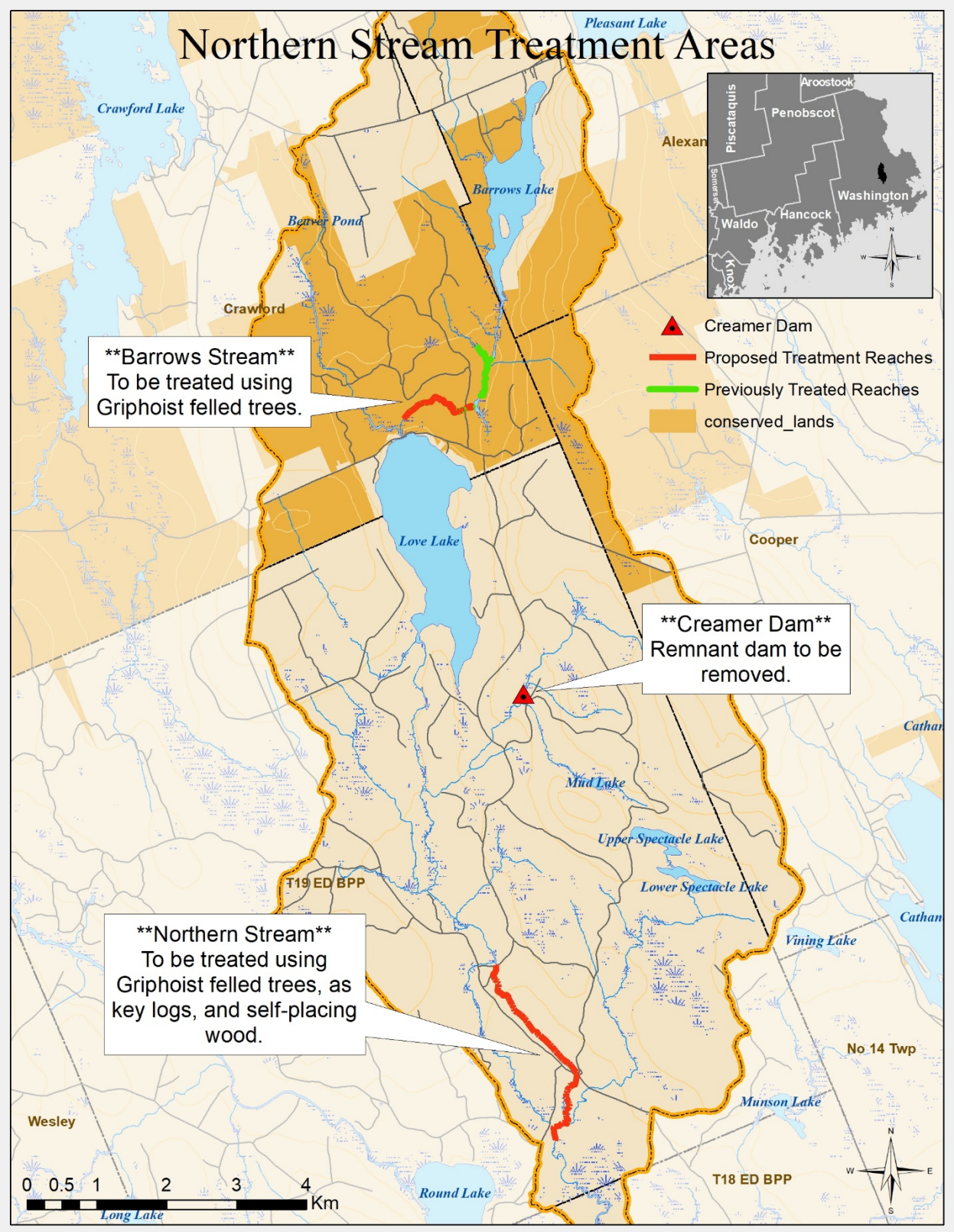
1. Decreasing embeddedness by mobilizing the river bed and increasing sediment sorting
2. Increase the number and depth of pools
3. Increased retention of allochthonous organic material which the aquatic food web relies on
4. Reduce dead waters and over-widened channels in legacy reservoirs
5. Increase watershed and cold-water fish population resiliency to climate change

G. Partner Information:

Partner Name	In-Kind Contribution (In-hand or Requested)	Cash Contribution (In-hand or Requested)	Federal or Non- Federal Contribution	Partner Category
Maine Dept. Marine Resources	In-hand		Non-Federal	State Agency
Maine Forest Service	In-hand		Non-Federal	State Agency
Maine Dept. Environmental Protection	In-hand		Non-Federal	State Agency
Maine Dept. Inland Fisheries & Wildlife	In-hand		Non-Federal	State Agency
Maine Dept. of Conservation	In-hand		Non-Federal	State Agency
Natural Resources Conservation Service	In-hand	In-hand	Federal	Federal Agency
US Fish & Wildlife Service	In-hand		Federal	Federal Agency
Washington Academy	In-hand		Non-Federal	School
Univ. of Maine Machias	In-hand		Non-Federal	School
Eastern Maine Conservation Initiative		In-hand	Non-Federal	Conservation Group (Local)
Fly Fishing in Maine		In-hand	Non-Federal	Conservation Group (Local)
Downeast Lakes Land Trust	In-hand		Non-Federal	Conservation Group (Local)
Maine Coast Heritage Trust	In-hand		Non-Federal	Conservation Group (Local)
American Forestry Management	In-hand		Non-Federal	Private Landowner
Landvest	In-hand		Non-Federal	Private Landowner
Wagner Land Management	In-hand		Non-Federal	Private Landowner

II. PROVIDE A MAP OF THE PROJECT AREA




Northern Stream Treatment Areas
Pleasant Lake
Crawford Lake
Barrows Lake
Beaver Pond
Crawford
Alexan
Love Lake
Cooper
Mud Lake
Upper Spectacle Lake
Lower Spectacle Lake
T19 ED BPP
Vining Lake
No 14 Twp
Munson Lake
Wesley
Round Lake
Long Lake
T18 ED BPP
Cathan
Aroostook
Piscataquis
Penobscot
Somerset
Washington
Hancock
Waldo
Knox
Creamer Dam
Proposed Treatment Reaches
Previously Treated Reaches
conserved_lands
Barrows Stream
To be treated using Griphoist felled trees.
Creamer Dam
Remnant dam to be removed.
Northern Stream
To be treated using Griphoist felled trees, as key logs, and self-placing wood.
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III. PROVIDE PHOTOGRAPH(S) OF THE PROJECT AREA

Large Wood Placements

Post Assisted Log Structure's (PALS)

Project Partners hard at work installing PALS in Upper Narraguagus (2017)

IV. Project Budget

Partner Name	Partner Category *	Activity of Partner **	Budget Category***	EBTJV NFHAP Request	Non-Federal Contribution		Federal Contribution		Total Contribution	Acres/Miles Affected
					In-Kind	Cash	In-Kind	Cash		
Project SHARE	Conservation Group (Local)	Restoration	Admin/tech services							
			Project Management	20,000					20,000	3 miles
			Labor (term)	12,000					12,000	redundant
			Supplies	4,000					4,000	redundant
			Monitoring	2,000					2,000	redundant
Maine DMR	State Agency	Restoration /monitoring	Labor		4,790				4,790	redundant
Maine Forest Service	State Agency	Restoration	Labor		2,520				2,520	redundant
Downeast Lakes Land Trust	Conservation Group (local)	Restoration	Labor		1,482				1,482	redundant
Maine Coast Heritage Trust	Conservation Group (local)	Restoration	Labor		2,370				2,370	redundant
Maine DEP	State Agency	Restoration	Labor		200				200	redundant
Maine IFW	State Agency	Restoration	Labor		728				728	redundant
Maine DOC	State Agency	Restoration	Supplies (wood)		1000				1,000	redundant
American Forestry Management	Private Land Owner	Restoration	Supplies (wood)		2000				2,000	redundant
Landvest	Private Land Owner	Restoration	Supplies (wood)		2,000				2,000	redundant

Wagner Land Management	Private Land Owner	Restoration	Supplies (wood)		2,000				2,000	redundant
Washington Academy	School	Restoration	Labor		12,640				12,640	redundant
University of Maine	School	Restoration	Labor		5,925				5,925	redundant
Fly Fishing in Maine	Conservation Group (local)	Restoration				3,000			3,000	redundant
Eastern Maine Conservation Initiative	Conservation Group (local)	Restoration				3,000			3,000	redundant
NRCS	Federal Agency	Restoration	Grant					72,682	72,682	redundant
			Labor				200		200	redundant
USFWS	Federal Agency	Restoration	Labor				1,200		1,200	redundant
			Monitoring							
Total Contribution				38,000	37,655	6,000	1,400	72,682	155,737	3 miles

*Partner Categories - Federal Agency, State Agency, Local Government, Conservation Group (Local), Conservation Group (National), Native American Tribe, Private Landowners, Corporations/Businesses

**Activity - Acquisition, Fish Ladder, Dam Removal, Culvert Removal, Restoration, Monitoring

***Budget Categories – Administration/Technical Services, Construction Material, Construction Labor, Equipment, Contractual, Travel, Supplies, Other.

NOTE: This is not a Federal Grant program and therefore does not exclude non-federal match used here from being matched to other Federal Grant sources to leverage funds for the project. Indicate if partnering contributions are in-kind or cash along with which funds are in-hand (committed) and which have been requested but are still pending. NFHAP requests should illustrate how the dollars will be spent and by what organization. Overhead such as utilities, office space, and salary to prepare applications and develop partnerships will not be funded with NFHAP funds and should not be a line item or built into the project. Activities that directly relate to completion of the project such as travel and salary to do design work let and/or monitor contracts are allowable expenses with NFHAP funds but should not constitute more than 10% of the funding request. For more information on the use of NFHAP funds, please see the FWS guidelines.

V. PROJECT EVALUATION QUESTIONS

1. **What are the GPS Coordinates for the Project site (please use UTM NAD 83):**

   Narraguagus mainstem (upper): Top: 570491 / 4978350 Bottom: 570318 / 4977551
   Narraguagus mainstem (lower): Top: 571468 / 4971613 Bottom: 571749 / 4970297
   Hemlock Dam: 573123.2 / 4967790.5
   West Branch Brook: Top: 569543.8 / 4977687.8 Bottom: 569788.4 / 4977186.4
   Northern Stream: Top: 617634.5 / 4977639.8 Bottom: 618559.9 / 4975350.8
   Creamer Brook Dam: 618011 / 4981518
   Barrows Stream: Top: 617307.8 / 4985630.4 Bottom: 616345.8 / 4985494.9

2. **List the type of Project that will be implemented (protection, enhancement, restoration; see definitions in the Appendix A).**

   Restoration

3. **Are Brook Trout currently present at the Project site or have access to the Project site?**

   Yes, wild brook trout are present within the treatment sites. The sites are occupied during cold water months; however, elevated summer temperatures require movement from the treatment sites to cold water refugia [Colby Bruchs, Maine DMR, personal Communication].

4. **Please describe how the Project will conserve Brook Trout and/or its habitat?**

   Removal of legacy unnatural hydraulic checks and addition of wood complexity will improve natural current velocities, restore natural stream processes, and increase hyporheic exchange. Restored natural stream processes will contribute to passive restoration of riverine habitat and resiliency of the watershed.

5. **Is the Project site located on/along private or public land? Is the land currently under any form of protection (e.g. conservation easement)?**

   Most of the riparian buffer in the Upper Narraguagus sub-watershed is private land that is not under a conservation easement; however, the land managers are stakeholder members of Project SHARE and voluntarily follow Project SHARE's conservation values. The land is also managed under the Sustainable Forestry Initiative guidelines.

   The riparian buffer associated with Barrows Stream in the Northern Stream sub-watershed is protected by a conservation easement.

6. **What percentage of the watershed above the Project site is protected in perpetuity?**

   The Barrows stream treatment reaches are contained within a conservation easement.

7. **List the specific EBTJV range-wide habitat goal(s) and objective(s) addressed by the Project and describe how the Project will contribute towards achieving them (refer to the list of EBTJV range-wide habitat goals and objectives in the Appendix B).**

   Goal: Maintain the current number of wild Brook Trout patches (i.e. no net loss)
   Objective: (1) Retain at least 6,022 allopatric wild Brook Trout patches (1.1) across the EBTJV geographic range by the year 2022.

8. **List the EBTJV key conservation action(s) the Project addresses (refer to the list of EBTJV key conservation actions in the Appendix C).**

   - Conserve and/or increase habitats that support robust wild Brook Trout populations
   - Restore and reconnect suitable habitats adjacent to robust wild Brook Trout populations
   - Minimize threats to wild Brook Trout populations (e.g., degraded water quality, invasive species, altered hydrologic regimes)

9. **What are the EBTJV Feature ID# and Classification Code for the catchment(s) where the Project work will be implemented (see Appendix D for a description on how to determine both items)?**

Narraguagus Mainstem	(lower reach)	(upper reach)
Catchment Feature ID#:	***2679432***	***2679304***
Catchment Classification Code:	***1.1***	***1.1***

West Branch Brook
- **Catchment Feature ID#:** ***2679306***
- **Catchment Classification Code:** ***1.1***

Hemlock Dam
- **Catchment Feature ID#:** ***2679454***
- **Catchment Classification Code:** ***1.1***

Northern Stream
- **Catchment Feature ID#:** ***2677520***
- **Catchment Classification Code:** ***1.1***

Barrows Stream
- **Catchment Feature ID#:** ***2674148***
- **Catchment Classification Code:** ***1.1***

Creamer Dam
- **Catchment Feature ID#:** ***2677476***
- **Catchment Classification Code:** ***1.1***

10. Will the Project result in re-establishing wild Brook Trout within the catchment?

Wild brook trout populations are currently located in the watersheds, particularly in cold water tributaries located in proximity to treatment areas. The restoration projects are intended to improve habitat suitability in the mainstem reaches that historically have been degraded and subject to increasing summer temperature.

11. Is/are the catchment(s) where the Project work will be implemented located in a Wild Trout Patch; if so what is the Wild Trout Patch Feature ID# and Classification Code (see Appendix E for a description on how to determine both items)?

Narraguagus Mainstem

- **Wild Trout Patch Feature ID#: *2677024.0***
- **Wild Trout Patch Classification Code: *1.1***

West Branch Brook

- **Wild Trout Patch Feature ID#: *2677024.0***
- **Wild Trout Patch Classification Code: *1.1***

Hemlock Dam

- **Wild Trout Patch Feature ID#: *2677024.0***
- **Wild Trout Patch Classification Code: *1.1***

Northern Stream

- **Wild Trout Patch Feature ID#: *2677520.0***
- **Wild Trout Patch Classification Code: *1.1***

Barrows Stream

- **Wild Trout Patch Feature ID#: *2677520.0***
- **Wild Trout Patch Classification Code: *1.1***

Creamer Dam

- **Wild Trout Patch Feature ID#: *2677520.0***
- **Wild Trout Patch Classification Code: *1.1***

12. Will the Project benefit any federally listed threatened or endangered species or FWS priority species (refer to the list of FWS priority species for Region 4 and Region 5 in Appendix F)?

Yes: Atlantic salmon federally listed as endangered; and USFWS priority species: Blueback Herring, Alewife, American eel, as well as brook trout.

13. Will the Project benefit any state listed threatened or endangered species or species of greatest conservation need?

Brook trout, American eel and Atlantic salmon are species of special concern for the State of Maine.

14. What are the root causes of degradation in the catchment(s) where the Project is located and which of these are addressed by the Project?

Historic commercial forestry involved log drives using the river and stream network as the principle transport mechanism. The log drive era left a legacy of remnant dams (and associated reservoirs) and reduced habitat complexity due to the removal of boulders and large wood from stream channels to facilitate the log drives. Mainstem water temperature is elevated and interaction of the river with its floodplain is reduced. Legacy impacts negatively affect natural stream processes, cold water fish habitat and flood resiliency.

The modern road system has negatively impacted habitat connectivity with the use of undersized round culverts.

15. Describe the plans for measuring the Project's success in meeting its goals and objectives.

Project evaluation will occur at several levels:
1) SHARE and DMR staff will assess the geomorphic changes due to wood additions using an iPad-based application [Camp 2015].
2) DMR staff will assess fish population response to wood additions via electrofishing methods.
3) USFWS has an extensive baseline of water temperature data in the treatment reaches. Water temperature assessment will continue post restoration actions.

16. Does the Project support any goals in existing action plan(s) (e.g. state fish & wildlife, watershed protection, water quality improvement, land or water-use plan(s), or other regional plan(s))?

Yes, Maine Brook Trout Management Plan [Bonney 2001]. 1) Protect/Restore/Enhance brook trout Habitat. 2) Maintain the integrity of self-sustaining brook trout populations. 3) Maintain brook trout populations at about 1,350 fish of all sizes for each stream mile

classified as permanent brook trout habitat; 5 to 7% of the late summer population should exceed 6 inches.

Brook Trout are a "Maine Heritage Fish" identified as a priority species in the state action plan. Although occurring statewide and in a diversity of habitats, their range is retracting due to multiple stressors including interactions with non-native species, land use conversion, fish passage constraints and climate change. In addition to threats associated with water quality and impediments to dispersal and migration, coldwater fishes are likely to be significantly affected by climate change in Maine.

17. Are there invasive fish species within the Project site or have access (no barrier) to it?

Smallmouth bass and chain pickerel exist in the focus areas. However, DMR biologists have not determined them to be a problem at this time as the size distribution is relatively small because current water temperatures are more suitable for brook trout and Atlantic salmon.

18. Are hatchery-reared salmonids stocked at the Project site or that have access (no barrier) to it?

River-specific captured brood-stock of endangered anadromous Atlantic salmon are raised at Craig Brook National Fish Hatchery, Green Lake National Fish Hatchery, and Peter Grey Hatchery and stocked in these rivers supporting restoration of the population.

19. Please describe the current status of the Project. Is it planned, permitted, and ready to begin?

Project SHARE has been piloting a variety of methods for addition of wood as a component of habitat complexity for a decade. Reach scale additions have begun on the Narraguagus River. We intend to expand that project area and begin reach scale additions on additional rivers. Project SHARE has extensive experience in removing remnant dams. Methods are in place, sites have been selected with preliminary treatment plans. Permits are in place including an extension of the instream work window to begin June 15 – September 30. The project is ready to implement.

20. Will public access be allowed at the Project site? If so, what kinds of recreational activities are allowed – fishing, hiking, camping, wildlife viewing, etc.?

Yes, the public is allowed access to the project sites. Fishing and canoeing are the principle activities. Hunting, camping and other recreational activities are allowed in the area along the rivers.

21. Will the Project improve recreational fishing opportunities for wild Brook Trout? If so, please describe the improvement and how the improvement will be measured?

Mainstem reaches are generally fished in the spring before water temperatures increase and brook trout move to cold water refugia. As habitat suitability improves over time it is expected that brook trout will find cold water refugia within the mainstem. Water temperature changes and the duration of the warm water season is being monitored by USFWS.

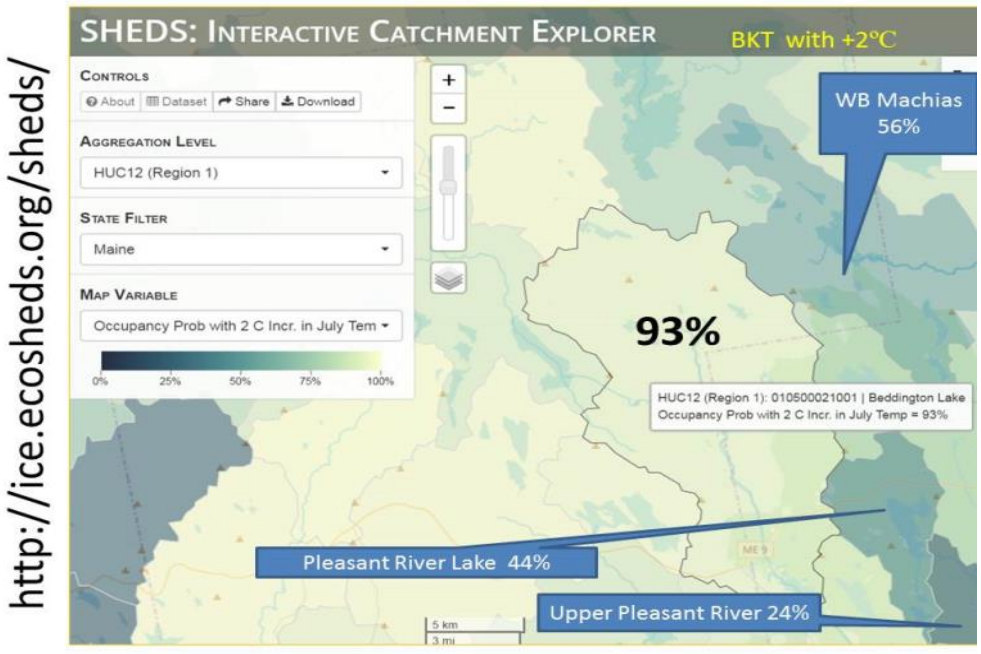
22. Please describe the outreach or educational components associated with the Project.

Project SHARE's outreach program includes workshops and trainings introducing state and federal agency staff, NGOs and students to restoration techniques we are implementing. Groups are regularly invited to assist on site and be a part of project implementation. SHARE also hosts restoration workshops that draw attendees from New England and Canada. SHARE will be co-hosting the 2020 Maine Atlantic Salmon Ecosystem Forum where aspects of these restoration efforts will be presented.

23. Please describe how this Project lessens the effects of climate change on Brook Trout.

Legacy effects of the log drive era include over-widened channels, blocked side channels, reduced pool frequency, reduced hyporheic exchanged and reduced shade from the riparian buffer. The project intends to restore natural stream processes as a means of reversing the legacy effects of the log drive era which contribute to the death-by-a-thousand-cuts that include elevated water temperatures. Restoration of natural stream processes contributes to watershed resiliency; a principle means of passively lessening the effects of climate change.

Upper Narraguagus has a 93% and Northern Stream has a 91% probability of maintaining brook trout given a 2ºC July air temperature increase. See http://ice.ecosheds.org/sheds/



24. Please explain how this Project is a good investment of funds, particularly in terms of its recreational and/or economic value.

Projects are located in the best of the best riverine habitat for brook trout in the Downeast Maine watersheds! Project SHARE has invested the past five years of restoration action in the Upper Narraguagus River and Northern Stream focus areas targeting road/stream connectivity restoration. By 2019, all connectivity actions on perennial, fish bearing streams will be complete. This project will build on the success of the connectivity restoration as we concentrate on Phase 2, restoration of stream complexity and habitat suitability. These actions will catalyze the restoration of natural stream process which will passively improve fish habitat in the future.

VI. SUPPORTING DOCUMENTATION:

- **Literature Cited**

Camp R. 2015. Short Term Effectiveness of High Density Large Woody Debris in Asotin Creek as a Cheap and Cheerful Restoration Restoration Action [dissertation]. [Logan (UT)]: Utah State University.

Gurnell AM, Piégay H, Swanson FJ, & Gregory SV. 2002. Large wood and fluvial processes. Freshwater Biology 47: 601-619.

MacCartney JM, Magee JA, and Field JJ. 2014. Restoring Trout Habitat in Difficult to Access Areas Using Mobile Wood Additions. Prepared for Wild Trout Symposium XI-Looking Back and Moving Forward.

Montgomery DR, Collins BD, Buffington JM, & Abbe TB. 2003. Geomorphic Effects of Wood in Rivers. American Fisheries Society Symposium. 27pp.

Naumann B. 2011. A Supplemental Guide for Large Wood Additions to Streams to Enhance Stream Function and Fish Habitat with Particular Focus in Downeast Maine. 17pp.

Wheaton J, Bennett S, Bouwes N, Camp R. 2012. Restoration for Charley Creek, North Fork Asotin, & South Fork Asotin Creeks. Prepared for Snake River Salmon Recovery Board. Prepared by Eco Logical Research Inc.

- **References to published interagency fishery or aquatic resource management plans.**

Bonney, FR. 2001. Maine Brook Trout Management Plan. Maine Department of Inland Fisheries and Wildlife. Augusta, Maine.

Appendix A

Definitions

Protection: Conservation actions that maintain, or prevent the decline of, aquatic habitat.
Enhancement: Conservation actions that heighten, intensify, or improve specific functions of aquatic habitat.
Restoration: Conservation actions that return natural/historic attributes or functions to aquatic habitat.

Appendix B

EBTJV Range-wide Habitat Goals and Objectives

GOAL	OBJECTIVE
Increase the average size (km^2) of wild Brook Trout patches, which is currently 19 km^2	Increase the size (km^2) of 30 wild Brook Trout patches by the year 2022.
Restore wild Brook Trout to catchments where they were extirpated	Establish wild Brook Trout in 15 extirpated catchments by the year 2022.
Maintain the current number of wild Brook Trout patches (i.e. no net loss)	Retain at least 6,022 allopatric wild Brook Trout patches (1.1) across the EBTJV geographic range by the year 2022. Retain at least 3,838 sympatric wild Brook Trout patches (1.2, 1.3, and 1.4) across the EBTJV geographic range by the year 2022.
Increase connectivity within and among wild Brook Trout catchments	Complete Aquatic Organism Passage projects within 45 wild Brook Trout catchments by 2022.

Appendix C

EBTJV Key Conservation Actions

- Increase recreational fishing opportunities for wild Brook Trout
- Conserve and/or increase habitats that support robust wild Brook Trout populations
- Restore and reconnect suitable habitats adjacent to robust wild Brook Trout populations
- Conserve genetic diversity of wild Brook Trout populations
- Conserve unique wild Brook Trout life history strategies (e.g., lacustrine populations, large river populations, and coastal populations).
- Minimize threats to wild Brook Trout populations (e.g., degraded water quality, invasive species, altered hydrologic regimes)

Appendix D

To determine the EBTJV Feature ID# and Classification Code for the catchment where your Project work will be implemented, please follow these steps:

1. Click on this Brook Trout Integrated Spatial Data and Tools link;
2. Put a √ mark in the box next to the Legend label EBTJV Classified Catchments to display this data layer;
3. Locate the catchment where your Project work will be implemented; you can increase or decrease the map scale by selecting the appropriate map scale (see drop down menu located in the lower left hand corner) or use the wheel on your mouse. You can also change the layer's transparency by clicking the yellow light icon that is associated with this layer in the Legend and sliding the opacity bar.
4. Once you have located the Project's catchment, find the Identify Features button at the top of the page (hovering your cursor over each button will identify its function). Open the drop down menu for this function and select the EBTJV Classified Catchments layer, and then click the Identify Features button once to turn it on.
5. Next move your cursor within the boundary of the project's catchment and click once. A Feature Information box will appear on your screen and you will see the catchment's "featureid" number and "ebtjv_code". Record both numbers in the appropriate locations in the Project Application Form.

Appendix E

To determine the EBTJV Wild Trout Patch Feature ID# and Classification Code for the catchment where your Project work will be implemented, please follow these steps:

1. Click on this Brook Trout Integrated Spatial Data and Tools link;
2. Put a √ mark in the box next to the Legend label Wild Trout Habitat Patches to display this data layer;
3. Locate the catchment where your Project work will be implemented; you can increase or decrease the map scale by selecting the appropriate map scale (see drop down menu located in the lower left hand corner) or use the wheel on your mouse. You can also change the layer's transparency by clicking the yellow light icon that is associated with this layer in the Legend and sliding the opacity bar.
4. Once you have located the Project's catchment, find the Identify Features button at the top of the page (hovering your cursor over each button will identify its function). Open the drop down menu for this function and select the Wild Trout Habitat patches layer, and then click the Identify Features button once to turn it on.
5. Next move your cursor within the boundary of the Project's catchment and click once. A Feature Information box will appear on your screen and you will see the catchment's "feat_id" number and "ebtjv_code". Record both numbers in the appropriate locations in the Project Application Form.

Appendix F

FWS Priority Species

	R5	R4
Acipenser brevirostrum, Shortnose Sturgeon	x	x
Acipenser fluvescens, Lake Sturgeon	x	x
Acipenser oxyrinchus, Atlantic Sturgeon	x	
Acipenser oxyrinchus, Atlantic Sturgeon - Carolina DPS		x
Acipenser oxyrinchus, Atlantic Sturgeon - Chesapeake Bay DPS	x	
Acipenser oxyrinchus, Atlantic Sturgeon - Gulf of Maine DPS	x	
Acipenser oxyrinchus, Atlantic Sturgeon - New York Blight DPS	x	
Acipenser oxyrinchus, Atlantic Sturgeon - South Atlantic DPS		x
Acipenser oxyrinchus desotoi, Gulf Sturgeon		x
Alasmidonta heterodon, Dwarf Wedgemussel	x	
Alosa aestivalis, Blueback Herring	x	x
Alosa alabamae, Alabama Shad		x
Alosa mediocris, Hickory Shad	x	x
Alosa psuedoharengus, Alewife	x	
Alosa sapidissima, American Shad	x	x
Ablema neislerii, Fat Threeridge		x
Ambystoma bishopi, Reticulated Flatwoods Salamander		x
Ambystoma singulatum, Flatwoods Salamander		x
Anguilla rostrata, American Eel	x	x
Atractosteus spatula, Alligator Gar		x
Cambarus hartii, Piedmont Blue Burrower		x
Crassostrea virginica, Eastern Oyster		x
Cryptobranchus alleganiensis bishopi, Ozark Hellbender		x
Crystallaria asprella, Crystal Darter		x
Crystallaria cincotta, Diamond Darter	x	
Cynoscion nebulosus, Spotted Seatrout		x
Cyprinelia callitaenia, Bluestripe Shiner		x
Cyprogenia stegaria, Fanshell	x	
Elliptio chipolaensis, Chipola Slabshell		x
Elliptio purpurella, Inflated Spike		x
Elliptoideus sloatianus, Purple Bankclimber		x
Epioblasma capsaeformis, Oyster Mussel	x	
Epioblasma torulosa rangiana, Northern Riffleshell	x	
Erimonax monachus, Spotfin Chub		x
Erimystax cahni, Slender Chub	x	
Etheostoma boschungi, Slackwater Darter		x
Etheostoma chienense, Relict Darter		x
Etheostoma moorei, Yellowcheek Darter		x

Etheostoma okaloosae, Okaloosa Darter		x
Etheostoma percnurum, Duskytail Darter	x	x
Etheostoma raneyi, Yazoo Darter		x
Etheostoma sellare, Maryland Darter	x	
Etheostoma sp., Bluemask Darter		x
Fundulus julisia, Barrens Topminnow		x
Ictalurus punctatus, Channel Catfish		x
Lampsilis subangulata, Shiny-rayed Pocketbook		x
Lampsilis virescens, Alabama Lampmussel		x
Lasmigona decorata, Carolina Heelsplitter		x
Lepomis auritus, Redbreast Sunfish		x
Lepomis macrochirus, Bluegill		x
Lepomis microlophus, Redear Sunfish		x
Limulus polyphemus, Horseshoe Crab	x	
Margaritifera hembeli, Louisiana Pearlshell		x
Marstonia castor, Beaverspond Marstonia		x
Medionidus penicillatus, Gulf Mocassinshell		x
Medionidus simpsonianus, Ochlockonee Mocassinshell		x
Micropterus cataractae, Shoal Bass		x
Micropterus dolomieu, Smallmouthl Bass		x
Micropterus henshalli, Alabama Spotted Bass		x
Micropterus punctulatus, Spotted Bass		x
Micropterus salmoides, Largemouth Bass		x
Morone chrysops, White Bass		x
Morone saxatilis, Striped Bass	x	x
Moxostoma robustum, Robust Redhorse		x
Moxostoma sp., Sicklefin Redhorse		x
Noturus flavipinnis, Yellowfin Madtom	x	x
Oncorhynchus clarkii, Cutthroat Trout		x
Oncorhynchus mykiss, Rainbow, Steelhead, Redband Trout		x
Percina caprodes, Logperch		x
Percina jenkinsi, Conasauga Logperch		x
Percina rex, Roanoke Logperch	x	
Percina sp. cf. palmeris, Halloween Darter		x
Percopsis omiscomaycus, Trout-Perch		x
Phencobius mirabillis, Suckermouth Minnow		x
Phoxinus cumberlandensis, Blackside Dace	x	
Pleurobema clava, Clubshell	x	
Pleurobema collina, James River Spinymussel	x	
Pleurobema pyriforme, Oval Pigtoe		x
Polyodon spathula, American Paddlefish		x

Potamilus capax, Fat Pocketbook		x
Procambarus econfinae, Panama City Crayfish		x
Pteronotropis euryzonus, Broadstripe Shiner		x
Pylodictus olivaris, Flathead Catfish		x
Quadrula sparsa, Appalachian Monkeyface Pearlmussel	x	
Rachycentron canadum, Cobia		x
Salmo salar, Atlantic Salmon	x	
Salmo salar, Atlantic Salmon, GOM DPS	x	
Salmo trutta, Brown Trout		x
Salvelinus fontinalis, Brook Trout	x	x
Salvelinus namaycush, Lake Trout	x	x
Sander canadensis, Sauger		x
Sander vitreus, Walleye		x
Scaphirhynchus albus, Pallid Sturgeon		x
Scaphirhynchus platorynchus, Shovelnose Sturgeon		x
Scaphirhynchus suttkusi, Alabama Sturgeon		x
Sciaenops ocellatus, Red Drum		x
Scomberomorus maculatus, Spanish Mackerel		x
Villosa fabalis, Rayed Bean	x	
Villosa perpurpurea, Purple Bean	x	

STATE OF MAINE
DEPARTMENT OF
INLAND FISHERIES & WILDLIFE
284 STATE STREET
41 STATE HOUSE STATION
AUGUSTA, ME 04333-0041
TEL: 207-287-8000

PAUL R. LEPAGE
GOVERNOR

CHANDLER E. WOODCOCK
COMMISSIONER

September 25, 2018

Steven Koenig
Project SHARE
14 Boynton Street
Eastport, Maine 04631

Dear Mr. Koenig:

As Maine's primary coordinator for implementing the EBTJV Conservation Strategy, I and the Maine Department of Inland Fisheries and Wildlife (MDIFW) greatly support your proposal for the ***'Restoration of Riverine Process and Habitat Suitability in the Upper Narraguagus River and Northern Stream Focus Areas, Maine'*** for funding under the National Fish Habitat Action Plan / Eastern Brook Trout Joint Venture Cost Share Program. This project, which proposes to remove known stream connectivity constraints and implement wood addition on multiple stream reaches, is a high priority action for brook trout conservation in forest lands with degraded in-stream habitats due to past logging practices. The goals of this project are consistent with those of the Department's Brook Trout Management Plan, Maine's Wildlife Action Plan and the range-wide goals of the EBTJV's Conservation Strategy.

Brook trout in the Narraguagus River and Downeast Maine support thriving local recreational fisheries, however, past land use and log driving practices have left many of our rivers and streams in compromised conditions with less than optimal instream habitat quality. These coastal drainages tend to be low gradient systems, so that any impounding or flow impediments caused by legacy log driving dams have the potential to drastically affect sediment transfer and thermal profiles. Hence, addressing these issues in brook trout habitats is a priority for improving coldwater habitat conditions. By removing the remains of past log driving structures coupled with wood addition, these reaches can transition from acting as partial connectivity barriers to reaches that facilitate sediment transport, pool and cover formation, and decrease impounded areas that tend to retain warmer waters. These effects can only benefit brook trout and their habitats. We expect that this strategy will increase the overall quantity of optimal holding areas for all size classes of trout during thermally stressed and low flow periods.

I heartily support this proposal and encourage more of this type of habitat improvement to occur in our wild brook trout areas. As has been the case for many years now, Project SHARE continues to be a committed partner to IFW, Maine's wild brook trout, and to the advancement of restoration actions and techniques to address degraded in-stream conditions due to past forestry practices. I continue to support your work and look forward to another successful project in Downeast Maine.

Best Regards,

Merry Gallagher
Native Fish Conservation Biologist

United States Department of the Interior

U. S. FISH & WILDLIFE SERVICE

Maine Fish and Wildlife Conservation Office
306 Hatchery Way
East Orland, Maine 04431
(207) 902-1566

September 25, 2018

Subject: Letter of Support to Project SHARE for September 2018 EBTJV Proposal.

The Maine Fish and Wildlife Conservation Office (MeFWCO) of the U.S. Fish and Wildlife Service (Service) greatly supports Project SHARE (Salmon Habitat and River Enhancement) in their endeavor to work with multiple partners to improve aquatic habitat complexity through the additions of large wood and removing remnant log drive structures.

MeFWCO has been intricately involved with aspects of this ongoing habitat restoration project since the USDA-NRCS Conservation Innovation Grant (CIG) was awarded in 2017. Besides providing several weeks of in-field assistance, MeFWCO has been the lead Action Agency for Federal Permits (ACOE, and ESA Section 7 (Formal consultation completed June 23, 2017). MeFWCO also assisted Project SHARE submit a proposal review of the CIG grant through the Atlantic Salmon Recovery Framework (Submitted May 23, 2017) and approval June 6th through the Freshwater Action Team.

My office has completed fisheries and habitat assessments at the proposed restoration sites, so MeFWCO can provide additional detail as to the importance of conducting the restoration actions outlined in their proposal.

The proposed restoration activities are situated two high quality subwatersheds that contain cool water habitats in non-urbanizing and 100% connectivity connected areas (no barrier dams) that support endangered Atlantic salmon, wild brook trout and River Herring, so the proposed restoration actions have a high probability of maintaining long-term survival of these species.

Brook trout in Downeast Maine watersheds are especially at risk for climate change related issues, but the proposed restoration sites have a high degree of resiliency in regard to climate change. Upper Narraguagus has a 93% and Northern Stream 91% probability of maintaining Brook trout given a +2°C July air temperature increase as predicted by the SHEDS Interactive Catchment Explorer (http://ice.ecosheds.org/sheds/).

In the past 10 years, MeFWCO and Project SHARE have collaborated on >200 connectivity projects within the Downeast Maine Rivers. These projects have been completed with the upmost standard in terms of both being environmental sound, on time and within allocated budgets. I can assure you that your contributions will be well spent and appreciated by a multitude of stakeholders.

We are looking forward to working with Project SHARE and partners on completing this high priority project that will greatly improve aquatic habitat complexity for salmonid's and other diadromous species.

If you have any comments or questions pertaining to this proposal, please contact me at 207-902-1566 or scott_craig@fws.gov.

Sincerely,

Scott D. Craig

Scott D. Craig
Project Leader
Maine Fish and Wildlife Conservation Office

U.S. Fish & Wildlife Service

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Name: Steven D. Koenig Executive Director Project SHARE

Address: 14 Boynton Street, Eastport, Maine 04631

Phone: (207) 214-6096

Signature: _____ Date: 9/25/2018

FWS Form 3-2259 10/03