DIVISION OF NATURAL RESOURCES
Operations Center
PO Box 67
Elkins, WV 26241-3235
Telephone (304) 637-0245
Fax (304-637-0250

Earl Ray Tomblin
Governor

Robert A. Fala
Director

March 30, 2016

Callie McMunigal
U.S. Fish and Wildlife Service
Northeast Regional Coordinator
National Fish Habitat Partnership
400 E Main Street
White Sulphur Springs, WV 24986

Dear Callie,

Please find attached the following documents for Eastern Brook Trout Joint Venture Grant F14AP00504, Mill Creek (Tygart River), WV: Large Woody Material Strategic "Chop and Drop":

- EBTJV Project Completion Report
- Project Final Report
- Completed SF-271
- Accompanying Invoice Letter
- Final SF-425

I am also sending electronic versions of these documents to you via email. Thank you and the EBTJV for all of your assistance to us in completing this important project on Mill Creek. We look forward to working with you on other projects in the future. Please contact me if you have questions or require additional information.

Sincerely,

David Thorne
Program Manager
Aquatic Habitat Program

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Callie McMunigal
U.S. Fish and Wildlife Service
Northeast Regional Coordinator
National Fish Habitat Partnership
400 E Main Street
White Sulphur Springs, WV 24986

Dear Callie,

By way of this correspondence, The West Virginia Division of Natural Resources is invoicing the U.S. Fish and Wildlife Service for a final reimbursement of $49,000, the total federal share of the *Mill Creek (Tygart River), WV: Large Woody Material Strategic "Chop and Drop"* project funded in part by Eastern Brook Trout Joint Venture Grant F14AP00504.

Budget Table and Expenditures	Budget Estimate in Application	Actual Expenditures
Budget Category		
Construction	150,000	161,934
Project Total	150,000	161,934

I am also sending electronic versions of all project documents to you via email. Thank you and the EBTJV for all of your assistance to us in completing this important project on Mill Creek. We look forward to working with you on other projects in the future. Please contact me if you have questions or require additional information.

Sincerely,

David Thorne

David Thorne
Program Manager
Aquatic Habitat Program

OUTLAY REPORT AND REQUEST FOR REIMBURSEMENT FOR CONSTRUCTION PROGRAMS *(See instructions on back)*	OMB APPROVAL NO. 0348-0002	PAGE 1 OF 1 PAGES
	1. TYPE OF REQUEST ☑ FINAL ☐ PARTIAL	2. BASIS OF REQUEST ☑ CASH ☐ ACCRUAL
3. FEDERAL SPONSORING AGENCY AND ORGANIZATIONAL ELEMENT TO WHICH THIS REPORT IS SUBMITTED U.S. Fish and Wildlife Service Fisheries	4. FEDERAL GRANT OR OTHER IDENTIFYING NUMBER ASSIGNED BY FEDERAL AGENCY F14AP00504	5. PARTIAL PAYMENT REQUEST NO.
6. EMPLOYER IDENTIFICATION NUMBER 55-6000763	7. RECIPIENT'S ACCOUNT NUMBER OR IDENTIFYING NUMBER	PERIOD COVERED BY THIS REQUEST FROM *(Month, day, year)* 06/01/2014 TO *(Month, day, year)* 12/31/2015
9. RECIPIENT ORGANIZATION *Name:* WV Division of Natural Resources *No. and Street:* 324 4th Avenue *City, State and ZIP Code:* South Charleston, WV 25305	10. PAYEE *(Where check is to be sent if different than item 9)* *Name:* *No. and Street:* *City, State and ZIP Code:*	

11. **STATUS OF FUNDS**

CLASSIFICATION	PROGRAMS -- (a)	FUNCTIONS -- (b)	ACTIVITIES (c)	TOTAL
a. Administrative expense	$	$	$	$ 0.00
b. Preliminary expense				0.00
c. Land, structures, right-of-way				0.00
d. Architectural engineering basic fees				0.00
e. Other architectural engineering fee				0.00
f. Project inspection fees				0.00
g. Land development				0.00
h. Relocation expense				0.00
i. Relocation payments to individuals and businesses				0.00
j. Demolition and removal				0.00
k. Construction and project improvement cost	161,934.00			161,934.00
l. Equipment				0.00
m. Miscellaneous cost				0.00
n. Total cumulative to date *(sum of lines a thru m)*	161,934.00	0.00	0.00	161,934.00
o. Deductions for program income				0.00
p. Net cumulative to date *(line n minus line o)*	161,934.00	0.00	0.00	161,934.00
q. Federal share to date	49,000.00			49,000.00
r. Rehabilitation grants (100% reimbursement)				0.00
s. Total Federal share *(sum of lines q and r)*	49,000.00	0.00	0.00	49,000.00
t. Federal payments previously requested	0.00			0.00
u. Amount requested for reimbursement	$ 49,000.00	$	$	$ 49,000.00
v. Percentage of physical completion of project	100 %	%	%	100 %

12. CERTIFICATION		SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL	DATE REPORT SUBMITTED
I certify that to the best of my knowledge and belief the billed costs or disbursements are in accordance with the terms of the project and that the reimbursement represents the Federal share due which has not been previously requested and that an inspection has been performed and all work is in accordance with the terms of the award.	a. RECIPIENT	TYPED OR PRINTED NAME AND TITLE Robert A. Fala, Director	TELEPHONE *(Area code, number, and extension)* 304-558-2754
	b. REPRESENTATIVE CERTIFYING TO LINE 11V	SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL David Thorne	DATE SIGNED March 22, 2016
		TYPED OR PRINTED NAME AND TITLE David Thorne, Program Manager	TELEPHONE *(Area code, number, and extension)* 304-637-0245

AUTHORIZED FOR LOCAL REPRODUCTION
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271-103

STANDARD FORM 271 (Rev. 7-97)
Prescribed by OMB Circular A-102 and A-110

FEDERAL FINANCIAL REPORT

(Follow form instructions)

1. Federal Agency and Organizational Element to Which Report is Submitted	2. Federal Grant or Other Identifying Number Assigned by Federal Agency (To report multiple grants, use FFR Attachment)	Page	of
U.S. Fish and Wildlife Service Fisheries	F14AP00504	1	1 pages

3. Recipient Organization (Name and complete address including Zip code)
West Virginia Division of Natural Resources, 324 4th Avenue, South Charleston, WV 25305

4a. DUNS Number	4b. EIN	5. Recipient Account Number or Identifying Number (To report multiple grants, use FFR Attachment)	6. Report Type	7. Basis of Accounting
093782766	55-6000763		☐ Quarterly ☐ Semi-Annual ☐ Annual ☉ Final	☑ Cash ☐ Accrual

8. Project/Grant Period From: (Month, Day, Year)	To: (Month, Day, Year)	9. Reporting Period End Date (Month, Day, Year)
6/1/2014	12/31/2015	12/31/2015

10. **Transactions**	Cumulative
(Use lines a-c for single or multiple grant reporting)	
Federal Cash (To report multiple grants, also use FFR Attachment):	
a. Cash Receipts	0
b. Cash Disbursements	0
c. Cash on Hand (line a minus b)	0
(Use lines d-o for single grant reporting)	
Federal Expenditures and Unobligated Balance:	
d. Total Federal funds authorized	49,000
e. Federal share of expenditures	49,000
f. Federal share of unliquidated obligations	0
g. Total Federal share (sum of lines e and f)	49,000
h. Unobligated balance of Federal funds (line d minus g)	0
Recipient Share:	
i. Total recipient share required	100,000
j. Recipient share of expenditures	112,934
k. Remaining recipient share to be provided (line i minus j)	0
Program Income:	
l. Total Federal program income earned	0
m. Program income expended in accordance with the deduction alternative	0
n. Program income expended in accordance with the addition alternative	0
o. Unexpended program income (line l minus line m or line n)	0

11. Indirect Expense	a. Type	b. Rate	c. Period From	Period To	d. Base	e. Amount Charged	f. Federal Share
				g. Totals:			

12. *Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation:*

13. Certification: By signing this report, I certify to the best of my knowledge and belief that the report is true, complete, and accurate, and the expenditures, disbursements and cash receipts are for the purposes and intent set forth in the award documents. I am aware that any false, fictitious, or fraudulent information may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)

a. Typed or Printed Name and Title of Authorized Certifying Official	c. Telephone (Area code, number and extension)
ROBERT A. FALA DIRECTOR	304-558-2754
	d. Email address robert.a.fala@wv.gov
b. Signature of Authorized Certifying Official Robert A. Fala	e. Date Report Submitted (Month, Day, Year) 3/31/2016
	14. Agency use only:

Standard Form 425 - Revised 6/28/2010
OMB Approval Number: 0348-0061
Expiration Date: 10/31/2011

Paperwork Burden Statement
According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is 0348-0061. Public reporting burden for this collection of information is estimated to average 1.5 hours per response, including 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 any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and Budget, Paperwork Reduction Project (0348-0061), Washington, DC 20503.

Eastern Brook Trout Joint Venture
Completed Project Report Form

Project Title: Mill Creek (Tygart River), WV: Large Woody Material Strategic "Chop and Drop"

- **Sponsor:** West Virginia Division of Natural Resources-Wildlife Resources Section-Aquatic Habitat Program (AHP)

- **Partners involved:** West Virginia University, West Virginia Division of Forestry, West Virginia Division of Natural Resources-Parks and Recreation Section

- **Project costs:**

1. Total cost: $161,934
2. Non federal amount: $112,934
3. Federal amount: $49,000

- **Funding Sources:** West Virginia Division of Natural Resources, EBTJV

- **Action strategy implemented in the project (according to EBTJV range wide, regional, or state level habitat strategies).**

  - Maximize Brook Trout habitat and water quality protection through state and federal agencies.
  - Mitigate factors that degrade water quality.
  - Maintain or restore natural hydrologic regimes

- **Priority score of the sub-watershed where the project took place.** 1

- **Describe any additional species of greatest concern or the state wildlife action plan listed habitat conservation goal (s) supported by the project.**
  Brook Trout are identified as a Species of Greatest Conservation Need in the 2015 West Virginia State Wildlife Action Plan. Mill Creek is in the High Alleghenies Conservation Focus Area identified in the SWAP. A priority conservation action identified in the SWAP for this CFA is to:

  - Continue and expand spruce/high elevation forest restoration

  The actions taken during this project will contribute to riparian spruce release.

- **Description: project objective(s):**
  Incorporate storm-downed, damaged and diseased wood into non-mobile, large woody material (LWM) structures and complexes to enhance aquatic habitat for Brook Trout and other aquatic species and to improve fishability.

- **Methods used:**
  Most LWM structures and complexes constructed during the project utilized downed trees or trees that were compromised by the storms or disease. During project construction, it became apparent that there were additional opportunities to utilize other trees whose removal facilitated release of Red Spruce trees in forest understory. Release of Red Spruce in riparian areas is a management objective for the Forest as a compensatory response to the decline of eastern hemlocks from wooly adelgid infestation.

  From restoration literature and reference complexes of large wood in Mill Creek itself, the restoration team developed a portfolio of natural-stream derived structural practices that were replicated at multiple locations over 3.5 miles of Mill Creek mainstem during the 18-month project period. They included:

  - Log cross-vanes
  - Single log vanes
  - Cross channel "digger" logs
  - Rootwads
  - Toe wood

- **Project outcomes: Describe outcomes and whether or not the objectives were met. If not why? What lessons were learned?**
  A successful 2014 construction season was followed within 45 days by a greater than bank full rainfall event that eliminated approximately half of the LWM structures that had been constructed. The structures had not had sufficient time to strengthen before they were subjected to a flood event. Forensic analysis also revealed some construction-related weaknesses, e.g., insufficient entrenchment. This analysis informed the restoration team's work during the 2015 construction season. Combining the accomplishments of the 2014 and 2015 construction seasons, the aggregate accomplishments of the Mill Creek EBTJV project were as follows:

  - 69 LWM structures were installed over the project period
  - 27 structures were lost in the 2014 flood event
  - 42 installed LWM structures are in place as of 3/31/2016
  - 3.5 miles of Mill Creek mainstem improved
  - 1.5 miles of angler access trail improved

- **What is the Brook Trout population response to the project outcome?**
  To assist with long-term monitoring of the impacts of the work, the WVDNR AHP has asked the WVU Wildlife and Fisheries Program include Mill Creek in its annual monitoring program for Brook Trout populations and habitat. That monitoring will be initiated in 2016.

Beginning in 2016, the WVDNR AHP will also be initiating an angler interview and creel survey effort on Mill Creek. This will provide baseline data in advance of a long-term research effort to assess the impact of proposed alternative harvest regulations on the Mill Creek Brook Trout population.

- **If applicable, what is the number of stream miles and or acres of Brook Trout habitat?:**

A Protected:
B.Restored/Enhanced: 3.5 miles

- **If applicable what is the number of stream miles and or lake/pond acres of Brook Trout habitat gained access to as a result of removing a fish barrier. Include the # of fish barriers removed?**

N/A

- **If applicable, what is the number of stream miles and or lake or pond acres of Brook Trout habitat with sediment, phosphorous, or nitrogen inputs that were rehabilitated to within 25% of natural or other desired levels such as numeric state water quality criteria?**

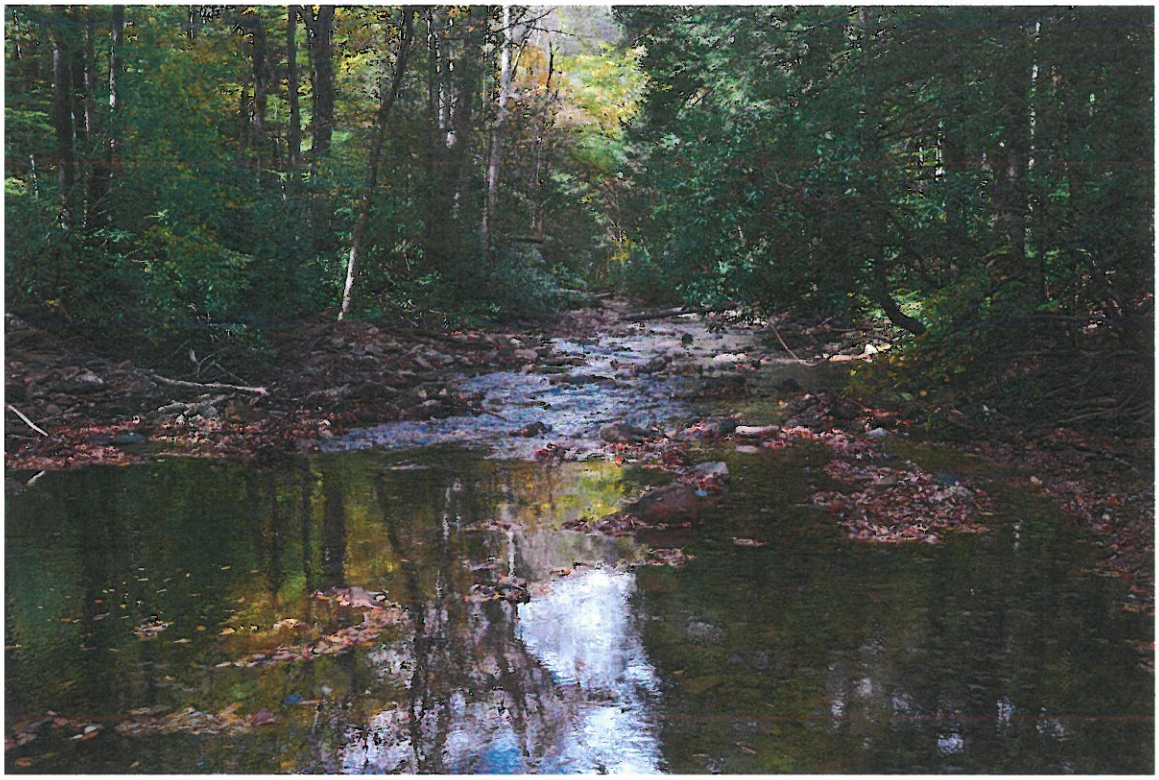
N/A

*******_**Please include before and after photos of the project.**_*********

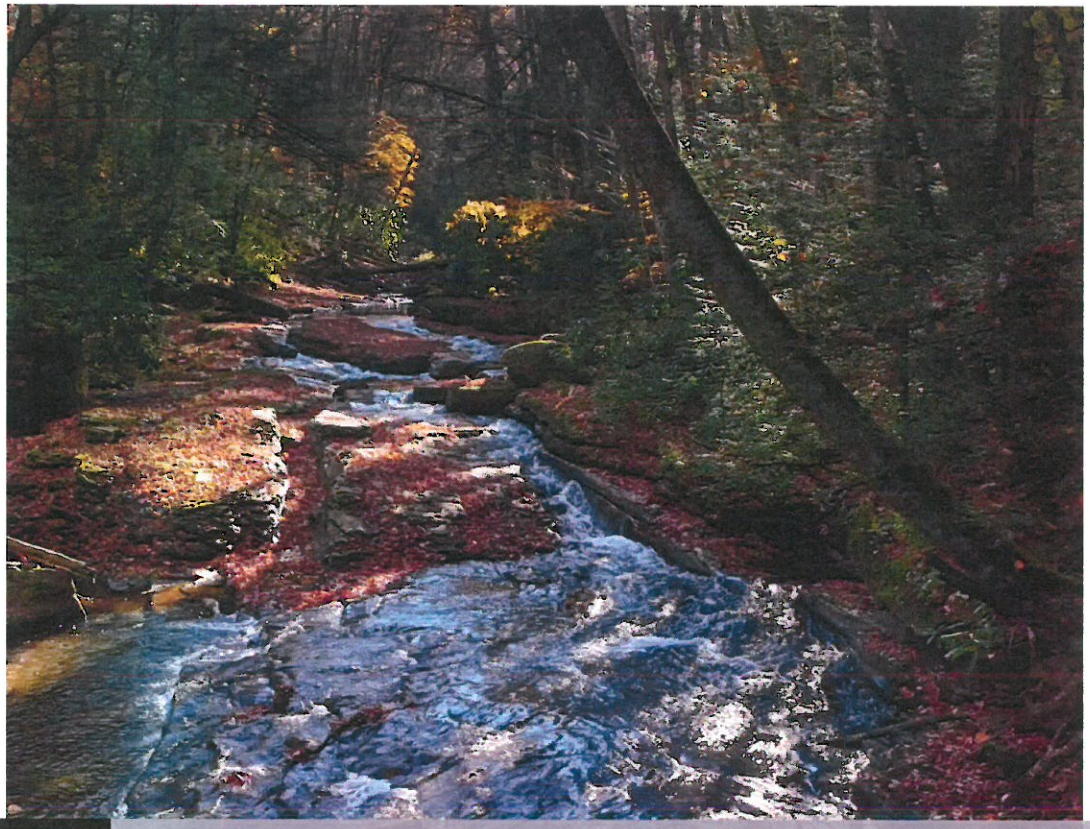
See attached pages

Mill Creek – Before photos:

Mill Creek – After photos



March 27, 2016

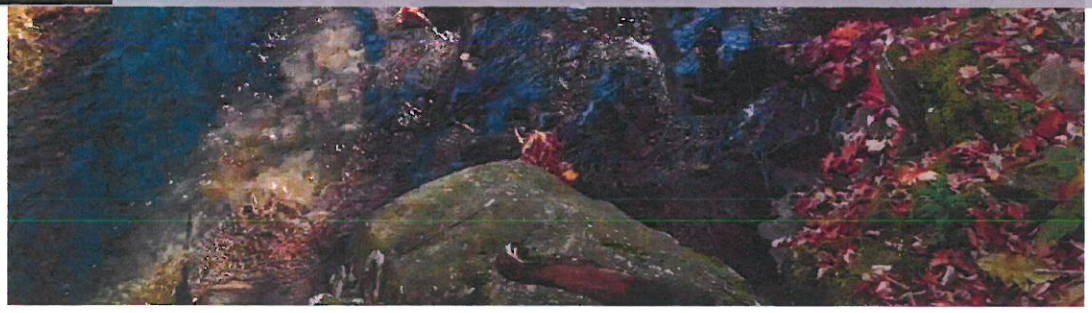


WEST VIRGINIA DIVISION OF NATURAL RESOURCES

MILL CREEK, WEST VIRGINIA

EASTERN BROOK TROUT JOINT VENTURE PROJECT

FINAL REPORT



EBTJV Grant F14AP00504 | David Thorne, Steve Brown and Paul Kinder

WV Division of Natural Resources

Aquatic Habitat Program
Eastern Brook Trout Joint Venture Project Final Report
Mill Creek (Tygart River), WV: Large Woody Material Strategic "Chop and Drop"
March 25, 2016

Project Sponsor: WV Division of Natural Resources, Wildlife Resources Section, Aquatic Habitat Program

Project Location: Kumbrabow State Forest (Randolph County), WV

EBTJV/NFHAP Funding: $49,000

Total Project Cost Estimated: $150,000

Total Non-Federal Matching Estimated: $101,000

Total Project Cost Actual: $161,934

Total Non-Federal Matching Actual: $112,934

Partners Involved: West Virginia Division of Natural Resources Parks and Recreation Section, West Virginia Division of Forestry, West Virginia University

Project Background

For several decades, stream ecologists, biologists, restoration specialists, and resource managers have observed and documented the ecosystem benefits of Large Woody Material (LWM) in high-gradient Brook Trout streams. LWM, from downed trees, affects stream channel morphology and produces positive fish habitat effects by offering velocity refuge, pool formation, and protection from predators. Furthermore, LWM can reduce stream flow flashiness and bank erosion as well as provide traps for organic sediments and spawning gravel important for Brook Trout fishery sustainability.

In 2012, the Mid-Atlantic Region, including West Virginia, suffered great loss and damages from a derecho in June and Super Storm Sandy in October. While these storms did billions of dollars of property and infrastructure damage, they also had profound impacts on streams. After the storms, many of West Virginia's best Brook Trout streams were covered densely in suspended trees offering few LWM benefits to fish and severely obstructing stream access for recreation and fishing. Along with suspended fallen trees in narrow valleys, large

debris jams were formed that damaged channel morphology, accelerated bank erosion, and increased sedimentation.

In the aftermath of the storms, the WV Division of Natural Resources, biologists with the West Virginia Division of Natural Resources' (WVDNR) Aquatic Habitat Program (AHP) concluded that, while there had indeed been negative impacts on aquatic habitats, storm-downed wood could, if properly managed, improve Brook Trout habitats in streams that were wood-depauperate. One site in particular, Mill Creek in Kumbrabow State Forest, presented a unique opportunity for such management. Mill Creek is one of the state's best and most intact Brook Trout populations and had been significantly impacted by the storms. Years before, the WVDNR had begun a significant long-term investment in Mill Creek by adding limestone sand to the stream to neutralize stream acidity caused by acid precipitation. Annual applications of limestone sand continue to sustain Brook Trout in eight miles of publicly accessible mainstem on the State Forest, as well as in additional stream mileage flowing through private lands downstream of the Forest. If some of the storm-downed wood on the Forest could be incorporated into non-mobile wood structures and complexes, the resulting combination of mobile and non-mobile wood could significantly enhance aquatic habitat for Brook Trout and other aquatic species for many years to come, thus leveraging the water chemistry progress already made while simultaneously reducing the storms' negative impacts on habitat and fishability.

In 2013, to capitalize on that opportunity, the WVDNR applied for and was awarded an Eastern Brook Trout Joint Venture grant of $49,000, to be matched with more than $100,000 of state funds to implement a Large Woody Material Strategic "Chop and Drop" project on Kumbrabow State Forest. The project was subsequently initiated in June 2014.

Project Pre-construction Planning and Permitting

During late winter/early spring of 2014, DNR AHP and West Virginia University, Natural Resource Analysis Center (WVU NRAC) initiated the process of reconnaissance and planning beginning with a low-elevation helicopter survey of Mill Creek from the headwaters beginning at the Kumbrabow Superintendent's Office through the Canyon to the Cabins and a half mile below the falls and on to the State Forest Property Boundary. The stream length from the Superintendent's Office north to the forest boundary below the cabins is approximately six miles. The helicopter survey was completed during leaf-off and snow-on conditions and was

extremely useful in remotely assessing stream pattern, valley form, and Super Storm Sandy impacts.

Next, WVDNR AHP biologists and WVU NRAC scientists reached out to familiar project partners that included:

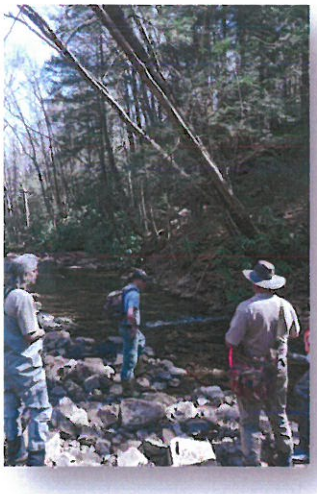
- West Virginia Division of Forestry (WVDOF)
- West Virginia Division of Natural Resources, Parks and Recreation Section (WV PRS)

Kumbrabow State Forest is owned by the State of West Virginia, with management responsibility divided as follows:

- Fish and Wildlife Management - WVDNR, Wildlife Resources Section
- Forest Management – WVDOF
- Recreation Management – WV PRS

These three public agencies have a long history of integrated, collaborative management of the Forest; their partnership in the Mill Creek project was thus a natural and valuable continuation of that collaboration. The addition of WVU NRAC as a partner was also a natural continuation of a relationship that was forged in previous research and management projects such as the Upper Shavers Fork Project and, as had been the case before, brought WVU's cutting edge technology and extensive analytical skills to bear on the Mill Creek Project. The partnership of the three state agencies and WVU NRAC thus formed the restoration team that implemented the project.

With the aerial reconnaissance completed, the restoration team evaluated stream reaches on Mill Creek for restoration need and potential. Factors considered in the evaluation included:

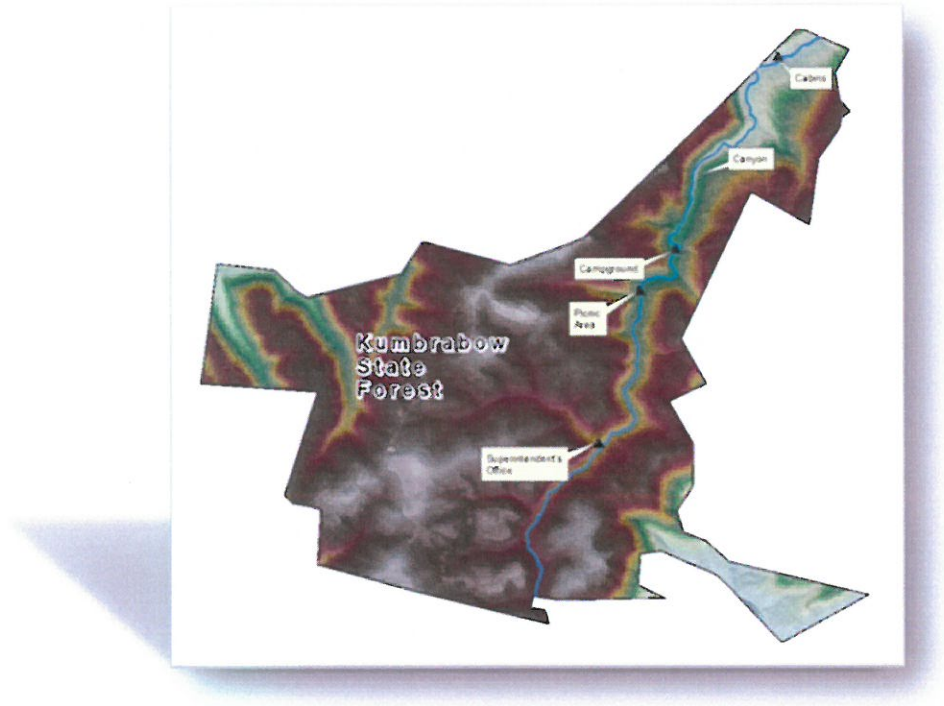


- Magnitude of storm impacts to riparian and instream habitats, as well as to trails and recreation areas
- Potential access for excavators and other equipment
- Existing patterns of angling and other recreational use
- Potential for biological lift from habitat restoration

From that evaluation, Mill Creek stream reaches were prioritized for restoration/enhancement as follows:

- Priority 1: A 1.93-mile reach from just below the Picnic Area to the Superintendent's Office
- Priority 2: A 0.37-mile reach from below the Cabins to the first ford above the Cabins
- Priority 3: A 0.43-mile reach from below the Campground to the bridge above the Campground
- Priority 4: A 0.76-mile reach from the first ford above the Cabins to the Glade Run confluence

Approximately 3.5 miles of the total eight miles of Mill Creek mainstem on the Forest being sustained with limestone sand were thus prioritized for LWM management during the 18-month project period. The restoration team concluded that the remaining 4.5 miles experience less angling pressure and/or had higher quality habitats that were less in need of restoration. This was particularly the case with the remote 1.5-mile canyon reach between the Glade Run confluence and the Campground.



Under a cooperative agreement between the WVDNR AHP and WVU NRAC, all requisite environmental permitting was subsequently completed with the contractual assistance of the Canaan Valley Institute. Project construction began in June, 2014.

Project Methodology

Most LWM structures and complexes constructed during the project utilized downed trees or trees that were compromised by the storms or disease. During project construction, it became apparent that there were additional opportunities to utilize other trees whose removal facilitated release of Red Spruce trees in forest understory. Release of Red Spruce in riparian areas is a management objective for the Forest as a compensatory response to the decline of eastern hemlocks from wooly adelgid infestation.

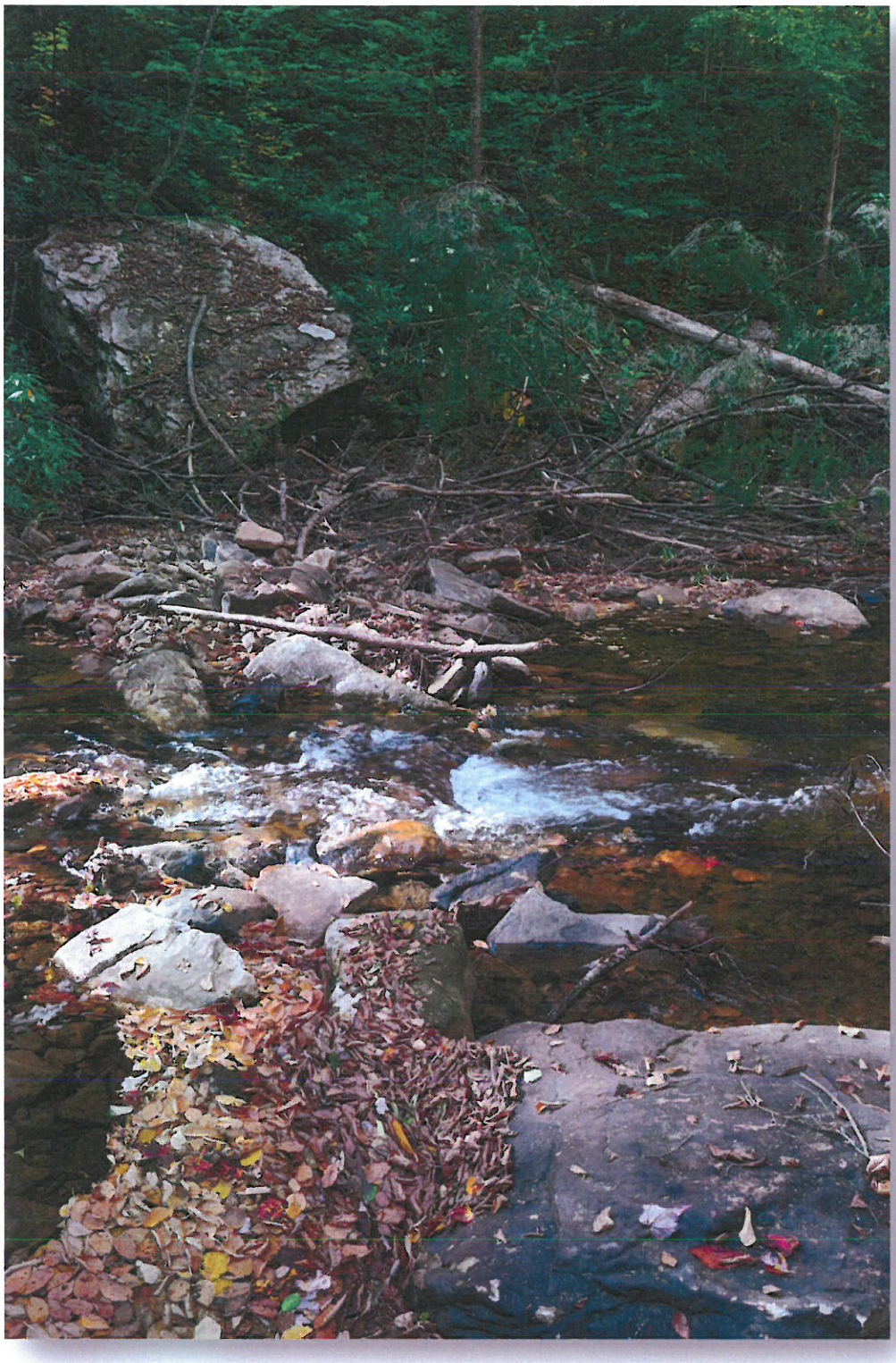
From restoration literature and reference complexes of large wood in Mill Creek itself, the restoration team developed a portfolio of structural practices that were replicated at multiple locations over 3.5 miles of Mill Creek mainstem during the 18-month project period. Those practices are described and illustrated in the next several pages.

Log cross-vanes (to promote channel narrowing and pool scour)

At Low Flow

At High Flow

Single log vanes (to improve channel sinuosity and increase habitat complexity)



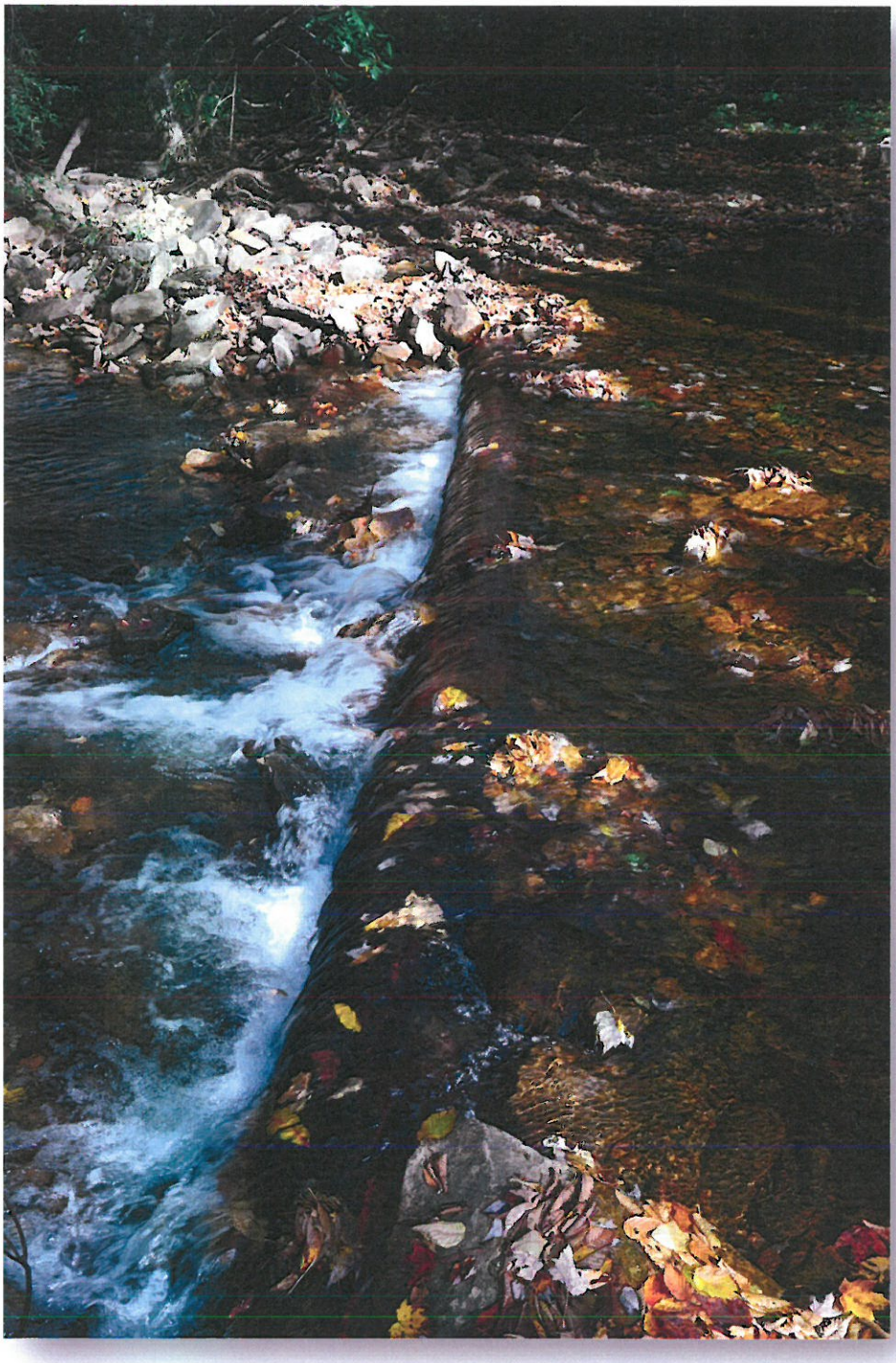
Elevated cross-channel "digger" logs (to promote pool scour and recruitment of mobile wood at the margins)

Toe wood/mud sills (to provide depth with overhead cover at stream margins and develop benches to control bank erosion)

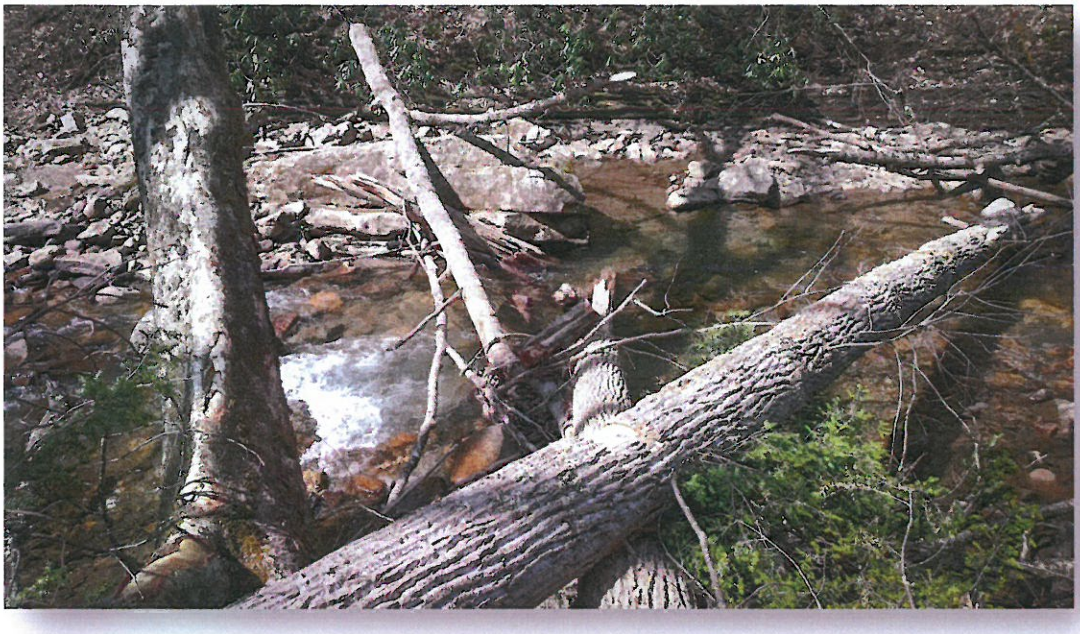
Rootwads (to promote channel scour)

Log deflector structures (to redirect flows)

Cross-channel grade control structures (to retain fords)



Felled log complexes (to provide overhead cover and recruit mobile wood)



The team leased an IHI 80 rubber-tracked excavator during the 2014 and 2015 construction seasons. Where possible, structures were installed using the excavator. In locations where access for the excavator was difficult, structures were installed using chain saws and a chain-saw winch.

A primary emphasis during installation of structures was speed. Moving quickly from site to site, the team often deployed practices at two to three sites per day. It was understood that better and more lasting structures could be installed by thoroughly engineering them, but the emphasis in this project was to deploy structures that could be installed inexpensively and rapidly at other locations in the future. It was acknowledged at the outset that some structures could fail, but that the large wood released by such failures would continue to enhance aquatic habitat at locations further downstream.

2014 Construction Season

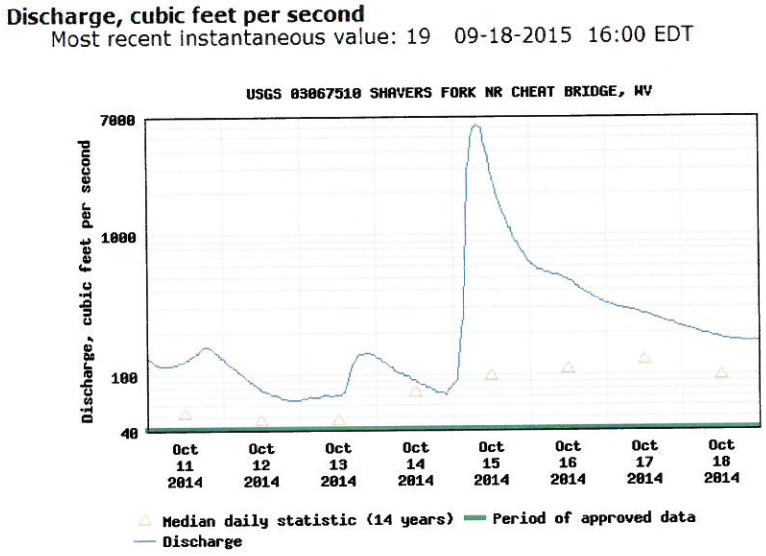
In June 2014, the restoration team began construction of fish habitat improvements in the 1.93-mile, Priority 1 reach from the Picnic Area to the Superintendent's Office. From then through July 2014, the team installed a total of 42 separate LWM structures in this reach. The IHI 80 excavator was used for virtually all of these structures. In early August, the restoration team moved to the 0.37-mile, Priority 2 reach above and below the Cabins, where the team installed four structures, again with the help of the excavator. From there, the team moved the excavator to the Priority 3 reach at the Campground. Two structures were installed there in the latter part of August using the excavator. At that point, the excavator was returned to the rental agency. The restoration team finished the 2014 construction season by installing four additional structures with chainsaws and the chainsaw winch; three of these structures were in the Priority 4 reach well above the Cabins and one was in the Priority 3 reach at the Campground. A total of 52 structures had been installed by the end of the construction season in September 2014.

During the course of stream restoration activities in 2014, and as a result of close coordination with the WV PRS, which administers and manages much of the outdoor recreation on Kumbrabow State Forest, the restoration team created or improved 1.5 miles of a recreational trail that was added to the Forest's trail system. This trail will be used by anglers to access the Priority 1 reach of Mill Creek, as well as by hikers, birdwatchers, mountain-bikers and other recreational users. The team also improved administrative access to the Forest Picnic Area as an ancillary consequence of securing the team's own equipment access to the stream at that location. Finally, overhanging wood was removed from above the plunge pool at Mill Creek Falls during the course of stream work below that site, thus removing a public safety hazard.

2014 October Flood

On the night of October 14th, 2014, Mill Creek experienced a significantly greater than bank full flood event just as the team's work had been completed. More than three inches of rain

fell in the watershed in less than six hours. During that event, water levels in some reaches pf the Mill Creek mainstem rose more than 10 feet very rapidly. Although Mill Creek has no USGS gage, the October 2014 flood event can been seen on the Shaver's Fork of Cheat River gage at Cheat Bridge. The Shaver's Fork Watershed is adjacent to Mill Creek to the east at approximately the same latitude.



The effects of the flood event on the recently installed LWM structures were extreme. None of the installed wood had had time to saturate nor had the rock and cobble anchors had time to set or harden. No cabling or deadman anchors had been utilized as the team had chosen to keep the structures as natural as possible. The structures were at the most vulnerable stage in their life span and many succumbed to the force of the event. During late fall 2014 and early spring 2015, forensic evaluations by the restoration team confirmed that 27 of the 52 structures had been lost entirely. Several others were weakened but were retained. In all, 25 of the installed structures survived what had been an extreme test of their stability. As had been envisioned for a worst case scenario, much of the large wood that was mobilized from failed structures eventually added to other wood in downstream LWM complexes, both man-made and natural, and is continuing to enhance Brook Trout habitat in those locations, as can be seen in the image below.

2015 Construction Season

In some ways, the October 2014 flood event was as fortuitous as it was unfortunate. Occurring as it did during the EBTJV project period that covered two successive construction seasons, it stress-tested the 2014 work and afforded an opportunity for the restoration team to rapidly incorporate modifications to the deployment of restoration practices during the remainder of the project period. Given that opportunity, the restoration team conducted forensic evaluations of both failed and surviving LWM structures during late fall 2014 and early spring 2015. Those evaluations yielded several conclusions that guided the restoration team going into the 2015 construction season. They included the following:

- Many single log vanes had been very vulnerable due to inadequate entrenching of in-stream tips; depth to bedrock was often the reason
- Log cross-vanes had also been vulnerable, again due to inadequate entrenching and/or installation in reaches with extreme bank-full widths; again depth to bedrock was frequently an issue
- Cross-channel digger logs failed where the ends of the logs had been insufficiently entrenched or secured
- Virtually all toe wood/mud sill structures had survived
- Structures in stream reaches that had some adjacent flood plain often survived well
- Many of the failed structures had been installed too aggressively, i.e., they were an attempt to force too great a change in channel morphology
- There had been too much emphasis on speed of construction during the 2014 season, at the expense of durability; a more modest pace would allow better construction practices that could enhance structural stability and durability

With that guidance in mind, the 2015 construction season began in late June. Again, the rented IHI 80 excavator was used for much of the work. From late June until the first week of August, the restoration team focused most of its attention on the Priority 1 reach from the Picnic Area to the Superintendent's Office. In that reach, 13 additional LWM structures were installed and nine of the surviving 2014 structures were modified to enhance their stability. The excavator was returned at that point. In early November, the team resumed its work, finishing the construction season by installing four felled log complexes in the Priority 4 reach above the Cabins. In total, 17 additional LWM structures were installed and nine LWM structures from 2014 were modified during the 2015 construction season.

Aggregate Project Accomplishments

Combining the accomplishments of the 2014 and 2015 construction seasons, the aggregate accomplishments of the Mill Creek EBTJV project were as follows:

- 69 LWM structures were installed over the project period
- 27 structures were lost in the 2014 flood event
- 42 installed LWM structures are in place as of 3/31/2016
- 3.5 miles of Mill Creek mainstem improved
- 1.5 miles of angler access trail improved

Future Activities

Although the EBTJV project ended on 12/31/2015, the restoration team will be using state funds and federal Sport Fish Restoration funds to do additional work on Mill Creek during summer and late fall of 2016. Plans are to install additional LWM structures in the Priority 2, 3 and 4 reaches. In the course of that work, approximately .7 miles of angler access trail will be improved.

The WV PRS has offered to produce durable interpretive signage to be installed in the vicinity of restoration work sites. The signage will explain the rationale for the restoration work and give credit to those entities that accomplished and funded the work, including the EBTJV.

To assist with long-term monitoring of the impacts of the work, the WVDNR AHP has asked the WVU Wildlife and Fisheries Program include Mill Creek in its annual monitoring program for Brook Trout populations and habitat. That monitoring will be initiated in 2016.

Beginning in 2016, the WVDNR AHP will also be initiating an angler interview and creel survey effort on Mill Creek. This will provide baseline data in advance of a long-term research effort to assess the impact of proposed alternative harvest regulations on the Mill Creek Brook Trout population.

Project Costs

Mill Creek EBTJV Project Costs, Final

	Budget Category	Costs
	Labor (DNR/WVU)	$133,792
	Equipment	$17,120
	Materials	$11,022
TOTAL PROJECT COSTS		**$161,934**

Federal share: $ 49,000
State share: $112,934