NEXTera ENERGY RESOURCES

June 28, 2012

ORIGINAL

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

RE: INDIAN POND PROJECT FERC NO. 2142 LICENSE
ARTICLE 401 COMPLIANCE

Dear Ms. Bose,

NextEra® Energy Maine Operating Services, LLC submits this letter pursuant to the July 25, 2001 Indian Pond Project Settlement Offer and Article 401 of the January 14, 2004 new FERC license.

Section 3.3.5 of the Settlement Offer outlines the following process regarding fish habitat/population assessments in the selected restoration streams: In consultation with other members of the Indian Pond Fish Habitat Restoration Committee, (i.e. Trout Unlimited, Maine Department of Inland Fisheries and Wildlife, United States Fish and Wildlife Service and Forks Chamber of Commerce) Licensee shall conduct periodic habitat/population assessments and geomorphic assessments at index sites where no restoration projects are proposed and at sites where habitat restoration projects have been implemented. The goal of the restoration projects is to benefit local brook trout populations through provision of stream cover, thermal and velocity refuge, habitat diversity, and to enhance productivity of benthic macroinvertebrate (BMI) communities. The purpose of the assessments is to compare fisheries population responses and changes and geomorphic changes at sites where restoration projects have been implemented (the "restoration sites") against sites where no restoration work is proposed (the "index sites"). The assessments included initial baseline work at the index sites and the proposed restoration sites in 2007, prior to construction of the habitat restoration projects in 2008.

The Cold Stream and Enchanted Stream restoration projects were constructed in late summer/early fall of 2008. In the fall of 2009, follow-up assessments were conducted to monitor changes in stream geometry, aquatic habitat, fish populations, spawning activity and stability of improvements at the restoration sites. The two index sites were also assessed during the same period. Two additional assessments were also completed at the index and restoration sites in 2010 and 2011 using the same types of assessment implemented in 2009.

The results of the fish population monitoring completed in 2009, 2010, and 2011 indicates that brook trout have responded well and are utilizing reaches where instream habitat structures were installed.

Brook trout abundance and percent dominance has increased in reaches where stream habitat improvements occurred. Similarly, the number of benthic macroinvertebrates and the number of important taxa (e.g., Ephemeroptera [mayflies], Plecoptera [stoneflies], Trichoptera [caddis flies]) have also increased since habitat improvements were completed. Similar results have also been noted within the reference (index) reaches.

The observed increase in relative abundance and percent dominance of brook trout is likely a result of several variables, including the utilization of the habitat structures for cover and velocity refuge, as well as increased macroinvertebrate production in the sample reaches which provides a larger forage base. The increased brook trout density over time is also likely related to the general success of wild brook trout populations in recent years in northern Maine. Reportedly, brook trout have had extremely good rearing and spawning success in northern Maine as a result of high water and cold temperatures (pers. comm., Dave Boucher, Maine Department of Inland Fisheries & Wildlife, December 29, 2011).

The results of the geomorphic assessments completed in 2009, 2010, and 2011 have demonstrated that all of the in-stream structures remain in place and are functioning as intended three years after implementation. Individually placed large boulders and most logs are also functioning in their original locations. Plan view maps of the sites document continued bank scour at the flanks of some rock sills and rock weirs, leading to the meander formation planned for in the restoration design. Flow diversion into a side channel at Cold Stream is enhancing channel complexity as the channel widens. Topographic cross sections show that pool depths remain greater than their pre-restoration depths. Repeat ground photographs corroborate the results of topographic surveys and demonstrate an increase in channel complexity throughout the restoration reaches. The lack of significant alterations to the in-stream structures during four years of monitoring suggest that the documented meander growth, pool development, increased channel complexity, and other aquatic habitat improvements will be sustainable into the future.

As per Section 3.3.5.2 of the Settlement Offer, NextEra is required to file reports with FERC within six months of completion of the third assessment, documenting the findings of the assessments and making recommendations regarding whether further restoration work or assessments are necessary. As part of the required consultation process, drafts of these reports were submitted to the Indian Pond Fish Habitat Restoration Committee for review and comment in late December 2011 (Fish Population Monitoring Report) and mid-January 2012 (Geomorphic Monitoring Report). TU, USFWS, MDIFW and the Forks Chamber of Commerce have provided comments (see attached) in support of the assessment report results.

Based on the results of the fish population monitoring which indicate that the fish are responding well to the in-stream habitat structures, and on the results of the geomorphic assessments which indicate that the structures are remaining in place and functioning well, NextEra believes that it has met its obligations under Section 3.3.5 of the July 25, 2001 Indian Pond Settlement Agreement and proposes that no further restoration work or assessments are necessary at these sites.

If you have any questions, please contact Bob Richter at Robert.Richter@NexteraEnergy.com or 207-242-5001.

Sincerely,

Kirk Toth
General Manager

enclosures

CERTIFICATE OF SERVICE

Indian Pond Project (FERC No. 2142)

I, Robert C. Richter III, Senior Environmental Specialist for NextEra Energy, hereby certify that copies of the foregoing documents have been transmitted to the following parties of record on June 28, 2012.

Kimberly Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, NE,
Washington, DC 20426
8 copies via UPS

Jeff Reardon
Trout Unlimited – Maine Council
9 Union St.
Hallowell, Maine 04347

Joe Christopher
Forks Chamber of Commerce/Three Rivers
P.O. Box 10
West Forks, Maine, 04985

Steven Shepard
U.S. Fish and Wildlife Service
17 Godfrey Drive, Suite 2
Orono, Maine 04473

Craig Denis
TU-KVCTU
38 Daggett Hill Rd
Athens, Maine 04912

Jason Seiders
Maine Dept of Inland Fisheries & Wildlife
270 Lyons Rd.
Sidney, Maine 04330

RCR III
ROBERT C. RICHTER III

DATE 6-28-12

Richter, Robert

From: Craig and Laurie [meweblz@tdstelme.net]
Sent: Thursday, June 21, 2012 5:06 PM
To: Richter, Robert
Subject: Re: Cold and Enchanted Stream efishing and geomorphic reports

Bob,
The reports indicate that the restoration sites are performing very well. Also, the selection process for the sites, and the coarse of actions taken, has been successful. This is evidenced by the count of healthy brook trout and benthic macroinvertebrates populations.

The reports also support the importance of protecting/preserving the watersheds as a means of maintaining/enhancing healthy brook trout populations in the Dead and Kennebec Rivers. The committee has weighted in support of making remaining funds available for the purchase of significant brook trout habitat within the "'Project" area.

On behalf of Maine Council & Kennebec Chapter Trout Unlimited, I support the findings within the reports and their summaries.

Craig Denis

From: Richter, Robert
Sent: Friday, June 15, 2012 8:30 AM
To: Seiders, Dwayne J ; Jeffrey Reardon ; Steven_Shepard@fws.gov ; Craig and Laurie ; info@threeriversfun.com
Subject: Cold and Enchanted Stream efishing and geomorphic reports

I had previously sent the KA efishing report and the John Fields geomorphic report to you for your review and comment. I need to file these reports with FERC by the end of this month. Can you get back to me with comments by June 22 so I can close the FERC consultation loop.

Thanks.

Richter, Robert

From: Steven_Shepard@fws.gov
Sent: Thursday, June 21, 2012 1:58 PM
To: Richter, Robert
Subject: Re: Cold and Enchanted Stream efishing and geomorphic reports
Attachments: graycol.gif; pic22386.gif; ecblank.gif

I reviewed these quite some time and did not see anything significant that we need to follow-up on. I just pulled them out again, and the FWS has no formal comments.

~~~~~~~~~~~~~~~~
Steven Shepard, C.F.P.
Maine Hydro Licensing Coordinator
U.S. Fish & Wildlife Service
17 Godfrey Drive, Suite 2
Orono, Maine 04473
Voice: 207-866-3344 x116
Cell: 207-949-1288
steven_shepard@fws.gov
~~~~~~~~~~~~~~~~

"Richter, Robert" <Robert.Richter@fpl.com>

"Richter, Robert"
<Robert.Richter@fpl.com>

06/15/2012 08:30 AM

To"Seiders, Dwayne J" <Dwayne.J.Seiders@maine.gov>, Jeffrey Reardon <JReardon@tu.org>, "Steven_Shepard@fws.gov" <Steven_Shepard@fws.gov>, "Craig and Laurie" <meweblz@tdstelme.net>, "info@threeriversfun.com" <info@threeriversfun.com>

cc

SubjectCold and Enchanted Stream efishing and geomorphic reports

I had previously sent the KA efishing report and the John Fields geomorphic report to you for your review and comment. I need to file these reports with FERC by the end of this month. Can you get back to me with comments by June 22 so I can close the FERC consultation loop.

Thanks.

Richter, Robert

From: Seiders, Dwayne J [Dwayne.J.Seiders@maine.gov]
Sent: Tuesday, June 26, 2012 4:16 PM
To: Richter, Robert
Cc: VanRiper, Robert
Subject: Reports: Enchanted Stream and Cold Stream Restoration Projects

Bob,

I reviewed the reports regarding the restoration projects on Cold Stream and Enchanted Stream. Both reports appear accurate and I have no comments at this time. I believe that NextEra has satisfied the FERC monitoring requirements related to these projects, and no further study is required. If you have any further questions or require any additional information please let me know.

Sincerely,

Jason Seiders

Jason Seiders
Regional Fisheries Biologist
Maine Dept. of Inland Fisheries and Wildlife
270 Lyons Road
Sidney, Maine 04330
Office: (207) 547-5314

Richter, Robert

From: Joe Christopher [joe@threeriversfun.com]
Sent: Thursday, June 28, 2012 9:49 AM
To: Richter, Robert
Subject: RE: Cold and Enchanted Stream efishing and geomorphic reports
Attachments: image002.gif; image003.gif

Hello Bob, I am very satisfied and happy with the Electro Fishing and Geomorphic reports and studies. I actually got to review some of the studies and on site efforts and think it has gone very well. I appreciate your help and guidance and think that this portion of the license and settlement has gone very well. Thank You

Joe Christopher
President
Three Rivers
"The Home Of Serious Fun!!"
1-800-786-6878
www.threeriversfun.com
www.jumpandraft.com


Become a Three Rivers Whitewater Fan on Facebook


Become a Jump n Raft Fan on Facebook

From: Richter, Robert [mailto:Robert.Richter@fpl.com]
Sent: Tuesday, June 26, 2012 12:07 PM
To: Three Rivers Fun; 'Joe Christopher'
Subject: RE: Cold and Enchanted Stream efishing and geomorphic reports

Joe,

Any chance of getting me an email today as I need to get this to FERC. Both the efishing report and the geo report say things look good and basically there is no need for additional restoration work or study. I agree and was planning to say something like that in the cover letter to FERC.

Thanks

Bob

From: Three Rivers Fun [mailto:info@threeriversfun.com]
Sent: Monday, June 25, 2012 2:56 PM
To: 'Joe Christopher'
Cc: Richter, Robert
Subject: RE: Cold and Enchanted Stream efishing and geomorphic reports

FYI…

Jaime
Three Rivers

Monitoring of Stream Restoration on Cold Stream and East Branch Enchanted Stream near The Forks, Maine – Year 4

Prepared for

Nextera Energy
Lewiston, ME

Cold Stream - 2011

Prepared by

Dr. John Field
Field Geology Services
Farmington, ME

December 2011

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EXECUTIVE SUMMARY

Baseline monitoring completed in 2008 at two stream restoration projects on Cold Stream and East Branch Enchanted Stream near The Forks, Maine was compared with follow-up monitoring in 2009, 2010, and 2011. All of the in-stream structures remain in place and are functioning as intended three years after implementation. Individually placed large boulders and most logs are also functioning in their original locations. Channel widening and meander development has removed individually placed logs along the side channel at Cold Stream that now conveys half of the stream's discharge and exhibits considerable channel complexity. Plan view maps of the sites document continued bank scour at the flanks of some rock sills and rock weirs, leading to the meander formation planned for in the restoration design. Flow diversion into a side channel at Cold Stream is enhancing channel complexity as the channel widens. Topographic cross sections show that pool depths remain greater than were present prior to restoration. Repeat ground photographs corroborate the results of topographic surveys and demonstrate an increase in channel complexity throughout the restoration reaches. The lack of significant alterations to the in-stream structures during four years of monitoring demonstrate the documented meander growth, pool development, increased channel complexity, and other aquatic habitat improvements will be sustainable into the future.

1.0 INTRODUCTION

This report describes the results of the fourth year of geomorphic monitoring at two stream restoration projects completed in Summer 2008 on Cold Stream and East Branch Enchanted Stream near The Forks, ME (Figure 1). (For brevity, the East Branch site is hereinafter referred to only as Enchanted Stream). The results from the first three years of monitoring are presented in Field (2009a), Field (2009b), and Field (2010). The restoration projects were completed as part of the settlement agreement between FPL Energy Maine Hydro LLC and the Federal Energy Regulatory Commission (FERC), detailed in Section 3.3.3.C of the Indian Pond Project, FERC No. 2142. The two separate projects consisted of boulder and log placements to encourage the reformation of meanders, channel complexity, and cover habitat that were likely present on these streams prior to decades of log drives in the 19th and 20th centuries. Channel straightening was a common practice associated with log driving in New England and was often accompanied by the removal of boulders and wood, loss of pool habitat, and overwidening of the stream channel. Streams with wood in the channel generally have higher fish populations (Flebbe, 1999), a greater abundance and richness of macroinvertebrates (Bond et al., 2006), and more complex physical habitat (Benke and Wallace, 2003).

Geomorphic monitoring of the restoration projects is being conducted to document pool formation, meander development, particle size segregation, and sustainability of the various project elements. Data collection at two guidance reaches in 2007 was used to select the restoration techniques used at the two project sites (Field, 2007). The two guidance reaches were not resurveyed in 2011 as little change was noted between the 2007 (Field, 2007) and 2010 (Field, 2010) surveys, indicating the changes observed at the project sites are the result of the restoration efforts and not due to natural variations occurring on the streams. The characteristics of the two restoration reaches and their associated guidance reaches are further described in Field (2007). The first year of project monitoring, as described in Field (2009a), occurred in Fall 2008 only two months after project construction and before any significant flows altered the constructed project elements. The third year of monitoring reported on here consisted of two parts: topographic surveys and repeat ground photography. An analysis of substrate particle size (i.e., pebble counts) was not completed given the limited change observed in previous monitoring years. The results of the 2011 monitoring are presented below and comparisons made with 2008-2010 monitoring efforts in order to document changes that have occurred since project construction. While water levels have not been monitored, at least one high flow, associated with Tropical Storm Irene, did occur in 2011 before the monitoring was completed in October and November.

2.0 TOPOGRAPHIC SURVEYS

Topographic surveying was completed with a Sokkia Set 5 Electronic Total Station. Multiple cross sections and a plan view map were measured at each site (Appendix 1). Longitudinal profiles were not surveyed in 2011. Monitoring at the Cold

Stream restoration site in 2011 extended upstream to Rock Sill 2. The 2011 surveying demarcated the position of the in-stream structures, but the position of each boulder within the structures was not mapped as ground photographs revealed individual large boulders had not moved (see Section 3.0 below).

A comparison of the 2008-2011 topographic surveys of the restoration sites documents only relatively minor changes (Appendix 1). The two rock sills at each site were designed to promote meander reformation along the straightened sections of channel by encouraging bank erosion and forcing additional flow onto the floodplain. Incipient meander growth observed in earlier monitoring (Field, 2009b; Field, 2010) continued at Rock Sill 2 at Cold Stream and at both rock sills at Enchanted Stream. While this meander growth due to recession of the bank opposite the rock sills is documented in the plan view and cross section surveys, the changes are more noticeable when comparing ground photographs from different years (see Section 3.0 below). Rock Sill 2 at Cold Stream diverts increasingly more flow into the side channel with the significant bank widening at Cross Section 4 and the growth of the gravel bar at the terminus of the side channel continuing (Figure 2; Appendix 1). Backwatering upstream of Rock Sill 1, enhanced by beaver activity, is diverting additional flow to the side channel and creating a headcut as the flow crosses the island between the side channel and main channel (Figure 3). The widening at Cross Section 4 is associated with the development of a meander along the side channel (Figure 2a). Beyond the abovementioned changes, the plan views of Cold Stream and Enchanted Stream reveal very little change, indicating the restoration sites are not sensitive to change and the observed increases in channel complexity would have unlikely occurred in the absence of restoration.

While the rock weirs on Enchanted Stream were designed to maintain flow in the active channel, small side channels were constructed around the weirs at Cold Stream to mimic the natural weir in the Enchanted Stream guidance reach (Field, 2007). The side channels have been sustained in the three years since restoration as revealed in Cross Section 3, but erosion continues to reduce the original height of the island between the main and constructed side channel (Appendix 1). The side channel development is also evident on the repeated ground photographs (see Section 3.0 below).

A comparison of the cross sections from 2008 to 2011 reveals that pools constructed downstream of the rock weirs have sustained their depth or infilled only slightly (Appendix 1). Partial infilling was expected at the time of construction as the pools were purposefully excavated deeply to break up the armor of cobbles that would have inhibited natural pool formation. Pool depth at the tip of Rock Sill 2 on Cold Stream appears to be increasing as the bank recession and meander formation into the opposite bank continues (see Cross Section 7). The downstream end of the plunge pool associated with Rock Weir 1 at Enchanted Stream infilled slightly between 2010 and 2011 (see Cross Section 3). This infilling might be the result of smaller flows in 2010 compared to 2011 with growth of the plunge pool likely to occur again when high flows are experienced. The maintenance of pools associated with the constructed in-stream

structures through three years of monitoring indicates the pools are likely to be sustained as long as the structures remain intact.

3.0 GROUND PHOTOGRAPHS

Digital ground photographs taken at both restoration sites in 2008 were repeated at, or very close to, the same locations in 2011 (Appendix 2). The photos were also redone in 2009 (Field, 2009b) and 2010 (Field, 2010). The structure numbers as indicated on the plan view maps (Appendix 1) are provided with each photograph along with the photo orientation in order to more readily relocate the photo points for future monitoring. The photographs document that through a third year with high flows the in-stream structures, individually placed boulders, and anchored large woody debris have remained largely in place with no significant movement. The only new significant change between 2010 and 2011 was removal of an anchored log in the side channel at Cold Stream where growth of a meander removed the bank material in which the log was buried (Appendix 2 – Photo 3).

Many of the minor changes observed in 2010 continued in 2011. Observations from the Cold Stream photo comparisons include: 1) considerable flow passes through the side channel at Rock Weir 2 at Cold Stream (Appendix 2 - Photo 9); 2) the side channel displays increased complexity as meanders form along its length (Photo 3); 3) wood and leaves have been trapped behind the structures (Photos 1 and 4); 4) flow deflection around Rock Sill 2 is causing continued recession of the opposite bank as intended (Photo 7); 5) overflow into the side channel from Rock Sill 2 has continued to increase during low flow periods (Photo 7); 6) the low-flow discharge in the side channel continues to increase (Photos 3 and 8); 7) scour around the left flank (looking downstream) of Rock Weir 1 continued between 2010 and 2011 (Photo 10; Figure 4). The ground photographs on Cold Stream document the increased channel complexity and improved aquatic habitat resulting from the restoration. Flow jets associated with Rock Sill 1 characterize these changes (Photo 4).

The minor changes along Enchanted Stream since 2010 include: 1) continued scour along the bank opposite Rock Sill 1 as intended (Photos 11 and 12); 2) scour on the left bank opposite Rock Sill 2 as intended (Photos 17 and 18), 3) trapping of leaves by placed wood on the bar form downstream of the bridge (Photo 18); and 4) continued rotation into the pool of the isolated boulder downstream of Rock Weir 2 (Photo 20). The wood added to the bar on the right bank between Rock Sill 2 and Rock Weir 2 has collected some woody material and fines as intended (Photo 18; Figure 5). If the accumulation of material can be sustained then additional flow may be contained within the channel and increase the intended scour on the left bank.

4.0 CONCLUSIONS

A fourth year of monitoring in 2011 at two restoration sites on Cold Stream and Enchanted Stream provides documentation of stream response to the addition of in-

stream structures and removal of floodplain constraints. The creation of a step-pool morphology through the construction of rock weirs and rock sills introduced channel complexity to a formerly plane bed channel. Topographic cross sections indicate that the pools associated with these in-stream structures have sustained their depth through the first three years following implementation. The rock sills and rock weirs were designed to add additional channel complexity by increasing channel sinuosity. Although the planform changes are developing slowly, continued bank scour around the flanks of some rock sills and weirs in 2011 are an indication that meander formation is occurring as designed. The documented success of the Cold Stream and Enchanted Stream restoration projects and lack of significant alterations to the in-stream structures during four years of monitoring demonstrate the meander growth, pool development, increased channel complexity, and other aquatic habitat improvements will be sustainable into the future. Similar restoration approaches should prove equally effective along other streams in New England where physical habitat has been greatly impacted by a legacy of log drives.

5.0 REFERENCES

Benke, A. C., and Wallace, J. B., 2003, Influence of wood on invertebrate communities in streams and rivers: American Fisheries Society Symposium, v. 37, p. 149-177.

Bond, N. R., Sabater, S., Glaister, A., Roberts S., and Vanderkruk, K., 2006, Colonisation of introduced timber by algae and invertebrates, and its potential role in aquatic ecosystem restoration: Hydrobiologia, v. 556, p. 303-316.

Field, J., 2007, Enchanted Stream and Cold Stream Restoration Planning, The Forks, Maine: Unpublished report submitted to Florida Power and Light, Lewiston, ME.

Field, J., 2009a, Monitoring of Stream Restoration on Cold Stream and East Branch Enchanted Stream near The Forks, Maine: Unpublished report submitted to Florida Power and Light, Lewiston, ME.

Field, J., 2009b, Monitoring of Stream Restoration on Cold Stream and East Branch Enchanted Stream near The Forks, Maine – Year 2: Unpublished report submitted to Florida Power and Light, Lewiston, ME.

Field, J., 2010, Monitoring of Stream Restoration on Cold Stream and East Branch Enchanted Stream near The Forks, Maine – Year 3: Unpublished report submitted to Nextera Energy, Lewiston, ME.

Flebbe, P.A., 1999, Trout use of woody debris and habitat in Wine Spring Creek, North Carolina: Forest Ecology and Management, v. 114, p. 367-376.

FIGURES

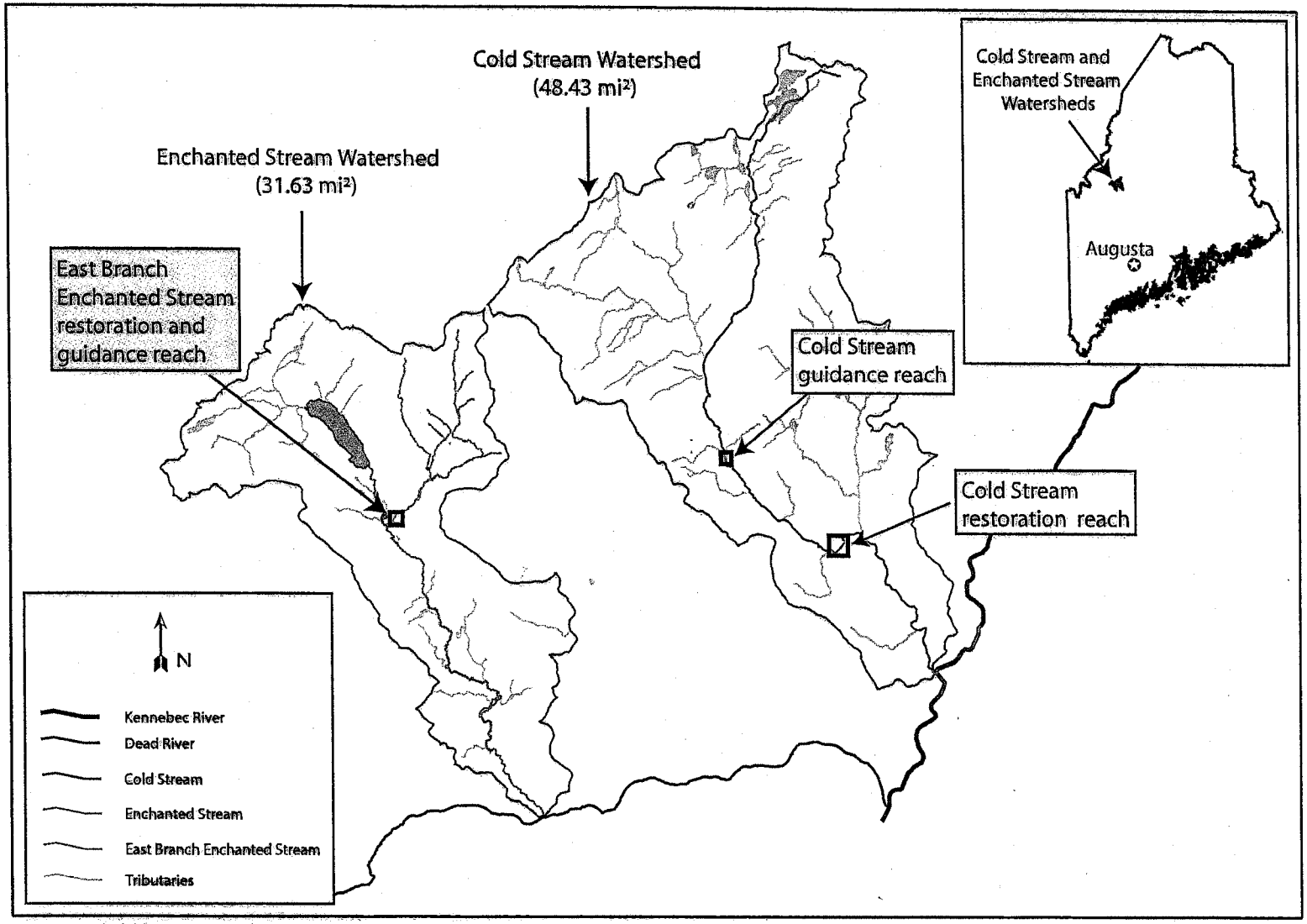


Figure 1. Cold Stream and Enchanted Stream watershed map.

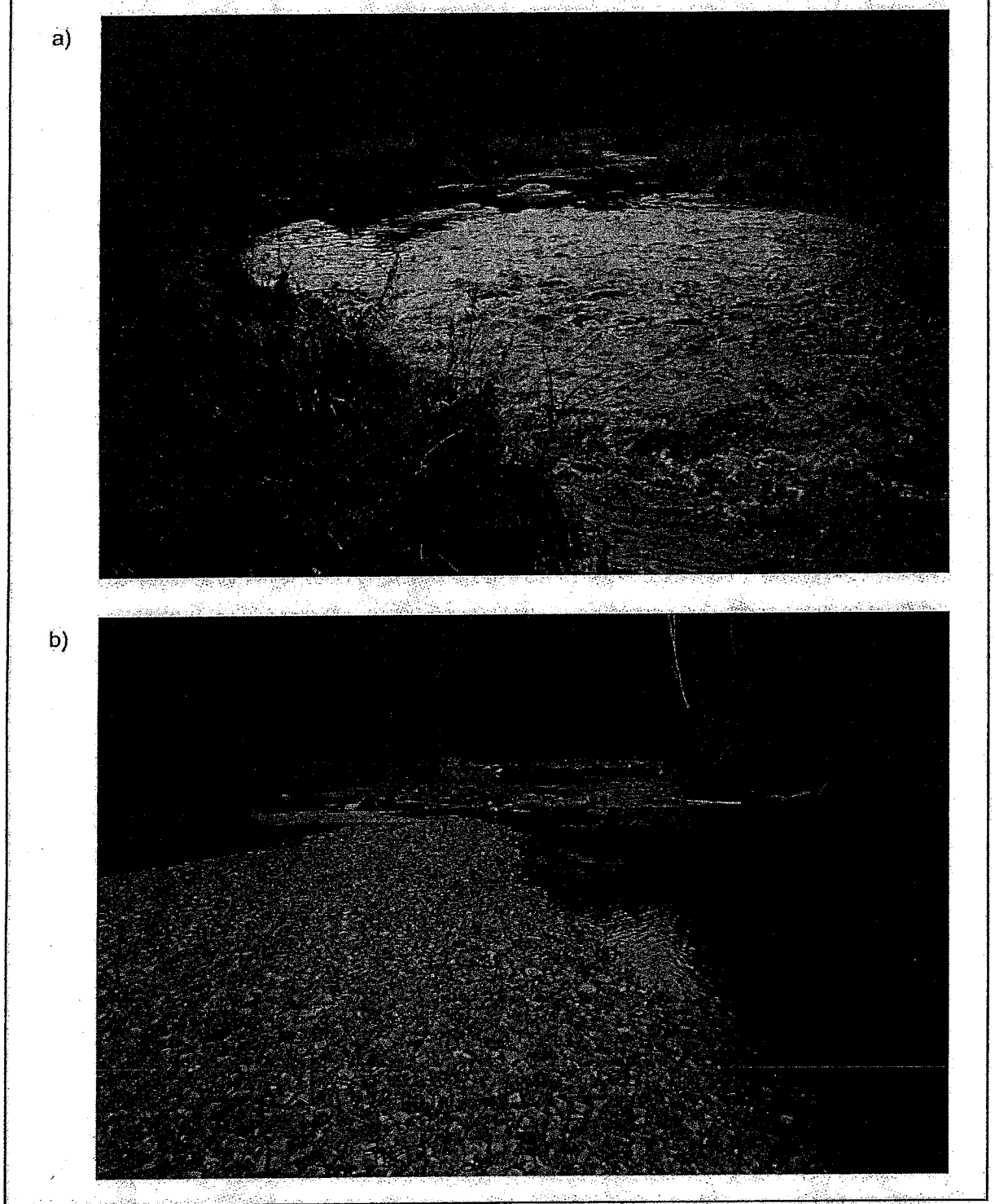


Figure 2. Changes along the Cold Stream restoration site resulting from increased flow in the side channel include a) development of meanders along the side channel and b) growth of the gravel bar at the terminus of the side channel.

Figure 3. Flow diversion into the side channel from upstream of Rock Sill 1 is causing a headcut across the island separating the side channel from the main channel.

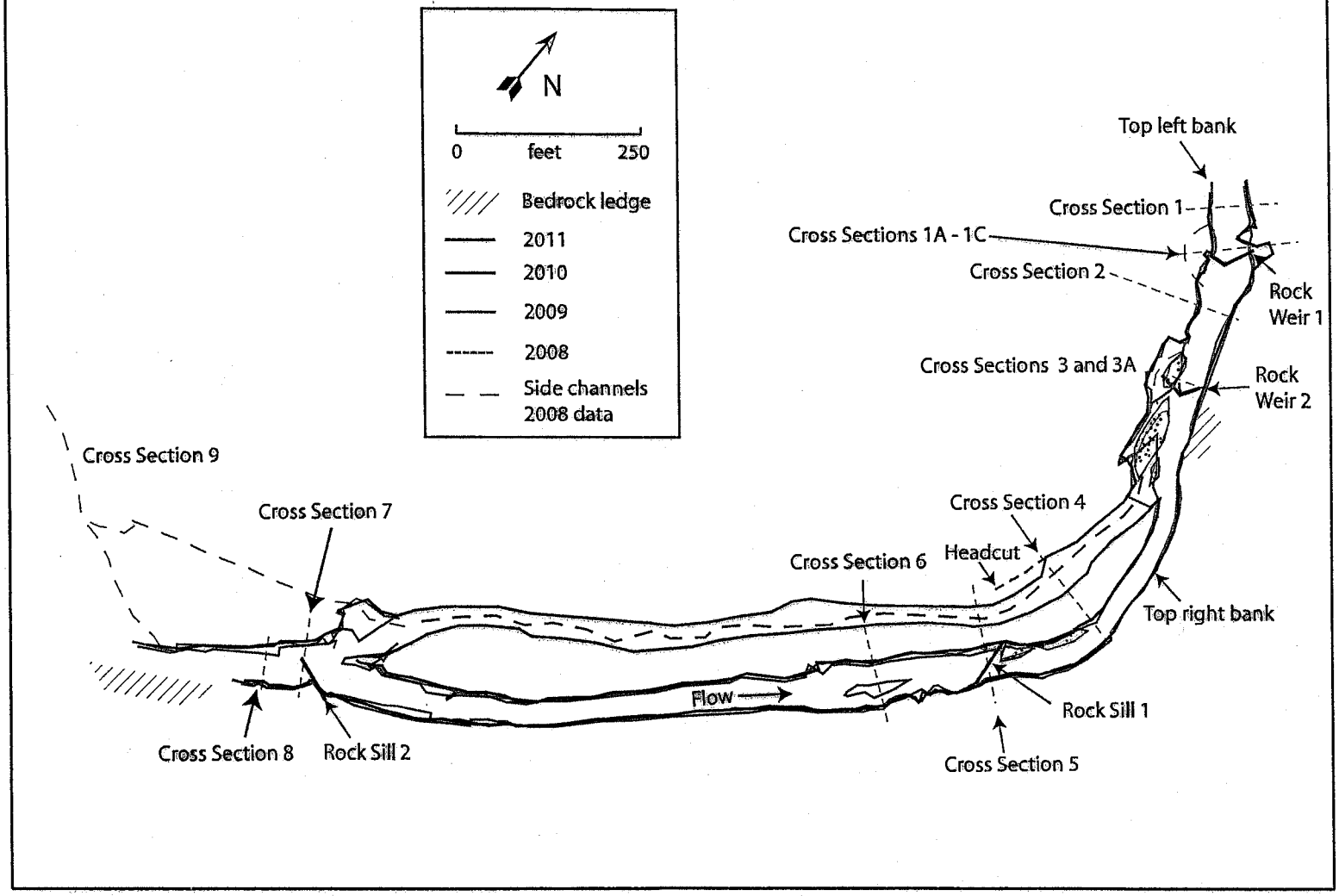
Figure 4. Scour around the left flank of Rock Weir 1 at Cold Stream continued in 2011.

Figure 5. Organic material is being trapped by the added wood on the bar form downstream of the bridge on Enchanted Stream.

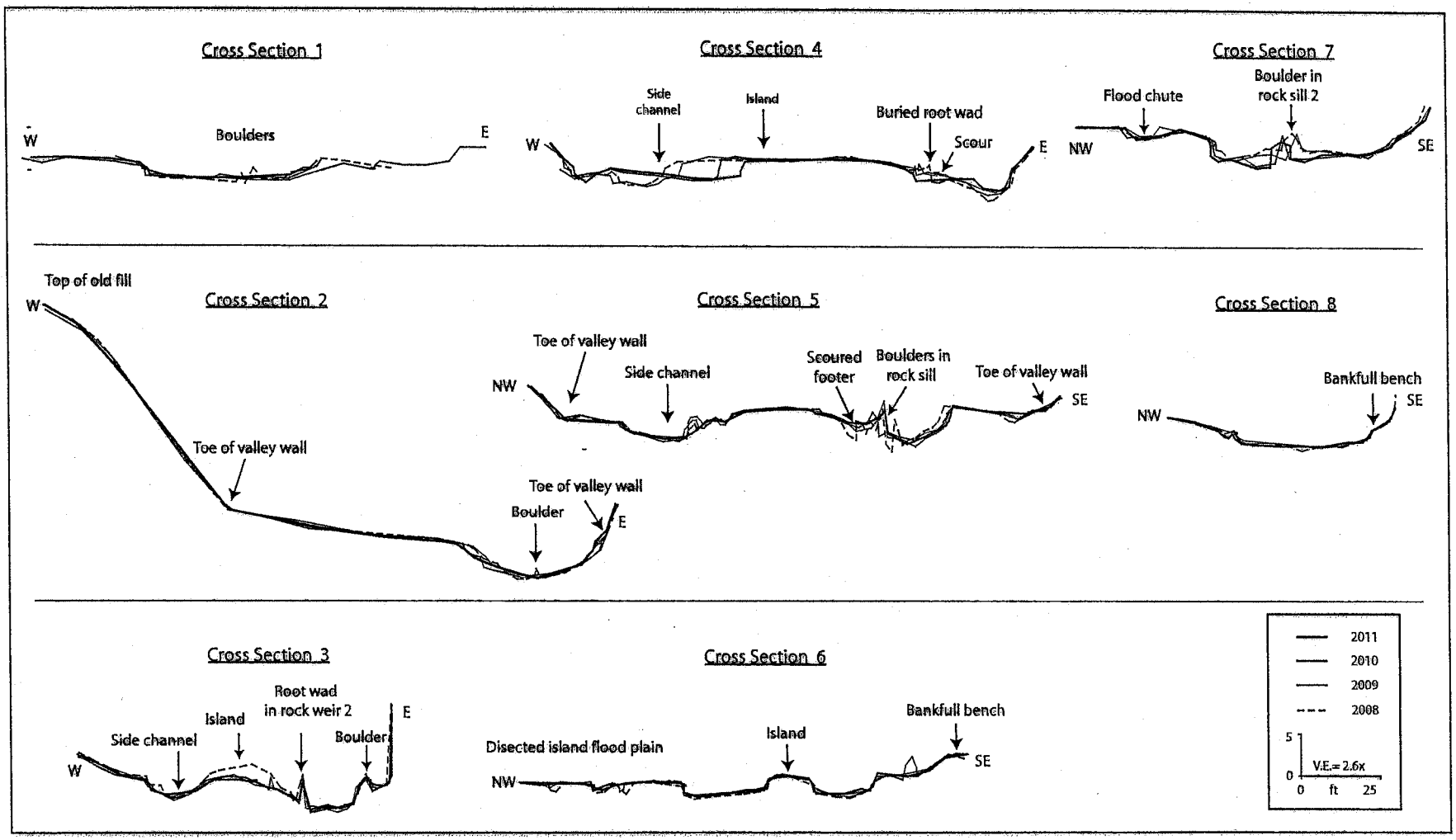
APPENDICES

APPENDIX 1

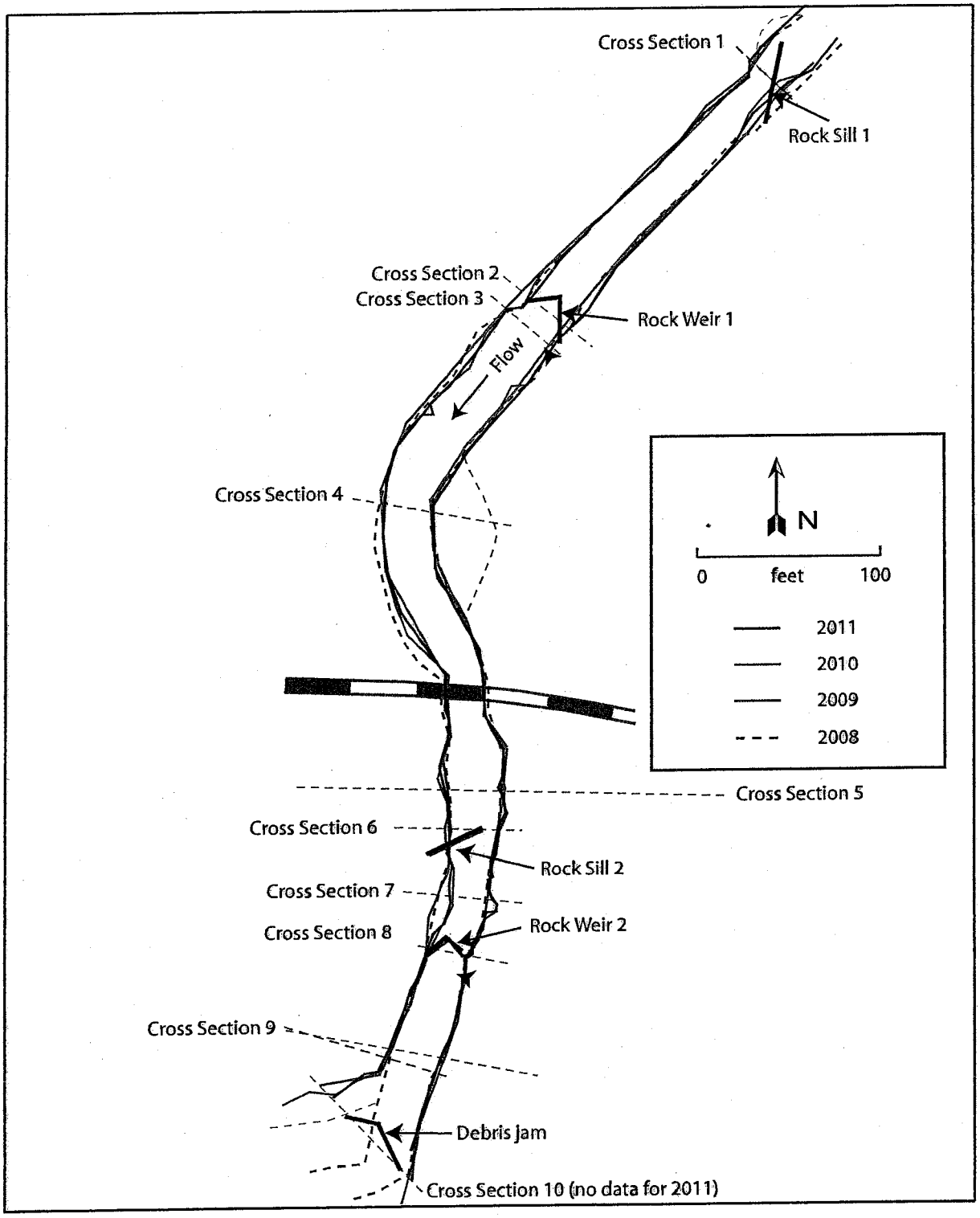
(Topographic survey data)



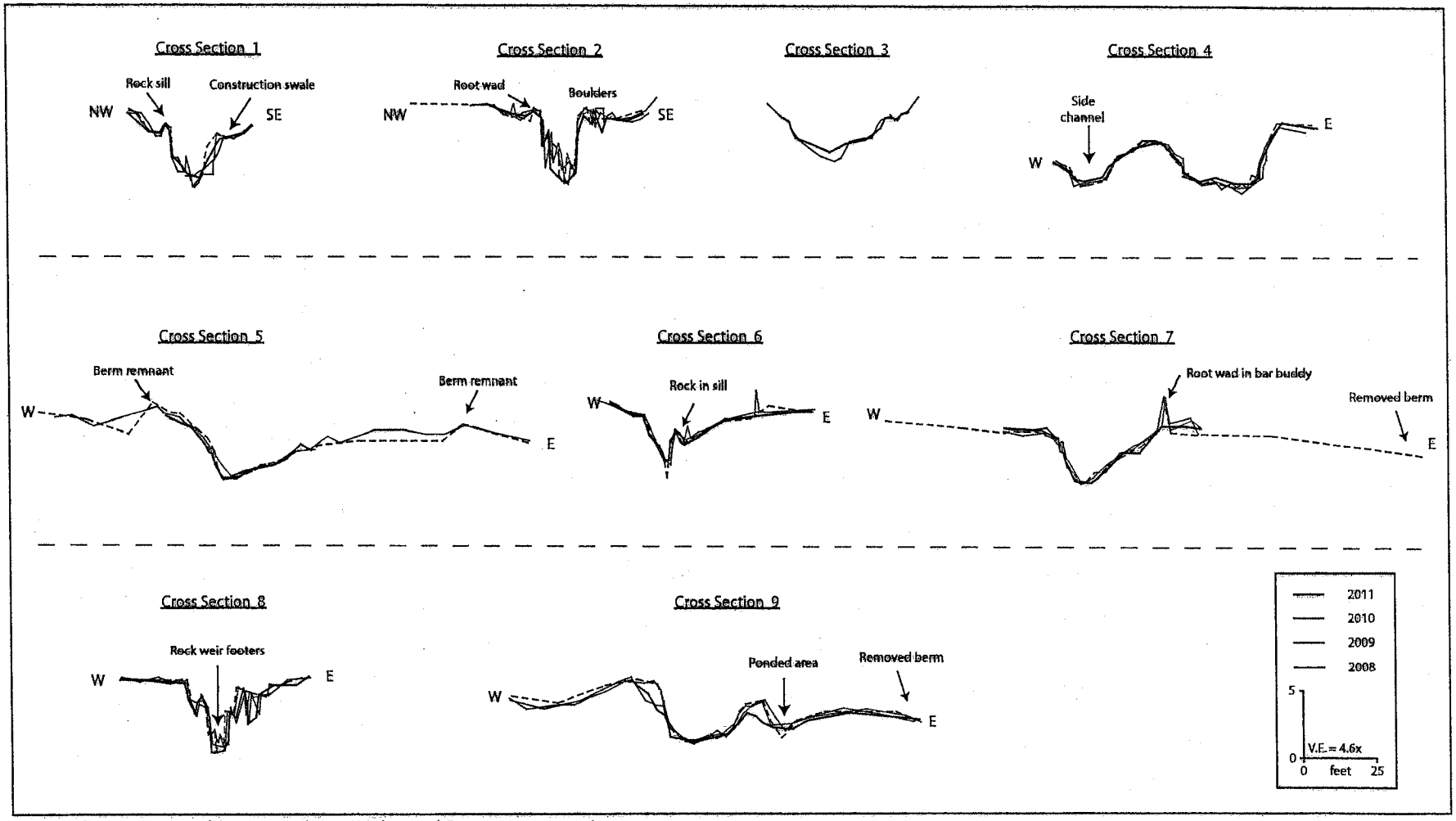
Appendix 1. Topographic survey data - Cold Stream plan view.



Appendix 1. Topographic survey data - Cold Stream cross sections.



Appendix 1. Topographic survey data - Enchanted Stream plan view.

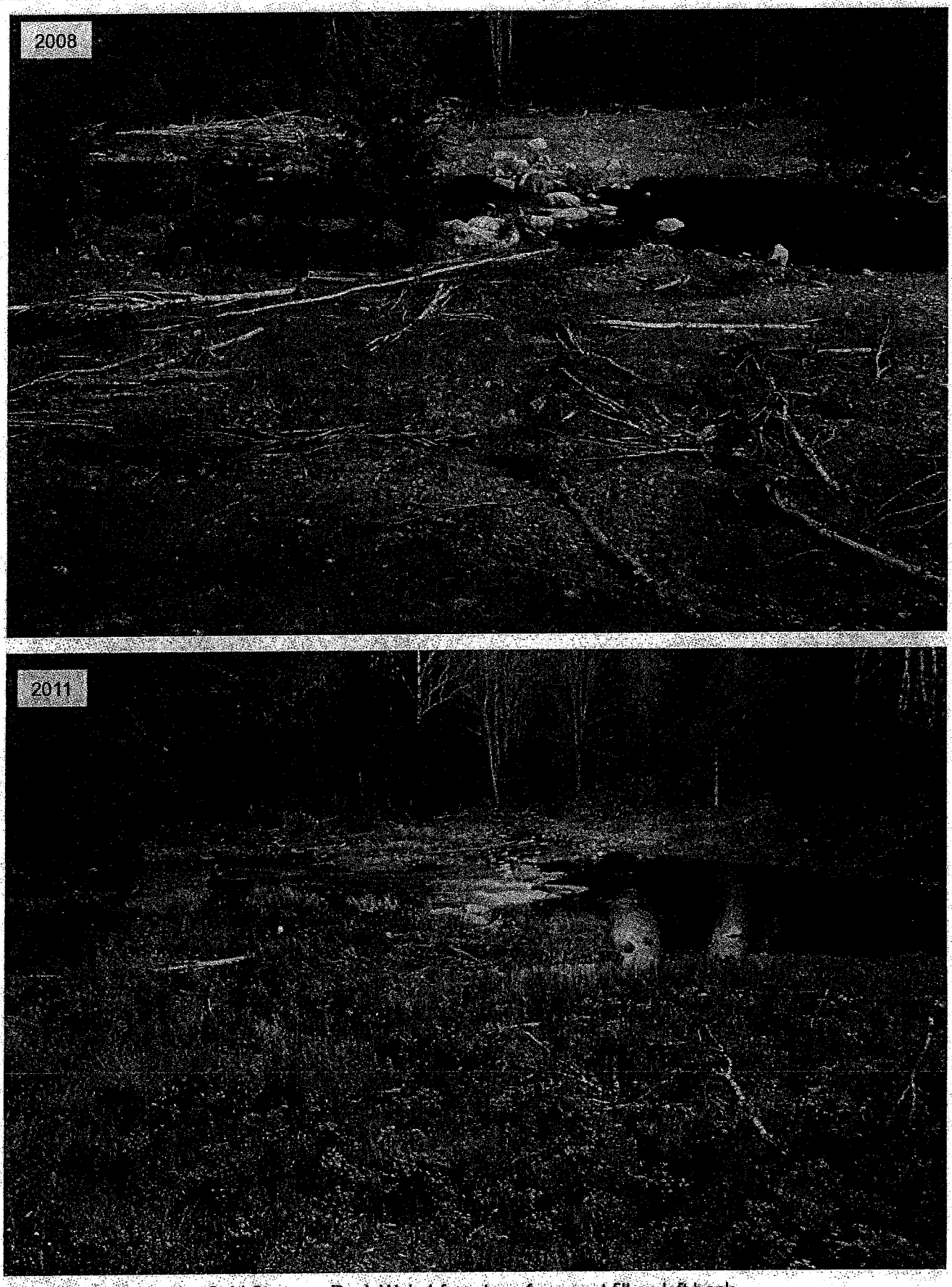


Appendix 1. Topographic survey data - Enchanted Stream cross sections.

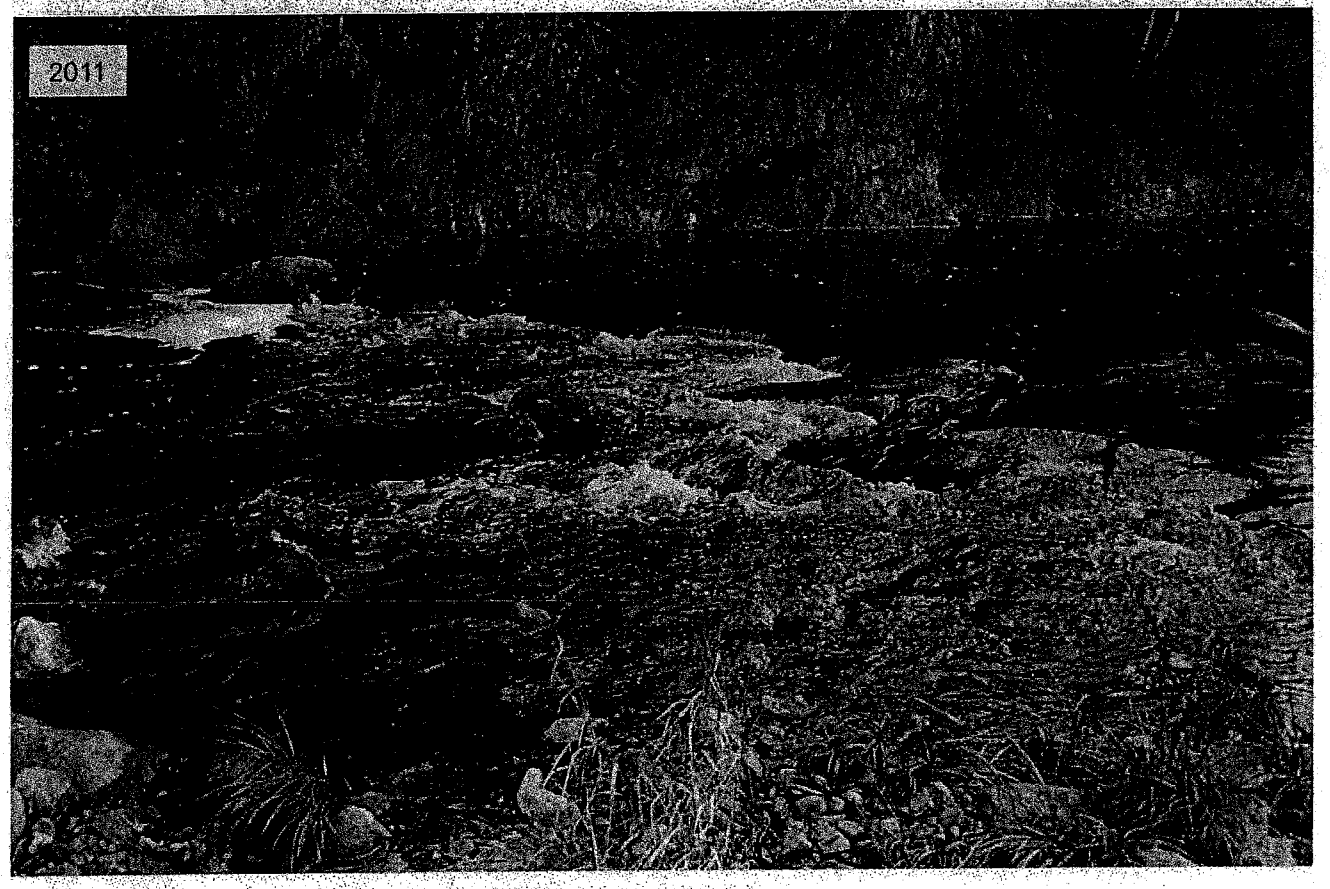
APPENDIX 2

(Repeated ground photographs)

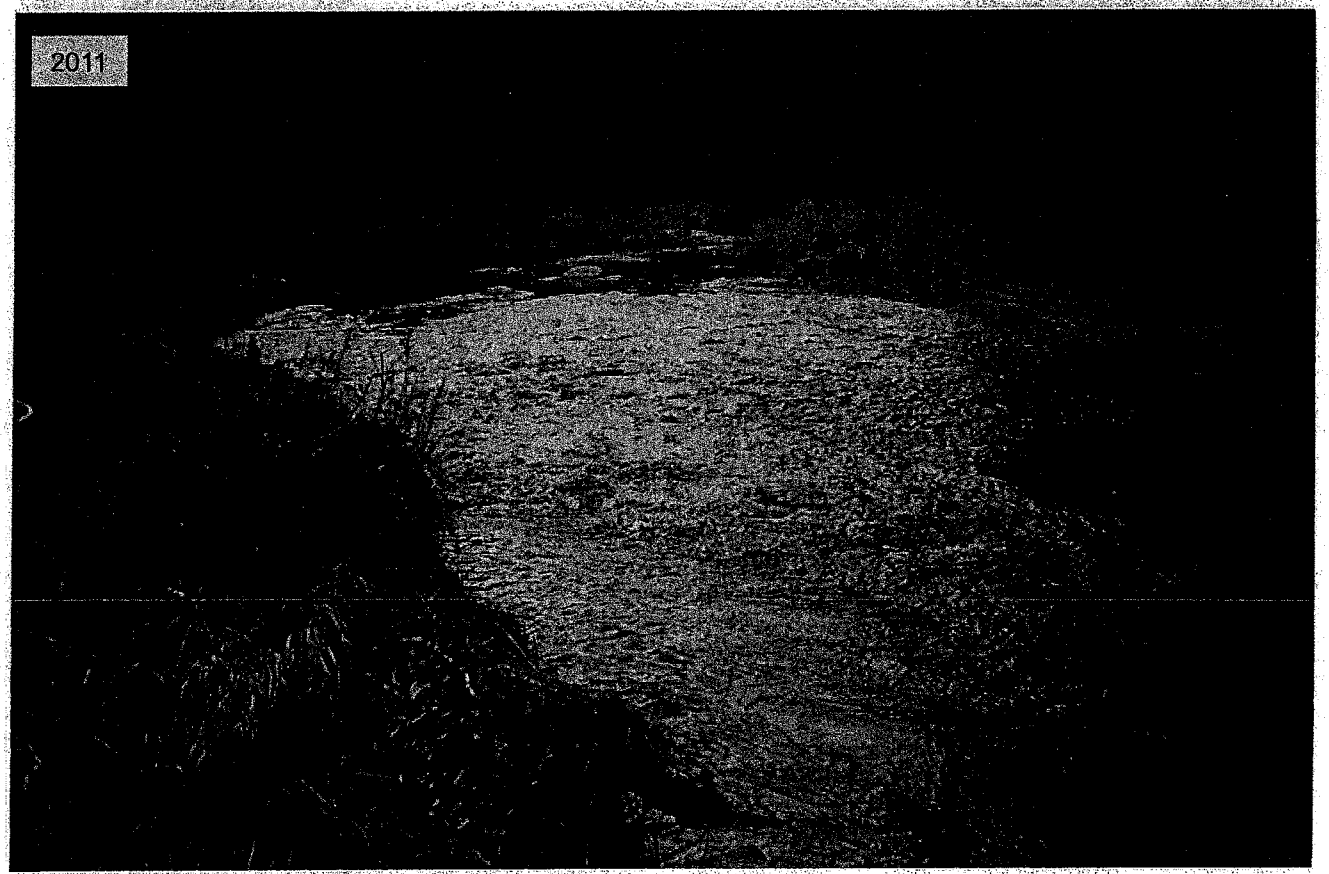
Appendix 2. Photo 1 - Cold Stream - Rock Weir 1 from right bank.



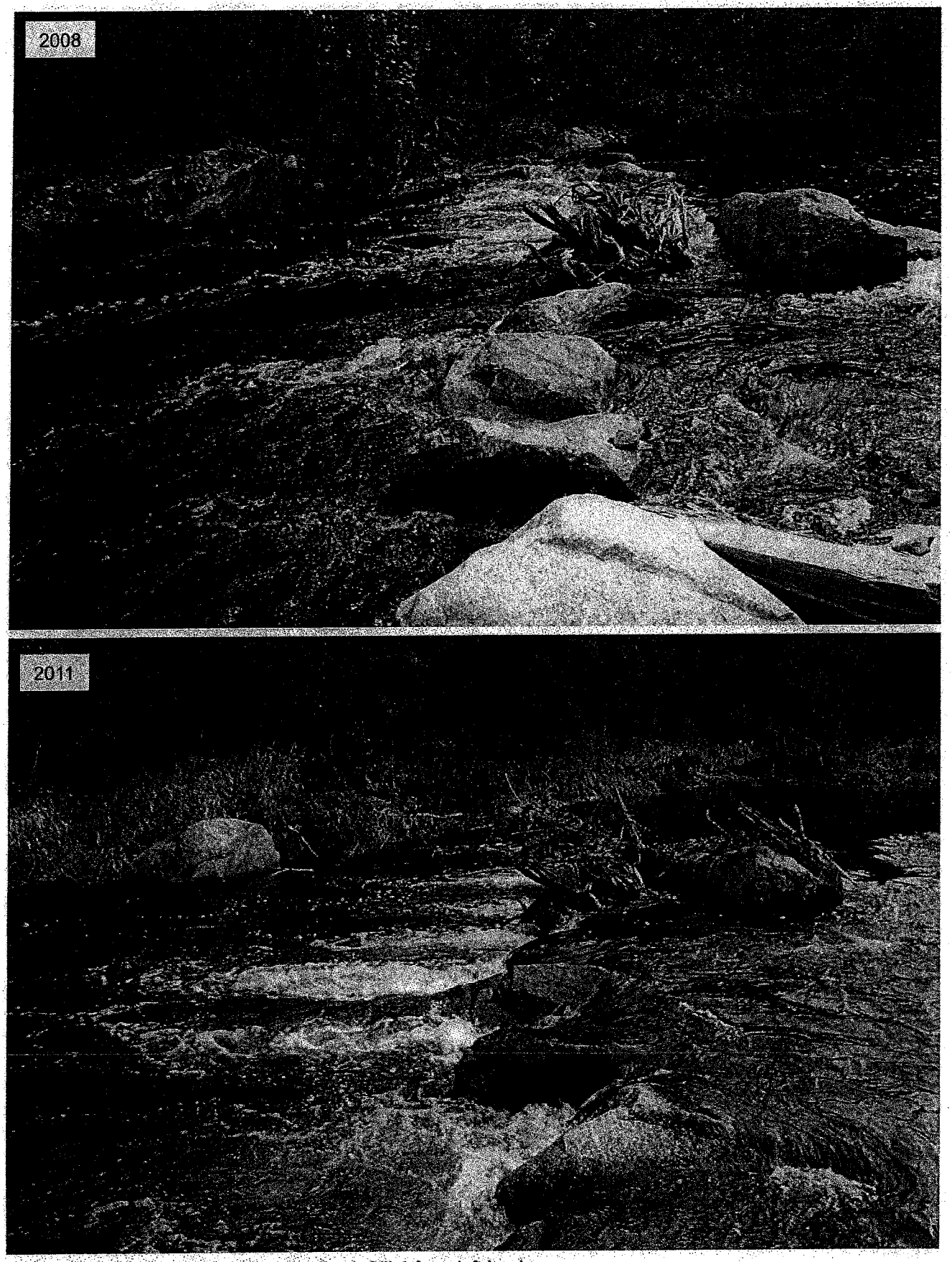
Appendix 2. Photo 1b - Cold Stream - Rock Weir 1 from top of remnant fill on left bank.



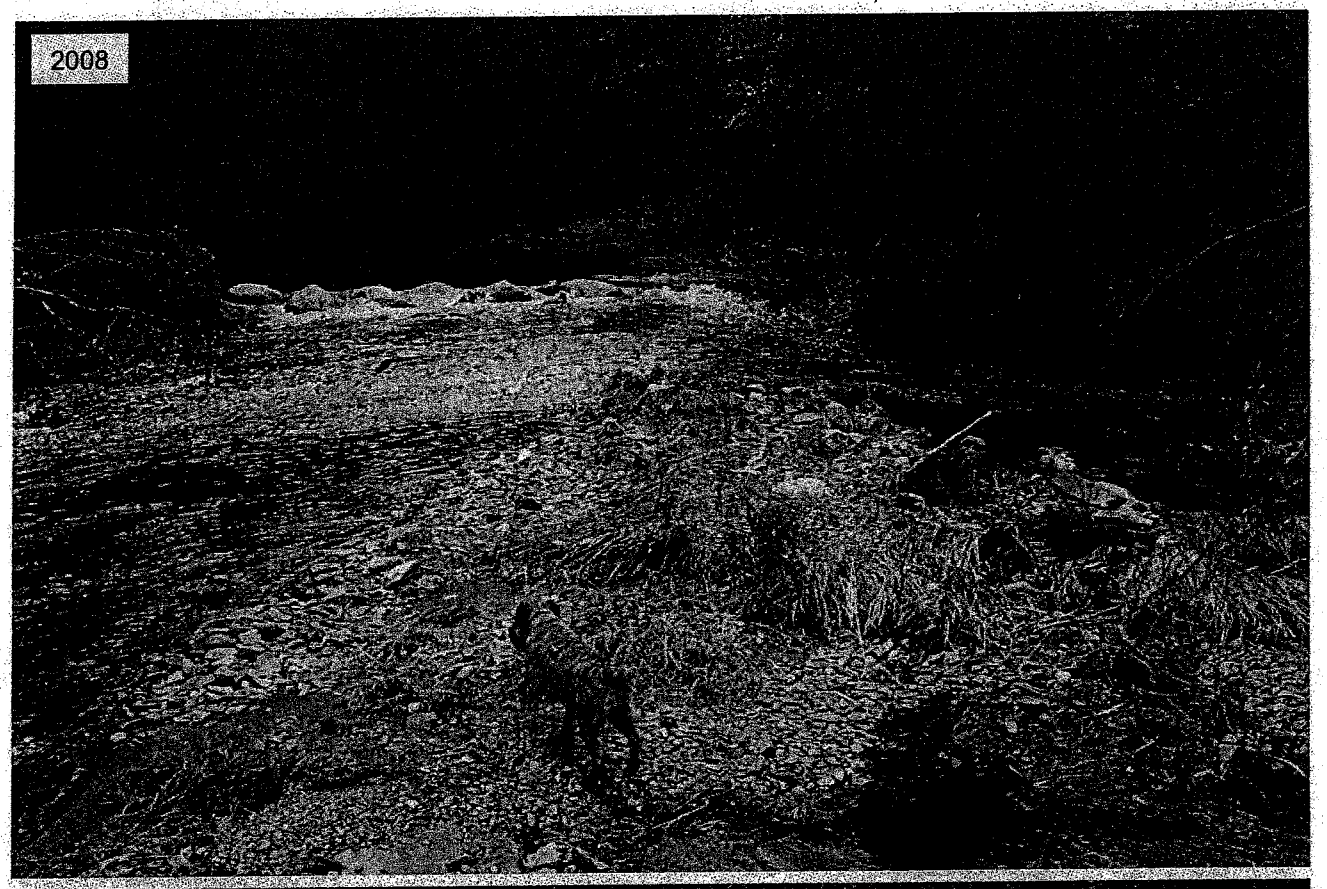
Appendix 2. Photo 2 - Cold Stream - Rock Weir 2 from left bank.

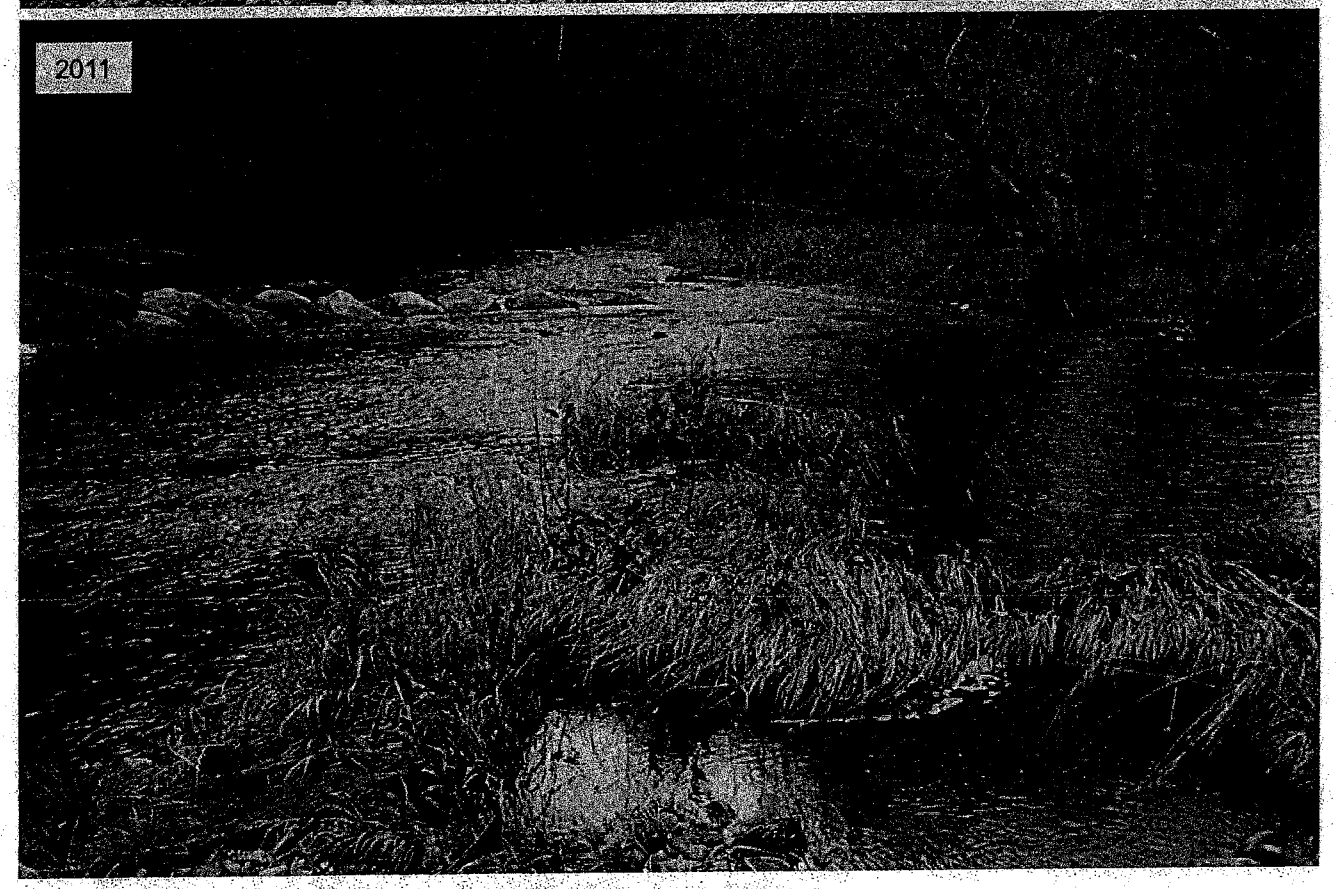


Appendix 2. Photo 3 - Cold Stream - Placed root wad in side channel. Note root wad removed.

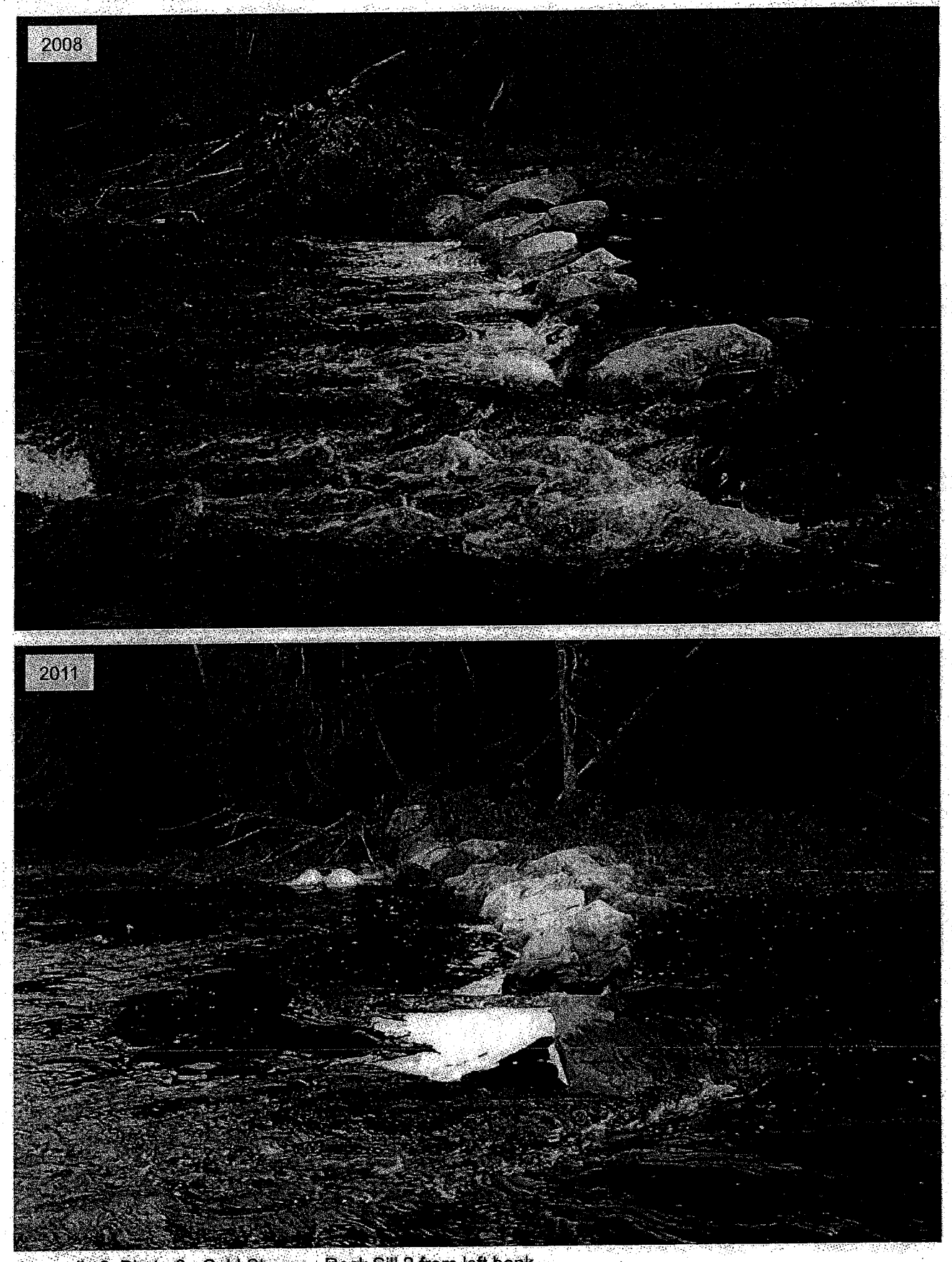


Appendix 2. Photo 4 - Cold Stream - Rock Sill 1 from left bank.

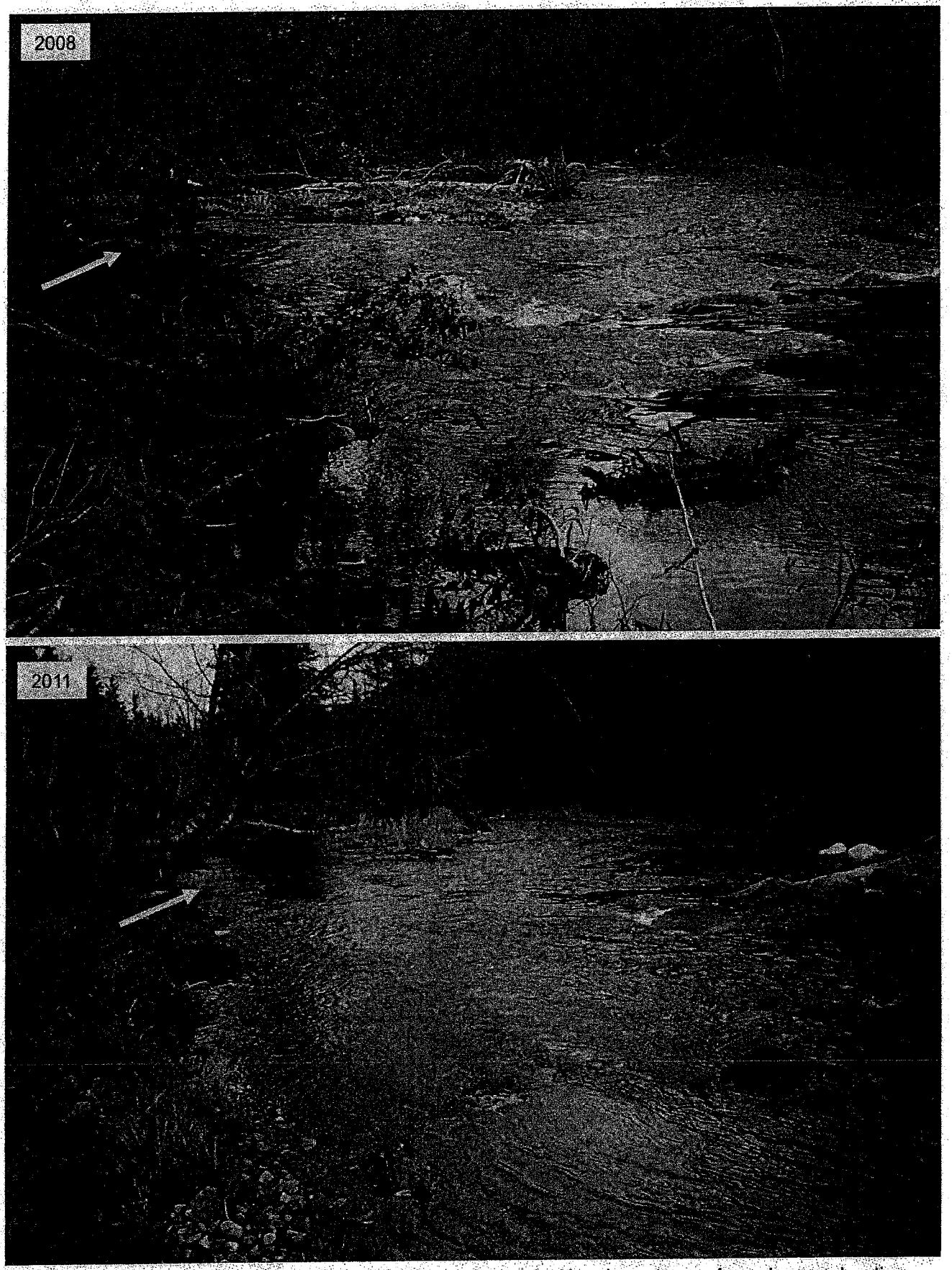




Appendix 2. Photo 5 - Cold Stream - Rock Sill 2 from downstream.

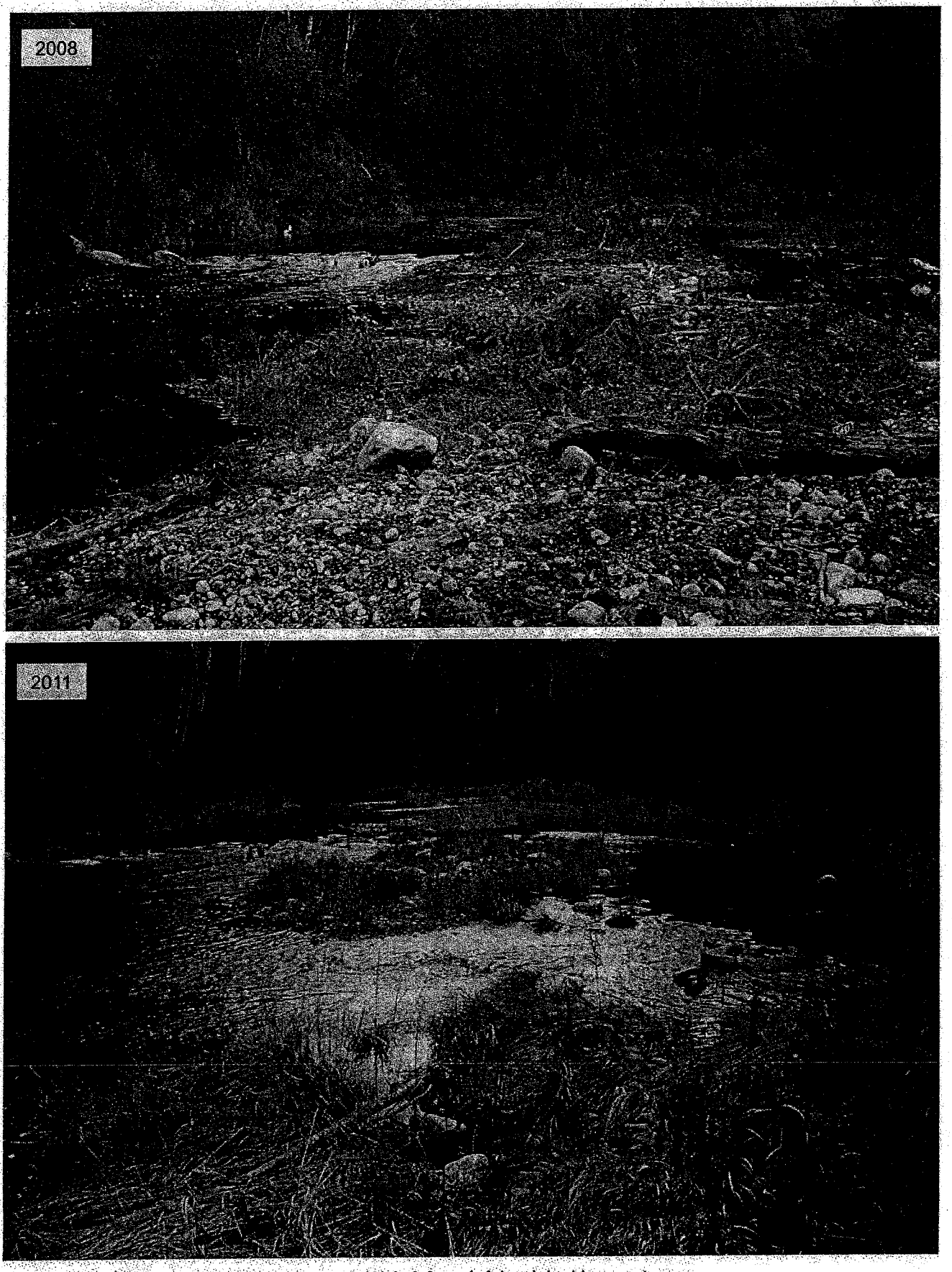


Appendix 2. Photo 6 - Cold Stream - Rock Sill 2 from left bank.

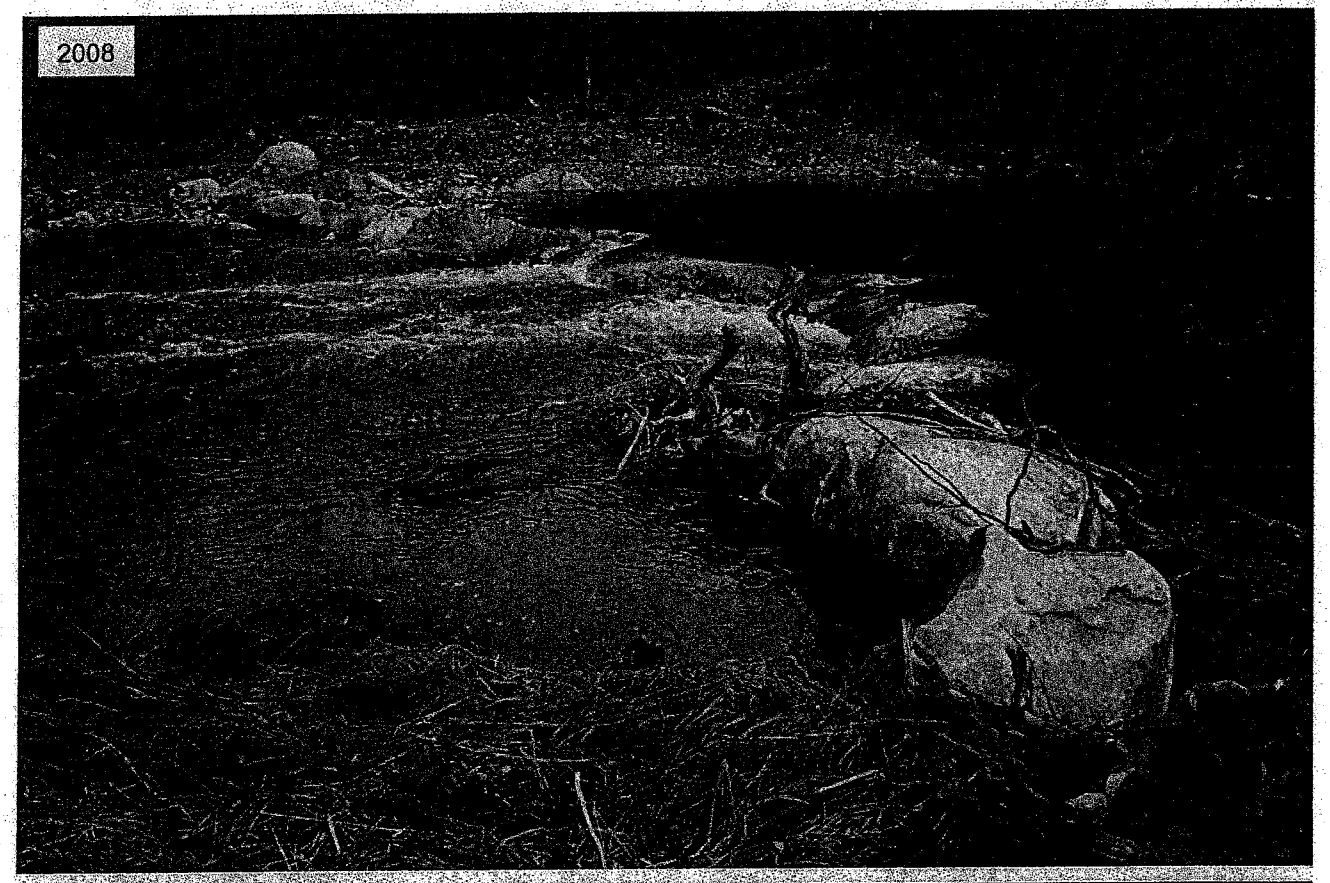


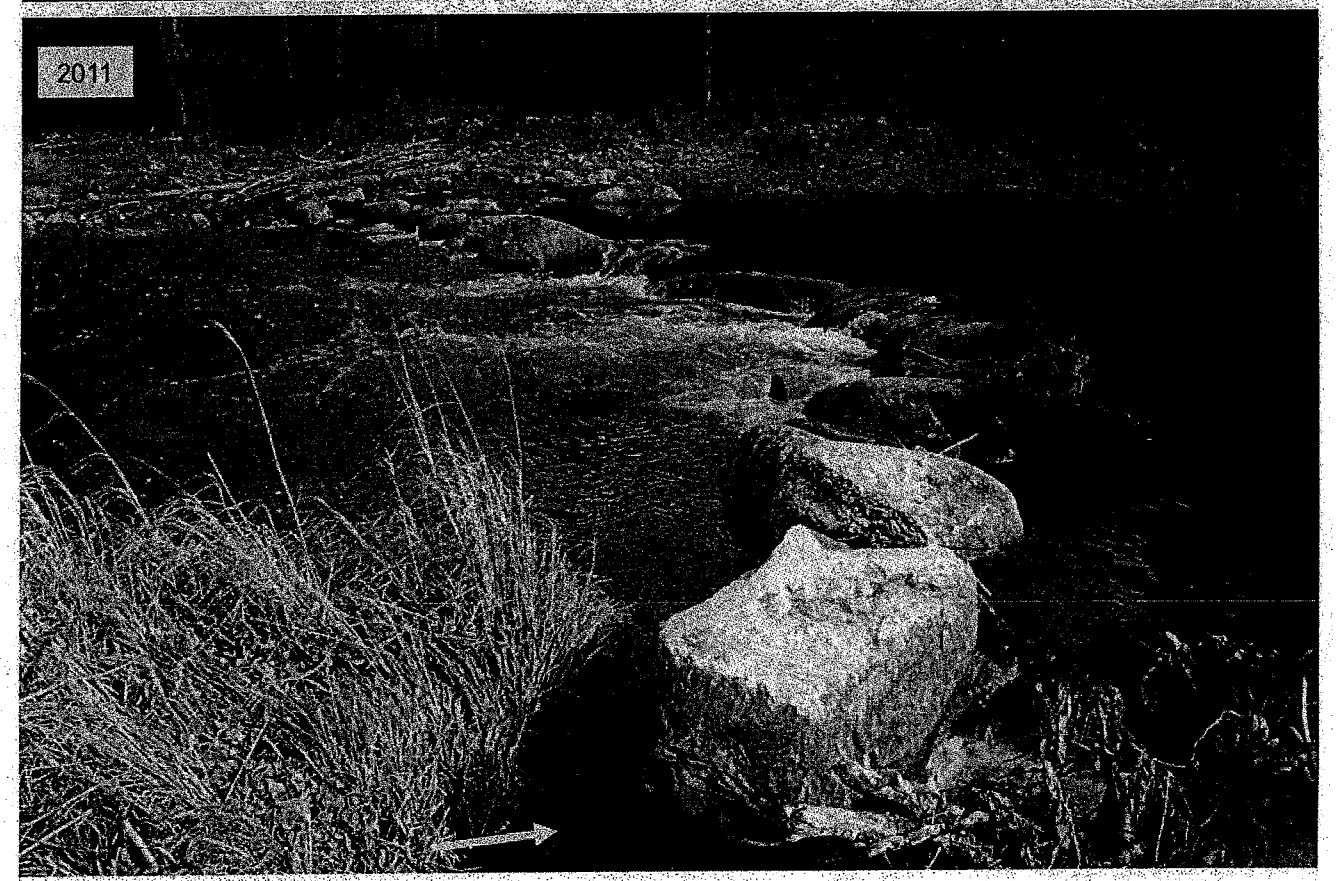
Appendix 2. Photo 7 - Cold Stream - Rock Sill 2 from left bank looking downstream. Arrow in same location.

Appendix 2. Photo 8 - Cold Stream - Side channel looking downstream from near Rock Sill 2.

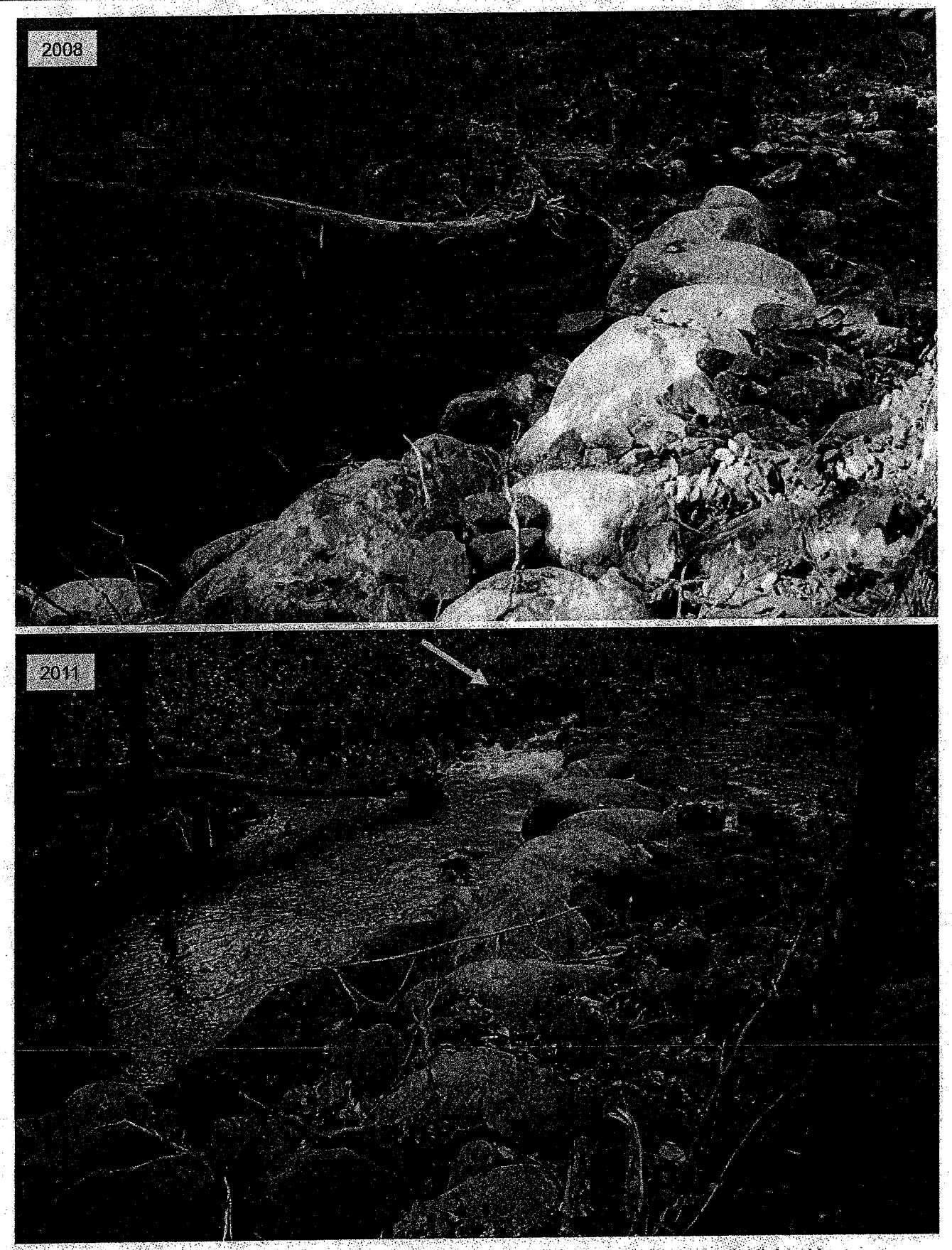


Appendix 2. Photo 9 - Cold Stream - Rock Weir 2 from left bank looking upstream.





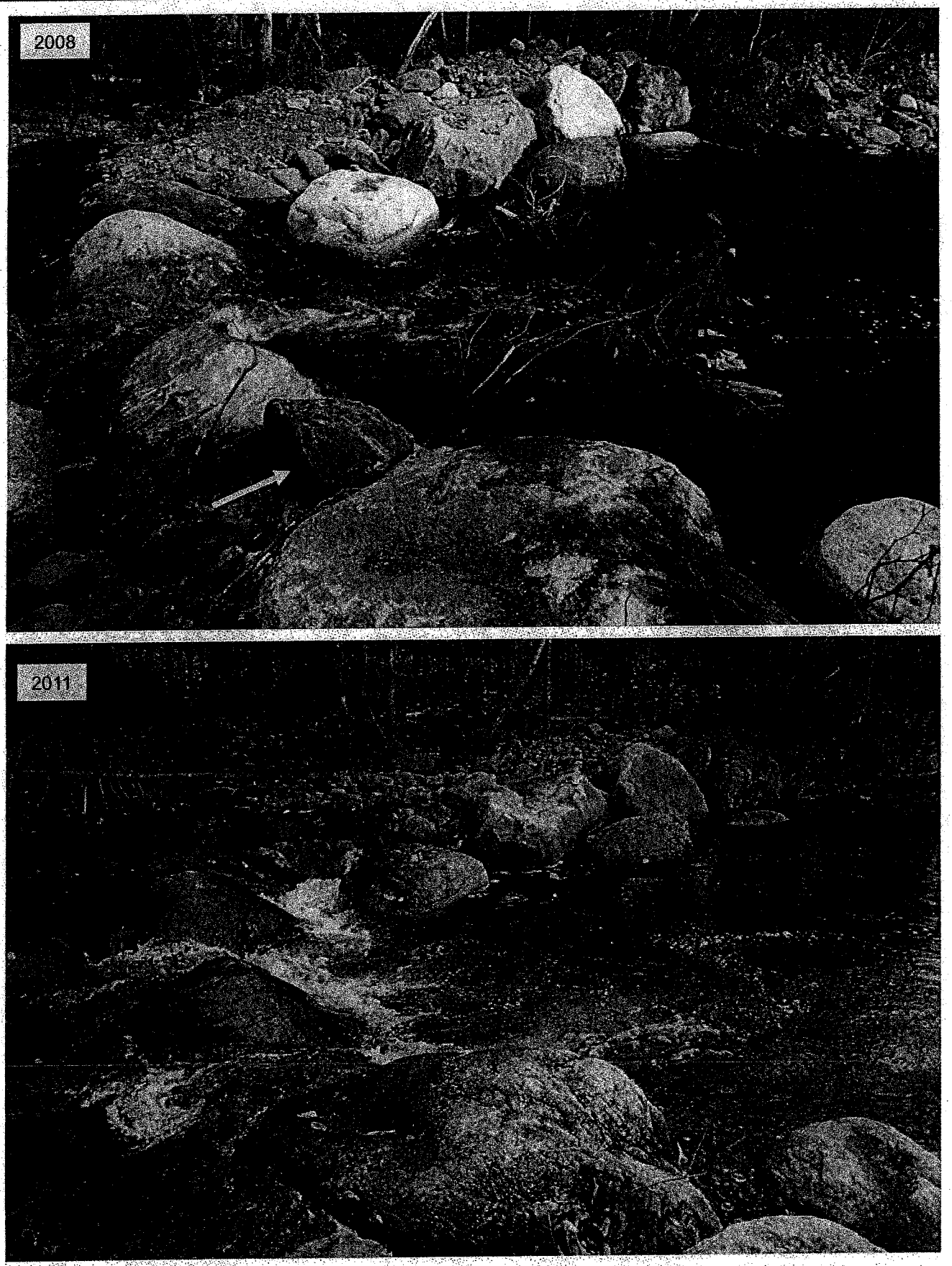
Appendix 2. Photo 10 - Cold Stream - Rock Weir 1 from left bank. Note scour around boulder by arrow.



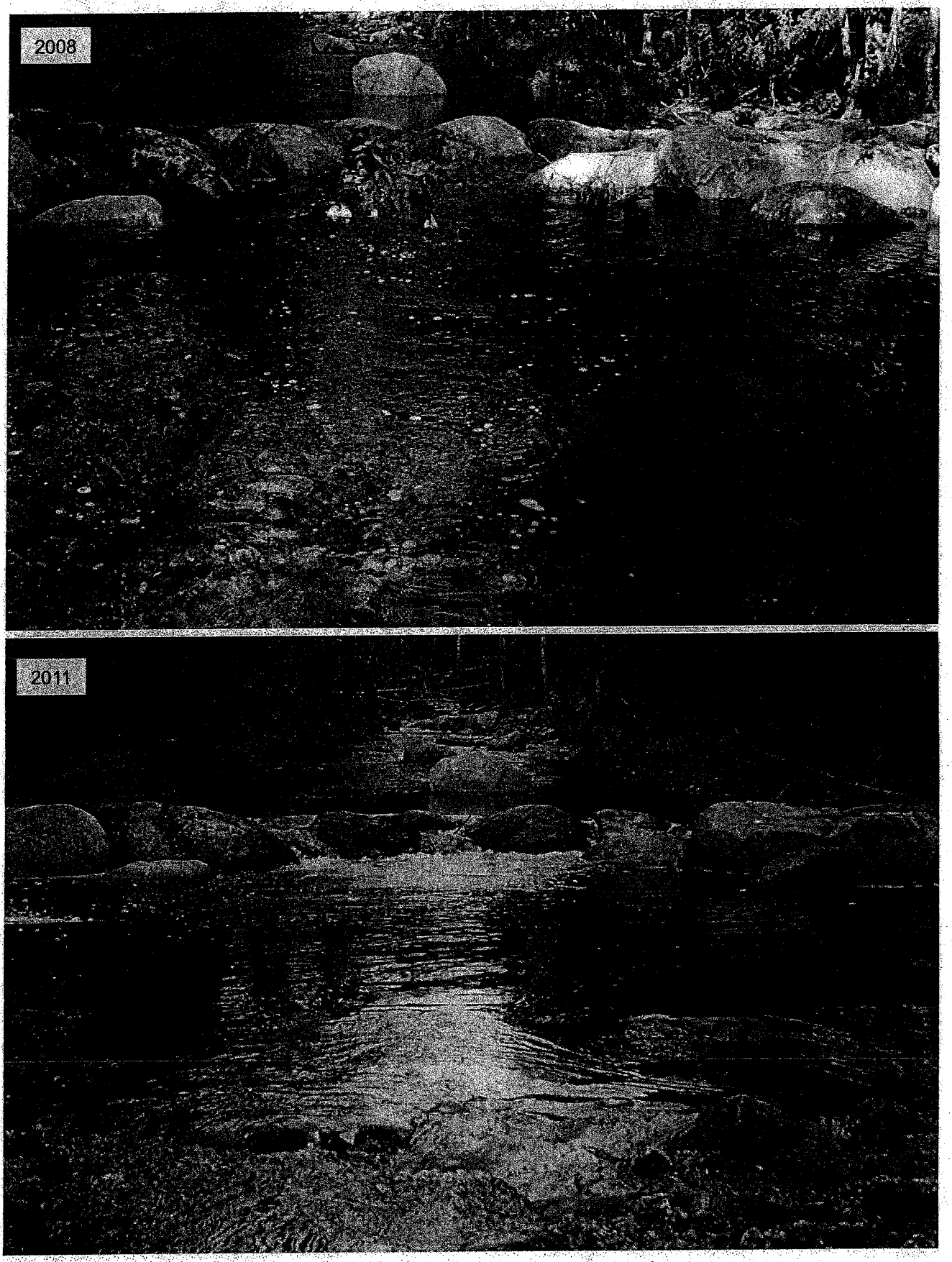
Appendix 2. Photo 11 - E. Branch Enchanted - Rock Sill 1 from left bank. Note scour highlighted by arrow.

Appendix 2. Photo 12 - E. Branch Enchanted - Rock Sill 1 from downstream. Note increased flow under log.

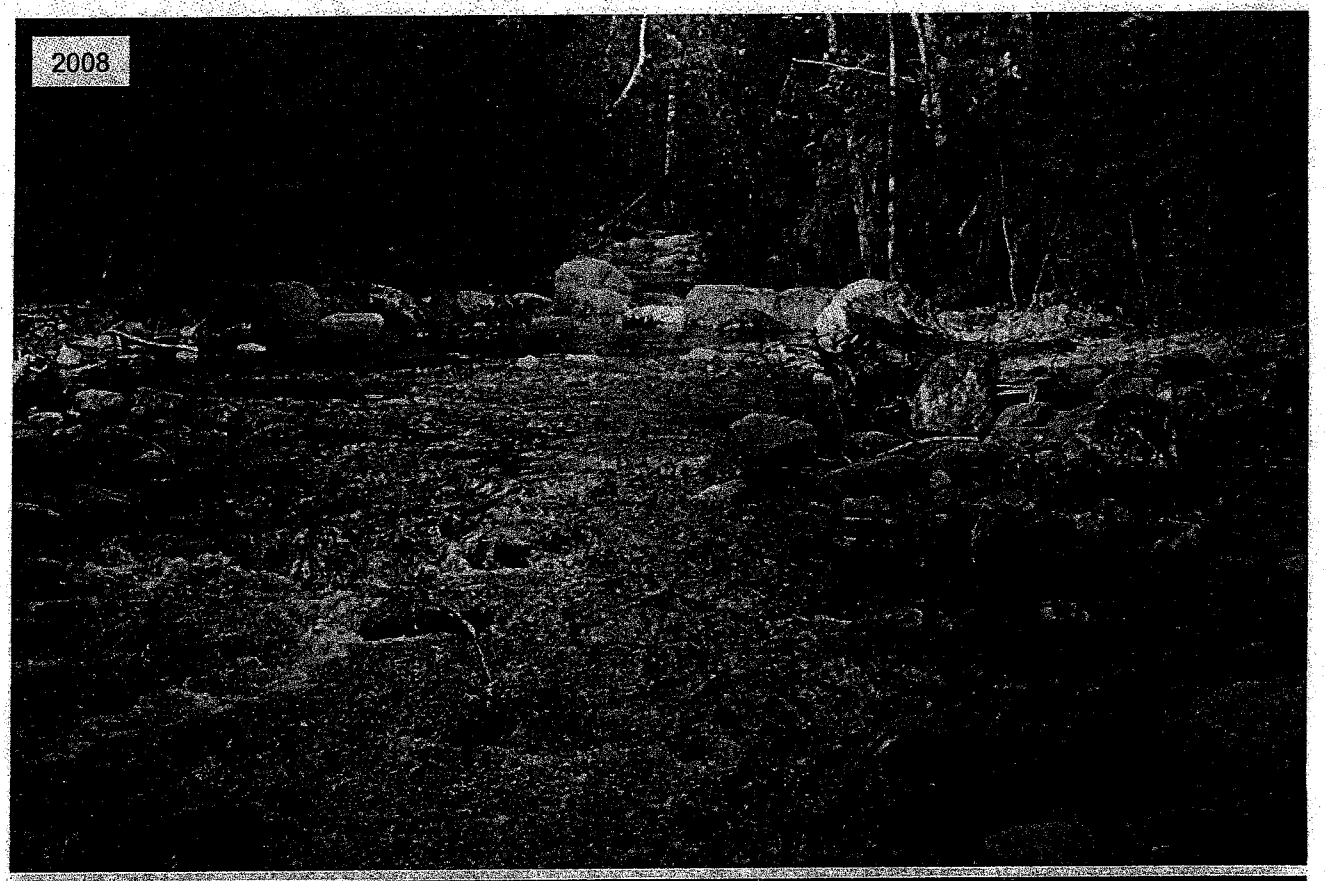
Appendix 2. Photo 13 - E. Branch Enchanted - Boulder additions from upstream standing on Rock Sill 1.

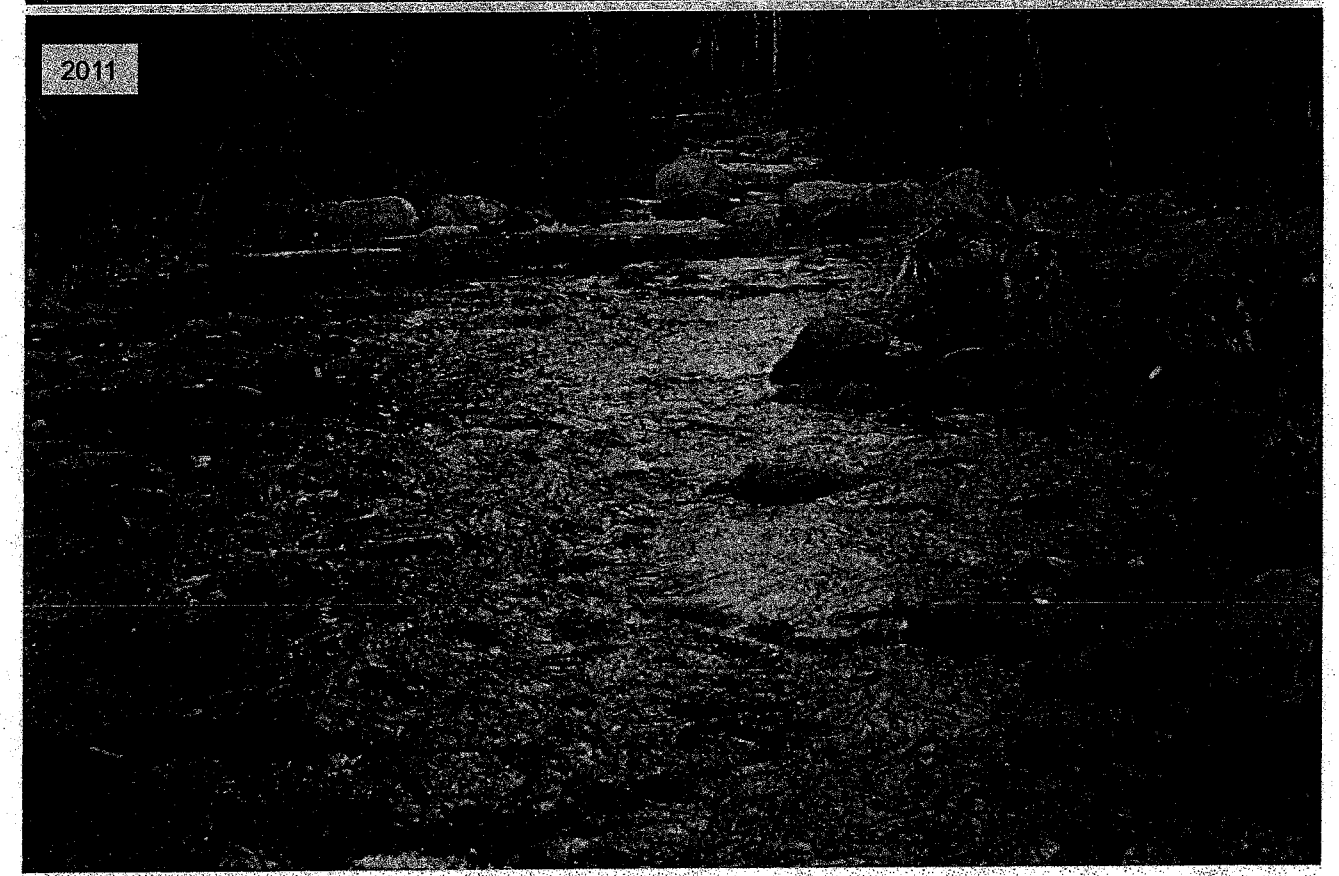


Appendix 2. Photo 14 - E. Branch Enchanted - Rock Weir 1 from right bank. Note boulder by arrow is missing.

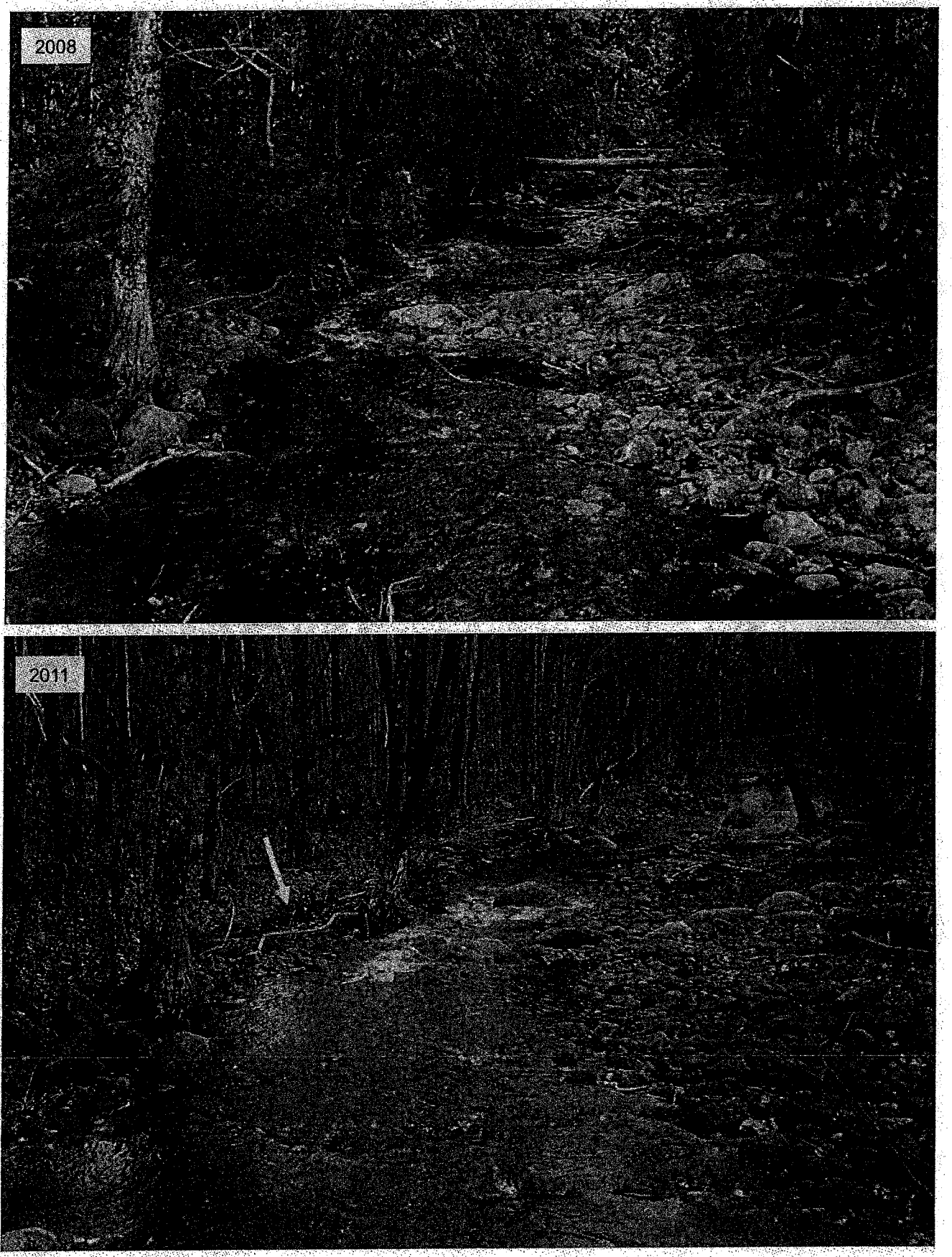


Appendix 2. Photo 15 - E. Branch Enchanted - Rock Weir 1 from downstream.

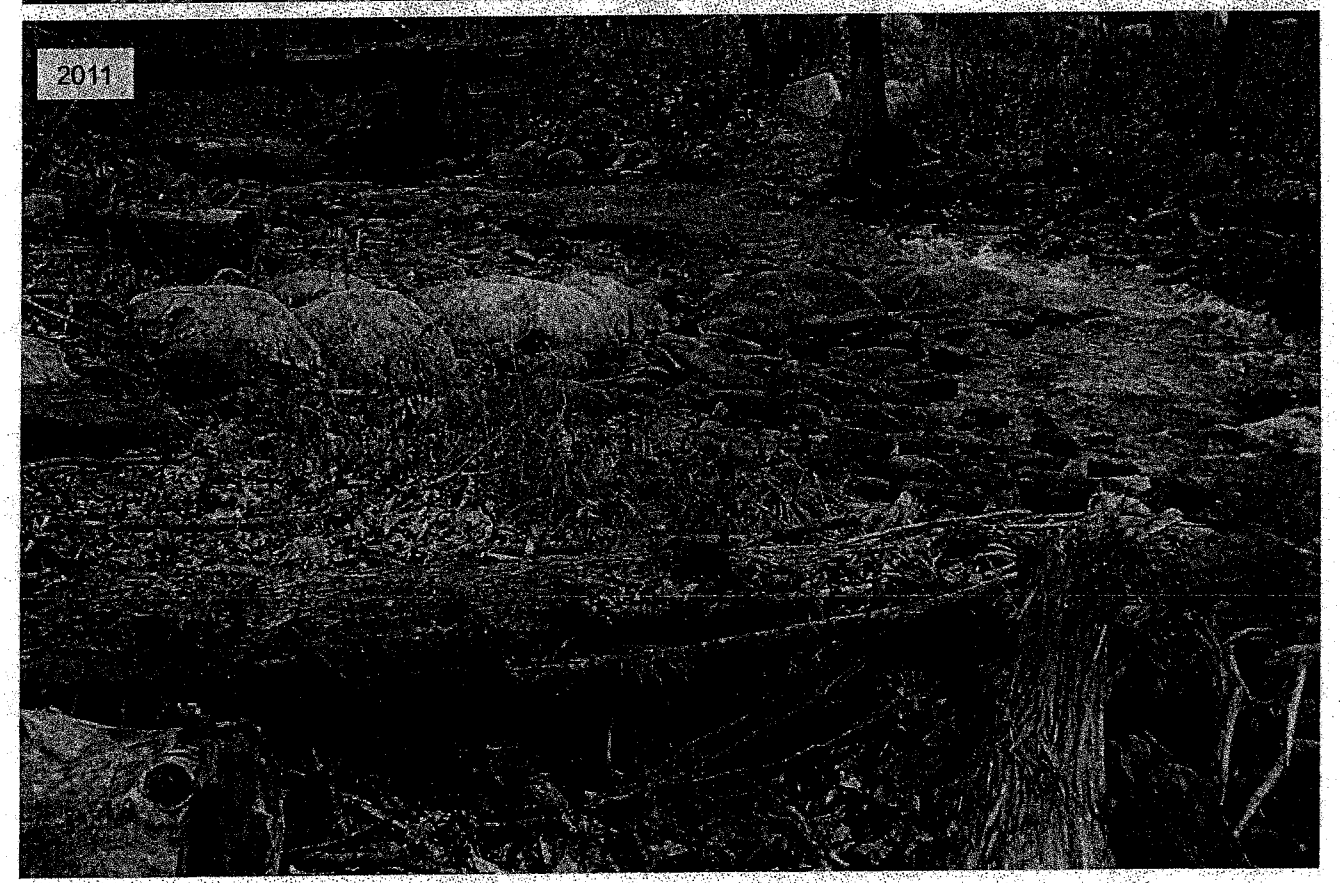




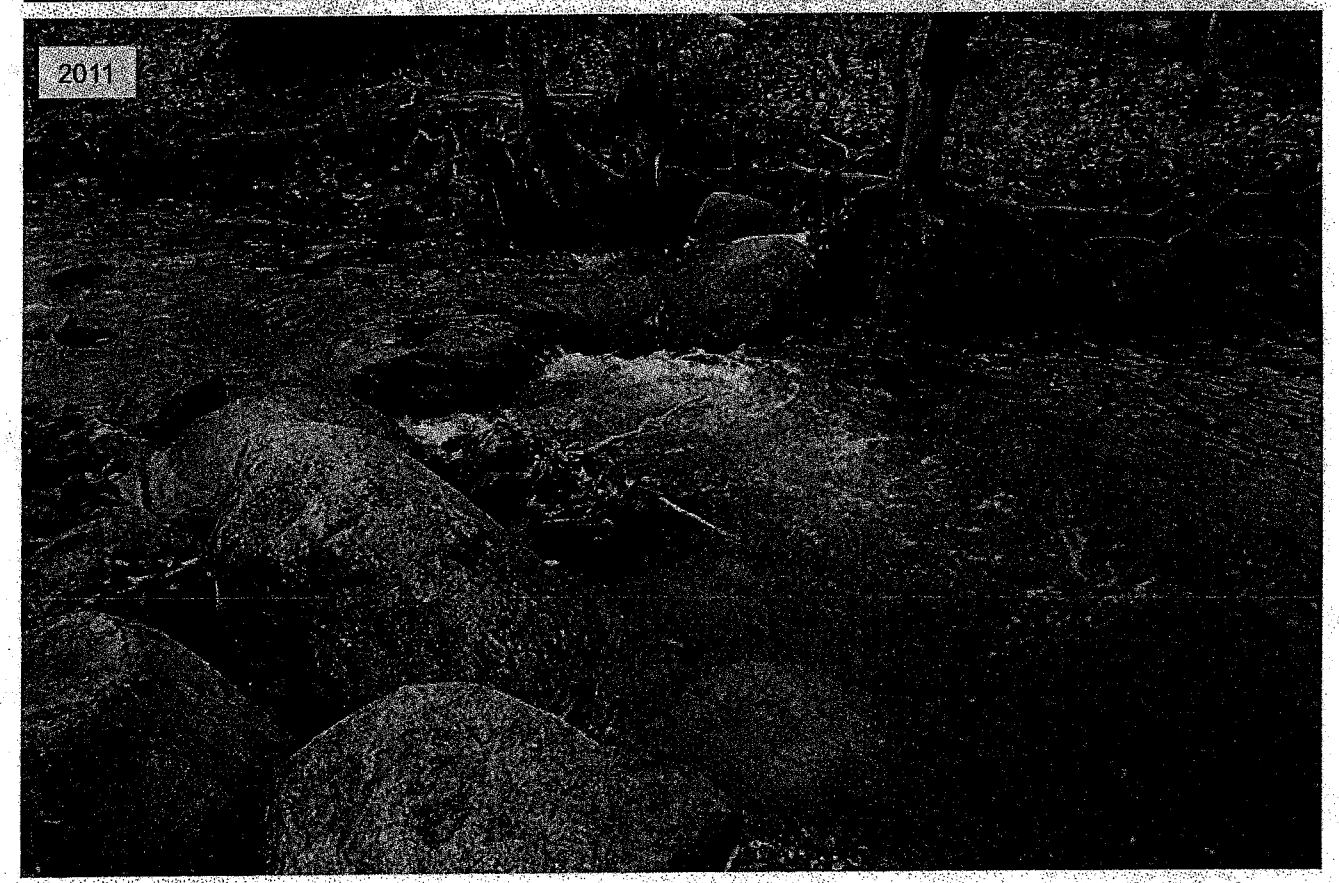
Appendix 2. Photo 16 - E. Branch Enchanted - Rock Weir 1 from downstream. Note placed log to right of photo.



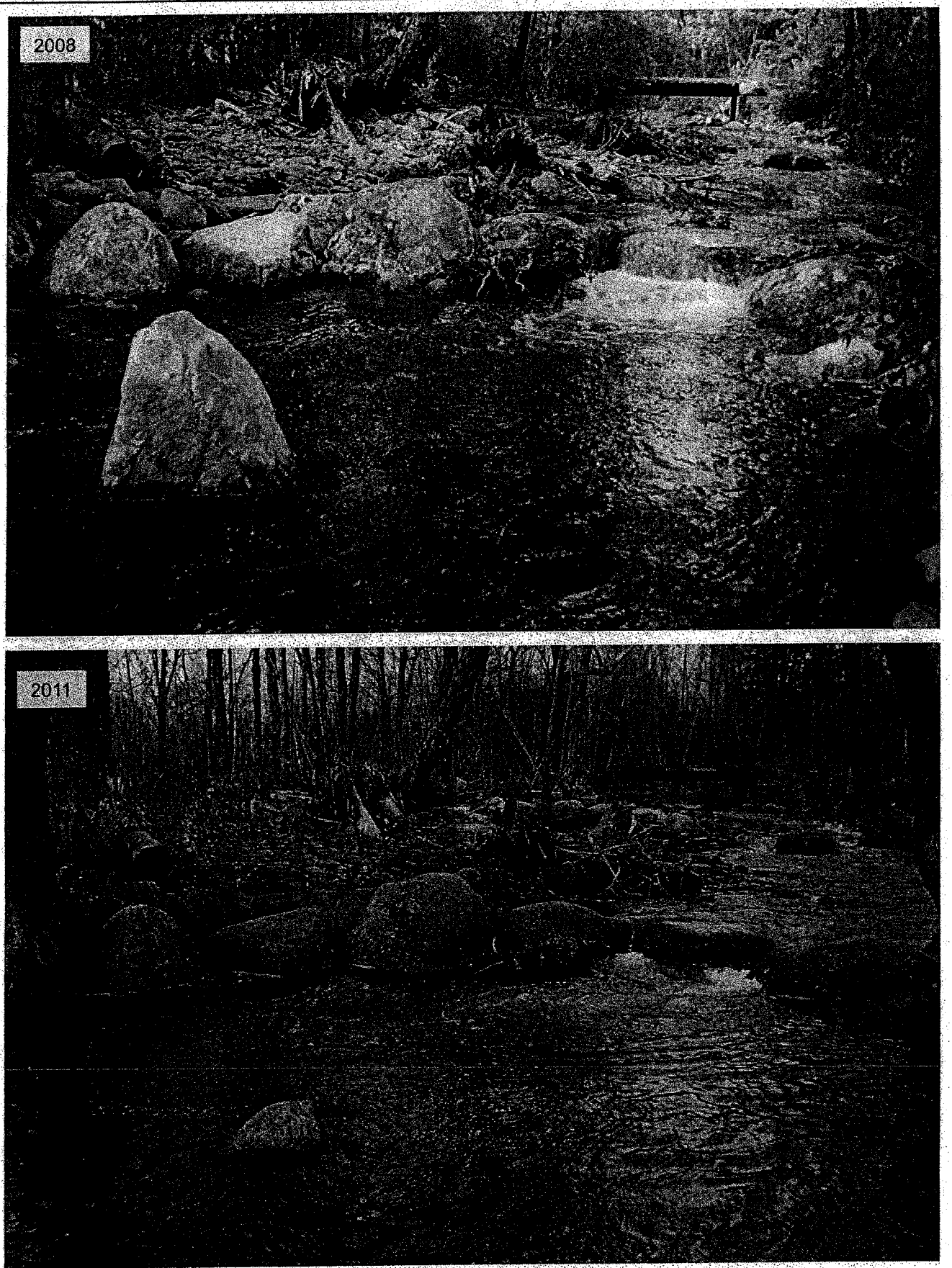
Appendix 2. Photo 17 - E. Branch Enchanted - Rock Sill 2 & wood on bar form from bridge. Arrow shows scour.



Appendix 2. Photo 18 - E. Branch Enchanted - Rock Sill 2 and wood on bar from right bank looking upstream.



Appendix 2. Photo 19 - E. Branch Enchanted - Rock Weir 2 from right bank. Note scour on opposite bank.



Appendix 2. Photo 20 - E. Branch Enchanted - Rock Weir 2 and wood on bar form from left bank.

2011 POST-HABITAT RESTORATION FISH AND BENTHIC MACROINVERTEBRATE SURVEY REPORT

COLD STREAM AND UPPER ENCHANTED STREAM

INDIAN POND PROJECT (FERC NO. 2142)

FINAL REPORT

Prepared for:

NextEra Energy Resources
Hallowell, Maine

Prepared by:

Kleinschmidt
Energy & Water Resource Consultants

141 Main Street
Pittsfield, Maine 04967
www.KleinschmidtUSA.com

December 30, 2011

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2011 Post-Habitat Restoration
Fish and Benthic Macroinvertebrate Survey Report
Final Report

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2011 POST-HABITAT RESTORATION
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1.0 EXECUTIVE SUMMARY

In 2008, pursuant to section 3.3.5 of the Indian Pond Project Settlement Offer dated July 25, 2001, NextEra completed stream habitat restoration efforts in Cold Stream and Upper Enchanted Stream, two small tributaries within the upper Kennebec River watershed. The goal of the stream improvements was to benefit local brook trout populations through provision of stream cover, thermal and velocity refuge, habitat diversity, and to enhance productivity of benthic macroinvertebrate (BMI) communities. This report describes pre-and post-monitoring efforts undertaken by NextEra as required by the Settlement Offer.

Existing baseline fish and benthic macroinvertebrate communities were surveyed in 2007 to characterize pre-habitat restoration conditions. Post-restoration monitoring was completed in 2009, 2010, and 2011. Survey methods included backpack electrofishing, brook trout age analysis, redd surveys, BMI sampling, and water quality monitoring.

Post-restoration monitoring indicates that brook trout have responded well to and are utilizing reaches where instream habitat structures were installed. Brook trout abundance and percent dominance has increased in reaches where stream habitat improvements occurred. Similarly, the number of benthic macroinvertebrates and number of important taxa [*e.g.,* Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddis flies)] has also increased since habitat improvements were completed. Similar results have also been noted within reference reaches.

The observed increase in relative abundance and percent dominance of brook trout is likely a result of several variables, including the utilization of the habitat structures for cover and velocity refuge, as well as increased macroinvertebrate production in the sample reaches, which provides a larger forage base. The increased brook trout density over time is also likely related to the general success of wild brook trout populations in recent years in northern Maine. Reportedly, brook trout have had extremely good rearing and spawning success in northern Maine as a result of high water and cold temperatures (pers. comm., Dave Boucher, Maine Department of Inland Fisheries & Wildlife, December 29, 2011).

As per the original study plan dated February 28, 2007, and the resultant data included in this report, NextEra has completed the 2007 pre-restoration baseline data collection and the 2009, 2010, and 2011 post- restoration surveys. Completion of this work concludes NextEra's obligations pursuant to section 3.3.5 of the Indian Pond Project Settlement Offer.

2.0 INTRODUCTION

As part of the Indian Pond Project (FERC No. 2142) Settlement Agreement, NextEra contracted with Fields Geological Services who designed and installed several instream habitat structures in Cold Stream and Upper Enchanted Stream to enhance local brook trout populations. The structures consisted primarily of boulder-weirs and large woody debris placed strategically in the stream channel to enhance scour, provide velocity refuge, and provide instream cover. In 2007, NextEra initiated a monitoring program to evaluate characteristics of the existing fish and aquatic communities prior to habitat restoration efforts. The monitoring program consisted of depletion backpack electrofishing surveys, brook trout age determination, environmental monitoring (*e.g.,* dissolved oxygen (DO) and water temperature), and benthic macroinvertebrate sampling in reference and restoration reaches in both streams. Following completion of the habitat improvements in 2008, NextEra and Kleinschmidt biologists completed similar monitoring efforts in 2009, 2010, and 2011. This report describes the results of post-restoration monitoring conducted by the research team in 2011 and compares findings with previous monitoring efforts.

2.1 STUDY AREA

The study reaches are located on Upper Enchanted Stream, a tributary to the Dead River, and Cold Stream, a tributary to the Kennebec River (Figure 1 and Figure 2). GPS coordinates for the top/bottom of each sample reach are provided in Table 1.

TABLE 1. GPS COORDINATES FOR RESTORATION AND REFERENCE SAMPLING REACHES, COLD STREAM AND UPPER ENCHANTED STREAM, AUGUST 2011.

SITE ID	GPS COORDINATES TOP	GPS COORDINATES BOTTOM
Cold Stream Restoration	45° 24.349' / 69° 59.228'	45° 24.387' / 69° 59.263'
Cold Stream Reference Site	45° 25.480' / 70° 01.829'	45° 25.457' / 70° 01.786'
Enchanted Stream Restoration	45° 24.543' / 70° 09.796'	45° 24.589' / 70° 09.785'
Enchanted Stream Reference	45° 24.648' / 70° 09.748'	45° 24.688' / 70° 09.714'

ENCHANTED STREAM ELECTROFISHING SITES

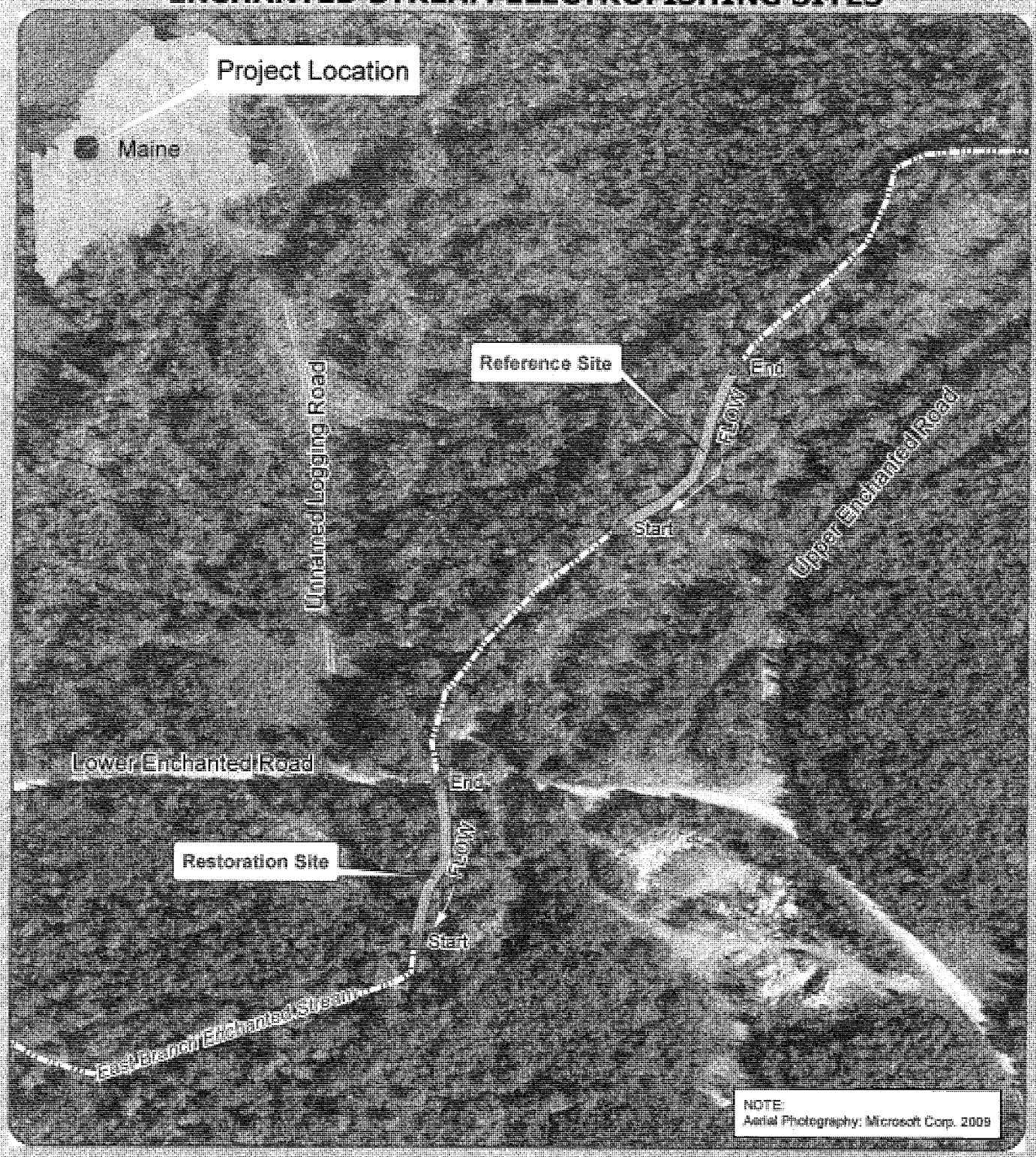

Figure 1

NextEra Energy

Kleinschmidt

Legend

- Electrofishing Transect Extents
- Electrofishing Transects

N
W E
S

150 75 0 150
Feet

COLD STREAM ELECTROFISHING SITES

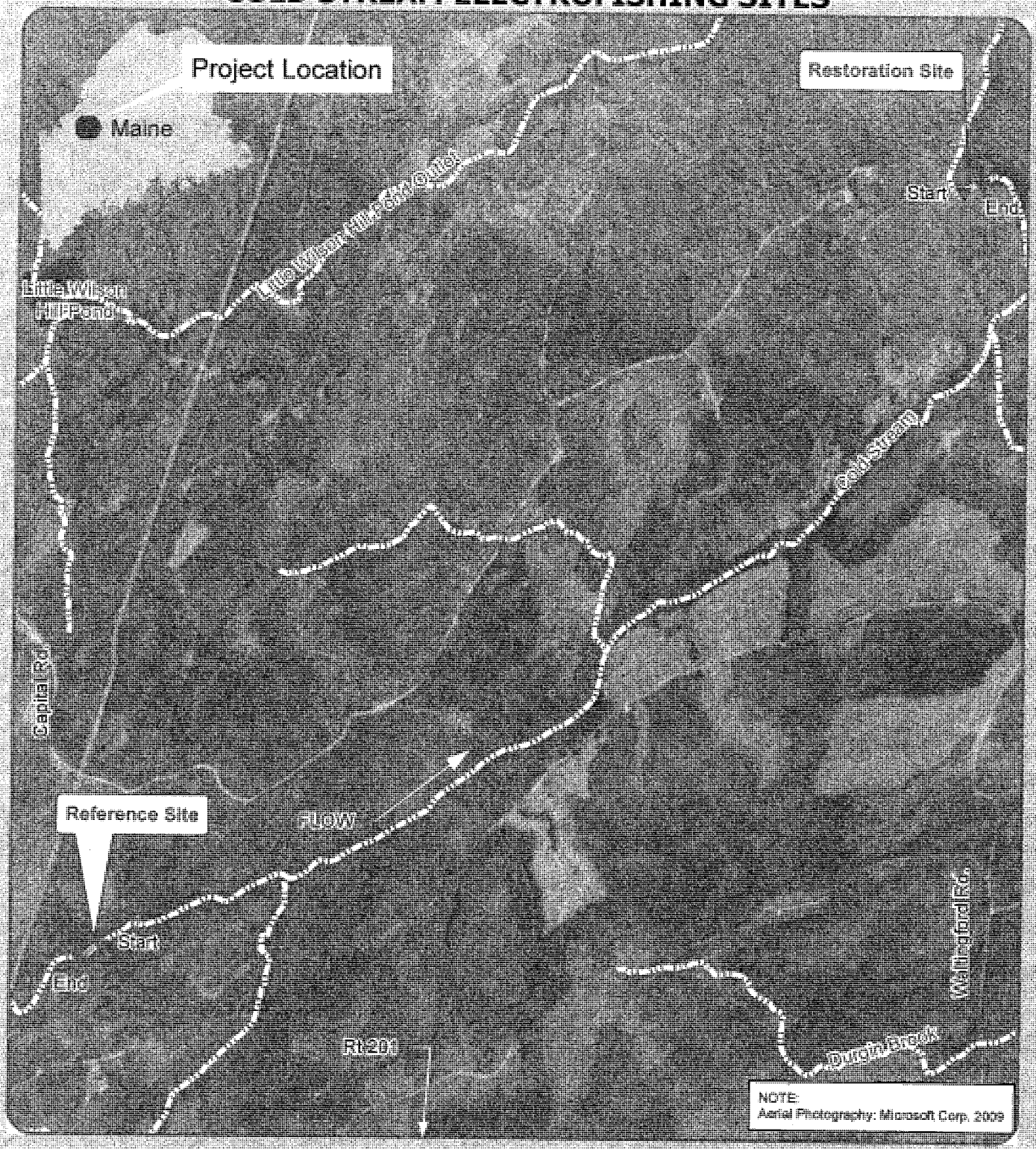

Figure 2

Legend

▲ Electrofishing Transect Extents

Electrofishing Transects

2,000 1,000 0 2,000

Feet

NextEra Energy

Kleinschmidt

Energy & Water Resource Consultants

3.0 METHODS

The 2011 survey was completed on August 25 and August 26, 2011. NextEra and Kleinschmidt biologists collected fish using a Smith-Root Model LR 20 backpack electrofisher. Block nets were erected at the top and bottom of each sample area to prevent fish from escaping from or entering into the reach during sampling. Each reach was approximately 100 meters in length and consisted of a variety of habitat types (*e.g.,* riffle, run, pool). Sampling was completed with one backpack electrofisher operator and two netters. Two to three electrofishing passes were completed with a total fishing time ranging from approximately 30 to 57 minutes at each site (Table 2).

TABLE 2. ELECTROFISHING SAMPLING INFORMATION FOR COLD AND UPPER ENCHANTED STREAMS, AUGUST, 2011.

LOCATION	SAMPLE DURATION (MINUTES)	NUMBER OF PASSES
Cold Stream (Reference)	57.2	3
Cold Stream (Restoration)	29.7	2[1]
Enchanted Stream (Reference)	30.1	3
Enchanted Stream (Restoration)	34.4	3

[1] Only 2 passes were completed at this site in 2011 because depletion was considered excellent after the 2nd pass.

For consistency among sample years, researchers used identical or similar settings for the backpack electrofishing equipment as had been used during previous sample years. Electrofisher settings used during the 2011 sampling are provided in Table 3.

TABLE 3. LR 20 ELECTROFISHER SETTINGS FOR 2011 SAMPLE EFFORT, COLD STREAM AND ENCHANTED STREAM.

Site ID	LR 20 Electrofisher Settings
Cold Stream Restoration	70 Hz (frequency), 35% duty cycle, 700 volts
Cold Stream Reference Site	70 Hz (frequency), 40% duty cycle, 700 volts
Upper Enchanted Stream Restoration	80 Hz (frequency), 40% duty cycle, 700 volts
Upper Enchanted Stream Reference	80 Hz (frequency), 40% duty cycle, 700 volts

After each pass, collected fish were identified, enumerated, processed, and released into the water downstream of the reach. Young-of-year brook trout were individually measured to the nearest millimeter (total length) and weighed in batches of five individuals (grams). All brook trout greater than 100 mm were weighed and measured individually. A length-frequency analysis was also completed to evaluate the size distribution of collected brook trout.

Scale samples were obtained from 50 brook trout for age determination. Scales were removed primarily from the mid-dorsal region with a surgical scalpel. Extracted scales were placed on waterproof paper, labeled, and placed in scale envelopes for subsequent age determination. Scales from each sample were cleaned, mounted, and the existence of annuli was determined through use of a compound microscope. Two experienced fisheries scientists independently examined the scale samples to verify age.

Aquatic benthic macroinvertebrate samples were obtained via kick net from varying substrate types within each study reach following Maine Department of Environmental Protection (MDEP) methods (pers. comm., Leon Tsomides, MDEP). One minute kick samples were completed at the top, middle, and lower portion of each reach by disturbing substrates in an approximately 1 meter square plot area. The three samples were then combined into one composite sample jar for each reach. Samples were preserved in the field with 91% isopropyl alcohol and transferred to ethanol for preservation and processing. A qualified entomologist subsequently identified all specimens to Family and provided information regarding macroinvertebrate community metrics as well as general water quality standards attainment as measured by invertebrate community metrics.

Researchers also collected information pertaining to water temperature, pH, DO content, DO saturation, and water conductivity at the time of sampling using handheld water quality meters that were calibrated prior to data collection.

4.0 RESULTS

4.1 ENVIRONMENTAL CONDITIONS AND SAMPLING INFORMATION

Weather during the Cold Stream survey (August 25) was warm and sunny with an air temperature ranging from approximately 21° to 26° C (70° to 80°F). Similar pH values were observed at both the restoration and reference sites, with measurements ranging from 8.1 to 8.2 (Table 4). Conductivity was typical for small streams in northern Maine, ranging from 25.0 to 29.0 µs (Table 4). Water temperature ranged from 17.8° to 18.0° C (64.0° to 64.4°F). DO measurements indicate that both Cold Stream reaches remain well oxygenated during summer low-flow high temperature condition with observed measurements ranging from 8.3 mg/L (87.5% sat) to 8.8 mg/L (92.5 % sat) (Table 4).

TABLE 4. COLD STREAM WATER QUALITY INFORMATION, AUGUST 25, 2011.

VARIABLE	COLD STREAM REFERENCE REACH	COLD STREAM RESTORATION REACH
pH	8.2	8.1
Conductivity (µs)	25.0	29.0
Water Temperature (C)	17.8	18.0
Dissolved Oxygen (mg/L)	8.8	8.3
Dissolved Oxygen (% sat)	92.5	87.5

Weather during the Upper Enchanted Stream survey (August 26) was warm and sunny with an air temperature ranging from approximately 21° to 26° C (70° to 80°F). Similar pH values were observed at both the reference and restoration reaches, with measurements ranging from 8.0 to 8.1 (Table 5). Conductivity was recorded as 25.0 µs at both sites, which is typical for small streams in northern Maine (Table 5). Water temperature ranged from 17.6° to 18.1° C (63.7° to 64.6° F). DO measurements indicate that both Upper Enchanted Stream reaches remain well oxygenated during summer low-flow high temperature condition with observed measurements ranging from 7.5 mg/L (78.9% sat) to 8.3 mg/L (87.2 % sat) (Table 5).

TABLE 5. UPPER ENCHANTED STREAM WATER QUALITY INFORMATION, AUGUST 26, 2011.

VARIABLE	ENCHANTED STREAM REFERENCE REACH	ENCHANTED STREAM RESTORATION REACH
pH	8.1	8.0
Conductivity (µs)	25.0	25.0
Water Temperature (C)	18.1	17.6
Dissolved Oxygen (mg/L)	8.3	7.5
Dissolved Oxygen (% sat)	87.2	78.9

4.2 RESULTS OF FISHERIES SAMPLING

4.2.1 SUMMARY OF TOTAL CATCH

Researchers collected a total of 363 fish representing four species during 2011 monitoring. The dominant fish species were brook trout (n=174, 48%) and blacknose dace (n=154, 42%) (Figure 3). Creek chub (n=28, 8%) and white sucker (n=7, 2%) made up a smaller proportion of the catch (Figure 3). The number of brook trout collected by site ranged from 37 (Cold Stream Restoration) to 51 (Cold Stream Reference) (Table 6).

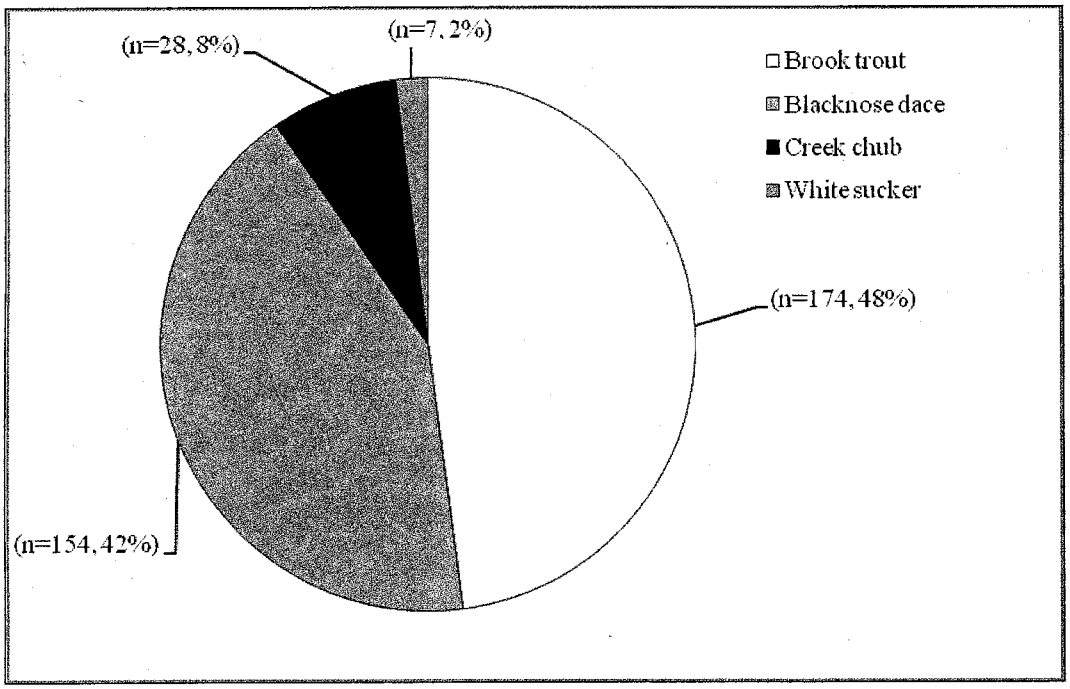

FIGURE 3. RELATIVE PERCENTAGE AND TOTAL NUMBER OF FISH COLLECTED DURING 2011 MONITORING, COLD STREAM AND UPPER ENCHANTED STREAM.

TABLE 6. RELATIVE ABUNDANCE OF FISH SPECIES COLLECTED WITHIN COLD STREAM AND ENCHANTED STREAM REFERENCE AND RESTORATION REACHES, AUGUST 25 & 26, 2011.

SAMPLE LOCATION	BROOK TROUT	BLACKNOSE DACE	CREEK CHUB	COMMON WHITE SUCKER	TOTAL BY LOCATION
Cold Stream Reference	51	26	0	0	77
Cold Stream Restoration	37	33	0	0	70
Enchanted Stream Reference	40	30	2	2	74
Enchanted Stream Restoration	46	65	26	5	142
Total By Species	174	154	28	7	363
Species Percent of Total	**48%**	**42%**	**8%**	**2%**	**100%**

A similar species assemblage was noted in all previous years of sampling (Figure 4 and Table 7). The total relative percentage of brook trout collected in 2011 (48%) was lower than that seen in 2009 and 2010 (71% and 63%) (Table 8); however, all three years of post-habitat restoration monitoring showed increased brook trout density as compared to pre-restoration sampling conducted in 2007 when a total of 75 brook trout (28% of total catch) were collected (Figure 4 and Table 8). In 2009, brook trout density was noticeably higher in restoration reaches as compared to reference reaches (Figure 4).

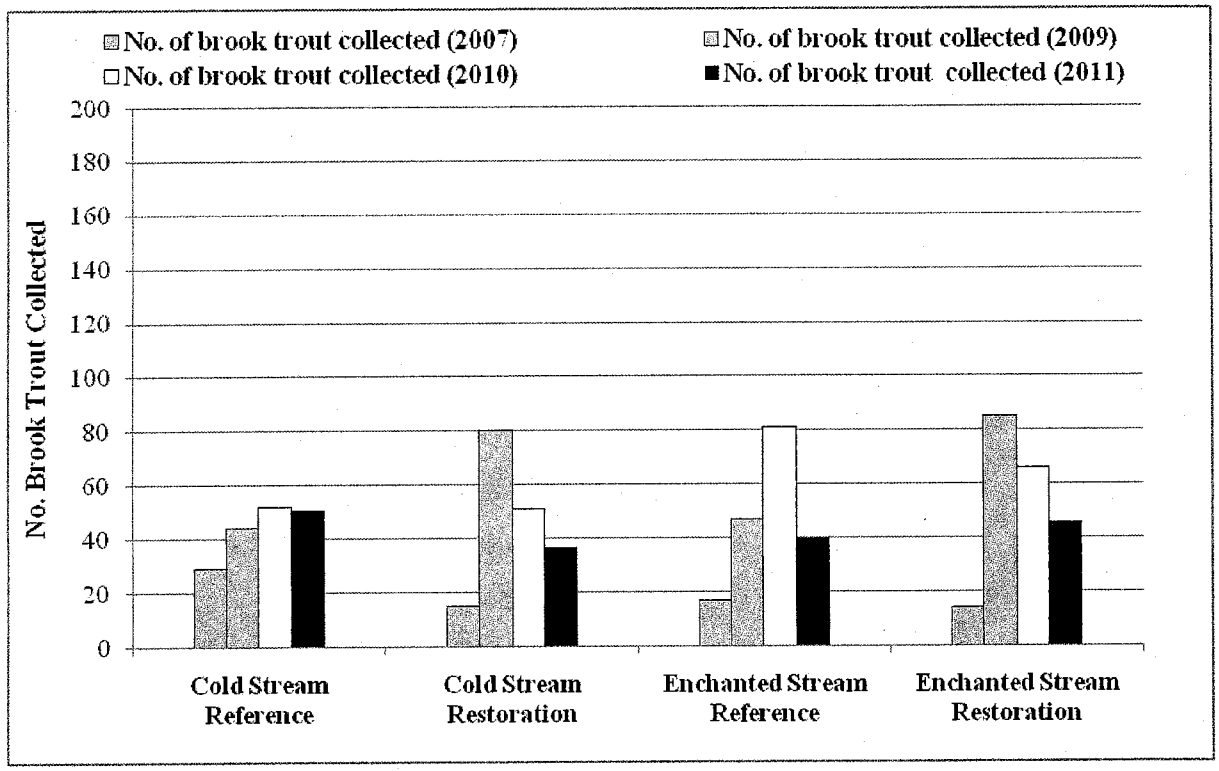

FIGURE 4. COMPARISON OF TOTAL NUMBER OF BROOK TROUT COLLECTED IN COLD STREAM AND UPPER ENCHANTED STREAM IN 2007, 2009, 2010, AND 2011.

TABLE 7. COMPARISON OF TOTAL CATCH FOR SAMPLE YEARS 2007, 2009, 2010, AND 2011 - COLD STREAM AND UPPER ENCHANTED STREAM.

YEAR	SPECIES					
-	Brook trout	Blacknose dace	Creek chub	White sucker	Total catch	% Brook trout
2007	75	183	13	1	272	28%
2009	256	87	9	10	362	71%
2010	250	136	11	2	399	63%
2011	174	154	28	7	363	48%

Because sample time (*i.e.,* time electrofished) among years differed, we extrapolated the results to a standard unit of time to evaluate the catch per unit effort (*i.e.,* fish collected per hour). In 2009 (Enchanted Stream) and 2011 (Cold Stream), noticeably more brook trout were collected per unit time from the restoration reaches (Figure 5). Alternatively, in 2010, fewer brook trout were collected per unit time in the restoration reaches (Figure 5).

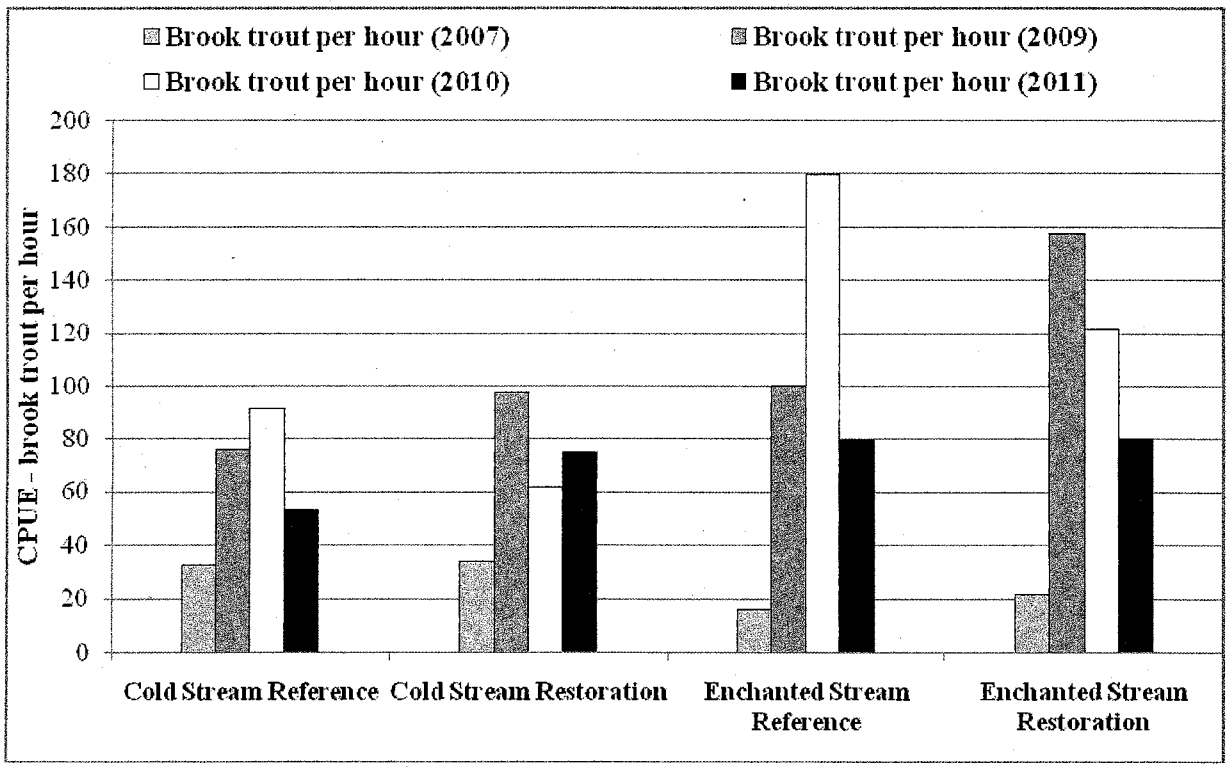

FIGURE 5. COMPARISON OF BROOK TROUT CATCH PER UNIT EFFORT IN COLD STREAM AND UPPER ENCHANTED STREAM IN 2007, 2009, 2010, AND 2011.

4.2.2 2011 RESULTS BY SURVEY SITE

Upper Enchanted Stream Restoration Site – Researchers collected a total of 142 fish from the Upper Enchanted Stream restoration reach representing four species (Figure 6). Blacknose dace were numerically dominant (n=65, 46% of the total catch) while brook trout (n=46, 32% of the total catch) were the next most abundant species (Figure 6). Brook trout ranged from 54 to 186 mm in total length with a median length of 118 mm. Creek chub (n=26, 18%) and common white sucker (n=5, 4%) were also collected from the restoration reach (Figure 6).

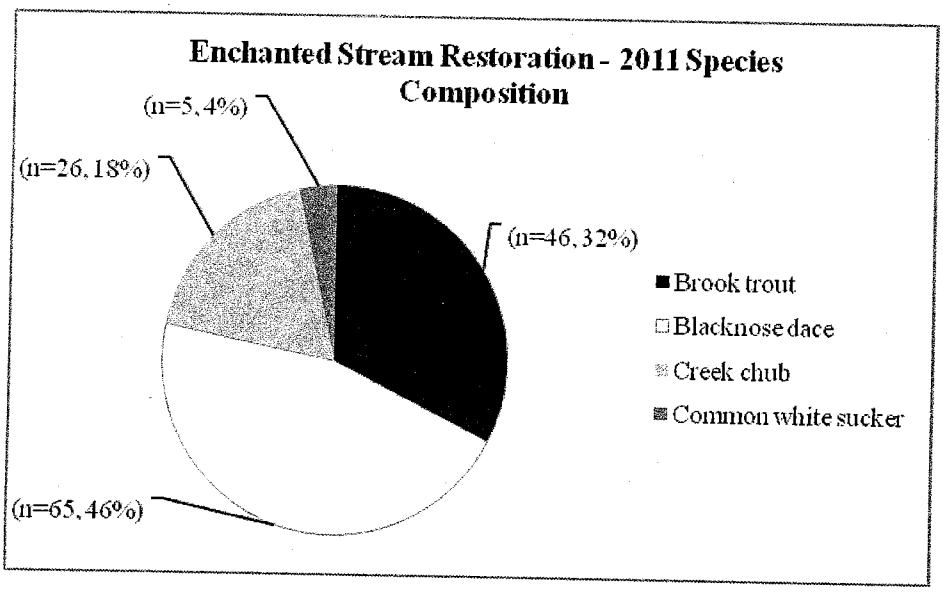

FIGURE 6. **RELATIVE ABUNDANCE OF FISH SPECIES COLLECTED FROM THE ENCHANTED STREAM RESTORATION SITE, AUGUST 2011.**

Upper Enchanted Stream Reference Site – Researchers collected a total of 74 fish from the Upper Enchanted Stream reference reach representing four species (Figure 7). Brook trout were numerically dominant (n=40, 54% of the total catch) (Figure 7), ranging in size from 55 to 176 mm with a median length of 114 mm. Creek chub and common white sucker were also collected although in limited numbers.

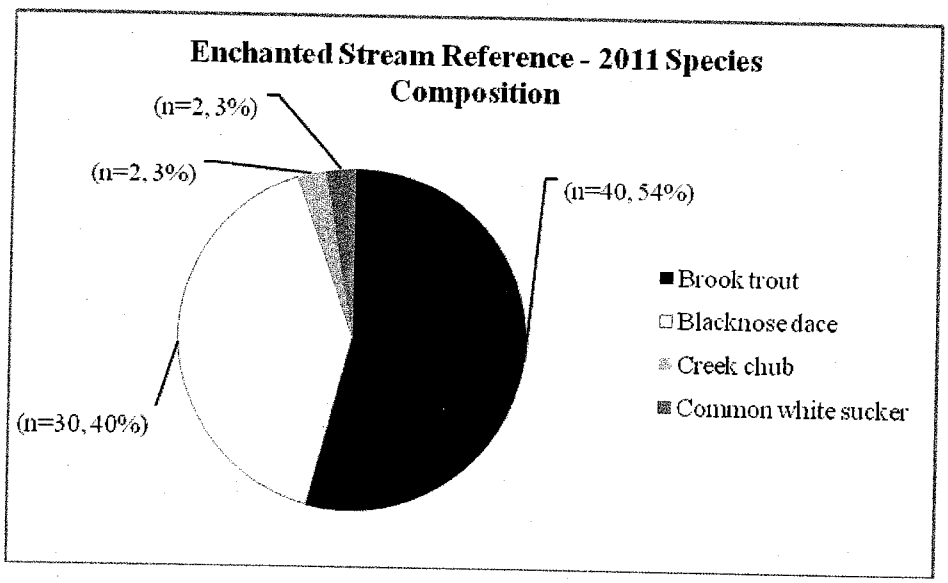

FIGURE 7. **RELATIVE ABUNDANCE OF FISH SPECIES COLLECTED FROM THE ENCHANTED STREAM REFERENCE SITE, AUGUST 2011.**

Cold Stream Restoration Reach[1] – Researchers collected a total of 70 fish from the Cold Stream restoration reach in 2011. Brook trout (n=37, 53%) and blacknose dace (n=33, 47%) (Figure 8) were the only two species collected. Brook trout ranged in size from 69 to 208 mm with a median length of 141 mm.

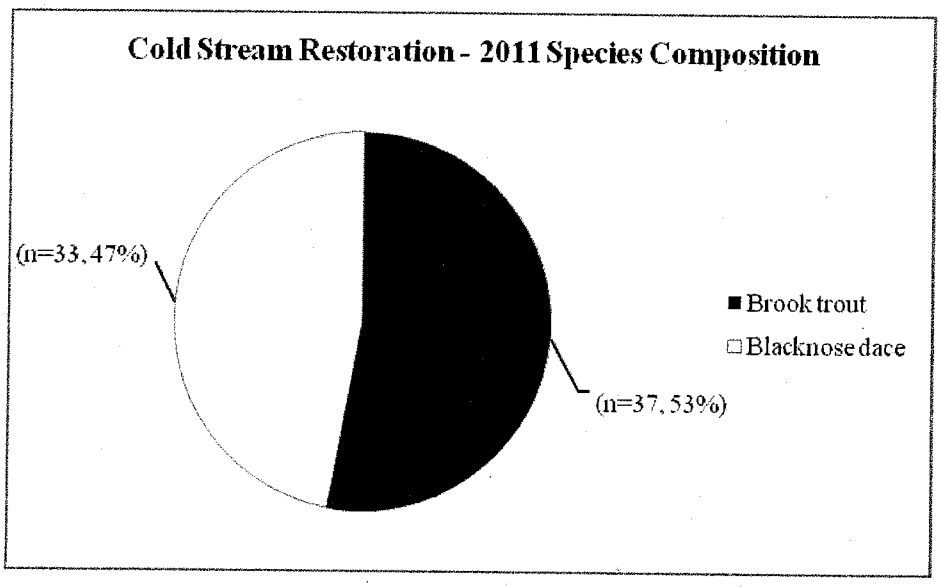

FIGURE 8. RELATIVE ABUNDANCE OF FISH SPECIES COLLECTED FROM THE COLD STREAM RESTORATION SITE, AUGUST 2011.

Cold Stream Reference Reach – Researchers collected a total of 77 fish from the Cold Stream reference reach in 2011 representing two species, brook trout (n=51, 66%) and blacknose dace (n=26, 34%) (Figure 9). Brook trout ranged in length from 66 to 205 mm with a median length of 84 mm.

[1] Only 2 passes were completed at this site in 2011 because depletion was considered excellent after the 2nd pass.

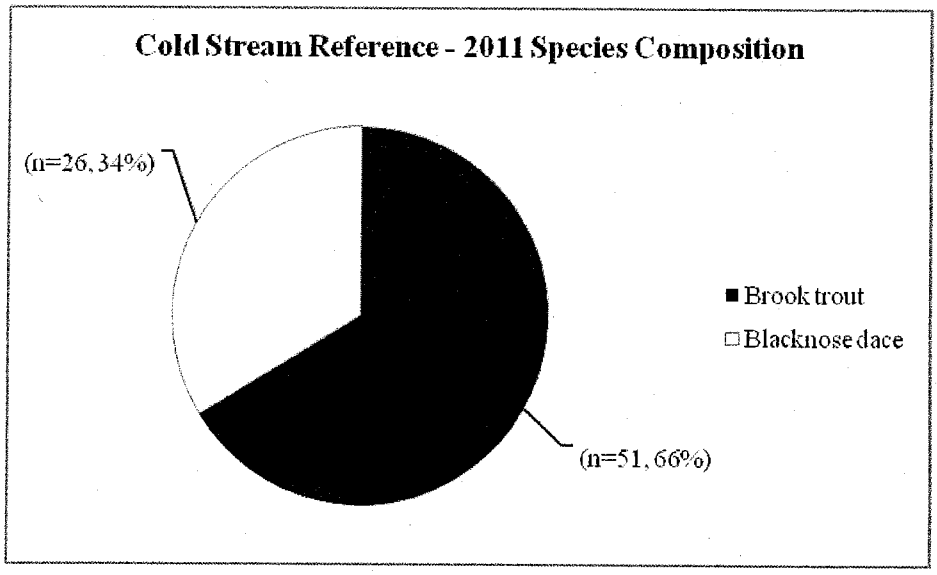

FIGURE 9. RELATIVE ABUNDANCE OF FISH SPECIES COLLECTED FROM THE COLD STREAM REFERENCE SITE, AUGUST 2011.

4.3 BROOK TROUT AGE CLASSIFICATION AND STRUCTURE

Based on the scale sample analysis, the age structure of collected brook trout was similar in 2007 and 2009 with age class 1 and 2 fish comprising approximately 68 and 28 percent of the population sampled (data from approximately 50 scale samples) in both years (Table 8). In contrast, in 2010 age 1 (n=11) and age 2 (n=18) fish comprised 22% and 37% of the sample (data from approximately 50 scale samples) (Table 8)[2]. In 2011, brook trout were dominated by age 2 fish (73 percent) (data from approximately 50 scale samples) (Table 8). Several age 3 fish were also collected in 2007, 2009, and 2011, but not in 2010. In total, the number of young-of-year brook trout (less than 100 mm) collected by electrofishing ranged from 18 in 2007 to 172 in 2009 (see Figure 11).

[2] The remaining fish in the sample were determined to be young-of-year.

TABLE 8. COMPARISON OF 2007, 2009, 2010 AND 2011 BROOK TROUT AGE STRUCTURE, COLD STREAM AND UPPER ENCHANTED STREAM (DATA FROM APPROXIMATELY 50 SCALE SAMPLES PER YEAR).

	2007				2009				2010				2011			
Site	Age 0	Age 1	Age 2	Age 3	Age 0	Age 1	Age 2	Age 3	Age 0	Age 1	Age 2	Age 3	Age 0	Age 1	Age 2	Age 3
Cold Stream Restoration	0	4	6	1	0	9	3	0	6	3	3	0	0	NA*	NA*	NA*
Cold Stream Reference	0	12	5	0	0	7	4	2	5	3	5	0	0	3	9	1
Enchanted Stream Restoration	0	7	1	0	0	9	3	0	6	4	3	0	0	2	8	2
Enchanted Stream Reference	0	12	3	0	0	9	4	0	3	1	7	0	0	2	10	0
Total	**0**	**35**	**15**	**1**	**0**	**34**	**14**	**2**	**20**	**11**	**18**	**0**	**0**	**7**	**27**	**3**
Percent of Total	**0.00**	**0.69**	**0.29**	**0.02**	**0.00**	**0.68**	**0.28**	**0.04**	**0.41**	**0.22**	**0.37**	**0.00**	**0.00**	**0.19**	**0.73**	**0.08**

*the 2011 Cold Stream samples from the restoration site were contaminated by fungus and were therefore not readable.

Brook Trout Length-Frequency Distribution - The majority of brook trout collected in 2011 fell within the 126 to 150 mm (n=48, or 28%) and 101 to 125 mm (n=40, or 23%) size classes (Figure 10). The smallest brook trout collected was 54 mm in total length. The largest brook trout collected was 208 mm in total length. Median brook trout length was 120 mm. The majority of brook trout collected in all four sample years were 175 mm or less (Figure 11 and Figure 12).

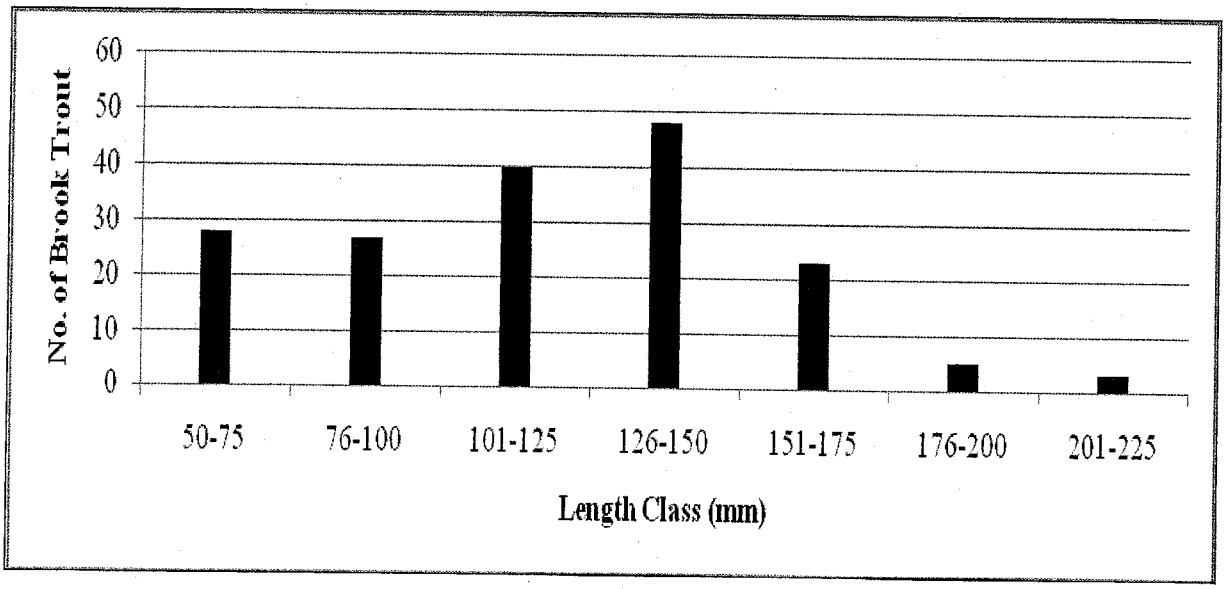

FIGURE 10. LENGTH-FREQUENCY DISTRIBUTION OF ALL BROOK TROUT COLLECTED IN COLD STREAM AND UPPER ENCHANTED STREAM, AUGUST 2011.

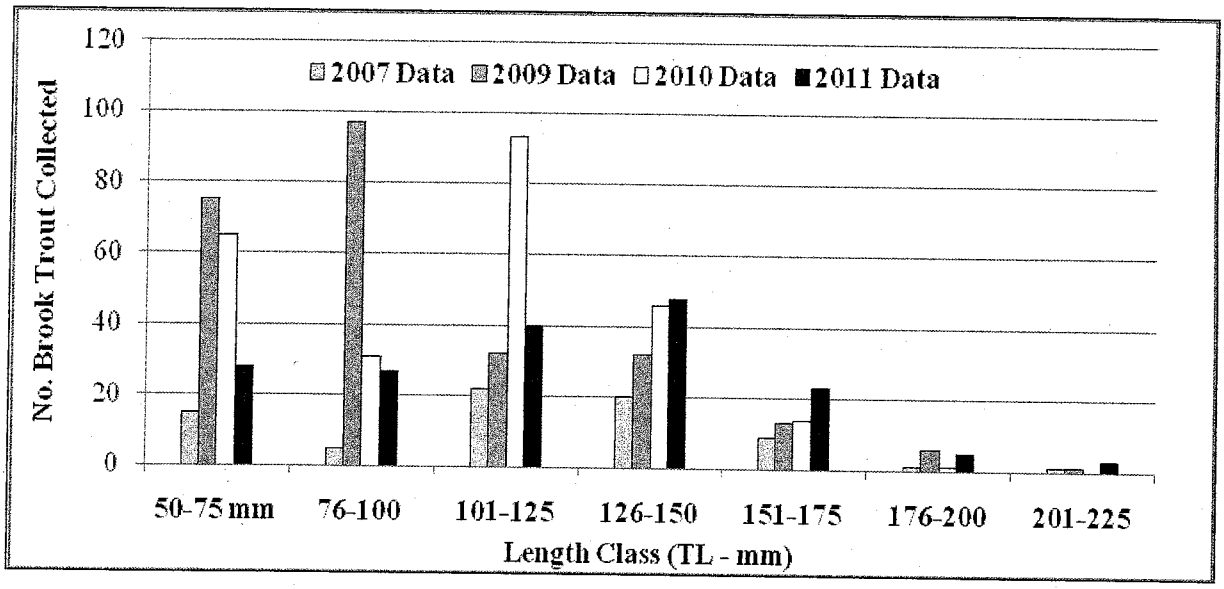

FIGURE 11. LENGTH-FREQUENCY DISTRIBUTION OF ALL COLLECTED BROOK TROUT (2007, 2009-2011), COLD STREAM AND UPPER ENCHANTED STREAM.

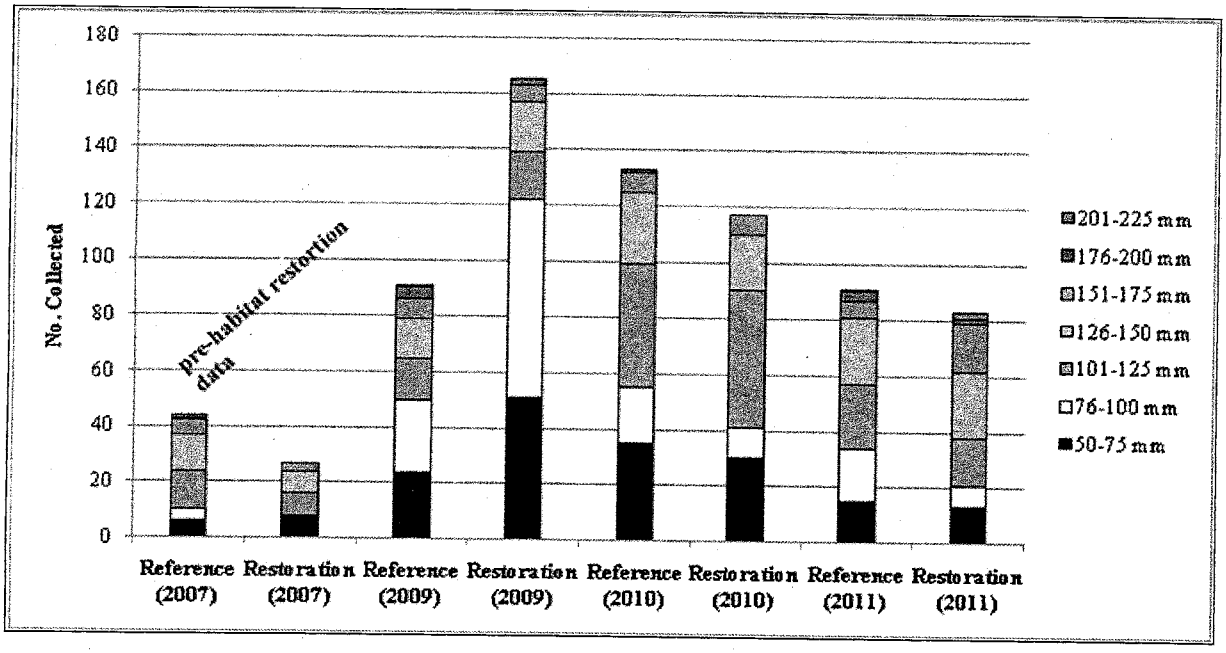

FIGURE 12. LENGTH-FREQUENCY DISTRIBUTION OF ALL COLLECTED BROOK TROUT UNDER REFERENCE AND RESTORED HABITAT CONDITIONS (2007, 2009-2011), COLD STREAM AND UPPER ENCHANTED STREAM.

4.4 BENTHIC MACROINVERTEBRATES

The dominant BMI taxa and their relative percentages have been similar in all sample years with the communities primarily consisting of individuals from the EPT and Diptera (true flies) Orders. During 2009 and 2010 monitoring, total invertebrate abundance was approximately 45 percent

higher than that noted in the 2007 pre-restoration sampling effort (Table 9). The total relative percentage of EPT taxa decreased by approximately 11 to 12% in 2009 and 2010 following installation of the instream habitat structures; however, in 2011 EPT taxa comprised approximately 56 percent of the total invertebrate community (Table 11). Similarly, the relative percentage of Dipterans' was much reduced in 2011 as compared to 2009 and 2010 (Table 9). Taxa diversity as measured by the number of families collected was highest in 2011 (n=55) (Table 9).

TABLE 9. SUMMARY OF BENTHIC MACROINVERTEBRATE DATA, COLD STREAM AND UPPER ENCHANTED STREAM, 2007, 2009, 2010, AND 2011.

METRIC	2007	2009	2010	2011
Total No. Individuals	5,568	10,023	10,003	8883
Total No. Families	45	41	45	55
Total No. EPT	3039	4241	4298	4963
Relative % EPT	54.6%	42.3%	43.0%	55.9%
Total No. Diptera	2379	5651	5147	3117
Relative % Diptera	42.7%	56.4%	51.5%	35.1%
Total (Other)	**150**	**131**	**558**	**803**
Relative % (Other)	**2.7%**	**1.3%**	**5.6%**	**9.0%**

In 2011, the total number of individuals collected ranged 1,477 (Cold Stream Reference) to 3,228 (Enchanted Stream Restoration) (Table 11). EPT composition ranged from approximately 44 (Cold Stream Restoration) to 71 percent (Enchanted Stream Reference) (Table 10).

Cold Stream – Researchers collected a total of 1,477 benthic macroinvertebrates representing 40 families from the Cold Stream reference reach in 2011 (Table 10). A total of 2,581 individuals representing 43 families were collected from the Cold Stream restoration reach (Table 11.). A comparison of the 2011 data to 2007, 2009, and 2010 is provided in Table 11. Since completion of the habitat improvements, increases of abundance and density of BMI's has been observed (Table 11) within Cold Stream reference and restoration sites. A complete tabular summary of all benthic macroinvertebrates collected in Cold Stream is provided in Appendix A.

Enchanted Stream - Researchers collected a total of 1,597 benthic macroinvertebrates representing 37 families from the Upper Enchanted Stream reference reach in 2010 (Table 12). A total of 3,228 individuals representing 43 families were collected from the Upper Enchanted Stream restoration reach (Table 12). A comparison of the 2011 data to 2007, 2009, and 2010 is provided in Table 12. Since completion of the habitat improvements, increases of abundance and density of BMI's has been observed at reference and restoration sites (Table 12). A complete tabular summary of all benthic macroinvertebrates collected in Cold Stream is provided in Appendix A.

TABLE 10. SUMMARY OF 2011 COLD STREAM AND ENCHANTED STREAM MACROINVERTEBRATE DATA.

	Cold Stream Reference		Cold Stream Restoration		Enchanted Stream Reference		Enchanted Stream Restoration		Total	
Order	Abundance	Relative %	Abundance	Relative %	Abundance	Relative %	Abundance	Relative %	Abundance	Relative %
Odonata	12	0.8%	20	0.8%	10	0.6%	18	0.6%	60	0.7%
Ephemeroptera	635	43.0%	618	23.9%	748	46.8%	1136	35.2%	3137	35.3%
Plecoptera	77	5.2%	229	8.9%	75	4.7%	221	6.8%	602	6.8%
Trichoptera	141	9.5%	297	11.5%	305	19.1%	481	14.9%	1224	13.8%
Coleoptera	15	1.0%	16	0.6%	61	3.8%	90	2.8%	182	2.0%
Megaloptera	15	1.0%	25	1.0%	10	0.6%	106	3.3%	156	1.8%
Diptera	560	37.9%	1288	49.9%	345	21.6%	924	28.6%	3117	35.1%
Mollusca	3	0.2%	3	0.1%	39	2.4%	248	7.7%	293	3.3%
Crustacea	0	0.0%	1	0.0%	0	0.0%	0	0.0%	1	0.0%
Turbellaria	2	0.1%	5	0.2%	2	0.1%	0	0.0%	9	0.1%
Annelida	17	1.2%	76	2.9%	2	0.1%	3	0.1%	98	1.1%
Acariformes	0	0.0%	3	0.1%	0	0.0%	1	0.0%	4	0.0%
Total No. Individuals	1477	100.0%	2581	100.0%	1597	100.0%	3228	100.0%	8883	100.0%
No. of Families	40	-	43		37	-	43	-	-	-
EPT Individuals (total)	853	57.8%	1144	44.3%	1128	70.6%	1838	56.9%	4963	55.9%

TABLE 11. COMPARISON OF 2007, 2009, 2010, AND 2011 BENTHIC MACROINVERTEBRATE TAXA DATA, COLD STREAM, MAINE.

	2007		2009		2010		2011	
Metric	Cold Stream Reference	Cold Stream Restoration	Cold Stream Reference	Cold Stream Restoration	Cold Stream Reference	Cold Stream Restoration	Cold Stream Reference	Cold Stream Restoration
No. Individuals	1615	1149	2077	1541	2770	1894	1477	2581
No. of Families	32	38	38	27	37	33	40	43
EPT (Total)	939	677	1033	835	1165	499	853	1144
Diptera (Total)	649	444	1013	682	1489	1154	560	1288
Other (Total)	27	28	31	24	116	241	64	149

TABLE 12. COMPARISON OF 2007, 2009, 2010, AND 2011 BENTHIC MACROINVERTEBRATE TAXA DATA, ENCHANTED STREAM, MAINE.

	2007		2009		2010		2011	
Metric	Ench. Stream Reference	Ench. Stream Restoration	Ench. Stream Reference	Ench. Stream Restoration	Ench. Stream Reference	Ench. Stream Restoration	Ench. Stream Reference	Ench. Stream Restoration
No. Individuals	1220	1584	3277	3128	3478	1861	1597	3228
No. of Families	33	33	33	30	39	29	37	43
EPT (Total)	613	810	1092	1281	1846	788	1128	1838
Diptera (Total)	558	728	2150	1806	1506	998	345	924
Other (Total)	49	46	35	41	126	75	124	466

5.0 DISCUSSION

The 2011 survey results indicate that brook trout continue to respond well to and are utilizing the reaches where instream habitat improvements were completed by NextEra in 2008. The observed increase in relative abundance and percent dominance of brook trout is likely a result of several variables, including the utilization of the habitat structures for cover and velocity refuge, as well as increased macroinvertebrate production in the sample reaches, which provides a larger forage base. The presence of a wide variety of age classes, including many young-of-year fish and some adults in spawning condition (observed during 2009 monitoring) indicates that brook trout in the Cold Stream and Upper Enchanted Stream survey areas are recruiting from natural reproduction. Reproduction is most likely occurring in reaches of the stream contiguous with the sample areas as redds have not been observed in the reference or restoration reaches during fall spawning surveys conducted by NextEra staff in 2009, 2010, and 2011.

Benthic macroinvertebrates provide a crucial link between a system's primary producers and aquatic biota through the conversion of plant biomass to consumable energy (Mandaville, 2002). The use of BMI community characteristics as an indicator of overall stream health has been widely accepted because changes in species metrics often occur as a result of deterioration or improvements to water quality. In general, an unpolluted waterbody is represented by a higher number of taxa comprised of relatively few taxa. A high percentage of taxa from EPT Orders is typical of healthy rivers, whereas low quality waters tend to be dominated by pollution tolerant taxa (*e.g.,* chironomids - midge flies). The benthic macroinvertebrate assemblages in Cold Stream and Enchanted Stream are diverse and comprised of a high percentage of EPT. EPT taxa are highly-sensitive to anthropogenic disturbances; therefore the consistent high percentage of these taxa indicates that Cold Stream and Upper Enchanted Stream contain water that is of good quality (Mandaville, 2002).

6.0 CONCLUSIONS

In comparison to pre-restoration data, the relative percentage of brook trout at the restoration sites has increased substantially since the installation of the instream habitat structures. Similarly, the number of benthic macroinvertebrates and number of EPT taxa has also increased. However, similar results have also been noted within reference reaches. The increased brook trout density over time is also likely related to the general success of wild brook trout populations in recent years in northern Maine. Reportedly, brook trout have had extremely good rearing and spawning success in northern Maine as a result of high water and cold temperatures (pers. comm., Dave Boucher, Maine Department of Inland Fisheries & Wildlife, December 29, 2011).

As per the original study plan dated February 28, 2007 and the resultant data included in this report, NextEra has completed the 2007 pre- restoration baseline data collection and the 2009, 2010 and 20011 post- restoration data collection. Completion of this work concludes NextEra's obligations pursuant to section 3.3.5 of the Indian Pond Project Settlement Offer dated July 25, 2001.

7.0 REFERENCES

Mandaville, S. M. 2002. Benthic macroinvertebrates in freshwater-taxa tolerance values, metrics, and protocols. Soil and Water Conservation Society of Metro Halifax. 48 pp.

APPENDIX A

BENTHIC MACROINVERTEBRATE DATA
UPPER ENCHANTED AND COLD STREAM
AUGUST 2011

Table 2. Results of Macroinvertebrate Identification and Enumeration. Cold Stream (CS), sampled 2011 and Enchanted Stream (ES), sampled 2011

	CS(REF)	CS(RES)	ES(REF)	ES(RES)				
Odonata								
Aeshnidae			2	2				
Coenagrionidae	1		1					
Cordulegastridae	4	7						
Gomphidae	6	13	1	9				
Libellulidae	1		6	7				
Ephemeroptera								
Baetidae	212(14.4)	260(10.1)	55(3.4)	94(2.9)				
Caenidae	1	6		5				
Ephemerellidae	34(2.3)	63(2.4)	118(7.4)	89(2.8)				
Ephemeridae		1	28	25				
Heptageniidae	293(19.8)	146(5.7)	360(22.5)	495(15.3)				
Leptophlebiidae	95(6.4)	142(5.5)	187(11.7)	428(13.3)				
Plecoptera								
Chloroperlidae	10	66(2.6)	29(1.8)	80(2.5)				
Leuctridae	13	22	7	44(1.4)				
Nemouridae	4	27(1.0)	5	11				
Peltoperlidae				1				
Perlidae	44(3.0)	53(2.1)	23(1.4)	72(2.2)				
Perlodidae	5	60(2.3)	11	13				
Pteronarcyidae	1	1						
Trichoptera								
Apatanidae	18(1.2)	11		5				
Brachycentridae	8	41(1.6)	2	2				
Glossosomatidae	13	12	1	30				
Helicopsychidae		1		11				
Hydropsychidae	27(1.8)	38(1.5)	99(6.2)	181(5.6)				
Hydroptilidae	2	68(2.6)	5	13				
Lepidostomatidae	28(1.8)	11	36(2.3)	106(3.3)				
Leptoceridae	5	80(3.1)	10	49(1.5)				
Molannidae			1					
Odontoceridae	11	3		1				
Philopotamidae	8	2	97(6.1)	3				
Polycentropodidae	15(1.0)	18	10	52(1.6)				
Psychomyiidae				1				
Rhyacophilidae	6	12	44(2.8)	27				
Coleoptera								
Elmidae	11	15	54(3.4)	29				
Dytiscidae			1					
Psephenidae	4	1	6	61				
Megaloptera								
Corydalidae	15(1.0)	25(1.0)	2	90(2.8)				
Sialidae			8	16				
Diptera								
Athericidae	7	6		5				
Ceratopogonidae	8	34(1.3)	2	19				
Chironomidae	527(35.7)	1147(44.4)	339(21.2)	883(27.4)				
Empididae	2			1				
Simulidae	8	3		3				
Tipulidae	8	98(3.8)	4	13				
Mollusca								
Ancylidae	1	1	36(2.3)	240(7.4)				
Pissidiidae	2	2	1	6				

Table 2. Results of Macroinvertebrate Identification and Enumeration. Cold Stream (CS), sampled 2011 and Enchanted Stream (ES), sampled 2011

Physidae			2					
Hydrobiidae				2				
Crustacea								
Cladocera		1						
Turbellaria								
Planariidae	2	5	2					
Annelida								
Oligochaeta								
Lumbriculidae	7	48(1.9)						
Naididae	10	28(1.1)	2	3				
Acariformes								
Hygrobatidae		1		1				
Sperchonidae		1						
Torrenticolidae		1						
Total Abundance	1477	2581	1597	3228				
# Taxa	40	43	37	43				
Percentages are not shown for taxa with abundances less than 1%								

APPENDIX B

UPPER ENCHANTED AND COLD STREAM ELECTROFISHING SURVEY FIELD DATA – AUGUST 2011

SampleID: 2011

Section 3.1.1 **Data Form – Species Relative Abundance**
LEVELS 1 AND 2 FISHERY SURVEY
Stream Survey: Species Composition or Relative Abundance Data Form

Nbx+Esa (Indian Pond) **Date:** 08/25/11 **Time of Day** 11:10

Stream: Cold Stream **LocationID:** Cold Stream Reference

Section Length _____ **Width** _____ **Area** _____ **Units** _____

GPS:
Top X coordinate _____ **Y coordinate** _____

Bottom X coordinate _____ **Y coordinate** _____

Gear: ~~SEP~~ LR20/Backpack **Net/seine length : mesh size** _____

Sample Duration:
Start _____ **Stop** _____ **Wand** _____

Electrofisher Settings: DC
Pulse Frequency ~~60~~ 70 **Pulse width** 40% **Voltage** 700

Sample Time (ST)
1357 ①
1932 ②
1069
431 ③

Species/Class	Count ①	②	③	Species/Class	Count
BkT	32 (pf)	16	3	(51)	
BND	15	6	0		

Habitat (Must add to 100%):
Riffle 70% **Pool** 10% **Run** 20% **Cascade** _____ **Rapid** _____
Deadwater _____

Water Quality:

pH 8.24 **Temperature** 17.8 **(C / F)**

DO 8.78 / 92.5% **Alkalinity** —

Conductivity ~~8.78~~ 25 µS

Comments:

Back of form

@ Scale Sample

Individual Information

Record individual info for all 1+ BKT, other species as directed. For YOY (all species) – ID, count, and measure (weights in groups of 5 – OK) all caught. Use as many sheets as necessary.

	Species	Length	Weight
1	BKT	74	4
2	BKT	205	83
3	BKT	198	85
4	BKT	118	17
5	BKT	115	14
(6)	BKT	170	54
7	BKT	135	25
8	BKT	124	16
(9)	BKT	153	46
10	BKT	131	23
11	BKT	136	28
(12)	BKT	80	5
13	BKT	142	29
14	BKT	96	8
(15)	BKT	114	15
16	BKT	114	14
(17)	BKT	146	33
(18)	BKT	124	17
(19)	BKT	76	4
20	BKT	67	2
21	BKT	74	4
22	BKT	83	5
23	BKT	72	4
24	BKT	71	3
25	BKT	84	5
26	BKT	72	4
27	BKT	70	2
28	BKT	79	5
29	BKT	80	5
30	BKT	81	5
31	BKT	81	6

	Species	Length	Weight
32	BKT	66	3
33	BWD	(x5)	96
~~34~~			
~~35~~	BWD	(x5)	69
~~36~~			
34 ~~37~~	BWD	(x5)	27
35 ~~38~~	BWD	(x5)	32
Pass 2 36 ~~39~~	BWD	(x5)	13
37 ~~40~~			
(38) ~~41~~	BKT	172	50
(39) ~~42~~	BKT	173	51
40 ~~43~~	BKT	175	63
41 ~~44~~	BKT	181	70
(42) ~~45~~	BKT	135	27
43 ~~46~~	BKT	146	35
44 ~~47~~	BKT	158	42
45 ~~48~~	BKT	75	3
46 ~~49~~	BKT	133	21
(47) ~~50~~	BKT	86	6
48 ~~51~~	BKT	70	3
49 ~~52~~	BKT	80	5
50 ~~53~~	BKT	81	5
51 ~~54~~	BKT	78	5
52 ~~55~~	BKT	81	5
53 ~~56~~	BKT	73	4
54 ~~57~~	BWD	(x5)	18
Pass 2 55 ~~58~~	BWD	—	2
56 ~~59~~	BKT	74	4
Pass 3 57 (60)	BKT	80	4
58 (61)	BKT	78	56
62			

SampleID: 2011

Section 3.1.1 **Data Form – Species Relative Abundance**
LEVELS 1 AND 2 FISHERY SURVEY
Stream Survey: Species Composition or Relative Abundance Data Form

NorthEra (Indian Pond) **Date:** 8/25/11 **Time of Day** 3:00

Stream: Cold Stream **LocationID:** Cold Stream Restoration

Section Length _____ **Width** _____ **Area** _____ **Units** _____

GPS:
Top X coordinate _____ **Y coordinate** _____

Bottom X coordinate _____ **Y coordinate** _____

Gear: LR 20 Backpack Shocker **Net/seine length : mesh size** _____

Sample Duration: ① 960 ② 820 ③ N/A
Start _____ **Stop** _____ **Wand** _____

Electrofisher Settings:
Pulse Frequency 80 **Pulse width** 40% **Voltage** 700v

Species/Class	Count	Species/Class	Count
BKT	37		
BnD	33		

Habitat (Must add to 100%):
Riffle _____ **Pool** 5% **Run** 95% **Cascade** _____ **Rapid** _____
Deadwater _____

Water Quality:

pH 8.09 **Temperature** 18.0° (C)/F)

DO 8.27 mg/L / 87.5% **Alkalinity** ---

Conductivity 29 MS

Comments:

Back of form

Individual Information

Record individual info for all 1+ BKT, other species as directed. For YOY (all species) – ID, count, and measure (weights in groups of 5 – OK) all caught. Use as many sheets as necessary.

	Species	Length	Weight
1	BkT	129	21
2	BkT	170	53
3	BkT	166	42
4	BkT	145	26
5	BkT	171	49
6	BkT	137	25
7	BKT	119	16
8	BKt	126	25
9	BKt	126	21
10	BKt	140	54
11	BKt	206	94
12	BKt	74	5
13	BKt	70	4
14	BKt	133	23
15	BKt	135	26
16	BKt	145	29
17	BKt	152	33
18	BKt	175	53
19	BKt	77	4
20	BKt	151	24
21	BKt	161	35
22	BKt	204	82
23	BKt	141	24
24	BKt	163	42
25	BKt	126	14
26	BKT	155	39
27	BKT	81	4
28	BKT	153	31
29	BKT	144	28
30	BKT	130	20
31	BKT	143	27

	Species	Length	Weight
32	BKT	83	5
33	BKT	83	5
34	BKT	77	5
35	BKT	72	4
36	BKT	69	3
37	BND	x 5	15
38	BND	x 5	17
39	"	x 5	13
40	"	x 6	16
41			
42	BKT	152	29
43	BND	x 12	11
44			
45			
46			
47			
48			
49			
50			
51			
52			
53			
54			
55			
56			
57			
58			
59			
60			
61			
62			

No Scales

and Peas

SampleID: 2011

Section 3.1.1 **Data Form – Species Relative Abundance**
LEVELS 1 AND 2 FISHERY SURVEY
Stream Survey: Species Composition or Relative Abundance Data Form

Montana (Indian Pond) **Date:** 8/26/11 **Time of Day** 1210

Stream: Enchanted Stream **LocationID:** Reference

Section Length _____ **Width** _____ **Area** _____ **Units** _____

GPS:
Top X coordinate _____ **Y coordinate** _____

Bottom X coordinate _____ **Y coordinate** _____

Gear: LR 20 Backpack EFish **Net/seine length : mesh size** _____

1429

Sample Duration: ① 820 ② 609 ③ 378
Start _____ **Stop** _____ **Wand** _____

Electrofisher Settings:
Pulse Frequency 80hz **Pulse width** 40.9% **Voltage** 700v

Species/Class	Count	Species/Class	Count
Brook Trout	28/10/2 (40)		
BND	20/8/2 (30)		
Creek chub	1/1/0 (2)		
~~White Sucker~~	~~2/0/0~~ (2)		
TOTAL	51~~/19/9~~		

Habitat (Must add to 100%):
Riffle_____ **Pool**_____ **Run**_____ **Cascade**_____ **Rapid**_____
Deadwater_____

Water Quality:

pH 8.05 **Temperature** 18.1 ° (C)/F)

DO 8.26 / 87.2% **Alkalinity** _____

Conductivity 25 µS

Comments:

Back of form

Individual Information

Record individual info for all 1+ BKT, other species as directed. For YOY (all species) – ID, count, and measure (weights in groups of 5 – OK) all caught. Use as many sheets as necessary.

	Species	Length	Weight
1	149	30	BKT
2	130	18	
3	145	27	
4	106	10	
5	98	6	
6	BKT	130	13
7		102	10
8		139	23
9		122	11
10		127	16
11		138	34
12		106	11
13		97	7
14	BHT	138	25
15		128	18
16		145	23
17		108	7
18		105	6
19		70	4
20	WHS	x1	5
21	BKT	135	21
22	BKT	66	1
23	BND	x4	13
24	BND	x8	31
25	BND	x7	14
26	BHT	122	12
27	BKT	131	15
28	BHT	136	27
29		115	13
30		116	13
31		106	11

	Species	Length	Weight
32	BHT	102	9
33	WHB	x1	7
34	CCB	x1	6
35	BND	x1	3
36			
2nd Pass 37	BKT	120	10
38		186	73
39		131	23
40		130	20
41		105	11
42		80	3
43	BND	x4	17
44	BND	x1	5
45	BHT	102	8
46	BHT	54	2
47	BND	x2	11
48	BHT	111	9
49	CCB	x1	2
50	BND	x1	5
51	BHT	111	8
52			
3rd Pass 53	BHT	147	32
54	BHT	112	12
55	BND	x2	12
56			
57			
58			
59			
60			
61			
62			

SampleID: 2011

Section 3.1.1 **Data Form – Species Relative Abundance**
LEVELS 1 AND 2 FISHERY SURVEY
Stream Survey: Species Composition or Relative Abundance Data Form

Next Era (Indian Pond) **Date:** 8/26/11 **Time of Day** 900 - 11:00

Stream: Enchanted Stream **LocationID:** Restoration

Section Length _____ **Width** _____ **Area** _____ **Units** _____

GPS:
Top X coordinate _____ **Y coordinate** _____

Bottom X coordinate _____ **Y coordinate** _____

Gear: LR 20 Backpack Fishing **Net/seine length : mesh size** _____

Sample Duration: ① 1291 ② 414 ③ 361
Start _____ **Stop** _____ **Wand** _____

Electrofisher Settings:
Pulse Frequency 80 hz **Pulse width** 40% **Voltage** 700v

Species/Class	Pass 1 / Count	Pass 2 / 3	Species/Class	Count
BKT	31	8 / 7 (46)		
BnT	54	19 / 2 (75)		
Ck Chub	23	3 / 0 (26)		
Wh Sucker	2	1 / 0 (3)		
Total				

Habitat (Must add to 100%):
Riffle _____ **Pool** _____ **Run** _____ **Cascade** _____ **Rapid** _____
Deadwater _____

Water Quality:

pH 8.00 **Temperature** 17.6° (C) / F)

DO 7.50 / 78.9% **Alkalinity** _____

Conductivity 25 MS

Comments:

Back of form

Individual Information

Record individual info for all 1+ BKT, other species as directed. For YOY (all species) – ID, count, and measure (weights in groups of 5 – OK) all caught. Use as many sheets as necessary.

	Species	Length	Weight
1	BKT	151	30
2	BKT	147	27
3	BKT	160	40
4	BKT	142	28
5	BKT	112	12
6	BKT	105	9
7	BKT	106	11
8	BKT	146	28
9	BKT	166	49
10	BKT	128	24
11	BKT	125	21
12	BKT	115	14
13	BKT	115	13
14	BKT	148	30
15	BKT	136	22
16	BKT	120	12
17	BKT	148	27
18	BKT	112	7
19	BKT	130	11
20	Creek chub = CRC	x3	19
21	BND	x8	15
22	CRC	x7	72
23	CRC	x2	22
24	BND	x7	3
25	CRC	x2	4
26	BND	x4	7
27	WHS	x1	7
28	CRC	x2	19
29	BND	x3	10
30	CRC	x2	7
31	BND	x3	7
32	CRC	x2	4
33	BKT	113	12
34	BKT	161	41
35	BKT	97	7
36	BKT	109	12
37	BKT	111	12
38	BKT	66	3
39	BKT	62	2
40	CRC	x1	11
41	BND	x4	11
42	CRC	x4	14
43	BKT	68	2
44	BND	x6	18
45	BND	x10	25
46	CRC	x1	3
47	WHS	x2	8
48	BKT	100	7
49	BKT	94	5
50	BKT	55	1
51	BND	x7	11
52	BKT	61	2
53	WHS	x1	5
54	CRC	x2	8
55	WHS	x1	6
56	BND	x2	9
57	BKT	141	24
58	BKT	139	28
59	BKT	101	9
60	BKT	102	9
61	BKT	62	2
62	BKT	66	2

SampleID: _____

Section 3.1.1 **Data Form – Species Relative Abundance**
LEVELS 1 AND 2 FISHERY SURVEY
Stream Survey: Species Composition or Relative Abundance Data Form

~~Enchanted~~ West Fk (Indn. Pond) **Date:** 8-26-11 **Time of Day** _____

Stream: Enchanted Stream (Restortnt) **LocationID:** Restoration

Section Length _____ **Width** _____ **Area** _____ **Units** _____

GPS:
Top X coordinate _____ **Y coordinate** _____

Bottom X coordinate _____ **Y coordinate** _____

Gear: LR20E - fishing **Net/seine length : mesh size** _____

Sample Duration:
Start _____ **Stop** _____ **Wand** _____

Electrofisher Settings:
Pulse Frequency _____ **Pulse width** _____ **Voltage** _____

Species/Class	Count	Species/Class	Count

Habitat (Must add to 100%):
Riffle _____ **Pool** _____ **Run** _____ **Cascade** _____ **Rapid** _____
Deadwater _____

Water Quality:

pH 8.00 **Temperature** 12.6 (C / F)

DO 7.50 / 78.9 % **Alkalinity** _____

Conductivity _____

Comments:

Back of form

Individual Information

Record individual info for all 1+ BKT, other species as directed. For YOY (all species) – ID, count, and measure (weights in groups of 5 – OK) all caught. Use as many sheets as necessary.

	Species	Length	Weight
1	BKT	71	3
2	BKT	72	3
3	BND	X9	11
4	CRC	X1	1
Run 3 → 5	BKT	176	57
6	BKT	169	45
7	BKT	152	27
8	BKT	107	15
9	BKT	147	32
10	BKT	98	8
11	BKT	123	16
12	BND	X2	4
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
31			

	Species	Length	Weight
32			
33			
34			
35			
36			
37			
38			
39			
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41			
42			
43			
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45			
46			
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