

# BROKEN BROOKS

Restoring Fish Passage and Habitat in the  
Petitcodiac Watershed

Report

2024 - 2025



ALLIANCE DU BASSIN VERSANT  
**PETITCODIAC**  
WATERSHED ALLIANCE

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## DISCLAIMER

The Petitcodiac Watershed Alliance (PWA) is a non-profit environmental charity that works to protect and improve the ecological systems within the Petitcodiac River watershed. We use local science to educate community members within the watershed about the ecology within the Petitcodiac River's watershed boundary, and the importance of protecting this unique river system.

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We also want to recognize the entire board of directors and staff of the PWA; we thank you for your help and support.

Finally, thank you to NBCC Moncton and the steel fabrication department for your continued partnership with us.

All our basic data maps were created by Petitcodiac Watershed Alliance using ArcGIS® software by Esri. ArcGIS® NS ArcMap™ is the intellectual property of Esri and are used herein under license. All our results concerning water crossing sites were added to QGIS, a free open-source geographic information system software developed by QGIS Development Team.

## Executive Summary

Over the eleven years of the Broken Brooks Project, 473 detailed culvert assessments have been completed, and our studies demonstrate that over half of these crossings are either a partial or full barrier to fish passage. Although cost-effective in comparison to other road-watercourse crossings, the environmental impact of these barrier culverts equates to over 520 kilometers of aquatic habitat that is lost or inaccessible to migrating fish species within the Petitcodiac River watershed.

The objective of the Broken Brooks project remains to facilitate fish passage through culverts assessed as barriers, and to increase habitat quality by reducing excessive sedimentation in the watercourse. To fulfill these objectives, remedial work from 2014 to 2025 has been completed at a total of 62 barrier culvert sites and 66 in-stream structure sites, and in doing so, improved fish passage to 191 kilometers of upstream habitat. This remedial work includes debris removals, outflow chute installations, and problematic in-stream structure removals. and problematic in-stream structure removals. and problematic in-stream structure removals.

During the 2024-2025 field season, the PWA conducted three debris removals, nine in-stream structure removals, and 55 site evaluations in the Petitcodiac watershed. After analyzing the data collected in 2024, it was found that 33% of culverts were measured as either partial (16.5%) or full barriers (16.5%) to fish passage, whereas 80.0% of the assessed culverts were classified as passable with respect to fish species attempting to access upstream habitat. This is a high rate of passability compared to the total results (38%), indicating that anadromous fish may encounter ease in reaching their spawning habitat in the sub-watersheds where culverts were assessed this year.

The PWA continues to make a concerted effort to expand the Broken Brooks Project beyond our watershed and outside of traditional environmental sectors by renewing diverse partnerships with the following organizations and government departments:

- Department of Transportation & Infrastructure (DTI)
- Department of Fisheries & Oceans (DFO)
- New Brunswick's Community College (NBCC)

Other highlights from 2024-2025 include consolidating all road-watercourse crossing data into QGIS from ArcGIS Online to enhance our analysis options and

mapping capabilities. We also shared our full set of crossing site assessment data with Fort Folly Habitat Recovery, an Indigenous organization focused on restoring Atlantic salmon populations. Additionally, the repair of outflow chute C-011 led to 1.720km of upstream habitat gain.

## Résumé général

Au cours des onze années du projet Broken Brooks, 473 évaluations de ponceaux ont été réalisées et démontrent que plus de la moitié de ces passages constituent une barrière partielle ou totale au passage des poissons. Bien que peu coûteux par comparaison avec d'autres types de passages routiers et cours d'eau, l'impact environnemental de ces ponceaux à barrières équivaut à la perte ou à l'inaccessibilité de plus de 520 kilomètres d'habitat aquatique pour les espèces de poissons migrateurs dans le bassin versant de la rivière Petitcodiac.

L'objectif du projet Broken Brooks est de faciliter le passage des poissons à travers les ponceaux considérés comme des obstacles et d'améliorer la qualité de l'habitat en réduisant la sédimentation excessive dans le cours d'eau. Pour atteindre ces objectifs, des travaux de remise en état ont été réalisés entre 2014 et 2025 sur un total de 62 sites de ponceaux constituant des obstacles et 66 sites de structures dans les cours d'eau, ce qui a permis d'améliorer le passage des poissons sur 191 kilomètres d'habitat en amont. Ces travaux de remise en état comprennent l'enlèvement des débris, l'installation de chutes d'évacuation et l'enlèvement des structures problématiques dans les cours d'eau.

Au cours de la saison 2024-2025, la PWA a procédé à trois opérations d'enlèvement de débris, 9 opérations d'enlèvement de structures dans les cours d'eau et à 55 évaluations de sites dans le bassin versant de la Petitcodiac. Après l'analyse de données recueillies en 2024, il a été constaté que 33 % des ponceaux constituaient des obstacles partiels (16,5 %) ou complets (16,5 %) au passage des poissons, tandis que 80,0 % des ponceaux évalués ont été classés comme praticables pour les espèces de poissons tentant d'accéder à leur habitat en amont. Il s'agit d'un taux élevé par rapport au résultat total (38 %), ce qui indique que les poissons anadromes peuvent atteindre facilement leur habitat de reproduction dans les sous-bassins versants où les ponceaux ont été évalués cette année.

La PWA continue de déployer des efforts concertés pour étendre le projet Broken Brooks au-delà de notre bassin versant et des secteurs environnementaux traditionnels en renouvelant divers partenariats avec les organisations et les ministères suivants:

- Ministère des Transports et de l'Infrastructure (MTI)
- Ministère des Pêches et des Océans (MPO)
- Collège communautaire du Nouveau-Brunswick (CCNB)

Parmi les autres faits marquants de 2024-2025, citons la consolidation de toutes les données relatives aux passages à niveau et aux cours d'eau dans QGIS à partir d'ArcGIS Online afin d'améliorer nos options d'analyse et nos capacités de cartographie. Nous avons également partagé l'ensemble de nos données d'évaluation des sites de passage avec Fort Folly Habitat Recovery, une organisation indigène qui se spécialise dans la restauration des populations de saumon de l'Atlantique. De plus, la réparation de la chute d'évacuation C-011 a permis de gagner 1,720 km d'habitat en amont.

# 1.0 Introduction

The PWA is a non-profit and non-governmental organization that works to restore and protect the ecological services that the Petitcodiac River watershed provides to the community. The PWA has been a leading organization in actively monitoring the watershed since its inception in 1997. Rigorous annual water quality sampling has resulted in a robust long-term databank encompassing parameters such as pH, dissolved oxygen, temperature, fecal and total coliforms, salinity, total dissolved solids, nitrates, phosphates, and suspended sediment concentrations. These parameters were chosen on the basis of the environment's ability to support life.

## 1.0 Overview of the Petitcodiac Watershed

The Petitcodiac River watershed extends from the village of Petitcodiac to beyond the boundaries of the city of Dieppe. The rivers and tributaries of the Petitcodiac, Memramcook, and Shepody watersheds run through roughly 3,000 square kilometers of land spanning multiple municipal jurisdictions, while supporting the most densely populated area of the province (approximately 170,000 people). The aquatic systems in these watersheds are likely stressed, as continued yearly water quality reports state that many parameters necessary for life are not being met. Additionally, increasing anthropogenic stressors over the past five decades have drastically altered the river's hydrology, morphology, and ability to support life. Current pressures affecting watershed health include increased development and industrialization as urban communities expand, continued agricultural and forestry land use stress, and potential development of natural gas extraction in rural areas.

## 1.1 Overview of the Broken Brooks Project

As anthropogenic expansion and development increases, instances of river crossings and alterations also increase. Culverts are commonly installed to divert water under roads, rail beds, and driveways to avoid pooling. The problem that often arises with culvert installation is the alteration of a river's morphology, negatively affecting fish and other aquatic fauna. For example, culverts can change water velocity, river hydrology, and often create full barriers to fish passage due to debris buildup. Because of this, a river may be conceptualized as being broken into segments.

The PWA established an aquatic connectivity program in the Petitcodiac watershed in 2014 with the objective of identifying road-watercourse crossings

(including bridges, culverts, dams, causeways, and fording sites) that were barriers to fish passage. To date, 1058 road-watercourse crossings have been identified throughout our watershed as one of the following:

- Bridge
- Fording Site
- Dam
- Crossing removed
- Not accessible
- Not Fish Habitat
- Culvert

Over the last ten years, detailed measurements have been taken of 473 culverts located on fish-bearing streams. Measurements taken with surveying equipment and a measuring tape enables a crossing to be labeled as 'Passable', a 'Partial Barrier' or a 'Full Barrier' to fish passage. The most common barriers to migrating aquatic species are steep culvert slopes, the presence of an outflow drop, and deteriorating infrastructure. The information gathered during the assessment process allows remedial work to be prioritized, through which the amount of aquatic habitat availability is increased.

In 2016, the Atlantic Canadian Culvert Assessment Toolkit (ACCAT) was created and uploaded to the PWA's website, providing any organization wishing to complete culvert assessments in their area with all the necessary datasheets and tutorial videos required to do so.

In 2020, PWA staff encountered multiple in-stream structures, including digger logs, wing deflectors, and solid log bank stabilizers along Jonathan Creek. These structures had been installed between 1999 and 2001 in three different sections (upper, middle, and lower) of Jonathan Creek. In 2021, the PWA found a total of 86 structures in all three sections. In the lower section, 18 structures were assessed in detail, eight of which were deemed problematic and removed.

In 2023, PWA staff assessed and removed the in-stream structures in Jonathan Creek. We assessed 24 structures and removed 13 of them, contributing to a total of 30 problematic structures removed to date. This year, we also reached the milestone of 1000 crossing sites assessed.

In 2024, PWA continued to assess in-stream structures in Jonathan Creek, including bank deflectors, bank stabilizers, and digger logs. We removed 9

structures identified as problematic and left 1 identified as ineffective, but not problematic. Additionally, we completed repairs on outflow chute C-011 to address structural issues and improve water flow.

## 1.2 Study Area

This year, the PWA focused its culvert assessment efforts within Johnathan Creek, Mud Creek, and the surrounding area's sub-watersheds. Jonathan Creek is an urban stream that flows through the city of Moncton and drains into the Petitcodiac River. Its lower reach flows into Centennial Park Pond and Jones Lake. Mud Creek is located in Lower Coverdale and drains into the west bank of the Petitcodiac River. The creek extends approximately 7 km upstream, primarily through forested terrain. It is fed by three unnamed tributaries, each contributing about 1 km of upstream flow. This was the sixth year that culvert assessments took place in the Greater Moncton Area, where road-watercourse crossings are more highly concentrated. In addition to culvert assessments, in-stream structure removals were conducted in the lower section of Jonathan Creek, downstream of Enviro Drive between Moncton and Berry Mills. Debris removals were performed in the Fox Creek and the Little River sub-watershed, and an outflow chute was installed in the Little River sub-watershed.

## 2.0 Methods

The methods outlined in this section include how in-stream structures are assessed and removed, how habitat is assessed, how culverts are assessed, how remedial actions are chosen, and how barrier culverts are prioritized for remediation. Before and after entering each watercourse, a water-vinegar mixture was used to disinfect waders and all equipment.

## 2.1 In-Stream Structure Assessment and Removal Procedure

In-stream structures, such as digger logs, wing deflectors, and solid, fixed bank stabilizers, were popular in the early 2000s for enhancing fish habitat by creating pools and slowing erosion.

However, many of these structures have proven problematic, as water energy is often displaced in unintended ways. For example, water going around a digger log rather than over it creates a bite-shaped area of erosion instead of the turbulence needed to form a pool, and in the case of deflectors and bank stabilizers, energy can be shifted downstream, accelerating erosion elsewhere in the watercourse. Figure 1 shows the latter scenario before and after the removal of a previous structure.



Figure 1. Bank stabilizer (JC-L04) and wing deflector (JC-L05) causing accelerated erosion into an old-growth area downstream before removal (left) and predicted flow after structure removal (right).

Structure assessment includes finding the structures during a walk of the stream section in which they are located. Once a structure is found, the surrounding area and downstream are inspected for signs of accelerated erosion caused by the structure. If evident signs are present, or if the structure is failing, for example, a digger log being uplifted from the riverbed, the structure is flagged for removal. Otherwise, the structure is deemed effective or ineffective (but not problematic).

Structures determined to be problematic are removed using axes and wrecking bars. Rebar used to fasten the structure in place is removed from the wood and collected at the end of the day. After having been chopped into smaller, more manageable sections, the wood is treated as regular woody debris and placed out of the watercourse and into the riparian zone.

## 2.2 Culvert Assessment Procedure

Within our watershed, there are several smaller rivers and streams that flow into the Petitcodiac River. The first step was to prioritize these smaller sub-basins based on water quality and the presence of abundant fish populations, most notably the target fish species: Atlantic salmon (*Salmo salar*) and brook trout (*Salvelinus fontinalis*). To improve and increase aquatic habitat for the target fish species, the first year of connectivity assessments was focused within the Pollett and Little River basins, where healthy populations of Atlantic salmon and brook trout are known to exist.

This year, the Johnathan Creek, Mud Creek, and surrounding areas sub-watersheds were selected for an aquatic connectivity analysis to further build upon the baseline understanding of freshwater habitat connectivity and availability in the Greater Moncton Area.

Having prioritized and selected a region to be assessed for aquatic connectivity, ArcGIS software was used to create a map of the area of study. The locations of potential culvert sites were identified by plotting a symbol at each instance where a road intersected a watercourse. Google Maps was also used to help verify the presence or absence of a crossing. Once maps were completed, field assessments were conducted using the ACCAT protocol. Coordinates from the maps were used to locate each site in the field. The data obtained during crossing assessments were added to a map on the QGIS software. The equipment required for each watercourse crossing assessment is outlined in Table I.

Table I: List of field equipment for site visits and detailed culvert assessments.

Materials/Supplies	Equipment	Safety/Personal
Pencil	60m measuring tape	Hip/Chest waders
Eraser	Automatic level	Rubber boots / Rain gear
Pencil sharpener	Tripod	Cell phone / flashlight
Topographic map	Level rod	Field first aid kit
Batteries	Meter stick	Reflective vests
Data sheets (on waterproof paper)	Clipboard	Water bottle
Mileage record	GPS	Camera
		Hat, sunscreen, insect repellent

Upon arrival at each road-watercourse crossing site, the first section of the datasheet (titled "Crossing Data"), was completed, and the crossing type was observed as one of the following: Bridge, fording site, dam, culvert removed, not accessible, not fish habitat, or culvert.

For every culvert located on a fish-bearing stream, a more detailed assessment was completed by filling out the 'Photos', 'Structure', and 'Elevation' sections of the assessment sheet (Appendix A: Atlantic Canadian Culvert Assessment Toolkit Watercourse Crossing Datasheet). A description of each of the parameters in the datasheet can also be found in Appendix B: Description of Full Assessment Parameters.

Using the information gathered in the datasheet, culverts were classified as 'Passable', a 'Partial Barrier', or a 'Full Barrier' based on the culvert slope and outflow drop (Table II). In general, the greater the slope and outflow drop of a culvert, the more difficult it becomes for a fish to pass through it and access upstream habitat.

Table II: Table of culvert conditions determining fish passability.

Barrier Type	Criteria
Passable	No outflow drop AND culvert slope < 0.5%
Partial Barrier	Outflow drop < 10 cm OR culvert slope between 0.5% and 2.5%
Full Barrier	Outflow drop > 10 cm OR culvert slope > 2.5%

## 2.3 Selecting a Remedial Action

Many culverts deemed to be a barrier had more than one issue contributing to their inability to pass fish. Remedial options were derived from *Guidelines for the design of fish passage for culverts in Nova Scotia* (Fisheries and Oceans Canada,

2015). The PWA first learned of these remedial techniques from NSLC Adopt A Stream during the ACCAT Steering Committee Meeting in 2016 (Table III).

*Table III: Remedial options for culverts classified as either a partial or full barrier.*

Culvert Measurements	Remedial Option
Outflow drop less than 15 cm	Rock weir
Outflow drop less than or equal to 25 cm	Outflow chute
Outflow drop between 25 cm and 40 cm	Outflow chute with downstream weirs
Outflow drop greater than 40 cm	Mini-fishway
Slope greater than 0.5%	Baffles

## 2.4 Prioritizing and Remediating Barrier Culverts

There are many factors to consider when not only prioritizing remediation of barrier culverts but also choosing a remediation technique. First, once the data has been compiled, culverts are sorted by upstream habitat gain in descending order. Next, culverts with natural bottoms, outflow drops between 0 and 40 centimeters, and/or severe erosion are filtered out from the list. As a result, only culverts on which remedial work would be successful remain. Finally, images taken during fieldwork are used to verify the conditions of the culverts in order to better judge the feasibility of remediation. It is recommended that each site be revisited and remeasured before plans for remedial work begin. One or more remedial techniques are chosen based on the conditions detailed in Table III.

### 2.4.1 Debris Removals

Woody debris, leaf litter, and sediment are natural and normal components of a stream ecosystem. However, a restrictive and narrow culvert can cause large debris to catch on the inflow. As a result, an accumulation of debris may occur, leading to a blockage at the inflow of the culvert and impeding fish passage upstream. Therefore, to maintain proper fish passage and adequate water depth, debris removals took place when blockages were encountered during culvert assessments.

### 2.4.2 Rock Weirs

On culverts assessed to have an outflow drop of 15 centimeters or less, a rock weir can be installed to increase the height of the existing plunge pool. By installing this type of structure, water levels are raised in the plunge pool, and the

barrier outflow drop is effectively reduced or eliminated (Figure 2). The size of the rock weir, and the crushed stone or river stone used to construct it, is calculated using the formula found in Appendix G: Rock Weir Calculations. The value for each parameter is obtained during the prior assessment of the culvert.



*Figure 2: Rock weir constructed in 2020, located in the Halls Creek sub-watershed.*

### 2.4.3 Outflow Chutes

An outflow chute is a preferred remediation structure for when a culvert exhibits an outflow drop of up to 25 centimeters, ideally between 15 and 25 centimeters, as an outflow drop of less than 15 centimeters can usually be eliminated with a rock weir on its own. However, both a rock weir and an outflow chute may be installed at a single site to eliminate an outflow drop of up to 40 centimeters. Outflow chutes are constructed by students of NBCC Moncton campus's steel fabrication department and installed by PWA staff in the following field season. Figure 3 details the schematic used to construct the outflow chute that was installed in the spring of 2025. Figure 4 shows an outflow chute installed in June 2024.

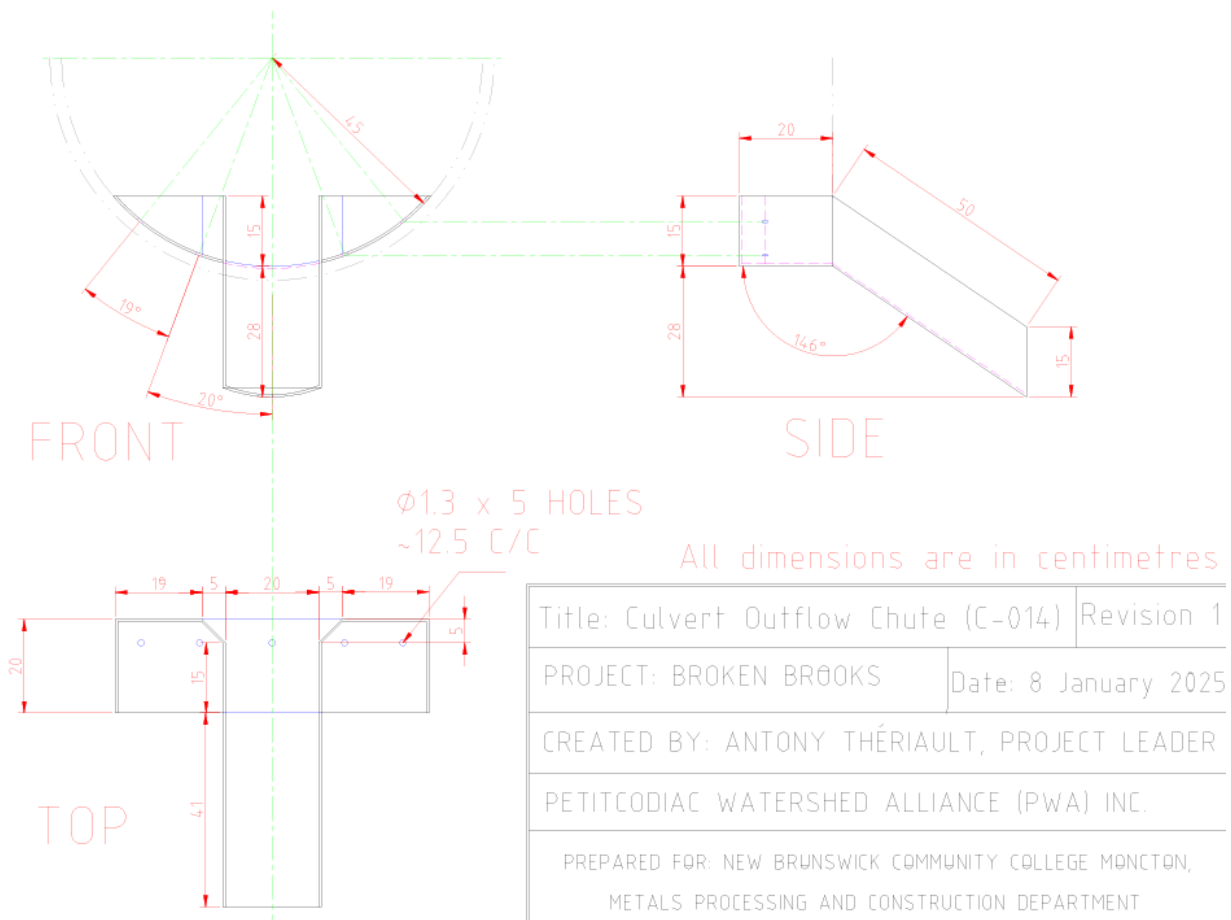


Figure 3: Front, top, and side views with dimensions of the outflow chute for culvert C-014.



*Figure 4: Outflow chute installed at a culvert.*

### 3.0 Results and Discussion

Results from the 2024-2025 Broken Brooks project have been divided into 2024-2025 field data followed by a total of all culverts and crossing work that has been conducted since the inception of the Broken Brooks project in 2014. Remedial efforts on barrier culverts that have taken place over the last ten years are also outlined in this section. All assessment and remedial work have been integrated into QGIS and have greatly increased our capacity to not only share data with stakeholders but also track habitat remediation work. A more detailed discussion of how to connect to other organizations, both in and outside of the environmental sector, has allowed us to continually grow the culvert program each year also appears in this section.

#### 3.1 Results from 2024-2025 Fieldwork

During the 2024-2025 season, PWA staff identified a total of 55 road-watercourse crossings throughout Jonathan Creek, Mud Creek, and surrounding areas. In addition to the 30 culverts assessed in these locations, a total of four bridges, one dam, one non-accessible site, six removed crossings, and 13 crossings situated on streams considered not to be suitable for fish habitat were found (Table IV and Figure 5).

*Table IV: 2024 Watercourse crossing totals for Jonathan Creek, Mud Creek, and surrounding areas.*

Crossing Type	Number of Crossings	Percent (%)
Culverts Assessed	30	54
Bridges	4	7
Fording Sites	0	0.0
Not Fish Habitat	13	24
Not Accessible	1	2
Crossing Removed	6	11
Dams	1	2
Total	55	100.0

Table V further classifies the 30 detailed culvert assessments within the Jonathan Creek, Mud Creek, and surrounding areas on fish passability. Most of the culverts (67%) were measured as passable to fish passage with respect to fish species attempting to access upstream habitat. The other portion of culverts (33%) were either partial (16.5%) or full barriers (16.5%) to fish passage. These results

indicate that anadromous fish may encounter ease in reaching their spawning habitat in the sub-watersheds where culverts were assessed this year. *Table V: 2024-2025 Culvert assessment results for Jonathan Creek, Mud Creek, and surrounding areas.*

Passability	Number of Culverts	Percent (%)
Passable	20	67
Partial Barrier	5	16.5
Full Barrier	5	16.5
Total	30	100.0

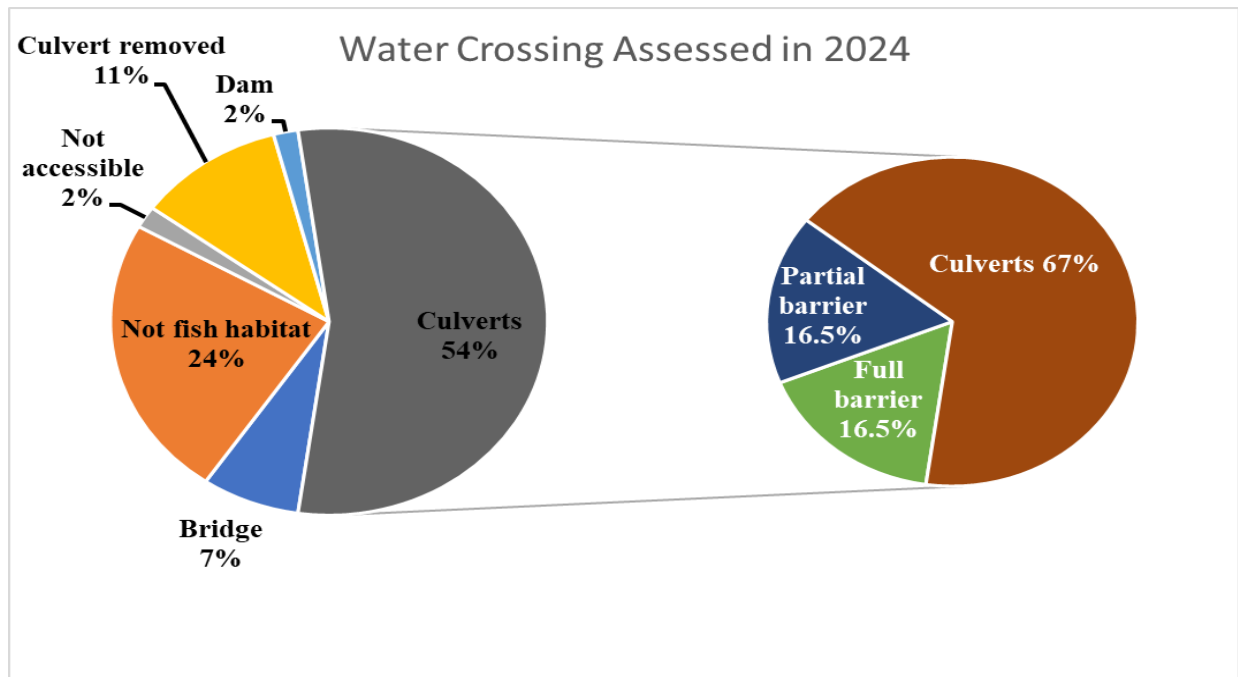


Figure 5: Watercourse crossing types identified in the Jonathan Creek, Mud Creek and surrounding areas in 2024.

### 3.2 Total Project Results from 2014 to 2024

Over the course of the last ten field seasons, our assessments have covered the following sub- watersheds: Pollett River, Little River, Lower Turtle Creek, Bannister Brook, Stoney Creek, Weldon Creek, North River, Anagance River, Memramcook River, Hall’s Creek, Jonathan Creek, Babineau Creek, and Mud Creek.

Throughout the above-listed sub-watersheds, we have identified a total of 1,058 road-watercourse crossings and have completed a grand total of 473 detailed culvert assessments. Table VI outlines the number of each crossing type encountered and its corresponding percent value. Figure 6 gives the percent value in pie-chart form.

*Table VI: 2014–2024 Watercourse crossing totals throughout the Petitcodiac watershed.*

Crossing Type	Number of Crossings	Percent (%)
Culverts Assessed	473	45
Bridges	164	15
Fording Sites	53	5
Not Fish Habitat	196	19
Not Accessible	142	13
Culvert Removed	17	2
Dams	13	1
Total	1058	100

Of the 473 culverts assessed between 2014 and 2024, 38% were evaluated as Passable, 22% were Partial Barriers and 40% were Full Barriers to fish passage (Table VII).

*Table VII: 2014–2024 Culvert assessment results throughout the Petitcodiac watershed.*

Passability	Number of Culverts	Percent (%)
Passable	181	38
Partial Barrier	103	22
Full Barrier	189	40
Total	473	100

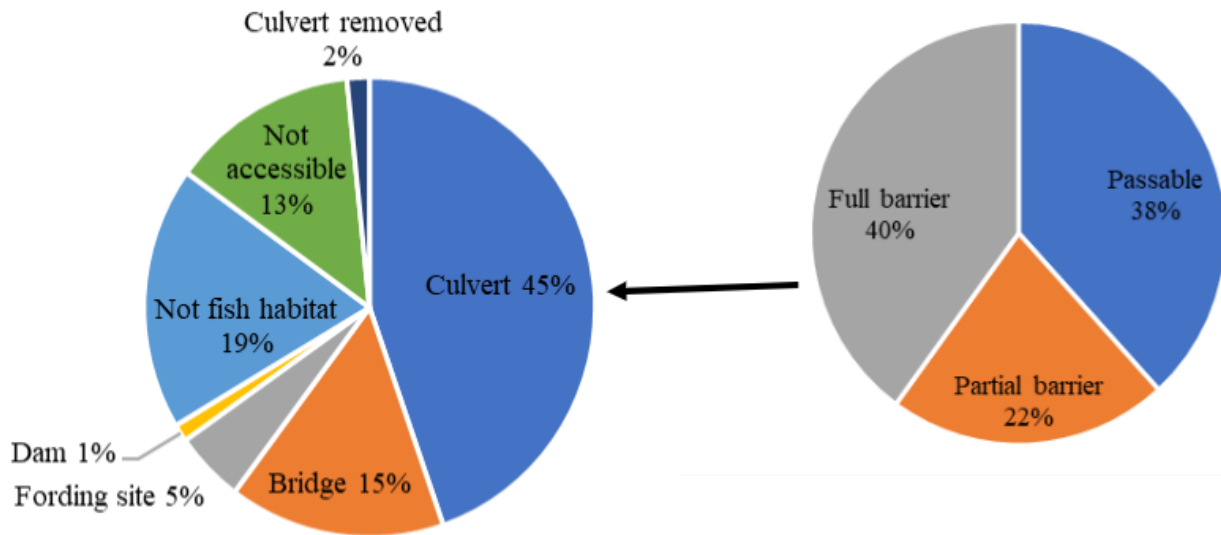


Figure 6: Watercourse crossing types identified in the Petitcodiac watershed from 2014 to 2024.

### 3.3 Remedial Efforts

Remedial efforts for the 2024-2025 field season include debris removals, in-stream structure removals, and an outflow chute installation.

#### 3.3.1 Debris Removals

Five debris removals were conducted in the Fox Creek sub-watershed resulting in a total of 3.7 kilometers of upstream habitat gain. Table VIII details the location and upstream habitat gain of each debris removal site.

Table VIII: 2024 Debris removals.

Site Id	Sub-watershed	Latitude	Longitude	Upstream habitat gain (m)
CFC16	Fox Creek	46.07589	-64.67633	1215
PBFC30	Fox Creek	46.07821	-64.66812	611
CFC41	Fox Creek	46.08888	-64.67728	1015
PBFC62	Fox Creek	46.09812	-64.67762	481
FBFC69	Fox Creek	46.11197	-64.70562	384

### 3.3.2 In-Stream Structure Removals

A total of 10 structures were found in the upper section of Jonathan Creek, nine of which were identified as problematic, causing evident accelerated erosion nearby. All nine problematic structures were removed successfully. Table VIII details in-stream structure removal activities undertaken this past field season.

*Table IX: In-stream structures in the upper section of Jonathan Creek.*

Structure	Latitude	Longitude	Status	Result
JC-U 55	46.096919	-64.882539	Ineffective	Removed
JC-U 56	46.096861	-64.8825	Ineffective	Removed
JC-U 57	46.096811	-64.881969	Problematic	Removed
JC-U 58	46.096919	-64.8803	Ineffective	No action taken
JC-U 59	46.096739	-64.880169	Problematic	Removed
JC-U 60	46.096631	-64.880019	Problematic	Removed
JC-U 61	46.09655	-64.879461	Ineffective	Removed
JC-U 62	46.096569	-64.87905	Ineffective	Removed
JC-U 63	46.096719	-64.878331	Ineffective	Removed
JC-U 64	46.096761	-64.877689	Problematic	Removed

### 3.3.3 Outflow chute installation

In June 2025, we installed an outflow chute at the C-014 culvert, located on a tributary in the Little River sub-watershed (45.8251, -65.0523), creating 2.9 km of upstream habitat. During the very dry conditions this summer, it became clear that a rock weir would be needed to raise the water level in the outflow pool. The planning and installation of the rock weir are expected to take place in 2026.

### 3.3.4 Structure Repair

The outflow chute at culvert C-011, located in the Pollet River sub-watershed, was repaired in September 2024, restoring access to 1.72 km of upstream habitat.



*Figure 7: Outflow chute at culvert C-011 repaired in September 2024.*

### 3.4 Project Outreach

The PWA continues to increase public awareness on the impacts of human infrastructure on our local fish populations. Publications were made for both Instagram and Facebook, reaching a vast number of people virtually. A total of 14 posts were shared on Instagram and Facebook, reaching 4,884 views, and generating 138 interactions. Project updates were provided in our Winter Newsletter, sent in March 2025 to 190 people. Presentations were done at the University of Waterloo Talk, Petitcodiac Sportsman's Club, and at the PWA AGM, reaching a total audience of 55 people. All funder's logos were used in all presentations given. We also trained 3 permanent staff and 2 summer students in 2024/2025 to do culvert assessments.

## 4.0 Conclusion

Culverts are the most common structure used to enable anthropogenic transportation across waterways, and in the case of those culverts assessed in the Petitcodiac watershed, are a barrier to fish passage 62% of the time. The 292 culverts that make up these partial and full barriers restrict access to over 520 km of aquatic habitat for various species attempting to migrate upstream to fulfill their life cycles. Fortunately, an integral part of this project has been to restore barrier culverts where expertise and resources allow. So far, fish passage has been improved to approximately 191 km of upstream habitat through the remediation of 62 barrier culverts and 66 in-stream structure sites over the past ten years.

With the addition of in-stream structure removals and debris removals, the PWA will continue to reduce the anthropogenic impacts threatening anadromous fish species, such as the inner Bay of Fundy Atlantic salmon and brook trout.

The PWA continues to expand its aquatic connectivity program by connecting with a diverse network of organizations. Discussions with NSLC Adopt A Stream have identified opportunities to expand the PWA's current culvert remedial techniques over the past couple of years. Furthermore, a partnership with NBCC Moncton is allowing trades outside of the environmental sector to apply their skills in reversing habitat fragmentation. In doing so, students experience the gratification that comes with conservation work and will potentially carry this initiative into their respective trades.

## 5.0 References

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[Untitled photographs of surveying equipment]. (n.d.). Retrieved November 5, 2014, from: <http://www.levelling.uhi.ac.uk/index.html>

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# Appendix A: Atlantic Canadian Culvert Assessment Toolkit Watercourse Crossing Datasheet

Crossing Data						
Observers						
Crossing ID				Date Observed		
Road Type	<input type="checkbox"/> Public	<input type="checkbox"/> Rail Bed ROW	<input type="checkbox"/> Private	<input type="checkbox"/> Logging Road		
Road Name				Crossing Condition	<input type="checkbox"/> New <input type="checkbox"/> Old <input type="checkbox"/> Eroding <input type="checkbox"/> Rusted <input type="checkbox"/> Collapsing	
Stream Name						
Upstream Habitat Gain						
Tidal Site	Yes <input type="checkbox"/> No <input type="checkbox"/> Unknown <input type="checkbox"/>					
Crossing Type	<input type="checkbox"/> Bridge <input type="checkbox"/> Ford <input type="checkbox"/> Dam <input type="checkbox"/> Removed <input type="checkbox"/> Inaccessible		<input type="checkbox"/> Not Fish Habitat <input type="checkbox"/> Culvert #			
GPS Coordinates	LAT			LONG		
Beaver dam present	<input type="checkbox"/> Yes <input type="checkbox"/> No		Fish observed		<input type="checkbox"/> Upstream	<input type="checkbox"/> Downstream
Evidence of erosion	<input type="checkbox"/> Upstream ( <input type="checkbox"/> Left bank <input type="checkbox"/> Right bank <input type="checkbox"/> Fill slope) <input type="checkbox"/> Downstream ( <input type="checkbox"/> Left bank <input type="checkbox"/> Right bank <input type="checkbox"/> Fill slope)			Estimated area of active erosion (m <sup>2</sup> )		

Photo IDs			
Upstream		Downstream	
Inlet		Outlet	
Other		Other	

Structure 1					
Debris blockage present	<input type="checkbox"/> Yes <input type="checkbox"/> No		Description of debris		
Culvert material	<input type="checkbox"/> Concrete <input type="checkbox"/> Corrugated Metal Pipe		<input type="checkbox"/> Corrugated Plastic <input type="checkbox"/> Smooth		<input type="checkbox"/> Wood <input type="checkbox"/> Other
Culvert shape	<input type="checkbox"/> Round <input type="checkbox"/> Pipe Arch		<input type="checkbox"/> Open bottom arch		<input type="checkbox"/> Box
Culvert bottom	<input type="checkbox"/> Unnatural <input type="checkbox"/> Natural	Culvert dimensions (m)	Width	Height	Length
Backwatered	<input type="checkbox"/> 0% <input type="checkbox"/> 25% <input type="checkbox"/> 50% <input type="checkbox"/> 75% <input type="checkbox"/> 100%		Baffles	<input type="checkbox"/> Present	<input type="checkbox"/> Absent
Water depth in crossing matches that of stream: yes no (significantly deeper) no (significantly shallower)					
Water velocity in crossing matches that of stream: yes no (significantly faster) no (significantly slower)					

Embedment	<input type="checkbox"/> from upstream <input type="checkbox"/> from downstream	Length of Culvert with Embedment	<input type="checkbox"/> 0% <input type="checkbox"/> 25% <input type="checkbox"/> 50% <input type="checkbox"/> 75% <input type="checkbox"/> 100%
-----------	---	----------------------------------	--

### Elevations (m)

Station	BS	HI	FS	Elevation (HI - FS)	Distances (m)	Tailwater Control Bankfull Width:	
Inflow							Distance from Tailwater Control to Second Riffle:
Outflow							
Tailwater Control							
Left Bankfull at Tailwater							
Right Bankfull at Tailwater							
Second Riffle							

Culvert Slope (%) (Inflow - Outflow)/Culvert length*100		Outflow Drop (outflow - tailwater control)	
--	--	---	--

Downstream Slope (Tailwater Control - Second Riffle/distance from tailwater control to second riffle)	
---	--

### Structure 2

Debris blockage present	<input type="checkbox"/> Yes <input type="checkbox"/> No	Description of debris	
-------------------------	--	-----------------------	--

Culvert material	<input type="checkbox"/> Concrete <input type="checkbox"/> Corrugated Metal <input type="checkbox"/> Corrugated Plastic <input type="checkbox"/> Pipe <input type="checkbox"/> Smooth	<input type="checkbox"/> Wood <input type="checkbox"/> Other
------------------	---	--

Culvert shape	<input type="checkbox"/> Round <input type="checkbox"/> Arch <input type="checkbox"/> Pipe <input type="checkbox"/> Open bottom arch <input type="checkbox"/> Box
---------------	---

Culvert bottom	<input type="checkbox"/> Unnatural <input type="checkbox"/> Natural	Culvert dimensions (m)	Width	Height	Length
----------------	---	------------------------	-------	--------	--------

Backwatered	<input type="checkbox"/> 0% <input type="checkbox"/> 25% <input type="checkbox"/> 50% <input type="checkbox"/> 75% <input type="checkbox"/> 100%	Baffles	<input type="checkbox"/> Present <input type="checkbox"/> Absent
-------------	--	---------	--

Water depth in crossing matches that of stream: yes no (significantly deeper) no (significantly shallower)
--

Water velocity in crossing matches that of stream: yes no (significantly faster) no (significantly slower)
--

Embedment	<input type="checkbox"/> from upstream <input type="checkbox"/> from downstream	Length of Culvert with Embedment	<input type="checkbox"/> 0% <input type="checkbox"/> 25% <input type="checkbox"/> 50% <input type="checkbox"/> 75% <input type="checkbox"/> 100%
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### Elevations (m)

Station	BS	HI	FS	Elevation (HI - FS)	Distances	Tailwater Control Bankfull Width:	
Inflow							Distance from Tailwater Control to Second Riffle:
Outflow							
Tailwater Control							
Left Bankfull at Tailwater							
Right Bankfull at Tailwater							
Second Riffle							

Culvert Slope (%) (Inflow - Outflow)/Culvert length*100		Outflow Drop (outflow - tailwater control)	
--	--	---	--

Downstream Slope (Tailwater Control – Second Riffle/distance from tailwater control to second riffle)										
<b>Structure 3</b>										
Debris blockage present		<input type="checkbox"/> Yes <input type="checkbox"/> No		Description of debris						
Culvert material	<input type="checkbox"/> Concrete Pipe		<input type="checkbox"/> Corrugated Metal		<input type="checkbox"/> Corrugated Plastic Smooth		<input type="checkbox"/> Wood		<input type="checkbox"/> Other	
Culvert shape	<input type="checkbox"/> Round Arch		<input type="checkbox"/> Pipe		<input type="checkbox"/> Open bottom arch		<input type="checkbox"/> Box			
Culvert bottom	<input type="checkbox"/> Unnatural		<input type="checkbox"/> Natural		Culvert dimensions (m)	Width	Height	Length		
Backwatered	<input type="checkbox"/> 0%		<input type="checkbox"/> 25%		<input type="checkbox"/> 50%		<input type="checkbox"/> 75%		<input type="checkbox"/> 100%	
Baffles	<input type="checkbox"/> Present		<input type="checkbox"/> Absent							
Water depth in crossing matches that of stream: yes no (significantly deeper) no (significantly shallower)										
Water velocity in crossing matches that of stream: yes no (significantly faster) no (significantly slower)										
Embedment	<input type="checkbox"/> from upstream		<input type="checkbox"/> from downstream		Length of Culvert with Embedment			<input type="checkbox"/> 0% <input type="checkbox"/> 25% <input type="checkbox"/> 50% <input type="checkbox"/> 75% <input type="checkbox"/> 100%		
<b>Elevations</b>										
Station	BS	HI	FS	Elevation (HI – FS)	Meas □	Tailwater Control Bankfull Width:				
Inflow										
Outflow										
Tailwater Control						Distance from Tailwater Control to Second Riffle:				
Left Bankfull at Tailwater										
Right Bankfull at Tailwater										
Second Riffle										
Culvert Slope (%) (Inflow- Outflow)/Culvert length*100					Outflow Drop (outflow – tailwater control)					
Downstream Slope (Tailwater Control – Second Riffle/distance from tailwater control to second riffle)										

## Appendix B: Description of Full Assessment Parameters

Variable	Units	Description
<b>Crossing Data</b>		
Researchers		Assessors collecting the data
Culvert ID		An identification code unique to each crossing
Date Observed		
Road Type		Indicate whether the crossing is located on a public road, rail bed, private property or logging road
Road Name		Ability of watercourse to support fish
Stream Name		Name of watercourse the structure is located on

Upstream Habitat Gain		The distance of upstream habitat from the current site to the next barrier or un-assessed water crossing
Tidal Site		Date the culvert assessment began
Crossing Type		Select one of the following: bridge, fording site, dam, inaccessible, not fish habitat or culvert (# of culverts present)
Crossing Condition		Indicate one of the following: new, old, eroding, rusted, collapsing
GPS Coordinates		Location of the culvert using latitude and longitude
Beaver activity present		Indicate if there are any signs of beaver activity including a beaver dam or lodge
Fish Observed		The observation of any fish observed. Include type, number & approximate size
Evidence of erosion		If erosion is present in the crossing area indicate whether it is occurring upstream, downstream, left bank, right bank and/or fill slope
Estimated area of active erosion	m <sup>2</sup>	Estimate the area of active erosion if indicated in the previous category
Photo IDS		
Photos		Photos of watercourse crossing site (U/S-upstream, Inflow, D/S- downstream, outflow, other) and corresponding id number as indicated on camera
Structure 1 (complete section when a culvert is located on a fish bearing stream)		
Debris blockage present		Indicate whether debris has built up either at the culvert inflow or within the stream
Description of debris		Describe what the debris blockage is composed of (large woody debris, deteriorating culvert material, garbage, etc)
Culvert material		Indicate what the material the culvert is composed of: concrete, corrugated metal pipe, corrugated plastic, smooth, wood, or other
Culvert shape		Indicate whether the shape of the culvert is round, pipe arch, open bottom arch, or box
Culvert bottom		Indicate whether the culvert bottom is natural (similar to the surrounding stream substrate) or unnatural
Culvert dimensions	m	Measure the culvert width, height, and length with a measuring tape in meters
Backwatered	%	Surface of the outflow pool extending back into the culvert negates the problematic slopes. Recorded as 25%, 50%, 75%, or 100% backwatered.
Baffles		Indicate the presence of baffles in a culvert
Water depth in crossing matches that of stream		Indicate whether the water depth in the culvert is deeper, shallower, or similar to that of the stream
Water velocity in crossing matches that of stream:		Indicate whether the water velocity in the culvert is faster, slower, or similar to that of the stream
Embedment		If the culvert is embedded into the stream substrate, indicate if it occurs upstream or downstream

Length of Culvert with Embedment	%	If embedment was indicated in the above category, indicate what percentage of the pipe was embedded.
Elevations		
Culvert Inflow	m	Elevation measurement taken at the bottom of the inflow of a structure
Culvert Outflow	m	Elevation measurement taken at the bottom of the outflow of a structure
Tailwater Control	m	Elevation measurement taken in the thalweg at the end of the outflow pool or at an identified location downstream of the structure
Left Bankfull at Tailwater	m	Elevation measurement of the left bankfull width of the watercourse taken downstream of structure
Right Bankfull at Tailwater	m	Elevation measurement of the right bankfull width of the watercourse taken downstream of structure
Second Riffle	m	Elevation measurement taken at the next riffle immediately downstream of the tailwater control point
Tailwater Control Bankfull Width	m	Measure the bankfull width at the tailwater control
Distance from Tailwater Control to Second Riffle:	m	Measure the distance between the tailwater control and the second riffle
Culvert Slope (%)	%	Slope of the culvert calculated by: $(\text{Inflow} - \text{Outflow}) / \text{Culvert length} * 100$
Outflow Drop	m	Distance between the bottom of the culvert outflow and the thalweg of the tailwater control. Calculated by subtracting the tailwater elevation from the outflow elevation
Downstream Slope	%	Natural slope of the streambed calculated by: $(\text{Tailwater Control} - \text{Second Riffle}) / \text{distance from tailwater control to second riffle}$
Structure 2 and/or Structure 3 Complete these sections if a double or triple culvert is present		

# Appendix C: Culvert Assessment Equipment Checklist

## Materials

- Clipboard
- Data Sheets (on waterproof paper)
- Pencils, Eraser, Sharpener
- GPS
- Topographic Map
- Camera
- Extra Batteries
- Data Sheets
- Mileage Record

## Equipment

- 60 m measuring tape
- Meter Stick
- Surveying: Automatic Level, Tripod & Level Rod

## Safety

- Hip or Chest Waders
- Rain Gear
- Flashlight
- Field First Aid Kit
- Reflective Vests
- Insect Repellant, Sun Screen, Hat, Water Bottle PFD (working in swift water)

## Appendix D: Automatic Level Survey Procedures for Culvert Assessments

The automatic level survey is an optical instrument that provides a height of reference from which you can determine changes in elevations, and in doing so the slope, from one location to another. The equipment required to conduct surveys is outlined below (must have a minimum of 2 people):

1. Tripod: as indicated in its name, the tripod has 3 'legs' that are adjustable for height. The automatic level will be secured onto the top of the tripod for the duration of the surveying procedure.
2. Automatic Level: Elevation measurements are taken by reading the staff through the lens of the automatic level.
3. Staff: 5 meter long measuring stick, divided into meters and centimeters. Readings are measured to the nearest centimeter.



*Figure 8: Pictures of the 3 pieces of equipment required for surveying: the tripod (left), the automatic level (center) and the staff (right) (Photographs of surveying equipment, n.d.).*

Terminology:

Height of Instrument (HI): arbitrary elevation from which all other elevations will be calculated.

Elevation: The goal of level surveying is to determine the elevation of each

location. For culvert assessments, the elevations of the following locations must be calculated:

1. First Riffle
2. Culvert Inflow
3. Culvert Outflow
4. Pool Depth
5. Tailwater Control
6. Second Riffle
7. Tailwater Control Horizontal Cross-Section

With the elevations of these locations, the slope of the following stream characteristics can be calculated:

1. Upstream Slope
2. Culvert Slope
3. Downstream Slope
4. Bankfull Height and cross-section of the Tailwater Control

Foresight (FS): The first measurement taken of the staff. If the tripod location does not change, the HI will remain static and only FS readings will be taken at each station. At the very most, only two formulas are needed throughout the procedure. The first is to find elevation:

$$\textit{Elevation} = \textit{HI} - \textit{FS}$$

Backsight (BS): If the tripod has to be moved, the staff must stay at the same location while it is being repositioned. Once relocated, the person at the tripod can take a BS reading from the staff and calculate the new HI.

$$\textit{HI}_{new} = \textit{Elevation} + \textit{BS}$$

## Procedure

If at all possible, set up the tripod in a location where all of the following can be observed:

1. First Riffle
2. Culvert Inflow
3. Culvert Outflow
4. Pool Depth
5. Tailwater Control
6. Second Riffle
7. Tailwater Control Horizontal Cross-Section (minimum of 5 locations)

Once the tripod is set up at a comfortable height and relatively level, place and secure the automatic level onto the tripod head. Use the three leveling screws to bring the bubble within the circle on the spherical level. Once the bubble is centered staff readings can be taken.



Figure 9: The automatic level must be secured onto the tripod head (left) before using the 3 leveling screws to bring the bubble within the circle on the spherical level (right). Once the bubble is centered, staff readings can be taken (Photographs of surveying equipment, n.d.).

After the tripod is set-up, look through the lens and rotate the level until the staff is visible. Focus the eyepiece and read the numbers (to the nearest centimeter) on the staff where the horizontal and vertical crosshairs meet.

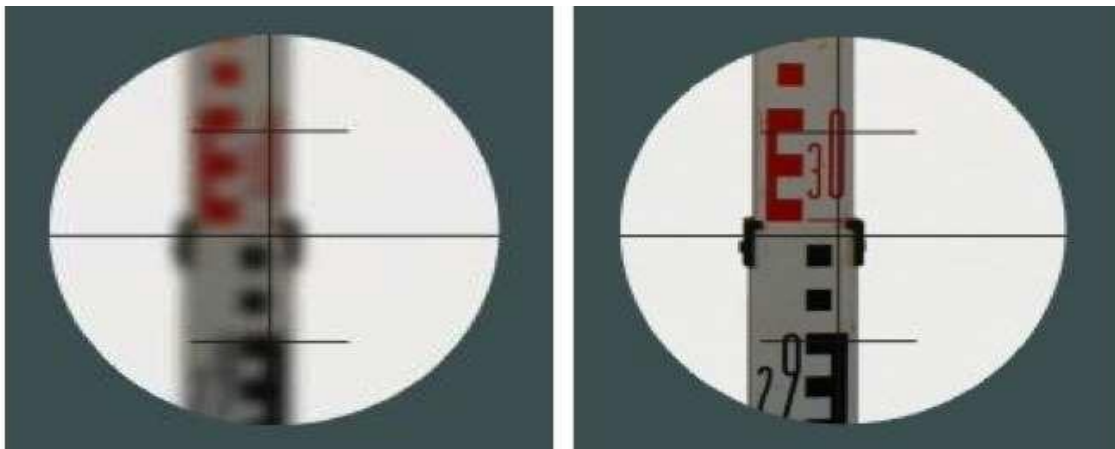


Figure 10: Pictures of the staff while looking through the automatic level before (left) and after (right) the lens is focused. The staff reading in this example is 2.99 m (Photographs of surveying equipment, n.d.).

In the example below (Table 11), the tripod location is static and only FS readings were taken. Each FS reading was recorded on the data sheet and subtracted from the HI to determine the relative elevation of each station.

Table IX: Example of staff measurement readings in a situation where the tripod remains in the same location throughout the surveying process.

Station	HI	FS (-)	BS (+)	Elevation (m)
First Riffle	10.00	3.67		6.33
Culvert Inflow	10.00	3.77		6.23
Culvert Outflow	10.00	3.82		6.18
Pool Depth	10.00	4.09		5.91
Tailwater Control	10.00	4.18		5.82
Second Riffle	10.00	4.21		5.79

If it is not possible to view all stations from one tripod location, backsight readings will be required to determine the new height of the instrument ( $HI_{new}$ ). In the example below (Table 12), after taking a FS reading of the *First Riffle* and *Culvert Inflow*, the tripod was relocated to enable a *Culvert Outflow* reading. The staff must be held in place at the *Culvert Inflow* station.

At this point, a BS reading of 1.71 m was taken and added to the elevation calculated at the *Culvert Inflow* (6.78 m) for a *Culvert Outflow* HI of 8.49 m:

$$HI_{at\ Culvert\ Outflow} = Culvert\ Inflow\ Elevation + Culvert\ Inflow\ BS$$

$$HI_{at\ Culvert\ Outflow} = 6.78\ m + 1.71\ m$$

$$HI_{at\ Culvert\ Outflow} = 8.49\ m$$

The next FS reading was taken at the *Culvert Outflow* (2.74 m) and is subtracted from the latest HI of 8.49 m for a *Culvert Outflow* elevation of 5.75 m:

$$Elevation\ of\ Culvert\ Outflow = HI - FS$$

$$Elevation\ of\ Culvert\ Outflow = 8.49\ m - 2.74\ m$$

$$Elevation\ of\ Culvert\ Outflow = 5.75\ m$$

The tripod was also moved after the *Tailwater Control*, changing the HI again to 7.77 m.

Table X: Example of surveying in a situation where the location of the tripod must be moved in order to obtain staff readings from each station.

Station	HI (m)	FS (-)	BS (+)	Elevation (m)
First Riffle	10.00	3.67		6.33
Culvert Inflow	10.00	3.22	1.71	6.78
Culvert Outflow	8.49	2.74		5.75
Pool Depth	8.49	3.01	2.29	5.48
Tailwater	7.77	2.86		4.91
Control				
Second Riffle	7.77	2.90		4.87

Slope was calculated by measuring the distance between each station and using a simple rise over run formula. For example, to find the slope of the culvert in Table 19, the following values were used:

$$\text{Slope of Culvert} = \frac{\Delta \text{elevation}}{\text{distance}} \times 100$$

$$\text{Slope of Culvert} = \frac{\text{culvert inflow} - \text{culvert outflow}}{\text{distance between inflow and outflow}} \times 100$$

$$\text{Slope of Culvert} = \frac{6.78 \text{ m} - 5.75 \text{ m}}{18 \text{ m}} \times 100$$

$$\text{Slope of Culvert} = 5.72\%$$

# Appendix E: Environmental Stream Survey Form

ENVIRONMENTAL STREAM SURVEY			
<p>Thank you for using the Environmental Stream Survey form to gather watercourse information. Please enter the field data into the electronic data entry application provided by the Canadian Rivers Institute's NB Aquatic Data Warehouse (<a href="http://www.unb.ca/research/institutes/cri/services/nbaquatic/">http://www.unb.ca/research/institutes/cri/services/nbaquatic/</a>) to ensure your data is preserved and shared with others. Your data is very important. If you have any questions concerning the use of the ESS form please contact the Water Sciences Section of the NB Department of Environment at 457-4844.</p>			
<b>SECTION A: SURVEY INFO</b>			
Date (YYYY-MM-DD):		Personnel: 1)	
Organization:		2)	
Field number (DENV programs):		3)	
Current Weather:	<input type="checkbox"/> Storm (heavy rain) <input type="checkbox"/> Rain (steady rain) <input type="checkbox"/> Showers (intermittent rain) <input type="checkbox"/> Snow <input type="checkbox"/> Overcast <input type="checkbox"/> Sunny / Clear	Significant Weather in Past 48 hrs:	<input type="checkbox"/> Storm (heavy rain) <input type="checkbox"/> Rain (steady rain) <input type="checkbox"/> Showers (intermittent rain) <input type="checkbox"/> Snow <input type="checkbox"/> Overcast <input type="checkbox"/> Sunny / Clear
<b>SECTION B: SITE IDENTIFICATION</b>			
Water Body ID:		Stream Name:	
Site No.		GPS Waypoint ID:	Longitude (x):
		Coord. System (Datum):	Latitude (y):
Site Name:			
Location Description:			
Photo File References:			
<b>SECTION C: SITE OBSERVATIONS (Reason for Identifying Site)</b>			
<b>POTENTIAL ENVIRONMENTAL ISSUES OBSERVED</b>			
<b>Water Crossing</b> <input type="checkbox"/> ATV <input type="checkbox"/> Cattle crossing or access <input type="checkbox"/> Vehicle crossing (ford) <input type="checkbox"/> Other Specify: _____	<b>Point Sources</b> <input type="checkbox"/> Ditch to watercourse <input type="checkbox"/> Erosion: (Circle one) Light / Moderate / Excessive <input type="checkbox"/> Gravel removal <input type="checkbox"/> Litter <input type="checkbox"/> Pipe outfall Pipe size (cm): _____ <input type="checkbox"/> Sedimentation pond outfall <input type="checkbox"/> Seepage <input type="checkbox"/> Waste pile/agriculture waste pile <input type="checkbox"/> Other: Specify: _____	<b>Non-Point Sources</b> <input type="checkbox"/> Agriculture practices <input type="checkbox"/> Commercial or industrial activities Specify: _____ <input type="checkbox"/> Forestry practices <input type="checkbox"/> Mining activities <input type="checkbox"/> Residential practices <input type="checkbox"/> Transportation activities <input type="checkbox"/> Urbanization activities <input type="checkbox"/> Other: Specify: _____	
2010-Dec-02		Page 1 of 3	

**POTENTIAL ENVIRONMENTAL ISSUES OBSERVED – Continued**

**Watercourse Alterations**

- |  |   |  |
|--|---|--|
| <input type="checkbox"/> Bridge with abutments   | Obstruction to fish passage (Y/N) _____ | <input type="checkbox"/> Stream diversion                    |
| <input type="checkbox"/> Channelization (e.g. rip-rap, etc)  |   | <input type="checkbox"/> Stream dredging                     |
| <input type="checkbox"/> Culvert   | Obstruction to fish passage (Y/N) _____ | <input type="checkbox"/> Tree removal within riparian buffer |
| <input type="checkbox"/> Habitat enhancement structure<br>(digger log, deflector, boulders,<br>rock weir, cover structure, etc.) | Obstruction to fish passage (Y/N) _____ | <input type="checkbox"/> Water withdrawal                    |
| <input type="checkbox"/> Infilling   |   | <input type="checkbox"/> Other                               |
| <input type="checkbox"/> Man-made dam  | Obstruction to fish passage (Y/N) _____ | Specify _____  |

**Indicators of Possible Impaired  
Water Quality**

- Abundant aquatic plants
  - Algae
  - Dead fish
  - Embedded substrate
  - Foam
  - Odor
  - Petroleum/oil
  - Suspended silt
  - Other
- Specify: \_\_\_\_\_

**Water Clarity**

- Cloudy/murky
- Transparent

**Water Colour**

- Brown
  - Clear
  - Green
  - Grey
  - Other
- Specify: \_\_\_\_\_

**NOTEWORTHY OBSERVATIONS**

**Uncommon Plant or Animal Present**

- Bird
- Name/Species: \_\_\_\_\_
- Invasive species
- Name/Species: \_\_\_\_\_
- Mammal
- Name/Species: \_\_\_\_\_
- Plant
- Name/Species: \_\_\_\_\_
- Other
- Specify: \_\_\_\_\_

**Cultural Use**

- Aesthetic (e.g. waterfalls)
  - Archeological site
  - Cemetery
  - Traditional activities (e.g. fiddleheads)
  - Other
- Specify: \_\_\_\_\_

**Recreational Use**

- Angling Pool
- Specify Name: \_\_\_\_\_
- Boat launch
- Seasonal cottage
- Swimming hole
- Other
- Specify: \_\_\_\_\_

**Geomorphology and Other Natural Instream Features**

- |   |   |                      |
|---|---|----------------------|
| <input type="checkbox"/> Active beaver dam  | Obstruction to fish passage (Y/N) _____ |                      |
| <input type="checkbox"/> Braided stream channel   |   |                      |
| <input type="checkbox"/> Groundwater source<br>(Complete Section F – Water<br>Measurements) |   |                      |
| <input type="checkbox"/> Inactive beaver dam  | Obstruction to fish passage (Y/N) _____ |                      |
| <input type="checkbox"/> Large woody debris   | Obstruction to fish passage (Y/N) _____ |                      |
| <input type="checkbox"/> Organic litter   |   |                      |
| <input type="checkbox"/> Rock dam / Falls   | Obstruction to fish passage (Y/N) _____ | Height: _____ meters |
| <input type="checkbox"/> Wetland  |   |                      |
| <input type="checkbox"/> Other  | Obstruction to fish passage (Y/N) _____ |                      |
- Specify: \_\_\_\_\_

**SECTION D: SITE MEASUREMENTS**

Parameter	Instrument Used*	Site Measurement
Section Length		meters
Avg Bankfull Stream Width		meters
Avg Bankfull Stream Depth		meters
Average Wet Stream Width		meters
Average Stream Depth		meters
Avg Stream Slope		%
<b>Stream Bank – True Right Bank</b>	<b>Stream Cover</b> _____%	Woody Debris: _____m Undercut left: _____m Undercut right: _____m
Stable _____%		
Unstable / eroding _____%		
<b>Stream Bank – True Left Bank</b>	<b>Stream Type (must add up to 100%)</b>	<b>Substrate Type (must add up to 100%)</b>
Stable _____%	Riffle _____%	Bedrock (ledge) _____%
Unstable / eroding _____%	Run _____%	Boulder (>460 mm) _____%
	Pool _____%	Rock ((180-460 mm) _____%
	Rapid _____%	Rubble (54-179 mm) _____%
	Other _____%	Gravel (2.6-53 mm) _____%
<b>Approximate Slope:</b>	Specify: _____	Sand (0.06-2.5 mm) _____%
<b>True Right Bank</b> _____%	Total: _____%	Fines (0.0005-0.05 mm) _____%
<b>Approximate Slope:</b>		Embeddedness: _____%
<b>True Left Bank</b> _____%		

**SECTION E: UPSTREAM VEGETATION (Within 30 m Riparian Zone)**

Vegetation Type	Left Bank (%)	Right Bank (%)
Lawn		
Row crop		
Forage/cover crop		
Shrubs		
Hardwood forest		
Softwood forest		
Mixed forest		
Meadow / Tall Grasses		
Wetland		
Altered		

**SECTION F: WATER MEASUREMENTS**

Parameter	Instrument Used *	Stream Measurement	Groundwater Source # 1 Measurement	Groundwater Source # 2 Measurement
Time of Day (24:00 format)				
Air Temperature (°C)				
Water Temperature (°C)				
Dissolved Oxygen (ppm)				
pH				
Conductivity (µSIE/cm)				
Stream Velocity (meters/second)				
Flow (cubic meters per second)				

\* Instrument might be tape measure, laser, meter stick, string box, electronic meter, field calculation, Hach or other field chemistry kit, mercury thermometer.





# BANK DATA

Date: \_\_\_\_\_ Site: \_\_\_\_\_ Crew: \_\_\_\_\_  
 Location: \_\_\_\_\_ Recorder: \_\_\_\_\_  
 Weather Description: \_\_\_\_\_

## RIGHT Bank – Downstream

Bank Type: Simple  Complex  Vertical  Overhang  Valley  Other

Height (m): \_\_\_\_\_

Angle: \_\_\_\_\_

Materials: \_\_\_\_\_

Torvane: \_\_\_\_\_

Undercut (cm) Height: \_\_\_\_\_  
 None Amount: \_\_\_\_\_

Surrounding Land Use: \_\_\_\_\_

Vegetation

Trees  Sp. \_\_\_\_\_  
 Shrubs   
 Herbs: Tall  Short   
 Grasses Tall  Short

Rooting Depth (cm)

Rooting Density  
 1  2  3  4  5  
Lowest Highest

% Protected by Vegetation \_\_\_\_\_

On Bank Woody Debris  
 Major  Minor  None

Bank Sample Yes  No

Sketch See Photos

## LEFT Bank – Downstream

Bank Type: Simple  Complex  Vertical  Overhang  Valley  Other

Height (m): \_\_\_\_\_

Angle: \_\_\_\_\_

Materials: \_\_\_\_\_

Torvane: \_\_\_\_\_

Undercut (cm) Height: \_\_\_\_\_  
 None Amount: \_\_\_\_\_

Surrounding Land Use: \_\_\_\_\_

Vegetation

Trees  Sp. \_\_\_\_\_  
 Shrubs   
 Herbs: Tall  Short   
 Grasses Tall  Short

Rooting Depth (cm)

Rooting Density  
 1  2  3  4  5  
Lowest Highest

% Protected by Vegetation \_\_\_\_\_

On Bank Woody Debris  
 Major  Minor  None

Bank Sample Yes  No

Sketch See Photos

## Observations & Comments