Fish Passage Restoration and Habitat Enhancement

In-stream restoration and enhancement for at-risk Atlantic salmon in the Annapolis and Cornwallis River watersheds

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Fisheries and Oceans Canada's Habitat Stewardship Program for Aquatic Species at Risk

Canada

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List of Acronyms

CARP	Clean Annapolis River Project
DFO	Fisheries and Oceans Canada
HSI	Habitat Suitability Index
iBoF	Inner Bay of Fundy
JWA	Jijuktu'kwejk Watershed Alliance
NSE	Nova Scotia Environment
NSFHAP	Nova Scotia Fish Habitat Assessment Protocol

Acknowledgements

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Executive Summary

The Clean Annapolis River Project (CARP) and the Jijuktu'kwejk Watershed Alliance (JWA) have launched a three-year initiative to restore fish habitat in the Annapolis and Cornwallis River watersheds, with a focus on Atlantic salmon recovery. In its first year, the project assessed habitat conditions and identified priority areas for restoration.

Human activities such as land use changes and erosion have significantly degraded freshwater ecosystems, impacting fish populations. To address these challenges, the project conducted habitat assessments using temperature monitoring, Habitat Suitability Index (HSI) assessments, and electrofishing surveys. Five key tributaries of interest in the Cornwallis watershed included Elderkin Brook, Mill Brook, Rochford Brook, Sharpe Brook, and Spidle Brook, along with two sites in the Annapolis watershed: Fales River and Roxbury Brook.

In the upcoming years of the project, restoration efforts will focus on improving in-stream habitat by managing sediment, installing habitat structures, and stabilizing riverbanks. These activities follow established best practices from the Nova Scotia Salmon Association's Adopt-a-Stream Program and the Department of Fisheries and Oceans (DFO). Post-restoration monitoring will assess effectiveness and inform ongoing conservation strategies.

By restoring critical fish habitat, this project supports the recovery of Atlantic salmon and enhances the ecological health of the Annapolis and Cornwallis River watersheds.

Introduction

In Nova Scotia, the precipitous decline of fish populations that had historically widespread distributions is a well-documented issue (Parrish et al., 1998; Klemetsen et al., 2003; NSDAF, 2005; Ryan & MacMillan, 2016). While threats to fish populations are numerous and diverse, degradation of freshwater habitats resulting from human activities remains one of the most significant contributors to observed declines in native fish species, including sport fish that have provided valuable economic contributions to the province (Taylor et al., 2010; DFO, 2006; Bohn & Kershner, 2002; Bardonnet & Baglinière, 2000). Much of this habitat loss has been attributed to modifications of the physical environment by human land uses. Human influences and land use changes surrounding a watercourse can lead to negative impacts such as erosion and sedimentation that damage aquatic ecosystems. Streams can become straightened and over-widened, which in turn can lead to greater erosion and sedimentation, thus reducing the thermal capacity of the watercourse, in-stream cover and food availability from vegetation as well as appropriate flows for spawning (NSE, 2018).

Restoration efforts aimed at mitigating these impacts focus on removing excess fine sediments to expose natural cobble and gravel substrates, as well as installing in-stream structures to promote sediment redirection and enhance natural stream functions. These actions are essential for improving habitat quality for native fish species such as Atlantic salmon (*Salmo salar*) and brook trout (*Salvelinus fontinalis*), which rely on these environments for spawning and early life stages.

In Nova Scotia, the Annapolis River watershed has a long history of human use and subsequent ecological degradation, necessitating conservation and restoration interventions. Recognizing this need, the Clean Annapolis River Project (CARP) initiated the Fish Passage Restoration and Habitat Enhancement Program, originally known as "Broken Brooks," in 2007. Since 2010, CARP has been actively assessing and restoring aquatic habitats within the watershed, with a particular focus on identifying and addressing barriers to fish passage. In 2012, CARP adopted a sub-watershed assessment approach to improve watershed management and planning, broadening the project's scope to include in-stream habitat restoration.

Similarly, the Cornwallis (Jijuktu'kwejk) River watershed has faced significant environmental challenges due to long-term human influence. The Jijuktu'kwejk Watershed Alliance (JWA), formed in 2016, has been dedicated to restoring and protecting the ecological health of the Cornwallis River and its tributaries. Building on a strong collaborative partnership, CARP and JWA have launched a three-year initiative to identify and restore freshwater fish habitat for anadromous species, with a particular emphasis on Atlantic salmon populations within the inner Bay of Fundy (iBoF) and Southern Upland designatable units.

This report summarizes the first year of this three-year initiative, which focused on assessing habitat conditions and identifying priority areas for restoration in both the Annapolis and Cornwallis River watersheds. The overarching objectives of this project are structured into two main categories: (1) evaluating fish habitat conditions in the Annapolis and Cornwallis River watersheds through comprehensive data collection and analysis, and (2) implementing targeted restoration measures to enhance freshwater spawning habitats, guided by Nova Scotia Salmon Association's Adopt-a-Stream Protocols.

Restoration efforts involved in-stream data collection and monitoring to identify priority areas for intervention. Within the Cornwallis River watershed, five key sub-watersheds—Elderkin Brook, Mill Brook, Spidle Brook, Sharpe Brook, and Rochford Brook—had been identified for targeted restoration. These sites were selected based on previous monitoring efforts that highlighted their potential as suitable Atlantic salmon habitat. Restoration efforts in the Annapolis River watershed similarly focused on priority sub-watersheds, such as Fales River and Roxbury Brook.

The project employed a combination of standardized assessment methods, including temperature data logging, Habitat Suitability Index (HSI) assessments, and electrofishing surveys. These data collection techniques provide critical insights into habitat conditions, species composition, and potential restoration needs.

Based on these assessments, restoration plans have been developed for one priority sub-watershed in each river system. Restoration activities are to be completed during years two and three of the project and may include installing in-stream structures, managing sediment through SandWanding, and stabilizing riverbanks. All work will follow best practices established by the Nova Scotia Salmon Association and the Department of Fisheries and Oceans (DFO). Post-restoration monitoring will measure the effectiveness of these efforts over time.

Through these efforts, CARP and JWA aim to improve fish habitat, support Atlantic salmon recovery, and enhance overall watershed health in the Annapolis and Cornwallis River systems.

Methodology

The project employed a combination of standardized assessment methods, including the deployment of temperature data loggers, HSI assessments, and electrofishing surveys. These data collection techniques provide critical insights into habitat conditions, species composition, and potential restoration needs.

Habitat Suitability Index Assessments

The Habitat Suitability Index is a widely used tool for evaluating stream and river characteristics based on the habitat requirements and limiting factors of key indicator species. During the 2024 field season, HSI surveys were conducted along each of the targeted sub-watersheds following the updated Nova Scotia Fish Habitat Assessment Protocol (NSFHAP, 2019). These assessments were carried out to evaluate changes in physical habitat and water quality, as well as the overall impact of restoration activities on fish habitats. Refer to Appendices 6.2 and 6.3 for examples of HSI data sheets and information on data collected during HSI assessments.

The collected data were entered into the NSFHAP online data entry sheet, which evaluates the data based on habitat suitability models for brook trout and Atlantic salmon. The 15 features assessed in the field methods are primarily based on an HSI for brook trout (Raleigh, 1982), with adaptations for Atlantic salmon and local conditions in Nova Scotia. The program calculates important criteria for each species on a scale from 0 to 1 (Table 1). These scores offer a detailed overview of habitat conditions, highlighting areas requiring further restoration or protection.

Table 1. Habitat suitability index and quality rating values for brook trout and Atlantic salmon habitat (NSFHAP, 2019).

Suitability Value	Quality of Habitat	Result
0.00 – 0.39	Poor	Will support none or small numbers of Atlantic salmon or brook trout.
0.40 – 0.80	Moderate	Will support some Atlantic salmon or brook trout.
0.81 – 1.0	Good	Will support many Atlantic salmon or brook trout.
1.00	Optimal	Optimum habitat to support Atlantic salmon or brook trout.

During the 2024 field season, HSI was conducted on each of the target sub-watersheds to identify limiting factors for both Atlantic salmon and brook trout. For full details of the assessment procedure and habitat suitability variables for Atlantic salmon and brook trout, refer to "The Nova Scotia Fish Habitat Suitability Assessment: A Field Methods Manual" (NSFHAP, 2019).

Electrofishing Surveys

Electrofishing is a scientific survey method used to sample fish populations and evaluate species' health, abundance, and density. An electrical current is created between two submerged electrodes—a positive anode and a negative cathode. Galvanotaxis draws fish toward the anode, and once a fish is positioned between the two electrodes, a closed circuit forms, allowing current to flow through the fish's body. The fish are then netted and placed in a temporary holding tank where they can recover and be assessed, measured, and sampled for data collection.

During the 2024 field season, backpack electrofishing was conducted at three sites along each sub-watershed, each representing an open reach approximately 100 meters long. A single pass was executed at each site, documenting the captured fish species and recording their fork lengths. Refer to Appendices 6.5 and 6.6 for examples of electrofishing data sheets and the information collected during the surveys.

Temperature Monitoring

Temperature data loggers were deployed at 3-5 sites within each sub-watershed from June to August 2024, covering the crucial summer season. The loggers were programmed to record data at 30-minute intervals to track annual temperature trends, identify areas needing restoration to address thermal pollution and pinpoint critical thermal refuge areas for protection.

Loggers were placed in pools, which serve as cool-water refuges for fish. Each logger was secured to a brick and tethered to a nearby tree to ensure stability and prevent displacement, maintaining data accuracy throughout the monitoring period.

Figure 1. (Left) HOBO pendant temperature logger. (Right) Temperature logger deployed in the Fales River.

Results

Habitat Suitability Index Assessments

Habitat suitability index surveys were conducted to assess salmonid habitat quality in each of the seven sub-watersheds of interest. Five to ten sites were surveyed per watercourse to gather a representative overview of the habitat quality and identify any major limiting factors.

Generally, for all seven watercourses, the HSI results indicate a lack of deep pools and in-stream cover for adult-sized fish—both critical features for providing refuge during the warmer summer months. Limited shading and insufficient habitat complexity contribute to the thermal stress experienced by salmonids. Furthermore, the results show an excess of fine sediment in areas designated for salmonid spawning. Fine sediment can reduce the watercourse's thermal capacity and disrupt loose gravel, limiting the availability of suitable spawning habitat. The full HSI results for each watercourse can be found in Appendix 6.4.

Table 2. Habitat suitability criteria for brook trout in each of the target sub-watersheds.

	Percent Pools	Percent In-stream Cover (Juvenile)	Percent In-stream Cover (Adult)	Dominant Substrate Type in Riffle-Run Areas	Average Size of Substrate in Spawning Areas	Percent Fines in Riffle-Run Areas	Percent Substrate Size Class for Winter Escape
Elderkin Brook	0.61	0.88	0.32	0.59	0.35	0.89	0.68
Mill Brook	0.55	0.99	0.28	0.80	0.44	0.97	1.00
Spidle Brook	0.45	1.00	0.46	0.48	1.00	0.55	0.31
Sharpe Brook	0.48	1.00	0.58	0.50	0.51	0.52	0.66
Rochford Brook	0.44	1.00	0.50	0.42	N/a	0.35	0.40
Fales River	0.45	0.89	0.32	0.80	0.32	1.00	1.00
Roxbury Brook	0.49	0.99	0.36	0.89	0.21	0.96	1.00

Table 3. Habitat suitability criteria for Atlantic salmon in each of the target sub-watersheds.

	Percent Pools	Percent In-stream Cover (Fry)	Percent In-stream Cover (Parr)	Dominant Substrate Type in Riffle-Run Areas	Substrate for Spawning and Incubation
Elderkin Brook	0.69	0.87	0.31	0.71	0.82
Mill Brook	0.57	0.97	0.25	0.80	0.89
Spidle Brook	0.38	1.00	0.46	0.48	1.00
Sharpe Brook	0.44	1.00	0.56	0.48	0.89
Rochford Brook	0.36	1.00	0.50	0.42	N/a
Fales River	0.37	0.91	0.33	0.84	0.82
Roxbury Brook	0.45	0.99	0.33	0.96	0.35

*Scores with results listed as N/a, contain data that was not documented during the time of assessment and therefore their scores could not be computed.

Electrofishing Surveys

Electrofishing surveys were conducted at three sites along each watercourse between July and September. The electrofishing surveys revealed significant variations in fish populations across the seven surveyed sub-watersheds. Brook trout (*Salvelinus fontinalis*) were present in six rivers, with the highest numbers recorded in Spidle Brook (143 individuals) and Elderkin Brook (110). In contrast, Roxbury Brook had the lowest brook trout count (2), while Fales River also had a relatively low number (13). The average fork length of brook trout varied, with the smallest individuals found in Fales River (7.6 cm) and the largest in Rochford Brook (17.9 cm), suggesting differences in habitat quality and growth conditions among the sites.

Atlantic Salmon (*Salmo salar)* were captured in only four watercourses—Elderkin Brook, Mill Brook, Sharpe Brook, and Fales River. Mill Brook had the highest salmon count (28 individuals) with an average fork length of 12.2 cm. A single Atlantic salmon was recorded in Elderkin Brook, measuring 18.4 cm, making it among the largest captured salmon. Notably, Mill Brook, despite having the highest Atlantic salmon count, contained no brook trout, which could indicate species-specific habitat preferences or competition.

Overall, the results highlight variations in fish abundance and size across streams, potentially influenced by habitat characteristics, water quality, and species interactions. The presence of both brook trout and Atlantic salmon in Sharpe Brook and Fales River suggests that these sites provide suitable conditions for both species, though in relatively low numbers. The full electrofishing results for each watercourse can be found in Appendix 6.7.

Table 4. Summary of salmonids, brook trout (*Salvelinus fontinalis*) and Atlantic salmon (*Salmo salar*), caught during electrofishing surveys.

Watercourse	Brook Trout Captured	Average Fork Length (cm)	Atlantic Salmon Captured	Average Fork Length (cm)
Elderkin Brook	110	8.0	1	18.4
Mill Brook	0	N/a	28	12.2
Spidle Brook	143	11.4	0	N/a
Sharpe Brook	95	11.1	2	10.7
Rochford Brook	22	17.9	0	N/a
Fales River	13	7.6	9	9.7
Roxbury Brook	2	7.65	0	N/a

Temperature Monitoring

From June to August 2024, water temperature measurements were recorded to assess thermal conditions for salmonid species. The temperature data collected from multiple watercourses shows significant variation, which may influence fish distribution and habitat suitability. Overall, water temperatures rose steadily through the summer, with some streams reaching levels that may cause stress for native salmonids.

The Fales River had the warmest average temperature at 20.13°C, with highs reaching 25°C in early August. Several days exceeded 23°C, a threshold known to cause thermal stress in Atlantic salmon. Roxbury Brook showed a similar pattern, averaging 19.4°C and peaking at 23.58°C, with multiple days above the stress threshold.

Sharpe Brook and Mill Brook had slightly cooler averages at 16.9°C and 18.36°C, respectively. Although temperatures in these streams did not exceed 23°C, both had many days above 20°C—15 days for Sharpe Brook and 26 for Mill Brook—indicating potential stress for salmon during hotter periods.

Spidle Brook recorded the coolest average temperature at 13.36°C, with only two days above 20°C. Rochford Brook averaged 17°C, with a peak of 22.24°C and 15 days above 20°C. While these streams remained below critical thresholds, their warming trends still raise concerns.

These differences highlight the potential for thermal stress in warmer streams like Fales River, particularly during hot summer months, while cooler streams like Rochford and Spidle Brooks may serve as important refuges for cold-water species. Understanding these thermal patterns is essential for evaluating habitat quality and informing conservation efforts.

Unfortunately, no temperature data was collected for Elderkin Brook, as all three loggers deployed in the river were missing when retrieval was attempted in August.

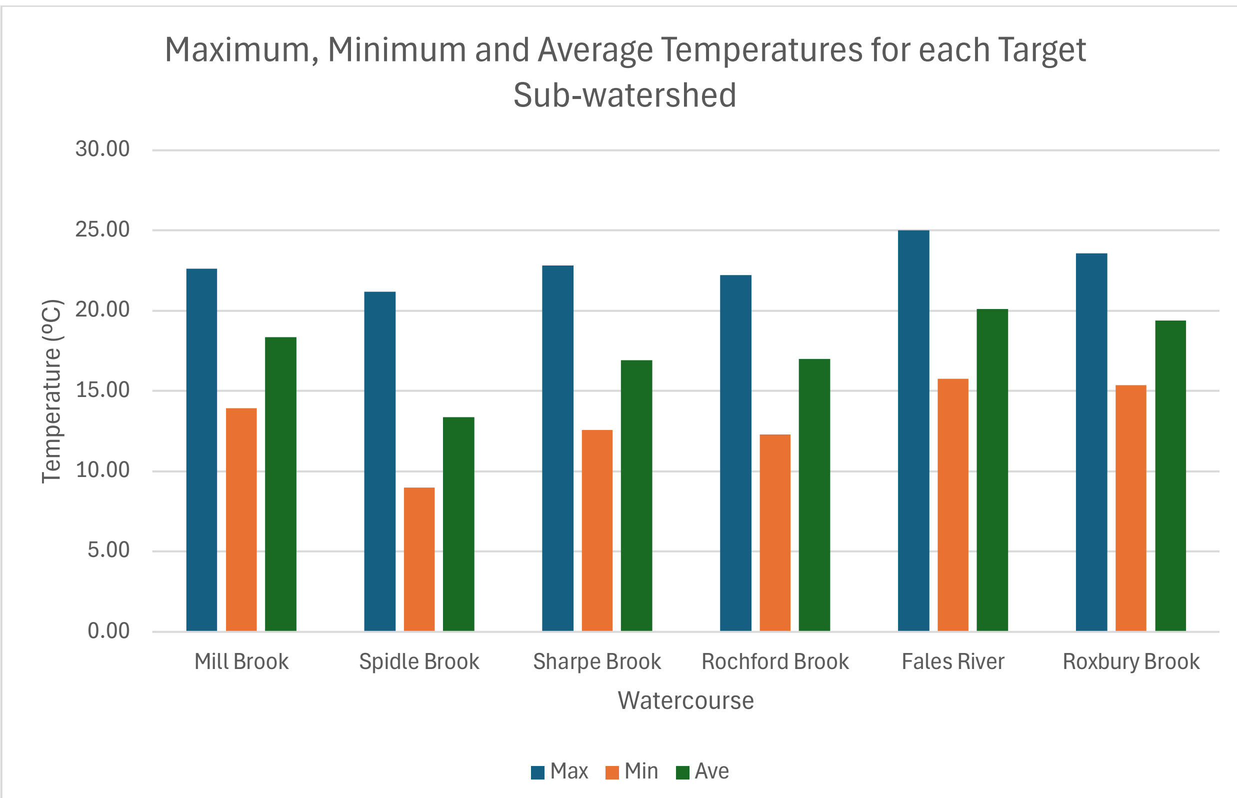

Figure 2. Summary of Maximum, Minimum, and Average Water Temperatures Across Surveyed Watercourses.

Recommendations

Based on the data collected, it is recommended that restoration efforts be prioritized at two sites: Fales River within the Annapolis River watershed and Sharpe Brook within the Cornwallis River watershed. While all watercourses showed similar HSI and temperature results, these two locations were the only ones where both brook trout and Atlantic salmon were captured.

Over the next two years, the primary objective of the project will be to enhance physical habitat quality and spawning grounds in Sharpe Brook and Fales River. The anticipated outcome is the improvement of habitat conditions for both Atlantic salmon and brook trout, achieved through increased habitat complexity, enhanced spawning areas, and stabilized pool habitats. The recommended restoration actions for each watercourse are outlined below.

Sharpe Brook:

- Install three digger logs or other suitable in-stream habitat structures to increase habitat complexity and provide refuge for aquatic species.
- Conduct approximately 50 meters of SandWanding to enhance spawning grounds by removing fine sediment from the streambed.
- Stabilize 15 meters of eroded streambank using willow staking and/or wattle fencing.

Fales River:

- Install five digger logs or other suitable in-stream habitat structures to increase habitat complexity and provide refuge for aquatic species.
- Secure three root wads and/or large woody debris to stabilize the streambank and enhance in-stream habitat.
- Stabilize 22 meters of eroded streambank using willow staking and/or wattle fencing.
- Plant 10 native trees and 100 live willow stakes to enhance riparian vegetation.

Monitoring and Evaluation

Pre- and post-restoration monitoring will be conducted to assess the effectiveness of the restoration efforts. This will include evaluating habitat suitability, temperature profiles, and species abundance. Electrofishing surveys will be used to assess the abundance and distribution of salmonids. Habitat assessments will measure changes in pool depth, substrate composition, and in-stream complexity, while temperature monitoring will track fluctuations in water temperature over time. Additionally, redd surveys will be conducted to monitor salmon spawning activity.

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Appendices

Maps

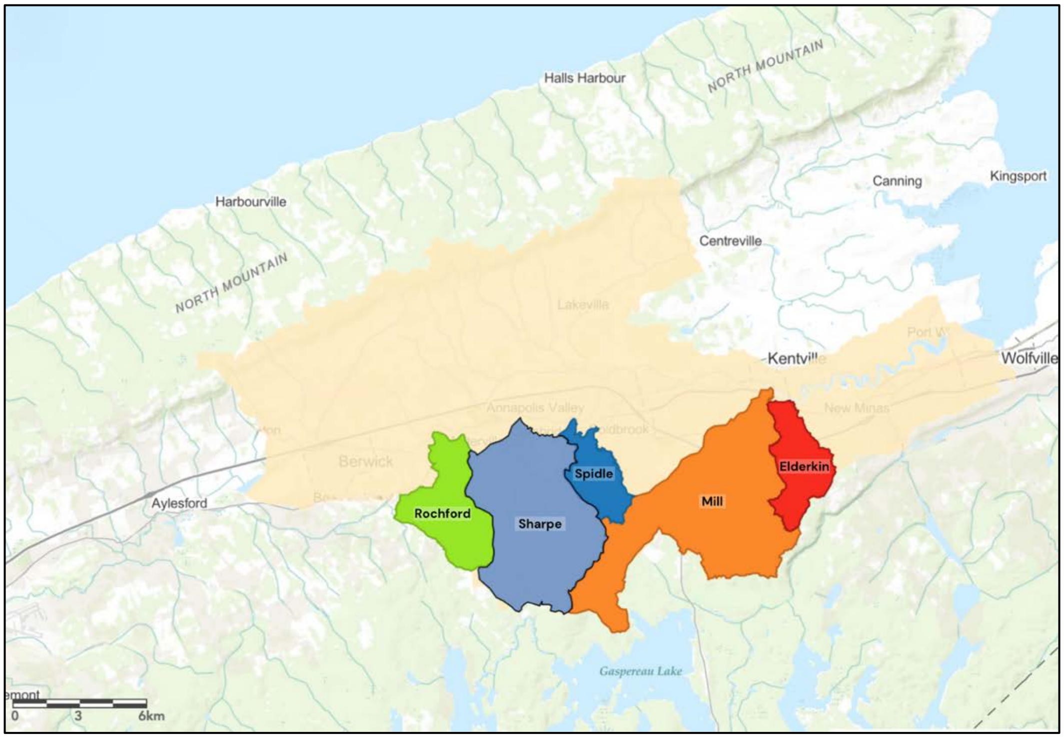

Figure 3. Target sub-watersheds within the Cornwallis River watershed.

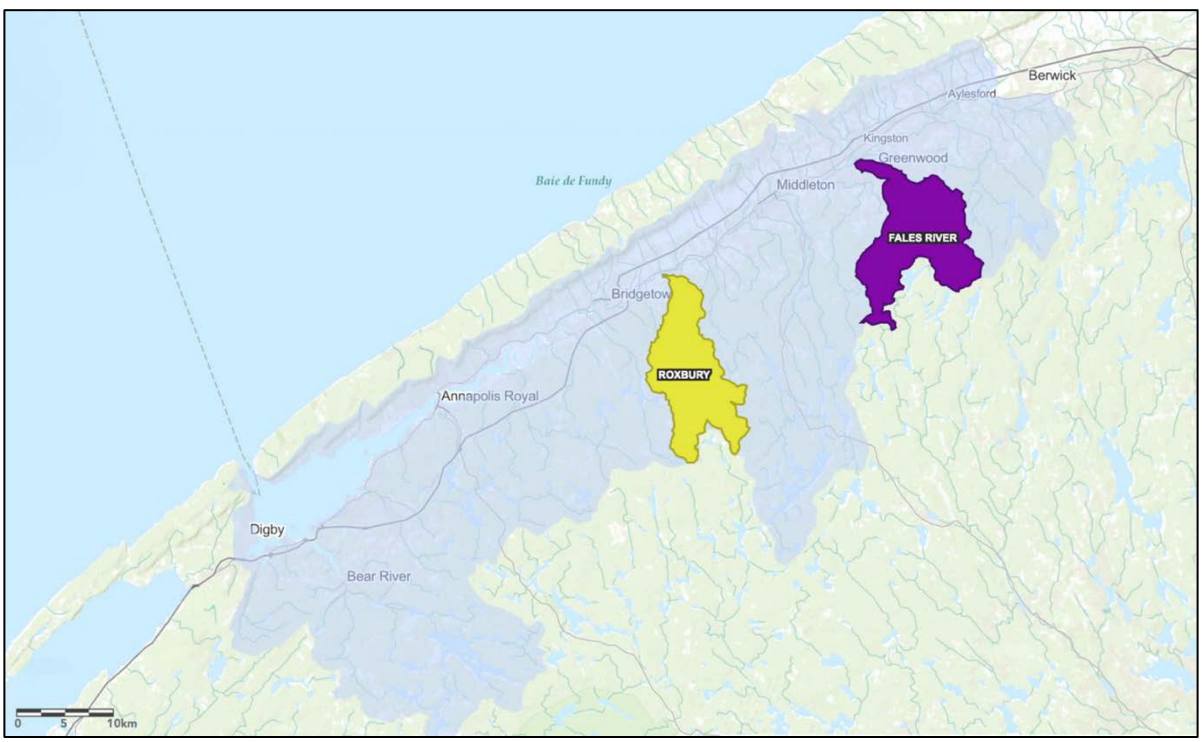

Figure 4. Target sub-watersheds within the Annapolis River watershed.

Figure 5. In-stream sampling points on Elderkin Brook.

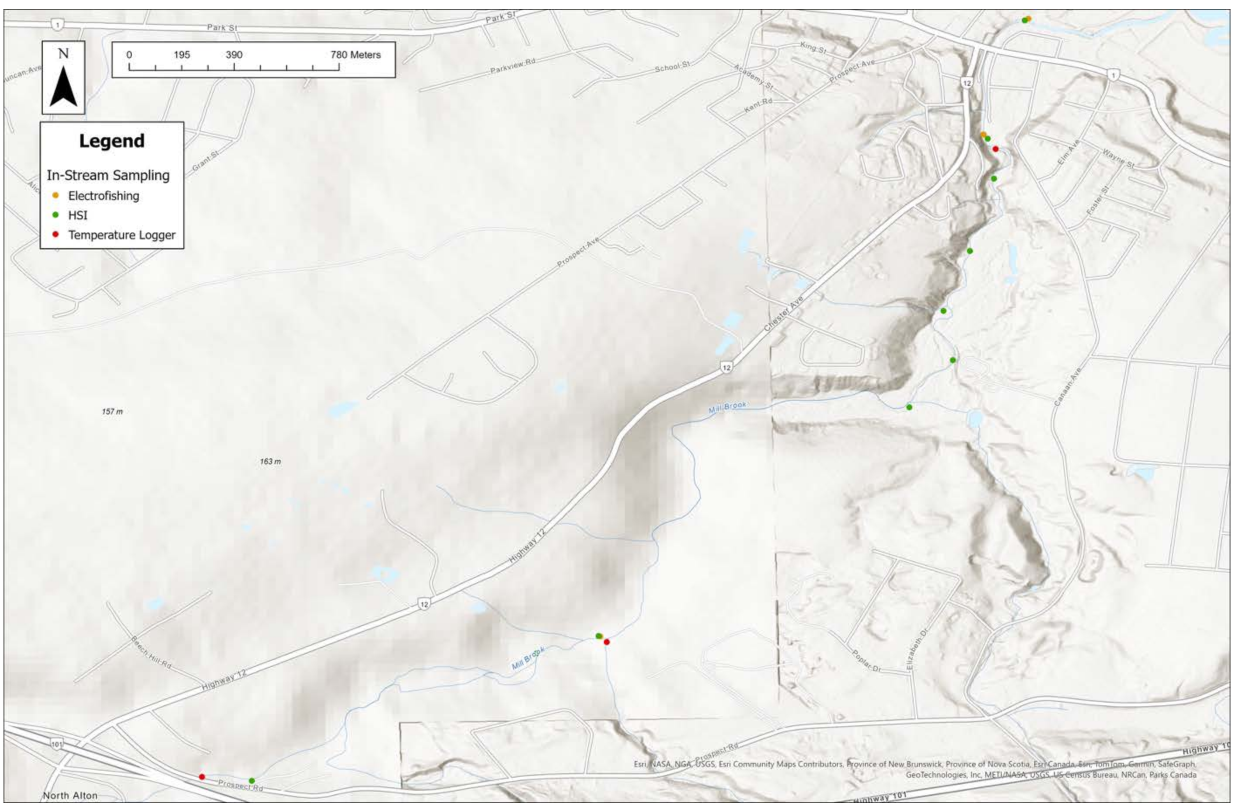

Figure 6. In-stream sampling points on Mill Brook

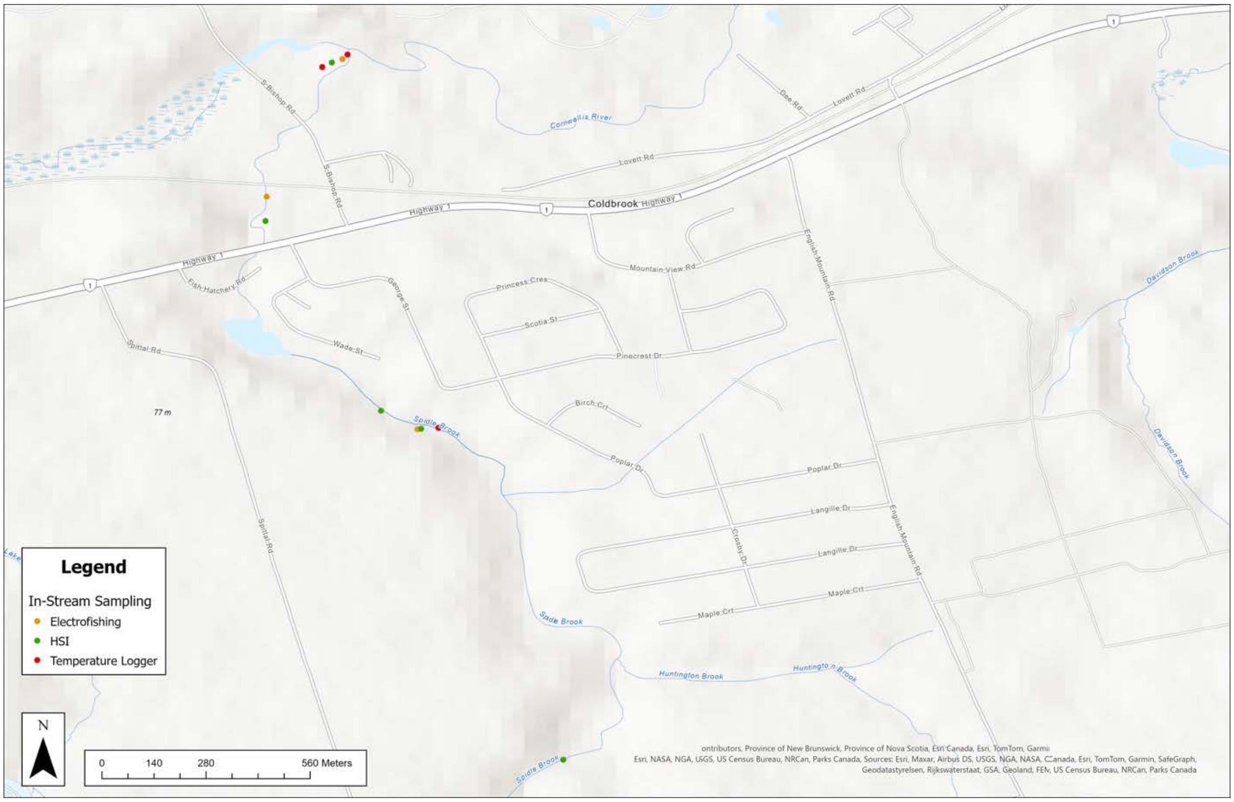

Figure 7. In-stream sampling points on Spidle Brook.

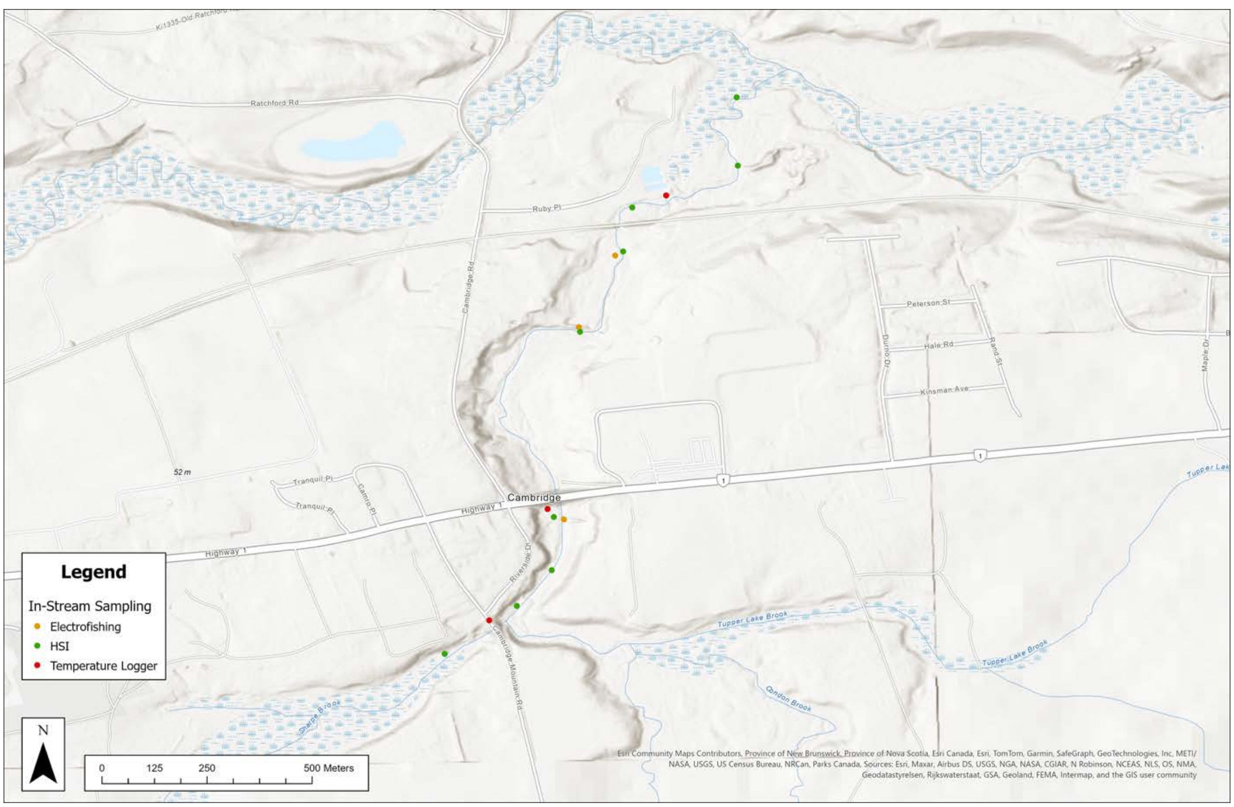

Figure 8. In-stream sampling points in Sharpe Brook.

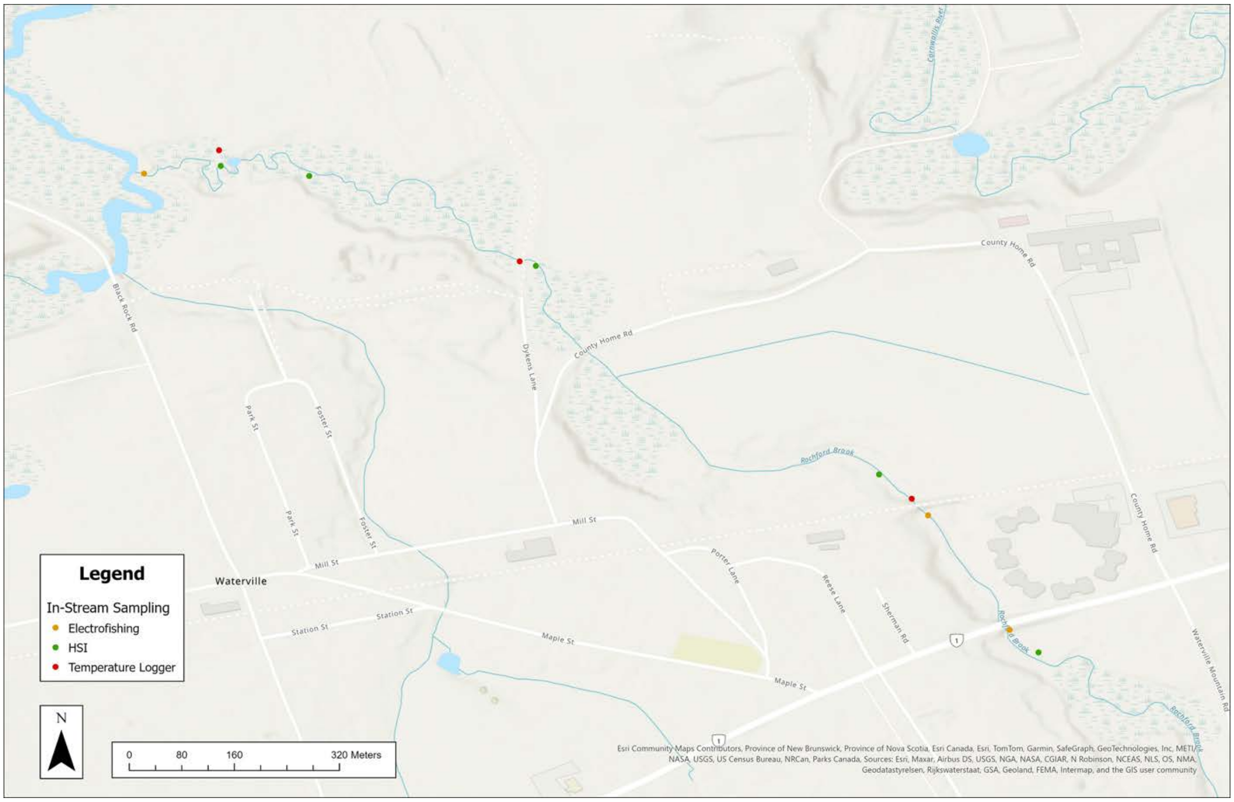

Figure 9. In-stream sampling points on Rochford Brook.

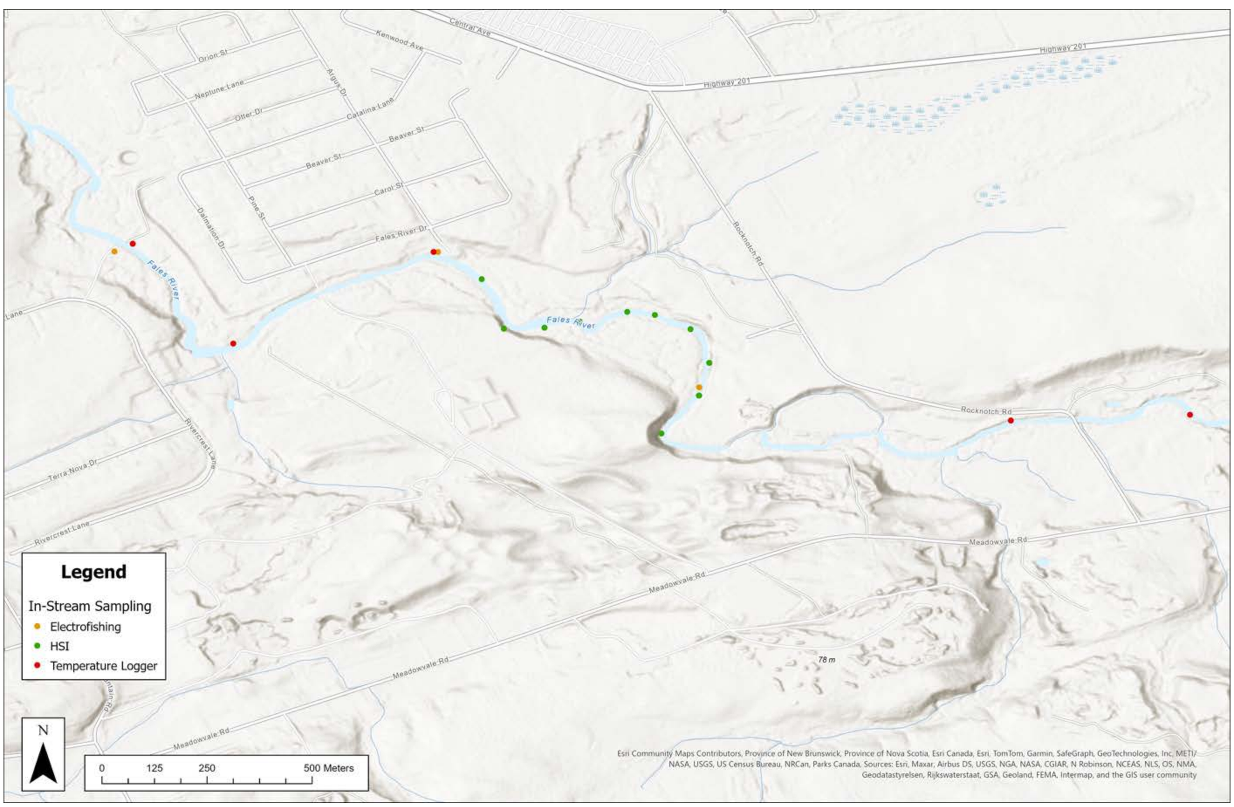

Figure 10. In-stream sampling points on Fales River.

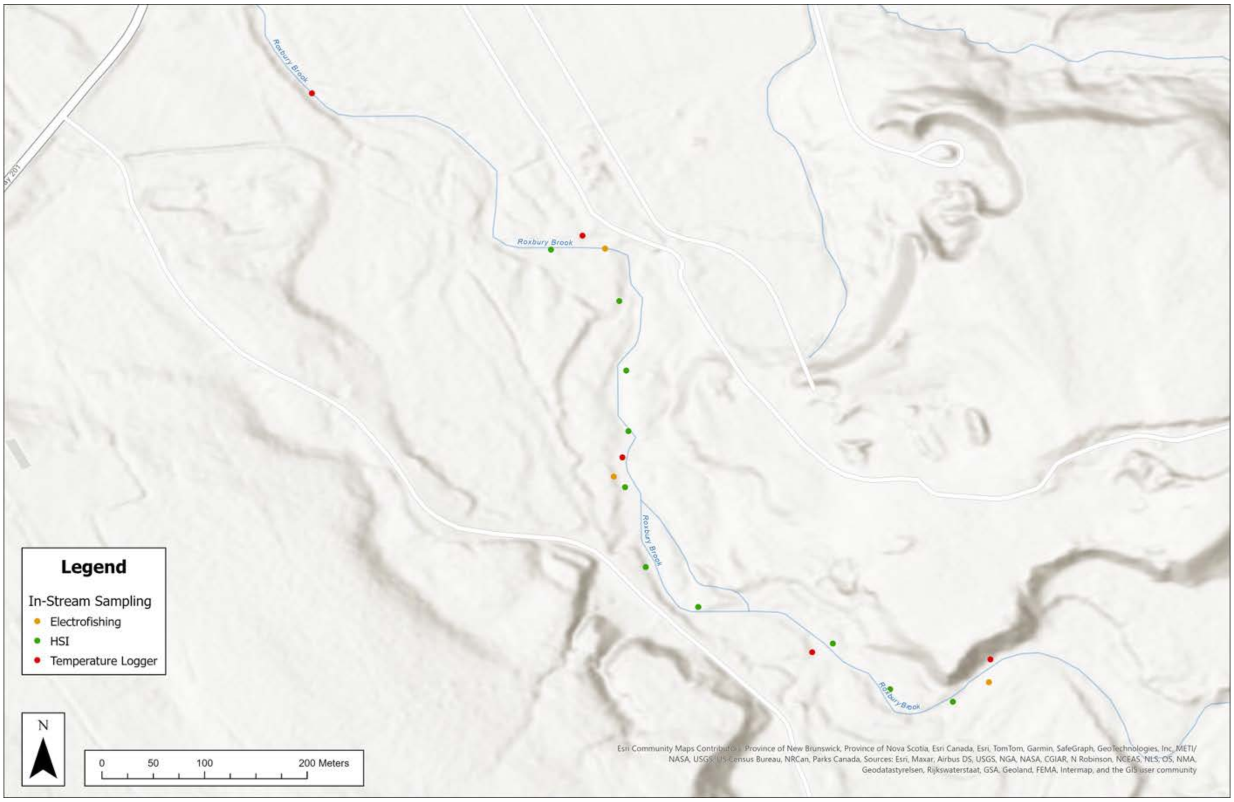

Figure 11. In-stream sampling points on Roxbury Brook.

Habitat Suitability Index (HSI) Data Sheet – NSFHAP

NSFHAP Field Sheet #:

River Name: __________________ Watershed Code: _______ Date: ________________ Time: ____________ Crew: ____

Site Boundary Coordinates in DMS (degrees/min/sec): Downstream _____˚_____'_____"N _____˚_____'_____"W Upstream _____˚_____'_____"N _____˚_____'_____"W

Watershed Area (km^2): ________ Calculated Bankfull Width (m): ___________ Transect Spacing (m): ___________ Site Length (m): _________ Stream Order: _________

Air Temp (˚C): _________ Water Temp: ___________ pH: ____________ Conductivity (S/m): ______________ TDS (mg/L): _____________ DO (mg/L): ___________

Channel Cross-sections

	Floodplains		Height and Widths			Wetted Depths				Thalweg	Slope
	Left Width (m)	Right Width (m)	Bankfull Width (m)	Bankfull Height (cm)	Wetted Width (m)	1/4 of Width (cm)	1/2 of Width (cm)	3/4 of Width (cm)	Thalweg depth (cm)	Location (m)	% Slope between riffles
T1											
T2											
T3											

Substrate and Cover

	GPS Coordinates		Habitat Type	¼ of Width					½ of Width					¾ of Width							
				Fines	Gravel	Cobble	Boulder	Bedrock	Fines	Gravel	Cobble	Boulder	Bedrock	Fines	Gravel	Cobble	Boulder	Bedrock	% Embedded (% Fines under surface)	10 cm Instream Cover (# of fish)	20 cm Instream Cover (# of fish)
T1																					
T2																					
T3																					

Riverbanks and Riparian Area

	% Trees	% Shrubs	% Grass	% Bare Soil	% Eroding	% Stable Ground	% Stream Shade	Ice Scar Height
Left Bank								
Right Bank								

Pool Measurements					
Transect #	Max Depth (cm)	Depth of Pool Tail (cm)	Average Length (m)	Average Width (m)	% Pool Cover

Pictures		
	upstream	downstream
T1		
T2		
T3		
#	Description	

Spawning Areas						
	Area		Substrate Size			Embeddedness
	Length (m)	Width (m)	Rock #1 (cm)	Rock #2 (cm)	Rock #3 (cm)	% fines under surface
Salmon						
Brook Trout						

Point Bars				
Transect	Present	Angle	Vegetation	Comments
T1	Y or N	Gradual or sharp	None, grasses, shrubs, trees	
T2	Y or N	Gradual or sharp	None, grasses, shrubs, trees	
T3	Y or N	Gradual or sharp	None, grasses, shrubs, trees	

Rock Grab: □		3 Minute Kick: □ Net Type/Mesh Size: _____ /___		
Common Name	Rock #1	Rock #2	Rock #3	Total
Midges				
Snails, Limpets				
Sow Bugs				
Aquatic Earthworm				
Beetles				
Mayflies				
Fishflies, Alderflies				
Stoneflies				
Caddisflies				

Notes and Section Sketch: Indicate right and left banks, tributaries and inflows, flow direction, and general river form description

Habitat Suitability Index (HSI) Assessment Parameters – NSFHAP

Table 5. Variables assessed during Habitat Suitability Index assessments.

Variable	Units	Description
Air Temperature	Celcius	The temperature of the air on the day of the assessment
Average Pool Length	m	Length of pool parallel to the flow
Average Pool Width	m	Width of pool perpendicular to flow
Bankfull Height	m	Height of elevation of the bankfull above the water surface
Bankfull Width	m	Horizontal distance between banks on opposite sides of the stream
Bedrock	%	Hard, solid rock often beneath surface materials such as soil and sediment
Boulder	%	Substrate measuring >25.6 cm
Channel		Area of the river within the bankfull, including potentially dry areas during low water and riverbanks, but not the floodplain
Cobble	%	Substrate measuring 6.4-25.6 cm
Conductivity	µS/cm	The ability of a solution (water) to carry an electrical current
Crest of Riffle		Area at the most downstream end of a pool or most upstream end of a riffle where a slow, deep section of river becomes a shallow and fast section. See also 'tail of pool'.
Date		The date on which the assessment was completed
Depth of Pool	cm	Depth of pool at the deepest section
Depth of Pool Tail	cm	Depth of water on the pool tail
Design Width	m	See also 'site bankfull width'
DO	mg/L	The amount of oxygen dissolved in the water
Embeddedness	%	Degree that boulder, cobble and gravel substrate is surrounded by finer sand and silt. Measured as percentage of fines underneath rocks.
Estimated Low Flow Max Depth	cm	How much of the pool will be covered in low flows
Final Pool Area	m^2	Total area of pool measured during the assessment
Floodplain	m	Relatively flat area of land adjacent to a river channel which gets submerged when water levels are high.
Field Crew		The assessors collecting the data
Fines	%	Sand or silt measuring <0.2 cm
Gravel	%	Substrate measuring 0.2-6.4 cm
Ice Scarring	m	Signs of damaging ice movement observed as scarring on riparian trees and shrubs
In-stream Cover (Adults)		Unembedded cover (substrate, aquatic vegetation, large woody debris, undercut banks, etc.) below the water surface that can shelter/hide a 10 cm long dowel (representing a juvenile fish)
In-stream Cover (Juveniles)		Unembedded cover (substrate, aquatic vegetation, large woody debris, undercut banks, etc.) below the water surface that can shelter/hide a 20 cm long dowel (representing an adult fish)
Meander Sequence (Full)		The meandering or sinuous pattern many rivers follow that feature steps, pools, riffles, and runs. A full meander sequence usually has two pool, riffle, and run areas in low gradient rivers and steps, pools and runs in higher gradient rivers.
Percentage of Pools	%	Calculated by determining the total area of each transect covered by pools
pH		The acidity of the water in the watercourse
Photos		The photos taken of the assessment site
Pool		Deep, slow section of river used by salmonids for cover and resting
Pool Class Rating		Pools can be classified as having an A, B or C rating based on depth and amount of cover
Pool Cover	%	Amount of pool bottom that is hidden by water colour, depth, or high surface velocities
Riffle		A shallow (<10 cm) and fast section of river that occurs between pools

Riparian Vegetation	%	Percentage of ground covered by trees, shrubs, grasses and sedges, and bare ground within 10 m of the banks edge
Riverbank Stability	%	Percentage of rooted vegetation and stable rocky substrate that protect riverbanks from erosion
Rock Grab Sampling		Cobble sized rock from a riffle is selected from the stream and the invertebrates/organisms on the bottom of the rock are counted and identified
Run		A moderately deep section, somewhat slower than a riffle, that occurs in varying locations in a river pattern
Site Bankfull Width	m	Proper stream width determined mathematically before entering the field. The formula is based on watershed area and annual precipitation. See also 'design width'
Site Length	m	6 channel width lengths or site bankfull width x 6
Spawning Areas (Brook Trout)		Spawning occurs in areas of groundwater upwelling which contains 2.5-6 cm gravel substrate
Spawning Areas (Atlantic Salmon)		Spawning occurs in areas of downwelling, such as the tail of pools or above a digger log which contains 2-9.5 cm g-cobble substrate
Step-Pool		Series of staircase-like pools, which usually occur in steeper channels
Stream Name		The name of the watercourse where the assessment is taking place
Stream Order		Measure of the relative size of a stream. The smallest streams in a watershed have the lowest numbers and the largest streams closest to the ocean have the highest numbers.
Stream Shade	%	Canopy cover created by riparian vegetation
Tail of pool		Area at the most downstream end of a pool or most upstream end of a riffle where a slow, deep section of river becomes a shallow and fast section. See also 'crest of riffle'.
TDS	mg/l	Total dissolved solids, the measurement of the combined content of all inorganic and organic substances in its suspended form
Thalweg	Depth: cm Location: m	Deepest section in a channel cross-section, and the area where the water will be found during low water events
Three-Minute Kick Sampling		Kick/disturbing the substrate for three minutes while a partner collects the invertebrates/organisms that are dislodged with a fine mesh net
Time		The time that the assessment began
Transect		Every two calculated bankfull widths
Transect Spacing	m	Site bankfull width x 2
UTM Coordinates		GPS position of the HSI assessment location, described with Northings and Eastings, using a NAD83 projection
Vegetation Index		Multiplication factors are used for each vegetation type and added together to obtain an index value
Water Temperature	Celcius	Downstream water temperature
Watershed Code		Obtained through the Nova Scotia environment and allows sites in the same watershed to be grouped together
Wetted Width	m	Width of the river that contains water at the time of the measurement

Habitat Suitability Index (HSI) Scores – NSFHAP

Elderkin Brook

Table 6. HSI scores for Atlantic salmon in the Elderkin Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover (Juveniles)	% In-stream Cover (Adults)	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Summer Rearing Temperature During Growing Season	pH	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	Stream Order	% Stream Shade
Atlantic Salmon	Site 1 June 10, 2024	45.07095, -64.47607	0.41	0.30	1.00	0.00	0.60	0.94	1.00	1.00	1.00	N/a	N/a	0.95	0.48	0.90	0.65
	Site 2 June 10, 2024	45.06825, -64.47425	0.41	0.60	0.71	0.08	N/a	0.99	1.00	0.95	1.00	N/a	N/a	1.00	0.85	0.90	0.72
	Site 3 June 14, 2024	45.06662 -64.47440	0.50	0.60	0.91	0.00	0.60	0.78	1.00	0.98	1.00	N/a	N/a	1.00	0.61	0.90	1.00
	Site 4 June 17, 2024	45.06373, -64.47984	0.99	0.30	1.00	0.05	0.60	0.96	1.00	1.00	1.00	N/a	N/a	0.91	0.46	0.90	0.33
	Site 5 June 17, 2024	45.06219, -64.47913	0.68	0.60	1.00	0.86	0.60	0.76	1.00	1.00	1.00	0.64	1.00	1.00	1.00	0.90	1.00
	Site 6 June 27, 2024	45.06607, -64.47486	0.96	0.60	1.00	0.11	1.00	0.43	0.91	1.00	1.00	1.00	1.00	1.00	0.71	0.90	0.93
	Site 7 June 27, 2024	45.06562, -64.47451	0.64	0.60	0.95	0.04	0.60	0.75	1.00	1.00	1.00	0.95	0.81	1.00	0.80	0.90	0.79
	Site 8 June 17, 2024	45.06548, -64.47436	0.12	0.30	0.62	0.00	0.60	0.80	0.77	1.00	1.00	N/a	N/a	1.00	0.71	0.90	1.00
	Site 9 June 17, 2024	45.06534, -64.47409	0.25	0.60	0.74	0.00	0.60	0.73	0.85	1.00	1.00	N/a	N/a	1.00	0.65	0.90	1.00
	Site 10 June 17, 2024	45.06477, -64.47463	0.69	0.60	1.00	0.66	0.60	0.74	1.00	1.00	1.00	N/a	N/a	1.00	1.00	0.90	1.00
	Site 11 June 17, 2024	45.06486, -64.47488	0.68	0.60	0.53	0.00	0.60	0.77	1.00	1.00	1.00	N/a	N/a	1.00	0.56	0.90	1.00
	Site 12 June 28, 2024	45.06467, -64.47543	0.45	0.60	1.00	1.00	0.30	0.71	1.00	1.00	1.00	0.79	0.81	1.00	0.58	0.90	0.81
	Site 13 June 28, 2024	45.06494, -64.47613	0.38	0.60	1.00	0.38	0.60	0.60	1.00	1.00	1.00	N/a	N/a	0.82	0.41	0.90	0.82

Table 7. HSI scores for brook trout in the Elderkin Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover Juvenile	% In-stream Cover During Late Growing Season Adult	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Average Maximum Water Temperature	pH	Average Size of Substrate in Spawning Areas	% Fines in Spawning Areas	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Average Thalweg Depth During the Late Growing Season	% Stream Shade
Brook Trout	Site 1 June 10, 2024	45.07095, -64.47607	1.00	0.30	1.00	0.00	0.60	0.94	1.00	1.00	1.00	N/a	N/a	1.00	0.00	0.12	0.65
	Site 2 June 10, 2024	45.06825, -64.47425	0.47	0.60	0.71	0.08	N/a	0.99	1.00	1.00	1.00	N/a	N/a	N/a	0.00	0.31	0.72
	Site 3 June 14, 2024	45.06662 -64.47440	0.52	0.60	0.91	0.00	0.60	0.78	1.00	1.00	1.00	N/a	N/a	1.00	0.58	0.43	1.00
	Site 4 June 17, 2024	45.06373, -64.47984	0.83	0.30	1.00	0.05	0.60	0.96	1.00	1.00	1.00	N/a	N/a	1.00	1.00	0.15	0.33
	Site 5 June 17, 2024	45.06219, -64.47913	0.61	0.60	1.00	0.86	0.60	0.76	1.00	1.00	1.00	0.00	1.00	1.00	0.47	0.30	1.00
	Site 6 June 27, 2024	45.06607, -64.47486	0.79	0.60	1.00	0.11	1.00	0.43	0.91	1.00	1.00	1.00	1.00	0.99	1.00	0.15	0.93
	Site 7 June 27, 2024	45.06562, -64.47451	0.58	0.60	0.95	0.04	0.60	0.75	1.00	1.00	1.00	0.72	0.81	1.00	1.00	0.19	0.79
	Site 8 June 17, 2024	45.06548, -64.47436	0.30	0.30	0.62	0.00	0.60	0.80	0.77	1.00	1.00	N/a	N/a	1.00	0.72	0.03	1.00
	Site 9 June 17, 2024	45.06534, -64.47409	0.38	0.60	0.74	0.00	0.60	0.73	0.85	1.00	1.00	N/a	N/a	0.98	0.81	0.15	1.00
	Site 10 June 17, 2024	45.06477, -64.47463	0.61	0.60	1.00	0.66	0.60	0.74	1.00	1.00	1.00	N/a	N/a	0.94	1.00	0.51	1.00
	Site 11 June 17, 2024	45.06486, -64.47488	0.61	0.60	0.53	0.00	0.60	0.77	1.00	1.00	1.00	N/a	N/a	1.00	1.00	0.11	1.00
	Site 12 June 28, 2024	45.06467, -64.47543	0.49	0.60	1.00	1.00	0.30	0.71	1.00	1.00	1.00	0.12	0.81	0.22	0.64	0.15	0.81
	Site 13 June 28, 2024	45.06494, -64.47613	0.46	0.60	1.00	0.38	0.60	0.60	1.00	1.00	1.00	N/a	N/a	1.00	0.28	0.15	0.82

Mill Brook

Table 8. HSI scores for Atlantic salmon in the Mill Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover (Juveniles)	% In-stream Cover (Adults)	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Summer Rearing Temperature During Growing Season	pH	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	Stream Order	% Stream Shade
Atlantic Salmon	Site 1 June 7, 2024	45.07693, -64.49040	0.43	0.60	1.00	0.31	0.60	0.69	0.49	0.90	0.97	N/a	N/a	1.00	0.92	0.50	1.00
	Site 2 June 7, 2024	45.07297, -64.49164	0.98	0.60	1.00	0.33	0.60	0.32	0.49	0.91	1.00	N/a	N/a	1.00	1.00	0.50	1.00
	Site 3 June 7, 2024	45.05636, -64.50464	0.31	0.60	1.00	0.01	1.00	0.72	1.00	0.93	1.00	N/a	N/a	1.00	0.70	0.50	1.00
	Site 4 June 7, 2024	45.05578, -64.50671	0.12	0.30	1.00	0.11	1.00	0.98	1.00	0.93	1.00	N/a	N/a	1.00	0.96	0.50	1.00
	Site 5 June 10, 2024	45.05152, -64.51622	0.91	0.60	1.00	0.39	1.00	0.71	1.00	1.00	1.00	0.85	0.27	1.00	1.00	0.50	1.00
	Site 6 July 8, 2024	45.07164, -64.49143	0.96	0.60	1.00	0.42	1.00	0.87	0.99	0.89	0.99	N/a	N/a	0.69	0.94	0.50	0.58
	Site 7 July 8, 2024	45.06922, -64.49224	0.12	0.30	1.00	0.66	0.60	0.96	0.27	0.81	1.00	N/a	N/a	0.95	1.00	0.50	0.58
	Site 8 July 8, 2024	45.06722 -64.49312	0.70	0.60	1.00	0.16	1.00	0.89	0.61	0.76	1.00	0.85	0.81	1.00	1.00	0.50	0.40
	Site 9 July 11, 2024	45.06558, -64.49280	0.51	0.60	0.86	0.04	0.60	0.92	0.61	0.62	0.93	0.94	0.00	1.00	1.00	0.50	0.58
	Site 10 July 11, 2024	45.06400, -64.49426	0.12	0.30	1.00	0.37	0.60	0.79	0.27	0.59	0.97	N/a	N/a	1.00	1.00	0.50	0.44

Table 9. HSI scores for brook trout in the Mill Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover Juvenile	% In-stream Cover During Late Growing Season Adult	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Average Maximum Water Temperature	pH	Average Size of Substrate in Spawning Areas	% Fines in Spawning Areas	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Average Thalweg Depth During the Late Growing Season	% Stream Shade
Brook Trout	Site 1 June 7, 2024	45.07693, -64.49040	0.48	0.60	1.00	0.31	0.60	0.69	0.49	1.00	1.00	N/a	N/a	1.00	1.00	0.60	1.00
	Site 2 June 7, 2024	45.07297, -64.49164	0.81	0.60	1.00	0.33	0.60	0.32	0.49	1.00	1.00	N/a	N/a	1.00	1.00	0.90	1.00
	Site 3 June 7, 2024	45.05636, -64.50464	0.41	0.60	1.00	0.01	1.00	0.72	1.00	1.00	1.00	N/a	N/a	1.00	1.00	0.24	1.00
	Site 4 June 7, 2024	45.05578, -64.50671	0.30	0.30	1.00	0.11	1.00	0.98	1.00	1.00	1.00	N/a	N/a	1.00	1.00	0.29	1.00
	Site 5 June 10, 2024	45.05152, -64.51622	0.75	0.60	1.00	0.39	1.00	0.71	1.00	1.00	1.00	0.32	0.27	1.00	1.00	0.57	1.00
	Site 6 July 8, 2024	45.07164, -64.49143	0.79	0.60	1.00	0.42	1.00	0.87	0.99	0.88	1.00	N/a	N/a	1.00	1.00	0.65	0.58
	Site 7 July 8, 2024	45.06922, -64.49224	0.30	0.30	1.00	0.66	0.60	0.96	0.27	0.81	1.00	N/a	N/a	0.95	1.00	0.95	0.58
	Site 8 July 8, 2024	45.06722 -64.49312	0.62	0.60	1.00	0.16	1.00	0.89	0.61	0.77	1.00	0.32	0.81	1.00	1.00	1.00	0.40
	Site 9 July 11, 2024	45.06558, -64.49280	0.52	0.60	0.86	0.04	0.60	0.92	0.61	0.65	1.00	0.68	0.00	1.00	1.00	0.86	0.58
	Site 10 July 11, 2024	45.06400, -64.49426	0.30	0.30	1.00	0.37	0.60	0.79	0.27	0.63	1.00	N/a	N/a	0.79	1.00	0.38	0.44

Spidle Brook

Table 10. HSI scores for Atlantic salmon in the Spidle Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover (Juveniles)	% In-stream Cover (Adults)	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Summer Rearing Temperature During Growing Season	pH	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	Stream Order	% Stream Shade
Atlantic Salmon	Site 1 June 19, 2024	45.06559, -64.59924	0.64	0.60	1.00	0.45	0.60	0.68	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.86
	Site 2 June 20, 2024	45.06176, -64.60084	0.12	0.30	1.00	0.27	0.60	0.68	0.79	1.00	1.00	N/a	N/a	1.00	0.51	0.90	0.41
	Site 3 June 20, 2024	45.05717, -64.59805	0.36	0.60	1.00	1.00	0.30	0.83	1.00	0.75	1.00	N/a	N/a	1.00	1.00	0.90	0.58
	Site 4 June 20, 2024	45.05674, -64.59708	0.45	0.30	1.00	0.17	0.30	0.77	1.00	0.74	1.00	N/a	N/a	1.00	0.93	0.90	1.00
	Site 5 June 20, 2024	45.04874, -64.59364	0.34	0.60	1.00	0.44	0.60	0.73	1.00	0.37	0.71	N/a	N/a	1.00	0.62	0.90	1.00

Table 11. HSI scores for brook trout in the Spidle Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover Juvenile	% In-stream Cover During Late Growing Season Adult	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Average Maximum Water Temperature	pH	Average Size of Substrate in Spawning Areas	% Fines in Spawning Areas	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Average Thalweg Depth During the Late Growing Season	% Stream Shade
Brook Trout	Site 1 June 19, 2024	45.06559, -64.59924	0.59	0.60	1.00	0.45	0.60	0.68	1.00	1.00	1.00	1.00	1.00	0.84	0.44	0.66	0.86
	Site 2 June 20, 2024	45.06176, -64.60084	0.30	0.30	1.00	0.27	0.60	0.68	0.79	1.00	1.00	N/a	N/a	0.96	0.33	0.58	0.41
	Site 3 June 20, 2024	45.05717, -64.59805	0.44	0.60	1.00	1.00	0.30	0.83	1.00	1.00	1.00	N/a	N/a	0.00	0.00	0.72	0.58
	Site 4 June 20, 2024	45.05674, -64.59708	0.49	0.30	1.00	0.17	0.30	0.77	1.00	1.00	0.98	N/a	N/a	0.20	0.44	0.49	1.00
	Site 5 June 20, 2024	45.04874, -64.59364	0.43	0.60	1.00	0.44	0.60	0.73	1.00	0.96	0.68	N/a	N/a	0.75	0.31	0.47	1.00

Sharpe Brook

Table 12. HSI scores for Atlantic salmon in the Sharpe Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover (Juveniles)	% In-stream Cover (Adults)	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Summer Rearing Temperature During Growing Season	pH	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	Stream Order	% Stream Shade
Atlantic Salmon	Site 1 May 31, 2024	45.06361, -64.63211	0.91	0.60	1.00	0.25	0.60	1.00	1.00	1.00	1.00	0.83	0.54	1.00	1.00	0.50	0.37
	Site 2 June 4, 2024	45.06267, -64.63230	0.39	0.30	1.00	0.53	0.60	1.00	1.00	0.87	1.00	N/a	N/a	1.00	1.00	0.50	0.45
	Site 3 June 6, 2024	45.06095, -64.63323	0.39	0.60	1.00	1.00	0.60	1.00	1.00	0.88	1.00	N/a	N/a	1.00	1.00	0.50	1.00
	Site 4 June 6, 2024	45.05699, -64.63378	0.55	0.60	1.00	0.52	0.60	1.00	1.00	0.96	0.97	N/a	N/a	1.00	1.00	0.50	1.00
	Site 5 June 7, 2024	45.05586, -64.63383	0.12	0.30	1.00	0.38	0.60	0.97	1.00	1.00	0.97	N/a	N/a	1.00	1.00	0.50	0.83
	Site 6 July 15, 2024	45.05509, -64.63457	0.46	0.60	1.00	0.40	0.60	1.00	1.00	0.72	1.00	0.96	0.27	1.00	1.00	0.50	1.00
	Site 7 July 15, 2024	45.05407, -64.63612	0.29	0.30	1.00	1.00	0.30	0.99	1.00	0.95	0.97	N/a	N/a	1.00	1.00	0.50	0.93
	Site 8 July 15, 2024	45.06450, -64.62985	0.12	0.30	1.00	0.81	0.30	1.00	1.00	0.74	1.00	N/a	N/a	0.95	1.00	0.50	0.41
	Site 9 July 15, 2024	45.06596, -64.62988	0.63	0.30	1.00	0.33	0.30	1.00	0.77	0.67	1.00	N/a	N/a	1.00	1.00	0.50	0.51

Table 13. HSI scores for brook trout in the Sharpe Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover Juvenile	% In-stream Cover During Late Growing Season Adult	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Average Maximum Water Temperature	pH	Average Size of Substrate in Spawning Areas	% Fines in Spawning Areas	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Average Thalweg Depth During the Late Growing Season	% Stream Shade
Brook Trout	Site 1 May 31, 2024	45.06361, -64.63211	0.74	0.60	1.00	0.25	0.60	1.00	1.00	1.00	1.00	0.24	0.54	0.37	0.86	0.80	0.37
	Site 2 June 4, 2024	45.06267, -64.63230	0.46	0.30	1.00	0.53	0.60	1.00	1.00	1.00	0.96	N/a	N/a	1.00	0.58	0.78	0.45
	Site 3 June 6, 2024	45.06095, -64.63323	0.46	0.60	1.00	1.00	0.60	1.00	1.00	1.00	0.98	N/a	N/a	0.90	0.47	0.47	1.00
	Site 4 June 6, 2024	45.05699, -64.63378	0.54	0.60	1.00	0.52	0.60	1.00	1.00	1.00	0.92	N/a	N/a	0.97	1.00	0.61	1.00
	Site 5 June 7, 2024	45.05586, -64.63383	0.30	0.30	1.00	0.38	0.60	0.97	1.00	1.00	0.93	N/a	N/a	0.66	1.00	0.28	0.83
	Site 6 July 15, 2024	45.05509, -64.63457	0.50	0.60	1.00	0.40	0.60	1.00	1.00	0.74	1.00	0.77	0.27	0.77	1.00	0.99	1.00
	Site 7 July 15, 2024	45.05407, -64.63612	0.40	0.30	1.00	1.00	0.30	0.99	1.00	0.93	0.93	N/a	N/a	0.00	0.00	0.91	0.93
	Site 8 July 15, 2024	45.06450, -64.62985	0.30	0.30	1.00	0.81	0.30	1.00	1.00	0.76	1.00	N/a	N/a	0.00	1.00	1.00	0.41
	Site 9 July 15, 2024	45.06596, -64.62988	0.58	0.30	1.00	0.33	0.30	1.00	0.77	0.70	1.00	N/a	N/a	0.00	0.00	0.91	0.51

Rochford Brook

Table 14. HSI scores for Atlantic salmon in the Rochford Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover (Juveniles)	% In-stream Cover (Adults)	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Summer Rearing Temperature During Growing Season	pH	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	Stream Order	% Stream Shade
Atlantic Salmon	Site 1 June 18, 2024	45.05841, -64.67840	0.52	0.60	1.00	1.00	0.30	1.00	0.45	1.00	1.00	N/a	N/a	1.00	0.64	0.90	0.54
	Site 2 June 18, 2024	45.05827, -64.67719	0.52	0.60	1.00	0.41	0.30	1.00	1.00	1.00	1.00	N/a	N/a	1.00	0.91	0.90	1.00
	Site 3 June 18, 2024	45.05704, -64.67409	0.12	0.30	1.00	0.00	0.30	1.00	1.00	1.00	1.00	N/a	N/a	1.00	0.76	0.90	0.93
	Site 4 June 18, 2024	45.05419, -64.66939	0.12	0.30	1.00	0.84	0.60	1.00	1.00	1.00	1.00	N/a	N/a	1.00	0.59	0.90	1.00
	Site 5 June 19, 2024	45.05175, -64.66721	0.55	0.60	1.00	0.24	0.60	0.96	1.00	1.00	1.00	1.00	0.06	1.00	1.00	0.90	1.00

Table 15. HSI scores for brook trout in the Rochford Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover Juvenile	% In-stream Cover During Late Growing Season Adult	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Average Maximum Water Temperature	pH	Average Size of Substrate in Spawning Areas	% Fines in Spawning Areas	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Average Thalweg Depth During the Late Growing Season	% Stream Shade
Brook Trout	Site 1 June 18, 2024	45.05841, -64.67840	0.53	0.60	1.00	1.00	0.30	1.00	0.45	1.00	1.00	N/a	N/a	0.00	0.00	0.33	0.54
	Site 2 June 18, 2024	45.05827, -64.67719	0.52	0.60	1.00	0.41	0.30	1.00	1.00	1.00	1.00	N/a	N/a	0.00	0.00	0.36	1.00
	Site 3 June 18, 2024	45.05704, -64.67409	0.30	0.30	1.00	0.00	0.30	1.00	1.00	0.98	1.00	N/a	N/a	0.00	0.00	0.16	0.93
	Site 4 June 18, 2024	45.05419, -64.66939	0.30	0.30	1.00	0.84	0.60	1.00	1.00	1.00	1.00	N/a	N/a	1.00	1.00	0.21	1.00
	Site 5 June 19, 2024	45.05175, -64.66721	0.54	0.60	1.00	0.24	0.60	0.96	1.00	1.00	1.00	1.00	0.06	0.75	1.00	0.49	1.00

Fales River

Table 16. HSI scores for Atlantic salmon in the Fales River sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover (Juveniles)	% In-stream Cover (Adults)	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Summer Rearing Temperature During Growing Season	pH	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	Stream Order	% Stream Shade
Atlantic Salmon	Site 1 Sept. 18, 2024	44.96208, -64.92515	0.55	0.60	1.00	0.24	0.60	0.92	0.69	1.00	0.86	0.73	0.00	1.00	1.00	0.90	1.00
	Site 2 Sept. 18, 2024	44.96102, -64.92468	0.40	0.60	0.70	0.15	1.00	0.53	0.53	1.00	1.00	N/a	N/a	1.00	1.00	0.90	1.00
	Site 3 Sept. 18, 2024	44.96104, -64.92381	0.43	0.60	0.97	0.30	0.60	0.99	1.00	1.00	1.00	0.88	0.08	1.00	1.00	0.90	0.86
	Site 4 Sept. 18, 2024	44.96117, -64.92305	0.73	0.60	1.00	1.00	1.00	1.00	0.97	1.00	1.00	N/a	N/a	1.00	1.00	0.90	1.00
	Site 5 Sept. 18, 2024	44.96138, -64.92204	0.19	0.30	0.46	0.02	1.00	0.99	0.69	0.94	0.99	1.00	0.00	1.00	0.79	0.90	0.93
	Site 6 Sept. 19, 2024	44.96131, -64.92145	0.46	0.60	1.00	0.30	1.00	1.00	0.53	1.00	1.00	N/a	N/a	1.00	1.00	0.90	1.00
	Site 7 Sept. 19, 2024	44.96101, -64.92069	0.36	0.60	1.00	0.31	0.60	1.00	0.65	1.00	1.00	0.75	0.08	1.00	1.00	0.90	1.00
	Site 8 Sept. 19, 2024	44.96029, -64.92029	0.12	0.30	1.00	0.48	0.60	1.00	1.00	1.00	1.00	N/a	N/a	1.00	0.54	0.90	1.00
	Site 9 Sept. 19, 2024	44.95959, -64.92051	0.31	0.60	1.00	0.27	1.00	1.00	0.92	1.00	1.00	0.79	0.00	1.00	1.00	0.90	0.72
	Site 10 Sept. 19, 2024	44.95878, -64.92131	0.12	0.30	0.78	0.16	0.60	0.96	0.85	1.00	1.00	N/a	N/a	1.00	1.00	0.90	1.00

Table 17. HSI scores for brook trout in the Fales River sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover Juvenile	% In-stream Cover During Late Growing Season Adult	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Average Maximum Water Temperature	pH	Average Size of Substrate in Spawning Areas	% Fines in Spawning Areas	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Average Thalweg Depth During the Late Growing Season	% Stream Shade
Brook Trout	Site 1 Sept. 18, 2024	44.96208, -64.92515	0.54	0.60	1.00	0.24	0.60	0.92	0.69	1.00	1.00	0.00	0.00	1.00	1.00	0.68	1.00
	Site 2 Sept. 18, 2024	44.96102, -64.92468	0.46	0.60	0.70	0.15	1.00	0.53	0.53	1.00	1.00	N/a	N/a	1.00	1.00	0.49	1.00
	Site 3 Sept. 18, 2024	44.96104, -64.92381	0.48	0.60	0.97	0.30	0.60	0.99	1.00	1.00	1.00	0.46	0.08	1.00	1.00	0.88	0.86
	Site 4 Sept. 18, 2024	44.96117, -64.92305	0.64	0.60	1.00	1.00	1.00	1.00	0.97	0.98	1.00	N/a	N/a	1.00	1.00	0.77	1.00
	Site 5 Sept. 18, 2024	44.96138, -64.92204	0.35	0.30	0.46	0.02	1.00	0.99	0.69	0.92	0.95	1.00	0.00	1.00	1.00	0.24	0.93
	Site 6 Sept. 19, 2024	44.96131, -64.92145	0.49	0.60	1.00	0.30	1.00	1.00	0.53	1.00	1.00	N/a	N/a	1.00	1.00	0.91	1.00
	Site 7 Sept. 19, 2024	44.96101, -64.92069	0.44	0.60	1.00	0.31	0.60	1.00	0.65	1.00	1.00	0.00	0.08	1.00	1.00	0.81	1.00
	Site 8 Sept. 19, 2024	44.96029, -64.92029	0.30	0.30	1.00	0.48	0.60	1.00	1.00	1.00	0.98	N/a	N/a	1.00	1.00	0.61	1.00
	Site 9 Sept. 19, 2024	44.95959, -64.92051	0.42	0.60	1.00	0.27	1.00	1.00	0.92	1.00	0.97	0.12	0.00	1.00	1.00	0.97	0.72
	Site 10 Sept. 19, 2024	44.95878, -64.92131	0.30	0.30	0.78	0.16	0.60	0.96	0.85	0.98	0.96	N/a	N/a	1.00	1.00	0.99	1.00

Roxbury Brook

Table 18. HSI scores for Atlantic salmon in the Roxbury Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover (Juveniles)	% In-stream Cover (Adults)	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Summer Rearing Temperature During Growing Season	pH	Substrate for Spawning and Incubation	% Fines in Spawning Areas	Fry Water Depth	Parr Water Depth	Stream Order	% Stream Shade
Atlantic Salmon	Site 1 July 10, 2024	44.86096, -65.20263	0.92	0.60	1.00	0.47	1.00	1.00	0.69	0.62	0.84	N/a	N/a	1.00	1.00	0.90	1.00
	Site 2 July 10, 2024	44.86051, -65.20203	0.14	0.30	1.00	0.32	1.00	0.97	1.00	0.55	0.68	1.00	0.08	1.00	1.00	0.90	0.81
	Site 3 July 10, 2024	44.85990, -65.20197	0.12	0.30	0.90	0.16	1.00	1.00	0.53	0.46	0.68	N/a	N/a	1.00	1.00	0.90	1.00
	Site 4 July 10, 2024	44.85937, -65.20195	0.36	0.60	1.00	0.32	0.60	1.00	1.00	0.39	0.57	N/a	N/a	1.00	1.00	0.90	1.00
	Site 5 July 11, 2024	44.85888, -65.20198	0.15	0.30	1.00	0.23	1.00	1.00	1.00	0.51	0.35	N/a	N/a	1.00	1.00	0.90	0.65
	Site 6 July 11, 2024	44.85818, -65.20180	0.42	0.60	1.00	0.24	1.00	1.00	0.99	0.48	0.46	0.79	0.54	1.00	1.00	0.90	1.00
	Site 7 July 11, 2024	44.85783, -65.20134	0.12	0.30	1.00	0.21	1.00	1.00	1.00	0.46	0.62	0.91	0.08	1.00	0.94	0.90	0.51
	Site 8 July 16, 2024	44.85751, -65.20016	0.60	0.60	1.00	0.35	1.00	1.00	0.92	0.51	0.74	0.84	0.00	1.00	1.00	0.90	1.00
	Site 9 July 16, 2024	44.85711, -65.19966	0.97	0.60	1.00	0.50	1.00	1.00	1.00	0.40	0.66	N/a	N/a	1.00	1.00	0.90	1.00
	Site 10 July 16, 2024	44.85700, -65.19911	0.44	0.60	1.00	0.83	0.30	1.00	0.88	0.32	0.62	N/a	N/a	1.00	1.00	0.90	1.00

Table 19. HSI scores for brook trout in the Roxbury Brook sub-watershed.

	Site Date	Latitude Longitude	% Pools	Pool Class Rating	% In-stream Cover Juvenile	% In-stream Cover During Late Growing Season Adult	Dominant Substrate Type in Riffle-Run Areas	Average % Vegetation Along the Streambank	Average % Rooted Vegetation and Stable Rocky Ground Cover	Average Maximum Water Temperature	pH	Average Size of Substrate in Spawning Areas	% Fines in Spawning Areas	% Fines in Riffle-Run Areas	% Substrate Size Class for Winter Escape	Average Thalweg Depth During the Late Growing Season	% Stream Shade
Brook Trout	Site 1 July 10, 2024	44.86096, -65.20263	0.76	0.60	1.00	0.47	1.00	1.00	0.69	0.65	0.78	N/a	N/a	1.00	1.00	0.69	1.00
	Site 2 July 10, 2024	44.86051, -65.20203	0.32	0.30	1.00	0.32	1.00	0.97	1.00	0.59	0.66	0.99	0.08	1.00	1.00	0.50	0.81
	Site 3 July 10, 2024	44.85990, -65.20197	0.30	0.30	0.90	0.16	1.00	1.00	0.53	0.48	0.65	N/a	N/a	1.00	1.00	0.69	1.00
	Site 4 July 10, 2024	44.85937, -65.20195	0.44	0.60	1.00	0.32	0.60	1.00	1.00	0.40	0.58	N/a	N/a	0.65	1.00	0.22	1.00
	Site 5 July 11, 2024	44.85888, -65.20198	0.32	0.30	1.00	0.23	1.00	1.00	1.00	0.54	0.45	N/a	N/a	0.96	1.00	0.38	0.65
	Site 6 July 11, 2024	44.85818, -65.20180	0.47	0.60	1.00	0.24	1.00	1.00	0.99	0.51	0.51	0.12	0.54	1.00	1.00	0.41	1.00
	Site 7 July 11, 2024	44.85783, -65.20134	0.30	0.30	1.00	0.21	1.00	1.00	1.00	0.48	0.62	0.59	0.08	1.00	1.00	0.50	0.51
	Site 8 July 16, 2024	44.85751, -65.20016	0.57	0.60	1.00	0.35	1.00	1.00	0.92	0.54	0.70	0.28	0.00	1.00	1.00	0.61	1.00
	Site 9 July 16, 2024	44.85711, -65.19966	0.80	0.60	1.00	0.50	1.00	1.00	1.00	0.42	0.64	N/a	N/a	0.98	1.00	1.00	1.00
	Site 10 July 16, 2024	44.85700, -65.19911	0.48	0.60	1.00	0.83	0.30	1.00	0.88	0.30	0.62	N/a	N/a	0.99	1.00	1.00	1.00

Electrofishing Data Sheet

Electrofishing Field Sheet #:

Crew:

Site Information			
Site Name		Date (dd/mm/yyyy)	
Stream Name		Time	
Wetted Width (m)		UTM Easting (m)	
Reach Length (m)		UTM Nothing (m)	
Depth (m)	*D1 :* *D2 :*	*D3 :*	*Average :*

Water Quality							
pH		DO (mg/L)		Conductivity (µS/cm)		Salinity (g/L)	
Water Temp (°C)		DO (% SAT)		Turbidity (NTU)		TDS (mg/L)	

Pass Information

Pass Number	Time Start	Time End	Total Time	Pulse Width (ms)	Pulse Frequency (Hz)	Duty Cycle (%)	Volts

Species Information

Pass Number	Species	Fork Length (cm)	Pass Number	Species	Fork Length (cm)

Electrofishing Survey Parameters

Table 20. Variables collected during electrofishing surveys.

Variable	Units	Description
Air Temperature	Celcius	The temperature of the air on the day of the assessment
Turbidity	NTU	Transparency of the water due to the presence of suspended particles
Salinity	g/L	The amount of dissolved salts in the water
Pass Number		Sample number
Time Start		Time recorded from the Electrofishing unit before the start of a pass
Time End		Time recorded from the Electrofishing unit at the end/completion of a pass
Total Time		Time End – Time Start using the numbers recorded from the Electrofishing unit (See 'Time Start' and 'Time End')
Pulse Width	ms	Duration of each individual pulse of electricity
Pulse Frequency	Hz	Number of pulses per second
Conductivity	mS/cm	The ability of a solution (water) to carry an electrical current
Duty Cycle	%	Frequency or pulse rate is
Date		The date on which the assessment was completed
Depth	cm	Depth measured at 3 locations that is representative of the survey site. Taken within the reach length.
Volts	V	Electrical pressure
DO	% SAT	The amount of oxygen dissolved in the water
DO	mg/L	The amount of oxygen dissolved in the water
Species		Identity of fish captured.
Fork Length	cm	Length of fish measured from the tip of the snout to the end of the middle caudal fin rays.
Field Crew		The assessors collecting the data
pH		The acidity of the water in the watercourse
Reach Length	m	Linear distance of area being surveyed
Site Name		The name of the site where the survey is taking place. Usually 'Test' or 'Control'
Stream Name		The name of the watercourse where the survey is taking place
TDS	mg/l	Total dissolved solids, the measurement of the combined content of all inorganic and organic substances in its suspended form
Time		The time that the assessment began
UTM Coordinates		GPS position of the HSI assessment location, described with Northings and Eastings, using a NAD83 projection
Water Temperature	Celcius	Downstream water temperature
Wetted Width	m	Width of the river that contains water at the time of the measurement

Electrofishing Results

Elderkin Brook

Table 21. Electrofishing results for the Elderkin Brook sub-watershed.

Site	Latitude	Longitude	Reach Length (m)	Species	# Captured	Ave. Fork Length (cm)
1	45.065948	-64.474665	85	American Eel	8	27.8
				Brook Trout	21	7.4
				Brown Trout	146	12
2	45.065049	-64.476136	140	American Eel	5	29.6
				Atlantic Salmon	1	18.4
				Brook Trout	44	7.2
				Brown Trout	100	10
3	45.063921	-64.479922	115	American Eel	9	23.8
				Brook Trout	45	9.2
				Brown Trout	154	12.9

Mill Brook

Table 22. Electrofishing results for the Mill Brook sub-watershed.

Site	Latitude	Longitude	Reach Length (m)	Species	# Captured	Ave. Fork Length (cm)
1	45.076977	-64.490279	100	American Eel	52	30.6
				Atlantic Salmon	10	12
				Brown Trout	21	16.6
2	45.073105	-64.491774	130	American Eel	7	30.4
				Atlantic Salmon	10	12.8
				Brown Trout	23	14.6
3	45.05634	-64.504584	100	American Eel	7	20.4
				Atlantic Salmon	8	11.5
				Brown Trout	19	10.2

Spidle Brook

Table 23. Electrofishing results for the Spidle Brook sub-watershed.

Site	Latitude	Longitude	Reach Length (m)	Species	# Captured	Ave. Fork Length (cm)
1	45.065673	-64.598982	85	American Eel	20	19.7
				Brook Trout	14	13.9
				Brown Trout	51	11.9
				Pearl Dace	1	10.9
				Threespine Stickleback	4	3.5
				White Sucker	5	7.2
2	45.062346	-64.600813	75	American Eel	22	23
				Brook Trout	51	9.2
				Brown Trout	61	15.8
3	45.056726	-64.597167	93	Brook Trout	78	12.4
				Threespine Stickleback	2	5.3

Sharpe Brook

Table 24. Electrofishing results for the Sharpe Brook sub-watershed.

Site	Latitude	Longitude	Reach Length (m)	Species	# Captured	Ave. Fork Length (cm)
1	45.06258	-64.632471	90	American Eel	3	26.3
				Brook Trout	32	9.5
				Brown Trout	70	10.9
				Golden Shiner	1	9.5
				Threespine Stickleback	4	3.6
2	45.06105	-64.633246	110	American Eel	6	25.2
				Atlantic Salmon	1	14.1
				Brook Trout	22	10.1
				Brown Trout	48	12.7
				Threespine Stickleback	2	4.3
				White Sucker	8	8.2
3	45.056939	-64.633567	101	American Eel	8	22.4
				Atlantic Salmon	1	7.3
				Brook Trout	41	12.8
				Brown Trout	58	13.2

Rochford Brook

Table 25. Electrofishing results for the Rochford Brook sub-watershed.

Site	Latitude	Longitude	Reach Length (m)	Species	# Captured	Ave. Fork Length (cm)
1	45.058301	-64.679448	217	American Eel	36	20.7
				Banded Killifish	1	6
				Brook Trout	2	15.9
				Brown Trout	64	14
				Creek Chub	8	6.1
				Fourspine Stickleback	1	5.5
				Lake Chub	12	7.1
				Ninespine Stickleback	4	3.6
				Threespine Stickleback	36	3.2
				White Sucker	8	6.4
2	45.053626	-64.668724	112	American Eel	7	29.9
				Brook Trout	4	17.6
				Brown Trout	94	13.3
				Creek Chub	1	9.3
				White Sucker	5	14
3	45.05206	-64.667606	80	American Eel	5	24.6
				Brook Trout	18	18
				Brown Trout	59	14.8
				Lake Chub	1	10.5

Fales River

Table 26. Electrofishing results for the Fales River sub-watershed.

Site	Latitude	Longitude	Reach Length (m)	Species	# Captured	Ave. Fork Length (cm)
1	44.962669	-64.933001	80	American Eel	8	20.8
				Brook Trout	5	9.2
				Creek Chub	12	6
				Lake Chub	10	7.1
				Sea Lamprey	5	8.8
				Threespine Stickleback	7	1.8
				White Sucker	2	2.6
2	44.96266	-64.92609	95	American Eel	63	18.5
				Atlantic Salmon	4	7.4
				Brook Trout	5	4.7
				Creek Chub	36	7
				Lake Chub	26	5.8
				Ninespine Stickleback	1	4.5
				Sea Lamprey	3	11.8
				Threespine Stickleback	6	4.2
				White Sucker	6	15
3	44.959766	-64.920503	95	American Eel	38	18.5
				Atlantic Salmon	5	11.5
				Brook Trout	3	9.5
				Creek Chub	21	6.8
				Lake Chub	13	7.9
				White Sucker	8	9

Roxbury Brook

Table 27. Electrofishing results for the Roxbury Brook sub-watershed.

Site	Latitude	Longitude	Reach Length (m)	Species	# Captured	Ave. Fork Length (cm)
1	44.857171	-65.198795	87	American Eel	6	21.1
				Creek Chub	3	6.6
2	44.858972	-65.202079	80	American Eel	17	18.6
				Brook Trout	1	11
				Creek Chub	10	2.3
3	44.860969	-65.202155	90	American Eel	30	21.4
				Brook Trout	1	4.3
				Creek Chub	4	7.7

Temperature Data Logger Deployment Information

Table 28. Temperature data logger deployment information, including geographic location, deployment and retrieval dates.

Watercourse	Latitude	Longitude	Date Deployed	Date Retrieved
Elderkin Brook	45.06681	-64.47394	June 17, 2024	August 20, 2024
	45.06550	-64.47293	June 17, 2024	August 20, 2024
	45.06479	-64.47503	June 17, 2024	August 20, 2024
Mill Brook	45.07262	-64.49137	June 13, 2024	August 20, 2024
	45.05615	-64.50436	June 13, 2024	August 20, 2024
	45.05165	-64.51788	June 13, 2024	August 20, 2024
Spidle Brook	45.06578	-64.59886	June 19, 2024	August 20, 2024
	45.06548	-64.59947	June 19, 2024	August 20, 2024
	45.05676	-64.59666	June 19, 2024	August 20, 2024
Sharpe Brook	45.06386	-64.63138	June 12, 2024	August 20, 2024
	45.05716	-64.63391	June 12, 2024	August 20, 2024
	45.05478	-64.63516	June 12, 2024	August 20, 2024
Rochford Brook	45.05862	-64.67842	June 12, 2024	August 20, 2024
	45.05710	-64.67431	June 12, 2024	August 20, 2024
	45.05385	-64.66894	June 14, 2024	August 20, 2024
Fales River	44.96283	-64.93261	May 24, 2024	October 18, 2024
	44.96070	-64.93046	May 24, 2024	October 18, 2024
	44.96265	-64.92618	May 24, 2024	October 18, 2024
	44.95905	-64.91384	May 24, 2024	October 18, 2024
	44.95918	-64.91001	May 24, 2024	October 18, 2024
Roxbury Brook	44.85737	-65.19878	May 23, 2024	October 18, 2024
	44.85743	-65.20034	May 23, 2024	October 18, 2024
	44.85914	-65.20200	May 23, 2024	October 18, 2024
	44.86108	-65.20235	May 23, 2024	October 18, 2024
	44.86232	-65.20472	May 23, 2024	October 18, 2024