2021-2022 FINAL REPORT

ETF PROJECT #210102

NASHWAAK WATERSHED ASSOCIATION INC.

17 FEBRUARY 2022

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PROJECT NAME:

Assessing and Improving the Health of the Nashwaak Watershed

EXECUTIVE SUMMARY

The Nashwaak Watershed Association Inc. (NWAI) received $40,000 from the NB Environment Trust Fund in the 2020-2021 fiscal year for our monitoring project. Match funding was provided by the NB Wildlife Trust Fund, WWF Canada, and the Atlantic Salmon Conservation Foundation. The overall objectives of the project were as follows: 1) monitor the health of the watershed through water quality monitoring, temperature logging, CABIN surveys, and cyanobacteria sampling; 2) assess and improve the aquatic connectivity of the watershed; and 3) community outreach on the topic of river health.

The objectives of the project were met, and in partnership with the Atlantic Datastream have made all data publicly available on our website. All deliverables were completed within the time frame of the grant; however, the project was set up to be a multi-year project. Therefore, the deliverables will carry over into the 2022 field season and beyond.

No permits were required for the field surveys or monitoring. NBDTI's permission was obtained and Watercourse and Wetland Alternation (WAWA) permit applications were granted for the projects on Campbell Creek and Limekiln Brook. NBDTI's permission has also been sought to move forward on an additional project, a culvert removal on Porter's Brook.

Project funding in 2021 allowed us to build on our last four successful field seasons. The overarching objective of the project is to increase our knowledge of the health of our watershed to grow our capacity to make restoration & management decisions based on sound science. Evaluation of trends in benthic community structure, water quality, and temperature will allow us to better develop and evaluate watershed and habitat management initiatives; assess the effects of particular industries on river health; communicate the health of the watershed to public; and assess the effects of our habitat restoration activities.

Priority Areas Measures: This project falls under the Priority Area Purpose of protecting and improving the water environment. In 2021 there were 8 measures carried out, all measures and their results reported. All intended management actions were completed within the timeline of the project.

We believe that the project had, and will continue to have, the intended long- and short-term impacts. By monitoring the health and connectivity of the watershed, the NWAI has an increased knowledge of natural and anthropogenic processes affecting the water quality in the Nashwaak. This has allowed us to incorporate this information into our Landowner Outreach and general education projects with the aim of communicating the health of the watershed to the wider public. By continuing to monitor the quality and temperature of the river as well as barriers to fish passage, we hope to continue to recognize problem areas or industries that are negatively affecting river health and connectivity. We also aim to increase the capacity of our organization to develop ecologically valuable restoration projects as well as to measure their effects on the health of the river.

OBJECTIVES

- gain more knowledge about:
    - water quality,
    - benthic community,
    - location of thermal refugia,
    - cyanobacteria
- prioritize areas of good aquatic habitat near cold-water that are under threat,
- improve our knowledge about the connectivity of the watershed,
- increase the amount of available upstream habitat,
- decrease the risk of damage to public infrastructure.

IMPORTANCE

There are large temporal gaps in monitoring the Nashwaak watershed's health. Long-term monitoring can support the use of statistical trend assessment to help evaluate the influences of human activities & other factors on the watershed over long periods. The Department of Fisheries and Oceans (DFO)'s Ecological Restoration of Degraded Habitats handbook recognizes both water quality and high temperatures as limiting factors to fish populations. Water quality and temperature were noted as data deficient areas in our 10-Year Strategic Plan and are important for determining baseline conditions for monitoring the state of the watershed.

WATER QUALITY AND BENTHIC INVERTEBRATES

Maintaining the quality of the surface water is extremely important for ensuring a healthy watershed. Due to a broad range of natural and anthropogenic influences, the quality and temperature of a river's water can vary substantially over time and space. Much has changed in the watershed over the last 15 years, including urbanization, putting stress on the river due to an increased human population, which has led to the removal of riparian vegetation and the release of pesticides, fuels, nutrients, and bacteria. Our 2016 geomorphic survey of the lower Nashwaak recognized large areas of erosion, especially downriver from Taymouth. Bank erosion increases siltation of rivers and leads to increased levels of metals and suspended sediments. Erosion was particularly noticeable in areas where riparian vegetation had been removed. Additionally, the Sisson Brook Mine may soon begin construction. Having a knowledge of what the water quality is before it begins operating will allow us to calculate its effects.

In 2021 NWAI monitored water quality via grab samples and probes at 11 historic sites, and 5 additional sites related to other projects, throughout the watershed monthly between June and October. In 2021 we monitored benthic invertebrates using the CABIN protocol at two sites in October. BMIs are a vital component of healthy streams and are considered good indicators of local conditions. However, we currently have limited knowledge of

the benthic community in our watershed. In addition, we conducted eDNA sampling, flow monitoring to determine baseline characteristics at two project sites; Campbell Creek and Porter's Brook.

The regular monitoring of water quality allows us to:

- Identify problem areas or industries,
- Assess the condition of the river and how it changes,
- Define and approach private landowners in problem areas and discuss management options with them,
- Determine how the changes in water quality are affecting wildlife and habitat, particularly Atlantic salmon,
- Make decisions on the management of the river's health, and
- Promote community stewardship of the Nashwaak River by making the information public.

CYANOBACTERIA

River health may also give us some insight into cyanobacteria blooms, a topic of concern in the last two years. In 2019 NWAI began monitoring cyanobacteria in Nashwaak lake and river and continued to monitor two sites in the river in 2021 in partnership with UNB and ACAP St John. We deployed solid phase adsorption toxin tracking (SPATT) collectors, took grab samples that were analyzed for nutrients and samples of any suspected cyanobacteria mats. Due to COVID-19 related delays at the lab analyzing the mat and SPATT collector samples, we do not have any results to share at this time.

TEMPERATURE

The risk of extreme temperature events in a river increases with riparian zone alteration and water extraction. The removal of forests requires road networks, which typically lead to an increase in water temperatures and sediment in rivers. Both factors impact the distribution of cool- and cold-water fishes. Other factors that increase river temperatures include higher air temperatures, sedimentation, and input from water treatment plants. Though most present-day industrial and municipal operations are regulated to protect aquatic ecosystems, the persistent impacts from historical forestry operations remain unknown.

Warmer water contains less oxygen than colder water so as river temperatures rise and dissolved oxygen decreases, fish begin to experience stress, particularly salmonids (salmon, charr, and trout species). To escape warm waters in the mid-summer, many fish species will move to smaller, cooler tributaries or pools near cold seeps to survive. High temperatures can delay migration; exhaust energy reserves, which can result in reproductive failure; reduce egg survival; slow growth of fry and smolts; and decrease resistance to disease.

"Spring-fed creeks" occur in areas where there are deep deposits of coarse soils that infiltrate a large portion of rain or snowmelt and where water tables are large and steeply sloped. Spring-fed creeks have more uniform and stable flows and temperatures. They can be extremely productive habitat for cold-water fish and can provide a refuge for fish from high summer water temperatures. Major upwelling or groundwater discharge areas are also critical locations for spawning and egg incubation. Areas of coarse gravel or sand with upwelling groundwater are the most sensitive and rare environments in a salmonid stream. Spring-fed streams are ecologically important as, being fed by groundwater, they are less susceptible to variations in air temperature & can buffer changes in climate. They support animals that do not occur in the main stem & maintain the base flow of the river.

Adult Atlantic salmon are less tolerant to high temperatures than juveniles. A DFO (2012) report determined that incipient lethal temperature (or the temperature that a fish can tolerate for at least seven days) was 27.8°C for juveniles, while for adults it was around 25°C. The report noted that juvenile and adult salmon begin aggregating near cool water sources and stopped feeding when minimum night-time temperatures remained above 20°C for two consecutive nights. Therefore, according to DFO, 20°C is considered the threshold minimum temperature for assessing physiological stress in Atlantic salmon.

Determining the location of, and protecting, cold-water tributaries were noted as High Priority action items in our management plan. Monitoring the temperature of our ecologically important tributaries helps us to:

- Better understand the sources of thermal inputs and where the cold-water (<20°C) refuges, which are so important to species such as the Endangered Atlantic salmon and other salmonids, are located within the watershed (as recommended by DFO's Ecological Restoration of Degraded Habitats document),
- Communicate the importance of cold-water refuges to the public, and
- Protect, manage, and restore those areas in the future.

In 2021 we installed 39 temperature loggers throughout the watershed, 3 loggers had battery failures and 2 could not be retrieved resulting data in from 32 loggers.

AQUATIC CONNECTIVITY

Significant urbanization has occurred in the lower Nashwaak watershed in the last decade, leading to an increase in roads and associated stream crossings. Aquatic organisms require access to a variety of habitats to spawn, feed, & find cool water. Poorly designed or undersized culverts can fragment aquatic populations, alter stream hydrology by changing water velocity & sediment transport, degrade water quality by increasing erosion & cause flooding.

Additionally, culverts can change water velocity, river hydrology, and become blocked with debris causing flooding and costly damage to infrastructure. Climate change & altered land use practices are shifting the timing & flow of streams. Older culverts, built decades ago, are now too small to handle the amount of water flowing through them. Remediation & debris clean-ups will improve water quality, restore stream hydrology & improve access for aquatic organisms.

Habitat fragmentation is a prolific issue in the Maritimes. The Clean Annapolis River Foundation found that 70% of culverts they assessed were barriers to fish passage and 80% of the culverts surveyed by the Petitcodiac Watershed Alliance in 2015 were either partial or full barriers to fish passage.

Prior to 2017, the aquatic connectivity of the Nashwaak Watershed was unknown. Therefore, the NWAI requested funds to conduct multi-year project to assess, prioritize, and restore barrier culverts in the Nashwaak watershed from the mouth of the river working up, to re-establish salmon access to important upstream habitat. 2020 was our fourth field season.

The Nashwaak River is an important salmon-producing tributary of the Saint John River and is one of DFO's priority rivers for restoration under their 2014 "Recovery Potential Assessment". This work is also in line with Atlantic Salmon Federation's 2013 "Recovery Strategy for Wild Atlantic Salmon". Habitat fragmentation and blocked access to cold-water or spawning habitats have been recognized as limiting factors for salmon populations.

RESULTS

A full summary and analysis of both the temperature and water quality data can be found in the attached PDF documents: “2021 – 2022 Health of the Nashwaak River Report” and the “NWAI 2021 Water Quality Report Card”. Water quality data and temperature data were all uploaded to the Atlantic Datastream portal. The CABIN results are attached to this report. The data was also uploaded to the ECCC database. A summary of our aquatic connectivity project can be found in the attached PDF entitled “2021 Aquatic Connectivity Report”. We have also attached an excel file detailing each barrier culvert surveyed in 2017-2021, engineering sketches for the remediations projects completed in 2021, DTI approval letters, and WAWA permits. In 2021 we successfully removed the Campbell Creek Dam and placed an additional weir at a culvert in Limekiln Brook to facilitate fish passage.

PRIORITY AREA MEASURES

In 2021 there 5 measures carried out in line with the ETF funding program under “Protecting Our Environment – Water Quality Improvements” All measures and their results reported in Table 1. All intended management actions were completed within the timeline of the project.

Priority Area Measures			
Protecting our Environment- Water quality improvements (e.g. water quality monitoring, benthic invertebrate sampling).			
Measures			
Description	**Intended Result**	**Formula**	**Data Collection**
Monthly Water Quality Monitoring	Baseline monitoring of watershed health	4 rounds of surface water quality sampling at 16 sites in the watershed	NWAI, ELG
		2021 Health of the Nashwaak Report	
		2021 Water Quality Report Card	
		Data uploaded to Datastream and website	
		4 rounds of Cyanobacteria sampling at stations	
		3 staff trained in sampling protocol	
		Communications, 1 full report, 1 report card, 10 social media posts	
		Summer water temperature monitoring, 39 loggers deployed in 2021	
		Water quality data uploaded on Atlantic Datastream	
CABIN Monitoring	Baseline monitoring of benthic community to assess impact of management actions	5 sites at two project locations sampled in 2021	NWAI
Flow Monitoring	Baseline monitoring of flow regime to assess impact of management actions	4 sites at two project locations assessed in 2021	NWAI
eDNA Monitoring for species at risk	Baseline monitoring to assess impact of management actions	10 sites at two project locations assessed in 2021	NWAI
Aquatic Connectivity	Monitor and improve aquatic connectivity in the watershed	Over 30 stream crossings surveyed in 2021	NWAI
		1 Dam removed and headpond restored (8 acres & 22 km of stream length restored)	
		Priority Barrier Shortlist for Remediation Created	NWAI
		2 Engineering drawings for culvert and dam removal developed	
		2 WAWA Permits obtained for resotration work	
		Updated barrier dataset for the watershed	
		Aquatic Connectivity Summary Report	NWAI
		Stream clean-up at each culvert fully assessed (5)	
		1 fish passage solution designed for a culvert removal project	
		3 staff trained in surveying protocol	
		Habitat survey, baseline report and management plan created for Porter's Brook	
		1 baffle installed for fish passage	

Table 1. Priority Area Measures for 2021

PROJECT STATUS

Estimated percentage of project complete: 100%

Estimated percentage of award spent: 100%

This ETF grant allowed for the creation of three full-time jobs at the NWAI (Executive Director, Project Coordinator, and Restoration & Outreach Coordinator).

PUBLICATION OF RESULTS

All documents, data, and maps will be available to the public on our website shortly. We will also prepare printed copies, which will be available for loan at our office, on request. All temperature and water quality data has been uploaded to Atlantic Datastream and sent to DELG. CABIN data were uploaded to the ECCC database. We will also make our water quality data and results available to the public via infographics posted on social media.

We have acknowledged the NB Environmental Trust Fund as a funder of this project on several occasions, including on our annual newsletter, which is distributed to 10,000 households and businesses; on social media; at our annual general meeting held in November attended by over 40 members; and on a sign, which we display at all organization events.

Our Instagram channel reaches over 922 people and Twitter also reaches over 804 people. Our Facebook page has 1,218 followers. We posted over 10 times on the topics of aquatic connectivity and water quality. Water Health and Temperature and Aquatic Connectivity were topics featured several times over the course of the field season. We use the #MyNashwaak and #EauNBWater tag to track engagement on posts.

ATTATCHED DOCUMENTS

Document	Summary
2021 Aquatic Connectivity Summary Report	PDF summary of our 2021 aquatic connectivity project
NWAI 2021 Health of the Nashwaak Report	PDF report comparing 2021 data to historic data
NWAI 2021 WQ Report Card	PDF summarizing 2021 water quality and temperature data
Nashwaak Watershed Culvert Data_2021	Excel database of all culverts surveyed 2017-2021
Temperature Logger Data 2021	Excel database summarizing temperature logger data collected in 2021
Water Quality Data	Excel database of the NWAI water quality data
Approval_Letter_Limekiln_Brook_Route_620_L285	DTI Approval Letter
Limekiln Brook_Additional Baffle Sketch	Limekiln Brook Engineering Sketches

Document	Summary
57990'21 - Nashwaak Watershed Association.Revision	WAWA permit for Limekiln Brook
Porters Brook_Drawings (Preliminary)	Porter's Brook Engineering Sketches
Campbell Creek_Preliminary Drawing Package (FVPO)	Campbell Creek Engineering Sketches
53490'21 - City of Fredericton.permit	WAWA permit for Campbell Creek
CABIN Data 2021	Excel table of 2021 benthic invertebrate data

Report submitted by: Natalie Deseta, NWAI Project Coordinator