

Integrated Watershed Management Plan for Chignecto Area Watersheds



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EOS would like to respectfully acknowledge that our work is done on the traditional, unceded lands and waters of the Mi'kmaq.

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- Members of the Fort Folly Habitat Restoration team and Amlamgog First Nation for their expertise and local knowledge
- Petitcodiac Watershed Alliance and Shediac Bay Watershed Association whose IWMPs (2012 and October 2021, respectively) provided the framework for this report.
- The Atlantic Canada Conservation Data Centre for their data contributing to this report
- Members of the community who provided their feedback in our consultation survey
- And many others for supporting EOS in establishing the Chignecto Watersheds Committee and starting up a long-term water quality monitoring program

Cover page photo: M. Corkum

Executive Summary

EOS Eco-Energy Inc. is an environmental charitable organization based out of Sackville, New Brunswick. EOS Eco-Energy is dedicated to community-based solutions to reducing and adapting to climate change in the Memramcook-Strait Shores-Tantramar region of southeast New Brunswick. In 2017, EOS formed the **Chignecto Watersheds Committee**, a committee dedicated to the long-term sustainability and resiliency of our local environment and to preparing our communities for the combined impacts of climate and land use change by promoting watershed awareness through **public education**, conducting long-term **water quality monitoring**, and performing subsequent **restoration and protection activities**. Members include representatives of Ducks Unlimited Canada, Nature NB, professors and research groups from Mount Allison University, the local planning commission, Fort Folly Habitat Recovery, Amlamgog First Nation, and Chignecto Soil and Crop Association. This wide range of expertise provides the capacity, mentorships, partnerships, networks, and volunteer bases to be successful in developing and implementing an Integrated Watershed Management Plan (IWMP). An IWMP will serve as a guide to help us maintain healthy, productive aquatic environments that will continue to ensure dependable, safe, high-quality water to recreational, agricultural, municipal, and industrial users.

Vision

The Chignecto Watersheds Committee envisions long-term sustainability and resiliency of our local watersheds.

Mission

The Chignecto Watersheds Committee is an advisory committee dedicated to the sustainability of our local environment and preparing our communities for the combined impacts of climate and land use change by promoting watershed awareness through public education, conducting long-term inland water monitoring, and performing subsequent restoration and protection activities.

Mandate

The Chignecto Watersheds Committee will establish the framework to conduct long-term inland water monitoring in the Inner Bay of Fundy and part of the Northumberland Strait watersheds, encourage water stewardship by raising awareness of local watershed issues through education and outreach activities, and engage volunteers to take action within our watersheds.

Primary concerns raised by Amlamgog First Nation, the Chignecto Watersheds Committee of experts, Municipality of Tantramar, Municipality of Strait Shores, local stakeholders and community members during the development of the Watershed Management Plan included the impacts of stormwater on water quality and quantity; the impacts of agricultural and forestry activities on water quality, inadequate on-site septic systems in the un-serviced areas of the watershed and the need for greater protection of wetlands and riparian zones.

This Integrated Watershed Management Plan establishes **6 goals** related to water quality and provides a list of actions to achieve those goals.

1. Implement the Integrated Watershed Management Plan
2. Work with Amlamgog First Nation, the Municipality of Tantramar, the Municipality of Strait Shores, the Village of Memramcook, agricultural producers, forestry operators, private corporations, federal and provincial governments, private landowners and other non-government organizations to develop beneficial management practices as they pertain to the protection of water quality and quantity.
3. Improve capacity of our organization to monitor and interpret water quality and quantity parameters.
4. Continue working with other Non-Government Organizations (NGOs), governments, corporations, industries, and stakeholders to reach the goals outlined in this management plan.
5. Begin working towards the restoration of degraded habitat and recognition of critical habitat.
6. Education, awareness and communication.

EOS Eco-Energy's Integrated Watershed Management Plan is not regulatory in nature. The use of a partnership-based approach will help encourage local ownership of and participation in the management strategies and ensure successful outcomes.

Integrated Watershed Management Plan (IWMP)

The Petitcodiac Watershed Alliance (PWA – Moncton, NB) and the Shediac Bay Watershed Association (SBWA – Shediac, NB) have pioneered efforts in Integrated Watershed Management Planning in New Brunswick. We have used their reports (Petitcodiac Watershed Monitoring Group 2012; Department of Environment and Local Government 2021) as a framework for the development of our own management plan.

What is it?

- A document prepared by members of a watershed community that describes the actions required over time to achieve a sustainable and healthy watershed. It is a roadmap for managing our resources with an outlook towards the future (PWSMG 2012).

What is the purpose (vision)?

- The purpose of this plan is to work together to protect and improve the health of the Chignecto Watersheds and nurture our connection and relationship with the land, water, and living beings (NB DELG 2021).

Water is dynamic in nature and its movements are not dictated by institutional or socio-political boundaries (Biswas 2004). As such, it is complex and difficult to manage. Integrated Watershed Management (IWM) is an approach for managing human activities and natural resources on a watershed basis, while taking into consideration the connected interests and needs of society, economy, and the environment (Conservation Ontario 2012).

An Integrated Watershed Management Plan applies IWM strategies with a focus on water quality, ecosystems and the environment. This IWMP developed by EOS Eco-Energy is not regulatory in nature. Its success will rely on effective partnerships between communities and local stakeholder groups, who will share ownership of and participate in the management strategies. The plan will allow for management strategies to adapt and respond to new or ongoing challenges within the watershed.

Characteristics of the Chignecto Watersheds

Geography, land use and population

The Chignecto Watersheds cover a large and varied geographical area that is primarily rural in nature (Appendix 1, Figure 10). They are characterized by a diversity of habitats, from salt marshes and tidally influenced waters in the Bay of Fundy and the Northumberland Strait coastal environments, to freshwater valleys that cut through forested areas around Johnson's Mills, and more stagnant tributaries upstream of old dyke systems across the Memramcook River in the Dorchester area.

The **Inner Bay of Fundy Composite** covers 495 km² of land area and has a total watercourse length of 546 km, with all water ultimately flowing into the Bay of Fundy (Figures 1, 2). This watershed is comprised of three sub-watersheds: the **Tantramar River Watershed**, the **Johnson Creek Watershed** (i.e. **Rockport-Dorchester Watershed**), and the **Misaquash River Watershed** (which crosses over the New Brunswick and Nova Scotia border). EOS has not yet completed any monitoring in the Misaquash River Watershed.

Major transportation, electric transmission and gas transmission lines transect the Tantramar, Rockport-Dorchester and Misaquash watersheds (i.e. Trans-Canada Highway, Trans-Canada Railway and Maritimes & Northeast Gas Pipeline). The Nova Scotia – New Brunswick electrical connect is about to be expanded.

Tantramar River Watershed

The Tantramar River Watershed is the largest watershed in this composite, covering 410.4 km² of the land area. It is focused around the Tantramar River whose headwaters start northwest of Cookville and wind down to the Highway 2 (Trans-Canada Highway) near the community of Sackville, New Brunswick (population 6,099; Statistics Canada 2023). The watershed also has the Aulac River, another > 4th order river (i.e. a medium-sized stream created when two third-order streams join). Both rivers ultimately flow into the Cumberland Basin of the Inner Bay of Fundy. The rest of the watershed is made up of a series of brooks and creeks. Land-use in the Tantramar River Watershed includes agricultural and forestry activities, industry (i.e. ALL Bridge and Infrastructure Services, former CBC Radio Transmission site), residential and commercial developments, municipal sewage lagoons and private wells, and the Tintamarre National Wildlife Area.

Rockport-Dorchester Watershed

The Rockport-Dorchester area covers ~150 km² of land area. The area is covered partially by the watershed boundaries of the Memramcook River watershed to the west/northwest, of which sub-watershed sites further downstream the Memramcook River have been monitored by EOS, and sites further upstream are monitored by Petitcodiac Watershed Alliance. Coastal drainage systems along Shepody Bay leading up towards the Tantramar River Watershed to the north/northeast have been monitored by EOS. Land-use in the Rockport-Dorchester Watershed

is primarily forested with agricultural and forestry activities, industry (i.e. AIL Bridge and Infrastructure Services) and residential development in the Village of Dorchester (population 906, Statistics Canada 2023) and Amlamogog First Nation. There is also a Nature Conservancy Canada, Johnson Mills Shorebird Interpretation Centre located in the Johnson Creek subwatershed, and a Fundy Biosphere Reserve designation recognizing the critical habitat.

Cape Tormentine Peninsula Watershed

To the north-east of the Inner Bay of Fundy Composite, the **Cape Tormentine Peninsula Watershed** covers 452 km² of land area, with a total watercourse length of 328 km (Figures 1 and 2). It is a part of the **Northumberland Strait Composite**, where all water ultimate flows into the Northumberland Strait. The watershed boundaries the watersheds covered by VisionH₂O in Cap-Pelé to the north, the Misaquash River Watershed to the south, and the Tantrammar River Watershed to the southwest. The Gaspereau River is the only 4th order river within the watershed, with its headwaters starting at Square Lake, north of Anderson Settlement, and winds southeast to its outlet in the Village of Port Elgin (population 381, Statistics Canada 2023). The rest of the watershed is made up of a series of brooks and creeks. According to the Canadian Rivers Institute New Brunswick Watershed map, this watershed is comprised of four level 3 sub-watersheds: the Baie Verte Creek Watershed, the Gaspereau River Watershed, the Oulton Creek Watershed, and the Kouchibouguac River Watershed which boundaries extend from Cape Tormentine over into the area monitored by Cap-Pelé-based watershed group, Vision H₂O. Land-use in the Cape Tormentine Watershed includes agricultural and forestry activities, residential and commercial developments, municipal sewage lagoons and private wells, and the Cape Jourmain National Wildlife Area.

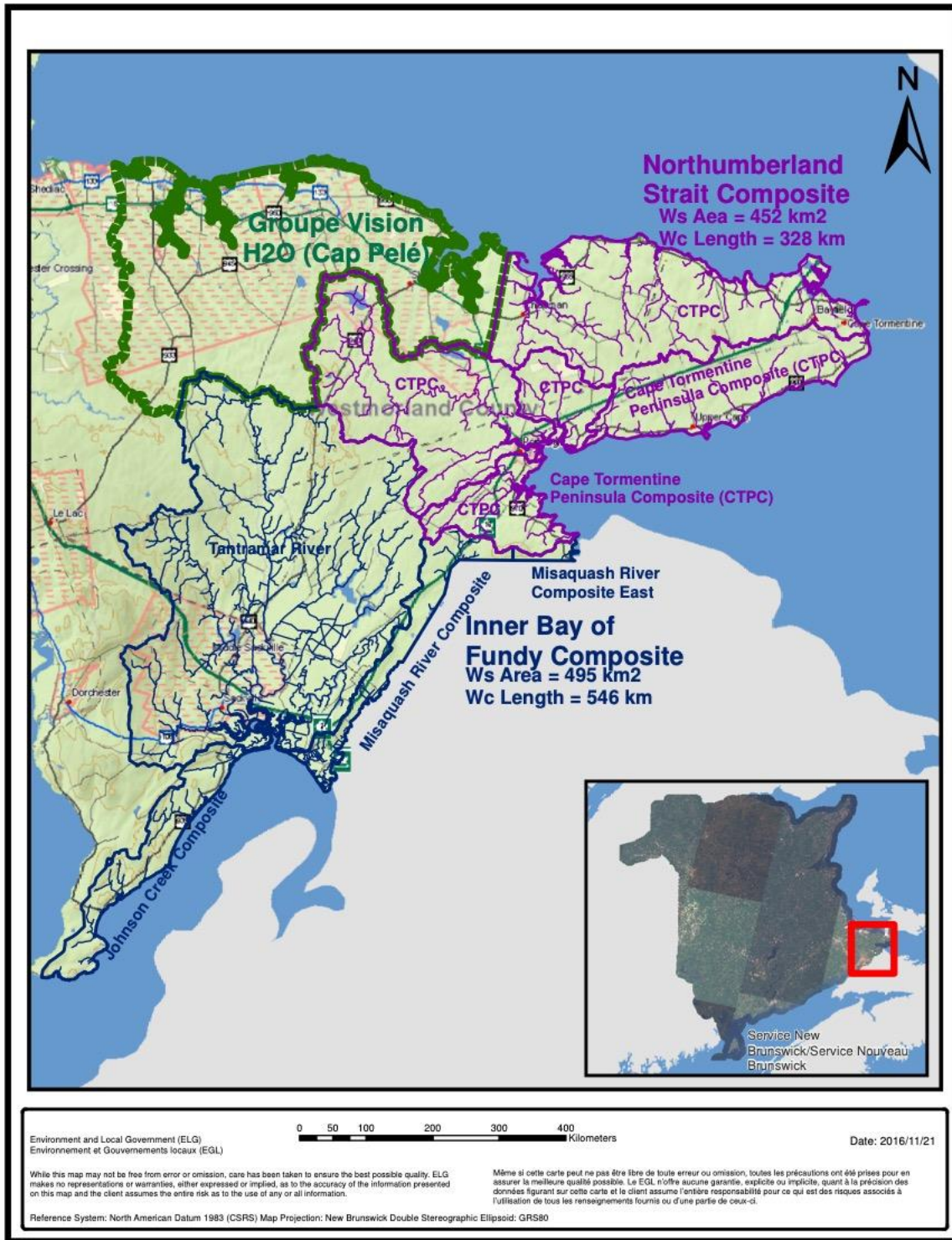


Figure 1: Map of Chignecto Watersheds originally provided by New Brunswick Department of Environment and Local Government



Figure 2: Overview map of Chignecto Watersheds (Source: J. Campbell, EOS Eco-Energy)

Natural Environment

Ecosystem services, or the benefits that ecosystems provide to humans, are vital for human existence. Biodiversity is essential because it supports ecosystem resilience, integrity, and function. According to Canada's 2030 National Biodiversity Strategy Milestone Document (ECCC 2024) biodiversity loss can have a negative economic impact on industries that rely on nature (i.e. through a reduction in biological resources, the spread of pests and diseases, wildland fires, and the loss of pollinators, which can lead to a decrease in harvests).

The Chignecto Watersheds are home to or a visiting place of many species at risk (Table 1).

Johnson's Mills, an internationally recognized shorebird reserve, is an important stopover site for migrating shorebirds that can number up to a quarter of a million individuals each year. The Nature Conservancy of Canada (NCC) has conserved 215 hectares (532 acres) in the area (<https://www.natureconservancy.ca/en/where-we-work/google-trekker/johnsons-mills.html>).

The Atlantic Canada Conservation Data Centre (AC CDC; <http://www.accdc.com>) is an organization that compiles and provides objective data about biological diversity in Atlantic Canada. In January 2024 an AC CDC search noted the presence of four birds currently listed as threatened under the Federal Species at Risk Act (SARA) as well as by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) (i.e. Chimney Swift, Eastern Meadowlark, Least Bittern and Wood Thrush).

Furthermore, the Bald Eagle, Cougar (eastern population) and Peregrine Falcon are currently listed as endangered under the New Brunswick Species at Risk Act. Bat hibernacula and Red Knot rufa ssp. Are also listed as endangered under SARA and COSEWIC.



Chimney Swift
© Serge Beaudette

Chimney Swift (*Chaetura pelagica*): photo from ECCC species at risk public registry



Eastern Meadowlark

Eastern Meadowlark (*Sturnella magna*): photo from ECCC species at risk public registry



Least Bittern (*Ixobrychus exilis*): photo from SARA Registry



Wood thrush (*Hylocichla mustelina*): photo from ECCC species at risk public registry

Table 1: Summary of provincially and federally listed species at risk found within a 2 km radius of at least one of the 40 Chignecto Watersheds sample sites. *Note: species marked with an asterisk are considered location sensitive by NB DNRED.

Common Name	Scientific Name	Provincial Listing	Federal Listing
American Eel	<i>Anguilla rostrata</i>	Threatened	Not at Risk
Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>	Threatened	Not at Risk
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Endangered*	Not at Risk
Barn Swallow	<i>Hirundo rustica</i>	Threatened	Threatened
Bat hibernacula	<i>Bat Hibernaculum or bat species I</i>	Endangered*	Endangered
Bobolink	<i>Dolichonyx oryzivorus</i>	Threatened	Threatened
Canada Warbler	<i>Cardellina canadensis</i>	Threatened	Threatened
Chimney Swift	<i>Chaetura pelagica</i>	Threatened	Threatened
Common Nighthawk	<i>Chordeiles minor</i>	Threatened	Data Deficient
Cougar - Eastern population	<i>Puma concolor pop. 1</i>	Endangered	Data Deficient
Eastern Meadowlark	<i>Sturnella magna</i>	Threatened	Threatened
Eastern Wood-Pewee	<i>Contopus virens</i>	Special Concern	Special Concern
Harbour –orpoise - Northwest Atlantic Population	<i>Phocoena phocoena pop. 1</i>	Special Concern	Special Concern
Least Bittern	<i>Ixobrychus exilis</i>	Threatened	Threatened
Monarch	<i>Danaus plexippus</i>	Special Concern	Endangered
Olive-sided Flycatcher	<i>Contopus cooperi</i>	Threatened	Special Concern
Peregrine Falcon	<i>Falco peregrinus pop. 1</i>	Endangered*	Not at Risk
Red Knot rufa ssp.	<i>Calidris canutus rufa</i>	Endangered	Endangered
Rusty Blackbird	<i>Euphagus carolinus</i>	Special Concern	Special Concern
Short-eared Owl	<i>Asio flammeus</i>	Special Concern	Special Concern
Snapping Turtle	<i>Chelydra serpentina</i>	Special Concern*	Special Concern
Wood Thrush	<i>Hylocichla mustelina</i>	Threatened	Threatened
Yellow Rail	<i>Coturnicops noveboracensis</i>	Special Concern	Special Concern

Also of note, the first recorded sighting of the Marsh Thistle (*Cirsium palustre*) in the province of New Brunswick occurred during our Scott Brook Habitat Assessment in Cape Tormentine Peninsula Watershed in 2022. Though not demonstrated within the AC CDC dataset of species observed within 2km of the water quality sites, Nature NB and Birds Canada have confirmed that the Federally Endangered Bank Swallow (*Riparia riparia*) have been observed by Johnson Mills and the Tantramar area.



Marsh Thistle (*Cirsium palustre*): photo submitted by L. Clark to iNaturalist

Climate Change

Climate change is a global issue with serious implications for Atlantic Canada. New Brunswick is already experiencing record temperatures, more frequent extreme storm and precipitation events and increasing sea levels (Bush and Lemmen 2019). These factors, combined with a reduction in sea ice cover, increase the risk of coastal flooding and erosion in our region (Daigle 2017). The low-lying Chignecto Isthmus, located along the border between New Brunswick and Nova Scotia near the Northumberland Strait and Bay of Fundy, is extremely vulnerable to rising sea levels and more frequent severe weather events (Wood 2022). It serves as the only road and rail connection between the two provinces.

Climate models for New Brunswick predict that average temperatures will increase by ~5 °C by 2080, and the number of projected hot days (> 30 °C) will increase by +40.99 days in Bathurst, +38.94 days in Moncton and +21.63 days in Saint John with cold days (< -20 °C) disappearing completely (Roy and Huard 2023). According to New Brunswick's Climate Change Action Plan (2022), preparing and adapting to future climate conditions will be essential for New Brunswick to minimize impacts on our communities, natural resources, and infrastructure, and to ensure the health and safety of the public.



Flooding along the Chignecto Isthmus dykes,
between New Brunswick and Nova Scotia (photo A. Marlin)



Historic flooding along the Tantramar marsh (Moncton Times & Transcript, 1962)



Lorne Street Flooding, downtown Sackville, New Brunswick (photo A. Marlin)



Queen Street flooding in Sackville on the way to Dorchester, New Brunswick (photo A. Marlin)

Water and Habitat Quality in the Chignecto Watersheds: what has been accomplished so far (2018-2023)

Monitoring Locations

Beginning in 2018, under guidance of the Chignecto Watersheds Committee, EOS Eco-Energy has been conducting baseline water quality monitoring, stream habitat assessments and educational outreach on a rotating yearly basis in each of our three watersheds. Tantramar River Watershed was visited in 2018 and 2021, Cape Tormentine Peninsula Watershed in 2019 and 2022, and Rockport-Dorchester Watershed in 2020 and 2023 with a total of 40 sites monitored (Figure 3; Table 2).

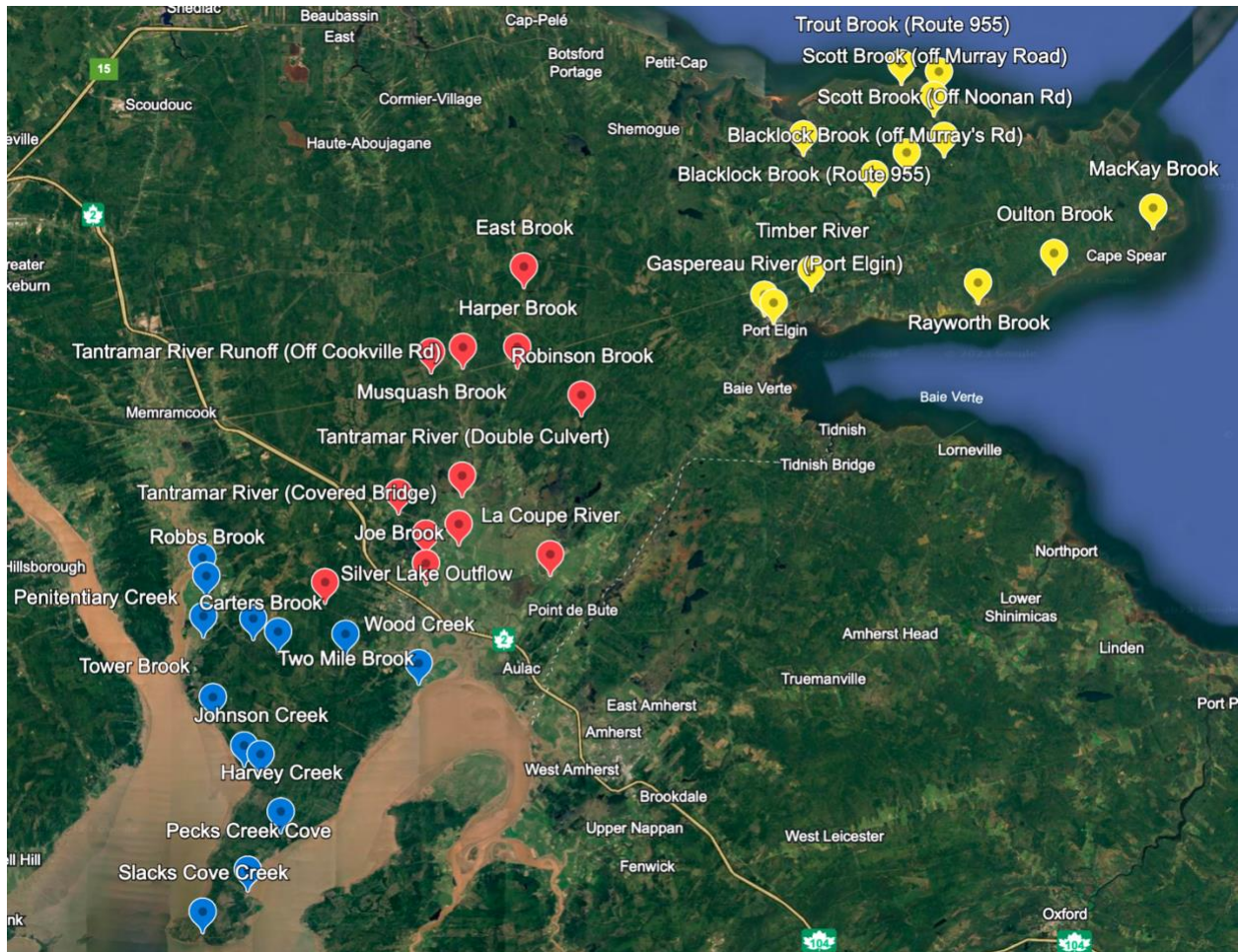


Figure 3: Map of Chignecto Watersheds Monitoring Locations: Tantramar River (red), Rockport-Dorchester (blue) and Cape Tormentine Peninsula (yellow) (Source: GoogleAirbusData SIO, NOAA, U.S. Navy, NGA, GEBCOCNES / AirbusImagery from the dates:12/14/2015–newer)

Table 2: Chignecto Watersheds Monitoring Locations

Watershed	Monitoring Site ID	Monitoring Site Name	Latitude	Longitude
Cape Tormentine Peninsula	CT-001	Gaspereau River Roundabout	46.05370	-64.09470
Cape Tormentine Peninsula	CT-002	Gaspereau River Port Elgin	46.04950	-64.08830
Cape Tormentine Peninsula	CT-003	Timber River	46.06690	-64.05910
Cape Tormentine Peninsula	CT-004	Blacklock Brook Route 955	46.13910	-64.06500
Cape Tormentine Peninsula	CT-005	Blacklock Brook off Murray Road	46.11760	-64.01040
Cape Tormentine Peninsula	CT-006	Trout Brook off Murray Road	46.12930	-63.98530
Cape Tormentine Peninsula	CT-007	Scott Brook off Murray Road	46.15980	-63.96427
Cape Tormentine Peninsula	CT-007B	Scott Brook off Noonan Road	46.13800	-63.95650
Cape Tormentine Peninsula	CT-007C	Chapman Brook Route 955	46.13531	-64.08173
Cape Tormentine Peninsula	CT-008	Scott Brook Route 955	46.17230	-63.96010
Cape Tormentine Peninsula	CT-009	Trout Brook Route 955	46.17670	-63.98910
Cape Tormentine Peninsula	CT-010	McKay Brook	46.09900	-63.79570
Cape Tormentine Peninsula	CT-011	Oulton Brook	46.07520	-63.87240
Cape Tormentine Peninsula	CT-012	Rayworth Brook	46.05970	-63.93100
Rockport-Dorchester	RD-001	Wood Creek	45.85780	-64.36110
Rockport-Dorchester	RD-002	Harvey Creek	45.77930	-64.46620
Rockport-Dorchester	RD-003	Pecks Cove Creek	45.74820	-64.49100
Rockport-Dorchester	RD-004	Slacks Cove Creek	45.72540	-64.52590
Rockport-Dorchester	RD-005	Johnson Creek	45.80920	-64.48160
Rockport-Dorchester	RD-006	Len Buck Brook	45.81410	-64.49440
Rockport-Dorchester	RD-007	Tower Brook	45.83970	-64.51820
Rockport-Dorchester	RD-008	Palmers Creek	45.88297	-64.52557
Rockport-Dorchester	RD-009	Robbs Brook	45.90430	-64.52350
Rockport-Dorchester	RD-010	Penitentiary Road Creek	45.91430	-64.52640
Rockport-Dorchester	RD-011	Two Mile Brook	45.88170	-64.48710
Rockport-Dorchester	RD-012	Three Mile Brook	45.87470	-64.46840
Rockport-Dorchester	RD-013	Carters Brook	45.87382	-64.41658
Tantramar River	TR-001	East Brook	46.06894	-64.28004
Tantramar River	TR-002	Harper Brook	46.02615	-64.28512
Tantramar River	TR-003	Tantramar River off Cookville Road	46.03112	-64.32729
Tantramar River	TR-004	Musquash Brook	46.02343	-64.35143
Tantramar River	TR-005	Robinson Brook	46.00088	-64.23582
Tantramar River	TR-006	Tantramar River at Double Culvert	45.95755	-64.32745
Tantramar River	TR-007	Joe Brook	45.94853	-64.37637
Tantramar River	TR-008	Silver Lake Outflow	45.92720	-64.35580
Tantramar River	TR-009	Tantramar River at Covered Bridge	45.93181	-64.33044
Tantramar River	TR-010	La Coupe River	45.91642	-64.26049
Tantramar River	TR-011	Morice Creek	45.91105	-64.35536
Tantramar River	TR-011B	Aulac River	45.93230	-64.23455
Tantramar River	TR-012	Reservoir Brook	45.90105	-64.43252

Monitoring

Each year water quality measurements were taken from 12 sites across the given watershed. *In-situ* measurements, consisting of pH, temperature, conductivity, dissolved oxygen, total dissolved solids, and salinity were taken from May to October using either a Hanna Multiparameter or YSI Multiparameter Meter. Water samples collected from June to September were brought to the RPC Laboratory in Moncton for analysis of 59 parameters including water chemistry, metals, and *Escherichia coli* bacteria. Water quality results were compared to provincial and federal water quality guidelines (Environment Canada 2011; Health Canada 2012) and Canadian Council of Ministers of the Environment recommended guidelines for the protection of aquatic life (freshwater) (CCME 2023).

Each year a report was compiled to summarize these findings and made accessible on the EOS Eco-Energy website (<https://eosecoenergy.com>). Data is also deposited in Gordon Foundation's Atlantic DataStream, an open-access platform for sharing water data (<https://atlanticdatastream.ca>).

Water Quality Monitoring Reports

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Stream Surveys and Habitat Assessments

Healthy riparian zones provide several ecosystem services which protect and strengthen the environment, such as improved water quality, water storage and flood mitigation, erosion protection, and groundwater recharge. In addition, healthy riparian zones benefit wildlife, as species living in riparian zones and the water body are dependent on the area for habitat and food requirements.

With funding from the New Brunswick Wildlife Trust Fund, EOS has completed 5 stream surveys and habitat assessments. These include the Tantramar River (2018), Gaspereau River (2019), Johnson Creek Watershed (2020), Joe Brook (2021) and Scott Brook (2022). The objective of this work was to help establish baseline conditions for these study streams and to identify areas of concern for future potential restoration projects.

Each year a report was compiled to summarize these findings and made accessible on the EOS Eco-Energy website (<https://eosecoenergy.com>). In situ water quality data collected during the surveys is also available on DataStream (<https://atlanticdatastream.ca>).

Stream Survey Reports

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Outreach and Education

Since 2018, EOS has coordinated, promoted, and hosted an extensive series of free public events for youth and adults to help raise awareness of protecting water quality and addressing climate change issues in our local watersheds, with much positive feedback. For example, we have coordinated Youth Water Rangers activities at local schools and summer camps for hands-on water testing experiences (2018-2023). We have hosted a webinar series on living shorelines and groundwater protection (2023) and coordinated a bulk well water testing event in Cape Tormentine Peninsula Watershed (2022) with a particular focus on investigating the presence of saltwater.

EOS helped protect aquatic resources in Sackville’s Silver Lake with “Clean Drain Dry” signage at the boat ramp, a public invasive species workshop, and gaining and sharing knowledge about cyanobacteria (2021). EOS coordinated a rain barrel giveaway and mail-out brochure to Rockport – Dorchester residents on water monitoring in the Chignecto Watersheds (2020). Partnerships have been fostered with Mount Allison University students through guest lectures (2019) and bringing student volunteers into the field for water monitoring to learn about water quality parameters (2018-2022). Environmental Microbiology students ran both *Enterococcus* and *Escherichia coli* samples in the laboratory for two popular community water sampling events in the Cape Tormentine Peninsula Watershed (2018).

Details of all Outreach and Education programming for years 2018-2024 can be found in the summary “Watershed ETF Final Reports” that are accessible on the EOS Eco-Energy website (<https://eosecoenergy.com>).



Figure 4: EOS Well Water Testing in Port Elgin and Cape Tormentine; Students at Port Elgin Regional School test local water using EOS’ Water Rangers Kits (summer 2022; Photo: A. Marlin)

What we have learned about our Watersheds

The Chignecto Watersheds cover a large and varied geographical area, encompassing forested and agricultural lands as well as Bay of Fundy and Northumberland Strait coastal environments. As such they experience different stressors and serve different priorities within their primarily rural communities, such as forestry, food production, fishing, and recreation.

We have within our boundaries some relatively pristine sites unimpacted by human activities (i.e. Musquash and Reservoir Brooks in the Tantramar area, Rayworth Brook in Cape Tormentine and Carters Brook, Slack's Cove, and Johnson Creek in the Rockport Dorchester area). However, many of our sites have been flagged each year for exceeding guideline levels for water quality indicators such as water temperature, Dissolved Oxygen, Total Phosphorous, *Escherichia coli* and Total Dissolved Solids (see Appendix 2 for plots of Total Phosphorous concentrations and *Escherichia coli* counts for years 2021-2023).

Areas of concern

Tantramar and LaCoupe Rivers wind through agricultural lands and receive extensive runoff after heavy rain events leading to elevated Total Phosphate concentrations and *Escherichia coli* counts. In some cases, fencing stretched across brooks allows direct livestock access. Historic dump sites are also an issue of concern.



Figure 5: La Coupe River with minimal riparian buffer zone, Tantramar River Watershed, October 2021 (Photo: M. Corkum)



Figure 6: Harper Brook with livestock fencing across brook, Tantramar River Watershed, October 2021 (Photo: M. Corkum)



Figure 7: Part of a dump site discovered during Joe Brook Riparian Health Assessment, Tantramar River Watershed, August 2021 (Photo: L. Clark).

Cape Tormentine Peninsula and Rockport-Dorchester areas are similarly affected by agriculture activities. All sites in Cape Tormentine have shown elevated Total Phosphate concentrations and many sites have *Escherichia coli* counts over recommended limits.



Figure 8: Trout Brook off Murray Road with livestock in water and fencing across brook, Cape Tormentine Peninsula Watershed, September 2022 (Photo: M. Corkum)



Figure 9: Palmers Creek with livestock fencing stretching across creek, Rockport-Dorchester Watershed, May 2023 (Photo: K. Dutta)

Monitoring Challenges

The scope of our program allows for **only one third of the 36 main sample sites to be visited each year**. While this approach has worked well in establishing baseline data over a large area, it has created gaps in the water quality dataset that make it more difficult to understand what, if any, changes might be occurring at a given site from one year to the next.

Site accessibility both for water quality monitoring and stream habitat assessments has also been a challenge in some cases owing to the rural nature of our watersheds combined with a lack of access to personal vehicles suitable for dirt/gravel roads especially during very wet and muddy field seasons.

Many of our Cape Tormentine Peninsula and Rockport-Dorchester sites are **tidally influenced** and it is not always logistically possible to collect samples at or near slack tide. As a result, the freshwater chemistry, metals, and *Escherichia coli* data obtained from the RPC certified laboratory are often overwhelmed by the marine water signal.

The **Misaquash River**, which marks the border between New Brunswick and Nova Scotia, and its watershed are part of the larger Chignecto Watersheds area. It is of historic significance for Indigenous peoples as a location for harvesting eels and as a portage route. However, it is not currently being monitored. EOS is already responsible for 3 sub-watersheds and adding a fourth would further stretch limited resources. In addition, the cross-border nature of the river complicates funding sources and, at times, site access (i.e. border restrictions that occurred during the COVID-19 pandemic).

Concerns Raised and Suggestions Made by Local Stakeholders and Community

Over the past seven years EOS has listened to members of Amlamog First Nation, the Chignecto Watersheds Committee of experts, the Municipality of Tantramar, the Municipality of Strait Shores, local stakeholders, and the wider community as they voiced concerns on the water quality, quantity and overall aquatic ecosystem health within our watersheds.

2023-24 Community Survey Results

In late November, 2023, EOS posted an online survey to Survey Sparrow (<https://sprw.io/stt-5wrfLHkmbn2WCbyZWyC1PR>) to assess local knowledge of water quality and provide residents a tool to give staff direct feedback, suggestions, and a means to get involved with further consultation. The survey received 30 responses, half of which were anonymous and most of the remaining responses were from Sackville residents.

Most responses indicated that people were somewhat familiar with their local watersheds, though only about half the responses showed that people were previously aware of EOS Eco-Energy's water quality monitoring program. Responses to the question regarding community

engagement yielded several requests for more involvement with Indigenous groups and farmers. Survey responses also expressed concern regarding flooding in Tantramar, especially in the King St and Main St areas of Sackville which are prone to heavy flooding. Some responses also suggested collaborating with Mount Allison University and work to be done to remove invasive species and address eutrophication in the Tantramar River. Additionally, nine respondents requested to be contacted for further consultation regarding the water quality monitoring program, indicating that future outreach will likely be met by willingness.

Additional Concerns

- In the Dorchester area, Amlamgog First Nation has raised concerns over the state of Palmer's Pond, a site of historic significance for the Indigenous community as it used to support salmon and eel harvesting.
- Community members, including our local MLA, have questioned the lack of cyanobacterial testing in the Chignecto Watersheds.
- Property owners in the Cape Tormentine Peninsula are increasingly concerned about the quality and quantity of their well water, with recent evidence of saltwater intrusion in some areas.
- Property owners in the Cape Tormentine Peninsula are also concerned about the recreational water quality of their marine beaches.
- Sackville area residents are concerned about the introduction of invasive species into the popular Silver Lake.
- Community members and experts alike have suggested that local farmers need to be better included in dialogue concerning water quality issues.
- The recent (January 1st, 2023) amalgamation of the Town of Sackville, Village of Dorchester, and Sackville, Dorchester, and Pointe de Bute Local Service Districts into the new entity of Tantramar has raised some concern over the governance of water quality issues in the expanded area.

Water Quality Program Goals and How to Achieve Them

Based upon consultations with Amlamgog First Nation, the Chignecto Watersheds Committee of experts, Municipality of Tantramar, the Municipality of Strait Shores, local stakeholders and the community, and our objectives as an organization, we propose to work toward the following 6 goals over the next ten years while using this list of actions as a guide:

1. Implement the Integrated Watershed Management Plan

- Prioritize actions and implement annually.
- Share progress publicly each year.

2. Work with Amlamgog First Nation, the Municipality of Tantramar, the Municipality of Strait Shores, agricultural producers, forestry operators, private corporations, federal and provincial governments, private landowners, and other non-government organizations to develop beneficial management practices as they pertain to the protection of water quality and quantity.

- Promote information sharing between the above-mentioned groups about watershed management policies.
- Work with municipalities within our watershed together to develop common policies on watershed and environmental issues.
- Work directly with individuals in the agricultural sector to review water management strategies.
- Work directly with the agricultural community to develop beneficial management strategies to protect freshwater and groundwater resources in our watershed.
- Work with the Municipality of Tantramar to ensure that the health of Silver Lake is prioritized in management decisions.

3. Improve capacity of our organization to monitor and interpret water quality and quantity parameters. The long-term collection of data from specific locations in the watershed will be used to guide EOS in mitigation projects that are most likely to have a positive influence on water quality and quantity.

- Select 12 sites for longer-term annual water quality monitoring.
- Use information accumulated through the previous six years of baseline data collection to focus monitoring efforts on 12 sites to be visited annually. Factors considered for site selection will include accessibility/safety, water quality metrics (i.e. Dissolved Oxygen, phosphate, *Escherichia coli* counts, and metals), community use/recreation, stream habitat conditions, tidal influence and elevation (see Appendix 3, Table 3).
- Build capacity to perform cyanobacterial testing (i.e. [ABRAXIS™ test kits](#)) through partnerships with the Department of Environment and Local Government who conduct more in-depth testing.
- Build capacity to monitor for fish and freshwater mussel species of interest using eDNA techniques (i.e. as a proxy for fish passage) through partnerships with Ducks Unlimited Canada (currently providing some coverage with pit tag monitoring in the Tantramar and Misaquash Rivers) and academic partners conducting testing at universities.
- Build capacity to perform stream sampling of benthic invertebrates using the [Canadian Aquatic Biomonitoring Network \(CABIN\)](#) protocol.
- Build capacity to deploy temperature data loggers and interpret data output.
- Partner with groups such as Birds Canada and researchers at Mount Allison University to better understand how the use of pesticides impacts aquatic life and birds at our monitoring sites.
- Build capacity for in house GIS analysis to develop better mapping tools.

4. Continue working with other Non-Government Organizations (NGO's), governments, corporations, industries, universities, and stakeholders to reach the goals outlined in this management plan.

- Improve ability of our organization to act in a consultation capacity to other environmental groups, governments, or organizations (i.e. provide support in the form of data management or field service expertise).

- Improve ability of our organization to serve as a local information hub on water quality issues to strengthen communication between organizations and avoid duplication or overlap of services.

Specifically:

- Foster connections with Amlamgog First Nation and its programs (i.e. Fort Folly Habitat Recovery) to support their work as co-stewards in water quality monitoring for the Rockport-Dorchester area.
 - EOS can gain important local watershed area knowledge and expertise from these established groups already serving the Rockport-Dorchester area.
 - EOS can provide training and/or support required for the development of an independent monitoring program through:
 - Shared use of our YSI Multiparameter Meter and other field equipment;
 - Improved data sharing and communication through coordinated data management and upload to Gordon Foundation's [Atlantic DataStream](#), an open access platform for sharing information on freshwater health.
- Foster connections and communication between Amlamgog First Nation and border Nova Scotia Confederacy of Mainland Mi'kmaq members, Municipality of Tantramar and Ducks Unlimited Canada to assemble existing knowledge and identify information gaps for the Misaquash Watershed area.
 - Learn from the example of the Chignecto Isthmus Project (Wood 2022), which has multiple collaborators from both the Nova Scotia and New Brunswick side of the border.

5. Begin working towards the restoration of degraded habitat and recognition of critical habitat.

- Use information accumulated through the previous six years of baseline water quality monitoring and stream habitat surveys to identify potential restoration projects.
 - Joe Brook garbage dump site clean-up (i.e. potential partnerships with local ATV club and Southeast Regional Service Commission).
 - Robbs Brook, La Coupe River and Penitentiary Road Creek (i.e. assessing culverts and riparian zone vegetation).

- Explore different ways to partner with our local farmers/landowners to establish healthy riparian zones to improve stormwater quality and reduce stormwater quantity in the watershed.
 - Livestock fencing initiatives at Harper Brook, Trout Brook and Palmers Creek.
- Gain knowledge from experienced environmental groups such as Vision H2O in Cap-Pelé and Shediac Bay Watershed Association on how to implement shoreline restoration demonstration projects in the Cape Tormentine area to increase community awareness on the importance of protecting coastal areas.

6. Education, awareness and communication.

- Continue to raise awareness of protecting water quality and addressing climate change issues in our local watersheds:
 - at our local public schools and summer camps (i.e. Youth Water Rangers workshops)
 - at Mount Allison University (i.e. work with faculty and students to host community Water Sampling events, coordinate student forums on watershed issues etc.), by fostering partnerships with professors and classes to engage students in current issues and challenges in watershed monitoring
 - at Tantramar Seniors College
- Improve stormwater quality and reduce stormwater quantity in the watershed through the promotion and development of community rain gardens and pet waste reduction programs.
- Explore different ways to partner with our local farmers to mitigate agricultural runoff, improve riparian zones, improve nitrogen management, and monitor soil health (i.e. [Living Lab New Brunswick](#)).
- Help to launch a Silver Lake Association to be headed by lakefront property owners in an effort to address issues such as invasive species and cyanobacterial blooms.
- Promote [iNaturalist](#), [iMapInvasives](#) and other community science tools for documenting invasives; explore partnership with [NB Invasives](#).
- Create a [Swim Guide](#) Partnership to spread awareness on where it is safe to swim, drink and fish in our watersheds.

- Work collaboratively with partners of existing education programs (e.g. Amlamgog First Nation programs, Ducks Unlimited, Birds Canada, Community Forests International, Mount Allison University Researchers etc.) to expand education and awareness programs throughout the watershed.
- Collaborate with Amlamgog First Nation to expand/support their education program aimed at sharing indigenous knowledge within the watershed. This would include information about the historical use of the land by indigenous people, the language, the use of medicinal plants, etc.
- Work with NB DELG to promote education/awareness for homeowners on how to improve the maintenance of on-site septic systems.

Summary: Desired Watershed Management Outcomes

The government of New Brunswick's State of Water Quality report (November 2019) suggests freshwater quality in the Chignecto Watersheds area remains poorly understood.

EOS Eco-Energy must work to strengthen partnerships between Amlamgog First Nation, the Municipality of Tantramar, the Municipality of Strait Shores, agricultural producers, forestry operators, private corporations, federal and provincial governments, private landowners, other non-government organizations and community members to ultimately improve our shared responsibility of watershed management and improvements to water quality, quantity and critical habitat.

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Appendix 1: Chignecto Watersheds Land Use Map

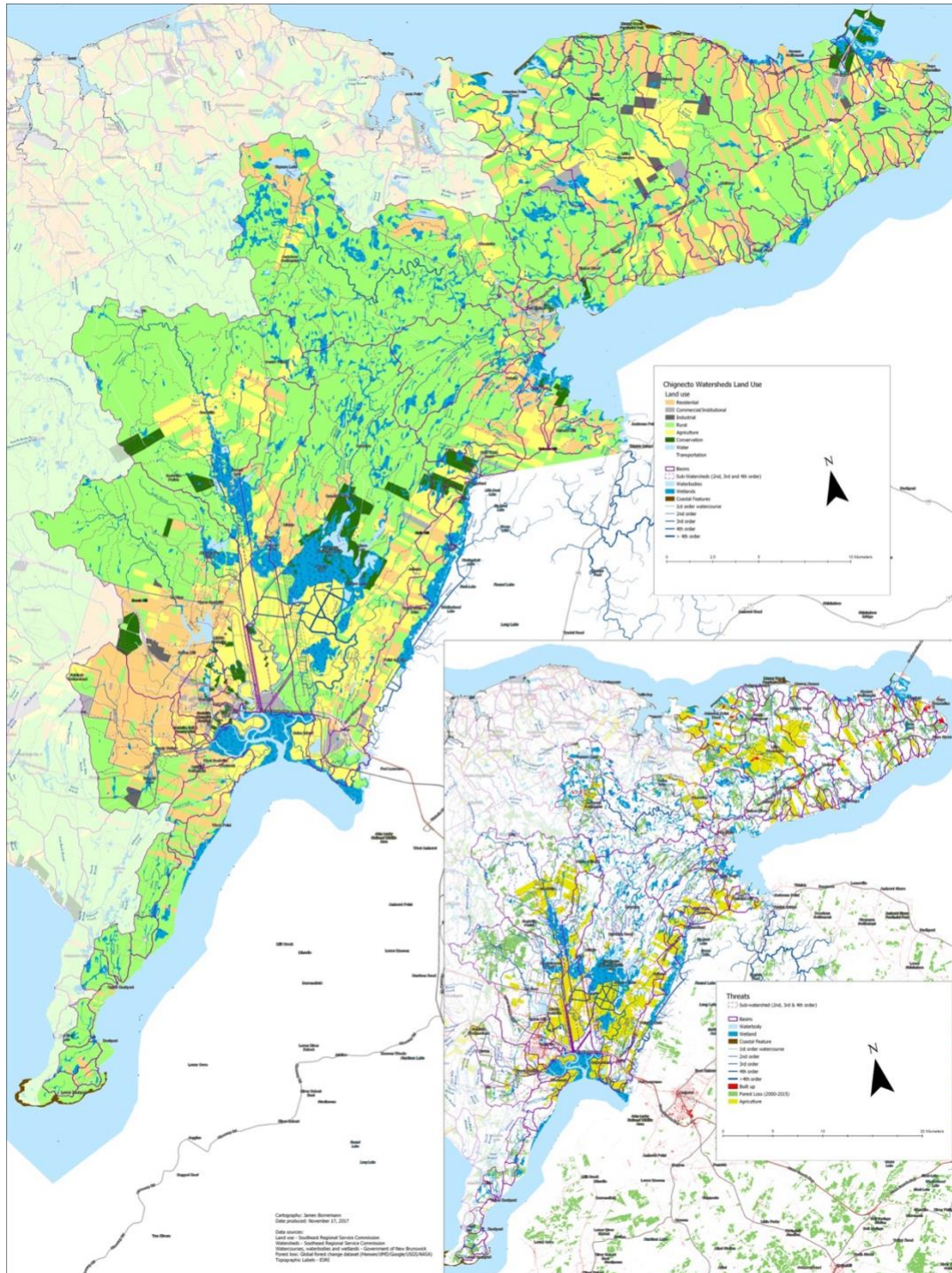
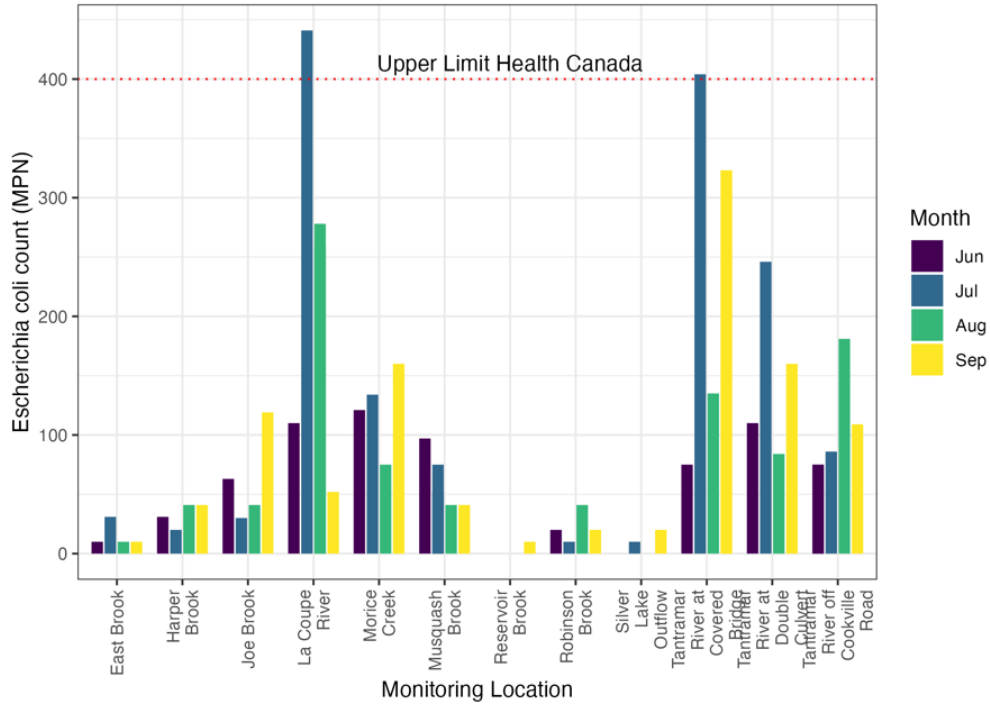


Figure 10: Chignecto Watersheds Land Use Map (James Bornemann, Southeast Regional Service Commission, 2017). Note: the Dorchester portion of the Rockport-Dorchester peninsula area is not included.

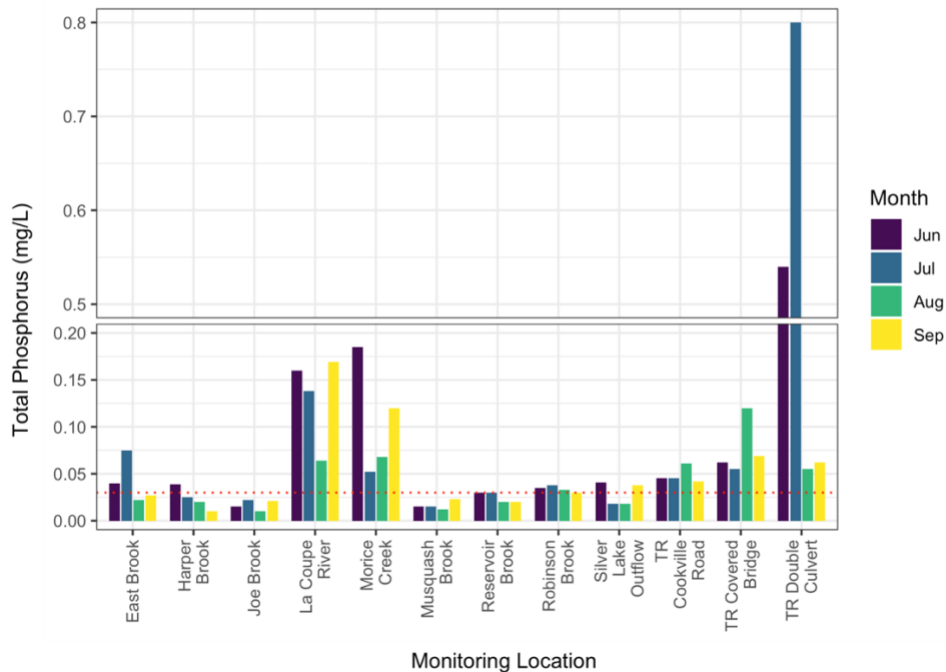
APPENDIX 2: Select Water Quality Results

Tantramar River Watershed, 2021

Monthly *Escherichia coli* counts with 400 MPN/100mL cut off.

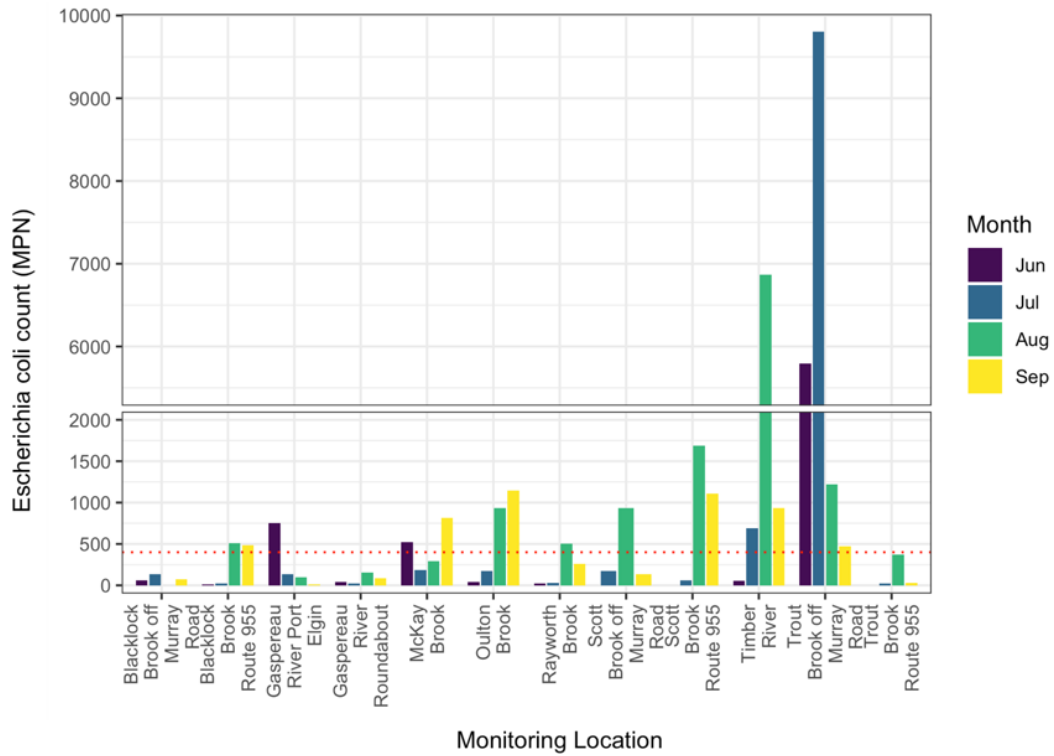


Monthly Total Phosphorus concentrations with 0.03 mg/L cut off.

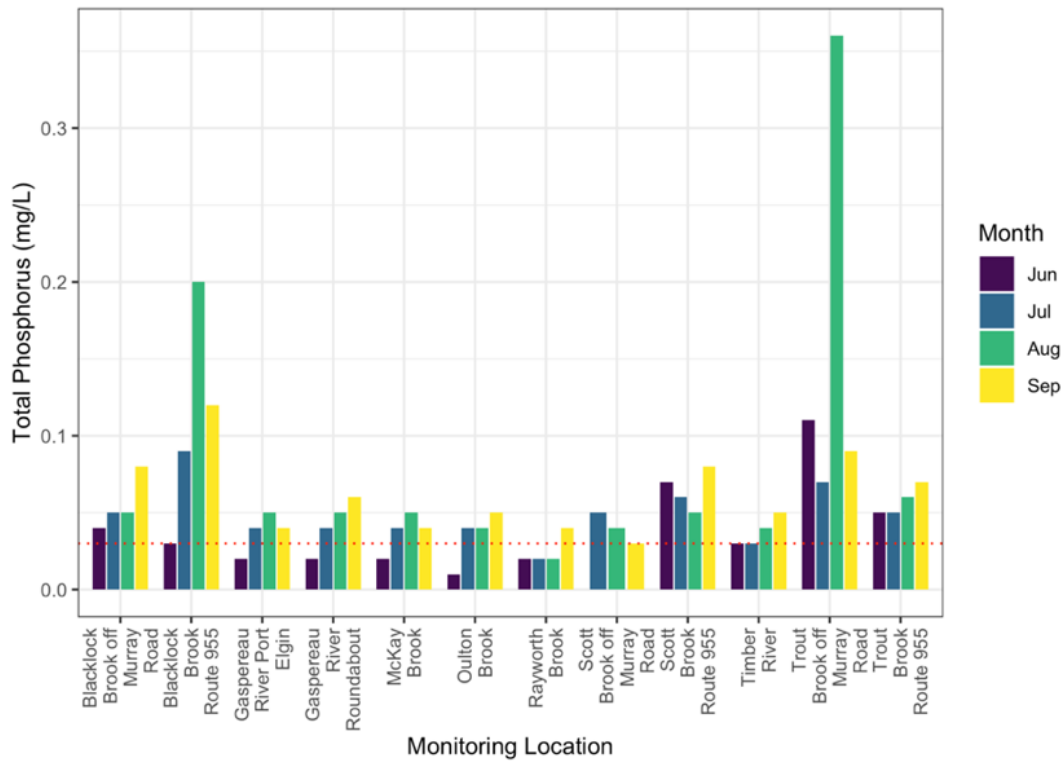


Cape Tormentine Peninsula Watershed, 2022

Monthly *Escherichia coli* counts with 400 MPN/100mL cut off.

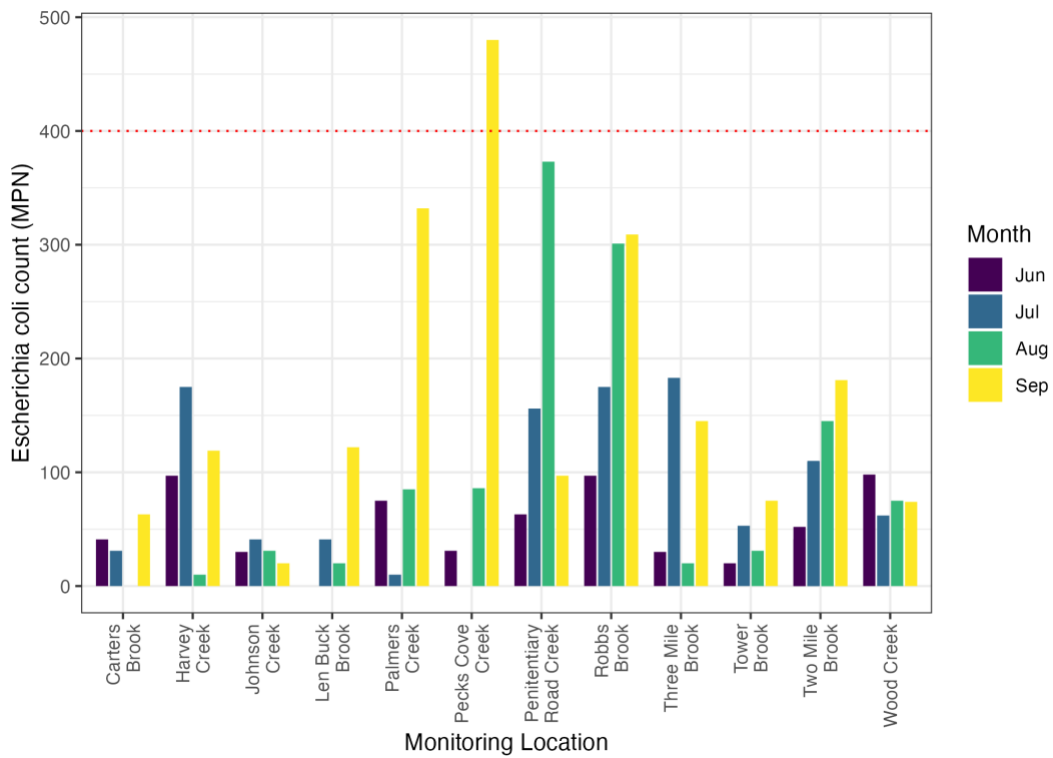


Monthly Total Phosphorus concentrations with 0.03 mg/L cut off.

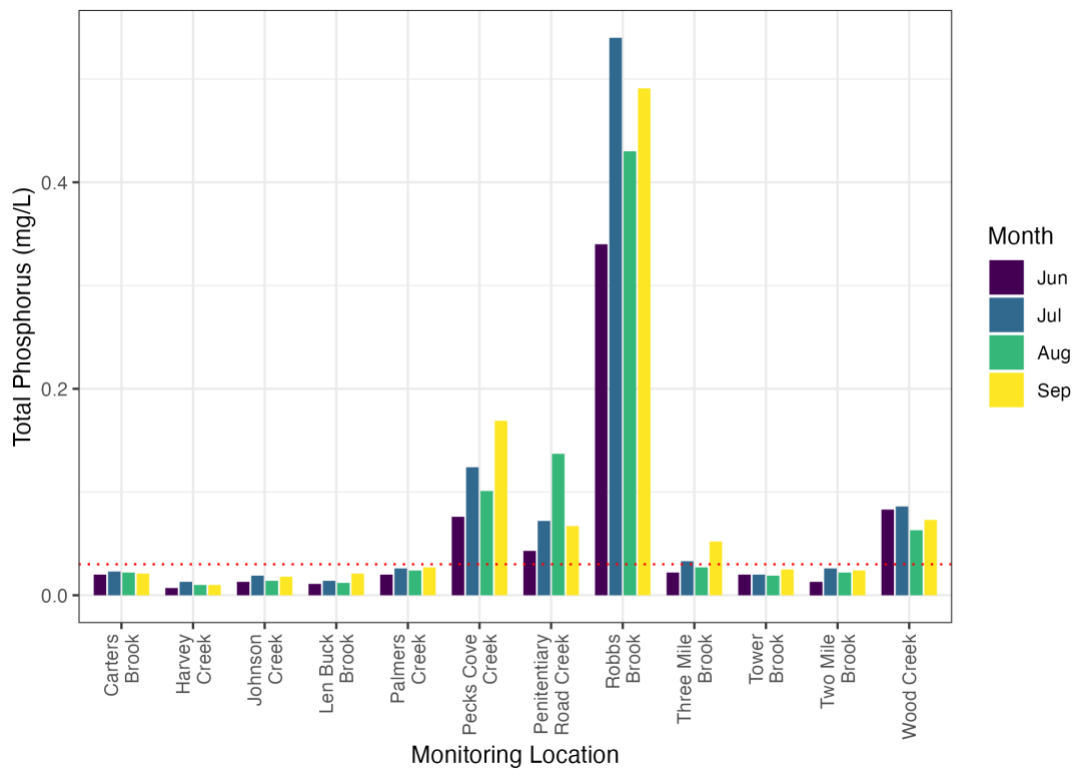


Rockport-Dorchester Watershed, 2023

Monthly *Escherichia coli* counts with 400 MPN/100mL cut off.



Monthly Total Phosphorus concentrations with 0.03 mg/L cut off.



Appendix 3: Site Selection Table

Table 3: Criteria used in the selection of 12 potential long-term water quality monitoring sites (yellow). Eight tidally influenced sites (blue) may be suitable for long-term monitoring of in-situ parameters only. Four sites have been selected for potential restoration activities (orange). Nine sites have been flagged for having accessibility issues (grey).

Watershed	Monitoring Location ID	Monitoring Location Name	Latitude	Longitude	Accessibility /Safety: Good (1); Moderate (2); Poor (3)	DO flag	Phosphate flag	Bacteria flag	Metals flag	Recreational Use (i.e. fishing, swimming, boating)	Stream Habitat Assessment	Temperature Data Logger	Tidally Influenced	Elevation (m)
Cape Tormentine Peninsula	CT-001	Gaspereau River Roundabout	46.05370	-64.09470	2			1		swimming at site	2019		1	3
Cape Tormentine Peninsula	CT-002	Gaspereau River Port Elgin	46.04950	-64.08830	1		1	1		residences, swimming at site	2019		1	2
Cape Tormentine Peninsula	CT-003	Timber River	46.06690	-64.05910	3			1	1				1	3
Cape Tormentine Peninsula	CT-004	Blacklock Brook Route 955	46.13910	-64.06500	1	1	1	1					1	4
Cape Tormentine Peninsula	CT-005	Blacklock Brook off Murray Road	46.11760	-64.01040	1			1						15
Cape Tormentine Peninsula	CT-006	Trout Brook off Murray Road	46.12930	-63.98530	1	1	1	1		1 downstream beach residents				18
Cape Tormentine Peninsula	CT-007	Scott Brook off Murray Road	46.15980	-63.96427	1	1	1	1		downstream beach residents	2022			6
Cape Tormentine Peninsula	CT-007B	Scott Brook off Noonan Road	46.13800	-63.95650	3			1		downstream beach residents	2022			10
Cape Tormentine Peninsula	CT-007C	Chapman Brook Route 955	46.13531	-64.08173	2			1					1	6
Cape Tormentine Peninsula	CT-008	Scott Brook Route 955	46.17230	-63.96010	2	1	1	1		downstream beach residents			1	0
Cape Tormentine Peninsula	CT-009	Trout Brook Route 955	46.17670	-63.98910	2			1		downstream beach residents			1	-2
Cape Tormentine Peninsula	CT-010	McKay Brook	46.09900	-63.79570	1	1	1	1		downstream beach residents				9
Cape Tormentine Peninsula	CT-011	Oulton Brook	46.07520	-63.87240	1		1	1		downstream beach residents		2022	1	6
Cape Tormentine Peninsula	CT-012	Rayworth Brook	46.05970	-63.93100	1			1	1	fish				6
Rockport-Dorchester	RD-001	Wood Creek	45.85780	-64.36110	2	1	1	1		1			1	7
Rockport-Dorchester	RD-002	Harvey Creek	45.77930	-64.46620	1			1						26
Rockport-Dorchester	RD-003	Pecks Cove Creek	45.74820	-64.49100	2			1	1	downstream bass fishing from beach			1	9
Rockport-Dorchester	RD-004	Slacks Cove Creek	45.72540	-64.52590	3			1						11
Rockport-Dorchester	RD-005	Johnson Creek	45.80920	-64.48160	3				1		2020			34
Rockport-Dorchester	RD-006	Len Buck Brook	45.81410	-64.49440	1									23
Rockport-Dorchester	RD-007	Tower Brook	45.83970	-64.51820	1				1					20
Rockport-Dorchester	RD-008	Palmers Creek	45.88297	-64.52557	1				1					5
Rockport-Dorchester	RD-009	Robbs Brook	45.90430	-64.52350	2	1	1	1					1	9
Rockport-Dorchester	RD-010	Penitentiary Road Creek	45.91430	-64.52640	2	1	1	1					1	9
Rockport-Dorchester	RD-011	Two Mile Brook	45.88170	-64.48710	2	1	1	1						27
Rockport-Dorchester	RD-012	Three Mile Brook	45.87470	-64.46840	2	1	1	1					1	53
Rockport-Dorchester	RD-013	Carters Brook	45.87382	-64.41658	1					fishing				23
Tantramar River	TR-001	East Brook	46.06894	-64.28004	1	1	1	1		1				38
Tantramar River	TR-002	Harper Brook	46.02615	-64.28512	2									32
Tantramar River	TR-003	Tantramar River off Cookville Road	46.03112	-64.32729	1			1	1	fishing	2018			11
Tantramar River	TR-004	Musquash Brook	46.02343	-64.35143	3									50
Tantramar River	TR-005	Robinson Brook	46.00088	-64.23582	3			1						23
Tantramar River	TR-006	Tantramar River at Double Culvert	45.95755	-64.32745	1			1	1	fishing	2018			9
Tantramar River	TR-007	Joe Brook	45.94853	-64.37637	1					1 fishing	2021			9
Tantramar River	TR-008	Silver Lake Outflow	45.92720	-64.35580	1			1		1 fishing				7
Tantramar River	TR-009	Tantramar River at Covered Bridge	45.93181	-64.33044	1			1	1	fishing				2
Tantramar River	TR-010	La Coupe River	45.91642	-64.26049	2	1	1	1					1	8
Tantramar River	TR-011	Morice Creek	45.91105	-64.35536	2			1	1					5
Tantramar River	TR-011B	Aulac River	45.93230	-64.23455	2									3
Tantramar River	TR-012	Reservoir Brook	45.90105	-64.43252	3					1				45