

Lake George Watershed Source Water Protection Plan



Executive Summary

The Lake George Watershed is the primary source of drinking water for the Town of Yarmouth, Wasoqopa'q First Nation, and surrounding communities in the Municipality of the District of Yarmouth. The Town operates the water utility and treatment plant under the regulatory oversight of Nova Scotia Environment and Climate Change (NSECC), with water rates approved by the Nova Scotia Regulatory and Appeals Board.

Designated as a protected watershed under Section 106 of the Environment Act, regulations govern land use and human activities within the watershed. These regulations are supported by municipal planning policies, land-use bylaws, and the guidance of the Watershed Advisory Committee, which brings together various stakeholders to ensure ongoing protection.

The Source Water Protection Plan (SWPP) provides a comprehensive description of the watershed, including its geography, hydrology, land use, water quality, and ownership. It identifies both natural and human-related risks to water quality and quantity, such as wildlife activity, residential development, agriculture, illegal dumping, mining, recreational use, forestry, and the impacts of climate change.

The Management Plan emphasizes the need for continuous monitoring, public education, forest management, septic system oversight, and emergency preparedness to manage these risks effectively. It also underscores the importance of regularly updating the plan to address new challenges and ensure the long-term availability of clean, safe, and reliable drinking water for present and future generations of Yarmouth Water Utility customers.

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List of Acronyms

Acronym	Definition / Full Name
DFA	Nova Scotia Fisheries and Aquaculture (formerly part of Agriculture and Fisheries, A&F)
DNRR	Nova Scotia Natural Resources and Renewables (formerly Natural Resources, NR)
LGW	Lake George Watershed Zone
LGWC	Lake George Watershed Committee
LUB	Land Use By-law
MIGD	Million Imperial gallons per day
MPS	Municipal Planning Strategy
MR	Nova Scotia Municipal Relations
NSE	Nash Sutcliffe Efficiency
NSECC	Nova Scotia Environment and Climate Change (formerly Environment and Labour, E&L, Nova Scotia Environment, NSE)
NSPW	Nova Scotia Department of Public Works (formerly Transportation and Infrastructure Renewal)
PWA	Protected Water Area
SNS	Service Nova Scotia (formerly Service Nova Scotia and Municipal Relations, SNSMR)
SWPP	Source Water Protection Plan

1.0 Introduction and Background

The Lake George Watershed is the drinking water source for the Town of Yarmouth and surrounding areas in the Municipality of the District of Yarmouth, including the Dayton and Hebron area, the Village of South Ohio, Hebron Industrial Park, North Ohio Cross Road, Spruce Hills Subdivision, Hillside Estates Subdivision, and the Wasoqopa'q First Nation.

The watershed area is located entirely within the Municipality of the District of Yarmouth. The Town of Yarmouth owns and operates the transmission and distribution system and provides full water treatment to the raw water from Lake George. The water system is operated as a utility. Nova Scotia Environment and Climate Change (NSECC) regulates the operation and issues approvals for the Lake George Water Treatment Plant. The Utility and Review Board reviews and approves the recommended water rates.

Lake George Watershed was first defined and prescribed as a protected water area on November 4, 1964, in the *Royal Gazette*. Between 1964 and 1968, the Nova Scotia Water Authority could prescribe protected water areas under the *Water Act* (1919) in which “no person shall place, deposit, discharge, or allow to remain therein any material of any kind that may impair the quality of the water, or bathe, wash, or otherwise impair the quality of the water.”. However, it was found over the years that restrictions imposed by prescribing the watershed were inadequate to protect the Lake George water supply.

In October of 2002, the Nova Scotia Department of Environment released a *Drinking Water Strategy for Nova Scotia* which outlined a multi-barrier approach to achieve safe, clean drinking water for all Nova Scotians. The three barriers to achieve safe drinking water are:

- Keeping clean water clean;
- Making the water safe to drink;
- Proving the water is safe to drink.

A source water protection plan (SWPP) was identified as a key tool with which to ensure protection of drinking water sources and to manage the human activities that could impact water quality and quantity. Therefore, proposals were solicited from qualified consultants for the preparation of a Management Plan and Protection Strategy for the Lake George Watershed, and the contract was awarded to the SGE Group Inc. in January 2001. Their responsibility was to identify and evaluate alternative options for a comprehensive watershed management plan and protection strategy and make recommendations on the methodology that maintains or enhances the quality of the raw water at the source. An interim Watershed Management Committee was formed with representations from the Town, Municipality, Department of Natural Resources (DNR), Department of Environment (DOE), Transportation and Infrastructure Renewal (TIR), Agriculture, and the general public.

A final report was submitted in December 2001, written by SGE, which contained several recommendations for protection of the watershed. Among these recommendations was a

proposal to designate the watershed as a Protected Water Area (PWA) under section 106 of the 1995 *Environment Act*, along with regulations that control activities in the watershed area. After an extensive public consultation process and input from landowners within the watershed, as well as, from the Municipality of the District of Yarmouth, the designation as a PWA was approved by the Minister of Environment and Labour on October 16, 2006, together with new regulations respecting activities within the Watershed. The area that was previously designated on November 2, 1964, under the *Water Act* (1919) was cancelled.

In 2023, the process of updating the SWPP for Lake George was initiated. The Town of Yarmouth partnered with the Center for Water Resource Studies at Dalhousie University to conduct a new watershed study and update the SWPP. The present SWPP is based upon the version completed by SGE Group Inc. dated December 2001. Each section has been updated, and the following substantial additions have been made:

- Updated watershed boundaries based on a Lidar digital elevation model
- New landcover classification map, rough bathymetric map and geospatial data analysis
- Additional detail was added to the hydrology section
- New section about potential climate change impacts on water quality and quantity
- Inclusion of emergency management plan and PWA fact sheet in the appendices
- Additional updates in response to feedback from NSECC staff

2.0 Designation of Lake George Watershed Area

Regulations were developed during the public consultation process that was required during the 2006 designation of the Lake George Watershed Protected Water Area. These regulations were approved by the Minister of Environment and are as identified in *Schedule B* attached to the designation; this is contained in Appendix B of this report.

The regulations control, or prohibit, or restrict activities within the area described in the designation. The designated watershed area corresponds to the natural topographic drainage area surrounding Lake George and was accepted as defined as the Lake George Watershed zone in the Municipality of the District of Yarmouth's *Municipal Planning Strategy* and *Land Use By-law*.

The enforcement of the regulations is the responsibility of the Yarmouth Water Utility. Currently, the Utility feels that it can adequately enforce the regulations through discussions with landowners. The Utility is therefore not currently pursuing the option to appoint "Special Constables" or "Inspectors" to enforce the regulations. More information is included here about this process as background information. If future enforcement issues arise, the following could be considered: There is an option for the Utility to appoint the Chief Treatment Operator and the Assistant Operator as "Special Constables" through provisions in the *Police Act* and "Inspectors" under the *Environment Act* to enforce regulations. The application for these designations would be submitted to the Regional Compliance and Inspection Coordinator at the local office of NSECC's Compliance Division. If Special Constables/Inspectors were appointed, there are two

mechanisms for laying a charge before Provincial Court if the PWA regulations were contravened: The municipality may issue a Summary of Offense Ticket (simplified process), or the operator may lay a charge via the Long Form Information process. The PWA fact sheet with further details about enforcement of regulations is attached in Appendix I.

3.0 Municipality of the District of Yarmouth MPS & LUB Bylaw

The Lake George Watershed is located entirely within the Municipality of the District of Yarmouth, and consequently, the Town of Yarmouth has limited authority regarding the establishment of effective zoning or by-law strategies for the protection of source water. However, the two jurisdictions work cooperatively to provide the strategies required. The Municipality of the District of Yarmouth has had a Municipal Planning Strategy (MPS) and Land Use By-law (LUB) in place since 1984. In 2001, a new MPS and LUB created a zone called the Lake George Watershed Zone, which supported water quality protection by setting requirements for minimum lot sizes of 3 acres (12,140 m²) and a building setback from watercourses of 300 feet (92 m). In 2013, an additional use for micro wind turbine generators was permitted within the Lake George Watershed Zone. The latest MPS and LUB came into effect for the Municipality of the District of Yarmouth on June 14, 2024. Section 6.31.1 of the 2024 LUB requires a 12-metre undisturbed buffer between any development and the ordinary high-water mark of all watercourses.

4.0 Watershed Advisory Committee

The Watershed Advisory Committee, acting in accordance with the Yarmouth Water Utility, is formally named as the Lake George Watershed Advisory Committee (LGWAC). Aside from providing advice and guidance to the Yarmouth Water Utility on the management of the Lake George Watershed, the LGWAC also offers a forum for landowners, residents, and others who may be affected to discuss issues related to the management of the watershed, as well as reviews and updates the management plan as needed.

Membership for the Watershed Advisory Committee consists of:

- two councillors from the Town of Yarmouth,
- one Band councillor from Wasoqopa'q First Nation
- one councillor from the Municipality of the District of Yarmouth
- up to three citizen representatives from the Lake George Watershed
- up to three customers of the Yarmouth Water Utility
- Yarmouth Water Utility (CAO of the Town of Yarmouth, Town Engineer of the Town of Yarmouth, Chief Operator of the Water Treatment Plant for the Town of Yarmouth, Administrative Assistant for Operational Services of the Town of Yarmouth)
- resource members (NS Department of Environment and Climate Change, NS Department of Lands and Forestry, NS Department of Transportation and Infrastructure Renewal)

The LGWAC Terms of Reference, last updated in 2022, are included in Appendix C.

5.0 Watershed Area Description

5.1 Location and Watershed Boundary

The Lake George Watershed is entirely located within the Municipality of the District of Yarmouth. A watershed is defined as the land area which drains to a particular point. It is often defined by a particular point (called the “pour point”) on a river or the outlet of a lake. The extent of a watershed is governed by the topography of the land. In this case, the Lake George watershed is defined as the area which drains to the Lake George outlet Dam. The original protected water area boundary (See appendix A) is an earlier delineation of the Lake George watershed, likely based on a topographic map. In 2023, the watershed topographic boundary was re-delineated using 1m-resolution Lidar-derived digital elevation model (DEM) which was provided by the Province and based on Lidar data collected in 2019. The revised boundary closely aligns with the original delineation. The biggest difference is that Little Brazil Lake is included within the watershed when using the Lidar DEM but not in the original delineation. The new watershed boundary is shown in Figure 1 and Appendix A. Consideration should be given to updating the PWA boundary to include the area around Little Brasil Lake; however, potential interference from roads and culverts within the new delineation should be reviewed prior to any boundary adjustments.

The watershed has an area of 29.9 km². Much of the land is forested with a mixture of deciduous and coniferous forest including some forested wetlands. The water surface area of Lake George is 11.6 km², or approximately 38.8% of the total watershed area. The maximum depth of Lake George is approximately 17 m and the mean depth is approximately 5.2 m. The volume of the lake is approximately 67.5 billion litres (15 billion gallons). A rough bathymetric map, based on limited depth data is shown in Figure 2. A more systematic bathymetric survey would be required to refine the bathymetric map.

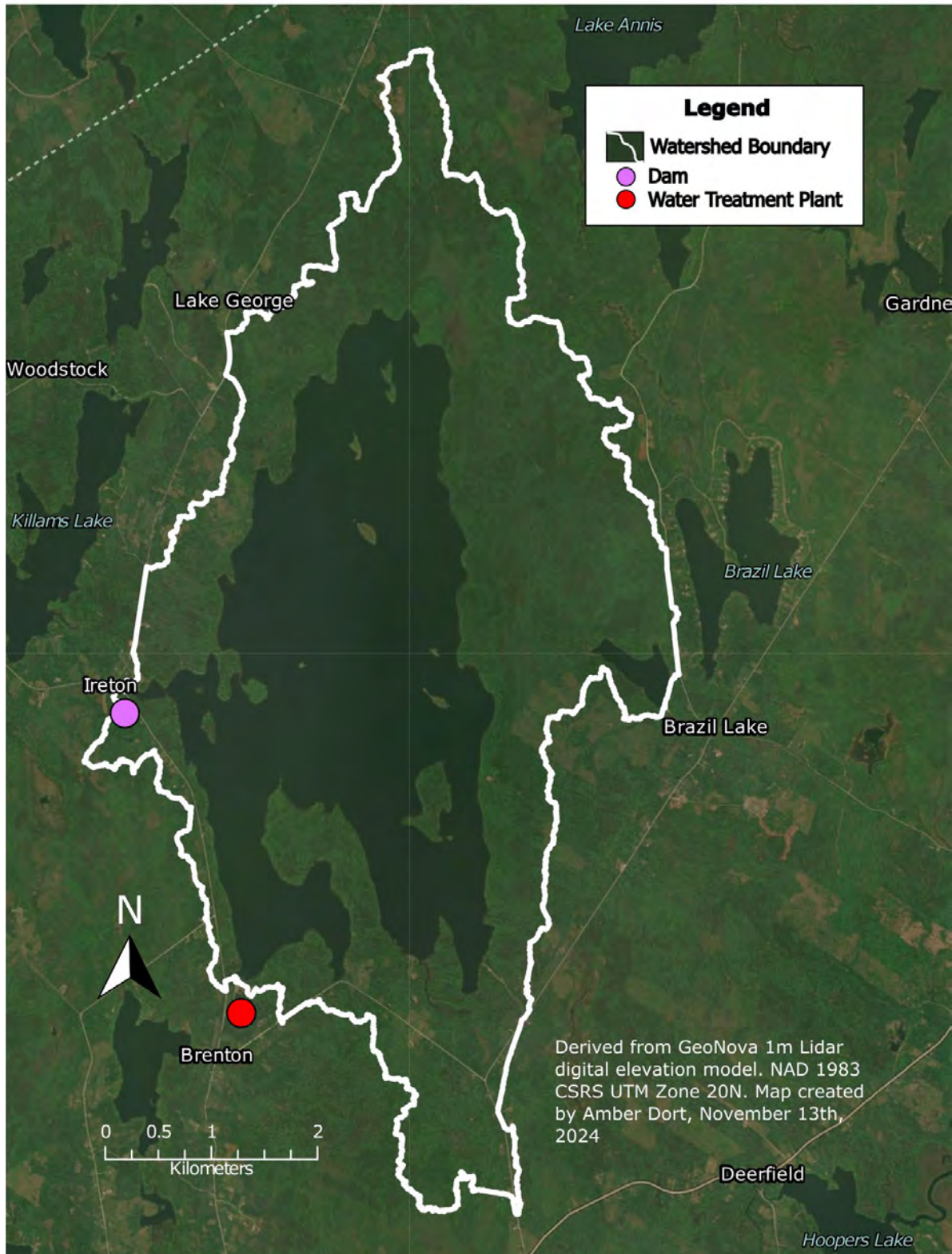


Figure 1: Lake George Watershed boundaries delineated with 1m Lidar digital elevation model

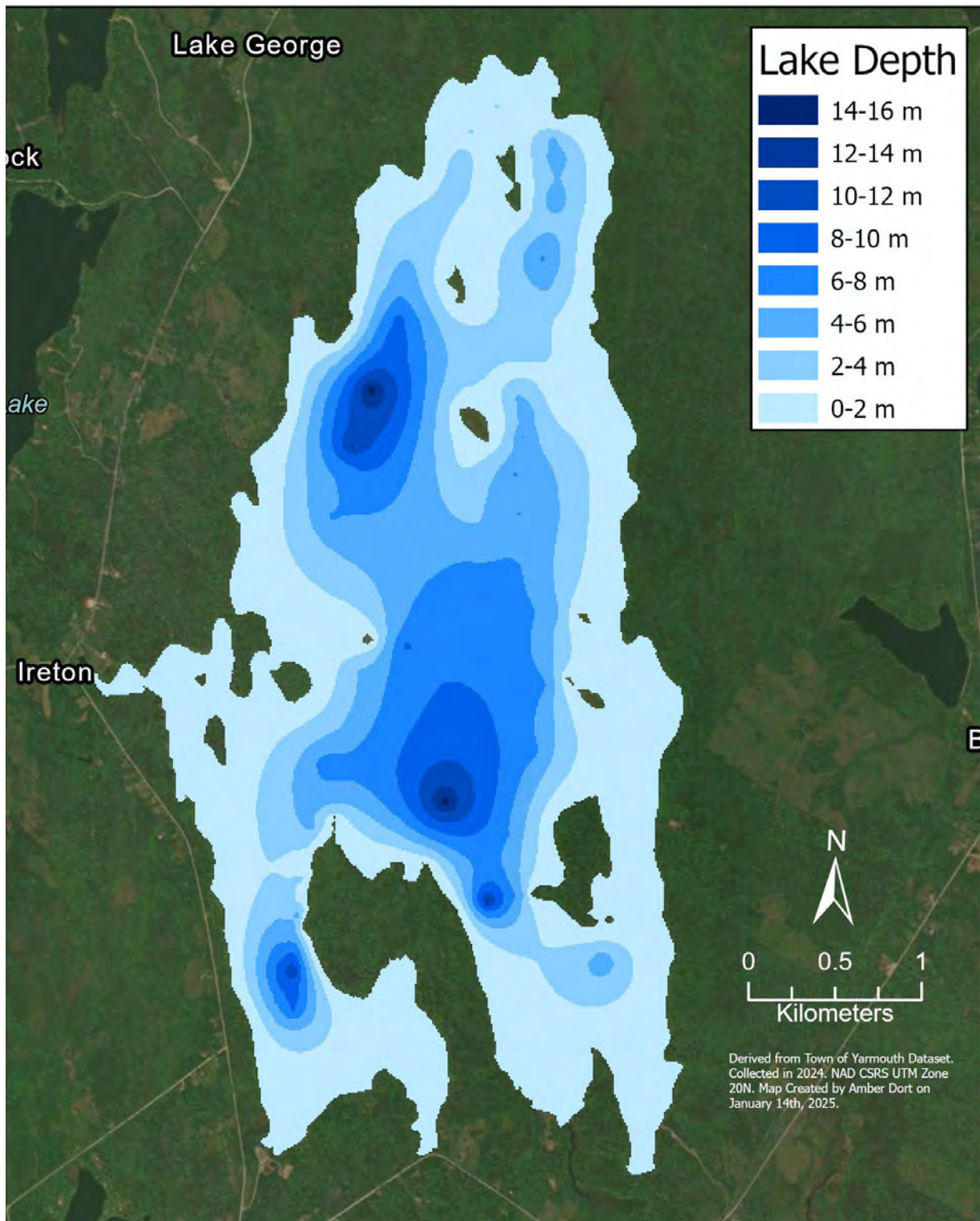


Figure 2: Approximate bathymetric map of Lake George. Note, this map is based on limited depth information and is not a precise representation of lake bathymetry and should therefore be used with caution. Depth measurements were collected in 2024 at approximately 70 locations.

5.2 Physiography

The Southern Upland physiographic unit of Nova Scotia in which the watershed is located is founded on bedrock comprised primarily of greywacke and slates of the Halifax formation. The trends of the folds are nearly north and south and tend to form shallow drainage systems in line with the shallow bedrock valleys. Glaciation, approximately 10,000 years ago, deposited a layer of glacial drift (eroded material) over the bedrock and interrupted the pre-glacial streams to form chains of lakes in line with the former river and stream valleys. Lake George is the uppermost lake in one of these chains.

The result of this physiographic and glacial history is a regional topography that is relatively flat and described as gently rolling to undulating. In keeping with the relatively flat topography, the groundwater gradients in the area are expected to be equally flat or slow. Flat topography combined with low-permeability glacial till deposits have facilitated the development of wetlands within the watershed (see landcover). The fact that Lake George is the uppermost in a chain of lakes lends to its limited catchment area. The lands immediately to the east and southeast of Lake George are drained to a separate chain of lakes and drainage systems defined by the Annis and Tusket River systems. The lands to the immediate north of Lake George drain to the north and west to the Salmon River drainage system. Lake George itself drains through a stream at the western edge of the lake, eventually discharging to the Atlantic Ocean near Short Beach.

5.3 Land Cover

Landcover of the Lake George Watershed area is mostly forested. Figure 3 shows the landcover classification of the Lake George watershed. Landcover data from the Nova Scotia Forest Inventory, based on photography from 2010-2011, indicates that natural stand forest dominates half of the watershed, covering 49% of the total watershed area (including the lake). 4% is treated/treated stand, mainly in the northern part of the watershed. Inland water, which includes Lake George and Little Brazil Lake, accounts for 39%, approximately a third of the watershed. Urban area and roads make up 1.7%. Wetlands account for around 2% of the area agriculture makes up less than 1%. However, wetland area is known to be underestimated in the Nova Scotia Forest Inventory, particularly for forested wetlands. The actual wetland area is likely to be substantially larger than 2% of the watershed area, in the range of 15-30%, and likely overlaps with some of the forested area. If a more precise understanding of wetland coverage is desired, future work could include using wet areas mapping and field surveys to determine wetland area within the watershed more precisely.

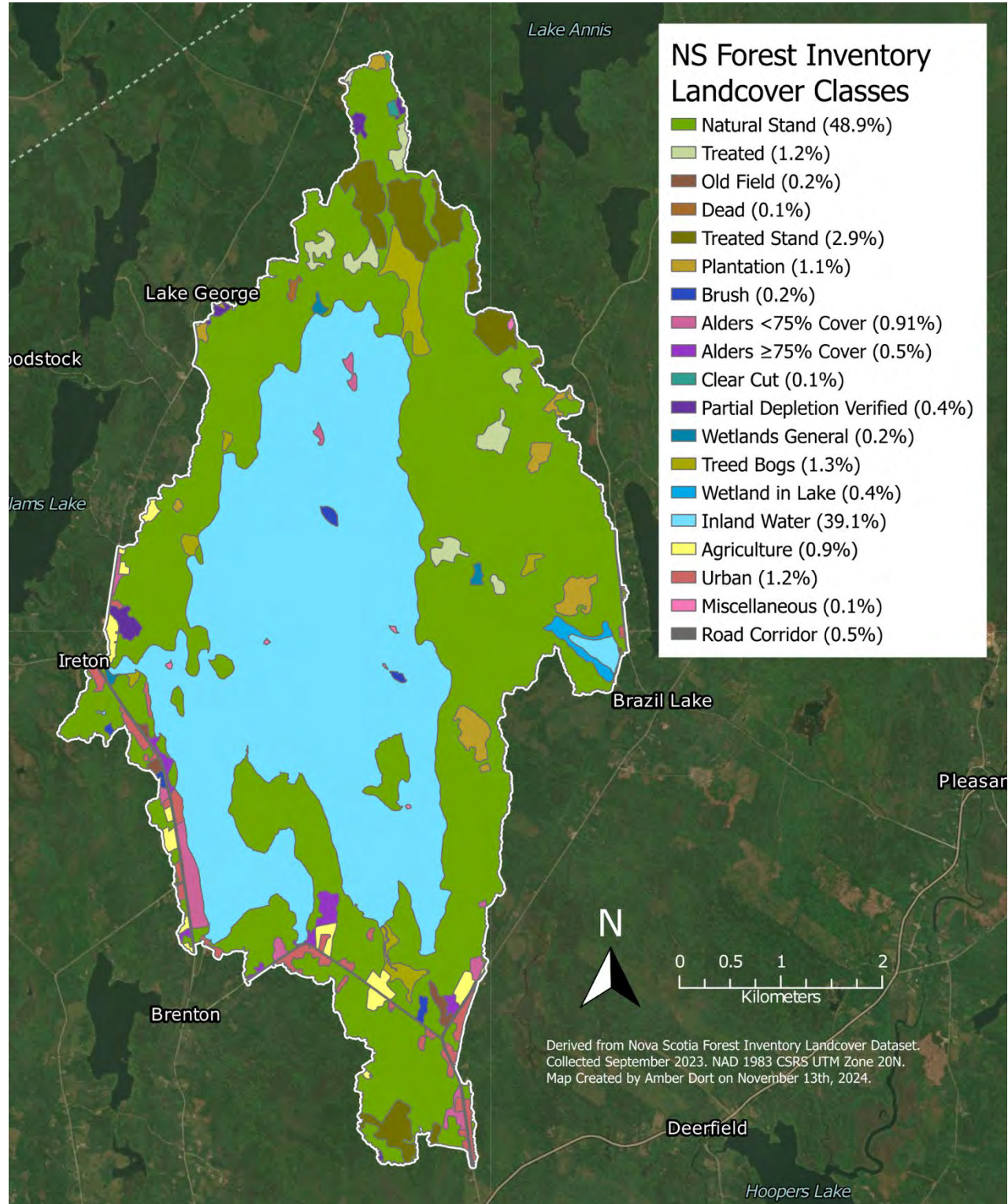


Figure 3: Watershed landcover map. Landcover data is from the Nova Scotia Forest Inventory.

5.4 Hydrology and Hydrogeology

The mean annual precipitation at Lake George was 1,368 mm and the mean annual temperature was 7.4°C during the 1981-2010 period (Climatedata.ca, 2025). The climate is characterized by warm summers and mild winters relative to the central and northern parts of the province. The Nova Scotia Department of Agriculture prepared a water budget for Yarmouth County as reported in the soil survey of Yarmouth County (Nova Scotia Department of Agriculture, 1960). The annual surplus (precipitation - evapotranspiration) for Yarmouth County was estimated to be 609 mm (24 inches) in that report. The monthly trends are typical for Nova Scotia with water deficits (evapotranspiration > precipitation) recorded in the warmer and dryer summer months of June, July and August. More recently, the annual surplus was estimated by comparing the total precipitation input to the Lake George watershed to the outflow recorded at the Lake George Dam. Figure 4 shows this data from 2019 to 2023. Over these five years, the average precipitation input was 1,247 mm per year and the outflow was 813 mm per year, indicating that evaporation and transpiration accounted for the remaining 434 mm (35% of precipitation).

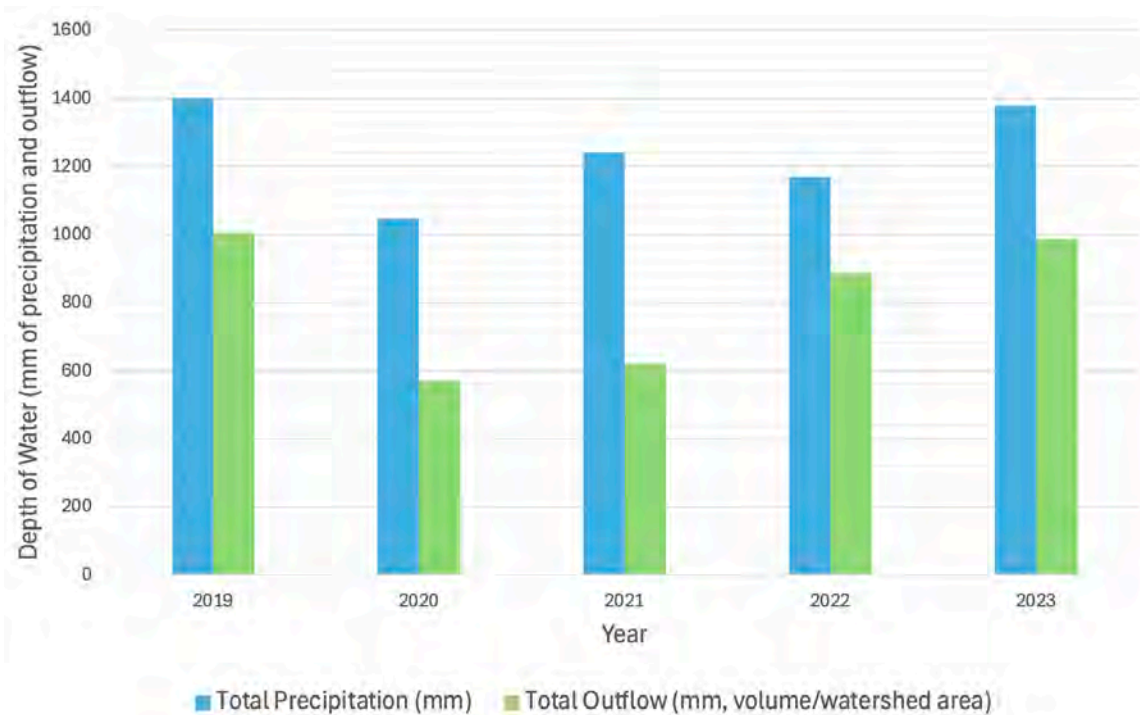


Figure 4: Total annual precipitation at Yarmouth compared to total outflow at the Lake George Dam for years 2019 to 2023. The precipitation was recorded at the Yarmouth ECCC weather station (#8206496). The outflow (volumetric streamflow) was recorded daily by the Yarmouth Water Utility and was divided by the watershed area to facilitate comparison to precipitation.

Lake George has three main tributary streams (in addition to some smaller tributaries that may be intermittent) and one outflow at the dam site. The outflow includes a piped outflow

which is designed and monitored to ensure that ecological maintenance flow requirements are met. Additionally, water flows over the top of the dam stoplogs when water level is sufficiently high. The annual water surplus was used to estimate a yield for Lake George. This estimate was calculated by allocating 100% of the surplus over the surface area of the lake and 75% of the surplus over the land area of the watershed. This accounts for surface water runoff to the lake as well as inputs of ground water discharge to the lake from the watershed area. This method resulted in a safe yield in the order of 41 million litres per day (9 million Imperial gallons per day [MIGD]).

The *Yarmouth Water Treatment Study* (CBCL Ltd., January 1993) estimated the yield of Lake George by interpolation of data available for the Meteghan River watershed, located approximately thirty-two kilometers to the northeast of Lake George. The yield was estimated at 46.3 million litres per day (10.2 MIGD). A report by the former Nova Scotia Department of the Environment (Porter, R.J. *Regional Water Resources, Southwestern Nova Scotia*, NSDOE, 1982) indicates that Montreal Engineering Company Ltd. estimated a reliable yield of approximately 54 million litres per day (12.0 MIGD). Stoplogs in the dam at the former Fisheries Canada Culture Station on Lake George Road regulate the level of Lake George. Allowing a freeboard of one foot on the existing dam, Interprovincial Engineering Ltd. calculated the existing storage at 8,010 million litres (1960 MIG) and the yield at 35 million litres per day (7.8 MIGD).

Lake George is replenished by both surface runoff and groundwater. There has been debate within the public as to the role of groundwater in Lake George and the magnitude of groundwater inflow to the lake remains unknown. A network of observation wells would be required to constrain the contribution of groundwater to the lake. The low permeability till and relatively low groundwater gradients observed in the Lake George watershed are generally associated with limited groundwater discharge. Based on yield estimates, the lake inflow is dominated (about 90%) by surface water. Groundwater recharge to the lake will represent more of the total inflow during the summer months when there is an overall water deficit in the system. However, wetlands within the watershed, particularly sphagnum-based peatlands, may play an important role in storing and transmitting groundwater to the lake and filtering contaminants.

5.5 Water Quality

Lake George water is coloured, very corrosive, of medium organic content, and has a high trihalomethane formation potential (THMFP) (*Yarmouth Water Treatment Study*, January 1993 CBCL Ltd). THMFP refers to the potential of the water to form trihalomethane (THM), a substance that is a by-product of chlorination and that has been classified as a carcinogen and one of the main reasons why health authorities require that municipalities fully treat their drinking water.

A review in 2025 of water analyses data from Lake George from 2007 to date, indicates a relatively consistent raw water quality. Variations can occur in colour and turbidity, both high and low, and can be dependant on both short and long term annual climatic variations. In 2016, there was a drought event through the warm months and the colour reached a low of below 10

True Colour Units (TCU) in late 2016, from a high of 29 TCU in the earlier months. Typically, the annual averages range from 20-40 TCU. The average turbidity was 0.53 Nephelometric Turbidity Units (NTU). Total Organic Carbon (TOC) in general remained relatively stable. Variation in TOC results generally correlated with colour changes, (higher colour, higher TOC) and thus can be somewhat susceptible to climatic variations. The averages for iron and manganese were both approximately 0.02mg/L. Total nitrogen (as ammonia nitrogen) and phosphorus (as P), were less than 0.05mg/L and 0.01mg/L, respectively. These quality indicating attributes are among the lowest (i.e., the best) in the province of Nova Scotia for a surface water supply. Lake George water has very low mineralization. This results in extremely soft or corrosive water. The low mineralization is also indicative of water that is predominantly surface water. Groundwater tends to be more highly mineralized.

Bacteriological quality in Lake George has been historically stable according to the regular monitoring program which includes E.coli counts. As is typical, in warmer months, the E.coli and total coliform counts are higher.

5.6 Land Ownership

According to property-to-property surveys undertaken by the SGE Group in the spring of 2001, there were 140 private lots located within the Lake George Watershed: 69 residential/agricultural properties; 5 commercial properties; 3 properties with only out-buildings; 63 properties with no structures. The remainder of the land making up the watershed was owned by the Crown or the Town of Yarmouth.

According to updated property records as of May 2024, there are 137 privately owned, 26 Town owned, and six Crown owned properties in the watershed. Five additional lots have unknown ownership. Property ownership details are provided in Appendix A, with a property boundary and ownership map, and an associated list of properties.

Due to the watershed location within the Municipality of the District of Yarmouth, the Town of Yarmouth is unable to directly control land ownership within the Lake George Watershed. However, the Town of Yarmouth *Municipal Planning Strategy* advocates the purchase of available land in the watershed as part of a long-term effort to increase management control over land-use in the watershed. Furthermore, the Town of Yarmouth has submitted a request to NSECC in 2023 that the Crown Lands within the Lake George Watershed and adjacent to the watershed be designated as a Protected Wilderness Area. As of December 2024, the request remains with the Province for a decision.

6.0 Water Quality and Quantity Impairment Hazards

To properly manage the quality of the source water, potential sources of contamination in the source water supply area and their associated risks must be identified. As per Nova Scotia Environment guidelines, both point and non-point potential contamination sources have been

identified and assessed. Point source contamination refers to pollutants or material released from a specific known location and are the simplest to monitor and control. Non-point contamination sources are diffuse in nature and can be difficult to locate; these sources of contamination can make their way into groundwater supplies via infiltration and then flow towards Lake George in through the subsurface.

Source water contamination can occur due to both natural sources and human activity. Hazards identified as posing a risk to the quality of the Town of Yarmouth's source water supply are detailed in the following sections. The hazards, as well as their respective severity, probability, and method of control are also summarized in the *Lake George Watershed Hazard Assessment Matrix*, located in Appendix D.

6.1 Natural Sources

Naturally occurring risks can be minimized by proper environmental monitoring and management. It is important to identify potential natural hazards so risk can be anticipated.

6.1.1 Wildlife

Lake George and the watershed area is predominantly natural and undeveloped and is host to a healthy variation of land cover and forest types; as such it can sustain a wide range of natural wildlife. Species that have been identified as potentially posing a risk to the quality of source water are described in the following sections.

6.1.1.1 Gulls, Herons & Cormorants

Several species of gulls and other birds nest and breed on the islands of Lake George. Observations of the gull population in May 2001 by the Canadian Wildlife Service estimates 560 breeding pairs of Herring Gulls or Great Black-backed Gulls, 100 pairs of Double-crested Cormorants and 50 pairs of Great Blue Herons. The gulls nest on grassy areas on 7 of 11 of significant islands on the lake. The cormorants are concentrated in on area of one island and the herons are on an island that is wooded with some open areas. Some herons may be nesting around the periphery of the lake.

Concerns of residents and Town officials are that the gulls may contribute significant quantities of pathogenic bacteria to the Town of Yarmouth's raw water intake. The opinion has been expressed that the gull population should be controlled.

Controls could either take the form of killing the birds or disturbing their nesting habits. Since the gulls are migratory birds, the *Migratory Birds Convention Act* protects them from disturbance or being intentionally killed by man. In accordance with the Act, it would be necessary for the Town to obtain a permit from Environment Canada to undertake any such control actions. We are given to understand that Environment Canada is fully aware of the need to manage and control risks to the quality of municipal water supplies. Consequently, a permit would likely be granted if a significant existing or potential problem could be demonstrated. Proposed control measures would have to be humane and have a high probability of being

effective. Also, control measures would need to be graduated such that the least disturbing method is tried first before more severe methods are used. It should be noted that this sort of control is unlikely to have long-term effects on the local population of gulls on the lake unless it is repeated on an annual basis.

With these facts in mind, the Town should consider the following analysis in selecting a prudent course of action that will address the perceived pollution concerns:

Risk of pathogens from birds in the Lake George intake of the Yarmouth Water Utility:

- The risk due to pollution from the gull population is unknown. Research elsewhere has shown that gulls are known to excrete pathogens. However, there are no data on the Lake George situation that shows that pathogens from gulls reach the water utility's intake.
- There are other sources of pathogens in the watershed including other birds, warm-blooded wildlife, agricultural runoff, domestic wastes from residents, and probably wastes from casual visitors. The potential contribution of each of these sources relative to the contribution from the gull population is not known.
- Studies to assess the foregoing unknowns would require a multi-year program costing over an estimated \$50,000 per year.
- Gull control would likely reduce the risk of pathogens entering the Water Utility's water supply intake. However, if other potential sources are not effectively controlled, the reduction to the risk level would probably be small. Studies, funded by the Town, to improve the knowledge of likely reductions in risk level as a result of gull control measures, are not recommended as a wise investment of resources.

Consideration of Gull Control Actions:

The viability and wisdom of applying the known methods of controlling gulls would be influenced by:

- Respectively, the Lake and the watershed cover approximately thirteen square kilometers and twenty-eight square kilometers and there are at least seven islands upon which the gulls nest. Given such a large area, physical barriers such as overhead lines and wires, or distress or alarm noises, would likely be impractical.
- Disturbing the habitat by disrupting nests and preventing eggs from hatching requires a multi-year program to be effective. The gulls can be long-lived, up to 20 years. When they begin to breed, which is after the first 3 years of life, gulls hatched on Lake George would probably return there. Consequently, any control program would require at least 3 years to implement, and it would have to cover all potential breeding spots on the lake.
- Gulls have been found to adapt to deterrent noisemakers and visual devices. A major concern about placing noisemakers on selected islands in the lake is that the gulls may merely move to other islands. The cost of buying noisemakers to cover the

- islands with the observed greatest concentration of birds is estimated to be in the range of \$22,000 with annual set-up costs and maintenance being an estimated additional \$2,600.
- Shooting the gulls could cost as much as an estimated \$5,000 per year for the foreseeable future. It would almost certainly generate a significant reaction from residents and naturalists, consuming even more resources in achieving damage control to the image of the Town. Killing by other means such as poisoning introduces toxic materials into the watershed and is thus not considered to be a desirable option.
 - Using animals introduced to the islands to destroy eggs and birds may introduce pathogens to Lake George excreted by animals themselves. Dogs under human control may achieve substantial results without causing significant pollution.
 - Disruption of the nesting process by human intervention, with or without the use of dogs, would require, as a minimum, a control program to cover a four-month period, April to July, each year for 3-4 years, and perhaps longer. The cost of such a program has been estimated in the range of \$10,000 to \$15,000 per year.

There is no guarantee that a gull control program would achieve a significant amount of risk reduction to the bacteriological quality of water at the Yarmouth Water Utility intake, and it is not recommended. Source water monitoring of raw water will provide warning for any actions required to control water quality. Samples are currently being collected at various locations around the lake on a biannual basis for total coliforms and E.coli. This will establish baseline data for various parameters and help to identify any problem areas if concentrations increase over time. Refer to the Monitoring Program for the Lake George Watershed, in Appendix F, for details.

6.1.1.2 Beavers & Muskrats

Beavers and muskrats have been observed in Lake George waters on several occasions. Beavers are associated with *Giardia Lamblia* which is a protozoan that causes disease in humans. It is a single celled water born organism that is ingested by a host organism, reproduces and causes disease in the host. *Giardia* cysts tend to be very resistant to disinfection. Removal of *Giardia* cysts is best achieved by coagulation and flocculation followed by filtration and disinfection. Filtration combined with optional coagulation has been found to remove greater than 99% of *Giardia* cysts depending upon turbidity levels. Detection of cysts in water is difficult because concentrations are usually low. A limited number of labs are equipped to perform this test and as such it is not practical to do this test on a regular basis.

In the interest of eliminating the possibility of *Giardia* cysts being present in the raw water and contaminating the finish water, trapping of the limited numbers of beaver and muskrats would eliminate this risk. The Yarmouth Water Utility currently undertakes periodic high level visual inspections of the watershed fauna. If an increase in the number of beavers and muskrats is anecdotally observed in the watershed, testing for *Giardia* cysts will be considered.

6.1.2 Fire and Natural Disasters

While forest fire risk in Nova Scotia has historically been low, the summer of 2023 saw historic wildfires, including a wildfire in nearby Shelburne. With increasing temperatures and more variable precipitation patterns due to climate change, the risk of forest fires may increase over time. Public knowledge of forest fires in NS has increased since 2023, which helps to moderate the risk of future fires. The probability of a forest fire occurring in the Lake George watershed can be considered low to moderate. Should a forest fire occur, risks to the source water include increased turbidity and sedimentation due to uncovered ground, increased runoff and erosion due to a lack of vegetation and increased hydrophobicity of the soil, potential contamination from firefighting foam or fire retardants, increase in nutrient levels and metals leached from ashes, and algal blooms associated with increased nutrients. The responding fire department would be the Lakes and District Volunteer Fire Department. The firefighting foam currently in use (as of 2025) is FIREBULL AB Fluorine Free Foam, which is Green Screen Silver certified and does not contain PFAS.

There is no simple answer to risk management regarding naturally occurring forest fires. The mixed forest nature of the watershed is not particularly fire prone, although periodic windstorms and dry spells that aid the spread of fire may occur in the region. Currently, the *Lake George Watershed Protected Water Area Regulations* forbid the lighting of open fires in the Protected Water Area from April 1 to October 15 and the burning of a product other than wood or charcoal in an open fire. Furthermore, the regulations require that any forestry operations comply with the *Forest Fire Protection Regulations* of the *Forests Act*.

6.2 Human Activities

To facilitate identification of potential sources of contamination due to human activity, land-use activities in the source water supply area that may impact or impair water quality have been reviewed. While the regulations put into place under the *Lake George Watershed Protected Water Area Regulations* and District By-Laws limit some human activities within the watershed, potential hazards due to human land use and activities still exist and must be considered.

6.2.1 Residential Development

Within the Lake George Watershed there is both public and private land ownership. Since the watershed is located entirely within the Municipality of the District of Yarmouth, zoning policies regarding development are dictated by the *Municipal Planning Strategy* and associated *Land Use By-law* ratified by the Municipality, rather than the Town of Yarmouth. Regarding the Lake George watershed area, the District's latest *Municipal Planning Strategy* and *Land Use By-law*—adopted in 2013—sets out a zone called the Lake George Watershed Zone (LGW) that coincides with the natural watershed. The plan sets out minimum lot sizes of 3 acres (1.3 hectares) and watercourse setback requirements of 300 feet (92 m) for new developments. In the 2013 plan, no residential development permit shall be issued for any use in the Lake George Watershed Zone except for single unit dwellings.

In the long term, residential development is also addressed through the Town of Yarmouth's *Municipal Planning Strategy*, adopted in 2016. Policies in the Town's Planning Strategy encourages the Yarmouth Water Utility to consider purchasing properties within the Lake George Watershed, as they become available and subject to feasibility.

Although limited through Municipal and Town Planning strategies, single unit residential development and existing ownership in the watershed has the potential for a wide range of contamination hazards:

- Construction or landscaping of residences
 - Risk of siltation and erosion of any exposed soils during process, potentially leading to sedimentation of watercourses
 - Risk of petrochemical or other hazardous material leakage from heavy machinery used in process
- On-site residential wastewater systems (i.e., septic systems)
 - Risk of bacterial or microbial contamination of groundwater from malfunctioning or unmaintained on-site wastewater treatment systems
 - Improper disposal of hazardous materials through on-site wastewater treatment systems
- Residential storage and use of petroleum products or toxic materials
 - Heating oil or fuel storage
 - Leaks due to damaged tanks or piping
 - Leaks during fuel delivery or transfer processes
 - Spills due to delivery vehicle collisions or accidents
 - Risk of pesticides runoff from use in home gardens
 - Materials used for residentially based small businesses
 - Risk from spills or leaks of solvents, paints, fertilizers, wood preservatives, fuels, oils, etc.

6.2.2 Agricultural Land Use

While agricultural operations generally pose a large risk to water quality, regulations set out in the Municipality of the District of Yarmouth's *Municipal Planning Strategy* and *Land Use By-law* limit the development of new agricultural operations, although existing farm buildings and agricultural operations are permitted to continue through a grandfathering exemption. The current *Lake George Watershed Protected Water Area Regulations* restrict certain agricultural practices and sets limits on the allowable proximity of agricultural operations to watercourses within the watershed. Despite this, identification of the risks inherent to any agricultural operations remains pertinent:

- Existing Agricultural Operations
 - Possible erosion and sedimentation resulting from land clearing for crops and pasture

- Risk of bacterial or viral contamination from livestock grazing watershed
- Risk of contamination from herbicides or pesticides used on crops
- Contamination of groundwater or surface water from leaking manure storage or runoff from manure applied to land
- Risk of contamination from fertilizer/nutrient loading in runoff
- Risk of fuel contamination to ground or surface water from agricultural equipment
- Household gardens
 - Risk of contamination from nutrients such as nitrogen or phosphorus due to fertilizer application
 - Risk of sedimentation through uncovering or erosion of soil

6.2.3 Illegal Dumping

Despite regulations currently in place under the Protected Water Area designation prohibiting illegal dumping of any material that may have an adverse effect on source water in the Lake George Watershed Protected Water Area, improper disposal of solid waste is possible. Given the sparse population and rural nature of the Lake George watershed, occurrences of illegal dumping on privately owned land may go unnoticed and unreported for significant lengths of time.

During the 2001 watershed survey, the SGE Group identified abandoned vehicles at three sites, one appearing to be used to store abandoned garbage trucks. Abandoned vehicles may leak oil, fuel, brake fluid and antifreeze; if these contaminants are left uncontained, they may leach into groundwater or enter surface water as runoff. At the time of this survey, it was also reported that rural landowners sometimes resorted to burning solid waste in open pits on their land, despite curbside collection programs.

Any illegal dumping of hazardous solid waste runs the risk of hazardous materials contained in that waste entering the source water supply, either through groundwater or runoff.

6.2.4 Mining

Mining activity within the Lake George Protected Water Area is not allowed according to the regulations under the Environment Act (Lake George Watershed Protected Water Area Regulations, 2006) given the risks it would pose to both water quality and quantity. Namely:

- Use of industrial machinery
 - Possible spills of petrochemicals or other hazardous materials could contaminate the lake, streams and groundwater
 - Risk of sedimentation from vegetation removal or construction
- Mineral extraction, earthworks, dewatering, tailings management
 - Possible leaching of metals (e.g., iron and manganese) or wastewater into groundwater, streams and the lake

- Possible changes to groundwater flow pathways within the watershed
- Extraction of peat would diminish water storage and water filtration capacity, potentially impacting baseflow to the lake.

Although mining is not allowed within the watershed, there are also some possible risks to water quality where mining activities take place outside but nearby the watershed boundaries. Groundwater flow across watershed boundaries (known as interbasin flow) is possible in certain geologic and topographic settings. Interbasin flow could allow groundwater contaminated by mining activities to flow from outside the watershed area into Lake George. However, there is no current observational evidence to confirm or eliminate this possibility at Lake George. Additionally, wind transport of fine materials is another potential pathway of contamination from nearby mining activities into the Lake George watershed. As identified in the 2001 SGE Group report, a minerals development company owns a property to the northeast of Lake George. The property encroaches to a small extent at the boundary of the Protected Water Area. Mineral exploration projects in the area have accelerated in the years since, and high-grade lithium deposits to the southeast of Brazil Lake have attracted extraction interest. These projects must be monitored to ensure that they will not impact the Lake George water supply.

6.2.5 Recreational Activities Within Watershed

Any human activity within the Lake George watershed has the potential to pose a risk to the quality of the raw source water. As such, Sections 4 and 5 of the *Lake George Watershed Protected Water Area Regulations* restricts certain recreational activities that have been identified as potential hazards to water quality. Given the significant amount of private landownership in the Protected Watershed Area and along the shoreline, private recreation is difficult to regulate, and voluntary environmental stewardship is essential for source water protection. Risks have been identified with the following activities:

- Swimming
 - Risk of sedimentation through riverbank erosion
 - Possible bacterial contamination
 - Likelihood of litter or improper waste disposal
- Fishing
 - Possible use of lead sinkers
 - Parking of cars on Brenton Cross Road increases likelihood of vehicular accident
- Motorsports & boating
 - Risk of sedimentation due to land-based vehicles
 - Introduction of invasive species from land or water-based vehicles
 - Risk of petrochemical spills
 - Risk of accidents and fuel spills related to winter use of Off Highway Vehicles (i.e., ATVs and snowmobiles) on and around the lake.

6.2.6 Public Roads

Both public and private roadways are present in the Lake George watershed area. Pertinent public road information is provided below, as reported in the 2001 SGE Group study:

Table 1: Lake George Watershed – Roadway Maintenance

Factor	Road Section		
	Lake George Road	Brenton Road	Brazil Lake Road
Length (m)	3200	2400	1900
Surface	Paved	Gravel	Paved
Traffic Volumes (AADD)	960	200	150
Level of Service	II	IV	II
Winter Maintenance (Salt; Tonnes/km/year)	9-10	0	9-10
Summer Maintenance (CaCl ₂)	0	1.6-2.0 Flake Tonnes/km	0
Herbicide Spraying	None	None	None
Proximity to Water Intake	Very High	High	Moderate
Hazardous Materials Transport	Fuel/Heating Oil	Fuel/Heating Oil	Fuel/Heating Oil

Both roadway construction and maintenance may be a source of contamination to the water supply; typically, best management practices are most effective for the elimination or reduction of any significant hazard:

- Winter servicing & summer dust control
 - Road salting risks well contamination, surface water contamination, aquatic and vegetation damage
 - A calculated chloride concentration increase of less than 2mg/L in Lake George is expected due to annual maintenance in the watershed
- Summer grading
 - Lack of grading risks sedimentation from runoff due to rut formation
- Ditching and shoulder maintenance
 - Risk of erosion and sedimentation due to loss of soil by action of water, ice, gravity, or wind
- Roadway spills and accidents

- Risk of significant spill from fuel or chemical tanker where public roads come in close proximity to Lake George, potentially particularly hazardous when close to the water utility intake
 - Risk of accident amplified due to sharp bend in Brenton Road along southwest corner of Lake George
- Roadway construction
 - Risk of siltation of a watercourse, particularly when installing or repairing culverts
 - Road construction must be performed as per specification found in the *Standard Specification for Highway Construction and Maintenance*

6.2.7 Recreational Flying

Due to the relatively large surface area of Lake George and the Protected Water Area, there is a probable chance of recreational aircraft flying in airspace above the watershed. Possible aircraft crashes in the watershed or lake itself, as well as amphibious landings or crash-landings would pose a significant hazard to source water quality. Risk of petrochemicals or other hazardous material spillage would be high if this were to occur.

6.2.8 Forestry

The type, extent and changing condition of the forest cover have significant effects on hydrologic processes. Forests hold the soil in place and regulate percolation, runoff, and snow melt. Trees also take up vast quantities of water required for growth and development and expel it into the air via transpiration. As a result, the management and harvesting of trees for wood production can significantly impact the forest's role in water production. Poorly planned and executed forestry techniques can contribute to erosion and subsequent sedimentation. In general, the potential threat and negative impact of forest activities on water quality are sediment and debris, chemicals such as nutrients and pesticides, and altered thermal effects:

- Removal of vegetation
 - Risks sedimentation of watercourses by way of soil erosion or runoff of organic or inorganic waste
 - Increases nutrient or organic material loss from ground into surface water or groundwater through runoff, seepage or percolation
 - Increases risk of pesticides or herbicides entering waterway
- Removal of forest canopy
 - Risk of increased temperature of waterways, which can have a significant impact on the water quality through changes in oxygen or bacterial content
- Forestry infrastructure and equipment
 - Herbicide and fuel contamination risks related to roads
 - Risk of fuel contamination from vehicles and equipment

6.3 Climate Change

Climate change is causing shifts in air temperatures and precipitation patterns across Canada with potential impacts on both water quantity and quality. In the Lake George area, average annual air temperature is projected to increase by 3.6°C and total annual precipitation is projected to increase by 131 mm by 2071-2100, relative to 1971-2000, under a moderate carbon emission scenario (SSP2-4.5). Under a high carbon emission scenario (SSP5-8.5), average annual air temperature is projected to increase by 5.7°C and average annual precipitation is projected to increase by 170 mm by 2071-2100 relative to 1971-2000 (Sobie et al., 2024 via Climatedata.ca; Figure 5). Observed trends in precipitation and droughts are somewhat less clear than trends in air temperature. A recent report notes that the southern part of Nova Scotia has been most impacted by drought in the last 20 years (LeRoux et al., 2024). For example, in 2016, a severe drought occurred where southwestern Nova Scotia received less than a third of normal summer precipitation.

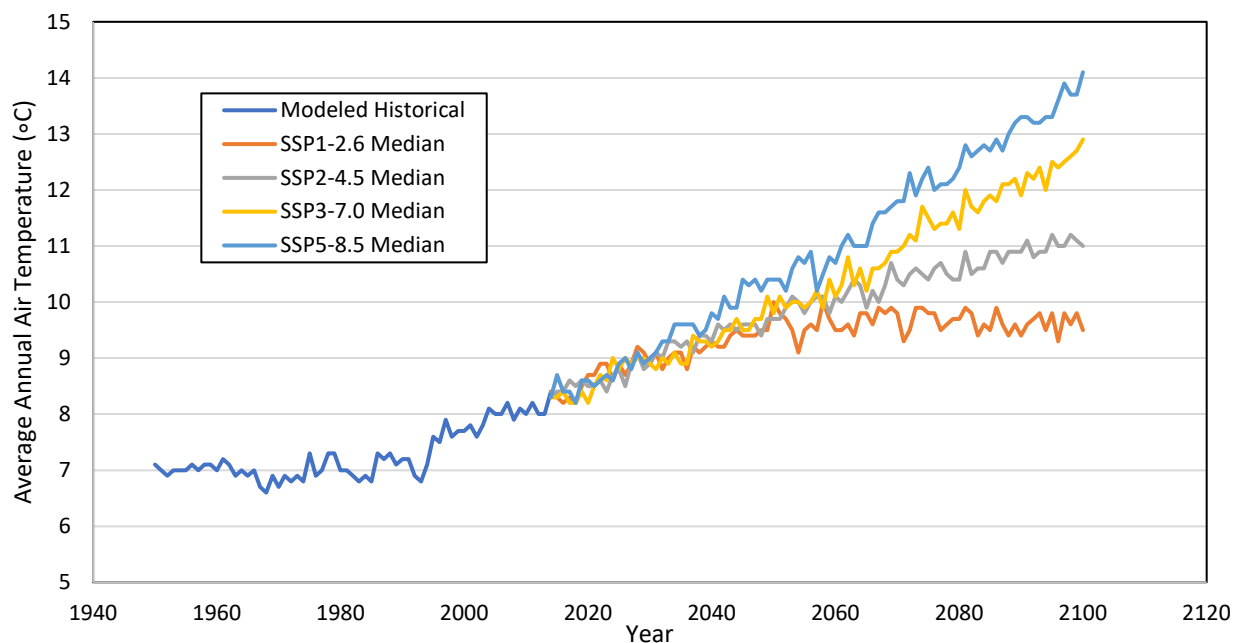


Figure 5: Projected average annual air temperature at Lake George according to CMIP6 projections (Sobie et al., 2024 via Climatedata.ca). SSP1-2.6 is a low carbon emission scenario, SSP2-4.5 and SSP3-7.0 are moderate carbon emission scenarios while SSP5-8.5 is a high carbon emission scenario. “Median” indicates that the line represents the median temperature projected by 35 climate models which form the CMIP6 dataset.

6.3.1 Climate Change Impacts on Water Quantity

From 2023-2025, researchers at Dalhousie University carried out a research project to assess the potential impacts of climate change on the water balance of Lake George. The results are summarized below. The full master’s thesis associated with this work will be accessible via the Dalhousie University Thesis Repository once submitted (Dort, in preparation). The

objectives of this work were to (1) calibrate a hydrological model of the Lake George watershed and (2) apply climate change projections to the model to assess climate-driven risks to water quantity in the lake.

A variety of field datasets were collected to support this work. First, existing records were obtained from the Yarmouth Water Utility including daily records of lake outflow, lake level and treatment plant withdrawal for recent years. Next, a weather station was installed adjacent to the dam. It collected meteorological data at an hourly interval for one year (May 2023-May 2024) including, air temperature, relative humidity, wind speed, solar radiation and snow depth.

HEC-HMS, a widely used hydrological model designed by the US Army Corps of Engineers, was used to model the Lake George hydrological system (USACE, 2012). The model domain consists of the watershed and the lake. The model simulates hydrological processes including precipitation, runoff, infiltration, baseflow, evapotranspiration, snow accumulation, lake evaporation, withdrawal for the treatment plant, and lake outflow over the weir and piped outflow. The model was calibrated to match observed lake level and lake outflow data as closely as possible over one year (May 2023-May 2024) at an hourly interval. The calibrated model achieved a satisfactory fit to the observed data (Figure 6). The Nash Sutcliffe Efficiency (NSE) was calculated to assess model performance. The NSE metric has a maximum value of one, which would indicate a perfect model fit to observed data. An NSE of zero or below indicates that the model performs worse than simply taking the average of the observed data. A NSE of 0.5 is considered a satisfactory model fit and 0.7 is considered very good. For the Lake George hydrological model, the NSE for the lake level was 0.521 and the NSE for the outflow was 0.753. The most obvious weakness of the model performance is that the model overestimates lake level during the fall period.

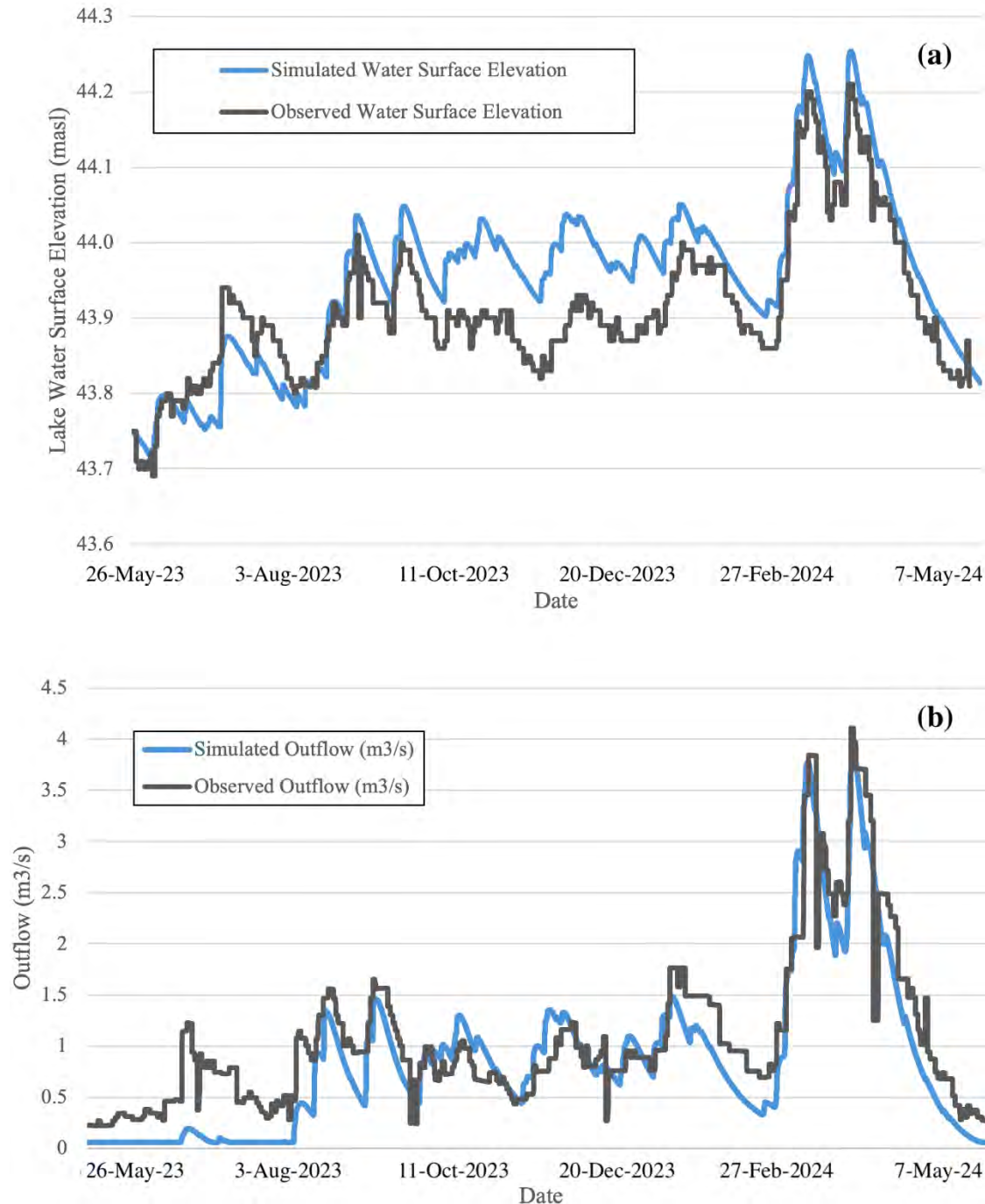


Figure 6: (a) Simulated and observed water level in Lake George and (b) simulated and observed Lake outflow from May 2023 to May 2024.

In addition to the calibration simulation, a “base case” was simulated to represent an average year. This was done because the year of observed data (May 2023-2024) happened to have a very wet summer, with approximately double the average summer precipitation. Therefore, a base case was simulated to represent a more average year and to facilitate comparisons to the future projections.

Future projections were applied to the calibrated hydrological model to represent a range of possible climatic and usage scenarios (Table 2). The drought season was defined as June 1 to September 30 for the purpose of modelling. This range of scenarios was selected to capture uncertainty in future carbon emissions, climate model performance, future population growth and future droughts. Three parameters were altered, including air temperature, precipitation patterns and usage (i.e., withdrawal for the treatment plant). The scenarios are categorized as “limited”, “moderate” and “severe” (coded as CL, CM and CS, respectively) change scenarios. The simulations also represent average conditions for two time periods, 2041-2070 and 2071-2100. The limited scenario follows temperature projections from SSP2-4.5 (a lower emissions scenario), assumes no summer drought, follows the projected small increase in average precipitation levels and assumes no population increase over time. The moderate scenario follows temperature projections from SSP2-4.5 but assumes a strong summer drought where only 30% of normal precipitation falls during the summer (as occurred in 2016). Additionally, the moderate scenario assumes a 1% increase in water usage per year which will mean a 32.5% increase by the middle of the century time period and a 62.5% increase by the end of the century time period. The severe change scenario follows temperature increases from SSP5-8.5 with a severe summer drought where only 20% of normal summer precipitation falls and includes a 2% increase in water usage per year (65 and 125% increases by the mid- and end of century time periods, respectively).

Table 2: Summary of future climate and usage scenarios simulated.

Simulation	SSP	Average Daily Temperature (°C)		Increase in usage* (% increase overall [per year])		Drought Conditions (% of normal summer precipitation)
		2041-2070	2071-2100	2041-2070	2071-2100	
Calibration	-	7.8		observed		200 (Observed in May 2023-2024)
Base case	-	7.8		observed		100 (normal)
Limited	4.5	10 (+2.8)	10.7 (+3.6)	no change	no change	112
Moderate	4.5	10 (+2.8)	10.7 (+3.6)	32.5 (+1)	62.5 (+1)	30
Severe	8.5	10.8 (+3.6)	12.8 (+5.7)	65 (+2)	125 (+2)	20

*Usage is the withdrawal for water treatment and municipal water supply.

Figure 7 shows the simulated lake water level for the eight change scenarios. Under higher air temperatures, evapotranspiration is expected to increase, which decreases the amount of water flowing into the lake, thereby decreasing lake level and outflow. However, with higher average annual precipitation, this difference is offset, according to the limited change scenarios (CL scenarios), such that lake level remains relatively high during the summer months and is unlikely to affect the water supply. The simulation results show that lake water level is much more sensitive to drought conditions than to temperature change alone. Under a moderate and severe summer drought (CM and CS scenarios, respectively), combined with warmer temperatures and increased usage, simulated lake level drops substantially, particularly for the end-of-century time period (CS7100) by which time air temperature and usage have increased.

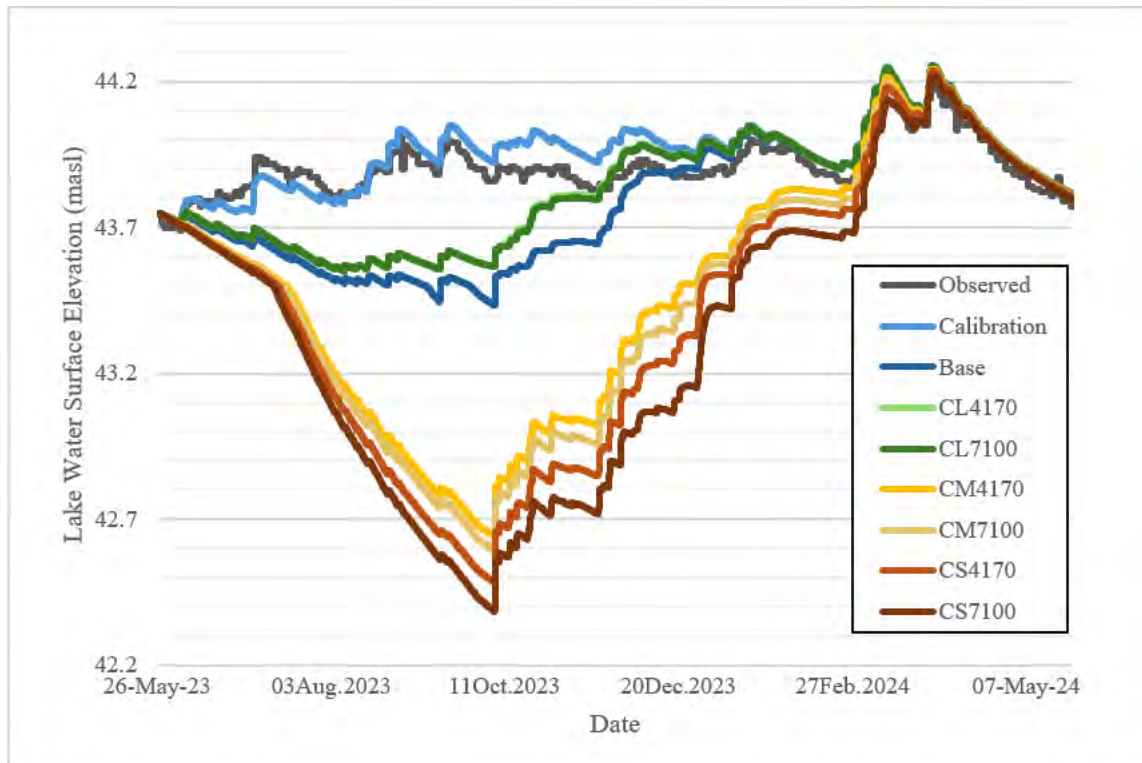


Figure 7: Simulated Lake George water level under climate and usage projections as defined in Table 2.

In the most severe projection scenario, Lake George water level is projected to drop to an elevation of 42.39 m asl at its lowest point in the simulation, which is 1.36 m below the level at the start of the simulation (which is approximately the average level). The top of the intake structure for the water treatment plant is at an elevation of 41.4 m asl. The approximate invert of the piped outlet, which maintains ecological maintenance flows, is at an elevation of 42.57 m asl. Therefore, under the most severe change scenario, the water treatment plant intake will remain submerged (~1 m of water) but the piped outlet may be exposed, potentially compromising the ecological maintenance flows. However, following the simulated droughts, water levels in Lake George rebound to normal levels within five months.

Overall, the results of the modelling exercise suggest that the water quantity provided by Lake George is likely to be somewhat robust against climate change impacts in the coming decades, particularly in years with near-average precipitation levels and if precipitation increases as is projected. However, droughts are the main threat to the available water quantity with severe droughts potentially causing problems for the piped outflow.

6.3.2 Climate Change Impacts on Water Quality

Climate change can facilitate changes in lake water quality. Increased temperatures can increase rates of microbial growth, potentially leading to higher bacterial levels in raw water. Increasing water temperatures have also been linked to algal blooms, including cyanobacteria (blue-green algae) which has been identified in several lakes across the maritime provinces. Cyanobacteria produce toxins which can be acutely harmful to humans. In many regions, a temporal trend of increasing dissolved organic matter has been observed, known as lake browning. This phenomenon is commonly associated with recovery from acid rain. However, increasing heavy precipitation events under climate change can increase the transport of dissolved organic matter from watersheds to lakes. Dissolved organic matter can be a treatment challenge in some Nova Scotia water supplies and should be monitored. Finally, as previously discussed, wildfires, which are expected to become more frequent with climate change, can also have important impacts on lake water quality (see section 6.1.2).

The existing Lake George monitoring program, outlined in section 7.3, incorporates key water quality variables which may be impacted by climate change (e.g., Fecal coliforms and total organic carbon) and provides the Utility with long-term water quality data with which to monitor changes over time.

7.0 Management Plan

To properly manage the quality of the source water, a Source Water Protection Management Plan must be implemented. Many of the core elements of the *Lake George Watershed Source Water Protection Plan* stem from recommendations developed by the SGE Group in their 2001 report, the *Protection Strategy and Management Plan for the Lake George Watershed*. The following management plan is a collection of the management options that have been implemented since the 2001 report. The original recommendations presented by the SGE Group were based on detailed studies of the area, as well as rigorous consultation with the public, watershed landowners, the Watershed Advisory Committee, the Town of Yarmouth and the District of the Municipality of Yarmouth. Since then, the main elements of the Protection Management Plan have been followed. Going forward, the SWPP will be reviewed on a yearly basis and updated as needed based on annual review.

The main mechanism for Source Water Protection is the designation of the Lake George Watershed as a Protected Water Area (PWA) under Section 106 of the 1995 *Environment Act*. Designation as a PWA allows for the Yarmouth Water Utility—after extensive public consultation—to develop regulations for activities or practices that have potential to impair source water quality. The Lake George Watershed PWA was designated in 2006, with the area to be protected matching the natural watershed; the resulting *Regulations Respecting Activities in the Lake George Watershed Protected Area* are detailed in Appendix B and the PWA fact sheet is included in Appendix I.

The following sections describe the remainder of the controls that are in place to ensure maintained quality of source water within the Lake George Watershed Protected Water Area.

The *Lake George Watershed Hazard Assessment Matrix* in Appendix D summarizes controls already in place or under evaluation for the risks identified in Section 6.

7.1 Land Acquisition

Land acquisition gives direct ownership and control of the source water protection area to the Utility or municipality. This is a preferred option because of its obvious benefits regarding governance and access; if the Town or Water Utility owns the land, they have unfettered control over how the land may be used or treated. Because the Lake George Watershed Protected Water Area is located wholly within the Municipality of the District of Yarmouth, and privately-owned properties already exist within the watershed, the Town of Yarmouth does not have jurisdiction over how the land can be developed. Instead, the Town of Yarmouth has adopted a *Municipal Planning Strategy* that encourages the Yarmouth Water Utility to consider purchasing any parcels of land within the Protected Water Area that become available. This is a long-term strategy, where progress is subject to the willingness of property owners to sell to the Town. However, complimentary Land Use By-laws adopted by the Municipality of the District of Yarmouth establishing minimum lot sizes and setback distances from the waterfront in the Lake George Watershed Protected Area helps to minimize the appeal of further residential development in the Lake George Watershed. This, in turn, provides the Town of Yarmouth with a strategic advantage in pursuing future land acquisitions within the watershed area.

7.2 Public Communication, Education and Awareness

Interactions with landowners and land users during regular patrols of the watershed serve to educate the local community about the PWA regulations. Signage is posted along Lake George Road to inform residents and other land users of the protected status of the watershed. Future public outreach about the Lake George Watershed will be undertaken through the Town of Yarmouth's Communications Office. While this SWPP will be kept internal, a one-to-two-page fact sheet will be published on the Town of Yarmouth webpage to summarize the most important points for the public.

7.3 Water Supply Area Monitoring Program

To ensure source water quality is maintained, and to alert the Yarmouth Water Utility to any need to address shortcomings in the Source Water Protection Plan, the Yarmouth Water Utility has implemented a Water Supply Area Monitoring Program that regularly evaluates the effectiveness of the controls in place. The details and methodology of the Water Supply Area Monitoring Program can be found in Appendix F.

The Utility endeavors to collect water quality samples at identified representative areas of Lake George twice per year, or at a minimum, once per year. Additional sampling may be performed subsequent to significant weather events when possible. Samples are collected from the locations indicated in Figure 8. The locations may be adapted based on weather, accessibility

or any specific water quality concerns. Samples are collected at the top, middle and bottom of the water column. A portable water quality meter is used to record temperature, dissolved oxygen, pH, and conductivity through the water column. Water samples are collected and analysed for the following parameters: total coliforms, E.coli, nitrate, phosphate, chloride, total petroleum hydrocarbons, total organic carbon, and metals.

Additionally, monitoring will consist of patrolling and visually inspecting the Lake George Watershed Protected Water Area to ensure none of the identified contamination risks are becoming a problem, and to ensure that no new contamination risks have developed. If statistical analysis of the data collected concludes that water quality is deteriorating, modification of the Lake George Water Protection Plan will be necessary.

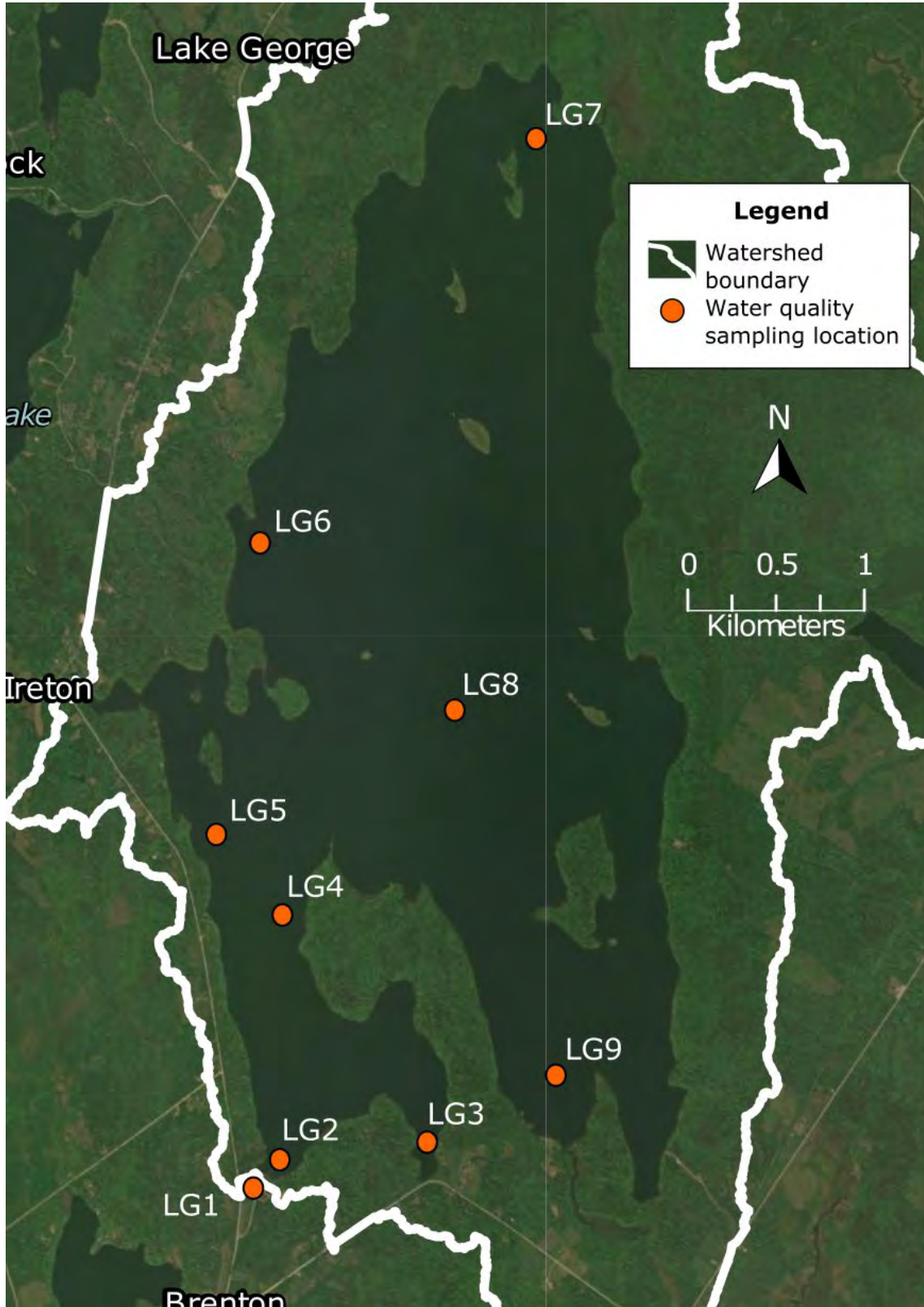


Figure 8: Sampling locations in Lake George. Note that LG1 is the raw lake water sampled in the treatment plant.

In addition to water quality monitoring, outflow volumetric flow from the Lake George dam is continuously (daily) recorded. The outflow is the combined flow measured by (1) an in-pipe current meter from the piped outflow and (2) flow over the dam crest which is calculated from the lake water level via a weir equation. Annual water withdrawal reports are submitted to NSECC to ensure that the environmental flow requirements are being met.

7.4 Forest Management Plan

As set out in the *Regulations Respecting Activities in the Lake George Watershed Protected Area*, any forestry activities undertaken within the Protected Water Area by anyone owning more than 5 hectares of property must be conducted pursuant to a forest management plan.

Pursuant to this regulation as a landowner in the watershed, and to achieve the primary goal of sustained source water quality for the Town of Yarmouth, the Town solicited the development of a Forest Management Plan for Town-owned lots in the Lake George Watershed Protected Water Area. Secondary objectives included the promotion of a healthy and diverse forest, the maintenance of an enhanced wildlife habitat, and a sustainable harvest regime of wood for products, revenue and forest health. The Town of Yarmouth's *Lake George Watershed Forest Management Plan* was developed by the Federation of Nova Scotia Woodland Owners & Mersey Tobeatic Research Institute in 2013; the full plan can be found in Appendix G.

7.5 Residential On-site Wastewater Treatment System Pumping Program

As identified in Section 6 as a potential hazard to source water quality, many residents in the Lake George Watershed Protected Water Area utilize on-site wastewater treatment systems (septic systems) for sewage and wastewater disposal. While these systems are of minimal risk to water quality if working as designed, proper functionality requires regular pumping and maintenance. As such, the Town of Yarmouth has developed and adhered to a Residential Septic System Pumping Program for homeowners in the Lake George Watershed. As part of the program, every 3 years the Town requests bids and awards tenders for septic pumping service providers to pump and inspect the septic tanks of residents within the Lake George Watershed Protected Water Area. After the tender is awarded, the service provider is to coordinate with each resident to find an appropriate time to empty their septic tank, and to complete a survey noting the tank type, capacity and condition. This program ensures that the risk of contamination due to a full or malfunctioning septic system is minimized and allows for the Town to maintain a record of septic disposal status. Tender details for the program are provided in Appendix H.

7.6 Emergency Measures

A *Watershed Emergency Response Plan* was established by the Lake George Utility and is included in Appendix E. The Emergency Response Plan lays out the notification procedures and phone numbers for emergencies, the roles of the response team, and specific actions to be taken in the case of emergencies like chemical spills within the watershed. This includes brief

guidance on containment and clean-up procedures for contaminants. The responding fire department would be the Lakes and District Volunteer Fire Department.

A Contingency Plan was also established by the Yarmouth Water Utility for the water supply system. The Contingency Plan outlines action to be taken in several emergency situations including power failure, security threats, raw water contamination and others. The Contingency Plan for Lake George is included in Appendix J.

8.0 Conclusion

This Source Water Protection Plan (SWPP) describes the Lake George protected watershed, identifies potential risks to water quality and quantity, and outlines measures to maintain a high-quality drinking water supply for the Town of Yarmouth and surrounding areas within the Municipality of the District of Yarmouth. The Lake George watershed is relatively flat and predominantly forested with a mix of deciduous and coniferous trees. Potential risks to water quality arise from both natural sources (e.g., wildlife, wildfires) and human activities (e.g., residential development, recreational use, agriculture, and mining). The plan also considers the growing impacts of climate change, including more frequent droughts and extreme precipitation events, which may further challenge the protection of this critical drinking water source.

The Lake George Watershed Source Water Protection Plan will be reviewed annually by the Lake George Watershed Committee to ensure it reflects current conditions, priorities, and management strategies necessary for the protection and sustainability of the watershed. Successful implementation of this plan depends on the collaborative efforts of NSECC, the Yarmouth Water Utility, the Lake George Watershed Advisory Committee, stakeholders, and the broader community.

To safeguard the drinking water supply for Yarmouth and surrounding communities, the SWPP emphasizes several key management strategies. These include acquiring land within the watershed when opportunities arise, conducting regular water quality monitoring, ensuring all large-scale forestry operations follow approved management plans, maintaining septic systems through a pumping program, and reviewing the Protected Water Area (PWA) boundary to include sensitive areas such as Little Brazil Lake. Taken together, these measures provide a framework for ensuring that Lake George remains a protected and sustainable drinking water source for the long term.

9.0 References

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10.0 Glossary

Contaminant	Biological, chemical, physical, or radiological substance (ordinarily absent in the environment) which, in great concentrations, can adversely affect living organisms through air, water, soil, and food.
Groundwater	Water below the water table contained in void spaces (pore spaces between rock and soil particles, or bedrock fractures).
Municipality	Municipality of the District of Yarmouth.

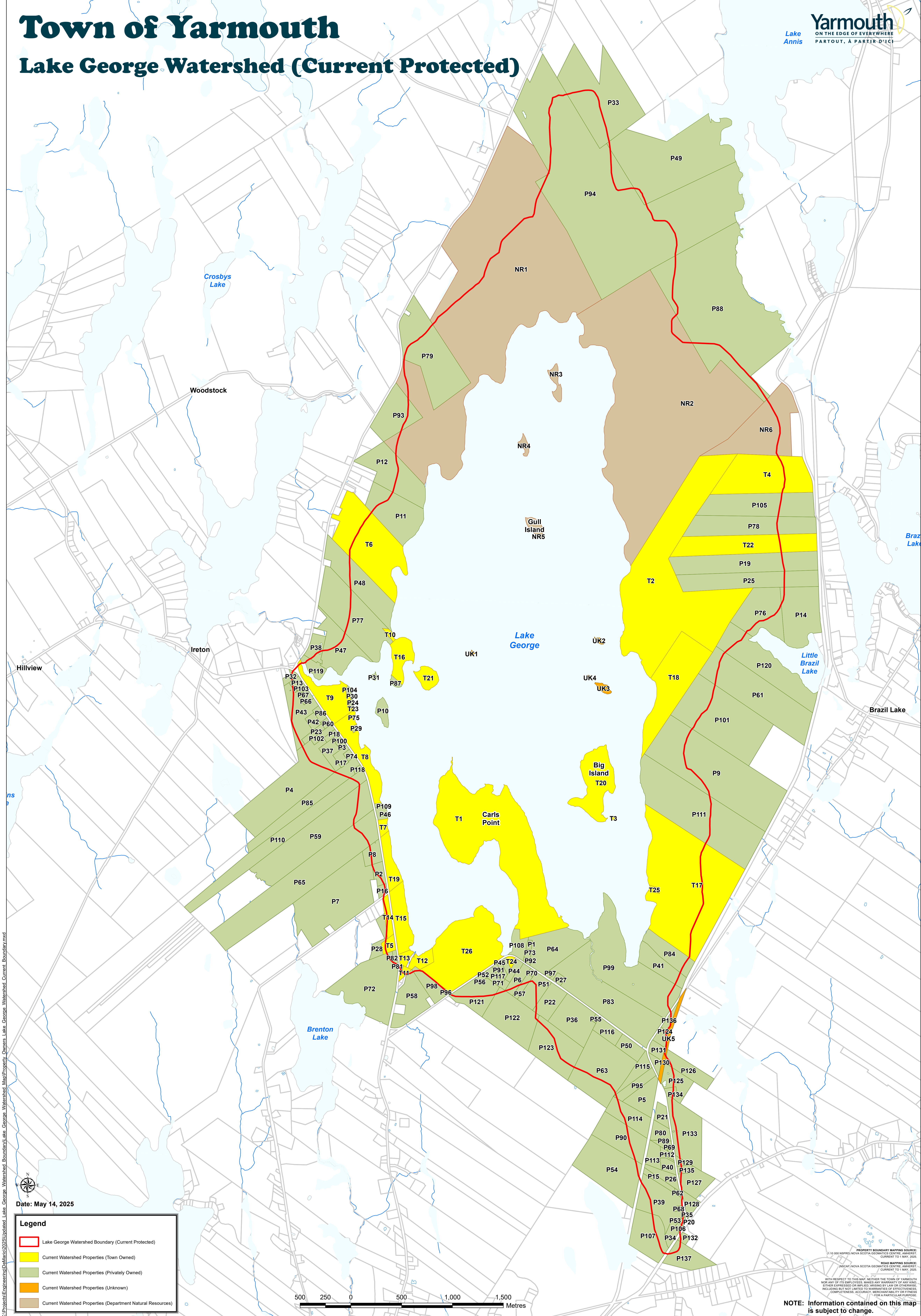
Province	Province of Nova Scotia.
Raw water	Untreated water that is found in natural sources like lakes, rivers, and groundwater.
Source water	Water in its natural or raw state, prior to withdrawal for treatment and distribution as a drinking water supply.
Surface water	Water that exists on the surface of the earth in the form of lakes, rivers, streams, brooks, and ponds.
Town	Town of Yarmouth.
Turbidity	The cloudiness or haziness of water caused by suspended particles that scatter or absorb light.
Utility	Town of Yarmouth Water Utility.
Watershed	A geographic area of land and surface water within the confines of a topographical drainage divide.

Appendix A

Lake George Watershed Boundary & Property Ownership

Town of Yarmouth

Lake George Watershed (Current Protected)



Date: May 14, 2025

Legend

- Lake George Watershed Boundary (Current Protected)
- Current Watershed Properties (Town Owned)
- Current Watershed Properties (Privately Owned)
- Current Watershed Properties (Unknown)
- Current Watershed Properties (Department Natural Resources)

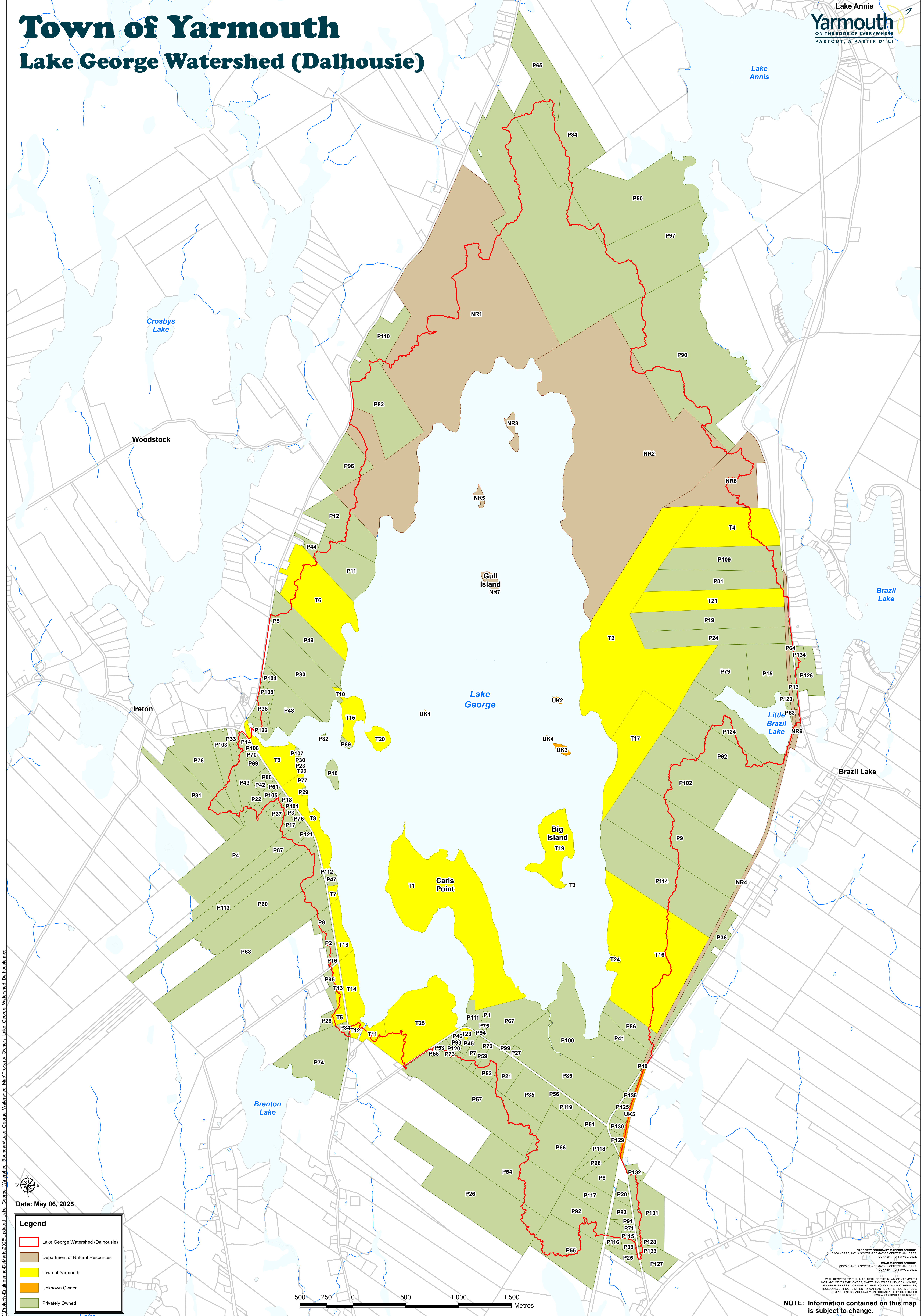
500 250 0 500 1,000 1,500 Metres

NOTE: Information contained on this map is subject to change.

PROPERTY BOUNDARY MAPPING SOURCE:
(1:10,000 NSRD) NOVA SCOTIA GEOMATICS CENTRE AMHERST, CURRENT TO MAY 2024.
ROAD MAPPING SOURCE:
(NSCAD) NOVA SCOTIA GEOMATICS CENTRE AMHERST, CURRENT TO MAY 2020.
WITH RESPECT TO THIS MAP, NEITHER THE TOWN OF YARMOUTH NOR ANY OF ITS EMPLOYEES MAKES ANY WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF EFFECTIVENESS, COMPLETENESS, ACCURACY, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Town of Yarmouth

Lake George Watershed (Dalhousie)



Date: May 06, 2025

Legend

- Lake George Watershed (Dalhousie)
- Department of Natural Resources
- Town of Yarmouth
- Unknown Owner
- Privately Owned

500 250 0 500 1,000 1,500 Metres

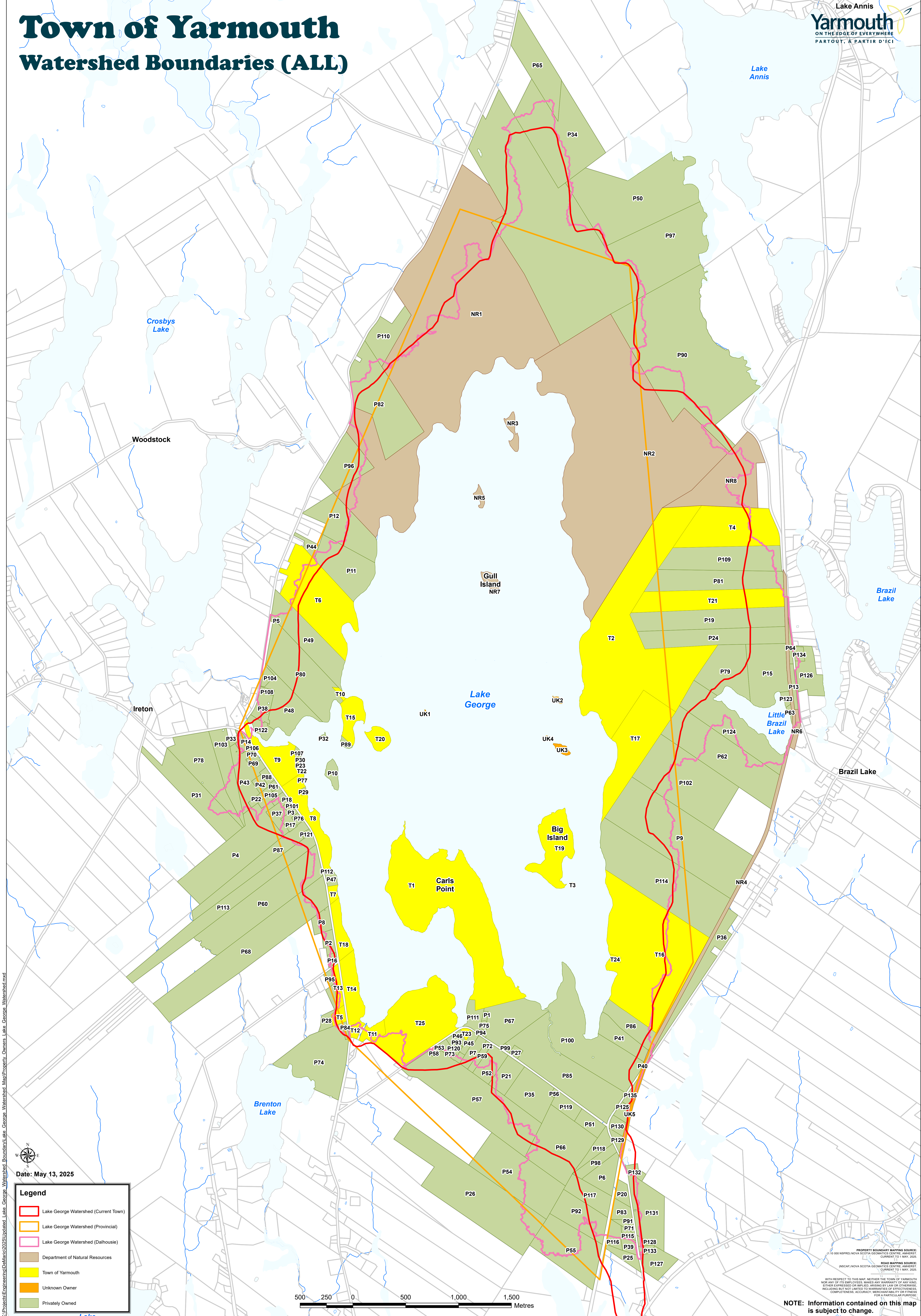
PROPERTY BOUNDARY MAPPING SOURCE:
 (1:10 000 NSRID) NOVA SCOTIA GEOMATICS CENTRE, AMHERST, CURRENT TO 1 APRIL 2020
 ROAD MAPPING SOURCE:
 (NSCA) NOVA SCOTIA GEOMATICS CENTRE, AMHERST, CURRENT TO 1 APRIL 2020

NOTE: Information contained on this map is subject to change.

C:\Projects\Engineering\Dalhousie\2025\Updated_Lake_George_Watershed_Boundary\Lake_George_Watershed_Map\Property_Owners_Lake_George_Watershed_Dalhousie.mxd

Town of Yarmouth

Watershed Boundaries (ALL)



Legend

- Lake George Watershed (Current Town)
- Lake George Watershed (Provincial)
- Lake George Watershed (Dalhousie)
- Department of Natural Resources
- Town of Yarmouth
- Unknown Owner
- Privately Owned

Date: May 13, 2025



NOTE: Information contained on this map is subject to change.

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PROPERTY BOUNDARY MAPPING SOURCE:
 (1:10 000 NSRID) NOVA SCOTIA GEOMATICS CENTRE AMHERST, CURRENT TO MAY 2025
 ROAD MAPPING SOURCE:
 (NSCA) NOVA SCOTIA GEOMATICS CENTRE AMHERST, CURRENT TO MAY 2025

WITH RESPECT TO THIS MAP, NEITHER THE TOWN OF YARMOUTH NOR ANY OF ITS EMPLOYEES MAKES ANY WARRANTY OF ANY KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO WARRANTIES OF EFFECTIVENESS, COMPLETENESS, ACCURACY, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

All Privately Owned Properties – Current Lake George Watershed

ID Number	PID	GCLat	GCLong
P1	90243759	43.96970908030	-66.04233437610
P2	90284167	43.97552977660	-66.06104563530
P3	90150152	43.98673061100	-66.06618319580
P4	90232877	43.98267531300	-66.07272060820
P5	90145798	43.95656836870	-66.02759833780
P6	90145657	43.96661537450	-66.04359908430
P7	90150293	43.97303096110	-66.06633557060
P8	90150277	43.97721544220	-66.06193969550
P9	90157264	43.98554772250	-66.02016970320
P10	90149709	43.98986177310	-66.06133883560
P11	90149865	44.00747197380	-66.06073166090
P12	90149923	44.01089259770	-66.06104442980
P13	90149964	43.99200791470	-66.07197759480
P14	90112301	43.99981293930	-66.01063742720
P15	90114513	43.94931105130	-66.02540988620
P16	90284159	43.97405168220	-66.06058869440
P17	90150160	43.98573312130	-66.06618359710
P18	90150111	43.98755366030	-66.06758760360
P19	90112046	44.00418399680	-66.01758648410
P20	90114588	43.94575637100	-66.02227143300
P21	90114398	43.95508126380	-66.02535200360
P22	90145699	43.96474676620	-66.03955929510
P23	90320458	43.98765894430	-66.06975416270
P24	90150053	43.99043466610	-66.06526260870
P25	90112053	44.00265954380	-66.01717821140
P26	90114497	43.94968987240	-66.02472852470
P27	90145723	43.96678128260	-66.03851796300
P28	90145350	43.96977608380	-66.06069667700
P29	90150137	43.98827880930	-66.06470696350
P30	90150061	43.99109349190	-66.06527125920
P31	90232901	43.99292205160	-66.06258900850
P32	90149956	43.99256597840	-66.07285943460
P33	90303371	44.04495845470	-66.03752885190
P34	90114620	43.94463806260	-66.02363679240
P35	90114562	43.94613350880	-66.02226158240
P36	90145715	43.96320575800	-66.03653316530
P37	90150129	43.98613165840	-66.06745196060
P38	90149543	43.99524973630	-66.06982712600
P39	90114539	43.94742189040	-66.02527860870
P40	90114489	43.95062510180	-66.02436233090
P41	90333931	43.96832624320	-66.02624840920
P42	90289786	43.98877349320	-66.06983787890
P43	90289794	43.98933523420	-66.07158850770
P44	90145608	43.96742215360	-66.04409167060
P45	90145582	43.96781876800	-66.04508078700

P46	90150269	43.98094236410	-66.06104181840
P47	90149592	43.99542380900	-66.06712259050
P48	90149758	44.00120896010	-66.06476071570
P49	90233230	44.03981374070	-66.02838928160
P50	90145756	43.96092053570	-66.02951353910
P51	90145681	43.96564635940	-66.04150449290
P52	90145541	43.96696829050	-66.04755930070
P53	90114570	43.94580145620	-66.02271216690
P54	90145806	43.95013669030	-66.03142166570
P55	90145749	43.96340318700	-66.03386756320
P56	90145525	43.96659301910	-66.04812633620
P57	90315474	43.96602028490	-66.04297536170
P58	90292749	43.96439988330	-66.05661596740
P59	90150228	43.97864481260	-66.06908692910
P60	90150038	43.98864271370	-66.06826530780
P61	90157256	43.99259702730	-66.01549041910
P62	90114521	43.94828350660	-66.02305017490
P63	90329772	43.95894502960	-66.03294444430
P64	90145624	43.96952071300	-66.03924118340
P65	90150251	43.97453408990	-66.07086188220
P66	90149998	43.99079326150	-66.07076118600
P67	90149980	43.99129895760	-66.07098940100
P68	90114547	43.94687807400	-66.02284429150
P69	90114430	43.95206717040	-66.02418031140
P70	90145665	43.96726456120	-66.04190899070
P71	90145558	43.96658013580	-66.04616050210
P72	90145426	43.96548511850	-66.06155314990
P73	90145616	43.96872090990	-66.04242758280
P74	90150178	43.98589320330	-66.06530663260
P75	90150103	43.98926316340	-66.06486806700
P76	90112293	43.99986105560	-66.01539336440
P77	90149618	43.99828901590	-66.06550253420
P78	90336876	44.00750505020	-66.01720847790
P79	90156787	44.02152204440	-66.05709881890
P80	90114414	43.95353779800	-66.02545496380
P81	90145400	43.96729991750	-66.05788938880
P82	90145384	43.96808103940	-66.05867108280
P83	90145731	43.96530992540	-66.03265238860
P84	90333949	43.96943937950	-66.02517133560
P85	90150186	43.98157343980	-66.07023952550
P86	90150004	43.98943279170	-66.06909091660
P87	90232893	43.99249102350	-66.05991959800
P88	90111741	44.02665730620	-66.02165070890
P89	90114422	43.95254266040	-66.02500232190
P90	90329376	43.95299651040	-66.03023604800
P91	90145574	43.96744058400	-66.04551520130
P92	90145640	43.96837376540	-66.04274110450

P93	90156746	44.01615269180	-66.06120554560
P94	90156993	44.03645918560	-66.03518201260
P95	90145780	43.95764477680	-66.02867157670
P96	90145483	43.96527499150	-66.05234147360
P97	90145707	43.96715223320	-66.03979957520
P98	90145475	43.96577956670	-66.05430847780
P99	90145863	43.96805565990	-66.03014033150
P100	90150145	43.98703966220	-66.06653035480
P101	90284738	43.99027221360	-66.01967734810
P102	90150095	43.98763974260	-66.06859757090
P103	90149972	43.99157864930	-66.07119632020
P104	90150087	43.99155746490	-66.06564171650
P105	90111840	44.00937513750	-66.01607867360
P106	90114653	43.94525243130	-66.02275239730
P107	90114638	43.94440571350	-66.02639898450
P108	90236100	43.96967771280	-66.04363724550
P109	90150236	43.98160853580	-66.06157667800
P110	90252651	43.97820974310	-66.07357395630
P111	90157272	43.98191541580	-66.02214288610
P112	90114448	43.95170950200	-66.02453516570
P113	90114463	43.95146134820	-66.02597936450
P114	90114414	43.95486482230	-66.02928805390
P115	90145764	43.95887527390	-66.02855613720
P116	90329764	43.96231753680	-66.03237943570
P117	90145566	43.96715060790	-66.04595680800
P118	90150210	43.98468489610	-66.06416567460
P119	90149527	43.99354012590	-66.06998113690
P120	90112277	43.99519321370	-66.01468016730
P121	90145517	43.96509153310	-66.04857639560
P122	90343393	43.96319692760	-66.04410593240
P123	90343401	43.96066062960	-66.03874027090
P124	90145848	43.96198294230	-66.02572642660
P125	90114372	43.95820773730	-66.02373227250
P126	90145830	43.95914292100	-66.02226159860
P127	90114505	43.94926709080	-66.02097561080
P128	90114554	43.94735007630	-66.02150905590
P129	90114455	43.95098825930	-66.02275660980
P130	90145772	43.95967304780	-66.02628202980
P131	90145822	43.96083576350	-66.02626203030
P132	90114646	43.94425338260	-66.02205350420
P133	90114406	43.95356367080	-66.02227846760
P134	90114380	43.95696919660	-66.02392982390
P135	90114471	43.95036756930	-66.02232049240
P136	90145855	43.96352120570	-66.02484013330
P137	90335472	43.94252983860	-66.02166991480

Town Owned Properties – Current Lake George Watershed

ID Number	PID	OWNER NAME	GCLat	GCLong
T1	90145632	TOWN OF YARMOUTH	43.97838773970	-66.04671265590
T2	90111808	TOWN OF YARMOUTH	44.00242839560	-66.02611917490
T3	90157280	TOWN OF YARMOUTH	43.98120654050	-66.03259957090
T4	90111832	TOWN OF YARMOUTH	44.01198296300	-66.01555989230
T5	90145376	TOWN OF YARMOUTH	43.96922634910	-66.05953592690
T6	90149808	TOWN OF YARMOUTH	44.00465874300	-66.06376502440
T7	90150244	TOWN OF YARMOUTH	43.97967650920	-66.06077309130
T8	90150202	TOWN OF YARMOUTH	43.98607337130	-66.06385222120
T9	90150020	TOWN OF YARMOUTH	43.99094851750	-66.06791290400
T10	90149626	TOWN OF YARMOUTH	43.99673792360	-66.06084567350
T11	90145392	TOWN OF YARMOUTH	43.96685638280	-66.05757185680
T12	90236068	TOWN OF YARMOUTH	43.96800615340	-66.05540484630
T13	90236050	TOWN OF YARMOUTH	43.96817194090	-66.05747476010
T14	90145343	TOWN OF YARMOUTH	43.97173016910	-66.05977970960
T15	90145368	TOWN OF YARMOUTH	43.97157145390	-66.05813411730
T16	90149659	TOWN OF YARMOUTH	43.99478144920	-66.05933299290
T17	90114331	TOWN OF YARMOUTH	43.97553735560	-66.02338222860
T18	90112285	TOWN OF YARMOUTH	43.99338826150	-66.02583680370
T19	90150285	TOWN OF YARMOUTH	43.97646875820	-66.05972973640
T20	90157280	TOWN OF YARMOUTH	43.98428638080	-66.03490754560
T21	90149659	TOWN OF YARMOUTH	43.99302478730	-66.05604083640
T22	90112020	TOWN OF YARMOUTH	44.00581643450	-66.01770729270
T23	90150046	TOWN OF YARMOUTH	43.99006284440	-66.06500187400
T24	90145590	TOWN OF YARMOUTH	43.96822953610	-66.04448570570
T25	90157298	TOWN OF YARMOUTH	43.97502525500	-66.02725197380
T26	90145533	TOWN OF YARMOUTH	43.96904824660	-66.05014086030

Department Natural Resources – Current Watershed Boundary

ID Number	PID	OWNER NAME	GCLat	GCLong
NR1	90156779	N S NATURAL RESOURCES	44.02697115730	-66.04971163800
NR2	90111774	NS DEPARTMENT OF NATURAL RESOU	44.01807336210	-66.02902139790
NR3	90233008	N S NATURAL RESOURCES	44.01952063680	-66.04160570600
NR4	90233024	N S NATURAL RESOURCES	44.01387295700	-66.04519485040
NR5	90233016	N S NATURAL RESOURCES	44.00675504960	-66.04354166020
NR6	90292335	NS DEPARTMENT OF NATURAL RESOU	44.01610010390	-66.01592093490

Unknown Properties – Current Watershed

ID Number	PID	OWNER NAME	GCLat	GCLong
UK1	00000000	OWNER UNKNOWN	43.99531615990	-66.05072783820
UK2	90232869	OWNER UNKNOWN	43.99686109990	-66.03517233400
UK3	90232869	OWNER UNKNOWN	43.99266533220	-66.03439884870
UK4	90232869	OWNER UNKNOWN	43.99357331180	-66.03610868020
UK5	90001959	OWNER UNKNOWN	43.96191045570	-66.02473051920

Appendix B

Designation of the Lake George Watershed Protected Water Area and
the Making of Regulations Respecting Activities in the Lake George
Watershed Protected Water Area



Yarmouth Water Utility Designation of
Lake George Watershed Protected
Water Area and Regulations
Respecting Activities in the Lake
George Watershed Protected Water
Area – Province of Nova Scotia dated
October 16, 2006

**CANADA
PROVINCE OF NOVA SCOTIA**

IN THE MATTER OF: the *Environment Act*, S.N.S. 1994-95, c.1, s.106

IN THE MATTER OF: the designation of an area surrounding Lake George, Yarmouth County, as a Protected Water Area, to be known as the "Lake George Watershed Protected Water Area"

**Designation of the Lake George Watershed Protected Water Area and the Making of
Regulations with Respect Thereto**

WHEREAS by order dated November 2, 1964, and published in the Royal Gazette [Part 1] on November 4, 1964, the Nova Scotia Water Authority defined and prescribed an area surrounding Lake George, Yarmouth County as the public water supply for the Town of Yarmouth;

AND WHEREAS subsections 106(4) and (5) of the *Environment Act* provide:

- (4) When requested by an operator of a water works or proposed water works, the Minister may cancel a designation made pursuant to this section, in whole or in part.
- (5) Any protected water area designated pursuant to the *Water Act* prior to the coming into force of this *Act* remains so designated;

AND WHEREAS the Town of Yarmouth Water Utility, operator of the Lake George Water Treatment Plant, has requested that the Minister of Environment and Labour cancel the November 2, 1964 designation;


AND WHEREAS Section 106 of Chapter 1 of the Acts of 1994-95, the *Environment Act*, provides for the designation by the Minister of Environment and Labour of a protected water area and the making of regulations under subsection (6) to prohibit, regulate or require the doing of any act or acts in a protected water area that may impair or prevent the impairment, as the case may be, of the quality of the water in the Protected Water Area;

AND WHEREAS the Town of Yarmouth Water Utility, operator of the Lake George Water Treatment Plant, has requested that the Minister of Environment and Labour designate the Lake George watershed as a Protected Water Area in order to protect the quality of the surface water and groundwater resource as a water supply;

AND WHEREAS the Town of Yarmouth Water Utility has provided opportunities for public consultation, including public meetings and the establishment of the Lake George Watershed Management Committee, an advisory committee comprising representatives of the Province of Nova Scotia, the Town of Yarmouth, members of the general public and landowners;

THEREFORE pursuant to Section 106 of Chapter 1 of the Acts of 1994-95, the *Environment Act*, the undersigned, Mark Parent, Minister of Environment and Labour hereby

- (a) cancels the area defined and prescribed on November 2, 1964 and designates as a protected water area, to be known as the "Lake George Watershed Protected Water Area", the area comprising the topographic drainage area surrounding Lake George and more fully described in Schedule "A", which corresponds to the area designated as of May 12, 2005, as the Lake George Watershed Zone by the Municipality of the District of Yarmouth in its Municipal Planning Strategy and Land Use By-law effective March 20, 2001; and
- (b) makes regulations respecting activity in the Lake George Watershed Protected Water Area, in the form set forth in Schedule "B".


Honourable Mark Parent
Minister of Environment and Labour

Halifax, Nova Scotia *Oct 16*, 2006

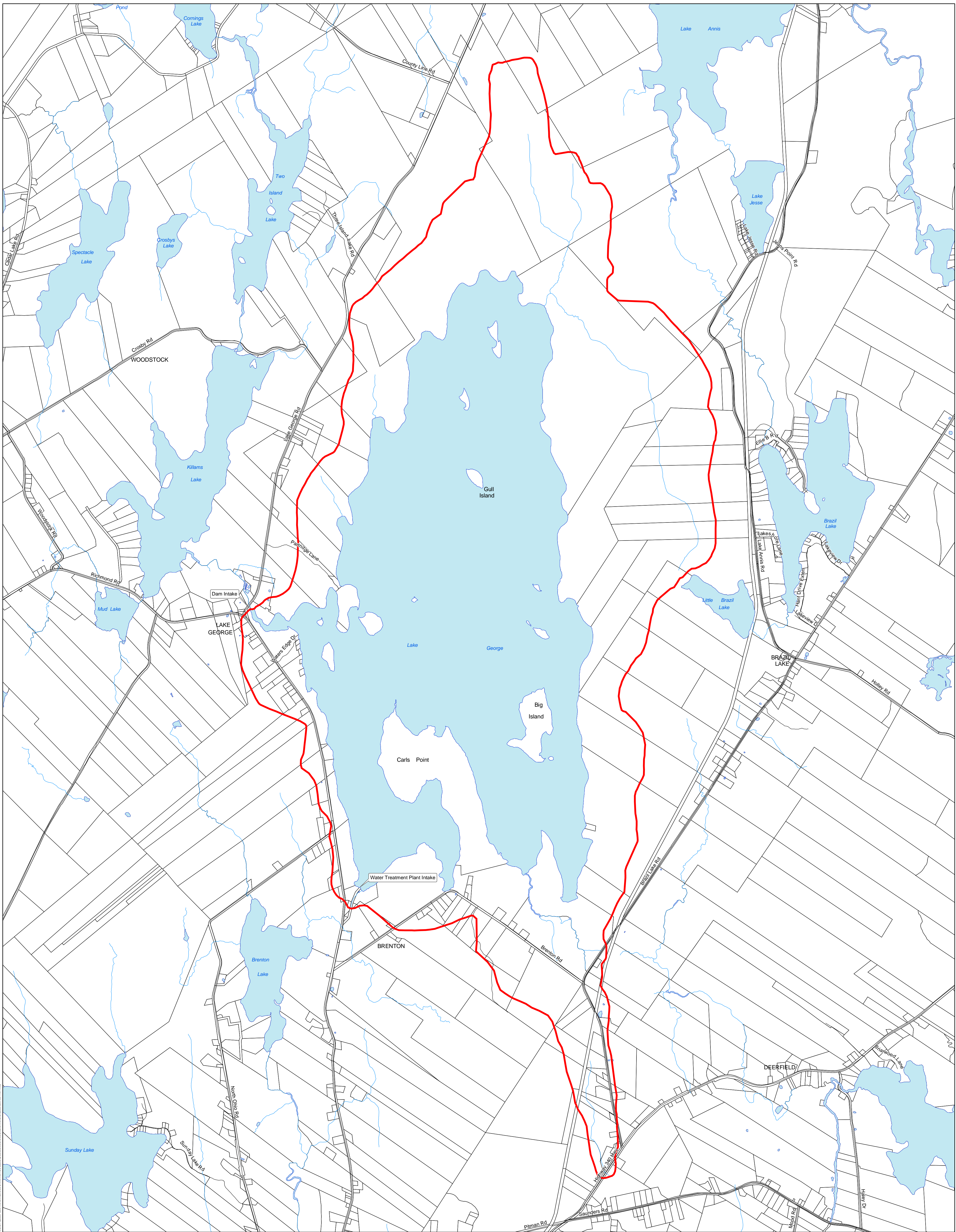
Schedule "A"

Lake George Watershed Protected Water Area Boundary Description


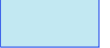


ALL and singular that certain lot, piece, parcel or tract of land and land covered by water located at or near Brenton, Yarmouth County, in the Municipality of the District of Yarmouth, Province of Nova Scotia, shown outlined in red on the attached Map "A" - Lake George Watershed Protected Water Area, dated May 12, 2005, prepared by the Town of Yarmouth and filed with the office of the Town Engineer.

Lake George Watershed Protected Water Area - Map 'A'

Yarmouth County

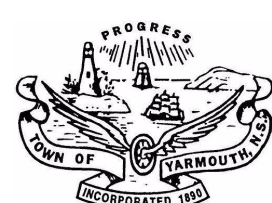


Legend

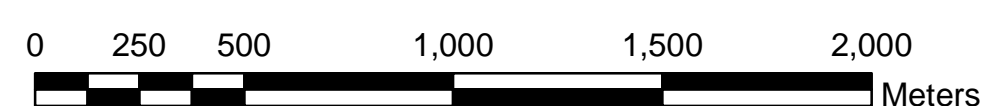
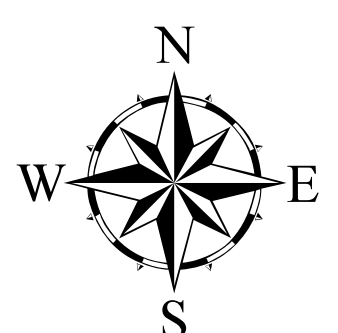
-  Property boundaries
-  Waterbodies
-  Lake George Watershed Protected Water Area boundary designated under the Environment Act
-  Hydrology

Date: May 12, 2005

Projection: NAD83 / UTM zone 20



NOTE: Information contained on this map is subject to change.



PROPERTY BOUNDARY MAPPING SOURCE: (1:10 000 NSRD) NOVA SCOTIA GEOMATICS CENTRE, AMHERST, CURRENT TO 2 DECEMBER 2004. PROPERTY BOUNDARIES SUBJECT TO CHANGE.

TOPOGRAPHIC MAPPING SOURCE: (1:10 000 NSTDR) NOVA SCOTIA GEOMATICS CENTRE, AMHERST, CURRENT TO 1999. DATA SUBJECT TO CHANGE.

ROAD MAPPING SOURCE: (1:10 000 NSCAF) NOVA SCOTIA GEOMATICS CENTRE, AMHERST, CURRENT TO 27 APRIL 2004. DATA SUBJECT TO CHANGE.

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Schedule "B"

Regulations Respecting Activities in the Lake George Watershed Protected Water Area made by the Minister of Environment and Labour pursuant to subsection 106 (6) of Chapter 1 of the Acts of 1994-95, the *Environment Act*

Citation

- 1 These regulations may be cited as the *Lake George Watershed Protected Water Area Regulations*.

Interpretation

- 2 In these regulations,
- (a) "Act" means the *Environment Act*;
 - (b) "agricultural operation" means a farming unit other than a household garden that
 - (i) houses livestock or where livestock graze or are pastured,
 - (ii) has greater than 2 ha of land in forage production,
 - (iii) has greater than 2 ha of land in annual crop production, or
 - (iv) grows and harvests Christmas trees on a commercial basis,or to which any combination of subclauses (i) to (iv) applies;
 - (c) "Committee" means the Lake George Watershed Management Committee;
 - (d) "Department" means the Department of Environment and Labour;
 - (e) "forestry operation" means any activity related to the use of a forest for producing timber, wood fiber or Christmas trees, including but not limited to the following activities:
 - (i) forest management planning,
 - (ii) silviculture,
 - (iii) harvesting,
 - (iv) road construction, and

- (v) operation, storage and use of equipment and supplies used in any aspect of the activity;
- (f) “Minister” means the Minister of Environment and Labour;
- (g) “nutrient management plan” means a plan for collecting, storing, handling, transporting, applying, treating, using and disposing of agricultural fertilizer, compost, manure and other materials containing nutrients that may be applied to lands, in a manner that prevents the impairment of the quality of the water in the Protected Water Area;
- (h) “open fire” means a fire that is not fully contained within a stove or other device in common usage for the burning of wood as a fuel source for domestic cooking or heat;
- (i) “pest control product” has the same meaning as set out in clause 2(q) of the *Pesticide Regulations* made under the Act;
- (j) “professional forester” means a graduate from a Canadian university with at least a bachelor’s degree in forestry;
- (k) “Protected Water Area” means the land and water designated by the Minister pursuant to subsection 106(1) of the Act as the Lake George Watershed Protected Water Area as described in the designation;
- (l) “release” means to spill, discharge, dispose of, spray, inject, inoculate, abandon, deposit, leak, seep, pour, emit, empty, throw, dump, place, drain, pump or exhaust;
- (m) “Water Works Operator” means the Town of Yarmouth Water Utility, operator of the Lake George municipal water works.

Public notification

- 3 (1) The Water Works Operator must post signs at appropriate locations around the perimeter of the Protected Water Area to provide notice to the general public of the designation of the Protected Water Area.
- (2) The Water Works Operator must replace any signs posted under subsection (1) that have been damaged or removed.
- (3) The Water Works Operator must take appropriate measures to advertise and provide notice to the general public of these regulations.

- (4) No person is permitted to remove or alter any sign, notice or advertisement posted under these regulations.

Activity restrictions

- 4 (1) No person is permitted to swim in Lake George except within 100 m of the dam.
- (2) No person is permitted to wash a vehicle or equipment in any watercourse or within 60 m of the shoreline or bank of any watercourse within the Protected Water Area.
- (3) No person is permitted to fish within 100 m of the intake for the water treatment plant.
- (4) No person is permitted to operate a motorized vessel or vehicle of any kind, including but not limited to
 - (a) motorized boat;
 - (b) jetskis;
 - (c) a hovercraft; or
 - (d) an amphibious vehicleon, through, or over Lake George other than for the protection of the Protected Water Area and unless authorized by the Water Works Operator.
- (5) No person is permitted to operate a snowmobile, all-terrain vehicle, or other off-highway vehicle on Lake George or any watercourse, whether covered by ice or not, other than for the protection of the Protected Water Area and unless authorized by the Water Works Operator.
- (6) No person is permitted to skate or participate in ice surface recreational activities on Lake George
 - (a) within 1000 m of the water treatment plant intake; and
 - (b) within 100 m of the dam.

Fire restrictions

- 5 (1) No person is permitted to light or be responsible for an open fire in the Protected Water Area from April 1 to October 15, inclusive, in any year.

- (2) No person is permitted to burn a product other than wood or charcoal during a time when an open fire is permitted.
- (3) Persons involved in a forestry operation within the Protected Water Area must comply with the *Forests Act* and regulations made pursuant thereto, including the *Forest Fire Protection Regulations*.

Forestry restrictions

- 6 (1) No person owning property in excess of 5 ha is permitted to undertake any type of forestry operation within the Protected Water Area unless the operation is conducted pursuant to a forest management plan that is
 - (a) prepared by a professional forester in accordance with the objectives and policies described in the “Lake George Watershed Management and Protection Strategy” issued by the Water Works Operator; and
 - (b) approved in advance by the Water Works Operator.
- (2) Despite subsection (1), a person who owns or occupies property in the Protected Water Area may harvest from the property
 - (a) less than 20 cords of wood in any one year; or
 - (b) any amount of wood so long as it is for their own personal use.
- (3) A forestry operation within the Protected Water Area must be conducted in accordance with the *Wildlife Habitat and Watercourses Protection Regulations* made under the *Forests Act* and the “Forest/Wildlife Guidelines and Standards for Nova Scotia” issued by the Department of Natural Resources, or its successor document or code of practice, as amended from time to time.

Road construction and watercourse alteration

- 7 No person is permitted to construct a forest access road within the Protected Water Area unless the route location and construction methods are approved in writing by the Water Works Operator.
- 8 A forest access road within the Protected Water Area must be constructed in accordance with the publication “Wood Lot Roads, Stream Crossings” issued by the Department of Natural Resources, or its successor document or code of practice, as amended from time to time.
- 9 No person is permitted to construct or remove a bridge or culvert or otherwise alter a watercourse within the Protected Water Area without first obtaining all necessary approvals

from the Department and providing the Water Works Operator with copies of such approvals.

- 10 An owner, operator or person who is responsible for an approved forest access road, bridge or culvert must maintain and repair the road, bridge or culvert to the satisfaction of the Water Works Operator.

Pest control restrictions

- 11 No person is permitted to use a pest control product within the Protected Water Area without first obtaining
- (a) written permission from the Water Works Operator; and
 - (b) an approval from the Department.

Refuse, waste and discharge restrictions

- 12 (1) No person is permitted to install an on-site sewage disposal system within the Protected Water Area unless
- (a) the person has obtained an approval from the Department; and
 - (b) the system is constructed in conformance with the *On-site Sewage Disposal Systems Regulations* made under the Act.
- (2) An on-site sewage disposal system in the Protected Water Area must be pumped and inspected every 3 years.
- (3) No person is permitted to release or cause or permit the release of oil, petroleum products, soap, detergent, toxic chemicals, pest control product waste, garbage, litter, solid or liquid waste, or any other material that causes or may cause an adverse effect to a watercourse or any other area within the Protected Water Area.
- (4) No person is permitted to establish a dump, landfill, an open windrow compost operation, or waste disposal site within the Protected Water Area.

Agriculture restrictions

- 13 (1) An agricultural operation undertaken within the Protected Water Area must be conducted according to a nutrient management plan prepared by a qualified nutrient management planner and approved by the Water Works Operator.
- (2) No person is permitted to conduct agricultural operations in the Protected Water Area within 100 m of any watercourse, well, or drainage ditch, including a public highway ditch.

- (3) No person is permitted to house livestock, or store manure, pest control products, or fertilizer as part of an agricultural operation in the Protected Water Area, within 100 m of a watercourse, well, or drainage ditch, including a public highway ditch or private roadway ditch.
- (4) No person is permitted to import manure or biosolids for application on land or storage for an agricultural operation in the Protected Water Area.
- (5) Agricultural operations are subject to the soil erosion and sedimentation control restrictions of section 16.

Easement restrictions

- 14 No person is permitted to construct a road, pipeline, railway, telephone line, power line, or other similar undertakings or grant an easement on, over, under, or across the Protected Water Area without first obtaining the written approval of the Water Works Operator, which the Water Works Operator will not unreasonably refuse.

Pit, mine, quarry restrictions

- 15 No person is permitted to extract peat, gravel, rock, minerals, aggregate materials, top soil or any non-renewable resources within the Protected Water Area.

Soil erosion and sedimentation control

- 16 (1) No owner, occupier, contractor or person responsible for a construction project or other activity within the Protected Water Area requiring grubbing or earth moving that would expose more than 250 m² of soil at any time is permitted to proceed unless they have
 - (a) developed an erosion and sedimentation control plan as described in the “Erosion and Sedimentation Control Handbook for Construction Sites”, published by the Department; and
 - (b) obtained prior written approval of the Water Works Operator.
- (2) No person is permitted to release at any time water that has a suspended solid concentration greater than 25 mg/L from any construction site within the Protected Water Area.

Home heating oil tanks and fuel storage tanks

- 17 (1) No person is permitted to install a home heating oil tank, a gasoline fuel storage tank, or a diesel fuel storage tank within the Protected Water Area unless the tank is

- (a) made of stainless steel;
 - (b) constructed with double walls; or
 - (c) approved prior to installation in writing by the Water Works Operator.
- (2) No person is permitted to install a petroleum storage tank within the Protected Water Area that is not located inside a dwelling or other building unless the tank is
- (a) supported by concrete footings;
 - (b) equipped with a fuel line guard;
 - (c) securely fastened to the dwelling or other building; and
 - (d) surrounded by a concrete containment capable of holding 110% of the volume of the tank.
- (3) No person is permitted to install a gasoline petroleum storage tank or a diesel petroleum storage tank within the Protected Water Area that holds more than 1135 L.
- (4) No person is permitted to install an underground petroleum storage tank within the Protected Water Area.
- (5) A person who is using mechanical equipment or transporting gasoline or oil within the Protected Water Area is not permitted to release, and must take precautions to prevent the release of, a petroleum product onto the ground or into a watercourse or runoff from the area.

Consultation with the Committee

- 18 (1) The Water Works Operator must consult with the Committee before granting any authorization or approval required by these regulations.
- (2) A permit or approval issued by the water works operator under these regulations may contain terms and conditions respecting time and other restrictions if the terms, conditions, or restrictions are deemed necessary to protect water quality in the Protected Water Area.

Approval by Water Works Operator

- 19 Any decisions regarding approvals made by the Water Works Operator under these regulations must be made no later than 60 days after the application is submitted.

Appendix C

Watershed Advisory Committee Terms of Reference

Lake George Watershed Management Committee Terms of Reference

These terms of Reference shall serve to constitute the Lake George Watershed Management Committee as an advisory committee to the Yarmouth Water Utility, the Province of Nova Scotia, and the stakeholders in the management of the Lake George Watershed.

Background

The Lake George Watershed provides drinking water to the Town of Yarmouth, parts of the Municipality of the District of Yarmouth, and Acadia First Nation. The Lake George Watershed is a designated Protected Water Area under the *Environment Act*, and is managed through the Lake George Watershed Protected Water Area Regulations.

General

1. The Committee will review and make recommendations to the Yarmouth Water Utility on all activities affecting water quality, quantity, and the health of the Lake George Watershed as requested by the Yarmouth Water Utility, Province of Nova Scotia and stakeholders in the watershed area.
2. The Committee will:
 - a. provide a forum to address issues and concerns within the Lake George Watershed
 - b. request that individuals or groups report to the Committee on matters affecting the Lake George Watershed
 - c. regularly review (i.e. at least once every two years) the Source Water Protection Plan, identifying any new risks and carrying out the necessary risk assessment
 - d. review these Terms of Reference at least once every three years

Membership

The membership for the Watershed Protection Advisory Committee shall consist of voting members, resource members and staff from the Yarmouth Water Utility.

Voting Members

- Two Councillors from the Town of Yarmouth
- One Band Councillor from Acadia First Nation
- One Councillor from the Municipality of the District of Yarmouth

- Up to three residents of the Lake George Watershed
- Up to three customers of the Yarmouth Water Utility (i.e. residents of the Town of Yarmouth, Municipality of the District of Yarmouth, or Acadia First Nation that receive water from the Lake George Watershed)

Resource Member

- NS Department of Environment
- Lands and Forestry
- NS Department of Transportation & Infrastructure Renewal

Yarmouth Water Utility

- Chief Administrative Officer for the Town of Yarmouth
- Town Engineer of the Town of Yarmouth
- Chief Operator of the Water Treatment Plant for the Town of Yarmouth
- Administrative Assistant for Operational Services of the Town of Yarmouth

Quorum

- Quorum will consist of at least 50% of voting members, including at least one Councillor from the Town of Yarmouth

Committee Organization and Operation

- The Chair shall be the Chair of the Yarmouth Water Utility. The Vice Chair shall be the other appointed Councillor from the Town of Yarmouth. Either the Chair or Vice Chair shall preside at meetings.
- Members are appointed for a term of at least three years, and are considered to be reappointed at the end of their term unless otherwise determined by the Yarmouth Water Utility or the member does not wish to have their term renewed.
- The Town of Yarmouth shall provide secretarial and administrative support for the Committee.
- The Committee shall endeavour to conduct business by consensus, but should the Committee be unable to obtain consensual agreement on an issue, the Chair may call for a vote. All motions require support from a majority of voting members.
- The Committee will meet as necessary, but no less than three times a year. The Chair may call a meeting with notice of three days.
- Voting members who miss three consecutive meetings and whose absence is not related to an unexpected event, emergency, or due to weather that prohibits travel, may be asked by the Committee to resign their membership.

Appendix D

Lake George Watershed Hazard Assessment Matrix

Lake George Watershed Hazard Assessment Matrix

Activity	Hazard	Severity of Consequence	Risk Probability	Controls (existing or considered)
Seagull, cormorant and blue heron nesting grounds	- Bacterial contamination at water intake	Low	Unknown	- Bacterial water quality monitoring program
Beaver and muskrat habitat	- Bacterial contamination at water intake - Contamination from Giardia Lamblia protozoa	Low to moderate	Unknown	- Bacterial water quality monitoring program
Forest fires	- Sedimentation and long-term impacts on water quality	High	Low to medium	- Protected Water Area Regulations regulate open fires
Construction or landscaping of residences	- Sedimentation	Moderate to High	Medium	- Protected Water Area Regulations regulate construction erosion control measures - District LUB sets minimum building setbacks
	- Petrochemical or other hazardous material leakage from construction equipment	Moderate to High	Medium	- Protected Water Area Regulations regulate toxic material discharge - Emergency Response Pan in place to contain chemical spill and cleanup
Residential septic systems	- Malfunctioning or overfilled septic systems causing bacterial or microbial groundwater contamination	Moderate	Low	- Residential Septic System Pumping Program in place (3-year pumping and inspection frequency)
	- Improper disposal of hazardous materials through septic system	Moderate	Low	- Provide information resources to residents
Residential heating oil or fuel storage	- Leaks due to damaged tanks or piping - Leaks during fuel delivery or transfer processes - Spills due to delivery vehicle accident or collision	High	Low to Moderate	- Protected Water Area Regulations regulate storage practices - Emergency Response Pan in place to contain chemical spill and cleanup
Residential-based small businesses	- Spill or leakage of solvents, paints, fertilizers, wood preservatives, fuels, oils, etc.	Moderate	Moderate	- Protected Water Area Regulations regulate toxic material discharge

Residential gardens	- Runoff from fertilizers, pesticides	Moderate	Low	- Protected Water Area Regulations regulate toxic material discharge - Provide information resources to residents
	- Sedimentation through uncovering or erosion of soil	Low	Low	- Provide information resources to residents
Illegal dumping	- Contamination of lake water from runoff or leaching of toxic materials into groundwater	Moderate to High	Moderate	- Protected Water Area Regulations regulate refuse, waste and toxic material discharge - Regular patrols and inspections in place - Provide information resources to residents
Agricultural Operations	- Erosion and sedimentation from land clearing - Bacterial or viral contamination from livestock - Contamination from pesticides, herbicides or fertilizer - Contamination from manure storage or use	High	Low	- District LUB prohibits new agriculture development - Protected Water Area Regulations regulate existing agriculture operations
Mining of rare metals (Lithium) adjacent to watershed boundary	- Groundwater contamination of metals or petrochemicals	High	Low	- Delineate groundwater recharge area in Brazil Lake area
Swimming in Lake George	- Sedimentation through riverbank erosion - Bacterial contamination - Litter	Low	Moderate	- Protected Water Area Regulations regulate areas where swimming permitted
Fishing	- Use of lead sinkers leading to contamination	Low	Low	- Protected Water Area Regulations regulate where fishing is permitted - Eliminate fishing in lake by non-residents
	- Vehicular accidents due to cars parking at Brenton Cross Road	Moderate to High	Low	- Eliminate parking and enforce - Eliminate thru traffic on road

Motorsports and boating	- Sedimentation due to land-based vehicles or boat launching	Moderate	Moderate	- Protected Water Area Regulations regulate use of motorized vehicles
	- Introduction of invasive species	Moderate	Low to Moderate	- Prohibit use of vessels and fishing in lake
	- Petrochemical spills	High	Low to Moderate	- Protected Water Area Regulations regulate use of motorized vehicles
Construction, use and maintenance of roadways within Lake George watershed	- Sedimentation due to construction or maintenance	Moderate to High	Moderate	- TIR follows regulations for construction and maintenance
	- Contamination from salt or chloride due to winter servicing and summer dust control	Low to Moderate	Moderate	- TIR follows regulations for construction and maintenance
	- Contamination from roadway spills of petrochemicals or toxic materials due to accidents	High	Low	- Emergency Response Plan in place to contain chemical spill and cleanup
Recreational aircraft flying over Lake George or watershed	- Petrochemical leakage due to crash or amphibious landing	High	Low	- Create voluntary or regulated no-fly zone over watershed
Commercial or residential forestry operations	- Increased runoff due to vegetation removal leading to sedimentation or contamination from nutrients or toxic materials - Thermal changes in waterways due to removal of forest canopy resulting in changes in water quality	Moderate to High	Low	- Protected Water Area Regulations regulates forestry operations, requires Forest Management Plan for forestry operations - District LUB prohibits industrial forestry uses - Provide information resources to residents

Appendix E

Watershed Emergency Response Plan

Appendix D: LAKE GEORGE EMERGENCY RESPONSE PLAN

1. GENERAL

1.1 Purpose of the Plan

The purpose of the Emergency response plan is to predetermine a set of actions and communications initiated after the occurrence of an incident or an event which may contaminate or has the potential to cause contamination to the fresh water supply in Lake George, to the area surrounding the lake, or to the residences in that area. The plan also includes telephone numbers of key personnel, and other resource people, as well as information on the availability of specialized equipment in the area.

For the plan to be effective it is critical that updates be made at reasonable intervals, that there be an ongoing, dated, sign-off responsibility and that the plan be widely publicized and distributed. It is also critical that it be integrated with broader municipal and regional plans.

1.2 Watershed Location

The plan is to be operational within the Lake George watershed boundary, which is located in Municipality of the District of Yarmouth, Nova Scotia, as depicted in Exhibit 2.2.

1.3 Groups Having Specific Responsibilities under the Plan

The following organizations or groups have specific responsibilities prescribed within this plan:

- Fire Departments
- Emergency Measures Coordinators
- R.C.M.P.
- District Office of the Department of Environment and Labour
- Town of Yarmouth

2 DESCRIPTION OF POSSIBLE HAZARDS

An Emergency response plan requires that all operations involved be looked at to identify what can create a hazard. Possible contamination of the Lake can occur from such things as how chemicals are stored, handled or transported. These issues as well as the question of how and where potential contamination can occur inside the watershed and what damage can result from it are contained in the main body of the *Lake George Watershed Management and Protection Strategy Report* (2001).

3 ACTION PLAN

3.1 Notification Procedures

The notification procedure outlined in the plan will be operational 24 hours/day. The plan lists all agencies, groups, etc. that must be called and their telephone numbers.

Local Fire Departments, R.C.M.P., provincial government, Municipality and Town employees are to report any accidents that involve the release of dangerous goods or hazardous wastes anywhere within the boundaries of the Lake George watershed. All calls should be directed first towards the Yarmouth Water Utility and in case of oil spills, also call the Emergency Oil Spill number 1-800-565-1633.

Callers should be prepared to report:

- the substance, if known, and amount
- the location of the spill
- the time of the spill
- the source of the spill

In the event of a major incident or an Emergency situation the first person on the scene with knowledge of this plan will be the key to proper notification. The Response Team Leader is to notify the EMO Zone Controller once the first response agencies have been contacted. The procedures to follow are outlined below. In all cases, any spill must be reported to the proper authorities.

3.2 General Spills

If the substance being discharged into Lake George, or its associated tributaries, is petroleum based, industrial or household chemical, animal waste, septic waste, hazardous waste, or undetermined, the **WATER SUPPLY INTAKE CONTROL GATE IS ONLY TO BE OPERATED UNDER THE AUTHORIZATION OF THE WATER UTILITY.**

Observations of discharge of any foreign substance directly into Lake George, or any tributary streams, should be reported to the Yarmouth Water Utility and to the Town Engineer. Reporting should be automatic regardless of the estimated volume of the discharge. The Emergency Response Team Leader is always responsible for determining the level of response required.

Oil or gasoline slick should not be flushed into ditches, watercourses, or storm sewers etc. Every attempt should be made to contain spilled substances and recover them before they can enter any watercourse or sewer system.

Official reports of spills and accidents will include detailed site descriptions indicating expected discharge areas likely to be impacted and key watercourses to be monitored closely (including culverts, catch basins, streams, tributaries, etc.)

In the case of vehicle related accidents, it will always be the case that attendance to accident victims and attendance to fires will take precedence over environmental considerations.

3.3 Hazardous Materials Spills

Almost all hazardous materials spills and/or fires are dangerous. For this reason safety should be prime concern.

The general response guidelines described for oil spills also apply for hazardous materials. The big difference here is that you are probably not going to be familiar with the material involved. A guidebook for first responders during the initial phase of a hazardous materials or dangerous goods incident called 1996 North American Emergency Response Guidebook is available from CANUTEC and includes emergency information on hundreds of chemicals. CANUTEC is the Canadian Transport Emergency Center, operated by the Transportation of Dangerous Goods Branch of Transport Canada. As a federal ministry, it seeks to be of service to Canadians who need and request help in case of transportation and nontransport related accidents involving dangerous goods. The Emergency Response Guidebook can be consulted to identify the type of product or dangerous goods involved.

The CANUTEC Emergency Information number (613) 996-6666 can be used to request information and provide proven emergency actions appropriate to the dangerous goods involved in the accident, for protection of personnel and property.

3.4 Notification List

In the event of an emergency, the following people should be contacted, as deemed necessary, for additional appropriate response:

- Response Team Leader
- Yarmouth Water Utility Manager
- Yarmouth Town Engineer
 - Office
 - Direct
 - Home
 - Cell phone
- Ambulance
- Canadian Coast Guard Emergency Number 1-800-565-1633
- CANUTEC 1-613-996-6666
- Department of Environment and Labour
- Nova Scotia EMO Zone Controller
- Department of Natural Resources
- Department of Transportation & Public Works
- Emergency - Police & Fire Nova Scotia Province Wide

-
- Emergency Measures Coordinator
 - Emergency Oil Spill 1-800-565-1633
 - Environmental Consultants
 - Fire Departments
 - Emergency
 - Fire Emergency Reporting 1-800-565-2224
 - Hospital
 - Poison Control Center
 - Police Department
 - Emergency
 - R.C.M.P.
 - R.C.M.P. Emergency Number 1-800-803-7267

3.5 Role of the Response Team Leader

The Yarmouth Town Engineer has been designated as the official Response Team Leader. He will perform or ensure the performance of the following:

- Make any decision that must be made
- Authorize the commitment of any resources that may be required
- Be responsible for all communication with government personnel
- Manage and direct the use of resources
- Act as the focal point for information exchange
- Ensure the collection of samples of spilled product
- Prepare and submit a report detailing the response when necessary

In order to effectively carry out these tasks, the Response Team Leader must be familiar with:

- The equipment and expertise available from local sources.
- The safety requirements in handling spill products. These requirements include the protective clothing and procedures necessary.
- The following acts: Emergency Measures Act, Dangerous Goods and Transportation Act, Environment Act.

The authority of the Response Team Leader, in the context of this Emergency Response Plan, is limited to the geographic area of the Lake George Watershed Study Area. In the event that an emergency occurs that threatens to cross the boundary of the Lake George Watershed into the adjacent watershed, the Response Team Leader will immediately call his counterpart in the adjacent watershed and fully brief him on the details of the emergency. In situations where there may not be an Environmental Emergency Response Plan in an adjacent watershed, the Response Team Leader will immediately call the Local Emergency Measures Organization and provide a detailed briefing on the nature and character of the emergency.

4. CONTAINMENT AND CLEAN-UP PROCEDURES

The intent of this plan is to present some common guidelines for responding to a large variety of possible situations. Containment of hazardous material is important for a number of reasons. By successfully containing a spill you aid in the recovery of the product, minimize health dangers, and reduce the likelihood of added environmental damage. There are several techniques of spill containment. In choosing the proper containment technique, several factors should be considered. The following section will provide simple procedures on containment actions.

4.1 Land Containment Methods

Many spill incidents occur on land. Whenever possible, containment on land is preferred over allowing the product to migrate into a water source.

- The flow of escaped product should be intercepted wherever possible. This will reduce the extent of contamination and ultimately the cost of clean up.
- Blockage of open drains. Open drains containing water can be blocked with soil dams or weirs. Once the flow of product has been blocked, the dam should be monitored to ensure it does not back-up on to local residences or other dwellings.
- Collection of spilled product can be achieved by the construction of a berm. This dam type barrier restricts the flow of product.
- A trench dug down stream of a spill can be used to collect the product

4.2 Containment on Water

Four general ways to contain a product on water are booms, weirs, under flow dams, and physical barriers. Booms are floating containment devices that are produced commercially. The parts of a boom to consider for a specific use are the flotation unit, connecting device, skirt ballast weights, and longitudinal strength member. When determining which boom to use some other factors are the type of product, storage, currents, wind, and temperature. The three different types of boom are the round boom, fence boom, and the inflatable/collapsing boom.

When dealing with small streams commercial boom devices are too large and often unavailable. Some practical containment methods are; board skinning device, earth dam and weir, wire fence filter boom, culvert weir, and underflow dam.

A barrier can be installed to stop the spread of product on a small waterway. This simple barrier, using snow fences and bails of hay should run at an angle of at least 30° to normal to facilitate the collection of oil.

Oil under ice can be contained or deflected by cutting trenches in the ice, inserting plywood and then allowing it to freeze.

In a situation where oil or any other visible or non-visible product has entered Lake George by means of water or air, booms are to be placed immediately across the water near the intake.

Containment of a sinking product is difficult due to the inability to visually monitor movement. Some methods of containment for a sinking product are dikes, damming, curtain barriers, air barriers, and submersible barriers. These devices rely upon the concept of dividing the area of product from the other water. Each method is dependent upon the product. When a product is water-soluble the containment of the entire water source is required.

4.3 Site Restoration

If site restoration is necessary, the Water Utility would work with the Department of Environment and Labour and qualified contractors to bring the site either back to its prior condition or to a condition acceptable to the Department of Environment and Labour. All contaminated soil would be removed from the site and brought to an approved Department of Environment and Labour site. Soil would be treated by the best method for the site (i.e.: onsite or existing) and the treatment would be approved by the Department of Environment and Labour.

Every attempt will be made to ensure that the affected site is restored so that it can be safely used for the same purposes as it was prior to the spill. Contaminated sediment will be trucked away to a designated disposal area.

In the case of a spill of carcinogenic chemicals, asphalted areas will be broken up and trucked away to designated disposal sites, and new asphalt will be laid. All such areas will be clearly posted and fenced until such a time as rehabilitation is completed.

In some instances it might be necessary to remove and replace soil that has been contaminated. Care must be taken to remove only the earthen material that has been subjected to the spill. Excavation precautions are particularly important when using mechanical equipment to ensure that underground items such as water, oil and gas pipeline or telephone cables are not broken or dislodged.

Severely eroded areas will be properly prepared and seeded, depending on the time of year. In case where planting may be impossible, temporary diversion terraces or other acceptable forms of temporary surface cover (geotextile filter fabric, temporary matting, straw, etc.) will be employed to minimize further erosion and sediment loading in water courses.

4.4 Disposal

Temporary storage facilities for contaminated soil; asphalt, etc. will be brought to an approved Department of Environment and Labour site. Under no circumstances will contaminated materials remain within the watershed area for more than six months. Within that time frame they will be delivered to appropriate incineration sites or long-term toxic waste disposal sites. The nearest hazardous waste disposal facility is ????. All contaminated materials will be transported in closed containers. Under no circumstances are contaminated materials to be transported in open or covered trucks or containers. Once contaminated materials are excavated and placed in containers, they will remain sealed in the same container until they reach their ultimate disposal site.

Any movement of containerized contaminants from temporary storage to final storage will not be undertaken without obtaining the necessary approvals from the Department of Environment and Labour, and the Department of Transportation and Public Works. Furthermore, at least two weeks notice will be given by the transportation company to the local detachment of the RCMP, local fire department, and the Town Engineer of the intention to transport contaminated materials out of the area. Included with the notice of transportation will be the ultimate destination, the route taken, and the mode of transportation.

4.5 Equipment and Resources

Inventories of resources that will be made available are listed below.

- The Town of Yarmouth owns and operates the following equipment that can be made available during clean-up, site restoration, and transporting contaminated materials.
- The Town's work crew is also available to operate the following equipment and to provide available manpower during the clean-up and containment procedures.

Cone funnels for unloading overturned oil tankers have been purchased by the Department of Environment and Labour and placed in several locations throughout the province. To ensure 24-hour access these items calls should be directed to the following fire department:

- **Fire Department**

The locations and telephone contact numbers for the industry emergency pollution equipment van are listed below:

- The following clean-up and waste disposal contractors are listed here for reference only.
A more complete description of local and regional contractors may be available in the telephone directory.

- The following industry contacts may be consulted and provide information and service when dealing in their respected field of expertise or affiliated company.
- The Yarmouth Water Utility will maintain oil booms at the pump house (water treatment plant), i.e. near the water intake. Sufficient booms are necessary to allow for placement at any of the four watercourses discharging into Lake George and to surround the main water intake situated near the pump house. All fire department personnel will be trained in proper deployment and use of oil booms. Absorbent materials will also be stored at the water intake area for the purpose of emergency use.

5 PUBLIC RELATIONS

In the event of an incident that would attract public attention, the Response Team Leader will be the spokesman and should be familiar with this plan and follow the prescribed policies on media relations during emergencies. Events that spark media interest include explosion, personal injury accidents, fires, and accidents involving a product spill or chemical leak that could endanger the quality of the water in Lake George.

The Town of Yarmouth will use every means possible to notify and keep the affected public informed of the situation and of remedial action being taken. All official communication will be channeled through the Response Team Leader and may take the form of newspaper releases, radio, or public meeting.

5.1 Reporting

The Response Team Leader will provide, on request, a detailed report of the circumstance to the Nova Scotia Department of Environment and Labour in accordance with their report specifications.

6 TRAINING

Rapid, systematic, effective response to emergency cannot be achieved without some training on the part of all participants in the environmental emergency response process.

The Water Utility will inform residents and property owners in the watershed as to what action they should take if they observe an incident or event taking place that may contaminate Lake George or the watershed area.

Appendix F

Monitoring Program for the Lake George Watershed

Monitoring Program for the Lake George Watershed

The key to success of the Lake George Watershed Protection Plan (LGWPP) is to have a monitoring component to evaluate its effectiveness.

Monitoring will consist of sampling identified representative areas in the lake at least once per year or twice per year when lake conditions (wind, weather) and time permits.

It will also consist of patrolling and visually inspecting the watershed area to ensure none of the identified contamination risks are becoming a problem and no new contamination risks have developed.

Data collected from the analysis of lake samples and information gathered from patrolling the watershed will be used to help determine if the LGWPP is effective or will need modification.

Modification of the LGWPP will be necessary if it is determined that a deterioration of the water quality is occurring according to statistical analyses of the data gathered or there are newly identified contamination risks observed when conducting patrols.

Lake George Watershed

Within the Lake George Watershed, there exists clusters of residential properties of which the majority are within the western boundary.

There are no known existing commercial forestry operations.

The watershed area generally contains large tracks of forestry lands.

A well used paved roadway, the Lake George road, runs along part of the west side of the lake in relatively close proximity and within the designated watershed boundaries.

Brenton Road is an unpaved road which runs partly on the south end of the lake.

The rest of the lake has relatively little population and/or current commercial/residential activity.

There has been some recreational use noted in the lake such as boating, fishing, and swimming.

The Lake George Water Treatment Plant is within the watershed boundaries.

There are varying amounts of populations of birds such as geese, seagulls, ducks, loons, etc.

Some cattle have been noted to be kept within the watershed boundaries.

Contamination Risk

Based on the knowledge of what is observable within the boundaries of the watershed, likely associated risks can then be identified. The identified contamination risks can then be monitored by evaluating results of the concentrations of associated analytes over time.

For example,

- a) If residential properties within the watershed had malfunctioning septic systems, water samples taken in the area could reveal an increase in coliform and/or fecal coliform counts, increases in nutrients, a decrease in dissolved oxygen and so on.
- b) Unauthorized harvesting of the forest or improper harvesting (clear cutting) could cause an increase in turbidity of the sample sets due to accelerated erosion, and/or unnaturally quick run off during large precipitation events.
- c) Sample sets could reveal that total petroleum hydrocarbon concentration has increased from baseline data due to improper handling of petroleum products particularly around residential sections of the watershed, or due to vehicle related leakage.
- d) Chloride and or sodium concentrations may begin to rise if there is excessive road salt usage.
- e) The Lake George Water Treatment Plant (LGWTP) uses various chemical agents as part of the treatment process which could negatively impact the lake if large amounts were accidentally released.

Reviewing Data

Baseline data will be gathered over the next several years. Statistical analysis of the results will guide the decision making process for LGWPP modifications and intervention activities if required.

Typical standard water quality indicating parameters that will be monitored will include, temperature, DO, pH, conductivity and fecal coliform.

Baseline data will be acquired over a period of time using the results of measurement of those parameters to show the present state of health of Lake George Watershed.

Also, the following parameters will be analyzed as well to give further baseline information of the quality of Lake George water presently and to help monitor analytes which, if began increasing in concentration, would signify a potential contamination event associated with identified risks;

- Nitrates – excessive fertilizers, septic tank mal-functioning
- Chlorides – road salt within watershed
- TPH (Total Petroleum Hydrocarbons) – residential oil usage, forestry operations, lube oil, petrochemical sudden leak event
- TOC (Total Organic Carbon) – increases in concentrations can be a good indicator of an organic contaminates (pesticide/fertilizer or improper activities allowing excessive organic material to enter and decay) in the lake.
- Phosphates – from improper use of fertilizers.
- Metals –industrial activities/products.

Preparing for Lake Sampling

- Check/prepare boat
- Ensure life jackets, oars, spare rope, anchor, and other required safety equipment are present.
- Check proper function of electric motor and batteries.
- Review required sampling for day; ensure correct type and number of containers and preservative methods (ice, pH adjustment, etc.).
- Check meters and probes for proper function; check that calibration is conducted according to manufacturer's recommendation.
- Ensure appropriate size cooler for sample transport.
- Check depth finder/GPS for proper function.
- Check sampling device for proper condition.
- Ensure proper log book/recording equipment is on hand.

Sampling Procedure

- At designated sampling site, make note weather/environmental conditions, time, date, and general observations in area and in water.
- Carefully and slowly lower anchor. When anchored record GPS position and depth.
- Ensure probe and meter are clean and ready for proper use.
- If taking samples at various depths for independent lab analyses, ensure sample containers are properly labelled. Carefully rinse with distilled water between samples.
- Take general parameter readings with probe, first at top, middle, and bottom.
- If it is noted that a thermocline (more than 1°C change over 1 meter or less) is present, sample thermocline at its top, bottom and middle, with both probe/meter and independent lab container sampling.
- Make careful note of readings from probe/meter.
- Conduct depth sampling with prepared sample containers. Ensure proper notes/labels and store in cooler with ice.
- Ensure proper preservation methods are conducted according to requirements of Standard Methods for Examination of Water and Wastewater.

For the analytes of interest, the specific storage/handling requirements as per standard methods for the examination of Water and Waste Water 22nd edition as follows:

Total organic Carbon	Glass or plastic	1 litre cool to $\leq 6^{\circ}\text{C}$ add HCl to pH <2
Chloride Color	p or g	50 ml no preservation 50 ml cool $\leq 6^{\circ}\text{C}$
Conductive	p or g	50 ml cool $\leq 6^{\circ}\text{C}$
Metals	p or g	50 ml for dissolved metals filter immediately nitric acid to pH<2
Nutrient	p or g	100 ml cool $\leq 6^{\circ}\text{C}$
Dissolved oxygen		300ml analyze immediately
pH	p or g	50 ml analyze immediately
Temperature	p or g	immediate
Turbidly	p or g	analyze same day
Total Petro chemical	p or g	
Hydrocarbons		lab supplied sample containers and cool to $\leq 6^{\circ}\text{C}$

Appendix G

Town of Yarmouth Forest Management Plan



**Federation of Nova Scotia Woodland Owners
&
Mersey Tobeatic Research Institute
FSC Woodlot Certification Program
WOODLOT MANAGEMENT PLAN
1157**



**Prepared for
Town of Yarmouth's Lake George Watershed**

**Prepared by
Patricia Amero, RPF, & Sandy Hyde, Forest Technician,
Picea Forestry Consulting & Woodlot Services**

November 20, 2013

I, the woodlot owner:

- Endorse the Principles and Criteria of the FSC and the Maritime SLIMF Standard (2008)
- Have reviewed this plan and commit to its contents
- Agree to manage the woodlands covered by this plan for a period of 10-years
- Agree, to the best of my ability, to implement the recommendations made in this plan
- Understand that this plan needs to be reviewed and revised within 5-years of signing

I, the woodlot management planner:

- Have reviewed the contents of this plan with woodlot owner
- Assure the recommendations in the plan were made to meet FSC requirements

Woodlot Owner(s)

Date

Woodlot Management Planner

Date

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1. INTRODUCTION

1.1 Landowner Information:

Name(s): Town of Yarmouth c/o Town Engineer, Dave Ernst

Address: 400 Main Street, Yarmouth, NS B5A 1G2

Telephone: 902-742-7525

Email: engineer@townofyarmouth.ca

1.2 Management Planner Information:

Name: Patricia Amero & Sandy Hyde

Organization/Company: Picea Forestry Consulting & Woodlot Services

Address: 324 Mossman Station Rd., West Northfield, NS B4V 5B7

Contact Info: Office phone: 902-527-1222, Cell: 902-890-4038,

Email: picea.forestry@ns.sympatico.ca

Describe credentials: Patricia: Registered Professional Forester (RPF); Sandy: Forest technician, Certified Forest Ecosystem Classification Instructor

1.3 Area of Woodlot:

The total area of the properties is 374.14 hectares (924.53 acres), which 362.80 hectares (896.50 acres) consists of forest land that includes 25.68 hectares (63.46 acres) of old field in early stages of reverting back to forest (refer to section 2.3 for more details).

1.4 Location of Woodlot: Lake George, Yarmouth County

This woodlot is situated within the Lake George Watershed with Parcel Identification Numbers (PID#s): 90149808, 90149626, 90149659, 90150020, 90150046, 90150202, 90150244, 90150285, 90145418, 90145343, 90145376, 90145368, 90236068, 90236050, 90145533, 90145590, 90145632, 90114331 and 90111808. Please refer to the parcel boundary PID map in **Appendix I** and the woodlot location map.

{Please note all maps referred to in this document can be found at a larger scale, via the attached digital files, at the Town of Yarmouth's office and as part of their GIS systems.}

All parcels that comprise the woodlot directly border areas of Lake George except for PID#s 90145343, 90236050 and 90145530. This watershed has a long history of serving the Town of Yarmouth with a continuous, clean source of drinking water; see section 2.5 for more information regarding the history. The Lake George Watershed is designated as a protected water area and there are restrictions on activities that can occur within the designated watershed area. Please refer to **Appendix II** to view the

Lake George Protected Water Area Designation and Regulations including the map outlining the protected water area boundaries. These regulations can also be found at the Town of Yarmouth's office.

1.5 The primary purpose of the Woodlot: To continuously supply the Town of Yarmouth with a high quality source of drinking water.

1.6 Strategies for Meeting Management Objectives, Table 1

Landowner Objectives	Strategy to Implement	Target Treatment/Timing
<i>1. Promote a healthy, diverse forest.</i>	<i>Apply appropriate low impact ecologically based management practices that will maintain ecosystem health and productivity over the long term.</i>	<i>Implement a combination of partial harvest systems that promote uneven aged conditions, species and structural diversity; such as single tree selection, group selection (small patch cuts), commercial thinnings, etc. Increase components of downed woody debris for nutrient cycling and moisture holding capabilities that help enhance ecosystem productivity.</i>
<i>2. Maintain / enhance water quality of Lake George</i>	<i>Protect water flow and quality of all watercourses, wet areas and seepages. Limit / prevent ground disturbance during any activities particularly involving machinery. Follow recommended guidelines for special management and machine exclusion zones.</i>	<i>Identify sensitive areas such as seepages, imperfectly drained sites prior to any activities. Pre-plan location of main roads and extraction trails that may be necessary to avoid sensitive areas. Plan to pursue activities during appropriate times of the year, which are during dry periods.</i>
<i>3. Optimize growth and development of best trees.</i>	<i>Identify best trees in forest stands, apply various tending treatments.</i>	<i>Apply periodic crop tree release and crown thinning treatment activities as growing space is necessary for crop tree crowns to fully develop.</i>
<i>4. Maintain sustainable harvest levels of wood volumes; with an aim to provide a sustainable range of forest products, revenue, along with the full suite of forest values.</i>	<i>Develop harvest regime based on tree growth and silvics.</i>	<i>Use the annual allowable cut as calculated in section 4.2. as a guide to follow.</i>
<i>5. Maintain & enhance wildlife habitat</i>	<i>Similar to objective #1. Consult wildlife biologist.</i>	<i>Similar to objective #1.</i>

6. Maintain readily identifiable parcel boundary lines.	Renew and in some cases re-establish location of boundary lines	Identify lines, cut / brush out lines, blaze trees & paint blazes. Once all renewed check lines regularly and upgrade as required.
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For an outline of various stand-level silviculture recommendations, please refer to Table 6 in **Appendix XV**. In regards to priority level and eligibility for silviculture funding please refer to the recommended silviculture summary, Table 7 in section 5.2. For recommended timing of silviculture treatment implementation please refer to the ten year operating plan in Table 8 of **Appendix XVII**, and associated map in **Appendix XVIII**.

1.7 Current uses for the woodlot include:

1. The primary use for the woodlot is to filter water entering into Lake George from the forest. |
2. Other uses of woodlot are primarily for recreation activities namely hiking. |
- |

Forecasted uses for the woodlot include:

1. Similar to #1 above. |
2. To conduct low impact, small scale harvest and silviculture activities that are ecologically based and promotes growth of a range of high quality forest products, as well as diverse forest conditions, to provide opportunities to generate revenue to invest back into the woodlot. |
3. To establish a modest access network to make for safe and efficient harvest and silviculture operations as well as to enhance recreational activities and provide ample opportunities for education to neighboring communities. |

1.8 Socioeconomic Conditions:

| Since this woodlot is located in the southern end of the Province markets for various wood products are limited to a few options in nearby counties in order to make it financially feasible to transport. The current available markets for spruce and pine sawlogs include Harry Freeman & Sons Lumber Ltd. located in Greenfield, Queens County, Hurlburt Lumber Ltd. located in South Ohio, Yarmouth County, and Lewis Mouldings & Wood Specialties for solely Pine log markets located in Weymouth, Digby County. AFT Sawmill Ltd. in St. Joseph, Digby County, is the only market for hardwood sawlogs in the western region of NS. There are two facilities that purchase low grade, biomass wood, one located at the old Comeau Lumber site in Meteghan, Digby County, and the other located in Brooklyn, Queens County, formerly Brooklyn Energy. Firewood is in continuous demand so markets for low grade hardwood as firewood would vary

within the county from either small scale or large scale firewood producers. Access to these aforementioned markets are considered fairly good however prices for all products vary considerably with the season and annually; currently prices are low for the producer when compared to what they were 5 years ago.

Subsidies are available for various silviculture work from some of these mills as well as from the Association for Sustainable Forestry (ASF). However the amount and distribution of available funds tends to be rather inconsistent and unpredictable on a year to year basis. These funds are primarily for small and large private woodlot owners preferably woodlots that have forest certification. The availability of contractors to do small scale harvesting and silviculture work in this and in many areas of Nova Scotia remains a huge challenge.]

1.9 Commitment to Sustainable Forest Management:

Management recommendations for this woodlot were developed to meet the Principles and Criteria of the Forest Stewardship Council (FSC) of Canada's Maritimes Standard for Small and Low Intensity Forests. This plan was designed to cover a 10-year period, with a 5-year review, but management strategies should consider an ecological timeframe of 100+ years.

Resulting management activities shall be implemented in compliance with applicable legislation, based on Nova Scotia's Best Management Practices, and with a commitment to long-term, ecologically sustainable forest management. The primary goal of this program is to manage forests in a way that restores, maintains or enhances conditions found in healthy Acadian Forests.

The FNSWO will provide encouragement and education to landowners to help them achieve their specific objectives, while developing strategies that consider long-term forest health. The latest understanding of forest ecosystem dynamics has been used in developing this plan. Recommendations were given to help achieve the specific objectives of the woodlot owner. However, because of the diverse factors affecting forest development, the plan writer can assume no liability for future forest conditions.

2. GENERAL PROPERTY DESCRIPTION

2.1 Ecological Landscape Classification and Positioning:

The woodlot is part of Nova Scotia's | Western | Ecoregion, the | Clare | Ecodistrict and | Ecosesions IMHO- imperfectly drained, medium soil texture, hummocky, and WMHO- well drained, medium soil texture, hummocky. | Please refer to Ecosesions Map of the Woodlot in **Appendix III**. The glossary for Ecological Land Classification Acronyms for Ecosesions mapping can be found in **Appendix IV**.

Information from the provincial "Ecological Land Classification for Nova Scotia" pertinent to the woodlot can be found in **Appendix V**.

2.2 Property Title:

Copies of various Schedule “A” documents of the deeds for each parcel can be found at the offices of the Town of Yarmouth.

2.3 Woodlot Description:

1. Forest Lands vs. Other Land Uses

There are a total of 66 stands that span over the entire 374.14 hectares of land area. Of these 66 stands, there are 63 stands that constitute 362.8 hectares of forest land. This forest land area includes 269.81 hectares (37 stands) of the coniferous, deciduous, and mixedwood forest types, 29.87 hectares (12 stands) of swamp or the Wet Coniferous (WC) and Wet Deciduous (WD) forest types, 37.44 hectares (5 stands) of the Old Field vegetation type (OF) that are dominated by mature White spruce, and 9 stands classed as early stage old field sites comprising of 25.68 hectares which are in various stages of reverting back to forest mostly dominated by Alders. The remaining 3 stands are classed as non-forest use, which 2 stands are currently used as agriculture fields totaling 5.25 hectares, and the remaining 6.09 hectares (15.06 acres) is stand 48 an old mill site.

The total operable area of woodlot stands constitutes 332.93 hectares or 91.8% of the total forest land. This total operable area includes the 25.68 hectares of early stage old field stands in processes of reverting back to forest, but does not include stands classified as swamp or as non-forest use. The operable area of the woodlot is where forest management activities should be concentrated. Please refer to the Woodlot Stand Map in **Appendix VI**.

2. Species Distribution

The primary softwood tree species within forested stands include:

- Red spruce, White spruce, Black spruce, Balsam fir, and Tamarack larch

The primary hardwood tree species within forested stands include:

- Red maple, Yellow birch, White birch, White ash, Beech, Poplars (Trembling and Large toothed aspen, and Sugar maple

Please refer to the stand information table in **Appendix VII**, and **Appendix VIII** for tree species code definitions.

3. Age Structure and Distribution

Dominant tree age tends range from 40 to 60 years old throughout the woodlot as a result of previous disturbances. Thus most stands are currently at immature to pole stages of growth or just reaching maturity depending on species (short lived species i.e., Balsam fir versus long lived species i.e., Red spruce reach maturity at different physiological ages).

Majority of stands are even aged consisting of one dominant age class. Stand areas along the west side of the Lake are mostly old field sites currently in stages of reverting back to forest.

The stand information table in **Appendix VII** outlines age as maturity levels which range from regeneration, 1 – 20 yrs (class 1) - Pole stage, 40-60 yrs (class 3) – Mature, 80 yrs (class 5), etc, please refer to **Appendix VIII** for the full list of maturity classes, their associated number identifier and definition; as well as tree species code definitions. Please refer to **Appendix IX** for the Woodlot Age Class Map.

4. **Current Acadian Forest Attributes**

The woodlot is situated within the Acadian Forest Ecozone and as such displays all the characteristics of the Acadian Forest with a mixture of long lived species of Red spruce, Yellow birch, White ash, Beech, and Sugar maple and shorter lived species of Red maple, White birch, Balsam fir, White spruce, Black spruce, Tamarack larch, and Poplars.

5. **Wetlands/ Bogs/ Streams**

There are 12 stands, #s 5, 6, 9, 16, 38, 45, 50, 52, 54, 55, 60 and 62 that are treed wetlands or swamps and are either classified as Wet Coniferous or Wet Deciduous forest vegetation types. Many of these stands are wet throughout the year and contain a small stream flowing through them which drain into the Lake.

All operable forest stands are mostly imperfectly drained and have occasional seepages. These features were not mapped during the field cruise. It is recommended to identify such sensitive features during pre-treatment assessments prior to commencing activities.

6. **NS Soil Series and FEC Forest Soil Types Distribution, Table 2**

NS Soil Series Mapping	NS FEC Forest Soil Type (ST)	Wetter ST found on lower slopes	Drier ST found on upper slopes	Stands where ST was found
Deerfield	3,3L	4,4L	2,2L	3,23,33,34,54,55,60,62
Deerfield	9	10	8	1,2,24,25,26,27,28,29,30,31,32,35,36,37,38,39,40,41,53,56,57,58,59,61,63,64,66
Yarmouth	3,3L	4,4L	2,2L	12,16,18,22
Yarmouth	9	10	8	14,15,17,19,20,21
Bridgewater	3,3L	4,4L	2,2L	42,43,45,47,49,50,51,52
Bridgewater	9	10	8	44,46
Pitman	3,3L	4,4L	2,2L	4,5,6,7,8,9,10,11

As described in the Soil Survey of Yarmouth County conducted by the NS and Federal Departments of Agriculture in 1960, the Yarmouth, Deerfield and Pittman soil series are derived from moderately coarse-textured glacial till parent materials of primarily schist though local variations containing granite or quartzite materials occur. In such areas the till is more coarse and stony. The Pittman soil series is poorly drained, the Deerfield soil series is mostly imperfectly drained, and the Yarmouth soil series tends to be more moderately well drained but smaller areas of imperfect drainage do occur.

The Bridgewater soil series is derived from medium-textured glacial till parent materials of primarily slate. This soil series is generally well drained except in areas where bedrock is close to soil surface which creates imperfect to poor drainage characteristics.

7. *Topographic Features*

- a. **Slope:** Mostly gradual / gentle long slopes. No steep slopes.
- b. **Aspect:** Variable, depending which side of the Lake you are facing
- c. **Elevation:** ranges from 40 meters to 70 meters above sea level. Higher elevations are more characteristic on the east side.
- d. **Drainage:** Majority of stand areas are imperfectly drained or worse, with occasional seepages.

8. *Roads, Trails, Access and Infrastructure*

Access to the various parcels are provided by the Lake George Road in the west, the Breton Road in the south, and the Brazil Lake Road and Lake Annis Road in the east. Other than this access to the parcels, there is very limited to no current access within woodlot stands of each of the parcels. The few roads and/or trails that were found have grown in and currently are only passable by foot. These were located within parcel #s (starting in the northeast):

- 90111808; there were two old truck roads that accessed this parcel from the Lake Annis Road. One road traveled from the north and the other road traveled from the east. The old road traveling north passes through one adjoining landowner, NSDNR. The old road traveling from the east travels through 2-3 adjoining properties. If desire to use both access roads each will require various forms of re-establishment and agreements with adjoining landowners. It may be considered more cost effective to re-establish and maintain one road, preferably the road to the north since it only passes through one adjacent property.

- 90114331; there is an old road that travels from the Brazil Lake Road through a residence area of an adjoining property, and through the agriculture field (stand 13) which continues through the center of this parcel towards the Lake in stand 21. This road needs upgrading and may require re-establishment depending on the degree of use.

- 90145632; there is an old road that travels north from the Brenton Road through a residence area of an adjoining property and continues to travel within the east section of this parcel to reach near the top of the point in stand 35. This road forks approximately 460 meters from the south property boundary line in stand 33 and continues northwest through stand 39 to reach the southern end of stand 34. In many areas the old roads have become unidentifiable due to amount of growth. Therefore if wish to obtain access these old roads will require full re-establishment.

- 90150202 & 90150020; each of these parcels have a well maintained road traveling through them (stand 3) to access adjoining cottage lots near the Lake. However these roads may not be able to be used for forest management activities due to the degree of disturbance by machinery and logging trucks that may occur.

- 90149626 & 90149659; there is a road of fair condition that provides access to the north section of parcel #90149626 from the Lake George Road. Beyond this point the road condition becomes poor and unidentifiable due to amount of vegetative growth. The entrance of the road is gated at the main road and rights to use this road to access these two parcels are uncertain. If possible an agreement to use and help maintain this road must be established especially if desire to extend / re-establish access into these parcels in order to conduct improvement activities.

- 90149808; the road heading southeast from the Lake George Road to the old mill site and to stands within this parcel is in relatively fair condition but could use some upgrading. However there is no merchantable wood remaining within woodlot stands to extract to help offset the cost of road improvements.

All these parcels listed except for PID#s 90150202 & 90150020 can only be accessed by crossing through adjoining parcels of different ownership, which right-of-way agreements are uncertain.

All remaining parcels, including PID#s 90150202 & 90150020, directly adjoin a government road, either the Brenton Road in the south or Lake George Road in the west, which provides access to them. However there is no direct access off of these government roads to get onto or through these parcels.

The only infrastructure found within woodlot stands are two old camps in stand 42 of PID# 90149626. It was evident these camps have not been used for some time.

9. Protected Areas- Riparian & Special Management Zones

The woodlot resides within the Lake George Watershed Protected Water Area designated as such in 2006 under the NS Environment Act by the Minister of Environment; please refer to section 2.5 on land history below for more information. (Please refer to **Appendix II** for the Lake George Protected Water Area Designation and Regulations as well as the map that outlines the protected water area boundaries.) Thus the woodlot is part of a critical riparian zone that continually filters ground water and steadily drains water into Lake George. Basically the forest acts as a sponge to

absorb, filter and slow the water flow from the sky to various water bodies. This works most effectively when the forest contains multiple age classes, contains fallen deadwood, and dominant canopy cover is at least partially maintained.

It is recommended that all parcels that comprise the woodlot be considered a “special management zone (SMZ)” and have precautionary measures applied to ensure all activities that occur within woodlot stands are of low impact and will not jeopardize ecological processes. If such precautionary measures are not applied this can have serious negatively impacts on water flow thus quality and supply. It is further recommended to regulate where, when and what heavy machinery can be used within woodlot stands. It is also highly recommended to establish “Machine Exclusion Zones” or “MEZs” within 15 meters of the Lake shore and of watercourses with streambeds classified greater than 50cm. The MEZs prevents machine traffic within such sensitive and critical areas of the larger riparian zone; therefore ensuring no ground disturbance occurs. Smaller watercourses and seasonal streams with streambeds less than 50cm wide should have a 10 meter MEZ from the watercourse banks.

As part of special management within woodlot stands an average basal area of 20m²/ha should be continually maintained, as much as possible, throughout forested areas particularly within 100 meters of the Lake Shore. This practice would help to ensure continuous partial canopy is maintained that will aid in regulating water filtration and flow.

This recommended designation of the special management and machine exclusion zones within the woodlot goes well beyond Nova Scotia’s legislated Watercourse Protection Regulations. This legislation requires the riparian buffer (or special management area) be maintained at a minimum of 20 meters from the Lake Shore and from the shore of watercourses with a streambed greater than 50cm width. Within the 20 meter buffer an average basal area of 20m²/ha must be maintained. For MEZs the legislation requires the width to be 7 meters for watercourses with streambeds greater than 50 cm wide. For watercourses with streambeds less than 50cm width the MEZ is required to be 5 meters. Please refer to section 7 for NS’s Wildlife habitat and Watercourse protection regulations. It is important to keep in mind these regulations were developed for traditional forest management on private, industrial and crown lands, not for management within watershed areas.

Majority of maps as part of this management plan outline the approximate location of the legislated thus required 20 meter riparian buffer zone as well as the recommended 100 meter special management zone. The protected water area boundary are also included on most of the enclosed maps.

10. High Conservation Value Forests (HCVF) – NOT APPLICABLE

Principle 9 of the FSC Maritime Region Standard focuses on HCVF. This includes identification, assessment for particular values with consultation from experts, documented strategies for maintenance and enhancement, specific measures for management, and annual monitoring to assess effectiveness of conservation measures.

There were no HCVPs identified within this woodlot mainly due to the extent of anthropogenic disturbance in this area since early European settlement and the current early successional stages of woodlot stands.

11. Landscape Aesthetic Considerations

A low impact, ecologically based approach to forest management and operations will enable maintenance and enhancement of aesthetic appeal by not implementing large scale, intensive harvesting and silviculture and excessive road building. As such this will not cause negative affects to neighbors and those who use the woodlot for recreational use but rather enhance their activities.

12. Landscape Connectivity Opportunities

There are opportunities to educate and promote ecosystem based forest management and low impact operations to adjacent landowners by providing examples of such practices within the woodlot which is an important watershed to neighbors and the Town of Yarmouth. The aim of such education is to promote awareness of the importance of conserving forest conditions in a responsible manner so we can all benefit from such critical use as clean and high quality water, as well as the range of other values provided. This may encourage adjoining landowners and others in the community to follow a similar management philosophy.

There may be environmental groups in the area that may wish to team up with the Town of Yarmouth to develop and deliver such education and outreach to neighboring communities, which could include school children, particularly as some woodlot activities get underway..

2.4 Parcel Boundary Lines

Majority of boundary lines surrounding the various parcels of the Town of Yarmouth were not identifiable on the ground. There were a few exceptions where they could be found, these include (starting northwest to northeast of Lake George):

- > PID# 90149808- boundary lines surrounding this parcel were readily identifiable
- > PID# 90149659- the north boundary line could be located however in the south section the boundary line that separates this parcel from an adjoining landowner (PID# 90232893) was not readily identifiable.
- > PID# 90114331- north and south lines were readily identifiable; however the adjoining cottage lot at the Lake shore was not readily identifiable.
- > PID# 90111808- only the south boundary line could be intermittently identified.

The main types of markings of identified parcel boundary lines were old blazes, old fence lines and old rock walls.

The parcel boundary lines surrounding cottage lots of adjoining landowners along the Lake shore adjacent to PID#s 90150020 and 90150202 could not be located. There appears to be infringement onto the Water Utility's land by these adjacent cottage lot owners.

Majority of adjacent landowners to the Town of Yarmouth properties are privately owned; the exception is in the north where land is owned by the Crown, NS Dept. of Natural Resources. Please refer to section 5.4 for parcel boundary line recommendations.

The property boundary lines as delineated by the Province's Land Registry Information System were used in the development of this management plan, refer to **Appendix I**.

Please note any stands with property boundary line issues must be addressed and identified on the ground prior to any access establishment and harvest activities being completed.

2.5 Land History

Areas near the sea shore across Nova Scotia have experienced a particularly long history of settlement and land use patterns especially for farming and forestry related purposes. In the case of Lake George, clean water of continuous supply has been a main focus of Yarmouth area residents for over 100 years.

Lake George was officially declared as the Town of Yarmouth's water source in 1879 and the Lake George Water Company was incorporated to provide Yarmouth residents with water. In 1891 the Town of Yarmouth purchased control of Lake George and distribution from the Lake George Water Company. This was the beginning of a long history for the Town and their concern for water quality and supply. The Town's focus has continuously been to upgrade water utility systems and purchase properties within Lake George watershed zone as opportunity permitted to ensure high quality water supplies.

The Town began acquiring parcels surrounding Lake George soon after the watershed area was defined and prescribed under the Water Act in 1964. The earliest parcels were acquired in 1966 (PID# 90145533) and in 1967 (PID# 90145632) within the south section of the Lake. The most recent acquisitions occurred west of the Lake in 2011 (PID# 90149626) and in 2007 (PID# 90149659). Currently the lands owned by the Town's Water Utility within the watershed encompass 19 parcels (PID#s). In 2001 the watershed zone was designated as the Lake George Watershed Zone by the Municipality of the District of Yarmouth in its Municipal Planning Strategy and Land

Use Bylaw. A map was prepared of the protected water area boundary by the Town Engineer in 2005; refer to **Appendix II** for the protected water area map. In 2006, the Lake George Watershed was designated as a protected water area under section 106 of the NS Environment Act approved by the Minister of Environment. As such, new regulations were approved by the Minister that respects activities within the Lake George Watershed Protected Area; refer to **Appendix II** to review the regulation document.

In 1981 the Town had a management plan prepared by Forsite Ltd. At that time the total area of the parcels owned by the Town of Yarmouth surrounding Lake George was 174 hectares (435 acres) which encompassed approximately 10 parcels. Many parcels, as included in the 1981 plan and this updated plan, are either abandoned farmland reverting back to forest or were heavily cut over or high graded, resulting most likely of the influx of forestry activities after the Second World War.

Very minimal forest management activities or access establishment were pursued as recommended in the 1981 management plan. This woodlot seems to be primarily used for recreation by neighboring residents.]

2.6 Challenges and Opportunities

Challenges:

1. Limited access network to and within many forest stands
2. Majority of stands have moist soil with imperfect drainage characteristics.
3. Lack of experienced and willing contractors to apply uneven aged management techniques using an ecological based approach. Large machinery and extensive cutting tends to be the norm in the industry that doesn't fit well within such a sensitive watershed area.
4. Volatile markets conditions in terms of availability and prices.
5. Many parcel boundaries are not readily identifiable.]

Opportunities:

1. Large forest ownership of approximately 362.8 hectares.
2. Generally high productive site capabilities of desired species such as Red spruce, Yellow birch, White ash.
3. Presence of shade tolerant species in many areas of the woodlot together with productive site capabilities set the stage for uneven aged management and applying partial harvest practices to maintain contiguous forest cover while promoting growth of existing trees and for natural regeneration establishment of these species

4. Location of the woodlot in close proximity to the Town and surrounding communities provides opportunities for education activities to promote awareness of how important a healthy forest ecosystem is in order to maintain clean water of continuous supply. |

2.7 Significant Habitats and Species-at-Risk

Determined by:

- a) On-site observation by Forest Manager at time of plan development

| There were no observations made of significant habitat or species at risk within woodlot parcels during forest inventory assessment. |

- b) Discussion with landowner

| There were no significant historical observations were made by landowner or other users.

- c) Significant Habitat and Species-at-Risk on line viewer map

| As per reference to the NSDNR online viewer map, there were no significant habitat or species-at-risk identified within the woodlot (website:- <http://gis4.natr.gov.ns.ca/website/nssighabnew/viewer.htm>).

However significant habitats were identified on islands within Lake George, which these properties are owned by NSDNR. This is of particular interest because the identified significant habitats are within 1 kilometer of woodlot boundaries and is important to note since access development and harvest operations in proximity to the Lake can have potential negative effects on wildlife use patterns on the islands. The significant habitat codes and corresponding species as identified for these islands, on the online viewer map, are as follows:

> YA 5 & YA 30 = both refer to Great Blue Heron and Greater Black-backed Gull nesting colonies.

> YA 6 & YA 7 = both refer to Greater Black-backed Gull nesting colonies

> YA 28 & YA 29 = both refer to Greater Black-backed Gull and Double Crested Cormorant nesting colonies.

Please refer to **Appendix X** for the significant habitat and species map.

- d) Notes from local DNR wildlife biologist

| Notes from the local wildlife biologist include: For the most part wildlife habitat on the islands would not be affected by harvesting in the area unless it was done at a large scale.

The management interpretations for these habitats would be to follow the Wildlife Habitat and Watercourse Regulations, as outlined in section 7 of this document, and leave sufficient buffers along the Lakeshore, watercourses and wetlands when harvesting timber. If harvesting were

done near one of the colonies they should postpone the harvesting until after the nesting season i.e., after August 15th.

To conclude, since an extended riparian / special management zone is recommended along Lake George and watercourses and there are no large scale harvest operations recommended within this woodlot the risk of negatively influencing these significant habitats are considered low. |

3. FOREST MANAGEMENT STRATEGY

This section outlines the woodlot owner's general strategy towards forest management. Many factors contribute to the selection of site-specific management techniques. The FSC Maritime Standard and the FNSWO/MTRI have identified a set of minimum forest management requirements to ensure sustainable practices are employed during management activities. The FSC Maritime Standard requires forest management regimes that maintain, enhance or restore ecological functions and values, consistent with natural succession and disturbance patterns of the Acadian Forest. To guide the landowner's strategy toward achieving this overarching goal, each heading below is followed by key points that should coincide with all management activities conducted on FSC group-certified woodlots. The landowner's individual strategies are documented below these points.

3.1 Harvesting

- Protection of wildlife, habitat, watercourses and protected areas
- Minimize risk of fire and mechanical damage area in operation
- Pursue prescribed harvest treatments as appropriate to stand conditions, access, market conditions, and to promote healthy natural regeneration
- Harvest methods should be designed to mimic historic local patterns of natural variability of ecological structures and functions on the site and surrounding landscape, including: a mixture of tree species, ages, diameters and height distributions; stand types; successional stages; natural range of canopy closure; maintenance of standing (snags) and fallen dead wood especially coarse sized woody debris; and natural disturbance regime appropriate to the ecosite
- Harvesting is restricted in HCVF and other protected areas
- Consider landscape impacts of the proposed harvest
- Utilize all harvested forest products to their full potential
- Utilize properly trained, competent and insured contractors
- Hire contractors and/or workers from the local area when possible

- Utilize equipment appropriate to site and prescription, time the operation to take best advantage of markets and minimize environmental impact
- Logging debris retained and distributed to protect soil and maintain forest productivity.

All management activities will be ecologically based of low impact that aims to prevent / limit ground disturbance, to maintain continuous forest canopy cover, and to encourage species and structural diversity. Such practices will help to maintain critical ecological functions and processes of a healthy, productive forest. This management philosophy is the underlying basis of all activities that may be pursued within this woodlot.

There are various activity restrictions pertaining to forestry related operations within the Lake George Watershed Protected Area, as outlined in the Forestry Restrictions of the Protected Water Area Regulations, Section 6, established in 2006, please refer to **Appendix II** for the regulation document. There are also restrictions on road construction and watercourse alteration, please refer to Sections 7 – 10 of the regulations in **Appendix II**.

3.2 Silviculture

- Protect wildlife habitat, watercourses, associated seepages and wet areas, including protected areas.
- Minimize risk of fire and mechanical damage area during operation. Ensure contractors have required suppression equipment.
- Pursue silviculture treatments as appropriate to stand conditions, access, market conditions, and to promote growth of Acadian Forest species.
- Maintain or enhance natural diversity, species distribution and vertical structures including standing deadwood and fallen deadwood especially coarse sized woody debris along the forest floor.
- Promote an appropriate mix of species according to site and soil conditions.

The aim of silviculture activities is to promote the growth and development of the best quality, most vigorous trees for high quality / high value end products while encouraging species and structural diversity and minimizing ground disturbance.

All management practices will aim to create / enhance natural forest conditions that will not require any use of biocides.

There are restrictions on both herbicide and pesticide (biocide) use to control competing vegetation, please refer to Section 11 of the regulation document in **Appendix II**. |

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3.3 Protected Areas

- Protected areas will be established on sites containing species-at-risk, significant habitat, identified heritage/ cultural sites as required by applicable legislation.
- Ecologically unique sites (HCVF) or features within a defined woodlot must be maintained or enhanced for biodiversity

During the course of management any identified cultural, archaeological, or other special feature within the woodlot, including significant habitat containing species at risk and/or High Conservation Value Forest (HCVF), will be mapped and either be classed as a protected or a special management area that would have precautionary measures applied during planning and implementation processes to maintain and enhance the integrity of these various important features.

3.4 Wildlife Management

- Maintain features used by wildlife during management activities; primary features to consider are mast trees, berry and fruit bearing trees and shrubs, trees with stick nests, tallest trees in the stand, large-diameter snags and cavity trees, and various size downed woody debris especially coarse (large diameter) size
- Maintain or develop a mixture of age classes, successional stages and vertical structural characteristics
- Protect watercourses, riparian zones, wetlands, seepages, vernal pools, and identified critical habitats such as deer wintering yards, raptor nest sites (stick nests), large cavity trees, old-growth or legacy trees (tall, large trees)
- Adjust management activities to protect as well as promote habitat for identified resident species.

Refer to section 7 which outlines Nova Scotia's Wildlife Habitat and Watercourse Protection Regulations.

It is recommended to have a wildlife survey completed by a local wildlife biologist to determine extent of available habitats within this forest and to identify wildlife currently utilizing the forest.

3.5 Access for Recreation

- Establishing and maintaining suitable access is paramount to woodlot management and recreation
- Recreational features should be protected during operations

- Multiple benefits from the forest for present and future use shall be maintained

[The main recreational use currently on the woodlot is for hiking; though this activity seems minimal and is likely due to the lack of suitable access.

There are various restrictions pertaining to recreational activities within the protected watershed boundary particularly in terms of use of the Lake, please refer to Section 4- Activity Restrictions of the Lake George Watershed Protected Water Area- of the regulation document in **Appendix II.**]

3.6 Non-Timber Forest Products

- Consider and evaluate timber vs. non-timber opportunities in potential stands
- Ensure any non-timber forest products management is sustainable
- Be aware of and follow applicable legislation and Best Management Practices during harvesting, road/trail establishment, and watercourse crossing / alternations.

3.7 Ecological Goods and Services

- Forests offer great services to society by providing natural air filters, water resources, erosion controls, carbon sequestration, recreational opportunities, and a wide variety of wood products and non-wood products such as berries, mushrooms, etc.
- The landowner must consider existing and potential services their woodlot provides, and implement measures to maintain or enhance these services by considering impacts of forest management as well as opportunities forest management actives may provide

The entire woodlot and surrounding properties are considered an important riparian area to Lake George and as such great care and precautions must be undertaken during any operation not to jeopardize forest ecosystem health and in turn the water supply.

3.8 Plantation Management

- No more than 10% of the forested land base may be plantation
- Plantations are forest stands where high intensity silviculture is used explicitly for timber production, leaving few features of a natural forest
- This non-natural succession results in limitations of: tree species diversity, stand structure, early successional habitats, mature trees and coarse woody debris

- Planted stands that exhibit a diversity of species and structure, and are not being managed intensively for rapid fibre growth are not considered plantations
- Areas recommended for planting must be sampled for FEC and have appropriate species recommended for the ecotype/ vegetation type, as listed on the FEC Vegetation Type management interpretations

The only instances where plantations may be established are on old field sites or in areas where seed sources are lacking in order to speed up the natural succession and species diversity of the site. Plantations will be of small scale, primarily fill planting to increase desired species stocking levels, and be of more than one species.

Table 3 Stands considered an established plantation

Stand #	Area Planted (ha)	% Total Forest Area	Species Composition	Year Planted	FSC Plantation?
63	2.1	0.6%	rS07,wS01,rM01,bF01	1973 approx.	No

This stand does not fully meet the FSC Maritime Region’s definition of a plantation since intensive silviculture is not recommended and there is increasing species diversity throughout the site.

Landowner objectives for areas classified as plantations are as follows:

Help restore the natural variability of the site in terms of promoting species and structural diversity, as well as aiming to increase components of various sized deadwood both standing and along the forest floor.

3.9 Integrated Pest Management

- Early detection of insect, disease or pest problems is crucial to effective control
- Forest pests will be controlled through sanitation harvesting as much as possible
- Use harvest treatments that promote desired natural regeneration and discourage aggressive shade intolerant tree and shrub species, such as Grey birch, Pin cherry, thereby reducing need for competition control
- When competition control treatments are deemed necessary utilize manual means to control such competition

Biocide use is not recommended as part of this management plan. Management practices be conducted without the use of biocides and will create forest conditions that will not require any use of biocides.

The only exception where use of biocides may be deemed necessary is to control exotic, invasive species such as Glossy leaf buckthorn or other foreign species that could potentially occur and harm natural forest conditions. Such use will be very restricted, well planned, application by only ground methods, and will not be applied without first obtaining permission from the Water Works Operator and the Department of Environment, as outlined in Section 11 of the Lake George Watershed Protected Area Regulations document in **Appendix II**.

3.10 FEC Forest Management Guidelines

Please refer to **Appendix XI** for Table 4 that outlines ecological data collected for the woodlot, classified by using the Forest Ecosystem Classification (FEC) system for Nova Scotia as designed by the Ecosystem Management Group of the Nova Scotia Department of Natural Resources (NSDNR). Classifying ecosystems allows forest managers to speak a common language when describing forest conditions, and helps them to consider all components that may affect the outcome of recommended treatments. Understanding the natural disturbance regime of a site helps to develop and ensure appropriate long-term harvesting strategies are applied. With this FEC framework in place, treatment recommendations should be more appropriate on a site specific basis, and the results of implementation should become more consistent and predictable. Please refer to **Appendix XII** that outlines the forest vegetation types for woodlot stands. The FEC vegetation and soil type data sheets associated with this woodlot can be found in **Appendix XIII**.

All operable stands have a similar natural disturbance regime of infrequent (I) or gap (G) disturbances and all have similar soil hazard ratings of high rutting (RT) and compaction (CP) hazards due to similar soil characteristics throughout the woodlot. The following glossary defines disturbance regime and soil hazard rating as well as other FEC terminology that are used in the table.

Disturbance Regime (including wind, fire, insect/disease, senescence, flooding):

(F)- Frequent Stand Initiating: rapid mortality of existing stand with replacement by a new even-aged stand. Intervals between stand initiating disturbances often shorter than average longevity of dominant tree species, resulting in perpetuation of early to mid – successional vegetation types.

(I)- Infrequent Stand Initiating: same as above, but intervals between stand initiating disturbance events is normally longer than the average longevity of the dominant tree species, thereby allowing gap dynamics to become evident. Generally result in mid to late successional vegetation types.

(G) *Gap Mosaic*: seldom exposed to stand initiating disturbances. Characterized by mortality and regeneration of small patches, often resulting in stands with multiple age classes, leading to perpetuation of late successional vegetation types.

(M) *Stand Maintaining*: exposed to frequent but light disturbances that favour the survival of certain species, thereby allowing those species to maintain their dominance.

Soil Hazards: These are ratings of medium-high to high hazard potentials for certain soil types found on the woodlot. Following is a list of hazard categories:

(CP) Compaction Hazard- especially in wet and/or fine textured soils

(RT) Rutting Hazard- especially in wet and/or fine textured soils with high organic content

(E1) Erosion Hazard on slopes <10% and (E2) on slopes >10%

(FH) Frost Heave Hazard- as it affects planted or natural regeneration rooting

(WT) Windthrow Hazard- as influenced by potential rooting depth

(VT)- FEC vegetation type, classified as per Part 1: Vegetation Types of the FEC Guide for NS

(ST)- FEC soil type, classified as per Part II: Soil Types of the FEC Guide for NS

(ET)- FEC ecosite, classified as per Part III: Ecosites of the FEC Guide for NS

(LC)- Land Capability: ability of that site to grow wood, expressed as volume growth, per unit area in one year (cubic meters/hectare/year)

Successional Stage:

A brief description of the successional (development) stage for any given VT, as described in the VT fact sheet. (i.e. early, mid or late; also climatic vs. edaphic climax)

Old Growth

Stands within an ecosite (a function of VT and ST) that have high potential to develop into old growth forests are listed here, either as conifer, mixed or deciduous.

(TSS)-Tree Species Suitability: species suitable for natural regeneration or planting

4. STEWARDSHIP PLAN

4.1 Methodology to determine volume:

- Volumes reported in this plan are rough estimates only. The sampling intensity was low and designed only to provide a qualitative description of wood volumes. A more intense cruise would be required to provide accurate volume estimates
- Each delineated stand on the defined woodlot was sampled at a rate of

Stand Area (ha)	# Cruise Points/ha
< 3 ha	1
3-10 ha	1/2
>10 ha	1/4

- One cruise point/ stand was GPS recorded and the following data was collected:
 - average tree height, and age to determine site capability (m³/ha/year)
 - average tree diameter (SW & HW), basal area and species composition
 - FEC Vegetation and Soil Type
 - Current condition and recommended treatment

The total merchantable softwood volume on the woodlot is 6,027 cords.

The total merchantable hardwood volume on the woodlot is 4,121 cords.

This equates to an overall total merchantable volume of 10,148 cords.

Please refer to **Appendix XIV** for a more detailed account of stand volumes.

4.2 Annual Allowable Cut (AAC)

- To be expressed as calculated growth capability of woodlot (m³/hectare/year) multiplied by productive area of woodlot (hectares/woodlot) = m³/year/woodlot (or imperial measure of cords per year).
- Historical harvesting regimes should be factored into harvest rates
- Recommended harvesting and/or merchantable silviculture treatments should not exceed AAC for any given year, except in situations where over-mature, fire prone or disease/insect infested stand conditions occur
- AAC should not be exceeded over the 10-year course of the management plan
- Reductions in AAC must be made to reflect the percentage of operable area within stands recommended for harvest. There were no reductions in AAC made

because the wood volume inventory already accounts for only the operable stands of the woodlot. Rather the AAC was reduced to reflect the percentage of area classed as old field sites at early stages of reverting back to forest since these stands will remain unmerchantable for some time. This area of 25.68 hectares relates to 7.7% of the total operable area, thus the AAC as calculated below was reduced by this amount.

- Von Mantel's formula for AAC is: $Y_a = 2 \times G_a / R$. $Y_a = \text{AAC}$, $G_a = \text{growing stock or total forest inventory (cords)}$, $R = \text{Rotation age in years (softwood} = 80 \text{ years, hardwood} = 60 \text{ years)}$

For softwood: $Y_a = 2 \times G_a / 80 = 150 \text{ cords/year} - 7.7\% = 138 \text{ cords}$

For hardwood: $Y_a = 2 \times G_a / 60 = 137 \text{ cords/year} - 7.7\% = 126 \text{ cords}$

Total Allowable Harvest for softwood over a 10 year period = 1,380 cords, and for the Allowable Harvest for hardwood over a 10 year period = 1,260 cords. |

4.3 Operational Planning

- Woodlot management activities will be carried out in a manner that minimizes environmental impact by complying with applicable legislation, using Best Management Practices, and planning the timing of activities to correspond with appropriate seasons and soil conditions
- Landowner is responsible for ensuring boundary lines are clearly identified, objectives of activity are clearly communicated to workers, workers are competent and have liability coverage and proper safety equipment according to the scale of operation, FNSWO is contacted when harvesting, silviculture or road building activities are about to commence
- Fragmentation caused by road and trail establishment, and other conversion to non-forest use such as landings, will be minimized as much as possible through careful planning and construction
- Any required watercourse crossings, culverts, etc will first be approved by the Water Utility, and will be established well before commencing any forestry related activity

- Local contractors, forest workers and processing facilities will be used as much as possible to contribute to the well-being of local communities
- Any recommended treatments that may have major impacts on affected parties shall be documented in this section and require the landowner to communicate with potentially affected parties about the upcoming treatment- see information sheet provided by the Federation in the Pre-Entry Information Package

4.4 Financial Considerations

- When implemented, this management plan will support some of the requirements of the Intergenerational Tax Transfer (ITT). This is not applicable due to woodlot being municipally owned.
- Wood products expected to result from harvest and/or silviculture activities should have pre-destined markets determined prior to planning and commencing such activities.
- When forestry related work is sub-contracted an agreement that outlines conditions and payment arrangements pertaining to the desired work activities will be developed and signed by the contractor and the Water Utility signifying each understands their responsibilities.
- Proper and legible records of revenues and expenses pertaining to woodlot activities must be kept on record and readily retrievable.
- Proper planning and implementation can help balance revenues and expenses
- The projected economic gain of harvest and extraction activities should always be weighed against possible negative ecological impacts that could occur.

5. STAND INFORMATION & RECOMMENDATIONS

5.1 Stand Information

Stand information is displayed in table format, Table 5, in **Appendix VII**. The forest vegetation types of woodlot stands is outlined in **Appendix XII**; and the associated data sheets can be found in **Appendix XIII**. Other ecological management notes and guidelines are outlined in section **3.10** above, and **Appendix XI**.

There were very few woodlot stands noted during the field cruise that received previous silviculture or harvest activities. The most recent activity was the final softwood harvest (or clear cut) of stand 51 in 2002, which has regenerated well with Red spruce, Red maple and Balsam fir. This stand is located on the old mill site parcel (PID# 90149808) and was harvested prior to the Yarmouth Water Utility obtaining ownership.

In 1996 stand 4 received a pre-commercial thinning treatment which has a high component of vigorous Red spruce. In 1993 stand 10 received a final softwood harvest (or clear cut) which has also regenerated well with good stocking levels of desired species. The earliest known silviculture treatment was the Red spruce plantation established in 1974, stand 63, which is located just north of the Water Treatment Plant Facility (PID# 90236068). This is the only plantation identified within the entire woodlot. The planted trees continue to grow well but could benefit from some tending (thinning) activities to provide growing space for the best stems. This plantation is on one of the earliest parcels owned by the Yarmouth Water Utility.

Stands 15, 19, 25, 28, 29, 31, 36, 39 and 64 all contain various components of maturing White spruce at varying stages of decline due to their maturity level. The composition of White spruce tends to be 20% for 6 of 9 of these stands while stand 64 has 80% composition, stand 19 has 50% composition and stand 15 has 30% composition. Majority of the White spruce are at or greater than 70 years of age, while some stands (stands 15, 19, 29 & 64) contain White spruce between 40 – 60 years of age. These stands are at earlier stages of decline as compared to stands 25, 28, 31, 36 and 39 which are furthest progressed since they are standing dead, blowing over or have obvious crown dieback (thinning crowns). In such condition most of the economic value of the declining White spruce has been lost or is dwindling at a rapid rate as decomposition processes set in. However, material with such questionable economic value then becomes worth more ecologically for the wide range of functions it provides for wildlife, soil replenishment, helping to slow water flow, and so on. The material left on the forest floor poses low fire risks. This is mainly due to its high moisture content, imperfect soil drainage characteristics and our moist humid climate being in close proximity to the Ocean particularly regarding the amount of fog the area regularly receives.

Majority of operable forest stands have imperfectly drained soil characteristics or contain smaller sections of imperfect drainage, wet areas and seepages. Such drainage characteristics are prone to high rutting and compaction hazards caused by heavy machinery, as described in section 3.10 above. This creates great challenges for operational planning and implementation to ensure ground disturbance is avoided or at least minimized, since such disturbance can have serious negatively affects to surface and sub-surface ground water flow as well as long term site productivity and soil health. Proper access establishment, timing of harvest activities particularly extraction and type of harvest system used can help mitigate such negative impacts.

5.2 Silviculture Recommendations

The recommended activities as outlined in this section are based on the goals and objectives of the Town of Yarmouth and the forest inventory. Since the underlying goal is to maintain / enhance water quality and supply within the Town's watershed, the primary means to achieve this would be to allow this forest to filter water undisturbed by letting it develop naturally. This is

the ultimate assurance to protect fundamental ecological processes and natural water flow. However with careful management planning and implementation that follows an ecological, low impact based approach, forest development (restoration) processes can be sped up and forest conditions improved in terms of increasing species and structural diversity, forest health, as well as tree quality and value. Ecological disturbances particularly caused by ground disturbance i.e., rutting and compaction, water flow diversion, as well as fragmentation of the forest canopy can be limited with proper planning, layout of roads, trails and the harvest / extraction activity. If such disturbances can be limited during harvesting not to negatively affect important ecological features, functions, and water flow water filtration and supply can be maintained and even enhanced with time. Pursuing such activities also provide the means to educate neighboring landowners and the general public through demonstration regarding how ecological based forest management of low impact can be conducted within a watershed area. The underlying goal of such education is to promote the importance of low impact management practices within a watershed and how they can be implemented to encourage them to follow suit when implementing activities in their forest.

All management activities conducted at one time within a defined area or stand should be of small scale and of low intensity that mimics the common small scale natural disturbance patterns of the area. These tend to be weather related events particularly from high winds, accompanied with heavy snow and ice that cause individual trees or small groups of trees to blow down. It is recommended no more than 25-30% of the basal area be removed during each entry of harvest activity to maintain partial canopy and help minimize fragmentation and exposure.

It is important to keep in mind the greatest ecological disturbances during forest management are commonly caused by access establishment and using heavy machinery during harvest and extraction operations. Access, in terms of establishing woods roads and high speed extraction trails, can create a great deal of fragmentation of the forest canopy, exposure to the residual forest, and alterations of water flow such as increase surface run-off. Harvest operations on imperfectly drained sites with high rutting and compaction hazards can potentially have detrimental soil impacts which negatively affect ecological processes and long term productivity. The scale and intensity of harvesting in terms of removal of all or most dominant forest cover over large areas (i.e., large clear cut areas) exposes the forest floor to full sunlight and causes extremes in temperature fluctuations which can have similar negative impacts to soil health. Therefore it is paramount that decisions during forest management be based on site specific information to minimize / limit such potential detrimental impacts to soil and overall ecosystem health.

A crucial aspect of forest management and restoration is to complete pre-harvest assessments prior to commencing any activity to identify environmental sensitive areas and to obtain detailed site-specific stand inventories. This is valuable information to identify suitable locations to establish access and determine the most appropriate silvicultural treatment method to increase diversity of forest conditions as well as to increase timber and non-timber values while limiting possible ecological disturbance.

Pre-harvest planning, layout, access establishment and the actual implementation of harvest / silviculture activities that help to restore desired forest conditions and limit ecological disturbance can be considered costly with limited economic return over the short term.

Therefore it may be best to:

- Concentrate management activities in stands that are most cost effective to access and operate in, will yield the best results for efforts expended, and provide the best opportunities for demonstration and education for neighboring landowners and the general public.
- Concentrate on helping old field sites revert back to forest by fill planting a mix of species. Conduct fill planting trials in more open areas of some these stands. Consider planting older, taller seedlings that once established will be better able to handle the heavy vegetative competition. On a periodic basis manually control the vegetative competition immediately surrounding the seedlings with brush saws to help alleviate root competition until seedlings are established. The seedlings, particularly any planted hardwoods, will need to be protected from browsers such as deer, rabbits and mice. This can be done by placing a wire mesh (i.e., chicken wire) in shape of a cylindrical tube around the planted seedlings, and/or by placing brush piles around the seedlings to deter the rabbits and deer; however brush piles may not deter mice activity. Once seedlings are established, are well above the competition and tall enough to escape deer browsing of upper most branches the competition control treatments and protection from browsing may no longer be necessary to the same degree. Pursue a few trials to determine costs and effectiveness of the fill planting activity and protection measures to help ensure seedling survival.

It is important to keep in mind Alders that occupy many of these old field sites are an important ecological feature to help restore the site in terms of nitrogen fixation and cycling. Alders, or the majority of them, should be permitted to carry out their ecological function since they will eventually become overtopped and naturally replaced by tree species.

As mentioned in the section above, stands comprising of maturing White spruce have declined and continue to decline at a fast rate and consist of very limited economic value particularly when the costs of planning, layout, access, harvest and extraction are considered. By the time suitable access is planned and established any economic value that may remain will most likely be lost. The materials are then worth more for the ecological features and benefits they provide.

The silviculture recommendations as outlined in Table 6 and associated map of **Appendix XV** are based on the assumption that all factors influencing implementation are “lined up” or “ideal” for the activities to occur and be cost effective. Such key factors include: suitable access being available, desired available markets, having capable local contractors available to do the work, and the value of materials extracted together with available silviculture funding will cover the cost of activities including necessary access improvements. It is important to keep in mind financial inputs from the landowner are likely inevitable to improve or establish access particularly initially due to lack of current accessibility. Improving access is an important investment in order for certain management activities as well as for recreation and education activities to be possible over the long term.

For stands where no material is extracted due to being at early stages of development the ideal situation and overall aim is to have silviculture funding available to cover the costs associated with improvement activities such as for fill planting and thinnings that promote diversity, good growing conditions, tree quality and value. There may be instances where some financial inputs from the landowner are required in order to properly complete improvement (restoration) activities of these younger stands and other stands that lack current economic value. Financial inputs from the landowner would ideally be drawn from any possible revenue that may be generated from other merchantable harvest activities from the woodlot. Management activities that promote tree quality and growth will increase components of valuable forest products that will help make harvest activities more profitable over time. In turn this may allow more opportunities for investments to be put back into the woodlot.

Table 6 also indicates if stands are within the 100 meter special management zone from the Lake and thus contains a 15 meter machine exclusion zone. As described in section 2.3- #9, these 100 meter SMZs require precautionary measures be taken and no machine traffic is permitted within the 15 meter zone from the Lake or any watercourse.

Please refer to **Appendix XV** for the silviculture recommendations table, Table 6, **Appendix XVI** for the treatment code definitions for Registered Buyers program and Certification program, and **Appendix XVIII** for the ten year silviculture operating plan map.

Table 7 below provides a summary of silviculture recommendations for operable forest stands, an assigned priority level in terms of when to implement the proposed prescription, and if the activity is eligible for silviculture assistance from available funding programs. The priority levels range from low – moderate – high. Classifications are primarily dependent on when suitable access can be made available in order to efficiently carry out management activities in the stands. The high and moderate priority levels signify access could be readily available to stands with some investment due to their proximity to main government roads, while low priority stands indicate a longer distance to a main road thus greater cost involved to upgrade / establish suitable access. So even though some stands should be classed as moderate or high priority they are currently classed at the low priority level for treatment activity until access can be upgraded / established, which most would then be considered moderate priority. In the case where access can be made available in the near future, high priority classed stands are those containing a fair amount of declining White spruce volume that may be financially feasible to harvest and extract; as well as stands that show evident signs of insect or disease infestations which there are none. Stands classed as moderate priority signify majority of trees are growing well but conditions could improve and benefit from recommended silviculture activities. The low priority classification, other than what is described above, indicates attention is not required for 10+ years due to current stage of development or amount of wet and seepage areas in the stand.

Table 7 Silviculture summary of operable forest stands, priority level and silviculture funding eligibility.

Stand #	Silviculture Prescription	Priority Level (H - M - L)	Silviculture Funding* (as of 2013) Y or N
1	Selection harvest if markets for Larch are available	M	N
2, 24, 30, 40, 56, 66	Fill planting trials in sections of specified stands	M	Y- for fill planting
3, 15	Swd selection harvest	M	Y- for selection harvest
4, 7, 8, 11, 12, 43	Swd selection harvest	L**	Y- for selection harvest
10	Swd crop tree release	L**	Y- for crop tree release
14, 17, 49, 58	Leave as is due to amount of imperfect drainage and wet areas.	L	N
18	Hwd shelterwood	L**	Y- as selection harvest
19, 25, 28, 31	Group selection (patch cuts)	H-M	Y- for selection harvest
20, 23, 29, 33, 63	Swd commercial thinning	M	Y- for commercial thinning
21, 35, 37, 41	Hwd commercial thinning	L**	Y- for commercial thinning
22, 27, 39	Leave to grow, re-assess in 10 years	L	N
26	Hwd shelterwood	M	Y- as selection harvest
32, 53, 59	Hwd crop tree release	M	Y- for crop tree release
34	Swd commercial thinning	L**	Y- for commercial thinning
36	Group selection (patch cuts)	L**	Y- for selection harvest
42	Hwd selection harvest	M	Y- for selection harvest
44	Leave as is since on Island	L	N
46	Hwd Selection harvest	L**	Y- for selection harvest
47, 51	Re-assess in 8-10 years for possible pre-commercial thinning	M	Y- for pre-commercial thinning
57	Hwd pre-commercial thinning	M	Y- for pre-commercial thinning
61	Re-assess in 10 years for fill planting (as for stand 2 above) after results from initial trials are realized.	M	Y-for fill planting
64	Swd commercial thinning/partial harvest, followed up with fill planting in created openings	H	Y- for fill planting. (Not eligible for commercial thinning or selection harvest due to high composition of short lived species)

* If the associated 2013 provincial silviculture technical criteria can be met post-treatment.

** Due to no current access and distance to government road.

5.3 Access Recommendations

In order to carry out safe and efficient management activities an appropriate access network is necessary. Initial access establishment should be concentrated in stands / parcels where merchantable wood material will be extracted, where the potential economic return from silviculture activity and the resulting forest condition would be considered greatest.

An ideal access network is considered to comprise of a main truck road, landing and turnaround areas, high speed extraction trails off of the main road and/or smaller extraction trails with landings off the main extraction routes. High speed extraction trails are excavated trails with proper drainage, take up less space as compared to truck roads, and are suitable for forwarding wood material at higher speeds to landing sites. As such these high speed extraction trails are considered a cost effective way to supplement the main access road and access more area, increase work productivity particularly in terms of extraction, and to limit the fragmentation effects as caused by larger truck roads. It is of utmost importance the number and distance of all season truck roads within the woodlot be minimized as much as possible; mainly due to the degree of ecological disturbance they cause, amount of area they taken out of forest production, and their associated cost to build and maintain.

In most cases it would be ideal, as needed, to re-establish old woods roads or sections of these old roads, landing areas, re-establish main extraction trails to serve as high speed extraction trails off of the main woods road, and establish smaller extraction trails and landings off of the high speed extraction trails. All roads and trails should follow the contours of the land, avoid wet and seepage areas, and travel through already disturbed areas, i.e., windfall patches, as much as possible. Any access improvements or establishments should be completed well prior to commencing activity.

In cases where necessary stream crossings and/or culverts are identified during pre-assessments it is strongly recommended to optimize no grub zones surrounding the watercourse and structure. The structure, be it a bridge, culvert or arches, must be appropriate to the size and maximum capacity of the watercourse. The use of arches, which are bottomless, or bottomless wooden culverts, rather than rounded culverts, should be given serious consideration so the stream bed is less disturbed to allow for proper flowage and movement of aquatic organisms.

Prior to commencing activities in parcels that adjoin a government road along the west side of the Lake will require a truck road of short distance suitable for a truck to pull off of the government road and turnaround. A landing site located off of this truck road will also be necessary along with a high speed extraction trail and perhaps a few smaller extraction trails with smaller landings off of the main extraction route.

The 5 parcels that do not adjoin a government road but instead cross adjoining parcel(s) of different ownership will first require agreements to be reached with the adjoining landowners regarding upgrading the old roads and using them to access these otherwise isolated parcels. This is critical to know at the onset because if reasonable agreements cannot be reached to

use the roads that cross their land alternate plans will need to be made to obtain access or the parcel(s) may have to remain inaccessible.

If agreements can be reached with adjoining landowners to access these 5 parcels, it would be best to re-establish / upgrade existing roads in sections, as they are needed, to help spread out costs over operating years. For instance, for PID# 90111808 consider working with NSDNR (owner of property to the north) to upgrade the road to the north property boundary and continue to upgrade the road into stand 7. This would require approximately 1.3 kms of road upgrading on NSDNR property and approximately another 300 meters of road re-establishment through stand 7 to enter into stand 8. Once complete this would allow high speed extraction trails to be established off of the truck road to commence management activities. However it is important not to use newly built road / extraction trails but rather wait at least one year before using them to ensure they have properly settled not to cause damage. Additional access improvements to access additional stands can be made as needed and as finances warrant. For this parcel it may be easier to have access solely from north since there is only one adjoining landowner to reach an agreement with versus the 3 adjoining landowners if access is re-established from the southeast into stands 11 and 4.

All roads entering parcels will need to be gated and locked to control access and to especially avoid illegal dumping and deter off-highway vehicle traffic.

Preferably there would be no permanent access established within the 100 meter special management zone. There is to be no access established or machine traffic whatsoever within the designated machine exclusion zones.

Access improvements and harvest and extraction activities should be completed during dry periods. Machine operators should place brush mats along extraction trails to help limit ground disturbance.

5.4 Parcel Boundary Line Recommendations

For parcels with boundary lines that are not identifiable or are not easily identifiable it is considered high priority to re-establish these lines, especially surrounding the cottage lots in PID#s 90150020 and 90140202. This can be accomplished by first attempting to come to an agreement with the adjoining landowners on the locations. Where this is possible, follow up by cutting / brushing out the boundary lines, blazing trees, painting them and GPSing them to have long term record. If or where an agreement is not possible to be reached, the other option is to have the boundary lines re-surveyed.

For boundary lines that are currently identifiable it is recommended to renew these lines over the next 3 years by brushing them out and reblazing them via cutting out a blaze either above or below the existing blaze on trees and painting with a color that will remain consistent for all boundary line of the Lake George Watershed.

Any stands with parcel boundary line issues will be addressed and identified on the ground prior to any access establishment and harvest activities being completed.

5.5 Educational Recommendations

As access is re-established in some stands and work is completed this brings forth opportunities to conduct various field tours and/or workshops to promote the awareness of the importance of watersheds to have clean water, how sensitive they are, how any forest management activity must be carefully planned and executed and why, etc. The main target groups for such education and outreach are neighboring landowners, local community groups, school children such as those involved in environmental groups such as the Envirothon, etc.

5.6 Ten year operating plan

The 10 year operating plan is based on the recommendations and priority levels for silviculture as discussed above. These recommendations and associated timing to implement are by no means set in stone. They merely serve as a guideline to follow as the landowner sees fit, particularly in terms of available access and as markets permit.

Please refer to Table 8 for the ten year operating plan in **Appendix XVII**, and associated operating map showing treatment years for the various silviculture recommendations in **Appendix XVIII**. This map also outlines the approximate location of the legislated thus required 20 meter riparian buffer zone as well as the recommended 100 meter special management zone.

After the recommendations of initial ten year operating plan are complete, return to stands where activities first started and proceed with additional tending work. Mainly in the form of individual tree selection to continue to thin to provide growing space for desired trees, and to create additional small patch cuts to release existing regeneration and to promote new regeneration to establish.

6. WOODLOT MONITORING

Throughout the term of the plan, the key to ensuring the success of the forest management implementation is regular monitoring of the woodlot stands. Treatment areas and general forest conditions should be monitored periodically. Triggers for unscheduled inspections (wind storms, fire, neighboring activities, etc.), and other important monitoring instructions are listed for each heading. It is extremely important that monitoring activities are documented for future reference. Under each of the following headings, it is clearly stated who will be responsible for monitoring and how often they will conduct inspections.

Throughout the course of the certification program, staff or representatives from either FNSWO or MTRI will inspect woodlots for conformance to the FSC Maritime SLIMF standard. Landowner records of woodlot monitoring aid in this process.

6.1 Harvest Monitoring

- First day of contractor on site: ensure objectives are clear, boundary lines are marked and workers are competent and have properly working safety equipment
- During operation: ensure objectives being met, workers within boundaries, harvested wood properly utilized, environmental impacts minimized
- Completion of harvest: infrastructure in good repair, all wood utilized, environmental impact was minimized
- Evaluate whether objectives of harvest were achieved

Harvest monitoring will be conducted by a staff representative appointed by the Town of Yarmouth during and after harvesting

6.2 Silviculture Monitoring

- First day of contractor on site: ensure objectives are clear, boundary lines are marked and workers are competent
- During operation: ensure objectives being met, workers within boundaries, environmental impacts minimized
- Completion of treatment: infrastructure in good repair, all areas treated, environmental impact was minimized
- Evaluate whether objectives of treatment were achieved

Silviculture monitoring will be conducted by a staff representative appointed by the Town of Yarmouth during and after treatments

6.3 Forest Condition Monitoring

- High attention given to stands prone to wind throw, fire, disease or insect infestation, or other possible damage
- Report serious disease or insect infestations to NSDNR (see emergency #s)
- Report significant changes in stand conditions to planner, alter WMP to reflect current stand conditions and required management needs

Forest condition monitoring will be conducted by a staff representative appointed by the Town of Yarmouth at a frequency of 2 years..

6.4 Environmental Impact Monitoring

- Road building, large clear-cutting operations, etc. on adjacent land
- High forest fire index during hot, dry times
- Extreme weather: high winds, heavy snow-loading, lightning storms, etc.

| Impact monitoring will be conducted by a staff representative appointed by the Town of Yarmouth when triggered by examples such as those provided above.

6.5 Plantation Monitoring

- Plantations must be monitored for competition and health
- Efficacy of silviculture treatments must be monitored and documented
- Negative impacts of the plantation on soil fertility and water quality should be documented, along with strategies to improve

| There are no plans for full plantation establishment; in the case they happen to occur, plantation monitoring will be conducted by a staff representative appointed by the Town of Yarmouth at a frequency of 5 years. |

6.6 Monitoring Results and Records

- When the landowner is the person responsible for monitoring exercises, the observations are recorded in the 10-year woodlot management journal provided by the Federation or MTRI
- When a representative from the Federation or MTRI conducts a scheduled inspection of the woodlot, the journal will be used to verify that regular monitoring of the woodlot has been conducted
- The first scheduled inspection of the woodlot by the Federation or MTRI will be dependent on when operations plan to commence | but an inspection will occur before November 30, 2015. |

7. NOVA SCOTIA'S WILDLIFE HABITAT AND WATERCOURSES PROTECTION REGULATIONS

Provincial regulations must be followed when forest management activities take place on any woodland in Nova Scotia. There are three main requirements that must be followed when harvesting forest land:

- 1) Leaving buffer strips along watercourses: when harvesting near watercourses, a special management zone (SMZ) is required. Watercourses that are 50-cm (20") or more in width require a 20-metre (66') SMZ along each edge with the following requirements:
 - SMZ width will be increased by 1-metre (3') for every 2% of slope over a 20% average slope
 - No machine allowed within 7-metres (23') of the watercourse
 - Partial harvesting is allowed within the SMZ: must retain a minimum of 20m²/ha of basal area, and not create a gap larger than 15-metres (50') in the canopy

Watercourses that are less than 50-cm (20") in width also require a 20-metre (66') SMZ along each edge with the following requirements:

- No machine allowed within 5-metres (17') of the watercourse
 - Merchantable trees may be harvested
 - Ensure understory vegetation and non-commercial trees within 20-metre SMZ of are retained to their fullest extent
- 2) Leaving Legacy Trees/ Wildlife Clumps: these specifications are required when harvesting any area larger than 3 hectares (7.4 acres):
 - Leave 10 living trees per hectare (2.5-acres) in a clump of representative trees with a minimum of 30-trees for every clump
 - Clumps shall be at least 20-metres (66'), but no more than 200-metres (660') from the edge of a cut, or from each other, where there is more than one clump
 - No harvesting allowed within clumps
 - 3) Leaving Coarse Woody Debris: all harvest sites will retain standing dead trees, fallen trees and large branches, as well as rotting logs on the harvested site, similar to naturally occurring patterns, when it is safe and possible.

Persons cutting in woodlots should obtain and read a copy of these guidelines from the Department of Natural Resources website: <http://www.gov.ns.ca/natr/forestry/strategy/>

Appendix H

Residential Septic System Pumping Program Request for Tender

2025

Lake George

On Site Septic Cleaning

Onsite septic tank cleaning program for the Lake George watershed area. Civics addresses for properties in the Lake George watershed area.



1	1801	HIGHWAY 340	DEERFIELD
2	1809	HIGHWAY 340	DEERFIELD
3	3	BRAZIL LAKE ROAD	DEERFIELD
4	7	BRAZIL LAKE ROAD	DEERFIELD
5	19	BRAZIL LAKE ROAD	DEERFIELD
6	27	BRAZIL LAKE ROAD	DEERFIELD
7	61	BRAZIL LAKE ROAD	DEERFIELD
8	63	BRAZIL LAKE ROAD	DEERFIELD
9	87	BRAZIL LAKE ROAD	BRENTON
10	125	BRAZIL LAKE ROAD	BRENTON
11	114	BRAZIL LAKE ROAD	BRENTON
12	128	BRAZIL LAKE ROAD	BRENTON
13	137	BRAZIL LAKE ROAD	BRENTON
14	161	BRAZIL LAKE ROAD	BRENTON
15	194	BRAZIL LAKE ROAD	BRENTON
16	219	BRAZIL LAKE ROAD	BRENTON
17	260	BRAZIL LAKE ROAD	BRENTON
18	284	BRAZIL LAKE ROAD	BRENTON
19	287	BRAZIL LAKE ROAD	BRENTON
20	319	BRAZIL LAKE ROAD	BRENTON
21	329	BRAZIL LAKE ROAD	BRENTON
22	328	BRAZIL LAKE ROAD	BRENTON
23	27	BRENTON ROAD	BRENTON
24	115	BRENTON ROAD	BRENTON
25	155	BRENTON ROAD	BRENTON
26	213	BRENTON ROAD	BRENTON
27	224	BRENTON ROAD	BRENTON
28	234	BRENTON ROAD	BRENTON
29	275	BRENTON ROAD	BRENTON
30	305	BRENTON ROAD	BRENTON
31	302	BRENTON ROAD	BRENTON
32	304	BRENTON ROAD	BRENTON
33	306	BRENTON ROAD	BRENTON
34	308	BRENTON ROAD	BRENTON
35	349	BRENTON ROAD	BRENTON
36	353	BRENTON ROAD	BRENTON

37	373	BRENTON ROAD	BRENTON
38	401	BRENTON ROAD	BRENTON
39	461	BRENTON ROAD	BRENTON
40	472	BRENTON ROAD	BRENTON
41	1085	LAKE GEORGE ROAD	BRENTON
42	1300	NORTH OHIO ROAD	BRENTON
43	1243	LAKE GEORGE ROAD	BRENTON
44	1257	LAKE GEORGE ROAD	BRENTON
45	1315	LAKE GEORGE ROAD	BRENTON
46	1386	LAKE GEORGE ROAD	BRENTON
47	1400	LAKE GEORGE ROAD	BRENTON
48	1463	LAKE GEORGE ROAD	LAKE GEORGE
49	1501	LAKE GEORGE ROAD	LAKE GEORGE
50	1517	LAKE GEORGE ROAD	LAKE GEORGE
51	1529	LAKE GEORGE ROAD	LAKE GEORGE
52	1547	LAKE GEORGE ROAD	LAKE GEORGE
53	1557	LAKE GEORGE ROAD	LAKE GEORGE
54	1556	LAKE GEORGE ROAD	LAKE GEORGE
55	1569	LAKE GEORGE ROAD	LAKE GEORGE
56	1572	LAKE GEORGE ROAD	LAKE GEORGE
57	1595	LAKE GEORGE ROAD	LAKE GEORGE
58	46	WATERS EDGE DRIVE	LAKE GEORGE
59	64	WATERS EDGE DRIVE	LAKE GEORGE
60	65	WATERS EDGE DRIVE	LAKE GEORGE
61	1597	LAKE GEORGE ROAD	LAKE GEORGE
62	1621	LAKE GEORGE ROAD	LAKE GEORGE
63	1649	LAKE GEORGE ROAD	LAKE GEORGE
64	1665	LAKE GEORGE ROAD	LAKE GEORGE
65	1673	LAKE GEORGE ROAD	LAKE GEORGE
66	1685	LAKE GEORGE ROAD	LAKE GEORGE
67	149	PARTRIDGE LANE	LAKE GEORGE
68	400	BRAZIL LAKE ROAD	BRENTON
69	438	BRAZIL LAKE ROAD	BRENTON
70	775	BRAZIL LAKE ROAD	BRAZIL LAKE
71	637	BRAZIL LAKE ROAD	BRAZIL LAKE

Appendix I

Protected Water Area Fact Sheet

Protected Water Area Regulations Enforcement

Fact Sheet for Municipal Water Utilities

March 2015

What is a Protected Water Area?

A Protected Water Area (PWA) is an area surrounding a drinking water source that has been designated under the *Environment Act* by the Minister of Environment at the request of the water utility. A PWA Designation is one management option available to water utilities to manage risks in the source water area. Designation uses a regulatory approach to prohibit or restrict activities that are a risk to the water supply. PWA regulations are specific to the area designated.

What are the steps to having an area designated?

There are a number of steps involved for a water utility to designate a PWA. These include defining the area to be designated, developing regulations, and holding public consultations.

Nova Scotia Environment (NSE) has developed a guidance document that outlines the steps required in designating a PWA:

(<http://www.novascotia.ca/nse/water/protectedwaterarea.asp>).

Who is responsible for enforcing PWA regulations?

Under Section 106 of the *Environment Act*, the enforcement of the regulations for a designated PWA is the responsibility of the municipal water utility.

Section 106 Environment Act, Subsection 3

The operator of a water works or proposed water works is responsible for taking all measures to protect the area designated, and the enforcement of any regulations made pursuant to subsection (6).

The water utility should seek their own legal advice on how to set up their enforcement program.

What options are available to enforce PWA regulations?

Under Section 158(hb) of the *Environment Act*, it is an offence to contravene a regulation made pursuant to subsection 106(6).

There are two options available for laying a charge before Provincial Court: the issuance of a Summary Offence Ticket (SOT) and the laying of a charge via the Long Form Information process.

The SOT process is a simplified version of the Long Form Information process which allows for the alleged offender to settle out of court by pleading guilty and paying a fine at any court office in the province. The SOT fine amount for violating 158(hb) is approximately \$700 and is set out in Schedule 9 of the Summary Offence Ticket Regulations

The Long Form Information process can be initiated by a municipality for a violation of any of the PWA's regulations. This process legally requires a defendant to appear before the Provincial Court. The Crown may seek fines of up to one million dollars or court orders as identified in section 166 of the *Environment Act*.

The water utility should seek their own legal advice on the options available to them through the Long Form Information process.

Who is qualified to enforce PWA regulations?

In order to enforce violations of the PWA regulations in Provincial Court, the water utility must apply to NSE for the appointment of an employee as:

- 1) a 'Special Constable' through provisions in the *Police Act*; and
- 2) an 'Inspector' under the *Environment Act*.

How does the water utility apply to appoint someone to these positions?

For more information on how to become appointed as a Special Constable and Inspector, the water utility should contact the Regional Compliance and Inspection Coordinator at the local office of NSE's Compliance Division.

The employer of a person that is applying to be appointed as a Special Constable and Inspector for the purpose of enforcing the PWA

regulations must enter into a Memorandum of Understanding (MOU) with NSE.

The employee(s) will be required to undergo an interview and criminal record check and may be required to take additional enforcement training before being appointed.

If someone has already been appointed a Special Constable, are they able to enforce the PWA regulations?

If someone has already been appointed a Special Constable, the original application will have to be reviewed to determine whether the PWA regulations were included. If not, the Special Constable will have to apply to have their appointment amended to include the name of the PWA regulations they are responsible for enforcing, and also apply to be appointed as an Inspector under the *Environment Act*.

For more information contact:

Nova Scotia Environment
www.novascotia.ca/nsc

Drinking Water and Water Resources Unit
www.novascotia.ca/nsc/water
(902) 424-5300

Compliance Division
<http://novascotia.ca/nse/dept/division.compliance.asp>
1-877-936-8476



Appendix J
Contingency Plan – Town of Yarmouth
Water Utility

**TOWN OF YARMOUTH
WATER UTILITY**

CONTINGENCY PLAN



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**GENERAL CONTACT &
EMERGENCY NUMBERS**

Contact Person/Company	Number
Non-Emergency RCMP Contact	902-742-1323 (Town) 902-742-9106 (Rural)
Nova Scotia Power	1-877-428-6004
Cassa Business Equipment – Software/PC Repair	902-742-7566 After hours cell 902-740-2200 Home 902-663-2067

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SECURITY THREAT

A security threat may be defined as follows:

“A person or persons that has or have communicated in any way i.e. via phone, letter, word of mouth, etc. that they intend to cause a contamination (or any other means) that will render the water supply in the Lake George watershed, treatment plant or in the distribution system unsafe for human consumption”.

In the event of a security threat, the following steps should take place:

- < If staff are in communication with a person or persons that have made a threat, they should ask as many questions as possible, provided their own safety is not in jeopardy.
- < Such things as name, address, phone number, why they intend to do this, and how they intend to carry out their threat should be asked.
- < If possible, the Supervisor should then be contacted immediately and advised of the situation.
- < The Supervisor and/or the Operators will then contact the RCMP via the non-emergency number and together, assess the threat.
- < Operators should then, monitor closely any vulnerable areas, as closely as possible until it is deemed by the proper authorities that there are no imminent acts of contamination.

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**VISITS BY REGULATORS/MEDIA
RELATIONS**

- < If possible the Supervisor should be informed of any visits, announced or unannounced by either Regulators or Media.
- < Media will be restricted to the Administration area unless otherwise authorized by the Supervisor.
- < Provided areas are safe (no chemical spills etc.) Regulators may have guided access to the entire treatment plant.

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POWER FAILURE

If the treatment plant should lose, both main power and stand by generator power, the following steps should take place.

- < The Supervisor should be contacted immediately, if possible.
- < Nova Scotia Power should be contacted immediately and informed of the situation. The necessity for quick repairs should be expressed to the dispatcher.
- < Trained individuals such as electrician, generator supplier and generator mechanic etc., should be contacted to repair the generator for backup power.
- < If necessary a portable backup generator could be brought in and put online under the supervision of trained industrial electrician (ordered from a rental company).
- < Necessary authorities such as Nova Scotia Department of Environment & Labour and the Medical Officer of the Department of Health should be contacted in the event of complete loss of pressure for a significant time throughout the distribution system.

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**FAILURE OF MONITORING
SYSTEM/SCADA**

- < Upon discovery of a monitoring system/SCADA system failure the back up computer will be installed and used.
- < If the use of a backup computer is not possible, software technicians should be contacted immediately to begin repairs. The original software installers may be contacted for advice or to try to bring them on site for repairs.
- < Until the monitoring/SCADA system is operating correctly, staff members will remain at the plant and manually monitor the operations. Scheduled operational procedures (i.e. backwashing) will be delayed as long as possible.
- < Should a necessary operational activity be required, operators can manually conduct those activities with at least two operators on site and with the Supervisor's approval.

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FIRE

- < In the event of a fire at the facility, an assessment of the operational condition of the SCADA system and water treatment equipment must be made by two operators.
- < If it is assessed that the plant operations cannot be continued automatically, the plant must be run in a manual mode, until repairs can be made.
- < Any equipment needing repairs before manual operation can occur, shall be done as soon as possible.
- < The necessary authorities will be contacted and informed of the situation.
- < The necessary contractors must be contacted to begin repairs of any treatment plant damage.

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RAW WATER CONTAMINATION

The amount of possible contaminating agents that would effect the water supply would be large. The scope of this contingency is not to identify individual contaminants, but to outline countermeasures for a contamination to minimize the impact on the water supply, and distribution. This is because the safety of the public is the highest priority in the event of a contamination incident.

In general (assessed at the time of discovery), a biological contamination can be handled with an increase in chlorine dosage.

Large known or unknown chemical contaminations or known or unknown acutely toxic substances must be treated as follows:

- < The public must be immediately notified so that the water will not be used.
- < Emergency numbers should be used to begin the process of informing the public and to inform the necessary authorities and town staff.
- < The high lift pumps that pump water into the distribution system will be shut down.
- < Key main water valves can be shut off to help isolate the contamination. These valves can be identified by the Public Works Supervisors and/or Senior Staff experienced in water distribution.
- < Isolate and eliminate if possible the contaminant source.
- < Assessments can then begin to try to determine the exact nature of the contaminate.
- < After the contaminate has been identified it can then be determined what will be necessary to treat the affected water.
- < Resumption of the water supply can be continued after it has been confirmed through independent laboratory analysis that the contaminant has been reduced to acceptable levels, for short term use (or after acceptability determined through involvement and approval of all relevant authorities).

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CHEMICAL SPILL/RELEASE

- < In the event that a treatment chemical is spilled or released, personnel will leave the area immediately to obtain necessary personal protective equipment.
- < If an employee is exposed to a chemical he/she will seek medical attention.
- < For a chlorine leak, refer to the Chlorine Emergency Plan.
- < If chemical delivery equipment is affected which could impact proper dosage to water treatment, the automatic control of the treatment process will be shut down before attempting repairs.
- < If it is determined that repairs can be safely conducted, two operators will be on hand to do so, while using appropriate personal protective equipment.
- < When the cause of the spill or release is repaired, the automatic plant operations can be re-enabled on the SCADA System.
- < If all product is lost, a temporary source of chemical can be used (such as a drum of caustic soda in the event that the caustic soda tank ruptures).
- < A separate clean drum should be used, obtain clean chemical from original tank if possible and set up temporary feed.
- < An assessment can then be made as to how to remove and dispose of any unusable treatment chemical.
- < The chemical supplier should be contacted for advice on how to proceed.
- < A chemical spill cleanup company name and number is included in the contact list.

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PROCESS FAILURE COAGULATION / FLOCCULATION/FLOATATION

- < A high clarified water turbidity alarm/indication will normally be a early warning for failure of the above processes.
- < If any of the above processes appear to have failed, the operator will assess (the operator may have to refer to the plant operating permit to determine if minimum requirements for water quality have been met and act accordingly) whether or not the plant needs to be shut down before trouble shooting the problem.
- < The processes may begin working properly after making necessary chemical dosage adjustments. Ensure that time has passed with a change in chemical dosage to allow for the problem to correct itself.
- < In the event of a major failure of one of the above processes, that cannot be repaired within several hours, the affected process train can be shut down and isolated so repairs can continue.
- < There are two separate process trains, each of which can be isolated. The plant can run with one train on-line to meet water demand.
- < Increase in the frequency of filter backwashing may be necessary depending on how long repairs take, and should be assessed daily.
- < Filter turbidities and effluent chlorine residual will be monitored closely. An increase in filter turbidities because of the loss of any of the above processes warrants an increase in chlorine dosage (a few pounds/24 hours) initially.
- < Chlorine dosage may need to be increased again if chlorine demand increases, which can be calculated based on dosage and residual.

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HIGH FILTER TURBIDITY

- < There is a written standard operating procedure that the operators will refer to in the event of high filter turbidities.
- < The plant operating permit outlines the minimum requirements to be met, and the maximum allowable turbidities over time and maximum allowable turbidity at any time. Operators will refer to this and act accordingly.
- < The operators will inform the Supervisor.
- < There are four filters on-line of which two may be taken out of service in the event of failure of the filter (i.e. excessive loss of media during backwashing) causing high turbidity events.
- < If an individual filter turbidimeter fails, there are sampling ports on the post filter piping that may be utilized. The operator can then check the turbidity in the lab by sampling from this spot.

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DISINFECTION

- < The supervisor will be contacted if a residual of 0.2 mg/l or less is found at the plant or in the distribution system.
- < The Nova Scotia Department of Environment & Labour will be contacted and advised of the situation when a chlorine residual of less than 0.2 mg/l occurs in the effluent from the treatment plant or in the distribution system.
- < Refer to activating the boil water advisory if advised to do so by the Nova Scotia Department of Environment & Labour.
- < If it is determined that there is a chlorine residual of less than 0.2 mg/l in the treatment plant effluent, and it is persistently low for 2-3 hours plus, the operators will check the residual along the distribution system close to the treatment plant and monitor the residual closely (hourly).
- < The distribution system will have a buffer chlorine residual that can normally adequately handle short term higher turbidity events.
- < If the cause of the low residual can be quickly fixed, a boil order may not be necessary.
- < If it is clear, due to a persistent process failure or high turbidities, that the residual will remain below 0.2 mg/l for an extended period of time, it may be necessary to activate the boil water advisory (Nova Scotia Department of Environment & Labour may require it or Town of Yarmouth Supervisory personnel may decide to proceed with it).

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**FAILURE OF DISINFECTANT
EQUIPMENT**

- < In the event of failure of the disinfectant equipment, the water plant will be disabled so that trouble shooting and/or repairs can take place.
- < A stand-by chlorinator may be placed on line if the duty chlorinator cannot be repaired quickly (within several hours).
- < Should the standby chlorinator fail as well, a simple temporary solution could be to dose by a metering pump a javex solution which is readily available by drum either in Hebron or at the Wastewater plant.
- < If these options are not available for a significant period and the chlorine residual goes below 0.2 mg/l the boil water advisory may need to be enacted. The chlorinator at Pleasant Street Reservoir can be adjusted to meet the incoming chlorine demand from the treatment plant.

If the on-line chlorine residual meter fails, grab samples can be taken and analyzed in the plant lab, in intervals requested by the Supervisor, until repairs can be made.

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BOIL WATER ADVISORY

A boil water advisory may need to be issued to the general public if:

- There is a residual below 0.2 mg/l of free chlorine discovered, and confirmed via multiple test, and testing sites.
- Positive coliform test has been confirmed twice from the same area.
- There is a known or unknown contamination in the water supply of a biological nature.
- There is a complete disinfection system pressure loss that has occurred for a significant period of time.
- Upon advisement of regulating authorities of the above events, they require an advisory be issued.
- Upon assessment by supervisory staff, a boil advisory would be a prudent course based on an event described above or similar in nature.

STEPS TO TAKE IN THE EVENT OF A BOIL WATER ADVISORY

1. Inform Supervisor and/or Town Engineer

2. Inform Nova Scotia Department of Environment & Labour

DOE Representative after hours 1-800-565-1633

3. Inform Medical Officer of Health
1-902-424-8698
1-902-424-2358

4. Contact Media to Advise Public
Radio CJLS 902-742-7175 Fax 902-742-3143
CBC radio 1-866-306-4636