



St. George Marsh Management Plan



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About the Author

Eastern Charlotte Waterways Inc. is a not-for-profit, environmental resource and research centre based in southwestern New Brunswick. Since its formation in 1993, the organization has promoted community well-being through sound environmental health. This is accomplished by facilitating collaborative projects that integrate common social, economic and environmental concerns.

Since its inception, the organization has worked closely with stakeholders in the Magaguadavic River watershed to ensure a healthy habitat and high water quality. In 2010 the organization conducted a comprehensive assessment of the Magaguadavic River watershed which included resident consultation and habitat assessments. In 2012, the organization completed its first integrated watershed management plan for the Chamcook watershed, and in 2013-2014 undertook a similar planning initiative in the Magaguadavic River watershed.

Since the creation of Environment and Climate Change Canada's National Wetland Conservation Fund (NWCFF) in 2014, Eastern Charlotte Waterways Inc. has been able to expand its work into the St. George Marsh which is located on the lower Magaguadavic River floodplain. ECW has partnered with J.D. Irving Limited, Ducks Unlimited Canada, the Town of St. George and Friends of the St. George Marsh to collect preliminary water level and water quality data, conduct wildlife surveys, remove invasive species, install interpretive signage, improve the walking trail, install an osprey platform, viewing platforms and benches, and produce a short video highlighting the marsh.

The St. George Marsh Management Plan has been produced to ensure ongoing conservation, monitoring, and management of the St. George Marsh. The Management Plan provides a framework of activity for the next five years and applies the principles of wise-use, research, and education. With the implementation of this plan, it is our hope that the biological, functional and socio-cultural values of the St. George Marsh are maintained and improved.



1.0 Introduction

Covering approximately 85 hectares, the St. George Marsh is found a few hundred meters up-river from First Falls in the Town of St. George, a New Brunswick municipality with a population of 1,500 people found approximately 70 km southwest of the City of Saint John. In the early 1990's, a Conservation Agreement was signed between the landowner J.D Irving Limited and Ducks Unlimited Canada (DUC), to create a permanent wetland at the site. Located on the Magaguadavic River floodplain, the St. George Marsh historically would flood during heavy rains, creating a semi-permanent wetland. During this time prior to the Conservation Agreement, the area was mainly used for hay production and pasture land. Although not used for agriculture today, the St. George Marsh is still zoned as "Agricultural and Rural". Evidence of its past use is dispersed throughout the marsh, as stewards have discovered apple trees and ornamental plants on the property (G. Taylor, personal communication, March 2016).

As the area's agricultural role declined, the potential of the St. George Marsh as a habitat for wildlife, particularly birds, became a management goal for the community. The Conservation Agreement granted DUC staff permission to access the wetland, manage issues that may arise, and conserve the property's valuable natural resources while J.D. Irving Limited retained ownership of the land. In order to restore the area to a permanent wetland, a dyke was constructed and water control structures were installed to maintain the water level of the marsh at an ideal depth. Water control structures are designed to regulate the water levels within the marsh at a normal operating level, and are engineered to handle "peak flows". Ducks Unlimited Canada staff inspect the water control structures once a year to ensure that all structures are intact and working properly.

Today, the St. George Marsh has become a centrepiece of the Town. It provides permanent habitat for a diverse range of flora and fauna, and provides breeding and foraging habitat for a range of species, including the at-risk Least Bittern (*Ixobrychus exilis*), Common Nighthawk (*Chordeiles minor*), and Snapping Turtle (*Chelydra serpentina*). The marsh's easily accessible walking trail - built by DUC in partnership with the Town of St. George - provides an opportunity for residents and visitors alike to explore and connect with the marsh. Viewing platforms, benches and interpretive signs add to public enjoyment of the wetland. However, despite the myriad of provincial and municipal policies in place to protect the St. George Marsh, it continues to be under direct and indirect pressures from adjacent land-uses, recreational activities, a changing climate, and invasive species. These pressures, if not properly managed may result in biodiversity loss and/or habitat degradation.

The St. George Marsh Management Plan has been prepared by Eastern Charlotte Waterways Inc. to ensure ongoing conservation, monitoring, and management of the St. George Marsh over the next five years. Building from five main objectives, the St. George Marsh Management Plan sets out strategies and tasks for conservation, land use, interpretation, operation and maintenance of the St. George Marsh. The Management Plan not only sets long-term direction for the St. George Marsh, but also gives direction and identifies specific actions to address immediate issues.

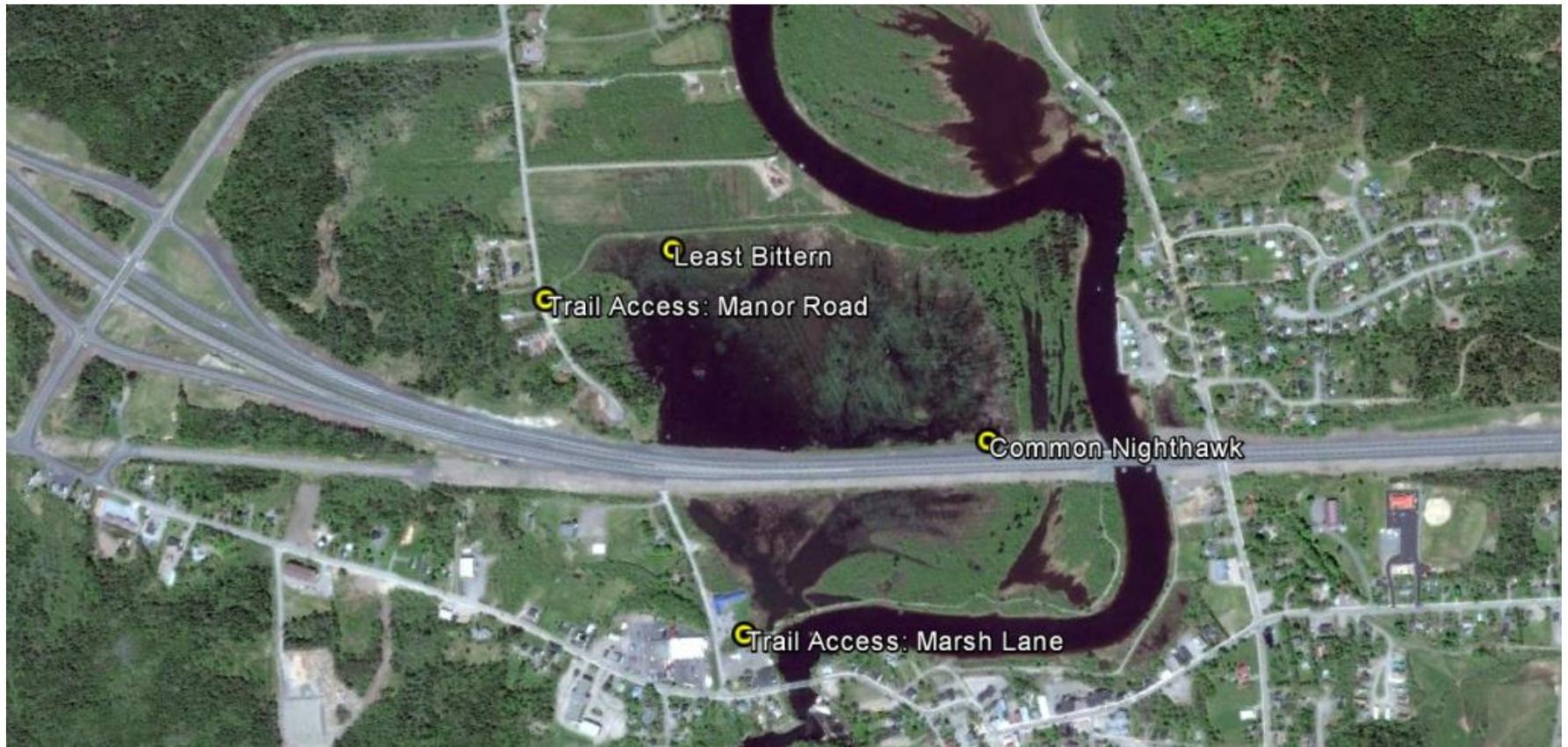


Figure 1: Aerial view of the St. George Marsh with known sightings of the Least Bittern (*Ixobrychus exilis*) and Common Nighthawk (*Chordeiles minor*), and access areas to the trail (Source: Google Earth).

2.0 Wetland Evaluation

The following section of the St. George Management Plan summarizes background information on the marsh, including its ecological, economic and socio-cultural values. These values were identified through consultation with stakeholders from Ducks Unlimited Atlantic Canada, J.D. Irving Limited, Town of St. George, Friends of the St. George Marsh, Bird Studies Canada and the Atlantic Canada Conservation Data Centre.

2.1 Ecological Values

The diversity of aquatic and emergent marsh vegetation in the St. George Marsh has increased since Ducks Unlimited Canada restored the area to a permanent wetland in the early 1990s. Shallow open water areas support emergent and floating aquatic vegetation. Dominant species include cattails (*Typha spp.*), pickerel weed (*Pontederia cordata*), arrowhead (*Sagittaria spp.*), blue flag iris (*Iris versicolor*), pondweed (*Potamogeton spp.*), spatterdock (*Nuphar variegata*), and fragrant water lily (*Nymphaea odorata*). Cattail areas are used for roosting, feeding and nesting by various birds including the threatened Least Bittern (*Ixobrychus exilis*). Mallards, wood ducks, hooded mergansers and other waterfowl use these areas for cover while flightless. These areas are also used for feeding and resting by beaver, muskrat, raccoon and river otter. Open water areas are utilized for feeding and resting by waterfowl species including dabbling ducks, diving ducks, and geese. Some species visit the marsh during fall and spring migration while others overwinter in the area.

The marsh riparian areas are utilized by various bird species for cover, foraging, and/or nesting, depending on the vegetation type. Dominant plant species in the riparian zone include alder (*Alnus spp.*), willow (*Salix spp.*), sweet gale (*Myrica gale*), tamarack (*Larix laricina*), birch (*Betula spp.*), poplar (*Populus spp.*), and white spruce (*Picea glauca*). Before the area became a permanent wetland, there were many large trees on the property. As the habitat changed, the trees died but did remain standing for several years, making ideal habitat for cavity nesting birds like wood ducks. As the trees have disappeared, the breeding population of some species has dropped (R. Eldridge, personal communication, March 2016).

A detailed survey of wetland vegetation has not been undertaken in the St. George Marsh. However, since 2013, as part of the Maritime Marsh Monitoring Program, Bird Studies Canada technicians have collected habitat data within a 100 m radius of their eight 'point count' survey stations in the St. George Marsh. Habitat data collected includes wetland type, open water and dominant floating plants, dominant herbaceous emergent vegetation, dominant shrub vegetation, dominant tree vegetation, and amount of exposed mud/sand or rock. Bird Studies Canada technicians surveyed the marsh using their protocol from 2013-2015 (H. Lightfoot, personal communication, March 2016). It will be crucial to maintain and improve the diversity of wetland vegetation found in the St. George Marsh as it provides important feeding, roosting and nesting habitat for a wide variety of wildlife species.

A diverse range of non-avian wildlife species have been observed in the St. George Marsh including: reptiles and amphibians such as the Northern Spring Peeper (*Pseudacris crucifer*), Garter Snake (*Thamnophis sirtalis*) and Snapping Turtle (*Chelydra serpentina*); invertebrates such as dragonflies (*Anisoptera sp.*); and mammals such as White-Tailed Deer (*Odocoileus virginianus*) and Muskrat (*Ondatra zibethicus*) (Figure 2).



Figure 2: A diverse range of wildlife species can be found in the St. George Marsh such as Muskrat (*Ondatra zibethicus*), Bullfrog (*Rana catesbeiana*), Dragonfly (*Anisoptera sp.*) and Snapping Turtle (*Chelydra serpentina*). Photographs by Ralph Eldridge, “Friends of the St. George Marsh”.

As part of the Maritime Marsh Monitoring Program, Bird Studies Canada technicians established eight 'point count' survey stations within the St. George Marsh in 2013. Three times a year, between May 15th and July 15th, technicians surveyed the marsh for primary species, secondary species, aerial foragers and outside/fly throughs, and other species. From 2013-2015, Bird Studies Canada technicians surveyed the marsh using this protocol and in 2016 an avid birder and member of the "Friends of the St. George Marsh" has volunteered to continue the surveys.

Over 100 bird species are known to occur within or adjacent to the marsh (Figure 3), including the Canada Goose (*Branta Canadensis*), Mallard Duck (*Anas platyrhynchos*), Wood Duck (*Aix sponsa*), Red-Breasted Merganser (*Mergus serrator*), Blue-Winged Teal (*Anas discors*), Red-Winged Blackbird (*Agelaius phoeniceus*), Red-Breasted Nuthatch (*Sitta canadensis*), Great Blue Heron (*Ardea herodias*), and Osprey (*Pandion haliaetus*). More secretive marsh birds such as Sora (*Porzana carolina*), Virginia Rail (*Rallus limicola*) and American Bittern (*Botaurus lentiginosus*) can also be found in the marsh.

The St. George Marsh also supports the at-risk Least Bittern (*Ixobrychus exilis*), Common Nighthawk (*Chordeiles minor*), Canada Warbler (*Cardellina Canadensis*) and Snapping Turtle (*Chelydra serpentina*). The Least Bittern (*Ixobrychus exilis*), Common Nighthawk (*Chordeiles minor*), and Canada Warbler (*Cardellina canadensis*) are designated as threatened under the federal Species at Risk Act. The St. George Marsh is identified as critical habitat in the Recovery Strategy for the Least Bittern in Canada (Environment Canada, 2014). The Least Bittern (male and female) have been observed near the northwest and northeast corner of the marsh. These two areas have an extensive amount of cattail. Although a nest of the Least Bittern has not been found in the marsh, a male has been seen and heard calling from the northwest corner of the marsh several times (Figure 1) (T. Watts, personal communication, March 2016). In 2015, a Common Nighthawk nest was found in the southeast corner of the northern impoundment of the St. George Marsh in the gravelly/rocky area just metres from the highway (Figure 1) (T. Watts, personal communication, March 2016). Evidence of Canada Warbler breeding in the St. George Marsh has not been observed, but the species is seen occasionally in the marsh. The Snapping Turtle is designated as special concern under the federal Species at Risk Act. Although the Snapping Turtle remains relatively abundant in eastern Canada, habitat is diminishing in both quantity and quality. The Snapping Turtle has been observed nesting in the gravel banks found along the St. George Marsh.

The habitat existing on this property provides valuable nesting and foraging areas for these species in southwestern New Brunswick. It will be important to continue to assess and monitor the status of wetland associated species and the habitats upon which they depend, in order to help establish and/or adjust conservation and management actions for the St. George Marsh.

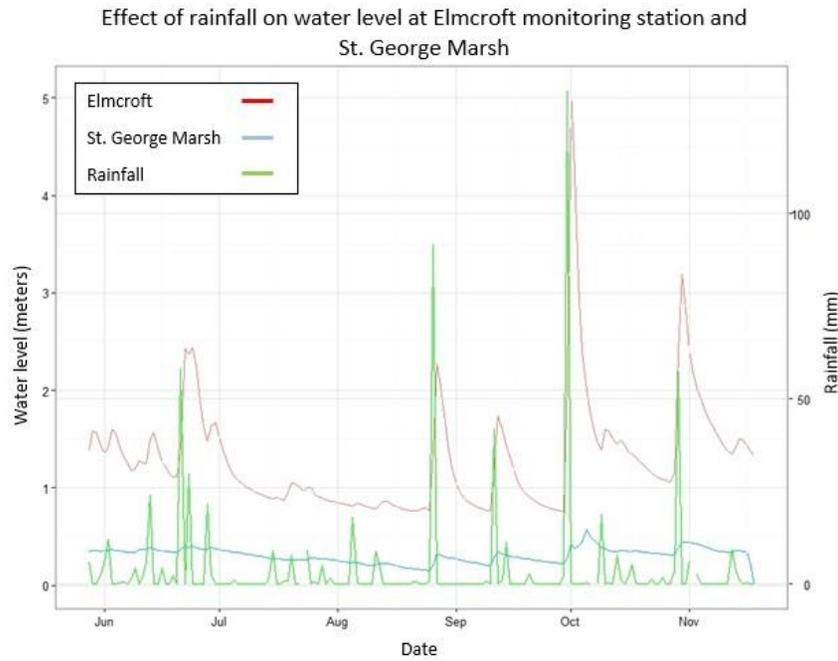


Figure 3: The St. George Marsh provides valuable nesting and foraging areas for over 100 bird species. American Bittern, Wood Duck, Red-Winged Blackbird, and Killdeer. Photographs by Ralph Eldridge, “Friends of the St. George Marsh”.

2.2 Economic Values

In addition to its considerable habitat value, the St. George Marsh serves to mitigate flood damage and may also filter excess nutrients from surface runoff and river flooding. Over the last five years, the Magaguadavic River watershed has seen an increase in significant rainfall events (> 50 mm in 24 hrs). Two notable events occurred in December 2010 and July 2013. In 2010, as much as 185 mm of rain fell in some areas. Many homes, cottages and businesses were damaged. Some roads were impassable, schools were closed for four days, and businesses had to be shut-down. Today, many homes and cottages, and the business centre located in known flood zones remain vacant, and are difficult to sell as they are uninsurable. With climate change, heavy precipitation events are expected to become more common. This increase in frequency of heavy precipitation events will likely increase the chances of reoccurring flooding within the community (Signer et al., 2014).

Located on the Magaguadavic River floodplain, the St. George Marsh helps to control flooding in the lower Magaguadavic by storing large amounts of water. Preliminary water level data collected by Eastern Charlotte Waterways Inc. from June – November 2015 indicate that during a significant rainfall event, the marsh stores water, and slowly releases it – acting like a natural “sponge” in the lower Magaguadavic (Figure 4). Without the marsh, the probability of a rainfall event causing flooding and floodwater damage in the Town of St. George increases.



No research has been conducted on the St. George Marsh’s capacity to filter excess nutrients (i.e., nitrogen, phosphorous) and sediments from the water column. However, marshes located in floodplains tend to be important sites for nutrient and sediment removal. Little is known about the nutrient and sediment removal capabilities of restored wetlands that receive unregulated water inflows. Further research is needed to better understand if the marsh is receiving nutrient and sediment input from outside its boundaries (i.e. run-off, river flooding, etc.) and what, if any, role it plays in their removal.

Figure 4: Effect of rainfall on water level in the St. George Marsh and Environment Canada’s Elmcroft monitoring station on the Magagudavic River.

2.3 Socio-Cultural Values

The St. George Marsh has important socio-cultural value to the surrounding community. There are currently two public access sites into the St. George Marsh located on Marsh Lane and Manor Road (Figure 1), each located adjacent to the Route 1 highway. The Ducks Unlimited Canada walking trail surrounding the marsh is easily accessible and enjoyed by hundreds of residents in the Town as well as tourists and visiting naturalists for walking, bird and wildlife viewing, photography and hunting and/or trapping. This property is also a valuable resource for education and research. Over the last five years, Eastern Charlotte Waterways Inc. has partnered with Ducks Unlimited Canada to facilitate field trips to the St. George Marsh for Grade 4 classes throughout southwestern New Brunswick (Figure 5). The wetland visit is part of DUC's Project Webfoot Program. The program consists of interactive classroom activities and a field trip designed to encourage stewardship of natural resources and foster an appreciation for wetland ecosystems. Visitor numbers and related pressure on the ecosystem may rise as the site's special wetland features become more commonly known.



Figure 5: Eastern Charlotte Waterways Inc. staff with student involved in Ducks Unlimited Project Webfoot Program. Photograph by Ducks Unlimited Canada.

3.0 Impacts and Threats

3.1 Adjacent Land Use Activities

The St. George Marsh is subject to direct and indirect pressures (i.e., dredging, draining, or infilling) from human settlement. October 2012 marked the completion of Route 1, a 240 km divided four-lane highway that extends from St. Stephen to River Glade, New Brunswick, passing through the centre of the St. George Marsh. Just downriver of the marsh, at First Falls, lies the St. George hydroelectric dam which is owned and operated by St. George Power, a subsidiary of J.D. Irving, Limited.

The St. George Marsh is zoned as agricultural and rural in the Town of St. George Zoning By-Law No. 25-A, and is bordered to the south by property that is zoned as commercial and residential, while the northern section of the St. George Marsh is bordered by property that is zoned as either agricultural and rural or residential. As of 2011, the marsh and adjacent land is also designated as a *Flood Risk Area* in the Town of St. George as seen in “Schedule B” of Zoning By-Law No. 25-A. Despite this designation, there is still potential for development within this area if the applicant provides a waiver which will indemnify the Town of St. George from any possible damage that may result from development within the *Flood Risk Area* (Town of St. George, 2011).

Provincially, the St. George Marsh is listed as an “Other Wetland” under the *New Brunswick Wetlands Conservation Policy*. Under this designation, all activities in, or within 30 m of the St. George Marsh are subject to a development review process that will assess wetland functions and the potential for detrimental effects. If development is deemed acceptable, a Watercourse and Wetland Alteration Regulation (WAWA) permit is obtained from Department of Environment and Local Government. The Province will not support development in or within 30 m of a “Provincially Significant Wetland”. Limited exceptions to this general ban on development within 30 m of a “Provincially Significant Wetland” are for those activities that are meant to enhance the wetland or are deemed to provide a necessary public function (Province of New Brunswick, 2002).

3.2 Recreational Activities

Tourism and recreation activities can have both direct and indirect effects on the St. George Marsh. Potential impacts of tourism and recreation on the St. George Marsh include:

- Impacts on populations of targeted species, through fishing, hunting and trapping. Without compliance with existing regulations, fishing, trapping and hunting aquatic animals (e.g., waterfowl, muskrat) can lead to population declines and can also impact entire ecosystems through changes in predator-prey interactions. For example, a small population of muskrats can play a key role in managing or maintaining an interspersed of open water and emergent vegetation within a wetland. However, muskrats have the potential to overpopulate wetlands quickly and exploit food resources, which often results in a complete clearing of emergent vegetation. Muskrats also can create burrows in dikes, causing potential damage and dike failure. Muskrat trapping is one of the most effective control methods in wetlands experiencing overpopulation;
- Changes in aquatic habitat due to habitat disturbance and pollution. Off-highway vehicles (OHVs), including all-terrain vehicles (ATVs, or quads) can lead to habitat destruction and degradation;
- Disturbance of wildlife can occur when human activity occurs too close to an animal or its habitat. Nesting sites are particularly susceptible to damage or disturbance through physical destruction of vegetation, and through human noise;
- Pollution of wetlands habitats can occur when humans introduce foreign substances into wetlands. Examples can include hydrocarbon residues from cars travelling along the Route 1 Highway or OHV engines.

As visitor numbers and related pressure on the ecosystem are expected to rise as the site's special wetland features becomes better known, it is important to discourage OHV vehicle access to the trail system, and monitor the impacts of human use on the flora and fauna found in the St. George Marsh.

3.3 Structural Integrity of the Perimeter Berm

Proper maintenance of berms and water control structures is critical to ensuring the St. George Marsh's values, attributes and functions are conserved. The structural integrity of the berm surrounding the St. George Marsh is slowly deteriorating through erosion, human use, animal activity and other factors (Ralph Eldridge, personal communication, March 2016). It is crucial that the integrity of these structures are monitored closely in the future, and if needed, repaired, replaced or removed.

3.4 Vegetation Dynamics

Several forces dramatically influence the composition of marsh vegetation communities and associated wildlife species. The most crucial is changing water depth, which is the deciding influence on what plants grow where, and on what plant life form (i.e., emergent or floating-leaf) dominates particular areas of a marsh. With the transformation of the land from a seasonally flooded area to a permanent wetland, the St. George Marsh has undergone a substantial change in vegetation since the early 1990s. For instance, before the area was permanently flooded, there were a number of large trees present in the area. The trees quickly died but remained standing for several years, making ideal habitat for some species, especially cavity nesting birds like the Wood Duck (*Aix sponsa*). As the trees have disappeared, the breeding population of some species has dropped. It has also been noted that the amount of open water is decreasing with the ingrowth of marsh vegetation (R. Eldridge, personal communication, March 2016).

A detailed wetland vegetation survey should be undertaken to record plant species, location, % cover and interspersions within the St. George Marsh in order to document and monitor changes in plant diversity and extent over time.

3.5 Water Level Fluctuations

The St. George Marsh receives its water from three water sources: (a) surface inflow (i.e., overflow of the Magaguadavic River during the spring freshet, or heavy precipitation events), (b) precipitation and (c) groundwater discharge. The berm and water control structures maintained by Ducks Unlimited Canada (DUC) manage the water level in the St. George Marsh. The water level management by DUC mimics natural water level fluctuation within the St. George Marsh to ensure productivity of vegetation and habitat use by wildlife. In some years, evaporative losses over summer months may exceed rainfall gains and water levels can drop in the marsh. Conversely, when rains are heavy levels can rise. In addition to these natural factors, the St. George Power hydroelectric dam may also influence water levels within the marsh because of its effect on the water levels within the Magaguadavic River watershed. Currently, the St. George Power hydroelectric dam bases its operations on a fisheries management plan which was first drafted in 2002. This plan was significantly updated in 2012 and has been annually updated since then as part of a continuous improvement program. The fisheries management plan addresses water levels during normal flow conditions (under 4300 cubic feet per second) and requires that water levels of 55-58 ft. are maintained in Lake Utopia. Dam adjustments to re-balance water levels and flows may cause water levels in the St. George Marsh to rise or drop while moving towards its water level targets.

Water level fluctuations are one aspect of wetlands that need to be managed. Water level management is important to promote the growth of beneficial plants and attract waterfowl and other wildlife. It will be important to continue to monitor the water levels in the St. George Marsh to determine how much they fluctuate throughout the year, how they fluctuate in relation to the river, and also to provide more information on groundwater connectivity.



Figure 4: Eastern Charlotte Waterways Inc. Field Technician, Ryan Martin, installing a barometrically adjusted water level logger in the St. George Marsh in Spring 2015.

3.6 Climate Change

As the temperature continues to increase, Charlotte County will experience an increase in frequency of days above 30°C, known as “hot days”. Currently, Charlotte County experiences an average of 4-5 hot days per year. However, by the latter part of the century that number could rise to as many as 26 hot days per year (ACASA, 2013). A shift in average temperature of a few degrees may not seem like much, but the occurrence of hotter, drier summers could reduce the supply of water to the St. George Marsh and lead to more frequent and extended droughts. On the other hand, as the air continues to get warmer, it is able to hold more moisture which has resulted in an increase in significant precipitation events (> 50 mm over a 24 hr period) over the last decade (Signer et al., 2014). Climate models predict that Charlotte County will experience less frequent, but more significant precipitation events (ACASA, 2013) causing the water levels in the St. George Marsh to rise rapidly at times.

Small changes in temperature or water supply could have significant effects on wetland vegetation and associated wildlife species. A rise in temperature could facilitate the establishment of new invasive plants in the marsh. A change in the seasonality of precipitation could harm plants or animals whose life cycles require certain amounts of water at specific times of the year. For example, the threatened Least Bittern requires relatively shallow water (10-50 cm) during the breeding season from May-September, as high water levels can flood nests that are constructed just above the water, whereas low levels reduce food availability and facilitate predators' access to nests. More frequent and extended droughts as a result of climate change may result in local, and possibly regional declines in a plant on which waterfowl depend, or insect species on which species-at-risk (e.g., Common Nighthawk) depend on.

As time goes on, climate change adaptation strategies will be vital, as climate change will inevitably influence the availability of water in the St. George Marsh, the key ecological driver of the marsh.

3.7 Invasive Species

Invasive plants often outcompete native vegetation by creating dense thickets that may also cause adverse changes to the microclimate and microhabitat that support at-risk species. Invasive plants such as Purple Loosestrife (*Lythrum salicaria*) have been identified in the St. George Marsh. Other species such as Glossy Buckthorn (*Frangula alnus*) and Common Reed (*Phragmites australis subsp. australis*) are threatening wetlands in New Brunswick, and have the potential to establish in the St. George Marsh. These species compete with their native counterparts for resources and thus have a detrimental impact on native flora and fauna. Often extremely difficult, if not impossible, to remove once established combatting them begins with preventing their spread and/or introduction in the first place.



Figure 5: The invasive, Purple Loosestrife (*Lythrum salicaria*) in the St. George Marsh. Photograph by Ryan Martin.

4.0 Management Objectives

The management objectives of the St. George Marsh are as follows:

1. Increase understanding of species at risk populations to ensure they are sustained at desired level and if feasible, increased
2. Maintain water quality and quantity within their natural or expected range of variability
3. Maintain habitat quality and connectivity for wildlife
4. Engage visitors in high quality, appropriate recreational or educational experiences without impairing the ecological character of the marsh
5. Improve public awareness, understanding and stewardship of the St. George Marsh among visitors and locals, leading to increased participation in maintaining the ecological character of the wetland

5.0 Management Actions

The management actions to address the objectives for the St. George Marsh are listed below and are followed by the responsible party for the action and timeline for completion.

Objective 1: Increase understanding of species at risk populations to ensure they are sustained at desired level and if feasible, increased

Action 1.1: Assess and monitor the distribution, number of individuals, habitat requirements and population trends of species at risk occurring in the St. George Marsh to improve knowledge and determine need.

Responsibility: Eastern Charlotte Waterways Inc., Friends of the St. George Marsh

Timeline: Annually

Action 1.2: Map and monitor priority habitats in the St. George Marsh to ensure composition and structure of vegetation are maintained.

Responsibility: Eastern Charlotte Waterways Inc., Friends of the St. George Marsh

Timeline: Fall 2017

Action 1.3: Engage regulators and stakeholders in the development and implementation of effective strategies to ensure the long-term viability of species at risk occurring in the St. George Marsh

Responsibility: Eastern Charlotte Waterways Inc., Ducks Unlimited, Bird Studies Canada

Timeline: Winter 2018

Objective 2: Maintain water quality and quantity within their natural or expected range of variability

Action 2.1: Develop and implement a water quality monitoring program for the marsh that includes collecting data for pH, temperature, turbidity, dissolved oxygen, total nitrogen and total phosphorous to monitor changes in water quality and better understand nutrient dynamics in the St. George Marsh.

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: Annually

Action 2.2: Develop and implement a water level monitoring program to determine how much water level fluctuates throughout the year and in relation to the Magaguadavic River. A monitoring program will ensure water level management is supported by data and creates optimal conditions for wildlife.

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: Annually

Action 2.3: Conduct a comprehensive study to improve understanding of the hydrology of the St. George Marsh focusing on the inflow and outflow of water to ensure the function of the marsh is maintained, and/or improved

Responsibility: J.D. Irving, Limited

Timeline: 2017

Objective 3: Maintain habitat quality and connectivity for wildlife

Action 3.1: Undertake a detailed wetland vegetation survey within the St. George Marsh both on the ground and through aerial photographs to record plant species, location, % cover and interspersions (vegetation-to-open water) in order to document and monitor changes in plant diversity and extent over time

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: Summer and Fall 2017, continue every 3-5 years

Action 3.2: Undertake a detailed wildlife survey in the St. George Marsh for wildlife including mammals, amphibians, reptiles and invertebrates.

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: 2016-2017

Action 3.3: Continue to survey the St. George Marsh for bird species and associated habitat in accordance with the Maritime Marsh Monitoring Protocol established by Bird Studies Canada to gain a better knowledge of species-habitat associations and habitat features that influence occupancy, abundance and distribution

Responsibility: Friends of the St. George Marsh

Timeline: Ongoing

Action 3.4: Analyze data collected to determine if and/or when intervention is required to restore waterfowl and wildlife habitat quality (e.g., increase open water habitat, increase tree habitat)

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: Fall 2017

Action 3.7: Provincial and municipal designations should be maintained and enforced for the continued protection of the St. George Marsh. Any unauthorized works within and adjacent to the marsh should be reviewed to ensure that potential effects on the St. George Marsh are avoided, or minimized.

Responsibility: Town of St. George, New Brunswick Department of Environment and Local Government

Timeline: Ongoing

Action 3.5: Monitor, maintain and add habitat enhancement structures [e.g., nesting boxes, tree protectors (i.e., to protect from porcupine, beaver) and water control structures] within the St. George Marsh to improve habitat quality

Responsibility: Friends of St. George Marsh, Eastern Charlotte Waterways Inc., Ducks Unlimited

Timeline: Summer and Fall 2016

Action 3.8: Explore the possibility of designating the St. George Marsh as a “Provincially Significant Wetland” under the *New Brunswick Wetlands Conservation Policy* based on its ecological, economic, and socio-cultural values.

Responsibility: Friends of the St. George Marsh

Timeline: Fall 2016

Action 3.6: Develop and implement appropriate prevention and control methods for invasive species that threaten native plant species and communities in the St. George Marsh

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: 2017

Objective 4: Engage visitors in high quality, appropriate recreational or educational experiences without impairing the ecological character of the marsh

Action 4.1: Explore possible opportunities to enhance the trail network within the St. George Marsh

Responsibility: Ducks Unlimited

Timeline: Fall 2017

Action 4.4: Install boxes at each trailhead to hold the St. George Marsh brochure and bird checklist

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: Summer 2017

Action 4.2: Design and install signage to encourage people to clean-up after dogs

Responsibility: Ducks Unlimited

Timeline: Summer 2016

Action 4.5: Monitor the St. George Marsh to identify off highway vehicle (OHV) access and, if deemed necessary, install vehicle barriers or signage as required

Responsibility: Ducks Unlimited

Timeline: Summer and Fall 2016

Action 4.3: Develop a St. George Marsh brochure that includes information on its ecological, economic and socio-cultural values

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: Fall 2017

Objective 5: Improve public awareness, understanding and stewardship of the St. George Marsh among visitors and locals, leading to increased participation in maintaining the ecological character of the wetland

Action 5.1: Develop and implement an education program to promote public awareness of the importance of the wetland to visitors, school groups and local residents. Begin community stewardship activities with a focus on educating neighbouring landowners on the environmental values of the property and how they can help preserve those values.

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: Summer 2017

Action 5.2: Host a free public talk related to the St. George Marsh on World Wetlands Day (February 2nd)

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: Annually

Action 5.3: Expand the New Brunswick Invasive Plant Patrol Program (IPP) to promote public awareness of, support for, and involvement in the control of non-native plants in wetland habitats

Responsibility: Eastern Charlotte Waterways Inc.

Timeline: Summer 2017

6.0 Implementation

Long term collaboration will be required to implement the recommendations of the St. George Marsh Management Plan. Eastern Charlotte Waterways will act as the bridging organization to bring together the stakeholders, monitoring the progress of the plan on an annual basis, and assist, where possible, the implementation of actions. All stakeholders must work together to enable the work to proceed. Each stakeholder will be expected to continue sharing resources such as data, information, in-kind support and funding.

The value of the plan will only be realized to the extent that stakeholders, individually and in collaboration, act on the actions as there is no specific statutory framework that requires adoption and implementation of this document. The plan has been designed to incorporate the views and knowledge of all interested parties. Work has been completed in acceptance of the fact that management must proceed even if we do not have all the information we would like. Management is not only a way to achieve objectives, but is also a process to learn more about the marsh. As we learn more, we can adapt our actions to improve management success and to be more responsive to future conditions such as a changing climate. All parties must continue to participate in the management of the St. George Marsh with good will and prudent efforts to sustain its ecological, economic and socio-cultural values.

7.0 References

Atlantic Climate Adaptation Solutions Association (ACASA). (2013). New Brunswick Climate Futures. Retrieved from <http://www.acasamaps.com/>.

Signer, K., Reeder, K. and Killorn, D. (2014). Community Vulnerability Assessment of Climate Change and Variability Impacts in Charlotte County, New Brunswick. St. Croix Estuary Project Inc., and Eastern Charlotte Waterways Inc.



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