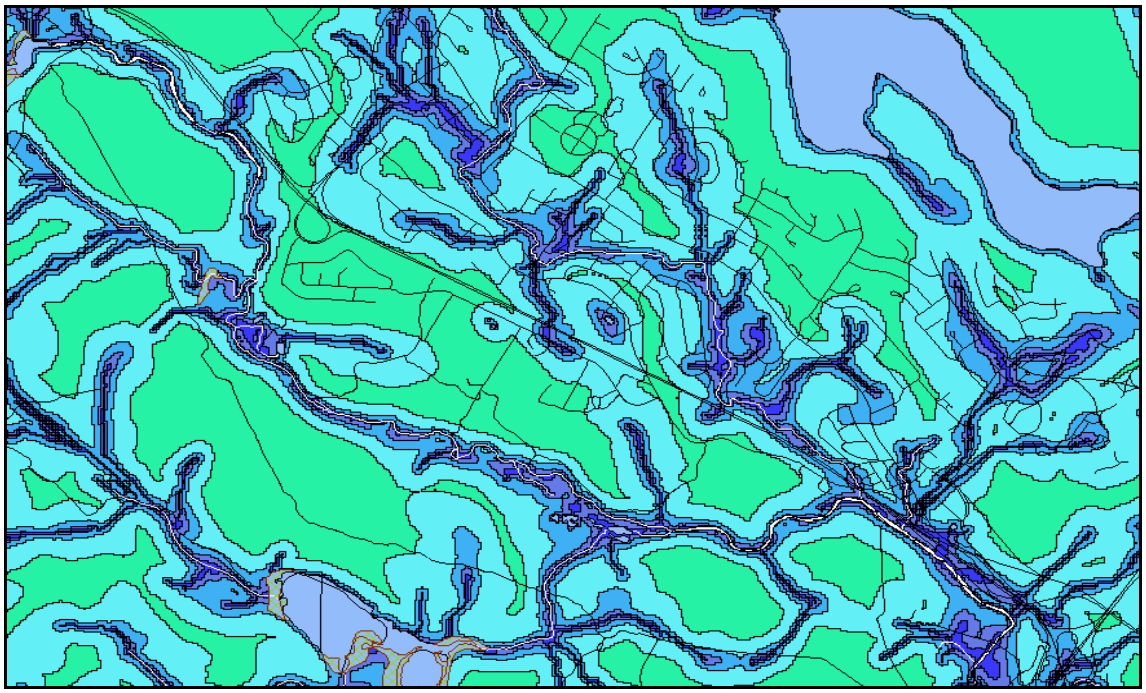
# Sackville River Watershed Wetland Inventory

*Prepared for the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR-ESS File:17.008.09)*



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March 31, 2010

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# ABSTRACT

*Wet Area Mapping (WAM) data was acquired and assessed in the field to identify and inventory wetland and wet area sites to locate areas for wetland creation, enlargement, and enhancement. These sites could be used for potential future wetland compensation projects in the Sackville River Watershed (SRW). The inventory project was initiated as part of the compensation for damaged wetlands from new interchanges on Highway 101 and 102 and the new French high school in the Halifax Regional Municipality. The WAM data was found to be accurate in identifying wet areas in the surveyed portions of the SRW. Three of the SRW's most urbanized sub-watersheds were field inventoried and revealed non-wetland wet areas as well as new, potential, and existing wetlands. These areas yielded the possibility for a total of 142,743 square meters of wetland creation, restoration, and enhancement. The remaining 10 sub-watersheds require 6 months of GIS work, field work, and report writing which could reveal approximately 100 additional wetland creation, enlargement, and enhancement sites.*

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## ACKNOWLEDGEMENTS

This project would not have been successful without the assistance of various individuals. Additional Sackville Rivers Association (SRA) staff members and volunteers were essential offering background information and support during fieldwork. SRA President Walter N. Regan offered an abundance of local knowledge on wetland areas and tributaries and Coordinator Stephen Caines and Assistant Coordinator Colin O'Neil were very helpful in the field. Kevin Smith, an SRA Katimavik volunteer, was invaluable as he also assisted throughout the duration of the fieldwork. Bob Rutherford of Thamus Environmental Consultants and Mike Parker of East Coast Aquatics offered crucial insight and recommendations for the project design and throughout the project. Also, Kevin Legere from Nova Scotia Geomatics was helpful with acquiring both the Nova Scotia Digital Topographic Series and Sackville River Watershed map layers as well as offering background information on the topographic wetland data.


## BIOGRAPHY

John-William Brunner has been working with the Sackville Rivers Association since May 2009. He originates from Huntsville, Ontario and attended Sir Sandford Fleming College in Lindsay, Ontario where he received an Ecosystem Management Technologist Diploma. Since graduating, John-William has been employed with the District Municipality of Muskoka, Ontario, as a Biological Monitoring Technician mainly sampling benthic macro invertebrates, and with the University of New Brunswick as a Field Technician on a Northern Flying Squirrel Research Project in Fundy National Park, New Brunswick. In the summer of 2009, he worked on installing in-river restoration structures in the Little Sackville River as well as conducted water quality monitoring, Atlantic salmon monitoring, and other activities with the SRA.

# SACKVILLE RIVER WATERSHED WETLAND INVENTORY

## 1. INTRODUCTION

The Sackville Rivers Association (SRA) conducted a wetland and wet areas inventory and compensation assessment of the Sackville River Watershed (SRW) during the months of September-December of 2009. The Sackville River Watershed Wetland Inventory (SRWWI) was initiated as one of two Nova Scotia Environment-approved compensation projects for damaged wetlands near new interchanges on Highways 101 and 102 and a new French secondary school in the Halifax area of Nova Scotia.

The goals of the SRWWI were to (i) locate existing wetlands that could be restored or enhanced, and (ii) identify 'wet areas' that could be developed into wetlands. These potential sites would be available for NSTIR and other proponents to use as compensation projects for future impacts on wetlands in the Halifax Regional Municipality (HRM). A key focus of the inventory was to discover the usefulness of, and utilize, Wet Areas Mapping (WAM) data to locate areas of potential wetland development, enhancement, or restoration.

### 1.1 SACKVILLE RIVERS ASSOCIATION

The SRA, located in Sackville, Nova Scotia, is an environmental non-governmental organization dedicated to the preservation, restoration and enhancement of the SRW. The association has been functioning for 21 years and has over 200 members. The SRA's mandate is to:

1. Protect and where necessary restore the environment of the Sackville River Watershed;
2. Raise awareness about the Sackville River and its adjacent watersheds;
3. Establish a Conservation Corridor along the length of the Sackville River, and;
4. Provide training and advice to community groups in other watersheds as needed, to restore the environment and raise environmental awareness.

In the past, the SRA has undertaken many projects, ranging from salmon habitat restoration to successfully lobbying for flood plain zoning and protection. The SRA's efforts are concentrated on restoring and protecting Atlantic salmon habitat, and reconnecting fragmented Atlantic salmon habitat through in-river restoration and restocking. The SRA also works towards educating the public through its two educational in-classroom programs River Rangers and Fish Friends.

The SRA is also developing the Sackville River Watershed Management Plan (SRWMP), based on the existing Sackville River Ecosystem Plan (SREP). A habitat assessment and restoration report on the Sackville River between Peverill's Brook and Webber Lake and the Sackville River Watershed Restoration Plan (SRWRP) for the main tributaries of the Sackville River have been recently completed and are components to the SRWMP. This report will contribute to a Sackville River Watershed Wetland Management Plan (SRWWMP), another element to the SRWMP.

### 1.2 SACKVILLE RIVER WATERSHED

The SRW is located northwest the metropolitan area of the City of Halifax, Nova Scotia, the largest urban centre in Atlantic Canada, and is the primary source of freshwater to the Bedford Basin and Halifax Harbour. Most of the SRW is found within the Halifax Regional Municipality (HRM), but has its headwaters in the Municipality of East Hants. The SRW has an area of approximately 147 sq km and its main stem, the Sackville River (SR), stretches approximately 44km (*see Figure 1*).

#### 1.2.1 Demographics

The Sackville River flows through the town of Lower Sackville, the largest urban centre in the watershed, which has a population of approximately 40,000. Lower Sackville is a suburban community of Halifax and has been subject to intense urban sprawl and development as a result of poor urban planning. The smaller communities of Mount Uniacke, Upper and Middle Sackville, Hammonds Plains, Lucasville, and Bedford are also located in the SRW.

#### 1.2.2 Natural Features

The SRW is made up of 15 sub-watersheds which contains 15 lakes, numerous ponds and wetlands, and many tributaries and feeder brooks (*see Figure 2*). A main tributary to the Sackville River is the Little Sackville River (LSR) which flows through the town of Lower Sackville and is 11km. The geology of the SRW is mainly comprised of granite bedrock and glacial till, most of which is found in the drumlins that surround surface water features. Because drumlins are comprised of mixed sizes and types of sediment, erosion and the transportation of these sediments adjacent to surface water features is sometimes problematic. The Sackville River discharges into the Bedford Basin in the town of Bedford, another suburb of Halifax, which has a population of over 17,000.

#### 1.2.3 Current State

Both the Sackville and Little Sackville Rivers are considered urban rivers, having both historical and present development and degradation along their banks. However, the northwestern portion of the watershed remains somewhat undeveloped. Despite the past and present human impacts, the watershed supports 16 fish species, including Atlantic salmon (*Salmo salar*).

## 2. WETLANDS

### 2.1 THE VALUE OF WETLANDS

Wetlands are areas of land that are permanently or seasonally inundated with water and display vegetation and soils indicative of wet conditions. Wetlands are recognized for their productivity and diversity, and provide a wide variety of habitats for both aquatic and terrestrial organisms. They are also crucial in maintaining high water quality in a watershed as wetland vegetation and soils bind pollutants and filter out excess nutrients and other organic compounds releasing them in a way beneficial to the productivity of the aquatic ecosystem. Wetlands are also valuable in controlling the flow of water through a

watershed; in flood periods wetlands hold water back mitigating damage, and in droughts they release water more readily (*NRCAN, 2009*).

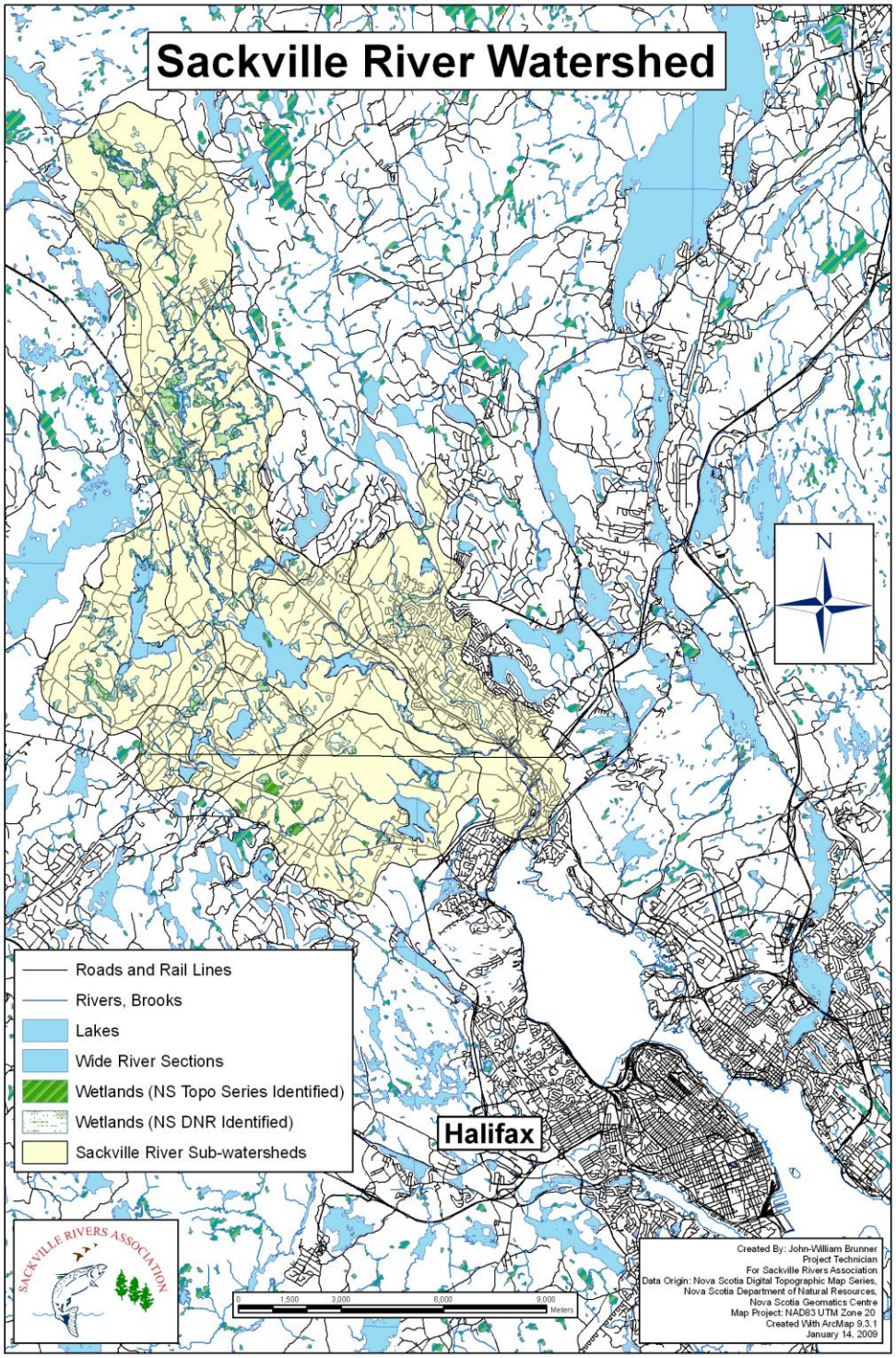



*Fig. 1 – Sackville River Watershed Regional Area*

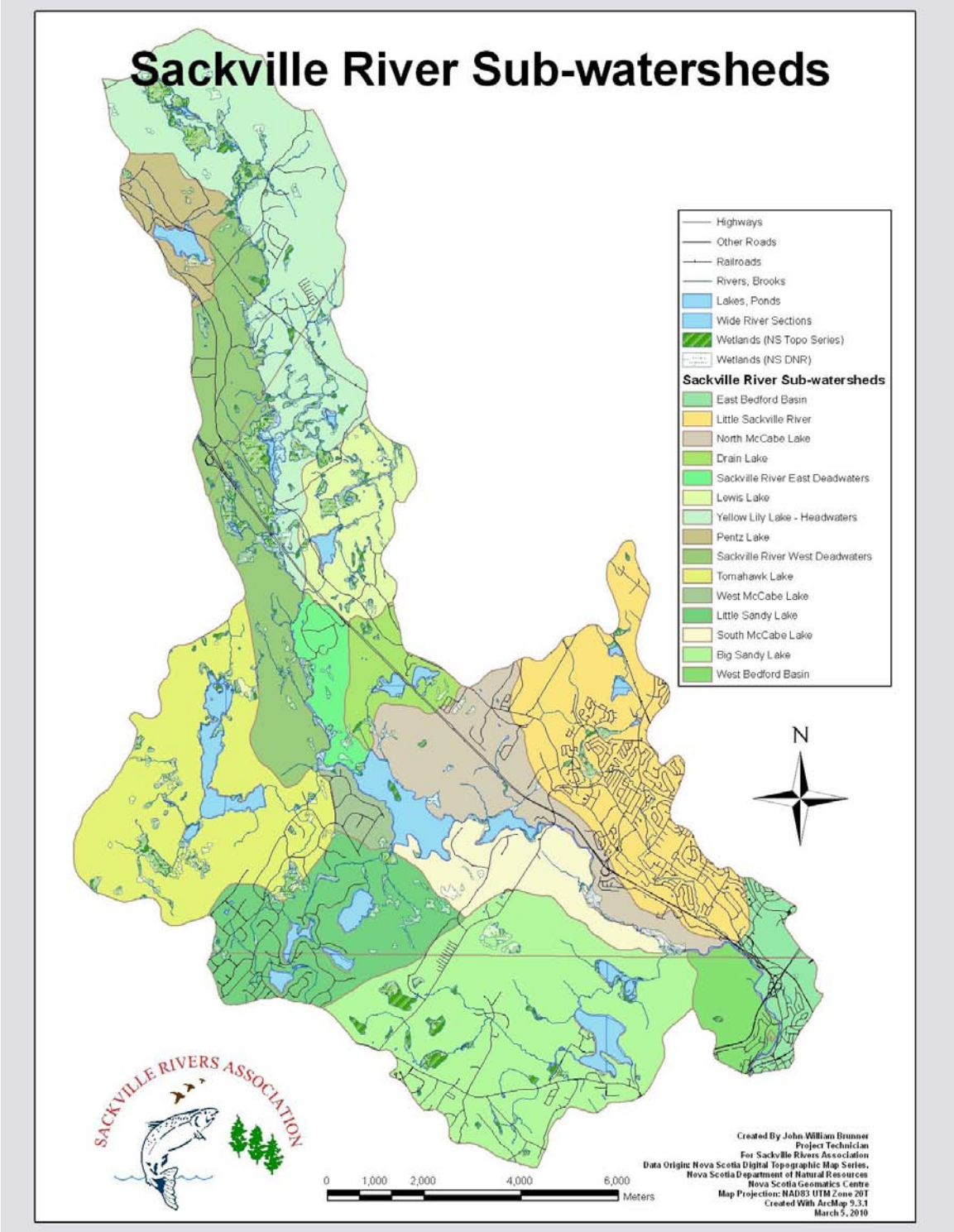



*Fig. 2 – Sackville River Sub-watersheds*

### 2.2 EXISTING WETLAND INVENTORIES

#### 2.2.1 Environment Canada & Nova Scotia Lands and Forests

During the 1970's and 1980's, a large scale wetland inventory was initiated in Nova Scotia, part of which covered the SRW. The inventory was a collaborative project completed by Environment Canada's Canadian Wildlife Services, along with Nova Scotia Department of Lands and Forests, now Nova Scotia Department of Natural Resources (NSDNR). The inventory was based on 1:50,000 hardcopy topographic maps. The inventory still has value today but users must be aware of its limitations in accuracy and precision (*NSDNR, 2009*).

#### 2.2.2 Nova Scotia Topographic Map Series

The wetland layer in the Nova Scotia Digital Topographic Series was also based on the digitization of aerial photography. The aerial photography was produced during flyovers in 1991 and 1997 at a scale of 1:40,000. The data includes various wetlands in the SRW but does not specify wetland types. Some wetlands in the topographic map are not inventoried in the NSDNR digital inventory, making the data another useful source of wetland information (*Kevin Legere, NS Geomatics*).

#### 2.2.3 Nova Scotia Department of Natural Resources

In 2000, the Nova Scotia Department of Natural Resources (NSDNR) replaced the previous wetland survey with a digital inventory comprised of visual interpretation and digitization of aerial photography. The new digital inventory has improved accuracy and versatility as the data can be viewed online, and easily downloaded and manipulated in a GIS (Geographic Information System) (*NSDNR, 2009*). However, there are still issues with data precision and the identification of some types of wetlands, for example, treed and shrub swamps.

## 3. WET AREAS MAPPING (WAM)

### 3.1 BACKGROUND

A Wet Areas Mapping (WAM) data set was initially developed for New Brunswick through the University of New Brunswick with the help of various governmental and industrial partners. WAM is a type of modelling created to delineate wet and dry areas based on depth-to-water tables (DTW) and flow accumulation channels (FACs) using digital elevation models (DEMs), mapped surface water features like lakes and streams, and wetland and forest inventories. Nova Forest Alliance and the NSDNR created the WAM data set for Nova Scotia based on the work in New Brunswick (*see Figure 3*) (*NSDNR, 2009*).

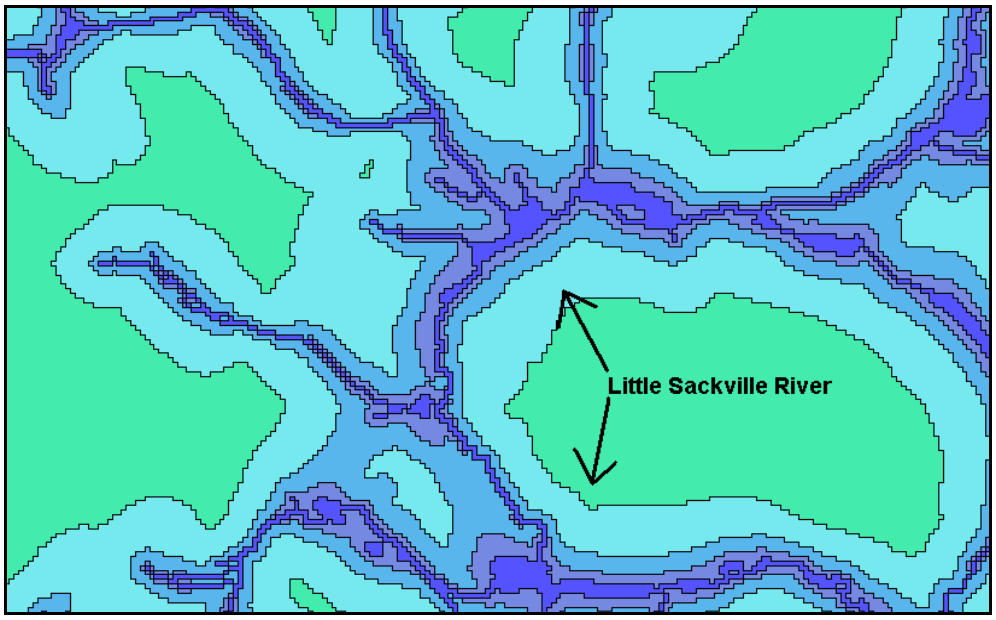



*Fig. 3 – Wet Area Mapping. WAM showing the LSR and the wetlands adjacent to Millwood Road*

**3.2 PRACTICAL USE**

During and after its development, WAM data has been used mainly in the forestry industry to improve harvest practices by lessening environmental impacts and increasing production by identifying wet areas before encountering them in the field. The mapping helps planners to design cutblocks and roads in an ecologically sound manner, improve watercourse crossing design, and delineate special management zones. It also assists in identifying suitable planting locations for different tree species *(Ogilvie, et al, 2007*

The Department of Natural Resources in New Brunswick has used WAM for identifying additional wetlands, wet forested areas, and locating habitats for certain types of wetland and forest species. NSDNR has recognized its use in improving ecosystem based planning methods, soil mapping, and the mapping of current and future tree habitat suitabilities *(Ogilvie, et al, 2007).*

**3.3 ROLE IN WETLAND INVENTORY**

Many wetlands in the SRW have been identified; however, many remain to be identified and evaluated. Also, there is a potential for a high number of wet areas that could be developed into wetlands. The WAM data was used to locate areas of potential wetland restoration, enhancement, and creation as it identifies depth-to-watertables (DTW) across a landscape and delineates wet and dry areas. However, proper usage of the WAM modelling data required field verification to understand its usefulness in this inventory project to identify areas of wetland compensation.

# 4. METHODS

## 4.1 MAPPING AND GIS

### 4.1.1 Map Data

The WAM data was acquired from NSDNR's Forestry website (*NSDNR, 2009*). The Nova Scotia 1:10,000 scale Digital Topographic Series Map sheets were acquired from the Nova Scotia Geomatics Geonova website. Both data sets are available to the public free of charge. Watershed and sub-watershed map layers was acquired through Kevin Legere at the Nova Scotia Geomatics Centre (*see 4.2.1 Sub-watersheds*) (*NS Geomatics, 2009*). All data sets are in the NAD83 map datum and were input into a Geographical Information System (GIS) called FGIS.

### 4.1.2 FGIS

Forestry GIS (FGIS) is a free GIS designed by the Wisconsin Department of Natural Resources and was used to manipulate data and view map layers. FGIS was acquired from the Forest Pal website which promotes the low cost use of GIS (*Forest Pal, 2008*). The program performed many useful tasks but is not as capable and compatible as more professional GIS. FGIS's inability to create uploadable waypoints onto a GPS created additional work using with other software programs to do the conversions. Once the inventory sites were identified, Universal Transverse Mercator (UTM) coordinates were obtained from the site's vertices.

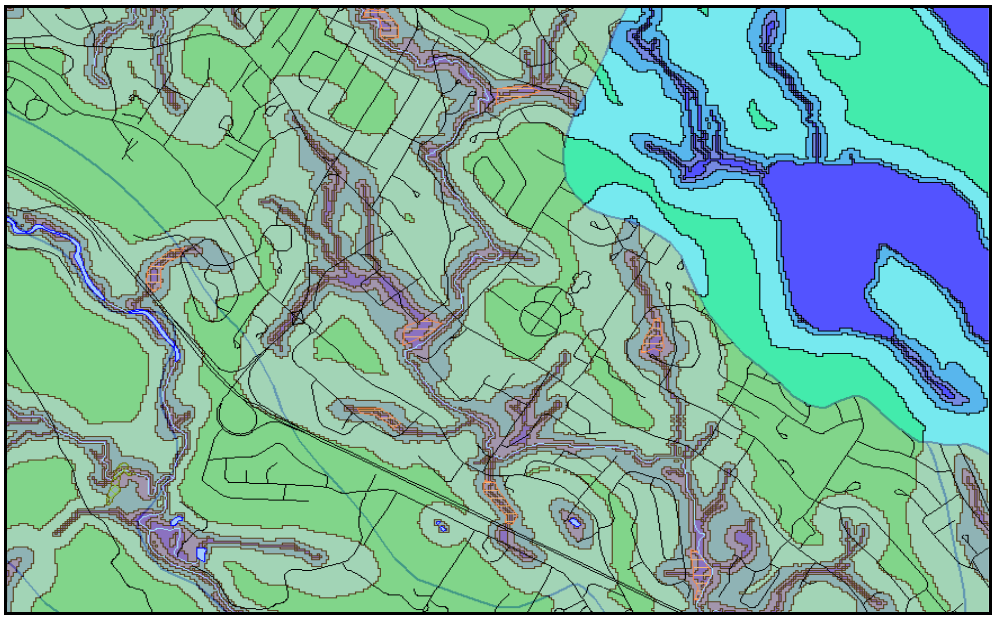


*Fig. 4 – FGIS. Wet Area Mapping and Nova Scotia Topographic Map sheets in FGIS showing potential compensation sites in the core area of Sackville (also shows watershed and sub-watershed boundaries).*

### 4.1.3 MapSource

MapSource is a GIS produced by Garmin to function with Garmin GPS units. The version that used for this project was MapSource Waypoint and Trip Manager 6.13.7.0. MapSource can create geographic data, such as waypoints and tracks, transferable onto a Garmin GPS unit, as well as download information collected from a GPS unit. UTM coordinates from the WAM sites in FGIS were manually input into MapSource to transfer the identified sites and coordinates into Google Earth and a GPS unit.

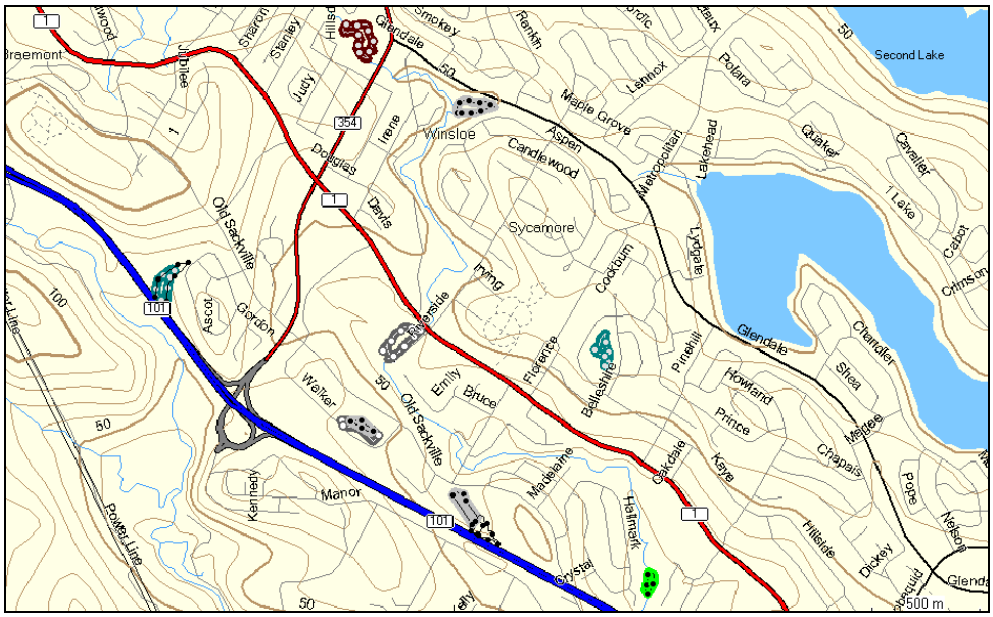



*Fig. 5 – MapSource. GPS tracks of surveyed WAM compensation sites in MapSource.*

### 4.1.4 Google Earth

The WAM sites were transferred into Google Earth to evaluate their location. Many of the WAM sites were found in developed areas and are not suitable for compensation projects (wet areas through residential sub-divisions, major streets, or commercial areas). However, other sites were found in more natural locations, some of which are adjacent to the Sackville River and LSR

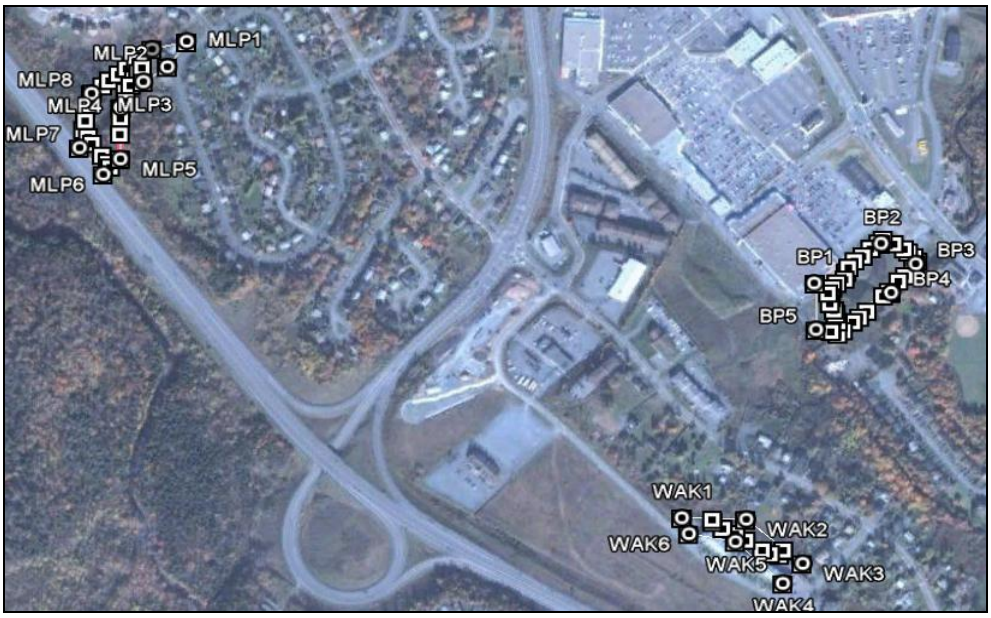


*Fig 6 – Google Earth. GPS tracks of WAM surveyed sites shown in Google Earth.*

## 4.2 PRIORITIZATION AND CLASSIFICATION

Because the WAM data shows wet to dry areas in 5 DTW delineations, we hypothesized that only the first two delineations would most likely exhibit wet conditions. Delineated depths of 0m-0.1m (#1), and 0.11m-0.5m (#2) were selected as suitable depths to work with when locating existing wetlands and potential areas to create wetlands. The identified WAM sites were also prioritized by location: sites found within more developed urban areas of the Sackville River Watershed were to be assessed first. The urbanized areas would most likely require a greater need for restoration and protection from future development.

### 4.2.1 Sub-watersheds

To further direct the inventory, the WAM sites were classified based on sub-watersheds. The four most southerly and urbanized sub-watersheds including the Little Sackville River Sub-watershed were surveyed first, as the urbanized areas of Sackville and Bedford are located within their boundaries. Environment Canada has identified all Canadian watersheds and major sub-watersheds giving each a unique code. The Sackville River Watershed's code is 1EJ4, and all sub-watersheds within it have the same prefix. Table 1 lists all surveyed sub-watershed names, codes, and major features.

Where the Sackville River discharges into the Bedford Basin, 1EJ4A is used for the east side of the river (Sackville River – East Basin) and 1EJ4Q is used for the west side of the river (Sackville River – West Basin). Further upstream, the Little Sackville River Sub-watershed's code is 1EJ4B and 1EJ4C is used for the section of the Sackville River upstream from the LSR and north of McCabe Lake (Sackville River – North McCabe Lake) (*EC, 2008*). Each surveyed site was assigned a number suffix to the sub-watershed code (1EJ4B1 for example). No priority was given to the numbering system within each sub-watershed, but usually the more urbanized sites were classified first.

*Table 1 – Surveyed Sub-watershed Codes and Major Features*

| Sub-watershed Name | Sub-watershed Code | Major Features |
|---|---|---|
| Sackville River - West Basin | 1EJBA | Sackville River |
| Sackville River - East Basin | 1EJ4Q | Sackville River |
| Little Sackville River | 1EJ4B | Little Sackville River, Feely Lake, Little Lake |
| Sackville River - North McCabe Lake | 1EJ4C | Sackville River, Webber Lake, McCabe Lake |

## 4.3 IDENTIFICATION OF COMPENSATION SITES

The WAM data delineates the elevations where water table depths are expected to be in a series of depth ranges. The mapping shows groundwater collecting in low lying in relatively higher terrain and forming channel-like areas as water collects and flows down-slope toward surface water features.

Because of its nature, the WAM is continuous and linear. The identification of an individual site was usually made by establishing physical separation of wet areas by roads, buildings or other highly developed areas. In addition, sites were established where the wet areas widths (less than 0.5m DTW) were less than 10 meters, usually due to adjacent steep gradients and/or a small brook. A minimum of 1,000 square meters (0.1 hectare) for identified WAM site size was used for the inventory sites.

## 4.4 BACKGROUND INVENTORY

The coordinates from the WAM site's vertices in FGIS were inputted into MapSource as waypoints. The waypoints were connected by tracks to recreate each site as a polygon. After recreating the sites, initial areas were calculated to be later verified in the field. The sites could then be transferred into a GPS unit or viewed in Google Earth and.

Background information was collected after a WAM site was assessed in Google Earth and found eligible for inventory. Adjacent surface water and existing wetlands were recorded, which was verified in the field. Areas of reference such as a street or water body were also recorded. WAM depths were recorded, but were the same for each site.

## 4.5 FIELD WORK / GROUND TRUTHING

The main goal for the field work was to identify what the WAM sites exhibited in the field and how the areas could be used as potential compensation projects to improve or create wetlands. Specifically, the goal was to acquire ground truthed areas of current wetlands to be enhanced or restored, and wet areas that could be developed into wetlands. This was ground truthed by GPS tracking and visual surveying of the vegetation and soil saturation. Prior to field work, MapSource tracks of the WAM sites were uploaded to a GPS unit, and site maps from FGIS were produced. Using the maps and GPS coordinates; the sites were located on the ground and surveyed.

### 4.5.1 Areas

For each site, a new track was created with the GPS, in the likely case that the boundaries of the WAM site would change from its original area in the GIS. The sites were approached as if a wetland was not present and regarded as a wet area until a wetland was discovered. The site's perimeter was travelled to verify the area, and site characteristics were recorded. Some larger sites required further inventory into the centre of the sites

using the GPS to ensure a significant portion of the site was surveyed. In some cases, a developed area such as paved surface or manicured or fenced yard was found within the site and was excluded from the total area recorded by GPS tracking.

While many sites did not displayed wetlands, some wetlands were found within the WAM boundaries. The wetlands were separated from the non-wetland areas for future compensation allocations. All types of inventoried land (wet areas, wetlands) were identified and the individual areas were recorded in square meters for later use. Some wetlands were found to span outside of the WAM site; however, areas were still recorded.

#### 4.5.2 Site Characteristics

In addition to confirming areas, other details were recorded for each site such as present surface water, dominant and under story vegetation, basic soil descriptions, general topography, and any other relevant information. Land uses (or adjacent land uses) were also recorded for each site, as well as any impacts to the site's hydrology, soils, and vegetation.

#### 4.5.3 Post-Field Work

Once the areas sites were inventoried in the field, property identification (PID) numbers and landowner types were obtained from the City of Halifax's 'Explore HRM' GIS website (*HRM, 2009*). The PID numbers from Explore HRM are not definite and official property surveys should be consulted in the future to obtain accurate PID numbers. GPS coordinates were also recorded for each site, usually for the closest location to a road or access point. All information gathered in the field was updated and recorded into a spreadsheet.

# 5. RESULTS

## 5.1 CUMULATIVE RESULTS

### 5.1.1 Site Categories

After the field inventory was complete, the sites were classified into four categories for use in this report:

1. a site that did not display definite wetland characteristics but exhibited some wet conditions (moist soils or surface water) was classified as a *wet area (no wetland)* site;
2. a site that exhibited a previously unknown or unidentified wetland was classified as a *new wetland* site;
3. a site with some, but not completely defining, wetland characteristics (some typical wetland vegetation, moist soil, or surface water), was classified as a *potential wetland* site;
4. and a site with an existing or previously identified wetland was classified as an *existing wetland* site.

The field inventory revealed that all 27 sites displayed wet characteristics, in varying degrees and combinations. Out of the 27 sites, 8 sites revealed new or previously unidentified wetlands, 4 sites revealed potential wetlands, and 1 site had a previously identified/known wetland. The remaining 14 sites displayed only *wet areas* (areas with wet conditions but no typical wetland characteristics) (s*ee Table 2 for total results)*. It is important to note that a site with a *new, potential,* or *existing wetland* also exhibited adjacent wet areas.

*Table 2 – Total number of Sites and Categories*

| **Total # of sites:** | **27** | **%** |
|---|---|---|
| Total # of sites with wet areas (no wetlands) | 14 | 52% |
| Total # of sites with new wetlands | 8 | 30% |
| Total # of sites with potential wetlands: | 4 | 14% |
| Total # of sites with officially identified wetlands | 1 | 4% |

### 5.1.2 Site Classifications

In contrast to the site categories, most sites have more than one wetland classification. These classifications were separated when calculating field verified areas. For example, the Harry Little Brook site (1EJ4B1) revealed a *new wetland* and a *wet area*. The areas of both classifications were recorded for future compensation work. The field verified areas of the classifications at each site determine the nature of potential future compensation work. Depending on the classifications of an individual site, different compensation projects are possible (*see Table 3 and Table 4*).

A total of 142,743 sq meters of wet areas and wetlands were found with different compensation possibilities. Of the 142,743 sq meters:

- 61,034 sq meters of *'wet areas*' could be developed into wetlands, or an adjacent wetland could be enlarged into them;
- 28,082 sq meters of *'new wetlands'* could be enhanced;
- 36,653 sq meters of '*potential wetlands*' could be developed into full wetlands, enlarged, or enhanced (depending on future assessment);
- and the16,984 sq meter '*existing wetland*' could be enhanced.

*Table 3 – Total Compensation Areas by Site Classification*

| **Site Classifications** | **Wetland Compensation Work** | **Total Area (sq m)** |
|---|---|---|
| Wet Areas | creation, enlargement | 61,034 |
| New Wetlands | enhancement | 28,072 |
| Potential Wetlands | creation/enlargement/enhancement | 36,653 |
| Existing Wetlands | enhancement | 16,984 |
| **TOTAL** | | **142,743** |

The potential wetland areas are not physical boundaries of a potential wetland; they are the areas of the initial wet area. These, and all inventoried new wetlands, will need to be assessed by a trained wetland assessment and classification technician to properly identify the boundaries at each site. The total areas are still useful for compensation

planning, but the specific type of work would be modified according to the characteristics.

*Table 4 – Total Compensation Areas by Sub-watershed and Site Classification*

| **Site Classifications** | **Wet Areas (sq m)** | **New Wetlands (sq m)** | **Potential Wetlands (sq m)** | **Existing Wetlands (sq m)** | **Total (sq m)** |
|---|---|---|---|---|---|
| **Compensation** | creation/ enlargement | enhancement | creation/ enlargement/ enhancement | enhancement | |
| **Sub-watersheds** | | | | | |
| Little Sackville River Sub-watershed (1EJ4B) | 18,828 | 8,748 | 36,653 | 0 | **64,229** |
| Sackville River - East Basin Sub-watershed (1EJ4A) | 27,950 | 6,613 | 0 | 0 | **34,563** |
| Sackville River - West Basin Sub-watershed (1EJ4Q) | 7,997 | 12,711 | 0 | 16,984 | **37,692** |
| Sackville River - North McCabe Lake Sub-watershed (1EJ4C) | 6,259 | 0 | 0 | 0 | **6,259** |
| **TOTAL (sq m)** | **61,034** | **28,072** | **36,653** | **16,984** | **142,743** |

## 5.2 SITE SPECIFIC RESULTS

The following delineated WAM sites were surveyed in the field to assess whether a wetland or wet areas were present, and to verify calculated areas on the ground. Images of FGIS show delineated sites from the WAM data and Google Earth captions show the field surveyed tracks and new wetlands. As seen in Google Earth, initial MapSource areas are shown in thin grey, and the final field verified wet areas are shown in pink. New wetlands are also shown in grey

The first field of each table describes the site name, both in sub-watershed classification and common name. **Location** is given in GPS coordinates (latitude and longitude), usually referenced to the most accessible point in the site. The **Site Categories** field is the assessed types of each WAM site after field inventory. The **Potential Compensation Work** field is a result of the Site Categories field and is the wetland compensation work that could be undertaken at each site.

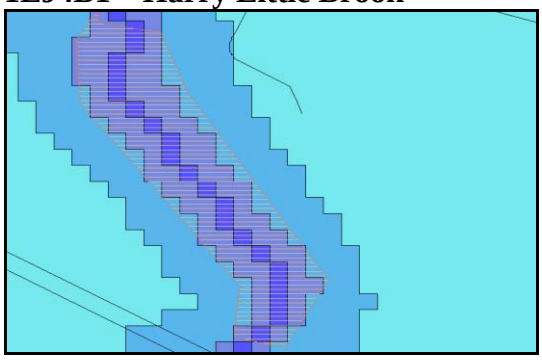
The **Initial MapSource Area** is the area derived from the WAM site's polygons in MapSource before field verification. ***Wet Area* Area** is the field verified area of the non-wetland wet areas. **New Wetland Area** is the field verified area of a newly identified wetland. All areas were recorded in square meters (sq m). The **Wetland Type** field describes the type of wetland found at a WAM site (marsh, swamp etc). Wetland areas and types were not recorded for potential wetlands.

The **Property Identification Numbers** are given for all properties found within the WAM site. Municipally owned properties may have classifications such as "Open Space" or "Park" depending on their designation. The **Land use / Impacts** field describes current land use in or around the site and their resulting impacts. Impacts with the potential to effect soils, hydrology, and vegetation were focused on. The **Date** field is the date the site

was field surveyed. The **Priority** field gives each site a compensation work priority ranking and was based on the number and type of property owners at each site. Sites with less property owners were given a higher ranking. In addition, sites on government owned land were ranked higher than sites on privately owned land.

### 5.2.1 Little Sackville River Sub-watershed (1EJ4B)

**1EJ4B1 – Harry Little Brook**



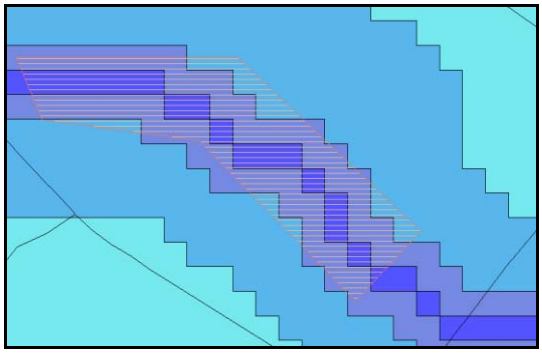

| 1EJ4B1 | Harry Little Brook |
|---|---|
| **Location:** (Lat Long) | 44.76308 N, 63.68741 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | create new wetland, enlarge/enhance wetland |
| **Initial MapSource Area (sq m):** | 8758 |
| ***Wet Area* Area (sq m):** | 6367 |
| **New Wetland Area (sq m):** (if applicable) | 6923 |
| **Wetland Type:** (if applicable) | alder swamp |
| **Property Identification Numbers:** | HRM Open Space-00363820, HRM Open Space-40495236<br>HRM Vacant-00363812, HRM Vacant-00363804, Private-00363747 |
| **Land use / Impacts:** | highway 101 (runoff, pollutants)<br>local/residential usage, potential new park |
| **Priority:** | high |
| **Date Visited:** | 26/10/2009 |

**Site Description**

This site buffers Harry Little Brook, a known, but unmapped feeder brook of the LSR. The area also revealed a 6,923 sq meter alder swamp, which Harry Little Brook drains. As a result of the found wetland, the field area is less than the initial area. The area outside of the wetland was mainly mixed forest with some small shrubs. A few small vernal pools were also found under the forest canopy. Most of the soil did not appear to be saturated and which could be a result of an anomaly in WAM due to underlying bedrock or others. There are several properties within the site; however, only 1 property is privately owned as most are owned by HRM.

For compensation work, the alder swamp could be enlarged into the rest of the wet area of 6,367 sq m for a total of 13,290 sq m, or a new wetland of 6,367 sq m could be created adjacent to the existing alder swamp. One neighbouring property, and the potential of a new HRM park, could influence the work at this site.

## 1EJ4B2 – Walker Avenue



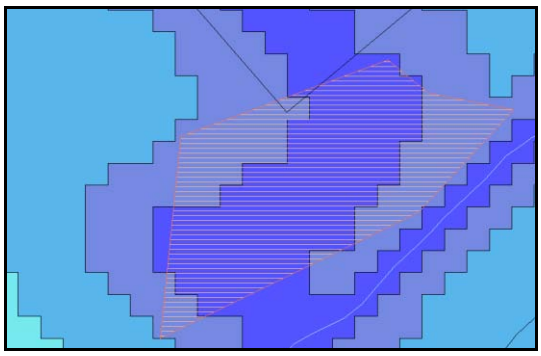

| 1EJ4B2 | Walker Avenue |
|---|---|
| **Location:** (Lat Long) | 44.76610 N, 63.69432 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, potential wetland |
| **Potential Compensation Work:** | enlarge/enhance potential wetland, create new wetland |
| **Initial MapSource Area (sq m):** | alder swamp |
| ***Wet Area* Area (sq m):** | N/A |
| **New Wetland Area (sq m):** (if applicable) | 6381 |
| **Wetland Type:** (if applicable) | 2081 |
| **Property Identification Numbers:** | Private-40585275, Private-40572612, Private-41026758 Private-40869216, Private-40102212, Private-40102238 |
| **Land use / Impacts:** | local usage/trails, garbage, parking lot runoff, residential runoff |
| **Priority:** | low |
| **Date Visited:** | 26/10/2009 |

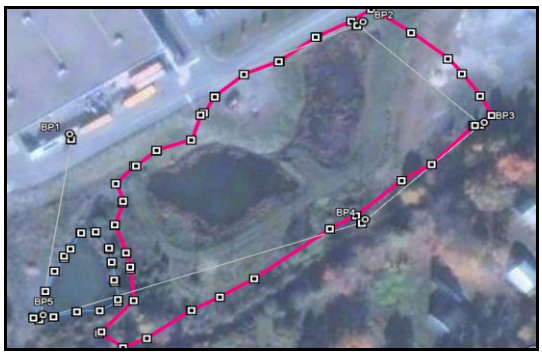
### Site Description

This site is located in a low lying area between an apartment complex and a housing development, adjacent to Walker Avenue. Most of the initial area was projected on the apartment complex and parking lot, thus the field area is much smaller. The verified field area displayed some wetland characteristics with alders, sphagnum moss, and minimal slow flowing surface water, mainly on the western portion of the site. Organic and saturated soils were also found in some areas. The western portion was dryer, with less organic soils with some dominant hardwood trees. The WAM data displayed that the flowing water could form a small feeder brook which would flow into the Little Sackville River after running under two roads but this was not field verified.

The site is classified as a potential wetland as defining wetland characteristics were few and the site was relatively small in size. If found not to be a wetland, a 2,081 sq meter wetland could be created in this area; however, if a wetland is found, enlargement, enhancement, or creation could be a possibility. Compensation could be hindered by the number of property owners, and its use as somewhat of an unofficial park area.

## 1EJ4B3 – Boston Pizza



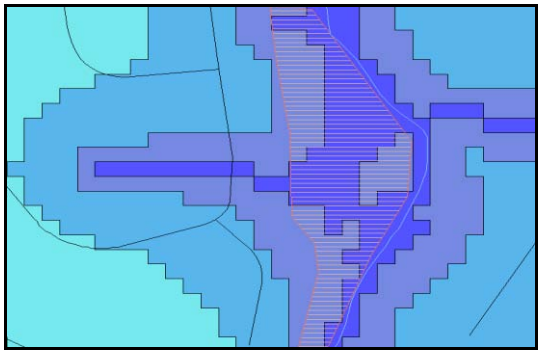



| 1EJ4B3 | Boston Pizza |
|---|---|
| **Location:** (Lat Long) | 44.76998 N, 63.69019 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | enlarge/enhance new wetland, create wetland |
| **Initial MapSource Area (sq m):** | 9809 |
| ***Wet Area* Area (sq m):** | 8846 |
| **New Wetland Area (sq m):** (if applicable) | 650 |
| **Wetland Type:** (if applicable) | marsh |
| **Property Identification Numbers:** | Private-41063983 |
| **Land use / Impacts:** | old parking lot surface, old holding ponds, adjacent to old Walmart, flooding, runoff, pollution |
| **Priority:** | low |
| **Date Visited:** | 28/10/2009 |

This WAM site was found to be an old parking lot for the now abandoned Walmart and runs along the LSR. The parking lot pavement is present but grown over. The site has three stormwater holding ponds; the first two were dry at the time of field inventory. The third stormwater pond had water present, with cattails, reeds, and a few other floating aquatic plants. This pond slowly flows through a small channel into the LSR. The pond was categorized as a marsh due to the present vegetation and has an area of 650 sq meters. Some of the initial area was projected on active paved surfaces and was removed. The rest of the wet area exhibited mainly grassy areas, some shrubs and small trees with some gravel areas and the remains of the old parking lot.

The marsh pond could be expanded into the 8,846 sq meter wet area. A new wetland could also be created along the bank of the LSR in addition to the current marsh. The site has a single private property owner.

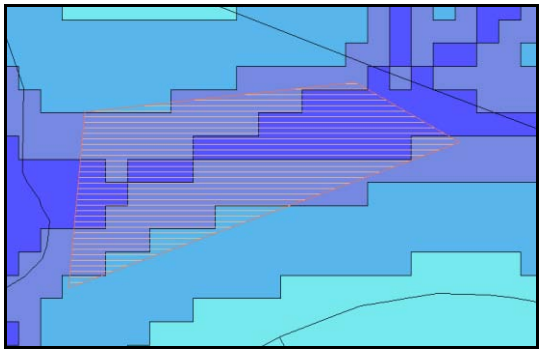
## 1EJ4B4 – Hallmark Avenue

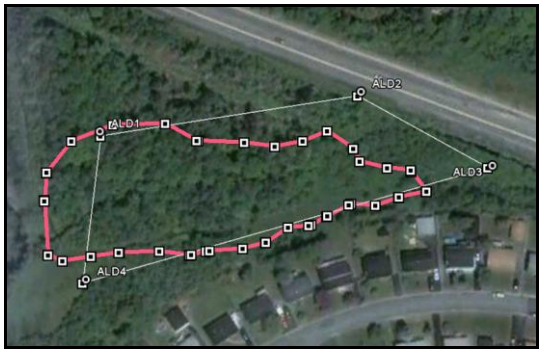



| 1EJ4B4 | Hallmark Avenue |
|---|---|
| **Location:** (Lat Long) | 44.75991 N, 63.67664 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 11608 |
| ***Wet Area* Area (sq m):** | 2519 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | HRM Open Space-40418261 |
| | |
| **Land use / Impacts:** | residential usage/trail, flooding, potential sewage access/new road?, vegetation clearing |
| **Priority:** | high |
| **Date Visited:** | 28/10/2009 |

This site is much smaller than originally projected, as manicured backyards of adjacent houses and the LSR were removed from the area. A small unofficial trail is found within the site which runs along the LSR. A few small vernal pools were found as well as some moist and organic soils. Most of the site was a mature mixed wood forest with some ferns and grasses. A municipal sewage line runs along the LSR in this area, and there are potential plans for an access road to the sewage catch basins. A new wetland could be created adjacent to the LSR in the 2,519 sq meter wet area. The site is on a single HRM property, with a designation of ‘Open Space’.

## 1EJ4B5 – Alder Crescent



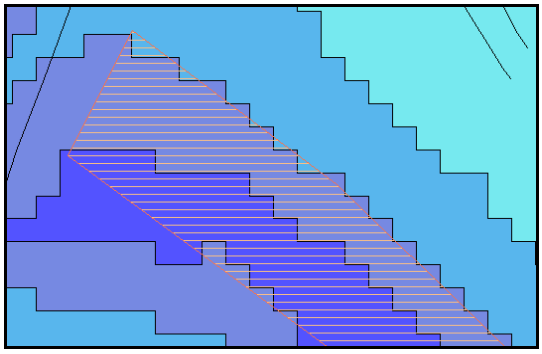



| 1EJ4B5 | Alder Crescent |
|---|---|
| **Location:** (Lat Long) | 44.77910 N, 63.68777 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, potential wetland |
| **Potential Compensation Work:** | enlarge/enhance potential wetland, create new wetland |
| **Initial MapSource Area (sq m):** | 8446 |
| ***Wet Area* Area (sq m):** | 7284 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | HRM Open Space-40014185 |
| | |
| **Land use / Impacts:** | flooding, cleared park area, recreational use, power lines, Glendale Road runoff, pollutants |
| **Priority:** | high |
| **Date Visited:** | 28/10/2009 |

This wet area is located between two major streets and is along the LSR. The site is a mix of upland mixed wood areas with small vernal pools and low lying alder swamp-like areas where a small brook was found. At the northwestern edge of the site, a power utility line runs along Glendale Road and has cleared vegetation. The site is located on a single HRM property designated as 'Open Space'.

This site exhibited some wetland characteristics but is classified as a potential wetland as some dryer characteristics were found and only small amounts of wetland characteristics were found. A new 7,284 sq meter wetland could be created if the site is found not to be a wetland, or a newly identified wetland could be enhanced or enlarged depending on its size.

**1EJ4B6 – Beaverbank/Windsor Junction**



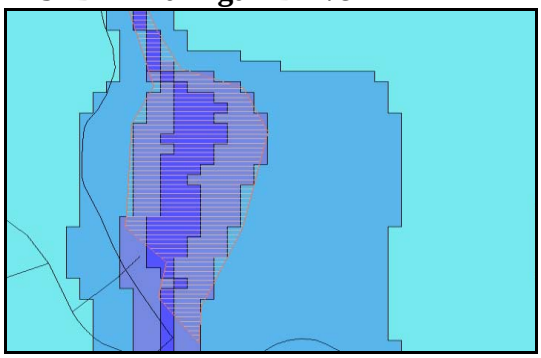

| 1EJ4B6 | Beaverbank/Windsor Junction |
|---|---|
| **Location:** (Lat Long) | 44.79316 N, 63.69175 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | enlarge/enhance new wetland, create new wetland |
| **Initial MapSource Area (sq m):** | 46621 |
| *Wet Area* **Area (sq m):** | 4471 |
| **New Wetland Area (sq m):** (if applicable) | 1775 |
| **Wetland Type:** (if applicable) | marsh |
| **Property Identification Numbers:** | Private-40117236, HRM Right-Of-Way-40911604, Private-40485252, Private-Rail-41037847, Private-41027582, Private-40608903 |
| **Land use / Impacts:** | cleared area/brownfield, small trails/usage, influx of water from adjacent marsh and small culverted brook |
| **Priority:** | high |
| **Date Visited:** | 12/15/2009 |

This site is located adjacent to Beaverbank Road and is the site of a previous development as some paved surfaces are present within the site. The site displayed many wet characteristics including pockets of surface water, sphagnum moss, and a small newly identified marsh and pond. The marsh has thick vegetation along its edge and is drained by a small brook which flows through a culvert under Beaverbank Road into the LSR near a small pond in Barrett's Lumber mill. Residential development encompasses the marsh which was within the initial WAM site.

Behind the residential areas, there are numerous wet areas with some sections of treed and shrub swamp-like areas. At some point, water flows away from the WAM site, which was later found to flow into the adjacent Shubenacadie Watershed (the WAM data displays these areas within the SRW) (*see Discussion section 6.4 WAM and Watershed Delineations*). In addition, some areas which appear to be outside of the WAM first two DTW delineations, display wet conditions and could be included in wetland creation, enhancement, or enlargement.

The surveyed marsh and pond (1775 sq meters) could be expanded into the wet area (4471 sq meters) or a new wetland of 4471 sq meters could be created.

## 1EJ4B7 – Larrigan Drive

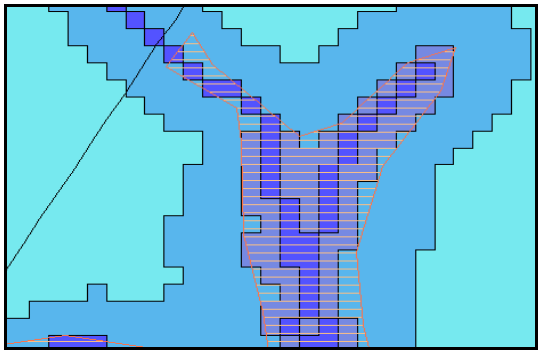



| 1EJ4B7 | Millwood/Larrigan Drive |
|---|---|
| **Location:** (Lat Long) | 44.79696 N, 63.70286 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, potential wetland |
| **Potential Compensation Work:** | enhance/enlarge potential wetland, create new wetland |
| **Initial MapSource Area (sq m):** | 17792 |
| ***Wet Area* Area (sq m):** | 11956 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-40695801, Private-41077009, Private-41076993, Private-40875676 Private-40669178, Private-40699787, Private-40885360, Private-40140519 |
| **Land use / Impacts:** | seasonal flooding, some old road/trail usage from residential, adjacent residential pollution |
| **Priority:** | medium |
| **Date Visited:** | 10/11/2009 |

This wet area site is located behind a residential development in the Millwood area. The field verified wet area is smaller than the initial area as manicured backyards were found and removed from the site. There was a series of small unofficial trails and old roads which seem to be used as walking trails. The site demonstrated some swamp-like characteristics including small pockets of surface water and an abundance of sphagnum and coniferous treed areas with organic soils. However, some areas demonstrated more upland traits with deciduous tree cover. Wet areas seemed to expand to the north outside of the WAM DTW delimitations; a larger area for wetland work could be possible.

If found not to be a wetland, an 11,956 sq meter wetland could be created in this area. If a wetland is found on the site, enlargement, enhancement, or creation would be possible. Wetland compensation could be difficult in this area due to the high number of property owners and the recreational use.

## 1EJ4B8 – Wilson Lake Drive A

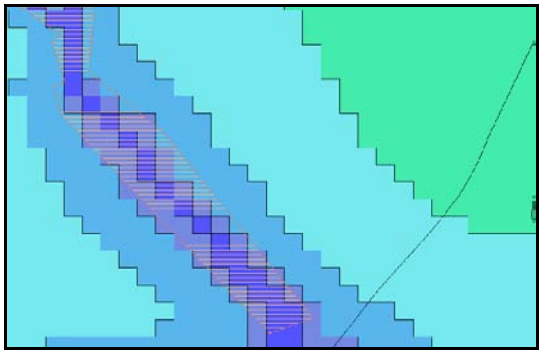



| 1EJ4B8 | Wilson Lake Drive A |
|---|---|
| **Location:** (Lat Long) | 44.79952 N, 63.71615 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, potential wetland |
| **Potential Compensation Work:** | enlarge/enhance potential wetland, create new wetland |
| **Initial MapSource Area (sq m):** | 21669 |
| ***Wet Area* Area (sq m):** | 15332 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-41215401, Private-40151094, Private-41215419, Private-00474676 |
| **Land use / Impacts:** | ATV road crosses brook, some silt, small old roads<br>Adjacent residential, usage of roads/trails. Small clearing |
| **Priority:** | medium |
| **Date Visited:** | 16/12/2009 |

This site was originally much larger (21,669 sq meters) but a private road and large clearing divided the site in two (Wilson Lake Drive A and B) by. To the north of this site is Wilson Lake Drive with a small amount of residential development. The site seems to be used for both walking and ATV use through a series of trails and potential old roads. One section of ATV trail crosses directly through a feeder brook and siltation of the watercourse was observed. The site is located in a headwater area for Jackladder Brook and an unmapped feeder brook was found at the site. This site was extremely wet with many swamp-like characteristics which seemed to expand outside the DTW delineations. One, or many, swamp areas could be potential at this site.

If found to be a wetland, enlargement, enhancement, or creation could be possible at this site. If a wetland is found not to be present, a 15,332 sq meter wetland could be created, with the potential to be even larger as the wet area seemed larger in the field than in the WAM. Wetland compensation could be hindered by the recreational use and high number of property owners.

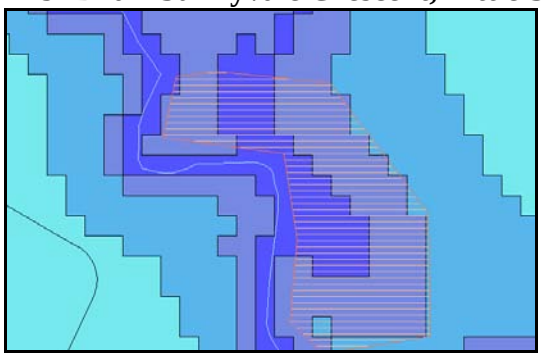
**1EJB9 – Wilson Lake Drive B**

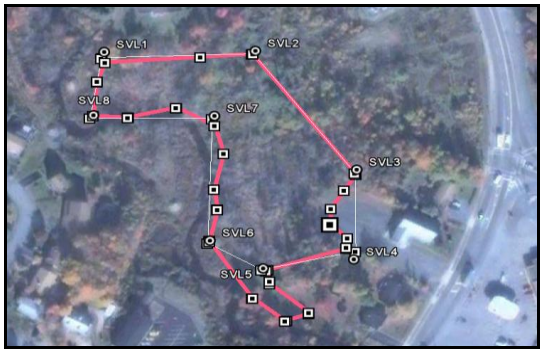



| 1EJ4B9 | Wilson Lake Drive B |
|---|---|
| **Location:** (Lat Long) | 44.79563 N, 63.71360 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 21669 |
| ***Wet Area* Area (sq m):** | 2948 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-40151185, Private-40014870 |
| **Land use / Impacts:** | Silt into brook from road, some garbage, cleared veg/trails<br>Fairly recently cut |
| **Priority:** | high |
| **Date Visited:** | 16/12/2009 |

This second section of the original site was much dryer with upland features and is south of the clearing and road. An unmapped feeder brook meandered into the site and the tributary with Jackladder Brook was also within the site where silt from the private road was found entering the brook. Immature hardwoods were found along with some shrubs which indicated the area may have been recently cleared. Some trails were found in the site as well as some garbage in and around both brooks. A 2,948 sq meter wetland could be created in this area adjacent to Jackladder Brook and the feeder brook. Compensation work could be hindered by the private use of the area.

**1EJ4B10 – Sunnyvale Crescent, Little Sackville River**



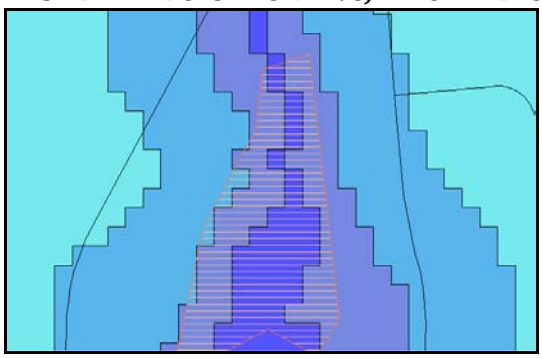



| 1EJ4B10 | Sunnyvale Crescent |
|---|---|
| **Location:** (Lat Long) | 44.78193 N, 63.69328 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 9828 |
| ***Wet Area* Area (sq m):** | 9468 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-40100166, Private-40100158, Private-40100133, Private-40100125 Private-40100083, Private-40100091, HRM Open Space-40294068 |
| **Land use / Impacts:** | sewage line/road, berms and moved soil in site, seasonal flooding |
| **Priority:** | medium |
| **Date Visited:** | 13/11/2009 |

This wet area site is adjacent to a meandering section of the LSR and is also adjacent to a few private properties. A municipal sewage line is located in the site as well as the potential for an access road to the sewage catchments. Small swamp elements were found on the perimeter opposite the LSR, and some marsh-like features were found near the LSR. Small channel-like pockets of surface water were also found within the site. The vegetation was mostly grassy with some conifers on the site's perimeter. The site was slightly smaller after field inventory as some of the site was projected onto the parking lot of a nearby church. A small culvert was also found on the northwest side of the site with small amounts of surface water. Also, some of the soil in the site formed mounds and seemed to have been moved or developed in the past.

The site was classified as a wet area as only small amounts of wetland vegetation was present and some dry areas were observed. A 9,468 sq meter wetland adjacent to the LSR could be created at this site. The high number of property owners and the possibility of a sewage line access road could impact wetland work at this site.

**1EJ4B11 – Bellshire Drive, Pinehill Brook**



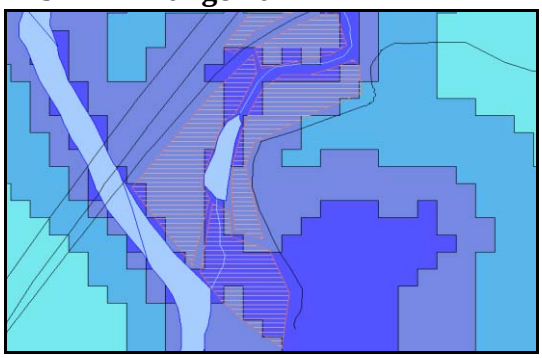

| 1EJ4B11 | Bellshire Drive/Pinehill Brook |
|---|---|
| **Location:** (Lat Long) | 44.76866 N, 63.67892 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 7631 |
| ***Wet Area* Area (sq m):** | 3893 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | HRM 'In Transition'-00361840 |
| **Land use / Impacts:** | trail in WAM, residential pollution, vegetation removal |
| **Priority:** | medium |
| **Date Visited:** | 13/11/2009 |

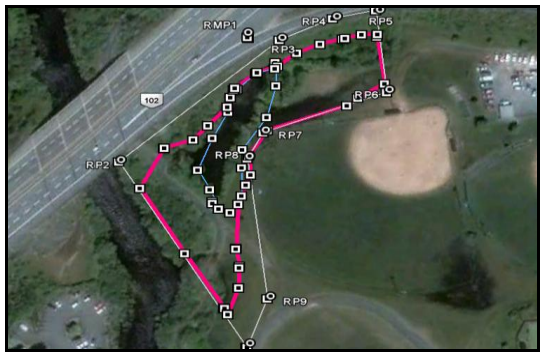
This wet area site is located on a single HRM 'In Transition' property where a heavily used official trail is located in a small green space surrounded by residential development. The wet area surrounds the near headwater areas for Pinehill Brook, a known but unmapped brook which flows into the LSR. There was an abundance of vegetation removal from the adjacent residents as well as some garbage and pollution on the site boundaries. Some wet soils and small pools were found adjacent to the brook; however, most of the vegetation was a mixed wood forest with some shrubs and fern species.

A 3,893 sq meter wetland could be created in this area, but would most likely be smaller to compensate for the trail. The treatment of HRM land as residentially owned and the trail could hinder wetland creation on HRM land at this site.

### 5.2.2 Sackville River – East Basin – Sub-watershed (1EJ4A)

#### 1EJ4A1 – Range Park



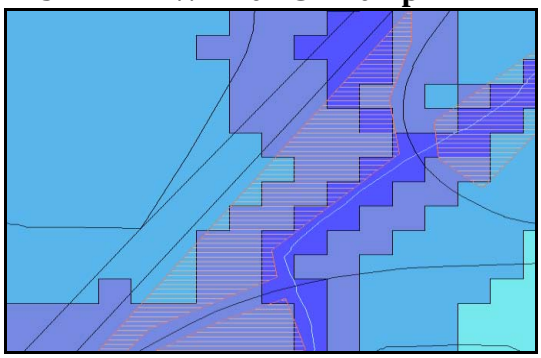


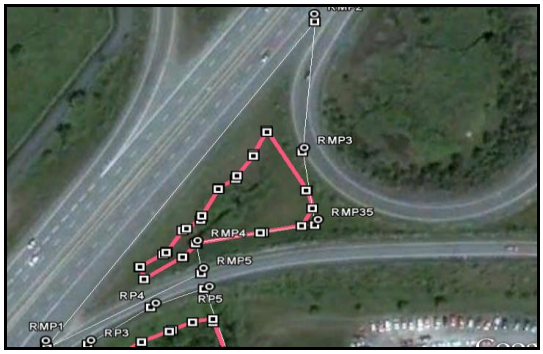

| 1EJ4A1 | Range Park |
|---|---|
| **Location:** (Lat Long) | 44.74103 N, 63.65834 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | enlarge/enhance new wetland, create new wetland |
| **Initial MapSource Area (sq m):** | 8531 |
| ***Wet Area* Area (sq m):** | 4435 |
| **New Wetland Area (sq m):** (if applicable) | 1324 |
| **Wetland Type:** (if applicable) | marsh/shallow open water |
| **Property Identification Numbers:** | HRM Open Space-40111494 |
| **Land use / Impacts:** | Bedford Sackville trail, SR flooding, pollution from highway, some cleared area for recreation, highway clearing |
| **Priority:** | high |
| **Date Visited:** | 16/11/2009 |

This site is located between the 102 Highway, the 102 off-ramp to the Bedford Highway (Trunk #1), the SR, and the Range Park baseball fields. The Bedford-Sackville Greenway Connector Trail runs along the SR and is included in the WAM site. The site is located where Oakmount Brook flows through a small pond and marsh beside the baseball fields before it flows into the SR. Range Park is known to flood during high waters in the SR and the WAM displays this accurately. The site is located on a single HRM 'Open Space' property but has effects from the 102 Highway including vegetation clearing, raised land, and some highway runoff.

Level gradients, moist soils, and alder shrubs were found near the pond where a new 4,435 sq meter wetland could be created. The existing 1,324 sq meter marsh/pond wetland could also be expanded into the wet area for a total of 5,759 sq meters. Compensation work at this site could be hindered as Nova Scotia Environment (NSE) does not currently advocate the creation of wetlands within highway interchanges.

**1EJ4A2 – HWY 102 Off-ramp**

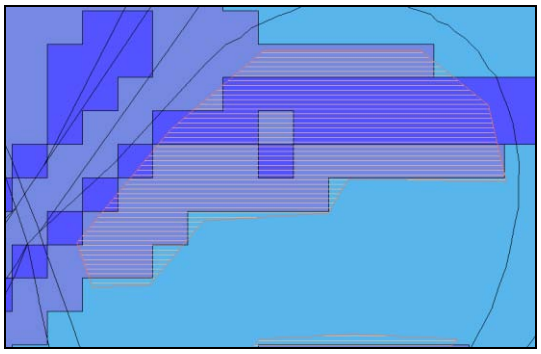


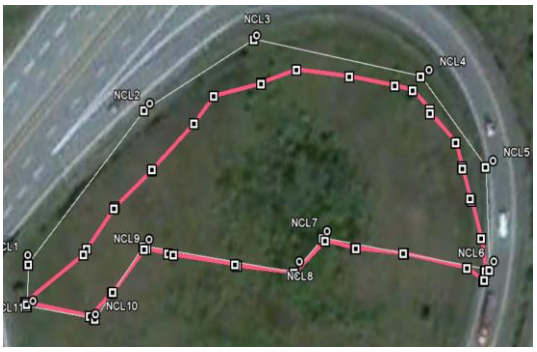



| 1EJ4A2 | 102 Off-Ramp |
|---|---|
| **Location:** (Lat Long) | 44.74276 N, 63.65803 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 3663 |
| ***Wet Area* Area (sq m):** | 1211 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-40916355 |
| **Land use / Impacts:** | Adjacent to 102 off-ramp. Cleared vegetation runoff and pollution from HWY |
| **Priority:** | low |
| **Date Visited:** | 16/11/2009 |

This wet area site adjacent from the Range Park 1EJ4A1 and is separated by the 102 Highway's off-ramp to the Bedford Highway (Trunk #1). Oakmount Brook flows through the site through many sets of culverts. The site is smaller than the initial area due to raised gradients from the 102 Highway. Grasses dominate the entire site as other vegetation has been cleared facilitating increased runoff from the highway into the brook. No wetland vegetation was observed at this site. A new 1,211 sq meter wetland could be created in this wet area between the Highway 102 and adjacent off-ramps and on-ramps. The work could be difficult given its size and location: NSE does not currently advocate the creation of wetlands within highway interchanges.

## 1EJ4A3 – East 102 Cloverleaf A

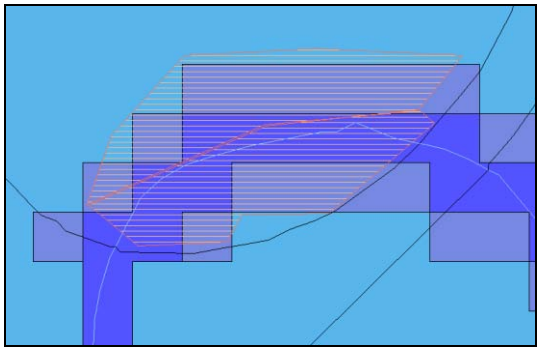


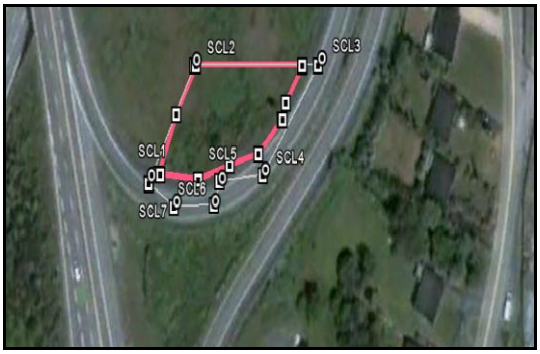



| 1EJ4A3 | East 102 Cloverleaf A |
|---|---|
| **Location:** (Lat Long) | 44.74470 N, 63.65593 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 4424 |
| ***Wet Area* Area (sq m):** | 3248 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-40917403 |
| **Land use / Impacts:** | 102 highway cloverleaf<br>cleared vegetation, highway pollution/runoff |
| **Priority:** | low |
| **Date Visited:** | 16/11/2009 |

This wet area site is located inside the western cloverleaf of the 102 Highway and the Bedford Highway (Trunk #1). This site is part of a drainage area from the Bedford Commons (*see sites 1EJ4A6, 1EJ4A7, 1EJ4A8*) and flows into Oakmount Brook at the Range Park site – 1EJ4A1. Small numbers of cattails were found along the 102 Highway where some surface water is carried in a ditch. Most of the site is grassy with some coniferous tree cover. Runoff from the 102 Highway may enter the watercourse in this area. A new 3,248 sq meter wetland could be created at this site. Again, work could be difficult considering its relatively small size and location: NSE does not currently advocate the creation of wetlands within highway interchanges.

**1EJ4B4 – East 102 Cloverleaf B**

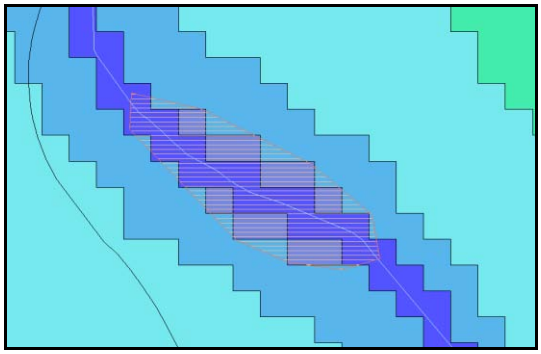





| 1EJ4A4 | East 102 Cloverleaf B |
|---|---|
| **Location:** (Lat Long) | 44.74274 N, 63.65803 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 1706 |
| ***Wet Area* Area (sq m):** | 1242 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-40917403 |
| **Land use / Impacts:** | highway cleared vegetation and pollution/runoff, |
| **Priority:** | low |
| **Date Visited:** | 16/11/2009 |

This wet area site is also located in the western cloverleaf of the 102 Highway and the Bedford Highway opposite 1EJ4A3 where Oakmount Brook flows towards the SR. The brook was mainly along the off-ramp in a ditch with some cattails. Most of the site has coniferous tree cover with some grassy areas. Some runoff pollution from the 102 Highway may enter the waterway at this site. A 1,242 sq meter wetland could be created at this site, but could be difficult due to its location: NSE does not currently advocate the creation of wetlands within highway interchanges.

## 1EJ4A5 – Oakmount Dr

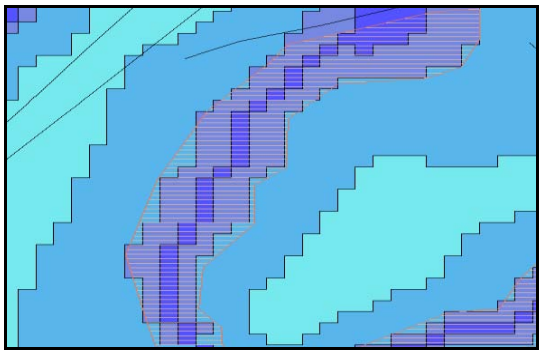


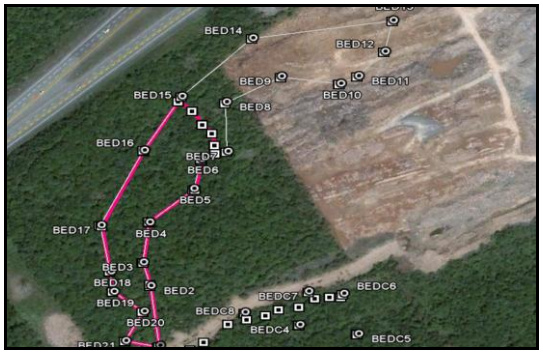

| 1EJ4A5 | Oakmount Drive |
|---|---|
| **Location:** (Lat Long) | 44.74.315 N, 63.65329 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 3115 |
| ***Wet Area* Area (sq m):** | 2540 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-40111957 |
| **Land use / Impacts:** | less water retention from boulder/bedrock, large gradient changes, abundance of res. Usage/pollution |
| **Priority:** | high |
| **Date Visited:** | 18/11/2009 |

This wet area site surrounds Oakmount Brook near its headwaters and is adjacent to residential development. There is a fairly large green area which buffers the brook. The north (downstream) side is bordered by land owned by NSTIR. Some unofficial trail usage by local residents was found within the site as well as an abundance of pollution in and around the brook. Along Oakmount Brook, substrates and gradients change dramatically from large bedrock and boulders with steep gradients to organic soils and mud with level gradient. The site exhibited a healthy mixed wood forest with some large Eastern white pine.

A new 2,540 sq meter wetland could be created at this site with the potential to be larger as the DTW seemed to expand further than what the WAM data displayed. The site is located on a single private property but more additional properties may be included if the site were to expand. Some areas with boulders and steep gradients could be problematic for wetland creation.

## 1EJ4A6 – Bedford Commons A



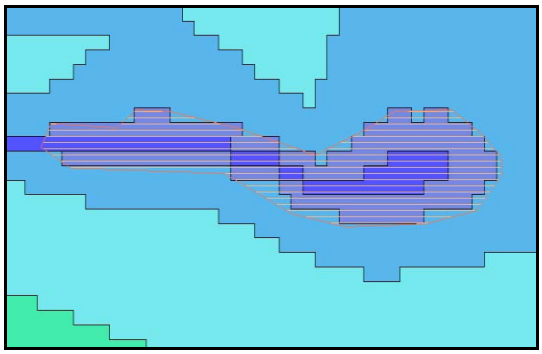


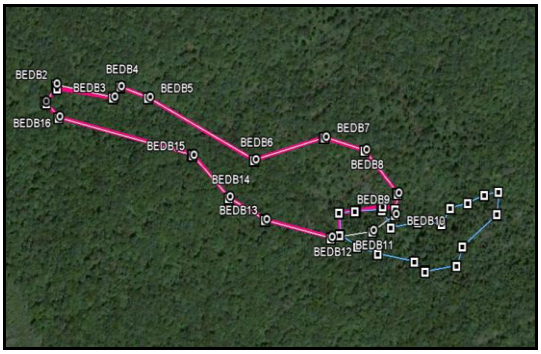

| 1EJ4A6 | Bedford Commons A |
|---|---|
| **Location:** (Lat Long) | 44.74763 N, 63.65007 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 17192 |
| ***Wet Area* Area (sq m):** | 8974 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-41214404 |
| **Land use / Impacts:** | cleared area for commons, potential future development |
| **Priority:** | high |
| **Date Visited:** | 16/12/2009 |

This site, along with two others (*1EJ4A7 & 1EJ4A8*), is located on the in-construction Bedford Commons (North Gate Power Centre) area and is owned by a single private property owner. The north-western section of this site had already been cleared and built up with rock for future development; however, a large portion of the site was currently undeveloped. This wet area site exhibited deposits of large cobble in channel-like arrangements which at times seemed to follow the site shape as a brook would. Some bedrock outcroppings were also noticed. Also, small pockets of surface water and vernal pools were found in and around the cobble areas. The site had mostly medium gradients with immature hardwood and alder forest cover.

A 8,974 sq meter wetland could be created at this wet area site. Wetland work could be hindered by the adjacent and potential future development and the high amount of large cobble and bedrock outcroppings.

**1EJ4A7 – Bedford Commons B**



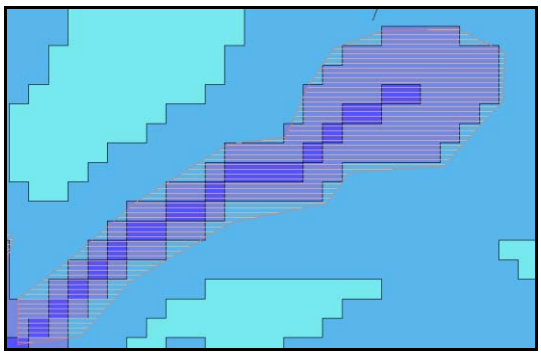


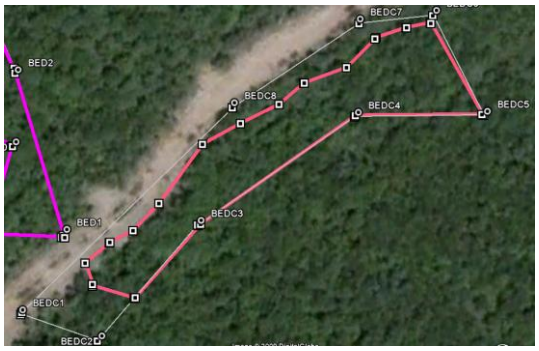

| 1EJ4A7 | Bedford Commons B |
|---|---|
| **Location:** (Lat Long) | 44.74701 N, 63.64837 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | create new wetland, enlarge/enhance new wetland |
| **Initial MapSource Area ($^2$m):** | 17680 |
| ***Wet Area* Area ($^2$m):** | 15514 |
| **New Wetland Area ($^2$m):** (if applicable) | 5289 |
| **Wetland Type:** (if applicable) | swamp |
| **Property Identification Numbers:** | Private-41214404 |
| **Land use / Impacts:** | abundance of small cut lines, potential future development |
| **Priority:** | high |
| **Date Visited:** | 16/12/2009 |

This site is also located on the future Bedford Commons retail centre but did not have current developments within in its borders. Large cobble and boulder channel-like deposits were also found in the site with pockets of surface water. Large bedrock outcroppings were found parallel to the site and cobble channels. Mixed tree cover was found within the site with an abundance of shrubs and immature hardwoods. A large 5,289 sq meter swamp wetland was found at the 'headwater' western edge of the site which expanded out from the surveyed DTW delineations. Upon analysis of the watershed and sub-watershed map layer, the western edge of the site, including the swamp, is shown to be outside of the watershed (*see Discussion section 6.4 WAM and Watershed Boundaries*).

A new15,514 sq meter wetland could be created at this site, or the swamp could be expanded to a total size of 20,803 sq meters. The newly found swamp could also be enhanced. Wetland work could be hindered by locations where bedrock outcroppings and potential future development is present.

## 1EJ4A8 – Bedford Commons C

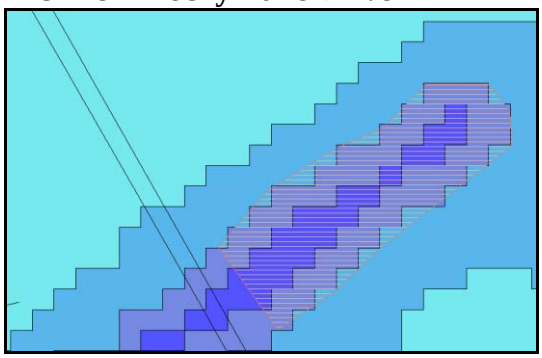





| 1EJ4A8 | Bedford Commons C |
|---|---|
| **Location:** (Lat Long) | 44.74837 N, 63.64830 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 5355 |
| ***Wet Area* Area (sq m):** | 3672 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-41214404 |
| **Land use / Impacts:** | Adjacent to road, could have silt input into surface water. To be developed? |
| **Priority:** | medium |
| **Date Visited:** | 16/12/2009 |

This site is also located on the Bedford Commons future development area and had cleared land and development in its northern section. A small clearing to the south of the larger development was found within the site and removed. Some steep gradients were found in addition to a large amount of cobble and boulder, but not in channel-like arrangements as in the other two adjacent sites. Some pockets of surface water were noted in the site which also exhibited immature hardwood and alder forest cover. A 3,672 sq meter wetland could be created at this site. Wetland work could be difficult in this area due to the steep gradients and the adjacent road and developments.

## 1EJ4A9 – Rocky Lake Drive

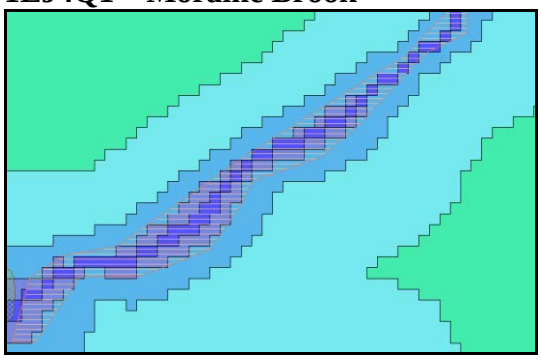


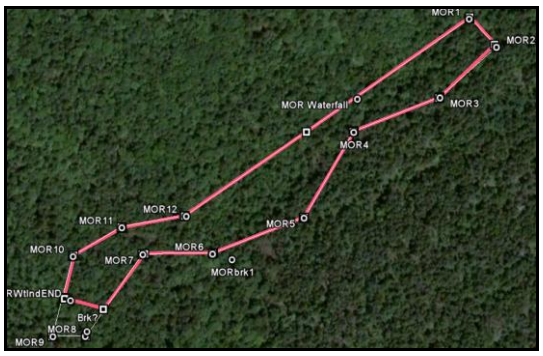

| 1EJ4A9 | Rocky Lake Drive |
|---|---|
| **Location:** (Lat Long) | 44.74250 N, 63.64579 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 7063 |
| ***Wet Area* Area (sq m):** | 7063 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-00416222, Private-41308420, Private-40918252 |
| **Land use / Impacts:** | potential runoff/pollution from Bedford Bypass |
| **Priority:** | low |
| **Date Visited:** | 24/11/2009 |

This wet area site is located just north of the Bedford Bypass and south of a power line corridor and lies on 3 privately owned properties. The site is similar to the Bedford Commons sites, as large cobbles seemed to form a channel-like arrangement is the same orientation as the WAM site. Small amounts of surface water were found flowing towards a culvert located at the southwestern 'downstream' area of the site. The site is located in a small valley between two gradually sloping hills with small boulders and cobbles and young hardwood tree cover. The initial area remained accurate as no adjacent developments were found within the site. A 7,063 sq meter wetland could be created at this site but could be hindered by the large amounts of cobble and boulder found within the site.

### 5.2.3 Sackville River – West Basin – Sub-watershed (1EJ4Q)

#### 1EJ4Q1 – Moraine Brook



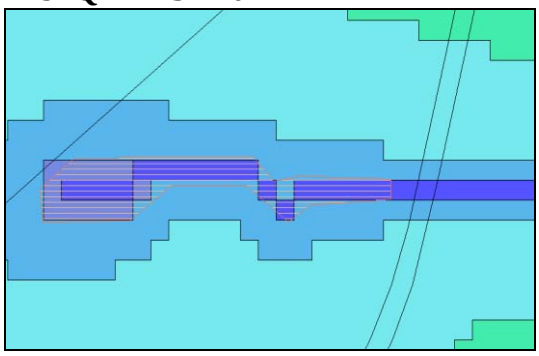


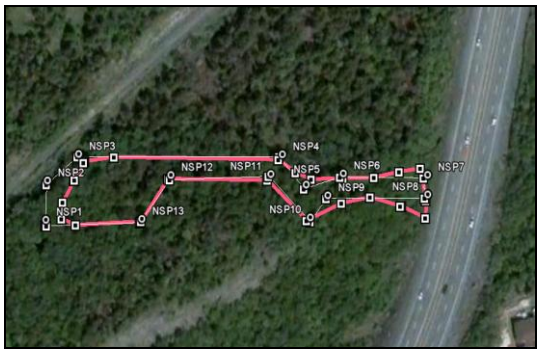

| 1EJ4Q1 | Moraine Brook |
|---|---|
| **Location:** (Lat Long) | 44.74092 N, 63.66437 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, existing wetland |
| **Potential Compensation Work:** | create new wetland, enlarge/enhance new wetland |
| **Initial MapSource Area (sq m):** | 13632 |
| ***Wet Area* Area (sq m):** | 12778 |
| **New Wetland Area (sq m):** (if applicable) | 16984 |
| **Wetland Type:** (if applicable) | swamp |
| **Property Identification Numbers:** | HRM 'Unknown'-40857138 |
| **Land use / Impacts:** | some small trails/old roads |
| **Priority:** | high |
| **Date Visited:** | 03/12/2009 |

This site encompasses the unmapped but known Moraine Brook as it flows from an existing wetland before it flows through a culvert under an access road for Nova Scotia Power (NSP) which is just upstream from the SR. The site is located on a single HRM 'Unknown' property. Along the access road, an old pit borders a portion of the site which inputs silt into the brook. A 16,984 sq meter Nova Scotia Topographic Map Series identified swamp wetland is located at the headwater area of Moraine Brook. Throughout the site, other small pockets of swamp-like habitats were found but not enough to be classified as a potential wetland (abundances of sphagnum mats, wetland coniferous tree species, and pockets of surface water). Large bedrock outcroppings and boulders were also found adjacent to the brook which seemed to influence the WAM orientation. One section of the WAM site seemed to move up-slope away from the brook and lower gradients which could be an inaccuracy in the WAM data (*See Discussion 6.5 WAM Anomalies*). Some unofficial trails and old roads were found through the site.

A new 12,778 sq meter wetland could be created in the wet area at this site, or the existing swamp could be enlarged into the wet area for a total of 29,762 sq meters. The existing swamp could also be enhanced within its current area. Wetland work could be hindered by the recreational use of the area, and the amount of bedrock present within the site.

**1EJ4Q2 – NSP 102**

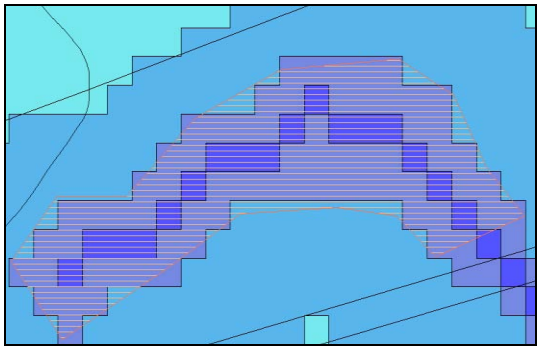


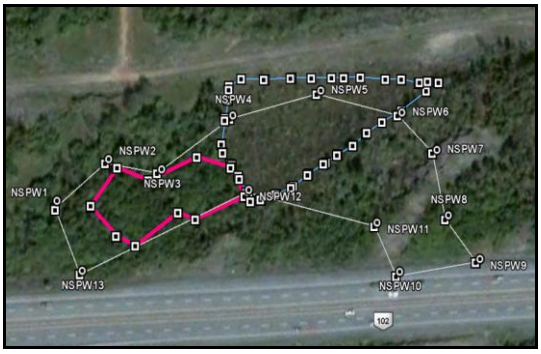



| 1EJ4Q2 | Nova Scotia Power Road / Highway 102 |
|---|---|
| **Location:** (Lat Long) | 44.73676 N, 63.66409 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 3022 |
| ***Wet Area* Area (sq m):** | 2971 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | HRM 'Unknown'-40857138, Provincial-40915506 |
| **Land use / Impacts:** | adjacent 102 highway and access road, potential silt, blow down from Highway blast rock from road, culverts on each end. |
| **Priority:** | medium |
| **Date Visited:** | 20/11/2009 |

This wet area site is located between the NSP access road and the 102 Highway on a HRM 'Unknown' designated property and a Provincial property along the 102 Highway. A small unmapped brook was found within the site which flows through a culvert under the 102 Highway. The site exhibited large gradient changes and blast rock from the access road and some boulders adjacent to the brook. Adjacent to the brook, a small amount of organic soils were found. The site revealed a mixed wood forest with some blowdown and tree damage. A new 2,971 sq meter wetland could be created at this site adjacent to the newly found brook. Wetland creation could be hindered by proximity to both the 102 Highway and the NSP access road.

**1EJ4Q3 – NSP West**



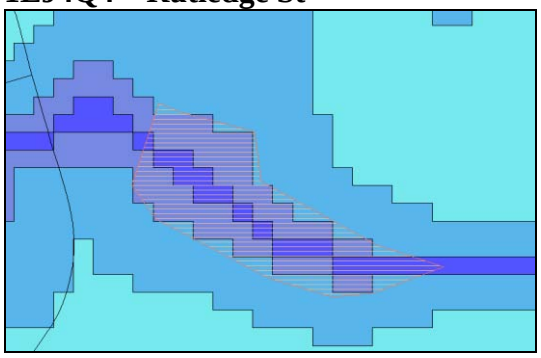


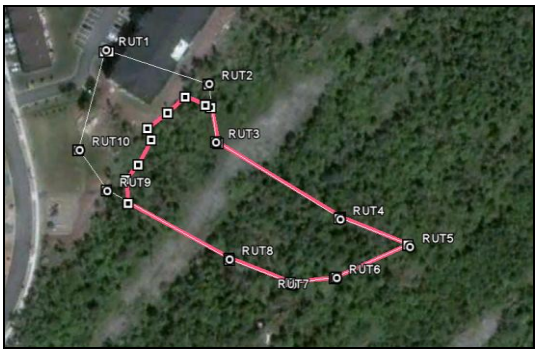

| 1EJ4Q3 | Nova Scotia Power Road West |
|---|---|
| **Location:** (Lat Long) | 44.73676 N, 63.66409 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | create new wetland, enlarge/enhance wetland |
| **Initial MapSource Area (sq m):** | 7594 |
| ***Wet Area* Area (sq m):** | 1794 |
| **New Wetland Area (sq m):** (if applicable) | 3176 |
| **Wetland Type:** (if applicable) | marsh |
| **Property Identification Numbers:** | HRM 'Unknown'-40857138, Provincial-40915506 |
| **Land use / Impacts:** | adjacent to marsh, exposed bedrock barren, and highway 102 some pollution from highway, blow down. |
| **Priority:** | medium |
| **Date Visited:** | 20/11/2009 |

Like 1EJ4Q2, this site is also located between the 102 Highway and the NSP access road and is located on the same HRM 'Unknown' and provincial properties. Large bedrock outcroppings and barren areas were found through a large portion of the site in addition to a newly found 3,176 sq meter marsh wetland adjacent to the access road which were both excluded from the final area. The remaining 1,794 sq meter wet area exhibited a conifer thicket with some surface water. The water flow seemed to be erratic due to the presence of the exposed bedrock. This is another site which, according to the watershed and sub-watershed map layer, is located outside of the SRW (*see Discussion 6.4 WAM and Watershed Boundaries*) but observed in the field to most likely be within the SRW's boundaries.

A new wetland could be created in the 1,794 sq meter wet area or the marsh could be expanded into it for a total of 4,970 sq meters. Wetland work could be hindered by the large amount of exposed bedrock and the proximity to both the 102 Highway and the Nova Scotia access road.

## 1EJ4Q4 – Rutledge St

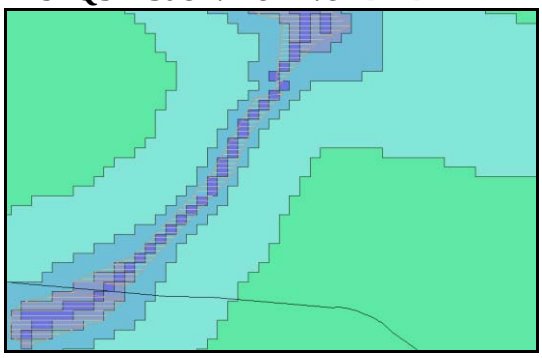


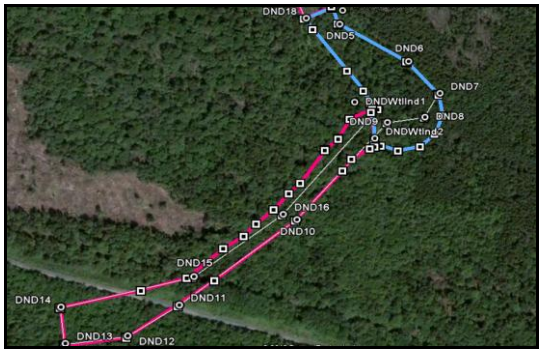



| 1EJ4Q4 | Rutledge Street |
|---|---|
| **Location:** (Lat Long) | 44.73131 N, 63.67031 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 7035 |
| ***Wet Area* Area (sq m):** | 5026 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Provincial Park/HRM-40648883 |
| **Land use / Impacts:** | large bedrock outcroppings, some small trails from res. |
| **Priority:** | Low |
| **Date Visited:** | 24/11/2009 |

This wet area site is located in the Bedford Barrens, a property with a Provincial Park status, but owned by HRM. The site is bordered to the northwest by an apartment building and small park which was removed from the final site size. The area within the site is mainly large and dry bedrock barren outcroppings with an abundance of mosses. Throughout the site, the dry barrens are divided by low lying 'valleys' with a mainly coniferous forest cover. Some surface water and vernal pools were observed in these areas. The total size of the wet area is 5,026 sq meters; however, the actual size would be much less if the barren areas were removed.

**1EJ4Q5 – Sackville River DND A**



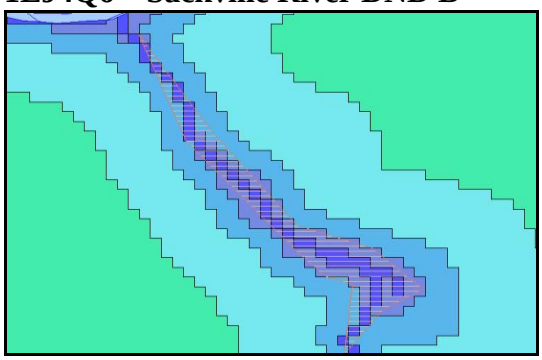


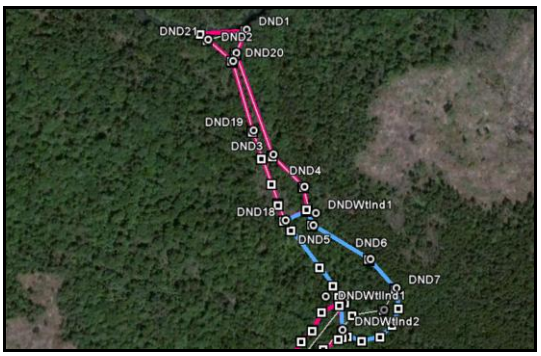

| 1EJ4Q5 | DND / Sackville River A |
|---|---|
| **Location:** (Lat Long) | 44.74555 N, 63.67335 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | create new wetland, enlarge/enhance new wetland |
| **Initial MapSource Area (sq m):** | 21067 |
| ***Wet Area* Area (sq m):** | 11476 |
| **New Wetland Area (sq m):** (if applicable) | 9535 |
| **Wetland Type:** (if applicable) | marsh |
| **Property Identification Numbers:** | DND-00361212, Private (NSP)-40111478, HRM 'Unknown'-40857138 |
| **Land use / Impacts:** | NSP access road: silt into brook, some clearing for DND fence, large blow down area. Mostly healthy conifers. |
| **Priority:** | medium |
| **Date Visited:** | 03/12/2009 |

This and the following site (*1EJ4Q6*) were initially a single site but a large newly found swamp wetland divided in the site in two. Both sites encompass an unmapped brook which flows into the SR. The headwater section of the brook and southern section of this site is located on an HRM 'Unknown' property, crosses under the NSP access road (private property), and the northern section of the site towards to newly found wetland is located on the Department of National Defence (DND) property. The topography exhibited steep gradients and a relatively pristine valley around the brook with a mature coniferous forest. Farther north and downstream, the gradients lessen and the brook flows into a fairly large unidentified swamp. Some wetland characteristics were noticed in some sections adjacent to the brook as the gradients became less steep. The swamp wetland was found to be 9,535 sq meters in size; however, its borders were somewhat gradual and unclear.

An 11,476 sq meter new wetland could be created in the wet area; however, the due to steep gradients farther upstream, a final area could be smaller in size. The newly identified wetland could be expanded into the wet area or be enhanced. Wetland work could be hindered by usages in and adjacent to the site.

**1EJ4Q6 – Sackville River DND B**



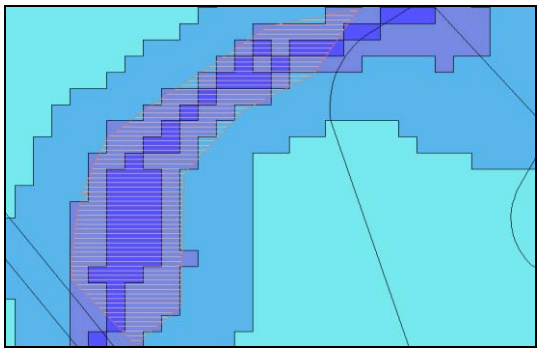



| 1EJ4Q6 | DND / Sackville River B |
|---|---|
| **Location:** (Lat Long) | 44.74861 N, 63.67263 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | create new wetland, enlarge/enhance new wetland |
| **Initial MapSource Area (sq m):** | 21067 |
| ***Wet Area* Area (sq m):** | 4961 |
| **New Wetland Area (sq m):** (if applicable) | 9535 |
| **Wetland Type:** (if applicable) | marsh |
| **Property Identification Numbers:** | DND-00361212 |
| **Land use / Impacts:** | Some blown down, shallow soil? Potential SR flooding |
| **Priority:** | medium |
| **Date Visited:** | 03/12/2009 |

This site is adjacent to the SR and north of the previous 1EJ4Q5 site and also borders the newly identified 9,535 sq meter swamp wetland. This site is located on a single DND property. The site exhibited gentle gradients and some wet soil conditions with mainly coniferous forest cover from the wetland to the SR. A new 4,961 sq meter wetland could be created at this site, or the newly identified wetland could be expanded. The newly identified wetland could also be enhanced.

### 5.2.4 Sackville River – North McCabe Lake – Sub-watershed (1EJ4C)

#### 1EJ4C1 – Meadowlands Park Drive




| 1EJ4C1 | Meadowlands Park |
|---|---|
| **Location:** (Lat Long) | 44.77288 N, 63.70415 W |
| **Site Categories:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area (sq m):** | 9923 |
| ***Wet Area* Area (sq m):** | 6259 |
| **New Wetland Area (sq m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | Private-41113218, Private-41113200, HRM Park-00375261 |
| **Land use / Impacts:** | cleared veg from residential, walkway, old roads/trails runoff from highway 101, adjacent to public park |
| **Priority:** | 24/11/2009 |
| **Date Visited:** | low |

This wet area site is the only field inventoried site in the Sackville River – North McCabe Lake – Sub-watershed. It is located mainly on an HRM 'Park' property as well as two privately owned properties. A small unmapped brook was found within the site which flows through a culvert under the 101 Highway into the SR. Wet and organic soils were noted throughout the site as well small side channels to the brook. A small wet area between a gap of residential housing was initially inside the site but was remove due to its small size. Also, a cleared park area, walkway, and some residential manicured areas were initially found within the site and removed from the final area. Large areas of vegetation were cleared, potentially from adjacent residential areas.

A new 6,259 sq meter wetland could be created in this area adjacent to the unmapped brook. The adjacent residential developments and the park use of the HRM land could effect wetland creation at this site.

# 6. DISCUSSION

## 6.1 WAM AUTHENTICATION AND EFFECTIVENESS

The field work conducted for the SRWWI revealed that the WAM data was extremely effective in locating and identifying wet areas in the landscape. Each inventoried site exhibited combinations of saturated and organic soils, pockets of surface water, or vegetation characteristic of moist sites. Some of the inventoried sites also revealed previously unknown wetlands, or areas which could potentially develop into wetlands. Many of the sites also exhibited small unmapped feeder brooks or streams (*see 6.3 Flow Accumulation Channels*). These previously unknown wet areas, wetlands, and feeder brooks would have only been identified by chance as no mapping sources or databases directly display these features.

## 6.2 DEVELOPMENT IN WET AREAS

Because the wetland inventory was conducted within the developed sections of the SRW, a large amount of the desired inventoried area from the WAM exhibited development of some kind. Roads and commercial and residential development along the Sackville and Little Sackville Rivers accounted for most of these developed wet areas. Largely, the commercial areas along the Bedford Highway and Sackville Drive (Nova Scotia Trunk 1) are all build on wet areas/historical wetlands adjacent to the Sackville River. It is unknown to what degree hydrological alterations due to sewers, ditches, and culverts have influenced the WAM data.

## 6.3 FLOW ACCUMULATION CHANNELS

A by-product of the WAM data, which was not assessed during this project, was the generation of Flow Accumulation Channels (FACs) data. While the WAM showed DTW at its shallowest depth (0-0.1m), the data could also approximate where small channels of flowing surface water (FACs) could occur in a landscape. The FAC data is another layer which can be acquired and input into a GIS. In most cases, the FAC's run through the middle of the WAM sites in the GIS.

The field inventory resulted in many small unmapped and previously unknown feeder brooks. In most cases the wet areas and wetlands feed these channels which most likely drain into the Sackville River and LSR. The FAC data seemed to be fairly accurate; however data were not directly evaluated.

## 6.4 WAM AND WATERSHED DELINEATIONS

The watershed and sub-watershed layers for the Sackville River were used to prioritize sites when deciding which to survey first. In some locations, it was found that the WAM data displayed areas which seemed to drain into the Sackville or Little Sackville Rivers but were, according to the watershed layer, outside the SRW. During the field inventory, some areas had surface water features and flow which dictated inclusion in the SRW. However, one site which seemed to be in the SRW was found to flow into the adjacent Shubenacadie River Watershed.

This difference between the two data sets could influence watershed delineations. The WAM data is much newer than the watershed layer but most likely requires further evaluation before other applications could be used. Level gradient 'table' areas that feed separate watersheds could also account for this problem.

### 6.5 ANOMALIES

Although the WAM data was very accurate in identifying wet areas in a landscape, there were some exceptions where dry conditions were found or the WAM site shifted away from the wet areas in the field. In one instance, shallow DTW areas followed a medium sized brook, but for a short distance, the WAM shallowest DTW areas went upslope, away from the brook and adjacent wet areas. A small number of other sites demonstrated this error in lesser degrees. Also, where the WAM data showed the DTW increasing (water table becoming deeper), the field inventory seemed to show similar topography and wet characteristics (FACs or feeder brooks) which would increase the area of shallower DTWs.

In other sites, the WAM sites were found on solid bedrock; however, some surface water was found. Wetland creation in these sites would be extremely difficult, but without field verification, these sites could have been potential compensation areas.

## 7. FUTURE INVENTORY WORK

### 7.1 REMAINING SUB-WATERSHEDS AND SITES

As only sites in three of the 13 Sackville River Sub-watersheds have been almost completely identified and field inventoried, the majority of the SRW remains to be assessed with WAM data. The Little Sackville River Sub-watershed (1EJ4B) is 15.9 sq km and may have a small amount of sites remaining and both the Sackville River – East Basin – Sub-watershed (1EJ4A) at 3.5 sq km, and the Sackville River – West Basin – Sub-watershed (1EJ4Q) at 2.9 sq km, also may have a small number of remaining sites to be identified and field inventoried. Only one site has been inventoried in the Sackville River – McCabe Lake North – Sub-watershed (1EJ4C) which is 9.7 sq km. However, some of this area has been surveyed on the ground for wetlands by consultants for development proponents and is being tested using the LIDAR information. Hopefully the two sets of data can be compared to determine the effectiveness of this approach.

Approximately 22 sq km (15%) of the SRW's 147 sq km has been field inventoried to date, leaving 125 sq km (85%) to be inventoried. However, since the WAM data was found to be effective, a methodology has been established, and remaining sites have been primarily identified, the remainder of the SRW inventory would require less time. From the primary survey, there are approximately 100 WAM sites remaining to be properly identified in FGIS and field verified in the SRW. Seven months of GIS work, field work, and report writing would be required to complete the wetland inventory for the SRW.

### 7.2 EXISTING WETLAND INVENTORY

The WAM inventory outlined in this report did not specifically locate and identify existing wetlands within the inventoried sub-watersheds. This was because using the WAM data was the main focus of the project and it was a higher priority to create new wetlands than to enhance or enlarge existing wetlands. In addition, many wetlands in the Sackville and Bedford area have been filled or drained for development. Only one existing wetland was included in the inventory as it was found to be adjacent to a wet area in a more natural area. There is a large number of mapped wetlands in the SRW, chiefly in the NSDNR inventory. These wetlands could also be found through WAM data and field inventoried.

## 8. RECOMMENDATIONS

This report describes locations of compensation work possible at the inventoried sites within the surveyed sub-watersheds of the SRW. However, as outlined in section 7 (*Future Inventory Work*), much of the SRW still requires GIS site identification and field verification to complete the inventory. It is recommended by the SRA that additional site identification and field verification be undertaken to complete the wetland inventory in the SRW should applicable funding become available.

## 9. CONCLUSION

After identifying WAM sites in various GIS and field inventory and verification, the WAM data was found to be very accurate and useful in identifying wet areas and wetlands in a landscape or watershed. The field inventory resulted in a total of 142,743 sq meters of wetland compensation possibilities (61,034 sq meters of wet areas, 28,082 sq meters of new wetlands, 36,653 sq meters of potential wetlands, and a 16,984 sq meter existing wetland) for future compensation consideration.

Wet areas can be created into a new wetland or have an adjacent wetland expanded into them, a new wetland could be enhanced or enlarged, a potential wetland could be created into a full wetland, enhanced or enlarged, and the existing wetland could be enhanced or enlarged.

Three Sackville River Sub-watersheds have been almost entirely field inventoried with the potential for a small amount of remaining sites in each. The remaining 10 sub-watersheds have been primarily surveyed in FGIS which revealed approximately 100 additional WAM sites which require field verification and inventory. Wetlands identified through NSDNR's wetland mapping could also be field inventoried in combination with WAM data.

The 27 inventoried sites described in this report yields an abundance of creation, enlargement, and enhancement wetland compensation possibilities in the surveyed Sackville River sub-watersheds. Proponents requiring wetland compensation projects should consider these options when future wetlands are likely to be damaged or destroyed.

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## GLOSSARY

**DEM –** Digital Elevation Model. A type of elevation modelling using a grid network of heights, usually acquired by remote sensing and interpolation to model remaining heights for given locations.

**DTW** – Depth-to-water table. The depth to the water table in a given area or location on the ground.

**FGIS** – Forestry GIS (Geographic Information System). A free downloadable GIS program somewhat comparable to professional GIS software developed by the Wisconsin Department of Natural Resources.

**GIS –** Geographic Information System. Any type of computer or technological system or device which deals with geographic location.

**GPS** – Global Positioning System. A space-based type of remote sensing which uses a system of satellites, ground stations, and GPS receivers to provide location, navigation, and time information to GPS receivers.

**GPS Unit** – A device which receives GPS signals to gather information on location, navigation, and time.

**HRM** – Halifax Regional Municipality.

**Map Datum** – A reference system of grid locations, or map projections, which relate to a position on the ground. Because the earth is not a perfect sphere, and different regions of the world interpret locations slightly differently, several map datums exist including NAD83.

**NAD83** – The North American Datum of 1983. It is the main map datum used in North America and is an improvement on The North American Datum 1927.

**NSDNR** – The Nova Scotia Department on Natural Resources.

**NSE** – The Nova Scotia Department of Environment.

**NSTIR –** The Nova Scotia Department of Transportation and Infrastructure and Renewal.

**Polygon** – A two-dimensional closed path of line segments creating a shape. Polygons are used in a GIS to outline features such as lakes or buildings.

**Property Identification Number (PID)** – A system of numbers to classify and identify individual properties or land tracts in a given municipality or district.

**Remote Sensing** – The collection of information of an object or event from a distant location, including GPS or LIDAR.

**Tracks (GPS) –** A trail or line used mainly in a GPS unit. A track is a GPS unit function which records a 'breadcrumb' trail as the unit moves along the ground. It can also be created in a GIS. A track can also be used in a GIS to create a polygon.

**UTM** – Universal Transverse Mercator. One of many mapping coordinate systems to specify locations of the earth and is based on a grid network.

**Vertices** – Used in geometry to describe the corners or intersections of the sides of a shape or polygon.

**Vernal Pools** – Temporary (ephemeral) pools or wetlands found in low-lying depressions close to the water table which dry up during the coarse of a year of over a few year period. These areas acquire water from spring snowmelt and after durations of heavy rain and are diverse in their biotic components mainly due to the absence of fish species.

**Waypoint** – An individual point of reference on the earth. It is recorded in a GIS or GPS unit by a set of coordinates and sometimes elevation.

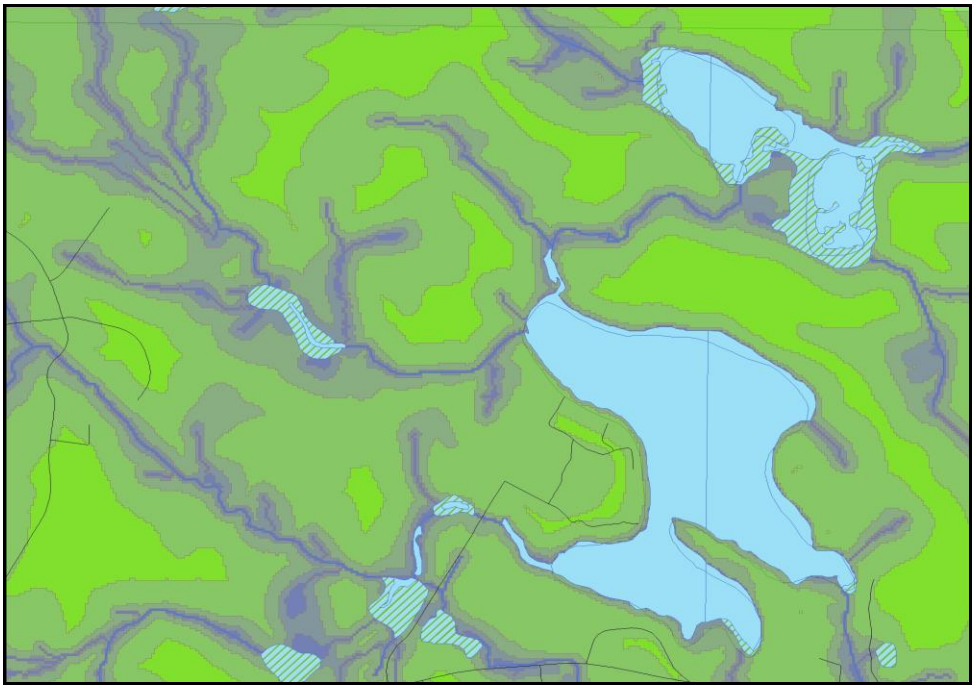
**Wet Area** – An area which occasionally exhibits wet conditions and may demonstrate characteristics of a wetland and be found adjacent to surface water features or in areas of groundwater recharge or discharge.

**Wet Area Mapping (WAM)** – A type of mapping data which delineates wet and dry areas in a landscape and creates depth-to-watertables (DTWs), and modelled flow accumulation channels (FACs). The data was modelled using existing data including digital elevation models (DEMs), mapped surface water features, and wetland and forest inventories.

**Wetland** – An area of land which is permanently or seasonally inundated with water and displays vegetation and soils which dictate wet condition

# SACKVILLE RIVER WATERSHED WETLAND INVENTORY PT. 2

*Prepared for the Nova Scotia Department of Transportation and Infrastructure Renewal (NSTIR-ESS File: 17.008.09)*



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August 2011

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# ABSTRACT

*Wet Area Mapping was utilized to identify sites in GIS for field inventory to evaluate wetland compensation possibilities in the Sackville River Watershed, Sackville Nova Scotia. Eight sites were assessed in the Big Sandy Lake Sub-watershed of the Sackville River Watershed and are areas for potential future wetland compensation projects. The inventory work acts as an appendix to the original "Sackville River Watershed Wetland Inventory, 2010" report completed by the Sackville Rivers Association and was initiated as part of a Nova Scotia Environment approved wetland compensation project for damaged wetlands. The eight sites revealed a preliminary total of 157,738 sq m of wetland creation, enlargement, and enhancement possibilities. Additional sites remain to be field assessed in both the Big Sandy Lake Sub-watershed (18 identified in GIS) and the remainder of the Sackville River Watershed (approximately 80 estimated in GIS) to complete a wetland compensation inventory of the Sackville River Watershed.*

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# BIOGRAPHY

John-William Brunner has been working with the Sackville Rivers Association since May 2009. He originates from Huntsville, Ontario and attended Sir Sandford Fleming College in Lindsay, Ontario where he received an Ecosystem Management Technologist Diploma. Since graduating, he has been employed with the District Municipality of Muskoka, Ontario, as a Biological Monitoring Technician mainly sampling benthic macroinvertebrates, and with the University of New Brunswick as a Field Technician on a Northern Flying Squirrel Research Project in Fundy National Park, New Brunswick. Since being employed with the SRA, John-William has worked on the initial Sackville River Watershed Wetland Inventory, the planning and installation of various in-river restoration structures, water quality monitoring, and fish population assessments.

# SACKVILLE RIVER WATERSHED WETLAND INVENTORY PT. 2

## 1. INTRODUCTION

During the months of September-December 2009, the Sackville Rivers Association (SRA) completed the Sackville River Watershed Wetland Inventory (SRWWI). The project was initiated through a Nova Scotia Environment (NSE) approved wetland compensation project (NSTIR-ESS File: 17.008.09) and was designed to assess and classify areas for consideration in future wetland compensation work. Wet Areas Mapping (WAM) was utilized in the field and was found to be accurate in identifying wetlands and wet areas.

This report – Sackville River Watershed Wetland Inventory Pt. 2 (SRWWI2) – is an appendix to the original inventory and assesses eight sites in the Big Sandy Lake Sub-watershed (BSLS) for future wetland compensation potential. The SRA completed the work for the SRWWI2 during the months of April-August 2010. This report does not complete wetland compensation field work in the BSLS as 18 (70%) identified sites remain to be field inventoried. As this report is an appendix, much of the background information and details on wetlands and wetland compensation, the SRA, WAM, Geographic Information Systems (GIS), and field methods are discussed in the original report and is available through the SRA.

## 2. BIG SANDY LAKE SUB-WATERSHED

For the appendix to the SRWWI, the BSLS – classified as 1EJ4P (Environment Canada) – was evaluated for wetland compensation possibilities. The sub-watershed has considerable amounts of urban development, mainly along the #213 Collector Highway, Hammonds Plains Road. Surveying the BSLS also follows a logical pattern with the previously surveyed sub-watersheds; the most southerly and downstream sub-watersheds have been surveyed first.

The BSLS is 23.7 sq kilometres in size making it the largest, by area, sub-watershed of the Sackville River Watershed (SRW). It has a large amount of existing wetlands as well as many small feeder brooks and rivers, ponds, and two lakes. The sub-watershed's main feature, Big Sandy Lake, flows via Peverill's Brook to Marsh Lake and continues to meet the main Sackville River 4.7 km upstream of Bedford Basin and 1.1 km upstream of the Little Sackville River. The BSLS includes areas of Hammonds Plains and Lucasville which contributes a significant portion of urban development to the entire SRW (*see Fig. 1*).

### 2.1 WAM Sites

In total, 26 sites were identified and delineated in ArcMap for the BSLS. As mentioned, only eight of the 26 sites were inventoried in the field to assess future potential wetland compensation possibilities. The inventoried sites are located in the eastern portion of the sub-watershed, all adjacent to Big Sandy Lake, Marsh Lake, and Peverill's Brook (*see Fig. 2*).

## 3. METHODOLOGY

Most of the methods are exact to that of the SRWWI with the exception of the use of the GIS ArcMap 9.3. Only the resulting changes will be described here. For a thorough explanation of GIS and field

methods, see Section 4. Methods of the SRWWI, which is available through the SRA.

Unlike the SRWWI which used Forestry GIS (FGIS) to identify and evaluate WAM sites, the SRWWI2 had the benefit of using ArcMap 9.3. The newer and much more effective GIS allowed WAM sites to be identified and created into individual shapefiles and directly uploaded to GPS unit. The SRWWI, using FGIS, required a longer process of transferring UTM coordinates into MapSource and recreating the site shapes. As in the original report, MapSource was used to evaluate their location in Google Earth and to combine the data with the SRWWI. The GPS tracks obtained in the field also simply uploaded to ArcMap and easily evaluated.

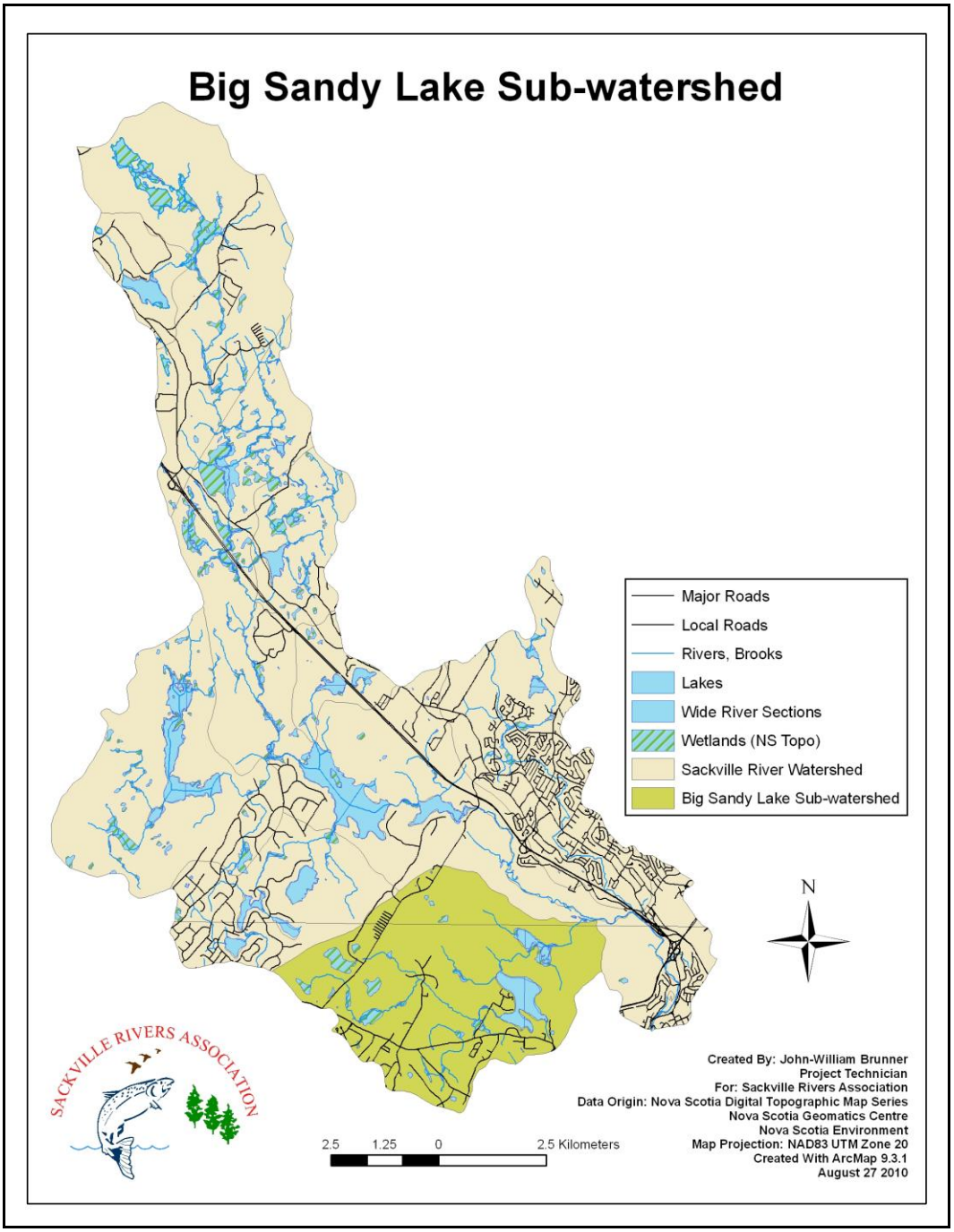



*Fig. 1 – Location of Big Sandy Lake Sub-Watershed in Sackville River Watershed*

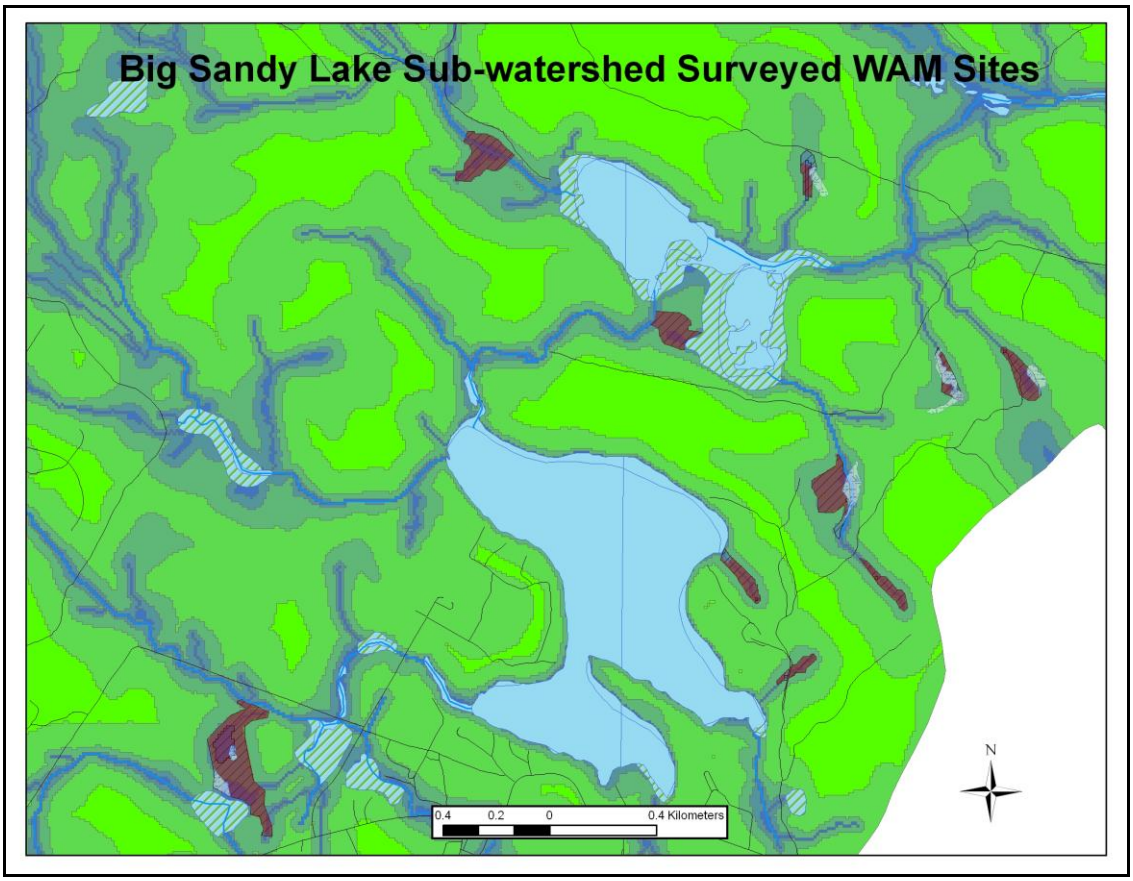


*Fig. 2 – Field Surveyed WAM Sites in BSLS (also shows new field delineated wetlands).*

## 4. RESULTS

### 4.1 Cumulative Results

As the SRWWI had revealed, the field work conducted in the BSLS demonstrated the effectiveness of the WAM data in identifying wet areas in a landscape. Out of the eight inventoried sites; five sites revealed new or previously unidentified wetlands, one site had a previously identified wetland, and no sites were classified as having potential wetlands. The remaining three sites revealed wet characteristics but no definitive wetland characteristics. Sites which contained new or previously identified wetlands also revealed varying amounts of wet areas. Much of the inventoried wet areas and wetlands revealed large amounts of natural forest and understory vegetation and a lack of degraded areas (see *5.2 Discussion – Natural and Impacted Areas*).

The same classifications for the inventoried sites are the same as the SRWWI. Please see the original report for explanations. A total of 157,738 sq meters of wet areas were field inventoried and revealed different compensation possibilities dependant on the type of classifications found at each site. As with the SRWWI, the surveyed areas are preliminary and shouldn't be considered as definite workable areas. Each site would require more in depth delineations to acquire accurate areas for compensation possibilities. Of the 157,738 sq meters:

- 108,652 sq meters of *'wet areas'* could be developed into wetlands, or an adjacent wetland could be enlarged into them;

- 26,037 sq meters of *'new wetlands'* could be enhanced;
- 23,049 sq meters *'existing wetlands'* could be enhanced.

*Table 1 – Total Compensation Areas by Site Classification*

| Type of Area | Wetland Compensation Work | Total Area (²m) |
|---|---|---|
| Wet Areas | creation / enlargement | 108,652 |
| New Wetlands | enhancement | 26,037 |
| Potential Wetlands | creation/enhancement | 0 |
| Known Wetlands | enhancement | 23,049 |
| **TOTAL** | | **157,738** |

**4.2 Site Specific Results**

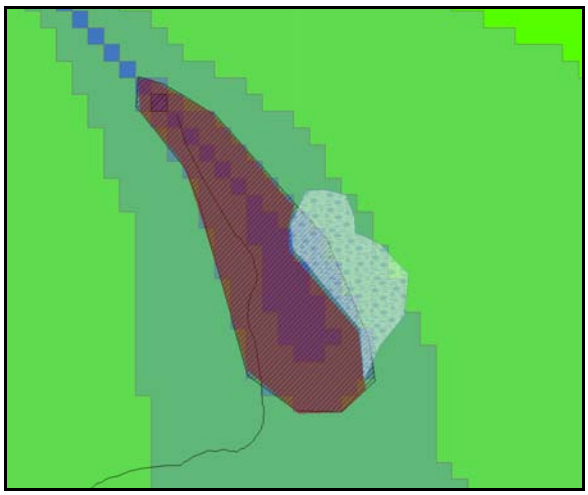
The following delineated WAM sites were surveyed and assessed in the field to evaluate their characteristics pertaining to wetness and wetland types. Areas in square meters (sq m) were verified in the field to provide workable areas for future potential compensation work. ArcMap images show the delineated sites with WAM and Google Earth images display the sites on the ground. As seen in Google Earth, original wet areas are shown in red and new wetlands are shown in blue.

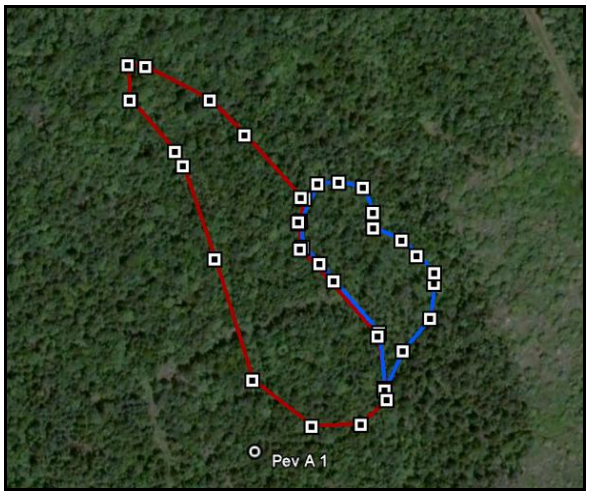
The first field of each table describes the site name, both in sub-watershed classification and common name. **Location** is given in GPS coordinates (latitude and longitude), usually referenced to the most accessible point in the site. The **Site Status** field is the assessed types of each WAM site after field inventory. The **Potential Compensation Work** field is a result of the Site Status field and is the wetland compensation work that could be undertaken at each site.

The **Initial MapSource Area** is the area derived from the WAM site's polygons in MapSource before field verification. ***Wet Area* Area** is the field verified area of the non-wetland wet areas. **New Wetland Area** is the field verified area of a newly identified wetland. All areas were recorded in square meters (sq m). The **Wetland Type** field describes the type of wetland found at a WAM site (marsh, swamp etc). Wetland areas and types were not recorded for potential wetlands.

The **Property Identification Numbers** are given for all properties found within the WAM site. Municipally owned properties may have classifications such as "Open Space" or "Park" depending on their designation. The **Land use / Impacts** field describes current land use in or around the site and their resulting impacts. Impacts with the potential to effect soils, hydrology, and vegetation were focused on. The **Date** field is the date the site was field surveyed. The **Priority** field gives each site a compensation work priority ranking and was based on the number and type of property owners at each site. Sites with less property owners were given a higher ranking. In addition, sites on government owned land were ranked higher than sites on privately owned land.

## 1EJ4P1 – Peverill's Brook A





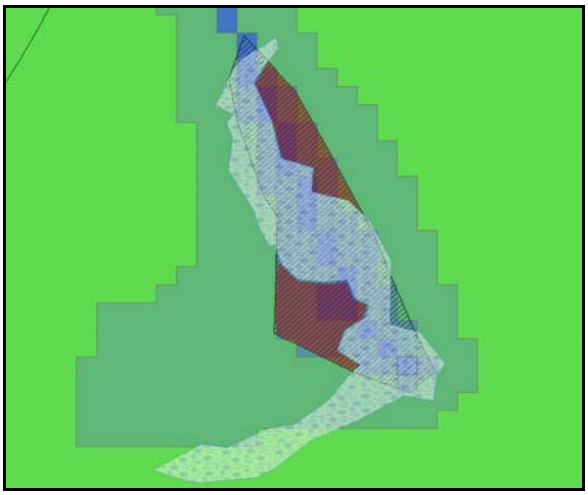

| 1EJ4P1 | Peverill's Brook A |
|---|---|
| **Location:** (Lat Long) | 44.74111N, 63.68178W |
| **Site Status:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | enlarge/enhance new wetland, create new wetland |
| **Initial MapSource Area ($^2$m):** | 12474 |
| ***Wet Area* Area ($^2$m):** | 10958 |
| **New Wetland Area ($^2$m):** (if applicable) | 5277 |
| **Wetland Type:** (if applicable) | conifer swamp |
| **Property Identification Numbers:** | 40857138 - HRM "Unknown" |
| **Land use / Impacts:** | main walking trail/old road in site,<br>large old logging road runs through site. |
| **Priority:** | low |
| **Date Visited:** | 21/04/2010 |

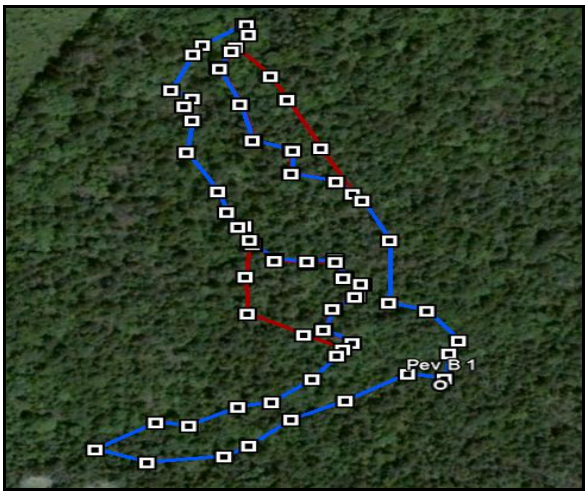
### Site Description

This site is located in a low lying area found within a predominantly dry upland site. The area's eastern edge revealed a 5,277 sq m conifer swamp with mostly red spruce and balsam fir canopy trees, an abundance of sphagnum moss, some grasses, and small pockets of surface water. Bedrock outcroppings and large cobble was also found throughout the site suggesting the area may not be ideal for wetland creation or enhancement. An unofficial trail runs through the site which originates near HRM's Sandy Lake Park as well as what appeared to be an old logging road which has likely impacted natural vegetation growth. The site is located on a single property which is owned by the Halifax Regional Municipality (HRM) and designated as "unknown".

There are multiple compensation possibilities for this site. The newly found conifer swamp could be expanded into the wet area or a new wetland could be created in the 10,958 sq m wet area.

## 1EJ4P2 – Peverill's Brook B





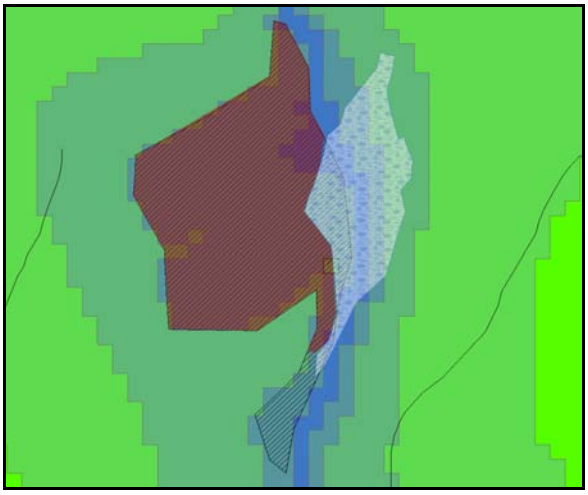

| 1EJ4P2 | Peverill's Brook B |
|---|---|
| **Location:** (Lat Long) | 44.74115N, 63.68400W |
| **Site Status:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | enlarge/enhance new wetland, create new wetland |
| **Initial MapSource Area ($^2$m):** | 8466 |
| *Wet Area* **Area ($^2$m):** | 2879 |
| **New Wetland Area ($^2$m):** (if applicable) | 8589 |
| **Wetland Type:** (if applicable) | conifer swamp |
| **Property Identification Numbers:** | 40857138 - HRM "Unknown" |
| **Land use / Impacts:** | old logging road through site |
| **Priority:** | low |
| **Date Visited:** | 21/04/2010 |

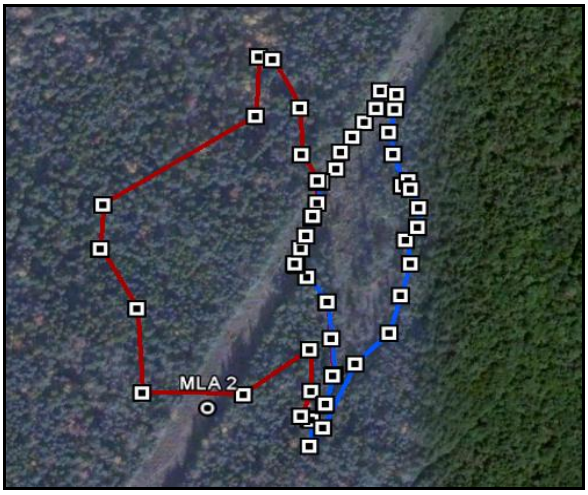
### Site Description

This site is located in a lower lying area separated from adjacent upland sites by bedrock ridges, although some small upland areas are located within the surveyed wet area. The site revealed a newly found 8,589 sq m conifer swamp which contained large amounts of sphagnum moss and surface water with a predominantly red spruce canopy. Some small grassy sphagnum areas were found within the new wetland area which displayed some bog characteristics. The remaining 2,879 sq m wet area contained some mixed wood species as well as small amounts of sphagnum moss. The site is located on a single HRM owned property with an "unknown" designation.

There are multiple compensation possibilities at this site. The newly found conifer swamp could be expanded into the adjacent wet area or a new wetland could be created. The newly found wetland could also be enhanced. The large amounts of bedrock and old road found within the site could impact wetland compensation work.

## 1EJ4P3 – Marsh Lake A





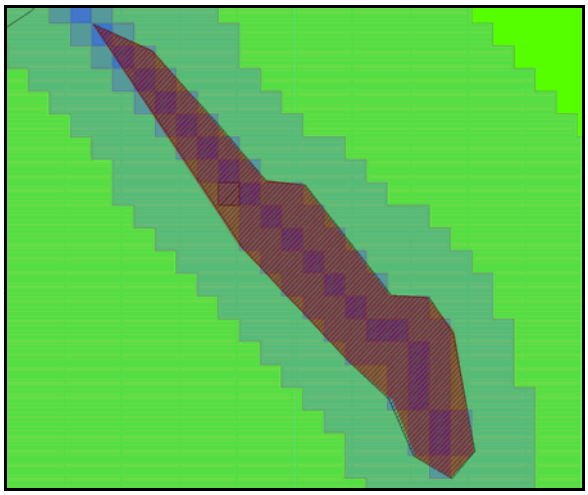

| 1EJ4P3 | Marsh Lake A |
|---|---|
| **Location:** (Lat Long) | 44.73715N, 63.68937W |
| **Site Status:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | enlarge/enhance new wetland, create new wetland |
| **Initial MapSource Area ($^2$m):** | 21188 |
| *Wet Area* **Area ($^2$m):** | 18203 |
| **New Wetland Area ($^2$m):** (if applicable) | 7398 |
| **Wetland Type:** (if applicable) | conifer swamp, bog |
| **Property Identification Numbers:** | 40857138 - HRM "Unknown", 360685 - Private |
| **Land use / Impacts:** | power line cut through site: cleared vegetation, poor drainage |
| **Priority:** | low |
| **Date Visited:** | 17/08/2010 |

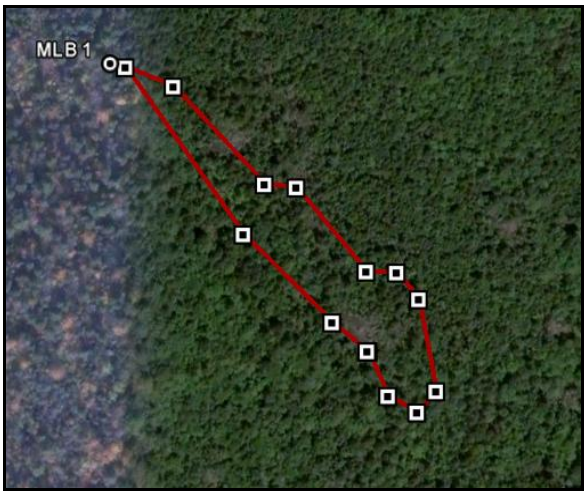
### Site Description

This site is located in a fairly flat wet area which demonstrated some treed swamp characteristics and a 7,398 sq m unmapped bog/swamp complex. Most of the bog/swamp complex was found in a Nova Scotia Power (NSP) powerline which may have resulted in cleared vegetation and influence on wetland composition. Most of the newly found wetland was located on the eastern edge of the original area, much of which was outside of the 0.5m WAM delineation. The remainder of the site was an 18,203 sq m swamp like area, bordered on one side by bedrock ridges, composed of mixed wood species with an abundance of wet soils which followed a mapped brook flowing to Marsh Lake. The site is located on two properties, one private, and one owned by HRM with an "unknown" designation.

Both wetland creation, enlargement, and enhancement compensation work is possible at this site. The bog/swamp complex could be expanded into the wet area, a new wetland could be created, and the newly found wetland could also be enhanced.

## 1EJ4P4 – Marsh Lake B





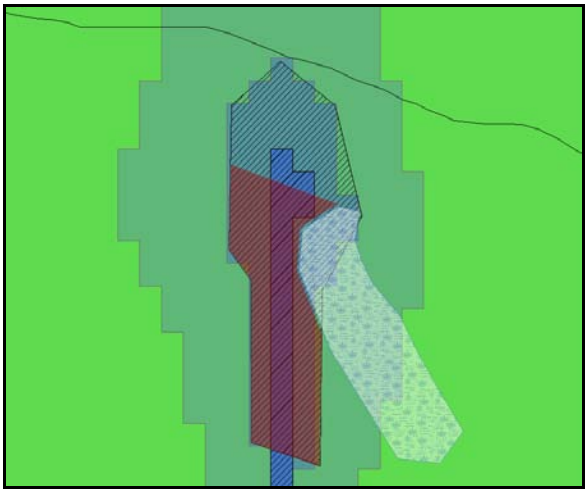

| 1EJ4P4 | Marsh Lake B |
|---|---|
| **Location:** (Lat Long) | 44.73715N, 63.68937W |
| **Site Status:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area ($^2$m):** | 7556 |
| *Wet Area* **Area ($^2$m):** | 7673 |
| **New Wetland Area ($^2$m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | 40857138 - HRM "Unknown" |
| | |
| **Land use / Impacts:** | some large blowdown |
| **Priority:** | low |
| **Date Visited:** | 17/08/2010 |

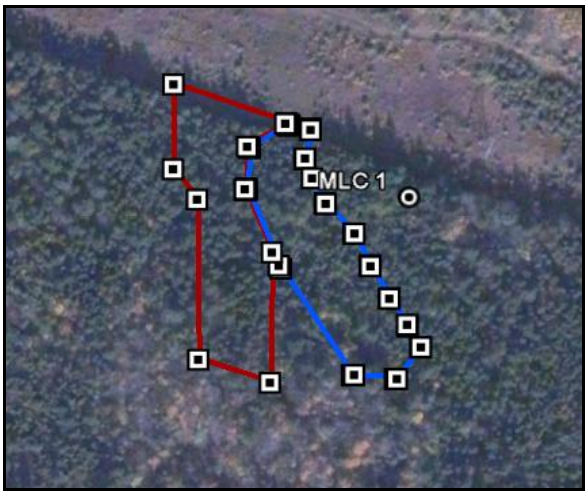
### Site Description

This site lies along a small unmapped section of brook which is the headwaters of a small mapped brook that flows into Marsh Lake. The 7,637 sq m site revealed a predominantly dry mixed wood forest with small amounts of wet soils and sphagnum moss adjacent to the brook. A large amount of blowdown was also found within the site. The site is located on a single property, owned by HRM with an “unknown” designation.

For compensation possibilities, the site could have a wetland created within it. However, as much of the site exhibited dry characteristics with abundant forest cover, it may not be an ideal location for wetland compensation.

**1EJP5 – Marsh Lake C**





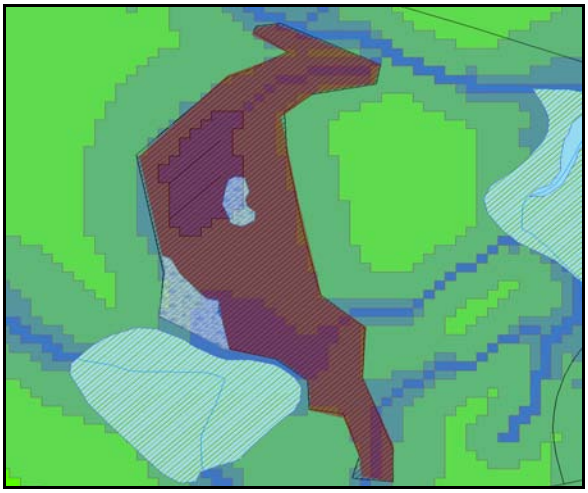

| 1EJ4P5 | Marsh Lake C |
|---|---|
| **Location:** (Lat Long) | 44.74877N, 63.69044W |
| **Site Status:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland |
| **Potential Compensation Work:** | create new wetland, enlarge/enhance new wetland |
| **Initial MapSource Area ($^2$m):** | 6935 |
| *Wet Area* **Area ($^2$m):** | 6211 |
| **New Wetland Area ($^2$m):** (if applicable) | 3637 |
| **Wetland Type:** (if applicable) | conifer swamp |
| **Property Identification Numbers:** | 00648188 – Private, 00648154 – HRM "Unknown" |
| **Land use / Impacts:** | Powerline road and cut in site, removed from area. Large muddy areas from clearing. |
| **Priority:** | low |
| **Date Visited:** | |

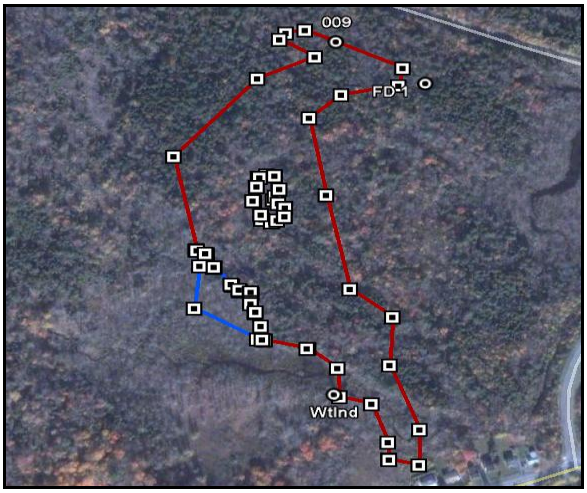
## Site Description

This site is located just south of a NSP powerline cut which runs along the perimeter of the Department of National Defence (DND) Rifle Range. Some of the original area was located in the cut and the DND land and was removed from the surveyed area. A 3,637 sq m conifer swamp was found in the site, but much of the wetland was located outside the 0.5m WAM delineation. The swamp revealed large amounts of sphagnum and grasses under a predominantly red spruce and balsam fir canopy with pockets of alders. An abundance of wet soils and surface water, much of which was located near a potential ephemeral brook which most likely flows to Marsh Lake, was also found. The remaining 6,211 sq m wet area displayed smaller amounts of wet soils and mainly mixed wood tree species. The site is located on two properties, one private, and one owned by HRM with an "unknown" designation.

There are multiple compensation possibilities at this site. The newly found conifer swamp could be expanded into the wet area and a new wetland could be created. The conifer swamp could also be enhanced. Like many sites, the functioning forest adjacent to the conifer wetland may reduce the desire to expand or enhance.

## 1EJ4P22 – Farmers Dairy





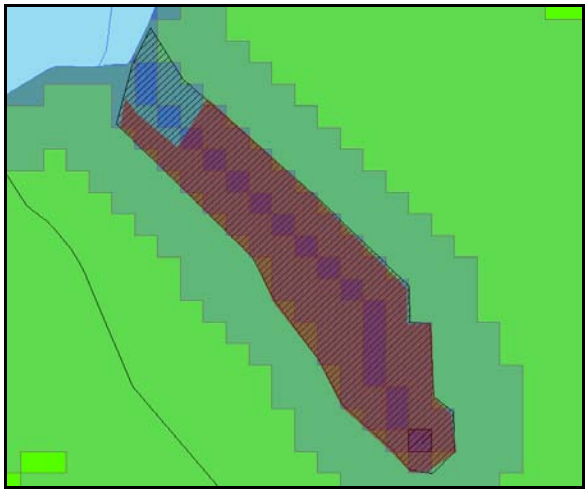

| 1EJ4P22 | Farmers Dairy |
|---|---|
| **Location:** (Lat Long) | 44.73035N, 63.71640W |
| **Site Status:** (wet area, new wetland, potential wetland, existing wetland) | wet area, new wetland, existing wetland |
| **Potential Compensation Work:** | enlarge/enhance existing/new wetland, create new wetland |
| **Initial MapSource Area ($^2$m):** | 54212 |
| *Wet Area* **Area ($^2$m):** | 49478 |
| **New Wetland Area ($^2$m):** (if applicable) | 1136 |
| **Wetland Type:** (if applicable) | marsh |
| **Property Identification Numbers:** | 41127747 - Private, 00417949 - Private, 40872806 - Private, 00488221 - Private |
| **Land use / Impacts:** | Site is within large clearcut/selective cut. Dried out sphagnum areas |
| **Priority:** | low |
| **Date Visited:** | 18/08/2010 |

### Site Description

This site is located adjacent to an existing wetland which was found to be larger than originally mapped as its features seemed to expand outside its mapped perimeter. A large clearcut/selective cut was found throughout most of the site, with some islands of vegetation and small upland areas with dryer characteristics. Much of the site revealed dried sphagnum which hinted at possibly wetter site characteristics before cutting. Some low lying areas revealed wet soils adjacent to small marsh-like components and a potential ephemeral brook. One small newly found marsh was large enough to survey and was found to be 1,136 sq m in size. The site is located on four private properties.

Compensation work at this site could include the expansion of the existing wetland into the wet area, possibly connecting with the newly found wetland. A new wetland could also be created within the cleared areas of the site. Both the existing and newly found wetland could also be enhanced. The dry upland sites in addition to the multiple property owners could affect compensation possibilities at this site.

## 1EJ4P23 – Sandy Lake A



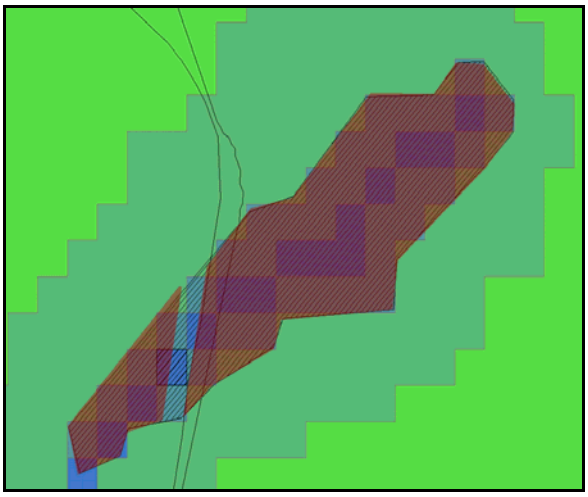

| 1EJ4P23 | Sandy Lake A |
|---|---|
| **Location:** (Lat Long) | 44.73424N, 63.69342W |
| **Site Status:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area ($^2$m):** | 9105 |
| *Wet Area* **Area ($^2$m):** | 8090 |
| **New Wetland Area ($^2$m):** (if applicable) | Cant seem to get border here. |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | 417360 - HRM "Open Space" |
| **Land use / Impacts:** | Small trail and park in area; cleared vegetation, gravel surfaces. Some blowdown. |
| **Priority:** | low |
| **Date Visited:** | 16/08/2010 |

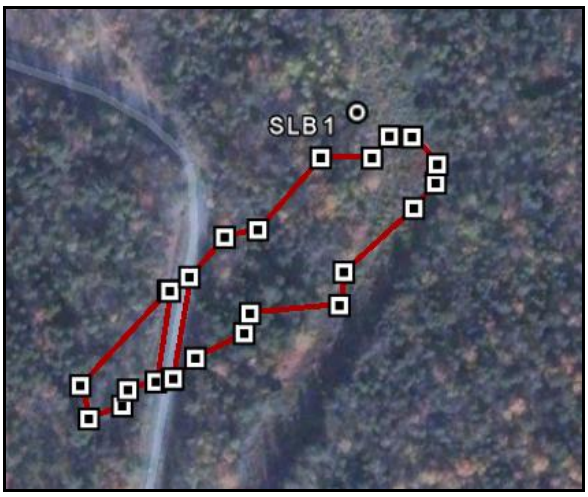
### Site Description

This site is adjacent to Big Sandy Lake as well as the parking lot for HRM's Big Sandy Lake Park. The parking lot was found to be inside the original area of the site and thus the field verified wet area is 8,090 sq m (smaller than original GIS area). A small trail towards the park was also found within the site but wasn't removed from the area. Most of the site exhibited dry upland characteristics with mixed wood species but some sphagnum and wet soils adjacent to a small, potentially ephemeral, unmapped brook flowing towards Sandy Lake. Some blowdown was also found within the site. It is located on a single HRM owned property with an "Open Space" designation.

The creation of a new wetland is the only creation possibility at this site. The trail though the site could impact compensation work as well the dryer upland sites adjacent to wetter areas along the brook.

## 1EJ4P24 – Sandy Lake B






| 1EJ4B7 | Sandy Lake B |
|---|---|
| **Location:** (Lat Long) | 44.73174N, 63.69226W |
| **Site Status:** (wet area, new wetland, potential wetland, existing wetland) | wet area |
| **Potential Compensation Work:** | create new wetland |
| **Initial MapSource Area ($^2$m):** | 5229 |
| *Wet Area* **Area ($^2$m):** | 5160 |
| **New Wetland Area ($^2$m):** (if applicable) | |
| **Wetland Type:** (if applicable) | |
| **Property Identification Numbers:** | 40857138 - HRM "Unknown", 40098139 – Private |
| **Land use / Impacts:** | Area split by road. Powerline cut also in eastern portion of site. |
| **Priority:** | low |
| **Date Visited:** | 18/08/2010 |

### Site Description

This site is divided in two by Smith's Road and also has a NSP powerline cut through the north eastern corner. The western section of the site contained a potential ephemeral brook with small amounts of moist soils and sphagnum moss with a mainly conifer forest canopy. The eastern portion revealed dryer conditions with mainly mixed wood tree species and a lack of moist soils. Vegetation was cleared under the powerline cut. The site is located on two properties, one private, and one owned by HRM with an "unknown" designation.

The creation of a new wetland is the only type of compensation work available at this site. The location of Smith's Road in relation to the western, more moist, portion of the site could limit the possibility of compensation work.

# 5. DISCUSSION

## 5.1 WAM Efficiency and Usage

As demonstrated by the original SRWWI, this inventory verifies the effectiveness of WAM and Flow Accumulation Channels (FACs) data (a by-product of WAM) in delineating areas of water accumulation, wetlands and smaller more ephemeral brooks. The eight inventoried sites in the BSLS revealed new wetlands, potentially ephemeral and unmapped brooks, and wet areas with accompanying wetland compensation possibilities.

However; as also discussed in the SRWWI, the field inventory occasionally demonstrated wet areas or wetlands moving geographically away from where the WAM modelled and outside the 0.0.5m depth-to-watertable (DTW) delineation. This could warrant expanding the site identification size to the third depth of 0.5m-2m (0-2m in total) in GIS for potential future inventories (*see Figure 3*). There were also many instances where sections of dry upland vegetation were found throughout a site with low lying areas with moist soils and surface water. This type of topography could affect wetland compensation and future surveys.

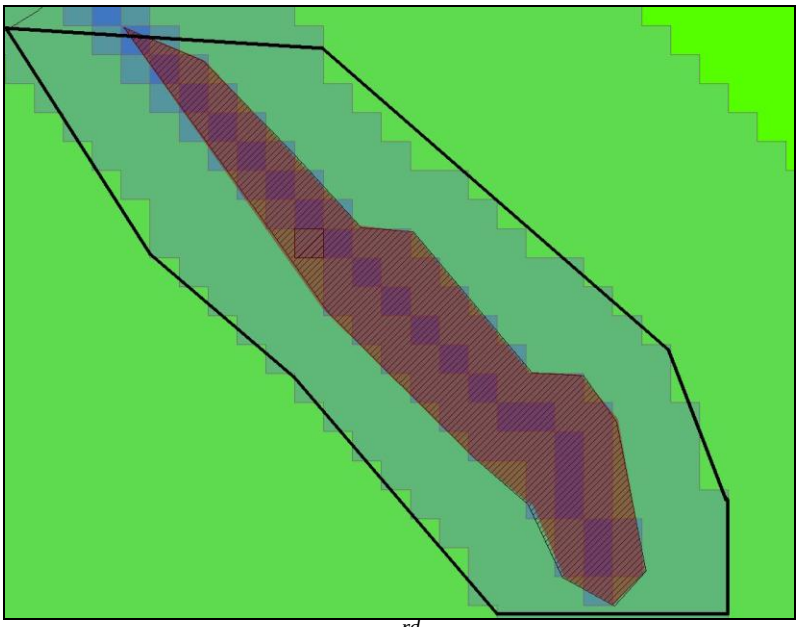


*Figure 3 – 1EJ4P4 Using the 3rd DTW Delineation (0-2m).*

## 5.2 Natural and Impacted Areas

A high percentage of areas in the inventoried sites revealed natural and healthy forest cover with healthy understory vegetation, including the newly found conifer swamps. Much of the wet area portions of the sites contained mature/semi-mature mixed wood species which would most likely require some degree of alteration (vegetation and soil removal) for wetland creation or enlargement and may not produce ideal wetland compensation situations. By nature of their composition, marshes may not require such modifications (lack of mature trees and vegetation) and could yield more preferred compensation possibilities.

The original SRWWI was conducted in the most urbanized sub-watersheds of the SRW and yielded sites with past ecological impacts. Some sites in the Little Sackville River Sub-watershed seemed to have had previous cleared land or vegetation which would have inevitably impacted the hydrological functions of the site (possible removal of historic wetland areas). The sites inventoried in the BSLS

were located in more natural settings and contained much less degradation, although other GIS identified sites are adjacent to more urbanized areas.

### 5.3 Future Work

As eight sites have been surveyed in the field, 18 sites identified in GIS remain to field inventoried in the BSLS (*see note below*). Completing the BSLS (1EJ4P), in addition to the previous completion of the Sackville River – East and West Basin Subwatersheds (1EJ4A, 1EJ4Q) and the Little Sackville River Sub-watershed (1EJ4B), would leave 11 of the 15 sub-watersheds remaining to be evaluated and assessed in GIS and the field.

The 18 sites in the BSLS were identified using the first two DTW delineations (0-0.5m). A different number of sites, possibly being much larger, may result in expanding the WAM site size to 0-2m depths as this deeper delineation spans much larger areas. When assessing larger sites in the field, a more rapid inventory approach could be used to reduce the amount of time spent at each site.

It could be affirmed that sites derived from WAM data, once evaluated with satellite imagery or Google Earth, that appear to be in a natural setting, may not be ideal wetland compensation candidates. Sites located in a natural setting may be less subject to past degradation such as changes to vegetation cover, removal and/or addition of soils or fill, and resulting changes to hydrology and may not yield many ideal wetland compensation possibilities and may be excluded from field assessment. However, there could be sites which were degraded in the past but have since naturalized which may hold viable compensation potential. Sites such as these may need to be evaluated through historical records, local knowledge, and other sources.

Identifying sites which have had past degradation such as old gravel pits and brownfield sites in conjunction with WAM data could improve identifying sites with higher compensation possibilities. In some situations like a gravel pit where the topography and hydrology has been significantly altered, impacted sites which may be outside the allocated the utilized DTW's may still exhibit wet conditions and viable compensation possibilities. Local knowledge or other information sources about flooding or wet conditions in brownfield sites could assist in this process.

## 6. CONCLUSION

WAM data was used in GIS to identify sites of wetland compensation in the BSLS. Eight sites were field inventoried and produced 157,738 sq m of wetland creation, enlargement, and enhancement possibilities and should be considered by proponents seeking wetland compensation sites. An additional 18 sites identified in GIS remain to be evaluated in the field. With the completion of the BSLS, 4 of the 15 sub-watersheds of the SRW will be evaluated, leaving 11 remaining to be assessed. Modification to how sites are identified and evaluated and field methods could alter the time needed to assess wetland compensation possibilities in the SRW.

# GLOSSARY

**DTW** – Depth-to-water table. The depth to the water table in a given area or location on the ground.

**GIS –** Geographic Information System. Any type of computer, technological system, or device which deals with geographic location.

**HRM** – Halifax Regional Municipality.

**NSE** – The Nova Scotia Department of Environment.

**NSTIR –** The Nova Scotia Department of Transportation and Infrastructure and Renewal.

**Potential Wetland** – An area of land with some, but not definite, characteristics indicative of a wetland but accompanied by features associated with dryer, upland sites.

**Property Identification Number (PID)** – A system of numbers to classify and identify individual properties or land tracts in a given municipality or district.

**Wet Area** – An area which occasionally exhibits wet conditions and may demonstrate characteristics of a wetland and be found adjacent to surface water features or in areas of groundwater recharge or discharge.

**Wet Area Mapping (WAM)** – A type of mapping data which delineates wet and dry areas in a landscape and creates depth-to-watertables (DTWs), and modelled flow accumulation channels (FACs). The data was modelled using existing data including digital elevation models (DEMs), mapped surface water features, and wetland and forest inventories.

**Wetland** – An area of land which is permanently or seasonally inundated with water and displays vegetation and soils which dictate wet conditions.