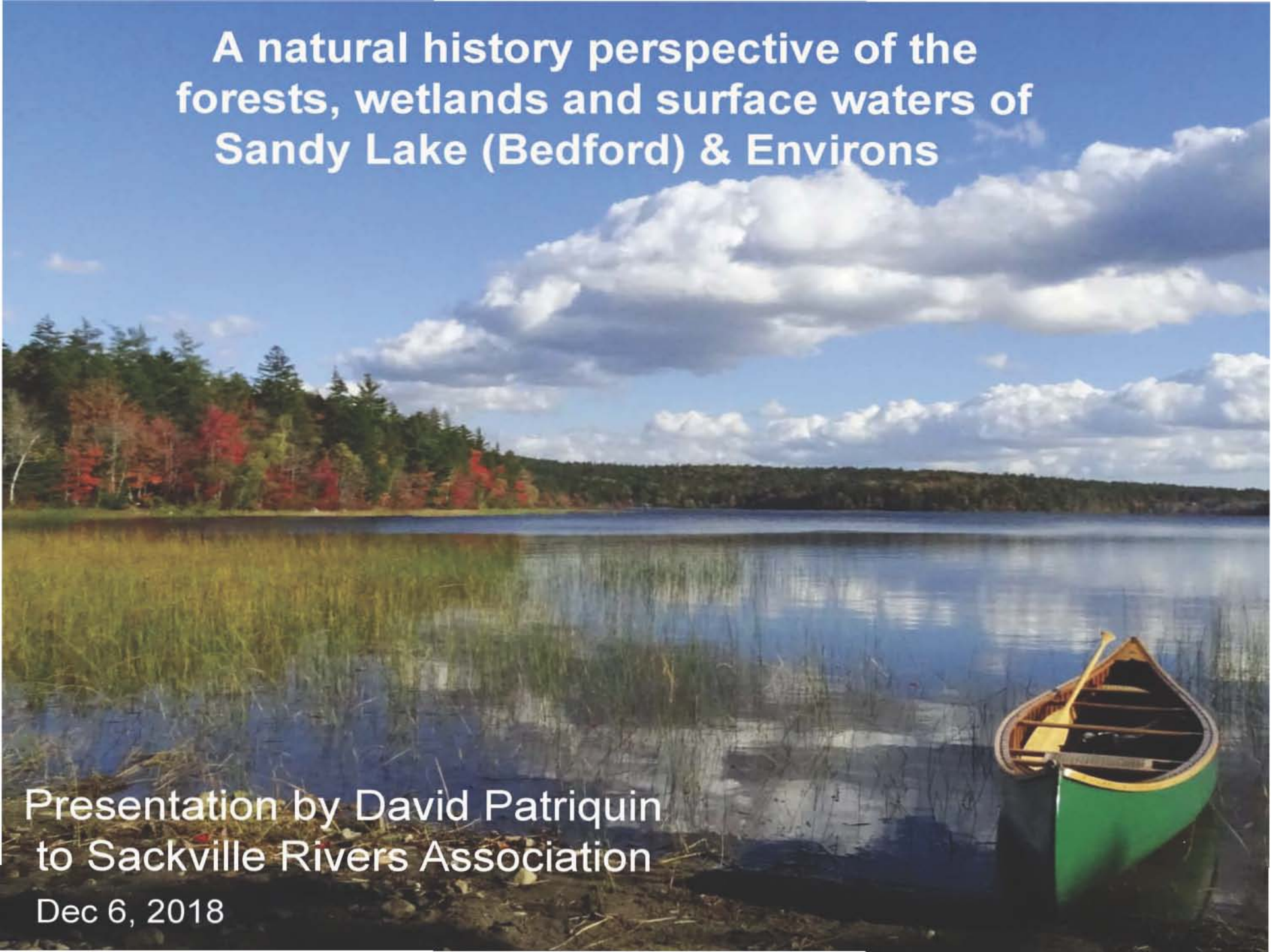


# A natural history perspective of the forests, wetlands and surface waters of Sandy Lake (Bedford) & Environs

Presentation by David Patriquin  
to Sackville Rivers Association

Dec 6, 2018





## Use of Images produced by David G. Patriquin\* (Halifax, N.S.)



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Contact David G. Patriquin at:

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Halifax, N.S.  
Canada B3H1R9

Phone 902-4235716  
e-mail: [patriqui@dal.ca](mailto:patriqui@dal.ca)

Please put "Use of Photographs" in the subject line of e-mails.

*David G. Patriquin*  
Dec 17, 2018.

\*Sometimes cited on photographs as David Patriquin, DGP, or David Graham Patriquin. (There are other individuals known as "David Patriquin" residing in Halifax but none, to my knowledge with the middle initial G.)

The "drone photos" are not mine and should be attributed to "Sandy Lake Conservation Association/Skyline Studio"



# Sandy Lake Regional Park

*A magnificent old forest, wildlife and recreation park protecting the Sackville River flood plain and located between the thriving communities of Bedford, Sackville, Kingswood and Hammonds Plains*

*"I view Sandy Lake and environs as they were viewed in 1971: an asset to all of Halifax municipality, indeed to the whole province. I see it as a very special place, complementing not replicating other major natural assets of Halifax."*

*Halifax naturalist/Trails volunteer*

## Unfinished business:

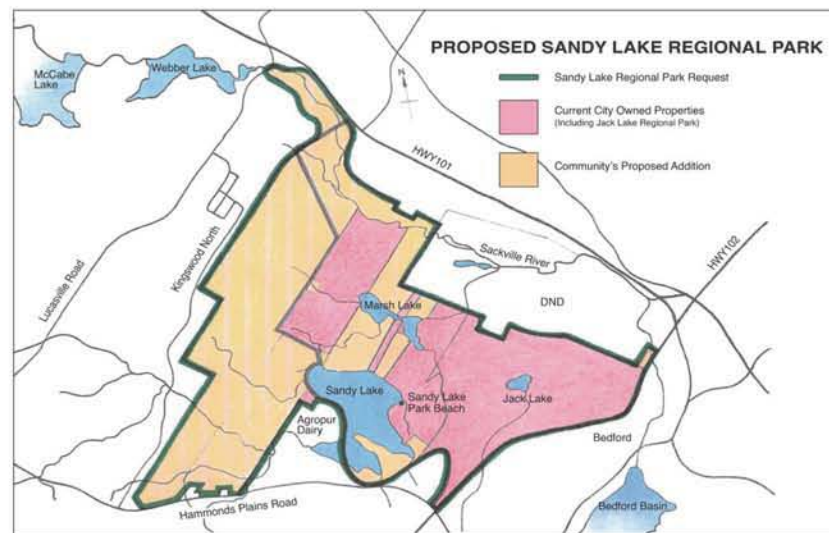
**Help us expand the existing park to protect this irreplaceable natural area. Time is running out.**

The proposed **Sandy Lake Regional Park** is two thousand acres of rich ecosystem that stretches between the Hammonds Plains Road and the Sackville River encompassing the lands and rivers of and between Sandy, Marsh and Jack Lakes and the Sackville River. It has been recognized for nearly five decades, provincially, municipally and locally, and in multiple reports and studies, to be a special landscape worth protecting. Community efforts plus some twists of fate have allowed these lands to remain largely in good condition, and other twists of fate have caused protective processes to fall short.



In 1971, the Sandy Lake area was selected as one of seven unique "jewels in the crown" of Halifax region – priority areas to be protected for their ecological richness and for community education and recreation. Plans were developed for the **Sandy Lake Regional Park**.

[www.sandylakecoalition.org](http://www.sandylakecoalition.org)



In 2006 the HRM-owned Jack Lake lands together with the Lions Club Beach on Sandy Lake were identified as lands for the Jack Lake Regional Park which is still to be formally designated. Those lands have their own special attributes and should remain protected, but about 1000 acres of the critical Sandy Lake to Sackville River corridor remain unprotected. Citizens have worked since the 1970s to protect this area and to finally achieve a comprehensive **Sandy Lake Regional Park**.

## Time is Running Out

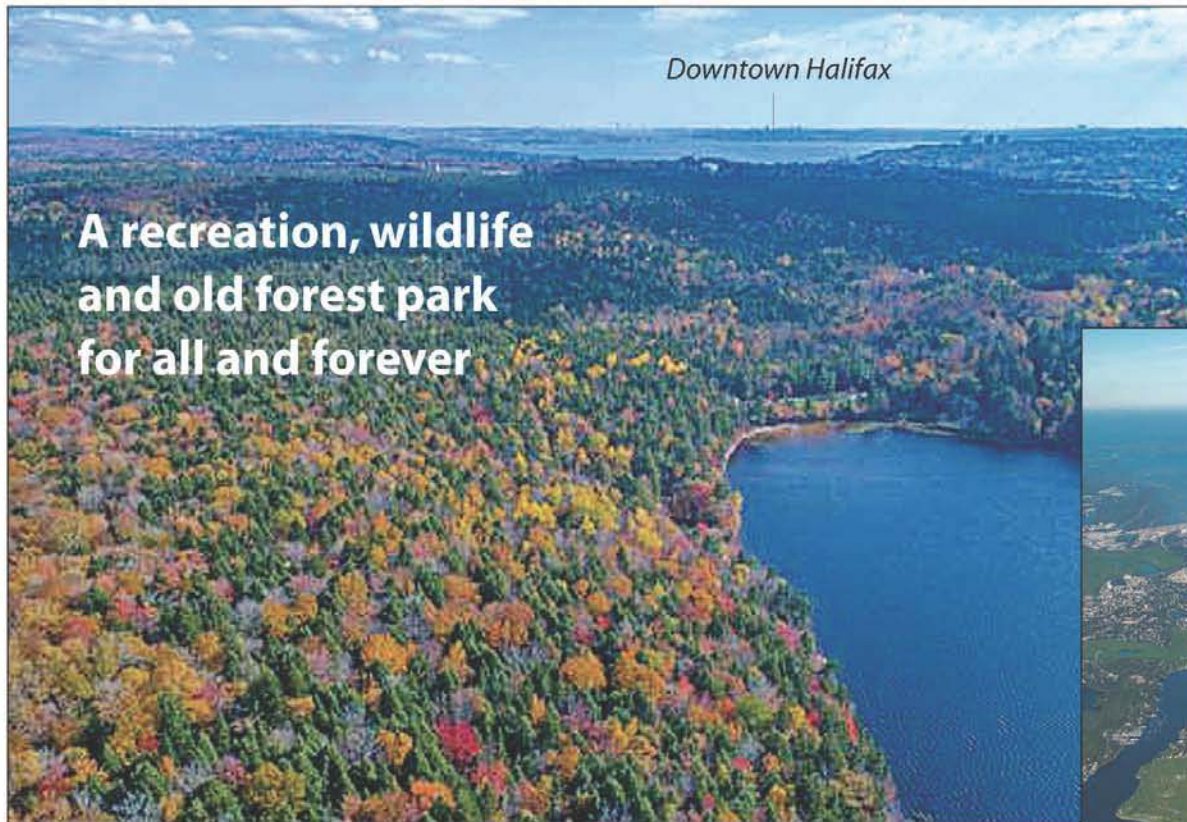
Housing development has been on a parallel path and is close to overtaking the park goals. We need concerted action from HRM to ensure that this jewel will be preserved for generations to come. There will likely never be another chance to preserve this stunning area for the long-term benefit of the entire city and province.



[www.sandylake.org](http://www.sandylake.org)

[www.sandylakebedford.ca](http://www.sandylakebedford.ca)





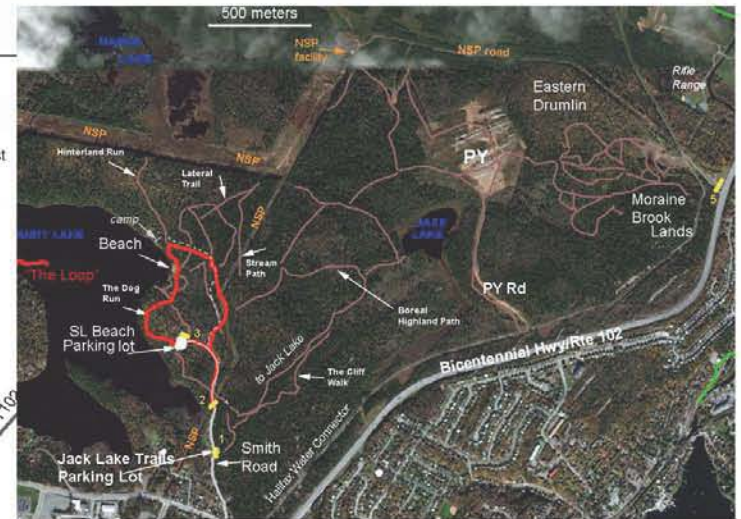
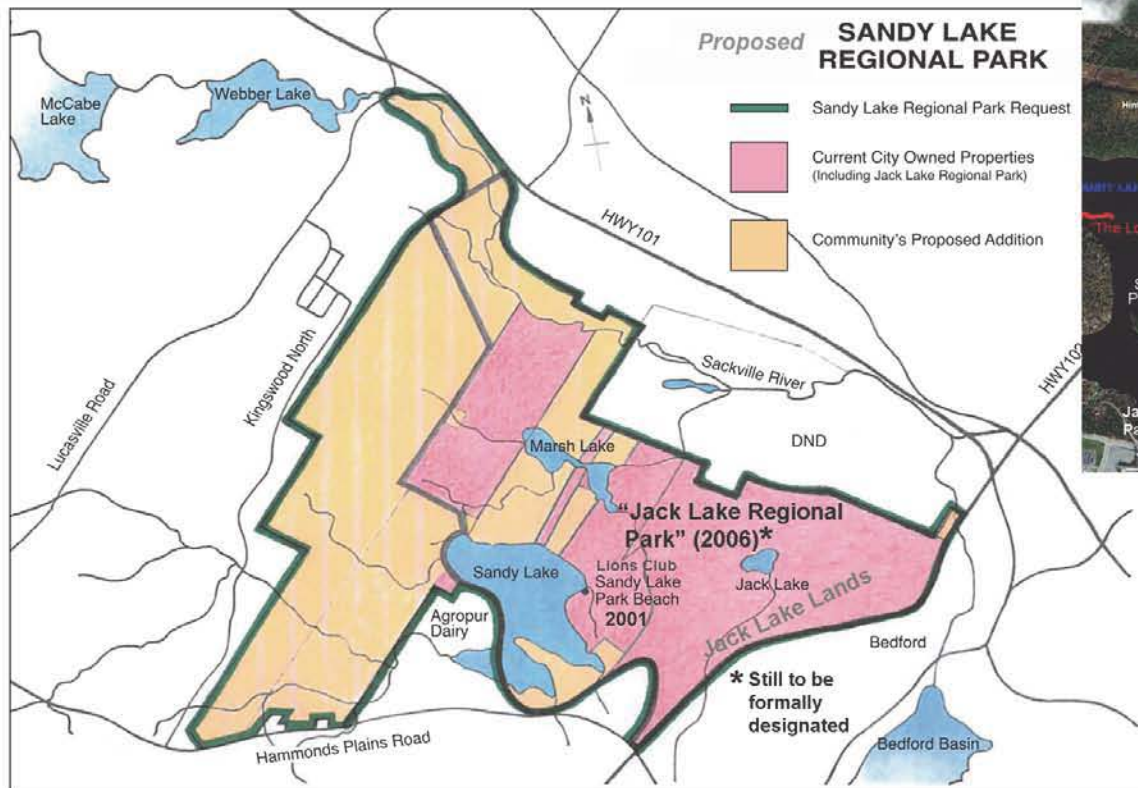
**A recreation, wildlife  
and old forest park  
for all and forever**



In 1971, the Sandy Lake area was selected as **one of seven unique “jewels in the crown”** of Halifax region – priority areas to be protected for their ecological richness and for community education and recreation. Plans were developed for the

**Sandy Lake Regional Park**





### Jack Lake Lands:

- Many trails, multiple uses all seasons; mostly informally managed

### Sandy Lake Beach Park:

- Formally managed; swimming, paddling, fishing

The proposed SLRP embodies more of the original concept of a Regional Park at Sandy Lake, which was for parkland around the lake, not to one side of it, and that of the 1979 MAPC plan which would "include more area on all sides, from the Sackville River to the Hammonds Plains Road and from the Bedford Rifle Range west toward the Lucasville Road (including buffers and flood plains)."

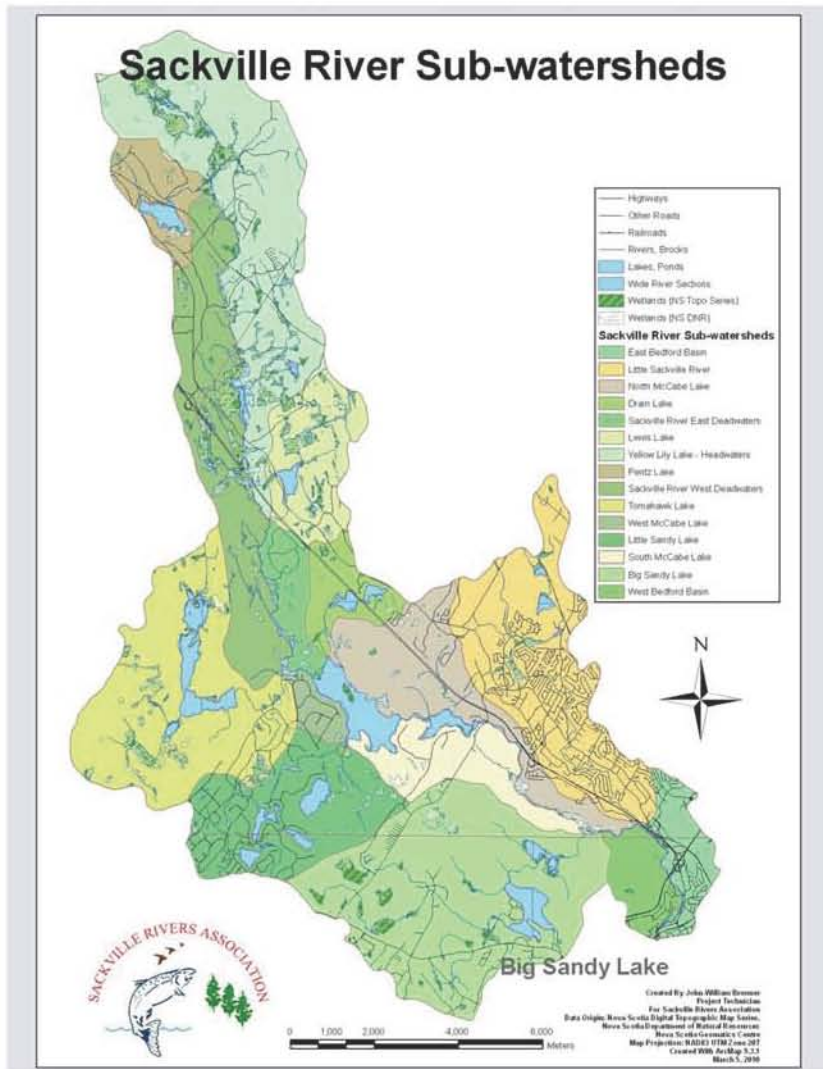
## Major reasons to expand the Park

### - Historical

- Protection of the Sandy Lake to Sackville River watercourse for migratory fish, reptiles, amphibians, waterfowl, otters... water quality/aquatic recreation; reduce downstream flooding
- Provide a forested wildlife corridor connecting lands of the Chebucto Peninsula with central and eastern mainland



# Sackville River Subwatersheds Map & Google Earth Image





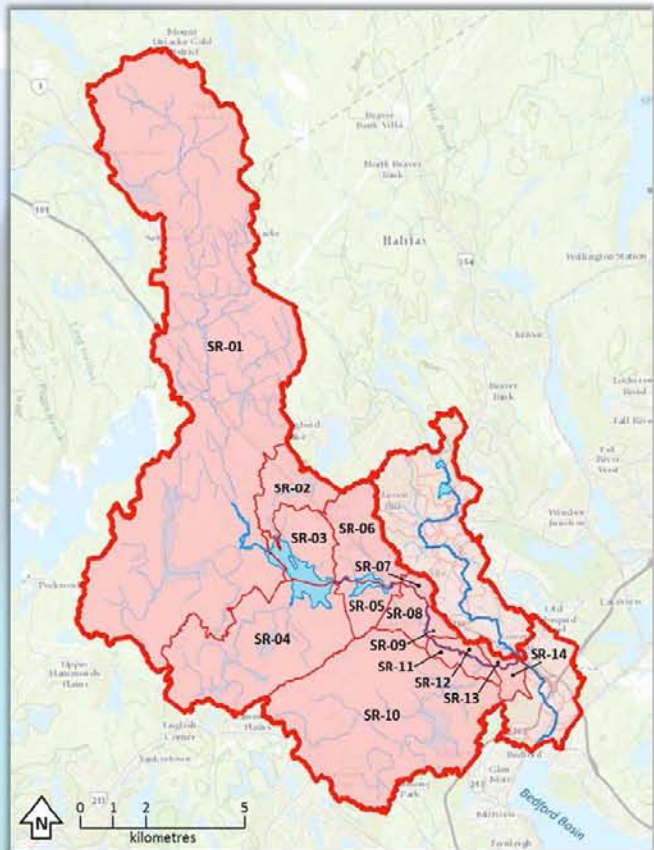


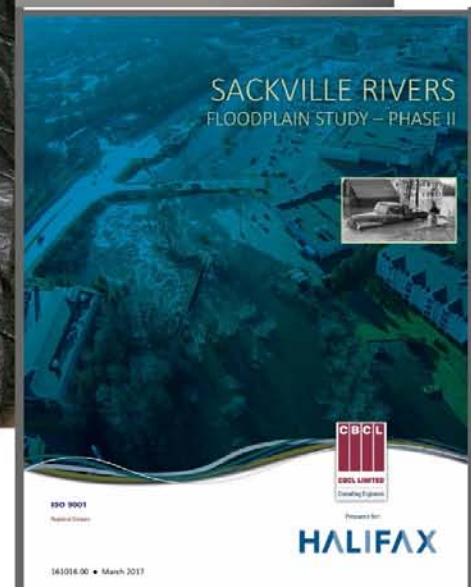
Figure 2.2: Sub-Watershed Delineation of the Upper Reach of the Sackville River (Background Map  
Source: Esri World Topographic Map)

CBCL Limited

Sackville Rivers Floodplain Study – Phase II 10



**April 4,  
2009**

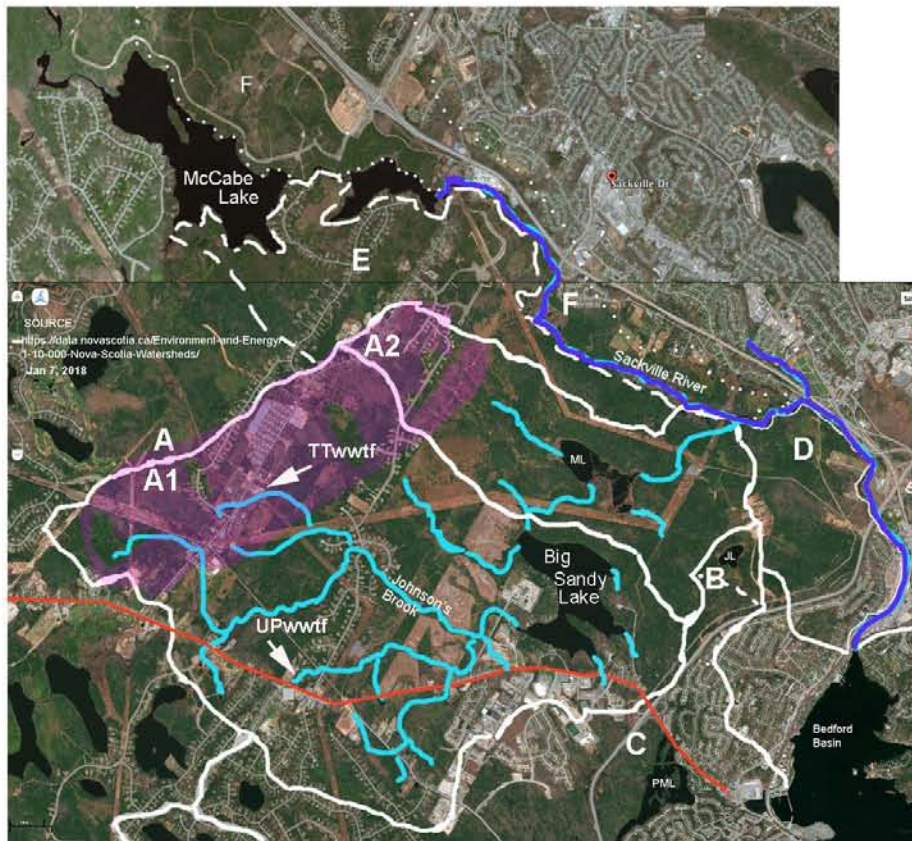


## Notes

- Developers are not allowed to increase flows
- Volumes may increase
- May be more surface flow (vs through the ground)
- There are mechanisms to increase infiltration
- **They did not model development in SL area**
- Eutrophication is an issue



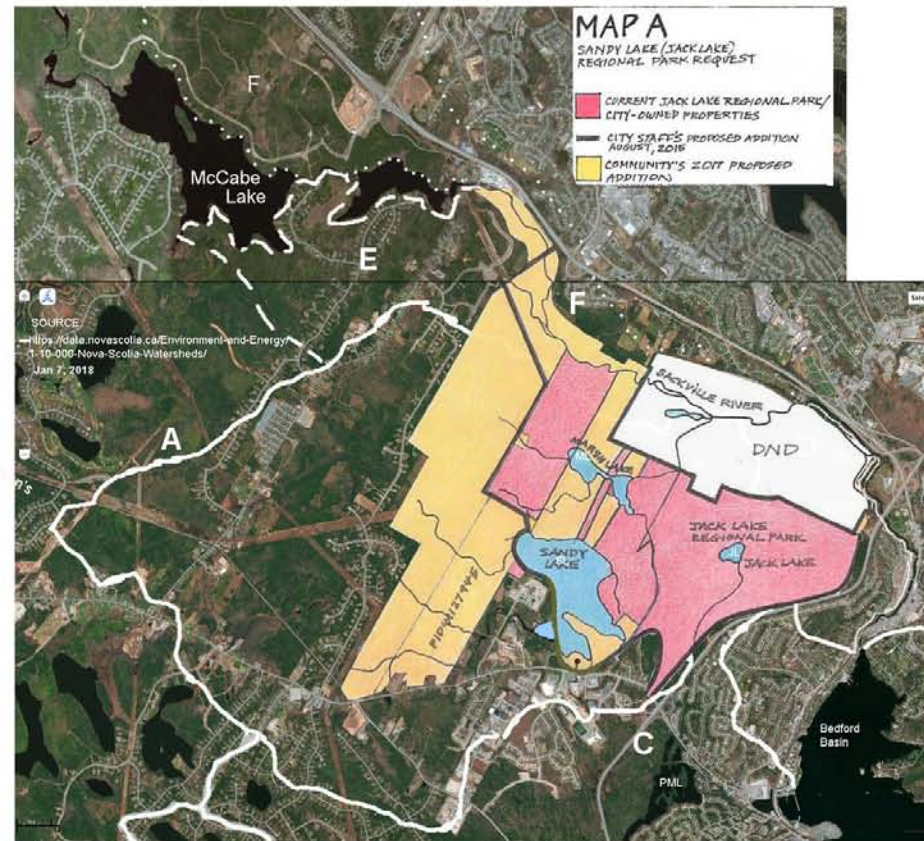
# Sandy Lake & Environs



A: Big Sandy Lake Sub-watershed & D Bedford West Sub-watershed in Sackville River Watershed  
 B: Jack Lake Sub-watershed of C: Papermill Lake Watershed E: South McCabe Lake & F North McCabe Lake Sub-watersheds

A1 Sandy Lake and A2 Marsh Lake are subwatersheds of the Sandy Lake Sub-watershed of the Sackville River Watershed  
 Purple highlighted area: Bedrock with acid-generating potential. UPwwtf: Uplands Park waste water treatment facility.  
 TTwwtf: Timber Trails waste water treatment facility. Blue highlighted streams are the major streams in the Sandy Lake  
 Sub-watershed as identified in the Sandy Lake Watershed Study Final Report (AECOM 2014)

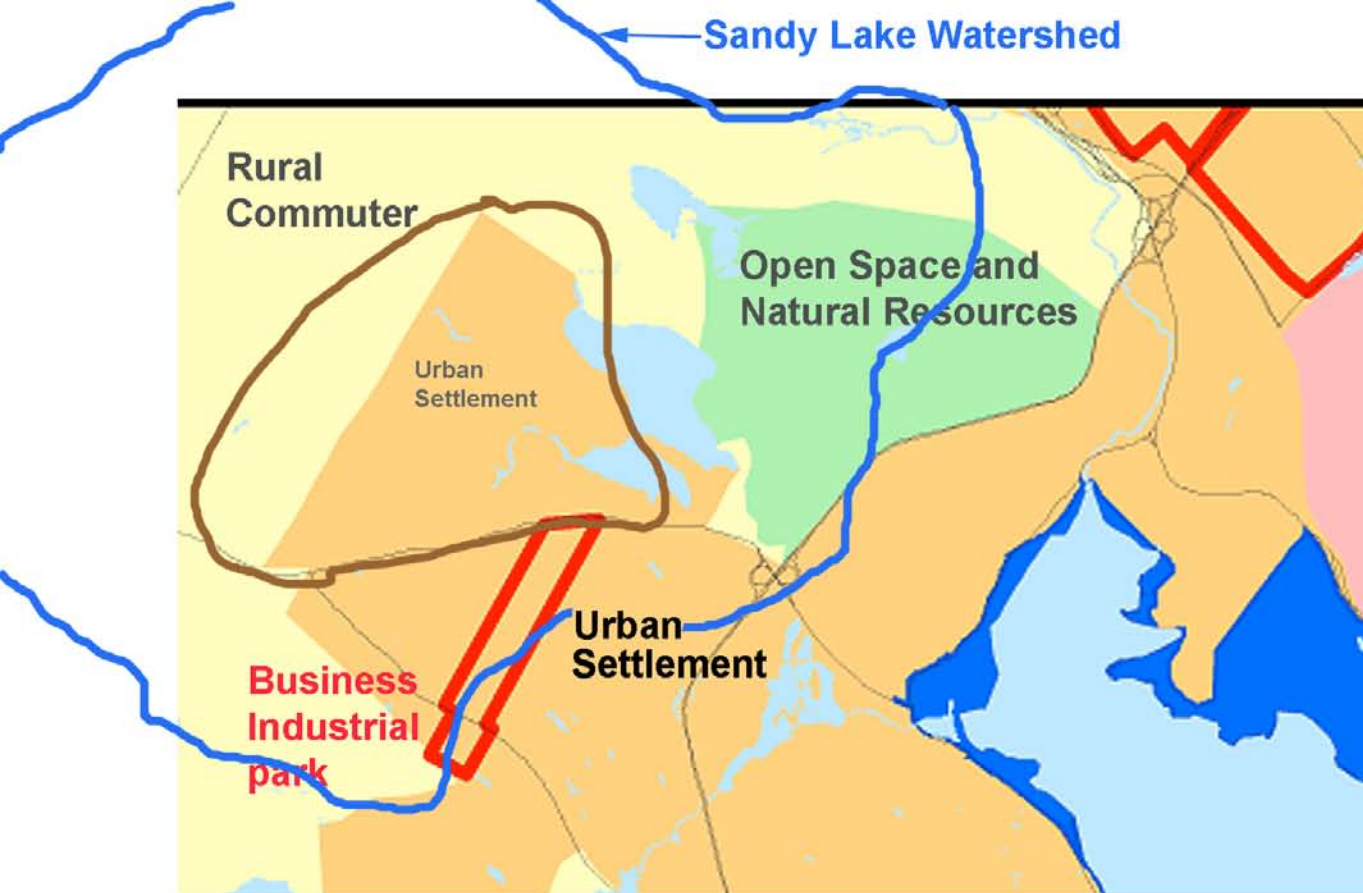
## Major streams of Sandy Lake Sub-Watershed



A: Big Sandy Lake Sub-watershed & D Bedford West Sub-watershed in Sackville River Watershed  
 B: Jack Lake Sub-watershed of C: Papermill Lake Watershed E: South McCabe Lake & F North McCabe Lake Sub-watersheds

## Existing and Proposed Parkland/Protected Area





Modified from Map 2 of HRM Regional Plan (2014)

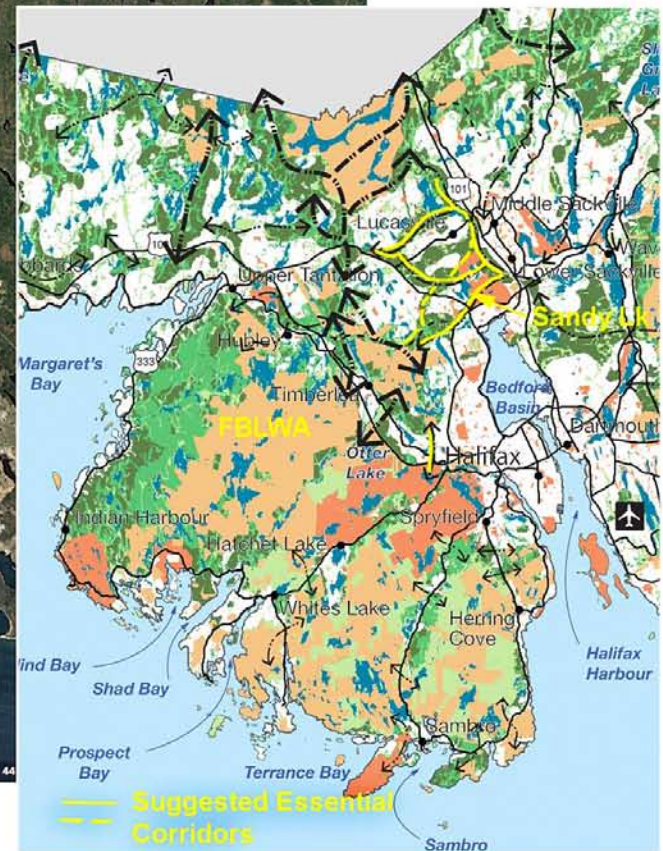
Of concern to the Sandy Lake Conservation Association is the prospect that 892 acres zoned Urban Settlement just west of Sandy Lake could be developed to accommodate 12,000 residents (CBCL, 2009)



## Sandy Lake & Environs: critical connectivity Chebucto Peninsula to central/eastern mainland



**Chebucto Peninsula: a significant  
conservation area**



**Modified from HGPN**



Drone photos on Oct 9, 2017 by Skyline Studio for the Sandy Lake Conservation Association



**Looking towards southwest: “The Peninsula”  
& Bluewater Road & Hammonds Plains Road**





**Looking east to Jack Lake and,  
in the distance, Bedford Basin**





**Looking NW towards Peverill's Brook  
and Marsh Lake**





**View NNE: Marsh Lake to Sackville River**





**View to northwest of Sandy Lake**





**View west  
onto clearcut,  
Peverill's Brook  
at top right**





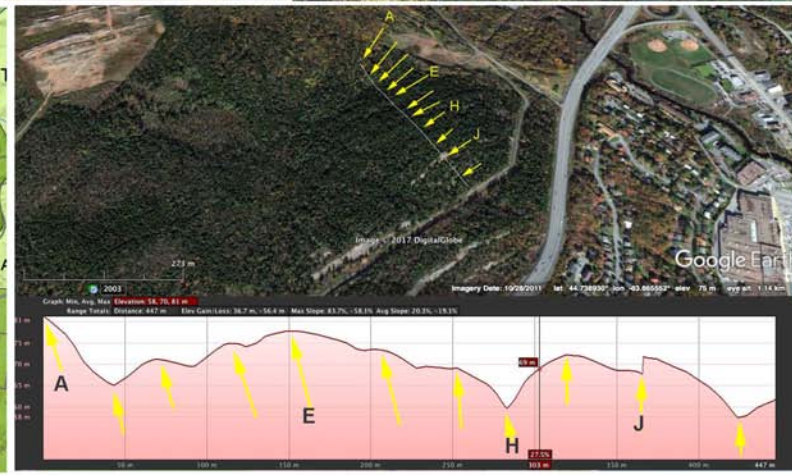
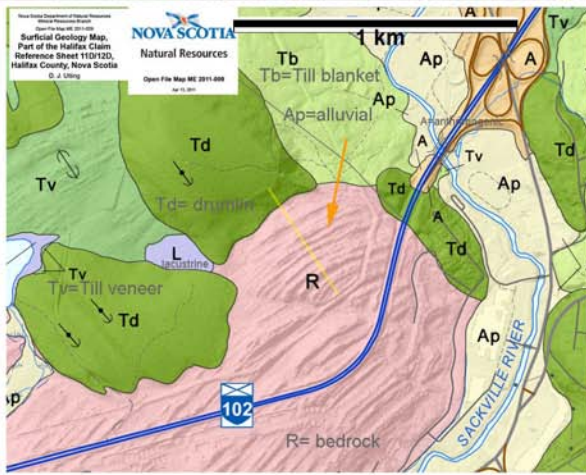
**Looking south-southwest of Sandy Lake**







# Moraine Brook



























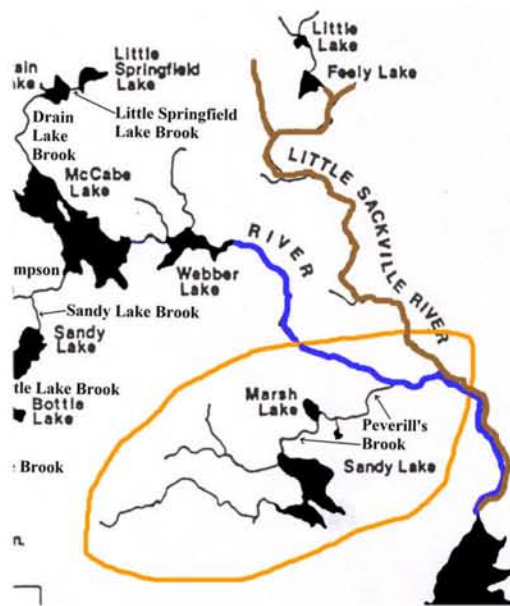








Moraine Brook forest



Upper Peverill's Brook



Marsh Lake



Gaspereau



Snapping turtle habitat



Sandy Lake



Jack Lake

Forest, Wetlands  
Streams, Lakes











LOCATIONS OF BEAVER LODGE & DAMS ON UPPER PEVERILL'S  
BROOK, AUG 3, 2018

Lodge &  
Dam1

Dam2

Dam3

Dam4

Peverill's Brook



Aug 15, 2017

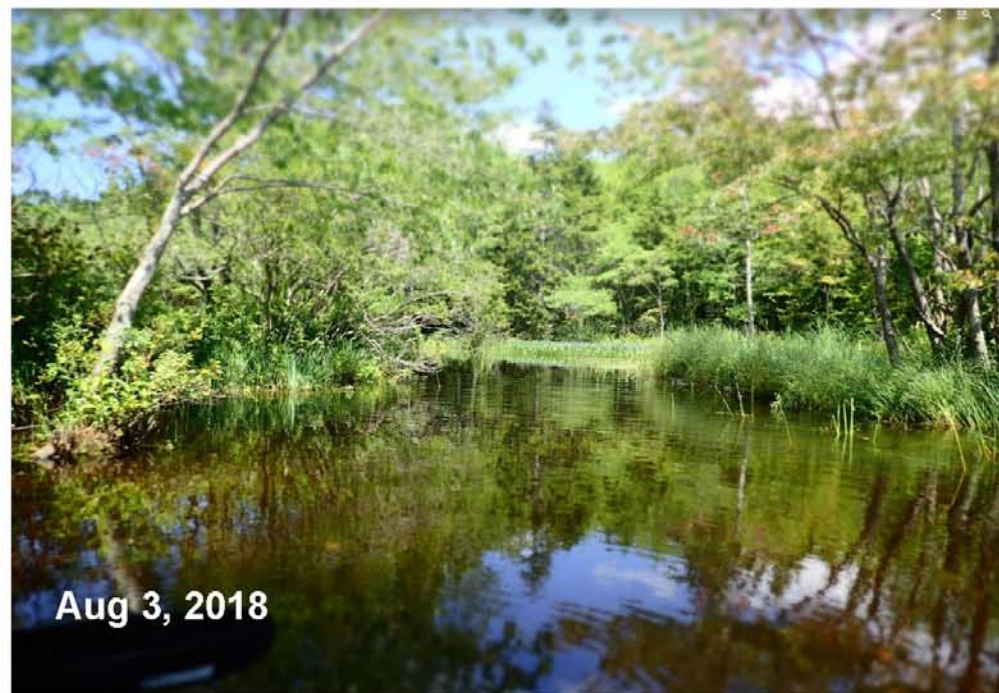
Entrance to  
Peverill's Brook



Approaching 4th  
dam Aug 3, 2018



Dam under construction  
Aug 15, 2017



Aug 3, 2018









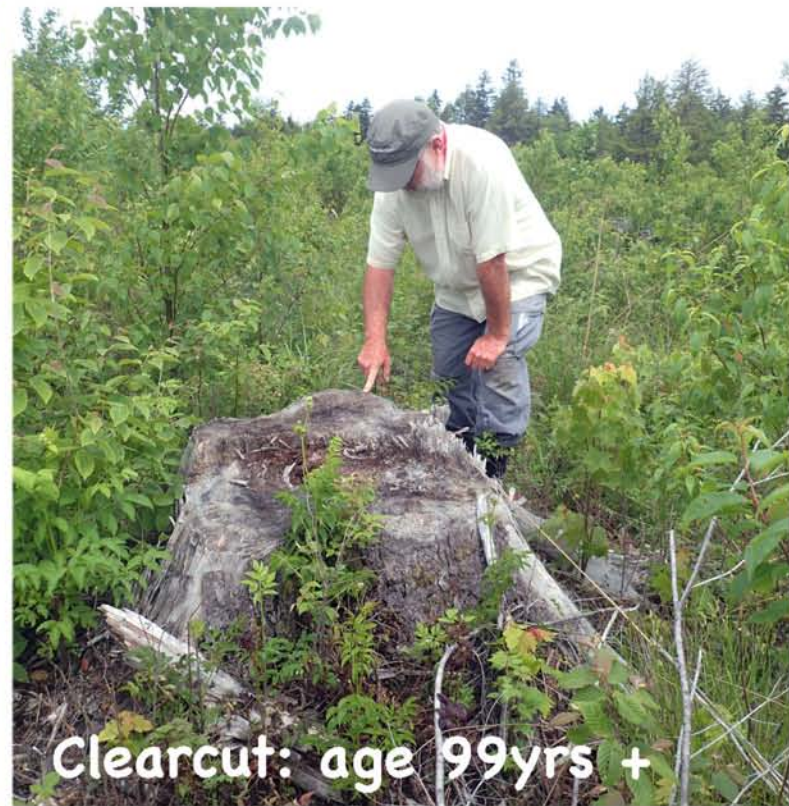








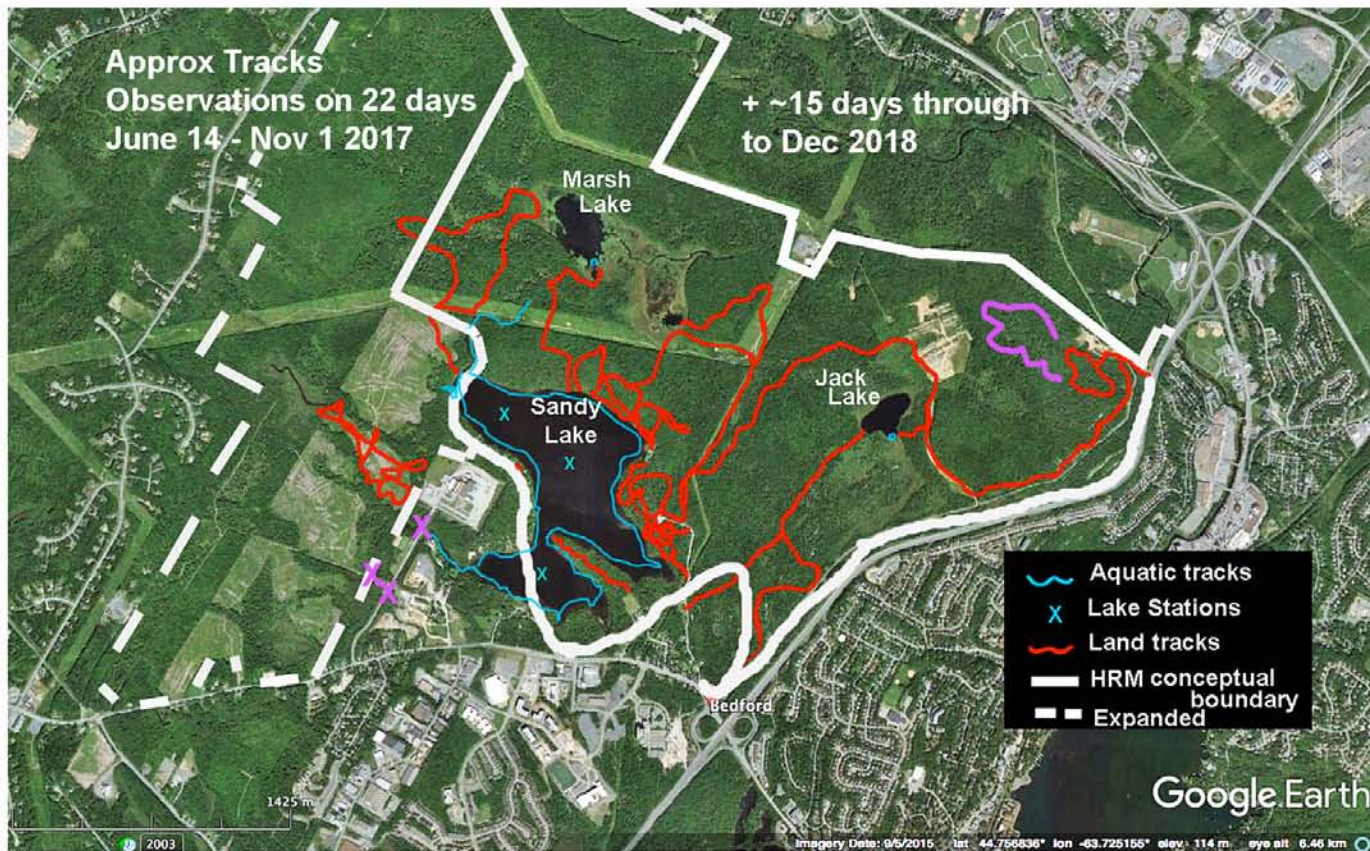












## Objectives:

- to describe *'what you see on the ground'*
- to document *significant ecological attributes* of the area
- to make some assessment of *existing or potential threats* to the *Ecological Integrity* of the area

## Added:

- to comment on *recreational attributes*

## Equipment

- cameras (GPS tagged photos);  
& low res video notes
- GPS unit
- tape measure
- compass
- soil auger
- tree cores for aging (with Colin Gray, MTRI)
- inflatable kayak; Ed's boat, DS's canoe
- Pocket pH, EC meters
- Wet- Pro Field Kit for O<sub>2</sub>, temp, pH, EC  
(from CBEM group at SM)



- On Land:** - description of plant communities; blowdowns, deadwood, outcrops etc.  
 - occurrence of all trees 16" (40 cm) and greater dbh  
 - "Old Forest Assessment" and measurements of "pit & mound" topography at 3 sites



**Bob Guscott**  
 DNR (retired)

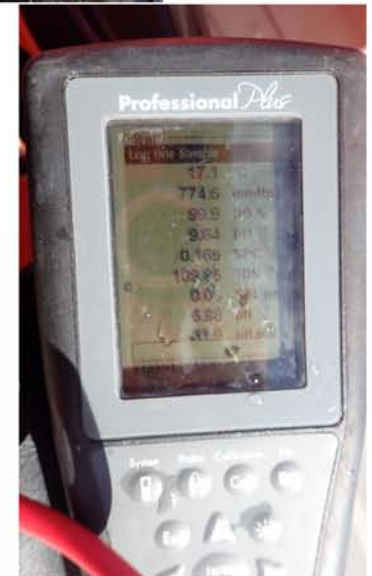
**Derek Sarty**  
 SLCA



**Colin Gray**  
 MTRI

**SMU**

- On or by Water** - extent and species composition of the wetland fringe  
 - routine measurement of EC and pH  
 - limnological profiles (temp, O2, pH, EC) at 3 sites on Sandy Lake  
 in Oct





# Forests and surface waters of Sandy Lake & Environs (Bedford, Nova Scotia)

A Natural History Perspective

As compiled in Sandy Lake Conservation Association and Sackville Rivers Association submission to the Halifax Green Network Plan Implementation public process (2017) Posted Dec 29, 2017



Home Intro Overview Lakes Streams & Wetlands Forests Invasive Species Recreation Species Lists Photo Albums Videos  
Maps Geology Links

## Mammals

Common Name	Scientific Name	Source
American Beaver	<i>Castor canadensis</i>	1
American Mink	<i>Nyctevision vison</i>	1,2
American Porcupine	<i>Erethizon dorsatum</i>	1,2
American Red Squirrel	<i>Tamiasciurus hudsonicus</i>	1,2
Black Bear - American Black Bear	<i>Ursus americanus</i>	1,2
Bobcat	<i>Lynx rufus</i>	1
Coyote	<i>Canis latrans</i>	1,2
Deer Mouse	<i>Peromyscus maniculatus</i>	1
Eastern Chipmunk	<i>Tamias striatus</i>	1
Ermine (Weasel)	<i>Mustela erminea</i>	2
House Mouse	<i>Mus domesticus</i>	1
Little Brown Bat	<i>Myotis lucifugus</i>	1
Meadow Vole	<i>Microtus pennsylvanicus</i>	1,2
Moles		2
Muskrat	<i>Ondatra zibethicus</i>	1
Northern Flying Squirrel	<i>Glaucomys sabrinus</i>	1
Raccoon	<i>Procyon lotor</i>	1,2
Red Fox	<i>Vulpes vulpes</i>	1
River Otter	<i>Lontra canadensis</i>	1,2
Short-tailed Shrew	<i>Blarina brevicauda</i>	1
Short-tailed Weasel	<i>Mustela erminea</i>	1
Smoky Shrew	<i>Sorex fumeus</i>	1
Snowshoe Hare	<i>Lepus americanus</i>	1,2
Striped Skink	<i>Mephitis mephitis</i>	2
White-tailed Deer	<i>Odocoileus virginianus</i>	1,2
Woodchuck (Groundhog)	<i>Marmota monax</i>	1,2
Woodland Jumping Mouse	<i>Naupactopus insignis</i>	1

## Birds

### Fish

Common Name	Source
American Eel	2,4
Atlantic Salmon	2
Banded Killifish	4
Brown Bullhead	4
Cattfish	2
Common White Sucker	4
Gaspereaux	2,4
Small Mouthed Bass	2
Speckled Trout	2,4
Yellow Perch	4

### Amphibians and Reptiles

Common Name	Source
American Toad	2
Bull Frog	2
Garter Snake	2
Leopard Frog	2
Peepers	2
Snapping Turtles	2,3*
Spotted Salamanders	2
Wood turtle	3*

Common Name	Source
Alder Flycatcher	1
American Black Duck	1
American Crow	1,2
American Goldfinch	1,2
American Redstart	1
American Robin	1,2
American Tree Sparrow	1
American Woodcock	1
Bald Eagle	1,2
Bank Swallow	3*
Barn Swallow	1,3*
Barred Owl	1,2
Bay-breasted Warbler	3*
Belted Kingfisher	1
Black Duck	2
Black-and-White Warbler	1
Black-backed Woodpecker	1
Black-capped Chickadee	1,2
Black-throated Blue Warbler	1
Black-throated Green Warbler	1
Blackburnian Warbler	1
Blue Jay	1,2
Blue-headed Vireo	1
Boreal Chickadee	1,3*
Broad-winged Hawk	1
Brown Creeper	1
Brown-headed Cowbird	1

Canada Geese	2
Canada Warbler	1,3*
Cedar Waxwing	1
Chestnut-sided Warbler	1
Chimney Swift	1,3*
Chipping Sparrow	1
Common Loon --- Common	1,2
Common Raven	1
Common Yellowthroat	1
Dark-eyed Junco	1,2
Double-crested Cormorant	1,2
Downy Woodpecker	1
Eastern Wood Pewee	1,3*
European Starling	1
Evening Grosbeak	1,2
Fox Sparrow	1
Golden-crowned Kinglet	1
Gray Catbird	1,3*
Gray Jay	1,3*
Great Black-backed Gull	1
Great Blue Heron	1
Green Heron	1
Green-winged Teal	1
Halcyon Woodpecker	1
Hermit Thrush	1
Herring Gull	1
Hooded Merganser	1
Killdeer	3*
Least Flycatcher	1
Little Blue Heron	1

Long-eared Owl	1
Magnolia Warbler	1
Mallard	1
Merganser	1
Merlin	1
Mourning Dove	1
Nashville Warbler	1
Northern Flicker	1
Northern Goshawk	1
Northern Harrier	1
Northern Mockingbird	3*
Northern Parula	1
Northern Saw-whet Owl	1
Northern Waterthrush	1
Olive-sided Flycatcher	1,3*
Osprey	1,2
Ovenbird	1
Palm Warbler	1
Pied-billed Grebe	1
Pileated Woodpecker	1
Pine Grosbeak	1
Pine Siskin	1,3*
Purple Finch	1,2
Red Crossbill	1
Red-breasted Nuthatch	1
Red-eyed Vireo	1
Red-winged Blackbird	1
Ring-billed Gull	1
Ring-necked Duck	1
Ring-necked Pheasant	1,2
Rock Dove	1

Ruby-crowned Kinglet	1
Rock Dove	1
Ruby-crowned Kinglet	1
Ruby-throated Hummingbird	1,2
Ruffed Grouse	1
Rusty Blackbird	1,3*
Scarlet Tanager	3*
Sharp-shinned Hawk	1
Solitary Sandpiper	1
Song Sparrow	1
Sora	1
Spotted Sandpiper	1,3*
Spruce Grouse	1
Swainson's Thrush	1
Swamp Sparrow	1
Tennessee Warbler	1,3*
Tree Swallow	1
Veery	1
White-breasted Nuthatch	1,2
White-crowned Sparrow	1
White-throated Sparrow	1
White-winged Crossbill	1
Wilson's Warbler	3*
Wood Duck	1
Yellow Warbler	1
Yellow-bellied Flycatcher	1
Yellow-bellied Sapsucker	1
Yellow-rumped Warbler	1



## Vertebrate species associated with certain structural features of older forests

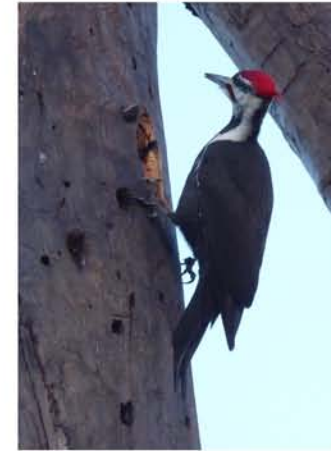
in New Brunswick include such species as

for old, shade-tolerant hardwood forest types:

- ✓ – downy woodpecker (*Picoides pubescens*)
- ✓ – pileated woodpecker (*Dryocopus pileatus*)
- ✓ – eastern wood pewee (*Contopus virens*)
- ✓ – white-breasted nuthatch (*Sitta carolinensis*)
- ✓ – black-throated blue warbler (*Dendroica caerulescens*)

for old spruce–fir forest types

- American marten (*Martes americana*)
- ✓ – black-backed woodpecker (*Picoides arcticus*)
- ✓ – red-breasted nuthatch (*Sitta canadensis*),
- ✓ – red crossbill (*Loxia curvirostra*)
- ✓ – white-winged crossbill (*Loxia leucoptera*)
- ✓ – evening grosbeak (*Coccothraustes vespertinus*)
- ✓ – olive-sided flycatcher (*Contopus borealis*)
- ✓ – winter wren (*Troglodytes troglodytes*)
- ✓ – golden-crowned kinglet (*Regulus setrapa*)
- ✓ – ruby-crowned kinglet (*R. calendula*)
- ✓ – solitary vireo (*Vireo solitarius*)
- Cape May warbler (*Dendroica tigrina*)
- ✓ – blackburnian warbler (*D. fusca*)
- ✓ – bay-breasted warbler (*D. castanea*)
- ✓ – pine siskin (*Carduelis pinus*)



older mixedwood forests

- ✓ – northern flying squirrel (*Glaucomys sabrinus*)
- ✓ – Swainson's thrush (*Catharus ustulatus*)
- ✓ – along with other species



Ovenbird - forest interior species



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American Robin	1,2
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American Woodcock	1
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Black-capped Chickadee	1,2
Black-throated Blue Warbler	1
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Common Yellowthroat	1
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European Starling	1
Evening Grosbeak	1,2
Fox Sparrow	1
Golden-crowned Kinglet	1
Gray Catbird	1,3*
Gray Jay	1,3*
Great Black-backed Gull	1
Great Blue Heron	1
Green Heron	1
Green-winged Teal	1
Halcyon Woodpecker	1
Hermit Thrush	1
Herring Gull	1
Hooded Merganser	1
Killdeer	3*
Least Flycatcher	1
Little Blue Heron	1

Long-eared Owl	1
Magnolia Warbler	1
Mallard	1
Merganser	1
Merlin	1
Mourning Dove	1
Nashville Warbler	1
Northern Flicker	1
Northern Goshawk	1
Northern Harrier	1
Northern Mockingbird	3*
Northern Parula	1
Northern Saw-whet Owl	1
Northern Waterthrush	1
Olive-sided Flycatcher	1,3*
Osprey	1,2
Ovenbird	1
Palm Warbler	1
Pied-billed Grebe	1
Pileated Woodpecker	1
Pine Grosbeak	1
Pine Siskin	1,3*
Purple Finch	1,2
Red Crossbill	1
Red-breasted Nuthatch	1
Red-eyed Vireo	1
Red-winged Blackbird	1
Ring-billed Gull	1
Ring-necked Duck	1
Ring-necked Pheasant	1,2
Rock Dove	1

Ruby-crowned Kinglet	1
Rock Dove	1
Ruby-crowned Kinglet	1
Ruby-throated Hummingbird	1,2
Ruffed Grouse	1
Rusty Blackbird	1,3*
Scarlet Tanager	3*
Sharp-shinned Hawk	1
Solitary Sandpiper	1
Song Sparrow	1
Sora	1
Spotted Sandpiper	1,3*
Spruce Grouse	1
Swainson's Thrush	1
Swamp Sparrow	1
Tennessee Warbler	1,3*
Tree Swallow	1
Veery	1
White-breasted Nuthatch	1,2
White-crowned Sparrow	1
White-throated Sparrow	1
White-winged Crossbill	1
Wilson's Warbler	3*
Wood Duck	1
Yellow Warbler	1
Yellow-bellied Flycatcher	1
Yellow-bellied Sapsucker	1
Yellow-rumped Warbler	1



# SANDY LAKE & ENVIRONS/PROPOSED SANDY LAKE REGIONAL PARK

## Services

**Conservation of  
Regional Biodiversity &  
Ecosystem Services**

**Social & Health  
benefits**

## Major Assets

### FORESTS

### SURFACE WATERS

(streams, lakes  
wetlands)

### WILDLAND RECREATION

close to high  
density residential  
areas/new  
developments

## Components

- Diverse forest types/  
All major tree species of  
the Acadian Forest
- ~50% multi-aged OG Forests
- Wildlife Habitat, e.g. bear,  
bobcat, goshawk, pileated  
woodpecker, parula warbler
- Connectivity Chebucto  
Peninsula to central & eastern  
Mainland

- Water storage
- Stratified lake pH~6.5
- Seagoing Fish incl salmon
- Frogs and Turtles +++
- Otter, beaver...waterfowl

- Power lines, Logging roads  
Many trails, Hfx Water Road
- "Amphitheatre"/The Yard
- Sandy Lake Beach Park
- Diverse activities: Mt biking,  
Hiking, motorized bikes, skiing,  
swimming, fishing, forest bathing,  
dog-walking





**Summary of morphometric data for Sandy, Marsh and Jack Lakes. Ranges for temperature and dissolved oxygen are also given.** From Jack Lake Environmental Evaluation Final Report. Canada Mortgage and Housing Corporation Nova Scotia Department of Housing, 1986

Lake	Elevation (m)	Surface area (ha)	Max depth (m)	Watershed Area (ha)
Sandy Lake	30.5	74.0	20.0	1670
Marsh Lake	23.5	22.0	2.2	493
Jack Lake	75.0	2.75	7.0	32.8

Lake	Retention time (yrs)	Volume M3	Temperature Deg C	Dissolved O2 (mg/L)
Sandy Lake	0.34	$5.1 \times 10^6$	2.5 - 11.5	9.9 - 11.7
Marsh Lake	0.01	$7.4 \times 10^5$	5.0 - 9.2	10.1 - 11.2
Jack Lake	0.18	$7.4 \times 10^4$	2.5 - 11.5	9.9 - 11.7

**Selected water chemistry values for Sandy, Marsh and Jack Lakes in Nov/Dec 1984 (top values) and May 1985 (bottom).**

From Jack Lake Environmental Evaluation Final Report. Canada Mortgage and Housing Corporation Nova Scotia Department of Housing, 1986.

Variable	Sandy Lake	Marsh Lake	Jack Lake
pH	6.14 5.44	6.10 5.30	4.63 4.50
Conductivity uS/cm	99.5 141	102 122	41.5 42.7
Calcium Mg/L	4.10 4.64	4.00 3.95	1.00 1.18

**Aug/Sep 2017**

	Sandy Lake	Marsh Lake	Jack Lake
pH	6.6	6.8	5.8
Cond.	163	158	25



Halifax Regional Municipality

**Sandy Lake Watershed Study  
Final Report**

Project #60303077

Prepared by  
AECOM Canada Ltd.  
1701 Hollis Street (SH400)  
(PO Box 576 GPO)  
Halifax, Nova Scotia, B3J 3M6  
www.aecom.com

August 2014

**“This body of work represents our current understanding of the environmental conditions in the watershed with a focus on lake water quality. The application of a phosphorus load model (Lake Capacity Model) provides a numerical narrative of how development may impact water quality. We identify several methods that can be utilized to mitigate water quality impacts.”**



FROM  
AECOM (2014)

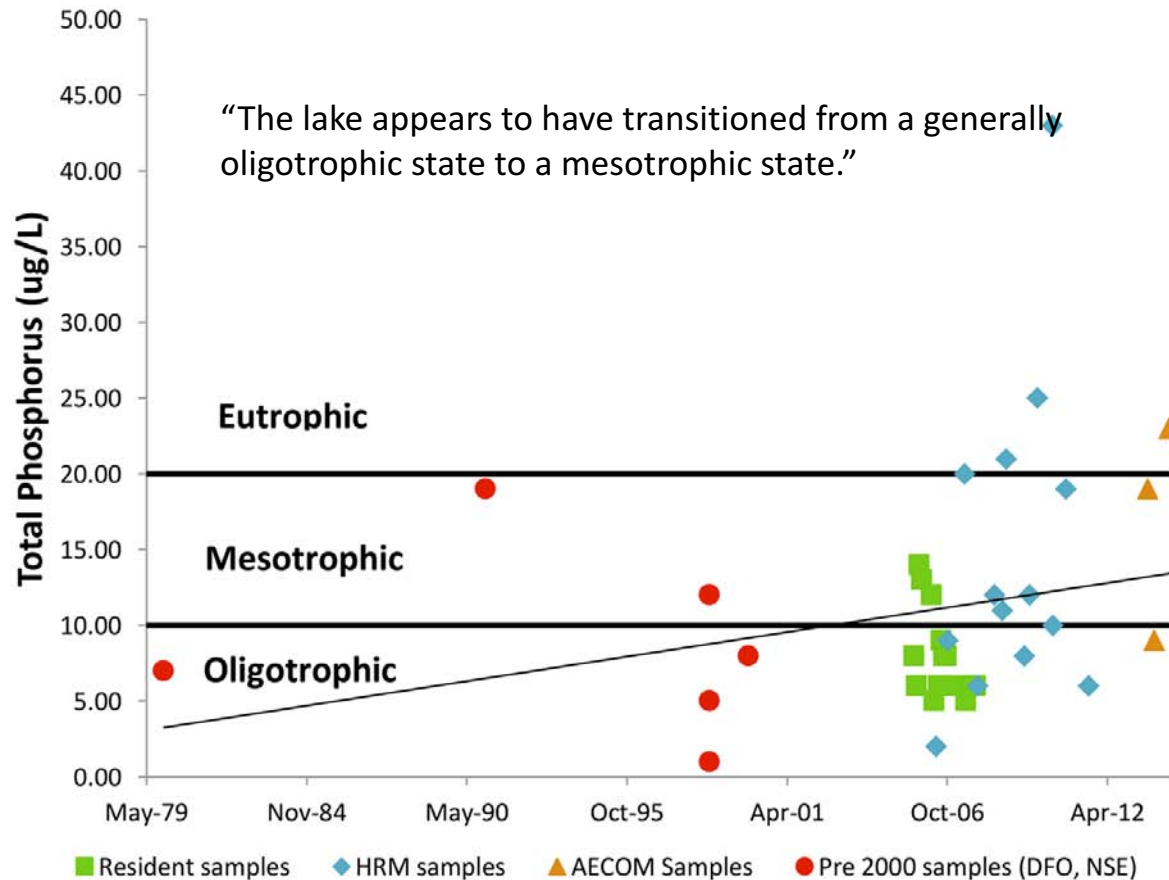


Figure 9: Sandy Lake Total Phosphorus - All Samples

Table 11. Water Quality Objectives and Early Warning Values for Total Phosphorus

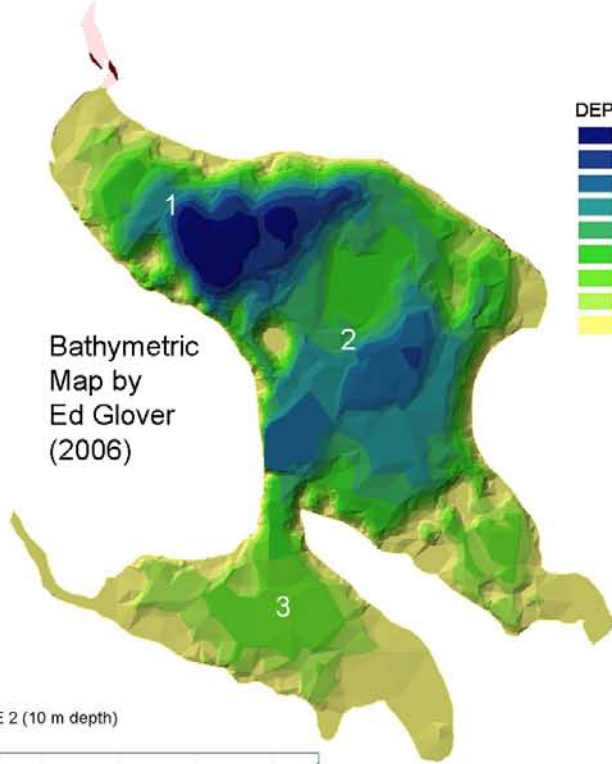
Lake	Trophic State Objective	Numerical Objective	Early Warning	Evaluation
Sandy Lake	Mesotrophic	< 18 µg/L	15µg/L	Based on 3 year running average
Marsh Lake	Mesotrophic	< 15.5 µg/L	13 µg/	Based on 3 year running average.



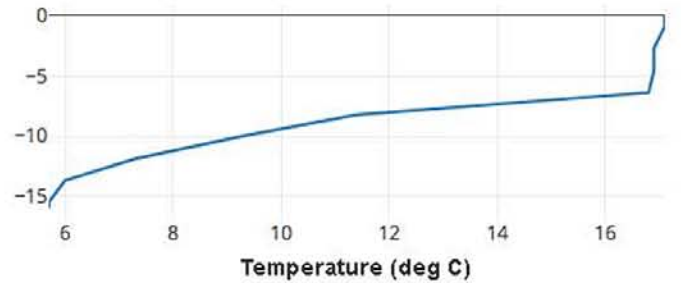
# Sandy Lake (Bedford, Nova Scotia) Limnological Profiles, Oct 3, 2017



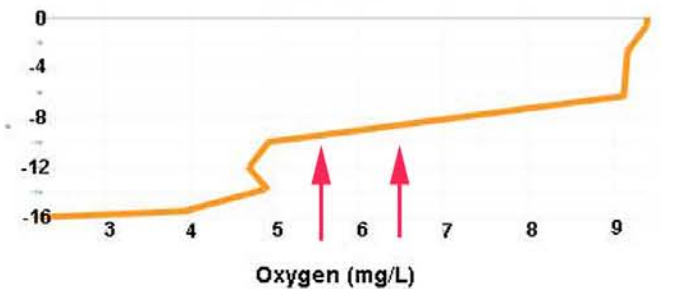
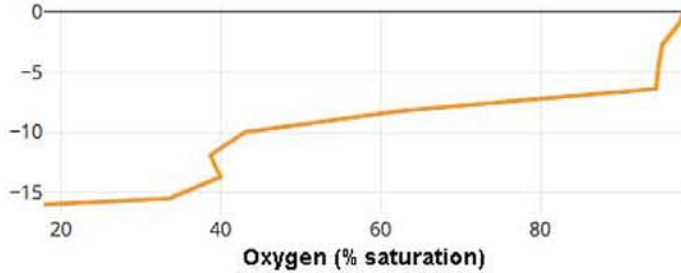
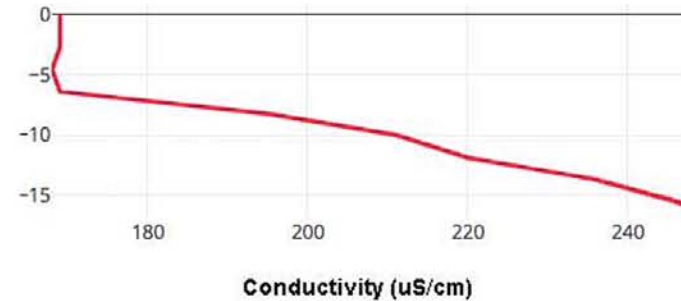
Bathymetric  
Map by  
Ed Glover  
(2006)



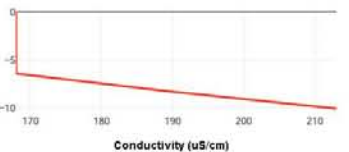
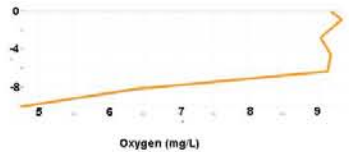
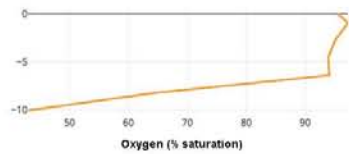
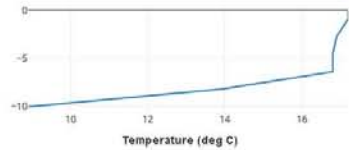
**SITE 1 (17.5 m depth)**



**Depth (meters)**

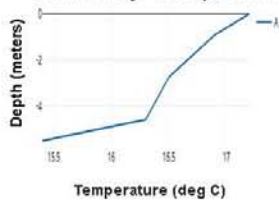


**SITE 2 (10 m depth)**

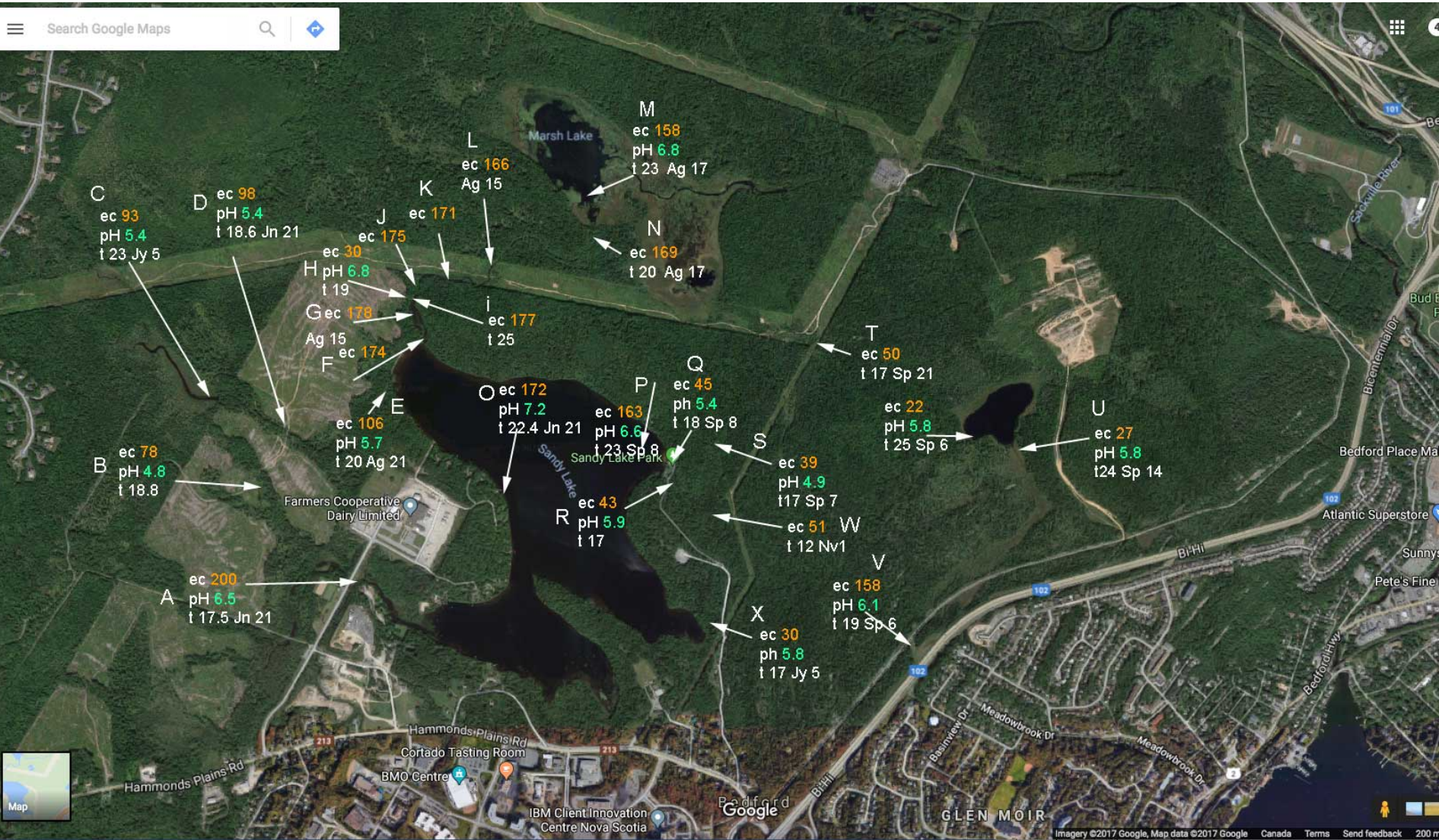


**SITE 3 (5.5 m depth)**

O2: 102-103% saturation  
Conductivity: 168 top, 170 Bot









## Some historical pH and conductivity values for Sandy Lake\*

Variable	1955	1971	1977	1980	1985	1991	2000	2010	2017
pH	5.10	-	4.57	4.90	5.44	5.29	5.65	7.56	6.70
EC (uS/cm)	40	37	100	58.9	141	113.7	133.0	167	168

Table 1. Water quality guidelines for dissolved oxygen in freshwater for the protection of aquatic life (based on CCREM 1987, AEP 1997, and Truelson 1997).

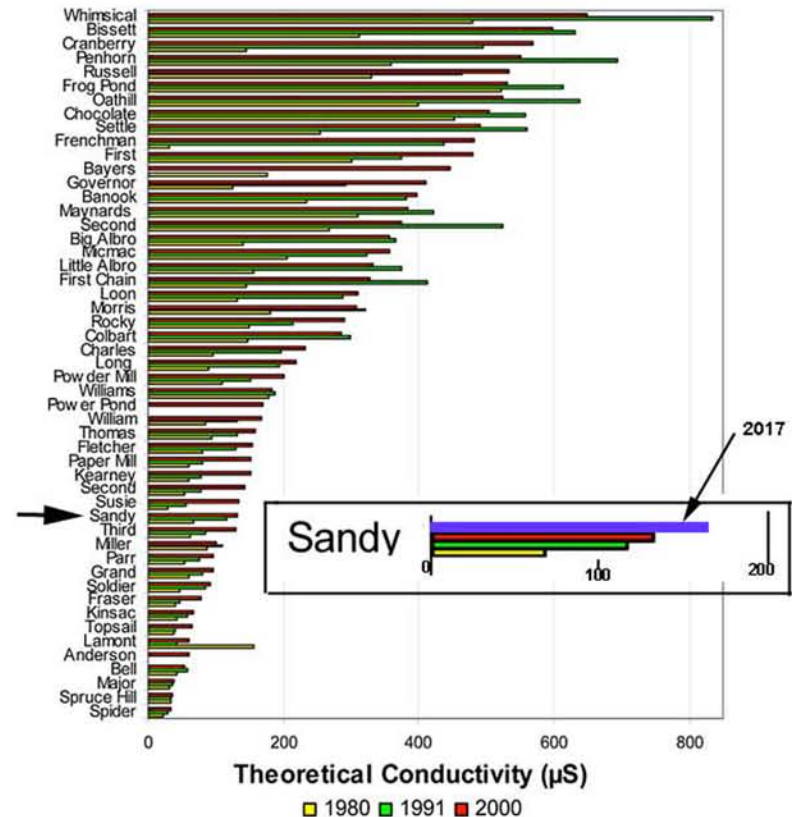
Ecosystem	Guideline value (mg.L <sup>-1</sup> ) <sup>*</sup>	
	Early life stages	Other life stages
Warm water	6	5.5
Cold water	9.5	6.5

<sup>\*</sup>Lowest acceptable dissolved oxygen concentration.

From Canadian Water Quality Guidelines for the protection of aquatic life: Dissolved Oxygen. Canadian Council of Ministers of the Environment 1999

Variable	1971 surface	1971 18 m	2017 surface	2017 17.5 m
Temp (°C)	21	-	17.1	5.7
Conductivity (uS/cm)	37	39	169	248
Oxygen (mg/L)	7.25	5.0	9.42	2.25

1971: from Metropolitan Area Planning Committee 1971-1972: Water Quality Survey for Selected Metropolitan Area Lakes. Sandy lake was sampled on Aug 30, 1971  
2017: Sampled on Oct 3]



Modified Fig 4 from Synoptic Water Quality Survey Of Selected Halifax Regional Municipality Lakes On 28-29 March 2000. P. Clement et al., 2007. Canadian Technical Report of Fisheries and Aquatic Sciences NNNN

1977 from: Watt, W.D. et al. 1979. Acidification and other chemical changes in Halifax County lakes after 21 years. *Limnol. Oceanogr.* 24: B-154. % 16 1. Sampled in Jan 1977

1971: Metropolitan Area Planning Committee 1971-1972: Water Quality Survey for Selected Metropolitan Area Lakes, Feb 1972. Data for Lake 31 (Sandy Lake). All ec data: N. Inlet 57.0; S. Inlet 57.0 Surface 37.0 59 feet 39.0 Outlet 39.0 Sampled Aug 30, 1971

1955 from: Gorham, E. 1957. The chemical composition of lake waters in Halifax County, Nova Scotia. *Limnol. Oceanogr.* 2: 12-21. Sampled in Dec 1977. pH avg of before and after aeration

\*

2018: Oct 3, 2017. View this website> Lakes>Limnological Profiles

2010: from HRM Water Quality Monitoring Program Results - Spring 2010

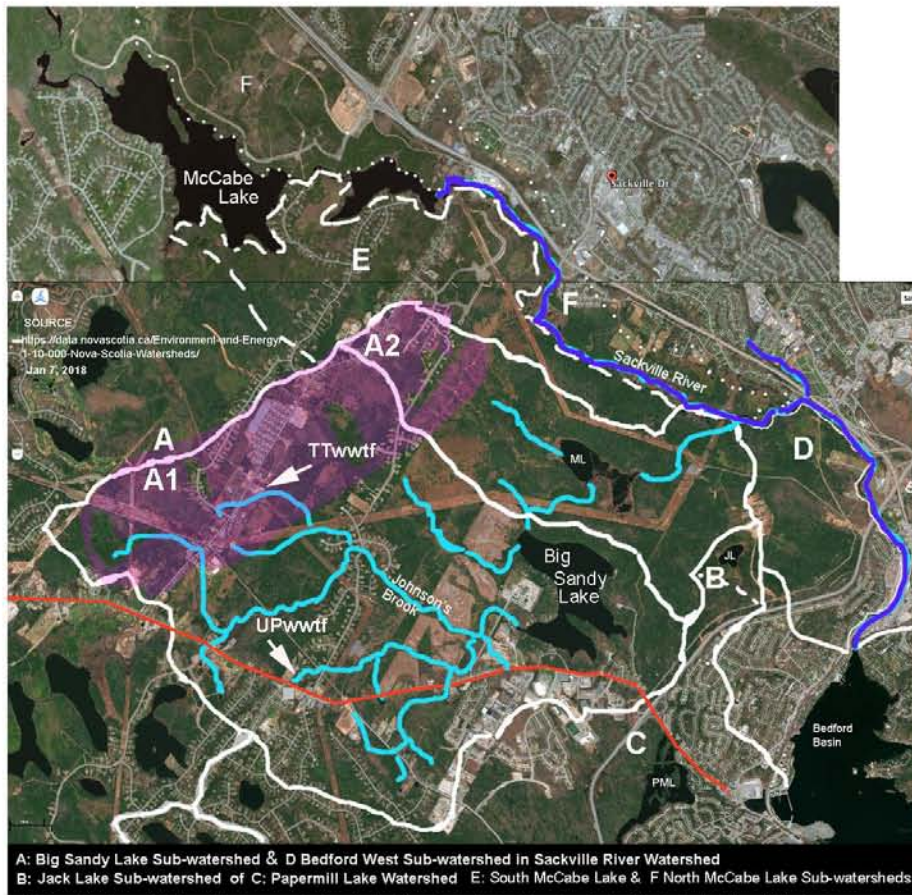
<http://www.region.halifax.ca/energy-environment/environment/documents/HRMLakesDeepstationSurveydata-Spring2010.pdf>

1980-2000 from: Synoptic Water Quality Survey Of Selected Halifax Regional Municipality Lakes On 28-29 March 2000. by P. Clement et al., 2007. Canadian Technical Report of Fisheries and Aquatic Sciences NNNN  
<https://novascotia.ca/nse/surface.water/docs/SynopticWaterQualitySurvey-MetroHalifaxLakes-2000.pdf>

1985 (May 14-15) from: JACK LAKE Environmental Evaluation Final Report, Canada Mortgage and Housing Corporation Nova Scotia Department of Housing, 1986.

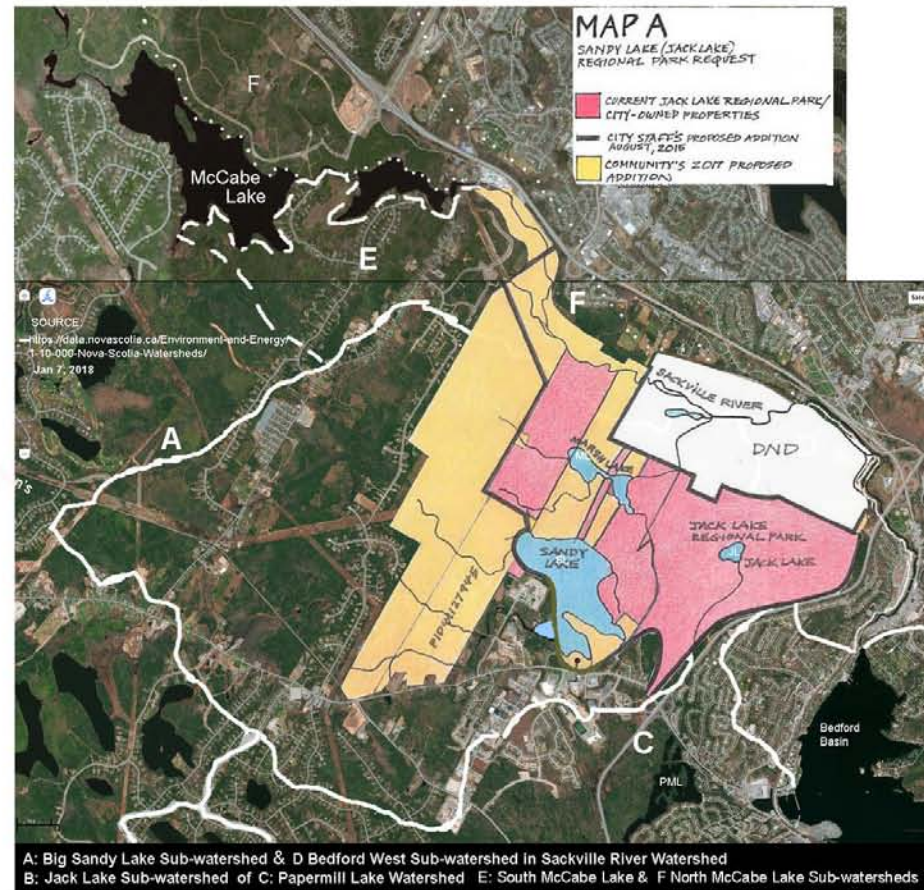


# Sandy Lake & Environs



A: Big Sandy Lake Sub-watershed & D Bedford West Sub-watershed in Sackville River Watershed  
 B: Jack Lake Sub-watershed of C: Papermill Lake Watershed E: South McCabe Lake & F North McCabe Lake Sub-watersheds  
 A1 Sandy Lake and A2 Marsh Lake are subwatersheds of the Sandy Lake Sub-watershed of the Sackville River Watershed  
 Purple highlighted area: Bedrock with acid-generating potential. UPwwtf: Uplands Park waste water treatment facility.  
 TTwwtf: Timber Trails waste water treatment facility. Blue highlighted streams are the major streams in the Sandy Lake  
 Sub-watershed as identified in the Sandy Lake Watershed Study Final Report (AECOM 2014)

## Major streams of Sandy Lake Sub-Watershed



A: Big Sandy Lake Sub-watershed & D Bedford West Sub-watershed in Sackville River Watershed  
 B: Jack Lake Sub-watershed of C: Papermill Lake Watershed E: South McCabe Lake & F North McCabe Lake Sub-watersheds

## Existing and Proposed Parkland/Protected Area



8/10/2017

pH 6.1  
22 deg

178

134 133  
176  
25 deg

132 27 deg  
203

28 deg  
271 291 27 deg  
127 128  
129 126

Sandy Lake

135 26 deg  
174

107  
177  
130  
108 170 26 deg

125  
124  
176

106  
171  
pH 7.05  
25 deg

170  
109  
110

123  
188

25 deg  
121 388  
420 120

107

138 137 170

398  
117  
115 118  
113 116  
111 114  
112 346

pH 7.4, 23 deg

Image © 2017 DigitalGlobe  
Image © 2017 DigitalGlobe

Google Earth

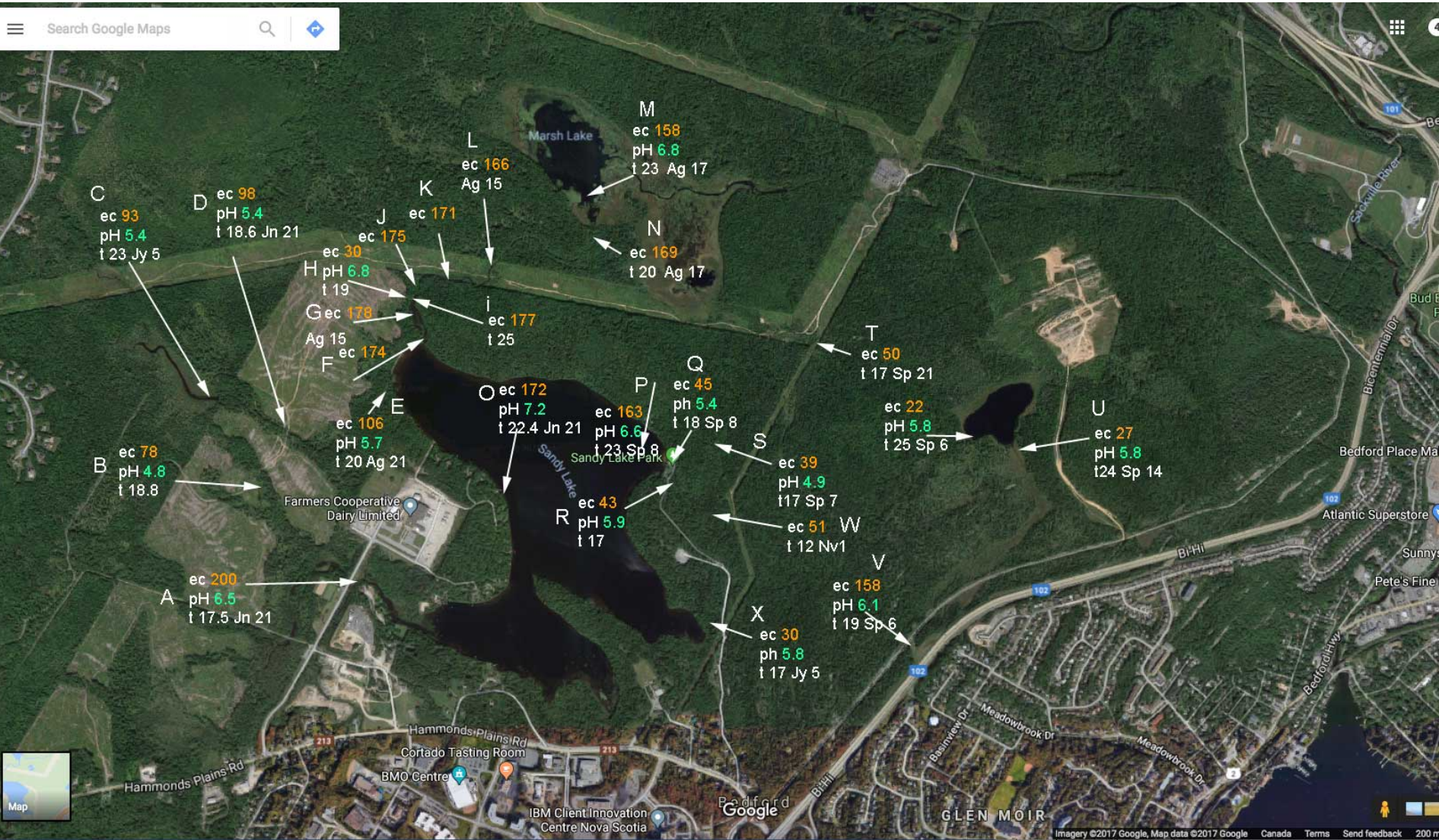
424 m

2003

Imagery Date: 7/19/2016

lat 44.739823° lon -63.695786° elev 71 m eye alt 2.04 km







10/31/2017

Nov. 8, 2018

1  
ec 50  
pH 6.0  
t 12

2  
ec 125  
pH 7.3  
t 9.3

5  
ec 57  
t 11

4  
ec 410  
pH 6.7  
t 12

6  
ec 155  
t 11

3  
ec 426  
pH 6.5  
t 11

7  
ec 81  
pH 6.2  
t 12

8  
Sandy Lake  
Beach

ec 134  
pH 6.5  
t 12

9  
ec 48  
pH 4.4  
t 10  
Stream  
by SL  
Beach

Image © 2018 DigitalGlobe

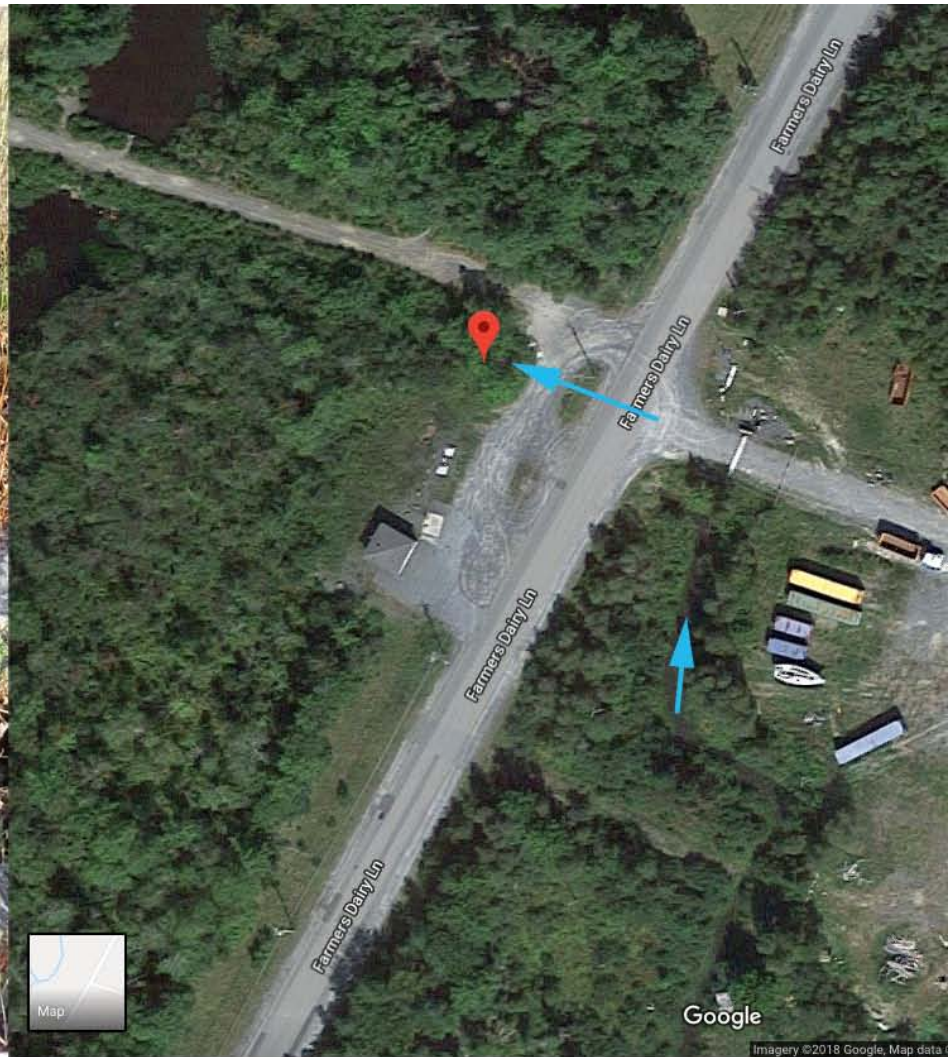
Google Earth

241 m

2003

Imagery Date: 10/31/2017 Lat: 44.731414° Lon: -63.714279° elev: 33 m eye alt: 1.13 km

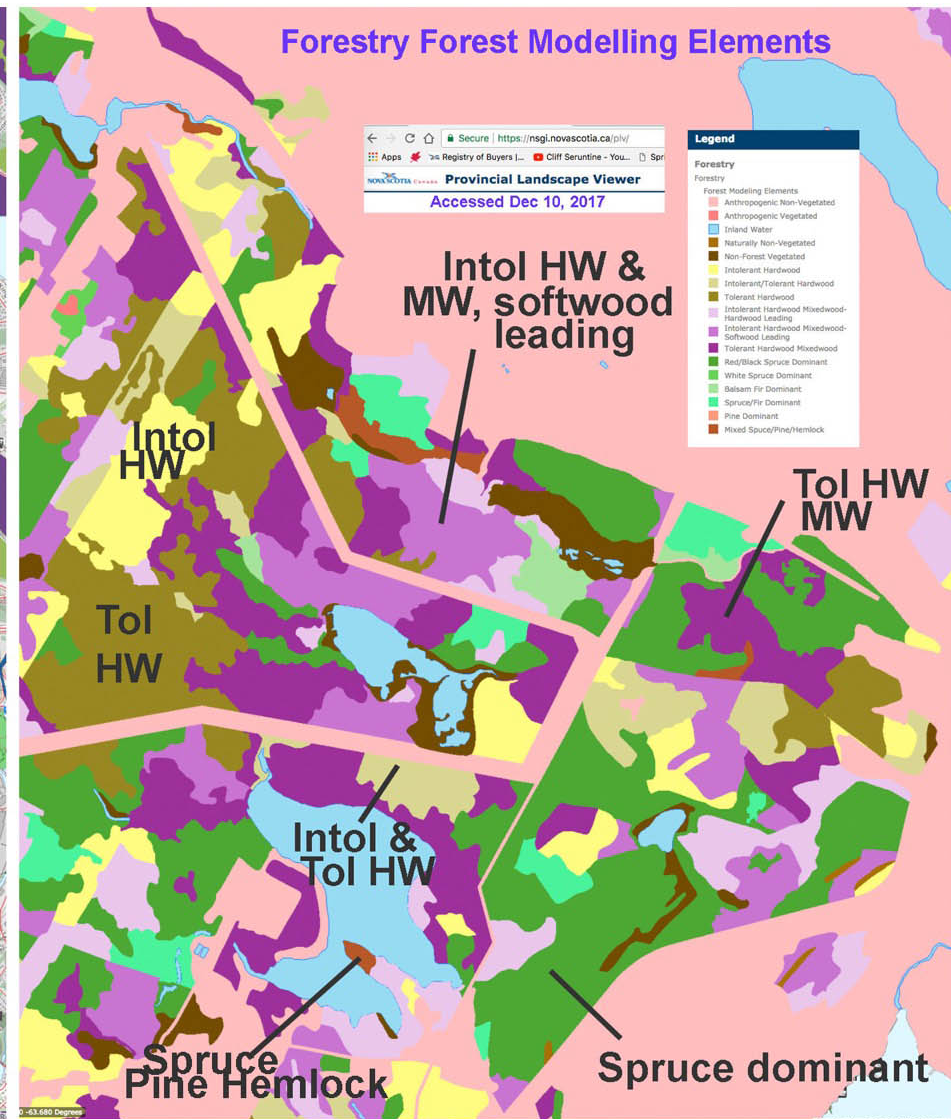
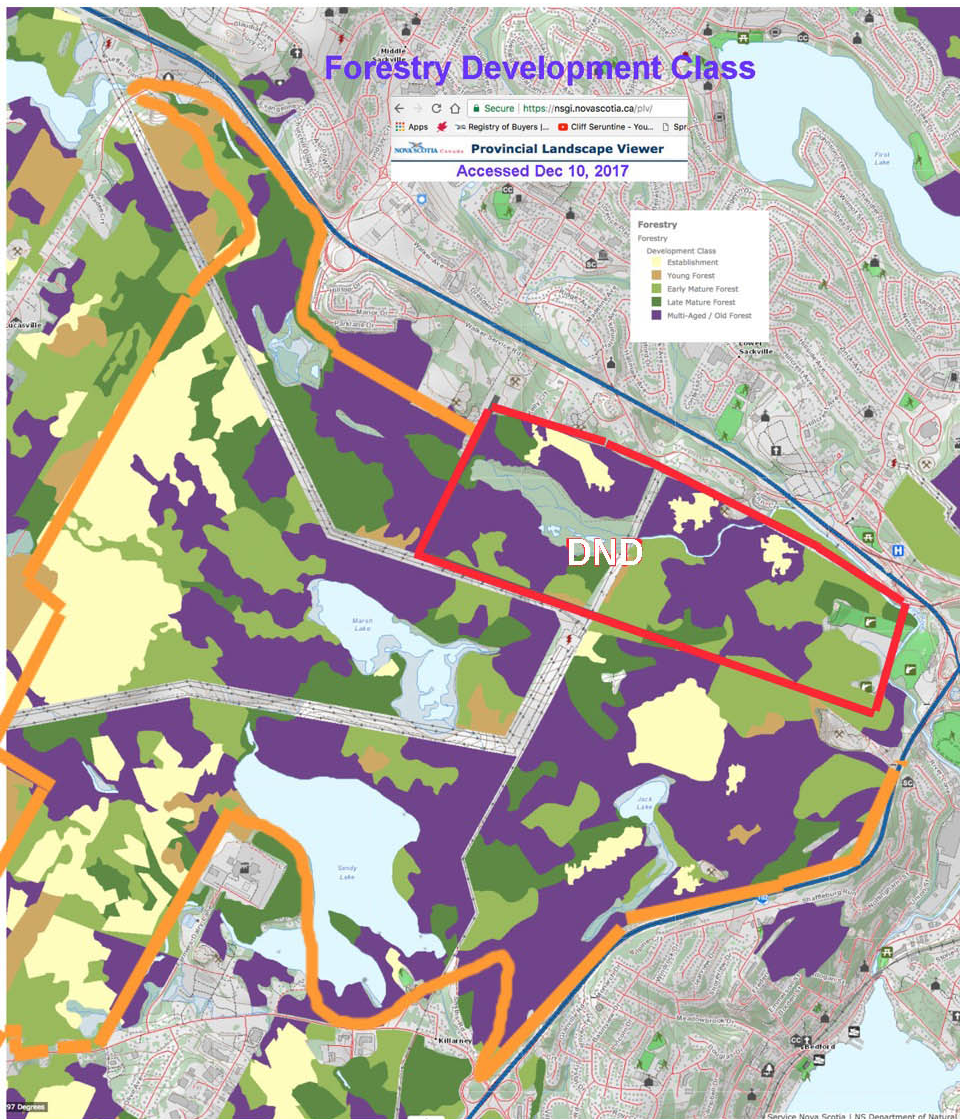




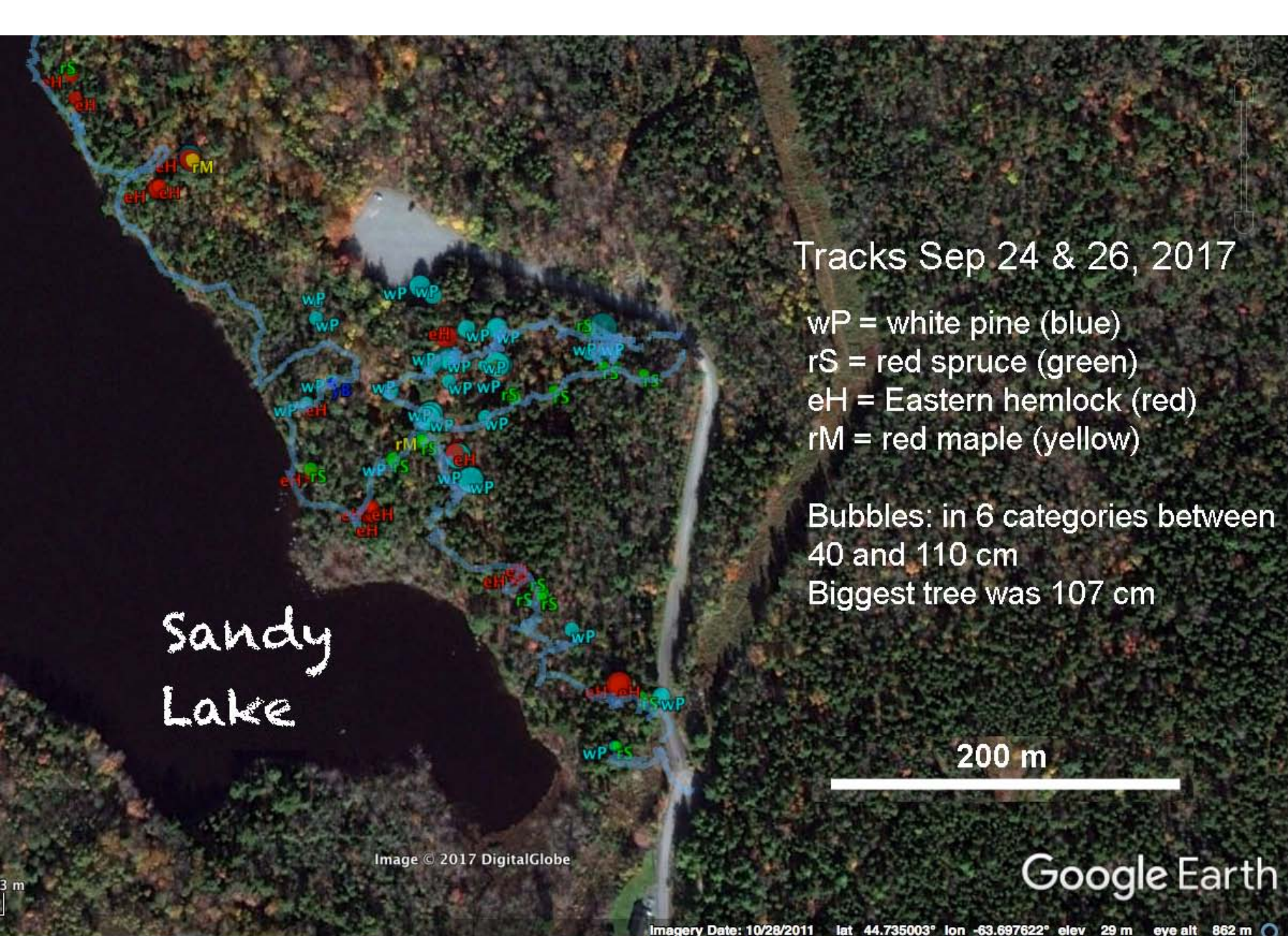




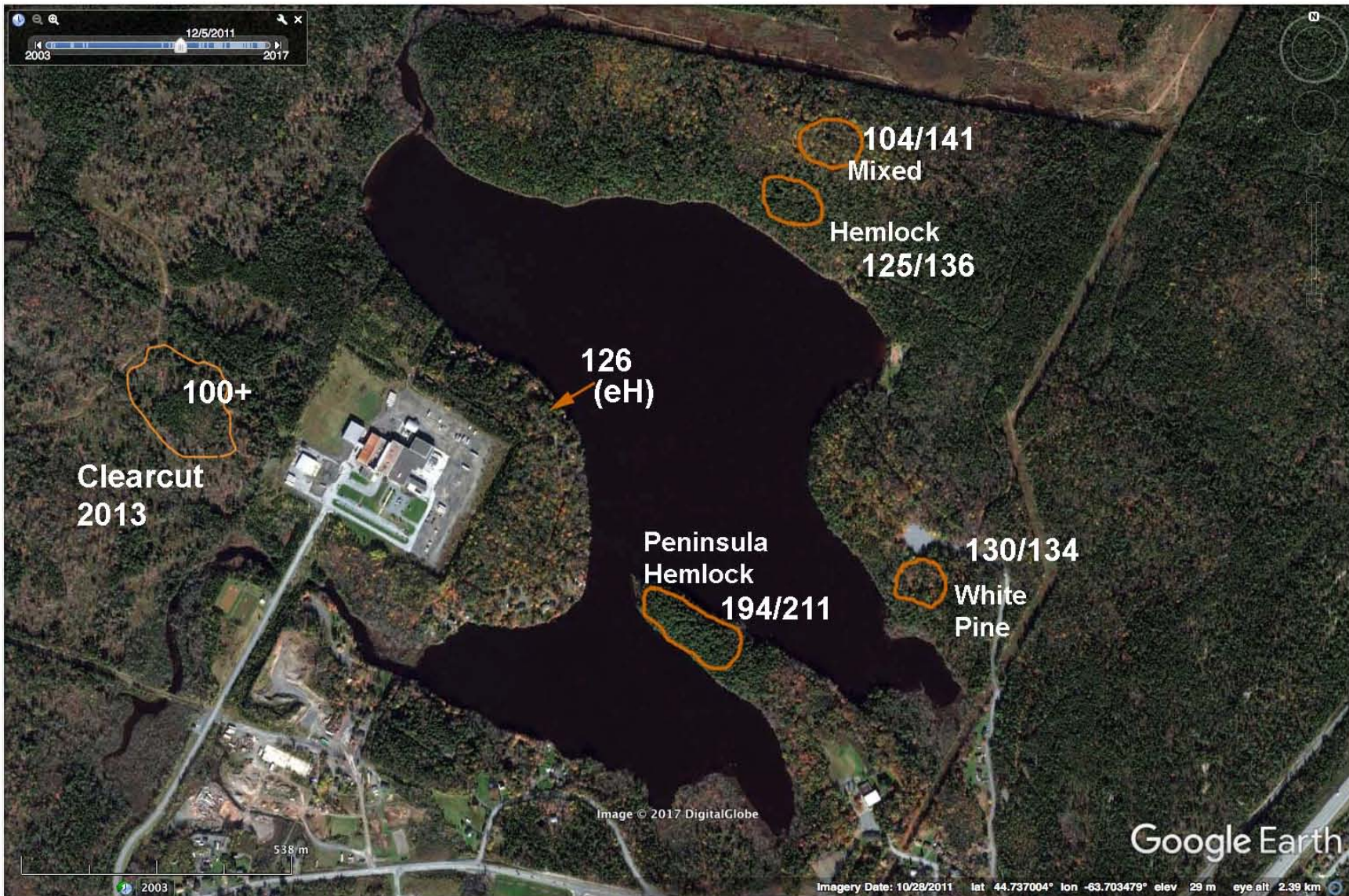












100+

Clearcut  
2013

126  
(eH)

104/141  
Mixed

Hemlock  
125/136

Peninsula  
Hemlock  
194/211

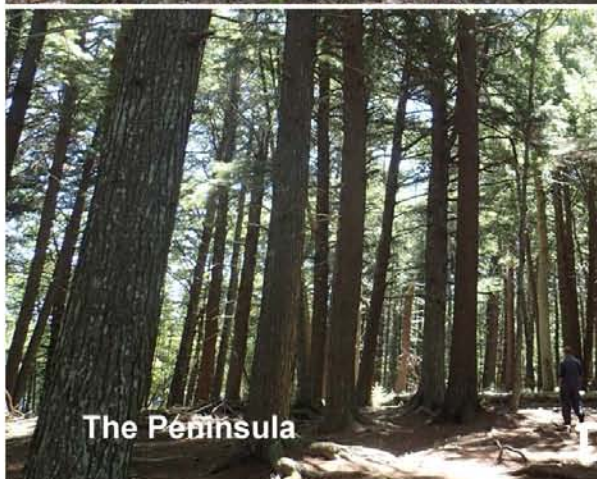
130/134  
White  
Pine

Image © 2017 DigitalGlobe

Google Earth

Imagery Date: 10/29/2011 lat 44.737004° lon -63.703479° elev 29 m eye alt 2.39 km



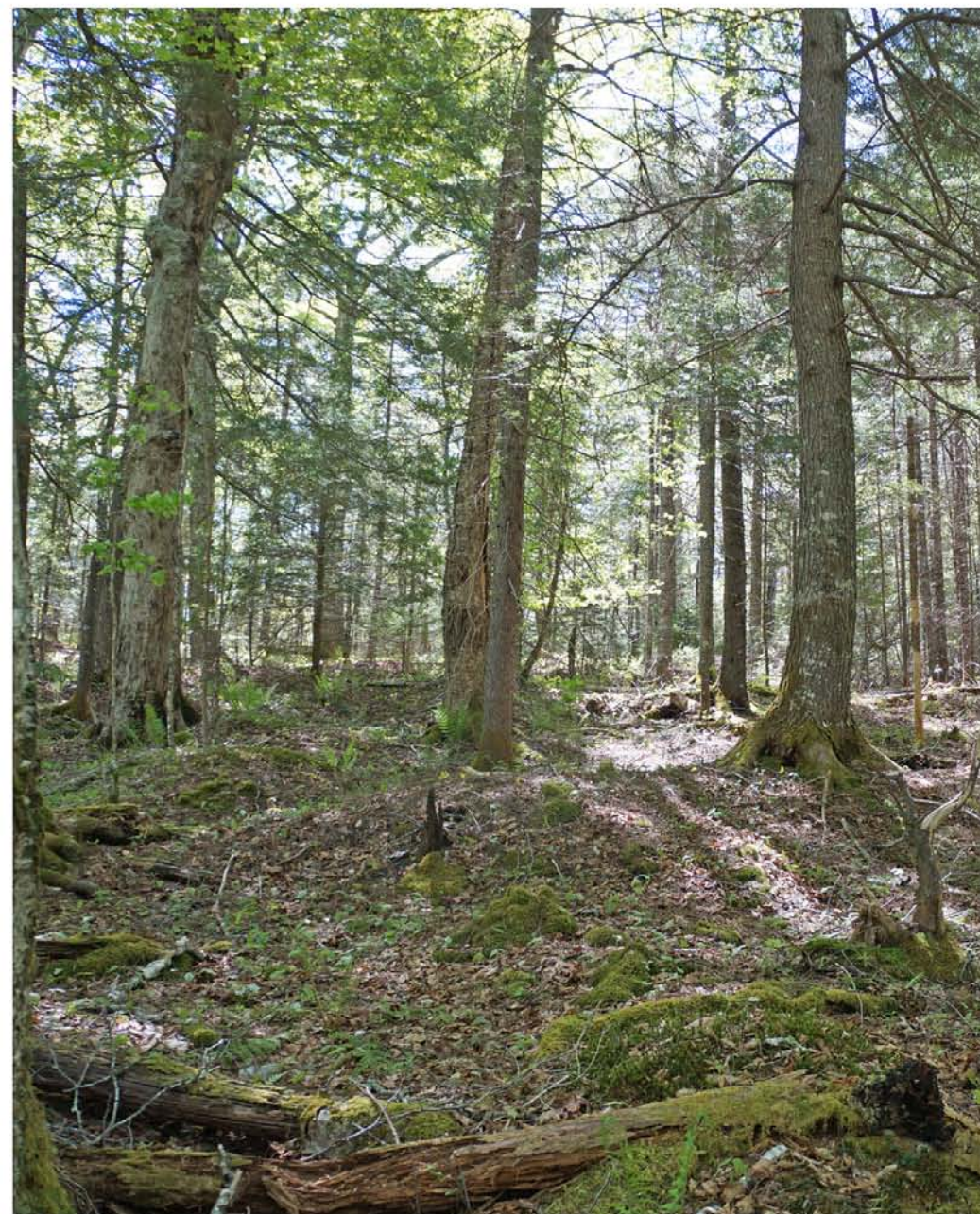


## Old Growth:

- fewer but bigger trees
- younger trees also present...gaps, multilayered
- lots of deadwood: snags & CWD; cavities
- trees with lichens, moss
- "spongy duff", beetles...
- \*\*forest floor not level but with "pits & mounds"

- Andrew Whitman of the Manomet Center for Conservation Sciences (Mass,) & Shawn Fraver of the University of Maine's School of Forest Resources cited by Joe Rankin in: "Old Growth" Forests Defined by Key Ecological Characteristics, Dec 20, 2016 on <http://www.forestsformainesfuture.org>





"One other telltale feature of an old growth forest is ] the forest floor itself, said Whitman and Fraver. It's not, by any means, level. Instead it's characterized by dips and mounds.

"Not coincidentally they're more or less the size of a large tree's root ball and its accompanying soil.

"This "pit and mound" topography occurs when old big trees are blown down, their roots upended. The mound is created by the exposed root ball, the hollow is where it once was.

"Gradually, over decades, the root rots and both the mound and pit are colonized by mosses, ferns, wildflowers and young trees.

"It could take an old field a thousand years to get that pit and mound topography," said Whitman. "In managed forests you rarely get that, because large trees are cut before they can fall down"

"The lack of pit and mound topography is a good indication that the land was once smoothed by the plow, even if it was a century or two ago. For Fraver, there's one pretty sure indication that a forest wouldn't qualify it as old growth".





**Dr. Elena Ponomarenko shows participants in the MTRI Old Forest Conference (Oct 19-21, 2016) how to read the forest floor to uncover past disturbances and forest types**



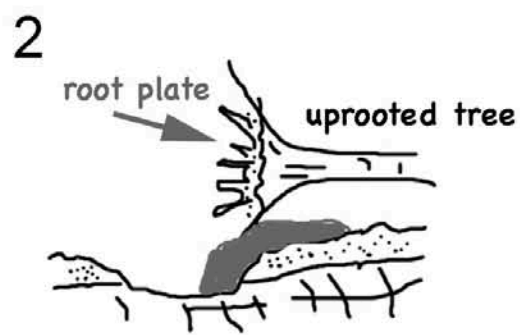
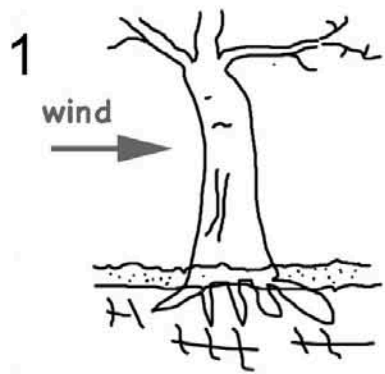


Diagram after Łukasz Pawlik 2013. The role of trees in the geomorphic system of forested hillslopes — A review *Earth-Science Reviews* 126: 250-265



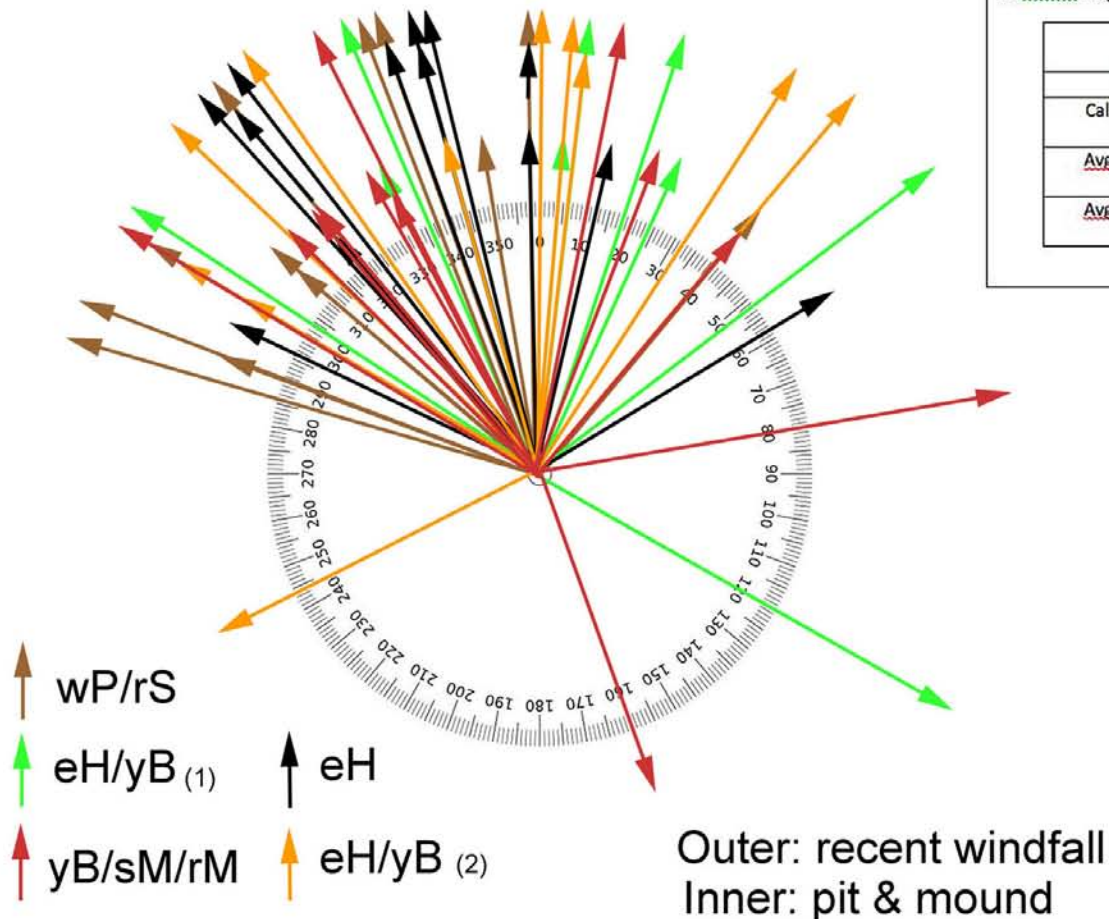


**Mound density and widths at  
three old forest sites at Sandy Lake**

**Mound width** is the dimension perpendicular to the inferred direction of the uprooted tree stem. i.e. it is the longest dimension of a mound.

**Mound density** is the number of mounds traversed over three, 25 meter transects, i.e. over 75 m all told. The 3 transects began at a single pit. The first or mid-transect was oriented in the "guesstimated" average direction of windfalls; the second transect was oriented approximately 30 degrees to one side of the first transect and the third at approximately 30 degrees to the other side. Mounds were classified as either H (high, approx. 50 cm +) or L (low, typically 10-30 cm height) as they were crossed.

Site:	White Pine	Hemlock	Mixed/ Hardwood
<b>Variable</b>			
No. mounds/75 m:	10H, 14L	14H, 11L	8H, 9L
Calculated avg distance between H mounds:	7.5 m	5.36 m	9.38 m
Avg width of H mounds:	3.14 m (n=3) range: 2.6-3.6 m	3.63 m (n=6) range: 2.7-4.8 m	4.22 m (n=6) range: 3.5-4.5 m
Avg width of L mounds:	2.67 m (n=4) range: 1.9-3.2 m	3.05 m (n=4) range: 2.1-4.3 m	-





## *How old are the mounds?*

Roughly, it is the age of the oldest trees on the mounds + 10-20 years

So  $140+20=160$ .  $2017-(150-1600)=$  **1857 to 1867**

... perhaps the **Saxby Gale 1869**

Mounds under The Peninsula

hemlocks  $\sim 2015-(220-230)$

$= 1784-94$











Acadian Forest  
Love Affair(s)









# Challenges to the ecological integrity of Sandy Lake and Environs

- (i) Water Quality/fish habitat - existing issues/development
- (ii) Power Boats - disturb habitats for loons, amphibians etc
- (iii) Invasive species - *Rosa multiflora*; aquatic species to look out for e.g., yellow floating heart, chain pickerel, Chinese mystery snail

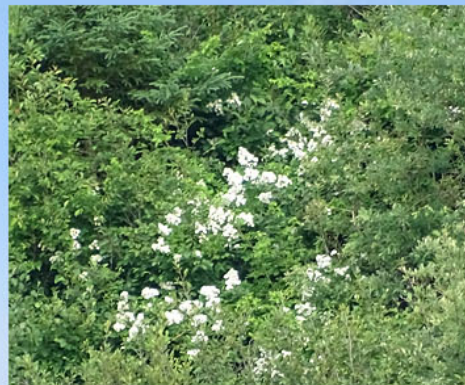
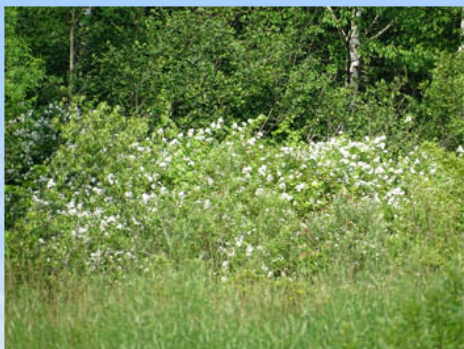


- (iv) Hemlock Woolly Adelgid  
- now in Nova Scotia



- (v) Wildlife Corridor functions x development:  
impacts on Chebucto Peninsula lands
- (vi) Recreational use - management/education issue







## Local Threats to the Ecological Integrity...: rising human use

### Some issues associated with rising use of The Bluff Trail in 2015

- Garbage – toilet paper and human waste in bushes, food waste in fire pits, garbage can was removed at trailhead
- Camping – completely inappropriate practices directly along main trail (left un-remediated these serve as models for other trail users; see examples below)
- Fire pits – inappropriate locations (directly on trail, on soft surfaces, on top of tree roots), leaving cookware and burning food and cans, chopping/sawing down live trees, peeling birch bark (some areas have 5-10 pits in a 50m radius)
- Trail deterioration (widening) in wet areas that have not received trail-hardening - especially 1<sup>st</sup> and 2<sup>nd</sup> loops
- Dogs - off leash and not under user's control, creating multiple small off-trails, scaring other hikers by barking, jumping, and unexpectedly appearing out of the woods
- Cairns – creating confusion in bare granite areas where rocks are used to mark the trail

Source: Report to WRWEO/The Bluff Trail by Heather Davis and Wade McIsaac, 2015



Ongoing degradation near Lake Frederick, Sep 2015



Brand new campsite on trail near Cranberry Lake Portage, Oct 2015

### Solutions:

- Trail hardening over wet spots
- Leave No Trace ethic
- Stewardship program
- More “wildland” trails in HRM!



Fire pit with food waste Oct 2015



Newly chopped tree by old sawed tree

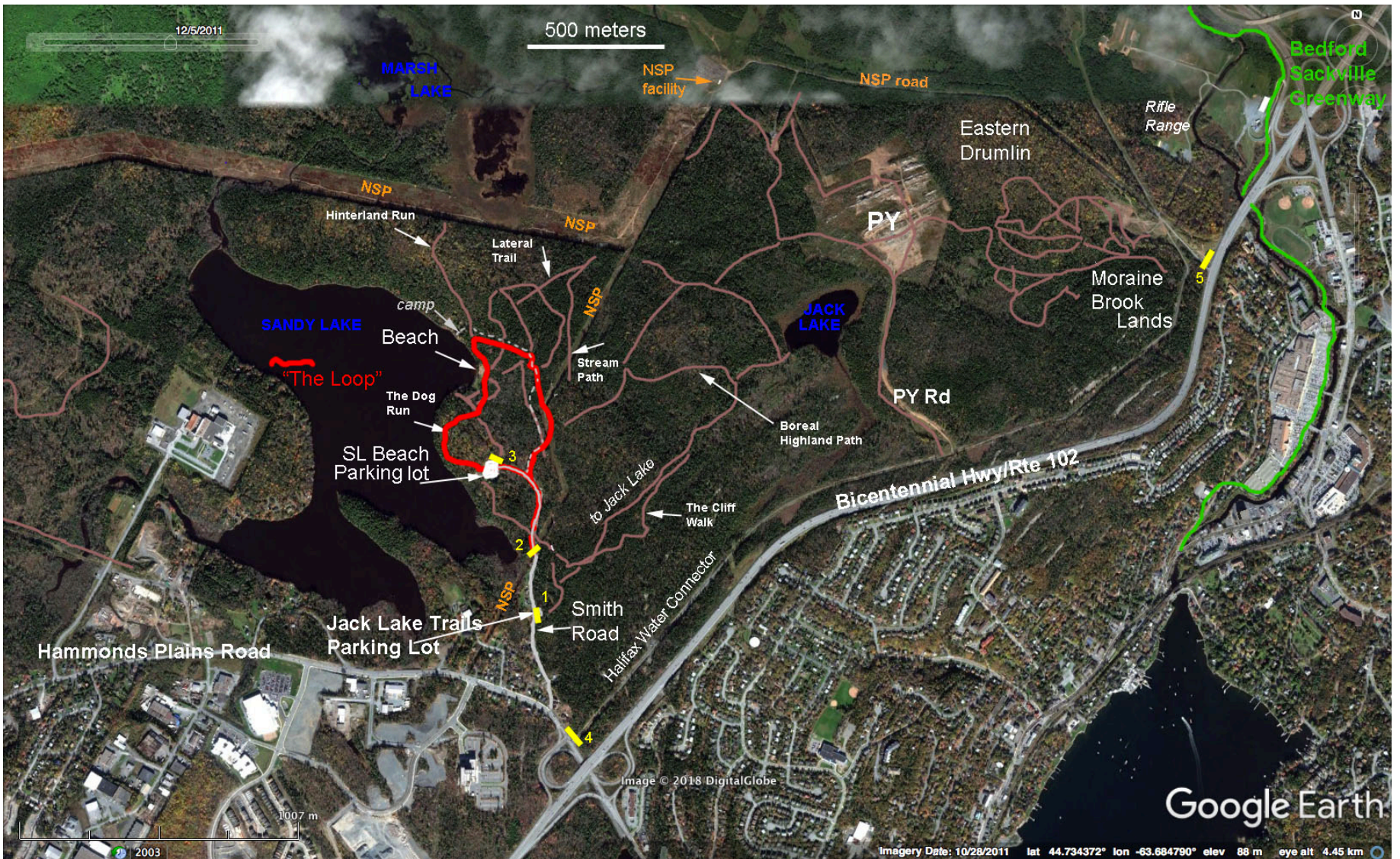


Fire right ON trail



Burning live birch







12/5/2011

500 meters

west & north:  
Corridor/  
Conservation  
Priority

MARSH  
LAKE

NSP  
facility

NSP road

Eastern  
Drumlin

Rifle  
Range

Bedford  
Sackville  
Greenway

NSP

Hinterland Run

NSP

Lateral  
Trail

camp

Beach

SANDY LAKE

"The Loop"

The Dog  
Run

SL Beach  
Parking lot

Stream  
Path

east:  
Integrated  
Conservation &  
Recreation

PY

JACK  
LAKE

PY Rd

Boreal  
Highland Path

Moraine  
Brook  
Lands

Bicentennial Hwy/Rte 102

to Jack Lake

The Cliff  
Walk

Halifax Water Connector

Smith  
Road

Jack Lake Trails  
Parking Lot

Hammonds Plains Road

Image © 2018 DigitalGlobe

Google Earth

1007 m

Imagery Date: 10/28/2011 lat 44.734372° lon -63.684790° elev 88 m eye alt 4.45 km

2003



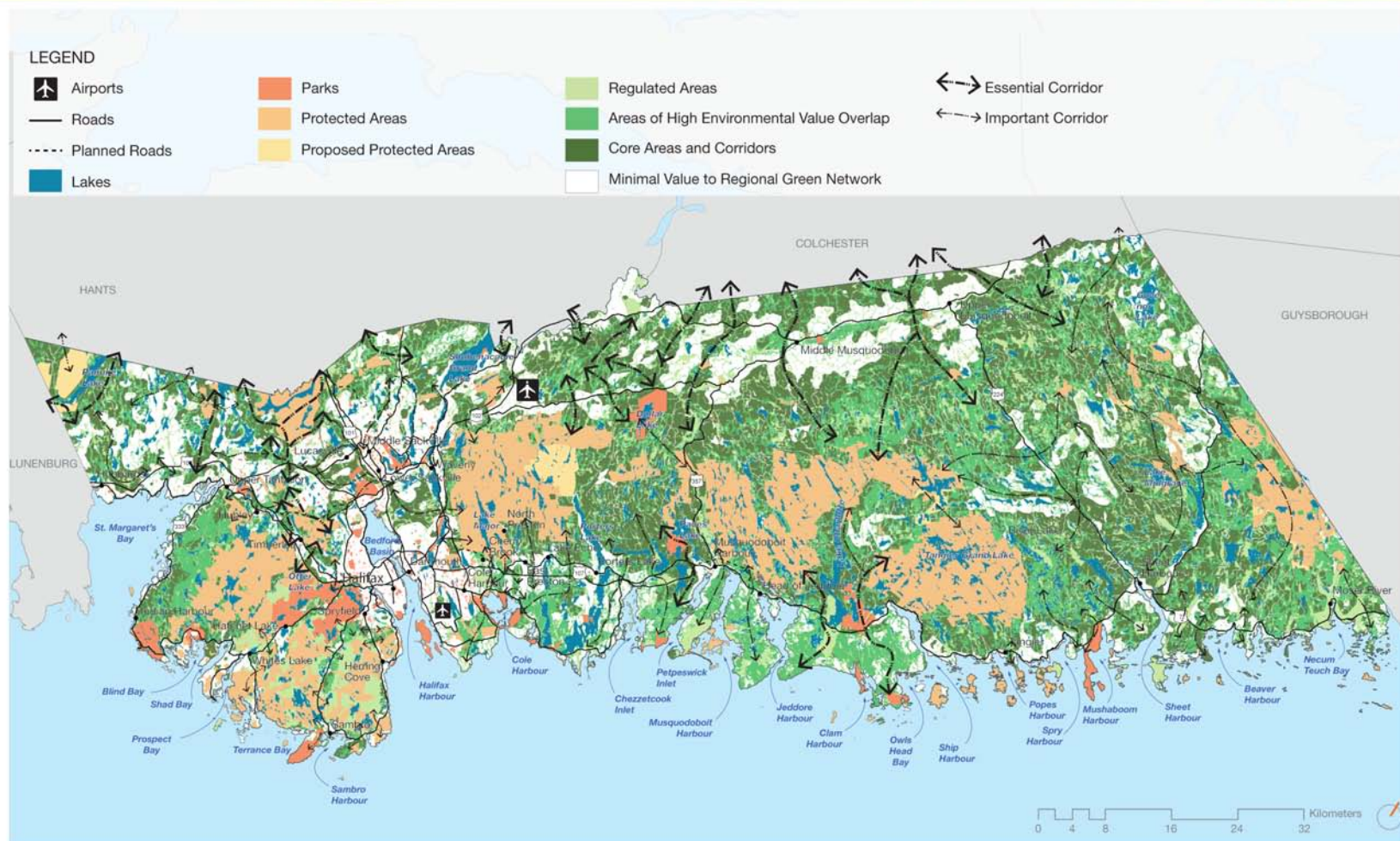




# HALIFAX

# GREEN NETWORK PLAN

JUNE 2018



Map 5: GREEN NETWORK ECOLOGY MAP