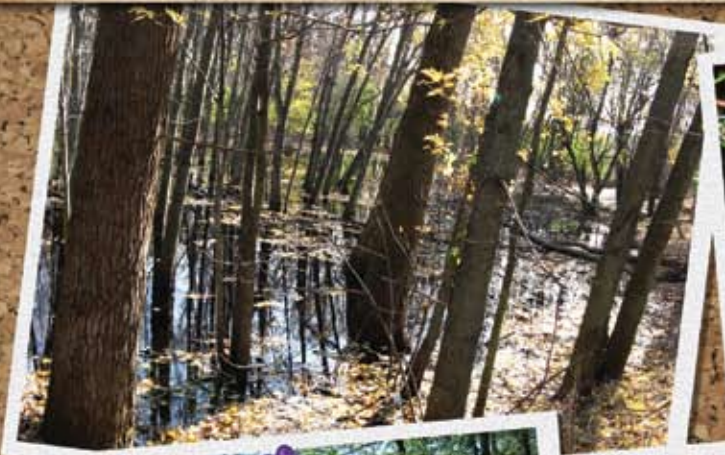


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Appendix A1. Factsheet Circulated for Master Plan Review Process



History

Evidence exists that aboriginal people used the Sifton Bog as a hunting ground. Some of the 20th century owners of this bog tried to exploit its natural resources by attempting to drain it to grow celery, removing layers of peat for sale, or by selling the Black Spruce for Christmas trees. During World War II the Alder Buckthorn was removed for use in the production of gun powder.

In 1957 a movement to preserve Byron Bog (as it was then called) was led by Dr. W. W. Judd, of the University of Western Ontario. Success came in 1967 when the UTRCA acquired the area through a grant from the Province of Ontario and a donation from the Sifton Construction Company. It was renamed the Sifton Botanical Bog. Currently, the bog is known as Sifton Bog.

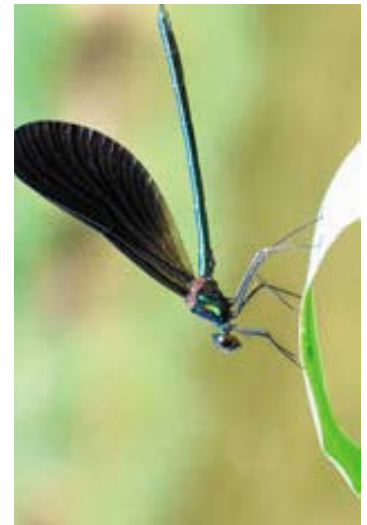


Photo by: Robin McLeod

A Bog in London? A Bog in London?

Sifton Bog is one of the most southerly bogs in Canada and London's most unique natural area. Here, you feel transported to northern Ontario where black spruce, orchids and insect-eating plants grow on a spongy mat of peat.



Master Plan Update Master Plan Update

A Master Plan Update for Sifton Bog Environmentally Significant Area (ESA) will take place during 2006 and 2007. The Upper Thames River Conservation Authority will lead this initiative in partnership with the City of London. Community organizations will play an important role in determining ways to care for this environmentally significant area.



The purpose of the Master Plan Update is to provide direction on the management of this environmentally significant area.

Some objectives include:

- identify and confirm sensitive ecological features,
- develop strategies for protection and interpretation,
- determine appropriate access points, and trails,
- and identify appropriate passive recreation uses.

Location/Size/Ownership/Size/Ownership

Sifton Bog Environmentally Significant Area is located on the south side of Oxford Street west of Hyde Park Road. The ESA is 58 hectares in size and ownership includes: UTRCA - 30 hectares, City of London - 10 hectares, Private - 18 hectares



Management Management

This Environmentally Significant Area is managed by the Upper Thames River Conservation Authority in cooperation with the City of London.

Environmental Significance Environmental Significance

Sifton Bog is environmentally significant because it contains many unique and regionally rare bog plants and vegetation communities. The habitat is more typical of Northern Ontario. Sifton Bog was designated as a Provincially Significant Wetland and an Area of Natural and Scientific Interest by the Ontario Ministry of Natural Resources. In addition to the bog, there are marsh, woodland, and shrub vegetation communities as well.



The biology of Sifton Bog has been examined through a variety of studies and inventories.

Findings include:

- 477 species of vascular plants, including 56 that are considered nationally, provincially, or regionally rare.
- 124 species of birds
- 19 species of mammals
- 19 species of amphibians & reptiles

Appendix A2. Open House #1 Invitation

Community Meeting



Photo by: Robin McLeod

UPPER THAMES RIVER
CONSERVATION AUTHORITY



For more information:
Steve Sauder
Upper Thames River Conservation Authority
(519) 451-2800 ext. 275
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www.thamesriver.on.ca

Sifton Bog Master Plan Update
Tuesday, September 19th, 7:30 PM

Oakridge Secondary School Cafeteria
1040 Oxford Street West, London

You are invited to the Master Plan Update meeting for Sifton Bog

- learn about the bog's environmental significance
- give your input for the plan
- find out about the schedule for developing the plan
- gain knowledge of current management practices



Appendix A3. Community Meeting #1 Notes

Sifton Bog - Master Plan Update Community Meeting #1 September 19, 2006 Notes

Community Input

Approximately 100 people attended the September 19th meeting to launch the master plan update process for Sifton Bog. The meeting started with several presentations about Sifton Bog and the proposed master plan process. The presentations were followed with an opportunity for meeting attendees to give their input.

The input given by community members included questions, concerns, issues, opportunities, and ideas for Sifton Bog or the master plan process. The following list summarizes the comments made during the meeting into topic areas.

Deer Issue

- Concerned that the deer population is too high
- Consider adding more fencing to keep deer in the bog and out of backyards
- The deer are also found in the neighbourhoods north of Oxford Street
- You may visit www.thamesriver.on.ca for more information about the deer issue at Sifton Bog and the report from the Sifton Bog White-tailed Deer Steering Committee
- The last official count of the deer at Sifton Bog was completed in November/December 2005. There were approximately 55 deer in Sifton Bog at that time.
- When do we start reducing the number of deer?
- Deer getting caught in the existing fences is an issue
- Could we consider changing the existing fencing so it will not injure deer (fencing that isn't pointed)
- Consider adding more traffic hazard signs around Sifton Bog warning of deer crossing
- Find ways to include deer hazards as part of defensive driving in driver's education

Vegetation

- There is a problem with the invasive garlic mustard especially in SW corner of Sifton Bog.
- What are the best native trees to plant adjacent to Sifton Bog to help the bog?
- Reforest London has a brochure that suggests native trees & shrubs for London. Visit www.reforestlondon.ca for more information
- Sifton Bog is one of the smallest ESA's and most sensitive areas and is surrounded by degraded forest.
- Should consider doing a vegetation study pertaining to the effect of deer such as the Deer Enclosures Study at Pinery Provincial Park
- Determine what plant species need to be protected from the deer
- Are there some positive schemes to revitalize areas that are stressed, e.g., vegetation restoration?

Education

- It would be nice to have more opportunities for school classes to go into Sifton Bog
- Possibly create some form of education partnerships
- Consider signage messaging such as, "take only pictures, leave only footprints"
- How to include children from the local schools, perhaps include curriculum development in master plan
- There is a garbage problem at Sifton Bog. How do we get people to use garbage cans. Toronto's garbage coming to London is another threat.

Appendix A3. Community Meeting #1 Notes (continued)

Access Points / Trails

- It would be beneficial to create focus points, such as signage at other entrances
- We should consider keeping access points limited
- We need to keep visitors on the trails
- Should consider making Sifton Bog a pet free ESA

Water Quality Monitoring

- Need a good water quality monitoring program for the East side development.
 - Concerned about how much impact monitoring was done
 - Is stormwater discharged directly from stormwater management ponds?
- Runoff from Oxford Street - issues around chlorides, petroleum monitoring, discharge from ditches
- Is the use of mosquito larvacide in stormwater management ponds an issue at Sifton Bog?
- Consider reviewing the water quality monitoring program and adding additional monitoring for the future

Master Plan Process

- Will it be possible to implement the recommendations that are developed in the master plan for Sifton Bog? Will the political process allow it to move forward?

Appendix A4. Open House #2 Invitation

COMMUNITY MEETING

SIFTON BOG MASTER PLAN UPDATE

Wednesday, October 29th, 7:00 PM

London Aquatic Centre

(also known as the Canada Games Aquatic Centre)

1045 Wonderland Road North (just north of Sarnia Road), London



**YOU ARE INVITED TO
THE MASTER PLAN UPDATE MEETING FOR SIFTON BOG.**

Learn about the new draft master plan.

AGENDA

Master Plan Presentation

- Introduction to the Master Plan
- Background Information
- Issues, Mission, and Guiding Principles
- Goals, Objectives & Recommendations

Displays and Discussion

- Deer: Deer enclosure study, deer population
- Hydrology: Sifton Bog hydrology
- Invasive Species: Vegetation communities and their threats
- Trails: Existing and proposed trails

For more information:
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Appendix B. Field Work Schedule, 2006 - 2007

Date	In-Field Time	Individuals	Notes
Jun. 24, 2006	10:00 a.m. to Noon (2 hrs)	C. Quinlan	Looked for and photographed orchids and other species on the bog mat.
Jul. 11, 2006	8:30 a.m. to Noon (3.5 hrs)	C. Quinlan, B. Bergsma	Inventoried vegetation communities from Oxford Street entrance, along boardwalk and throughout shrub bog mat.
Aug. 18, 2006	9:00 a.m. to Noon (3 hrs)	C. Quinlan, B. Gallagher, B. Williamson	Looked for extent of Glossy Buckthorn ticket community north of bog. Mapped vegetation and issues along the north-south trail on Crich-Drewlo lands and east of Old Hyde Park Road.
Sep. 13, 2006	9:00 a.m. to Noon (3 hrs)	C. Quinlan, B. Bergsma	Mapped vegetation along the north-south trail to the east-west trail. Hiked and mapped along a transect from the slope in the south, through the swamp and buckthorn ticket north to the bog and boardwalk.
Nov. 1, 2006	9:00 a.m. to Noon (3 hrs)	C. Quinlan	Spent some time looking at extent of buckthorn south of Redmond's Pond and area. Moved to southern access points and mapped vegetation and noted issues along the east-west trail.
Feb. 8, 2007	9:00 a.m. to Noon (3 hrs)	C. Quinlan, B. Gallagher	Conducted Basal Area measurements in mature woods in southwest and south end of the ESA.
May 4, 2007	9:00 a.m. to 10:00 a.m. (1 hr)	C. Quinlan	Looked for and photographed plants in bloom including Leatherleaf.
May 23, 2007	9:00 a.m. to Noon (3 hrs)	C. Quinlan, B. Gallagher	Looked for and photographed plants in bloom on bog mat including blueberry and huckleberry, Pale Laurel. No pitcher plants in bloom.
May 23, 2007	9:00 p.m. to 9:30 p.m. (0.5 hrs)	C. Quinlan	Paid evening visit to listen for frog calls along boardwalk.
Jun. 9, 2007	9:00 a.m. to 10:00 a.m. (1 hr)	C. Quinlan	Looked for Pitcher Plants (none in flower) south of boardwalk, Spatulate-leaved Sundew (none found), ferns, etc.
Jun. 22, 2007	9:00 a.m. to Noon (3 hrs)	C. Quinlan, B. Gallagher	Mapped vegetation in the meadow marsh and examined soil with a soil auger. Mapped vegetation in the moat that runs along the eastern edge of slope. Mapped vegetation along the north-south trail including the prairie/savanna and young forest in southeast end and along Old Hyde Park Road.
Oct. 9, 2007	2:00 p.m. to 4:00 p.m. (2 hrs)	C. Quinlan	Took soil samples with a soil auger to determine if swamps in southwest are organic or mineral.
Jun. 25, 2008	8:30 a.m. to 11:00 a.m. (2.5 hrs)	C. Quinlan	Assisted York University students with plant identification and looked for Pitcher Plants since they were absent the previous fall.
TOTAL	30 hours +		

Notes:

- Several additional quick visits of under an hour were made to the ESA to look for plants in bloom.
- Individuals: Cathy Quinlan, Terrestrial Biologist, UTRCA
 Brenda Gallagher, Forestry Technician, UTRCA
 Brandon Williamson, ESA Management Team, UTRCA
 Bonnie Bergsma, Ecologist Planner, City of London

Appendix C. Logs of Probe Holes in Sifton Bog (Applegate Groundwater Consultants)*(Retyped from original; See Map 5)***REPORT OF PROBE HOLES**

At the request of BioLogic, Applegate Groundwater Consultants sampled the organic Sphagnum mat and probed the firm bottom of the bog at the locations of the biological monitoring plots in the bog.

The Sphagnum mat was penetrated and sampled using a 50 mm diameter hand auger. Samples were described and saved for possible later analysis. Once the mat had been fully penetrated by augering, the firm (sand) bottom of the bog was probed using PVC plastic pipes. An indication of the material that the pipes passed through was visible as a coating on the outside of the pipes once they were removed from the hole.

The probe hole logs that follow describe the organic mat, the soft sediment beneath the mat and provide the depth to the firm sand bottom of the bog.

LOGS OF PROBE HOLES IN SIFTON BOG**Probe Hole, Station 1 November 19, 1998**

0.0 – 0.50 m Light brown fibrous sphagnum moss.
Sample 1 0.0 - 0.15 m, Sample 2 0.15 - 0.3 m, Sample 3 0.3 - 0.52 m.

0.52 – 9.5 m Water transitioning into an amorphous greenish grey organic slime, then to a greenish grey muck.

9.5 – 14.2 m Grey, fine to coarse poorly sorted sand with some fine gravel.

14.2 m End of hole.

Probe Hole, Station 2 November 24, 1998

0.0 – 0.9 m Dark brown sphagnum moss with fine roots.
Sample 1 0.0 - 0.15 m, Sample 2 0.15 - 0.45 m, Sample 3 0.45 - 0.75 m.

0.9 – 2 m Light brown sphagnum moss.
Sample 4 0.75 - 1.1 m, Sample 5 1.1 - 1.4 m.

2.0 – 9.4 m Watery greenish grey slime becoming a firm muck with depth.

9.4 – 11.95 m Grey, poorly sorted sand and gravel.

11.95 m End of hole.

Probe Hole, Station 3 December 15, 1998

0.0 – 0.9 m Light brown sphagnum moss with fine roots, becoming darker at 0.45 m.
Sample 1 0.0 - 0.3 m, Sample 2 0.3 - 0.6 m, Sample 3 0.6 - 0.9 m.

0.9 – 1.7 m Dark brown, fibrous organic muck.
Sample 4 1.2 - 1.5 m.

1.7 – 6.8 m Watery greenish grey slime becoming a firm muck with depth.

22.3 m Probe encountered firm bottom of native sandy soil.

Probe Hole, Station 4 December 15, 1998

0.0 – 0.7 m Light brown Sphagnum moss with fine roots.
Sample 1 0.0 - 0.15 m, Sample 2 0.15 - 0.7 m.

0.7 – 9.9 m Watery greenish grey slime becoming a firm muck with depth.

9.9 m Probe encountered firm bottom of native sandy soil.

Probe Hole, Station 5 December 15, 1998

- 0.0 – 0.45 m Light brown Sphagnum moss with fine roots.
Sample 1 0.0 - 0.15 m, Sample 2 0.15 - 0.3 m.
- 0.45 – 1.2 m Slightly darker brown Sphagnum moss.
Sample 3 0.3 - 0.6 m, Sample 4 0.6 - 0.9 m.
- 1.2 – 7.3 m Watery greenish grey slime becoming a firm muck with depth.
- 7.3 m Probe encountered firm bottom of native sandy soil.

Probe Hole, Station 6 December 26, 1998

- 0.0 – 0.75 m Dark brown Sphagnum moss with fine roots and some silt. Becoming wet and less silty at 0.15 m.
Sample 1 0.0 - 0.15 m, Sample 2 0.15 - 0.3 m, Sample 3 0.3 - 0.45 m.
- 0.75 – 1.2 m Becoming lighter brown Sphagnum moss.
Sample 4 0.45 - 0.6 m, Sample 5 0.6 - 1.4 m.
- 1.2 – 2.1 m Light brown Sphagnum moss.
- 2.1 – 6.5 m Watery greenish grey slime becoming a firm muck with depth.
- 6.5 m Probe encountered firm bottom of native sandy soil.

Probe Hole, Station 7 December 15, 1998

- 0.0 – 0.15 m Light brown Sphagnum moss with fine roots.
Sample 1 0.0 - 0.15 m.
- 0.15 – 0.3 m Slightly darker brown Sphagnum moss.
Sample 2 0.15 - 0.3 m.
- 0.3 - 1.4 m Light brown Sphagnum moss.
Sample 3 0.3 - 0.9 m.
- 1.4 – 6.7 m Watery greenish grey slime becoming a firm muck with depth.
- 6.7 – 7.0 m Light grey clay.
- 7.0 m Probe encountered firm bottom of native sandy soil.

Probe Hole, Station 8 December 15, 1998

- 0.0 – 0.3 m Light brown Sphagnum moss with fine roots.
Sample 1 0.0 - 0.15 m, Sample 2 0.15 - 0.3 m.
- 0.3 – 0.6 m Darker brown, loose, fibrous moss with roots.
Sample 3 0.3 - 0.6 m.
- 0.6 – 2.3 m Light brown Sphagnum moss.
Sample 4 0.6 - 0.9 m, Sample 5 0.9 - 1.2 m, Sample 6 1.2 - 2.3 m.
- 2.3 – 4.9 m Watery amorphous greenish grey slime.
Sample 7 2.3 - 3.0 m.
- 4.9 – 6.8 m Greenish grey soft organic rich muck.
- 6.8 m Probe encountered firm bottom of native soil.

Probe Hole, Station 9 November 13, 1998

- 0.0 – 0.3 m Dark brown to black silty top soil with fine roots.
Sample 1 0.0 - 0.3 m.
- 0.3 – 0.6 m Light brown Sphagnum moss with some fine roots.
Sample 2 0.3 - 0.6 m.
- 0.6 – 1.05 m Brown to grey Sphagnum moss with some clay and fine sand.
Sample 3 0.6 - 0.9 m, Sample 4 0.9 - 1.05 m.
- 1.05 – 2.3 m Light brown to grey, very soft, clayey to sandy silt muck.
Sample 5 1.05 - 2.1 m, Sample 6 2.1 - 2.25 m.
- 2.3 – 3.7 m Brown, loose silty sand.
- 3.7 m End of probe hole.

Probe Hole, Station 10 December 26, 1998

- 0.0 – 0.3 m Dark brown silty organic top soil with fine roots.
Sample 1 0.0 - 0.15 m, Sample 2 0.15 - 0.3 m.
- 0.3 – 0.75 m Light brown Sphagnum moss.
Sample 3 0.3 - 0.45 m, Sample 4 0.45 - 0.75 m.
- 0.75 – 1.2 m Dark brown Sphagnum moss.
Sample 5 0.75 - 1.2 m.
- 1.2 – 1.8 m Dark brown soft organic muck.
Sample 6 1.2 - 1.8 m.
- 1.8 m Probe encountered firm bottom of native sandy soil.

Probe Hole, Station 11 See Probe Hole, Station 15

Probe Hole, Station 12 See Probe Hole, Station 15

Probe Hole, Station 13 December 15, 1998

- 0.0 – 0.15 m Dark brown fibrous organic rich soil with fine roots.
Sample 1 0.0 - 0.15 m.
- 0.15 – 0.75 m Light brown Sphagnum moss.
Sample 2 0.15 - 0.3 m, Sample 3 0.3 - 0.45 m, Sample 4 0.45 - 0.6 m, Sample 5 0.6 - 0.75 m, Sample 6 0.75 - 0.9 m.
- 0.9 – 2.1 m Lighter brown, loose Sphagnum moss.
Sample 7 0.9 - 1.2 m, Sample 8 1.2 - 1.5 m.
- 2.1 – 2.4 m Water.
- 2.4 – 3.7 m Greenish grey organic rich muck.
- 3.7 m Probe encountered firm bottom of native sandy soil.

Probe Hole, Station 14 October 16, 1998

- 0.0 – 0.45 m Dark brown Sphagnum moss with fine roots.
Sample 1 0.0 - 0.15 m, Sample 2 0.15 - 0.3 m, Sample 3 0.3 - 0.45 m.
- 0.45 – 1.8 m Light brown Sphagnum moss with a few fine roots.
Sample 4 0.45 - 0.6 m, Sample 5 0.6 - 0.9 m, Sample 6 0.9 - 1.2 m, Sample 7 1.2 - 1.8 m.
- 1.8 – 3.05 m Greyish brown fibrous clayey and silty muck.
Sample 8 2.4 - 2.55 m.
- 3.05 – 3.2 m Grey fine to silty sand.
- 3.2 – 4.2 m Brownish grey, loose, fine to medium sand.
- 4.2 m End of probe hole.

Probe Hole, Station 15 November 13, 1998

- 0.0 – 0.15 m Dark brown silty top soil with fine roots.
- 0.15 – 0.45 m Greyish brown silty clay with roots.
Sample 1 0.15 - 0.45 m.
- 0.45 – 0.8 m Black organic fibrous peat with some clay.
Sample 2 0.45 - 0.8 m.
- 0.8 – 1.2 m Light brown Sphagnum moss.
Sample 3 0.8 - 1.2 m.
- 1.2 – 2.1 m Grey muck, very soft with some silt and sand.
Sample 4 1.2 - 1.5 m.
- 2.4 – 2.4 m Light grey, soft clayey silt.
Sample 5 2.1 - 2.4 m.
- 2.4 – 3.5 m Grey, loose, very poorly sorted, fine to coarse sand.
- 3.5 m End of probe hole.

Appendix D. Plant Species Observed in Sifton Bog ESA by Author

Genus species	Common Name	Observers	Crawford1926	Judd1966	Waldron1972	Small1977	PR1979	Graham1987	McLeod1989	McLeod1992	BioLogic2000	Bergsma2006	UTRCA2007
Tree													
<i>Acer negundo</i>	Box Elder	4		*		*				*			*
<i>Acer platanoides</i>	Norway Maple	3				*				*			*
<i>Acer rubrum</i>	Red Maple	7	*		*	*		*		*	*		
<i>Acer saccharinum</i>	Silver Maple	9		*	*	*	*		*	*	*	*	*
<i>Acer saccharum ssp.nigrum</i>	Black Maple	2					*			*			
<i>Acer saccharum ssp.saccharum</i>	Sugar Maple	3			*					*			*
<i>Acer spicatum</i>	Mountain Maple	3								*		*	*
<i>Acer x freemanii</i>	Hybrid Soft Maple	4							*	*	*	*	*
<i>Aesculus hippocastanum</i>	Horse Chestnut	1								*			
<i>Amelanchier arborea</i>	Downy Serviceberry	1								*			
<i>Betula alleghaniensis</i>	Yellow Birch	2	*							*			
<i>Betula papyrifera</i>	White Birch	10	*	*	*	*	*	*		*	*	*	*
<i>Carpinus caroliniana</i>	Blue Beech	3	*							*			*
<i>Carya cordiformis</i>	Bitternut Hickory	3					*			*			*
<i>Carya glabra</i>	Pignut Hickory	1	*										
<i>Carya ovata</i>	Shagbark Hickory	1											*
<i>Celtis occidentalis</i>	Hackberry	3		*						*			*
<i>Cornus alternifolia</i>	Alternate-leaf Dogwood	2								*			*
<i>Crataegus (varieties)</i>	Hawthorns	2		*						*			
<i>Fagus grandifolia</i>	American Beech	2											*
<i>Fraxinus americana</i>	White Ash	4			*	*				*			*
<i>Fraxinus nigra</i>	Black Ash	1	*										
<i>Fraxinus pennsylvanica</i>	Green Ash	2					*			*			
<i>Juglans nigra</i>	Black Walnut	4			*		*			*			*
<i>Juniperus virginiana</i>	Eastern Red Cedar	3			*								*
<i>Larix laricina</i>	Tamarack	11	*	*	*	*	*	*	*	*	*	*	*
<i>Malus (most)</i>	Flowering & Domestic Crab Apple	1								*			
<i>Morus alba</i>	White Mulberry	2								*			*
<i>Ostrya virginiana</i>	Hop Hornbeam	4	*		*					*			*
<i>Picea glauca</i>	White Spruce	2					*			*			
<i>Picea mariana</i>	Black Spruce	11	*	*	*	*	*	*	*	*	*	*	*
<i>Pinus resinosa</i>	Red Pine	3								*		*	*
<i>Pinus strobus</i>	White Pine	10	*	*	*	*	*	*		*	*	*	*
<i>Pinus sylvestris</i>	Scotch Pine	1								*			
<i>Populus deltoides</i>	Eastern Cottonwood	2								*			*
<i>Populus grandidentata</i>	Large-tooth Aspen	3	*							*			*
<i>Populus tremuloides</i>	Trembling Aspen	6	*		*	*				*	*		*
<i>Prunus americana</i>	American Plum	3		*	*					*			
<i>Prunus nigra</i>	Canada Plum	1								*			
<i>Prunus pensylvanica</i>	Pin Cherry	1								*			
<i>Prunus serotina</i>	Black Cherry	8	*	*	*	*	*			*	*		*
<i>Pyrus communis</i>	Common Pear	2		*						*			
<i>Quercus alba</i>	White Oak	6	*		*	*	*			*			*
<i>Quercus bicolor</i>	Swamp White Oak	2								*	*		
<i>Quercus macrocarpa</i>	Bur Oak	6		*	*	*		*		*			*
<i>Quercus muhlenbergii</i>	Chinquapin Oak	3		*						*			*
<i>Quercus prinoides</i>	Dwarf Chinquapin Oak	1	*							*			
<i>Quercus rubra</i>	Red Oak	7	*	*	*	*	*			*			*
<i>Robinia pseudo-acacia</i>	Black Locust	1								*			
<i>Salix alba</i>	White Willow	3	*		*					*			
<i>Salix fragilis</i>	Crack Willow	1								*			
<i>Salix nigra</i>	Black Willow	5	*		*	*		*		*			
<i>Thuja occidentalis</i>	Eastern White Cedar	1								*			
<i>Tilia americana</i>	American Basswood	3					*			*			*
<i>Tilia x vulgaris</i>	Hybrid Linden	1								*			
<i>Ulmus americana</i>	American Elm	7	*	*	*	*	*			*	*		*
<i>Ulmus rubra</i>	Slippery Elm	2	*							*			

Appendix D. Plant Species Observed in Sifton Bog ESA by Author (continued)

Genus species	Common Name	Observers	Crawford1926	Judd1966	Waldron1972	Small1977	PR1979	Graham1987	McLeod1989	McLeod1992	BioLogic2000	Bergsma2006	UTRCA2007
Shrub													
<i>Acer ginnala</i>	Amur Maple	1								*			
<i>Alnus incana</i> ssp. <i>rugosa</i>	Speckled Alder	1						*					
<i>Amelanchier</i> sp.	Serviceberry	1	*										
<i>Andromeda polifolia</i> ssp. <i>glaucophylla</i>	Bog Rosemary	7	*	*		*		*	*	*	*		
<i>Aronia melanocarpa</i>	Black Chokeberry	3	*	*						*			
<i>Berberis thunbergii</i>	Japanese Barberry	2		*						*			
<i>Berberis vulgaris</i>	European Barberry	2		*						*			
<i>Cephalanthus occidentalis</i>	Buttonbush	4		*						*	*		
<i>Cercis canadensis</i>	Redbud	1											*
<i>Chamaedaphne calyculata</i>	Leatherleaf	11	*	*	*	*	*	*	*	*	*	*	*
<i>Cornus amomum</i> ssp. <i>obliqua</i>	Silky Dogwood	4		*						*	*		*
<i>Cornus canadensis</i>	Bunchberry	1	*										
<i>Cornus foemina</i>	Grey Dogwood	4			*	*				*			*
<i>Cornus rugosa</i>	Round-leaved Dogwood	1								*			
<i>Cornus stolonifera</i>	Red-osier Dogwood	6	*	*				*		*	*		*
<i>Corylus americana</i>	American Hazelnut	3	*	*						*			
<i>Crataegus compacta</i>	Compact Hawthorn	1								*			
<i>Crataegus crus-galli</i>	Cockspur Hawthorn	1								*			
<i>Crataegus dodgei</i>	Hawthorn	1								*			
<i>Crataegus holmesiana</i>	Holmes' Hawthorne	1								*			
<i>Crataegus mollis</i>	Hawthorn	2	*							*			
<i>Crataegus pedicellata</i>	Scarlet Hawthorn	1								*			
<i>Crataegus pringlei</i>	Hawthorn	1								*			
<i>Crataegus punctata</i>	Dotted Hawthorn	2	*							*			
<i>Crataegus schuettei</i>	Hawthorn	1								*			
<i>Crataegus</i> sp.	Hawthorn	4		*	*		*						*
<i>Crataegus succulenta</i>	Fleshy Hawthorn	1								*			
<i>Euonymus europaea</i>	European Spindle Tree	1								*			
<i>Euonymus fortunei</i>	Winter Creeper	1								*			
<i>Gaultheria procumbens</i>	Wintergreen	2	*							*			
<i>Gaylussacia baccata</i>	Black Huckleberry	9	*	*			*	*	*	*	*	*	*
<i>Hamamelis virginiana</i>	Witch-hazel	2	*							*			
<i>Ilex verticillata</i>	Winterberry	3	*							*	*		
<i>Kalmia polifolia</i>	Pale Laurel	9	*	*	*		*	*	*	*	*		*
<i>Ledum groenlandicum</i>	Labrador Tea	3	*							*			*
<i>Ligustrum vulgare</i>	European Privet	1								*			
<i>Lindera benzoin</i>	Spicebush	1								*			
<i>Lonicera dioica</i>	Mountain Honeysuckle	1								*			
<i>Lonicera tatarica</i>	Tartarian Honeysuckle	4			*	*				*			*
<i>Malus coronaria</i>	Wild Crabapple	1								*			
<i>Malus pumila</i>	Common Apple	2								*			*
<i>Mitchella repens</i>	Partridge-berry	1								*			
<i>Nemopanthis mucronatus</i>	Mountain Holly	2	*							*			
<i>Philadelphus pubescens</i>	Hoary Mock Orange	1								*			
<i>Physocarpus opulifolius</i>	Ninebark	2	*							*			
<i>Prunus virginiana</i>	Choke Cherry	6	*	*	*	*				*			*
<i>Rhamnus cathartica</i>	European Buckthorn	7	*		*	*				*	*	*	*
<i>Rhamnus frangula</i>	Glossy Buckthorn	10	*	*	*	*	*	*	*	*	*	*	*
<i>Rhus rydbergii</i>	Western Poison-ivy	2	*							*			
<i>Rhus typhina</i>	Staghorn Sumac	4	*				*			*			*
<i>Ribes americanum</i>	Wild Black Currant	3	*				*			*			
<i>Ribes cynosbati</i>	Prickly Gooseberry	2	*							*			
<i>Ribes rubrum</i>	Northern Red Currant	1								*			
<i>Rosa blanda</i>	Smooth Rose	1								*			
<i>Rosa multiflora</i>	Multiflora Rose	1								*			
<i>Rosa palustris</i>	Swamp Rose	2	*							*			
<i>Rosa</i> sp.	Rose	1					*						
<i>Rubus allegheniensis</i>	Allegheny Blackberry	3	*				*			*			
<i>Rubus flagellaris</i>	Northern Dewberry	2					*			*			

Appendix D. Plant Species Observed in Sifton Bog ESA by Author (continued)

Genus species	Common Name	Observers	Crawford1926	Judd1966	Waldron1972	Small1977	PR1979	Graham1987	McLeod1989	McLeod1992	BioLogic2000	Bergsma2006	UTRCA2007
Rubus idaeus ssp melanolasius	Red Raspberry	2								*	*		
Rubus occidentalis	Black Raspberry	1								*			
Rubus odoratus	Purple Flowering Raspberry	2		*						*			
Rubus pubescens	Dwarf Raspberry	1	*										
Salix discolor	Pussy Willow	4	*		*			*		*			
Salix eriocephala	Willow	1								*			
Salix exigua	Sandbar Willow	2		*						*			
Salix lucida	Shining Willow	3			*				*	*			
Salix petiolaris	Slender Willow	1								*			
Salix pyrifolia	Balsam Willow	2							*	*			
Sambucus canadensis	Common Elderberry	4	*		*					*	*		
Sambucus racemosa	Red-berried Elderberry	2		*						*			
Sorbus aucuparia	European Mountain-ash	1								*			
Spiraea alba	Narrow-leaved Meadow-sweet	4	*	*				*		*			
Staphylea trifolia	American Bladdernut	2		*						*			
Symphoricarpos albus	Snowberry	2					*			*			
Syringa vulgaris	Lilac	1								*			
Vaccinium corymbosum	Highbush Blueberry	10	*	*	*		*	*	*	*	*	*	*
Vaccinium macrocarpon	Large Cranberry	7		*				*	*	*	*	*	*
Vaccinium myrtilloides	Velvetleaf Blueberry	1	*										
Vaccinium oxycoccos	Small Cranberry	10	*	*	*	*	*	*	*	*	*	*	*
Viburnum acerifolium	Maple-leaved Viburnum	2	*							*			
Viburnum cassinoides	Northern Wild-raisin	3	*				*			*			
Viburnum lantana	Wayfaring Tree	1								*			
Viburnum lentago	Nannyberry	3		*						*			*
Viburnum opulus	Guelder Rose	2								*			*
Viburnum rafinesquianum	Downy Arrow-wood	1								*			
Viburnum trilobum	Highbush Cranberry	2								*			*
Vine													
Clematis virginiana	Virgin's-bower	2		*						*			
Convolvulus arvensis	Field Bindweed	1								*			
Cuscuta gronovii	Gronovius Dodder	2								*			*
Euonymus obovata	Running Strawberry-bush	3		*			*			*			
Lonicera canadensis	Fly Honeysuckle	2					*			*			
Lonicera oblongifolia	Swamp Fly Honeysuckle	2					*			*			
Parthenocissus inserta	Virginia Creeper--climbing	2					*			*			
Parthenocissus quinquefolia	Virginia Creeper	2			*								*
Rhus radicans ssp negundo	Climbing Poison-ivy	1						*					
Smilax herbacea	Smooth Herbaceous Greenbrier	3		*	*					*			
Smilax hispida	Hispid Greenbrier	2		*						*			
Smilax lasioneura Hook.	Herbaceous Greenbrier	1								*			
Solanum dulcamara	Climbing Nightshade	4			*					*	*		*
Vitis labrusca	Northern Fox Grape	1								*			
Vitis riparia	Riverbank Grape	3					*			*			*
Forb													
Acalypha virginica var. rhomboidea	Three-seeded Mercury	1								*			
Achillea millefolium	Common Yarrow	3					*			*			*
Aegopodium podagraria	Goutweed	2								*			*
Agrimonia gryposepala	Tall Hairy Groovebur	1								*			
Alliaria petiolata	Garlic Mustard	6			*	*	*			*	*		*
Amaranthus albus	White Pigweed	1								*			
Ambrosia artemisiifolia	Annual Ragweed	1								*			
Anemone americana	Round-lobed Hepatica	1								*			
Anemone canadensis	Canada Anemone	2					*			*			
Anemone cylindrica	Thimbleweed	1								*			
Anemone quinquefolia L.	Wood Anemone	1								*			
Anemone virginiana L.	Virginia Anemone	1								*			
Antennaria howellii ssp.petaloides	Field Pussy-toes	1								*			
Apocynum androsaemifolium	Spreading Dogbane	1								*			
Apocynum cannabinum	Indian Hemp	2								*			*

Appendix D. Plant Species Observed in Sifton Bog ESA by Author (continued)

Genus species	Common Name	Observers	Crawford1926	Judd1966	Waldron1972	Small1977	PR1979	Graham1987	McLeod1989	McLeod1992	BioLogic2000	Bergsma2006	UTRCA2007
<i>Aquilegia canadensis</i>	Wild Columbine	2	*							*			
<i>Aralia racemosa</i>	American Spikenard	1								*			
<i>Arctium minus</i>	Common Burdock	1								*			
<i>Arenaria serpyllifolia</i>	Thyme-leaf Sandwort	1								*			
<i>Arethusa bulbosa</i>	Swamp-pink	9	*	*	*	*	*		*	*		*	*
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit	1								*			
<i>Asarum canadense</i>	Wild Ginger	1								*			
<i>Asclepias exaltata</i>	Poke Milkweed	1								*			
<i>Asclepias incarnata</i>	Swamp Milkweed	4			*					*		*	*
<i>Asclepias syriaca</i>	Common Milkweed	1								*			
<i>Asclepias tuberosa</i>	Butterfly Milkweed	1								*			*
<i>Asparagus officinalis</i>	Asparagus	2					*			*			
<i>Aster cordifolius</i>	Heart-leaf Aster	1								*			
<i>Aster ericoides</i> ssp <i>ericoides</i>	White Heath Aster	1								*			
<i>Aster laevis</i> var <i>laevis</i>	Smooth Blue Aster	1								*			
<i>Aster lanceolatus</i> ssp <i>lanceolatus</i>	Panicled Aster	2								*	*		
<i>Aster lateriflorus</i> var. <i>lateriflorus</i>	One-sided Aster	1								*			
<i>Aster macrophyllus</i>	Large-leaved Aster	1								*			
<i>Aster novae-angliae</i>	New England Aster	1								*			
<i>Aster pilosus</i>	Hairy Aster	1								*			
<i>Aster urophyllus</i>	Arrow-leaved Aster	2					*			*			
<i>Barbarea vulgaris</i>	Yellow Rocket	1								*			
<i>Bidens frondosa</i>	Devil's Beggar-ticks	1								*			
<i>Bidens tripartita</i>	Beggar-ticks	2								*	*		
<i>Bidens vulgata</i>	Tall Bur-marigold	1								*			
<i>Boehmeria cylindrica</i>	False Nettle	2								*	*		
<i>Calopogon tuberosus</i>	Tuberous Grass-pink	7	*	*				*	*	*		*	*
<i>Capsella bursa-pastoris</i>	Common Shepherd's Purse	1								*			
<i>Cardamine concatenata</i>	Cutleaf Toothwort	1								*			
<i>Cardamine pennsylvanica</i>	Pennsylvania Bitter-cress	2								*	*		
<i>Cerastium fontanum</i>	Mouse-eared Chickweed	1								*			
<i>Chaenorrhinum minus</i>	Dwarf Snapdragon	1								*			
<i>Chamaesyce maculata</i>	Spotted Spurge	1								*			
<i>Chelidonium majus</i>	Celandine	1								*			
<i>Chenopodium album</i> var. <i>album</i>	Lamb's Quarters	1								*			
<i>Chenopodium glaucum</i> ssp. <i>glaucum</i>	Oak-leaved Goosefoot	1								*			
<i>Chrysanthemum leucanthemum</i>	Oxeye Daisy	2								*			*
<i>Cichorium intybus</i>	Chicory	1								*			
<i>Cicuta bulbifera</i>	Bulb-bearing Water-hemlock	1								*			
<i>Circaea lutetiana</i> ssp. <i>canadensis</i>	Enchanter's Nightshade	3			*		*			*			
<i>Cirsium arvense</i>	Creeping Thistle	1								*			*
<i>Cirsium muticum</i> Michx.	Swamp Thistle	1								*			*
<i>Clinopodium vulgare</i>	Field Basil	1								*			
<i>Clintonia borealis</i>	Clinton Lily	1						*					
<i>Coeloglossum viride</i> var. <i>virescens</i>	Bracted Green Orchid	1								*			
<i>Commelina communis</i>	Asiatic Dayflower	1								*			
<i>Conyza canadensis</i>	Canada Fleabane	1								*			
<i>Coptis trifolia</i>	Goldthread	1	*							*			
<i>Cypripedium acaule</i>	Pink Lady's-slipper	2	*							*			
<i>Daucus carota</i>	Wild Carrot	3					*			*			*
<i>Desmodium glutinosum</i>	Pointed-leaved Tick-trefoil	1								*			
<i>Dianthus armeria</i>	Deptford-pink	1								*			
<i>Dipsacus fullonum</i> ssp. <i>sylvestris</i>	Wild Teasel	1								*			
<i>Drosera intermedia</i>	Spoon-leaved Sundew	2		*						*			
<i>Drosera rotundifolia</i>	Roundleaf Sundew	10	*	*	*		*	*	*	*	*	*	*
<i>Echium vulgare</i>	Common Viper's-bugloss	2								*			*
<i>Epilobium coloratum</i>	Purple-leaf Willow-herb	2								*	*		
<i>Epilobium leptophyllum</i>	Linear-leaved Willow-herb	1								*			
<i>Epilobium parviflorum</i>	Small-flower Willow-herb	2		*						*			
<i>Epipactis helleborine</i>	Eastern Helleborine	2								*	*		

Appendix D. Plant Species Observed in Sifton Bog ESA by Author (continued)

Genus species	Common Name	Observers	Crawford1926	Judd1966	Waldron1972	Small1977	PR1979	Graham1987	McLeod1989	McLeod1992	Biologic2000	Bergsma2006	UTRCA2007
<i>Erechtites hieracifolia</i>	Fireweed	2											
<i>Erigeron annuus</i>	White-top Fleabane	1								*			
<i>Erigeron philadelphicus</i>	Philadelphia Fleabane	2					*			*			
<i>Erigeron pulchellus</i>	Robin's Plantain	1								*			
<i>Erigeron strigosus</i>	Daisy Fleabane	1								*			
<i>Erysimum cheiranthoides</i> ssp. <i>cheiranthoides</i>	Wormseed Mustard	1								*			
<i>Erythronium americanum</i>	Yellow Trout Lily	1								*			
<i>Eupatorium maculatum</i> ssp. <i>maculatum</i>	Spotted Joe-pye-weed	1								*			
<i>Eupatorium perfoliatum</i>	Common Boneset	4			*			*		*	*		
<i>Euphorbia cyparissias</i>	Cypress Spurge	2					*			*			
<i>Euthamia graminifolia</i>	Flat-top Fragrant-golden-rod	1								*			
<i>Fragaria virginiana</i> ssp. <i>virginiana</i>	Virginia Strawberry	3					*			*	*		
<i>Galium boreale</i>	Northern Bedstraw	1								*			
<i>Galium brevipes</i>	Limestone Swamp Bedstraw	1								*			
<i>Galium lanceolatum</i>	Torrey's Wild Licorice	1								*			
<i>Galium mollugo</i>	White Bedstraw	1								*			
<i>Galium obtusum</i>	Blunt-leaf Bedstraw	1			*					*			
<i>Galium palustre</i>	Marsh Bedstraw	3								*		*	*
<i>Galium tinctorium</i>	Stiff Marsh Bedstraw	2								*	*		
<i>Galium triflorum</i>	Fragrant Bedstraw	1								*			
<i>Geranium maculatum</i>	Wild Crane's-bill	4			*	*	*			*			
<i>Geranium robertianum</i>	Herb-robert	3			*		*			*			
<i>Geum aleppicum</i>	Yellow Avens	2					*			*			
<i>Geum canadense</i>	White Avens	2								*			*
<i>Geum laciniatum</i>	Rough Avens	1								*			
<i>Glechoma hederacea</i>	Ground Ivy	1								*			
<i>Goodyera pubescens</i>	Downy Rattlesnake-plantain	1								*			
<i>Hemerocallis fulva</i>	Orange Daylily	1								*			
<i>Hesperis matronalis</i>	Dame's Rocket	1								*			
<i>Hieracium caespitosum</i> ssp. <i>caespitosum</i>	Yellow Hawkweed	2					*			*			
<i>Hypericum mutilum</i> ssp. <i>boreale</i>	Northern St. John's-wort	4				*				*		*	*
<i>Hypericum perforatum</i>	Common St. John's-wort	2					*			*			
<i>Impatiens capensis</i>	Spotted Jewel-weed	2				*				*			
<i>Impatiens pallida</i>	Pale Jewel-weed	1			*					*			
<i>Inula helenium</i>	Elecampane Flower	1								*			
<i>Iris versicolor</i>	Blueflag	9	*	*	*		*	*		*	*	*	*
<i>Lactuca biennis</i>	Tall Blue Lettuce	1								*			
<i>Lactuca serriola</i>	Prickly Lettuce	1								*			
<i>Lamium purpureum</i>	Purple Deadnettle	1								*			
<i>Lapsana communis</i>	Common Nipplewort	2								*			*
<i>Lathyrus palustris</i>	Vetchling Peavine	1								*			
<i>Leonurus cardiaca</i>	Motherwort	1								*			
<i>Lepidium campestre</i>	Field Pepper-grass	1								*			
<i>Linaria vulgaris</i>	Butter-and-eggs	2								*			*
<i>Lindernia dubia</i> var. <i>dubia</i>	Low-stalked False Pimpernel	1								*			
<i>Lotus corniculatus</i>	Birds-foot Trefoil	1								*			
<i>Lycopus americanus</i>	American Bugleweed	3								*		*	*
<i>Lycopus uniflorus</i>	Northern Bugleweed	3					*			*	*		
<i>Lysimachia ciliata</i>	Fringed Loosetrife	2						*		*			
<i>Lysimachia thyriflora</i>	Water Loosetrife	3					*			*	*		
<i>Lythrum salicaria</i>	Purple Loosetrife	2								*	*		
<i>Maianthemum canadense</i>	Wild-lily-of-the-valley	4			*	*	*			*			
<i>Maianthemum racemosum</i>	False Solomon's Seal	5	*		*	*	*			*			
<i>Maianthemum trifolium</i>	Three-leaf Solomon's-seal	3	*		*					*			
<i>Malva moschata</i>	Musk Mallow	1								*			
<i>Medicago lupulina</i>	Black Medic	2					*			*			
<i>Melilotus alba</i>	White Sweet Clover	1								*			
<i>Melilotus officinalis</i>	Yellow Sweet Clover	2					*			*			
<i>Mentha arvensis</i>	Field Mint	3				*				*	*		
<i>Menyanthes trifoliata</i>	Bog Buckbean	4			*	*	*		*	*			*

Appendix D. Plant Species Observed in Sifton Bog ESA by Author (continued)

Genus species	Common Name	Observers	Crawford1926	Judd1966	Waldron1972	Small1977	PR1979	Graham1987	McLeod1989	McLeod1992	Biologic2000	Bergsma2006	UTRCA2007
<i>Monarda fistulosa</i>	Wild Bergamot Bee-balm	3					*			*			*
<i>Monotropa uniflora</i>	Indian Pipe	1								*			
<i>Nepeta cataria</i>	Catnip	1								*			
<i>Oenothera parviflora</i>	Northern Evening-primrose	1								*			
<i>Onopordum acanthium</i>	Scotch Cotton-thistle	1								*			
<i>Oxalis stricta</i>	Upright Yellow Wood-sorrel	2								*	*		
<i>Panax quinquefolius</i>	American Ginseng	1								*			
<i>Pastinaca sativa</i>	Wild Parsnip	1								*			
<i>Penthorum sedoides</i>	Ditch-stonecrop	1								*			
<i>Phlox paniculata</i>	Fall Phlox	1								*			
<i>Physalis heterophylla</i>	Clammy Ground-cherry	1								*			
<i>Pilea fontana</i>	Springs Clearweed	1								*			
<i>Pilea pumila</i>	Canada Clearweed	4			*					*	*	*	*
<i>Plantago lanceolata</i>	English Plantain	2					*			*			
<i>Plantago major</i>	Nipple-seed Plantain	1								*			
<i>Plantago rugelii</i>	Black-seed Plantain	1								*			
<i>Platanthera hyperborea</i>	Leafy Northern Green Orchid	1								*			
<i>Platanthera lacera</i>	Green-fringed Orchid	2	*							*			
<i>Platanthera psycodes</i>	Small Purple-fringed Orchid	2							*	*			
<i>Podophyllum peltatum</i>	May Apple	5			*	*	*			*			*
<i>Pogonia ophioglossoides</i>	Rose Pogonia	9	*	*	*		*	*	*	*		*	*
<i>Polygonatum pubescens</i>	Downy Solomon's-seal	2					*		*	*			
<i>Polygonum aviculare</i>	Prostrate Knotweed	1								*			
<i>Polygonum convolvulus</i>	Black Bindweed	1								*			
<i>Polygonum hydropiper</i>	Mild Water-pepper	3								*	*	*	*
<i>Polygonum lapathifolium</i>	Dock-leaf Smartweed	1								*			
<i>Polygonum pennsylvanicum</i>	Pennsylvania Smartweed	2				*				*			
<i>Polygonum persicaria</i>	Lady's Thumb	1								*			
<i>Potentilla argentea</i>	Silvery Cinquefoil	1								*			
<i>Potentilla norvegica</i>	Norway Cinquefoil	2								*	*		
<i>Potentilla recta</i>	Sulphur Cinquefoil	2					*			*			
<i>Prenanthes alba</i>	White Rattlesnake-root	1								*			
<i>Prunella vulgaris ssp.lanceolata</i>	Heal-all	1								*			
<i>Ranunculus abortivus</i>	Kidney-leaved Buttercup	2					*			*			
<i>Ranunculus acris</i>	Tall Butter-cup	3					*			*			*
<i>Ranunculus recurvatus var. recurvatus</i>	Rough Crowfoot	1								*			
<i>Rudbeckia hirta</i>	Black-eyed Susan	1								*			
<i>Rumex acetosella ssp. acetosella</i>	Sheep Sorrel	2	*							*			
<i>Rumex crispus</i>	Curly Dock	1								*			
<i>Rumex orbiculatus</i>	Water Dock	1								*	*		
<i>Saponaria officinalis</i>	Bouncing-bet	1								*			
<i>Sarracenia purpurea</i>	Northern Pitcher-plant	11	*	*	*	*	*	*	*	*	*	*	*
<i>Satureja hortensis</i>	Summer Savory	1								*			*
<i>Scrophularia marilandica</i>	Carpenter's Square Figwort	1								*			
<i>Scutellaria galericulata</i>	Hooded Skullcap	2								*	*		
<i>Scutellaria lateriflora</i>	Mad Dog Skullcap	2								*	*		
<i>Sicyos angulatus</i>	Bur Cucumber	1								*			
<i>Silene latifolia</i>	Bladder Champion	1								*			
<i>Silene virginica var. virginica</i>	Fire-pink	1								*			*
<i>Silene vulgaris</i>	Bladder Champion	2								*			*
<i>Sinapis arvensis</i>	Corn Mustard	1								*			
<i>Sisyrinchium montanum</i>	Strict Blue-eyed-grass	1								*			
<i>Sium suave</i>	Hemlock Water-parsnip	3								*	*		*
<i>Solidago altissima var. altissima</i>	Tall Goldenrod	1								*			
<i>Solidago canadensis</i>	Canada Goldenrod	1								*			
<i>Solidago flexicaulis</i>	Broad-leaved Goldenrod	1								*			
<i>Solidago gigantea</i>	Smooth Goldenrod	1								*			
<i>Solidago juncea</i>	Early Goldenrod	1								*			
<i>Solidago rugosa</i>	Rough Goldenrod	1								*			
<i>Sonchus asper ssp. asper</i>	Spiny Annual Sow-thistle	1								*			

Appendix D. Plant Species Observed in Sifton Bog ESA by Author (continued)

Genus species	Common Name	Observers	Crawford1926	Judd1966	Waldron1972	Small1977	PR1979	Graham1987	McLeod1989	McLeod1992	BioLogic2000	Bergsma2006	UTRC-A2007
<i>Sonchus oleraceus</i>	Common Sow-thistle	1								*			
<i>Spiranthes cernua</i>	Nodding Ladies'-tresses	1								*			
<i>Symplocarpus foetidus</i>	Skunk Cabbage	5	*		*					*		*	*
<i>Taenidia integerrima</i>	Yellow Pimpernell	1								*			
<i>Taraxacum officinale</i>	Common Dandelion	3					*			*	*		
<i>Thalictrum dioicum</i>	Early Meadowrue	2			*					*			
<i>Tiarella cordifolia</i>	Heart-leaved Foam-flower	1								*			
<i>Tragopogon dubius</i>	Meadow Goat's-beard	1								*			
<i>Tragopogon pratensis ssp. pratensis</i>	Meadow Goat's-beard	2					*			*			
<i>Triadenum fraseri</i>	Marsh St. John's-wort	1								*			
<i>Triadenum virginicum</i>	Marsh St. John's-wort	5		*				*		*	*	*	*
<i>Tridentalis borealis ssp. borealis</i>	Star-flower	1								*			
<i>Trifolium hybridum ssp. elegans</i>	Alsike Clover	1								*			
<i>Trifolium pratense</i>	Red Clover	1								*			
<i>Trifolium repens</i>	White Clover	2					*			*			
<i>Trillium erectum</i>	Red Trillium	2			*					*			
<i>Trillium grandiflorum</i>	White Trillium	3			*		*			*			
<i>Triosteum aurantiacum</i>	Wild Coffee	1								*			
<i>Urtica dioica ssp. dioica</i>	European Stinging Nettle	2								*			*
<i>Urtica dioica ssp. gracilis</i>	American Stinging Nettle	1								*			
<i>Verbascum thapsus</i>	Great Mullein	1								*			
<i>Verbena hastata</i>	Blue Vervain	1								*			
<i>Verbena urticifolia</i>	White Vervain	1								*			
<i>Veronica agrestis</i>	Field Speedwell	1								*			
<i>Veronica arvensis</i>	Corn Speedwell	1								*			
<i>Veronica officinalis</i>	Gypsy-weed	2	*							*			
<i>Veronica serpyllifolia ssp. serpyllifolia</i>	Thyme-leaved Speedwell	1								*			
<i>Vicia cracca</i>	Tufted Vetch	1								*			
<i>Vicia sativa ssp. nigra</i>	Common Vetch	1								*			
<i>Vicia villosa</i>	Hairy Vetch	1								*			
<i>Vinca minor</i>	Periwinkle	2								*			*
<i>Viola canadensis</i>	Canada Violet	1								*			
<i>Viola conspersa</i>	Dog Violet	1								*			
<i>Viola macloskeyi ssp. pallens</i>	Northern White Violet	1								*			
<i>Viola pubescens</i>	Downy Yellow Violet	1								*			
<i>Viola sororia</i>	Woolly Blue Violet	2					*			*			
<i>Zigadenus elegans ssp. glaucus</i>	White Camass	1								*			
Fern or Fern Ally													
<i>Athyrium filix-femina var. angustum</i>	Lady Fern	1								*			
<i>Botrychium virginianum</i>	Rattlesnake Fern	1								*			
<i>Cystopteris fragilis</i>	Fragile Fern	3								*	*	*	*
<i>Dryopteris carthusiana</i>	Spinulose Wood Fern	7	*		*	*	*	*	*	*	*	*	*
<i>Dryopteris cristata</i>	Crested Wood Fern	1								*			
<i>Dryopteris intermedia</i>	Evergreen Wood Fern	1								*			
<i>Equisetum arvense</i>	Field Horsetail	1								*			
<i>Huperzia lucidula</i>	Shining Club-moss	1								*			
<i>Lycopodiella inundata</i>	Nothern Bog Club-moss	2							*	*			
<i>Lycopodium dendroideum</i>	Prickly Tree Club-moss	1								*			
<i>Lycopodium obscurum</i>	Ground-pine	1						*					
<i>Onoclea sensibilis</i>	Sensitive Fern	8	*		*		*	*	*	*	*	*	*
<i>Osmunda cinnamomea</i>	Cinnamon Fern	3	*		*				*	*			
<i>Osmunda regalis</i>	Royal Fern	3	*		*				*	*			
<i>Pteridium aquilinum var. latiusculum</i>	Bracken Fern	3	*					*	*	*			
<i>Selaginella selaginoides</i>	Low Spike-moss	1								*			
<i>Thelypteris palustris var. pubescens</i>	Marsh Fern	5					*		*	*	*	*	*
<i>Woodwardia virginica</i>	Virginia Chainfern	2						*	*	*			
Graminoid													
<i>Agrostis gigantea</i>	Red-top	1								*			
<i>Agrostis stolonifera</i>	Spreading Bentgrass	2					*		*	*			
<i>Andropogon gerardii</i>	Big Bluestem	4					*		*	*	*	*	*

Appendix D. Plant Species Observed in Sifton Bog ESA by Author (continued)

Genus species	Common Name	Observers	Crawford1926	Judd1966	Waldron1972	Small1977	PR1979	Graham1987	McLeod1989	McLeod1992	BioLogic2000	Bergsma2006	UTRCA2007
<i>Arrhenatherum elatius</i>	Tall Oatgrass	1								*			
<i>Bromus inermis</i> ssp. <i>inermis</i>	Awnless Brome	2					*			*			
<i>Calamagrostis canadensis</i>	Blue-joint Reedgrass	1						*					
<i>Carex arctata</i> Boott	Black Sedge	1								*			
<i>Carex atlantica</i> ssp. <i>Capillacea</i>	Eastern Sedge	1								*			
<i>Carex blanda</i>	Woodland Sedge	1								*			
<i>Carex brunnescens</i> ssp. <i>brunnescens</i>	Green Bog Sedge	2		*						*			
<i>Carex canescens</i> ssp. <i>canescens</i>	Gray Bog Sedge	1								*			
<i>Carex chordorrhiza</i>	Creeping Sedge	1								*			
<i>Carex communis</i>	Fibrous-root Sedge	2					*			*			
<i>Carex comosa</i>	Bristly Sedge	1								*			
<i>Carex crinita</i>	Fringed Sedge	3			*					*	*		
<i>Carex cristatella</i>	Crested Sedge	1								*			
<i>Carex deweyana</i>	Short-scale Sedge	1	*										
<i>Carex diandra</i>	Lesser Panicked Sedge	1								*			
<i>Carex disperma</i>	Soft-leaved Sedge	4								*	*	*	*
<i>Carex gracillima</i>	Graceful Sedge	1								*			
<i>Carex granularis</i>	Meadow Sedge	1								*			
<i>Carex hystericina</i>	Porcupine Sedge	1								*			
<i>Carex interior</i>	Inland Sedge	2					*			*			
<i>Carex intumescens</i>	Bladder Sedge	1								*			
<i>Carex lacustris</i>	Lake-bank Sedge	5		*						*	*	*	*
<i>Carex lasiocarpa</i>	Slender Sedge	2								*	*		
<i>Carex leptalea</i> ssp. <i>leptalea</i>	Slender Sedge	1								*			
<i>Carex limosa</i>	Mud Sedge	3					*		*	*			
<i>Carex lupulina</i>	Hop Sedge	2								*	*		
<i>Carex magellanica</i> ssp. <i>irrigua</i>	Bog Sedge	1								*			
<i>Carex oligosperma</i>	Few-seeded Sedge	1								*			
<i>Carex pauciflora</i>	Few-flowered Sedge	2							*	*			
<i>Carex pedunculata</i>	Longstalk Sedge	1								*			
<i>Carex pensylvanica</i>	Pennsylvania Sedge	1								*			
<i>Carex projecta</i>	Necklace Sedge	2								*	*		
<i>Carex pseudo-cyperus</i>	Cyperus-like Sedge	2								*	*		
<i>Carex retrorsa</i>	Retorse Sedge	2						*		*			
<i>Carex rosea</i>	Rosy Sedge	2		*						*			
<i>Carex spicata</i>	Spiked Sedge	1								*			
<i>Carex stipata</i>	Stalk-grain Sedge	2								*	*		
<i>Carex tenuiflora</i>	Sparse-flowered Sedge	1								*			
<i>Carex tribuloides</i> Wahlenb.	Blunt Broom Sedge	1								*			
<i>Carex trisperma</i> var. <i>trisperma</i>	Three-fruited Sedge	6		*		*				*	*	*	*
<i>Carex trisperma</i> var. <i>billingsii</i>	Three-fruited Sedge	1								*			
<i>Carex vulpinoidea</i>	Fox Sedge	1								*			
<i>Dactylis glomerata</i>	Orchard Grass	2								*		*	
<i>Danthonia spicata</i>	Poverty Oat-grass	1								*			
<i>Digitaria ischaemum</i>	Smooth Crabgrass	1								*			
<i>Digitaria sanguinalis</i>	Hairy Crabgrass	1								*			
<i>Dulichium arundinaceum</i>	Three-way Sedge	6					*	*		*	*	*	*
<i>Eleocharis erythropoda</i>	Red-stemmed Spike-rush	2						*		*			
<i>Eleocharis intermedia</i>	Matted Spike-rush	1								*			
<i>Eleocharis obtusa</i>	Blunt Spike-rush	1								*			
<i>Eleocharis olivacea</i>	Bright-green Spike-rush	1								*			
<i>Eleocharis ovata</i>	Ovate Spike-rush	2							*	*			
<i>Eleocharis smallii</i>	Creeping Spike-rush	1								*			
<i>Elymus repens</i>	Quack Grass	2					*			*			
<i>Eragrostis cilianensis</i>	Stinkgrass	1								*			
<i>Eragrostis pectinacea</i> var. <i>pectinacea</i>	Tufted Love Grass	1								*			
<i>Eriophorum callitrix</i>	Sheathed Cotton-grass	1	*										
<i>Eriophorum gracile</i>	Slender Cotton-grass	1								*			
<i>Eriophorum tenellum</i>	Rough Cotton-grass	1						*					
<i>Eriophorum virginicum</i>	Tawny Cotton-grass	8		*			*	*	*	*	*	*	*

Appendix D. Plant Species Observed in Sifton Bog ESA by Author (continued)

Genus species	Common Name	Observers	Crawford1926	Judd1966	Waldron1972	Small1977	PR1979	Graham1987	McLeod1989	McLeod1992	BioLogic2000	Bergsma2006	UTRCA2007
<i>Festuca arundinacea</i>	Kentucky Fescue	1								*			
<i>Festuca subverticillata</i>	Nodding Fescue	1								*			
<i>Glyceria grandis</i>	American Mannagrass	2								*	*		
<i>Glyceria striata</i>	Fowl Manna-grass	4								*	*	*	*
<i>Juncus canadensis</i>	Canada Rush	6		*	*		*	*		*	*		
<i>Juncus dudleyi</i>	Dudley's Rush	1								*			
<i>Juncus effusus ssp. solutus</i>	Soft Rush	3								*		*	*
<i>Juncus pelocarpus</i>	Brown-fruited Rush	3							*	*	*		*
<i>Leersia oryzoides</i>	Rice Cutgrass	2								*	*		
<i>Lolium perenne</i>	Perennial Ryegrass	1								*			
<i>Luzula acuminata</i>	Hairy Woodrush	1								*			
<i>Muhlenbergia mexicana var. mexicana</i>	Mexican Satin Grass	1								*			
<i>Panicum capillare</i>	Old Witch Panic-grass	1								*			
<i>Phalaris arundinacea</i>	Reed Canary Grass	2								*	*		
<i>Phleum pratense</i>	Meadow Timothy	3					*			*			*
<i>Poa annua</i>	Annual Bluegrass	1								*			
<i>Poa compressa</i>	Canada Bluegrass	2					*			*			
<i>Poa palustris</i>	Fowl Bluegrass	2						*		*			
<i>Poa pratensis ssp. pratensis</i>	Kentucky Bluegrass	2					*			*			
<i>Rhynchospora alba</i>	White Beaked-rush	6		*					*	*	*	*	*
<i>Schizachyrium scoparium</i>	Little Bluestem	3								*		*	*
<i>Scirpus atrovirens</i>	Dark-green Bulrush	3								*		*	*
<i>Scirpus cyperinus</i>	Wool-grass	5						*		*	*	*	*
<i>Scirpus pedicellatus</i>	Stalked Bulrush	1								*			
<i>Scirpus smithii</i>	Smith's Club-rush	2							*	*			
<i>Scirpus validus</i>	Softstem Bulrush	1								*			
<i>Setaria pumila</i>	Yellow Foxtail	1								*			
<i>Setaria viridis</i>	Green Bristle Grass	1								*			
<i>Sorghastrum nutans</i>	Yellow Indian-grass	1								*			*
<i>Sphenopholis intermedia</i>	Slender Wedge Grass	1								*			
<i>Sporobolus cryptandrus</i>	Sand Dropseed	1								*			
<i>Sporobolus vaginiflorus</i>	Sheathed Dropseed	1								*			
<i>Typha angustifolia</i>	Narrow-leaved Cattail	2								*	*		
<i>Typha latifolia</i>	Broad-leaf Cattail	10	*	*	*	*	*	*	*	*	*	*	*
Aquatic Plant													
<i>Alisma plantago-aquatica</i>	Broad-leaved Water-plantain	2								*	*		
<i>Brasenia schreberi</i>	Watershield	3						*		*			*
<i>Lemna minor</i>	Lesser Duckweed	6		*	*				*	*	*	*	*
<i>Lemna trisulca</i>	Star Duckweed	1								*			
<i>Myriophyllum spicatum</i>	Eurasian Water-milfoil	1						*					
<i>Nuphar advena</i>	Yellow Pond-lily	11	*	*	*	*	*	*	*	*	*	*	*
<i>Nuphar variegata</i>	Yellow Cowlily	1											*
<i>Spirodela polyrhiza</i>	Common Water-flaxseed	2		*						*			
<i>Utricularia cornuta</i>	Horned Bladderwort	4	*	*						*			*
<i>Utricularia vulgaris</i>	Greater Bladderwort	5	*	*				*		*			*
<i>Wolffia borealis</i>	Dotted Watermeal	1								*			
<i>Wolffia columbiana</i>	Columbia Watermeal	1								*			
			70	69	72	35	96	47	32	484	78	47	119

Appendix E. Vegetation Community, Ecological Land Classification (ELC) and Ontario Wetland Evaluation System (OWES) Equivalents (read in conjunction with Map 10b)

Vegetation Community ELC and OWES equivalents

Redmond's Pond 1a	ELC: SAF1 Floating-leaved Shallow Aquatic Ecosite OWES: <i>open water floating-leaved shallow aquatic [Brasenia-Utricularia] (Redmond's Pond)</i>
Crawford 1926	floating zones (ponds, ditches, tracks)
Judd 1957	(d) Redmond's Pond
Waldron 1972	open water
Small 1977	
Proctor & Redfern 1979	pond
Graham 1987 & Wu 1989	open water pond
McLeod 1989	
McLeod 1992	(1a) aquatic / open water/ water shield-Bladderwort
BioLogic 1999	
Bergsma & Quinlan 2006	
Redmond's Pond 1b	ELC: MAS3 Organic Shallow Marsh Ecosite OWES: <i>Spatterdock Organic Shallow Marsh</i>
Crawford 1926	
Judd 1957	
Waldron 1972	
Small 1977	
Proctor & Redfern 1979	
Graham 1987 & Wu 1989	
McLeod 1989	
McLeod 1992	(2a) robust emergent cattail - spatterdock marsh
BioLogic 1999	
Bergsma & Quinlan 2006	reM1; ls Rhamnus frangula; gc Thelypteris palustris, Arethusa bulbosa; ne Dulichium arundinaceum; re Nuphar variegatum, Typha latifolia; m Sphagnum
Redmond's Pond 1c	ELC: FEO1 Open Fen Ecosite OWES: <i>open floating sphagnum-sedge zone [Rhynchospora-Sphagnum-Drosera-Dulichium] 3 small bog ponds south of Redmond's Pond</i>
Crawford 1926	sedge zone (pond margin)
Judd 1957	(a-a) outer border of open floating sphagnum mat, open floating bog
Waldron 1972	leatherleaf-cranberry heath
Small 1977	
Proctor & Redfern 1979	open bog
Graham 1987 & Wu 1989	Typha / Group B (Vaccinium-Onoclea-Typha)
McLeod 1989	
McLeod 1992	(3a) low shrub floating sphagnum mat leatherleaf-cranberry
BioLogic 1999	1 and 3
Bergsma & Quinlan 2006	neOPF1 ts Larix laricina;ls Chamaedaphne calyculata, Vaccinium macrocarpon; gc Arethusa bulbosa, Drosera rotundifolia, Sarracenia purpurea, Thelypteris palustris; re Nuphar variegatum, Typha latifolia; ff Lemna minor; m Sphagnum

Appendix E. Vegetation Community, Ecological Land Classification (ELC) and Ontario Wetland Evaluation System (OWES) Equivalents (read in conjunction with Map 10b) (continued)

Open Bog 2a	ELC: BOO1 Open Bog Graminoid Ecosite OWES: <i>open beaked rush-cotton grass-graminoid-spruce bog (mat north of Redmond's Pond)</i>
Crawford 1926	
Judd 1957	
Waldron 1972	
Small 1977	
Proctor & Redfern 1979	
Graham 1987 & Wu 1989	
McLeod 1989	
McLeod 1992	
BioLogic 1999	
Bergsma & Quinlan 2006	gcOB1 ls Picea mariana, Chamaedaphne calyculata, Vaccinium macrocarpon, Gaylussacia baccata; gc Hypericum virginicum, H. mutilum; re Typha latifolia; ne Rhynchospora alba, Eriophorum virginicum, Scirpus cyperinus, Dulichium arudinaceum; m Sphagnum
Open Bog 2b	ELC: BOS2 Shrub Kettle Bog Ecosite OWES: <i>open sphagnum-heath bog [Chamaedaphne-Vaccinium-Eriophorum] mat east of Redmond's Pond, south of boardwalk and mat west of pond</i>
Crawford 1926	shrub-sphagnum (pond edge to tall treed edge)
Judd 1957	(a-a) open floating bog
Waldron 1972	1C13: very wet closed evergreen heath, Chamaedaphne-Sphagnum-Vaccinium oxycoccus
Small 1977	(1) leatherleaf-cranberry heath, floating mat, very wet
Proctor & Redfern 1979	(Stn: 14, 15, 16) open bog (E)
Graham 1987 & Wu 1989	Chamaedaphne-Vaccinium-Eriophorum bog / GROUP A
McLeod 1989	B1: ts(Black Spruce-Tamarack) gc(Pitcher Plant) ne(grasses, sedges) re(Typha) ff(water lily) m(Sphagnum)
McLeod 1992	(3b) tall shrub bog
BioLogic 1999	5
Bergsma & Quinlan 2006	lsOB1 ts Larix laricina; ls Chamaedaphne calyculata, Vaccinium macrocarpon; gc Calopogon tuberosus, Pogonia ophioglossoides, Drosera rotundifolia; ne Rhynchospora alba, Eriophorum virginicum; m Sphagnum
Open Bog 2c	ELC: BOT2 Treed Kettle Bog Ecosite OWES: <i>open spruce-larch-sphagnum and heath treed bog [Picea-Larix-Sphagnum-Chamaedaphne-Vaccinium-Sarracenia-Eriophorum] mat east of pond, north of boardwalk</i>
Crawford 1926	Tamarack-Spruce zone (bog outer margin)
Judd 1957	low woods
Waldron 1972	very wet evergreen heath on peat
Small 1977	
Proctor & Redfern 1979	open treed bog
Graham 1987 & Wu 1989	Picea-Larix-Vaccinium / GROUP C (Picea-Kalmia-Poa palustris)
McLeod 1989	B2: c(Tamarack) ts(Highbush blueberry-Rhamnus frangula) gc(Mixed herbs) s(Sphagnum)
McLeod 1992	(3c) Treed Black Spruce -Tamarack bog
BioLogic 1999	2 and 7
Bergsma & Quinlan 2006	lsBT1 ts Larix laricina; ls Vaccinium macrocarpon, V. angustifolium, Rhamnus frangula; gc Drosera rotundifolia, Polygonum hydropiper; ne Carex disperma; m Sphagnum

Appendix E. Vegetation Community, Ecological Land Classification (ELC) and Ontario Wetland Evaluation System (OWES) Equivalents (read in conjunction with Map 10b) (continued)

Swamps 3a	ELC: SWC4 Tamarack - Black Spruce Organic Coniferous Swamp Ecosit OWES: <i>closed spruce-tamarack swamp [Picea-Larix-Vaccinium-Sphagnum] outer edge of bog mat</i>
Crawford 1926	
Judd 1957	
Waldron 1972	1A17a: wet, closed coniferous forest Picea-Larix-Vaccinium corymbosum-Chamaedaphne-Carex trisperma-Sphagnum)
Small 1977	(3) spruce-tamarack forest, very wet sphagnum mat
Proctor & Redfern 1979	(Stn: 11, 12, 13) treed bog (D)
Graham 1987 & Wu 1989	Limit of woods / bog margin / GROUP C
McLeod 1989	S1: c(Black Spruce-Tamarack) ts(Rhamnus franfula) ls(Cranberry) gc(Mixed herbs) m(Sphagnum)
McLeod 1992	(4c) Treed Black Spruce-Tamarack
BioLogic 1999	6 and 8
Bergsma & Quinlan 2006	cS1 c Picea mariana, Larix laricina; m Sphagnum
Swamps 3b	ELC: SWM5 Maple Organic Mixed Swamp Ecosite OWES: <i>closed organic mixed swamp [Pinus-Larix-Acer rubrum-Betula]</i>
Crawford 1926	closed low wet deciduous woods and swamp
Judd 1957	(b-b) outer border of lower, damp woods
Waldron 1972	wet, closed deciduous swamp forest
Small 1977	
Proctor & Redfern 1979	lowland
Graham 1987 & Wu 1989	Acer rubrum -Vaccinium / Group D
McLeod 1989	
McLeod 1992	(4d) Silver/Red Maple-White Birch-White Pine Mixed Swamp
BioLogic 1999	13
Bergsma & Quinlan 2006	mS1(conifer dominant) Pinus strobus, Larix laricina; h Betula papyrifera, Acer saccharinum, A. freemanii; ts R. frangula, Vaccinium corymbosum; ls R. frangula, A. saccharinum; gc Pilea pumia, Symplocarpus foetidus; ne Carex disperma, Carex sp.; m Sphagnum
Swamps 3c	ELC: SWD6 Maple Organic Deciduous Swamp Ecosite OWES: <i>closed organic deciduous swamp [Acer-Betula-Rhamnus]</i>
Crawford 1926	deciduous wood zone (originally bog/now non-bog)
Judd 1957	low woods
Waldron 1972	1A21: wet, closed deciduous swamp forest (Acer rubrum-Acer saccharinum-Betula papyrifera-Rhamnus frangula)
Small 1977	(4) maple-birch swamp forest, very wet muck
Proctor & Redfern 1979	(Stn: 7, 8, 9, 10) lowland (C)
Graham 1987 & Wu 1989	Acer rubrum-Vaccinium-Rhamnus / Group D
McLeod 1989	S3/S4/S5/S6: h(silver maple) ts (Silver Maple-Willow-Rhamnus frangula) ls-(Silver Maple) ne(grasses) gc(mixed herbs) ff(duckweed) m(Sphagnum)
McLeod 1992	(4e, 4f, 4g) Silver/Red Maple-White Birch-Bur Oak-Willow
BioLogic 1999	10 and 12
Bergsma & Quinlan 2006	chS(deciduous dominant) Acer saccharinum, A. freemanii, Betula papyrifera, Larix laricina, Pinus strobus; ts Rhamnus frangula; gc Pilea pumila, Galium palustre, Cystopteris fragilis; ne Carex trisperma; m Sphagnum

Appendix E. Vegetation Community, Ecological Land Classification (ELC) and Ontario Wetland Evaluation System (OWES) Equivalents (read in conjunction with Map 10b) (continued)

Swamps	ELC: SWT3	Organic Thicket Swamp Ecosite
3d	OWES: <i>tall shrub organic swamp thicket [Rhamnus-Salix]</i>	
Crawford 1926		bog margin to lagg zone
Judd 1957		low woods
Waldron 1972		1B22a: very wet closed deciduous scrub land (Willow-Buckthorn-Dogwood-Onoclea sensibilis-Carex crinita)
Small 1977		(2) willow-dogwood-buckthorn scrub on very wet muck soil
Proctor & Redfern 1979		lowland
Graham 1987 & Wu 1989		Salix-Rhamnus / GROUP D
McLeod 1989		S2: ts(Rhamnus frangula) ls(Silver Maple) ne(grasses) gc(Silver Maple) m(Sphagnum)
McLeod 1992		(4a, 4b) Glossy Buckthorn-Willow Tall shrub thicket swamp
BioLogic 1999		9 and 11
Bergsma & Quinlan 2006		tsS1 dc Pinus strobus; dh Acer saccharinum, Acer spicatum; ts Rhamnus frangula, ls Rhamnus frangula; gc Pilea pumila
Lagg	ELC: MAM3	Organic Meadow Marsh Ecosite
4	OWES: <i>Organic Graminoid Meadow Marsh</i>	
Crawford 1926		
Judd 1957		
Waldron 1972		
Small 1977		
Proctor & Redfern 1979		
Graham 1987 & Wu 1989		
McLeod 1989		
McLeod 1992		
BioLogic 1999		4
Bergsma & Quinlan 2006		gcM1 h Acer saccharinum; gc Asclepias incarnata, Polygonum hydropiper; ne Carex lacustris, Juncus effusus, Scirpus cyperinus, Glyceria striata;
Terrestrial	ELC: FOD1	Dry - Fresh Oak Deciduous Forest Ecosite
5	OWES: <i>Dry - Fresh Oak Deciduous Forest</i>	
Crawford 1926		
Judd 1957		(c-c) outer border of open wooded slopes
Waldron 1972		1A21ab: mesic closed deciduous forest (Quercus-Prunus-Fraxinus americana-Ulmus americana-Lonicera-Ostrya virginiana)
Small 1977		(5,6) oak-cherry forest, dry-mesic loam
Proctor & Redfern 1979		(Stn: 4, 5, 6) wooded slope (B)
Graham 1987 & Wu 1989		
McLeod 1989		
McLeod 1992		(5a, 5b, 5c) mesic slope deciduous forest, red/white oak-black cherry-sugar maple
BioLogic 1999		
Bergsma & Quinlan 2006		

Appendix E. Vegetation Community, Ecological Land Classification (ELC) and Ontario Wetland Evaluation System (OWES) Equivalents (read in conjunction with Map 10b) (continued)

Terrestrial	ELC: CUW1	Mineral Cultural Woodland Ecosite
6a	OWES: <i>Mineral Cultural Woodland [Crataegus-Rhamnus-Lonicera-Populus]</i>	
Crawford 1926		
Judd 1957		
Waldron 1972		
Small 1977		
Proctor & Redfern 1979		
Graham 1987 & Wu 1989		
McLeod 1989		
McLeod 1992	(5d) mesic to dry mesic early successional slope hawthorn-buckthorn-grey dogwood-tartarian honeysuckle	
BioLogic 1999		
Bergsma & Quinlan 2006		
Terrestrial	ELC: CUT1	Mineral Cultural Thicket Ecosite
6b	OWES: <i>Mineral Cultural Thicket [Rhus-Crataegus-Cornus-Rhamnus]</i>	
Crawford 1926		
Judd 1957		
Waldron 1972		
Small 1977		
Proctor & Redfern 1979		
Graham 1987 & Wu 1989		
McLeod 1989		
McLeod 1992	(6) dry mesic slope thicket staghorn sumac-hawthorn-grey dogwood-buckthorn	
BioLogic 1999		
Bergsma & Quinlan 2006		
Terrestrial	ELC: CUM1	Mineral Cultural Meadow Ecosite
6c	OWES: <i>Mineral Cultural Meadow</i>	
Crawford 1926		
Judd 1957		
Waldron 1972		
Small 1977		
Proctor & Redfern 1979	(Stn: 1, 2, 3) open field (A)	
Graham 1987 & Wu 1989		
McLeod 1989		
McLeod 1992	(7) dry mesic forb/graminoid old field	
BioLogic 1999		
Bergsma & Quinlan 2006		

Appendix E. Vegetation Community, Ecological Land Classification (ELC) and Ontario Wetland Evaluation System (OWES) Equivalents (read in conjunction with Map 10b) (continued)

Terrestrial	ELC: TPS1 Dry Tallgrass Savannah Ecosite
7	OWES: <i>Dry Tallgrass Savannah [Schizachyrium scoparium, Andropogon gerardii]</i>

Crawford 1926

Judd 1957

Waldron 1972

Small 1977

Proctor & Redfern 1979

Graham 1987 & Wu 1989

McLeod 1989

McLeod 1992

(8) abandoned sand and gravel pit Big Bluestem

BioLogic 1999

Bergsma & Quinlan 2006

Appendix F1. Plant Species Observed by Six or More Authors (Frequency of Authors by Plants Observed)

No. of Authors	Form	Latin Name	Common Name	True Bog Species
11	Aquatic Plant	<i>Nuphar advena</i>	Yellow Pond-lily	
	Forb	<i>Sarracenia purpurea</i>	Northern Pitcher Plant	+
	Shrub	<i>Chamaedaphne calyculata</i>	Leatherleaf	+
	Tree	<i>Larix laricina</i>	Tamarack	
	Tree	<i>Picea mariana</i>	Black Spruce	+
10	Forb	<i>Drosera rotundifolia</i>	Roundleaf Sundew	+
	Graminoid	<i>Typha latifolia</i>	Broad-leaf Cattail	
	Shrub	<i>Rhamnus frangula</i>	Glossy Buckthorn	
	Shrub	<i>Vaccinium corymbosum</i>	Highbush Blueberry	
	Shrub	<i>Vaccinium oxycoccos</i>	Small Cranberry	+
	Tree	<i>Betula papyrifera</i>	White Birch	
	Tree	<i>Pinus strobus</i>	White Pine	
9	Forb	<i>Arethusa bulbosa</i>	Swamp-pink	
	Forb	<i>Iris versicolor</i>	Blueflag	
	Forb	<i>Pogonia ophioglossoides</i>	Rose Pogonia	
	Shrub	<i>Gaylussacia baccata</i>	Black Huckleberry	
	Shrub	<i>Kalmia polifolia</i>	Pale Laurel	+
	Tree	<i>Acer saccharinum</i>	Silver Maple	
8	Fern or Fern Ally	<i>Onoclea sensibilis</i>	Sensitive Fern	
	Graminoid	<i>Eriophorum virginicum</i>	Tawny Cotton-grass	+
	Tree	<i>Prunus serotina</i>	Black Cherry	
7	Fern or Fern Ally	<i>Dryopteris carthusiana</i>	Spinulose Wood Fern	
	Forb	<i>Calopogon tuberosus</i>	Tuberous Grass-pink	
	Shrub	<i>Andromeda polifolia</i> ssp. <i>glaucophylla</i>	Bog Rosemary	+
	Shrub	<i>Rhamnus cathartica</i>	European Buckthorn	
	Shrub	<i>Vaccinium macrocarpon</i>	Large Cranberry	+
	Tree	<i>Acer rubrum</i>	Red Maple	
	Tree	<i>Quercus rubra</i>	Red Oak	
	Tree	<i>Ulmus americana</i>	American Elm	
6	Aquatic Plant	<i>Lemna minor</i>	Lesser Duckweed	
	Forb	<i>Alliaria petiolata</i>	Garlic Mustard	
	Graminoid	<i>Carex trisperma</i> var. <i>trisperma</i>	Three-fruited Sedge	
	Graminoid	<i>Dulichium arundinaceum</i>	Three-way Sedge	
	Graminoid	<i>Juncus canadensis</i>	Canada Rush	
	Graminoid	<i>Rhynchospora alba</i>	White Beakrush	+
	Shrub	<i>Cornus stolonifera</i>	Red-osier Dogwood	
	Shrub	<i>Prunus virginiana</i>	Choke Cherry	
	Tree	<i>Populus tremuloides</i>	Trembling Aspen	
	Tree	<i>Quercus alba</i>	White Oak	
	Tree	<i>Quercus macrocarpa</i>	Bur Oak	

Appendix F2. Floral Regional Indicators

Form	Latin Name	Common Name	Bog	Canadian Shield	Atlantic Coastal Plain
Tree	<i>Acer spicatum</i>	Mountain Maple		+	
	<i>Picea mariana</i>	Black Spruce	+	+	
Shrub	<i>Andromeda polifolia</i> ssp. <i>glaucophylla</i>	Bog Rosemary	+	+	
	<i>Chamaedaphne calyculata</i>	Leatherleaf	+	+	
	<i>Cornus canadensis</i>	Bunchberry		+	
	<i>Kalmia polifolia</i>	Pale Laurel	+	+	
	<i>Ledum groenlandicum</i>	Labrador Tea	+	+	
	<i>Mitchella repens</i>	Partridge-berry		+	
	<i>Ribes rubrum</i>	Northern Red Currant		+	
	<i>Rubus flagellaris</i>	Northern Dewberry		+	
	<i>Vaccinium macrocarpon</i>	Large Cranberry	+	+	
	<i>Vaccinium myrtilloides</i>	Velvetleaf Blueberry	+	+	
	<i>Vaccinium oxycoccos</i>	Small Cranberry	+	+	
<i>Viburnum cassinoides</i>	Northern Wild-raisin		+		
Forb	<i>Clintonia borealis</i>	Clinton Lily		+	
	<i>Drosera intermedia</i>	Spoon-leaved Sundew	+	+	
	<i>Drosera rotundifolia</i>	Roundleaf Sundew	+	+	
	<i>Galium boreale</i>	Northern Bedstraw		+	
	<i>Hypericum mutilum</i> ssp. <i>boreale</i>	Northern St. John's-wort		+	
	<i>Menyanthes trifoliata</i>	Bog Buckbean	+	+	
	<i>Platanthera hyperborea</i>	Leafy Northern Green Orchid		+	
	<i>Platanthera lacera</i>	Green-fringed Orchid		+	
	<i>Sarracenia purpurea</i>	Northern Pitcher Plant	+	+	
	<i>Triadenum fraseria</i>	Marsh St. John's-wort		+	+
	<i>Trientalis borealis</i> ssp. <i>borealis</i>	Star-flower		+	
<i>Viola macloskeyi</i> ssp. <i>pallens</i>	Northern White Violot		+		
Fern or Fern Ally	<i>Lycopodiella inundata</i>	Northern Bog Club-moss		+	
	<i>Lycopodium dendroideum</i>	Prickly Tree Club-moss		+	
	<i>Lycopodium obscurum</i>	Ground-pine		+	
Graminoid	<i>Carex canescens</i> ssp. <i>canescens</i>	Gray Bog Sedge	+	+	
	<i>Carex magellanica</i> ssp. <i>irrigua</i>	Bog Sedge	+	+	
	<i>Eriophorum callitrix</i>	Sheathed Cotton-grass	+	+	
	<i>Eriophorum gracile</i>	Slender Cotton-grass	+	+	
	<i>Eriophorum tenellum</i>	Rough Cotton-grass	+	+	
	<i>Eriophorum virginicum</i>	Tawny Cotton-grass	+	+	
Aquatic Plant	<i>Rhynchospora alba</i>	White Beaked-rush	+	+	
	<i>Brasenia schreberia</i>	Water-shield		+	+
	<i>Wolffia borealis</i>	Dotted Watermeal		+	
TOTAL			10	38	2

Appendix G. Records of *Sphagnum* Moss Species

	Judd's Zones	BioLogic Plots
A	Floating mat	1, 2, 3, 4, 5, 7
B	Low damp woods	Inner limits – 6, 8, 13 Outer limits – 9, 10, 11, 12
C	Wooded slopes	?
D	Redmond's Pond	?

BioLogic Plot	Judd's record of <i>Sphagnum</i> 1969	BioLogic's record of <i>Sphagnum</i> 2001
1	f, m	ca, co, fu, m, re
4	f, s, ce	ca, cu, fu, m, re
3	f	ca, ce, co, cu, m, re
5	m, re	ca, cu, fu, m
2	ca, m	ca, ce
6	m, re	re, f, ce
7	t, m, re	ca, ce, cu, f, fu, m, re
8	f, ca	ca, ce, f, m, re
13	ca, m, re	ca, f
9	ca, m	none
10	f	none
11	ca, m	none
12	f	ce, f

ca - <i>Sphagnum capillifolium</i>	fu - <i>S. fuscum</i>
ce - <i>S. centrale</i>	m - <i>S. magellanicum</i>
co - <i>S. compactum</i>	re - <i>S. recurvum</i>
cu - <i>S. cuspidatum</i>	s - <i>S. subsecundum</i>
f - <i>S. fimbriatum</i>	t - <i>S. teres</i>

Appendix H1. Bird Observations (BioLogic, 1999)

Species	Number of Observations	Species	Number of Observations
Fixed Point Count		Random Surveys	
Canada Goose	7	Mallard	11
Great Crested Flycatcher	2	Turkey Vulture	2
Barn Swallow	1	Common Snipe	1
Blue Jay	16	Great Horned Owl	1
American Crow	33	Belted Kingfisher	1
Black-capped Chickadee	28	Northern Flicker	3
House Wren	12	Great Crested Flycatcher	1
American Robin	23	Golden-crowned Kinglet	4
Gray Catbird	14	Wood Thrush	1
Cedar Waxwing	13	Yellow Warbler	2
European Starling	34	Chestnut-sided Warbler	1
Common Yellowthroat	6	Common Yellowthroat	3
Northern Cardinal	45	Eastern Towhee	1
Rose-breasted Grosbeak	8	Field Sparrow	1
Song Sparrow	23	Green Heron	2
Swamp Sparrow	7	Mourning Dove	1
Red-winged Blackbird	3	Downy Woodpecker	7
Common Grackle	34	Northern Flicker	8
Brown-headed Cowbird	6	Cliff Swallow	2
Baltimore Oriole	1	Red-eyed Vireo	2
House Finch	10	Black-and-white Warbler	1
American Goldfinch	25	American Redstart	1
Other Animals		Indigo Bunting	6
Painted Turtle	36		
Eastern Chipmunk	2		
Tiger Swallowtail	1		

Notes:

1. June 4th, 1999, 1000h to 1100h. Weather: no wind, mostly clear, 15°C to 20°C.
2. Location: bog and swamp.

Appendix H2. Incidental Wildlife Sightings, 2006 - 2007

	Bog Area	Other Parts of the ESA	Other birders (1)
Birds	American Goldfinch	American Robin	Cooper's Hawk
	American Robin	Black-capped Chickadee	Dark-eyed Junco
	Black-capped Chickadee	Blue Jay	Eastern Phoebe
	Blue Jay	Brown Creeper	Hairy Woodpecker
	Canada Goose	Cedar Waxwing	Herring Gull
	Common Grackle	Common Crow	House Finch
	Northern Cardinal	Common Grackle	House Sparrow
	Red-breasted Nuthatch	Great Horned Owl	
	Red-tailed Hawk	Mallard	Mourning Dove
	Red-winged Blackbird	Northern Cardinal	
	Song Sparrow	Northern Flicker	Turkey Vulture
		Red-tailed Hawk.	
		Red-winged Blackbird	
		Ruby-throated Hummingbird	
Insects	Red-spotted Purple	Cricket species	
	Bumble Bee	European Skipper	
	European Skipper	Cabbage White Sulphur	
	several damselfly species	Viceroy	
	several dragonfly species	Wood Satyr	
	Yellow Jacket		
Herpeto-fauna	Garter Snake	American Toad	
	Gray Tree Frog		
	Green Frog		
	Painted Turtle		
	Spring Peeper		
Mammals	Gray Squirrel	Gray Squirrel	
	White-tailed Deer		
	Meadow Vole (dead)		
Fish	Goldfish		

Notes:

1. The animals were observed during visits to the Sifton Bog ESA in 2006-2007 by UTRCA and City of London staff.
2. Other birders: Bruce de Boer, 2007 (LAC member)

Appendix I. Basal Area Analysis: Stand 1 of 3

FOREST STAND ANALYSIS FOR HARVEST OR INTERMEDIATE CUTTING																											
Ownership	Sifton Bog, City of London					Stand #	1	Stand Area																			
Address																											
Lot	Conc.	County					Date	8-Feb-07																			
Township	Phone					Fax																					
Email	Timber Cruisers					BG CQ																					
Stand Composition	Mh6 Aw2 Or1 Cb1																										
PRISM TALLY: 2 m ² /ha																											
STATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	28	29	30	31	32	33	34	35	36	37	38	39	40														
2																											
STAND ANALYSIS TALLY (by Species, Size Class, and Quality Class)																											
TREE SIZE CLASSES (dbh)	Polewood 10-24 cm		Sawtimber								TOTAL ALL																
	AGS	UGS	SMALL 26-36 cm		MEDIUM 38-48 cm		LARGE 50-60 cm		X-LARGE >62 cm		AGS	UGS															
SPECIES	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS													
Red Oak									3				3	0													
Sugar Maple	5	1	6		6		1						18	1													
Silver Maple								1					0	1													
White Ash		2	2	1									2	3													
Bitternut Hickory						1							0	1													
Black Cherry				2		1							0	3													
White Oak								1					0	1													
TOTAL TREES	5	3	8	3	6	2	4	2	0	0	23	10															
BA (m ² /ha) quality class	5.0	3.0	8.0	3.0	6.0	2.0	4.0	2.0	0.0	0.0	23.0	10.0															
BA (m ² /ha) Total	8.0		11.0		8.0		6.0		0.0		33.0																
Target BA (m ² /ha)																											
Ideal BA (m ² /ha) for sawlog	4		5		5		4		2		20																
Ideal BA (m ² /ha) for old growth																											
Total Trees	33	X	BAF (2)		66		33.0		Actual BA/ha																		
	# of stations (plots)		2																								

See Map 8 for locations

BA = Basal Area

AGS = Acceptable Growing Stalk (alive in 10 yrs)

UGS = Unacceptable Growing Stalk (probably won't be alive in 10 yrs)

Appendix I. Basal Area Analysis (continued): Stand 2 of 3

FOREST STAND ANALYSIS FOR HARVEST OR INTERMEDIATE CUTTING																											
Ownership	Sifton Bog, City of London							Stand #	2		Stand Area																
Address																											
Lot		Conc.		County				Date	8-Feb-07																		
Township								Phone			Fax																
Email								Timber Cruisers	BG CQ																		
Stand Composition	Cb3 Aw2 Ew2 Mh2 Wb&Ms1																										
PRISM TALLY: 2m ² /ha																											
STATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	28	29	30	31	32	33	34	35	36	37	38	39	40														
2																											
STAND ANALYSIS TALLY (by Species, Size Class, and Quality Class)																											
TREE SIZE CLASSES (dbh)	Polewood 10-24 cm		Sawtimber								TOTAL ALL																
	AGS	UGS	SMALL 26-36 cm		MEDIUM 38-48 cm		LARGE 50-60 cm		X-LARGE >62 cm		AGS	UGS															
SPECIES	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS															
Ironwood	1										1	0															
Black Cherry			3	2		1					3	3															
White Elm			1	3		1					1	4															
Black Walnut							1				1	0															
White Ash	1	2	1			1					2	3															
Silver Maple								1			0	1															
Hackberry	1										1	0															
Sugar Maple	3		1								4	0															
Cottonwood									1		1	0															
TOTAL TREES	6	2	6	5	0	3	1	1	1	0	14	11															
BA (m ² /ha) quality class	6.0	2.0	6.0	5.0	0.0	3.0	1.0	1.0	1.0	0.0	14.0	11.0															
BA (m ² /ha) Total	8.0		11.0		3.0		2.0		1.0		25.0																
Target BA (m ² /ha)																											
Ideal BA (m ² /ha) for sawlog	4		5		5		4		2		20																
Ideal BA (m ² /ha) for old growth																											
Total Trees	25	X	BAF (2)	50			25.0	Actual BA/ha																			
	# of stations (plots)		2																								

See Map 8 for locations

BA = Basal Area

AGS = Acceptable Growing Stalk (alive in 10 yrs)

UGS = Unacceptable Growing Stalk (probably won't be alive in 10 yrs)

Appendix I. Basal Area Analysis (continued): Stand 3 of 3

FOREST STAND ANALYSIS FOR HARVEST OR INTERMEDIATE CUTTING																											
Ownership	Sifton Bog, City of London					Stand #	3	Stand Area																			
Address																											
Lot	Conc.	County					Date	8-Feb-07																			
Township	Phone					Fax																					
Email	Timber Cruisers					BG CQ																					
Stand Composition	Or4 Ow2.5 Cb1.5 Ms1.5																										
PRISM TALLY: 2m ² /ha																											
STATIONS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
	28	29	30	31	32	33	34	35	36	37	38	39	40														
2																											
STAND ANALYSIS TALLY (by Species, Size Class, and Quality Class)																											
TREE SIZE CLASSES (dbh)	Polewood 10-24 cm		Sawtimber								TOTAL ALL																
	AGS	UGS	SMALL 26-36 cm		MEDIUM 38-48 cm		LARGE 50-60 cm		X-LARGE 62+ cm		AGS	UGS															
SPECIES	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS	AGS	UGS													
Basswood			1										1	0													
Black Cherry	1			2		1	1						2	3													
Silver Maple			2		2		1	1					5	1													
Sugar Maple				1									0	1													
Red Oak					1		10	1	3				14	1													
White Oak			1	1	7			1					8	2													
TOTAL TREES	1	0	4	4	10	1	12	3	3	0	30	8															
BA (m²/ha) quality class	1.0	0.0	4.0	4.0	10.0	1.0	12.0	3.0	3.0	0.0	30.0	8.0															
BA (m²/ha) Total	1.0		8.0		11.0		15.0		3.0		38.0																
Target BA (m²/ha)																											
Ideal BA (m²/ha) for sawlog	4		5		5		4		2		20																
Ideal BA (m²/ha) for old growth																											
Total Trees	38	X	BAF (2)		76		38.0		Actual BA/ha																		
	# of stations (plots)		2																								

See Map 8 for locations

BA = Basal Area

AGS = Acceptable Growing Stalk (alive in 10 yrs)

UGS = Unacceptable Growing Stalk (probably won't be alive in 10 yrs)

Appendix J. “The Sustainable Management of an Urban Wetland: Can Urban Development and Wetlands Co-Exist?” (Nicks, Bergsma and Briggs, 2003)

Paper presented at June 2003 Conference of the Canadian Water Resources Association “Water Stewardship: How are we Doing?”

The Sustainable Management of an Urban Wetland: Can Urban Development and Wetlands Co-Exist?

Linda P. Nicks¹, Bonnie Bergsma² and Ted Briggs¹

Abstract

Sifton Bog is a Class 2, Provincially Significant wetland located in London, Ontario. A series of groundwater monitoring wells was installed around the wetland in the summer of 1990 and the water quality and levels have been documented on a regular basis. The bog is recharged primarily by rainwater with a small groundwater recharge component. Since the installation of the monitoring wells, development has occurred around the bog. A trend towards decreasing water table elevations has been observed since 1990. Is this trend associated with urbanization? What are the long-term implications of a decreasing water table in an urban wetland?

Location

Sifton Bog is a Class 2, Provincially Significant wetland located in London, Ontario, a municipality of 340,000 people. The 53-hectare wetland is the most southerly large bog in Canada and is owned by the Upper Thames River Conservation Authority (28 ha) and private landowners. The Bog is jointly managed by the Upper Thames River Conservation Authority and the City of London.

The Upper Thames River Conservation Authority manages the upper watershed of the Thames River, an area of 3,432 square kilometres in southwestern Ontario and home to 422,300 people. In August 2000, the Thames River was designated a Canadian Heritage River. The two Conservation Authorities on the Thames River are working with many stewardship groups to conserve and revitalize the river's many natural, cultural and recreational values in an area of Canada that is subject to intense urban and agricultural pressures.

The Bog is located near the Thames River as shown in Figure 1. Since 1957, Sifton Bog has been identified in official plans as an open space area that should be left

in its natural state (Judd, 1967). The wetland complex consists of an open pond (Redmond's Pond), bog and fen vegetation communities surrounded by a mixed deciduous coniferous swamp, upland deciduous forest and a variety of anthropogenic communities. The Bog is isolated from other natural areas by agriculture on the east (site of proposed residential/commercial development), residential development to the west and south, and a major street (Oxford Street) and commercial area to the north as shown in Figure 1.

Background

Sifton Bog is one of several distinctive kettle depressions that transect London in a northwest-southeast direction (Dreimanis *et al.*, 1998). The kettle lake peatland that was found at Redmond's farm in the 1800s represents a relict landscape and disjunct biotype. The Bog has attracted the attention of geologists, ecologists and naturalists since its discovery.

Sifton Bog has been exposed to development pressures since the time of European settlement 150 years ago, and has proven to be resistant to deleterious impacts to the water balance and peat accumulation. The bog

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Appendix J. "The Sustainable Management of an Urban Wetland: Can Urban Development and Wetlands Co-Exist?" (Nicks, Bergsma and Briggs, 2003) (continued)

was first described in 1899 as "occupying a low spot bordered by higher hills to the north and the east and isolated from the Thames River to the south" (Judd, 1957). There have been many attempts to derive some commercial benefit from the Bog's natural resources. In 1902, in an attempt to drain the Bog for growing celery, the Kirk Drain was installed from Redmond's Pond to the Thames River as shown in Figure 1. Records indicate that the drain consisted of a series of clay tiles installed about 3 metres below ground and that it failed and was abandoned. The drain, as shown in Figure 1, can be observed as a line traversing the bog from the northeast to the southwest. Attempts were also made to harvest the peat for fuel and to sell the black spruce for Christmas trees. The abundant growth of alder-buckthorn was harvested for use

as a component of fuse powder during the Second World War. Abundant growth of buckthorn remain as evidence of the futility of these ventures (Judd, undated and Judd, 1968).

The Bog was surrounded by agricultural fields until 1959 when the first of several developments occurred along the western edge. The first subdivision was developed in the early 1960s by Sifton Properties along the western edge of the Bog (Judd, 1967). At that time there was little interest in and no requirements regarding the environmental impact of development adjacent to the wetland. The delivery of water into the Bog was identified as a concern and the development was designed to convey rear yard surface water and rooftop water from lots

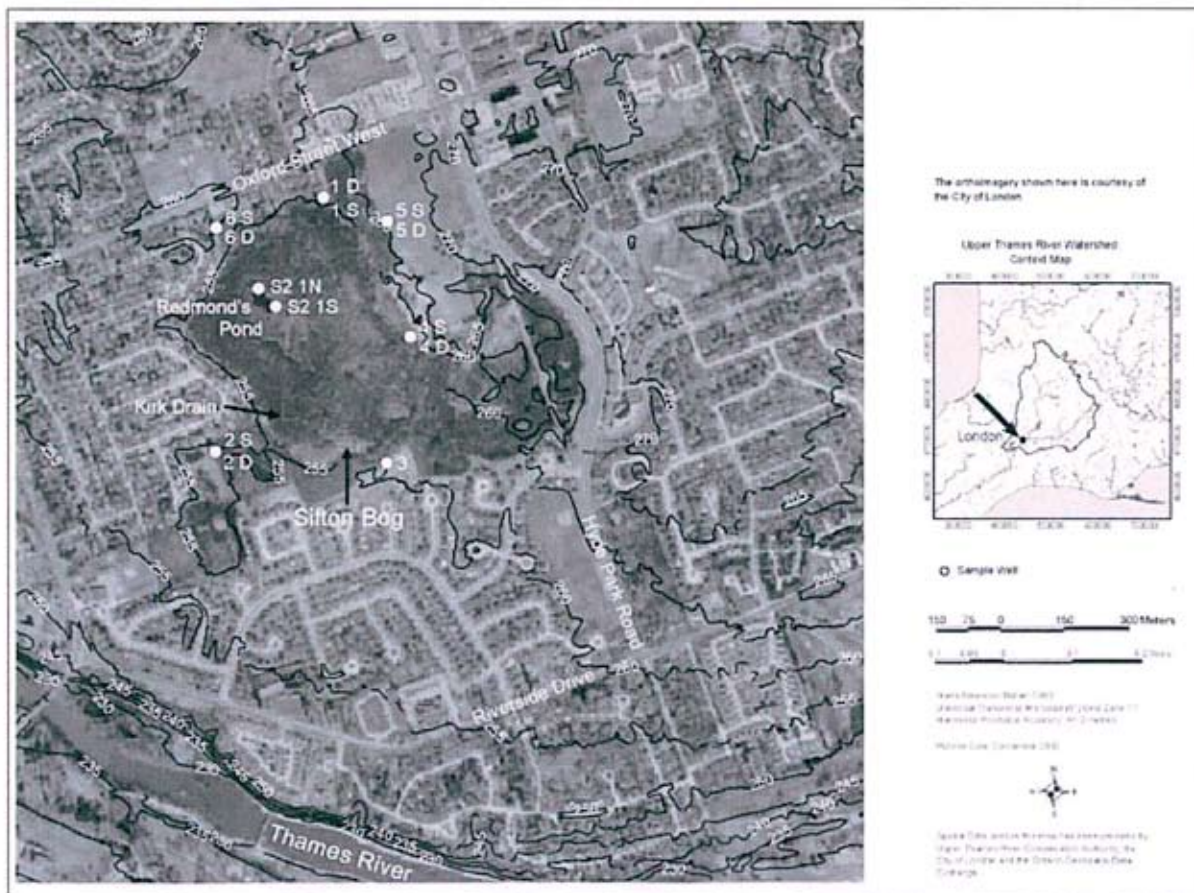


Figure 1. Upper Thames River Watershed, Sifton Bog, London Ontario.

Appendix J. "The Sustainable Management of an Urban Wetland: Can Urban Development and Wetlands Co-Exist?" (Nicks, Bergsma and Briggs, 2003) (continued)

bordering the wetland into the Bog. Road water and drainage from the front yards were collected in a storm sewer. During installation of water and sewer services for this subdivision, the Kirk Drain was opened and connected to the storm drainage system. Flow measurements in the drain were measured at a steady rate of 4 L/s. There was concern that the Kirk Drain might drain the Bog and the drain was subsequently blocked to prevent dewatering of the Bog. Development was also under way north of the bog and north of Oxford Street. In 1987, land clearing and grading began for a subdivision between Riverside Drive and the Bog's south border. The land east of the bog is presently agricultural lands and has been tenant farmed since the mid-1980s and, with the exception of two years, has been in corn production. These lands are currently under review for residential and commercial development.

Other documented historical impacts, both natural and human influenced, include burning of the wetland forest (1886), ice storms (1968), sand and gravel extraction on adjacent lands, agricultural cropping (corn, wheat and oats), road and utility infrastructure, and trampling of the floating bog mat by an increasing deer population and by increased user access to Redmond's Pond along a boardwalk (1974). Despite these disturbances, Sifton Bog has persisted.

Study Area

The physical attributes of Sifton Bog are defined by the climate, water balance, hydrological and hydrogeologic catchment of the Bog, and the private and public lands adjacent to the Bog. A positive water balance (precipitation + water inflow > evapotranspiration + runoff) and a year-round humid environment are essential for peatland development and survival (Mitsch, 1993). In addition, peat production must exceed decomposition (Mitsch, 1993). The London area receives approximately 960 mm/year of precipitation (Golder Associates, 1991) and evaporation of 500–600 mm/yr, and enjoys a temperate climate due to its proximity to the Great Lakes. The hydrological or surface water catchment area of the study area is defined by the watershed divide surrounding Redmond's Pond and occupies approximately 44 hectares.

The wetland complex is located in an isolated glacial depression (kettle) on an outwash deltaic deposit of sand and gravel. Sifton Bog is located at the northern edge of the deciduous Carolinian Life Zone, but is a community type usually found much further north in the coniferous boreal forests of Canada. The Bog exhibits characteristics of a raised boreal peat dome (*Sphagnum* bog), a lagg zone surrounding the bog, a mounded water table, low nutrients and pH, presence of black spruce, ericaceous shrubs (e.g., heathers) and sphagnum mosses. Bogs are a soft living carpet of sphagnum floating on a sponge-like mass of dead sphagnum fragments that hold great volumes of water. Since bogs derive most of their water from precipitation and surface runoff, a change in the climate or decrease in the surface water runoff component could have serious implications to the long-term survival of the bog.

Over the past 40 years, there have been varying site-specific investigations of the Bog (Upper Thames River Conservation Authority, 1992). However, very little is understood about the inter-relationships of the hydrology, hydrogeology, chemistry, and climate and how they affect the Bog.

Hydrogeology

Methodology: A series of 11 monitoring wells and piezometers was installed at six locations in and around Sifton Bog in August 1990 as shown in Figure 1. Water levels in the monitoring wells, piezometers and Redmond's Pond were measured at approximately monthly intervals from September 1990 to August 1991 and less regularly after this time. Water was collected and analyzed for basic chemistry in a varying nature over time. The frequency of water level measurements and chemistry decreased over time but varies from approximately six times a year to a few times a year to the present, except for the time period of June 1995 to June 1998 for which there are no data.

Water Level: The water level data from monitoring wells and Redmond's Pond are shown in Figure 2. Again, only the shallow wells are displayed. Redmond's Pond (S21N) has the highest water

Appendix J. "The Sustainable Management of an Urban Wetland: Can Urban Development and Wetlands Co-Exist?" (Nicks, Bergsma and Briggs, 2003) (continued)

elevation, while monitoring well SG2S has the lowest elevation of the shallow wells. All water levels have been decreasing since September 1990. Monitoring well SG2S is notable because the rate of decrease is much less than that of the other wells. The rate of decrease in elevation of the water levels at Redmond's Pond (S21N) is less than that of the other monitoring wells (SG1S, SG3S, SG5S and SG6S). There was no monitoring during 1995-1998.

Water Chemistry: The water chemistry or nutrient sources are also an important aspect of bog health. Only three monitoring wells and Redmond's Pond are included to simplify the diagram as shown in Figure 3. The pH of the monitoring wells does not vary much over time. The soil and overburden is carbonate rich and quickly neutralizes the groundwater. However, over the monitoring time the Bog's pH has increased and has varied more since 1998, when monitoring was resumed.

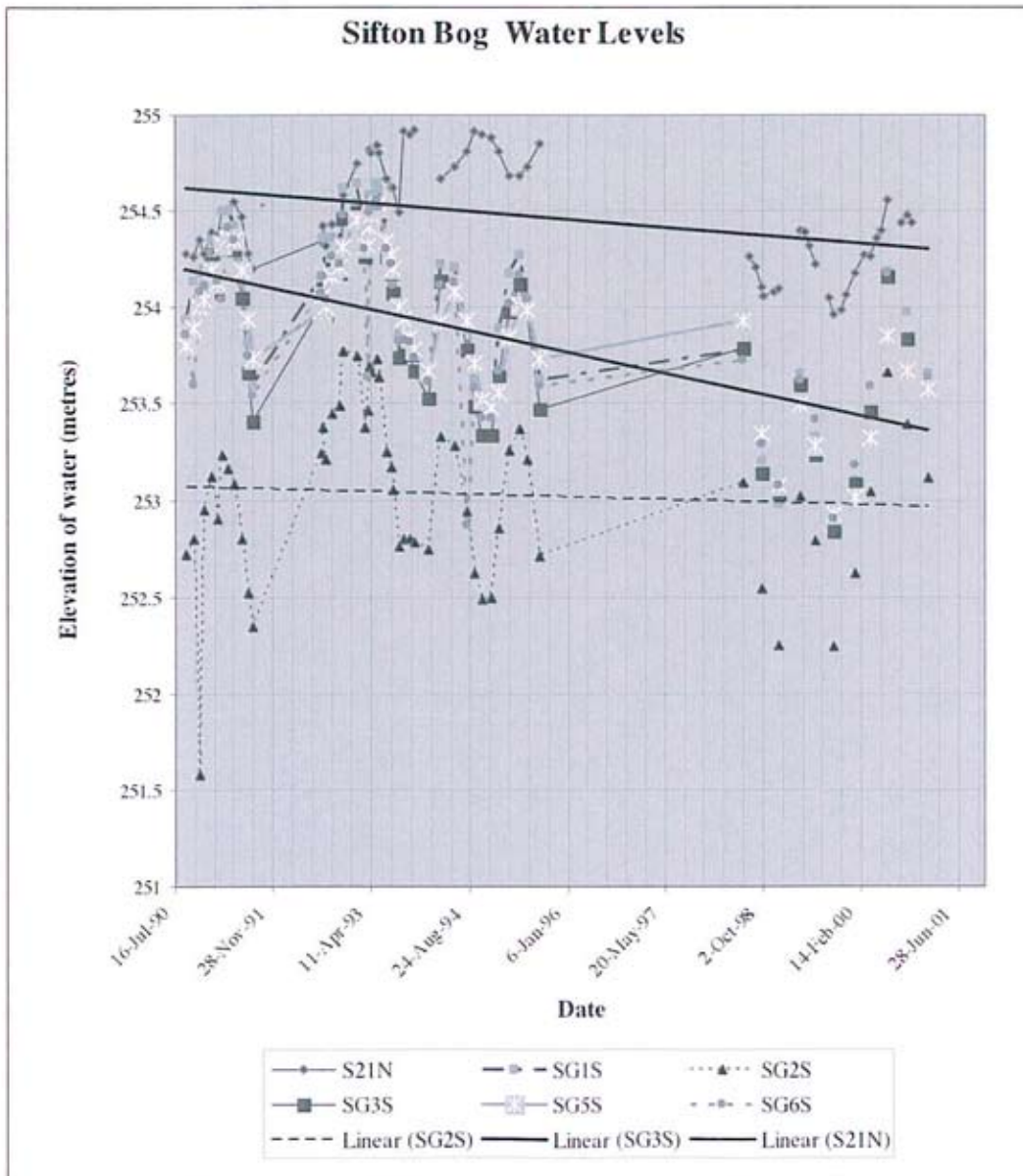


Figure 2. Graph of Water Levels in the Shallow Wells Around the Bog and Redmond's Pond (S21N). Trend lines were added for Wells SG2S, SG3S, and Redmond's Pond (S21N).

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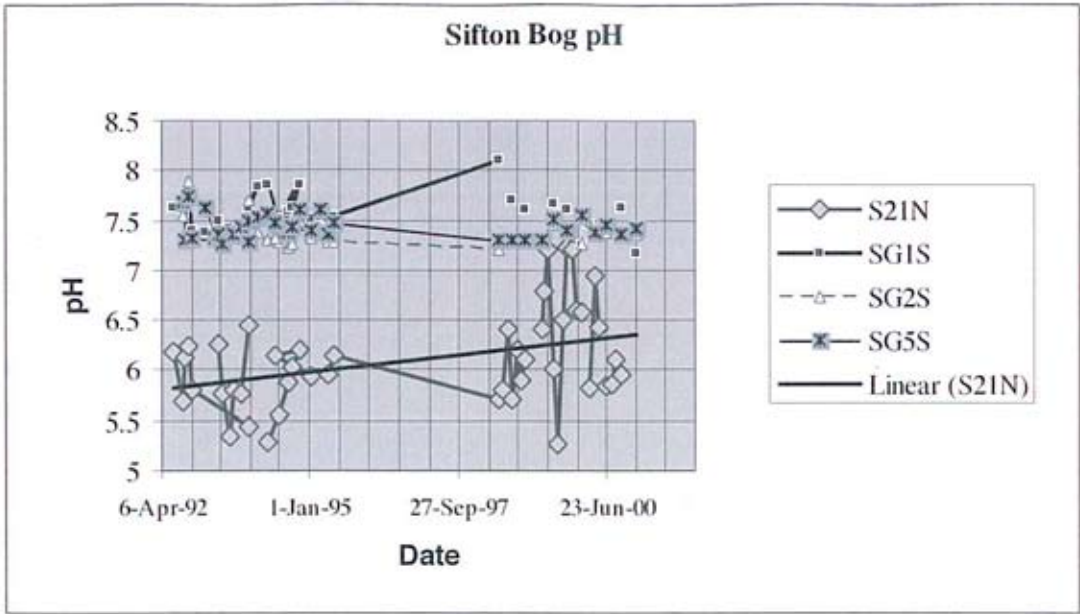


Figure 3. Sifton Bog pH versus Time. A trend line through the north sampling location at Redmond's Pond (S21N) shows that there is an increasing trend in pH.

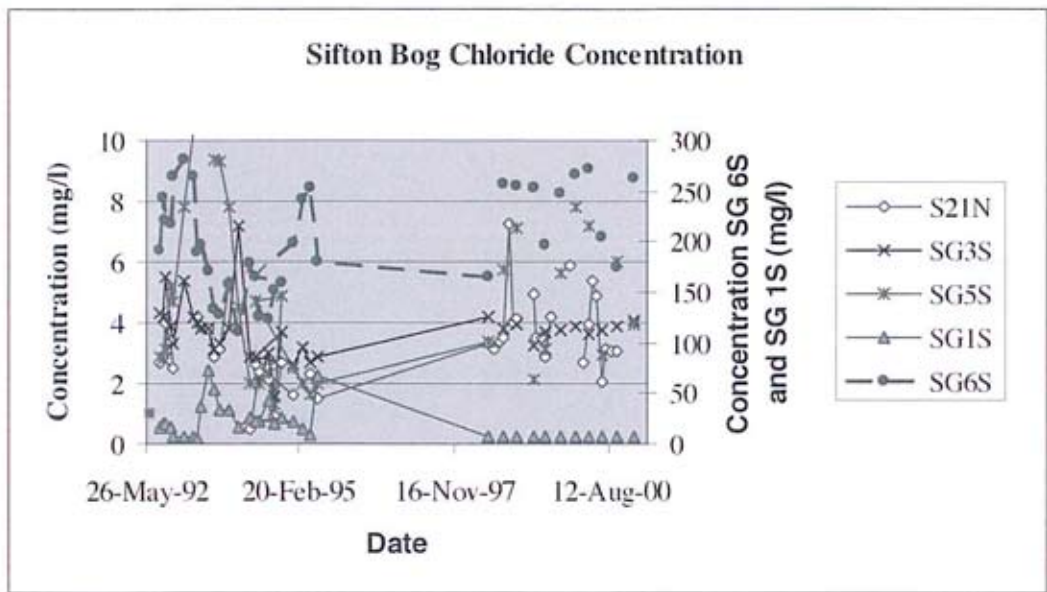


Figure 4. Sifton Bog Chloride Concentration versus Time. The concentration from monitoring well SG6S is much higher than the other wells and the north station of Redmond's Pond (S21N) and is shown on the second Y axis.

Nicks, Bergsma and Briggs

Appendix J. “The Sustainable Management of an Urban Wetland: Can Urban Development and Wetlands Co-Exist?” (Nicks, Bergsma and Briggs, 2003) (continued)

Storm water runoff also supplies an important recharge component for the Bog. Road salt (primarily sodium chloride) is applied to sidewalks and roads in the area and infiltrates the Sifton Bog as shown in Figure 4 which illustrates the chloride concentration variations over time. Well SG6S is located adjacent to a paved church parking lot and probably receives additional runoff from the lot. Well SG1S has elevated levels of chloride but the levels decreased significantly between 1995 and 1998 when sampling resumed. The current levels of chloride in Redmond’s Pond (S21N) are still low but there is a slight increasing trend. The highest levels of chloride occur in the summer months when evaporation rates are highest and the brine is concentrated.

Summary

In the future, runoff inputs from Oxford Street may be altered when the road is widened. Surface water inputs into the Bog from a section of Oxford Street have proved to be contributing to increased chloride levels due to road salt and so it has been suggested that these waters be routed to storm sewers instead. Runoff from the street and from the adjacent agricultural tile drains on the fields is necessary to maintain water balance. Eventually, development will surround the entire perimeter of the Bog. If the Bog’s water levels continue to decline, the consolidation of the peat mounds and the spread of black spruce and tamarack may continue to fill in Redmond’s Pond in an accelerated bog succession.

Sifton Bog has historically tolerated urban encroachment over the past century. Can the Bog survive with less water or more? Can the Bog ecology sustain the level of contamination? If water quality continues to decline and pH increase, the competitive advantage of the specialized Bog vegetation will be replaced by other species such as cattail and three-way sedge.

Urbanization and the associated multitude of impermeable surfaces such as roads, rooftops, storm sewers, and decreased natural areas create large areas of increased runoff and decreased groundwater recharge. This raises a broader question—are we paving our future to diminished groundwater resources?

References

Dreimanis, A.C., G. Winder and R.A. Aaltonen. 1998. London, Ontario: Geology, Geomorphology, Geodata of Canadian Cities. Geological Association of Canada. P: 241–264.

Golder Associates Ltd. 1991. Hydrogeological Evaluation of Sifton Bog, Integrated Resource Assessment, London, Ontario, Prepared for the Upper Thames River Conservation Authority.

Judd, W.W. undated. “Preservation of Byron Bog—A Case History in Conservation”. Microfilm Record, London Public Library, r574.97132.J886p.

Judd, W.W. 1957. “Studies of the Byron Bog in Southwestern Ontario. I. Description of the Bog.” *Canadian Entomologist*, 89 (5): 235–238.

Judd, W.W. 1967. “Preservation of the Byron Bog.” *The Canadian Field-Naturalist*, 81 (3): 232–233.

Judd, W.W. 1968. “Preservation of Byron Bog in London, Ontario.” *Biological Conservation*, 1(1): 84–85.

Judd, W.W. 1985. Historical Account of Byron Bog (Sifton Botanical Bog) at London, Ontario with a Record of Property Transfers to the Year 1984 in North Half, Lot 25, Concession I, London Township Which Includes the Bog. Phelps Publishing Co., London, Ontario. 61 p.

Mitsch, William J. and James G. Gosselink. 1993. *Wetlands*. Van Nostrand Reinhold, 115 Fifth Avenue, New York, NY.

Upper Thames River Conservation Authority. 1992. *Sifton Bog: Integrated Resource Management Study*. Summary Report, November 1992.

Appendix K1. Summary of the White-tailed Deer Issue in Sifton Bog ESA

Date	Action or Issue
Summer 2000	The UTRCA receives numerous calls from residents of the community surrounding Sifton Bog, reporting increasingly frequent sightings of White-tailed Deer on private residential properties. Reports of costly landscaping damage and fear of Lyme disease and deer-vehicle collisions.
Jun 2001	The UTRCA and the City of London host a community meeting to provide residents with information about White-tailed Deer in the bog and potential deer management options, as well as to discuss future directions. A Community Steering Committee is formed to study the issue and make recommendations to the agencies involved.
Mar 2003	After 18 months of investigation and review of accepted management options the Sifton Bog White-tailed Deer Committee recommends that a controlled archery hunt be implemented to decrease the number of deer in the bog.
Apr 2003	The UTRCA passes a motion recognizing the wishes of the local community and supports the recommendation of the Community Steering Committee that the herd be reduced by an archery hunt in 2003.
Jun 2003	Information report to Planning Committee regarding the final recommendation of the Sifton Bog White-tailed Deer Community Steering Committee, and recommendation that a Public Meeting be held at the Planning Committee meeting of June 30, 2003.
Jun 2003	Report to Planning Committee recommending a fall, 2003 harvest of White-tailed Deer in Sifton Bog, noting that a minimum of 8 deer is to be retained in the bog. Planning Committee and Municipal Council do not accept the staff recommendation, and direct that staff report back in the fall of 2003 regarding a fall/winter deer count and other measures to address deer management.
Oct 2003	Information Report to Planning Committee addressing the six issues identified by Municipal Council for follow-up and reporting.
Aug 2004	Information Report to Planning Committee – Further information on two issues: the 2003 Deer Count results and the potential for a chemo-sterilization control program.
Nov 2003	First annual deer count conducted by UTRCA staff and volunteers. Findings: 27 deer.
Sep 2004	Municipal Council upholds a Planning Committee recommendation “That the UTRCA be requested to take whatever steps are necessary to manage the deer in Sifton Bog.”
May 2005	City of London’s Corporate Management Team considers a plan for a controlled archery hunt as recommended by the Sifton Bog Community Steering Committee. In the team’s view the plan would have a limited effect on deer populations, be controversial, address only a small portion of the City and start the municipality on a path of annual deer management without a long-term strategy.
Dec 12, 2005	Report to Planning Committee recommending an eight-step strategy for addressing the rising deer population in the City of London, as developed in conjunction with the UTRCA, is accepted.
Dec 19, 2005	Municipal Council accepts seven of the eight steps of the strategy accepted by Planning Committee. Council drops the seventh step “to plan for a managed cull at Sifton Bog as a pilot test, if permitted by the MNR and if annual counts show an uncontrolled increase in deer and/or increasing destruction of natural features and/or unacceptable level of car-deer incidents.”
Aug 7, 2007	Staff report to Planning Committee. Committee accepts proposal to install light reflectors along city streets with heavy deer-collision statistics and purchase cameras for use in conducting deer counts in other ESAs.
Fall 2007	City funds a deer enclosure study with the contract awarded to Dr. Bazely of York University.
Nov 2007	Fifth annual deer count undertaken. Results: 52 deer (conservative estimate).
Aug 11, 2008	Staff update report to Council on activities to implement the seven acceptable deer management strategies approved by Council in response to specific concerns around the Sifton Bog.
Nov 2008	Sixth annual deer count undertaken. Results: 35 deer (conservative estimate).

Appendix K1. Summarized Chronology of the White-tailed Deer Issue in Sifton Bog ESA (continued)

Date	Action or Issue
Jan 26, 2009	Sifton Bog Master Plan - Planning Committee approval of the Conservation Master Plan with 55 recommendations to address the long-term management of Sifton Bog ESA, including assessing the impacts of surplus deer on the sensitive bog ecosystem.
Feb 2, 2009	<p>City Council adopted and approved the Sifton Bog Environmentally Significant Area (ESA) Conservation Master Plan for 2009-2019, and requested that the Civic Administration report back at a future Environment and Transportation Committee meeting with respect to the following, as it pertains to the white-tailed deer in the Sifton Bog:</p> <ul style="list-style-type: none"> - immediate non-lethal solutions that would include anaesthetizing the deer to remove and relocate them from the Bog; - options on the best way to keep the deer from returning to the Bog, once removed, including the creation of a - feeding station away from the Bog area; - long term solutions that may include the Spay-Vac Vaccine.

The Sifton Bog White-tailed Deer Community Steering Committee

The Community Steering Committee met 14 times over the year and a half (2001 - 2003) and studied numerous aspects of deer management issues, including deer biology, population trends, carrying capacity, neighbour surveys, disease, forest impacts, and a large range of non-lethal and lethal deer management options. Experts from the Ministry of Natural Resources and other agencies participated. The final report is found on the UTRCA website (www.thamesriver.on.ca).

The Committee concluded the deer were indeed a problem within Sifton Bog and explored management options. Each option was researched and discussed with emphasis on benefits and disadvantages. The following non-lethal options were not supported due to low effectiveness, impracticality and/or cost:

- live capture and relocation,
- chemosterilization,
- supplemental feeding,
- aversive conditioning,
- fencing, and
- doing nothing.

The Committee researched and discussed lethal methods (i.e., deer harvest). The following lethal options were not supported for safety, cost and efficacy reasons:

- sharpshooters (rifles),
- live capture and shoot, and
- introduction of natural predators.

The only method acceptable to the entire committee was a controlled bow hunt. The Committee felt that this method addressed:

- the need to decrease the deer population,
- the desire to minimize any suffering to the deer, and
- the need to protect the safety of the community members and bog users.

Appendix K2. Summary of London Municipal Council Response to the White-tailed Deer Community Steering Committee Report, July 8, 2003



London
CANADA

July 8, 2003

V.A. Cote
General Manager of Planning and Development

I hereby certify that the Municipal Council, at its session held on July 7, 2003 resolved:

- a. That a “white-tailed deer management action plan” for the Sifton Bog be prepared by the General Manager of Planning and Development for submission to the Planning Committee by no later than October 2003 and that the said plan include but not be limited to addressing the following matters:
 - i. Provision for a study of the numbers of deer and their movement patterns to be conducted in the fall of 2003 by trained experts;
 - ii. A request/application to the Ministry of Natural Resources (MNR) to initiate a study with respect to the use of chemo sterilization techniques to control the deer population in the Sifton Bog on the understanding that the request/application would ask the MNR to provide status reports at 3 and 6 month intervals as to the progress that is being made towards initiating such a study;
 - iii. A recommendation about whether or not the City's Fence By-law should be amended to permit higher fences to keep the deer out of backyards;
 - iv. A program to prohibit landowners from feeding the deer population;
 - v. An examination of connecting linkages in areas subject to future development to ensure wildlife corridors are maintained; and
 - vi. Providing information about aversion control measures such as liquid fencing etc. that could be employed by land owners adjacent to the Bog to ward off deer;
 - vii. The undertaking by the City and the Upper Thames River Conservation Authority of a regular monitoring program of the vegetation in the Bog to track any changes/impacts to and on the vegetation that can be determined to be the result of deer grazing; and further,

That NO ACTION BE TAKEN at this time to permit a harvest of white-tailed deer in the Bog;

Appendix K3. Council Resolution, December 19, 2005, White-tailed Deer Issue



300 Dufferin Avenue
P.O. Box 5035
London, ON
N6A 4L9

London
CANADA

December 20, 2005

R. Panzer
General Manager of Planning and Development

I hereby certify that the Municipal Council, at its session held on December 19, 2005 resolved:

6. That, on recommendation of the General Manager of Planning and Development, the following White-tailed Deer Management Strategy, as developed in conjunction with the Upper Thames River Conservation Authority, **BE APPROVED** to address the issue of the over-population of white-tailed deer in London's natural areas:

- (a) develop a communications and education program for neighbours of our natural areas and for the general public to identify the problems with rising deer numbers and provide information about how residents can deal with deer issues, such as impacts on their private yards;
- (b) expand yearly deer counts to include Westminster Ponds and Kilally Meadows ESAs in order to develop a better City-wide assessment of the situation. Expand our vegetation monitoring program into other ESAs;
- (c) the UTRCA has approached Conservation Ontario to lead a province wide workshop on urban deer management, so that we may all benefit from the latest information and techniques;
- (d) implement non-lethal deer management strategies as recommended by the MNR and/or Conservation Ontario as a result of these broader discussions;
- (e) request that Animal Care and Control, the London Police Service and our wildlife contractor coordinate the reporting of all deer incidents;
- (f) proceed with an update to the Sifton Bog Conservation Master Plan and examine the deer issue in the context of all related issues at the Bog – invasive plant species management, fencing, continued water monitoring, pathway/trail development, expanded nature interpretation opportunities, linkages to adjacent natural features, etc.; and
- (g) work with the MNR, the UTRCA and other urban centres within this watershed to develop a provincial/regional plan for urban wildlife management;

it being noted if there is concurrence on these steps, staff would proceed with strategies that can be implemented in the short term and expand on the details and costs of the larger, long term strategies.
(1.1.4.05) (AS AMENDED) (6/1/PC)

Kevin Bain
City Clerk
/rw

cc: Upper Thames River Conservation Authority, 1424 Clarke Rd. London, ON N5V 5B9
Animal Care and Control, 121 Pine Valley Blvd., London, ON N6K 3T6
Staff Sergeant O'Brien, London Police Services
Ministry of Natural Resources, 353 Talbot Street West, Aylmer ON N5H 2S8
A. Macpherson, Manager III, Parks Planning and Design

*original (g) eliminated
"managed cull"*

Appendix K4. Council Resolution, February 2, 2009, White-tailed Deer Issue



February 3, 2009

R. Panzer
General Manager of Planning and Development

I hereby certify that the Municipal Council, at its session held on February 2 2009 resolved:

14. That, on the recommendation of the General Manager of Planning and Development, the following actions be taken with respect to the Sifton Bog Environmentally Significant Area (ESA) Conservation Master Plan for 2009-2019:

- (a) the Sifton Bog Environmentally Significant Area(ESA) Conservation Master Plan for 2009-2019 **BE APPROVED** and **ADOPTED** as a Conservation Master Plan in accordance with Section 15.3.8 of the Official Plan;
- (b) the Civic Administration **BE REQUESTED** to report back at future Environment and Transportation Committee meeting with respect to the following, as it pertains to the white tail deer in the Sifton Bog:
 - (i) immediate non-lethal solutions that would include anesthetizing the deer to remove and relocate them from the Bog;
 - (ii) options on the best way to keep the deer from returning to the Bog, once removed, including the creation of a feeding station away from the Bog area;
 - (iii) long term solutions that may include the Spay-Vac Vaccine; and
 - (iv) the effectiveness of a lethal cull and how it could be done;

such report to also include details of the costs associated with any and all options and which of these options have been effective in other communities;

- (c) the Animal Welfare Advisory Committee, Ontario Federation of Anglers and Hunters, the First Nations groups, and the Environmental and Ecological Planning Advisory Committee **BE CONSULTED** in the preparation of the Staff report as noted in (b) above.
- (d) the Civic Administration **BE REQUESTED** to report back to the Planning Committee by the end of March 2009, on an aggressive plan to deal with the issue of encroachment in the Sifton Bog, which may include By-law changes and enforcement on the activities that can be detrimental to the Bog, etc.; and,
- (e) the volunteer members of the Sifton Bog Local Advisory Committee (LAC) **BE THANKED** for their work in the preparation of the Sifton Bog Environmentally Significant Area (ESA) Conservation Master Plan for 2009-2019.

Kevin Bain
City Clerk

NOTE:

At the public participation meeting associated with this matter (February 3, 2009, Planning Committee), several members of the public made oral submissions. Some individuals did not support the deer recommendations because they were opposed to any lethal means of reducing deer herd numbers. Several members of the LAC (Local Advisory Committee of the Sifton Bog Master Plan) did not support the deer recommendations (and hence, the entire Master Plan) because they maintained their support of the original recommendation of the White-tailed Deer Community Steering Committee – a recreational hunt to drastically and swiftly reduce deer numbers – to protect the ecosystem of the ESA. These LAC members included: Karen Boswell, Joe Donaldson, Anita Caveney, Stan Caveney, D'Arcy McFalls, Winifred Wake and Rosemary Dickinson.

Appendix K5. White-tailed Deer Count Methodology

White-tailed Deer Count Methodology

In 2003 the City of London requested that information be collected on the numbers of deer in the Sifton Bog ESA. The UTRCA agreed to undertake the count as an extension of management responsibilities for the ESAs within London. A technical team was formed to make a decision about the methodology and included technical staff from the UTRCA and Ontario Ministry of Natural Resources (OMNR). A summary of the methodology is presented below. A more detailed methodology and literature review is in UTRCA, 2003.

Map and select viewing stations:

1. Define and map the study area. The Sifton Bog ESA and adjoining undeveloped agricultural lands were included. Private, residential and commercial lands were not included.
2. Superimpose a grid over the study area, creating 16 squares. Randomly insert stations into each square, discounting those that contain very little natural area. Ground-truth the exact location of the stations, finding spots where there is good visibility.
3. GPS the visual area of each station (i.e., the distance that can be seen, on all sides, from one vantage point).
4. Map the stations and visual areas and calculate the total visual area as a percentage of the study area. There are 16 stations with a total of 22 acres (9 ha) of visual area. The study area size is 124 acres (50 ha). There were 14 stations in previous years, and some stations have been moved after the agricultural field in the northeast was developed. Map 11 shows the mapping for the deer count.

Develop data sheets, select time and dates for count.

5. Develop data sheets (deer survey forms) to be used by each volunteer counter. (See attached)
6. Set dates. Four to six days are pre-selected in November (usually Tuesday and Thursday nights). The count proceeds in all weather, except where safety is a concern.
7. Set times. The times are based on sunset. Generally, the counts take place 1.5 to 2 hours before darkness, roughly between 4:00 and 5:30 PM. Deer are nocturnal animals and tend to leave their bedding areas around 3 PM to start looking for food. After dark, the animals cannot be seen or counted.
8. Train volunteers. The ESA Team trained numerous UTRCA staff and other volunteers to conduct the count, outlining how the data sheets are to be used, what to wear, how to stay quiet, etc.

The count

9. Prior to the count, volunteers meet at a nearby parking lot. Instructions are given and clocks are synchronized. Team leaders take volunteers to their stations, approximately 15 minutes before the official count begins.
10. Volunteers count and record the maximum number of deer seen in any given minute for one hour (data sheets outline each minute). The volunteer also notes the direction the animals are moving to or from (to avoid double counting). The deer's activities or other extraneous activities in the ESA are also recorded. Deer with antlers are noted.
11. After the hour, the volunteers rejoin their group leader and all meet back at the parking area. The count leader asks each station volunteer to summarize their findings so all can hear. The data sheets are handed into the count leader. Pizza or hot snacks are provided to the volunteers.

Data computation

12. At the office, the count leader enters all of the data into a spreadsheet (see attached). The total number of deer sightings in each of the 60 minutes is added. This total is divided by 60 minutes to produce the average number of deer per minute (e.g. 6.1 deer/min).
13. To extrapolate the number of deer seen in the visual plots to the entire site, the study area is divided by the visibility area (e.g. $50 / 9 \text{ ha} = 5.5$). The number of deer/min is multiplied by the magnitude factor to extrapolate the number of deer over the entire site based on those seen in the subset (e.g. $6.1 \text{ deer/min} \times 5.5 = 34 \text{ deer}$).
14. The data for all of the count nights is summarized and an average number of deer is derived.

See survey form and Map 11.

Appendix K5. White-tailed Deer Count Methodology (continued)

STANDARD DEER SURVEY FORM

UPPER THAMES RIVER

CONSERVATION AUTHORITY

NAME _____ AFFILIATION _____ DATE

29	11	2007
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 GROUP LEADER _____ WEATHER _____ (day) (month) (year)

STATION NUMBER

START TIME	3:55pm	STOP TIME	4:55pm
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TIME (PM)	number not antlered	number antlered	coming from (circle)	going to (circle)	ACTIVITY	COMMENTS
3:55pm			N S W E	N S W E		
3:56pm			N S W E	N S W E		
3:57pm			N S W E	N S W E		
3:58pm			N S W E	N S W E		
3:59pm			N S W E	N S W E		
4:00pm			N S W E	N S W E		
4:01pm			N S W E	N S W E		
4:02pm			N S W E	N S W E		
4:03pm			N S W E	N S W E		
4:04pm			N S W E	N S W E		
4:05pm			N S W E	N S W E		
4:06pm			N S W E	N S W E		
4:07pm			N S W E	N S W E		
4:08pm			N S W E	N S W E		
4:09pm			N S W E	N S W E		
4:10pm			N S W E	N S W E		
4:11pm			N S W E	N S W E		
4:12pm			N S W E	N S W E		
4:13pm			N S W E	N S W E		
4:14pm			N S W E	N S W E		
4:15pm			N S W E	N S W E		
4:16pm			N S W E	N S W E		
4:17pm			N S W E	N S W E		
4:18pm			N S W E	N S W E		
4:19pm			N S W E	N S W E		
4:20pm			N S W E	N S W E		
4:21pm			N S W E	N S W E		
4:22pm			N S W E	N S W E		
4:23pm			N S W E	N S W E		
4:24pm			N S W E	N S W E		
4:25pm			N S W E	N S W E		
4:26pm			N S W E	N S W E		
4:27pm			N S W E	N S W E		
... to						
4:55pm			N S W E	N S W E		

Appendix K6. Sifton Bog Deer Count Data, 2003 to 2008

Year	Date	Air Temp. (°C)	Weather	Study Area (ha)	Viewing Area (ha)	% Study Area Viewed	No. Stations Viewed	Highest Count on the Minute	Average Count on the Minute	Multiplying Factor	Estimated Nightly Population	Estimated Deer Population
2003	Nov 11	8	Overcast	59	12	21	12	19	9	4.9	44	24
	Nov 12	14	Drizzle				12	24	14		68	
	Nov 18	12	Overcast				12	11	4		19	
	Nov 19	9	Clear				8	20	2		9	
	Dec 9	3	Overcast				11	11	3		14	
	Dec 16	3	Drizzle				12	11	1		4	
2004	Nov 17	12	Drizzle	52	8	15	14	11	3	6.5	19	26
	Nov 18	12	Overcast				14	12	4		26	
	Nov 22	7	Clear				14	11	4		26	
	Nov 29	0	Overcast				14	13	7		45	
2005	Nov 8	12	Clear	52	8	15	14	14	7	6.5	45	53
	Nov 14	8	Overcast				14	15	9		58	
	Nov 23	-2	Snow				14	16	8		52	
	Dec 5	-12	Overcast				14	26	9		58	
2006	Nov 6	9	Clear	52	8	15	14	16	8	6.5	52	52
	Nov 8	10	Overcast				14	17	10		65	
	Nov 20	0	Overcast				14	18	9		58	
	Nov 22	7	Clear				14	20	7		45	
2007	Nov 8	5	Overcast	52	8	17	16	21	10	5.8	57	52
	Nov 13	10	Clear				16	20	10		57	
	Nov 15	0	Rain				16	17	9		52	
	Nov 28	-2	Overcast				15	16	9		52	
	Nov 29	-2	Overcast				16	20	10		57	
2008	Nov 5	15	Clear	52	8	17	15	9	3	5.8	17	35
	Nov 10	3	Overcast				15	11	4		23	
	Nov 19	-1	Clear				15	16	8		46	
	Nov 24	0	Drizzle				16	21	10		57	

Notes:

- See Map 11 for location of deer count stations.
- *Study Area* = Area of the ESA. In 2003, the 7 ha agricultural field east of the ESA was included also.
- *Viewing Area* = Area of each station's visible area, added together.
- *% of Study Area Viewed* = Divide the Viewing Area by the Study Area.
- *Highest Count on the Minute* = Highest number of deer seen at any given minute within the hour from all stations combined (e.g., at 5:02 PM, add all the deer seen from all stations for that 1 minute period).
- *Average Count on the Minute* = Add together the total number of deer seen from each station for each 60 minute segment. Divide this number by 60 to produce the average number of deer per minute.
- *Multiplying Factor* = Divide the Study Area by the Visibility Area to produce the Multiplying Factor (e.g., 52 ha/9 ha = 5.8). This factor is used to extrapolate the number of deer seen at the stations to the entire ESA. Assume deer are equally distributed across the ESA.
- *Estimated Nightly Population* = Multiply the Average Count on the Minute by the Multiplying Factor. All figures are rounded down to produce a conservative number. Note: the Highest Count on the Minute is not used to calculate population.
- *Estimated Deer Population* = Add together the Estimated Nightly Populations for each night that year and divide by the number of nights, to produce the overall deer population reported. All fractions are rounded down to the nearest whole number throughout the calculations.
- It is presumed that most deer counted are resident deer, as opposed to wandering deer. Deer in the ESA allow humans to get very close, unlike deer from other areas of the city or countryside.

Appendix K7. Deer Exclosure Study Methodology Summary

Deer Exclosure Study Methodology Summary

Study Title

The Effects of White-tailed Deer Browsing on different Vegetation Community Types in Three Environmentally Significant Areas in the City of London.

Study Consultants

York University under Dr. Dawn Bazely of the Biology Department, with Masters student Christie Cestra.

Timing

Fall of 2007 to Fall 2009.

Sites

Sifton Bog ESA, Medway Valley ESA, Meadowlily Woods ESA. Locations for exclosures were selected following reconnaissance visits to select areas of different vegetation types and deer density.

Exclosures

The exclosures are 4 x 4 m by 2.7 m high built of wire (approx. 6" x 3" mesh) with cedar and iron support poles. On the Sifton Bog mat, the exclosures are 2 x 2 m by 2.7 m high.

Sifton Bog:	9 exclosures (4 on the mat, 2 in the wet meadow, 3 in the upland areas)
Medway:	2 exclosures in the floodplain woods.
Meadowlily Woods:	6 exclosures (3 in mature woods, 3 near edge of farm field)

Winter Deer Browse Survey

The consultants brought in university students to conduct the survey. One year's growth is clipped from the woody plants, weighted and analyzed. This is repeated the following winter to determine how much of the plant's annual growth is consumed by deer.

Species Composition

The species present both inside the exclosures and in control plots outside the exclosures are recorded in the spring and summer of 2008 and again in the spring/summer of 2009. In addition, data on trillium are collected as it is an indicator plant of deer browse intensity.

Final Report

The study will document any changes in the vegetation inside the exclosures compared to the vegetation outside the exclosures. The study will also quantify the current impact of deer browse on the vegetation in the different ESAs and any impact this browse is or will have on vegetation growth and composition patterns for the future.

The study may be extended to monitor the exclosures over the long-term.