

RIVERDALE FARM PONDS STEWARDSHIP PROGRAM:
2003 REPORT

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EXECUTIVE SUMMARY

The Riverdale Farm Ponds Stewardship Program involves Task Force to Bring Back the Don volunteers in data collection and maintenance activities.

The Stewardship Program has been implemented at the ponds for five years. During this time, volunteers have managed non-native invasive species, collected litter, and recorded information on wildlife inhabiting and using the ponds, vegetation growing in and around the ponds, chemical properties of the water, and surface water levels and precipitation data. The information allows the Task Force to Bring Back the Don to assess the site and evaluate past and ongoing restoration efforts.

Notable observations include:

- The Riverdale Farm Ponds are an important habitat for birds. The ponds are used extensively as a stop over and foraging area by migrating birds and provide full time or seasonal habitat to many species.
- Vegetation at the Lower Pond is dense with maturing native tree and shrub species. The edge of the pond is primarily a mixture of native aquatic vegetation, such as cattails, arrowheads and sedges, and non-native European water horehound. The Sanctuary Pond and the ravine slope adjacent to the Lower Pond are dominated by non-native invasive species and these species are seeding into the Lower Pond.
- Water chemistry parameter results compared favourably with those of a healthy aquatic ecosystem, except for dissolved oxygen levels in the Sanctuary Pond. The Sanctuary Pond suffers from severe anoxic conditions.
- The water levels in the Lower Pond were quite variable. The water levels in the Sanctuary Pond were relatively stable.
- Other species noted include raccoon, chipmunk, muskrat, snapping turtle, and red-eared slider turtle.

The Community Stewardship Program will continue at the Riverdale Farm Ponds in 2004.

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1.0 BACKGROUND INFORMATION

1.1 Riverdale Farm Ponds

The Riverdale Farm is a City of Toronto Park located on the west side of Riverdale Park in the heart of Cabbagetown, where Winchester Street and Sumach Street meet. This working farm attracts thousands of visitors throughout the year, including many school groups. Two farm ponds are being naturalized to provide wildlife habitat, improve water quality, and contribute to the overall restoration of the Don River. These restoration efforts are being coordinated by the Task Force to Bring Back the Don, the City of Toronto Parks and Recreation Department, and a number of other public and private sector partners (Appendix A).

Restoration efforts began in 1998 and have included the following:

- naturalization of the Lower Pond's edge by removing concrete and stone and planting emergent vegetation;
- enhancement of a stream connecting the two ponds;
- removal/control of invasive non-native species;
- planting native species; and
- installation of six viewing platforms and interpretive signs to increase public access and awareness.

1.2 Community Stewardship Program

The Community Stewardship Program involves volunteers in data collection and maintenance activities. This is the fourth year that the Task Force to Bring Back the Don has coordinated the Community Stewardship Program for the Riverdale Farm Ponds.

The goal of the Stewardship Program is to help the Riverdale Farm Ponds become a functional natural ecosystem and to involve the community in the naturalization of the site.

The objectives for the Stewardship Program are as follows:

1. to ensure that planted vegetation is not out-competed by invasive species encroachments;
2. to install and maintain habitat structures;
3. to monitor the changes of the area over time, including colonization by both native and non-native species;
4. to provide information to signal maintenance requirements, such as control of invasive vegetation;
5. to involve interested groups and individuals in restoration activities;
6. to educate the community about the natural environment; and
7. to train the community in proper naturalization techniques.

1.3 Report Objectives

The purpose of this report is to:

1. provide a description of the 2003 Community Stewardship Program;
2. provide a comprehensive up-to-date description of the Riverdale Farm Ponds ecosystem;
3. provide an integration and interpretation of the data generated by the Stewardship Program in its sixth year of operation; and
4. provide recommendations for maintenance and monitoring activities to be implemented at the ponds.

2.0 2003 STEWARDSHIP PROGRAM

2.1 Participants

The following groups participated in the Riverdale Farm Ponds Stewardship Program in 2002: Community Stewardship Team (6 participants), bird monitors (2 participants).

2.2 Stewardship Activities

The following maintenance activities were completed:

- Collecting and disposing of litter.
- Planted material was watered during periods of drought and re-mulched
- Native trees and shrubs were planted in the spring of 2003
- Native herbaceous plants were planted in the summer of 2003
- Weeding non-native invasive herbaceous species: garlic mustard, water horehound, purple loosestrife, burdock, stinging nettle.
- Treatment of non-native, invasive vegetation such as Japanese Knotweed and Dog Strangling Vine was performed in the summer and early fall of 2003 by the Stewardship Crew
- Non-native tree species Norway Maple, Manitoba Maple and Siberian Elm were cut and treated with herbicide in summer of 2003

The following monitoring activities were completed:

- Bird survey.
- Vegetation survey.
- Water chemistry testing.
- Surface water levels and precipitation monitoring.
- Benthic invertebrate survey.
- Incidental observations.

3.0 2002 RIVERDALE FARM PONDS MONITORING RESULTS

3.1 Results and Summaries

3.1.1 Bird Survey

Bird surveys were conducted using the Marsh Monitoring Program (MMP) protocol, a cooperative project of Environment Canada and the Long Point Bird Observatory. The Marsh Bird Monitoring Program provides volunteer monitors with a standard protocol for monitoring marsh birds and amphibians throughout the Great Lakes Basin. As such, the bird populations information gathered by the volunteers is helpful in developing an understanding of the ecological dynamics at the Riverdale Farm Ponds and in allowing a comparison with other wetlands in the Great Lakes Basin. In 2003, volunteers conducted the surveys on June 11th and June 21st. The observations were recorded during a standard ten-minute period between 6:00PM and sunset. The numbers and species observed by sight and call were recorded.

In 2001 and 2002, community bird surveys were also conducted over a series of mornings and evenings throughout the spring and fall migration and summer breeding season in an attempt to poll all the bird species using the Riverdale Farm Ponds.

There were a total of 94 bird species observed in the community survey during the 2002 season. Table 1 lists the birds observed by volunteers in 1999, 2000, 2001 and 2002, and professionals in the 1999, 2000 and 2001.

Table 1: Bird species recorded at Riverdale Farm Ponds during the 1999, 2000, 2001 and 2002 surveys.

Common Name	Scientific Name	1999	2000	2001	2002	2003
American Black Duck	<i>Anas rubripes</i>				C	C
American Crow	<i>Corvus brachyrhynchos</i>	P	P	PC**	C	C
American Goldfinch	<i>Carduelis tristis</i>	P		C**	C**	C*
American Kestrel	<i>Falco sparverius</i>			C	C	C
American Redstart	<i>Setophaga ruticilla</i>				C	C
American Robin	<i>Turdus migratorius</i>	P	P	PC**	C**	C*
American Tree Sparrow	<i>Spizella arborea</i>			C	C	
Baltimore Oriole	<i>Icterus galbula</i>			C**	C**	C*
Bank Swallow	<i>Riparia riparia</i>		C	C		
Barn Swallow	<i>Hirundo rustica</i>	P		PC*	C*	C**
Bay-Breasted Warbler	<i>Dendroica castanea</i>				C	C
Belted Kingfisher	<i>Ceryle alcyon</i>	C		PC*	C	C
Black-and-White warbler	<i>Mniotilta varia</i>		P	C	C	C
Blackburnian Warbler	<i>Dendroica fusca</i>				C	C

Black-Capped Chickadee	<i>Parus atricapillus</i>			PC**	C*	C*
Black-Crowned Night Heron	<i>Nycticorax nycticorax</i>	P	PC	PC	C	C
Blackpoll Warbler	<i>Dendroica striata</i>			C	C	C
Black-Throated Blue Warbler	<i>Dendroica caerulescens</i>		P	C	C	C
Black-Throated Green Warbler	<i>Dendroica virens</i>			C	C	C
Blue-Gray Gnatcatcher	<i>Polioptila caerulea</i>				C	
Blue-Headed Vireo	<i>Vireo solitarius</i>				C	C
Blue Jay	<i>Cyanocitta cristata</i>	P	P	PC*	C	C
Bohemian Waxwing	<i>Bombycilla garrulus</i>			C		
Brown Creeper	<i>Certhia familiaris</i>			C	C	C
Brown Thrasher	<i>Toxostoma rufum</i>			C	C	C
Brown-headed Cowbird	<i>Molothrus ater</i>			C*	C	C
Canada Goose	<i>Branta canadensis</i>	P	PC	PC**	C*	C*
Canada Warbler	<i>Wilsonia canadensis</i>			C	C	C
Cedar Waxwing	<i>Bombycilla cedrorum</i>			C	C	C
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>			C	C	C
Chimney Swift	<i>Chaetura pelagica</i>			C	C	C
Chipping Sparrow	<i>Spizella passerina</i>				C	C
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>			C		
Common Grackle	<i>Quiscalus quiscula</i>	P	PC	PC**	C**	C**
Common Nighthawk	<i>Chordeiles minor</i>				C	C
Cooper's Hawk	<i>Accipiter cooperii</i>				C	C
Dark-eyed Junco	<i>Junco hyemalis</i>			C*		C*
Double-crested Cormorant	<i>Phalacrocorax auritus</i>			C	C	C
Downy Woodpecker	<i>Picoides pubescens</i>			C*	C*	C**
Eastern bluebird	<i>Sialia sialis</i>					C
Eastern Kingbird	<i>Tyrannus tyrannus</i>				C*	C*
Eastern Meadowlark	<i>Sturnella magna</i>			C		
Eastern Phoebe	<i>Sayornis phoebe</i>				C*	C*
Eastern Towhee	<i>Pipilo erythrophthalmus</i>				C	
European Starling	<i>Sturnus vulgaris</i>	P	P	C**	C**	C**
Field Sparrow	<i>Spizella pusilla</i>	P	P	C**		
Fox Sparrow	<i>Passerella iliaca</i>				C	
Gadwall	<i>Anas strepera</i>				C	C
Golden-Crowned Kinglet	<i>Regulus satrapa</i>			C	C	C
Gray Catbird	<i>Dumetella carolinensis</i>	P		C**	C**	C**
Gray-Cheeked Thrush	<i>Catharus minimus</i>				C	
Great Blue Heron	<i>Ardea herodias</i>	P	PC	P	C	
Great Crested Flycatcher	<i>Myiarchus crinitus</i>			C*		C*
Green-Winged Teal	<i>Anas crecca</i>				C	
Hairy Woodpecker	<i>Picoides villosus</i>	P	P	C*	C*	C*
Hermit Thrush	<i>Catharus guttatus</i>			C	C*	C*
Herring Gull	<i>Larus argentatus</i>			C	C	
House Finch	<i>Carpodacus mexicanus</i>	P	P	PC*	C*	C**
House Sparrow	<i>Passer domesticus</i>	PC	P	PC**	C*	C**
House Wren	<i>Troglodytes aedon</i>				C*	C**
Indigo Bunting	<i>Passerina cyanea</i>				C	
Killdeer	<i>Charadrius vociferus</i>	P	P	PC	C	C
Least Flycatcher	<i>Empidonax minimus</i>			C*		
Lesser Yellowlegs	<i>Tringa flavipes</i>				C	
Magnolia Warbler	<i>Dendroica magnolia</i>			C	C	C

Mallard	<i>Anas platyrhynchos</i>	P	PC	PC**	C**	C**
Mourning Dove	<i>Zenaida macroura</i>	P	P	PC**	C*	C**
Mourning Warbler	<i>Oporornis philadelphia</i>				C	C
Mute Swan	<i>Cygnus olor</i>			P	C*	
Nashville Warbler	<i>Vermivora ruficapilla</i>			C	C	C
Northern Cardinal	<i>Cardinalis cardinalis</i>	P	P	PC**	C**	C**
Northern Flicker	<i>Colaptes auratus</i>			PC**	C**	C**
Northern Parula	<i>Parula americana</i>			C	C	C
Northern Rough-Winged Swallow	<i>Stelgidopteryx serripennis</i>	C		C	C	C
Northern Waterthrush	<i>Seiurus noveboracensis</i>			C	C	C
Ovenbird	<i>Seiurus aurocapillus</i>			C		
Palm Warbler	<i>Dendroica palmarum</i>		P			C
Pine Warbler	<i>Dendroica pinus</i>			C	C	
Purple Martin	<i>Progne subis</i>			C		
Red-Eyed Vireo	<i>Vireo olivaceus</i>			C*	C**	C**
Red-Headed Woodpecker	<i>Melanerpes erythrocephalus</i>				C	C
Red-Shouldered Hawk	<i>Buteo lineatus</i>			P		
Red-Tailed Hawk	<i>Buteo jamaicensis</i>			C	C	C
Red-Winged Blackbird	<i>Agelaius phoeniceus</i>	P	PC	PC**	C**	C**
Ring-Billed Gull	<i>Larus delawarensis</i>	P	PC	PC	C	C
Rock Dove	<i>Columba livia</i>			PC*	C**	C**
Rose-Breasted Grosbeak	<i>Pheucticus ludovicianus</i>				C	
Ruby-Crowned Kinglet	<i>Regulus calendula</i>			C	C	C
Ruby-Throated Hummingbird	<i>Archilochus colubris</i>			C	C	
Rusty Blackbird	<i>Euphagus carolinus</i>			C		
Sharp-Shinned Hawk	<i>Accipiter striatus</i>				C	C
Song Sparrow	<i>Melospiza melodia</i>	P	PC	PC**	C**	C**
Spotted Sandpiper	<i>Actitis macularia</i>			C	C	
Swainson's Thrush	<i>Catharus ustulatus</i>			C	C	C
Tennessee Warbler	<i>Vermivora peregrina</i>			C	C	C
Tree Swallow	<i>Tachycineta bicolor</i>	P	P	PC**	C*	C*
Veery	<i>Catharus fuscescens</i>			C*	C	
Virginia Rail	<i>Rallus limicola</i>					C
Warbling Vireo	<i>Vireo gilvus</i>			C*	C*	C*
White-Breasted Nuthatch	<i>Sitta carolinensis</i>			C*	C	C
White-Crowned Sparrow	<i>Zonotrichia leucophrys</i>				C	C
White-Throated Sparrow	<i>Zonotrichia albicollis</i>			C*	C	C
Willow Flycatcher	<i>Empidonax traillii</i>			C	C	C
Wilson's Warbler	<i>Wilsonia pusilla</i>			C	C	C
Winter Wren	<i>Troglodytes troglodytes</i>				C	C
Wood Duck	<i>Aix sponsa</i>	P	PC	PC*	C*	
Yellow-Bellied Flycatcher	<i>Empidonax flaviventris</i>			C		
Yellow-Bellied Sapsucker	<i>Sphyrapicus varius</i>				C	
Yellow Warbler	<i>Dendroica petechia</i>	P	P	PC*	C*	C*
Yellow Breasted Chat	<i>Icteria virens</i>					C
Yellow-Rumped Warbler	<i>Dendroica coronata</i>	C	P	PC*	C	C

P: Recorded in Professional Survey

C: Recorded in Volunteer Survey

*: Resident

** : Nesting Evidence

Ninety-four bird species were observed in 2002. Thirty species are thought to have resided near the ponds in 2002 and seventeen of these species showed evidence of nesting. The remaining sixty-four bird species listed probably used the ponds to forage or as a place to rest during spring and/or fall migration.

3.1.2 Vegetation

The vegetation around the ponds was not monitored in 2003. The vegetation monitoring will continue in the 2004 spring and summer seasons. The following are the 2002 results, the vegetative composition of the pond areas are hopefully quite similar to the 2002 list along with the addition of new trees, shrubs and herbaceous plants planted in 2003.

Table 2: Vegetation species recorded at the Riverdale Farm Lower Pond during the 2002 Stewardship Program.

Common Name	Latin Name	Non-Native Species
Austrian pine	<i>Pinus nigra</i>	Yes
Bittersweet nightshade	<i>Solanum dulcamara</i>	Yes
Black locust	<i>Robinia pseudoacacia</i>	Yes
Boneset	<i>Eupatorium perfoliatum</i>	
Bull thistle	<i>Cirsium vulgare</i>	Yes
Canada goldenrod	<i>Solidago Canadensis</i>	
Cattail	<i>Typha latifolia</i>	
Chicory	<i>Cichorium intybus</i>	Yes
Common duckweed	<i>Lemna minor</i>	
Common milkweed	<i>Asclepias syriaca</i>	
Common burdock	<i>Arctium minus</i>	Yes
Common elderberry	<i>Sambucus Canadensis</i>	
Common arrowhead	<i>Sagittaria latifolia</i>	
Eastern cottonwood	<i>Populus deltoids</i>	
Crack willow	<i>Salix fragilis</i>	Yes
Dame's rocket	<i>Hesperis matronalis</i>	Yes
Dog-strangling vine	<i>Cynanchum nigrum</i>	Yes
Eastern white-cedar	<i>Thuja occidentalis</i>	
European stinging nettle	<i>Urtica dioica</i>	Yes
European water-horehound	<i>Lycopus europaeus</i>	Yes
Garlic mustard	<i>Alliaria petiolata</i>	Yes
Green ash	<i>Fraxinus pensylvanica</i>	
Manitoba maple	<i>Acer negundo</i>	
New England aster	<i>Aster novae-angliae</i>	

Osage orange	<i>Maclura pomifera</i>	Yes
Purple loosestrife	<i>Lythrum salicaria</i>	Yes
Queen Anne's lace	<i>Daucus carota</i>	Yes
Red osier dogwood	<i>Cornus stolonifera</i>	
Riverbank grape	<i>Vitis riparia</i>	
Scotch elm	<i>Ulmus glabra</i>	Yes
Siberian elm	<i>Ulmus pumila</i>	Yes
Silver maple	<i>Acer saccharinum</i>	
Speckled alder	<i>Alnus rugosa</i>	
Spotted Joe-Pye weed	<i>Eupatorium maculatum</i>	
Swamp milkweed	<i>Asclepias incarnata</i>	
Swamp rose	<i>Rosa palustris</i>	
Tree of heaven	<i>Ailanthus altissima</i>	Yes
Weeping willow	<i>Salix alba</i>	Yes
White elm	<i>Ulmus americana</i>	
White mulberry	<i>Morus alba</i>	Yes

Areas characterized by dry soil conditions were densely covered by saplings and shrubs. Many trees and shrubs that have been planted or grown naturally have been very successful around the Lower Pond. Elderberry, red osier dogwood, speckled alder, swamp rose, Eastern cottonwood, green ash, and several native willow species are examples of native woody vegetation thriving at the wetland. However, non-native species, which likely seeded in from the Sanctuary pond and the adjacent slope, are also plentiful. Invasive non-native species, including Manitoba maple, black locust, tree of heaven, white mulberry and Siberian elm saplings are abundant around the Lower Pond.

The edge of the pond is primarily a mixture of native aquatic vegetation, such as cattails, arrowheads and sedges, and non-native European water horehound.

3.1.3 Water Chemistry

A Cole-Parmer multi-parameter instrument was used to measure dissolved oxygen, water temperature, pH and conductivity. A thermometer was used to measure air temperature. Volunteers tested water chemistry only once in 2003 on July 28th.

Table 3: Water chemistry data recorded by volunteers at the Riverdale Farm Ponds during the 1999, 2000, 2001, 2002 and 2003 monitoring season.

Lower Pond

Parameter	1999			2000			2001			2002			2003		
	Min	Mn	Max	Min	Mn	Max	Min	Mn	Max	Min	Mn	Max	Min	Mn	Max
Air Temperature (degrees C)	23.5	28	33	21	24.5	26	21	25	32	19	20	24	24	24	24
Water Temperature (degrees C)	23	27.3	34	20.6	23.4	26.5	17.5	23.2	29	19.4	20.9	24.4	25	25	25
PH	7.5	8.5	10.1	7.45	8.03	8.5	6.99	7.88	9.08	7.76	8.4 ²	9.04	ND	ND	ND
Dissolved Oxygen (mg/L)	5.5	7.4	8.4	¹ 3.7	6.1	7.1	0.5	6.19	12.5	5.3	7.18	9.1	8.3	8.3	8.3
Conductivity (µS)	637	688	776	657	708	810	625	746	832	474	616	942	484	484	484

Sanctuary Pond

Parameter	1999			2000			2001			2002			2003		
	Min	Mn	Max	Min	Mn	Max	Min	Mn	Max	Min	Mn	Max	Min	Mn	Max
Air Temperature (degrees C)	23.5	27.5	34	21	24	26.5	19	24	31.5	18	20	24	22	22	22
Water Temperature (degrees C)	19.5	24.8	28.6	19.6	21.6	24.1	17.2	21.7	26.8	18.4	20.0	22.7	19	19	19
PH	7.3	7.7	8.5	7.14	7.77	8.51	6.99	7.26	7.55	7.36	7.55 ²	7.73	ND	ND	ND
Dissolved Oxygen (mg/L)	2.4	4.8	7	5.5	6.6	7.5	0.0	0.38	2.3	0.7	2.58	5.2	2.0	2.0	2.0
Conductivity (µS)	818	941	1011	829	905	1025	657	797.5	968	497	686	1139	565	565	565

¹ Dissolved oxygen in 2000 was recorded only in June

² pH meter was not functional at time of testing

3.1.3.1 *Dissolved Oxygen*

Dissolved oxygen is measured as the concentration of free (not chemically combined) molecular oxygen (a gas) dissolved in water, and is usually expressed in milligrams per litre. Dissolved oxygen in water comes from the atmosphere, and from algae and aquatic plants that deliver oxygen to water through photosynthesis. Adequate concentrations of dissolved oxygen are necessary for the life of fish, invertebrates, plants, and aerobic bacteria, which all require oxygen for respiration. Impairment of aquatic life begins to occur when DO levels fall to 5.5 mg/L and moderate impairment occurs when DO levels fall to 5.0 mg/L. Acute mortality of very young fish, macro and micro invertebrates can occur as the dissolved oxygen levels drop below 4.0 mg/L and acute mortality of many adult fish occurs when dissolved oxygen levels drop below 3.0 mg/L. The build-up of dead organic material is often the main cause of oxygen depletion in aquatic systems, as the decay of organic material consumes oxygen.

Dissolved oxygen readings in the Lower Pond in 2003 were only measured once and was at 8.3mg/L which was within the range measured in 2002 (5.3 – 9.1mg/L) and was slightly higher than the mean dissolved oxygen of 7.18mg/L.

The dissolved oxygen reading for the Sanctuary pond was measured at 2.0mg/L. This reading is again within the range measured in 2002 (0.7-5.2mg/L) and is slightly lower than the mean of 2.58mg/L. The dissolved oxygen readings recorded for the Sanctuary Pond were very low for the duration of the monitoring season in both 2002 and 2003.

The dissolved oxygen levels in the Sanctuary Pond reached extremely low values. The low oxygen content of the pond likely resulted in serious impairment of aquatic life. Further, due to the extremely low oxygen conditions, the Sanctuary Pond emitted an offensive odor. The odor was likely a combination of gasses produced by anaerobic decomposition (the decomposition of organic matter in the absence of oxygen), including hydrogen sulphide, methane and ammonia.

The Sanctuary Pond, because it has very little water flow, is prone to low dissolved oxygen conditions. Over time, a considerable amount of organic matter has accumulated in the pond and the decomposition of this material uses up all available oxygen. The drying up of the Lower Pond has been beneficial in the sense that it permits organic matter to come into contact with air and decompose rapidly. The Lower Pond does not suffer from an accumulation of organic matter and therefore oxygen is available within the ecosystem for other uses. The Lower Pond has very little flow, therefore during drought periods the Lower Pond is prone to anoxic conditions.

3.1.3.2 *Temperature*

Temperature exerts a major influence on the biological activity and growth of aquatic organisms and is also important because of its influence on water chemistry. The rate of chemical reactions generally increases as temperature increases, which in turn affects biological activity. An important example of the effects on temperature on water chemistry is its impact on oxygen.

Warmer water holds less oxygen than cool water. Warm water may be saturated with oxygen but still not contain enough oxygen for the survival of aquatic life.

The temperature recorded for the Lower Pond in 2003 was 25°C and the dissolved oxygen reading was 8.3 mg/L, indicating that on that one day the water was approximately 95% saturated.

The temperature recorded for the Sanctuary Pond in 2003 was 19°C and the dissolved oxygen reading for the Sanctuary Pond was 2.00 mg/L, indicating that the water was approximately 16% saturated with oxygen.

Aquatic systems with a high saturation value for dissolved oxygen are generally considered healthiest. However, this is subjective to the type of ecosystem being studied, and lower values would be expected for a wetland versus a moving river.

3.1.3.3 pH

pH is a measure of the concentration of hydrogen ions. The pH scale ranges from 0 to 14. A pH of 7 is considered neutral. Substances with a pH of less than 7 are acidic, and substances with a pH greater than 7 are basic. A one unit difference on the pH scale is significant because it represents a factor of 10 in acidity. The pH of water determines the solubility and biological availability of nutrients, such as phosphorus, nitrogen, and carbon, and heavy metals, such as lead, copper, and cadmium. Most aquatic organisms can survive in water ranging in pH from 6.5 to 8.2, and cannot survive at extremely high (above pH 9.0) or low (below pH 4.5) pH values. Young of any species are usually more sensitive to pH extremes than adults.

The pH in both the Lower Pond and the Sanctuary Pond was not measured in 2003. A likely reason is that the pH metre was not functional at the time of the testing in July.

The pH in the Lower Pond during the 2002 monitoring season, ranged from 7.76 to 9.04 with a mean of 8.4. The pH was lower (or more acidic) in the Sanctuary Pond, and ranged from 7.36 to 7.73 with a mean of 7.55.

3.1.3.4 Conductivity

Conductivity is a measure of the ability of water to conduct an electric current and is directly related to the total dissolved salts (ions) in the water. High levels of dissolved salts produce a high conductivity reading. Conductivity is also temperature sensitive and increases with increasing water temperature. The lower the number of ions in the water, the lower the electrical conductivity.

The conductivity for the Lower Pond was 484 μ S, within the range measured in 2002 from 474 μ S to 942 μ S, but lower than the mean conductivity of 616 μ S. The Sanctuary Pond had a conductivity of 565 μ S again, within the range measured in 2002 from 497 μ S to 1139 μ S, but lower than the mean conductivity of 686 μ S.

3.1.4 Surface Water Levels and Precipitation

Volunteers from July 28th through to September 8th monitored water levels and precipitation six times. The measurements were taken from one-meter staff gauges in the Lower and Sanctuary Ponds in order to record the variances in water levels. In the Lower Pond, a water level reading of 0.10 reflects zero water conditions. Precipitation data was gathered from a rain gauge mounted in the Lower Pond to monitor the amount of rainfall over time.

Table 4: Precipitation data and water levels recorded at the Riverdale Farm Ponds during the 1999, 2000, 2001, 2002 and 2003 monitoring season by volunteers.

Parameter	1999			2000			2001			2002			2003		
	Min	Mn	Max	Min	Mn	Max	Min	Mn	Max	Min	Mn	Max	Min	Mn	Max
Water Level (m): Lower Pond	-----			0.22	0.45	0.63	0.18	0.38	.69	0.2	0.51	0.69	0.49	0.57	0.69
Water Level (m): Sanctuary Pond	0.60	0.70	0.90	0.67	0.69	0.70	0.80	0.82	.85	0.80	0.85	0.90	0.92	0.93	0.96
Total Precipitation (cm)	Missing data			201.9 cm June 7 – August 25			103.0 cm June 4 – August 27			133.1 June 17 – August 28			Missing data		

The water levels at the Lower Pond in 2003 ranged from 0.49 to 0.69m, these readings were much higher than the 2002 range of 0.2-0.69m. However, the water levels in 2002 were only slightly lower than 2003 levels on average. By early fall in 1999, 2001 and 2002 the Lower Pond reportedly had dried out to a mud flat.

The water levels recorded for the Sanctuary Pond in 2003 ranged from 0.92-0.96m, which is again much higher than the levels recorded in 2002 and before. It is likely that the recorded water level increase is a result of an increased amount of water flowing from an ornamental pond to the Sanctuary pond via a waterfall.

3.1.5 Benthic Invertebrates

Benthic invertebrates are those aquatic invertebrates that are bottom dwellers and include any invertebrates that reside on or in any substrate within the aquatic habitat.

Benthic invertebrates were examined as part of the monitoring program because they are useful indicators of water quality. Benthic invertebrates are sensitive to physical and chemical changes in their habitat, many live in the water over a year, they cannot easily escape pollution as some fish are able to do, and are easily collected.

Volunteers took benthic invertebrate samples on August 12th, 2003. A bottom grab and a D-frame dip net were used to collect samples. The samples were placed in enamel trays where invertebrates were visually sorted and identified to the level of Class or Order using simple identification keys. The results of the 2003 survey are presented in Table 5 below, along with the 2002 results. Please see appendix B for 1999, 2000 and 2001 results.

Save our Streams provides a key featuring pollution tolerance levels. The pollution tolerance groups featured in the table are as follows:

Group 1: Pollution sensitive organisms found in good quality water.

Group 2: Somewhat pollution tolerant organisms can be found in good or fair quality water.

Group 3: Pollution tolerant organisms can be found in any quality water.

Pollution sources causing poor or fair water quality include sewage treatment plants, industries, construction sites, sewer overflows, and landfills. Pollution can be chemical or physical and can impact flow rates, result in unfavorable turbidity, conductivity, dissolved oxygen, pH, and temperature levels, and cause nutrient enrichment.

Table 5: Benthic invertebrates recorded at Riverdale Farm Ponds during 2002 and 2003 volunteer surveys.

Common Name	Class/Order	Pollution Tolerance Group	2003 Lower Pond	2002 Lower Pond	2002 Sanctuary Pond
			12-Aug	22-Jul	22-Jul
Aquatic Worm	Class Oligochaeta	3		1	
Beetle Larva	Order Coleoptera	2			
Damselfly Larva	Order Odonata	2			
Dragonfly Larva	Order Odonata	2	2		
Fly Larva	Order Diptera	Variable			
Leech	Class Hirudinea	3		6	4

Mayfly Nymph	Order Ephemeroptera	1			
Midge Fly Larva	Order Diptera	3		2	
Scud	Order Amphipoda	2		7	2
Snail	Class Gastropoda	Variable			
Snail Gilled	Class Gastropoda	1		3	
Snail Lunged	Class Gastropoda	3		14	2
Sowbug	Order Isopoda	2			2
Water Beetle	Order Coleoptera	Variable			
Water Boatman	Order Hemiptera	Tolerant	7		
Riffle Beetle	Order Coleoptera	Sensitive	1		
Whirligig Beetle	Order Coleoptera	Tolerant	1		
Water snipefly larvae	Order Diptera	1	1		
Watermite	Order Hydracarina	Unknown	1		
Water Strider	Order Hemiptera	Tolerant	1		
Water Flea	Order Cladocera	Unknown			

* Invertebrates were not surveyed in the Sanctuary Pond in 2003 and only once at the Lower Pond

3.1.6 Incidental Observations

Incidental observations are provided by staff and volunteers who, outside of set monitoring activities, have reported wildlife sightings and made other noteworthy observations.

The colony of muskrats inhabiting the Lower Pond in 2002 consumed a significant portion of the pond's shoreline vegetation, including arrowhead, sedge, and cattail plants. The damage caused by the muskrats in 2003 was far less severe. Whether this is due to the muskrats abandoning the site or the discovery of another food source is uncertain at this time.

The red-eared slider is a non-native species that could be harming the ecosystem. Further information on this species is provided below.

Red-Eared Slider Turtles

Red-eared slider turtles were observed in both the Lower and Sanctuary Pond in 1999, 2000, 2001 and 2002. Red-eared sliders are not native to Canada. It is believed that the individuals at the Farm are unwanted pets that have been intentionally released into these ponds. At a young age red-eared sliders are mainly carnivorous, feeding on insects, crayfish, worms, snails,

amphibians, and small fish. As they age, they consume more plant matter and their diet largely consists of algae, duckweed, and other aquatic plants. It is possible that these turtles are stressing the populations they feed on, and that they are responsible for the relatively low numbers of amphibians detected at the ponds. Since they are a non-native species, they often carry diseases to which our native turtles have not been exposed and therefore are not resistant. It is possible that the lack of painted turtles at the ponds is due to the presence of the red-eared sliders.

3.2 Sources of Error

Although volunteers and staff collected the data as accurately as possible, some degree of error is likely to occur. For instance, it is possible that species were misidentified or missed during the surveying period due to limited experience of the volunteers.

3.3 Future Monitoring Activities

The monitoring program in 2003 was missing several key elements including a vegetation survey, precipitation measurements and a benthic invertebrate study in the Sanctuary Pond.

The program in 2004 should continue to observe and record native and non-native vegetation communities in the Lower Pond, water levels, water chemistry, benthic invertebrates, and birds in both ponds. The professional monitoring component, including a vegetation and bird survey, should resume in 2006.

Volunteers should continue to participate in the monitoring program, as they provide an efficient method of collecting information pertinent to assessing the health of restoration projects. Further, the monitoring program provides the public with an excellent opportunity to learn about the natural environment in Toronto; and it is an effective way to encourage people to visit the Don Valley to learn about and appreciate the efforts of the Task Force to Bring Back the Don. The data collected by volunteers can be used with some level of confidence to assess the health of the marsh, as volunteers follow specific protocols and are trained, and frequently accompanied by staff. For more details on future monitoring activities, see 3.3.1 – 3.3.4.

3.3.1 Birds

Bird data collected by volunteers over the course of the monitoring program has been quite variable. A wide range of identification abilities exist among volunteers and caution should be taken when making direct comparisons among data.

The program has been very popular but volunteers who sign up often lack real birding experience. A person with sound bird identification skills should accompany less experienced volunteers on outings to ensure accurate data.

3.3.2 Vegetation

Volunteers are capable of surveying vegetation, as long as a staff person is on site that is able to help identify the species being surveyed.

Non-native species should be surveyed prior to maintenance efforts to ensure accurate observations of the abundance of invasive species present.

Vegetation monitoring should be conducted every year, as it provides useful information from which to determine the maintenance needs of the site and allows maintenance efforts from the previous year to be evaluated.

3.3.3 Water chemistry, water level, and precipitation data

The water chemistry and water level data collected by volunteers can be used to assess the health of the ponds. Volunteers need to be trained on an individual basis to use the equipment; however, once this is done, the data should be as accurate as the equipment allows.

3.3.4 Benthic Invertebrates

A knowledgeable staff person should accompany volunteers during benthic invertebrate surveys because volunteers generally have no experience collecting and identifying these organisms. Sampling of benthic invertebrates should be done on approximately the same dates, across all sites and years, in order for accurate comparisons to be made.

4.0 STEWARDSHIP PROGRAM RECOMMENDATIONS

The data gathered from the Stewardship Program are extremely valuable in order to determine maintenance requirements for the Riverdale Farm Ponds. Based on this report, the following recommendations will be made:

- Care for trees and shrubs planted at the marsh in the fall of 2002 and spring of 2003. The trees will need to be watered during drought periods, mulched, and tall vegetation growing around the trees will need to be clipped back. Also care for and monitor the herbaceous plants that were planted in the summer of 2003.
- Collect and dispose of litter.
- Continue to monitor vegetation, birds, water chemistry, water levels, and benthic invertebrates.
- Overall, the amount of monitoring performed in 2003 was far below average and will need to be stepped up in 2004.
- Continue to manage invasive non-native species, namely black locust, creeping/Canada thistle, Dame's rocket, dog-stangling vine, European stinging nettle, European water-horehound, garlic mustard, Manitoba maple, purple loosestrife, scotch elm, Siberian elm, tree of heaven, and white mulberry.

- Mechanically aerate the Sanctuary Pond to create more favourable habitat conditions for aquatic life.
- Plant arrowheads and other aquatic vegetation to compensate for muskrat damage.
- Put up regulatory signage to inhibit people from dumping unwanted pet turtles and fish into pond ecosystem.
- Work with the City of Toronto Urban Forestry Section to manage woody invasive non-native species on the slope adjacent to the Lower Pond, as well as around the Sanctuary Pond.
- Work with the City of Toronto Works Department to redirect overflow water from an ornamental pond into a sanitary sewer. Currently the water overflows into the Sanctuary Pond.

5.0 REFERENCES

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Appendix A: Riverdale Farm Ponds Acknowledgements

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Task Force to Bring Back the Don

Toronto and Region Conservation Authority

Unilever Canada

Appendix B: Benthic Invertebrates 1999, 2000 & 2001 Data

Table 6: Benthic invertebrates recorded at the Riverdale Farm Ponds during 1999, 2000 and 2001 volunteer surveys.

Common Name	Class/Order	Pollution Tolerance Group	1999		2000			
			7-Jul	18-Aug	6-Jun	4-Jul	30-Aug	
Aquatic Worm	Class Oligochaeta	3	30+	6	5	22	11	
Beetle Larva	Order Coleoptera	2						
Copepod	Order Copepoda	Unknown	1					
Crayfish	Order Decapoda	2	1					
Damselfly Larva	Order Odonata	2						
Dragonfly Larva	Order Odonata	2						
Fly Larva	Order Diptera	Variable	2					
Leech	Class Hirudinea	3	2		6	4	1	
Mayfly Nymph	Order Ephemeroptera	1	4			2		
Midge Fly Larva	Order Diptera	3	1	2	5	10	1	
Scud	Order Amphipoda	2	2			4	1	
Seed Shrimp	Order Ostracoda	Unknown	Many					
Snail	Class Gastropoda	Variable	19	9		2	19	
Snail – Gilled	Class Gastropoda	1	-----					
Snail – Lunged	Class Gastropoda	3	-----					
Sowbug	Order Isopoda	2	7		6	3		
Water Beetle	Order Coleoptera	Variable	3				1	
Water Flea	Order Cladocera	Unknown						
Water Mite	Order Hydracarina	Unknown	Many					
Watersnipe Fly Larva	Order Diptera	1		3				

Common Name	Class/Order	Pollution Tolerance Group	2001 Lower Pond			2001 Sanctuary Pond		
			10-Jun	8-Jul	26-Aug	10-Jun	8-Jul	26-Aug
Aquatic Worm	Class Oligochaeta	3	8	21	8		1	
Beetle Larva	Order Coleoptera	2	10	5				
Damselfly Larva	Order Odonata	2	37					
Dragonfly Larva	Order Odonata	2	3	2				
Fly Larva	Order Diptera	Variable					1	
Leech	Class Hirudinea	3	3	1	3			
Mayfly Nymph	Order Ephemeroptera	1	2					
Midge Fly Larva	Order Diptera	3			3	3		
Scud	Order Amphipoda	2	10	29	5	1	4	
Snail	Class Gastropoda	Variable		6				
Snail – Gilled	Class Gastropoda	1	1					

Snail Lugged	Class Gastropoda	3	3	10	41	1	
Sowbug	Order Isopoda	2	17	15			6
Water Beetle	Order Coleoptera	Variable	3				
Water Flea	Order Cladocera	Unknown		21			