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Sifton Bog White-Tailed Deer Management Study
City of London

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1.0 Introduction

1.1 Background

The City of London, like many portions of southern Ontario, has experienced considerable land use changes over the past few decades. Despite urbanization changing the landscape around cities from rural agricultural lands, white-tailed deer (*Odocoileus virginianus*) have been able to adapt and thrive in urban natural areas such as those found in the City of London. A number of factors have contributed to the continued presence of deer within the City of London, including retention of remnant natural areas in the City, high reproductive rates of the deer, and lack of natural population controls. In the past decade concerns have been growing regarding the deer population in portions of the City, especially the habitats associated with the Sifton Bog,. These concerns include the potential impact of deer on the significant natural areas within the City of London. In the case of Sifton Bog, concerns include concerns over irreparable harm to the bog habitat as well as concerns for human safety as a result of deer-vehicle collisions. The concerns associated with the Sifton Bog white-tailed deer were the catalyst behind the development of a City-Wide Deer Management Strategy that is provided under separate cover (NRSI 2011).

The issues of negative deer-human interactions within the City of London started in 2000 when the Upper Thames River Conservation Authority (UTRCA) began receiving more calls regarding deer on private property. This resulted in the formation of a community steering committee to study the issue of white-tailed deer. In 2003, the City of London reviewed a report prepared by the White-tailed Deer Community Steering Committee with an ultimate recommendation to permit lethal control of the deer population to reduce the number of deer in the Sifton Bog area to 8 individuals. This recommendation was not approved by City Council. Later the same year, City Council outlined specific areas that should be addressed in a more complete and detailed white-tailed deer management action plan. Key aspects of this action plan were to address population size and movement patterns, as well as potential management options, with a focus on non-lethal techniques. A White-tailed Deer Management Strategy, prepared by Upper Thames River Conservation Authority (UTRCA) and the City of London in 2005 provided numerous action strategies including a “managed cull” ‘to reduce deer numbers.

Council did not support this 'last resort' option due to the difficulty in carrying out the hunt and the lack of guarantee that deer would not simply return to the bog. A number of other population management strategies and monitoring tools were brought forward for discussion and supported by Council

A report was prepared for the Planning Committee in August 2007, providing an update on actions taken to implement the White-tailed Deer Management Strategy. The Sifton Bog Conservation Master Plan 2009-2019 (City of London and UTRCA 2009) further examined some of the management recommendations outlined in the 2007 report. During the Master Plan process, the topic of deer was a prominent issue and members of the Local Advisory Committee for the Master Plan were still supportive of a lethal population reduction to protect the ecological integrity of the ESA. Once again, lethal control was examined and rejected.

In January 2009, a public meeting for the Sifton Bog Conservation Master Plan 2009-2019 was held. Concerns were raised that vegetation would not be protected/preserved if management options were not implemented to reduce the deer population within Sifton Bog ESA in a timely manner. The debate over lethal versus non-lethal control was once again referred to staff for further review and was to be based upon the results of other studies being completed, including vegetation monitoring plots in the Sifton Bog ESA, deer population counts, and an evaluation of deer exclosures undertaken by the City of London, UTRCA, and local academics.

A chronology of events regarding the white-tailed deer in the Sifton Bog ESA has been prepared by the UTRCA. It is available on their website, and has been appended to this report (see Appendix I).

Natural Resource Solutions Inc. (NRSI) was hired by the City of London in 2009 to coordinate all efforts by the City to address the ecological and social impacts of the Sifton Bog deer population in detail, including some new data collection and assessment of the herd. The goal was to develop a Sifton Bog white-tailed deer management plan. It was recognized, however, that the deer issues within the Sifton Bog ESA may not be an isolated situation. To avoid creating future situations in the City of London similar to that of the Sifton Bog ESA, an over-arching city-wide deer management strategy was

needed, which could guide the development of future management strategies for areas with deer issues. This city-wide management plan is contained in the City of London City-Wide White-tailed Deer Management Strategy, prepared by NRSI concurrently with this Sifton Bog White-Tailed Deer Management Study. Its management framework has guided the development of the recommendations contained within this report.

1.2 Organization of this Document

The following is an overview of the organization of this report.

Section 2 includes an overview of the Sifton Bog ESA habitats. Section 3 provides a discussion of white-tailed deer ecology and management. The current understanding of the Sifton Bog deer herd is detailed in Sections 4 and 5. Section 6 includes a discussion of the recommended deer management options for the Sifton Bog deer.

2.0 Overview of the Sifton Bog and White-tailed Deer

The Sifton Bog is located in the west portion of the City of London and is bounded on the north by Oxford Street West, Hyde Park Road on the east, and to the west by a residential neighbourhood that lies east of Sanatorium Road. The Sifton Bog, one of the most southerly peat bogs in Canada (City of London and UTRCA 2009), is approximately 50ha in area and is classified as an Environmentally Significant Area (ESA) on Schedule B of the Official Plan for the City of London (City of London 2006), Provincially Significant Wetland (PSW) and a Life Science Area of Natural and Scientific Interest (ANSI-LS) by the Ontario Ministry of Natural Resources (OMNR). The bog is also classified as an International Biological Program (IBP) site in Region 5, Area 259 (City of London and UTRCA 2009).

The Sifton Bog ESA is owned by the UTRCA (30ha), City of London (10ha), and private landowners (10ha) (City of London and UTRCA 2009). Figure 1 is extracted from the Sifton Bog ESA Conservation Management Plan 2009-2019, and provides an overview of the Sifton Bog ESA, as well as ownership boundaries. As of 2008, the Sifton Bog ESA became completely surrounded by urban development, isolating it from other natural features, thus leading to resource management challenges, including possible conflicts between white-tailed deer and sensitive bog vegetation (City of London and UTRCA 2009). Based on available airphotos and the Sifton Bog ESA Conservation Master Plan 2009-2019, the nearest natural feature is the Thames River corridor, located approximately 500m southwest of the bog.

The Sifton Bog ESA is comprised of open water (Redmond's Pond), surrounded by a floating peat bog mat with scattered leatherleaf (*Chamaedaphne calyculata*) shrubs and small black spruce (*Picea mariana*) and tamarack (*Larix laricina*) in it. A narrow band of black spruce swamp surrounds the open peat bog mat. Mixed and deciduous swamp, buckthorn thicket swamp, and small open marsh surround the open bog and occupy a large area of the kettle depression. Young to mature upland forests and shrub thickets occupy the slopes around the central bog (City of London and UTRCA 2009). Detailed vegetation community mapping, as well as community descriptions are outlined in the Sifton Bog ESA Conservation Master Plan 2009-2019 (City of London and UTRCA 2009) and shown on Figure 2.

Within the vicinity of the Sifton Bog ESA , there are several issues and challenges regarding the white-tailed deer population. These relate to concerns over deer-vehicle interactions, the potential spread of diseases, damage to the bog ecosystem and surrounding private property, and supplemental feeding of deer. These issues are presented below.

Deer-vehicle collisions are a threat to human safety and are one of the predominant causes of deer mortality within suburban environments where a lack of natural predators or hunting bans exist. Vehicle collisions with deer can result in serious vehicle damage, personal injury and human mortality. High deer-vehicle interaction rates have been observed in the vicinity of the Sifton Bog ESA.

There is concern that deer populations within residential or suburban areas may pose a threat to human health by increasing the exposure to disease such as Lyme disease, encephalitis and parasites. As described in City of London City-Wide White-tailed Deer Management Strategy (NRSI 2011), Lyme disease is not currently a concern in Middlesex-London. There are also concerns that a large deer population would pose a threat to the herd health by increasing the potential spread of disease or parasites within the herd (such as Chronic Wasting disease (CWD)).

Anecdotally, concerns have been raised in the past regarding the impact deer may be having on the bog mat and surrounding vegetation. Studies on the vegetation within the Sifton Bog ESA have been conducted to qualify and quantify these impacts.

Deer frequently prefer landscape plantings and agricultural crops to other wild foods in their range. Throughout past years some residents living in close proximity to the Sifton Bog ESA have been providing supplemental food for the deer. Recently the UTRCA has enforced a ban on feeding all wildlife within the Sifton Bog ESA, among other natural areas within London. Signage and educational information about the detrimental effects of feeding wildlife have been utilized in an attempt to educate residents and alter human behavior.

Figure 1. Property Ownership (from City of London and UTRCA 2009)

Figure 2. 2007 Vegetation Communities (from City of London and UTRCA 2009)

3.0 Understanding White-Tailed Deer Ecology

3.1 Deer as "Keystone" Species in Urban Natural Areas

Deer are often 'keystone' species in temperate habitats, in that they have a disproportionate effect on the natural environment relative to their number, especially in the absence of most predators. However, accidents with human vehicles and some increases in coyotes, may be affecting deer populations in some areas. Nonetheless, deer often have many urban-to-exurban habitats available without much competition from other (often extirpated) ungulates and/or predators.

The characteristics of areas that have experienced an over-population of deer include impacts to forest regeneration, damage to nearby crops and landscape plants, as well as elimination of preferred deer foods. Deer impacts on their habitats are both immediate and cumulative. One of the major impacts is foraging of understorey herbs (especially *Trillium* and *Panax* species) without assisting dispersal via scat. The damage is often so extensive that the plants do not survive. The browse on trees can be quite damaging due to removal of lower branches, and bark, as well as impacts to roots that allows disease or girdling to occur. If densities of deer are high, then they may start damaging saplings and seedlings of trees and shrubs and as a result hinder the development of the understory, and the forest declines.

Over-browsing and intensive foraging on preferred plants can compromise the long-term efforts of ecosystem preservation and restoration efforts in remnant natural areas by altering the composition and structure of flora (Witham and Jones 1992). High deer densities in remnant natural areas have been shown to virtually extirpate rare or endangered plants (Miller et al. 1992), reduce the abundance, cover, density, vigor and diversity of native plant species (Strole and Anderson 1992, Witham and Jones 1992, Tilghman 1989), and potentially provide a competitive edge to exotic plant species.

Deer also trample, dig, and erode soils which can cause nutrient loss, and more importantly, allow for invasive plant or invertebrate species to colonize and set in motion a cycle of ever-increasing invasive species populations and decreases in native species. This is especially true if the habitat edge has been made abrupt as a result of urban or

road development adjacent to remnant natural areas. In such cases, the edge to interior ratio of a habitat often increases, making it vulnerable to windthrow, increased light penetration, increased temperatures and reduced humidity (especially in forests, marshes, fens, and bogs).

Once invasive species establish, deer often avoid them and do not destroy them (e.g. garlic mustard (*Alliaria petiolata*)). In many cases deer may browse and disperse the seeds from these invasive plant species while not dispersing the seeds of native species (e.g. invasive buckthorns (*Rhamnus* species) are often dispersed by deer) (Waller et al. 2009). Avoidance of unpalatable species and differential impacts of grazing have been found to shift groundcover vegetation composition in some areas, for example increasing the abundance of grasses, sedges and some ferns (Rooney 2003).

These shifts in vegetation composition create a further series of cascading and indirect effects as the habitat changes so much that other mammals, birds, invertebrates (spiders, springtails, ground beetles), lichens, fungi (especially mycorrhizae), and even bacteria can be harmed, and invasive or less conservative native species replace them. The cumulative impact is that deer can foster an alternate stable state of an ecosystem, where the state is a new and relatively degraded habitat that has diminished nutrient and water-cycling, as well as low biodiversity. The problem is severe because the alternate stable state means that extreme measures of restoration and deer management may be needed if there is to be any hope of restoring the degraded state to some form of more complex and sustainable 'original' state.

White-tailed deer have also been found to impact other wildlife species either directly or indirectly. For example, heavy browse in a park area in Ohio was found to influence recovery of vegetation being established to support a re-introduction program of Karner blue butterflies (*Lycaeides melissa samuelis*) (Kuntz 2009). An overabundant island population of deer was found to reduce the abundance and diversity of intermediate canopy-nesting songbirds due to vegetation changes as well as actual consumption of ground-nesting eggs and young (Raposa and Greene 2009). In a Pennsylvania study, DeCalesta (1994) also found that changes in vegetation via deer browsing impacted intermediate canopy-nesting songbirds and reduced bird species richness and abundance.

Humans also have one further reason to avoid habitats where deer are overabundant as they can carry ticks (*Ixodes*) that vector Lyme disease. Lyme disease is not the direct 'fault' of deer – the disease does best where humans have created fragmented habitats with lush edges of invasive species where ticks can gestate and deer will be attracted. Within the City of London and surrounding region, to date there have been no reported instances of the deer tick or Lyme Disease.

3.2 Ecological and Social Carrying Capacity

Ecological carrying capacity (generally denoted 'K') is the maximum number of individuals that a habitat can sustain (McCullough 1984). From the perspective of population dynamics, the ecological carrying capacity is the point at which annual recruitment to the population creates a residual population that does not change over time (McCullough 1984). Hayne (1984) stated that although the actual population level at K is often of interest, knowing the rate of population growth and the population level relative to K is generally of more importance from a management perspective. That is, how close is the population to K and what is the rate of population change (McCullough 1984). It is common for populations to overshoot the ecological carrying capacity both as a result of growth rates as well as the fact that as the population approaches the ecological carrying capacity, the impact of the population (e.g. on the browse availability) can depress the carrying capacity. McCullough (1984) stressed that when a deer population is at the ecological carrying capacity there will be considerable vegetation impact; the maximum level of vegetation impact that is sustainable.

In cases where the deer population exceeds the ecological carrying capacity, the herd often includes smaller numbers of fawns, higher mortality rates (especially of fawns and older deer), lower average weight in age classes, smaller antlers, , and increased prevalence of parasites and disease (Brinkman et al. 2005).

Social (or cultural) carrying capacity may be equally relevant in urban areas. Social carrying capacity is the level at which the deer population can coexist with the human population without negative impacts (D'Angelo 2009). It is possible that social carrying capacity can be greater than ecological carrying capacity. This was the case presented

in the 2003 Sifton Bog Deer Management Plan prepared by the Community Steering Committee. However, an important distinction must be made here. Although the social carrying capacity may be greater than the ecological carrying capacity, i.e. the population level at which there is a deer-human conflict is greater than the habitat can sustain, it does not imply that the social carrying capacity should be a management target. If the goal is to have a deer population above that which the habitat could support, it would certainly result in negative impacts to the habitat. Substantial habitat destruction and either the collapse of the population or the need for considerable intervention (e.g. supplemental feeding) would result. In cases where social carrying capacity is greater than the ecological carrying capacity, this level should be regarded as an upper population threshold above which management measures (or perhaps more aggressive measures) may be triggered.

Management of a population at a social carrying capacity that is lower than the ecological carrying capacity would avoid impacts to the habitat, but would require human intervention since the population would continually increase towards K. If the social carrying capacity is close to the maximum number, the growth rate of the population would then be at its maximum. This would require considerable intervention, such as either actively depressing the population levels by removal of deer or actively reducing habitat quality/quantity (thereby reducing the ecological carrying capacity to the desired social carrying capacity).

Ecological carrying capacity is often presented in the literature as a density (all citations converted from original to number of deer per hectare in following discussion). A wide range of densities are presented in the literature, but these reflect local habitat conditions and may have limited value in determining ecological carrying capacity for a local population. In fact, Halls (1984) claimed that there is no standard methodology for determining carrying capacity. As such, estimates are generally subjective and include wide margins of error. Generally researchers cite densities at which visible negative impacts, especially to vegetation, occur. However, Halls (1984) noted that by the time damage to vegetation is evident to the manager, the impacts to the vegetation are generally great and the population may be on a trajectory to far overshoot carrying capacity. The only exceptions are where specific actions like harvesting are taken, in which case more accurate values (for ungulates) are possible because of more precise

population counts related to each harvested deer being measured and geo-referenced (Nielsen et al 1997, Keyser et al 2006, Majudano 2007). However, this would not apply to urban deer populations since direct harvesting is generally not permitted or publically accepted in urban areas.

Brinkman et al. (2005) reported carrying capacities in agriculturally-dominated upland landscapes at 0.01 deer/ha, and in lowlands at 0.2 to 0.31 deer/ha. Masters et al. (no date) provided a similar average for agricultural lands: 0.07 deer/ha (ranging from 0.02 deer/ha on low productivity sites to 0.17 deer/ha on high productivity sites). DeNicola et al. (2008) studied suburban deer populations and found that deer became problematic when the density exceeded 0.2 deer/ha, but found it was common to find suburban deer densities greater than twice that. Raposa and Greene (2009) cited a number of deer densities that caused vegetation impacts ranging from 0.02 deer/ha to 0.17 deer/ha. Recommendations were cited to avoid human-deer conflicts in suburban areas of 0.04 deer/ha, and 0.02 deer/ha to avoid impact to plant diversity in forested areas.

There are very few examples of ecological carrying capacity calculated for urban deer populations. Some of this relates to the difficulty in calculations wrought by an instability in reproductive rates as populations approach carrying capacity (i.e. fawn survivorship may plunge as the ecosystem degrades rapidly and the carrying capacity is not reached – although the ecosystem may be shattered) (Peterson et al. 2004). In other cases, variation in dispersal can make calculations difficult (Porter et al. 2004), although suburban habitats can, ironically, make this easier if they are ecological traps for deer with effectively one way in/out.

Much of the issue with calculating carrying capacity relates to the challenge of determining the size of the habitat being used by urban deer. When there is a natural habitat embedded in an urban matrix, the determination of the spatial scale of the population is difficult to assess as it includes both natural habitats as well as portions of the urban matrix. So, for example detecting a number of deer in a remnant habitat patch in an urban area in which the home ranges of deer extend into the urban matrix, the density would be in error if based solely on the area of remnant natural habitat. Some component from the urban matrix must be included in the determination of carrying capacity in such situations.

3.3 Home Range

No discussion of carrying capacity can be complete without a clear understanding of the scale of the assessment. Many researchers emphasize the need to assess deer populations at a landscape level (e.g. Webb et al 2009, Brinkman 2003) and caution that focusing on a relatively small specific habitat can lead to erroneous conclusions. These researchers also emphasize the dangers of extrapolating from population studies in rural and forested habitats to urban and suburban areas. An important consideration is whether a habitat area, such as the Sifton Bog, provides sufficient habitat area to sustain a deer, or whether the home range of the animal exceeds the habitat patch.

Brinkman et al (2005) listed a number of sources citing white-tailed deer home ranges in a number of habitat types from 50 to 4800ha. They recognized that home range size varies through the year with winter ranges in agriculturally-dominated landscapes (averaging 5200ha) being greater than summer ranges (averaging 2300ha). Several researchers have found that home range sizes in suburban and urban areas are less than in rural areas. For example, Gaughan and Destefano (2005) found that home ranges of suburban deer populations were one tenth those of rural deer. Similarly D'Angelo (2009) found that deer home ranges in suburban habitats ranged from 20 to 800ha with most averaging 260ha. Suburban and urban deer also tended to have more elongated home ranges (Piccolo et al. 2000). Home range size is also known to change (increase) as deer density decreases.

3.4 Annual Cycle/Movement of White-tailed Deer

In regions with heavy snow, deer will congregate to traditional "deer yards" for the winter months, often forming groups of up to 50 individuals or more. These yards will usually occur in low-lying areas with dense cover, where an abundance of food and shelter will help to sustain the deer for a long period of time. Yards also help to keep trails open for easy movement through the snow as well as to provide protection from predators (National Audobon Society 1996). In most portions of southern Ontario, winter conditions, especially snow depth, are not sufficiently severe to force deer into yards. As such, true yarding may be very rare in many areas including the City of London, but deer may still preferentially use areas providing cover for thermoregulation, energy conservation, etc..

During the winter months, the deer will drastically reduce activity levels thereby limiting energy expenditure. Its diet during this time of year primarily consists of twigs and buds of maple, dogwood, aspen, willow and sumac, as well as evergreens and cedar in the more northerly part of their range (Kurta 2005). Grasses, herbs and leaves are browsed during the summer months, along with acorns, mushrooms, apples, corn and celery, when available. White-tailed deer may travel many kilometers between their summer and winter habitats. Although they may occupy the same home range throughout the years, they are not territorial animals.

Antler growth on the males will begin in the early spring. Growth will cease in late summer, and by fall the velvet will begin peeling off to reveal the hard boney tissue beneath. Most antlers will drop by January, although it is possible to see them on some individuals until early spring of the following year, just before growth begins again.

Rutting, or the breeding season, occurs in autumn for this species, peaking in November and lasting for approximately 2 months. Males that are still running in bachelor groups will begin sparring amongst themselves to establish strength and dominance. Buck groups will diminish and individuals will travel great distances in search of multiple mates, often challenging any male encountered during this time. If a doe is not successfully fertilized, she will come into heat again 28 days after the first attempt (Kurta 2005).

Fawns, usually twins, are born in late spring (late May-June). The doe will hide her young in tall grasses as she browses during the day, and will return periodically to nurse. A few weeks later, the fawns will begin feeding on grasses, however will not be completely weaned until they are approximately 4 months in age. Although some deer will become sexually mature during their first winter, it is highly unlikely males will have the opportunity to mate until they are older and stronger. Six or seven month old females may mate, and if successful, they will usually birth one fawn instead of two (Hinterland Who's Who 2010).

During the spring and summer months, male white-tailed deer will sometimes form small bachelor groups, and will spend the majority of their time feeding while slowly walking. Although similar movements and feeding patterns are observed amongst females, the

does will live the majority of the year in a family group, with her newest fawns of the year, as well as the yearlings from the season prior (Kurta 2005).

White tail deer can live for up to 15 years in the wild, however, few individuals survive for more than 3 to 6 years (Swihart et al. 1995). The age structure of white-tailed deer in urban areas in the northeastern United States has been found to be skewed towards older age classes (Cornicelli 1992, Witham and Jones 1992). Studies by Witham and Jones (1992) and Cornicelli (1992) indicated 50-70% of urban deer to be >2.5 years of age. According to Swihart et al. (1995) the age structure of white-tailed deer in urban areas is similar to that of rural unhunted deer populations.

3.5 Urban Deer Behavioral Considerations

In the urban context, natural areas which offer cover habitat for deer are typically isolated or there are weak corridors of habitat leading to more rural woodlots. The location of roadways can influence the type and extent of habitats used by deer and have a direct impact on deer populations. The extent of impact is greater on major than minor traffic arteries. Three key behavioural considerations of rural versus urban white-tailed deer are discussed below. These factors can help provide some insight into the causes of negative deer-human interaction in urban areas.

1. Movement and Daily Routes.

   There are four daily movement occurrences of the white-tailed deer under rural conditions. Major feeding and travel opportunities for white-tailed deer are usually at dusk and dawn and last from one to three hours. Minor feeding and travel opportunities occur at noon and midnight and last one-half to two hours. Because travel and feeding in urban areas are influenced by human activity, the major and minor feeding occurrences in the urban setting are compressed into almost exclusively nocturnal movements. During the nocturnal movements of deer in the urban environment, deer will forage on residential lawns and landscaping and therefore regularly cross main roads and residential streets. The nocturnal movements of deer in the urban environment increases the risk of deer-vehicle collisions as it is a time when drivers have reduced visibility and deer activity is high.

2. Security Zones

   All white-tail deer have security zones which are used repetitively for bedding. Locations of these zones can vary both seasonally and year to year, based on factors such as human activities and environmental conditions (e.g., water levels and time of leaf-drop in fall). In rural areas, most white-tailed deer have numerous security bedding areas that cover a relatively large area to escape detection.. Escape cover is also more readily available in a variety of directions should predators or an alarm response be triggered. The London urban white-tailed deer have smaller areas for the locations of safe bedding areas, and few options for a safe escape, should they be disturbed in a security area that is positioned poorly within an urban setting.

3. Deer Physiology

   Deer are prey animals that respond to threats by what is termed “the flight response”. Urban white-tailed deer are ill equipped to run over smooth surfaces like pavement, or cement, which dominate a large part of the urban landscape. Their aversion to movement, traffic, humans, and lights exacerbates the deer’s panic response. Full flight response through residential areas can result in deer leaping fences and becoming trapped, or they run across roads resulting in collisions, or in some cases, death.

3.6 Overview of Data Requirements

White-tailed deer researchers agree that setting goals is a basic first step in determining appropriate management activities. This is often overlooked and may have a number of ecological, social, political, and financial aspects. There is also a need to understand the population dynamics of the herd in order to predict effects of management. Generally the key information needs relate to population growth and habitat sustainability and include mortality, growth rate, immigration and emigration. In many white-tailed deer management programs immigration and emigration are assumed to balance and are often ignored. In those cases it is assumed that the numbers of deer leaving and entering the population are roughly equal. However, in some instances a habitat may act as a ‘source’, i.e. providing more individuals to the overall population and thereby having a net larger emigration. In other cases the habitat may act as a ‘sink’ in which

the population experiences a net greater immigration, perhaps due to mortality. In either case it is important to know whether the population being managed has known spatial bounds and whether the population is 'closed' (i.e. contained within the specific area) or subject to exchange of individuals with neighbouring habitats (i.e. 'open').

Based on our experience with white-tailed deer management, a list of information needs for managing an urban deer population was assembled as follows:

- Immigration and emigration
- Availability of browse (quality and quantity)
- Impact of browsing on regeneration in the habitat, influences on invasive species and change in the vegetation community
- Size of the home range of deer
- Seasonal and annual movement patterns
- Sources and amount of mortality (road kills, other)
- Role/influences of predators
- Critical habitats for the deer (e.g. security zones, winter yards)
- Population growth rate, including seasonal/annual variations
- Age structure of the deer population
- Sex structure of the deer population
- Current health of the herd

A fundamental goal of most studies is to understand the carrying capacity of the habitat. This concept is discussed in more detail below. Although white-tailed deer studies vary, most researchers emphasize the need to manage on a landscape level, not focus on a specific habitat patch or sensitive habitat component. The management of white-tailed deer at a landscape level is necessary in order to understand the broader population of deer within the management area. Managing deer at a broad landscape scale enables an understanding by managers of things such as where deer are emigrating from and where movement corridors exist. In some examples of urban wildlife studies, it is assumed that the remnant natural habitats are the extent of the area that needs to be assessed to understand the species. However, in the case of deer, the neighbouring urban land uses (including lawns and parks) can form an integral part of this mobile

species' habitat. The contribution of these urban land uses and movements between the remnant natural habitats and the urban matrix must also be considered.

4.0 Review of Existing White-tailed Deer Data

The following is a synthesis of information on the Sifton Bog white-tailed deer population. It is based on background information sources, namely the deer counts conducted in the bog by the UTRCA and others, deer-vehicle incident statistics and mapping, as well as field surveys and mapping completed in the winter of 2009/2010 by NRSI.

4.1 Collection and Review of Background Information

To obtain a thorough understanding of the Sifton Bog ESA and develop a successful management strategy, NRSI conducted a review of background information from a number of sources (e.g. City of London, UTRCA). During this review, NRSI focused on obtaining information regarding flora and fauna studies conducted within the bog, annual deer count methodology and findings, as outlined by UTRCA, City of London deer incident reports, previous management recommendations for the Bog and white-tailed deer management reports for a variety of other urban areas and parks.

4.2 Deer Counts

Staff of the UTRCA and volunteers have been conducting an annual deer count in the Sifton Bog ESA since 2000. Standard point counts at 12 to 16 stations are annually monitored, and details regarding the methodology and results are summarized on the UTRCA website. A summary of the results is shown in Table 1.

Table 1. Annual White-tailed Deer Counts at Sifton Bog ESA (source: UTRCA)

Year	Number of deer	Notes
2000	20	Agricultural field still present on eastern tablelands
2001	23	Agricultural field still present on eastern tablelands
2002	45	Agricultural field still present on eastern tablelands
2003	24	Agricultural field still present on eastern tablelands
2004	26	Agricultural field still present on eastern tablelands
2005	53	Development of agricultural field begins
2006	52	Development of former agricultural field continues
2007	52	Development of former agricultural almost complete
2008	35	Development complete
2009	4	Water levels in the bog were unusually high
2010	6	Water levels down, supplementary feeding stopped, coyotes present

As the methodology used for the population count remained the same from year to year, the number of deer counted represents a relative population count, and can be used to compare trends year-to-year. However, these numbers do not represent an absolute count of the deer population for a given year, and do not represent an absolute value of deer population size within the Sifton Bog ESA.

The City of London has provided comments on local development conditions and other environmental factors that may have influenced the deer population in Sifton Bog (see Table 1). From 2000 to 2004, an active agricultural field was located adjacent to the Bog and numerous deer were routinely observed feeding in this field. From 2005 to 2008 development occurred on these lands. No provision for deer habitat or movement was included in the layout of the development permitted on this land.

The UTRCA deer counts in Sifton Bog show increasing deer numbers up to 2005. From 2005 to 2007 the number of deer observed by the counts remained steady at over 50 deer. From 2008 on the number of deer observed appears to have declined with 2009 having the lowest count of deer over the ten years of monitoring followed by a slight increase to 2010. The decline in observed deer appears to follow the completion of the development of the agricultural lands adjacent to the bog which once provided a supplemental food source for the deer in Sifton Bog. High water levels in 2009 are also believed to be an important contributing factor to the decreased number of deer observed wintering in the Sifton Bog ESA. The high water levels are believed to have reduced both the foraging opportunities and amount of area available for bedding areas around the bog community.

4.3 Deer-Vehicle Incidents

Deer-vehicle collisions are a threat to human safety and are one of the predominant causes of deer mortality within suburban environments where lack of natural predators and hunting bans exist. Collisions with deer can result in serious vehicle damage, personal injury and human mortality.

Past studies have shown that the number of deer-vehicle collisions has been correlated to both traffic volume (Bryant 1992), and greater deer abundance (Blouch 1984). Most

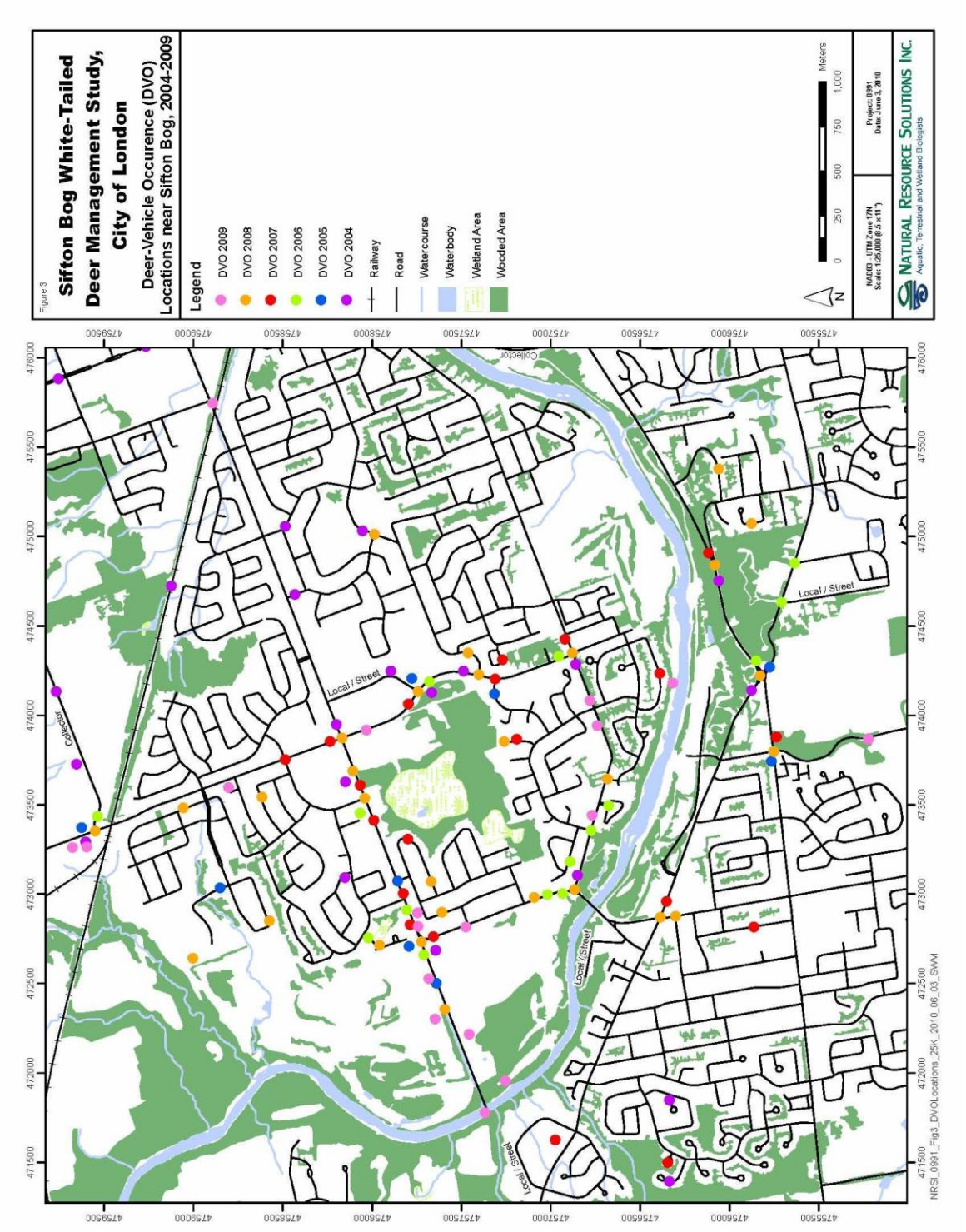
deer collisions occur during October through to December and to a lesser extent May to June. These periods coincide with heightened deer activity during the autumn breeding season and the spring as yearling deer disperse from their birth ranges (Allen and McCullough 1976 (Michigan data), Decker et al. 1990 (New York data), Puglisi et al. 1974 (Pennsylvania data)).

Information collected on deer-vehicle interactions throughout the City of London was reviewed to identify the extent of occurrences (refer to the City of London City-Wide White-tailed Deer Management Strategy (NRSI 2011) for further details). Note that "occurrences" do not necessarily refer to mortality. Using this information, deer data from near the bog was isolated in order to provide some spatial information on deer-vehicle occurrences (DVO) in the vicinity of the Sifton Bog ESA.

Deer-vehicle occurrence (DVO) records from 2004 to 2008 were provided by the UTRCA and are based on London Police Department records and reported locations of deer that were picked up by a contractor for the City. In 2008, 7% of all DVO within the City of London took place within 1km of the Sifton Bog ESA, which is average for the period over the previous 5 years. Based on this, there does not appear to have been a change in the proportion of DVO around the bog compared to the rest of the City. Figure 3 provides DVO locations in the vicinity of the Sifton Bog ESA. Note that the DVO locations are shown based on recorded nearest intersection or street address, and are approximate.

Deer mortality data from 2006 to 2009 was provided by the City of London. In order to observe seasonal variation, Figure 4 presents the monthly mortality data of deer killed within 1km of Sifton Bog ESA's centre.

Figure 3. Deer-Vehicle Occurrence Locations Near Sifton Bog, 2004-2008



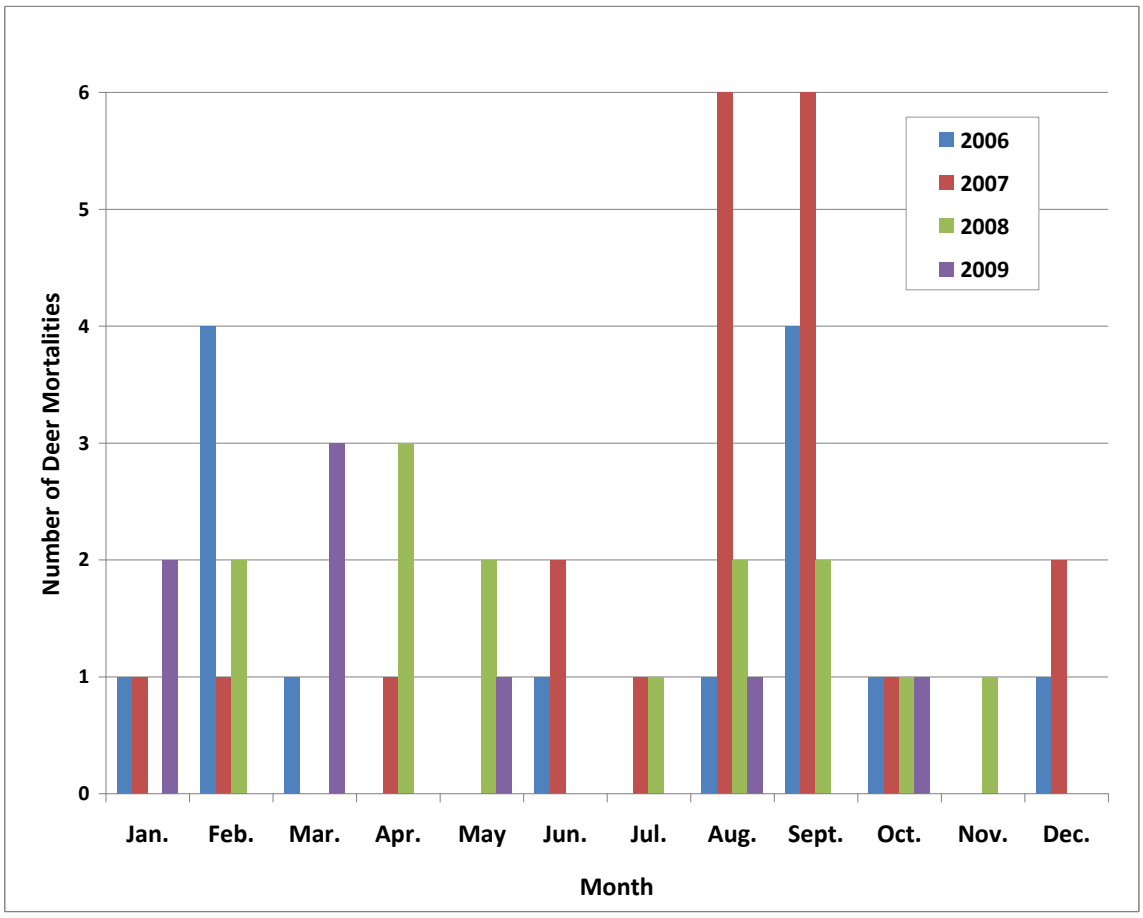


Figure 4. Deer Mortalities Within 1km of Sifton Bog ESA, 2006 – 2009 (City of London)

The peaks in DVO discussed above from other jurisdictions occur in spring and fall. The DVO in the immediate vicinity of the Sifton Bog ESA appear to be highest in August and September although the small sample size somewhat obscures the peaks visible in Figure 4.

A summary of the available DVO and deer count data in the vicinity of the Sifton Bog ESA is provided in Table 2.

Table 2. Summary of Deer-Vehicle Occurrences (DVO) and Deer Counts, 2004 - 2010

Year	Deer Count Sifton Bog ESA (UTRCA)	DVO within 1km of Sifton Bog ESA (UTRCA)	Deer Mortalities within 1km of Sifton Bog ESA (City of London)
2004	26	15	Unknown
2005	53	6	Unknown
2006	52	16	14
2007	52	22	21
2008	36	17	14
2009	4	Unknown	8
2010	8	Unknown	Unknown

The deer count for Sifton Bog ESA discussed in the previous section takes place in the fall of each year (November/early December) to estimate the total population. The deer vehicle occurrence records are a total for the entire year. Therefore there may be a direct relationship between the estimated deer population to the following year of DVOs (i.e., a population increase one year leads to higher DVO the following year). This pattern can be observed in the population size between 2005 and 2007, and the DVO in 2006 to 2008.

4.4 Summary of Vegetation Monitoring

Vegetation monitoring in the Sifton Bog ESA was conducted by the City of London in 1998 and 2008, and more recently by researchers at York University. The findings are discussed below.

In 2008, the City of London hired Bradwill Ecological Consulting to conduct vegetation monitoring in the Sifton Bog ESA (Bergsma and DeYoung 2010). Nine of 13 vegetation plots established in 1998 were re-sampled in 2008. Vegetation plots are only located around the bog itself and do not include the upland deciduous woodland and shrub thicket which surround the bog. Survey plots were 10x10m with three corners marked with wooden stakes and one with an iron bar and all vegetation species within the plot were identified along with their abundance. Forbes and mosses were monitored within four 1x1 m quadrats at each of the corners of the plot, where percent cover of individual species was identified. For shrubs and saplings in the plot, the number of stems and

percent cover were recorded. Trees within the plots were tagged and numbered, with their diameter at breast height (dbh) and health index determined.

The comparison of vegetation data from 1998 with that of 2008 indicates that some of the vegetation plots are showing evidence of successional changes taking place within the bog. One plot showed increased leatherleaf cover suggesting succession towards a thicker bog mat. Two plots showed shifts from shrub bog to tall shrub bog as the result of increasing young black spruce and tamarack. The information from vegetation plots also indicates a decrease in species presence on the open bog mat from 54 to 42 species from 1992 to 2008, a 28% decrease. The majority of these lost species occurred as small communities or individual specimens and were never found in abundance. Between 1969 and 2008 three keystone species of *Sphagnum* have been abundant in the bog, suggesting the bog is maintaining the critical metabolic control over nutrient and hydrogen ion concentrations required to support the bog vegetation. Glossy buckthorn has invaded the swamp communities and displaced many native species. Localized impacts to the bog mat were associated with deer trails where depression of the Sphagnum causes reduced growth and loss of species. Overall, the bog communities have good ecological integrity, as they have remained relatively stable over the ten-year period.

It is difficult to ascertain whether the loss of 28% of species presence in the bog mat itself is either the result of natural succession taking place, due to deer browse or a combination of these factors. Regardless, the 2008 study found that plant species diversity in the bog mat remains high for a bog habitat.

York University conducted vegetation monitoring studies in the Sifton Bog ESA involving the use of deer exclosures (Cestra and Bazely 2010). This study found that deer have had a measurable impact on wetland and upland vegetation, and that unless deer browse is reduced, future declines in plant biodiversity are expected.

Based on these two studies, it is evident that deer are having a definite impact on upland plant species, but that the magnitude of the impact on wetland plants is less clear. Further information on the impact deer are having on wetland plant species is required.

4.5 2009/2010 Winter Surveys

4.5.1 Deer Count Methodology Background

To assist in selecting appropriate survey methods for the 2009/2010 monitoring, a background review of methodologies was completed. Deer count techniques vary and are often combined in various ways:

- cameras
- radio or satellite telemetry
- forward looking infrared radar (FLIR)
- aerial surveys (helicopter, fixed wing, remote control small craft, airship); these may be visual or may involve thermal imaging (night-based surveys)
- track pad counts in mud or snow (dependent on non-manipulated surveys)
- track plates (using manipulated substances to capture tracks)
- spotlight counts
- road counts
- line transect counts, usually involving faecal pellet measures
- mark recapture and modeling
- mortality surveys (including reports from hunters or accidents with vehicles)
- incident surveys (these can include mortality incidents but are not limited to such events – incidents may be reports of sightings by citizens or experts and associated population estimates)
- hair snares
- projections based on habitat suitability indexes (spatially explicit or implicit maps including browse quality based on vegetation surveys)
- comparisons of historical versus contemporary data and comparisons of cross spatial data (e.g. larger area watershed surveys versus local area habitat fragment community surveys)

Comparing the peer reviewed literature related to deer counts, there are some 1,200 broadly relevant papers published since 1950 (using ISI Web of Knowledge), with many of these originating over the past 20 years. The wider literature on ungulate or mammalian counts plus discussions of general sampling theory and practice would increase this to over 3,000 papers since 1950. While daunting, the literature is in fact clear on the current state of the science of sampling design and techniques in general

and specifically related to deer counts. The best technique is the most expensive one: using some form of thermal or FLIR detection in association with aerial surveys. There is little error or bias - as long as sufficient flights are arranged. This becomes expensive as 3 to 5 flights a year may be required.

According to the literature, cameras are ranked next in terms of accuracy. Cameras are subject to bias because of choice of placement, range of sensitivity of the activating sensor, and problems with vandalism, natural causes of damage and electronic or battery failures. However, most camera surveys are based on empirical evidence of deer trail or other habitat use, hence there is a means to place a sufficient number of cameras that allow estimates of population numbers, behaviour or actions (e.g., do they eat or are they simply moving through an area?), residency, impact on vegetation and sometimes age or gender characterization.

The remaining methods have their merits if budgets are tight but the advent of relatively efficient and cost effective cameras has rendered these somewhat moot. It is acknowledged that accurate demographic data in terms of object-oriented models that will specify age and gender differences or individual fate models are only possible if deer are actually captured and then tracked via telemetry.

In many cases where management is the main interest, such details may not be critical though their value is not denied here. To construct good management models based on structured and spatially explicit population or community models or a landscape scale model, then such information is necessary. This can be a second phase for most urban, suburban or exurban locales since the main initial driver is perceived damage and the need for immediate short term decisions on options. For that reason, the critical issue is accuracy in assessing basic population numbers and a defensible sample size to avoid Type I or Type II analytical errors (i.e. concluding a false hypothesis is true or a true hypothesis is false because of under sampling – the implications are that the wrong management decision could be made). Aerial imaging surveys and cameras avoid errors.

These methods are, however, constrained by the length of a study and consistency over time. One season or even one year will not provide insight into the implications or

reasons for population fluctuations in deer. If one wishes to justify and choose the best management approach, a minimum of 5 to 7 years of data would be needed in light of demographic and environmental stochasticity. However, if damage is already measurable and attributable to deer then it is appropriate to take immediate action while considering a long term study and strategy to reduce costs. In the case of urban and suburban habitats, the deer populations are constrained by residential and commercial buildings, roads etc.. In the urban context deer are relatively easy to count or estimate accurately because of limits to the area needed to be searched and populations below between 10 to 75 deer per urban-to-exurban habitat fragment are typical. This means that even a one season study can establish a snapshot of whether the population is small (under 10 per 50ha) or large (over 30 per 50ha). Nonetheless, care must be taken to provide context for one season studies, as a wet year will usually reduce deer numbers (they sink into the mud and can die or will learn to avoid an area) and a dry year will usually increase deer numbers unless the dry years persist consecutively and kills vegetation or reduce browse quality.

Based on this review it was decided that the 2009/2010 monitoring would consist of camera-based monitoring of deer population, distribution and movement, and a mid-winter aerial survey of deer use within the Sifton Bog ESA and nearby habitats, as well as other natural areas of interest within the City (The Coves, Warbler Woods, Kilally Woods, and Meadowlily Woods). This survey was intended to include winter track mapping and a winter yard assessment within the Sifton Bog ESA.

4.5.2 Winter 2009/2010 Digital Deer Monitoring Cameras

Four digital deer monitoring cameras (Stealth Cam: *Rogue IR*), with the ability to take either video or still photos, were used to further our understanding of the deer population in the Sifton Bog ESA. These cameras were equipped with infrared flashes with a range of 12.2m for night time images, with the motion sensor being triggered by anything within 9.1m of the camera's sensor. Each photo or video recording is stamped with the date, time, ambient temperature (in Fahrenheit), and moon phase. Cameras were placed between 1 and 1.5m off the ground.

The cameras were placed in different habitats within the Sifton Bog ESA and were sited in locations where there was evidence suggesting high deer use, such as intersections of several deer trails. Cameras were set to take either video or still photos. Video recordings lasted 30 seconds to 1 minute, with 5 minute separation times between recordings. For still photos, cameras were set to take 3 to 9 photos sequentially with a 1 to 5 minute separation time between triggering of the camera. These settings allow for some indication to be made on the direction of deer movement when in the viewshed of the camera.

A Moultrie digital deer camera was used at the location of a buck carcass found along the edge of the bog mat. This camera was set to take still photos, with the date and time recorded on each photo. This camera was placed between 0.5 and 0.75m above ground in order to capture scavengers, which are of lower stature than white-tailed deer.

The locations of the camera monitoring stations are shown on Figure 5.

Figure 5. Locations of White-tailed Deer Camera Monitoring Stations

4.5.3 Winter 2010 Aerial Survey, Deer Track Surveys, Deer Yard Assessment

NRSI staff and Doug Smith of WREN Inc. completed an aerial flyover of the Sifton Bog ESA on March 8, 2010. The aerial survey was conducted in a Cessna-172. Both video and still photos were taken of the areas examined during the aerial survey and any pertinent information noted (e.g. location of any deer observations, numbers of deer, locations of prime wintering habitat and locations of trails).

The winter of 2009/10 was rather unusual with higher than normal temperatures extending into late fall and early winter, causing substantial snow melt to occur in December. Consequently, snow did not remain on the ground for prolonged periods until late January and into February. Relatively shallow snow depths throughout the winter resulted in few observations of typical winter yarding behavior. Due to the unusual winter weather conditions detailed deer track and yarding surveys were not conducted, as results would not have been representative of typical winter deer behaviour within the Sifton Bog ESA.

5.0 Summary of Findings

5.1 Deer Habitat

An ideal deer habitat provides both food and shelter. In the winter, deer seek out yarding or shelter areas where vegetation and topography create sheltered and warm thermal pockets. Once the summer crop of tender herbaceous browse (such as grasses, herbs and leaves) has been consumed, deer will forage on less ideal woody vegetation.

The flyover of the Sifton Bog ESA established a clear lack of dense high quality winter habitat that would attract and/or support a large congregation of deer within the bog. The only area of winter habitat is a narrow ring of black spruce and tamarack around the edge of the bog mat. The southern end of the bog mat contains the widest and largest section of this exclusively coniferous area. All other areas in the Sifton Bog ESA are deciduous dominated (except for a few scattered large white pines), which causes the area to be very open during the winter. The aerial survey also revealed that even the thicket areas are fairly open and exposed and may not provide as much thermal warmth and cover habitat for bedding and congregating as was initially thought. Winter deer habitat is limited within the bog, although deer are still present as per the 2009/2010 camera monitoring. Year-round study is needed to better understand the ways in which deer make use of the habitat within the Sifton Bog ESA.

During the aerial survey on March 8 2010, no deer were seen. Trails were observed in several locations, particularly around the edges of the property, but it is difficult to ascertain whether tracks were of dogs, people or deer. During the deer camera reset on February 3, 2010, a deer bed of four to five deer was found on the west side of Hyde Park Road (see Figure 6), indicating that some yarding is occurring with the Sifton Bog ESA, despite the poor winter habitat conditions.

Figure 6. Photo of Deer Beds on West Side of Hyde Park Road, Facing North-West

Over-browsing and intensive foraging on preferred plants can compromise the long-term ecosystem integrity and restoration efforts in remnant natural areas by altering the composition and structure of flora (Witham and Jones 1992). High deer densities in remnant natural areas have been shown to virtually extirpate rare or endangered plants (Miller et al. 1992), reduce the abundance, cover, density, vigor and diversity of native plant species (Strole and Anderson 1992, Witham and Jones 1992, Tilghman 1989), and potentially provide a competitive edge to exotic plant species.

Based on vegetation monitoring (Bergsma and DeYoung 2010) and NRSI fieldwork, it does not appear that the amount of deer browse in the Sifton Bog ESA is threatening the bog proper. However, there is a notable lack of dense understory and new growth above 15cm throughout the rest of the natural area. Whether within the glossy and common buckthorn (*Rhamnus cathartica*) thickets, hardwoods or softwoods in the south west of the bog, all areas displayed openness from 1.5m down to 15cm above ground level.

On the bog mat itself, little evidence of recent severe browse was found. In December when snow cover was limited there was evidence that the deer had not yet undergone the transition from herbaceous food sources to woody food sources. This was believed to be the case as some soft-stemmed bulrush, grass sp. and aster sp. were found to have been browsed upon at that time. Some of the deer monitoring camera photos and

video (in particular) also showed deer in the bog still foraging on herbaceous material at that time. During the February 3, 2010 site visit to reset the deer monitoring cameras, a walk-through of the ring of black spruce at the east side of the bog identified moderate browse on several leatherleaf plants. Elsewhere around the rim of the bog, browse on leatherleaf was not observed. As defined by Donoughe and Wolf (2007), moderate browse occurs where 50% or more of a stem is browsed. Figure 7 shows both stem and leaf browse on a leatherleaf shrub located among the black spruce which ring the bog.

Figure 7 . Photo of Deer Browse on Leatherleaf (*Chamaedaphne calyculata*) Stems and Leaves

In the deciduous upland forest areas of the Sifton Bog ESA there is generally a high upper canopy which creates a shaded understory. This may in part influence the limited growth of tree saplings in these areas. There are also few, if any, shrubs present within the upland forest habitats which would typically provide some browse opportunity. Historical overbrowsing by deer may also be a contributing factor to the limited amount of winter browse available in the upland habitats. Severe browse, as defined by Donoughe and Wolf (2007), occurs when saplings are severely hedged and under 15cm high. Little evidence of new severe browse was observed by NRSI staff during field visits. During the 2009/2010 winter, recent evidence of light browse (less than 50% of all stems browsed) was found by NRSI staff in some of the upland forest habitats.

Several changes to the Sifton Bog deer habitat have occurred in recent years, and may have contributed to a reduced white-tailed deer population. These changes relate to availability of food and changing water levels within this bog.

Historically, an agricultural field on the northeast side of the Sifton Bog ESA provided winter foraging opportunities. Starting in 2005, the land was developed into commercial and residential space, and is no longer available to the deer. In addition, the UTRCA identified that some residential landowners had been artificially influencing the wintering deer population by purposely feeding deer apples, corn and other kitchen scraps. Following recent education and enforcement efforts, this supplemental feeding has been reduced or eliminated.

Another important factor that was made evident through the study team's field visits was that the water levels in the bog were high relative to previous years. This was also documented by the UTRCA (Jones pers. comm. 2009) as being the highest water level in several decades. As a result, a large area had varying degrees of standing water. With standing water in a wide area around the bog, the area available for foraging and bedding for deer would have been reduced this year compared with other years. Similar impacts of high water on deer habitat have been reported in the literature, for example Comiskey and Gross (1997) reported that changes to the water regime in a wetland area influenced deer reproduction, recruitment, movement and foraging. The availability of food sources and dry bedding areas was influenced by high water levels, and does and fawns were found to be especially susceptible.

5.2 Home Range and Carrying Capacity

In the 2003 Final Report of the Sifton Bog White-tailed Deer Community Steering Committee on the Sifton Bog White-tailed Deer, an ecological carrying capacity of 3 deer for the 55ha area of the Bog was determined by applying a general deer density for good quality habitats from the Ontario Ministry of Natural Resources (0.04 to 0.05 deer/ha). In that same report, a cultural carrying capacity of 6 to 8 deer in the 55ha bog was presented. These numbers are reiterated in several of the follow-up reports. More recent reports such as the Master Plan identify the area of the Bog as 50ha. In the 2009 White-tailed Deer Management at Sifton Bog Environmentally Significant Area prepared

by Bergsma (City of London 2009), an ecological deer density of 4 to 10 deer/km^2 in rural areas was cited, which would translate into 0.4 to 1 deer in the Bog.

As discussed in previous sections, there is limited information on a number of the white-tailed deer population parameters (such as growth rates, immigration/emigration), which restricts the ability to assess potential ecological carrying capacity. Home ranges for deer using the Sifton Bog ESA have not been studied, nor have immigration/emigration activities. Using home range information from previous studies, an approximate ecological carrying capacity has been calculated below.

Although the home range areas provided in the literature are from a range of geographic areas and habitats, it is notable that the area of the Sifton Bog ESA (approximately 55ha, as per the Sifton Bog White-tailed Deer Community Steering Committee 2003) is far less than the home range sizes presented by researchers in the literature. As such, it is anticipated that the bog, as an isolated habitat area, is insufficient to sustain individual deer from a home range perspective. This translates into the need for the deer to use neighbouring habitat areas and/or local residential areas (backyards, etc.) as a part of their home range. In such cases, remnant habitat areas in the urban matrix will become habitat refugia for white-tailed deer. These are areas that provide protective cover and other habitat conditions not found in the balance of the home range. In the refugia, apparent densities will appear greater due to the temporal concentrating of the deer. As well, the deer in the area may use the refugia, including browse, at a higher rate than the balance of the habitat.

Based on the discussion above, the literature suggests that white-tailed deer home ranges in urban areas may be as large as several hundred hectares, and although these ranges are often elongated, as an approximation the radius of a home range of this size is 750 to 900m. The deer-vehicle statistics recorded for the area show deer incidents are found within 1km of the centre of the bog (many are associated with roadways that are less than half of this distance). The low but relatively consistent numbers of incidents at other times of the year (relative to the peaks and population counts) indicate that these incidents are likely to be the routine movements within the deer home ranges. As such an estimated home range radius of 750 to 900m would seem reasonable.

Based on the ideal deer density used in the 2003 Sifton Bog study (i.e. 0.05 deer/ha) and a home range of approximately 250ha, a total ecological carrying capacity of 12.5 deer is calculated. However, this assumes an average habitat quality for the entire home range. There has been little to no research into the influences of habitat refugia like the Sifton Bog ESA on white-tailed deer population densities or carrying capacity. An approximation of the refugia affect can be derived by using a deer density typical of higher quality habitats for the refugia and a lower density for the balance of the home range area. A density value from the literature for a high density urban refuge may be approximately 0.17 deer/ha, but this would only apply to the portions of the Sifton Bog ESA that are not actual open bog mat and open water. These portions of the Sifton Bog ESA and the balance of the urban matrix would have a relatively low density from the literature of 0.02 deer/ha. Applying these densities to the relative area of the home range estimate would give a total ecological carrying capacity of approximately 10 deer.

In the absence of more accurate information on the white-tailed deer population, an approximate ecological carrying capacity of the Sifton Bog ESA and surrounding urban habitats is 10 deer.

5.3 Deer Movement

Based on background information, deer-vehicle incidents and first hand information, possible deer movement patterns within and beyond the bog were identified in the 2009 Management Plan (City of London 2009). These patterns are shown on Figure 8. These patterns should be regarded as conceptual only.

NRSI reviewed spatial trends of DVO's and mortalities. Of particular note is the comparison of these results to the patterns anticipated in the 2009 Management Plan (City of London 2009). As can be seen in Figure 3, it is evident that there is not a clear pattern of incident locations that would suggest a predominance of movement towards the nearest habitats associated with the Thames River. The majority of incidents are actually recorded to the north and northwest of the bog along Oxford Street. The distribution of data is likely influenced by the speed and volume of traffic using the roadways and as such, the northern cluster of incidents may reflect traffic conditions as much as deer movement patterns. However, the cluster of incidents along Oxford Street

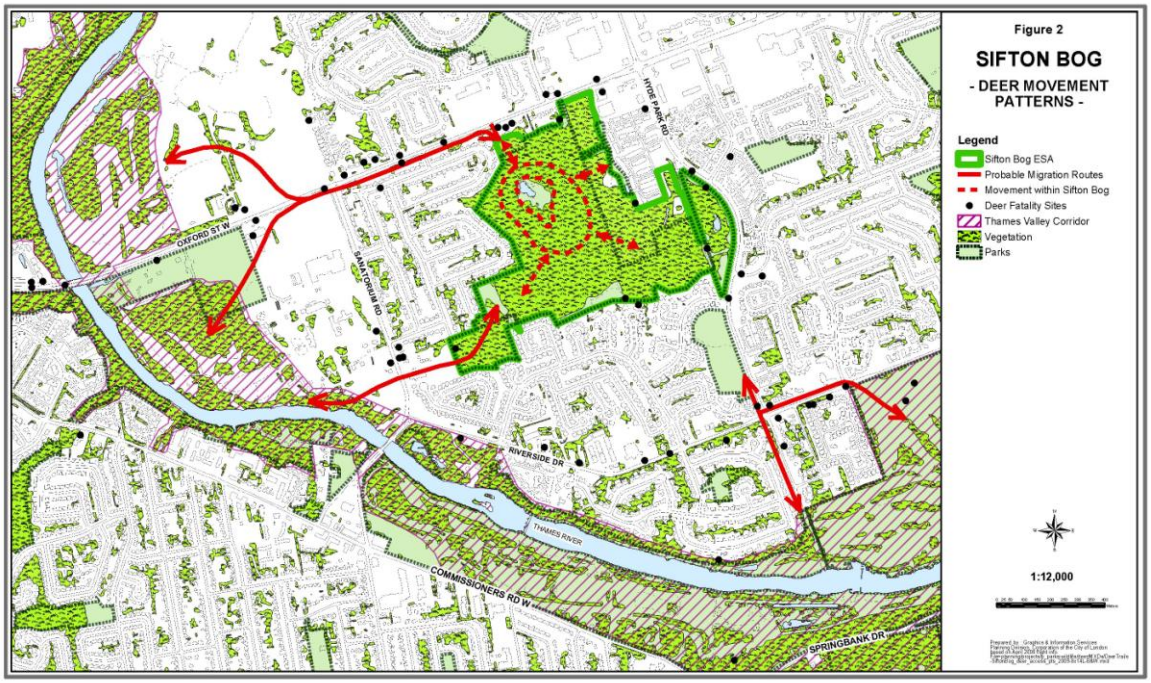
is consistent with the probable movement route identified along Oxford Street in the 2009 Management Plan by Bergsma (2009). Notably few incidents have been recorded between the southwest corner of the Bog and the Thames River (i.e. none in 2004, 2005, or 2007).

The 2009/2010 winter surveys conducted by NRSI were analyzed to determine deer movement patterns within the Sifton Bog ESA. Deer movements within the bog were found to be random with a focus on searching for food while walking instead of taking regular routes to specific foraging locations. Later in the winter (January and February 2010), deer movements became more limited and infrequent, although snow accumulation during the winter of 2009/2010 was unusually low.

Based on observations from site visits on December 4 and December 22 2009 and January 11 2010, no heavily used trails were found, indicating a lack of significant movement corridors within the bog. Trails are generally considered to be heavily used if they are 30cm wide and worn down several inches. Deer trails found from December 4 onwards were most typically tracks of individuals, with the tracks of two or three individuals walking beside each other being found occasionally.

The reduced movement of deer later in the winter were observed two ways. The number of deer triggers of the digital deer monitoring cameras were lower than found in early winter, and during the camera re-setting fewer tracks were observed. No triggers of the deer monitoring cameras were made by deer between February 3, 2010 and February 23, 2010 (however TCM-003 was vandalized during this time and the SD memory card stolen). It is unclear whether the deer in the late winter used other foraging areas within the bog (i.e., those not within view of a camera), had reduced their movements but remained within the bog, or left the area entirely.

Figure 8. Sifton Bog ESA Deer Movement Patterns (from City of London 2009)



Deer movement within the Sifton Bog ESA may have been influenced by increased human presence in areas where people do not regularly go at other times of the year. During January and February of 2010, the deer monitoring cameras picked up increasing numbers of people in off-trail areas. Of note especially is that between February 3rd and the 23rd, fourteen of fifteen triggers at TCM-001 (sited on the bog mat) were of individual people and families who had obviously left the boardwalk that leads to the open water area of the bog. In the west side of the study area at station TCM-006 the camera was triggered on several occasions by individuals either walking or skiing off-trail. The cold temperature and snow cover over January and February enables the public to go off-trail and into areas that are usually wet or difficult to walk through at other times of the year. As a result of people encroaching into areas in which deer had regularly been observed earlier in the year, it is possible that the deer may have begun avoiding these areas.

5.4 Population Size and Growth Rate

The UTRCA conducted deer counts in the Sifton Bog ESA in 2009 on four dates starting in November. Based on these deer counts, it was estimated that 4 white-tailed deer are present within the bog. Due to the count methodology, this value is best used to establish relative annual population size, and does not represent an absolute value of deer population size within the bog. The camera-based winter survey completed by NRSI was used to establish a more accurate population size.

The cameras were set-up in several different habitats and dispersed spatially throughout the bog. December 15 2009 provided the best single-day estimate of deer population size. At deer camera station TCM-003, a video was recorded which showed 7 individual deer during a 1 minute period. This video, along with one recorded 5 minutes prior, identify a single buck.

The estimate of the number of deer within the Bog over winter was further assisted by a video taken at TCM-001 (on the bog mat) on January 31, 2010. This video identified seven deer closely following each other one behind the other, with most following the trail created by the deer ahead of them. Another video was triggered four minutes later showing three deer in the foreground. Due to the time lapse between videos it is difficult

to ascertain if all three are additional deer or not. Conservatively, however, it appears that there was at least one additional deer to the seven originally seen.

Based on the use of the deer monitoring cameras it is estimated that a minimum of seven deer, and possibly as many as 10 individuals were present within the bog from December 4, 2009 to February 3, 2010.

Of note is that through the use of the deer monitoring cameras, NRSI staff were able to confirm the presence of coyotes within the Sifton Bog ESA. Prior to the 2009/2010 monitoring, it was assumed that coyotes were not present within the bog.

Several factors may account for the reduction in population size observed in 2009 (see Table 1). These factors include both natural and unintentional anthropogenic factors, along with some initial deer population management techniques. They include:

- High water levels in many areas around the bog throughout most of 2009,
- Possible predation pressure on fawns from coyotes,
- Reduction of available winter food sources due to historical overgrazing,
- Removal of last remnant agricultural field and creation of housing development and strip mall,
- Reduction or elimination of supplemental feeding by nearby residents.

Detailed information on population growth rate, immigration and emigration, and causes of mortality was not collected as part of this study.

5.5 Age and Sex Structure of Heard

Understanding the age and sex structure of individual deer populations is an important part of being able to understand the status of a given population. Understanding the sex ratios of does to bucks, and the ratio of does to fawns provides information on the status of their habitat. Fertility rates are largely related to the nutritional status of does and postnatal survival of fawns is inversely related to population density (Swihart et al. 1995). Therefore, the greater the quality of deer habitat the more fawns can be born and the greater the likelihood of their postnatal survival. White-tailed deer population density may also influence the population structure, as when densities increase the number of suitable fawning sites within their home range may become limiting (Swihart et al. 1995).

The ratio of does to fawns is often used as an indicator of population growth rate. In high quality habitats, first year does may breed, and older does may have twins or even triplets. By the fall of the year, post-partum mortality combined with low initial breeding success result in a lower recruitment level. For deer populations in high quality habitats researchers have found doe to fawn ratios greater than 1.

Based on the deer camera monitoring, the estimated doe to fawn ratio in the Sifton Bog ESA is approximately 2:1, indicating a low recruitment. Information on doe to fawn ratios over several years is required, and could be obtained during the UTRCA annual deer count.

In the urban environment it is unclear whether a normal sex ratio for bucks and does exists, as they are so greatly influenced by a variety of factors, such as level of human disturbance, quality of habitat, and habitat types present. It is expected in a hunted population that does would outnumber bucks (D'Angelo 2009). DeNicola *et al*. (2008) found in a hunted deer population that doe to buck ratios were 3:1 to 6:1, but in an unhunted population a ratio of 2:1 was found. The greater dispersal of bucks in the population may subject them to increased mortality.

Through review of the photos and video recorded at the Sifton Bog ESA, it is evident that deer population wintering in the bog during 2009/10 is largely skewed towards does. The doe to buck ratio is estimated at ranging from 6:1 to 10:1 based on the deer camera monitoring. Jones (pers. comm. December 22, 2009) suggested that vehicular mortality of deer around the Sifton Bog ESA was dominated by does and fawns. Further information is required to more accurately determine the sex ratio.

5.6 Health of Heard

Review of winter survey video and photos suggests that all of the deer within the bog appear physically healthy based on fur condition, lack of rib cage protuberance and lack of physical injuries.

6.0 Sifton Bog ESA Deer Management Recommendations

The transient nature of deer, their adaptability, and the bog's close proximity to the Thames River suggests that the Sifton Bog ESA will continue to be a refuge for urban white-tailed deer. While some deer will always be present, management of the Sifton Bog deer population can minimize the deer's impacts on the bog ecosystem and the surrounding residents. White-tailed deer management options are explored in detail within the City of London White-Tailed Deer Management Report (NRSI 2011). The following recommendations for the Sifton Bog ESA are made within the framework of the recommendations provided in the aforementioned report.

6.1 Conduct Future Studies and Monitoring

This report provides a summary of the current state of our understanding of the Sifton Bog deer herd. Based on this information, there are many gaps in our knowledge. These gaps are substantial and limit the ability to assess the potential effectiveness of any deer management techniques. The key future study and monitoring needs within the Sifton Bog ESA, are as follows:

- As detailed in the City of London City-Wide White-tailed Deer Management Strategy (NRSI 2010), collect enhanced information on collision-related deer mortalities and deer-vehicle occurrences. Information on sex and age of deer mortalities in conjunction with date will provide information on reason for travel, seasonality as well as information on sex, age and health of herd. Deer-vehicle collision data should be reviewed annually to ensure the City is aware of the deer-vehicle collision trends and to assist in appropriate management of the deer herd in Sifton.

- More detailed study into keystone vegetation responses as well as basic water/nutrient dynamics (e.g. in overbrowsed areas, is the effect mainly structural or does it also affect ecosystem processes like biogeochemical cycling?). The purpose is to ensure the bog does not fail ecologically. The study design is to be detailed, but could consist of a basic stratified regular design, including

permanent plots with repeated measures over a 3-5 year period with a focus on mosses, sedges, rushes, and grasses.

- Conduct browse surveys within the Sifton Bog ESA, with particular focus on the bog mat itself. These surveys should be used to clarify the magnitude of the impact of browsing deer on the bog mat versus the upland areas.

- Extending the camera monitoring program will provide additional information on deer movements, sex, age and health of herd including seasonal fluctuations.

- Enhanced annual deer point counts with information on sex, age and health. Multiple occurrences through the year (4 times) will provide additional information on seasonal fluctuations.

- More detailed study into the year-round use of the Sifton Bog ESA habitat, including yarding activities.

6.2 Include Deer Management in Sifton Bog ESA Planning

Consider the implication that general management of the Sifton Bog ESA could have on deer populations. Any management of the Sifton Bog ESA, including removal of invasive species, should incorporate the potential effects on deer. For example any plans to remove buckthorn (and subsequent restoration) needs to recognize that such actions may influence both the quantity and quality of browse available for deer and could thus affect the population size. Evidence of deer browsing on buckthorn berries was observed during the 2010 monitoring at Sifton Bog. Evidence of deer feeding on buckthorn was particularly evident at the woodland edge along the Sifton Bog parking lot, where numerous deer tracks, fallen berries in the snow and chewed off branches where berries would have been were observed. Deer foraging on buckthorn berries was also evident as deer pellets found within the Sifton Bog ESA were found on occasion to contain buckthorn berries. The remove of buckthorn as part of restoration activities conducted by the UTRCA could act to remove a winter food source for the deer wintering in Sifton Bog. However, large scale remove of this food source all at once it might reduce food availability and force deer to then forage in residential areas. One

must also consider whether large scale removal of buckthorn in Sifton bog might shift browse pressure onto the bog plant species which are trying to be protected. Any plant species used in restoration activities to replace removed buckthorn etc. need to be carefully chosen and not species preferred by white-tailed deer.

6.3 Create Trail System Through Key Habitats

A series of unauthorized trails exists within the Sifton Bog ESA. Creating a year-round trail system (with educational signage) through sensitive deer habitats will result in greater disruption to the deer population. While deer will eventually habituate to human presence, reductions in deer population sizes can still occur, as evidenced by the off-trail use of the bog mat in winter for cross-country skiing.

The most important aspect of the trail system's function is its placement with respect to white-tailed deer movement and security zones. Placement of the trail system through these areas will passively minimize the size of the deer's security zone and minimize the number of resident deer.

The trail system should also be positioned to cause minimum impact on the bog proper. A circular trail can be designed to intercept with all approved human access t locations. The existing trails not incorporated into the new system should be closed and naturalized. Wherever possible, formulate the trail system in conjunction with the recommendations of the Conservation Master Plan to remove invasive species within the bog.

6.4 Educate Landowners

Educational workshops and brochures on urban deer management can help to mitigate the social, environmental and economic impact of deer. These workshops and brochures should include valuable information on basic white-tailed deer ecology, the effect of human-deer interactions, and what individual property owners can do.

Landowner information packages were prepared and distributed to residents around the Sifton Bog ESA, along with a letter regarding supplemental feeding of deer. Examples

of these are included in Appendix II. This letter provides a good example of a way to influence the behavior of the residents of the Sifton Bog area. It outlined the impacts that human actions are having on the deer, and informed the residents that the UTRCA has the authority to deal firmly with non-compliance through its provincial offences officers, while making it clear that doing so is a last resort.

Several aspects of the distribution and timing of information packages should be considered. In order to include all residents living in the vicinity of the bog, it is recommended that residences within 1km of the bog be provided with such information. The timing of the distribution should reflect the content of the information. For example, information on not feeding the deer should be provided before the winter (when negative impacts to deer health are the greatest), while information on "deer-resistant" plants should be provided in spring, before gardening season. Information should be provided on a regular basis until such time as the deer population in the Sifton Bog ESA does not require management for their negative social interactions.

Eye-catching brochures, such as that prepared by the Hamilton-Halton Watershed Stewardship Program (see Appendix III), should be developed. Over time, information packages should be updated with results of any new studies completed in the bog. Future content considerations for landowner packages include:

- Information on basic deer ecology, including basic deer facts, and behaviour characteristics of urban deer.
- The importance of not feeding the deer, and the possible legal repercussions.
- A detailed plant list of non-palatable "deer resistant" plants, trees and shrubs. Any native plant species should be suggested as options before horticultural varieties.
- Advertise the opportunity to volunteer at the annual deer counts in the bog.

Additional sources of information for landowners can be found at:

- Upper Thames River conservation Authority: http://www.thamesriver.on.ca/Native_species/do-not-feed-the-wildlife.htm
- City of Guelph: http://guelph.ca/living.cfm?subCatID=1787&smocid=2363

- City of Ottawa: http://www.ottawa.ca/residents/onthemove/driving/road_safety/integrated/mto_award_en.html

6.5 Implement Traffic Safety Measures

In addition to creating a traffic safety education program, as discussed in the City of London City-Wide White-tailed Deer Management Strategy (NRSI 2010), it is recommended that speed limiting measures and wildlife warning systems be investigated for use around the Sifton Bog ESA.

Reducing the speed limits around intersections and travel routes with high deer-vehicle incidents would help reduce deer-vehicle collisions. This would be most beneficial on Oxford Street. Another traffic slowing technique is installing speed bumps in areas around the bog which are experiencing high deer-vehicle collisions. This option may be widely accepted by local residents, as it can reduce speeding on residential streets and increase safety in areas where children may be playing. It may not be practical on Oxford Street.

When properly installed and maintained, Strieter-Lite Reflectors may reduce the number of deer-vehicle collisions by 78-90% (Grenier 2002). Strieter-Lite reflectors create a reflective light that appears to be moving. The intent is to keep deer and other wild animals from crossing the road until the vehicle has passed. To the driver the reflection is hardly noticeable because the light is reflected across the road and not back to the driver. As the vehicle approaches the reflectors from dusk to dawn its headlights shine on 70 small curved mirrors. The curved surfaces of the small mirrors reflect flashes of dim light at 54 angles horizontally and vertically. Each curved mirror beams light across the roadway, and each reflection moves across the road as the angle of the light from the vehicle changes. Spacing of the reflectors along each roadside is equal to the distance between the reflector lines resulting in complete coverage. The light grows more intense as the vehicle nears the reflector. The result is a strobe-like effect that indicates movement to animals. The potential for installation of Streiter Lite reflectors in the Sifton Bog area was examined by the City of London Transportation and Geomatics

Divisions. No appropriate locations of Streiter Lite reflectors were identified by the City of London Transportation and Geomatics Divisions.

6.6 Maintaining the Population of the Herd at 10-12 Individuals

It is recommended, based on this studies detailed examination of the Sifton Bog deer herd, that a herd size of 10-12 individuals is what this natural area can support without significant impacts to the vegetation communities within the ESA. To manage the deer herd in Sifton Bog it is necessary that some form of regular monitoring takes place such as the UTRCA deer counts. The baseline information that such monitoring collects can than be what the management of the deer herd is based on.

Based on the deer camera monitoring in 2009/2010 the herd size in Sifton Bog was approximately 8 deer. There is some room for population growth in Sifton Bog from the winter of 2009/2010, but this was also the year with the lowest deer count of the 10 year count period. 8 deer were recorded during the late 2010 deer count by the UTRCA. It would appear that the deer population in the Sifton Bog may be stabilizing.. However, it is necessary to identify triggers that will be used by managers to initiate some form of intervention.

A threshold of 17 deer (5 over the 12 deer = 17) consecutively over two years is a potential trigger to initiate some form of management. Initial management options could be centered on habitat management, options that could reduce the habitat available to support the increased number of deer. Options could include:

- Invasive species removal- Remove significant areas of buckthorn and other invasive plants that are eaten by deer. Holding off on restoration of areas where removal occurs should be done to ensure restoration plants do not become a food source.
- Development of trail a system through key habitats- The development of trail systems as outlined in Section 6.3 could be developed to increase the amount of human presence in key areas of deer habits. The goal of this approach is to make deer leave the bog or not remain in the Bog year round as a result of increase human disturbance and presence.

- Exclusionary fencing- The use of fencing of appropriate height and style can be used if significant harm to rare plant species or the overall bog community is identified to be occurring. If the entire bog community is at risk it could potentially be fenced off, with gates that have hinges that automatically swing closed after people walk through. One way gates could be installed just in case a deer does find its way in, so that the deer would be able to get out of the enclosed bog community but not get back in. Alternatively, smaller areas with rare plant species could be fenced off, with emphasis on protecting areas of the bog with particularly high densities of rare plants. Exclusion fencing could also be used to close off the access of deer to important habitats for foraging, bedding, or fawning.

As the Sifton Bog is an ESA with multiple ecological values for which it has been protected, it is important to remember that protection of those ecological values should be considered first and foremost. If the values for which the ESA has been protected for are lost, than protection of the area as an ESA has failed. Therefore while it may be desired to manage the deer population in Sifton Bog so the public can still see them, this should not supersede the need to protect the ecological values for which the ESA was designated for.

6.7 Thresholds for Implementing Population Control

Implementing this site-specific white-tailed deer management plan is intended, amongst other things, to avoid the need for population control measures. Typically population control measures have been implemented in other areas where wildly fluctuating deer populations are encountered. This type of fluctuation was seen in the Sifton Bog area when the local habitats were under transformation from partially agricultural to fully urban, but levels appear to be stabilizing.

Deer herds have the ability to increase quickly as a result of available resources, but without predators or human removal, do not have a population mechanism to quickly reduce population numbers that does not have the associated public concerns over deer-vehicle collisions, damage to landscaping and the public relations issues associated with seeing animals in poor condition.

Are there thresholds in the white-tailed deer population in the City of London that would trigger the use of population control measures? This is as much or more a social question as opposed to an ecological one, as much management of residents as it is deer. It can be expected that some residents would never support deer removal, while others may accept it especially if human safety was in the forefront. In the end, education of residents in terms of expected deer population fluctuations, implications of artificial feeding, landscaping choices, etc are the best tools for the City to use for managing the white-tailed deer issue.

If the population of deer is found to continue to increase and significant impacts to rare and common species are found to occur as a result, or the values for which Sifton Bog has been protected for, appear to be approaching the point of experiencing significant negative impacts, than a direct population management approach should be reviewed. This means that the other management approaches have been unsuccessful and the Bog is in jeopardy.

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APPENDIX I

White-tailed Deer in Sifton Bog ESA – Chronology of Events (UTRCA 2010)

8.0 White-tailed Deer in Sifton Bog - Chronology of Events

- Sifton Bog Deer Count
- City of London council and committee meeting information

Summer 2000
The Upper Thames River Conservation Authority (UTRCA) receives calls from residents of the community surrounding Sifton Bog reporting more frequent sightings of White-tailed Deer on private residential properties.

June 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.

February 3, 2003
After 18 months of investigation and review of accepted management options, the Sifton Bog White-tailed Deer Community Steering Committee submits its Final Report, which outlines the research undertaken regarding deer ecology, the situation of deer in the Bog in 2002, and a full discussion on various lethal and non-lethal management techniques, and recommends that a controlled archery hunt be implemented to decrease the number of deer in the Bog.

April 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 archery hunt in 2003.

June 9, 2003
Information report submitted 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.

June 30, 2003
Report to Planning Committee recommending a Fall 2003 harvest of White-tailed Deer in Sifton Bog, noting that a minimum of 8 deer are to be retained in the Bog. Planning Committee and Municipal Council do not accept the recommendation of the Community Steering Committee or City staff, and direct that staff report back in the Fall of 2003 regarding a Fall/ Winter **deer count** and other measures to address deer management.

October 27, 2003
Information Report to Planning Committee addressing the six issues identified by Municipal Council for follow-up and reporting.

August 30, 2004
Information Report to Planning Committee – Further information on two issues: the 2003 Deer Count results and the potential for chemo-sterilization control program.

September 2004
Municipal Council upholds a Planning Committee recommendation "That the Upper Thames River Conservation Authority 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, would be controversial, would address only a small portion of the City, and would start the municipality on a path of annual deer management without a long-term strategy.

July 12, 2005
Sifton Bog Deer issue Update - The requirement for a City-wide deer management plan was requested by Council; however, a course of action would not be implemented until the 'deer management strategies' have been addressed.

December 12, 2005
Report to Planning Committee recommending an eight step strategy for addressing rising deer population in the City of London, as developed in conjunction with the Upper Thames River Conservation Authority, is accepted.

December 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 the 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."

August 7, 2007
City staff update report to Council on activities to implement the seven acceptable deer management strategies approved by Council.

August 11, 2008
City 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.

January 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.

February 2, 2009
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:

1. immediate non-lethal solutions that would include anaesthetizing the deer to remove and relocate them from the Bog;

2. 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;

3. long term solutions that may include the Spay-Vac Vaccine.

April 6, 2009
Environment and Transportation Committee resolved that the following actions be taken with respect to white-tailed deer management options in Sifton Bog:

a. the Ministry of Natural Resources and the UTRCA be asked by the Municipal Council to conduct a legal deer hunt in the Fall of 2009;

b. the Civic Administration be asked to report back to the Environment and Transportation Committee by July, 2009 with respect to the following:

    i. an integrated white-tailed deer management action plan for the medium and long-term strategy to preserve the Sifton Bog, relating to the removal of buckthorn and inappropriate human activity in the Sifton Bog;

    ii. the City Solicitors Office be asked to investigate the feasibility of establishing a fine for people feeding deer in the Sifton Bog; it being noted that the requested fine amount is $250.00;

    iii. a communication strategy to educate Londoners, in the area around the Sifton Bog, on the significance of the Sifton Bog; and

c. the City Solicitors Office be asked to investigate the feasibility of establishing a fine for people feeding deer in the Sifton Bog; it being noted that the requested fine amount is $250.00.

April 20, 2009

City Council amended and approved the ETC report as follows:

That the following actions be taken with respect to white-tailed deer:

a. the request for a legal deer hunt in the Fall of 2009 by the Ministry of Natural Resources and the Upper Thames River Conservation Authority be deferred pending receipt of the staff report containing additional scientific data and research, which is anticipated to be submitted for consideration in February 2010;

b. the Civic Administration be asked to report back to the Environment and Transportation Committee by July, 2009 with respect to the following:

i. an integrated white-tailed deer management action plan for the medium and long-term strategy to preserve the Sifton Bog, relating to the removal of buckthorn and inappropriate human activity in the Sifton Bog;

ii. a communication strategy to educate Londoners, in the area around the Sifton Bog, on the significance of the Sifton Bog;

c. the City Solicitors Office be asked to investigate the feasibility of establishing a fine for people feeding deer in the Sifton Bog; it being noted that the requested fine amount is $250.00;

d. the Civic Administration be requested to ask the Ministry of Natural Resources (MNR) for detailed information on what options are available to address deer overpopulation concerns in the Sifton Bog, including the possibility of a "deer drive", and to report back thereon, including estimates of the costs associated with the various options, including fencing, that are brought forward by the MNR; and

e. the Civic Administration be asked to consult with the Upper Thames River Conservation Authority and report back at a future meeting of the Environment and Transportation Committee with respect to the broader issues of deer management in the City of London.

APPENDIX II

Previous Sifton Bog ESA Education Materials

Landowner Options
Letter to Landowners
UTRCA Website Information on Feeding Deer

COMPARISON OF DEER MANAGEMENT OPTIONS

	Immediately Reduces Deer Population	Effectiveness of reducing deer problems	Ease to Implement (D Difficult, M Moderate, E Easy)	Duration of Effect	Repetition of Treatment	Cost over three years (Low < 25 k, Medium 25 - 100 k, High 101 - 250 k, Very High > 250 k)	Fish and Wildlife Conservation Act (MNR)	EEPAC (Yes) Endorse, (CS) Conditional, (X) Oppose, (-) No Opinion	AWAC
v) Landowner Options									
NOTE: these options do not reduce surplus deer population									
p Acceptance of living next to natural area (behaviour modification)	No	Not Effective	E	long term	Annual	Low	Legal	Yes	Yes
deer feeding must be discouraged									
q Aversion technologies (landowner initiated)									
1 cherry guns	No	Somewhat	E	short term	Permanent	Low	Legal	X	_
CONS									
* noise pollution to neighbourhood (MOE and Municipal concerns)									
* deer habituate to sounds									
2 defensive plantings of non-target species	No	Somewhat	E	long term	Permanent	Low	Legal	Yes	Yes
3 Liquid Fence and other spray repellants or Wolf Urine	No	Somewhat	E	short term	Seasonal	Low	Legal	Yes	Yes
PROS									
* mimics nature by making plants unpalatable									
CONS									
* repellants may be ignored by people tolerant deer or if food resources are scarce									
* requires re application after rain and active growth									
4 Fences	No	Very	E	long term	Permanent	Low	Legal	Yes	Yes
* for individual property owners woven wire fences are adequate deterrents									

COMPARISON OF DEER MANAGEMENT OPTIONS

D Difficult
M Moderate
E Easy

Cost Range
Low < 25 k
Medium 25 - 100 k
High 101 - 250 k
Very High > 250 k

(Yes) Endorse
(CS) Conditional
(X) Oppose
(-) No Opinion

	Options to reduce Deer/Vehicle collisions	Immediately Reduces Deer Population	Effectiveness of reducing deer problems	Ease to Implement	Duration of Effect	Repetition of Treatment	Cost over three years	Fish and Wildlife Conservation Act (MNR)	EEPAC	AWAC
r	**Options to reduce Deer/Vehicle collisions**	**No**	**Very**	**E**	**long term**	**Permanent**	**Low**	**Legal**	**Yes**	**Yes**
	1 driver education * Implement City-wide "Speeding can cost you Deerly" program									
	PROS * City of Ottawa achieved significant reduction in deer-MVA									
	2 Aversion technologies (e.g. reflectors)	**No**	**Somewhat**	**M**	**short term**	**Permanent**	**Med**	**Legal**	**_**	**Yes**
	* lights placed along road near deer crossing locations									
	CONS * short-term solution with questionable effectiveness in this setting * effective at night, only									
s	**Enhance corridor and wildlife crossings by planting "live fences"**	**No**	**Somewhat**	**M**	**long term**	**Permanent**	**Low**	**Legal**	**Yes**	**Yes**
	* guides deer to safer crossing locations									
	PROS * is effective when combined with fencing									
	CONS * will take years to establish									

RE: Deer Update Sept 05th, 2007

Dear Neighbours of Sifton Bog,

The City of London would like to update you on the status of the deer within our city as well as inform you of some of the management strategies we are currently implementing to reduce their impacts.

The City of London and The Upper Thames Valley Conservation Authority will be releasing a brochure in the fall which updates residents on the urban deer problem in a provincial and local context. It will detail some of the current strategies that we are undertaking, as well as highlight some of the key actions that you can do to help reduce the impacts at a neighbourhood level.

In addition, there is now a link on the City's website under the *'City Services'* tab in the '*News and Public Notices'* section on *Urban Deer Management*. This outlines the City's position with respect to wildlife management in more detail and provides a link to the Upper Thames Valley Conservation Authority's website for additional information.

A research team of students and professors from York University, including the Province's foremost leader on deer impacts, Professor Dawn Bazely, will be conducting deer-browse studies over the next 2-5 years in London's Environmentally Significant Areas (ESA). Specifically, the exclosure structures will be constructed in the Meadowlily, Medway and Sifton Bog ESAs with the primary goal of identifying the dynamic effects that the deer may be having on our precious ecosystems. The Sifton Bog Master Plan Update is also intended for release by end of year, which outlines the comprehensive management of the Sifton Bog with respect to a range of environmental management concerns.

Recent data demonstrates that the overabundance of urban deer is no longer a myth, rather an existing environmental circumstance. The most important thing that we would ask of you is not to feed the deer, as this contributes to the problem of overpopulation. The City has a Parks & Recreation by-law in place with regards to Wildlife Disturbance (PR2 - 4.1.17) where feeding deer can be interpreted as a violation. The City is prepared to enforce this regulation but would rather educate the public about the negative consequences that occur from supplemental feeding.

The issue of urban wildlife management is controversial because we have to evaluate our social and economic interests against the values that we place on the protection of wildlife. There is no 'ideal' solution that will satisfy everyone's best interests, however, the City will continue its efforts to try and resolve this challenging predicament and we appreciate your patience, insight and involvement along the way.

Sincerely,

The City of London

UTRCA Website Information on Feeding Deer

Do Not Feed Wildlife

The UTRCA and the City of London, like many other provincial and federal agencies, do not encourage the feeding of wildlife.

Feeding wildlife almost always has negative consequences for the wildlife involved, including:

- Increased disease transmission
- The loss of natural foraging skills
- Eating foods that are nutritionally incompatible
- Altered reproduction rates caused by artificial food sources. Feeding wildlife may sustain higher than natural population levels.
- Affecting migration patterns
- Altering the ecological balance. Feeding one wildlife species and not another puts some at an unfair advantage and alters the ecological balance.
- Increasing human/ wildlife interaction. Wildlife may lose their natural fear of people, which could result in dangerous encounters with people and collisions with vehicles.

People who feed wildlife do so with the best of intentions and feel they are looking after the welfare of these wild animals; however, they should be aware that wildlife needs to remain wild. Wild animals should derive their food and shelter from natural habitats and under natural conditions. This will help maintain natural adaptations that ensure the long-term survival of the individual animals and of the species. For these reasons, it is illegal in many municipalities (including London, Ontario) to feed wildlife. The general rule is: **Do not feed wildlife.**

Feeding Deer

People are often tempted to feed White-tailed Deer during the winter in order to “save” them from winter conditions. This practice causes a particular set of problems. Research has shown that deer actually get little or no benefit from being fed during the winter. In fact, there are a number of negative consequences.

- Deer visiting feeding areas lose their natural wildness and aversion to people.
- Feeding manufactured food products removes the deer's natural adaptations to cope with severe winters in their natural habitat.
- Natural migration patterns to wintering areas may be disrupted if the animals are enticed to remain at a feeding area.
- Deer become concentrated around feeding areas, resulting in the destruction of natural habitat.
- Concentrations of deer at feeding stations increase the risk of disease transmission among the animals.
- The digestive system of deer adapts to their typical natural food (woody browse) that is available during winter. Improper feeding of other food types can cause digestive problems that may result in death.
- Deer that become accustomed to feeders and are then not fed proper quantities or quality of food may die.
- Most of the food at a feeding area is typically eaten by a few dominant deer.
- Many deer feeding areas are near populated areas and homes, increasing the risk of dogs chasing and killing deer.
- Feeding deer near populated areas or highways greatly increases the risk of deer / vehicle collisions.
- Deer concentrated at feeding areas near homes inevitably cause a nuisance problem for neighbours, as deer eat and damage nearby shrubs and gardens.
- Winter mortality is a major driving force in keeping populations at long-term sustainable levels.

Special thanks to the New Brunswick Department of Natural Resources for providing much of the information for this factsheet.

APPENDIX III

Examples of Landowner Education Materials

October 9, 2008

Dear Resident,

The City of London and the Upper Thames River Conservation Authority (UTRCA) are in the process of completing a Conservation Master Plan for the Sifton Bog Environmentally Significant Area (ESA). This Master Plan will help guide future management initiatives inside and surrounding this ESA over the next 10 years. This report has been through an extensive community consultation process and is expected to be completed in December, 2008.

One of the pressing management issues that we as land managers face, and you as landowners and stewards of this unique natural area deal with on a daily basis, is the increasing population of urban wildlife, particularly White-tailed Deer. This issue has been one of many discussed during the preparation of the Sifton Bog Master Plan. One recommendation that will be coming out of this Master Planning process is that any feeding of wildlife, specifically White-tailed Deer, by the general public be stopped.

Annual deer counts completed by the UTRCA over the past five years indicate that there are approximately 55 deer within Sifton Bog and surrounding upland habitats. The Ministry of Natural Resources (MNR) suggests that this area's natural carrying capacity is three deer. Supplementary feeding of White-tailed Deer by the general public is one of the many factors that contribute to this unusually high concentration. While we all enjoy seeing wildlife, research has demonstrated that deer actually get little to no benefit from being fed (please refer to the attached fact sheet for more information).

The Sifton Bog ESA is monitored and managed by the Upper Thames River Conservation Authority ESA Management Team, under contract with the City of London. This ESA Management Team will continue to educate the public in an effort to stop illegal feeding of wildlife. If these proactive measures do not prove effective, the UTRCA's Provincial Offences Officers will have the option to issue a ticket to anyone caught feeding deer.

We ask that you respect this request out of concern for the health of the deer, the integrity of the sensitive bog ecosystem, and for the benefit of all residents. For more information, please contact Dan Jones, Environmentally Significant Areas Operations Supervisor, at 519-451-2800 ext. 281.

Sincerely,

UPPER THAMES RIVER CONSERVATION AUTHORITY
Alex Shivas
Coordinator, Lands and Facilities

Deer Deterrent information, who to call, etc.

The City of London and the Upper Thames Conservation Authority have been working to find feasible solutions to address the concerns of overabundant deer within the City. For many of us, seeing deer crossing the road ahead or wandering about in backyards and parks is a common occurrence. The current deer issue initially arose around the Sifton Bog and has been gaining public attention over the past few years.

While there is no socially and politically acceptable method of deer management to all, we hope that by helping to reduce the impacts that deer are having on our neighbourhoods and significant natural areas, we can move closer to a natural balance between humans and wildlife.

For those of us who have enjoyed the pleasure of walking down the sturdy boardwalk towards the picturesque and provincially rare Sifton Bog, you may have noticed the lack of ground cover in the swamp thicket as you enter, the freshly clipped twigs or the multitude of deer runs that penetrate the bogmat vegetation. It is evident that there are deer within the Sifton Bog and many professionals and provincial documents have referenced our Sifton Bog as having one of the most dense urban deer populations in Ontario. The Sifton Bog is not the only place where the impacts of deer are being seen, but it does deserve special attention and protection because it is a unique ecosystem trapped in the middle of our city. Following are some strategies that are currently underway and will be monitored over the next few years to evaluate their effectiveness.

What Can I Do?
The progression of urbanization and the loss of wildlife habitat are two of the major factors contributing to the overpopulation of deer within our urban centres. As a result, public encounters with deer occur quite frequently, so if we can become educated on what to do and what not do to in certain situations, we can help to ensure the health and safety of the public as well as the deer.

When Driving:

- Drive with your headlights on before dusk and after dawn because the light can reflect off a deer's eyes, helping you see it standing on the side of the road.
- Always take deer crossing signs seriously -- these areas have been identified due to past accidents or current deer populations. Reduce your speed and be on the lookout.
- Deer travel around at all times of the day, so be especially cautious at dawn and dusk.
- Deer travel in groups, so if you see one deer there are probably more.
- Never swerve to try and avoid a deer. That's how the most serious accidents often occur. If a deer is on the road in front of you hold the wheel, brake firmly and safely and stay in your lane so the deer can decide where it's going to run.
- If you do hit a deer, don't try and move the deer yourself. Report the incident to the police and your insurance company.

DO NOT Feed the Deer:*

- When unnatural feeding opportunities are available, deer congregate in that area, causing stress and other ecological impacts on the immediate environment. Usually these areas are located near roadways or other property owners, and create a nuisance or increase the chances of deer/vehicle collisions.

• During favourable environmental conditions, does give birth to twins or triplets. Supplemental feeding may enable the deer to have multiple births, which increases the population at an unsustainable rate.

If a Deer is in my Backyard:

• Leave the animal alone and try not to spook it. Deer become stressed easily when pursued by humans. They panic when startled which could result in damage to your property, injury to you, and injury or even death to the deer. Call animal control.

How Can I Deter the Deer:

• The truth is that when deer are hungry enough they will brave your backyard and munch down on anything they find. There are however, several plant species that deer would rather not eat, which when planted around the periphery of your property may work to keep the deer out.

• Deer don't like ornamental grasses or herbs and plants that have a strong fragrance such as Sage, Lemon Balm, Monarda and Russian Sage. They also don't like plants with thorns and thistles such as cleome, barberry and purple coneflower (but they do like roses).

• Below are links to some of the most recent and effective deer repellent methods that are currently being used. There are countless websites that identify other techniques and ideas to use.

Gardening:

Look on the 'Plant Guides' page at www.northerngardening.com for a wide selection of unpalatable perennials, biennials, annuals, shrubs and trees that deer would rather not eat. The website also lists many homemade and store bought repellents, as well as landscaping tips that will help keep the deer out of your yard.

'Garden Web' is an excellent forum where people relate their personal experiences with deer repellents and deer resistant plantings.
http://forums.gardenweb.com/forums/load/difficult/msg1119510325699.html

Repellents:

The products listed below were all developed in the US but do currently ship to Canadian locations. Most of the repellents can be found at your local Home Hardware or Canadian Tire store.

• Wireless Deer Fencing - www.wirelessdeerfence.com/wdf/index.html
• Liquid Fence - www.liquidfence.com
• Wildlife Management - www.lake-aeration.com/animal_control.asp

Who To Call

Sick and Injured deer ONLY, on public and private property:

• Animal Control (London Animal Care Centre) at **519-685-1330**. Hours: Monday to Friday, 8 am to 8 pm (9 pm from May 1 to October 31), Saturday/Sunday 8 am to 4 pm. For emergencies outside of those hours call **519-685-1640**.

Deceased deer on PUBLIC & PRIVATE property:

• Environmental Services Dispatch – City of London at **519-661-4965**, 24 hours a day, year round. If the carcass is deemed to be on private property, the City will

forward you on to their wildlife contractor and the property owner will be responsible removal of the deer at their expense.

Deceased deer on PRIVATE property:

- Property Owners are responsible for removal of the carcass at their own expense. You are encouraged to call the Environmental Services Dispatch for the City of London at **519-661-4965** and you will be referred on to the City's wildlife contractor.

Sick, injured or deceased deer OUTSIDE of the city:

- Regional Ontario Provincial Police (OPP) at **1-888-310-1122** or ***OPP** from a cell phone.

***Do Not Feed Wildlife (from UTRCA fact sheet/ website) - See Appendix II**