Analysis of Strategies & Tactics:
Managing Canada Geese (*Branta canadensis*) in the Greater Winnipeg Area

by

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A Thesis submitted to the Faculty of Graduate Studies of the University of Manitoba
in partial fulfillment of the requirements of the degree of

MASTERS OF ENVIRONMENT

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ABSTRACT

This study is a proposed management plan for Canada geese (*Branta canadensis*) and associated human/goose conflicts in the urban and near urban areas of Winnipeg, Manitoba. The proposed plan identifies and analyzes strategies and tactics for managing Canada geese at an acceptable level within human health and safety, biological, economic, and social tolerances. The strategies and tactics proposed in the management plan are based on a literature inquiry, SWOT analysis, and field observations in the Capital Region of Manitoba. The literature review explores Canada geese in North America, Canada geese in the Greater Winnipeg Area, and resident/urban goose management at the Flyway and local level. A SWOT analysis of the strategies and tactics proposed in the management plan identifies the strengths and weaknesses both internal and externally of each treatment. Field observations provide the framework for identifying the relevancy of proposed actions to the attributes of the Winnipeg human/goose conflict.

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CHAPTER ONE

Introduction

Over the past 40 years, restoration efforts in Canada and the United States (US) have resulted in the biological restoration of the subspecies giant Canada goose (*Branta canadensis maxima*) to well beyond its historical population and range (Ankney, 1996; Belant *et al.,* 1997; Dolbeer *et al.,* 1998; Hundgen *et al.,* 2000). Much of this effort was concentrated on establishing self-sustaining, free-flying flocks of giant Canada geese in urban and near urban areas of southern Canada and contiguous US (Atlantic Flyway Counsel, 1999; Gabig, 2000; Giant Canada Goose Committee, 1996; Kokel & Andrew, 2002; Pacific Council, 2000). As a result, the number of Canada geese in urban and near urban areas has increased significantly, producing a range of human/goose conflicts including property damage, environmental degradation, economic loss, and public health and safety concerns in these areas (Ankney, 1996; Cleary, 1994; Conover & Chasko, 1985; Dolbeer *et al.,* 2000; Ettl, 1993; Gosser *et al.,* 2000; MacKinnon, 1996).

An intrinsic component of this situation is a positive correlation between the number of geese and the occurrence of conflict with human activities (Christens *et al.,* 1995; Dolbeer *et al.,* 2000; MacKinnon, 1996). The positive relationship demands management actions to reduce the number of geese to mitigate such occurrences. A

variety of management treatments have been developed which have proven effective in achieving short and long term reductions in the total number of geese at treatments sites (Cooper, 1991; Cooper & Keefe, 1997; Kokel & Andrew, 2002; Smith *et al.*, 1999). The management technique appropriate for a specific conflict is dictated by the desired outcome and the objectives of the management plan. The evolution of resource management planning over the past 50 years has challenged managers to develop tailored solutions to site specific conflicts reflecting the unique biological, ecological and socioeconomic attributes of the issue (Schusler *et al.*, 2000). Relative to urban goose management, contemporary management programs in Canada and the US manage resident Canada geese at a population level, consistent with migratory population objectives and the cultural carrying capacity of the area, which minimizes human/goose conflicts to an acceptable level (Gabig, 2000; Giant Canada Goose Committee, 1996; Kokel & Andrew, 2002; Subcommittee on the Pacific Population of Western Canada Geese, 2000; Subcommittee on Rocky Mountain Canada Geese, 2000).

Similar to other urban areas of North America, the City of Winnipeg has not been immune to the expansion of Canada goose populations. Since the early 1990's, Winnipeg has experienced a significant increase in the number of migrant and resident Canada geese occupying the Greater Winnipeg Area (GWA), the land contained within the bounds of the Perimeter Highway (Figure 1). This measured increase has produced a range of human/goose conflicts comparable to those reported by other urban areas in North America (Urban Goose Working Group, Unpublished Report, 2004). To date there is no Canada goose management plan for urban geese in the GWA. However, the positive relationship between Canada goose populations and conflict rates and the

expectation of continued increases in both resident and migrant populations utilizing the GWA underpin the necessity for a program to manage the number geese within the City of Winnipeg. To that end, this document presents a summary of all relevant literature pertaining to urban geese and goose management in North America as the foundation for the proposed GWA Canada Goose Management Plan (GWA-CGMP). The GWA-CGMP provides an operational framework for managing Canada geese in the GWA to mitigate the associated human/goose conflicts. The strategies and tactics are based on a fine-filter approach, tailored to the unique attributes of the GWA conflict (Chase *et al.,* 1999).

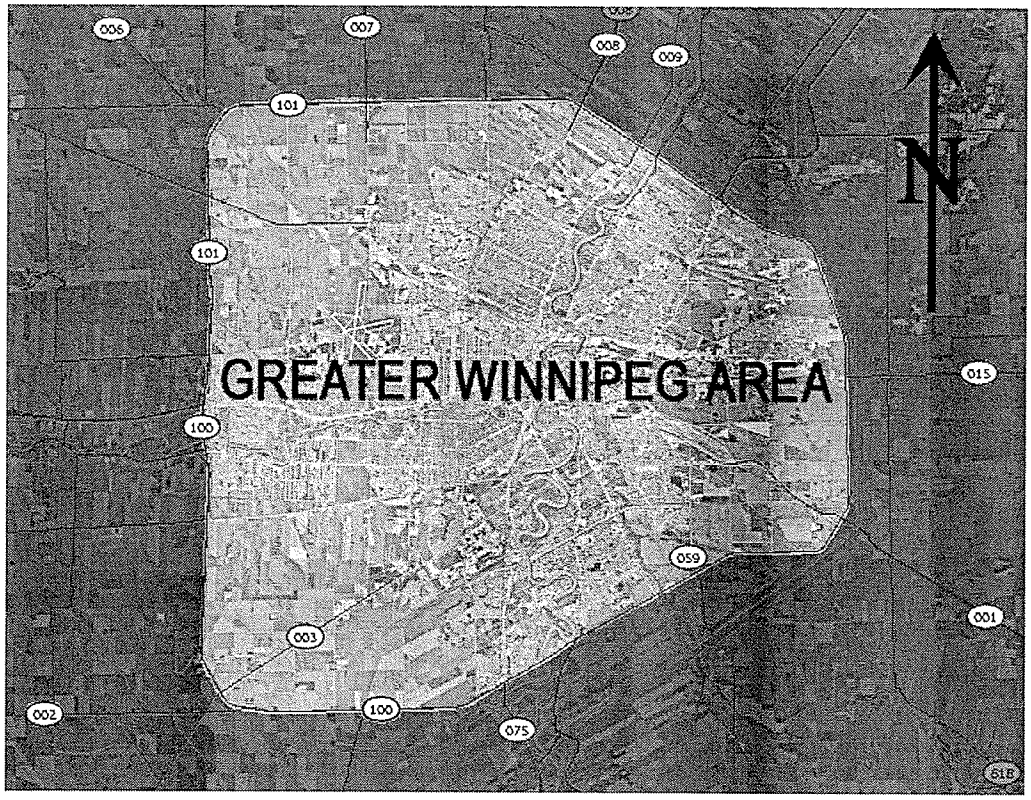

Figure 1 Greater Winnipeg Area (GWA)

This document is divided into five chapters. Chapter one, the introduction provides an overview of urban geese and associated conflicts at both a macro and micro scale. Chapter two, entitled "Canada Geese (*Branta canadensis*) in North America", consists of two sections summarizing urban geese in North America. The first section,

2.1 provides an overview of the biology and ecology of Canada geese in North America. The overview outlines the biological and ecological characteristics at play in urban human/goose conflicts, as well as differentiating and contrasting resident and migrant Canada geese. The second section, 2.2 explores the common environmental attributes attracting Canada geese to urban areas and the prominent human/goose conflicts resulting from the presence of geese in urban centres of North America.

Chapter three, entitled "Canada geese in the Greater Winnipeg Area", consists of two sections summarizing urban geese in the GWA. The first section, 3.1 examines the prominent attributes contributing to the number of Canada geese in the GWA. The second section, 3.2 documents all reported conflicts resulting from the presence of geese in the GWA. This chapter details the magnitude of the GWA human/goose conflict and the necessity for management intervention, as well as identifying principal areas for treatment actions.

Chapter four, entitled "Resident/Urban Canada goose Management", follows the need for management laid out in chapters two and three, exploring management treatments, the contemporary management model and current management programs. The chapter consists of three sections. The first section, 4.1 is a summary of Canada goose management treatments which have demonstrated a feasible method of reducing and/or preventing goose damage with minimal negative impacts on the environment, humans and other species. The second section, 4.2 illustrates the evolution of modern resource management towards greater participation by all stakeholders in the management process. The third section, 4.3 concludes the chapter with a synopsis of urban goose management at both the Flyway and local level.

The fifth and final chapter, entitled "Greater Winnipeg Area Canada Goose Management Plan", builds on the preceding three chapters as a foundation for the proposed management plan. The chapter consists of five sections. The first section, 5.1 details the management goal of the proposed plan. The second section, 5.2 quantifies the population objectives in the proposed management plan. The third section, 5.3 is an outline of the plan, including associated strategies and tactics to achieve the management goal and an analysis and matrix of all actions prescribed in the GWA-CGMP. The fourth section, 5.4 is a discussion of the proposed GWA-CGMP. This section details the implications and limitations of the proposed management plan, as well as identifying several areas for future research. The fifth section, 5.5 is the conclusion to the document, summarizing the human/goose conflict and proposed management plan with an optimism for Canada geese continuing to represent a connection to the natural world, not a nuisance burdening urban dwellers.

CHAPTER TWO

Canada Geese (*Branta canadensis*) in North America

Canada geese (*B. canadensis*) are endemic to each Province and Territory of Canada, each State in the US except Hawaii, and many States in Mexico. The current range and population of Canada geese in North America is greater than any other time in history (Ankney, 1996; Mid-winter Survey unpublished reports in Kokel & Andrew, 2002; Rusch *et al.,* 1995). The majority of Canada geese nest in localized aggregations in remote regions of northern Canada and Alaska and are commonly referred to as migrant geese. However, the distribution of geese has extended southward for the past several decades, increasing significantly the number of nesting geese in the southern regions of Canada and the contiguous US (Rusch *et al.,* 1995). Geese nesting in southern regions of Canada and the contiguous US or residing in these regions between April and August are commonly classified as resident geese (Kokel & Andrew, 2002). Much of the growth in the southern portion of the range can be attributed to the introduction and translocation of large race geese, primarily the giant Canada goose, to urban and near urban areas of Canada and the US during the latter half of the 20th century.

2.1 BIOLOGY & ECOLOGY OF CANADA GEESE (*B. canadensis*)

There are 11 subspecies of Canada geese which differing primarily in color and body size but are typically recognized by a white check patch against a black neck (Johnsbard, 1978). The largest two Canada geese subspecies are the giant Canada goose (*B. c. maximus*) and the western Canada goose (*B. c. moffitti*), varying in weight from 3.5 to 8kg. Giant and western Canada geese makeup the majority of resident goose populations in North America. The historical breeding range of these geese includes the temperate regions of Canada and northern US, wintering close to their nesting areas except in years of a severe winter. The remaining nine Canada goose subspecies (heretofore referred to as migrant geese) typically nest in the boreal regions of Alaska and Canada, sub-Arctic and Arctic, ranging in size from the dusky Canada goose (*B. c. occidentalis*) at 3-4.5 kg to the cackling Canada goose (*B. c. minima*) at 1-2kgs (Kokel & Andrew, 2002). These geese migrate twice a year between breeding and wintering ranges, traveling distances up to 4800km during the migration period.

2.11 General Characteristics of Canada geese

2.11a *Appearance*

Colour and size is the primary indicia of the Canada goose subspecies (Bellrose, 1976). However, enough overlap of visible characteristics occurs between some subspecies that classification by visible indicators only is difficult.

2.11b Food Habits

Canada geese are herbivores, acquiring nutrition from leaves, seeds, fruits, and roots of plants. They forage by grazing, preferring the new portions of growing plants, typically high in protein. The consumption of high fibrous material combined with a

relatively inefficient digestive system results in an elevated intake and turn over of forage resources, producing a defecation occurrence every 3-4 minutes by most subspecies of geese (Owen, 1980). Prior to the introduction of modern agriculture and the appearance of crop residues in the diet of Canada geese, wetland vegetation was traditionally the only forage resource of Canada geese (Bent, 1925; Eggeman *et al.,* 1989; Hanson & Smith, 1950). During periods of high energy requirements, such as migration, Canada geese feed primarily on high carbohydrate foods such as spent cereal grains produced in modern agriculture.

2.11c *Spring Migration*

Migrant Canada geese are one of the earliest waterfowl to leave wintering areas, tracking the snowline and a 0°C isotherm as they travel northward (Bellrose, 1976). They arrive on the breeding grounds only in time for the hatch of goslings to coincide with the emergence and most prolific growing period of spring vegetation (Owen, 1980).

2.11d *Pairing*

Canada geese generally form pair bonds in spring of their second year. Bonds are maintained until the death of a partner, at which time the survivor will typically form a new pair bond the following spring (MacInnes *et al.,* 1974).

2.11e *Nesting*

Canada geese reach sexual maturity at two years of age but may delay nesting until three or four years of age despite being physiologically capable of successful nesting (Craighead & Stockstad, 1964; Kossack, 1950; Moser & Rusch, 1989). Delayed nesting by Canada geese increases reproductive success, demonstrating the positive

relationship between breeding age and successful rearing of young (Hardy & Tacha, 1989; Raveling, 1981).

Canada geese are highly philopatric to nesting sites, often utilizing the same site from previous years (Brakhage, 1965). They prefer to nest on elevated areas within 50m of water bodies with good visibility of the surrounding area (Bellrose, 1976). Clutch size ranges from 1-8 eggs with a single egg laid daily. Depending on subspecies, incubation ranges from 24-30 days and is conducted by the female who spends 91-99 percent of her time at the nest site (Afton & Paulus, 1992).

In anticipation of the spring migration and nesting season the female Canada goose will accumulate needed protein and fat reserves. Upon arrival at the breeding grounds female geese are at their highest annual body mass, nearly double their winter mass. Immediately following the incubation period females have dropped to their lowest weight, losing up to 34 percent body mass, often near starvation (Gates *et al.,* 1998; Moser & Rusch, 1998; Raveling & Lumsden, 1977). If conditions during the spring migration, prenesting, or nesting periods require excessive stores of energy, female geese may abandon nesting attempts (Krapu & Reinecke, 1992; Moser & Raush, 1998; Newton, 1977)

Gander contribution during the nesting period is the provision of protection for both the female and nest from depredation. Predator defense mechanisms are quite effective, large mammals and overland flooding provide the only significant threat to nest success (Bellrose, 1976; Campbell, 1991; MacInnes & Misra, 1972; Stephenson & Van Bellenberghe, 1995). At southern latitudes mating pairs often initiate renesting efforts in response to failed nests. However, at northern latitudes, renesting attempts are

uncommon as both the time required to fledge goslings prior to the fall migration and female energy reserves are often insufficient (Bellrose, 1976).

2.11f *Brood-rearing & Family Structure*

Goslings rarely spend more then 24 hours in the nest prior to relocating to brood rearing areas with both parents. Brood rearing areas typically possess protein rich vegetation for gosling development and open water for predator avoidance. Precocial goslings will spend the next 6-8 weeks with both parents, feeding continuously during daylight hours.

Canada geese form strong family units, generally migrating and wintering together (Raveling, 1968; Raveling, 1969). They will aggressively defend their offspring and mates from predators.

2.11g *Moult*

Once a year adult Canada geese replace their flight feathers during the moult period. The moult coincides with the end of the hatch, both parents and goslings are flightless during this period. At this time geese are most susceptible to predation and congregate near water bodies as a means of escape from approaching predators. Both adults and goslings achieve flight ability at the same time, 4-6 weeks following the start of the moult (Bellrose, 1976).

2.11h *Fall Migration & Wintering*

Canada geese initiate the fall migration in response to a variety of variables including weather, instinct, disturbance, and food. The ultimate latitude at which geese will winter is largely dependant on body size, food availability and weather. Larger bodied geese typically winter at latitudes north of smaller bodied geese consequent to

their ability to better withstand the colder climate (Lefebvre & Raveling, 1967). Geese select wintering sites which possess sufficient foraging opportunities, protection, open water, and other Canada geese (Kokel & Andrew, 2002).

2.11i *Annual Survival*

Canada geese are long lived and have a high annual survival rate. Survival rates of juveniles range from 30 to 70 percent, adults range from 65-85 percent depending on subspecies (Bellrose, 1980; Harris *et al.,* 1998; Hestbeck & Amlecki, 1989; Johnson & Castelli, 1998; Lawerence *et al.,* 1998b; Raveling *et al.,* 1992; Samual *et al.,* 1990). The greatest occurrence of mortality occurs within 3 weeks of hatching (Bellrose, 1976; Ely, 1998; Huskey *et al.,* 1998; Lawerence *et al.,* 1998a; Sargeant & Raveling, 1992). Hunting is the predominate source of mortality of post fledging geese with few natural predators taking mature geese (Chapman *et al.,* 1969; Krohn & Bizeau, 1980; Raveling & Lumsden, 1977; Tacha *et al.,* 1980).

2.12 Comparison of Migrant and Resident Canada geese

The general behavior and ecology of migrant and resident Canada geese is similar, however a number of differences do exist. These differences provide resident geese advantages over migrant geese, increasing both annual survival and reproductive success, as a function of increased energy stores available for reproduction efforts and lower exposure rates to hunting. Table 1 provides a summary of the following comparison of resident and migrant geese food habitats, spring migration, nesting, moulting, brood rearing, and fall migration traits demonstrating the advantages resident geese possess compared to migrant geese.

Table 1. Comparison of "resident" and "migrant" Canada geese (*B. canadensis*) (Kokel & Andrew, 2002).

Attribute	Large Race "Resident" Geese	Medium Race "Migrant" Geese	Small Race "Migrant" Geese
	Population Dynamics		
Age at first breeding	2-3 Years	4 - 5 Years	4 Years
Clutch size	5-7 Eggs	3 - 5 Eggs	2 - 5 Eggs
Nest success	High	Variable	Variable
Renesting	Yes - Frequent	Yes - Frequent	No
Annual reproductive success	High - Constant	Medium - Variable	Low, "Boom/Bust"
Adult survival	90%	70 - 90%	70%
Migration distance	Short	Medium	Long
Hunting exposure	50 - 100 Days	120 Days	160 Days
Population trend	Long-term Increase	Fluctuation	Fluctuating
	Time Constraints		
Nesting period	February - June	April - June	June - July
Incubation period	28 - 30 Days	28 Days	24 Days
Egg laying rate	1 egg/1.5 days	1 egg/day	1 egg/day
Gosling time to survival	85 Days	63 Days	43-55 Days
Adult Moult time	35 Days	32 Days	26 Days

2.12a *Food Habits*

One area of advantage resident geese have over migrant geese is food habits. Migrant geese traveling to northern breeding grounds time their arrival to coincide with the disappearance of snow and access to nest sites. Foraging opportunities and caloric intake at arrival on the nesting grounds is generally limited to underground plant material. It is only after the hatch that lush sedge and grasses are abundantly available. By contrast, resident Canada geese nest in areas with comparatively long growing seasons including areas with a year round growing season. Additionally, resident geese associate with areas of high human activity, correspondent with active horticultural and agricultural production of food resources. The occupation of these areas by resident geese ensures a consistent food source throughout the entire nesting season. Therefore, in comparison of food habits, migrant geese must endure long periods of limited forage and significantly lower opportunities for consumption of horticultural and agricultural residues compared to resident geese (Kokel & Andrew, 2002).

2.12b *Spring Migration*

A second advantage resident geese possess compared to migrant geese occurs during the spring migration period. Migrant geese expend significant energy stores during their migration to nesting areas. Flying Canada geese consume as much as twice the quantity of energy as resting or loafing geese (LeFebvre & Raveling, 1967; Raveling & Lumsden, 1977). Therefore by comparison, the long distances traveled during the spring by migrant geese requires a greater expenditure of energy and reduces the time available for breeding activity, up to four months, compared to resident geese (Bellrose, 1976)

2.12c *Nesting, Moulting & Brood Rearing*

A third advantage resident geese have over migrant geese occurs in the nesting, moulting and brood rearing season. The larger body size of resident geese facilitates the storage of additional protein and fat internally, both absolutely and proportionately, compared to the smaller body of migrant geese (Ankney & MacInnes, 1978). This ability enables resident geese to enter the nesting, moulting, and brood rearing season with greater nutrient reserves compared to migrant geese.

2.12d *Fall Migration*

A fourth advantage resident geese have over migrant geese occurs during the fall migration period. During the fall migration, migrant geese must travel a greater distance to wintering areas then resident geese. The greater distance elevates energy needs and increases exposure to hunting pressure over a longer period of time. Provincial and state hunting seasons typically occur at the peak of the fall migration through their respective jurisdictions, exposing migrating geese to consecutive hunting seasons over the entire

length of the migration corridor. Exposure to hunting varies from 120 to 160 days for migrant geese compared to 50-100 days for resident geese (Rusch *et al.*, 1996).

2.13 Population Growth

Despite the advantages resident geese have compared to migrant geese both populations are increasing. The total number of Canada geese in North America has increased from 980 000 in 1960 to 3 734 500 in 2000, greater then any other time in history (Ankney, 1996; Mid-winter Survey unpublished reports in Kokel & Andrew, 2002; Rusch *et al.*, 1995). All 15 Canada goose populations recognized in North American Waterfowl Management Plan are exhibiting stable or increasing population trends (Kokel & Andrew, 2002). The five populations which experienced significant declines since the 1900's, Aleutian, Dusky, Cackling, Atlantic, and Southern James Bay, have all recovered and are currently stable (Kokel & Andrew, 2002).

2.14 Population Interactions

As migrant and resident populations increase so too does the occurrence of overlap between populations. Despite migrant and resident Canada geese being allopatric during segments of their nesting seasons, it is evident that overlap occurs in staging and wintering areas, as well as, overlap of moult migrants in summer nesting ranges of migrant geese. The concurrent presence and interaction of migrant and resident geese in time and space introduces intricacies to Canada goose management including, assessment of population parameters, resource competition, and habitat and distribution changes (Kokel & Andrew, 2002).

2.14a *Assessment of Population Parameters*

Goose management in Canada and the US is concentrated on achieving population levels which minimize sociological conflicts and maximizes socioeconomic benefits consistent with the ecosystem status (Kokel & Andrew, 2002). Desired population levels are achieved by balancing annual mortality and production levels, utilizing a variety of methods and surveys to monitor change. Accurate population assessment, traditionally conducted on wintering grounds, has become increasingly difficult as the concurrent occupation of wintering areas by resident and migrant populations makes differentiation difficult. As a result, most agencies now conduct population surveys on the breeding grounds. However, as resident goose populations increase, so too does the occurrence of moult migrants on the breeding grounds of migrant geese during the nesting season, increasing the potential for inaccurate surveys (Abraham *et, at.,* 1999).

2.14b *Resource Competition*

Increasing resident Canada goose populations threaten to force migrant geese to compete for food resources in summer and winter ranges where the two overlap. In all four flyways, resident Canada goose populations nearly equal or exceed migrant populations compared to 30 years ago when resident populations were only a fraction or migrant populations (Kokel & Andrew, 2002). Increased agricultural activity and crop residues in similar staging and wintering areas have benefited both resident and migrant Canada geese through the provision of increased forage resources. However, a finite quantity of residues and improved cropping efficiencies limit the availability of agricultural food sources to both resident and migrant geese. Additionally, growing

resident goose populations are increasing the number of moult migrants depleting food resources in northern breeding ranges of migrant geese (Abraham *et al.,* 1999; Ankney, 1996). Degradation of breeding areas and food consumption by moult migrants has been considered in the poor population growth, low reproduction, poor gosling growth, and declining body size of adult migrant geese on Akimiski Island in James Bay (Abraham *et al.,* 1999; Ankney, 1996; Leafloor *et al.,* 1998).

2.14c *Habitat and Distribution*

Migrant Canada geese have continued to shift their wintering range northward for decades (Hankla & Rudolph, 1967; Hestbeck, 1998; Pacific Flyway Council, 1998). One reason attributed to this shift is the presence of resident geese in temperate regions of Canada and northern US and their decoying effect on migrant geese (Atlantic Flyway Council, 1999; Central Flyway Council, 1998; Mississippi Flyway Council, 1996). The increased utilization of urban areas by wintering migrant geese reinforces the hypothesis that resident geese are attracting migrants to those locations by acting as decoys (Smith *et al.,* 1999).

2.2 HUMAN/GOOSE CONFLICTS IN NORTH AMERICA

In spite of the increasing utilization of urban areas by migrant geese the majority of urban goose populations in North America consist of individuals from the subspecies giant Canada goose and to a lesser extent the western Canada goose (Coluccy, 2002; Dornbush *et al.,* 1996; Kokel & Andrew, 2002). Once feared extinct, a population of giant Canada geese was discovered in the early 1960's by Harold C. Hansen (Ankney, 1996; Coluccy, 2002; Dornbush *et al.,* 1996; Gabig, 2000; Kokel & Andrew, 2002). Following this discovery a restoration effort was undertaken by provincial and state

wildlife agencies, conservation groups, and private individuals. Numerous cities throughout Canada and the US established giant Canada goose populations as part of the initiative (Conover, 1992; Gabig, 2000; Kokel & Andrew, 2002; Smith *et al.*, 1999). In the 40 years that followed, giant Canada goose populations have expanded well beyond historic ranges with the majority of growth occurring in urban centres as a result of the restoration program (Ankney, 1996; Dolbeer *et al.*, 1998; Gosser & Conover, 1999; Kokel & Andrew, 2002). The restoration program has also benefited other Canada goose subspecies' and breeding populations (Kokel & Andrew, 2002). Canada geese can now be found in almost every urban centre in Canada and the US (Belant *et al.*, 1996; Belant *et al.*, 1997; Christens *et al.*, 1995; Conover, 1985; Conover & Chasko, 1985; Dolbeer *et al.*, 1998; Hundgen *et al.*, 2000; Smith *et al.*, 1999).

2.21 Urban Attributes Contributing to the Human/Goose Conflict in North America

The success of the giant Canada goose restoration program grew from the ability of Canada geese to adapt to the urban environment and a number of common attributes found in most urban areas of North America (Ankney, 1996; Cleary, 1994; Gabig, 2000). These attributes include; urban planning design, landscape management, low predator populations, and reduced hunting opportunities (Hundgen *et al.*, 2000; Masswildlife, 2002; PA Game, 2002; Wheaton, 2002).

Contemporary urban planning has resulted in the increased construction of storm water retention basins adjacent to open and maintained green spaces in urban areas of Canada and the US (Ankney, 1996; Coluccy, 2002; Conover & Chasko, 1985; Wheaton, 2002). This type of design is increasing in urban areas as it provides an efficient method of managing storm water runoff and creates a landscape type attractive to urban dwellers

(Addison & Amernic, 1983). However, this landscape type also attracts Canada geese through the provision of preferred nesting and feeding sites, consisting of expansive green spaces with unobscured sight lines adjacent to open water in the storm water retention basin (Conover & Kania, 1991; Kokel & Andrew, 2002). Turf maintenance programs of scheduled mowing, irrigation and fertilizer applications further increases the sites attraction through the provision of preferred forage, young green shoots (Conover, 1985b; Conover, 1992; Conover & Kania, 1991; Kokel & Andrew, 2002; MacKinnon, 1999; Smith *et al.,* 1999). Additionally, Kentucky bluegrass (*Poa pratensis*), a preferred forage of Canada geese is the most prominent ground cover used in urban and near urban areas of Canada and the US (Conover, 1985b; Conover, 1992; Smith *et al.,* 1999).

Low predator populations, a common attribute of urban and near urban areas, have also contributed to the increasing number of geese utilizing urban areas (Coluccy, 2002; Hundgen *et al.,* 2000; Masswildlife, 2002; PA Game, 2002). The elimination of most natural predators in urban areas has significantly increased recruitment, raising first year survival rates of urban geese to 90 percent compared to 59 percent for rural geese (Cleary, 1994; Kokel & Andrew, 2002; Smith *et al.,* 1999). Improved recruitment and the goose's philopatric nature of returning to successful nest sites further increases the number of geese occupying urban areas (Kokel & Andrew, 2002).

Another prominent attribute of urban centres contributing to the increasing number of geese is the elimination or reduction of hunting opportunities in urban and near urban areas. Many urban centers have restrictions prohibiting the discharge of firearms both within the centre and the surrounding area (Conover & Kania, 1991).

Reduced hunting opportunities provide urban geese feeding, nesting and loafing areas free of hunting pressure not typically found in rural areas (Conover & Kania, 1991).

2.22 Common Human/Goose Conflicts in North America

The mere presence of Canada geese in an urban area does not create a human/goose conflict. However, when the number of geese is allowed to exceed 40-60 birds at a single location, the human/goose conflict threshold level, conflict with human activities will likely occur (Conover & Chasko, 1985; Wittmann *et al.,* 1998). The most common source of conflict in North America between human and goose activity results from the large quantity of fecal matter deposited by feeding geese (Conover, 1992; Conover & Chasko, 1985; Gabig, 2000; Kokel & Andrew, 2002; Reguly, 2002; Volz & Clausen, 2001). A large quantity of goose feces depreciates the recreational and esthetic values of urban areas, reducing visitor attendance and/or park usage (Breault & McKelvey, 1991; Connecticut, 1999; Conover & Chasko, 1985; Cummings *et al.,* 1991; Cummings *et al.,* 1995; Volz & Clausen, 2001).

Other human/goose conflicts have also developed as a consequence of geese feces in urban areas including the degradation of aquatic ecosystems. High concentrations of goose feces in water reservoirs will greatly alter the aquatic ecosystem (Breault & McKelvey, 1991). A significant influx of fecal matter elevates Nitrogen (N) loads within the basin, over fertilizing the reservoir and typically resulting in large algae blooms and/or eutrophication of the pond cell (Conover, 1985; Conover & Chasko, 1985; Cummings *et al.,* 1991; Cummings *et al.,* 1995; Volz & Clausen, 2001). Additionally, sizable numbers of geese will also degrade aquatic recreation values and drinking water quality, resulting from the presence of escalated virulence pathogen counts consistent

with increased fecal matter content (Breault & McKelvey, 1997; Connecticut, 1999; Conover, 1985; Conover & Chasko, 1985; Volz & Clausen, 2001).

Recent research has identified pathogen transmission at urban green spaces as an additional source of conflict resulting from the presence of goose feces, the primary vector of pathogen transmission. In the report, *Management of Conflicts Associated with Resident Canada Geese in Wisconsin,* by the United States Department of Agriculture (USDA), Canada goose feces was shown to posses a number of virulence pathogens. The report identified the following pathogens, transmissible to humans via direct or indirect contact, present in goose feces sampled from urban areas; Cryptosporidiosis (*Cryptosporidium parvum*), Giardiasis (*Giardia Lambia*), Salmonella (*Salmonella spp*), *Chlamydia psittacia*, and E.coli (*Escherichia coli*) (USDA, 2000). Additional research conducted in Colorado, New York, Wisconsin, Washington, Oregon, and California revealed the presence of pathogenic E. coli in over 25 percent of all Canada goose feces found in urban green spaces (Clark, 2003). The same study concluded a person walking a distance of 1.5km in an urban park, where conflict levels of Canada geese are present, will come in direct contact with four to eight pieces of feces containing virulence pathogens.

The physical presence of Canada geese concentrated in urban green spaces is another source of conflict between human and goose activity. High concentrations of loafing geese in an urban green space can cause topsoil to become hard pan, preventing vegetative growth and resulting in soil erosion, lose of esthetic value and property damage (Conover, 1988; Smith *et al.,* 1999). Additionally, the physical presence of resident geese in an urban area can attract migrant geese during migration period by

acting as decoys, further increasing the potential for conflict (Barras & Wright, 2002; Conover & Chasko, 1985; Cooper, 1991; Crisley *et al.,* 1968; Woronecki, 1992).

Bird strikes by aircrafts account for the highest economics costs and human fatalities incurred in the conflict between human and goose activities in urban and near urban areas (Barras & Wright, 2002; Conover *et al.,* 1995; Cooper, 1991; MacKinnon, 1996). Wildlife strikes with large mammals such as deer result in the most damage per strike, however, wildlife strikes with birds are most common and account for the greatest cumulative damage (Barras & Wright, 2002). Bird strikes principally occur in urban areas with 90 percent of strikes occurring below 1000m near airport facilities and involve all types and sizes of aircraft (Barras & Wright, 2002; Conover *et al.,* 1995; Cooper, 1991). The chance of a bird strike below 1000m is exaggerated as a pilots ability to perform evasive maneuvers is limited during take off and landing (Cooper, 1991). Between 1990 and 1998 the financial cost of bird strikes to both civilian and military aircrafts in Canada and the US averaged over $500 million USD annually (Kokel & Andrew, 2002). However, the actual cost is likely to be significantly higher. Conover *et al.,* (1995) found only 31 percent of all US civilian bird strikes are reported to the Federal Aviation Authority, Transport Canada also claims a comparable reporting rate of 30 percent for all Canadian civilian aircraft/bird strikes (MacKinnon, 1996).

Canada geese are the third most dangerous animal in wildlife strikes, only white-tailed deer (*Odocoileus virginianus)* and turkey vultures (*Cathartes aura*) are more dangerous (Dolbeer, 2000). Dolbeer (2000) determined Canada geese were involved in 56 percent of all wildlife strikes where there was some damage to aircrafts and involved in 21 percent of all wildlife strikes where an aircraft was either seriously damaged or

destroyed. Bird strikes with Canada geese are attributable to the goose's attraction to airport facilities and response to air movements. Canada goose attraction to airport facilities results from the provision of ideal nesting and forage areas. Large open grassy areas near standing water are often found on the landscape of airport facilities, providing geese preferred nesting areas (Cooper, 1991; MacKinnon, 1999; Winnipeg Airport Authority, 2002). Airport maintenance of grassland infields, as a method of fire suppression, provides geese attractive feeding areas through the exposure of new grass shoots (Cooper, 1991). The Canada goose's response to flying aircrafts further increases the risk of a bird strike near airport facilities. Feeding Canada geese have the greatest response to aircraft at altitudes between 305m and 760m (Ward *et al.,* 1999). This response causes geese to take flight when both fixed winged and helicopters reach this altitude and places geese in the flight path of aircrafts taking off or landing (Ward *et al.,* 1999). In addition, the Canada goose's tendency to flock together in flight increases the potential for multiple strikes with an aircraft.

The summary of Canada goose biology and ecology at the start of this chapter demonstrates the relevance of these characteristics on urban goose conflicts in North America. The differentiation and contrasting of resident and migrant geese illustrates the difficulties inherent in Canada goose management and will be further explored in chapters four and five. The general overview in the latter portion of this chapter of attributes attracting Canada geese to urban areas and associated conflicts common in Canada and the US provides a background for delineating and comparing the GWA attributes and conflicts presented in the following chapter.

CHAPTER THREE

Canada Geese in the Greater Winnipeg Area

Similar to other urban centres in North America the City of Winnipeg has experienced a significant increase in the occurrence of Canada geese and associated human/goose conflicts. These conflicts have expanded to all regions of the City and include a range of conflicts when overlap occurs.

3.1 PROMINENT ATTRIBUTES CONTRIBUTING TO CANADA GEESE IN THE GWA

A variety of factors contribute to the increasing number of Canada in the GWA which are unique and similar to factors in other urban centres in Canada and the US. The prominent attributes contributing to the increasing number of geese in the GWA are, increasing migrant and resident populations of Canada geese in the Mississippi Flyway, agriculture in the GWA, proximity to Oak Hammock Marsh, limited hunting opportunities in Game Hunting Area 38, decoy affect of resident geese, and storm water infrastructure in the City of Winnipeg.

3.11 Increased Canada goose Populations

One prominent attribute contributing to the increasing number of Canada geese in the GWA is the growing populations of Canada geese utilizing the GWA. These

populations consist of resident and migrant Canada geese and have steadily increased in Winnipeg since the 1990's, mirroring the expansion of goose populations in other urban centres, the Mississippi Flyway, and North America as a whole (Gabig, 2000; Giant Canada Goose Committee, 1996; Kokel & Andrew, 2002; Manitoba Conservation, 1999; Manitoba Conservation, 1999b; Manitoba Conservation, 2005; Manitoba Conservation, 2005b).

3.11a *Migrant Geese*

The GWA's location in the Mississippi Flyway corridor makes it an ideal resting and staging area for continental geese traveling through the migration corridor during the spring and fall migration. Six continental breeding populations of Canada geese exist within Manitoba; however, only four populations have a migratory pattern and/or breeding range which contribute individuals to the GWA.

The first Canada goose population contributing geese to the GWA is the Mississippi Flyway Giant Population (MFGP). The MFGP consists of giant Canada geese (*B. c. maxima*), transplanted to urban centres throughout the temperate areas of Canada and continental US during the latter half of the 20th century (Kokel & Andrew, 2002). The MFGP has steadily grown since the early 1990's and has expanded beyond its historic range (Dennis *et al.,* 2000; Kokel & Andrew, 2002). The 2003 spring breeding pair survey estimates the MFGP at 1,635,000 individuals, far exceeding the population goal of one million individuals (Ankney, 1996; Belant *et al.,* 1997; Giant Canada Goose Committee, 1996; Kokel & Andrew, 2002).

The second continental breeding population contributing Canada geese to the GWA is the Eastern Prairie Population (EPP). The EPP consists of interior Canada geese

(*B. c. interior*). EPP geese nest in the Hudson Bay Lowlands and follow a migration route along the eastern half of Manitoba to their winter range in northern Missouri (CWS, 2003). Estimated spring population counts of the EPP have recorded a 2 percent increase annually over the past 10 years to 229,200 individuals in 2003 (CWS, 2003; USFWS, 2003). The fall migration of the EPP is believed to contribute significantly to the total number of Canada geese in the GWA (Urban Goose Working Group, Unpublished Document, 2004).

The third continental breeding population of Canada geese in the GWA is the Tallgrass Prairie Population (TGPP). The TGPP is predominantly made up of Richardson Canada geese (*B. c. hutchinsii*), lesser Canada geese (*B. c. parvipes*) make up the remainder of the TGPP. The nesting range of the TGPP includes the eastern Arctic and Baffin Island (CWS, 2003; USFWS, 2003). During fall, TGPP geese migrate south-easterly across Manitoba. Historically, this population will stage in the south eastern portion of Manitoba on the way to its winter range in southeast South Dakota and northeast Nebraska (Bellrose, 1976). Spring TGPP counts on Baffin Island have demonstrated an annual increase of 5 percent in the number of nesting geese from 1994 to 2002 (USFWS, 2003). The 2003 mid-winter survey estimated the TGPP at 611,800 individuals, a 21 percent increase over the previous year (USFWS, 2003)

The final continental breeding population of Canada geese contributing individuals to the GWA is the Interlake-Rochester Giant Canada Goose Population (IRGCGP). As the name implies, the IRGCGP is made up of giant Canada geese (*B. c. maxima*). The IRGCGP migrates from its breeding range in the Interlake area of Manitoba, through the GWA, to its winter range in Rochester, Minnesota. Population

estimates placed the IRGCGP at approximately 60,000 individuals in 2003 (Kokel & Andrew, 2002).

The total migrant population in the City of Winnipeg has steadily increased since the mid 1990's (Manitoba Conservation, 1999). The 2005 fall migration survey of Canada geese in the City of Winnipeg estimated the daily peak population at over 165 000 individuals, a 65 percent increase since 1998, the first year of the GWA fall staging survey (Manitoba Conservation, 1998; Manitoba Conservation, 2005).

3.11b *Resident Geese*

Resident geese occupy the GWA between the spring and fall migration periods, consisting of nesting and molt-migrant Canada geese. The resident nesting population in GWA returns yearly for the breeding season and belongs to MFGP. Similarly, the resident moult-migrant population belongs to the MFGP, consisting of sub-adults and unsuccessful breeding geese which migrate north from their winter range to moult in regions of Canada and the northern US, including the GWA. Moult migrants remain in these regions until the fall migration when they will return to their winter range (Kokel & Andrew, 2002). Once sub-adults reach sexual maturity they typically remain at their birth place to initiate nesting.

The resident goose population in the City of Winnipeg has steadily increased since the mid 1990's (Manitoba Conservation, 2005b). The 2005 spring brood production survey of resident Canada geese conducted in the City of Winnipeg estimated the population at 2709 individuals, a 34 percent increase since 1999, the first year of the survey (Manitoba Conservation, 2005b). This increase occurred despite management programs at sites across the City of Winnipeg to reduce the reproductive success of

nesting Canada geese in the GWA (R. Bruce, personal. communication; Winnipeg Airport Authority, 2002).

3.12 Agricultural Cropping Methods in the GWA

A second prominent attribute contributing to the number of Canada geese in the GWA is the cropping methods employed by area producers. The agricultural land within and surrounding the City of Winnipeg is comprised largely of intensive grain farming operations. Cereal cropping methods of drying swathes, exposed residues, and voluntary growth provide migrant geese a source of high-energy food resources needed for the fall migration (Kokel & Andrew, 2002; Leafloor, 2003). Geese feeding on cereal crops in the GWA create travel corridors between feeding and resting areas inside the City of Winnipeg, avoiding natural predation and hunting pressure (M. Gillespie, personal communication, 2003).

3.13 Oak Hammock Marsh & Fort Whyte Nature Centre

The third prominent attribute contributing to the number of Canada geese in the GWA is Oak Hammock Marsh and Fort Whyte Nature Centre. Both facilities attract Canada geese to the GWA through the provision of waterfowl habitat and are increasingly utilized by significant populations of Canada geese during the fall migration (Ducks Unlimited, 2002; Manitoba Conservation, 1999; Manitoba Conservation, 2000; Manitoba Conservation, 2001; Manitoba Conservation, 2002; Manitoba Conservation, 2003; Manitoba Conservation, 2004; Manitoba Conservation, 2005). Fort Whyte Nature Centre is a mixed 160ha upland and wetland wildlife preserve located in the southwest corner of Winnipeg (Fort, 2003). The five pond cells at Fort White have consistently held the highest number of Canada geese during the past three fall migration periods of

any cell inside the City of Winnipeg (Manitoba Conservation, 2003; Manitoba Conservation, 2004; Manitoba Conservation, 2005). Oak Hammock Marsh, located 20 km north of Winnipeg, holds the highest concentration of waterfowl in North America during the fall migration with Canada geese making up the largest segment of migrating fowl (Ducks Unlimited Canada, 2003).

3.14 Reduced Hunting Opportunities in the GWA

The fourth prominent attribute contributing to the growing populations of Canada geese in the GWA is the reduced hunting opportunities in the surrounding regions. Conover & Kania (1991) found human/goose conflicts are more likely to occur in areas where local ordinances prohibit either the discharge of firearms or hunting, the same is true of the GWA conflict. Canada goose attraction to the GWA results from the provision of safe resting areas inside the City and energy rich food resources in nearby agricultural fields. The lack of hunting pressure or disturbance in the surrounding croplands encourages many birds to return annually.

The GWA, which has the same boundaries as Game Hunting Area 38, has a combination of factors which have reduced hunting opportunities in Game Hunting Area 38 and the surrounding Game Hunting Areas. The land area in Game Hunting Area 38 has traditionally been closed to waterfowl hunting in all eight of the Rural Municipalities inside Game Hunting Area38 (Manitoba Conservation, 2002c). In 2003 and again in 2004, Manitoba Conservation approved the provisional opening of limited waterfowl hunting in Game Hunting Area 38 in the Rural Municipalities of Rosser and Macdonald respectively as part of the Waterfowl Crop Damage Prevention Program (Figure 1). However, the remaining six Rural Municipalities within Game Hunting Area 38 remain

closed to waterfowl hunting, as well as the City of Winnipeg under a firearms discharge ordinance, By-Law No. 2890/81 (City of Winnipeg, 2003). Additionally, of the eight Rural Municipalities on the perimeter of Game Hunting Area 38 only the Rural Municipalities of Macdonald (By-Law 23/04), Rosser (By-Law 04/05) and Tache (By-Law 32/97) have no limitations or discharge ordinance against firing shotguns (Macdonald Rural Municipality, 2006; Rosser Rural Municipality, 2006; Tache Rural Municipality, 2006). Of the remaining 5, the Rural Municipalities of Springfield (By-Law 97/03) and Richot (By-Law 24/79) have discharge ordinances which limit the discharge of shotguns and the Rural Municipalities of Headingly (By-Law 26/95), West St. Paul (By-Law 11/99), and East St. Paul (By-Law 95/89) have firearms discharge ordinances prohibiting the discharge of shotguns (East St. Paul Rural Municipality, 2006; Headingly Rural Municipality, 2006; Ritchot Rural Municipality, 2006; Springfield Rural Municipality, 2006; West St. Paul Rural Municipality, 2006).

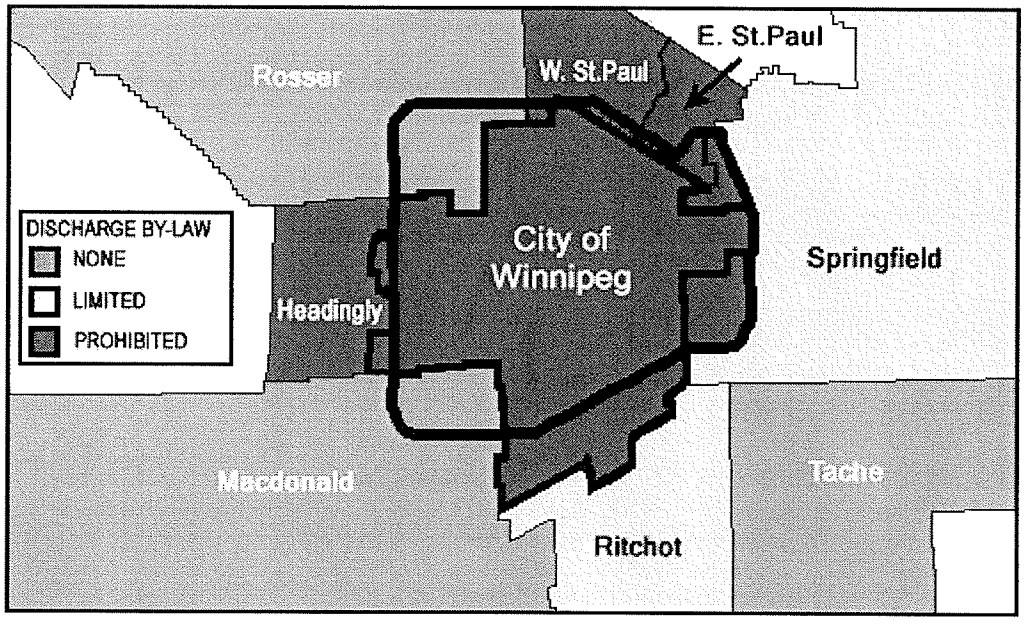

Figure 2. Shotgun discharge ordinances by Rural Municipality in the Greater Winnipeg Area.

Additional features have also contributed to a reduction in hunting opportunities in the GWA. The lack of public land surrounding the City of Winnipeg has reduced hunter access as a trend towards giantism and commercial farming has increased the difficulty in securing permission to hunt on private land (Campbell, 2003). The close proximity of Oak Hammock Marsh to the City of Winnipeg has further reduced the ability of hunters to access land in the GWA. Oak Hammock Marsh provides world class waterfowl hunting opportunities and has become a destination spot for waterfowl hunters from around the world. As a result, private land surrounding Oak Hammock Marsh is often leased by outfitters who permit only a small number of hunters on leased land at one time. Increased profit potential for landowners who allow hunter access has resulted in the increased use of trespass fees, reducing hunting opportunities for those hunters unwilling or unable to pay these fees.

3.15 Decoy Affect of Resident & Moult Migrant Canada geese

The fifth prominent attribute contributing to the increasing occurrence of Canada geese in GWA is the decoy-affect created by resident geese occupying the City of Winnipeg (Crisley *et al.,* 1968; Kokel & Andrew, 2002; Woronecki, 1992). Resident goose populations within the City of Winnipeg, just over 2,700 at the 2005 spring survey, is relatively small compared to migrant populations traveling through the GWA along the Mississippi Flyway corridor (Manitoba Conservation, 2005b). However, resident geese contribute greatly to the total number of geese in an urban centre through the decoy affect, attracting migrant geese to the area (Barras & Wright, 2002; Connecticut, 1999; Conover & Chasko, 1985; Cooper, 1991; Crisley *et al.,* 1968; Woronecki, 1992). The

decoy-affect is compounded as migrant geese staging in GWA typically return in subsequent years, accompanied by offspring (Kokel & Andrew, 2002).

3.16 Urban Planning – Storm Water Infrastructure

The final prominent attribute contributing to the number of Canada geese in the GWA is the increased availability of attractive goose habitat in the City of Winnipeg. The increased number of areas attractive to Canada geese in the GWA has occurred as a result of contemporary urban planning trends in storm water infrastructure and landscape management adopted by the City of Winnipeg (City of Winnipeg, 2001; Kokel & Andrew, 2002; Smith *et al.*, 1999). The City of Winnipeg's storm water infrastructure attempts to lower over-land flood potential by collecting precipitation runoff in storm water retention basins, allowing runoff to dissipate over a sustained time period in an effort to remain within sewer capacity during periods of heavy precipitation (City of Winnipeg, 2002a). In addition, the storm water retention basin system reduces the cost and quantity of water entering the City of Winnipeg sewer water treatment system by draining captured runoff directly into the river basin (City of Winnipeg, 2002a).

The City of Winnipeg currently operates 75 storm water retention basins within City limits and has an additional 85 storm water retention basins scheduled for future installation (City of Winnipeg, 2001) (see Appendix A). During the fall migration these storm water retention basins provide Canada geese an attractive resting and loafing area. Migrant geese concentrate in these storm water retention basins and the agricultural croplands in the GWA, resting and feeding on high carbohydrate energy-rich cereal grains in preparation for the fall migration (Kokel & Andrew, 2002; M. Gillespie, personal communication, 2004). Daily fall migration counts at Winnipeg storm water

retention basins, conducted by Manitoba Conservation, the City of Winnipeg, and the Canadian Wildlife Service, estimated the peak population exceeded 165 000 individuals in the fall of 2005 (Manitoba Conservation, 2005). The fall survey also demonstrates the areas of highest goose concentrations are in the northwest and southern portions of Winnipeg, consistent with the greatest density of storm water retention basins (Manitoba Conservation, 1999; Manitoba Conservation, 2000; Manitoba Conservation, 2001; Manitoba Conservation, 2002; Manitoba Conservation, 2003; Manitoba Conservation, 2004; Manitoba Conservation, 2005; Manitoba Conservation, 2005b).

3.2 HUMAN/GOOSE CONFLICTS IN THE GWA

The prominent attributes of the GWA, outlined in the preceding section, are the primary factors contributing to the increasing occurrence of Canada geese in the City of Winnipeg. As the numbers of geese in the GWA has increased so too has the rate of conflict between humans and geese when overlap occurs. Human/goose conflicts have now expanded to all areas of Winnipeg and include a range of conflicts. The following provides a summary of reported human/goose conflicts occurring in the GWA.

3.21 Degradation of GWA Green Spaces and Recreation Sites

The presence of Canada geese in Winnipeg green spaces and recreation sites is increasingly resulting in the degradation of these areas. From 1993 to 2002 the Winnipeg district office of Manitoba Conservation recorded a 400 percent increase in the number of complaints by Winnipeg residents concerning the impact of Canada geese at Winnipeg green spaces (Urban Goose Working Group, Unpublished Document, 2004). Complaints by Winnipeg residents concerning the impact of Canada geese include reduced

recreational values, property damage, and health concerns for persons utilizing these areas.

3.21a *Reduced Recreational Values and Public Health Concerns*

The current number of Canada geese in the GWA during the fall migration gives rise to public health concerns of pathogen transmission in the upland zone of storm water retention basins at Winnipeg green spaces. Considering conflict levels of geese were observed at 85 of 91 observation points throughout the City of Winnipeg in the fall 2005, transmission of virulence pathogens to Winnipeg residents utilizing these areas is sure to occur according to the previously cited research conducted by the USDA (Clark, 2003; Manitoba Conservation, 2005). Large congregations of Canada geese in the GWA have also forced the closure of recreation sites due to public health concerns. In the fall of 2003, administrators in River Park South School Division temporarily canceled all outdoor recesses. Administrators suspended outdoor activities in response to concerns expressed by parents over the presence of excessive goose feces on playground areas at schools within the division (Urban Goose Working Group, Unpublished Document, 2004).

The current number of Canada geese in the GWA during the fall months also gives rise to public health concerns for pathogen transmission in the wetland zones of storm water retention basins at Winnipeg green spaces. The occurrence of geese in the City of Winnipeg has demonstrated a positive correlation to pathogen counts within City wetlands. In the fall of 2002, Manitoba Conservation tested water samples for the presence of pathogens from three City of Winnipeg storm water retention basins, where Canada geese numbers exceeded the human/goose conflict threshold (Converse *et al.*,

1999; Hailu *et al.*, 2001; Kullas *et al.*, 2002; Manitoba Conservation, 2002b; Wakelin *et al.*, 2003; Waldenstrom *et al.*, 2003; Wittmann *et al.*, 1998). From 21 August 2002 through 30 October 2002 weekly water tests were conducted at City of Winnipeg storm water retention basins, W3-04 on Garton Avenue, W3-09 on Foxwarren drive, and W3-11 on Inksbrook. Five random samples were drawn weekly from each pond cell and analyzed for the presence of fecal coliform bacteria (E. coli). Test results indicated the presence of pathogenic E. coli in each of the three basins tested (Manitoba Conservation, 2002b; Wakelin *et al.*, 2003). At the peak of fall migration, mean E. coli counts were over 60 percent higher than the recommended maximum limits for non-consumptive/non-recreational water (Walkelin *et al.*, 2003). The weekly mean pathogen count was compared to the number of geese observed at each storm water retention basin during the same period (Figures 2, 3, & 4).

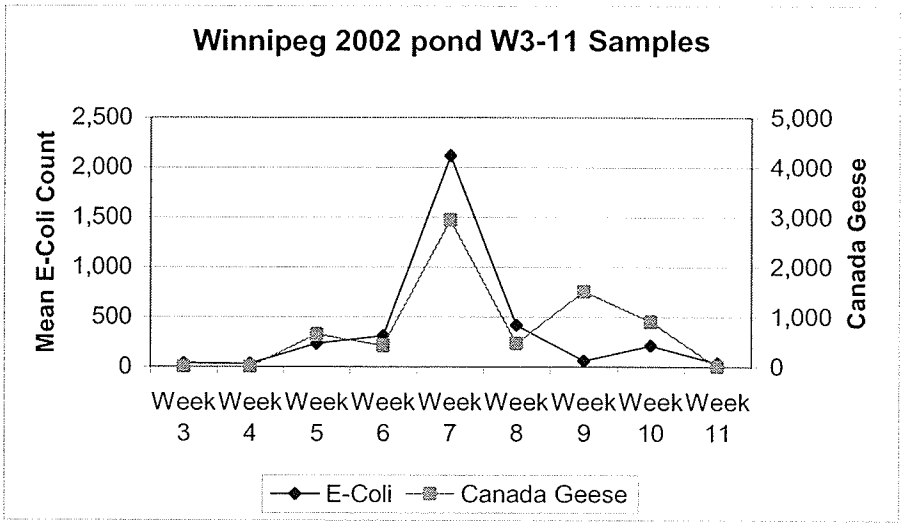

Figure 3. Comparison of Canada goose estimates & mean E. coli counts at W3-11 in 2002 (Manitoba Conservation, 2002b).

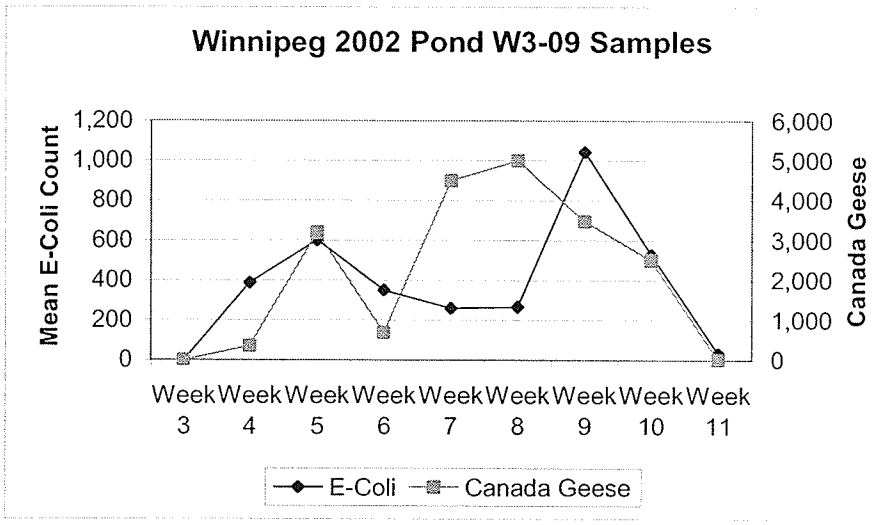

Figure 4. Comparison of Canada goose estimates & mean E. coli counts at W3-09 in 2002 (Manitoba Conservation, 2002b).

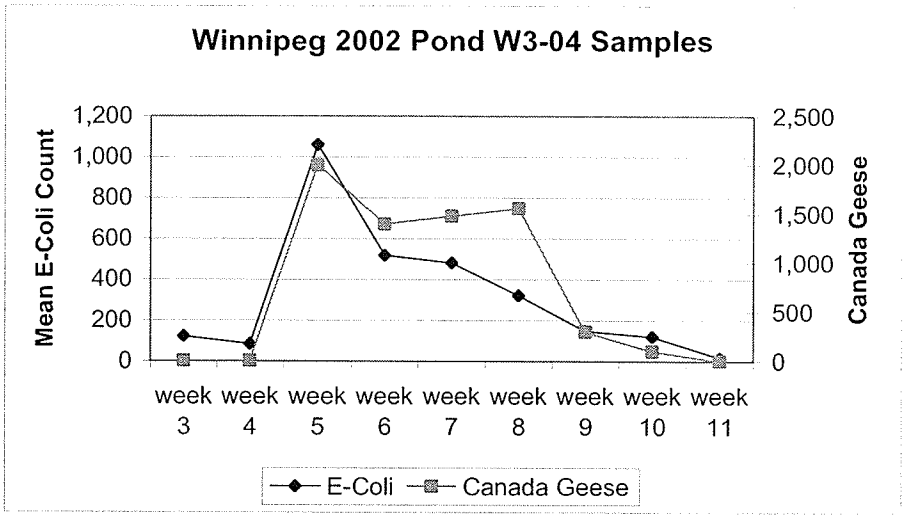

Figure 5. Comparison of Canada goose estimates & mean E. coli counts at W3-04 in 2002 (Manitoba Conservation, 2002b).

The results of this comparison demonstrate a positive correlation between E. coli levels and the number of geese observed at each pond cell (Manitoba Conservation, 2002b; Wakelin *et al.,* 2003). Based upon these findings, over 50% of the storm water retention basins in the City of Winnipeg which held >1000 Canada geese, comparable to the 3 cells tested in Wakelin *et al.*, 2003, during the 2003, 2004 and 2005 fall migrations, will have mean pathogen counts 60% higher then the recommended maximum limit for non-

consumptive/non-recreational water. Similar pathogen increases have occurred in recreational waterways of the GWA. In 1998, the presence of resident Canada geese in Birds Hill Park, on the north eastern fringe of the GWA, forced park officials to close the swimming and beach areas of the Park to all visitors. The resident population was the suspected source of a large algae bloom and outbreak of swimmers-itch (*Chistosome cercarial dermatitis*) at the park (Edmonton, 2003; Ettl, 1993). Following the closure of the swimming and beach area park attendance dropped substantially (Edmonton, 2003).

3.21b *Financial Losses Incurred by Recreation Areas*

Increasingly, the presence of Canada geese at recreation sites in the GWA has also resulted in economic losses to these locations. The 1998 algae bloom and swimmers itch outbreak at Birds Hill Park forced the expenditure of fiscal resources on treatments to mitigate conflicts between park users and resident geese. In 1999 the park received close to three million dollars for a variety of improvements including the installation of a pump and aeration systems to flush the water in the swimming area, as well as dredging the lake bottom to remove goose feces (Edmonton, 2003). In addition, the Park has also incurred the cost of continued goose management programs including energy costs associated with the operation of pump and aeration systems, nightly irrigation of heavy use areas by geese and the periodic replacement of sand in the beach area.

Golf courses in the GWA have also incurred economic costs as an artifact of urban geese. Niakwa Golf and Country Club, in response to member complaints hired a dog and handler to haze nuisance geese during the 2004 golf season (R, Burke. Personal communication, 2003). Mr. P. Reise, President of Meadows Golf and Country Club claimed damages and lost revenue in excess of $100,000 in 2003 as a direct result of

grazing geese (P, Reise, personal communication, 2003). In 2003, Harbour View Golf Course in a cost-shared agreement with Manitoba Conservation installed a raised wire grid and perimeter fencing at two retention ponds to reduce the presence of Canada geese in response to visitor complaints and lost revenue (R. Bruce, personal communication, 2003; S. Read, personal communication, 2003).

3.22 Crop & Ornamental Plant Depredation

Depredation of agricultural crops and ornamental plantings by Canada geese is also a significant source of conflict between human and goose activities in the GWA. Crop depredation represents a financial loss to Manitoba producers which the Province of Manitoba compensates producers for under the Canada – Manitoba Waterfowl Crop Damage Compensation Program (WCDCP). During the 1990's the Winnipeg district office of Manitoba Conservation recorded a 300 percent increase in the number of crop damage complaints by GWA producers (Manitoba Conservation, 2004b). During the same period, the Province doubled its expenditure on prevention programs in an effort to alleviate crop depredation. Since 1999, the Province of Manitoba, through the WCDCP, has awarded Manitoba producers in excess of $500,000 annually in compensation payouts for crop damages by waterfowl (Manitoba Conservation, 2004b). The region with the largest concentration of payouts for crop depredation by waterfowl is in the areas concentrated around Oak Hammock Marsh and the GWA (see Appendix B) (Urban Goose Working Group, Unpublished Document, 2004). Damage to ornamental plantings represents a financial loss to land-owners for which no compensation program currently exists. As such, no summary cost figures exist as to the financial loss of ornamental

plantings to waterfowl depredation; however, it is believed to be significant (M. Gillespie, personal communication, 2003).

3.23 Bird Strikes at Winnipeg International Airport

Aircraft/bird strikes represent the greatest potential for catastrophic consequences in the conflict between humans and geese in the GWA (Kokel & Andrew, 2002). As demonstrated at JFK Airport in New York State, the occurrence of bird strikes is proportionate to the number of geese in the area surrounding airport facilities (MacKinnon, 1996). Both Transport Canada and the Federal Aviation Authority warn of increasing bird strikes if urban goose populations are not managed near airport operations (Barras & Wright, 2002; Chartier, 2002; MacKinnon, 1996). Both agencies also caution the 1995 death of all 24 passengers on a United States Air Force E3 Airborne Warning and Control System aircraft which crashed after striking 13 Canada geese on take off from Elmdorf, Alaska is indicative of the catastrophic potential of Canada geese near airport facilities (Dolbeer *et al.,* 1998; Eschenfelder, 2001; Kokel & Andrew, 2002; MacKinnon, 1996).

Data collected by Transport Canada shows Winnipeg International Airport as having 341 reported bird strikes over the past 10 years, the fifth highest of commercial airports in Canada (see Appendix C) (MacKinnon, 2003). The Winnipeg Airport Authority, through its Wildlife Management Program has initiated various treatments methods including landscape modifications, hazing, water management, egg depredation, turf management, and nest shooting to reduce the number of geese at Winnipeg International Airport (Winnipeg Airport Authority, 2002). The Winnipeg Airport Authority Wildlife Management Program has achieved some level of success; the annual

number of reported bird strikes at Winnipeg International Airport has been on a gradual decline over the past five years (MacKinnon, 2003). However, the Winnipeg Airport Authority – Wildlife Management Program has had little effect on deterring or controlling goose movement near or over airport facilities. An estimated 20,000-40,000 Canada geese continued to fly daily over or near the Winnipeg International Airport, during the fall migrations of 2003, 2004 and 2005 (Manitoba Conservation, 2003c; Manitoba Conservation, 2004c; Manitoba Conservation, 2005c). Additionally, if recent predictions by both the USFWS and Winnipeg Airport Authority are accurate, this gradual decline will likely be reversed within 10 years (MacKinnon, 1996). According to the USFWS the population of Canada geese in the Mississippi Flyway is expected to increase 50 percent over the next 10 years (Kokel & Andrew, 2002). Similarly, the Winnipeg Airport Authority also anticipates a substantial increase in the number of air-movements at Winnipeg International Airport over the same period of time (Urban Goose Working Group, Unpublished Report, 2004) (see Appendix D). An increase in both the number of air-movements at Winnipeg International Airport and goose populations traveling through the GWA will likely result in an increase, similar to those occurring at JFK Airport, in the number of bird strikes with geese occurring at Winnipeg International Airport (Barras & Wright, 2002; Kokel & Andrew, 2002; MacKinnon, 1996).

As illustrated in this chapter the issue of Canada geese in the GWA is both similar and unique to human/goose conflicts occurring else where in Canada and the US. The main similarity between the GWA and the typical urban goose issue is the nature of conflicts associated with the presence of Canada geese in urban areas. However, the duration and magnitude of Canada geese and associated human/goose conflicts in the

GWA is relatively unique in North America (Manitoba Conservation, 1999; Manitoba Conservation, 2000; Manitoba Conservation, 2001; Manitoba Conservation, 2002; Manitoba Conservation, 2003; Manitoba Conservation, 2004; Manitoba Conservation, 2005). As noted earlier in the chapter, migrant populations are the predominate segment of Canada geese in the GWA. As a result, the occupation of the GWA by these populations and the associated conflicts is generally limited to the migration periods. This feature presents a unique challenge and opportunity for management strategies and tactics not present in most urban goose conflicts which typically involve relatively small numbers of resident geese spending the majority of the year, in many cases the entire year, within an urban centre. This factor plays a pivotal role in the selection of treatment methods, summarized in the following chapter, in the development of the GWA-CGMP proposed in Chapter five.

CHAPTER FOUR

Resident/Urban Canada Goose Management

As evidenced in the preceding chapter on the North American and GWA human/goose conflicts a positive relationship exists between the number of geese and the occurrence of conflict between human and goose activities where overlap occurs (Christens *et al.,* 1995; Dolbeer *et al.,* 1998; Kokel & Andrew, 2002; MacKinnon, 1996). This positive relationship demands a reduction in the number of Canada geese at conflict sites to affectively reduce the rate of conflict (Ettl, 1993; Kokel & Andrew, 2002; Smith *et al.,* 1999). A range of management techniques have been developed in Canada and the US which have achieved a measured reduction in the number of Canada geese at treatment sites.

4.1 CANADA GOOSE MANAGEMENT TECHNIQUES

The following summary of management techniques includes a variety of feasible and proven methods of reducing and/or preventing goose damage with minimal negative impacts on the environment, humans and other species (Kokel & Andrew, 2004). The management treatments are categorized into either short or long term treatments, based on the duration of effectiveness (Cooper, 1997).

4.11 Short-term Treatment Methods

Short-term treatments are typically non-lethal and generally result in some level of initial success (Cooper, 1997). They can be categorized into one of three types, deterrent, hazing or repellent.

4.11a *Deterrents*

Visual deterrents are the most commonly used deterrent in managing urban Canada geese (Smith *et al.,* 1999). They work by initiating the predator flight response in geese, resulting in the abandonment of treatment areas (Kokel & Andrew, 2002). Visual deterrents have an advantage over other deterrents by being a relatively inexpensive and portable treatment, normally unobtrusive to urban residents (Smith *et al.,* 1999). The most commonly used visual deterrents are flags, balloons, scarecrows, and decoys. Flags are generally constructed by attaching reflective tape or panels, typically Mylar, to either posts or other fixed objects at the treatment site. Both the movement and reflection of the flag material is designed to initiate the predator flight response (Heinrich & Craven, 1990; Smith *et al.,* 1999). Balloons or kites with large eyes painted on their surface, in elevated locations, work by imitating large birds of prey to initiate the predator flight response (Kokel & Andrew, 2002; Smith *et al.,* 1999). Scarecrows are visual deterrents which dissuade geese from an area by replicating the human form. The last commonly utilized visual deterrent is a life-like decoy imitating either a predator or deceased goose to initiate the flight response and abandonment of the treatment area. (Shilts, 1998).

Trained dogs and birds of prey are another commonly used deterrent treatment for managing urban geese. These natural predators of Canada geese are trained to pursue stationary geese to initiate the flight response or deter in flight geese from accessing

treatment areas (Conover & Chasko, 1985; Woodruff & Green, 1995). Birds of prey and dogs can be an effective deterrent over a large treatment area (Cleary, 1994; Dornbush *et al.,* 1996).

Discontinuance or banning of hand feeding waterfowl by recreationists is the last commonly used deterrent treatment (Cleary, 1994; Dornbush *et al.,* 1996). The passage of a bylaw banning hand feeding of waterfowl combined with enforcement and educational signage creates an additive affect when utilizing the three methods in concert (Chartier, 2002). Additionally, aversion therapy can also create an additive affect when used in conjunction with a feeding ban by conditioning geese to avoid hand outs from people by feeding geese bread treated with a chemical repellant (Gosser & Conover, 1999).

4.11b *Hazing*

Hazing techniques are another commonly used short-term urban goose management treatment. Similar to deterrent treatments, hazing treatments cause geese to abandon a treatment site by initiating the predator flight response (Cleary, 1994; Kokel & Andrew, 2002). Hazing is typically preformed with pyrotechnics and can be conducted without a federal permit in Canada or the US. However, hazing treatments may be subject to either municipal noise bylaws or federal/municipal firearms regulations.

The two most commonly used methods of hazing are propane bangers and self propelled cracker or screamer shells. These treatments work by imitating hunting pressure to initiate the flight response. Propane bangers are typically used in large areas and have an effective range up to 20 ha (Smith *et al.,* 1999). Bangers can be programmed to fire either randomly or at specified periods and do not require an operator. Screamers

shells are projectiles that emit a whistle and explosion, similar to a firecracker, at the end of its travel. Screamers are typically launched from a specialized pistol and travel a distance of 20-30m. Crackers shells are projectiles similar to screamers but are launched from a conventional 12 gauge shotgun and travel up to 100m (Aguilera *et al.,* 1991; Smith *et al.,* 1999). Aguilera *et al.,* 1991, found both screamer and cracker shells effective at reducing both migrant and resident geese from treatment areas. A lesser used hazing device is an electronic distress call. Recordings of goose distress calls can be played through a loud speaker to cause geese to abandon a treatment site by mimicking alarms calls from a flock of geese (Mott & Timbrook, 1988).

4.11c *Repellants*

A third short-term management treatment is chemical repellants. A number of non-toxic chemical repellants have been developed to reduce feeding opportunities of Canada geese in urban areas. Chemical repellants, excluding lime, have an advantage over other short-term treatments of leaving neither an acoustic nor visual trace. Repellents which have demonstrated a reduction of urban geese at treatment sites include diethyl anthranilate (DMA), methyl anthranilate (MA), anthraquinone, methiocarb, and lime (Belant *et al.,* 1997; Conover, 1985; Conover, 1989; Cummings *et al.,* 1991; Cummings *et al.,* 1992; Cummings *et al.,* 1995; Dolbeer *et al.,* 1998; Glahn *et al.,* 1989). These chemical repellents require ingestion by geese to be an effective treatment and may require federal approval prior to its application.

Grass treated with methiocarb is the most effective chemical repellant (Conover, 1985; Cummings *et al.,* 1991; Cummings *et al.,* 1992). Field studies by Conover (1985) demonstrated a 71 percent reduction in the number of geese feeding on treated lawns.

Methiocarb was effective for 56 days despite the grass being cut and watered during the study period (Conover, 1985). However, methiocarb has only been approved for experimental use as a goose repellant in Canada and the US (Conover, 1985; Conover, 1989; Smith *et al.,* 1999).

DMA is a non-toxic, bio-degradable, human safe, federally approved food additive which has demonstrated an effective repellency of Canada geese. It is the second most effective chemical repellant, producing a 96 percent reduction in the number of geese at treatment sites (Cummings *et al.,* 1991; Cummings *et al.,* 1992). However, the effectiveness of DMA falls to 50 percent within 28 days and is only approved in the US for use as an avian repellant (Cummings *et al.,* 1991; Cummings *et al.,* 1992).

MA is also a non-toxic, bio-degradable, human safe, federally approved food additive (Cummings *et al.,* 1991; Cummings *et al.,* 1992). MA is the third most effective chemical goose repellant which has proved to be an effective repellant for up to four days (Cummings *et al.,* 1992; Cummings *et al.,* 1992). However, its low cost, one fifth the cost of DMA, allows for repeated applications to achieve performance levels similar to DMA at comparable treatment costs (Conover & Chasko, 1985; Cummings *et al.,* 1991). Currently MA is marketed under the brand name *Rejex-It* and is an approved avian repellant in both Canada and the US (Belant *et al.,* 1997; Cummings *et al.,* 1991).

Anthraquinone, marketed under the brand name, *Flight Control* (FC) is a federally approved chemical goose repellant. FC's advantage over other repellents is that it has a lower toxicity then DMA or MA (Dolbeer *et al.,* 1998). However, similar to MA, FC's effective repellency is limited to four days (Dolbeer *et al.,* 1998).

Finally, lime can be used as an effective chemical goose repellant. Lime is routinely used by the agriculture industry to increase the PH level of soils and does not pose a safety hazard to humans when used. Lime's greatest advantage is that treatment costs are the lowest of any chemical repellent, one third the cost of MA the next lowest cost repellant (Belant *et al.,* 1997). Lime has an effective repellency rate of 77 percent for up to four days and is approved for use on turf in both Canada and the US (Belant *et al.,* 1997). However, its use on golf courses or parks may be limited as it turns treated turf grey in color.

4.12 Long-Term Treatment Methods

Long-term treatments are generally lethal and typically provide long-term goose management by stabilizing populations at desired levels. A number of treatments fall into this category, including contraception, habitat modification, egg depredation, translocation, and harvest/take.

4.12a *Contraception*

One long-term method of urban goose management being developed is contraception. The development of birth control methods came in response to demands for non-lethal long-term methods of population control, as well as the decreasing number of locations willing to accept translocated geese (Hundgen *et al.,* 2000; Kokel & Andrew, 2002). Currently, no pharmaceutical contraceptives have been approved for use on Canada geese in Canada or the US, however, surgical sterilization is an approved method of controlling reproduction and provides long-term management by limiting recruitment and stabilizing goose populations at desired levels (Kokel & Andrew, 2002). There are a number of benefits to surgical sterilization, typically vasectomies, including a high

success rate ranging form 88 -100 percent on treated males (Converse & Kennely, 1994; Hundgen *et al.,* 2000). In addition, sterile males continue to maintain both pair bonds and yearly nest attempts despite previous reproductive failures (Converse & Kennelly, 1994; Hundgen *et al.,* 2000). In areas with limited nesting sites, treated males will often prevent new breeding pairs from establishing nests (Hundgen *et al.,* 2000). The total cost for the vasectomy procedure is in excess of $100USD/bird when all associated costs are included in the calculation (Converse & Kennelly, 1994; Keefe, 1996).

4.12b *Habitat Modifications*

A second long-term management treatment is habitat modifications. This technique requires the manipulation of urban landscapes to decrease the qualities attractive to geese, facilitating a long-term reduction of Canada geese at treatment sites (Smith *et al.,* 1999). There are four types of habitat modifications which can be used to achieve this goal.

The first type of habitat modifications is the reduction of attractive nest sites in urban and near urban areas. One method of reducing attractive nest sites is the elimination of islands, the preferred nesting area of Canada geese (Conover & Chasko, 1985; Gosser & Conover, 1999). This treatment can be accomplished by either raising water levels to submerge island structures or drawing down levels until the island joins the mainland. The advantage of this treatment is that it forces geese to either abandon the area completely or re-nest on the mainland where ease of access permits additional treatments and increases the chance of egg depredation by natural predators (Gosser & Conover, 1999). A second method of reducing attractive nest sites is the removal of artificial nesting structures. Historically private citizen's, wildlife associations, and

government agencies placed nesting structures along waterways to increase nest success by lowering egg depredation (Smith *et al.,* 1999). The removal of these structures provides an immediate reduction of attractive nesting sites in urban centres.

The second type of habitat modifications is the reduction of attractive forage areas in urban centres. One method is the utilization of turf management programs which reduce the availability of preferred forage in urban green spaces (Cleary, 1994; Conover, 1992; Conover & Kania, 1991; Dornbush *et al.,* 1996; Kokel & Andrew, 2002). The availability of preferred forage, young grass shoots, can be decreased by maintaining lawn heights above 13cm and eliminating the use of irrigation and fertilizer. This treatment reduces both the production of and access to young grass shoots in urban areas (Conover, 1992; Dornbush *et al.,* 1996; MacKinnon, 1999; Smith *et al.,* 1999). A second method of reducing the availability of preferred forage types in urban areas is the installation of unpalatable ground cover such as Tall fescue (*Festuca arundinacea*), Japanese pachysandra (*Pachysandra terminalis*), common periwinkle (*Vinca minor*), or English Ivy (*Hedera helix*) (Cleary, 1994; Conover, 1992; Conover & Kania, 1991; Dornbush *et al.,* 2002; MacKinnon, 1999). The effectiveness of treatments which reduce the availability of attractive forage areas can be increased when combined with the installation of a lure crop at an acceptable site, creating an additive effect between the two treatments (Cleary, 1994; Conover, 1985; MacKinnon, 1999).

The third type of habitat modifications is the exclusion of geese from riparian areas of urban centres. One method of exclusion is allowing pond cells to freeze as early as possible (Cleary, 1994). Devices such as aerators, pumps, or fountains which inhibit freezing should be removed in anticipation of early cell freeze up (Cleary, 1994; Smith *et*

al., 1998). Allowing cells to freeze over as early as possible can initiate the fall migration which may be delayed if cells remain artificially open (Ankney, 1996; Belant *et al.,* 1997). A second method of exclusion is the installation of trees with a dense canopy at pond sites, increasing the descent/ascent flight angle to the cell surface. This treatment impedes the Canada goose's preferred method of accessing feeding and loafing areas by landing first on the adjacent water body and entering the area by foot (Conover & Kania, 1991). Trees must be planted in close proximity to a water body to create a descent/ascent angle of $>13^{o}$ to effectively exclude geese from accessing the water surface on the wing (Conover & Kania, 1991; Dornbush *et al.,* 1996). A third method of exclusion is the installation of a raised grid above the waters surface (Cleary, 1994; Kokel & Andrew, 2002). Similar to increasing ascent/descent angles, a raised grid prevents geese from accessing the water surface on the wing. The effectiveness of a grid system can be increased with the installation of a barrier fence along the perimeter of the cell, preventing access to the cell from the upland area. A fourth method of exclusion is the placement of floating balls on a pond cell, covering the entire water surface. Similar to a raised grid treatment, floating balls work by forming a barrier to the water surface. This technique is typically employed in areas where little concern for aesthetics is present (Kokel & Andrew, 2002; Smith *et al.,* 1999).

The fourth type of habitat modification is intended to interrupt sightlines in urban green spaces (Gosser *et al.,* 1997). Canada geese typically avoid areas where the ability to see approaching predators from <9m occurs (Conover, 1992; Conover & Kania, 1991). The installation of a physical barrier, of sufficient height, blocks sightlines as well as impedes the ability of geese to move between the upland and wetland zones by foot

(Conover, 1992; Dornbush *et al.,* 1996; Gosser *et al.,* 1997; MacKinnon, 1999; Smith *et al.,* 1999). Barriers can be constructed from either natural or conventional building materials (Smith *et al.,* 1999). A conventional fence should be a minimum of 1m tall and have a picket spacing no greater then 10cm (Cleary, 1994; Smith *et al.,* 1999). Vegetation barriers in either the upland or wetland zones should be dense enough to obstruct sightlines as well as prevent geese from moving through the barrier (Conover, 1992; MacKinnon, 1999; Smith *et al.,* 1999). Large rocks can also be utilized as barriers, often providing a more esthetically appealing barrier (Kokel & Andrew, 2002; Smith *et al.,* 1999).

4.12c *Egg Depredation*

A third long-term management treatment is egg depredation. This treatment provides long-term management of Canada goose populations by limiting recruitment and stabilizing population levels. Egg depredation is the interruption of embryos and is accomplished through a variety of techniques. One method of egg depredation is addling, the vigorous shaking of an egg until the embryo is destroyed. Addled eggs must be returned to the nest to facilitate continued incubation, ensuring the mating pair does not attempt to re-nest in response to egg removal (Christens *et al.,* 1995; Cleary, 1994; Smith *et al.,* 1999). A second method of egg depredation is puncturing an egg with a long needle or spike after incubation has been initiated. The purpose of puncturing the egg is to introduce bacteria and to destroy the embryo through the twisting action of the needle (Smith *et al.,* 1999). Again, treated eggs must be returned to the nest to promote continued incubation and to deter re-nesting attempts. A third method of egg depredation is the application of a mineral oil to the exterior surface of an egg (Christens & Blokpoel,

1991; Christens *et al.,* 1995; Smith *et al.,* 1999). Application of mineral oil, over the entire surface of the egg, blocks the pores of the egg and results in the disruption of the embryo due to asphyxiation (Blokpoel & Hamilton, 1989; Christens & Blokpoel, 1991; Christens *et al.,* 1995). As with the first two techniques, treated eggs must remain in the nest to encourage incubation (Christens *et al.,* 1995; Cleary, 1994; Smith *et al.,* 1999). The final method of egg depredation is the removal of eggs for destruction at an offsite location. Dummy eggs replace the removed eggs in the nest to ensure continued incubation and prevent re-nesting efforts (Christens *et al.,* 1995; Cleary, 1994; Smith *et al.,* 1999).

4.12d *Translocation*

Translocation is the forth long-term goose management treatment. Translocation allows specific populations to be targeted for management and provides an immediate reduction of nuisance geese at the treatment sites (Cooper, 1991; Cooper & Keefe, 1997; Smith, 1996). Typically, flightless geese are captured during the molt period either through netting or sedation (Belant & Seamens, 1997; Cleary, 1994). Captured geese are then transported to a release site willing to accept the birds (Kokel & Andrew, 2002). Cooper & Keefe (1997) determined translocation success rates, as measured by the number of translocated birds returning to the capture site following release, is largely dependant on the age of captured birds and ranges from 20-80 percent.

4.12e *Harvest/Take*

The fifth long-term Canada goose management technique is harvest/take. Harvesting geese provides immediate and long-term urban goose management, lowering treated populations to desired levels. Increasing the mortality of adult geese in urban

flocks is nine to 15 times more effective at managing urban geese then any other short or long-term treatment (Ankney, 1996; Ettl, 1993). In addition, all harvest programs provide the most immediate method of dispersing geese from a conflict area (Ankney, 1996). A range of harvest programs have been developed to manage Canada geese.

One harvest program is the regular hunting season, the historical method of regulating Canada goose populations in Canada and the US (Kokel & Andrew, 2002). Wildlife managers can adapt harvest rates by changing season length, bag limits, and season dates (Harvey *et al.,* 1995; PA Game, 2002). An additional advantage of the regular hunting season is it provides the most cost effective method of managing Canada goose populations (Kokel & Andrew, 2002; PA Game, 2002; Smith *et al.,* 1999).

A second harvest program is the special hunting season. In 1998 the North American Waterfowl Management Plan (NAWMP) was amended to include special goose hunting seasons in an attempt to increase harvest opportunities for snow (*Chen caerulescens*) and Canada geese (Kokel & Andrew, 2002). Special hunting seasons typically occur prior to and/or following the migration period in an effort to increase the harvest of resident geese while lowering the harvest of migrant geese (Kokel & Andrew, 2002; Leafloor *et al.,* 1996; Lindberg & Malecki, 1994; Schultz *et al.,* 1988; Smith *et al.,* 1999). To further increase harvest rates of resident geese, special hunting seasons often include regulation changes permitting the use of electronic calls, increased bag limits and/or the elimination of shotgun plug restrictions (Kokel & Andrew, 2002; Smith *et al.,* 1999). Similar to the regular hunting season, special hunting seasons has the added advantage of providing the most cost effective method of managing Canada goose populations.

A third harvest program is the limited entry hunt. An advantage of a limited entry hunt is it provides wildlife agencies the ability to target specific populations of geese at a conflict sites (Conover & Kania, 1991; Kokel & Andrew, 2002). These hunts typically occur at sites where hunting is not permitted, such as golf courses, industrial parks, water treatment plants, or energy providers and provide a cost effective method of managing urban geese (Ankney, 1996; Belant *et al.*, 1997; Conover & Kania, 1991; Leafloor *et al.*, 1996; Lindberg & Malecki, 1994; Schultz *et al.*, 1988).

The final harvest program occurs under permission of a special kill permit issued by the CWS or USFWS (Kokel & Andrew, 2002). The advantage of kill permits is the ability to depopulate a specific area. Kill permits are typically issued for areas where an immediate reduction in the number of geese is required. These areas are generally high risk sites where the presence of geese pose an immediate danger or low risk sites where a limited entry hunt is not practical or desired. At high risk sites such as airport facilities, the harvest method typically used is nest shooting. At low risk sites geese are typically collected during the molt and sent to an abattoir for inspection and processing prior to donation to local food banks (Cooper, 1997). In the US where this method is increasingly common, federal law requires food products intended for donation to food banks be inspected and approved safe for human consumption prior to donation (Kokel & Andrew, 2002).

4.2 EVOLUTION OF WILDLIFE MANAGEMENT

As evidenced in the preceding summary of urban goose management techniques a wide range of long and short-term treatments are available to wildlife managers. However, the selection of treatment methods for use at specific sites requires more of

responsible agencies then the simple selection of treatments to reduce the greatest number of birds. The selection of treatments appropriate for a specific conflict is dictated by the desired outcome of the action and the objectives of the management plan. Contemporary management planning is increasingly involved in complex issues, occurring within social and ecological systems which are nonlinear and highly dynamic (Riley *et al.,* 2003). As the complexity of wildlife management issues have evolved over the past 50 years, so too has the resource management model.

Historically, wildlife management principally dealt with the regulation and husbandry of mammal and bird populations hunted for sport. Management actions were undertaken for the benefit of people, predominately consumptive users (Bolen & Robinson, 2003; Decker *et al.,* 1996; Riley *et al.,* 2003). Management initiatives reflected the popular philosophy of conservation, a management of wise use and the production of commodities from the resource, achieving this objective by focusing on manipulation of ecological and biological inputs and the resulting outcomes from management decisions (Decker *et al.,* 1996; Ewert, 1996; Riley *et al.,* 2003; Wittman *et al.,* 1998). However, in the 1950's modern resource management began to evolve in response to the emergence of new stakeholders and competing attitudes towards wildlife and its management (Bolen & Robinson, 2003; Riley *et al.,* 2003).

4.21 Increased Stakeholders in Resource Management

The first stakeholder valuations incorporated into the modern resource management model were those of consumptive user groups (Riley *et al.,* 2003). In the years that followed the first inclusion of consumptive stakeholder valuations in resource decisions a variety of new stakeholder groups emerged, demanding inclusion of new

valuations in the management process. Decker *et al.,* (1996) identified the four stakeholder types recognized in the contemporary resource management model. First, *public official* stakeholders are representatives of provincial/state, federal or municipal resource agencies charged with managing natural resources. Second, *longstanding nongovernmental organization* stakeholders are organizations such as the Winnipeg Humane Society, Ducks Unlimited Canada or the Manitoba Wildlife Federation that are commonly formed around beliefs or valuations relative to resource management. Third, *citizen action* stakeholders are organized groups which develop out of a concern for a particular resource conflict or issue and typically disband following the resolution of the issue. Fourth, *grassroots* stakeholders are individuals who desire a voice for their opinion, belief, taxpaying status, knowledge, or perceived threat to well being by resource decisions. Grassroots stakeholders are not generally organized nor do they have formal representation, however, they can be highly visible and vocal in issues of their concern.

Ewert (1996) attributes the evolution of the resource management model towards greater participation by a variety of stakeholder groups to three sociological changes occurring during the same period. First, an increased level of awareness by the general public regarding natural resources issues. Second, an increased valuation of non-commodity outputs of the natural environment. Third, a growing reluctance by the general public in Canada and the US to automatically accept an absolute authority of natural resource agencies in deciding how resources are to be managed or utilized. These sociological changes compel contemporary resource management adhere to a mixed value model that integrates ecological, political, economic, and sociocultural valuations

into decision making that creates goals for natural resources and initiates actions to achieve them (Brown & Manfredo, 1987; Decker *et al.,* 1996; Krueger *et al.,* 1986). The evolution of resource management forces responsible agencies to reconcile management programs with a variety of stakeholders with diverse and often divergent valuations towards the resource in question.

4.22 Stakeholder Valuations – Human Dimensions of Wildlife Management

The increased demand by competing stakeholders, for recognition and participation in the wildlife management model, was the precipitating factor behind the development of an accurate measure of stakeholder attitudes. The measure developed to meet this demand is Human Dimensions research. Human Dimension research in natural resource management is a scientifically valid method of predictive modeling of stakeholder attitudes. Attitudes are, "a learned disposition to respond in a consistently favorable or unfavorable manner with respect to a given object" (Fishbein & Azjen, 1975 pp. 10). Human Dimensions research into stakeholders' attitudes is therefore an investigation which attempts to describe, predict, understand, and affect human thought and action toward natural environments and to acquire such understanding for the primary purpose of improving stewardship of natural resources (Campbell & MacKay, 2003; Decker *et al.,* 1996; Ewert, 1996; Fishbein & Azjen, 1975).

The role of Human Dimension research is significant in contemporary wildlife management when it is recognized that any management action in almost every management program will have an impact of some type or degree on people in some manner (Decker *et al.,* 1996; Riley *et al.,* 2003). This is especially true of urban human/wildlife conflicts which are generally location-specific and often, at a community

level, expectant of tailored solutions to the unique attributes of the conflict as opposed to the traditional coarse filter of broad, province-wide regulation and policy (Schusler *et al.,* 2000). However, most communities are rarely homogenous, having a range of stakeholders with diverse conflict acceptance capacities and attitudes towards management methods with a potential to polarize the community. Tailored responses to specific conflicts are dependant on accurate human dimension assessment to overcome the increased potential for controversy because of a diversity of valuations associated with the decision making process.

Human Dimension research ensures all stakeholders valuations are recognized and that their stake and reason for participation in the process is articulated and comprehended by other the stakeholders (Manfredo *et al.,* 1996). It facilitates awareness and understanding of stakeholder values regarding natural resources, improves communication with the stakeholders on natural resource issues, and predicts the social impacts of natural resource decisions. Accurate Human Dimension research allows managers to identify competing valuations that may lead to conflict between stakeholders over management treatments or strategies and helps to create an understanding that decisions were arrived at fairly by stakeholders with an exchange analysis that lead to a program of acceptable compromise (Berryman, 1987; Decker *et al.,* 1996; Ewert, 1996; Sample, 1990). Management decisions formulated through stakeholder participation are more likely to be maintained because of higher support and ownership by stakeholders (Gregory, 2000; Riley *et al.,* 2003). In addition, Human Dimensions research is critical to successful communication and education. In some instances, citizen action and grassroots stakeholders may not have the perspective or knowledge to make well-founded

judgments on natural resource issues (Lauber *et al.,* 2002). The quality of management programs may be diminished if responsible agencies simply adopt programs according to what stakeholders' desire based on their limited experience (Lauber & Knuth, 1998; Loker *et al.,* 1998). It is therefore argued by a variety of authors, that when citizen action and grassroots stakeholders participate in decision making, education plays a vital role (Bath, 1989; Duda & Case, 1996; Maguire *et al.,* 1997; Smith & Vickerman, 1997; Van Ryn, 1997). Education allows citizen action and grassroots stakeholders to participate more effectively by encouraging critical discourse, developing an understanding and judgment on public policy, and contributing to informed consent (Boggs, 1991). However, education programs must not be misinterpreted as advancing an agencies view or particular agenda. Rather, education programs provide an opportunity to assist stakeholders in making informed decisions based on their analysis of the issue (House, 1981).

4.3 RESIDNT/URBAN GOOSE MANAGEMENT PROGRAMS IN NORTH AMERICA

A number of contemporary management plans have been developed by agencies responding to increasing human/goose conflicts occurring within their jurisdiction. The remainder of this chapter will examine contemporary urban/resident goose management at the Flyway and local GWA level.

4.31 Background, Authority & Responsibility for Canada goose Management

Canada Geese in North America are an international resource, federally protected by the 1916 Migratory Bird Convention Treaty (MBCT) between Canada and the US. All management programs must adhere to the guidelines framed in this treaty governing

Canada geese. Within Canada the governing authority for regulating and enforcing the MBCT is Environment Canada through the Canadian Wildlife Service (CWS), under Canada's 1918 (amended in 1999) proclamation of the Migratory Birds Convention Act (MBCA) (Nelson & Bartolek, 1990). Each province within Canada has also been granted a level of regulatory authority over migratory birds through the Province's respective natural resources transfer agreement from Canada and the Wildlife Act of each Province. In Manitoba the regulatory authority of the Province is derived from the 1930 Manitoba Natural Resources Transfer Act, as well as Manitoba's, Wildlife Act, C.C.S.M. c. W130.

The 11 subspecies of Canada geese recognized in the North American Waterfowl Management Plan are divided into 19 management populations reflecting their geographic distribution (Rusch *et al.,* 1995). The management of these populations occurs at the flyway level through each of the respective Flyway Councils. First introduced by Lincoln (1935) and later adopted by the CWS and USFWS in 1948, member provinces and states from each of the four Flyways including the Atlantic, Mississippi, Central and Pacific Flyways, work with and make recommendations to the CWS and USFWS through the Flyway Council to manage migratory birds, including Canada geese, occurring within their geographic areas (Kokel & Andrew, 2002).

4.32 Flyway Management of Resident Canada geese

In response to the growing conflicts between humans and geese within each of the four Flyways, each Council drafted a resident goose management plan to mitigate these conflicts. The four management plans provide the framework for member provinces and states to operate under when initiating resident goose management within their

jurisdiction. Table 2 is a summary of the four Flyway's resident geese management plans outlined in the following sections, 3.32a, 3.32b, 3.32c, and 3.32d.

Table 2. Flyway management plans of resident/urban geese (Kokel & Andrew, 2002).

	Atlantic Flyway	Mississippi Flyway	Central Flyway	Pacific Flyway
Plan Inception	1999	1996	2000	2001
Management Goal	Optimal balance between positive values and conflicts	Provide maximum recreational oppurtunities consistent with social responsibility	Achieve maximum benefit from resident geese while minimizing human/goose conflicts	Optimized recreational opportunity and reduced depredation and nuisance problems
Population Objective	650,000	1,000,000	No single objective	115,000
Current Population: 2001-2003 Average	1,410,000	1,440,000	871,474	121,556*
Primary Treatment Methods	Regular, Limited Entry & Special Hunting Season	Regular & Special Hunting seasons	Regular hunting season	Regular hunting season
Urban Treatment Methods	Integrated approach reflecting site attributes at the discretion of provincial/state agencies	Integrated lethal and non-lethal approach. Reflecting site attributes and provincial/state agencies	hazing, repellents, egg depredation, translocation, special hunting seasons, habitat modifications, kill permits	Kill Permits and treatments which reflect the nature of the conflict site
	*Breeding population indicies (Subcommittee on Rocky Mountain Canada Geese, 2000)			

4.32a *Atlantic Flyway Resident goose Management Plan*

In response to growing human/goose conflicts within the Atlantic Flyway, the Flyway Council drafted a resident goose management plan in 1999 (Atlantic Flyway Council, 1999).

History

By the end of the 19th century the original resident geese of the Atlantic Flyway were extirpated as a result of unregulated market hunting. However, early in the 20th century the current resident population was initiated by individuals releasing captive birds throughout the Flyway. Additional flocks of geese were released by individuals when new hunting regulations in 1935 prohibited the use of live decoys. Wildlife agencies in the Flyway were also actively involved in restoration efforts from the 1950 – 1980's, predominantly through stocking and relocation programs. By 1990, the majority

of programs were discontinued as the restoration effort had been highly successful in establishing resident Canada geese throughout much of the Flyway. In the decade that followed, resident geese became the most abundant goose population within the Flyway and prompted the Council to create the Atlantic Flyway Resident Goose Management Plan (AFMP) (Atlantic Flyway Council, 1999).

Management Plan Goal

The AFMP goal is to, "manage resident Canada goose populations in the Atlantic Flyway to achieve an optimal balance between the positive values and conflicts associated with these birds" (Kokel & Andrew, 2002 pp. 20).

Population Objective

The population objective of the AFMP is to reduce the number of resident Canada geese to 650,000 by 2005 from the 2001-03 spring average of 1.41 million individuals (Atlantic Flyway Council, 1999; Moser &Caswell, 2003). The population objective of the AFMP is the sum of all population objectives from each of the individual provinces and states within the Flyway. Population objectives are reviewed periodically by the Council to determine whether adjustments are required to reflect changes in damage levels, public input, population levels, or other factors in the resident goose conflict (Atlantic Flyway Council, 1999).

Harvest Management

The primary objective of the AFMP is to maximize appreciation and use of resident geese, consistent with migrant population objectives within the Flyway. Accordingly, member provinces and states within the Flyway attempt to reduce the harvest of unintended goose populations by employing flexible hunting regulations and

conducting hunts in areas not typically utilized by migrant geese (Atlantic Flyway Council, 1999).

Damage Relief and Nuisance Control

The Flyway permits a wide range of effective management methods to reduce the conflict and damage resulting from resident geese. The primary management technique selected by the Council is sport hunting; however, the Council admits that its use may no always be applicable, especially in urban conflicts. Consequently, the Flyway endorses an integrated approach, including a range of lethal and non-lethal methods when required by the attributes of a specific conflict.

4.32b *Mississippi Flyway Resident goose Management Plan*

In response to growing human/goose conflicts within the Mississippi Flyway, the Flyway Council drafted a resident goose management plan in 1996 (Giant Canada Goose Committee, 1996).

History

Historically, giant Canada geese (*B. c. maxima*) were prevalent through out the upper Midwest region of the Flyway when Europeans first settled in the area. By the 1930's wetland destruction and unregulated hunting resulted in the disappearance of resident Canada geese from much of their historic range within the Flyway (Kokel & Andrew, 2002). Near the same time, prohibitions against the use of live decoys for hunting resulted in efforts in Ontario, Michigan, Wisconsin, and Minnesota to establish self-sustaining, free-flying flocks from the release of captive geese. Between the 1940's and 1970's, provincial and state agencies in Manitoba, Ontario, Minnesota, Missouri, Ohio, Wisconsin, Illinois, Indiana, Iowa, Louisiana, Tennessee, Alabama, Arkansas and

Kentucky also participated in restoration programs to establish local flocks of Canada geese. By 1996, the Flyway Council drafted a resident goose management plan in response to the rapid growth of resident geese and corresponding human/goose conflicts throughout the Flyway (Giant Canada Goose Committee, 1996).

Management Plan Goal

The goal of the Mississippi Flyway Giant Canada Goose Management Plan (MFMP) is, "To manage the population of giant Canada geese in the Mississippi Flyway at a level that provides maximum recreational opportunities consistent with social responsibility" (Giant Canada Goose Committee, 1996, p.1).

Population Objective

The MFMP population goal of 1 million resident geese is below the current population of 1.44 million, estimated in the 2001-03 spring breeding survey (Giant Canada Goose Committee, 1996; Mississippi Flyway Council, 1996; Moser & Caswell, in press). The resident goose population goal in the MFMP is the sum of population objectives derived by individual provincial and state members of the Flyway. Periodic review of the population goal is conducted to determine whether modifications are needed to address changes in the damage levels, public input, population levels, or other factors included in the calculation.

Harvest Management

The primary objective of the MFMP is to provide maximum opportunities to harvest giant Canada geese consistent with provincial/state population objectives, the objectives for other Canada goose populations within the Flyway, and the management of geese in areas of human/goose conflicts. However, overlap of various goose populations

in wintering and migration areas of the Flyway and the differential status and harvest regulations of each population limit the flexibility of harvesting resident geese. The Council attempts to overcome these limitations with the introduction of two management initiatives. First, creation of flexible regulations and special seasons which permit member provinces and states to achieve desired harvest rates of resident geese. Second, the development of a robust Canada goose harvest-derivation analysis to apportion harvest estimates of the various populations within the Flyway (Giant Canada Goose Committee, 1996).

Damage Relief and Nuisance Control

The MFMP recognizes the main objective of the program is the management of resident goose populations where human/goose conflicts occur with treatment techniques to mitigate these conflicts at the discretion of provincial and state agencies. The primary management technique promoted by the Council is licensed hunting, however, its use may not always be applicable, especially in urban areas. Consequently, the Flyway endorses an integrated approach, including a range of lethal and non-lethal methods in response to specific conflict attributes.

4.32c *Central Flyway Resident goose Management Plan*

In response to growing human/goose conflicts within the Central Flyway, the Flyway Council drafted a resident goose management plan in 2000 (Gabig 2000).

History

Unregulated and market hunting was responsible for a significant reduction of resident Canada goose populations throughout the Flyway by the start of the 20th century (Gabig, 2000). From the 1930's to 70's, provincial and state wildlife agencies within the

Flyway released goslings from captive breeding stocks as part of a restoration initiative. By the 1990's, wildlife agencies discontinued breeding programs but continued restoration efforts through the relocation of over 120 000 nuisance Canada geese to areas of the Flyway (Gabig, 2000). By 2000 all restoration efforts had been discontinued with the exception of Saskatchewan's which continued relocating geese within the province (Kokel & Andrew, 2002). At the same time, the Council developed a management plan for addressing nuisance large race Canada geese from each of the three populations occurring within the Flyway, including the Western Prairie, Hi-Line and Great Plains populations (Gabig, 2000).

Management Plan Goal

The goal of the Central Flyway Management Plan (CFMP) is, "manage resident Canada geese in the Central Flyway to achieve maximum benefits from these birds while minimizing conflicts between geese and humans" (Gabig, 2000, p.8).

Population Objective

Resident Canada geese in the Flyway originate from one of three large race populations within the Flyway, therefore the CFMP does not propose a single population goal for resident geese. Population objectives in the CFMP are determined by individual provinces or states in relation to the goose populations occurring within their jurisdiction, consistent with objectives for continental breeding populations. The total spring count of resident Canada geese occurring within the Central Flyway, 2001-03 average, is estimated at 871 434, significantly above all resident population objectives established within the Flyway (Gabig, 2000; Moser & Caswell, in press).

Harvest Management

Common to each management plan for the individual populations of large Canada geese within the Flyway is the maximizing of harvest opportunities consistent with habitat constraints, international treaties, and the objectives of individual populations. Hunting and harvest regulations are integral to meeting population objectives and determine the actioning of either restrictive or liberal harvest levels set by the Council.

Damage Relief and Nuisance Control

Sport hunting is the primary method of controlling resident goose populations within the Flyway. However, the Council recognizes that hunting may not always be a practical solution and that other treatment methods will be required for managing resident geese. The Council proposes 11 management techniques ranging from no action to kill permits for managing geese at conflict sites. The Council outlines these treatments on an Action Matrix and predicts the consequence of each action relative to the financial cost, social acceptance, expected impact on various populations, and resolution of the human/goose conflict (Gabig, 2000).

4.32d *Pacific Flyway Resident goose Management Plan*

In response to growing human/goose conflicts within the Pacific Flyway, the Council developed Canada goose management plans for both the Rocky Mountain Population (RMP) and the Pacific Population (PP) of resident western Canada geese (*B. c. moffitti*) within the Flyway.

History

Pacific Population

PP geese occur in the western half of the Pacific Flyway. The northern portion of the PP are migrant geese while the southern portion are non-migratory geese, however, some overlap occurs between the two at nesting and wintering areas (Subcommittee on Pacific Population of Western Canada Geese, 2000). Over the past 20 years the PP has expanded beyond its traditional range due largely to transplant programs and natural pioneering. By 1998, a crop depredation management program was introduced by the Council in response to crop depredation by PP geese in southwest Washington and northwest Oregon (Pacific Flyway Council, 1998).

Rocky Mountain Population

Geese from the RMP are largely migrant, moving between wintering and breeding ranges in the eastern portion of the Pacific Flyway (Subcommittee of Pacific Population of Western Canada Geese, 2000). In 1955 restrictive harvest regulations were introduced for the RMP in response to population declines in the preceding years (Subcommittee on Rocky Mountain Canada Geese, 2000). Similarly, various state agencies initiated transplant programs in areas throughout the Flyway in an effort to enhance the RMP. By the 1990's, liberal harvest regulations were introduced by the Council to address crop depredation conflicts resulting from the increased population of RMP geese within the Flyway (Subcommittee on Rocky Mountain Canada Geese, 2000).

Management Plan Goal

The goal of the Pacific Flyway Management Plan (PFMP) for the PP is, "to maintain PP western Canada geese at a level and distribution that will optimize recreational opportunity and minimize depredation and/or nuisance problems in

agricultural and urban areas" (Subcommittee on Pacific Population of Western Canada Geese, 2000).

The goal of the PFMP for the RMP is, "to maintain the Rocky Mountain Population of Western Canada geese at a level and distribution that optimizes recreational opportunity and reduces depredation and nuisance problems" (Subcommittee on Rocky Mountain Canada Geese, 2000).

Population Objective

The Council has also developed separate population objectives for PP and RMP geese in the Flyway. The PFMP population objective for the PP is the sum of the individual population objectives from member provinces and states within the Flyway. The population objective for the RMP is 115 000 individuals (Subcommittee on Rocky Mountain Canada Geese, 2000). A recent survey, conducted in the spring of 2000, estimates the RMP at 121 566 individuals (Subcommittee on Rocky Mountain Geese, 2000).

Harvest Management

Management plans for both the PP and RMP list maximum hunting, educational, scientific, and viewing opportunities as the primary objective for Flyway management of Canada geese. The Flyway RMP harvest plan employs a liberal/moderate/restrictive harvest level based on population indices of the previous three year spring breeding estimates. The Flyway PP harvest management plan is the sum of the individual harvest levels for each province and state within the Flyway (Subcommittee on Pacific Population of Canada Geese, 2000). The Flyway utilizes a variety of techniques including harvest surveys and banding programs to determine a reliable harvest estimate

in areas where Hi-Line and PP populations may overlap (Subcommittee on Rocky Mountain Canada Geese, 2000).

Damage Relief and Nuisance Control

Sport hunting is the preferred method of managing crop depredation by Canada geese within the Flyway. However, in both the PP and RMP management plans, the preference for sport hunting to mitigate crop depredation does not apply to urban human/goose conflicts (Kokel & Andrew, 2002). The PFMP for both the PP and RMP recommends local agencies initiate management programs to aid landowners in dealing with specific conflicts and proposes kill permits be included in all management programs (Kokel & Andrew, 2002).

4.33 Canada goose Management in the GWA

At the local level, Canada goose management in the GWA falls under the authority of the CWS and Manitoba Conservation on behalf of the Province of Manitoba. In 2000, Manitoba Conservation and the CWS entered into a partnership with several stakeholders, creating the Urban Goose Working Group (UGWG), to cooperatively manage Canada geese in the GWA. The UGWG was created in response to the increasing number of geese and associated conflicts in the GWA. The UGWG operates under the mission statement, "to cooperatively manage urban geese within the City of Winnipeg in order to reduce the risk of goose-related adverse effects to human safety, health, and property, as well as the overall goose population itself" (Urban Goose Working Group, 2002, pp. 1.). Its membership consists of public officials and longstanding nongovernmental organization stakeholders, including Manitoba Conservation, Canadian Wildlife Service, City of Winnipeg, Winnipeg Airport Authority,

Air Canada, Manitoba Wildlife Federation, and Winnipeg Humane Society (Urban Goose Working Group, 2002).

In 2004 the UGWG drafted the management plan, *Inter-agency Action Plan for the Management of Canada Geese within the Greater Winnipeg Area* (Urban Goose Working Group, Unpublished Document, 2004). However, the proposed plan never received final approval from all members of the UGWG, as a result, no urban goose management plan currently exists for the GWA. There are however, two wildlife programs operating in the GWA which include the management of Canada geese within each of their respective mandates. Similarly, a number of management treatments are currently in use at isolated sites throughout the GWA in an effort to manage localized resident populations within the site's domain.

4.33a *Canada – Manitoba Crop Damage Prevention Program*

One wildlife management program operating within the GWA is the Canada – Manitoba Crop Damage Prevention Program (CMCDPP). The CMCDPP assists Manitoba producers in protecting vulnerable crops from waterfowl depredation (Manitoba Conservation, 2003c). In an effort to mitigate crop depredation the program operates feeding stations and lure crops in prone areas and loans scarecrows, propane bangers, and cracker shells to Manitoba producers (Manitoba Conservation, 2004c). Under the CMCDPP, Urban Goose Management (UGM) technicians utilize a number of short-term management treatments in an attempt to reduce crop depredation in agricultural areas of the GWA. Daily monitoring by UGM technicians of agricultural areas of the GWA facilitates the response to large numbers of Canada geese with propane bangers and scarecrows. During the fall migration these same treatments are conducted

on private and crown cropland adjacent to Winnipeg International Airport at a rate of three and 12 respectively per 65 hectares, within 1500m of the Winnipeg International Airport perimeter fence (Personal observation, 2005) These actions are intended to prevent the accumulation of Canada geese in this area. In addition, UGM technicians, in cooperation with infield and tower staff at Winnipeg International Airport, haze Canada geese with pyrotechnics when numbers exceed 500 Canada geese within 1000m of Winnipeg International Airport perimeter fence (Personal observation, 2005).

In addition to hazing treatments administered under the CMCDPP, Manitoba Conservation amended The Wildlife Act in 2003 to create limited waterfowl hunting opportunities within Game Hunting Area 38 in the Rural Municipality of Rosser to further mitigate crop depredation in the GWA (Manitoba Conservation, 2003). Again in 2004 Manitoba Conservation amended The Wildlife Act to create limited waterfowl hunting opportunities within Game Hunting Area 38 in the Rural Municipality of Macdonald in an attempt to further mitigate crop depredation within the GWA (Manitoba Conservation, 2004).

4.33b *Winnipeg Airport Authority Wildlife Management Program*

The second wildlife management program operating within the GWA, which includes the management of Canada geese in its mandate, is the Winnipeg Airport Authority Wildlife Management Program (WAA-WMP). Currently the WAA-WMP operates a range of management treatments in an effort to reduce the number of wildlife strikes occurring at Winnipeg International Airport. Sheet-water drainage, pyrotechnic hazing, egg predation, nest shooting, and changes in turf management are being utilized

to reduce the presence of Canada geese on airport property (Winnipeg Airport Authority, 2002).

4.33c *Additional Actions*

In addition to the CMCDPP and WAA-WMP a number of management treatments are being employed at sites throughout the GWA in an effort to manage local populations of resident geese. Niakwa Golf and Country Club conducts hazing with a trained dog and handler to reduce the presence of Canada geese on club facilities. Fort Whyte Nature Centre conducts an egg depredation program to reduce recruitment and maintain resident goose populations at desired levels within the facility (R. Bruce, personal communication, 2004). Harbour View Golf Course installed a raised wire grid and perimeter fencing at two retention ponds to reduce the presence of Canada geese on the property (R. Bruce, personal communication, 2003; S. Read, personal communications, 2003). A recent project by LADCO Company Ltd., and Native Plant Solutions (NPS) is reducing the attraction of storm-water retention basins in the GWA by developing sites free of attractive nesting and loafing areas. LADCO with assistance from NPS constructed two ecologically functioning wetlands and native grass buffer strips, which eliminate attractive nesting and loafing areas, for the use of managing urban storm water, in place of conventional retention ponds in Royal Woods in Winnipeg south (Fallding, 2006).

The intent of this chapter was to summarize all facets of urban/resident Canada goose management in North America. The range of treatments documented at the beginning of this chapter demonstrates the depth of applicable techniques for Canada goose management in urban and near urban areas. The outline of the contemporary

resource management model, at the midpoint of this chapter, demonstrates the criteria for selecting appropriate treatments in the development of a management plan responding to human/goose conflicts. The summary of Canada goose management at the Flyway and local level, at the conclusion of this chapter, delineates the guidelines governing Canada goose management in North America and current management programs. These three sections provide the foundation for the proposed GWA-CGMP in the following chapter.

CHAPTER FIVE

Greater Winnipeg Area Canada Goose Management Plan

As illustrated in Chapter three, the number of Canada geese in the GWA has grown significantly in recent years. It is also recognized in the preceding chapters that there are real and demonstrable economic loses, property damages, environmental degradations, and human health and safety concerns that the public expects agencies charged with managing Canada geese will address (Gabig, 2000; Kokel & Andrew, 2004; Urban Goose Working Group, Unpublished Material, 2004). In the absence of action by these agencies, positive growth trends in both Canada goose populations and attractive urban habitat, including the 110 percent increase in the number of City of Winnipeg storm water retention basins, will continue to increase the occurrence of geese and associated conflicts in the GWA (City of Winnipeg, 2001; Ettl, 1993; Kokel & Andrew, 2002; MacKinnon, 1996; Smith *et al.,* 1999; Urban Goose Working Group, Unpublished Material, 2002). If the current growth rate of goose populations utilizing the GWA over the past seven years continues, the GWA daily staging population can be expected to exceed 250 000 by the fall of 2010 (Figure 5) (Manitoba Conservation, 1999; Manitoba Conservation, 2000; Manitoba Conservation, 2001; Manitoba Conservation, 2002;

Manitoba Conservation, 2003; Manitoba Conservation, 2004; Manitoba Conservation, 2005).

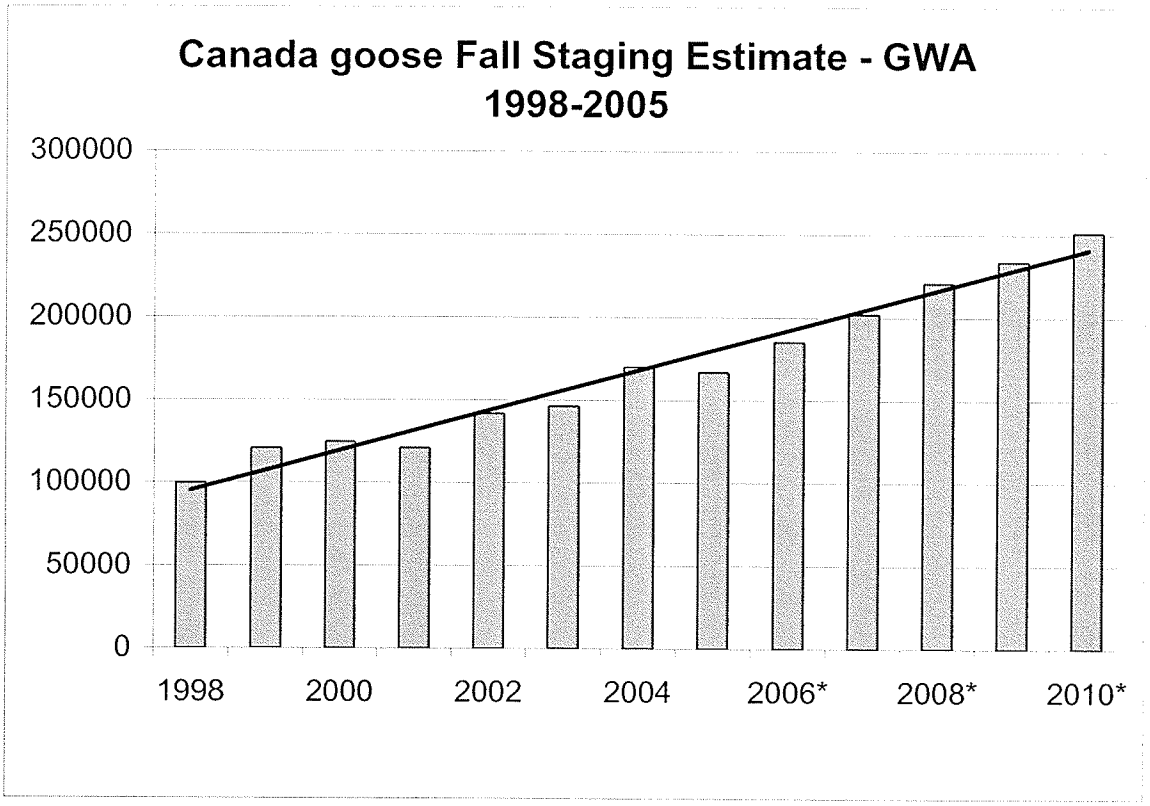

Figure 6. Canada goose fall staging estimate 1998-2005, forecasted growth trend (Manitoba Conservation, 1999; Manitoba Conservation, 2000; Manitoba Conservation, 2001; Manitoba Conservation, 2002; Manitoba Conservation, 2003; Manitoba Conservation, 2004; Manitoba Conservation, 2005)

Notes: *Exponential growth model for urban Canada geese (Ankney, 1996; Cooper & Keefe, 1997)

However, if goose populations in the GWA can be managed or reduced in the immediate, the total effort and cost required for maintaining desired populations levels will be less than if action is delayed (Ettl, 1993; Gabig, 2000; Kokel & Andrew, 2002). To that end, the following GWA Canada Goose Management Plan (GWA-CGMP) provides the operational framework for managing the GWA human/goose conflict.

5.1 MANAGEMENT GOAL OF THE GWA-CGMP

The objective of the GWA-CGMP is the management of urban geese in the GWA at an acceptable level consistent with human health and safety, biological, economic, and

social tolerances. This objective was adopted from the UGWG objective, "to manage the Winnipeg urban goose population at an acceptable level within human safety, health, economic, biological and social tolerances" (Urban Goose Working Group, 2002, pp. 1) because of its similar form to the objectives in each of the four Flyway management plans and because it already enjoys stakeholder support. In addition, the objective blends socioeconomic inputs with biological and ecological inputs into the solutions for the GWA human/goose conflict, reflecting the contemporary resource management model (Decker *et al.,* 1996; Ewert, 1996; Kokel & Andrew, 2002; Smith *et al.,* 1999).

5.2 POPULATION OBJECTIVE OF THE GWA-CGMP

As outlined in the summary of the four Flyway management plans, the method of calculating resident goose population objectives is based on the cultural carrying capacity of conflict areas (Gabig, 2000; Giant Canada Goose Committee, 1996; Kokel & Andrew, 2002; Smith *et al.,* 1999). Cultural carrying capacity reflects the maximum number of Canada geese which can coexist compatibly with humans in terms of economic and sociological conflicts in areas of overlap. Similarly, the Urban Goose Working Group, 2004 based the cultural carrying capacity of Canada geese in the GWA on the annual rate of socioeconomic conflicts reported to member agencies as the index of a tolerable urban goose population level. The UGWG concluded the GWA cultural carrying capacity of urban geese had been exceeded in 1999 and proposed a return to pre-1999 population levels to mitigate human/goose conflicts to an acceptable level of tolerance (Urban Goose Working Group, Unpublished Material, 2004).

Prior to 1999, the estimated spring breeding and peak staging populations of Canada geese in the GWA had never exceeded 2000 and 100 000 respectively. However,

in 1999 the estimated spring breeding and peak staging populations of the GWA surpassed 2000 and 120 000 respectively (Manitoba Conservation, 1999; Manitoba Conservation, 1999b; Urban Goose Working Group, Unpublished Material, 2004). Based on this data the UGWG calculated the cultural carrying capacity for both resident and migrant geese, identifying two population objectives necessary to manage Canada geese in the GWA at an acceptable level. The first population objective identified is a resident goose population at or below 1100 individuals, including a spring breeding population at or below 225 breeding pairs, limiting annual production to 450 fledglings, and maintaining moult migrant and non-breeding populations at or below 200 sub-adults/non-adults. The second population objective identified is a fall staging peak population at or below 80 000 Canada geese.

The population goals proposed by Urban Goose Working Group, 2004 are representative of a finite population of Canada geese in the GWA that does not exceed the socioeconomic carry capacity of stakeholders in the Winnipeg human/goose conflict. To that end, the population goals of 1100 resident and 80 000 migrant Canada geese have also been adopted by the GWA-CGMP as both figures represent a logical starting point, reflectent of all stakeholders in the UGWG. It bears noting that the population goals proposed, by magnitude of difference from current resident and migrant populations of 2709 and 166 957 respectively, provide the impetus for a comprehensive urban goose management plan for the GWA (Manitoba Conservation, 2005; Manitoba Conservation, 2005b).

5.3 OUTLINE AND ACTIONING OF THE GWA-CGMP

To realize the GWA-CGMP population objectives or a revised population objective the following outline provides the operational framework necessary to achieve these objectives, consistent with the goal of managing the urban goose population at acceptable levels within human health and safety, economic, biological, and social tolerances. The following outline deconstructs the goal of the GWA-CGMP into four separate objectives, reflecting the individual parts of the management goal, and provides strategies and tactics to achieve these objectives. The outline of the four objectives also delineates the execution of the GWA-CGMP and concludes with an Action Matrix which offers an overview of the management actions prescribed and identifies the sociological, economic and biological affects of each action.

5.31 Objective 1 – Manage Urban Geese within Human Health & Safety Tolerances

One objective needed to realize the GWA-CGMP goal is managing urban geese at an acceptable level within human health and safety tolerances. To achieve this objective 3 strategies and associated tactics have been identified.

5.31a *Strategy 1 – Establish Population Level within Human Health and Safety Tolerances*

Strategy one is the establishment of an acceptable urban goose population level within health and safety tolerances of all stakeholders in the Winnipeg human/goose conflict. A survey of all stakeholders in the GWA human/goose conflict is required to quantify the bounds of acceptable population tolerance levels. The tactic selected to achieve this strategy is a phone survey of all stakeholders in the GWA (Table 3). The

phone survey of health and safety tolerances will coincide with other surveys of stakeholders to further increase cost efficiencies (see Appendix E).

Table 3. SWOT analysis, telephone survey of stakeholder human health and safety tolerances.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	- High Cost - Only households with telephones will be surveyed - Low response rates	- Communication / Education - Quantify stakeholder health & safety tolerances - Identify unreported health & safety conflicts	- Screening technology - Salience of the survey to participants

5.31b *Strategy 2 – Establish Annual Review of Human Health and Safety Tolerances*

Strategy two is the development of a mechanism to review the accepted urban goose population level with all stakeholders to detect and quantify any changes in human health and safety tolerances through the course of the management program and to recalculate population levels if necessary. An annual survey of all stakeholders in the GWA human/goose conflict will be required to detect and adapt to changes occurring over the management period. The tactic selected to achieve this strategy is a telephone survey of all stakeholders in the GWA (Table 4).

Table 4. SWOT analysis, telephone survey of changing health and safety tolerances.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	- High Cost - Only households with telephones will be surveyed - Low response rate	- Communication / Education - Quantify stakeholder biological tolerances - Identify desired resident population levels	- Screening technology - Salience of the survey to participants

5.31c *Strategy 3 – Establish Technical Committee to Review Health and Safety Research.*

Strategy three is the establishment of a UGWG technical committee, made up of qualified stakeholder members, for the purpose of reviewing current research of human health and safety concerns documented in urban goose conflicts occurring elsewhere.

The technical review committee will assess the relevance and implications of new findings to the GWA human/goose conflict and determine unidentified or emerging threats to Winnipeg residents and to adapt the GWA-CGMP to new discoveries. The tactic selected to achieve this strategy is the formation of a UGWG technical committee (Table 5).

Table 5. SWOT analysis, technical committee to review health and safety research.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Stakeholder participation - Low cost	- Time commitment - Selection process	- Disseminate health & safety research to all stakeholders	- Low participation

5.32 Objective 2 – Manage Urban geese within Biological Tolerances

A second objective needed to realize the goal of the GWA-CGMP is the management of urban geese at an acceptable level within biological tolerances. Biological tolerance refers to the finite population level of a specific Canada goose population. Therefore, managing urban goose populations at an acceptable level within biological tolerances is the management of Canada geese consistent with Flyway management objectives for the population to which the geese belong. In the Mississippi Flyway, management of resident Canada geese including the establishment of population objectives/biological tolerances occurs under the authority of the individual province or state. However, management of migrant Canada geese, including determination of population objectives/biological tolerances, occurs at the Flyway level and is under the authority of the Council and all its members, the CWS and USFWS (Giant Canada Goose Committee, 1996; Kokel & Andrew, 2002). Because the GWA urban goose population is

made up of both resident and migrant Canada geese, managing urban geese in the GWA at an acceptable level will require separate strategies for the management of resident and migrant geese in order to remain within biological tolerances. To achieve the objective of managing urban geese at an acceptable level within biological tolerances 6 strategies and associated tactics have been identified.

5.32a *Strategy 1 – Establish Resident Population Level within Biological Tolerances.*

Strategy one is the establishment of an acceptable urban goose population level of resident geese within biological tolerances of all stakeholders in the Winnipeg urban goose conflict. A survey of all stakeholders in the GWA human/goose conflict will be required to quantify the bounds of an acceptable resident goose population within biological tolerance levels. The tactic selected to achieve this strategy is a phone survey of all stakeholders in the GWA (Table 6).

Table 6. SWOT analysis, telephone survey of acceptable resident population levels within biological tolerances.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	- High Cost - Only households with telephones will be surveyed - Low response rate	- Communication / Education - Quantify stakeholder biological tolerances - Identify desired resident population levels	- Screening technology - Salience of the survey to participants

5.32b *Strategy 2 – Manage Resident Population within Biological Tolerances.*

Strategy two is the management of resident geese at the proposed population objective of 1100, including a spring breeding population at or below 225 breeding pairs, limiting annual production to 450 fledglings, and maintaining moult migrant and non-breeding populations at or below 200 sub-adults. This strategy will require a significant reduction of resident Canada geese in the GWA from its current estimated population. Because the current regulatory framework in the Mississippi Flyway charges the individual Province

or State with establishing resident goose population goals, utilization of long-term management treatments including lethal techniques will provide the GWA the most effective and cost efficient means of managing the resident goose population at acceptable levels within biological tolerances (Ettl, 1993).

The two primary methods used to achieve the resident goose population goal will be harvest under a kill permit and capture/translocate. The management method selected for specific sites will reflect the attitudes of stakeholders of the site under management (Loker *et al.,* 1996). The assessment of these attitudes will be outlined in the fourth objective, social tolerance. Egg depredation will play a lesser role in the management of resident geese in the GWA, its primary use will be to maintain the resident goose population at sites where the desired levels have been achieved (Ettl, 1993). The tactics selected to achieve this strategy are, egg depredation, kill permits, and capture/translocate (Table 7).

Table 7. SWOT analysis of kill permits, capture/translocate & egg depredation treatments in the GWA.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
Kill Permit			
- Efficient population control - Ability to target conflict site - Limit recruitment - Moderate/high public support	- High relative cost	- Opportunity for communication and education programs - Provide meat product to food banks or shelters	- Access to private land - Animal rights protest - Negative media coverage - Legal challenges
Capture/Translocate			
- Ability to target conflict sites - High public support	- Few locations willing to accept new Canada geese - High relative cost - Variable success rates - Short treatment time frame	- Opportunity for communication and education programs	- Access to private land
Egg Depredation			
- Limit recruitment - Ability to target conflict sites - High public support	- High relative cost - Variable success rates - Short treatment time frame	- Opportunity for communication and educational programming	- Access to private land - Animal rights protest - Negative media coverage

5.32c *Strategy 3 – Establish Annual Review of Resident geese Biological Tolerances*

Strategy three is the development of a mechanism to review the accepted resident Canada goose population level with all stakeholders to detect and quantify any changes in biological tolerances through the course of the management program and to recalculate population levels if necessary. This mechanism will enable the GWA-CGMP to adapt to possible changes occurring over the management period. The most efficient mechanism will be a survey representative of all stakeholders in the GWA human/goose conflict. The tactic selected to achieve this strategy is a phone survey of GWA stakeholders (Table 8).

Table 8. SWOT analysis, telephone survey of changing biological tolerances of resident geese.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	- High cost - Only stakeholders with a telephone will be surveyed - Low response rate	- Opportunity for education and communication - Quantification of stakeholder attitudes towards resident geese in the GWA	- Screening technology - Salience of the survey to participants

5.32d *Strategy 4 – Establish Migrant Population Level within Biological Tolerances*

Strategy four is the establishment of an acceptable urban goose population level of migrant geese within biological tolerances of all stakeholders in the GWA human/goose conflict. A survey of all stakeholders will be required to quantify the bounds of an acceptable migrant population level within tolerance levels. The tactic selected to achieve this strategy is a phone survey of stakeholders in the GWA (Table 9).

Table 9. SWOT analysis, telephone survey of acceptable migrant populations in the GWA.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	- High cost - Only stakeholders with a telephone will be included in the survey - Low response rates	- Opportunity for education and communication - Quantification of stakeholder attitudes towards migrant geese in the GWA	- Screening Technology - Salience of the survey to participants

5.32e *Strategy 5 – Manage Migrant Populations within Biological Tolerances*

Strategy five is the management of migrant Canada geese at an acceptable population level in the GWA within biological tolerances. This strategy requires maintaining the peak fall population of migrant Canada geese at or below 80 000 individuals and will require a significant reduction of migrant geese in the GWA from current levels. Because the current regulatory framework in the Mississippi Flyway establishes the biological tolerances for migrant populations occurring in the GWA, individual provinces or states cannot utilize lethal treatments outside of the regular hunting season to deal with localized conflicts with migrant populations (Giant Canada

Goose Subcommittee, 1996). As a result the GWA-CGMP must reduce the migrant goose populations in the GWA by largely non-lethal management methods of to achieve acceptable population levels within biological tolerances of stakeholders in the GWA and Flyway objectives.

The application of both lethal and non-lethal treatments will be used to achieve the migrant population goal of 80 000 Canada geese at the peak of the fall migration. The intended outcome of these treatments is the dispersion of migrant geese to regions beyond the GWA. To maximize the efficiency of the GWA-CGMP management treatments will be focused on areas holding the highest concentrations of migrant geese, including storm water retention basins and surrounding agricultural croplands (Manitoba Conservation, 2003; Manitoba Conservation, 2004; Manitoba Conservation, 2005). The primary treatment methods appropriate to the GWA, based on effectiveness and efficiency, is increased exposure to hunting pressure and habitat modifications at storm water retention basin sites. Both treatments provide the most cost efficient and effective method of dispersing urban geese. Additional treatments which replicate hunting pressure will also be utilized at sites where hunting is not practical or desired. The exposure of migrant geese to increased hunting pressure during the regular hunting season and storm water retention basin modifications will create an additive effect which is intended to reduce geese in the GWA by causing them to abandon treatment areas as opposed to a reduction through the harvest of geese (Ankney, 1996; Conover & Kania, 1991; Kokel & Andrew, 2002; Lindberg & Malecki, 1994; Schultz *et al.,* 1988). The management method selected for specific sites within the GWA will reflect the attitudes of stakeholders at the site under going management (Loker *et al.,* 1996). The assessment

of stakeholder preferences for management treatments is outlined in the following fourth objective, social tolerances. The tactics selected to achieve this strategy are expanding hunting opportunities in the GWA during the regular hunting season, formation of a technical committee to provide assistance to landowners with nuisance geese, storm-water retention basin drawdown, habitat modifications of current storm-water retention basins, changes to the specifications of storm-water retention basins to reduce attractive habitat, change storm-water retention basin turf maintenance to reduce the availability new grass shoots and change aquatic vegetation maintenance programs to promote the presence of a vegetative barrier in the wetland zone, hazing with scarecrow treatments, hazing with pyrotechnics, and hazing with a trained dog and handler (Table 10).

Table 10. SWOT analysis, expanded hunting, technical committee, limited entry hunts, SRB drawdown, SRB specification changes, SRB maintenance, pyrotechnics, scarecrows, and trained dogs.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
Expanded hunting opportunities in the GWA during the regular hunting season			
- High public support - Low cost - Efficient hazing & dispersion treatment - Population reduction	- Not applicable to all sites	- Opportunity for education and communication -Increase waterfowl hunter recruitment - Profit potential for locations	- Access to private property - Federal firearms regulations - Municipal noise bylaws
Formation of a technical committee to advise landowners			
- Stakeholder participation - Low cost	- Time commitment - Selection process	- Ability to disseminate biological research	- Low participation
Limited entry hunts in the GWA			
- High public support - Low cost - Target conflict sites - Efficient hazing, dispersion & population control method	- Not applicable to all sites - Safety considerations	- Opportunity for education and communication - Increase waterfowl hunter recruitment - Profit potential for sites	- Access to private property - Federal firearms regulations - Municipal noise bylaws
Storm-water Retention Basin drawdown			
- High public support - Low cost - High effectiveness - Areas traditionally holding high concentrations of geese	- Low public support - Temporary treatment	- Opportunity for education and communication - Permits basin maintenance	- Reduced recreational opportunities - Degraded esthetics
Storm-Water Retention & specification changes			
- Permanent treatment - Target conflict sites - Areas traditionally holding high concentrations of geese - High effectiveness	- Low public support - High relative costs	- Opportunity for education and communication - Increased water quality entering river basin - Increased property values	- Access to private property - Esthetic degradation - Reduced property value
Storm-water Retention basin turf and aquatic vegetation maintenance regime changes			
- Low cost - Target conflict sites - Areas traditionally holding high concentrations of geese	- Temporary treatment - Moderate effectiveness	- Reduced fertilizer use - Increased water quality - Reduced maintenance costs	- Access to private property - Esthetic degradation
Hazing with pyrotechnics			
- Low relative cost - Target conflict sites - Reinforce other treatments	- Temporary treatment	- Opportunity for education and communication	- Access to private property - Federal firearms regulations - Municipal noise bylaws
Scarecrow Treatments			
- Low cost - Target conflict sites - High public support - No operator required	- Temporary treatment - Habitulization - Visual residue - Requires wind	- Opportunity for education and communication	- Access to private property - Reduced esthetics - Vandalism/theft
Hazing with trained dogs			
- Low/moderate cost - Target conflict sites - High public support - Effective over large area	- Temporary treatment - Requires operators	- Opportunity for education and communication - Volunteer positions	- Access to private property - May require fencing

5.32f *Strategy 6 – Establish Review of Migrant geese Biological Tolerances*

Strategy six is the development of a mechanism to review the accepted population level of migrant geese with all stakeholders in the GWA to detect and quantify any changes in biological tolerances through the course of the management program. This mechanism will enable the GWA-CGMP to detect and adapt to possible changes occurring over the management period and to recalculate migrant population levels if necessary. This strategy will require the annual survey of all stakeholders in the GWA human/goose conflict. The tactic selected to achieve this strategy is a telephone survey of all stakeholders in the GWA (Table 11).

Table 11. SWOT analysis, telephone survey reviewing accepted migrant population level.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	- High cost - Only those stakeholders with a phone will be surveyed - Low response rate	- Opportunity for education and communication - Quantification of changing stakeholder attitudes towards migrant geese in the GWA	- Screening technology - Salience of the survey to participants

5.33 Objective 3 – Manage Urban geese within Economic Tolerances

A third objective needed to realize the management goal of the GWA-CGMP is managing urban goose populations at an acceptable level within economic tolerances. To achieve this objective three strategies and associated tactics have been identified.

5.33a *Strategy 1 – Establish Urban goose Population Level within Economic Tolerances*

Strategy one is the establishment of an acceptable urban goose population level within economic tolerances of all stakeholders in the GWA human/goose conflict. The established urban goose population level must reconcile the associated costs of both damages incurred and management program costs resulting from the GWA human/goose conflict within acceptable tolerances. A survey of all stakeholders in the GWA

human/goose conflict will be required to quantify the bounds of an acceptable population level within economic tolerances. The tactic selected to achieve this strategy is a telephone survey of GWA stakeholders (Table 12).

Table 12. SWOT analysis, telephone survey of an acceptable urban goose population level within economic tolerances.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	High cost - Only those stakeholders with a phone will be surveyed - Low response rate	- Opportunity for education and communication - Quantification of acceptable goose populations within economic tolerances	- Screening technology - Salience of the survey to participants

5.33b *Strategy 2 – Annual Review of Population level within Economic Tolerances*

Strategy two is the development of a mechanism to review the accepted population level of urban geese by all stakeholders to detect and quantify any changes in economic tolerances through the course of the management program and to recalculate population levels if necessary. This mechanism will enable the GWA-CGMP to adapt to possible changes occurring over the management period. The review of economic tolerances should be conducted annually and would coincide with other surveys of stakeholders to increase cost efficiency. The tactic selected to achieve this strategy is a telephone survey of stakeholders in the GWA (Table 13).

Table 13. SWOT analysis, telephone survey reviewing the accepted urban goose population level within economic tolerances.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	- High cost - Only those stakeholders with a phone will be surveyed - Low response rate	- Opportunity for education and communication - Identify unreported cost - Quantify changing stakeholder cost tolerances	- Screening technology - Salience of the survey to participants

5.33c *Strategy 3 – Establish Technical Committee to Review Economic Research.*

Strategy three is the establishment of a technical review committee, made up of qualified stakeholder members, for the purpose of reviewing current research in management and conflict costs from urban goose conflicts occurring elsewhere. The technical review committee will assess the relevance of new findings in light of the GWA human/goose conflict and determine the implications and suitability of these findings in the GWA-CGMP. The tactic selected to achieve this strategy is the formation of a technical review committee of economic costs (Table 14).

Table 14. SWOT analysis, formation of a technical review committee examining economic components in urban goose management/conflicts.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Stakeholder participation - Low cost	- Time commitment - Selection process	-Opportunity for education and communication - Disseminate and identify research of economic losses and program costs	- Low participation

5.34 Objective 4 – Manage Urban geese within Social Tolerances

A fourth objective in the GWA-CGMP is the management of urban geese at an acceptable population level within social tolerances. Management of Canada geese in the GWA within social tolerances consists of two parts. The first part of managing urban geese at population levels within social tolerances requires the quantification of stakeholder attitudes towards urban geese to determine a population level consistent with social tolerances. The second part of managing urban geese within social tolerances requires the quantification of stakeholder attitudes towards goose management and acceptable management techniques for achieving population goals within the GWA (Loker *et al.*, 1996). To achieve this objective four strategies and associated tactics have been identified.

5.34a *Strategy 1 – Quantify Attitudes of Stakeholders towards Urban Geese in the GWA*

Strategy one is the quantification of all stakeholder attitudes towards urban geese in the GWA. Quantification of all stakeholder attitudes towards urban geese in the GWA must be conducted as a function of calculating an acceptable population of Canada geese within social tolerances. This strategy will require the survey of all stakeholders in the GWA human/goose conflict. The tactic selected to achieve this strategy is a phone survey of stakeholder attitudes in the GWA towards urban geese (Table 15).

Table 15. SWOT analysis, telephone survey of stakeholder attitudes towards urban geese in the GWA.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	- High cost - Only those stakeholders with a phone will be surveyed - Low response rate	- Opportunity for education and communication - Quantification of stakeholder attitudes towards urban geese in the GWA	- Screening technology - Salience of the survey to participants

5.34b *Strategy 2 – Quantify Attitudes of Stakeholders Towards goose Management in the GWA.*

Strategy two is the quantification of all stakeholder attitudes towards urban goose management in the GWA. Quantification of stakeholder attitudes towards urban goose management must be conducted as a function of selecting acceptable management methods to achieve population levels of urban geese in the GWA within the bounds of social tolerances (Loker *et al.,* 1996; Riley *et al.,* 2003). This strategy will be accomplished by a representative survey of all stakeholders in the GWA human/goose conflict. The tactic selected to achieve this strategy is a telephone survey of GWA stakeholder attitudes towards urban goose management (Table 16).

Table 16. SWOT analysis, telephone survey of stakeholder attitudes towards urban goose management in the GWA.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	- High cost - Only those stakeholders with a phone will be surveyed - Low response rate	- Opportunity for education and communication - Quantification of stakeholder attitudes towards urban goose management	- Screening technology - Salience of the survey to participants

5.34c *Strategy 3 – Develop Communication Program Based on Stakeholder Attitudes.*

Strategy three is the development of communication programs aimed at stakeholders in the GWA human/goose conflict, based on the attitudinal preferences for population goals and management methods by all stakeholders. The communication program is aimed at facilitating awareness and understanding among stakeholders groups, articulating competing valuations by stakeholders, improving communication between stakeholder groups, and reducing conflicts between stakeholders regarding management treatments and strategies. An effective communication program can help achieve acceptable population goals for Canada geese in the GWA within social tolerances by helping to create and understanding among stakeholders that management decisions were arrived at fairly by all stakeholders within an exchange analysis that lead to a program of acceptable compromise (Berryman, 1987; Decker *et al.,* 1996; Ewert, 1996; Sample, 1990). In addition, a communication strategy aimed specifically at grassroots stakeholders can address deficiencies in knowledge relative to human/goose conflicts and raise understanding and support for the necessity of management and of treatment actions (Bazin, 2002). The tactic selected to achieve this strategy is the development of a communication strategy of print, television, radio, and online campaign directed at stakeholders in the GWA (Table 17).

Table 17. SWOT analysis, communication program directed at stakeholders in the GWA based on attitudinal preferences collected from various stakeholder surveys.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Informed consent - Stakeholder support for management programs - Increase stakeholder participation effectiveness	- High cost	- Opportunity for education and communication - Reduce effectiveness of "anti" campaigns	- Lack of access to media outlets

5.34d *Strategy 4 – Establish Annual Review of Population Levels within Social Tolerances.*

Strategy four is the development of a mechanism to review the accepted population level of urban geese by all stakeholders in the GWA to detect and quantify any changes in social tolerances through the course of the management program and to adapt new population levels or management techniques if warranted. The review of social tolerances should be conducted annually and would coincide with other surveys of stakeholders to increase cost efficiency. The tactic selected to achieve this strategy is a telephone survey of changing social tolerances of urban geese in the GWA (Table 18).

Table 18. SWOT analysis, telephone survey of changing social tolerances of accepted urban goose population levels in the GWA.

Internal		*External*	
Strength	**Weakness**	**Opportunity**	**Threat**
- Efficient data collection - Probative value - Accurate data	- High cost - Only those stakeholders with a phone will be surveyed - Low response rate	- Opportunity for education and communication - Quantify changing social tolerances of urban geese in the GWA	- Screening technology - Salience of the survey to participants

5.35 Management Matrix of Tactics in the GWA-CGMP

The following action matrix provides an overview of all actions prescribed in the GWA-CGMP and identifies the sociological, economic and biological affects of the proposed actions Table 19). This matrix can be utilized to address specific conflicts and

identify the results of actions prior to initiation, providing a field reference for responsible agencies initiating Canada goose management actions in the GWA.

Table 19. Management matrix, projected impacts of management treatments prescribed in the GWA-CGMP.

Goose Management Treatment			Projected Effect on			
Action	**Social Acceptance**	**Relative Cost**	**Migrant Population**	**Resident Population**	**Treatment Site**	**Winnipeg Fall Population**
No Action	Low /Moderate	Low	None to minimal increase	Moderate Increase	Moderate Increase	Moderate Increase
Provide Technical Advice to Property Owners	Moderate	Low	None	Low/Moderate decrease	Moderate/High decrease	Low decrease
Exclusion Fencing and Suspended Wire Grids	Low /Moderate	Low	None	None	High	Low to Moderate Reduction
Trap & Translocate	High	High	None	Moderate Reduction	Small/Moderate Reduction	Minimal Reduction
Limited Entry Hunts	Moderate	Moderate	Minimal Reduction	Moderate to High Reduction	Moderate to High Reduction	Moderate Reduction
Telephone Survey	Moderate /High	Low/ Moderate	None	None	None	None
Scientific Review Committee	Moderate /High	Low	None	None	None	None
Egg Depredation	High	High	Minimal Reduction	Moderate Reduction	Moderate Reduction	Minimal Reduction
Strom water retention basin Draw Down	Low/High	Low	None	None	Moderate to High Reduction	Moderate to High Reduction
Storm water retention basin habitat modifications	Low/High	Low/High	None	Minimal Reduction	Low to Moderate Reduction	Low to Moderate Reduction
Storm Water Retention Basin Specifications	Low/High	Low	None	Minimal Reduction	Moderate to High Reduction	Moderate to High Reduction
Strom water retention basin Turf & Aquatic Management	Low/High	Low	None	Minimal Reduction	Moderate to High Reduction	Moderate to High Reduction
Expand Hunting in GHA38 Including The City of Winnipeg	High	Low	Low to Moderate Reduction	Moderate to High Reduction	Moderate to High Reduction	Moderate to High Reduction
Special Hunting Seasons	High	Low	Minimal Reduction	Moderate to High Reduction	Moderate to High Reduction	Moderate to High Reduction
Take & Consume	Moderate /High	High	None	Moderate/High	High	Low
Kill Permit	Low /Moderate	Low	None	Moderate/High	High	Low
Pyrotechnic Hazing	Moderate /High	Low	None	None	High	Moderate to High Reduction
Communication Program	Moderate /High	High	None	None	None	None
Hazing With Train Animals	Moderate	Moderate	None	Moderate to High Reduction	High	Low to Moderate Reduction

5.4 DISCUSSION

Underpinning the GWA-CGMP is an exhaustive analysis of the contributing factors and reported conflicts in the GWA human/goose conflict. The contemporary design of the management plan addresses the prominent attributes and conflicts of the GWA and proposes applicable solutions resulting from the incorporation of all stakeholder valuations in the assessment, methodology and evaluation process. However, the GWA-CGMP possesses a number of implications and limitations which may diminish the effectiveness of the plan if not addressed by responsible agencies. In addition, the plan identifies a number of areas for future research which would benefit the efficiency and effectiveness of Canada goose management in urban and near urban areas including the GWA.

5.41 Implications

Two principal limitations are manifest in the proposed GWA-CGMP. First, there is no quick fix to the human/goose conflict in the GWA. All stakeholders must recognize that long-term, comprehensive and adaptive management of Canada goose populations in the GWA is necessary to address the increasing number of Canada geese and associated conflicts. Support by all stakeholders throughout the duration of the management program will be critical in achieving and maintaining the management objectives of the GWA-CGMP. Continued participation by stakeholders is necessary to the rigorous evaluation of impacts resulting from management interventions (Riley *et al.,* 2003). Adjustments to the GWA-CGMP will occur over time, reflecting the increased knowledge quantified through the evaluation process. Adapting the GWA-CGMP over

time to the dynamic human/goose conflict will increase the success of the management objective.

Second, the UGWG must be expanded to include grassroots stakeholder valuations and participation. The identification and inclusion of grassroots stakeholders in the management process will provide critical information currently absent in the UGWG. Quantification and inclusion of these valuations is necessary as a majority of sites in the GWA with Canada goose rates above the conflict threshold level occur either on or adjacent to grassroots stakeholders' residences (Conover & Chasko, 1985). Recognition of these valuations, as prescribed in objective 4, will increase the knowledge base of grassroots stakeholder attitudes towards urban geese including population objectives and attitudes towards goose management including the acceptability of specific management treatments held by urban residents in the GWA (Loker *et al.,* 1996). This knowledge will allow responsible agencies to create management programs that respond to and are supported by the public, particularly those stakeholders living in close proximity to conflict sites where a management program and the effects of management decisions is likely to occur. If the UGWG continues to exclude grassroots stakeholders there is an increasing potential for distrust between grassroots stakeholders and government agencies, increased enforcement expenditures and transactions costs, and reduced public awareness of conservation concerns (Schusler *et al.,* 2000). Exclusion of grassroots stakeholders from the UGWG may trigger disruption of management actions and public protest (Kirkpatrick *et al.,* 1997) inflammatory and inaccurate media reports (Green *et al.,* 1997; Peck & Stahl, 1997) and the need for special legislation to continue management actions (DeNicola *et al.,* 1997).

5.42 Limitations

The proposed GWA-CGMP has several limitations. First, the GWA-CGMP has been created in the absence of grassroots stakeholders from the GWA, despite an operational framework which includes and adapts to changing stakeholder valuations. The plan attempts to accommodate GWA grassroots stakeholder valuations in the development of management objectives and population goals of the GWA-CGMP. However, until the proposed strategies and tactics outlined in the plan quantify the Human Dimension valuations of all stakeholders in the GWA it is unknown if the proposed management goal or population objectives will differ greatly then those proposed.

A second limitation of the GWA-CGMP is the proposed population objectives are for the entire GWA, not specific sites within its boundaries. Site specific population objectives can only be determined upon completion of the prescribed survey of all relevant stakeholders. Similarly, the proposed treatment methods to manage resident and migrant Canada geese are not site specific. The prescribed survey of all stakeholder attitudes towards urban goose management in the GWA will be critical in determining the management methods acceptable to stakeholders at specific sites (Loker *et al.,* 1996; Riley *et al.,* 2003). The survey of relevant stakeholder attitudes towards urban geese and goose management will enable agencies to tailor population objectives and treatment methods to the conflict site. In addition, attitudinal preferences may dictate the need for an educational communication program to facilitate informed consent by relevant stakeholders.

A third limitation of the GWA-CGMP is it is intended only for the City of Winnipeg. Therefore it is uncertain how the proposed actions may be inferred to other urban centres. It is possible that the management plan for the City of Winnipeg will not be the pertinent to other Canadian or American cities. Unfortunately this is beyond the scope of this paper and as such, only the City of Winnipeg is the target of the proposed action plan.

5.43 Future Research

Considerable research has been conducted on examining the contributing factors in human/goose conflicts, as well as the development of urban goose management treatments. However, the subject of human/goose conflicts in urban centres could benefit from further research in several areas. One area that clearly requires further research would be the quantification of socioeconomic attitudes of the general public in other urban centres towards urban geese and goose management (Loker *et al.,* 1996). Identification of grassroots stakeholders' attitudes towards urban geese and goose management would provide critical information needed in the formulation of urban goose management objectives and methods supported by all stakeholders (Riley *et al.,* 2003). A second area for future research could address the fastest growing wildlife management issue, urban and near urban wildlife conflicts (Bolen & Robison, 2003; Conover *et al.,* 1995). New research could be conducted to determine if the outline of GWA-CGMP is applicable to other human/wildlife conflicts in urban and near urban areas. The third area which would benefit from future research would be the determination of whether a spatially significant difference exists in the attitudes towards urban geese and goose management held by urban residents' based on the proximity of their residence to

human/goose conflict sites. A spatially significant difference would provide an assessment of management objectives and method preferences by those stakeholders who would likely incur management effects and programs either on or in close proximity to their residence compared to urban residents living a greater distance from conflict sites (Loker *et al.,* 1996).

5.5 CONCLUSION

Since the 1960's, Canada goose populations in North America have increased significantly, benefiting from the giant Canada goose restoration initiative, expanded agriculture and urban planning designs (Kokel & Andrew, 2002). Much of this increase has occurred in urban and near urban areas of North America and has resulted in a range of human/goose conflicts where overlap of activity occurs. Similar to other urban areas of North America the GWA has not been immune to the growth of Canada geese. The increasing presence of resident and migrant goose populations in the GWA has resulted in human/goose conflicts including, property damage, economic loss, environmental degradation, and threats to human health and safety.

Research has demonstrated that Canada goose populations and associated conflicts in the GWA can be expected to increase at the current rate of growth in the absence of action (Conover & Chasko, 1985; Dolbeer *et al.,* 2000; Kokel & Andrew, 2002; Manitoba Conservation, 1999; Manitoba Conservation, 2000; Manitoba Conservation, 2001; Manitoba Conservation, 2002; Manitoba Conservation, 2003; Manitoba Conservation, 2004; Manitoba Conservation, 2005). The positive relationship between goose numbers and human/goose conflicts demands a reduction in the number geese in the GWA to mitigate these conflicts. A range of lethal and non-lethal

management techniques are available to achieve this reduction, however, current research cautions responsible agencies from responding to a specific conflict with the simple selection of techniques to reduce the greatest number of birds (Kokel & Andrew, 2002; Smith *et al.,* 1999). The evolution of modern resource management demands blending traditional biological and ecological valuations with socioeconomic valuations in the development of an effective management plan supported by all stakeholders (Decker *et al.,* 1996; Fishbein & Manfredo, 1992; Riley *et al.,* 2003; Wittmann *et al.,* 1998).

The GWA-CGMP was developed in response to this anticipated growth and proposes solutions to address the unique attributes of the GWA. It is a modern resource management plan which includes traditional biological and ecological valuations with contemporary economic and sociological valuations from all stakeholders in the formation of actions prescribed in the GWA-CGMP (Decker *et al.,* 1996; Ewert, 1996; Kokel & Andrew, 2002; Riley *et al.,* 2003; Smith *et al.,* 1999; Wittmann *et al.,* 1998). It provides the operational framework to adapt management decisions to a dynamic conflict between humans and geese, managing the GWA urban goose population at an acceptable level within human health and safety, biological, economic, and social tolerances. Insuring the presence of Canada geese in the GWA remains a celebration of a connection to the natural world (Leopold, 1949) rather then a nuisance to be tolerated.

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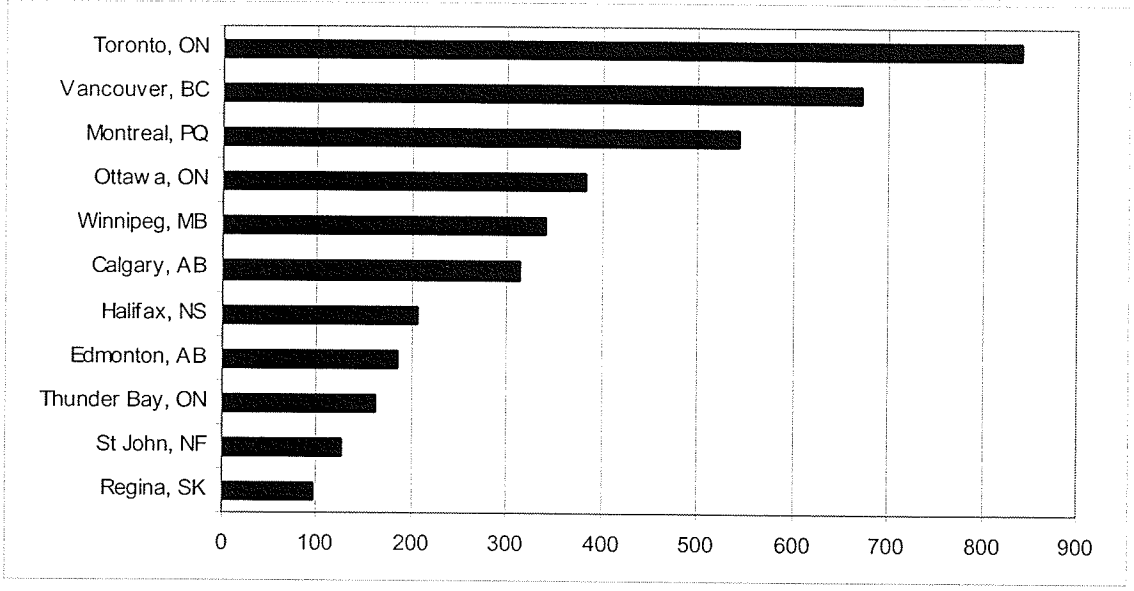
APPENDIX A

REPORTED BIRD STRIKES AT WINNIPEG INTERNATIONAL AIRPORT XWY



APPENDIX B

Telephone Survey Script, (Bergen, 2005)
Stakeholders in the GWA Human/Goose Conflict

Hello, I'm _____ calling from the Urban Goose Working Group. We're conducting a survey in the City of Winnipeg to learn more about people's attitudes concerning some important issues related to urban wildlife. This number was selected at random. According to our research procedure, I have to speak to a person aged 18 or older.

IF CANNOT MEET QUOTA, POLITELY TERMINATE

---

1. We're interested in people's opinion about Canada geese in your area. Canada geese are larger than ducks and are identified by their gray body, black head and neck and white cheeks. Often they are seen flying in a familiar "V" formation, swimming in lakes and ponds, or feeding in grassy areas. In the past year, have you seen Canada geese in the City of Winnipeg or surrounding rural community? .
1) Yes
2) No (Skip to q.5)
9) oth,dk

_____(1)

2. Thinking back for a moment, what time of year are you most likely to observe Canada geese in your area - winter, spring, summer, or fall?[PROBE in uncertain: Well, what's your best guess?
1) Winter
2) Spring
3) Summer
4) Fall
8) No difference
9) oth,dk

_____(2)

3. In the past year, on average, how often have you seen Canada geese in the City of Winnipeg area? Would you say it's...[PROBE: if unsure: Well, on average, what's your best guess?]
1) Daily or almost daily
2) Weekly
3) Monthly
4) Seasonally
5) Just a few times
9) oth,dk

_____(3)

4. What are geese usually doing when you notice them? Are they flying by, swimming in lakes and ponds, or feeding on land? (PROBE: Well, most often, what are they doing?)
1) Flying
2) Swimming
3) Feeding
4) oth,dk

_____(4)

5. In your community in the future, would you like to see more Canada geese, fewer, or about the same number of Canada geese around your community.
1) More
2) Fewer
3) About the same
4) oth,dk

_____(5)

6. Do you own property in the City of Winnipeg that has been used by Canada geese?
1) Yes
2) No (Skip to q.9)
9) oth, dk

_____(6)

7. How would you describe the impact that geese have had on your property? Would you say they have caused a serious or unacceptable amount of damage, noticeable but acceptable damage, small or unimportant damage, or no damage to your property?
1) Serious/Unacceptable
2) Noticeable/Acceptable
3) Small/Unimportant
4) No Damage
9) oth,dk

_____(7)

8. (IF ANSWERED 1-3) What kind if damage have the geese caused on your property? (WRITE, DO NOT CODE BELOW)

_____

_____ _____(8)

I'm going to read some statements people have made about Canada geese in your area. For each statement, please tell me if you strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree with how you feel about Canada geese.

READ LIST, REPEAT CHOICES IF NECESSARY, AND CODE EACH AS:
1) strongly agree
2) somewhat agree
3) neither agree nor disagree
4) somewhat disagree
5) strongly disagree
9) oth,dk

9. I enjoy Canada geese in our community. _____(9)

10. I enjoy Canada geese, but they sometimes cause problems. _____(10)

11. Canada geese in our community area are a nuisance. _____(11)

12. And which of the preceding statements is most descriptive of how you feel about Canada geese? [REPEAT LIST IF NECESSARY]
1) Enjoy Canada geese
2) Sometimes a nuisance
3) Geese are a nuisance
4) No preference
5) oth,dk

_____(12)

As you may know, sometimes Canada geese can cause problems, ranging from nuisances on parking lots and golf courses, major damage on farm land, pollution in lakes and streams, to collisions with aircrafts. There are several ways officials could deal with Canada geese when they become a serious enough problem. I'm going to read a list of possible measures wildlife officials could use to deal with the geese, For each measure, tell me if you strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, or strongly disagree with the statement. Additionally, for each measure, tell me if you strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, or strongly disagree with the effective of the method. We'll start with....

READ LIST, CODE EACH AS:
1) Strongly agree
2) Somewhat agree
3) Neither agree nor disagree
4) Somewhat disagree
5) Strongly disagree
9) oth,dk

13. The City of Winnipeg should pass a bylaw ordinance prohibiting the feeding geese within the City of Winnipeg. _____(13)

13A. This method will deal with problem geese in Winnipeg. _____(14)

14. Using loud noises to scare geese away. _____(15)

14A This method will deal with problem geese in Winnipeg. _____(16)

15. Trying to capture geese and move them away from the Winnipeg area. _____(17)

15A. This method will deal with problem geese in Winnipeg. _____(18)

16. Shaking the eggs of geese in the spring to keep them from hatching. _____(19)

16A This method will deal with problem geese in Winnipeg. _____(20)

17. Draining retention ponds for 6 weeks during the fall migration. _____(21)

17A This method will deal with problem geese in Winnipeg. _____(22)

18. Using trained dogs, accompanied by a handler, to scare geese away. _____(23)

18A This method will deal with problem geese in Winnipeg. _____(24)

19. Holding a closely managed hunt in the outlying areas of Winnipeg to reduce the goose populations. _____(25)

20. This method will deal with problem geese in Winnipeg. _____(26)

21 How much have you heard about a closely managed goose hunt that has been held in the Winnipeg area the last two years? Some, a lot, not much, or nothing about the special goose hunt?
1) a lot
2) some
3) not much
4) none
5) oth,dk _____(27)

21A [IF A LOT/SOME] Did you participate in that hunt?
1) yes
2) no
9) oth,dk _____(28)

22 If it could be demonstrated that the geese are causing serious damages to farms and wetlands, and if killing geese is the only means to controlling them, would you strongly approve, somewhat approve, neither disapprove or approve, somewhat disapprove or strongly disapprove of special hunts or special landowner permits to hunt geese?
1) strongly approve
2) somewhat approve
3) neither approve nor disapprove
4) somewhat disapprove
5) strongly disapprove
9) oth,dk

_____(29)

23 (IF DK, SOMEWHAT DISAPPROVE OR STRONGLY DISAPPROVE) Some have suggested that, if only lethal means can control geese, they should be humanely killed, and then the meat should be processed and given to food banks or homeless shelters. If this was proposed to control goose populations , would you strongly approve, some approve, neither approve nor disapprove, somewhat disapprove, or strongly disapprove of this program?
1) strongly approve
2) somewhat approve
3) neither approve nor disapprove
4) somewhat disapprove
5) strongly disapprove
9) oth,dk

_____(30)

(IF STILL DISSAPROVE) And why is that? (WRITE RESPONSE BELOW, DO NOT CODE)

_____
_____ _____(31)

24 If you had a question about Canada geese on your property, what government agency would you go for answers? [PROBE: and where else might you go?---DO NOT READ---CODE FROM LIST BELOW]
1) Manitoba Conservation
2) Wildlife Branch
3) Natural Resources
4) Canadian Wildlife Service
5) Manitoba Agriculture
6) University of Manitoba
7) City of Winnipeg
8) Ducks Unlimited
9) University of Winnipeg
10) Don't know/no answer
11) oth,dk

_____(32)

24A [SECOND RESPONSE] _____(33)

25 Who do you think is responsible for damage that geese might cause to private lands? Government agencies, or private land owners?
1) gov't agencies
2) land owners
3) oth,dk

_____(34)

And now, a few questions for classification purposes

---

26. What was the last grade or year of school you completed?
1) Less than high school
2) High school
3) Trade school
4) Some college
5) College
6) College +
7) Other _____(35)

27. Do you currently own or rent your place of residence?
1) Yes
2) No
3) Other _____(36)

28. In what age group are you, are you...
1) 18-24
2) 25-34
3) 35-44
4) 45-54
5) 55-64
6) 65-74
7) 75 or older
9) oth,dk _____(37)

29. Could you tell me how long you have lived at your current address?
1) 0-2yrs
2) 3-5
3) 6-10
4) 11-20
5) 21+
9) oth,dk _____(38)

30. Of course, we don't need the exact amount, but will you tell me which category I read best represents your total family income - before taxes - for 2005?
1) under $15000
2) $15,000-$24,999
3) $25,000-$39,999
4) $40,000-$59,999
5) $60,000-$79,999
6) $80,000 -$99,999
7) $100,000+
9) oth,dk _____(39)

31. GENDER - DON'T ASK - JUST CODE BELOW
1) Male
2) Female _____(40)

And that completes our survey. Thank you for your time and cooperation.