Image Source: World Atlas

BIRD-SAFE CITY:

BIRD-SAFE DESIGN GUIDELINES FOR THE BIOPHILIC CITY

PLANNING REPORT

Toronto Metropolitan University
School of Urban & Regional Planning
Faculty of Community Services
TORONTO

Attributions

Mona Khan:
Context, Method, Case Studies, Geospatial Analysis, Conceptualization of Recommendations, Future Research, Report Formatting, Toolkit
Maaha Nomani:
Context, Method, Case Studies, Geospatial Analysis, Conceptualization and Writing of Recommendations, Conceptualization of Next Steps: Integrating Recommendations, Report Formatting, Toolkit
Susan Deer:
Context, Method, Policy Scan, Certification and Programs, Conceptualization of Recommendations, Future Research, Report Formatting, Toolkit
Christina Chiefari:
Introduction, Context, Certifications and Programs, Annotated Pages for Next Steps: Integrating Recommendations, Report Formatting, Toolkit
Rachael Nash:
Executive Summary, Context, Sections 5.1 & 5.4, Conceptualization of Recommendations, Toolkit
Guillaume Perreault:
Context, Geospatial Analysis, Conceptualization of Recommendations, Appendix, Toolkit

Cite This Report as Follows:

Khan, Mona; Nomani, Maaha; Deer, Susan; Chiefari, Christina; Nash, Rachael; Perreault, Guillaume (2023). Bird-Safe City: Bird-Safe Design Guidelines for the Biophilic City. https://doi.org/10.6084/m9.figshare.24848097

PL 8109: GRADUATE PLANNING STUDIO 1
SCHOOL OF URBAN AND REGIONAL PLANNING
TORONTO METROPOLITAN UNIVERSITY

Prepared for:

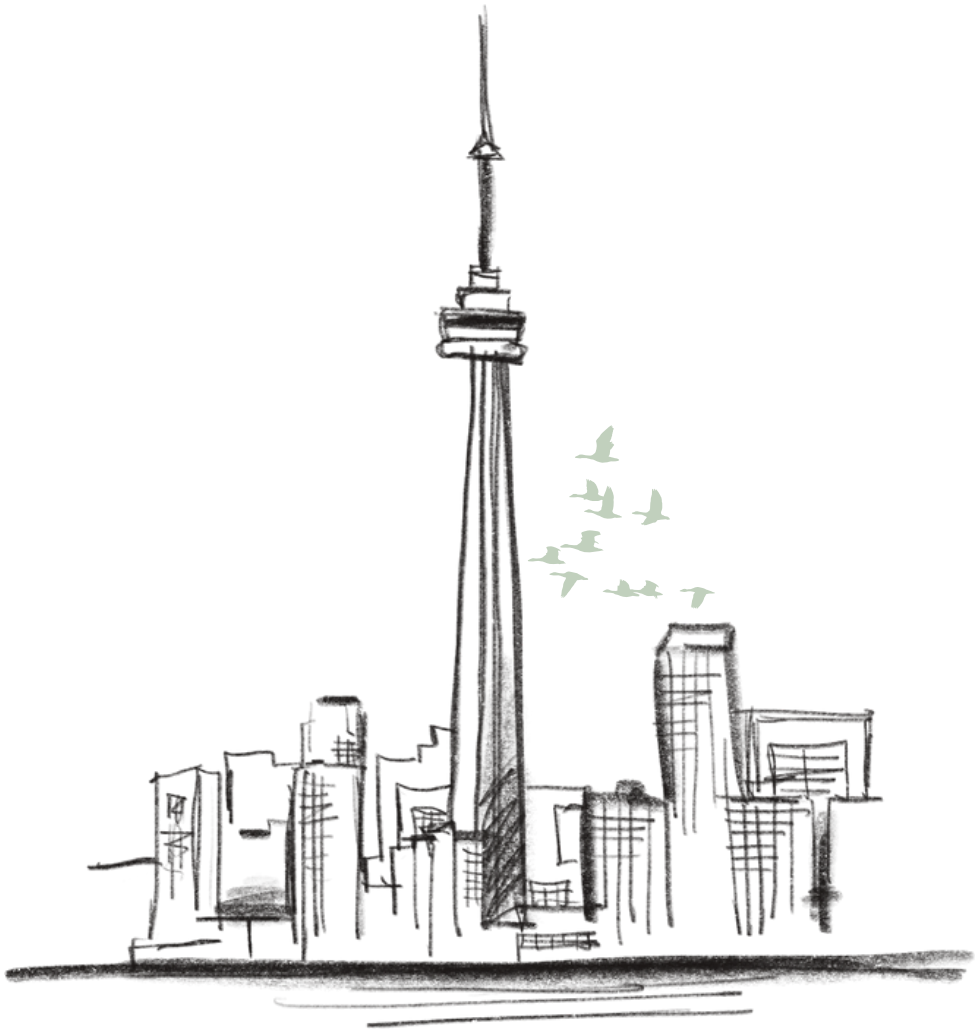
Supervisor:	Prof. Nina-Marie Lister, MCIP RPP Hon ASLA
Client:	City of Toronto, Strategic Initiatives, Policy & Analysis Unit Jane Welsh, Project Manager for Environmental Planning
Mentor:	Brendon Samuels, PhD Candidate, Department of Biology, University of Western Ontario
Field guides:	Yuko Miki, FLAP Canada Carly Davenport, Bird Safe University of Toronto

Prepared by (“Bird-Safe City Team”):

Mona Khan, Maaha Nomani, Susan Deer, Christina Chiefari, Rachael Nash, Guillaume Perreault

December 5, 2023

TABLE OF CONTENTS



1.0 EXECUTIVE SUMMARY

The Bird-Safe City project is an important initiative that seeks to address the decline in bird populations resulting from collisions within the built environment, contributing to a global biodiversity crisis. By providing recommendations to update the existing City of Toronto's Bird-Friendly Development Guidelines, this project aims to incorporate bird-safe design practices into urban planning policies to minimize the impact of urbanization on biodiversity loss. This project's primary objectives include comprehensive research on bird-safe planning and design, a policy scan, and an examination of emerging standards.

The project deliverables include a Planning Report, Bird-Safe Design Toolkit, and updated Bird-Safe Design Guidelines. Together, they will contribute to a holistic approach aimed at ensuring safe passage and improved urban habitats for birds. By aligning with the City's commitment to the Biophilic Cities Network, Toronto aims to strengthen its position as a champion of urban biodiversity through innovative and sustainable planning practices. Successful implementation of this project promises a future where cities and nature coexist sustainably, demonstrating the critical role of urban planning in fostering biodiversity protection.

2.0 INTRODUCTION

Many birds in North and South America are experiencing significant decline due to urbanization and climate change resulting in new ecological interactions, outpacing their ability to adapt (Whelan et al., 2015). The expansion of urban areas and human infrastructure has resulted in the fragmentation and loss of bird habitats. Larger urban areas within migratory paths pose a significant threat to bird life as these areas typically emit high levels of light pollution and have countless buildings containing large amounts of glass. The combination of the two hazards pose a lethal threat to bird safety. Bird's rely on the sun and stars to navigate and when these celestial cues are obscured by excess artificial light, birds are disoriented, leading to collisions with windows.

As light pollution and glass surfaces intensify, the impact on bird populations become more pronounced. Since 1970, there has been an estimated loss of 3 billion birds. Native bird populations have declined 29 percent in the last 50 years, with decline of 60 percent among aerial insectivores (insect-eating birds) (Lallensack, 2019). The decrease in bird populations and species diversity can be attributed to the combined and systemic influences of climate change, habitat loss, and pesticide usage (Rosenberg et al., 2019). The risk is heightened in urban areas, particularly as migratory birds navigate through a growing built environment.

Figure 1. Image bird population decline in North America (Cornell Lab of Ornithology, 2019)

In 2019, the global Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) released a report highlighting a worldwide unprecedented decline in biodiversity, wherein the projected loss of species is 1 million over the next decade (Paşca Palme, 2019). The findings were supported by compelling data, revealing an unprecedented and catastrophic loss of species currently in progress. The United Nations (UN) recognized that the protection of biodiversity is the strongest natural defense against climate change.

However, this is not an intractable problem: we know what the solutions are and how to achieve them with effective resolution. Preventing window collisions is achievable through established methods employing planning and design tools. These tools encompass bird-safe glass, bird-friendly building design, landscape planning that supports birds, guidelines promoting bird-friendly planning, zoning bylaws, and regulations, including building codes.

3.0 CONTEXT

3.1 Objective

The purpose of the Bird-Safe City project is to update and expand Toronto's bird-safe policies, tools, guidelines, and standards. The team has conducted research on bird-safe planning, design, and a detailed analysis of the development approval process implementing bird-safe design guidelines in Toronto. Our aim is to expand existing tools and provide an array of strategies for protecting bird life in the urban environment. The team's goal is to provide recommendations to enhance Toronto's current bird-friendly design guidelines, with tailored recommendations regarding the TGS, municipal code, and provincial policies and regulations.

A principal recommendation involves replacing the term *bird-friendly* with the term *bird-safe*. The term *bird-friendly* is utilized throughout this report because it reflects the current vernacular used in the City of Toronto guidelines. However, as part of our final recommendations, the team highlights the importance of updating the term to *bird-safe* in all of initiatives moving forward.

Toronto has set a precedent by becoming the first city in North America to establish bird-friendly guidelines in 2007, later updated in 2017. This momentum led to the City's first ever Toronto Green Standard (TGS) in 2010 which established sustainable design requirements for new private and City-owned developments that must be approved during the development application process. The TGS includes a mandatory checklist of development features that must be successfully completed. Additionally, it refers to supplementary standards and guidelines that, while not part of the checklist, require compliance for approval of the development application. Further details about the TGS will be discussed in subsequent sections of this report.

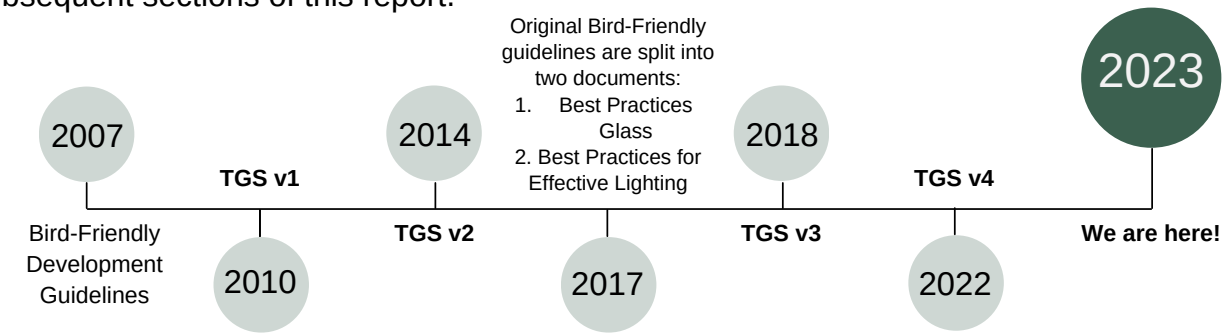


Figure 2. TGS and Toronto's Bird Friendly Guidelines Timeline (Bird-Safe City Team, 2023)

As of May 1, 2022 the fourth version of the Toronto Green Standard (TGS V4.0) went into effect referring to the six-year-old bird-friendly design guidelines. As more data emerges, it becomes imperative that Toronto leverages this new research ensuring that the bird-friendly design guidelines are current and effective in addressing existing and anticipated concerns regarding the protection and loss of bird life.

3.2 Biodiversity Crisis

The biodiversity crisis is an urgent and escalating global challenge marked by the continued rapid loss of species and ecosystems. This crisis not only threatens the network of life on earth, but also jeopardizes essential ecosystem services upon which human societies depend. The loss of biodiversity can lead to the destabilization of ecosystems, compromising its resilience and ability to adapt to changing conditions. Bird population are estimated around 50 billion worldwide accounting for 9,700 species of the estimated 1 to 6 billions species that make up our biodiversity (Callaghan et al., 2021; Larsen et al., 2017) and especially vulnerable due to urbanization, habitat degradation, and climate change. The loss of bird species not only diminish the beauty and diversity of the natural world, but also compromises the structure of our ecosystem. Birds play an essential role such as promoting successful plant reproduction in thousands of plants (Whelan et al, 2015). Protecting, recovering, and preserving biodiversity is essential not only for the sake of individual bird species but also for maintaining the health and resilience of entire ecosystems.

Figure 3. Illustration of the Biodiversity Crisis (Doval, 2022)

3.3 Biophilic Cities

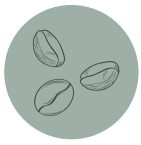
Biophilic Cities is a global network where partner and member cities build an understanding on the value and contribution of nature to cities and the lives of urban residents (Biophilic Cities, n.d.). Together, these partner and member cities actively work to conserve and celebrate the diverse forms of nature within their locales, recognizing the numerous ways in which both the city and its residents benefit from the richness of biodiversity and the presence of wild urban spaces. Biophilic Cities highlights the importance of regular encounters with nature as an integral part of a fulfilling urban lifestyle, underscoring the moral responsibility cities bear in preserving global nature as a shared habitat. Within the Biophilic Cities network, four cities - Toronto, San Francisco, Portland, and Maryland - have enforceable bird-safe design guidelines.

Figure 4. Global map pin pointing all Biophilic Member Cities. (Bird-Safe City Team, 2023)

3.4 Benefits of Birds

Bird populations contribute significantly to urban economic activity through benefiting industry and human well being (Bevil, W., 2020; Birds Canada | Oiseaux Canada, 2020; and Ontario Human Rights Commission, n.d.).

Moreover, declining bird populations also have negative impacts on mental health and overall human wellbeing. Cox et al. (2017) found a positive relationship between nature (including birds) and mental health, where it is most important in urban environments. Therefore, the loss of biodiversity from bird window collisions can cause unwanted negative effects on urban dwellers' mental health.



Birds transport seeds

Bird droppings spread nutrients

Birds are nature's exterminators

Birds create habitats for other cavity-nesting species

Some birds eat carrion exclusively

Some birds help other species

Figure 5. Red-eyed Vireos are identified as vagrant by the City of Toronto's Birds of Toronto (Kessel, 2022)

3.5 Mitigating Bird Collisions: City of Toronto Bird-Friendly Design Guidelines

As previously mentioned, the City has actively addressed the issue of bird collisions since the introduction of its bird-friendly design guidelines in 2007. These guidelines highlighted light pollution and glass as the primary factors contributing to the decline of migratory bird species.

It is critical to understand the design and material elements that also play a role in the loss of bird life. This section will examine Toronto's current Bird-Friendly Design Guidelines, the Best Practices for Bird-Friendly Glass and Best Practices for Effective Lighting, to provide a concise overview of the issues accompanied with effective solutions.

Impact of Light Pollution

Migratory birds struggle to adjust to the urban setting as they travel at night for safety from predators. However, birds rely on natural cues such as the moon and stars to navigate, and the artificial light emitted from urban areas disrupts these cues, leading to disorientation and confusion. The "fatal light attraction" draws migratory birds into unfamiliar environments where they become trapped.

Solution

Exterior Lighting

- All exterior lighting must be dark sky compliant

Interior Lighting

- Interior lighting should be reduced after business hours and from sunset to sunrise.

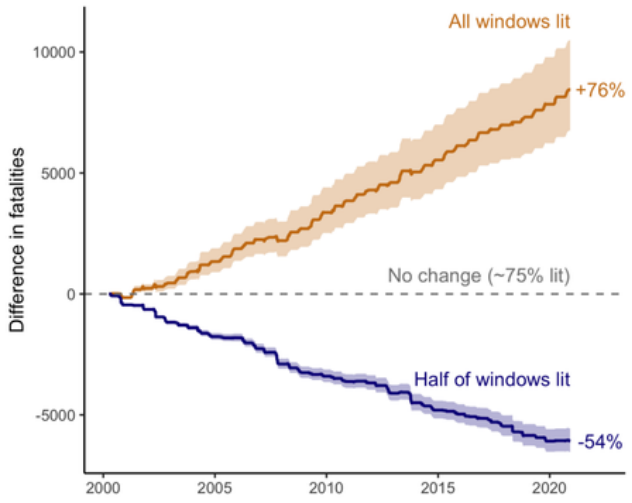


Figure 6. Difference in fatalities. (Van Doren, 2021)

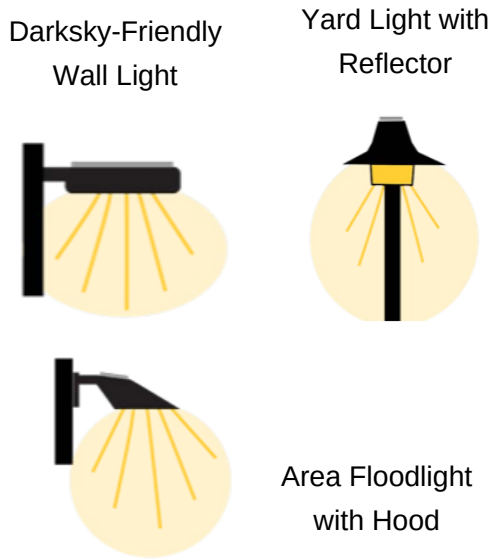


Figure 7. Effective Lighting Fixtures (City of Toronto, 2017)

Impact of Glass

Figure 8. Imprint of bird collision (Grace, 2014)

Birds collide with clear windows when they try to reach perceived perches, plants, food or water sources, and other attractions visible through the glass. Hazards like glass "skywalks" linking buildings, or glass walls enclosing planted atria, windows forming glass corners, and exterior glass guardrails or walkway dividers, as birds perceive these structures as unobstructed pathways to the other side.

Transparency

Birds collide with clear windows when they try to reach perceived perches, plants, food or water sources, and other attractions visible through the glass. Hazards like glass "skywalks" linking buildings, or glass walls enclosing planted atria, windows forming glass corners, and exterior glass guardrails or walkway dividers, pose threats as birds perceive these structures as unobstructed pathways to the other side.

Figure 9. Glass (FLAP Canada, 2022a)

Reflection

Reflective surfaces are especially dangerous to birds because these surfaces reflect the adjacent natural habitat which attracts birds. Notably, reflected vegetation presents the most significant risk, as birds collide with glass anticipating shelter within the foliage.

Figure 10. Reflection (FLAP Canada, 2022a)

Fly-Through Traps

Fly-through traps occur when birds mistake glass surfaces due to the design of buildings. Places like glass bridges, walkways, outdoor railings, free-standing glass features, parallel glass, and buildings with glass walls or windows at corners can be especially risky. Birds might see these areas as clear pathways and attempt to fly through, unaware of the glass barrier.

Figure 11. Fly-through Trap (Bird-Safe City Team, 2023)

Adjacent Vegetation

Untreated windows account for the majority of bird collisions and the resulting loss of bird life. However, an accomplice to these collisions is the architecture and landscape design. Birds are often attracted by vegetation in the landscape design, leading them to become inadvertently trapped within the building. While vegetation in landscape designs often attract birds, the presence of vegetation is important. Oppose to limiting the quantity or variety of vegetation, instead, we should focus on the treatment of windows to mitigate window collisions.

Solution

- Visual markers created by **frit, film, etched patterns on the first surface** (exterior surface) of the glass and ultraviolet-reflective patterns are effective methods in mitigating bird collisions. Visual markers arranged by a 5 x 10 cm (2 x 4 inch) pattern are extremely effective in deterring birds from colliding with the transparent surface (Brown et al., 2021).
- Windows manufactured with **patterns that reflect ultraviolet light** shorten the reflected wavelengths of light that are visible to many birds and less noticeable to a human. While studies prove that ultraviolet-reflective patterns are effective in reducing bird collisions, it is important to recognize that bird species differ in their ability to see ultraviolet reflections and can become less visible on cloudy days (Brown et al., 2021).

Figure 12. Visual window markers. (FLAP Canada)

4.0 METHOD

This research is informed by a policy scan, case studies, geospatial analysis, field work with FLAP Canada, and a comprehensive literature review to understand local and global bird-safe design approaches in the urban environment.

4.1 Policy Scan

A policy scan was conducted at the federal, provincial and municipal levels of government in Canada to identify relevant environmental protection legislation that may inform recommendations and best practices for improving enforceability of bird-safe design standards. Specifically, legislation passed in Ontario and in the City of Toronto were explored to understand the current implementation of relevant legislation and areas of improvement.

4.2 Case Studies

Case studies were completed in conjunction with the policy scan to examine how jurisdictions outside of Toronto approach biodiversity protection and bird-safe design. This jurisdictional scan, which began with 15 Biophilic (member) Cities, was narrowed down to three municipal case studies - selected based on the categories of enforceability, biophilic city membership, topography, and migration flyway - to determine best practices and opportunities for Toronto. The principal criteria for this determination were whether or not jurisdictional bird-safe guidelines were enforceable, as many cities have recommendations for bird-safe design yet few have implemented these standards within their building or planning codes. Enforceability was highlighted through the policy scan to be a crucial component in ensuring sustainable and equitable development within the City of Toronto. Although Biophilic Cities are considered leaders in urban nature, less than 50% have any form of recommendations for bird-safe design guidelines, and only 4 out of 15 (member) cities have enforceable bird-safe design guidelines, where this commitment to sustainable design is only voluntary in the latter cities. Detailed information regarding the criteria for case study selection of New York City, the City of Ottawa, and San Francisco can be found in Section 7 of this report.

4.3 Geospatial Analysis

Geospatial analysis was used to identify location-related hazard thresholds for the City of Toronto specific to vegetation. This highlights the importance of vegetation in the scope of biodiversity, and why applying bird-safe design is crucial across the City. The distance tested for location-related hazards was informed from the San Francisco case study findings.

4.4 Bird Patrolling

The role of advocacy is important to raise awareness of larger societal problems. Advocacy through community outreach and education programs help to incite change. To understand the extent to which birds are negatively impacted by building design, the research team made it a priority to participate in fieldwork by accompanying Yuko Miki, a representative from FLAP Canada, during morning patrolling sessions. This fieldwork allowed the team to examine first-hand how building design can have devastating impacts on bird safety, well-being, and survival. The sessions consisted of patrolling downtown Toronto to rescue birds who were injured or secure those who lost their lives due to building structures. We also had the opportunity to learn about the types of design features that cause fatal bird collisions and injuries, including glass, windows, lighting and vegetation.

FLAP CANADA

Figures 13-16. Bird-Safe City Team's images from bird patrolling

4.5 Deliverables

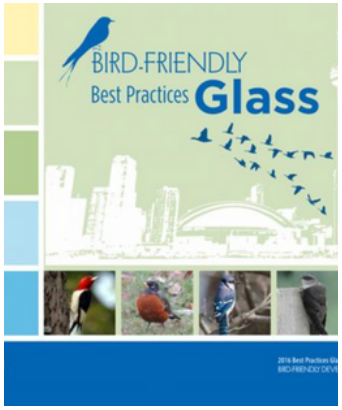
1. PLANNING REPORT

This report is intended to highlight key opportunities and challenges for bird-safe design guidelines and associated regulations for the City of Toronto. It is a **culmination of all findings by the research team towards ensuring Toronto can continue to be a leader in bird-safe design and biodiversity protection.** This report provides recommendations for the adoption of bird-safe standards specific to the TGS along with an overview of provisions and supportive policy alternatives to champion a diversity of urban and migratory bird populations.

2. BIRD-SAFE DESIGN: PLANNER'S TOOLKIT

The Planner's Bird-Safe Design Toolkit was created to provide practitioners with **key information based on the findings from the research team on the implementation of bird-safe design.** An applicant questionnaire is included specifically for the City of Toronto to find out if a property is subject to the Toronto Green Standard, enforced through Site Plan Control, to identify the requirements for bird-safe design.

3. UPDATED CITY OF TORONTO BIRD-SAFE GUIDELINES



This report includes excerpt pages with **recommendations for the updated City of Toronto Bird-Safe Guidelines** in Section 9.0. It includes modifications that reflect the criteria set out in the CSA *A460:19 Bird-friendly building design* standard (CSA Group, 2019). The select pages include updated directions for window glazing and visual markers, along with a recommendation for buildings in proximity to vegetation. The intent is to provide an easy to use reference guide for planners, developers and building owners.

5.0 POLICY SCAN

As planners, we have an obligation to our profession and the community to value, respect, and balance a variety of interests (Ontario Professional Planners Institute, n.d.). Our role involves planning for both the built and natural environments. Therefore, we have a responsibility to all that inhabit and play a role in our ecosystem. This notion is supported by the current policy and legislative framework that regulates the protection of the environment and wildlife, including resident and migratory birds (*Canadian Environmental Protection Act, 1999*; *Endangered Species Act, 2007*; *Environmental Assessment Act*; *Environmental Protection Act*; *Impact Assessment Act*; *Migratory Birds Convention Act, 1994*; *Species at Risk Act*; City of Toronto *Official Plan,* 2022; City of Toronto *Official Plan, June Consolidation*, 2023).

The following section is intended to help decision-makers acquaint themselves with the existing framework to encourage bird-safe building design. A review of existing policies and legislation will help to inform preventative and enforcement measures to mitigate bird collisions with buildings.

Note: Before taking any legal action, please consult your legal department or representative.

5.1 Regulatory Bodies

Canadian Institute of Planners (CIP)

The Canadian Institute of Planners (CIP) is a membership-based organization at the national level that advocates for pressing issues related to planning and community development (CIP, 2023). CIP states that their collective vision involves the creation and maintenance of "inclusive and vibrant communities, respectfully connected to the natural world, for the well-being of current and future generations" (CIP, 2023). As part of CIP's vision, climate policy is a core focus of the organization's advocacy. CIP states that the role of planner's within the context of climate change involves effective decision-making, cross-sectoral collaboration, and community engagement with an emphasis on Indigenous peoples and youth (CIP, 2023).

Figure 17. Canadian Institute of Planners (n.d.) Logo

Figure 18. Ontario Professional Planners Institute (n.d.) Logo

Figure 19. Northern Cardinals (Canva, n.d.)

Ontario Professional Planners Institute (OPPI)

The Ontario Provincial Planners Institute (OPPI) is a provincial-level membership-based organization, which serves as the voice for Ontario's planning professionals (OPPI, 2023). OPPI members come from a multitude of industries, including academia, non-profit, private practice, and civil service (OPPI, 2023). Participating members from various industries support the organization's mission to "leverage knowledge, resources and relationships to facilitate excellence in planning by professional planners" (OPPI, 2023). OPPI also holds the authority to grant Registered Professional Planner (RPP) designation through the Ontario Professional Planners Institute Act and the OPPI By-law (OPPI, 2023). OPPI's granting designation authority also extends into academia, whereby OPPI holds the responsibility to determine academic examination requirements for entry into the planning profession (OPPI, 2023).

5.2 National Standards

CSA Group

The CSA Group, formerly known as the Canadian Standards Association, is a not-for-profit, non-governmental organization, that develops standards and provides certification for various industries, including health care, electrical, and environment and natural resources (Standards Council of Canada - Conseil Canadien Des Normes, 2016; CSA Group, 2023b). It derives its authority as a national standards association by the Standards Council of Canada ("SCC") (CSA Group, 2021*b*), which is a federally regulated body (*Standards Council of Canada Act*, R.S.C., 1985, c. S-16). The SCC's mandate is "to promote efficient and effective voluntary standardization in Canada, where standardization is not expressly provided for by law" (Standards Council of Canada - Conseil Canadien Des Normes, 2018; see also *Standards Council of Canada Act*, R.S.C., 1985, c. S-16, at s. 4). The SCC is a member of the International Organization for Standardization ("ISO"), which includes several organizations that aim to develop voluntary international industry standards (International Organization for Standardization, n.d.).

Notwithstanding their national and international standing, the CSA Group, the SCC, and the ISO, are responsible for developing standards that are completely voluntary.

Figure 20. Blue Jay (Canva, n.d.)

Figure 21. Eastern Blue Bird (Canva, n.d.)

Figure 22. City of Ottawa (Ottawa Tourism, n.d.)

In its efforts to help protect the natural environment, the CSA Group published the *A460:19, Bird-friendly building design* standard in 2019, which is a voluntary national standard that applies to "new construction and existing buildings and is intended to reduce bird collisions with buildings" (CSA Group, 2019, at s. 1.1). Even though it is optional, cities including Winnipeg and Ottawa recognize the significance of the *A460:19 Bird-friendly building design* standard. In 2021, the city of Winnipeg, adopted the standards city-wide with a view to amending their zoning by-laws to conform accordingly (City of Winnipeg, n.d.; see also Klein, 2021). Further, the City of Ottawa modeled its *Bird Safe Design Guidelines* (2022) to be consistent with the *CSA A460:19 Bird-friendly building design* standard (City of Ottawa, 2022, at p. 5) .

The *A460:19 Bird-friendly building design* standard informs how bird-safe strategies can be implemented with respect to the following (CSA Group, 2019, at ss. 3.4 to 3.7):

Figure 23. City of Winnipeg (Canva, n.d.)

- Buildings (i.e., specifying the height of bird-friendly strategies in relation to tree canopy and green roofs, outlining glazing and visual markers required on windows, glass, and balconies, and mitigating fly-through areas);
- Building accessories (i.e. guidance when buildings incorporate shades, screens, grilles, mesh, and shutters);
- Lighting (i.e., interior, and exterior); and
- Other elements, including vegetation and bird feeders near buildings.

The CSA Group standards are updated every five years (CSA Group, 2023*c*), so by adopting the *A460:19 Bird-Friendly Building Design* standard, the policies will effectively reflect the most current scientific research and appropriate measures for building design.

Figure 24. Laboratory (Canva, n.d.)

Figure 25. Window Factory (Canva, n.d.)

Figure 26. Factory (Canva, n.d.)

Opportunities

Many industry leaders, including the federal, provincial, and municipal governments, rely on CSA Group standards and codes to improve safety and efficiency (CSA Group, 2023*a*). As a result, manufacturing and business leaders have opted to have their products tested by the CSA Group in order to place the CSA Group mark or certification on their products to gain a competitive advantage within their industry (CSA Group, 2021*a*). As such, having a CSA mark "demonstrates that a product has been rigorously tested to applicable standards" (CSA Group, 2021*a*). CSA Group is a non-for-profit organization, does not approve products for sale, and acts as an objective third party organization (CSA Group, 2023*c*). However, having products tested by the CSA Group would help to ensure that the products adhere to the *CSA A460: 19 Bird-friendly building design* standard. Municipalities may choose to encourage developers and other professionals to use products that meet the CSA Group criteria to guarantee that they are bird-friendly.

National Building Code of Canada 2020

The *National Building Code of Canada 2020 ("Code")* (Canadian Commission on Building and Fire Codes, 2022) is another set of standards that are voluntary and provide general guidelines that can help ensure consistency among provincial building codes (Volume 1, at p. v). The objectives of the *Code* are to minimize any safety and health risks to people, prevent fire or structural damage of a building, minimize harmful environmental effects, as well as to promote accessibility for users (Canadian Commission on Building and Fire Codes, 2022, at Division A, s. 2.2.1.1, p. 55-59). Although the standards speak to environmental objectives, this is limited to energy efficiency for buildings, and does not apply to environmental hazards related to wildlife (Canadian Commission on Building and Fire Codes, 2022, at Division A, Notes to Part 2 Objectives, p. 60).

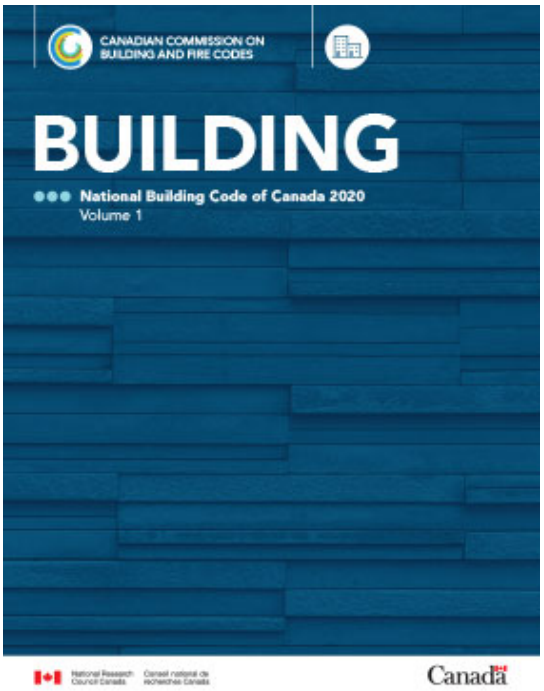


Figure 27. Cover of the National Building Code 2020, Volume 1 (Canadian Commission on Building and Fire Codes, 2022)

Opportunities

Although the *Code* is intended to provide guidance in terms of consistency for building codes across provinces (Canadian Commission on Building and Fire Codes, 2022, Volume 1, at p. v), (1)), by advocating for bird-friendly design standards to be included in the *Code*, there is a potential to encourage other provinces to adopt bird-friendly building design, and protect wildlife on a much larger scale.

Figure 28. Birds flying (Canva, n.d.)

5.3 Federal Government

Since birds travel freely from one area to the next, moving across boundaries, we need to understand the types of protections each level of government has in place to protect them. There are general protections in place for migratory and resident birds, and a limited degree of protection for birds in relation to design guidelines for buildings and structures. For instance, courts have found that developers can be held accountable under the current legislative regime if they fail to show due diligence to protect birds when they are harmed or killed because of a building's design (*Podolsky v. Cadillac Fairview Corp*., 2013 ONCJ 65; *Species at Risk Act*, at subs. 32(1); *Environmental Protection Act*, at subs. 14(1)). However, there are still gaps in the legislation, resulting in insufficient compliance, enforcement measures and penalties.

The legislation that affords protection to wildlife and the environment in which they inhabit includes the *Migratory Birds Convention Act, 1994*, the *Species at Risk Act*, the *Canadian Environmental Protection Act, 1999,* and the related *Impact Assessment Act*. Although their general applications are different, each offers protection to migratory birds.

Figure 29. 4100 Yonge St, Toronto, one of the subject buildings in *Podolsky v. Cadillac Fairview Corp.*, 2013 ONCJ (Deer, 2023)

Opportunities

***Species at Risk Act,* S.C. 2002, c. 29.**

The *Species at Risk Act* is the most notable, as it has been used by the courts to find private developers liable if their building design causes death or injury to birds (at subs. 32(1); see also *Podolsky v. Cadillac Fairview Corp*., 2013 ONCJ 65). Specifically, Cadillac Fairview Corporation Limited, CF/Realty Holdings Inc., and YCC Limited were found to have committed an offence under s. 32(1) of the *Species at Risk Act*, as their windows were highly reflective and resulted in killing or harming birds who were protected under the *Act* (*Podolsky v. Cadillac Fairview Corp*., 2013 ONCJ 65, at paras. 3 & 85). Although the court ultimately found in favour of the developers, as they exercised due diligence by taking steps to mitigate bird strikes (*Podolsky v. Cadillac Fairview Corp*., 2013 ONCJ 65, at paras. 88 to 95), it creates a clear precedent that municipalities may use this decision as leverage to compel developers to adopt bird-friendly building design.

5.4 Government of Ontario

Under the provincial jurisdiction, legislation that offers similar protection for wildlife and the environment, include the *Endangered Species Act, 2007*, the *Environmental Protection Act* and the related *Environmental Assessment Act*.

Opportunities

***Environmental Protection Act,* R.S.O. 1990, c. E. 19**.

The *Environmental Protection Act* was also used by the court in *Podolsky v. Cadillac Fairview Corp*., 2013 ONCJ 65, to find that companies can be found guilty of an offence if birds are injured or die as a result of a building's design. Specifically, light from reflective windows is deemed to be a contaminant, and therefore, an offence is made out where it results in, or is likely to result in, death or injury to birds (*Environmental Protection Act* at subs. 14(1); see also *Podolsky v. Cadillac Fairview Corp*., 2013 ONCJ 65, at para. 84). Notably, this Act applies to municipalities, and as such, they can be subject to a fine if they are found guilty of an offence under this *Act* (*Environmental Protection Act*, at subs. 1(3)). Therefore, municipalities must take proactive measures to ensure that their buildings are bird-friendly.

***Planning Act*, R.S.O. 1990, c. P. 13 & *Building Code Act, 1992*, S.O. 1992, c. 23**

Further, the *Planning Act* and the *Building Code Act*, *1992*, along with the accompanying regulation, the *Building Code*, also need to be considered. The *Planning Act*, the *Building Code Act, 1992,* and the *Building Code,* speak to general provisions for health and safety but omit standards that specifically require buildings to be bird-friendly. It is well-documented that birds help improve our economy, enhance our physical and mental health, and contribute to our ecosystem (Yeoman, 2013). By including specific provisions that offer protection to birds in relation to building design, it would compel stakeholders to recognize the importance of birds and the impact that building design has on biodiversity more largely.

Figure 30. Scarlet Tanager (Canva, n.d.)

Opportunities

***Planning Act*, R.S.O. 1990, c. P. 13**

It could be argued that where the *Planning Act* speaks to enhancing the health and safety of our communities (at subs 1.1(a) and ss. 2(a), (h), (p), and (r)), municipalities can point to these sections to push for standards that enhance biodiversity, as birds are inextricably linked to the health and well-being of our societies. Specifically, these sections speak to the following:

- At subs. 1.1(a): “to promote sustainable economic development in a healthy natural environment…”;
- At s. 2(a): “the protection of ecological systems…”;
- At s. 2(h): “the orderly development of safe and healthy communities”;
- At s. 2(p): “the protection of public health and safety”; and
- At subs 2(r): “the promotion of built form that (i) is well-designed…(iii) provides for public spaces that are of high quality, safe…”. (*Planning Act*)

Figure 31-35. Construction in the city (Canva, n.d.)

Opportunities

***Building Code Act, 1992*, S.O. 1992, c. 23**

The *Building Code Act, 1992*, and its regulations, *O. Reg. 332/12: Building Code,* legislate the "construction, renovation, demolition, and change of use of buildings in Ontario" (Government of Ontario, n.d.). Before any developer is allowed to build, demolish, or change a building or structure, the provisions under the *Building Code Act, 1992*, and its regulations, *O. Reg. 332/12: Building Code*, must be complied with, upon which a permit shall be issued (*Building Code Act, 1992*, at s. 8). Each municipality is delegated the responsibility of enforcing the policies under the *Act* and its regulations (*Building Code Act, 1992*, at subs. 3(1)), through the adoption of by-laws (*Building Code Act, 1992*, at subs. 15.1(2) and (3), and ss. 35(1)). Accordingly, the provisions are specifically intended to provide standards "for public health and safety…structural sufficiency…environmental integrity…" (Government of Ontario, n.d.), with respect to the <u>occupants</u> of a building (*Building Code Act, 1992*; and *O. Reg. 332/12: Building Code)*, which may be why building standards related to the health, safety and wellbeing of birds have been excluded.

Figure 36. Queen's Park, Legislature of Ontario (Canva, n.d.)

Despite this, on October 31, 2023, a Private Member's Bill introduced by NDP MPP Chris Glover, to amend the *Building Code Act, 1992,* to include the *CSA A460: Bird-friendly building desig*n standard, received its first reading and ordered for second reading (Bill 145, *An Act to amend the Building Code Act, 1992, with respect to bird-safe windows*; see also Ontario NDP, 2023). This opens the possibility that all buildings would be subject to bird-friendly design standards. This would affect the issuance of building permits, determine whether a permit is subject to revocation upon an inspection, and possibly expose developers to monetary penalties. By referencing the CSA *A460:19 Bird-friendly building design* standard through legislation, there are opportunities for enforcement (*Building Code Act, 1992*, at subs. 34(1) at (3), (39.4), and (39.5) and subs. 34 (1.1)(3); see also *Municipal Act, 2001*, at s. 97.1; *City of Toronto Act, 2006*, at s. 108.1). Having consistency at the provincial level would allow different stakeholders, including developers, building material manufacturers, architects, and planners, to follow the same rules despite working in multiple municipal jurisdictions. This will make implementation and enforcement simple and straightforward.

Figure 37-39. Robin, Yellow Warbler, Woodpecker (Canva, n.d.)

5.4 Government of Ontario - Building Code Process Flow Chart

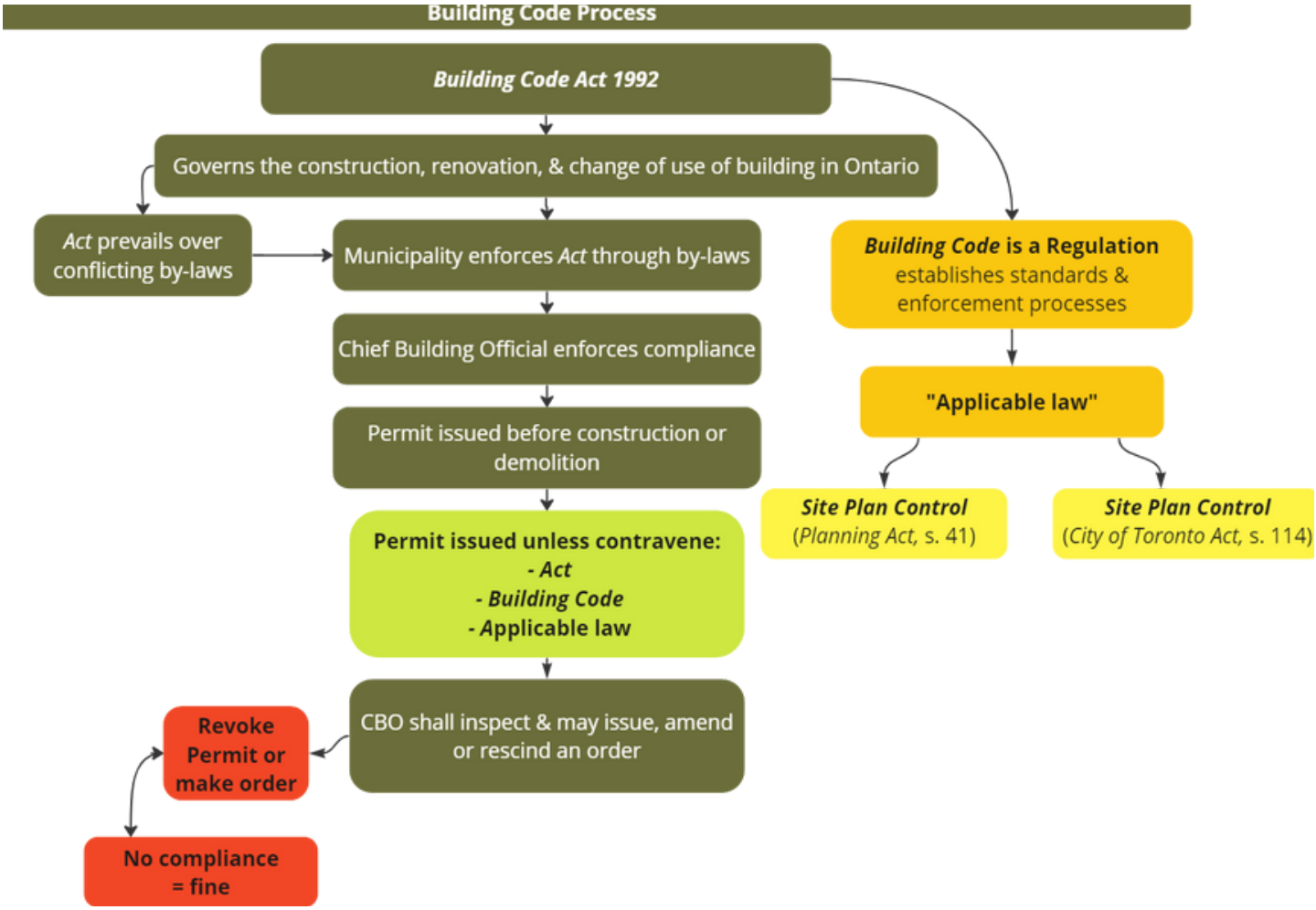


Figure 40. Building Code Process Flow Chart (Bird-Safe City Team, 2023)

5.5 City of Toronto

The municipal policy framework could arguably provide the mechanisms necessary to make buildings and structures increasingly bird-safe. Unfortunately, some of these policy and legislative instruments are limited in their application. The *City of Toronto Act, 2006* (at subs. 8(2), (5), (6), (9), and (10)), the City of Toronto *Municipal Code* (2021, see at City of Toronto, *Municipal Code*, Chapters 349, 363, 629, and City of Toronto, *by-law 660-2023*), and the Toronto *Official Plan* (2022, at Ch. 3, subs. 3.4.1(v) and Ch. 5, at subs. 5.1.3 (f); see also June 2023 Office Consolidation), play significant roles in establishing standards related to building design guidelines, health and safety, and environmental matters. Currently, however, Site Plan Control is the only component that ensures bird-friendly building design compliance.

The *City of Toronto Act, 2006* , the City of Toronto *Municipal Code* (2021), and the Toronto *Official Plan* (2022; June 2023 Office Consolidation) all speak to Site Plan Control. The *City of Toronto Act, 2006*, enables council to pass by-laws related to Site Plan Control (s. 114). Council passed a by-law that designated the entire city under Site Plan Control (City of Toronto, by-law No. 774-2012), and therefore this by-law is listed in the City of Toronto *Municipal Code* (*City of Toronto Act, 2006*, at s. 196). Accordingly, the City of Toronto *Official Plan* (2022), “allows the city to use Site Plan Control to implement Tier 1 of the Toronto Green Standard”, which includes building design guidelines to mitigate “migratory bird collisions” (at Ch. 5, subs. 5.1.3 (f); see also June 2023 Office Consolidation).

Figure 41-42. City of Toronto (Canva, n.d.)

Figure 43. Great Tit (Canva, n.d.)

Opportunities

City of Toronto *Official Plan*, 2022, and June 2023, Consolidated Version

The City of Toronto *Official Plan* guides a vision for the city, including human development on land, to ensure that "everyone can enjoy a good quality of life" (2022, at Ch. 1, p. 1-1; see also June 2023 Office Consolidation; Government of Ontario, n.d. *b*). Therefore, official plan policies that speak to bird-friendly design signifies the importance of this issue. Currently, the City of Toronto is taking steps to amend their official plan, by proposing additional policies to protect birds through Site Plan and building design. For instance, a new policy has been proposed, which gives special attention to "minimizing hazards to local and migratory birds" (Environmental Registry of Ontario, 2022, Amendment No. 583 at sub-policy 3.4.1 a) ix) in instances where the built environment is concerned (see "Natural Environment" section 3.4.1). Currently, these changes are before the Ontario Land Tribunal for a decision (Environmental Registry of Ontario, 2022). By including policies that speak directly to protecting birds in the official plan, this will help to guide planners to make decisions that are in line with protecting birds through built form (City of Toronto, 2022*b*).

Enforcement Gap

A significant concern is enforceability. Since the current municipal policy framework is limited in its application, enforcement of bird-friendly building design is only available through Site Plan Control. Unfortunately, once Site Plan Control designs are approved, there are no legislative requirements that ensure developments adhere to bird-friendly design guidelines post-construction. As a result, there are several buildings in the City of Toronto that fail to adhere to bird-friendly standards. If bird-friendly building design requirements were included in the *Building Code Act, 1992*, and its regulations, *O. Reg. 332/12: Building Code*, or the City of Toronto *Municipal Code*, there would be enforcement mechanisms that would require on-going compliance.

Site Plan Control

The entire City of Toronto is subject to Site Plan Control, the powers of which are established in Section 114 of the City of Toronto Act (2006). Under the City of Toronto Act (2006), the City can exercise the use of Site Plan Control to evaluate aspects of a development's design pertaining to the exterior of the building, including landscaping, parking, and lighting. Site Plan Control applies to residential buildings with 11 or more dwelling units, and non-residential buildings (City of Toronto Act, 2006). Some developments may be exempt from Site Plan Control, depending on certain elements of the proposal. In order to verify if a development is subject to Site Plan Control, it is important to review City of Toronto By-law 774-2012, to see if any exemptions apply (City of Toronto, 2012).

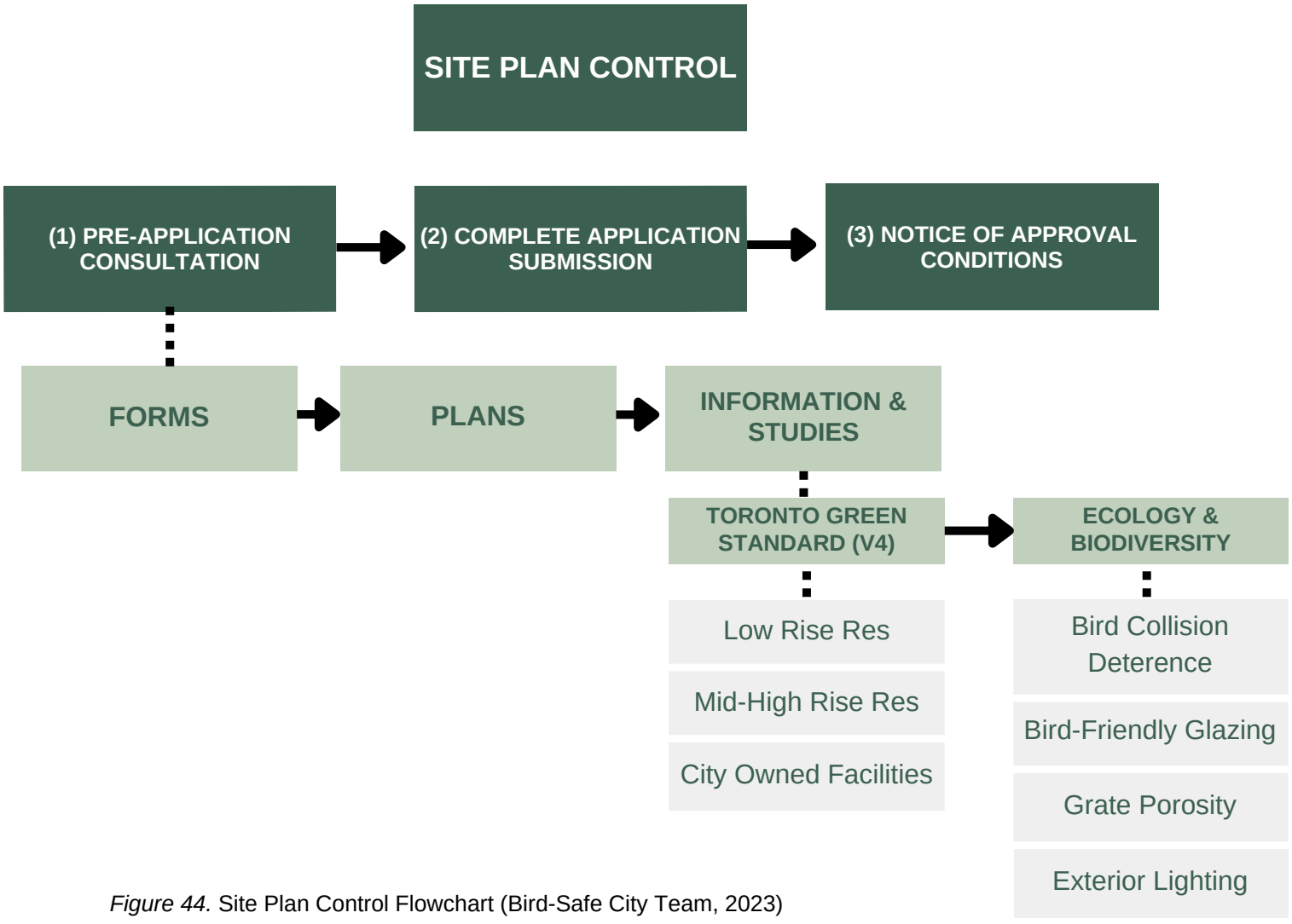


Figure 44. Site Plan Control Flowchart (Bird-Safe City Team, 2023)

Toronto Green Standard

The Toronto Green Standard is enforced through Site Plan Control and represents the City of Toronto's initiative to incorporate climate resilience into the development process (City of Toronto, 2023). The Toronto Green Standard is divided into tiers, with Tier 1 requirements being mandatory, and Tier 2-4 requirements being optional. If a developer incorporates features specified under Tiers 2-4, they are eligible to apply to the City's Development Charge Refund Program (City of Toronto, 2023).

	APPLICABLE TO	REQUIREMENT	DESCRIPTION
TIER 1	LOW-RISE RES & MID-HIGH RISE RES	Bird Friendly Glazing	85% of all exterior glazing within the first 16m treated including fly-through and High Hazard Areas, to reduce bird collisions
	MID-HIGH RISE RES	Rooftop Vegetation	Glazing 4m above rooftop vegetation is treated to reduce bird collisions
	MID-HIGH RISE RES	Grate Porosity	Maximum porosity of ventilation grate is 20mm x 20mm or 10mm x 50mm
	MID-HIGH RISE RES	Exterior Lighting	Dark sky compliant fixtures

Figure 45. Tier 1 of the Toronto Green Standard (Bird-Safe City Team, 2023)

The City's Bird-Friendly Design Guidelines are incorporated within Tier 1 of the Toronto Green Standard, making bird-friendly design a mandatory requirement of development within the City (City of Toronto, 2023). Depending on the type of development, the City has created two sets of performance measures that are applicable to residential developpents (City of Toronto, 2023). The first of which includes the Low-Rise Residential (Version 4), whereby the Toronto Green Standards Tier 1 requirements are applicable to a residential development containing 11 or more units if the building is less than four storeys (City of Toronto, 2023). Secondly, the City created Mid-High Rise Residential (Version 4), whereby the Toronto Green Standard's Tier 1 mandatory requirements are applicable to the development if it is four storeys or higher (City of Toronto, 2023). Within Tier 1 of the Toronto Green Standard for both Low-Rise Residential and Mid-High Rise Residential, bird-friendly window glazing is a requirement (City of Toronto, 2023). The requirements further extend under Mid-High Rise Residential to include bird-friendly treatment to rooftop vegetation, maximum measurements for grate porosity, and dark sky-compliant exterior lighting (City of Toronto, 2023).

An enforceability gap exists within TGS, whereby compliance is confirmed through a third-party verifier (City of Toronto, 2023). However, the applicant is responsible for hiring the third-party verifier, which creates the potential for bias within the confirmation process.

Policy Scan Conclusions

It is important to highlight that both mandatory and voluntary measures can be used to encourage developers to adopt bird-friendly building design practices. A study by Aragón-Correa, Marcus, and Vogel (2020), explores "how mandatory and voluntary pressures on firms affect their environmental strategies and performance" (p. 339). Accordingly, the most effective measure may include an approach that is a combination of the two (Aragón-Correa, Marcus, and Vogel, 2020).

Figure 46. Scales of Justice (Canva, n.d.)

Figure 47. Books (Canva, n.d.)

Considerations: Mandatory Compliance

Many firms consider the financial costs and how it will impact their bottom line as a main consequence to adhering to environmental legislation (Aragón-Correa, Marcus, and Vogel, 2020, p. 343). However, there are several other factors that should be considered. For example, when considering compliance to mandatory regulations, issues regarding the size of the firm (i.e., smaller firms may only comply with the minimum standards because of a lack of resources) (see p. 343), the perspectives held regarding environmental laws (i.e., if senior management has a negative perception of environmental regulation, this will impact their efforts to change their practices) (see p. 344), and whether the regulations are outcome-based or means-based (i.e. regulations that focus on "the desired result that regulated parties must meet, rather than the means by which it must be achieved") (Government of Canada, 2019), are all factors that determine the level at which mandatory measures are followed.

Considerations: Voluntary Compliance

In terms of voluntary practices, companies are likely to integrate them into their own practice if they are associated with economic rewards for compliance (p. 348), there is pressure from external stakeholders (i.e. including from local governmental organizations and the greater community) (p. 349), and opportunities have been identified by internal departments which leverage their power or visibility (i.e., “gaining visibility for the marketing department or reinforcing informal relationships with regulatory stakeholders for the legal affairs”) (Aragón-Correa, Marcus, and Vogel, 2020, p. 348).

Figure 48. Chimney Swift (Canva, n.d.)

Next Steps

The current policy framework includes both voluntary and mandatory measures that speak to bird-friendly building designs. Taking into consideration the findings above, municipalities should use this to understand why stakeholders are hesitant to adopt certain practices with respect to environmental measures, but also see it as an opportunity to adapt their current policies to encourage compliance. Municipalities need to take action to understand which measures are working effectively, why developers, building owners and operators are inclined to adhere to certain standards instead of others, and assess how policies can be improved to advance compliance and support. Clearly there are gaps that need to be filled with the current policies in place. Fortunately, there are many opportunities that have been identified to fill these gaps to advance bird-friendly design within the built environment.

Figure 49. City of Toronto (Canva, n.d.)

6.0 CERTIFICATIONS AND PROGRAMS

Certification systems and programs provide significant incentives for promoting sustainability and addressing climate change, but they often fall short in tackling the biodiversity crisis. Unfortunately, at times, builders, architects, and owners engage with these certification systems more for virtue signaling rather than genuine commitment. In this report we would like to highlight two notable certification systems that make reference to bird friendly/safe design practices.

The first certification system worth noting is the Building Owners and Managers Association (BOMA), which provides bird-friendly guidelines in collaboration with FLAP. These guidelines, a crucial component of the BOMA BEST Sustainable Buildings certification, aim to address both daytime and nighttime hazards.

Figure 50. BOMA Best Sustainable Program Logo (BOMA, n.d.)

Various types of buildings, including offices, enclosed shopping centers, open-air retail spaces, light industrial facilities, multi-unit residential buildings, health care facilities, and other universal asset classes, are required to incorporate bird-safe strategies to attain the BOMA BEST Sustainable certification. Leadership in Energy and Environmental Design (LEED) is another certification system that offers a Bird Collision Deterrence by complying with “Building façade and site structures,” “Exterior lighting,” and “Performance monitoring plan” in exchange for one pilot credit.

While certification systems play a crucial role in incentivizing sustainability and addressing climate change, their effectiveness in tackling the biodiversity crisis is often limited. The Building Owners and Managers Association (BOMA) stands out for its collaboration with FLAP to develop bird-friendly guidelines, an integral aspect of the BOMA BEST Sustainable Buildings certification that includes strategies to combat the biodiversity crisis. LEED also deserves recognition for offering a pilot credit for Bird Collision Deterrence. Our goal is to encourage other certification systems by highlighting the efforts and contributions that have been made.

Better Building Partnership

In Toronto, the Better Building Partnership program is an initiative to help reduce greenhouse gas emissions (City of Toronto, 2023*b*). The program includes providing incentives to help building owners and operators reduce their energy consumption, distributing grants to fund building retrofits to reduce carbon emissions, providing low-interest loans for buildings to become energy efficient, and programs to help reduce water consumption (City of Toronto, 2023*b*).

The Better Building Partnership currently offers environmental grants, incentives, and resources for building owners through:

- Deep Retrofit Challenge
- Energy Retrofit Loans
- High-Rise Retrofit Improvement Support Program
- Eco-Roof Incentive Program
- Energy & Water Reporting and Benchmarking
- Home Energy Loan Program
- Sustainable Towers Engaging People (STEP)

Although these programs are intended to help meet carbon reduction goals, initiatives that include protecting biodiversity are unaccounted for. Biodiversity is said to be “our strongest natural defence against climate change” (United Nations, n.d.), and birds are part of a biodiverse environment. Birds are often used to determine the health of our communities (Forest and Rangeland Ecosystem Science Centre, 2022; Zhang, Ye, Liu, Lai, You, Dong, & Dong, 2023).

Through the Better Building Partnership program, initiatives should be implemented to provide financial support and other incentives to developers, as well as building owners and operators, so that they will partner with bird-friendly building design manufacturers (i.e., bird-friendly glass and lighting). By developing programs to help retrofit buildings and encourage bird-friendly building design, this will help the City improve biodiversity and effectively reduce the carbon footprint.

Figure 51. City of Toronto (Canva, n.d.)

7.0 CASE STUDIES

This section will expand on the methods deployed in selecting jurisdictional case studies as a form of analysis that allowed the research team to determine best practices and recommendations for the City of Toronto. Our methods comprised of four different categories including enforceability, migratory flyways, city topography, and membership within the Biophilic Cities Network to determine jurisdiction selection. The overarching criteria in the selection process was whether or not bird-safe design guidelines were enforceable, making up 50% of the selection criteria. The scope for jurisdiction selection was limited to North American cities as an initial scanning of global bird-safe design guidelines was insubstantial due to information accessibility. Our findings reveal that although many cities have recommendations for bird-safe design, few have implemented these standards within their building or planning codes, and are instead voluntary recommendations.

Membership within the Biophilic Cities Network comprised of 25% of the case study selection criteria. While these cities are meant to be leaders in urban nature, less than 50% have any form of recommendations for bird-safe design guidelines. The final two categories of the selection criteria are topography and migration flyway (see Figure 52). These two categories were based on determining if cities had similar geographies and migration routes to that of Toronto to assess the feasibility and applicability of their recommendations and successes respective to their locales (Cusa et al., 2015). Nonetheless, expanding our scope to various migratory flyways and topographies, such as San Francisco which is categorically different from the City of Toronto, allowed for a greater understanding of the latest science and best practices to mitigate bird-building collisions. **Section 7.4 of this report contains a summary of opportunities for the City of Toronto based on findings from the case studies.**

Migratory flyways are considered a "simplified illustration" of common routes used by a majority of migratory birds. The City of Toronto provides a key "stopover habitat" for migratory birds due to its location near Lake Ontario (Cusa et al., 2015, p. 4).

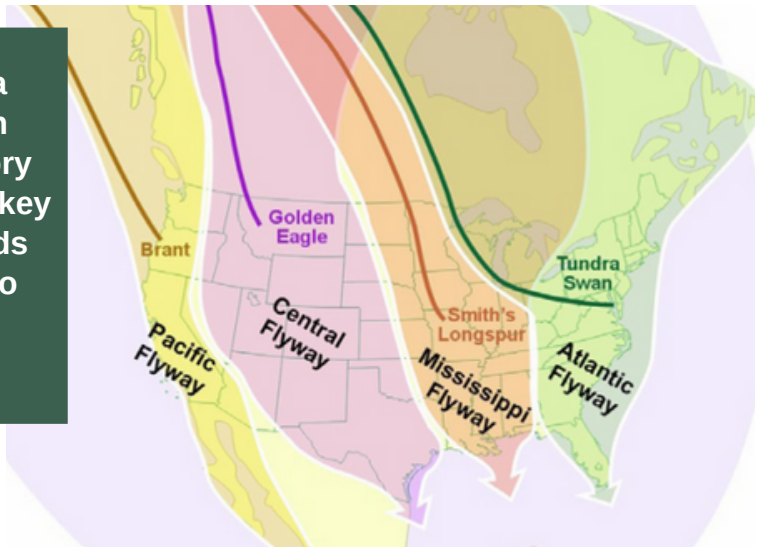


Figure 52. Illustration of North American Migratory Flyways (Migration Science and Mystery, n.d.)

7.1 New York City

The first case study is New York City in the United States. Beyond its notable skyscrapers such as the Empire State Building, the City is also rich in biodiversity. Despite its dense urban landscape, New York City provides a home for a variety of wildlife due to its abundance of green spaces. Central Park, with its sprawling landscapes, serves as a sanctuary for birds and other animals (Central Park Conservancy, 2019). The City is also considered a hub for birders, with the Jamaica Bay Wildlife Refuge attracting many migratory birds (National Park Service, 2023). This relationship between the natural and built environment in the City that 'never sleeps' is truly unique and underscores the City's commitment to ensuring the ongoing protection of its biodiversity.

Figure 53. Central Park
(Central Park Conservancy, 2019)

998

MILLION

Annual estimate for birds killed by building glass in the United States (Audobon Magazine, 2023)

Although New York City is not a part of the Biophilic City Network, it has made significant efforts towards bird-safe design and is situated in the same migratory flyway as Toronto – the Mississippi Flyway. This flyway is a major migration route for over 300 bird species annually, with most flying at night (Beilke, 2023). Research shows that up to 230,000 birds collide with building glass in New York City each year (Audubon Magazine, 2023). However, the City has implemented several measures to reduce the number of migratory bird deaths, such as a 2019 law mandating bird-safe building materials on the exteriors of new buildings or major alterations up to 75 feet above the ground, and a "Lights Out" legislation that requires city-owned buildings to turn off unnecessary outdoor lighting between 11 PM and 6 AM during fall and spring migration. The "Lights Out" legislation follows CSA A:460 19's lighting recommendations, as well as the City of Toronto's recommendations to turn lights off where appropriate. Local Law 15, also known as Initiative 1482-2019, was adopted in 2020 and is considered the most comprehensive bird-safe building regulation in the United States, in part developed using the City of Toronto's guidelines.

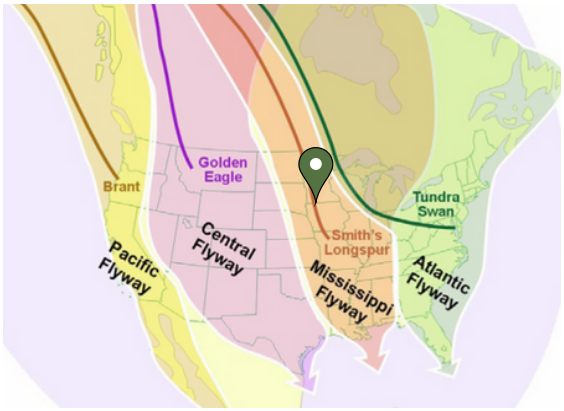


Figure 54. Illustration of North American Migratory Flyways (Migration Science and Mystery, n.d.)

The following analysis examines key findings from New York City's Bird Friendly Building Design & Construction Requirements Guidance Document, referred to as Local Law 15, highlighting opportunities and comparisons as they pertain to the City of Toronto's Bird Friendly Guidelines. Local Law 15 is specific to glass , and so this case study will address opportunities and comparisons accordingly.

01 Enforceability

Local Law 15 has jurisdiction over all of New York City through its integration into the state Building Code, making New York City a leader in enforceable bird-safe design guidelines. The Building Code is a crucial part of ensuring bird-safe design guidelines are incorporated throughout the development process, and its inclusion as a case study is primarily due to this fact of enforceability as we advocate for bird-safe building design to be mandated across Ontario, and one day, federally. Although the CSA guidelines have informed bird-safe design guidelines in some Canadian jurisdictions, they are still considered voluntary and therefore birds continue to be at risk for collisions. The integration of bird-safe design into the Province of Ontario's Building Code not only addresses aspects of the ongoing biodiversity crisis but ensures that planning and development can be done in a way that upholds the natural values of the land and all beings within it. Mandating bird-safe design to this level can be a progressive change in terms of biodiversity protection.

02 Bird Hazard Installation

New York City's approach to Bird Hazard Installations, is defined in the state Building Code in Section BC 1402.1 as "an installation with monolithic glazing that provides an unobstructed view outside buildings." This includes structures like glass awnings and railings. Section BC 1403.8.2 mandates Bird Hazard Installation to be made with bird-safe materials, irrespective of their height. This is an important observation, as the TGS has a height limit of the first 16m of the building above grade, covering 85% of all exterior glazing.

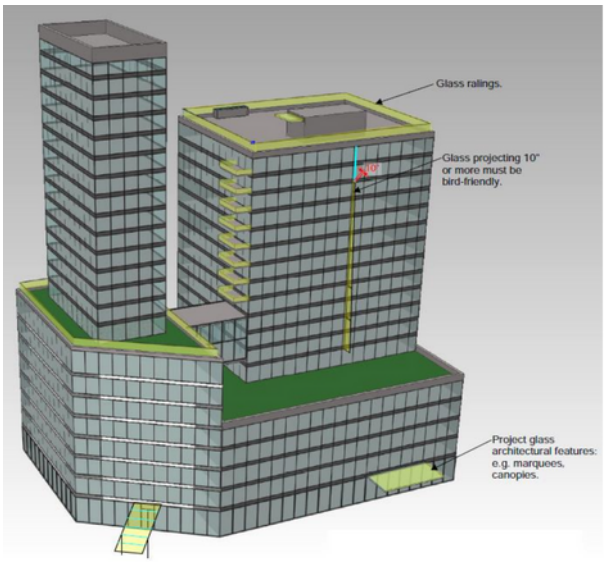


Figure 55. Bird Hazard Installations (Alina Kurchenko of Vidaris, Inc. as cited by NYC Buildings, 2020)

03 Bird-"Friendly" Material

The New York City Building Code defines bird-safe material as assembly or material that is treated to have a "maximum threat factor of 25 using the *American Bird Conservancy Bird Collision Deterrence Material Threat Factor Reference Standard,* or with the *American Bird Conservancy Bird-Friendly Materials Evaluation Program at Carnegie Museum's Avian Research Center Test Protocol,* or with an American Society for Testing and Materials standard, similar to the CSA Group in Canada. A Material Threat Factor ranging from 1 to 100 is defined as a concept to create scores that indicate a measure of how well materials can avoid bird collisions, allowing researchers to use collision deterrence as a factor when designing buildings. The Threat Factor Scores also allowed for the creation of a credit for reducing bird collisions in the LEED certification system (American Bird Conservancy, 2023). The following treatments are mentioned in Local Law 15:

- Glazing Treatments
- Visual Markers
- Building Integrated Structures
- UV-Reflective Configurations
- Low-Emissivity

Both New York City and the City of Toronto recommend for bird-safe treatment to be applied on first (exterior) surface.

Bird-safe material is required to be applied 75 feet (22 860 mm) above grade on the exterior wall envelope or any associated openings. For non-bird-safe material, Local Law 15 outlines it should not exceed an aggregate of 10 square feet (0.93 square metres) within any 10 feet (3048 mm) by 10 feet (3048 mm) square area of the exterior wall below 75 feet (22 860 mm) above grade.

The same is applicable where fly-through conditions are created (Figure 58. as illustrated within Local Law 15). In terms of visual markers and spacing, New York City adopts the “2 x 4 rule” referring to some research that indicates most birds will not attempt to fly through spaces less than 2 inches high and 4 inches wide (50x100 mm). In the United States, nine of the 17 jurisdictions that have some form of bird-safe design guidelines follow the “2x4” rule though some have reduced this to 2x2 inches which is the same as the CSA Group and the City of Toronto (50x50 mm) (Vitro, n.d.). This is similar as it combines the TGS’ 50 mm by 50 mm for City-owned buildings, and 100 mm x 100 mm for all other buildings, although the CSA recommends 50 mm by 50 mm for all buildings and any form of application of bird-safe material.

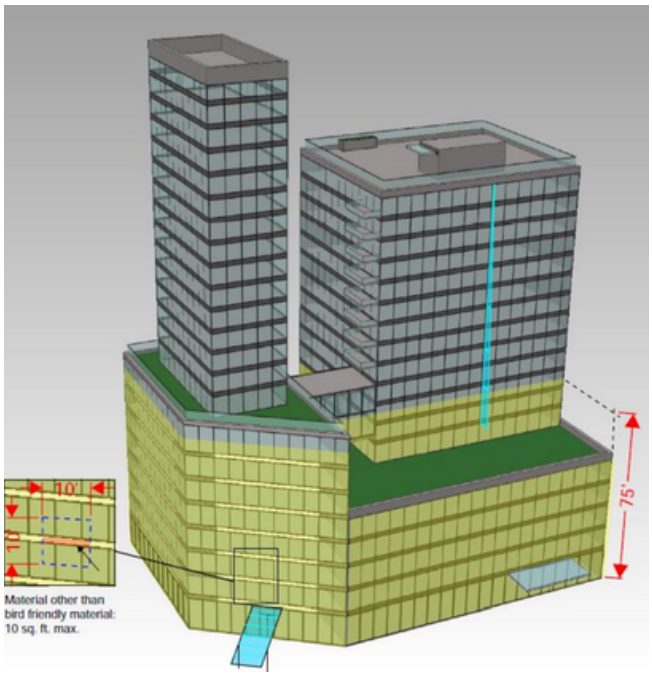


Figure 56. Locations where Exterior Wall Envelope is required to meet requirements set forth in Section BC 1403.8.1 (Alina Kurchenko of Vidaris, Inc. as cited by NYC Buildings, 2020)

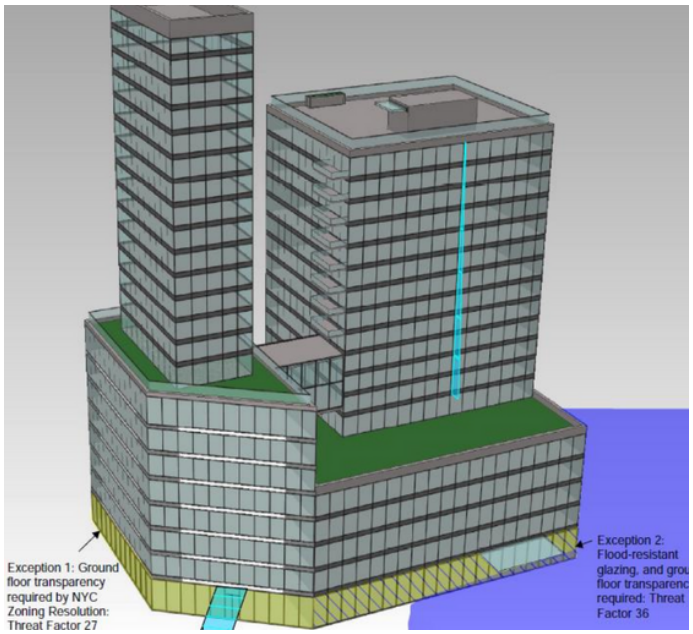


Figure 57. Exceptions 1 and 2 of Section BC 1403.8.1 (Alina Kurchenko of Vidaris, Inc. as cited by NYC Buildings, 2020)

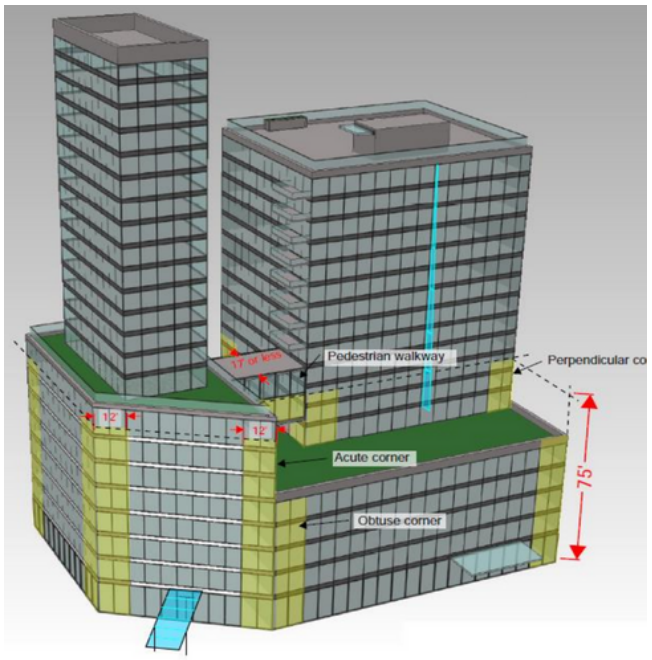


Figure 58. Fly-Through Conditions (Alina Kurchenko of Vidaris, Inc. as cited by NYC Buildings, 2020)

As this report seeks to update the City of Toronto's Bird Friendly Guidelines, it has examined New York City as a leader in enforceable bird-safe design to inform necessary recommendations. New York City's leadership in mandating bird-safe design specific to glass is a notable takeaway in global biodiversity protection. The following opportunities will focus on aspects where the City of Toronto can improve its existing policy to improve its enforceability.

Opportunities for The City of Toronto

No. 01 — Address Enforcement Gap

Based on findings from New York City, to ensure the bird-safe design is enforced within the City of Toronto, it is recommended that bird safety is recognized within the Province of Ontario's Building Code. Although this recommendation pertains to the jurisdiction of the Province, it is recommended that the City itself adopt the CSA Group's standards (A460:19) in the interim, similar to Local Law 15's reference to the American Society for Testing and Materials standard to allow for a unified national approach to bird conservation.

No. 02 — Formal Update

While New York City's Local Law 15 of 2020 has been implemented to promote bird-safe design, Toronto's Bird Friendly Design Guidelines have not been updated since 2017. It is crucial to renew the guidelines to incorporate the latest research on bird-safe design. Not only will this demonstrate a renewed commitment to biodiversity protection, but it will also align with other North American jurisdictions.

7.2 City of Ottawa

The urban environment of Canada's capital has a vast network of green spaces that provide a home for numerous migratory birds and other animals. The City of Ottawa is committed to preserving its ecologically diverse landscape, as demonstrated by its recent implementation of Bird-**Safe** Design Guidelines in May 2020. Ottawa serves as a case study due to its adoption of the CSA Bird-friendly building design Standard and is located on the same flyway as New York City and Toronto.

Figure 59. City of Ottawa (Britneff, 2019)

Unlike Toronto, the City of Ottawa is also not a Biophilic City, but it has made significant strides in bird-safe design guidelines. Ottawa's bird-safe guidelines are comprehensive and innovative and align with the CSA Bird-friendly building design Standard. (City of Ottawa 2020). Further, the City of Ottawa uses the term “safe” rather than “friendly,” a notable initial observation in ensuring that the **safety of birds** is a principal commitment.

01 Enforceability

Ottawa has identified that during migration periods, nearly seven million birds and other species pass through the City. As such, the City has recognized the need to protect its biodiversity by implementing bird-safe design measures that are consistent with CSA A:460 19. By including the City of Ottawa as a case study, we can draw an important conclusion: **Toronto should adopt the CSA guidelines following Ottawa’s implementation of a unified national standard. This would ensure consistency in bird-safe design practices across the country.**

Over 180 bird species can be found in Ottawa, with an approximate number of two million birds nesting in its urban area, several of which are listed as Species at Risk under provincial and/or federal legislation (Ottawa Bird Count, 2019; City of Ottawa, 2020).

Figure 60. Northern Cardinal (Canva, n.d.)

02 Glazing

According to the CSA Group, the size and spacing of visual markers play a crucial role in minimizing bird collisions. Birds perceive larger, densely patterned markers as solid objects, and studies suggest that visual markers placed no more than 10 cm apart vertically or 5 cm apart horizontally are effective in preventing bird collisions with glass. However, the most effective pattern is a tighter 50 x 50 mm configuration (City of Ottawa, 2020; CSA Group, 2019). Although the City of Toronto maintains the same distance measures of 50 x 50 mm for visual markers, this is only for city-owned property. Non-city-owned property can be 5mm in diameter and 100 mm x 100 mm apart for visual markers, which is not consistent with the most effective practice for visual markers in bird-safe design. **Birds are unable to distinguish between city and non-city-owned buildings, so it is imperative that this distancing is consistent throughout all buildings within the City.** In terms of transparency and reflection guidelines, the City of Ottawa recommends treatment of 90% of glazing within the first 16 metres as stated in the CSA Standards, whereas Toronto's design guidelines recommend treatment of 85% of glazing within the first 16 metres. 90% as part of the CSA Group's glazing recommendations is ideal as it covers more area and therefore is in line with recommendations for the City of Toronto to adopt language in CSA A460:19.

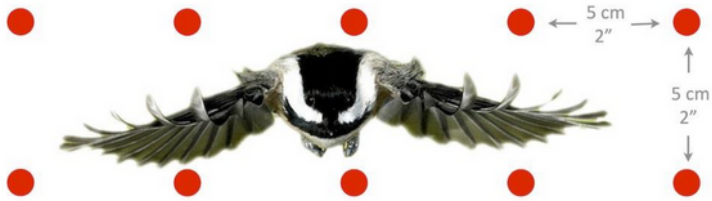


Figure 61. The City of Ottawa adds their recommendation for the spacing of markers "is representative of the area occupied by a flying songbird, the most numerous victims of collisions" (American Bird Conservancy / Safe Wings Ottawa; City of Ottawa, 2020, p. 11).

When it comes to bird-safe glass, the City of Ottawa's guidelines, from the CSA Group, suggest the use of permanent or built-in treatments for durability. However, if this is not feasible, surface treatments such as acid etching or digital printing can be utilized. As mentioned, high-contrast visual markers in patterns like lines and dots are also recommended, with a maximum spacing of 50mm x 50mm. The markers must be a minimum of 4mm in diameter or 2mm wide by 8mm long for linear elements, in compliance with the CSA Group. Unlike Toronto, Ottawa mandates densely patterned or some form of glazing for all buildings, regardless of ownership type. Both jurisdictions recommend that this treatment be applied on first (exterior) surface.

Figure 62. Creative glazing at the University of Ottawa (Safe Wings Ottawa, 2021)

03 Vegetation and Landscaping

For buildings incorporating vegetation such as green roofs, rooftop gardens, or terraces, the City of Ottawa's guidelines recommend treating the glazing to a height of 4 meters from the surface of the roof or terrace, or the height of the adjacent mature vegetation, whichever is greater. The City of Ottawa also requires bird-safe materials to be used in combination with glass regulations, regardless of the height of such features (City of Ottawa, 2020). Furthermore, it is recommended to reduce the number of linear landscape features that lead into glass doors or other structures and avoid planting species that attract birds to locations that could result in collisions, such as flowers that hummingbirds find attractive, to mitigate the occurrence of fly-through conditions (See Figure 63).

Mitigating Design Traps

Ottawa's guidelines add that if avoiding fly-through conditions is not possible, it is recommended to use bird-safe glass or other protection measures for glazing, as well as treating glass corners to make them bird-safe within a 5-metre range in each direction. Both the City of Toronto and the City of Ottawa maintain the same treatment for glass corners or railings to help protect birds.

With this, the City of Toronto's guidelines mention ensuring ground-level ventilation grates have a porosity of less than 20 mm X 20 mm (or 40 mm x 10 mm) but do not make specific mention to other features such as pipes, flues, vents, and free-standing features, even though they can all be integrated into buildings. The City of Ottawa recommends a porosity of 20mm x 20mm or 40mm x 10mm for all features, and the use of self-supporting lattice or monopole towers for free-standing features. The City of Ottawa's guidelines, inspired by the CSA Group's guidelines, demonstrate the application of bird-safe design to all forms of building design, and it is imperative the City of Toronto improve their specificity of language, achievable through adopting CSA guideline language to ensure standardization of biodiversity protection.

Figure 63. Fly-Through Conditions (Feather Friendly, 2023)

04 Lighting

The City of Ottawa also has guidelines for exterior and interior lighting to minimize collisions, particularly at night. These include:

- Avoid up-lighting
- Specify Dark Sky compliant, full-cutoff exterior fixtures to reduce light trespass
- Use motion detectors and other automatic lighting controls to reduce or extinguish non-essential lighting between 11 pm and 6 am
- Use minimum wattage fixtures to achieve appropriate lighting levels (note: minimum required lighting levels are established in the Ontario Building Code)
- Minimize the amount and visual impact of perimeter lighting
- Avoid use of floodlighting

The City of Toronto also discusses lighting quite comprehensively including skyglow which is disorienting for birds during migration season and can increase the risk of collisions. In the Best Practices for Lighting (2017), it is mentioned:

- Avoid directing light upward, as these impact migratory pathways
- Reduce glare
- Ensure the lighting being used has a necessary purpose, such as the provision of safety enhancement
- Ensure lighting fixtures are Dark Sky Compliant

applying to Tier 1 of the TGS

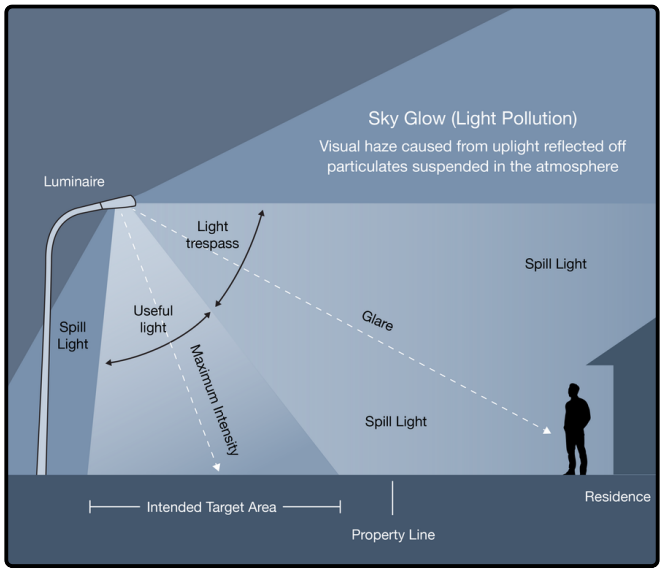


Figure 64. (Evluma, 2023)

Figure 65. Understanding Light Pollution (Bright Vest Africa, nd)

Overall, the City of Toronto should aim to have its updated guidelines informed by the CSA Group, as done in Ottawa, to contribute towards a national standard for bird-safe design and can encourage other Canadian jurisdictions to do the same. At present, there are aspects of bird-safe building design guidelines such as uniformity in glazing treatment and visual marker guidelines that can be improved towards positioning the city as a leader in bird-safe design as it once was. Moreover, the City of Ottawa's use of the term **"safe"** is a key highlight as this report's overall recommendations include updating "Bird-Friendly" to "Bird-Safe" in the updated version of the City of Toronto's guidelines.

Opportunities for the City of Toronto

No. 01 — Adopt CSA Group Language for Bird-Safe Design

While the Building Code is referred to in the New York City case study as the main vehicle to address the enforcement gap, in the interim the City of Toronto can consider adopting CSA language into its updated guidelines to reflect the City of Ottawa's approach towards a unified national standard to biodiversity protection.

No. 02 — Adopt Bird Safe Language

As jurisdictions such as the City of Ottawa shift towards bird-safe rather than bird-friendly language, Toronto should follow suit by updating the language used in their guidelines to prioritize safety as the primary commitment.

No. 03 — Formal Update

While the City of Ottawa's Bird-Safe Design Guidelines from 2020 have been implemented to promote bird-safe design, Toronto's Bird Friendly Design Guidelines have not been updated since 2017. It is crucial to renew the guidelines to incorporate the latest research on bird-safe design. Not only will this demonstrate a renewed commitment to biodiversity protection, but it will also align with other North American jurisdictions.

7.3 San Francisco

Figure 66. San Francisco (Biophilic Cities, n.d.)

This section of the report will examine bird-safe design guidelines in the city of San Francisco to inform updates to the City of Toronto's Bird Friendly Design Guidelines. San Francisco was selected as a case study of interest due to its role as a bird-safe city with enforceable measures that ensure urban design does not compromise bird-safety throughout the region. `

The following analysis of San Francisco identifies that the city clearly distinguishes between differing design hazards - locations and features - and ensures treatment is respective to the threats they uniquely pose to bird-safety. Moreover, the report highlights the importance of integrating bird-safe design into enforceable policy through the city's Planning Code, demonstrating the benefits of enforceable bird-safe design, as distinct from bird friendly recommendations in Toronto. This section concludes that enforceability within San Francisco, alongside its ability to clearly illustrate design threats, makes it a notable example to engage and learn from to improve Toronto's Bird Friendly Design Guidelines. `

Bird-Safe Guideline Overview

The city of San Francisco was selected as a relevant case study due to its role as a Biophilic Member city with enforceable bird-safe guidelines. San Francisco, unlike Toronto, New York, and Ottawa, is located within the Pacific Flyway, which has less densely populated tall buildings and extends from Alaska to Patagonia. Moreover, San Francisco differs from Toronto with its hilly topography and major elevations.

Figure 67. Illustration of North American Migratory Flyways (Migration Science and Mystery, n.d.)

San Francisco first introduced its guidelines for bird-safe design in 2011, when the city successfully integrated its Standards for Bird-Safe Buildings into its Planning Code under Section 139 (San Francisco Planning Department, 2011). The purpose of the section, according to the Planning Code, is to establish Bird-Safe standards for both new building construction and replacement facades to reduce bird mortality under circumstances that are known to pose a high risk to birds and are considered to be "bird hazards" (American Legal Publishing, 2023). The Planning Code specifically outlines the purview and application of bird-safe design, categorizing its regulated scope for two distinct circumstances; location related hazards and feature related hazards. The following section outlines the delineation of each hazard and their corresponding treatments as detailed in San Francisco's Planning Code Section 139;

01

Location Related Hazard

The siting of a structure that may create increased risk to birds.

02

Feature Related Hazard

A feature that creates hazards for birds in flight unrelated to the location of the building.

01 Location Related Hazard

Location Hazard: The siting of a structure that may create increased risk to birds. Buildings within 300 feet of an “Urban Bird Refuge” are deemed location hazards, defined as any open spaces 2 acres or larger dominated by vegetation, including vegetated landscaping, forest, meadows, grassland, water features or wetlands. These standards also apply to buildings less than 300 feet from an Urban Bird Refuge if such buildings are in an unobstructed line to the refuge. The portion of the structure most likely to sustain bird-strikes requires facade treatments (San Francisco Planning Department, 2011).

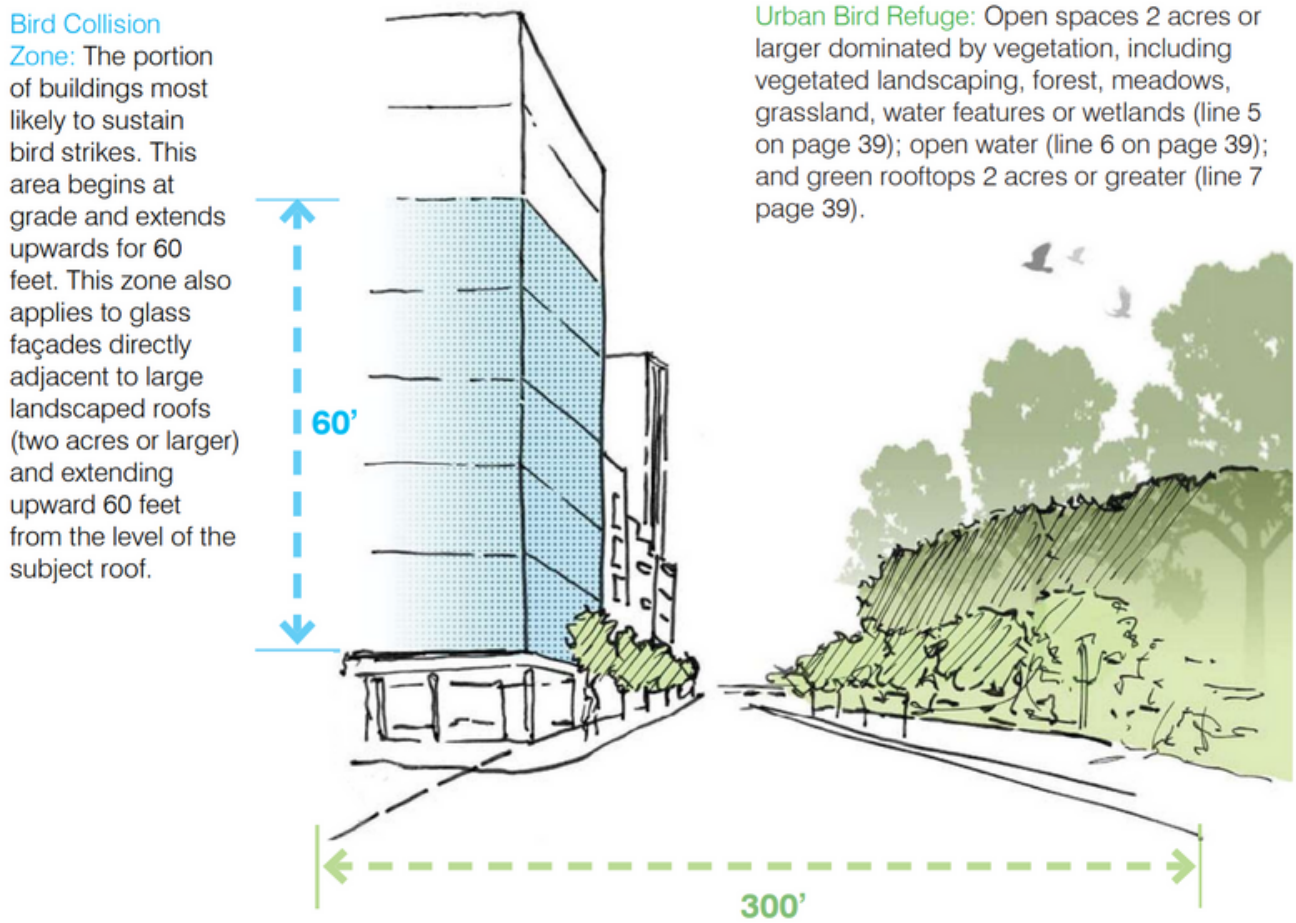


Figure 68. Location Hazards (San Francisco Planning Department, 2011)

Treatment for Location Related Hazard: The portion of the structure most likely to sustain bird-strikes requires facade treatments. Treatment required for location hazard includes

Facade treatments

Bird-Safe Glazing Treatment is required so that the Bird Collision Zone facing the Urban Bird Refuge consists of no more than 10% untreated glazing. The Bird Collision Zone is defined as the portion of buildings most likely to sustain bird-strikes from local and migrant birds in search of food and shelter and includes:

- The building facade beginning at grade and extending upwards for 60 feet, or
- Glass facades directly adjacent to landscaped roofs 2 acres or larger and extending upwards 60 feet from the level of the subject roof.

Wind generators

- The site must not feature wind generators, specifically horizontal access windmills or vertical access generators.
- Wind generators in this area shall comply with the Planning Department's permitting requirements, including any monitoring of wildlife impacts that the Department may require.

Figure 70. Vertical axis wind generators vary in appearance.Blades that present a solid appearance (left image) are encouraged.(San Francisco Planning Department, 2011)

Lighting

- Minimal lighting shall be used
- Lighting shall be shielded
- No uplighting shall be used
- Event searchlights are prohibited on property subject to these controls.

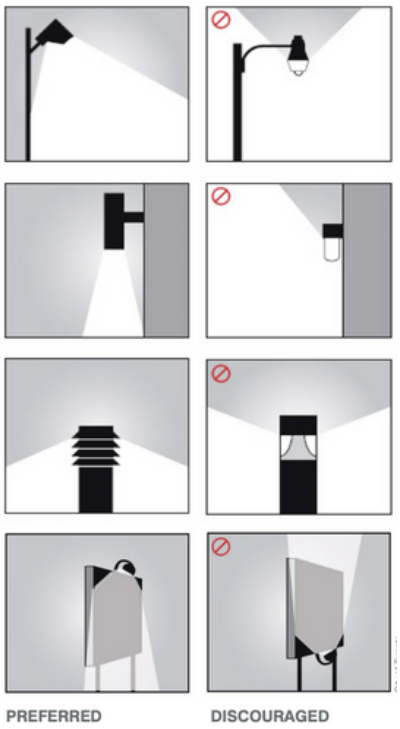


Figure 69. Effective vs Non-effective lighting (San Francisco Planning Department, 2011)

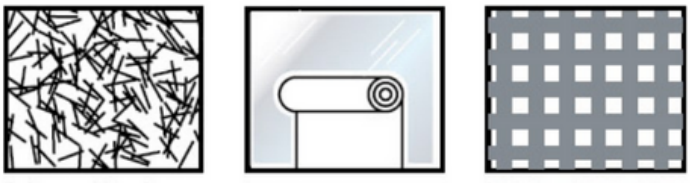


Figure 71. (San Francisco Planning Department, 2011)

02 Feature Related Hazard

Feature Hazard: a hazard which may create increased risk to birds regardless of where the structure is located. This occurs where there is a feature that creates hazards for birds in flight unrelated to the location of the building.

Treatment for Feature Hazard: structures with such feature-related hazards are required to treat 100% of the feature-related hazards. Building feature-related hazards include free-standing glass walls, wind barriers, skywalks, balconies, and greenhouses on rooftops that have unbroken glazed segments 24 square feet and larger in size (American Legal Publishing, 2023). 100% of building feature-related hazards shall be treated regardless of whether the site is located inside or adjacent to an Urban Bird Refuge. Feature-related hazards can occur throughout the City. Any structure that contains these elements shall treat 100% of the glazing on Feature-Specific hazards (San Francisco Planning Department, 2011).

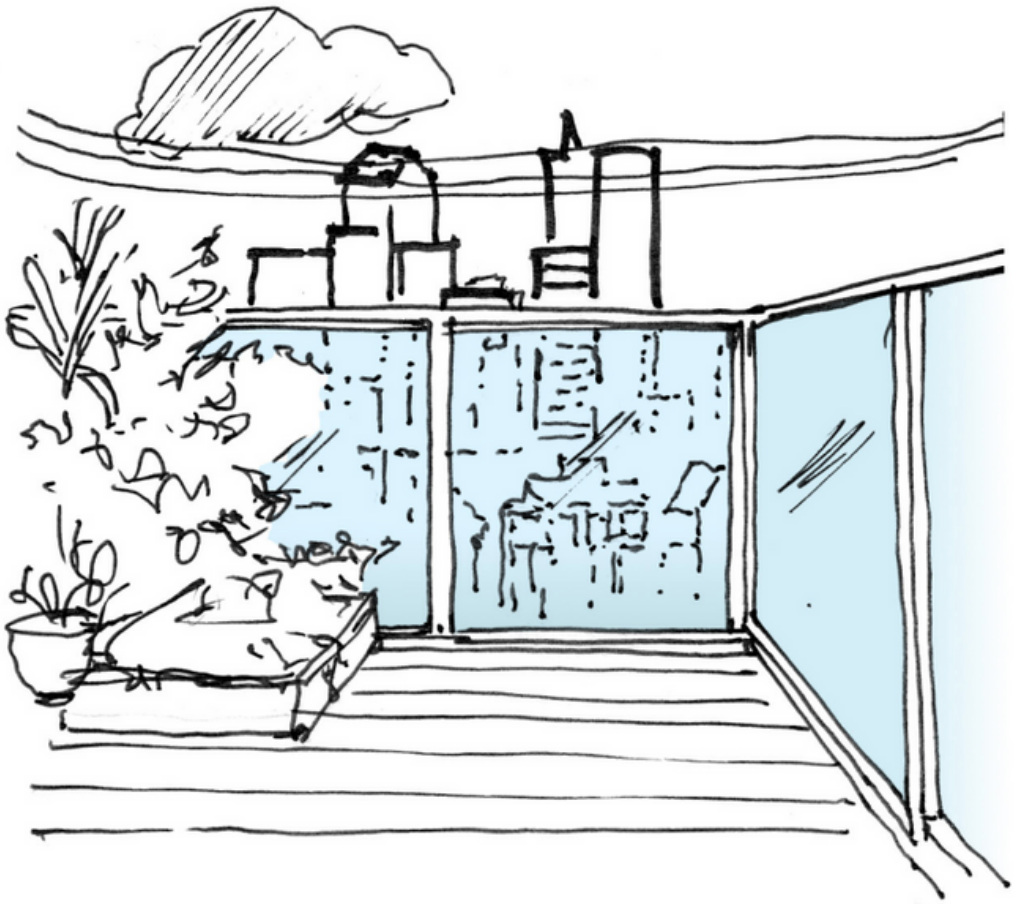


Figure 72. (San Francisco Planning Department, 2011)

Figure 72 illustrates an example of a feature related hazard: balcony with untreated glass

03 Exceptions

Section 139 Standards for Bird-Safe Buildings allows for certain exceptions including;

- A Zoning Administrator may either waive or modify requirements for both Location-Related Hazards or Feature-Related Hazards to allow equivalent Bird-Safe Glazing Treatments based upon the recommendation of a qualified biologist.
- Exceptions for Location-Related Standards to be Applied to Residential Buildings Within R-Districts.

    - **Limited glass facade:** residential buildings in R districts that are less than 45 feet in height and have an exposed facade composed of less than 50% glass are exempt from new or replacement facade glazing requirements.
    - **Substantial glass facades:** residential buildings that are less than 45 feet in height but have a facade with surface area composed of more than 50% glass, shall provide glazing treatments for 95% of all large, unbroken glazed segments that are 24 square feet and larger.
    - **General Exceptions for Historic Buildings:** treatment of replacement glass facades for structures designated as City landmarks or within landmark districts, shall conform to the Secretary of Interior's Standards for Rehabilitation of Historic Properties. Reversible treatment methods such as netting, glass films, grates, and screens are recommended. Netting or any other method demonstrated to protect historic buildings from pest species that meet the Specifications for Bird-Safe Glazing Treatment also may be used to fulfill the requirement.

Figure 73. Koshland House, San Francisco (Hoffman, 2008)

Key Findings Relevant to Toronto

The following analysis examines key findings from San Francisco's bird-safe guidelines, highlighting opportunities, challenges, and comparisons as they pertain to the City of Toronto's Bird-Friendly Guidelines.

Enforceability

San Francisco has a comprehensive set of standards for bird-safe buildings, and through its inclusion within the city's Planning Code, it ensures that such measures are enforced to reduce bird hazards and collisions throughout the city. Within the Biophilic Cities Network, only 4 member cities have enforceable bird-safe design guidelines, one of which is San Francisco. Being a leading example of enforceable bird-safe design, San Francisco demonstrates the legislative capacity to not only recommend bird-safety and biodiversity protection, but to implement it within the urban environment. Bird-safety is integral to sustainable urban design, and cities should actively seek to incorporate such standards within their respective planning and or building codes.

Toronto, despite being a leader in bird conservation, has yet to incorporate bird safe guidelines within the city's Building Code. The city has taken measures to include its bird-safe standards within the planning process - through the Toronto Green Standard as discussed in previous sections of this report - however, the inability to introduce such legislation within the Building Code has resulted in the continual development of non-bird-safe structures. Through enforcing bird-safe design within the Building Code, Toronto can ensure that the measures it takes to promote bird conservation is followed through from policy to development.

Design Scope

San Francisco's bird-safe standards outline two categories for which bird collisions are likely to occur. In Section 139 of the Planning Code, the city clearly distinguishes between differing design hazards - location and feature - and ensures treatment is respective to the threats they uniquely pose to bird-safety. The treatments for location hazards address facade, lighting, and wind generators, whereas for feature related hazards - which include free-standing glass walls, wind barriers, skywalks, balconies, and greenhouses on rooftops that have unbroken glazed segments 24 square feet and larger in size - it requires that 100% of the feature hazard be treated, but does not specify how or what treatment for such hazards are required.

Figure 74. American Goldfinch (Golden Spike Company, 2023)

The City of Toronto also specifies the design scope of its bird-friendly guidelines into 2 categories; Best Practices for Bird-Friendly Glass and Best Practices for Effective Lighting. Both reports outline bird-friendly practices to reduce the impacts of glass and lighting on bird collisions within the city. Best Practices for Bird-Friendly Glass address the building envelope, buildings adjacent to natural features, awnings and overhangs, exterior screens, grilles, shutters, and sunshades and provide design solutions such as creating visual markers, and facade treatments. Best Practices for Effective Lighting specifies light pollution as glare, light trespass, overlighting and sky glow, and outlines approaches to effective lighting as it pertains to low, mid, and high-rise residential, building, and commercial areas, as well as parks, natural heritage, and street lighting.

Despite both cities providing detailed design scopes for their bird-safe/friendly design guidelines, Toronto provides more treatment options but covers lighting and glass, whereas San Francisco deals with all building features that pose a risk to bird-safety. Treatment for all building related features ensures that all aspects of building design reinforce bird-safety, whereas in Toronto, treatment addresses lighting and glass of the overall structure. Toronto's design scope does however also apply to low-rise residential development that is abutting a ravine or natural area and contains more than 5 units.

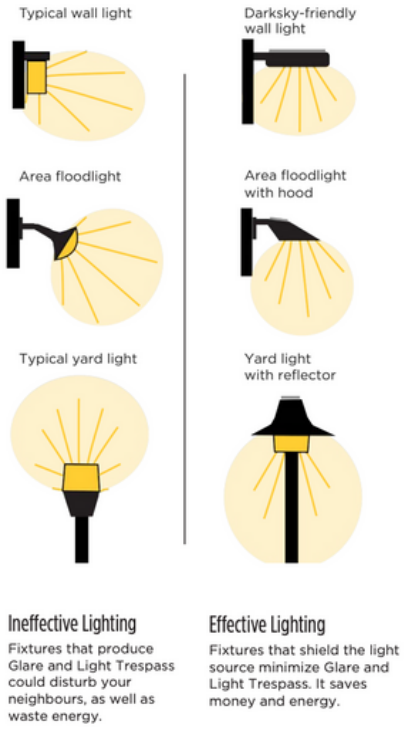


Figure 75. Effective v. Ineffective Lighting (City of Toronto, 2017)

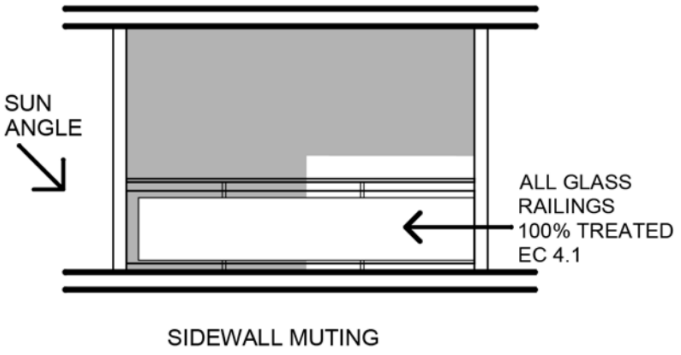


Figure 76. Balcony Treatment (City of Toronto, 2017)

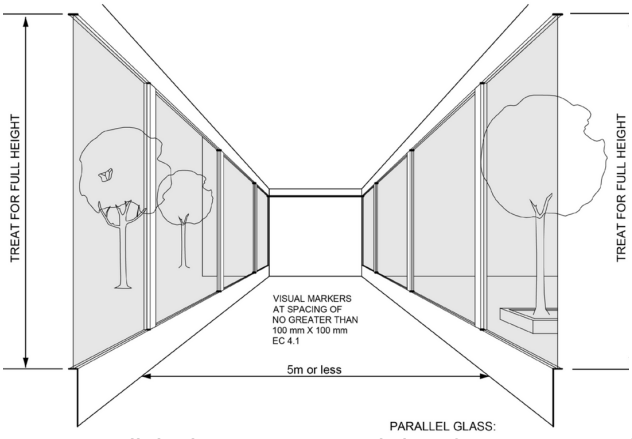


Figure 77. Parallel Glass Treatment (City of Toronto, 2017)

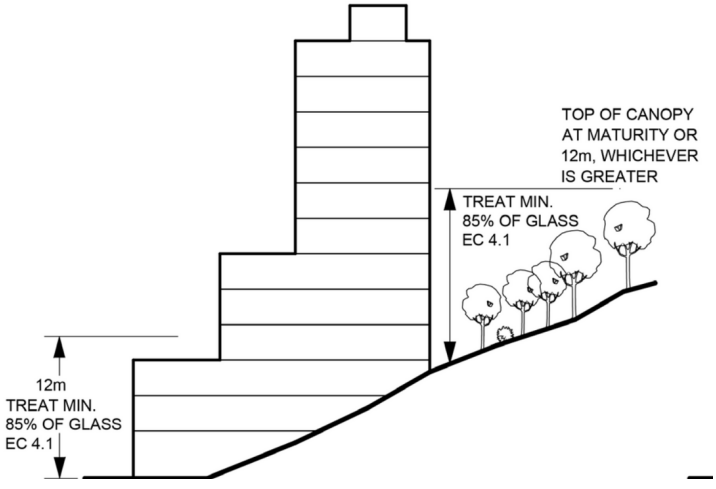


Figure 78. Treatment for Buildings Adjacent to Natural Features (City of Toronto, 2017)

Bird-Safe Vs Bird Friendly

Both San Francisco and Toronto have bird conservation policies in place, however the distinction between bird-friendly and bird-safe is an important one. San Francisco's Standards for Bird-Safe Building Design reinforces language that specifically denotes bird-safety as the primary concern. Through the term 'safety' rather than 'friendly', San Francisco ensures that policies, practices, and recommendations all fall within the category of life-safety, (implicating both mortality and injury) whereas 'friendly' implies that safety is not the priority. In the city of Toronto's Bird-Friendly Guidelines, the term friendly allows for recommendations that include bird conversation in mind but do not ensure safety directly. For example, the marketing of bird-safe decals, which scientific evidence shows are ineffective, are being classified as bird friendly.

Figure 79. Summer Tanager (iNaturalist, n.d.)

Bird-Safe Policy Updates

A key challenge that the city of San Francisco faces is its failure to update Section 139 of its Planning Code. Through diligent advocacy work by the Golden Gate Bird Alliance, a non-profit organization dedicated to protecting Bay Area birds, other wildlife, and their natural habitats, and the American Bird Conservancy's Bird Collisions Campaign, the two were able to implement the Standards for Bird-Safe Buildings into law in 2011 (American Bird Conservancy, 2011). Unfortunately, since 2011 the city of San Francisco has yet to update the standards to reflect more recent understandings of bird-safe design. Toronto, on the other hand, updated its guidelines in 2017, after first introducing them in 2007. Toronto's more recent update to its Bird-Friendly Guidelines demonstrates a renewed commitment to bird conservation, one that San Francisco has yet to demonstrate. Albeit a more recently updated bird-safe guidelines, Toronto still requires an update to its existing guidelines, which will be explored further in the following sections.

Figure 80. Golden Gate Bird Alliance Logo (Golden Gate Bird Alliance, n.d.)

Figure 81. American Bird Conservancy Logo (American Bird Conservancy, n.d.)

As this report seeks to update the City of Toronto's Bird Friendly Guidelines, it has examined the city of San Francisco as a leading exemplar of enforceable bird-safe design to inform necessary recommendations. As discussed, both San Francisco and Toronto have many key differences in their bird-safe practices, however the following opportunities focus on aspects where Toronto can improve its existing policy to ensure more comprehensive bird conservation practices.

Opportunities for the City of Toronto

No. 01 — Address Enforcement Gap

San Francisco's bird-safe standards are integrated within the planning code, therefore ensuring enforceability of their guidelines, a critical component missing in Toronto's guidelines. Therefore, an opportunity for the city may include implementing their bird-safe design standards within the Building Code. Although this recommendation pertains to the jurisdiction of the Province, it is encouraged that the city support this initiative to guarantee bird-safe design is ensured in all existing and new developments.

No. 02 — Expand Design Scope of Bird Friendly Guidelines

The City of Toronto's Bird Friendly Guidelines currently address glass and lighting related bird hazards, however, San Francisco also denotes location related hazards as equally important in impacting bird collisions. An opportunity for Toronto may include expanding its design scope to address all building feature and location related hazards that pose a risk to bird safety.

No. 03 — Adopt Bird Safe Language

San Francisco uses the term bird-safe rather than "friendly" within their guidelines, and this shift in language reinforces a rights based approach to bird safety. Moreover, as the industry shifts towards bird-safe rather than bird-friendly, Toronto should follow suit with updating the language used in their guidelines to prioritize safety as the primary commitment.

7.4 Case Studies Summary: Opportunities for the City of Toronto

Note: Information in Section 7.4 is taken directly from the guidelines of the respective jurisdiction, bolding indicates opportunities

Bird-Safe Building Design	City of Toronto	New York City	San Francisco	City of Ottawa
Visual Marker Guidelines				
Visual Marker Size & spacing	5mm diameter, 50 mm x 50 mm (city owned property) 5mm diameter, 100 mm x 100 mm (non-city owned property), must be applied to the first (exterior) surface	The 2 x 4 Rule (In accordance with state Building Code, Bird Friendly Design and Construction Requirements Guidance Document).	Vertical elements of the window patterns should be at least 1/4 inch wide at a maximum spacing of 4 inches, or have horizontal elements at least 1/8 inch wide at a maximum spacing of 2 inches	**Visual markers spaces at 50mm x 50mm and a marker of min, 4mm diameter for all buildings, applied to the first (exterior) surface**
Individual Markers Size & Spacing	N/A		N/A	**Individual marker elements 4mm, or 2mm wide by 8mm long for linear elements, must be applied to the first (exterior) surface**
Linear Design Size & Spacing	N/A		N/A	
Transparency and Reflection Guidelines				
Glazing Treatment	Treatment of 85% of glazing within the first 16m, solid back-painted frit or silicone backing opaque coating or reflective or low e-coating that has an outside reflectance of greater than 15% should be used in combination with other strategies	Apply treatment according to the Threat Factor. Options include frits, UV patterned glass, opaque, etched, stained, frosted glass, and window films	Bird-Safe Glazing Treatment is required such that the Bird Collision Zone consists of no more than 10% untreated glazing. 100% of building feature-related hazards shall be treated	**Treatment of 90% of glazing within the first 16m, Avoid monolithic, undistinguished expanses of glazing, Incorporate visual interest or differentiation of material, texture colour, opacity, or other features to fragment reflections**

Bird-Safe Building Design	City of Toronto	New York City	San Francisco	City of Ottawa
Buildings Adjacent Natural Features Guidelines				
Treatment	Treatment of glass to the first 16m of the building or top of the surrounding tree canopy at maturity, whichever is greater	The 2 x 4 Rule (In accordance with state Building Code, Bird Friendly Design and Construction Requirements Guidance Document).	Glazing treatments will be required for the façade(s) such that the amount of untreated glazing is reduced to less than 10% for the façade facing the landscaping, forest, meadow, grassland, wetland, or water	Adjacent glazing should also be treated to a height of 4 metres from the surface of the roof or terrace or the height of the adjacent mature vegetation, whichever is greater
Avoiding Design Traps Guidelines				
Glass Corners	5mm diameter, 100 mm x 100 mm	**Fly-through conditions located 75 feet (22 860 mm) or less above grade shall be constructed with bird friendly materials**	100% of building feature-related hazards (including potential bird traps) shall be treated	Treating glass corners within a 5-metre range in each direction
Glass Railings	5mm diameter, 100 mm x 100 mm	Building material to be in accordance with NYC Building Code, Bird Friendly Design and Construction Requirements Guidance Document.	100% of building feature-related hazards (including potential bird traps) shall be treated	Bird-safe glass on railings in order to prevent collisions with transparent barriers surrounding buildings
Vegetation & Landscape Design Guidelines				
Rooftop Treatment & Vegetation Near Buildings	Treatment of glazing to the first 4m above the feature and a buffer width of at least 2.5m on either side of the feature	The exterior wall envelope, and any associated openings, installed adjacent to a green roof system on the same building constructed with bird friendly materials up to 12 feet above the walking surface	**Structures that feature an above ground or rooftop vegetated area of two acres or greater in size require glazing treatment**	**Green roofs, rooftop gardens or terraces require glazing treatment to a height of 4 metres from the surface of the roof or terrace or the height of the adjacent mature vegetation, whichever is greater**

Bird-Safe Building Design	City of Toronto	New York City	San Francisco	City of Ottawa
Lighting Design				
Lighting Design	Tier 1 of the TGS: • Avoid directing light upward, as these impact migratory pathways • Reduce glare • Ensure the lighting being used has a necessary purpose, such as the provision of safety enhancement • Ensure lighting fixtures are Dark Sky Compliant	N/A in Local Law 15*	For structures with location related hazards, Minimal lighting shall be used. Lighting shall be shielded. No uplighting shall be used. be shielded. No uplighting shall be used	• Avoid up-lighting. • Specify Dark Sky compliant, full-cutoff exterior fixtures to reduce light trespass. • Use motion detectors and other automatic lighting controls to reduce or extinguish • non-essential lighting between 11 pm and 6 am. • Use minimum wattage fixtures to achieve appropriate lighting levels (note: minimum • Required lighting levels are established in the Ontario Building Code). • Minimize amount and visual impact of perimeter lighting. • Avoid use of floodlighting

8.0 GEOSPATIAL ANALYSIS

Based on information from the San Francisco Case Study, this section of the report will outline geospatial analysis using Global Bird Collision Mapper (GBCM) data and the City of Toronto vegetation data to identify a vegetation location-related hazard threshold within the City. Although GBCM data is volunteer data and does not cover the entire city, this analysis is intended to provide insight into opportunities for the City of Toronto to expand its design scope, noting that this dataset is biased towards patrolled areas. GBCM was used as it offers the largest amount of collision reporting for the City. This analysis uses 90 metres as the preferred distance to apply bird-safe treatment based on provisions outlined in San Francisco's Bird Safe Guidelines as a benchmark (San Francisco Planning Department, 2011). ***This is notwithstanding that the TGS already requires treatment for all new builds. The key here is to apply these findings to retrofits, and the main benefit of this metric is that it could offer insights into policy or even perhaps enforceable regulations that require window treatments within a given distance from beneficial vegetation.***

To examine the relationship between vegetation distance and the rate of bird collisions across the City, the first analysis used collision data reported between 1996 and October 2023. A subsequent analysis was conducted where the collision data only included those collisions for 2023 (See Appendix C). Kernel density was used to allow the collision point layer to be translated into a raster layer where higher counts produce higher density values. A full list of the geoprocessing tools is located in Appendix B.

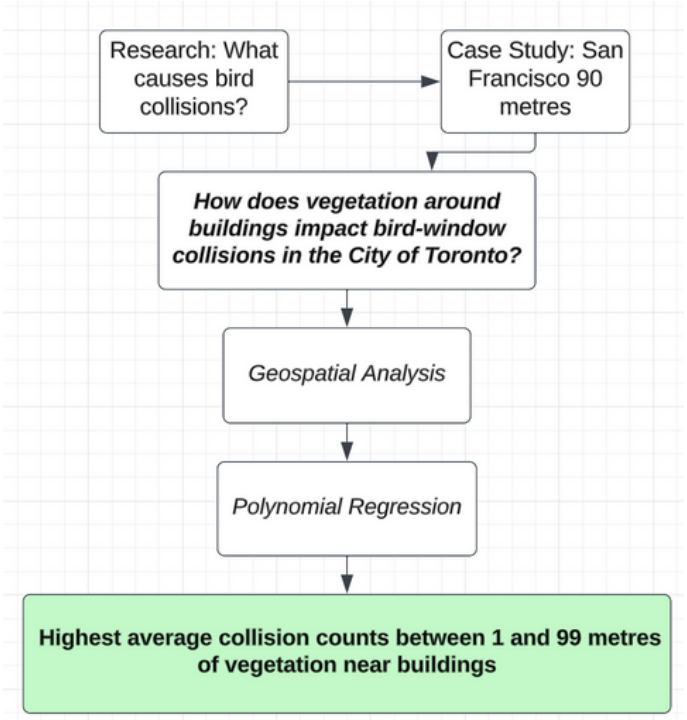


Figure 82. Geospatial Analysis Method (Bird-Safe City Team, 2023)

Note that the analysis' goal does not imply avoiding or cutting down vegetation near buildings, but rather recognizing where to apply bird-safe treatment adjacent to vegetated areas

Bird Collision Analysis

The first map (Figure 83) shows the hot spots and cold spots of bird collisions reported by GBCM volunteers between 1996 to 2023. As shown below, higher counts exist in the Yonge Street corridor, the Downtown Core, York University, and other centres in the city (Scarborough, North York). However, the density counts are not representative of what are the actual bird collisions in lower residential areas, as GBCM is biased towards patrolled areas. These areas include Etobicoke, Scarborough and Rexdale, and are currently shown as cold spots or missing data. Such an observation therefore requires further analysis where the second map showcases potential bird collisions.

The second map (Figure 84) was completed using existing building data with vegetation data from the City of Toronto's Open Data Portal. The vegetation layer was obtained by merging parks, natural areas, and ravines layers. The properties layer shows buildings located within 90 metres of the vegetation layer, where the resulting map shows a much larger coverage over the city. In contrast to the previous map, bird collisions can therefore be expected on all the dark blue areas of the map.

City of Toronto: Total Bird Collisions (1996 to 2023)

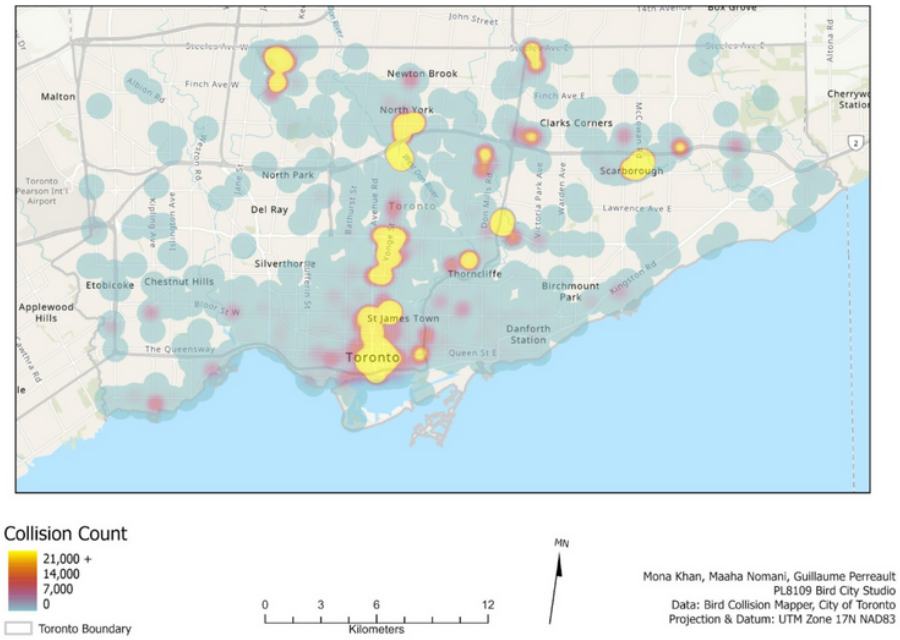


Figure 83. Density of reported bird collisions (patrolled areas) (Bird-Safe City Team, 2023)

City of Toronto: Potential Bird Collisions

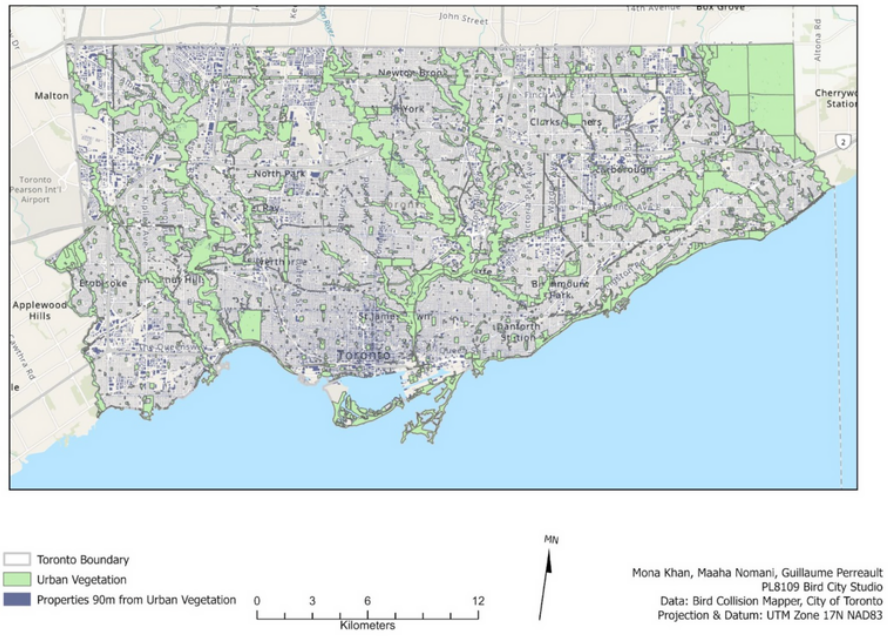


Figure 84. Identified properties located 90 metres from vegetation and natural features (Bird-Safe City Team, 2023)

City of Toronto Buildings: Collisions per Building

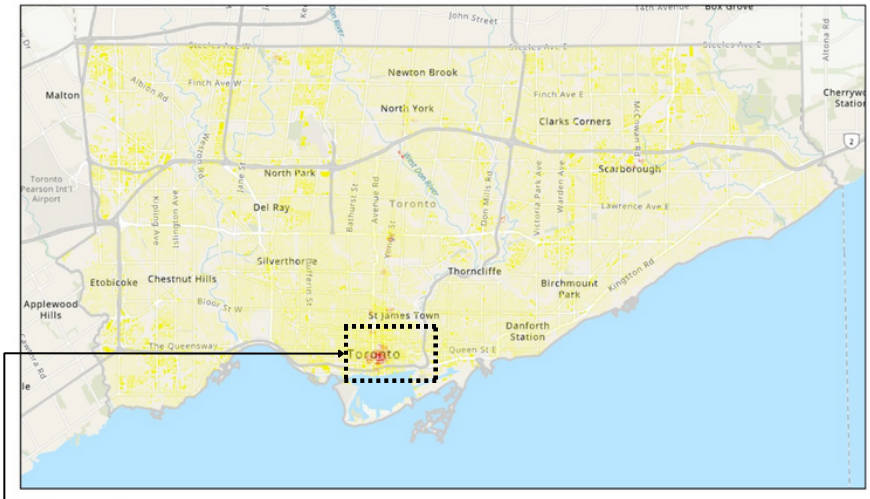


Figure 85. Count of bird collisions (patrolled areas) per building within 180 metres (Bird-Safe City Team, 2023)

City of Toronto Buildings: Collisions per Building Magnified

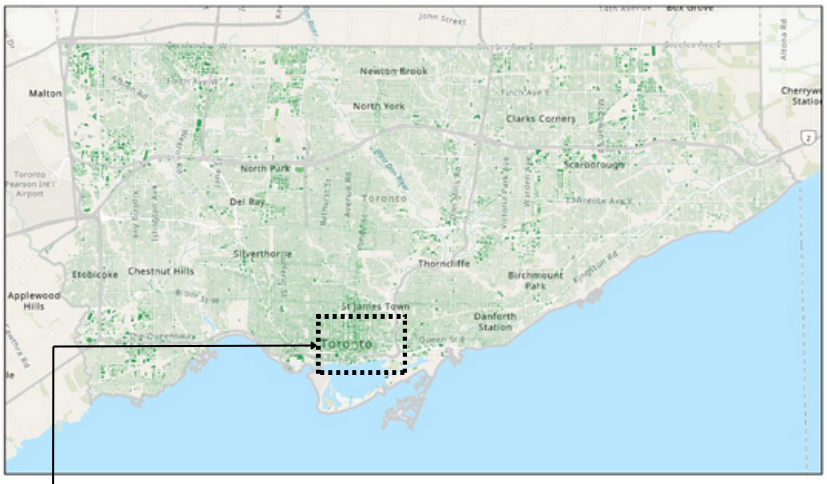
Figure 86: Count of bird collisions (patrolled areas) per building within 180 metres (Bird-Safe City Team, 2023)

The subsequent set of maps uses the buildings in the City of Toronto in relation to the vegetation and bird collisions reported by GBCM. The third and fourth maps (Figures 85 and 86) show the bird collision counts in relation to buildings at both the city level and downtown.

The third map identifies collision counts within 180 metres in relation to buildings. Similar to Figure 83, pockets of higher counts are located in buildings in the Downtown, Scarborough, Yonge Corridor, and York University.

Figure 86 is a magnified version of Figure 85, with collision counts within 180 metres in relation to buildings in the Downtown area. It shows the cluster of buildings in the financial district (south of City Hall and north of Union Station) to have the highest collision rates.

City of Toronto: Distance Between Buildings and Vegetation



This map identifies the distance in metres between the buildings and nearest vegetation. It supplements Figure 85 by showing how most buildings in the city are near vegetation, where the farthest clusters of buildings exist in Etobicoke, Rexdale, Scarborough and the Downtown Core.

Figure 87: Distance between buildings and vegetation in metres (Bird-Safe City Team, 2023)

City of Toronto: Distance between Buildings and Vegetation

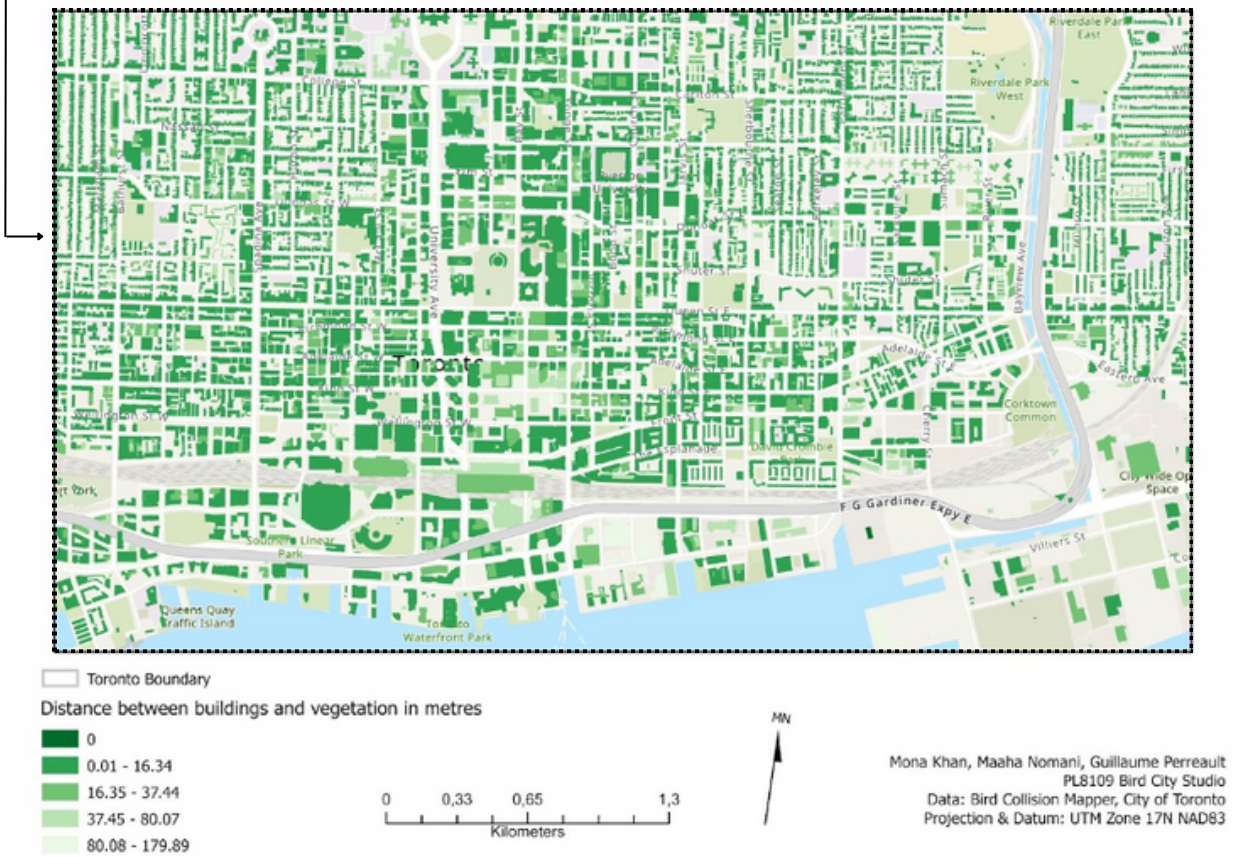


Figure 88: Distance between buildings and vegetation in metres (Bird-Safe City Team, 2023)

This map is a magnified version of Figure 87 with the distance in metres between the buildings and the nearest vegetation for Downtown. It shows how there is a mix of buildings that are near and far from vegetation, with larger distances along the eastern waterfront and surrounding Union Station.

Regression Analysis

Linear Regression

Linear regression was used to understand the relationship between vegetation and bird collisions to see how the number of collisions changed based on the distance between vegetation and buildings using the 90-metre benchmark. The analysis revealed a weak but positive relationship between the distance between vegetation and buildings and the collision count.

Polynomial Regression

We performed polynomial regression to the second degree as our dataset was not linear, giving us a distance on the regression line where we would expect the counts to drop off. The same variables from the linear regression analysis were used although the independent variable, distance between vegetation and buildings, was squared.

The polynomial regression analysis revealed a weak but positive relationship between the distance of vegetation and buildings and collision count, indicating that as distance increases, the potential for collision would decrease after reaching a drop-off distance. Results from this test were plotted with the regression line and the drop-off line. The results show that the drop-off line is located at 99.9 metres, therefore only 9 metres off from our benchmark distance to apply bird-safe solutions. This distance therefore indicates that, for our volunteer dataset, the buildings in Toronto have the highest average collision counts between 1 and 99 metres, where collision counts drop off closer to 1 per building for the remainder of the dataset. See Appendix B for more information regarding the statistical analyses.

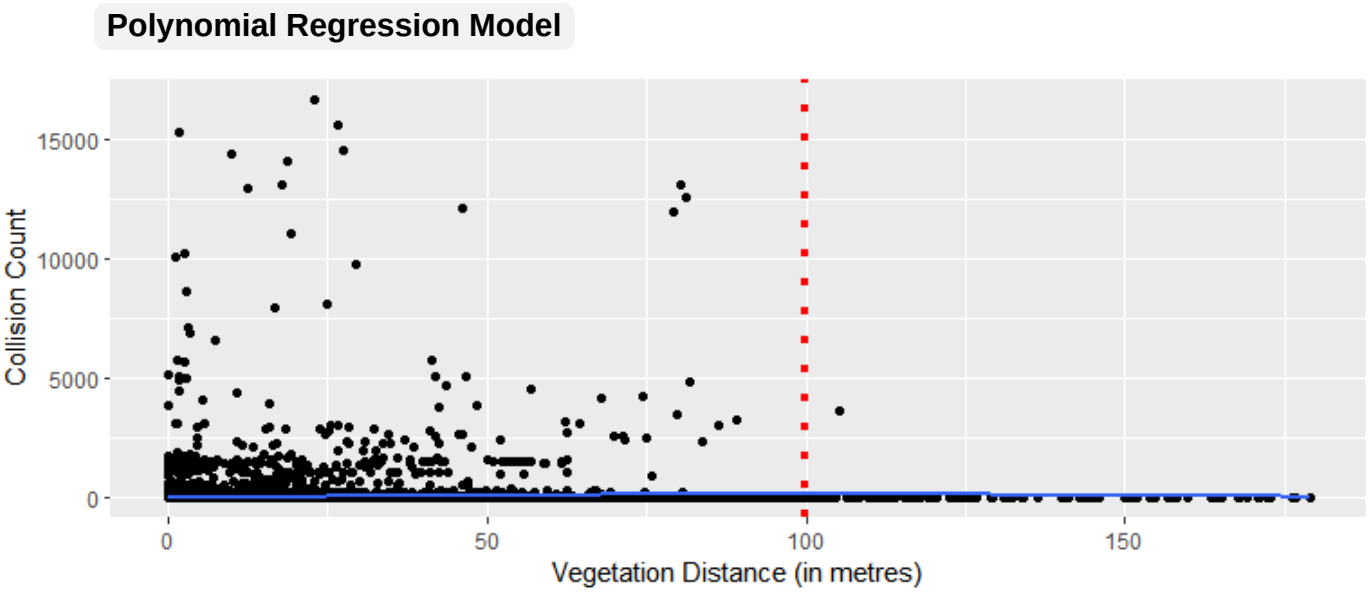


Figure 89: Polynomial Regression Plot (Bird-Safe City Team, 2023)

The results from the regression analysis can therefore be used to inform our recommendations for both retrofits and new builds, where we were able to successfully test the 90 metres that was used as the preferred distance based on provisions outlined in San Francisco's Bird Safe Guidelines that denoted 90 metres between building and vegetation as a criteria for required treatment.

9.0 RECOMMENDATIONS

In 2007, the City of Toronto introduced the original Bird-Friendly Development Guidelines which offered a comprehensive list of strategies to make new and existing buildings less dangerous to migratory birds. These guidelines were developed with the support and participation of architects, development corporations, property management corporations, bird advocacy groups and City staff (City of Toronto, 2023). Since 2007, these guidelines have informed similar bird-friendly policies and documents for several cities across North America demonstrating Toronto's leadership in bird safety.

Up to date, the City of Toronto has produced two documents that support the application of the Toronto Green Standard (TGS) "Bird Collision Deterrence" and "Light Pollution" performance measures, both of which are required as part of Tier 1 of the TGS (City of Toronto, 2023). These documents, produced in 2017, supplement the original Bird-Friendly Development Guidelines by building and expanding on the City's original work to reflect strategies and technologies that have changed. These two documents supersede the information found in the original guidelines.

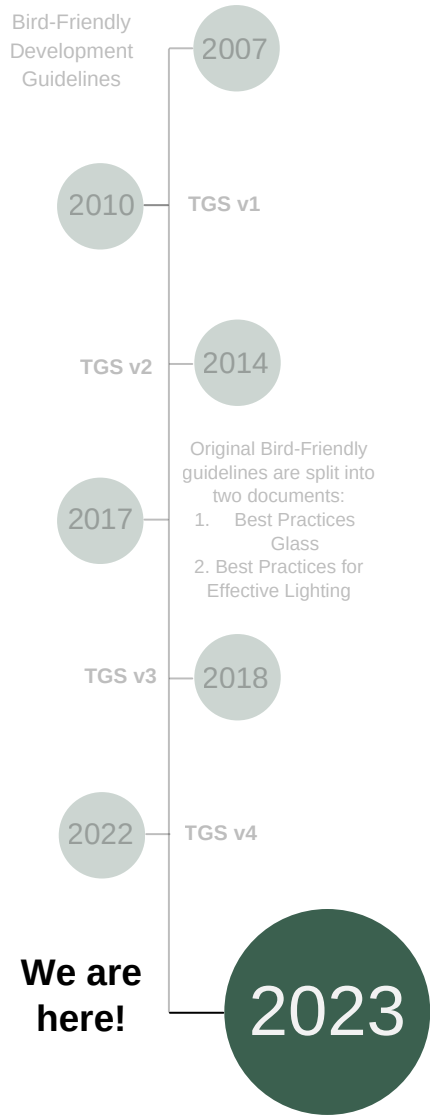


Figure 90: TGS and Toronto Bird-Friendly Standards Timeline, (Bird-Safe City Team, 2023)

In 2023, it is now recommended that the City update its bird-friendly guidelines to support a more thorough and current understanding of bird safety that accurately reflects the changes in strategies and knowledge on bird conservation practices. Toronto must leverage this new research to ensure that the City's Bird-Friendly Design Guidelines are current and effective in addressing existing and anticipated concerns about protecting the loss of bird life. Moreover, the following recommendations seek to address gaps within Toronto's existing bird-friendly practices to meet national and global standards so that the City can demonstrate a renewed commitment to bird conservation and reinforce its position as a leader in this key environmental policy area.

Recommended Updates: Toronto Bird-Friendly Guidelines

The following recommendations outline aspects where Toronto can improve its existing policy, whilst also encouraging larger policy objectives outside the scope of the City to encourage a broader approach and understanding of bird-safe design. These recommendations were developed and informed by the team's analysis on the existing state of bird safety and biodiversity protection within the City of Toronto, followed by a thorough literature review, a policy scan, and case studies on bird friendly practices both locally and across other jurisdictions. The research conducted, outlined in the methods section of this report, drew out clear findings regarding Toronto's existing Bird-Friendly Guidelines and how they can be improved.

1

Address Enforcement Gap

1. To ensure bird-safe design is enforced within the City of Toronto, it is recommended that the city work towards implementing bird-safe guidelines within the Building Code. Although this recommendation pertains to the jurisdiction of the Province, it is recommended that the city itself adopt the CSA standards so as to allow for a unified national approach to bird conservation.
2. As outlined in this report, the lack of enforceable bird-safe practices pose the greatest risk in achieving effective bird-safe design, therefore, it is highly encouraged that the city supports initiatives that seek to implement bird safe practices within larger overarching policy documents and codes.

2

Adopt CSA Standard

1. The adoption of the *CSA A460:19 Bird-friendly building design* standard (CSA Group, 2019) in Toronto's Bird-Friendly Guidelines to promote a national unified bird-safe standard within Canada.
2. As this report highlights, many industry leaders, including the federal, provincial, and municipal governments, rely on CSA Group standards and codes to improve safety and efficiency, which has in turn, pushed many manufacturing and business leaders to have their products tested by the CSA Group to be able to place the CSA Group mark or certification on their products to gain a competitive advantage within their industry (CSA Group, 2021*a*).
    a. Having products tested by the CSA Group would help to ensure that the products adhere to the *CSA A460:19 Bird-friendly building design* standard (CSA Group, 2019).
    b. Municipalities may choose to encourage developers and other professionals to use products that meet the CSA Group criteria to guarantee that they are bird-friendly.

3

Expand Design Scope

1. The City of Toronto's Bird-Friendly Guidelines currently address glass and lighting related bird hazards, and this report recommends the City expand its scope to address all building feature related hazards that pose a risk to bird safety.
2. In proviso (see c. below): As the geospatial analysis provided in this report highlights that a 99 metre distance between buildings and vegetation increases the risk of bird collisions, therefore, the design scope of the new Bird-Friendly Guidelines, should specify the location of vegetation within 99 metres of a building as a potential location related hazard. This does not advocate for the avoidance or cutting down of vegetation, rather to denote the presence of vegetation in the identified zone. It would also apply to both retrofits and new builds. To note that the analysis was done using collision counts from 1996 to 2023.
    a. The buildings in Toronto have the highest average collision counts are between 1 and 99 metres, where collision counts drop off closer to 1 per building for the remainder of the dataset.
    b. The second analysis done in this report used collision data for the year 2023, where it was found that buildings in Toronto have the highest average collision counts between 1 and 78 metres.
    c. Further research and analysis outside of the scope of this report is encouraged in order to reaffirm the validity of San Francisco's Standard for Bird-Safe Buildings criteria of 90 metres and the full acceptance of this recommendation.
3. Increase density of visual markers
    a. Best Practices for Glass currently suggest that visual markers are to be 50 x 50 mm on municipal buildings and a 100 x 100 mm pattern must be designed to meet the following criteria under TGS Tier 1. Numerous studies indicate that the most effective pattern to mitigate window-collisions is a 50 x 100 mm (2 x 4 inches) (Brown et al., 2021)

4

Combine Best Practices for Glass and Lighting Solutions

1. The City provides two comprehensive documents detailing best practices for glass and light, however, this report finds that a unified document - Best Practices for Bird-Safe Design - may be better suited to support a more holistic approach towards bird safety.

5 Adopt Bird Safe Language

1. As the industry shifts towards bird-safe rather than bird-friendly, and as observed within both Ottawa and San Francisco, Toronto should follow suit with updating the language used in their guidelines to prioritize safety as the primary commitment.
    a. In the City of Toronto's Bird-Friendly Guidelines, the term friendly allows for recommendations that include bird conversation in mind but do not ensure safety directly. For example, the marketing of bird-safe decals, which scientific evidence shows are ineffective, are being classified as bird-friendly.
2. Adopting "safe" rather than "friendly" language further supports a rights based approach that denotes birds as equal to humans, with the right to be protected from harm.
    a. Language can be a critical - and often overlooked - characteristic that shifts perception and influences how we engage with the species around us. Moreover, literature on the use of the term "friendly" as it pertains to other groups highlights its role in reinforcing paternalistic dynamics and structures of exclusion (Swaffer, 2014).

6 Biodiversity Protection as a Critical Component to Sustainability Planning

1. Current language regarding sustainable planning practices prioritize energy based programs. The City should work towards shifting the scope of sustainable planning to also include biodiversity protection.
2. The City may seek to do so through examining existing incentive and energy based programs such as Energy Efficiency Incentives for Homeowners or Better Buildings Partnership that encourage sustainable practices, to also include incentives for bird-safe retrofits.
    a. Better Buildings Partnership has several initiatives available under its green eco roof program, however, upon review it does not specify the interaction of wildlife on these green roofs (City of Toronto, 2023). The city may take this as an opportunity to provide a cash in lieu so that green standards also require bird-friendly treatment beside green roofs, which this report highlights as a factor that increases bird collision.

7 Bird Safe Standards Consistent Throughout all TGS Tiers

1. Current bird-safe standards are required as part of Tier 1 of the TGS and apply most extensively to mid to high rise developments, however as outlined in this report, bird safety is also equally compromised within low rise residential developments, which only require bird-friendly glazing. Therefore, it is recommended that the City update and strengthen TGS Tier 1 requirements for low rise residential so as to reflect the same conditions for mid to high rise developments.

8 Update TGS Language

1. The TGS version 4 is missing language defining lines as patterns. The TGS should include two different requirements, one for dots and another for linear requirements.

9 Bird Safe Awareness within Planning Urban Design Department

1. Knowledge and awareness is critical in ensuring that bird safety is enforced within the planning process. Planners are principal actors within the site plan process, and as inspectors of compliance the City should ensure that all staff members are informed on bird-safe standards and practices for new developments.
    a. Training/Information sessions for planners on new version of Bird-Safe Guidelines
    b. Distribution of Toolkit for Planners
    c. Annual review/report on bird safe activities and status of Toronto

10

Alignment and Accessibility of Information

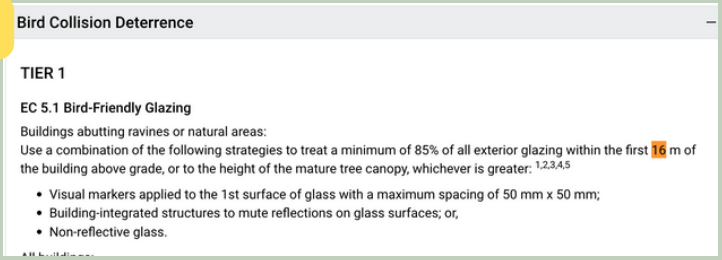
Address discrepancies between existing guidelines, TGS requirements and City of Toronto Ecology and Biodiversity webpage specifications

- It is recommended that the City develop a system to ensure all data points are succinct to improve implementation and enforcement of accessible bird-safe design measurement requirements.

*Example of discrepancies (Bird-Friendly Glazing), 1 - the webpage indicates 85% at 16m, whereas the TGS specifies 85% at 12m, 2- for visual markers the TGS/guidelines recommend 5mm, whereas the webpage specifies 6mm:

- Webpage: https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-4/low-rise-residential-version-4/ecology-biodiversity/

1



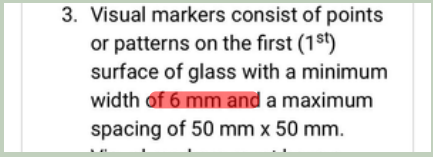
Bird Collision Deterrence

TIER 1

EC 5.1 Bird-Friendly Glazing

Buildings abutting ravines or natural areas:
Use a combination of the following strategies to treat a minimum of 85% of all exterior glazing within the first 16 m of the building above grade, or to the height of the mature tree canopy, whichever is greater: [1,2,3,4,5]

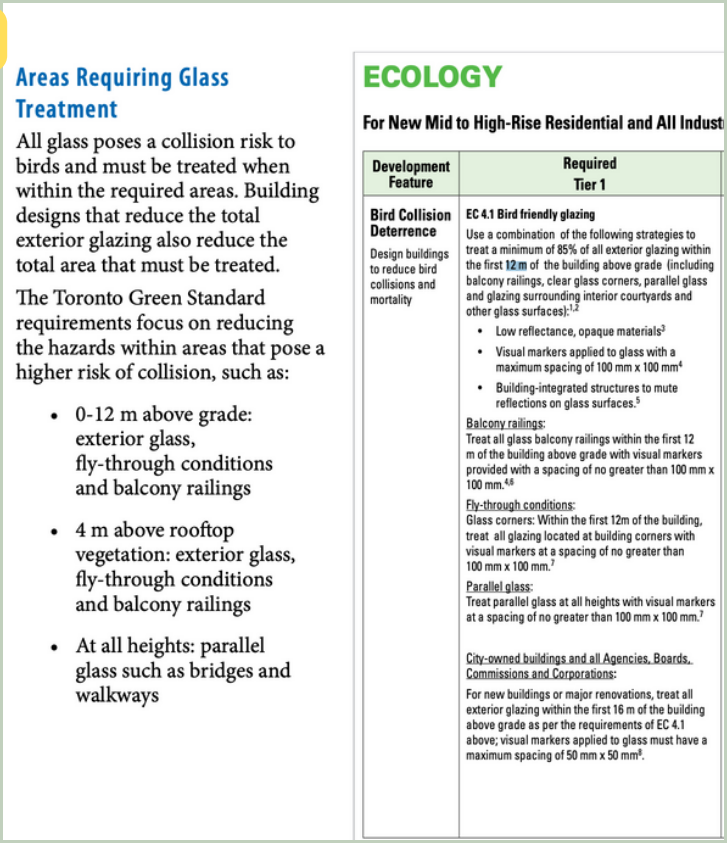
- Visual markers applied to the 1st surface of glass with a maximum spacing of 50 mm x 50 mm;
- Building-integrated structures to mute reflections on glass surfaces; or,
- Non-reflective glass.



3. Visual markers consist of points or patterns on the first (1st) surface of glass with a minimum width of 6 mm and a maximum spacing of 50 mm x 50 mm.

- Bird-Friendly Best Practices Glass (2017) pp. 27, 35: https://www.toronto.ca/wp-content/uploads/2017/08/8d1c-Bird-Friendly-Best-Practices-Glass.pdf

2



Areas Requiring Glass Treatment

All glass poses a collision risk to birds and must be treated when within the required areas. Building designs that reduce the total exterior glazing also reduce the total area that must be treated.

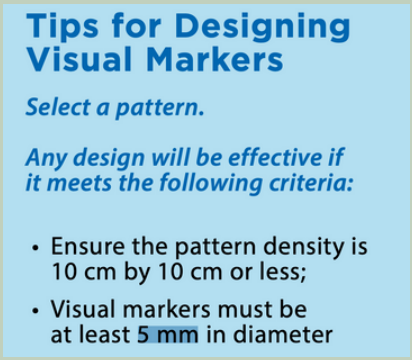
The Toronto Green Standard requirements focus on reducing the hazards within areas that pose a higher risk of collision, such as:

- 0-12 m above grade: exterior glass, fly-through conditions and balcony railings
- 4 m above rooftop vegetation: exterior glass, fly-through conditions and balcony railings
- At all heights: parallel glass such as bridges and walkways

ECOLOGY

For New Mid to High-Rise Residential and All Indust

Development Feature	Required Tier 1
Bird Collision Deterrence Design buildings to reduce bird collisions and mortality	**EC 4.1 Bird friendly glazing** Use a combination of the following strategies to treat a minimum of 85% of all exterior glazing within the first 12 m of the building above grade (including balcony railings, clear glass corners, parallel glass and glazing surrounding interior courtyards and other glass surfaces):[1,2] • Low reflectance, opaque materials[3] • Visual markers applied to glass with a maximum spacing of 100 mm x 100 mm[4] • Building-integrated structures to mute reflections on glass surfaces.[5] Balcony railings: Treat all glass balcony railings within the first 12 m of the building above grade with visual markers provided with a spacing of no greater than 100 mm x 100 mm.[4,6] Fly-through conditions: Glass corners: Within the first 12m of the building, treat all glazing located at building corners with visual markers at a spacing of no greater than 100 mm x 100 mm.[7] Parallel glass: Treat parallel glass at all heights with visual markers at a spacing of no greater than 100 mm x 100 mm.[7] City-owned buildings and all Agencies, Boards, Commissions and Corporations: For new buildings or major renovations, treat all exterior glazing within the first 16 m of the building above grade as per the requirements of EC 4.1 above; visual markers applied to glass must have a maximum spacing of 50 mm x 50 mm[8].



Tips for Designing Visual Markers

Select a pattern.

Any design will be effective if it meets the following criteria:

- Ensure the pattern density is 10 cm by 10 cm or less;
- Visual markers must be at least 5 mm in diameter

11

Intergovernmental & Interdisciplinary Bird-Safe Network of Communication

1. Updated and consistent knowledge and communication regarding new science, policies, and best practices on bird-safe design may provide benefits for municipalities and practitioners to discuss and learn.
    a. It is recommended that the city engage with municipalities outside their jurisdiction and with external networks, advocacy groups, institutions, and disciplines to advance and engage bird-safe practices.
        i. Examples include Information sessions at;
            1. OPPI (Ontario Professional Planners Institute)
            2. Biophilic Cities Network
        ii. Bird-Safe information sessions/classes/programs for practitioners at university institutions for Planning, Architecture, and Urban Design departments.
        iii. Intergovernmental communication between Canadian Municipalities (Toronto, Ottawa, etc.) who have existing bird-safe guidelines or are seeking to integrate bird-safe standards within their jurisdictions to discuss best practices and policy gaps.
        iv. The City of Toronto and professional associations and allied design disciplines should engage in regular consultation and dialogue to provide feedback on the feasibility, enforcement and costs of bird-safe guidelines.

10.0 NEXT STEPS

Next Steps: Integrating Recommendations in Toronto's Bird-Friendly Guidelines

The following section outlines how recommendations may be integrated within Toronto's Best Practices for Bird-Friendly Glass.

Example 1 : Integrating CSA to Bird-Friendly Glazing

This is how the revised Toronto's Bird-Safe Guidelines might look by adopting CSA Standards.

The original Best Practices for Bird-Friendly Glass recommends a strategy to treat a minimum of 85% of all exterior glazing within the 12 m of the above grade. The adoption of the CSA would mandate treatment to a minimum of 90% of all glazing material to be treated, regardless of height.

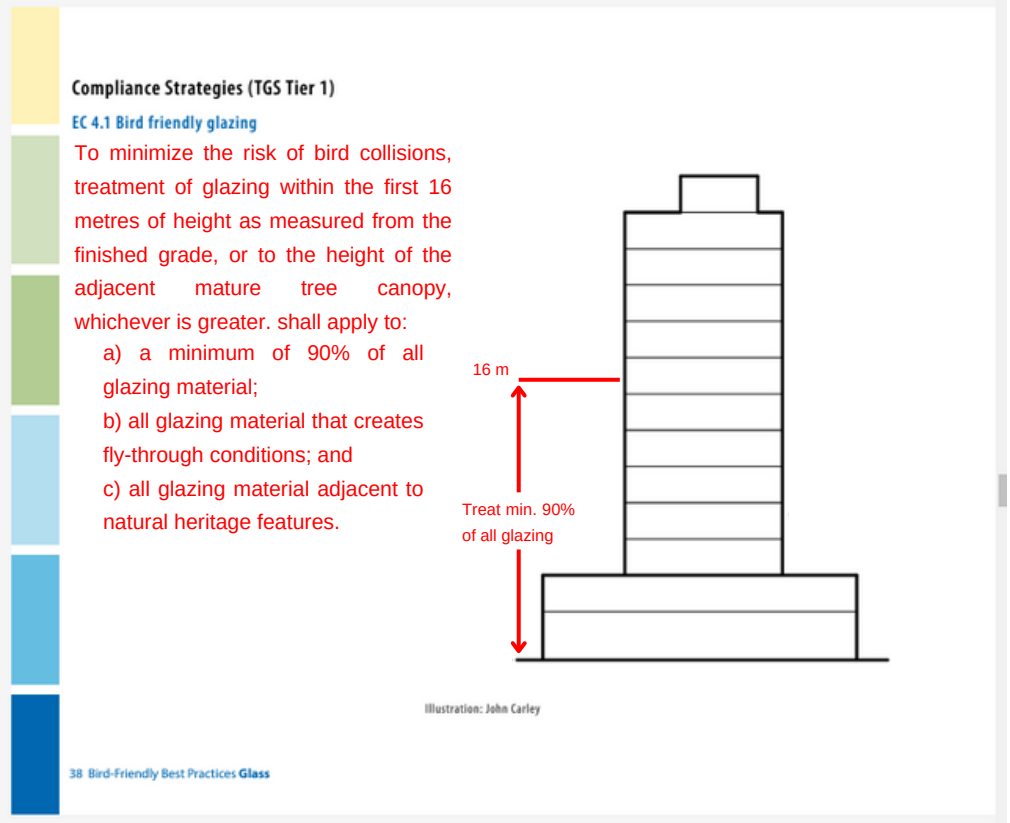


Figure 91: Annotated Toronto Bird-Friendly Standards Timeline, (Bird-Safe City Team, 2023)

Example 2 : Integrating CSA to Visual Marker Requirements

Currently, the existing Toronto's Best Practices for Bird-Friendly Glass requirements for visual markers is a minimum diameter of 5 mm for individual elements with a density pattern of 50 x 50 mm for municipal buildings and 100 x 100 mm for all other buildings. According to the CSA, a minimum diameter of 4 mm and a density no more than 50mm between and must be in high contrast to the glazing material on which they are present, This has been proven to be more effective in deterring window-collisions.

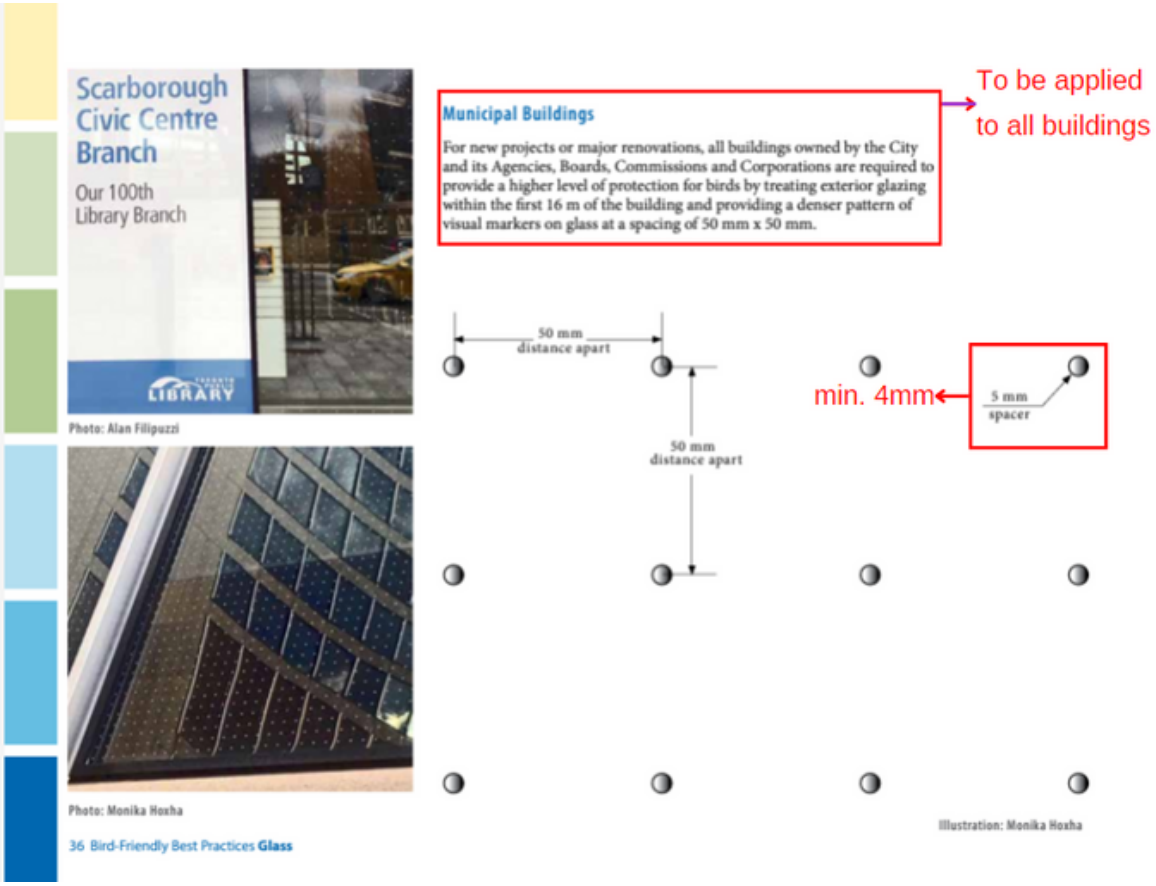


Figure 93: Annotated Toronto Bird-Friendly Standards Timeline, (Bird-Safe City Team, 2023)

The following visual marker requirement suggested in the the existing Toronto's Best Practices for Bird-Friendly Glass must be removed from the guidelines as there are numerous studies, including the CSA, that indicate a density of 100m between visual markers is not effective.

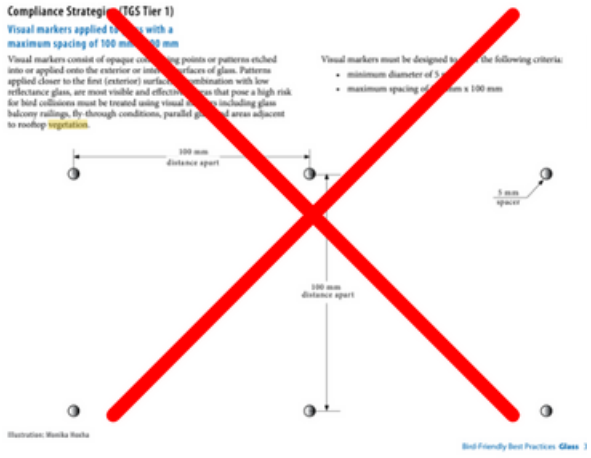


Figure 94: Annotated Toronto Bird-Friendly Standards Timeline, (Bird-Safe City Team, 2023)

Example 3 : Integrating CSA & Geospatial Analysis Findings

The existing Best Practices for Bird-Friendly Glass recognizes that vegetation around buildings will bring more birds into the vicinity. In addition to the recommended treatment to a minimum of 90% of all glazing material, as well as the findings from the geospatial analysis, we propose extending the recommendation to include the treatment of buildings within 99 metres of vegetation, regardless of whether they have vegetation on their property.

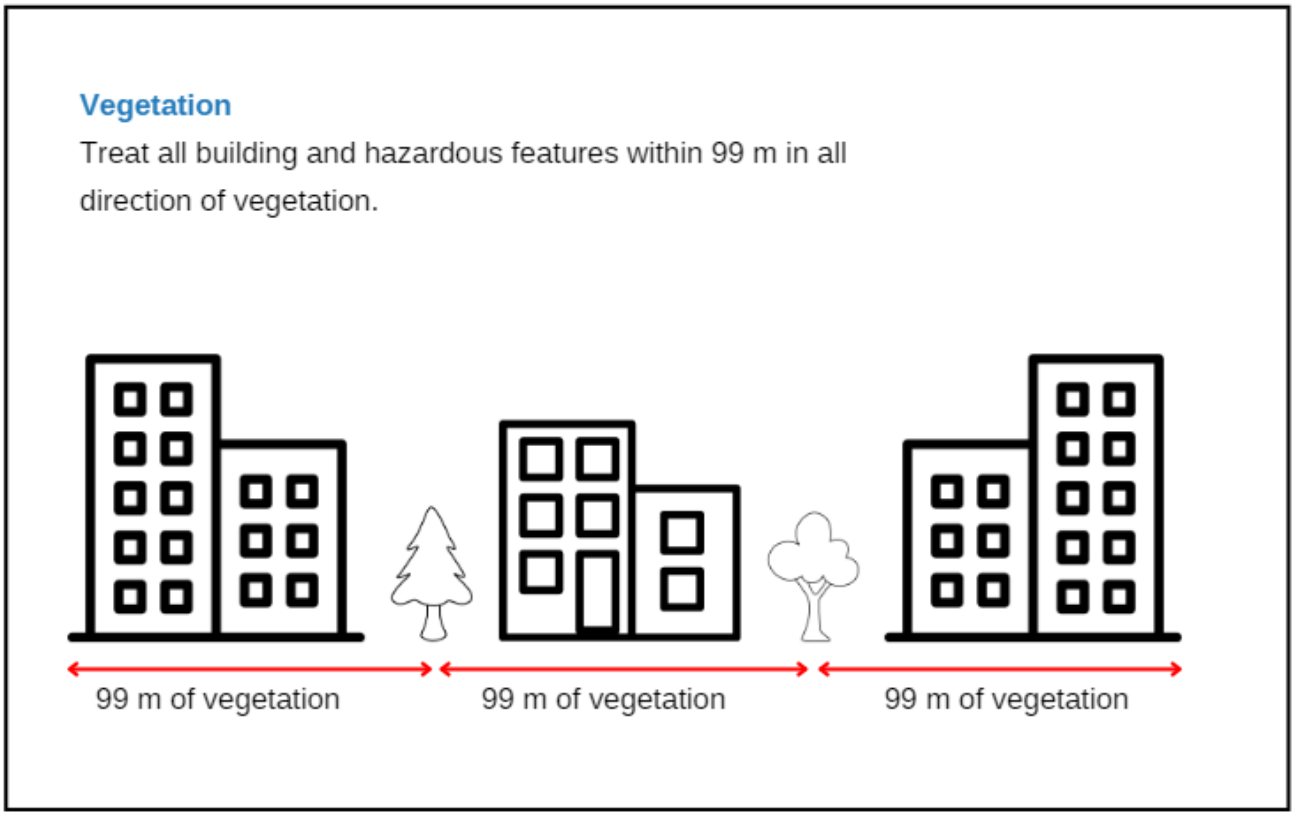


Figure 95: Annotated Toronto Bird-Friendly Standards Timeline, (Bird-Safe City Team, 2023)

As previously mentioned, vegetation in close proximity to buildings poses a liability for increased bird-window collisions. The results from the regression analysis and the case studies indicate that treated windows within 90 meters of both new buildings and retrofits significantly reduce the number of bird-window collisions.

The recommendation stipulates that all buildings, whether new or retrofit, must be treated within 90 meters of vegetation.

11.0 FUTURE RESEARCH

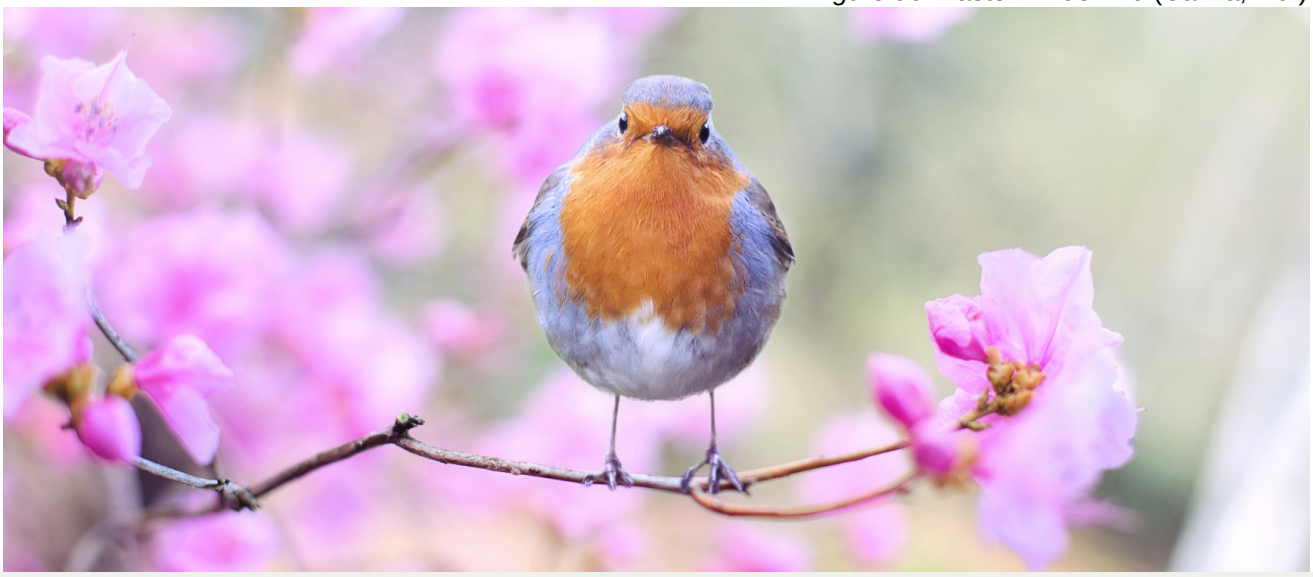
The opportunities to advance bird-safe building design are available to us. Advocacy groups, scientists, environmentalists, and planners understand that more protections are needed to keep birds safe from preventable deaths caused by our built environment. The City of Toronto was a leader in implementing the bird-friendly design guidelines in 2007, and now, the City has an opportunity to make additional changes that are required to continue protecting our feathered friends.

Although this project highlights several recommendations to advance bird-safe building design, further steps need to be taken. Educational initiatives and research regarding bird collisions with respect to low-rise development and single-family detached homes, also need to be made a priority. Reports suggest that “only 1% of collisions occur at high-rise buildings; most collisions occur at low-rise buildings” (Environment and Natural Resources Canada, 2023; see also Loss, 2014, as cited in Barges & Morris, 2023). As such, there is an opportunity for the City of Toronto to initiate steps needed to ensure low-rise building developers and owners, as well as residents of single-family homes, adopt bird-safe building design.

Additionally, the Bird-Safe Design Toolkit was created to provide practitioners with key information based on the findings from the research team on the implementation of bird-safe design. Developing toolkits geared toward different stakeholders, including architects, landscape architects, homeowners, and building suppliers would help to raise awareness and encourage others to implement bird-safe building design.

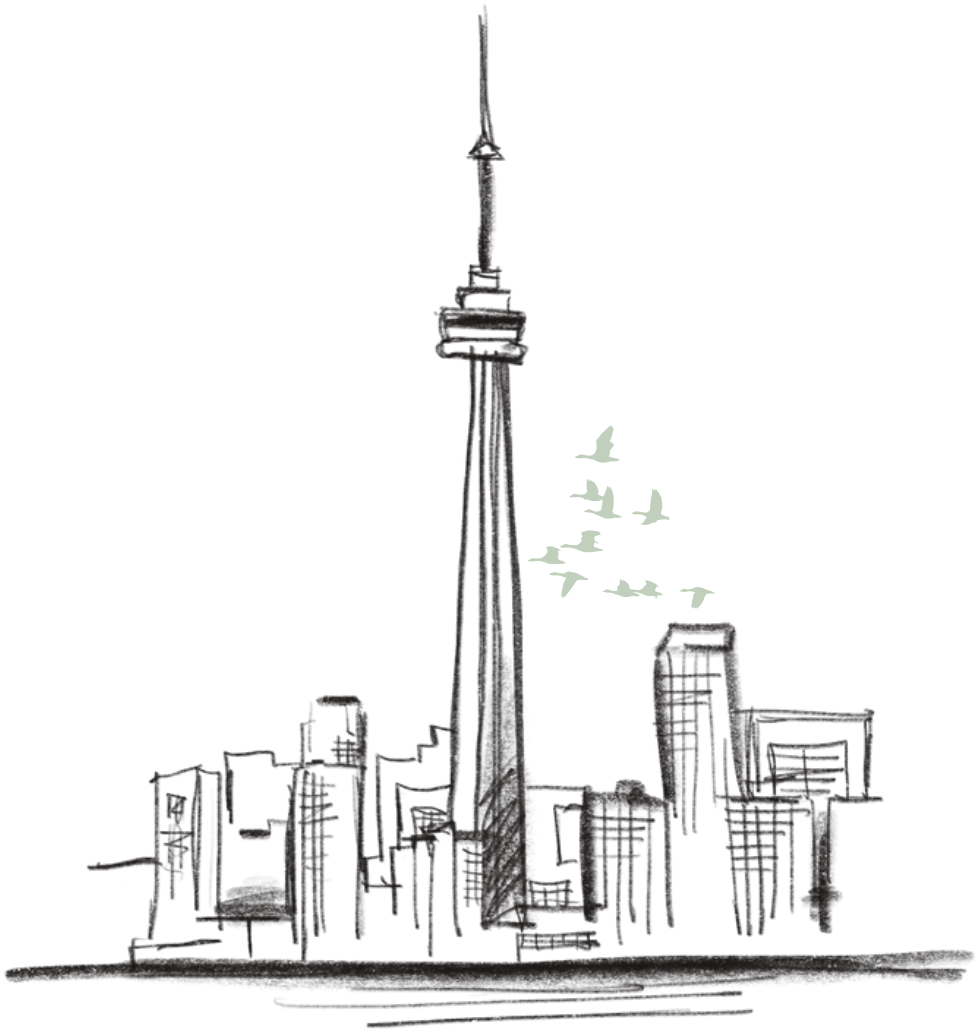
Fostering healthy, safe, and inclusive communities means that we must develop new methods to enhance both the built form and natural environments. Through education and engagement, we can support all who inhabit our world.

Figure 96. Eastern Blue Bird (Canva, n.d.)



12.0 CONCLUSION

This report aims to expand and enhance Toronto's bird-safe policies. By aligning with other tools for climate resilience, urban nature enhancement, and urban biodiversity protection, Toronto can strengthen its approach to supporting bird-safe design and planning. The ultimate goal is to support urban habitats and promote safe passage for birds through the use of policy, regulation, and design. As a global member in the Biophilic Cities Network, Toronto is committed to promoting urban biodiversity and making bird-safe design an essential component of the City's overall strategy.



13.0 REFERENCES

American Legal Publishing. (April, 2013). SEC. 139. STANDARDS FOR BIRD-SAFE BUILDINGS.https://codelibrary.amlegal.com/codes/san_francisco/latest/sf_planning/0-0-0-18643

American Bird Conservancy. (2011). IV. San Francisco's Bird-Safe Requirements. https://abcbirds.org/wp-content/uploads/2020/11/San-Francisco.pdf

American Bird Conservancy. (2011). San Francisco Mayor Approves New Standards

American Bird Conservancy. (2023). Threat Factor Table & Supporting Materials for NYC's Local Law 15. American Bird Conservancy. https://abcbirds.org/glass-collisions/nyc-threat-factor

American Goldfinch, (2023). *Golden Spike Company.* https://goldenspikecompany.com/yellow-birds-canada/

Aragón-Correa, J. A., Marcus, A. A., & Vogel, D. (2020). The effects of mandatory and voluntary regulatory pressures on firms' environmental strategies: a review and recommendations for future research. *The Academy of Management Annals, 14*(1), 339–365. https://doi.org/10.5465/annals.2018.0014

Barges, M. & Morris, V. (2023, August). *Building Safer Cities for Birds – How Cities Are Leading the Way on Bird-Friendly Building Policy*. Yale Bird-Friendly Building Initiative. https://law.yale.edu/sites/default/files/documents/pdf/building_safer_cities_for_birds.pdf

Beilke, S. (2023, October 17). Mass Collision of Birds in Chicago Reminds Us of the Important Steps We Can Take to Protect Migrating Species. Audubon Great Lakes. https://gl.audubon.org/news/mass-collision-birds-chicago-reminds-us-important-steps-we-can-take-protect-migrating-species

Bill 145, *An Act to amend the Building Code Act, 1992, with respect to bird-safe windows*, 1st Sess, 43rd Leg, Ontario, 2023 (First Reading Ordered for Second Reading 31 October 2023). https://www.ola.org/en/legislative-business/bills/parliament-43/session-1/bill-145/debates

Bird-Safe Buildings. https://abcbirds.org/news/san-francisco-mayor-approves-new-standards-for-bird-safe-buildings/.

Bird-Friendly Building Design | NYC Audubon. (2023). Nycaudubon.com. https://www.nycaudubon.org/our-work/conservation/project-safe-flight/bird-friendly-building-design#:~:text=1482%2FLocal%20Law%2015%20requires

Biophilic Cities. (2023). Partner cities. https://www.biophiliccities.org/partner-cities

Boma Best Sustainable. BOMA BEST - English. (2023, April 18). https://bomabest.org/boma-best-sustainable/

Bright Vest Africa (n.d.) Understanding Light Pollution. Retrieved from: https://www.brightvestafrica.com/news/Light_Pollution.pdf

Britneff, B. (2019, October 28). What Ottawa nature spots need protecting? Nature Conservancy wants input for top 10 list - Ottawa | Globalnews.ca. Global News. https://globalnews.ca/news/6091535/ottawa-nature-spots/

Brown, B. B., Hunter, L., & Santos, S. (2020). Bird-window collisions: Different fall and winter risk and protective factors. PeerJ, 8, e9401. https://doi.org/10.7717/peerj.9401

Brown, B. B., Santos, S., & Ocampo-Peñuela, N. (2021). Bird-window collisions: Mitigation efficacy and risk factors across two years. PeerJ, 9, e11867. https://doi.org/10.7717/peerj.11867

Building Code Act, 1992, S.O. 1992, c. 23. https://www.ontario.ca/laws/statute/92b23

Canadian Commission on Building and Fire Codes. (2022, March 28). *National Building Code of Canada 2020*. Government of Canada, National Research Council of Canada. https://doi.org/10.4224/w324-hv93

Canadian Environmental Protection Act, 1999, S.C. 1999, c. 33. https://laws-lois.justice.gc.ca/eng/acts/c-15.31/

Canadian Institute of Planners. (2023). About Us. Retrieved from: https://www.cip-icu.ca/About/About-Us

City of Ottawa. (2022, December). Bird-Safe Design Guidelines. https://documents.ottawa.ca/sites/documents/files/birdsafedesign_guidelines_en.pdf

City of Ottawa (2020). Bird-Safe Design Guidelines DRAFT -May 2020. Retrieved from https://documents.ottawa.ca/sites/documents/files/birdsafe_designguidelines_en.pdf

City of Toronto Act, 2006, S.O. 2006, c. 11, Sched. A. https://www.ontario.ca/laws/statute/06c11#BK140

City of Toronto. (2023b, November 22). *Better Buildings Partnership*. City of Toronto. https://www.toronto.ca/services-payments/water-environment/net-zero-homes-buildings/better-buildings-partnership/

City of Toronto, by-law 600-2023, *To adopt City of Toronto Municipal Code Chapter 660, Climate Change Goals and Governance, to codify the City of Toronto's climate change policies and programs, including targets, reporting requirements, and governance processes* (13 August 2023). https://www.toronto.ca/legdocs/municode/1184_363.pdf

City of Toronto, by-law No. 774-2012, *To amend City of Toronto Municipal Code Chapter 415, Development of Land, by adding Article V, Site Plan Control* (8 June 2012), s. 415-43. https://www.toronto.ca/legdocs/bylaws/2012/law0774.pdf

City of Toronto. (2022*b*, June 15). *City Council Agenda Item History 2022.PH34.1*. toronto.ca. https://secure.toronto.ca/council/agenda-item.do?item=2022.PH34.1

City of Toronto. (2023). Development Charge Refund Program. Retrieved from: https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/development-charge-refund-program/#:~:text=Since%202010%2C%20the%20Toronto%20Green,and%20high%20performance%20development%20projects

City of Toronto. (2022, August 18). *Official Plan*. https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/official-plan/

City of Toronto. (2023, June). *Official Plan, June Consolidation*. https://www.toronto.ca/wp-content/uploads/2023/10/960f-city-planning-official-planoffice-consolidation-chapters1-5.pdf

City of Toronto. (2021). *Municipal Code*. https://www.toronto.ca/legdocs/bylaws/lawmcode.htm?1697410366053#I

City of Toronto, *Municipal Code, Chapter 349, Animals* (15 May 2023). https://www.toronto.ca/legdocs/municode/1184_349.pdf

City of Toronto, *Municipal Code, Chapter 363, Building Construction and Demolition* (1 March 2023). https://www.toronto.ca/legdocs/municode/1184_363.pdf

City of Toronto, *Municipal Code, Chapter 629, Property Standards* (15 August 2022). https://www.toronto.ca/legdocs/municode/1184_629.pdf

City of Toronto. (2019). Ravines & Natural Feature Protection Area [Data set]. City of Toronto. https://open.toronto.ca/dataset/ravine-natural-feature-protection-area/

City of Toronto. (2019). Regional Municipal Boundary [Data set]. City of Toronto. https://open.toronto.ca/dataset/regional-municipal-boundary/

City of Toronto. (2023). Toronto Green Standard, Version 4. Retrieved from: https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/toronto-green-standard-version-4/

City of Toronto. (2022). 3D Massing [Data set]. City of Toronto. https://open.toronto.ca/dataset/3d-massing/

City of Toronto. (2022). Green Spaces [Data set]. City of Toronto. https://open.toronto.ca/dataset/green-spaces/

City of Toronto. (2022). Parks [Data set]. City of Toronto. https://open.toronto.ca/dataset/parks/

City of Toronto. (2023). Property Boundaries [Data set]. City of Toronto. https://open.toronto.ca/dataset/property-boundaries/

City of Winnipeg. (n.d.). *Bird-friendly resources - Planning, Property and Development - City of Winnipeg*. https://legacy.winnipeg.ca/ppd/CityPlanning/BirdFriendlyResources/default.stm#:~:text=Bird%2DFriendly%20Design%20Standard%20for%20new%20and%20existing%20buildings&text=In%20September%202021%2C%20the%20City,before%20beginning%20any%20building%20project.

Central Park Conservancy. (2019, May 11). Park History. Central Park Conservancy. https://www.centralparknyc.org/park-history

Cornell Lab of Ornithology. (2019). [Image of 2.9 billion birds gone since 1970, *Source: Science, 2019*]. North America's bird population down three billion since 1970, Arctic breeders hit hard. *Eye on the Arctic. CBC News*. https://www.rcinet.ca/eye-on-the-arctic/2019/09/20/bird-population-decline-north-america-canada-united-states-arctic/

Cox, D. T. C., Shanahan, D. F., Hudson, H. L., Plummer, K. E., Siriwardena, G. M., Fuller, R. A., Anderson, K., Hancock, S., & Gaston, K. J. (2017). Doses of Neighborhood Nature: The Benefits for Mental Health of Living with Nature. BioScience, 67(2), 147–155. https://doi.org/10.1093/biosci/biw173

CSA Group. (2021*b*, October 1). *Accreditation | CSA Group*. https://www.csagroup.org/accreditation/

CSA Group (2019, June). *CSA A460:19 Bird-friendly building design*. https://www.csagroup.org/store/product/CSA%20A460:19/ (see also: https://birdsafe.ca/csa-bfbd/)

CSA Group. (2023*a*). *CSA Group Annual Report 2022-2023*. https://www.csagroup.org/wp-content/uploads/CSA-Group-2022-23-Annual-Report_EN3.pdf

CSA Group. (2023*b*, May 23). *CSA Standards -- Standards Development | CSA Group*. https://www.csagroup.org/standards/

CSA Group. (2023*c*). *Frequently Asked Questions | CSA Group*. https://www.csagroup.org/

CSA Group. (2021*a*, April 28). *Product Certification Marks - CSA Mark | CSA Group*. https://www.csagroup.org/testing-certification/marks-labels/

Cusa, M., Jackson, D. A., & Mesure, M. (2015). Window collisions by migratory bird species: urban geographical patterns and habitat associations. Urban Ecosystems, 18, 1427-1446.

Endangered Species Act, 2007, S.O. 2007, c. 6. https://www.ontario.ca/laws/statute/07e06

Environment and Natural Resources Canada. (2023, May 30). *Frequently Asked Questions on Bird Collisions with Glass Windows*. Canada.ca. https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/faq-bird-collisions-glass-windows.html

Environmental Protection Act, R.S.O. 1990, c. E. 19. https://www.ontario.ca/laws/statute/90e19

Environmental Registry of Ontario. (2022, December 5). *City of Toronto - Approval to amend a municipality's official plan. Official Plan Amendment 583*. https://ero.ontario.ca/notice/019-5721; see also Amendment No. 583 at https://www.toronto.ca/legdocs/mmis/2022/ph/bgrd/backgroundfile-225898.pdf

Esri Inc. (2023). ArcGIS Pro (Version 3.2.0). Esri Inc. https://www.esri.com/en-us/arcgis/products/arcgis-pro/overview

Evluma (2023). Illuminating the pursuit of dark skies. Retrieved from: https://evluma.com/dark-sky-friendly-lighting/

Feather Friendly. (2023). Commercial Gallery. Retrieved from: https://www.featherfriendly.com/commercial-gallery

Government of Canada. (2019, January 8). Questions and answers: Outcome-based regulations policy. Canadian Food Inspection Agency. https://inspection.canada.ca/about-cfia/acts-and-regulations/safe-and-responsive-regulatory-framework/outcome-based-regulations/questions-and-answers/eng/1545935508937/1545935509234

Government of Ontario. (n.d.). 12. Building regulation | The Ontario municipal councillor's guide. ontario.ca. https://www.ontario.ca/document/ontario-municipal-councillors-guide/12-building-regulation#:~:text=The%20Building%20Code%20Act%20defines,barrier%2Dfree%20accessibility%20of%20buildings

Government of Ontario. (n.d. b). Official plans | Citizen's guide to land use planning. ontario.ca. https://www.ontario.ca/document/citizens-guide-land-use-planning/official-plans

Global Bird Collision Mapper. (2023). Bird Collision Data - public [Data set]. Global Bird Collision Mapper https://www.birdmapper.org/datasets/d9eac7adf402430c9cbd5654ba7c42ad_0/explore?location=43.649805%2C-79.390771%2C11.00

Impact Assessment Act, S.C. 2019, c. 28, s. 1. https://laws.justice.gc.ca/eng/acts/i-2.75/index.html

International Organization for Standardization. (n.d.). About us. https://www.iso.org/about-us.html

Klein, K. (2021, November 12). Our Communities: City adopts bird-friendly building standard. *Winnipeg Free Press*. https://www.winnipegfreepress.com/our-communities/metro/2021/11/12/city-adopts-bird-friendly-building-standard

Lallensack, R. (2019, September 19). North America Has Lost Nearly 3 Billion Birds Since 1970. *Smithsonian Magazine*. https://www.smithsonianmag.com/science-nature/north-america-has-lost-nearly-3-billion-birds-180973178/#:~:text=Since%201970%2C%20North%20America%20has,than%20one%20in%20four%20birds.

LEED rating system. LEED rating system | U.S. Green Building Council. (n.d.). https://www.usgbc.org/leed

Migratory Birds Convention Act, 1994, S.C. 1994, c. 22. https://laws-lois.justice.gc.ca/eng/acts/m-7.01/

Municipal Act, 2001, S.O. 2001, c. 25. https://www.ontario.ca/laws/statute/01m25#BK111

National Park Service. (2023). Jamaica Bay Wildlife Refuge - Gateway National Recreation Area (U.S. National Park Service). www.nps.gov. https://www.nps.gov/gate/learn/historyculture/jamaica-bay-wildlife-refuge.htm

North American Flyways. (n.d). Migration Science and Mystery. https://migration.pwnet.org/stopovers/arctic_slope_where.php

NYC Audubon. (2019, April). Bird-Friendly Building Design: NYC Audubon. nycaudubon.com. https://www.nycaudubon.org/our-work/conservation/project-safe-flight/bird-friendly-building-design

NYC Gov. (2020, November). Bird friendly construction requirements - nyc.gov. https://www.nyc.gov/assets/buildings/bldgs_bulletins/bird_friendly_guidance_document.pdf

Ontario. (2023). Site plan control guide. Retrieved from: https://www.ontario.ca/page/site-plan-control-guide

Ontario Professional Planners Institute. (2023). *About OPPI.* Retrieved from: https://ontarioplanners.ca/oppi/about-oppi

Ontario Professional Planners Institute. (n.d.). *Professional Code of Practice & Standards | OPPI*. https://ontarioplanners.ca/oppi/about-oppi/professional-code-of-practice-standards

Ontario NDP. (2023, October 30). *NDP MPP Glover tables solution to protect migratory birds with bird-safe building cod*e. Ontario NDP. https://www.ontariondp.ca/news/ndp-mpp-glover-tables-solution-protect-migratory-birds-bird-safe-building-code#:~:text=Glover's%20Bill%20will%20amend%20the,new%20construction%20and%20major%20renovations

O. Reg. 332/12: Building Code. https://www.ontario.ca/laws/regulation/120332

Ottawa Tourism. (n.d.). [Photograph of the Parliament Buildings in Ottawa]. Ottawa Tourism. https://ottawatourism.ca/en/about-ottawa

Paşca Palme, C. (2019). Nature's Dangerous Decline 'Unprecedented'; Species Extinction Rates 'Accelerating.' https://www.ipbes.net/news/Media-Release-Global-Assessment

Planning Act, R.S.O. 1990, c. P. 13. https://www.ontario.ca/laws/statute/90p13

Podolsky v. Cadillac Fairview Corp., 2013 ONCJ 65. https://www.canlii.org/en/on/oncj/doc/2013/2013oncj65/2013oncj65.html?autocompleteStr=Podolsky%20v.%20Cadillac%20Fairview%20Corp.%2C%202013%20ONCJ%2065&autocompletePos=1

Rosenberg, K. V., Dokter, A. M., Blancher, P. J., Sauer, J. R., Smith, A. C., Smith, P. A., Stanton, J. C., Panjabi, A., Helft, L., Parr, M., & Marra, P. P. (2019). Decline of the North American avifauna. Science, 366(6461), 120–124. https://doi.org/10.1126/science.aaw1313

Safe Wings Ottawa (2021). Safe Wings partners with local artist to create bird-friendly mural at the University of Ottawa – Safe Wings Ottawa. Retrieved from https://safewings.ca/safe-wings-partners-with-local-artist-to-create-bird-friendly-mural-at-the-university-of-ottawa/

San Francisco Planning Department. (2011, July). Standards For Bird-Safe Buildings. https://sfplanning.org/sites/default/files/documents/reports/bird_safe_bldgs/Standards%20for%20Bird%20Safe%20Buildings%20-%2011-30-11.pdf

Species at Risk Act, S.C. 2002, c. 29. https://laws.justice.gc.ca/eng/acts/s-15.3/

Standards Council of Canada Act, R.S.C., 1985, c. S-16. https://laws-lois.justice.gc.ca/eng/acts/S-16/

Standards Council of Canada - Conseil Canadien Des Normes. (2018, April 18). *Corporate profile*. https://www.scc.ca/en/corporate-profile#:~:text=Table%20of%20Contents-,Mandate,Canadians%20in%20voluntary%20standards%20activities

Standards Council of Canada - Conseil Canadien Des Normes. (2016, May 27). *Frequently asked Questions (FAQ)*. https://www.scc.ca/en/help/faqs

Summer Tanager, (n.d). M. Elliott. *iNaturalist.* https://www.inaturalist.org/guide_taxa/490571

Swaffer, K. (2014). Dementia: Stigma, language, and dementia-friendly. Dementia, 13(6), 709-716. doi:10.1177/1471301214548143

United Nations. (n.d.). *Biodiversity - our strongest natural defense against climate change | United Nations*. https://www.un.org/en/climatechange/science/climate-issues/biodiversity

Vitro. (n.d.). Bird-Friendly Glass Legislation. Glassed.vitroglazings.com. Retrieved December 5, 2023, from https://glassed.vitroglazings.com/topics/bird-friendly-glass-legislation

Whelan, C. J., Şekercioğlu, Ç. H., & Wenny, D. G. (2015). Why birds matter: From economic ornithology to ecosystem services. *Journal of Ornithology*, *156*(S1), 227–238. https://doi.org/10.1007/s10336-015-1229-y

Yeoman, B. (2013, April 8). What do birds do for us? *Audubon*. https://www.audubon.org/news/what-do-birds-do-us#:~:text=Pest%20control%2C%20public%20health%2C%20seed,the%20ways%20birds%20benefit%20humans.

Zhang, Y., Ye, E., Liu, F., Lai, N., You, X., Dong, J., & Dong, J. (2023). The Relationship between Landscape Construction and Bird Diversity: A Bibliometric Analysis. *International Journal of Environmental Research and Public Health, 20*(5), 4551. https://doi.org/10.3390/ijerph20054551

14.0 APPENDIX

14.1 Appendix A: Course Syllabus

Toronto Metropolitan University | School of Urban & Regional Planning | Faculty of Community Services

PL8109 Graduate Planning Studio 1

Bird City:
Bird Safe Design Guidelines for the Biophilic City

Image credits: (L) Charley Harper Art Studio, 2022, (R) NM Lister with FLAP, 2023

Professor: Prof. Nina-Marie Lister, MCIP RPP Hon ASLA

Office Hours: Tuesdays 14-16h or by appointment at nm.lister@torontomu.ca

Weekly Team Meeting: Tuesdays 10-11h on campus (part of studio period 10-13h)

Client: City of Toronto, Strategic Initiatives, Policy & Analysis Unit
Jane Welsh, Project Manager for Environmental Planning
Jane.Welsh@toronto.ca

Mentor: Brendon Samuels, PhD Candidate, Ornithology, UWO bsamuel2@uwo.ca

Field guides: Yuko Miki, FLAP Canada yuko5613@hotmail.com and
Carly Davenport, Bird Safe UofT birdsafeuoft@gmail.com
(**NOTE**: students will be invited to join weekly building patrols to collect and rescue birds, downtown on Tuesdays at 7 AM, details to be discussed.)

Problem Context

In 2019, the global Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) released a dire report that identified a global biodiversity crisis supported by data that show an unprecedented and catastrophic loss of species is underway. Multiple human-induced factors are driving this loss, related to habitat

1

14.1 Appendix A: Course Syllabus

destruction through urban expansion, industrial agriculture, and resource extraction. The UN has since recognized that, while at risk, biodiversity is the strongest natural defence against climate change. A key part of a climate resilient strategy is to **reverse loss and recover biodiversity**.

In the scope of the biodiversity crisis, **birds** are suffering significant impacts. A steep decline has been documented in bird species across North America, with estimates showing close to 3 billion birds gone since 1970. Native bird populations have declined by 29% or 1 in 4 birds have been lost in the last 50 years[1], with losses closer to 60% among aerial insectivores (insect-eating migratory birds such as swallows, swifts and flycatchers). The decline in bird populations and species diversity is related to the cumulative and systemic effects of climate change, habitat loss, and pesticide use[2]. In urban areas these risks are compounded, as birds are additionally vulnerable during migration as they pass through an unfamiliar, altered and built environment.

During the peak of fall and spring migration periods in North America, billions of birds must navigate thousands of kilometres, including through cities as they make their way south from their northern breeding grounds to their southern overwintering grounds and back again. In addition to the many natural hazards encountered during migration, urban areas pose a particularly deadly risk to birds in the prevalence of large expanses of window glass, which birds cannot see or recognize as a barrier. **Between 365 and 988 million birds in the US and 16 to 42 million birds in Canada will die enroute following a collision with a building**[3]. This short film, *When Worlds Collide (2022),* by FLAP Canada summarises this poignantly.

But this problem can be solved, and the solutions are known. We know how to prevent window collisions through proven solutions using planning and design tools. These tools include bird safe glass, bird safe building design, bird supportive landscape design, bird friendly planning guidelines, zoning bylaws, and regulations such as building codes.

Project Overview

The City of Toronto published the world's first municipal Bird-Friendly Development Guidelines in 2007. The purpose of these guidelines was to make buildings safer for migratory birds and to reduce the number of birds killed by colliding with windows. These guidelines have since prompted other North American municipalities to adopt similar guidelines, and in some cases, regulatory standards. Now part of the Toronto Green Standard, the guidelines have evolved into two separate **best practices** for bird friendly glass and effective lighting. Both documents provide specific techniques to support two performance measures, "Bird Collision Deterrence" and "Light Pollution", both of which are required as part of Tier 1 of the TGS v4. As Toronto's original guidelines have evolved, there has been a surge in this area of research and considerable development around bird safe building technologies, planning polices and regulations, including advances in legislation. As more cities recognize the need to protect bird

[1] Rosenberg, et al., 2019.
[2] Rosenberg, et al., 2019.
[3] Bracey et al., 2016, Machtans et al., 2013, Loss et al., 2013, Klem, 2015.

14.1 Appendix A: Course Syllabus

populations, bird safe design is now part of mainstream planning and development, and an emerging component in climate resilience strategies.

Goal

This project will advance Toronto's leadership as a **Bird Safe City**. The aim here is to provide a "bigger tent" for bird safe design and planning under which Toronto can extend and improve its own policies to align, amplify and better integrate with other tools for climate resilience, urban nature enhancement, and urban biodiversity protection. The overall goal is to provide, through design, policy and regulations, safe passage and improved urban habitat for birds in the wider context of nature-based solutions and green infrastructure designs for climate resilience. Further, as a partner city in the global Biophilic Cities Network, Toronto has pledged to protect and enhance urban biodiversity for which bird safe design is a key requirement.

Key Tasks

Specifically, the **Bird Safe City** project will update and expand Toronto's bird safe policies, tools, guidelines, and standards. In this context, the team will undertake research on bird safe planning and design, advances in associated technologies, legislation, and emerging standards. Through a comparative *best-and-next practices* case study approach, the team will consider a broader constellation of planning tools and a wider context for bird safe design. For example, these may relate to advances in building technologies, alignment with carbon zero buildings, emerging research on bird population health and urban species' needs, and to landscape design elements, including (e.g.) Sustainable Sites Initiative component (a LEED aligned certification for landscape design).

Deliverables (for preliminary guidance and discussion)

In the context of the key objectives and tasks above, the deliverables for this project will include the following content (to be determined in consultation with the Client):

1. Planning report highlighting key ***opportunities and challenges*** for bird safe design guidelines and associated regulations for the city of Toronto. The report should include:
    a. an ***overview*** of the problem (benefits of birds to humans and other species *vis à vis* risks to bird population (documented population declines associated with (e.g.) window collisions, light traps, and inhospitable landscape design);
    b. the ***background*** history and evolution of bird safe design guidelines and standards (to be differentiated);
    c. a robust content ***analysis*** of the current research; and
    d. a critical ***assessment*** of opportunities for and challenges to updating Toronto's guidelines, including alignment with related climate resilient

14.1 Appendix A: Course Syllabus

strategies (e.g. carbon neutral buildings, nature-based solutions and green infrastructure guidelines for climate resilience).

2. A detailed set of ***case studies of best practices*** elsewhere, with specific reference to innovative bird safe design policies, regulations, and related provisions, within *and beyond* the current standards and guidelines (either included in the planning report above or provided as a separate addendum / handbook);
3. Development of a ***methodological framework*** including ***specific research instruments*** (e.g. a survey tool or interview guide for municipal staff, researchers, NGOs) to facilitate further, broader research to determine extent and success of bird safe policies and design provisions both in terms of adoption (frequency) and improvements (outcomes) in support of bird populations and related biodiversity;
4. Based on the analyses above, the planning report will also provide ***recommendations*** for adoption of bird safe standards, specific to the Toronto Green Standard, along with related municipal code (bylaw) revisions, provisions and supportive ***policy alternatives*** to support a diversity of urban and migratory bird populations. These recommendations should include (e.g.) ***place-specific examples*** as well as any additional or ***alternative land-based planning policies*** that may be needed. The analysis and recommendations may be supported by ***mapping***.
5. Updated version of Bird Safe Design Guidelines (or Standards) for the City of Toronto; and
6. An ***oral and visual presentation*** of analysis, findings and recommendations to be made for and shared with City staff and relevant community members.

Key Dates

Launch meeting: Tues. Sept 5th at 1pm (**outside** on campus in the quad)
Interim Studio Presentations and Reviews: Tues. Oct 17th
Final Studio Presentations and Reviews: Tues. Nov. 28th
Final deliverables submitted: Tuesday December 5th by 4pm
(Please see the course syllabus for all important dates and assignment deadlines)

Preliminary References

American Bird Conservancy, Glass Collisions: Preventing Bird Window Strikes:
https://abcbirds.org/glass-collisions/

Axelson, Gustave (2019) *Vanishing: More Than 1 In 4 Birds Has Disappeared In The Last 50 Years*. The Cornell Lab: All About Birds.
https://www.allaboutbirds.org/news/vanishing-1-in-4-birds-gone

Beatley, Timothy (2020) *The Bird Friendly City: Creating Safe Urban Habitats*. Island Press.
Overview and lecture: https://www.biophiliccities.org/bird-friendly-city

Birds Canada (2023) *Ontario Breeding Bird Atlas 3.0*. Birds Canada, Environment and Climate Change Canada, Ontario Field Ornithologists, Ontario Nature, and Ontario Ministry of Natural Resources and Forestry.
About: https://www.birdsontario.org/

14.1 Appendix A: Course Syllabus

Storymap: https://www.birdsontario.org/storymap/

Biophilic Cities Network (n.d.): https://www.biophiliccities.org

BirdSafe.ca (2022): https://birdsafe.ca/ (a project of FLAP Canada)

BirdWatching Daily (2022) *Study: Being around birds boosts mental health.* BirdWatching Daily. BLOG:https://www.birdwatchingdaily.com/news/birdwatching/study-being-around-birds-boosts-mental-health/

Brown, JD and Fink, Helen (2022) *Planning for Biophilic Cities.* A Report of the American Planning Association, PAS Report 602. Available at https://www.planning.org/publications/report/9255203/

Environment and Climate Change Canada (2022) *Government of Canada announces certification of fourteen new bird friendly cities.* Government of Canada. https://www.canada.ca/en/environment-climate-change/news/2022/12/government-of-canada-announces-certification-of-fourteen-new-bird-friendly-cities.html

Fatal Light Awareness Program, FLAP Canada (2022): https://flap.org/

FLAP Canada (2022) *Why Do Birds Hit Buildings?* FLAP Canada. https://flap.org/why-do-birds-hit-buildings/

Global Bird Collision Mapper (2022): https://www.birdmapper.org/

Lallensack, Rachael (2019) North America has lost nearly 3 billion birds since 1970. *Smithsonian Magazine*. Sept. 19. https://www.smithsonianmag.com/science-nature/north-america-has-lost-nearly-3-billion-birds-180973178/#:~:text=Since%201970%2C%20North%20America%20has,than%20one%20in%20four%20birds.

Leffer, Lauren (2022) *6 Unexpected Ways Birds Are Important for the Environment (and People).* National Audubon Society. Benefits of Birds: https://www.audubon.org/news/6-unexpected-ways-birds-are-important-environment-and-people

Michigan Audubon (n.d.). Bird-window Collisions: https://www.michiganaudubon.org/bfc/bird-window-collisions/

National Audubon Society (2023) *Prevent Bird Deaths from Building Collisions.* Audubon Action Centre. Fast Action: https://act.audubon.org/a/bird-safe-buildings-act-2023

Panlasagui, S., E. Spotswood, E. Beller, and R. Grossinger. (2021). "Biophilia Beyond the Building: Applying the Tools of Urban Biodiversity Planning to Create Biophilic Cities." *Sustainability.* 13(5): 2450. doi:10.3390/su13052450. https://www.mdpi.com/2071-1050/13/5/2450.

Sheppard, Christine., Lenz, Bryan. (2019) *Birds Flying Into Windows? Truths About Birds & Glass Collisions from ABC Experts.* American Bird Conservancy. https://abcbirds.org/blog/truth-about-birds-and-glass-collisions/

14.1 Appendix A: Course Syllabus

The Cornell Lab: All About Birds, *Why Birds Hit Windows—And How You Can Help Prevent It.* https://www.allaboutbirds.org/news/why-birds-hit-windows-and-how-you-can-help-prevent-it

Science & Standards

American Bird Conservancy (2021) *American Bird Conservancy Prescriptive Rating Guidelines for Bird-friendly Materials.* American Bird Conservancy. https://abcbirds.org/wp-content/uploads/2021/05/Prescriptive-rating-for-LL15-3.pdf

BirdCast: Migration Monitoring Platform: https://birdcast.info/
BirdCast: Lights Out: https://birdcast.info/science-to-action/lights-out/

Bracey AM, Etterson MA, Niemi GJ, Green RF (2016) Variation in bird-window collision mortality and scavenging rates within an urban landscape. *Wilson Journal of Ornithology* 128: 355–367. https://doi.org/10.1676/wils-128-02-355-367.1

City of Toronto (2021) *Toronto Green Standard* (current v4). https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/

Cusa M, Jackson DA, Mesure M (2015) Window collisions by migratory bird species: urban geographical patterns and habitat associations. *Urban Ecosystems* 18: 1427–1446. https://doi.org/10.1007/s11252-015-0459-3

Environment and Climate Change Canada (2023) *Environment and Climate Change Canada Status of Bird Populations.* Environment and Climate Change Canada.: https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/trends-bird-populations.html

Feather Friendly: https://www.featherfriendly.com/
FF CSA blog: https://www.featherfriendly.com/blog/enjoy-free-access-to-the-csa-bird-friendly-building-design-standard#:~:text=The%20CSA%20A460%3A19%20standard,scale%20to%20reduce%20bird%20deaths.

FLAP Canada (2018) *Bird-Safe Standard for Federal Government Buildings A Synthesis of Bird-Friendly Guidelines and Standards.* FLAP Canada. https://flap.org/wp-content/uploads/2020/06/SYNTHESIS-STANDARD-FLAP-CWS-2018.pdf

Klem, Daniel (2014) Landscape, legal, and biodiversity threats that windows pose to birds: a review of an important conservation issue. *Landscape* 3: 351–361. https://doi.org/10.3390/land3010351

Klem, Daniel (2015) Bird–Window Collisions: A Critical Animal Welfare and Conservation Issue. *Journal of Applied Animal Welfare Science.* https://journals-scholarsportal-info.proxy1.lib.trentu.ca/details/10888705/v18isup1/s11_bcacawaci.xml

Loss, Scott., Will, Tom., Loss, Sara., Marra, Peter. (2013) Bird–building collisions in the United States: Estimates of annual mortality and species vulnerability. *The Condor.* https://www.jstor.org/stable/90008043

14.1 Appendix A: Course Syllabus

Machtans, Craig., Wedeles, Christopher., Bayne, Erin. (2013) A First Estimate for Canada of the Number of Birds Killed by Colliding with Building Windows. *Avian Conservation and Ecology*
http://dx.doi.org/10.5751/ACE-00568-080206

NCC (National Capital Commission), Bird-Safe Design Guidelines.
https://ncc-website-2.s3.amazonaws.com/documents/NCC_Bird-Safe_Guidelines_EN_Mar26.pdf#page=10

Rosenberg, Kenneth., Dokter, Adriaan., Blancher, Peter., Sauer, John., Smith, Adam., Smith, Paul., Stanton, Jessica., Panjabi, Arvind., Helft, Laura., Parr, Michael., Marra, Peter. (2019) Decline of the North American avifauna. *Science*.
https://www.science.org/doi/10.1126/science.aaw1313

Standards Council of Canada (2019) *Canadian Standards Association CSA A460:19*. Standards Council of Canada.
https://www.scc.ca/en/standardsdb/standards/29805
Free view-only access: https://www.featherfriendly.com/csa-building-standards

Sustainable SITES Initiative (for landscaping standards): https://sustainablesites.org/

Van Doren, Benjamin (2021) *A new publication on drivers of fatal bird collisions in Chicago*. BirdCast.
https://birdcast.info/news/a-new-publication-on-drivers-of-fatal-bird-collisions-in-chicago/

Policies & Regulations

City of Ottawa (Bird Safe Guidelines, Dec 2022):
https://documents.ottawa.ca/sites/documents/files/birdsafedesign_guidelines_en.pdf#page=15

City of Toronto (Bird Safe Design Guidelines 2007, updated into TGS):
https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/design-guidelines/bird-friendly-guidelines/
Policy 1: Best Practices for Bird Safe Glass 2017:
https://www.toronto.ca/wp-content/uploads/2017/08/8d1c-Bird-Friendly-Best-Practices-Glass.pdf
Policy 2: Best Practices for Bird Safe Lighting 2018:
https://www.toronto.ca/wp-content/uploads/2018/03/8ff6-city-planning-bird-effective-lighting.pdf

Harvard Campus: https://www.thecrimson.com/article/2023/6/18/animal-law-bird-letter/

The New York City Council (2020) *A Local Law to amend the administrative code of the city of New York and the New York city building code, in relation to bird friendly materials*. The New York City Council.
https://legistar.council.nyc.gov/LegislationDetail.aspx?ID=3903501&GUID=21B44B73-D7E1-4C55-83BD-1CA254531416&Options=&Search=

Media

Beatley, Tim (2021) LECTURE: *The Bird Friendly and Biophilic City*. Hosted by Birds on the Niagara, Feb. 13, 2021. https://www.youtube.com/watch?v=LIX7i8QMkFk

14.1 Appendix A: Course Syllabus

Biophilic Cities, The Bird-Friendly City:
https://www.biophiliccities.org/bird-friendly-city

FLAP Canada (2022) FILM: *When Worlds Collide*. FLAP Canada.
https://www.youtube.com/watch?v=eWcE2YM-rbI

Globe & Mail, 2021:
https://www.theglobeandmail.com/business/article-countermeasures-being-installed-at-td-centre-to-reduce-bird-building/

Katz, Brigit (2019) *New York Is Poised to Require Bird-Friendly Glass on All New Buildings*. Smithsonian Magazine.
https://www.smithsonianmag.com/smart-news/new-york-poised-require-bird-friendly-glass-all-new-buildings-180973760/

Lee, Michael and Zaidi, Deena (2022) *Canadian urban skies turn lethal for migratory birds*. CTV News.
https://storymaps.arcgis.com/stories/25328cfaded4444aaf01cb09c90705a3

Saha, Purbita (2017) *Lights Out for the Texas Skyscraper That Caused Hundreds of Songbird Deaths*. Audubon. https://www.audubon.org/news/lights-out-texas-skyscraper-caused-hundreds-songbird-deaths

Samuels, Brendon (2022) *The Winding Path of Advocating for Bird Friendly Buildings*. FLAP Canada.
https://flap.org/winding-path-advocating-bird-friendly-buildings/

The Warblers by Birds Canada (2022): PODCAST: *The Bird Friendly City*.
https://thewarblers.buzzsprout.com/1784269/10288117-the-bird-friendly-city

Wetzel, Corryn (2021) *Turning Off Lights at Night Could Halve Bird Deaths On Chicago's Lakeshore*. Audubon.
https://www.audubon.org/news/turning-lights-night-could-halve-bird-deaths-chicagos-lakeshore

14.2 Appendix B: Geospatial Processing and Statistical Results

The following is a list of geoprocessing performed using ArcGIS Pro 3.2.0 and R version 4.2.2 in R Studio IDE 2023.06.0 for both the 1996-2023 and 2023 dataset. The collision data for the year 2023 includes an additional step below in italics.

Geospatial processing in ArcGIS Pro:

- Clipped bird collision layer to the City of Toronto boundary to only get collisions for the city
- Performed a kernel density on the collision layer using 700 metres search radius, as it is the average city block size
- Used select by attribute to obtain the collisions for the year 2023
- Merged 3 layers to obtain a natural features layer: green spaces, parks, and ravines
- Created a buffer of 1 metre for tree layer to get approximate tree size
- Merged the tree layer with the natural features to obtain our final vegetation layer
- Created a buffer of 90 metres around this final vegetation layer
- Used the select by location tool on the 3DMassing (building) layer to get buildings that are located in the 90 metres of natural features
- Used the near tool to calculate distance in metres between the collision layer and the vegetation layer. Identified this variable in our dataset as “VegDist”
- Used the spatial join tool between the collision layer and the building layer to obtain collisions for each building
- Used the dissolve tool to get a total collision count for each building (dissolved the counts by using sum to get total collision counts). Identified this variable in dataset as variable “ColCount”
- Used the join tool to have both the vegetation distance and the total collision count into final layer

14.2 Appendix B: Geospatial Processing and Statistical Results

Statistical processing in R Studio IDE:

- Imported the final layer in R, and removed buildings with no vegetation distance (value = -1) and no collision counts (value = 0)
- Perform correlation between collision count and vegetation distance
- Performed simple linear regression between collision count and vegetation distance, where the resulting plot was non-linear
- Performed a polynomial regression to the second degree between collision count and vegetation distance (as we knew through previous research that polynomial regression is used when datasets do not have a linear relationship)
- Polynomial graph used ggplot2 version 3.4.4 in R Studio. This allowed drawing the polynomial regression line and a vertical line showing the distance where collision counts peak at a distance of 99 meters for the 1996-2023 dataset, and 78 metres for the 2023 dataset.

Statistical Analysis

A statistical analysis was done using the dataset with VegDist (vegetation distance) as our independent variable and ColCount (collision counts for patrolled areas) as our dependent variable. We used the linear regression formula ColCount ~ VegDist and polynomial regression formula ColCount ~ VegDist + VegDist^2.

Results 1996-2023

Linear Regression: weak but positive statistically significant relationship.
Coefficients: 0.38786
p-value: <2.2e-16

Polynomial Regression: weak but positive statistically significant relationship.
Coefficients: 0.38786
p-value: <2.2e-16

Results 2023

Linear Regression: weak but positive statistically significant relationship.
Coefficients: 0.088791
p-value: <2.2e-16

Polynomial Regression: weak but positive statistically significant relationship.
Coefficients: 0.088791
p-value: <2.2e-16

14.3 Appendix C: Bird Collision Analysis and Regression for 2023

Additional analysis was conducted using only the bird collision reports for the 2023 year ending in October, for patrolled areas. The methods and geoprocessing tools follow the same procedure as the previous analysis, except for the use of an additional tool to extract bird collisions for 2023 (See Appendix B).

The map (Figure 97) shows the collision counts for the year 2023 in relation to the buildings in the city. Similarly to Figure X, there are higher counts in the downtown area due to bias in the GBCM data from patrolled areas.

By again using regression and polynomial regression analysis on the 2023 dataset, we measured the relationship between vegetation and bird collisions following the same statistical procedures (Appendix B). Regression results shows a significant and weaker positive relationship between both variables.

City of Toronto: Bird Collisions Counts for 2023

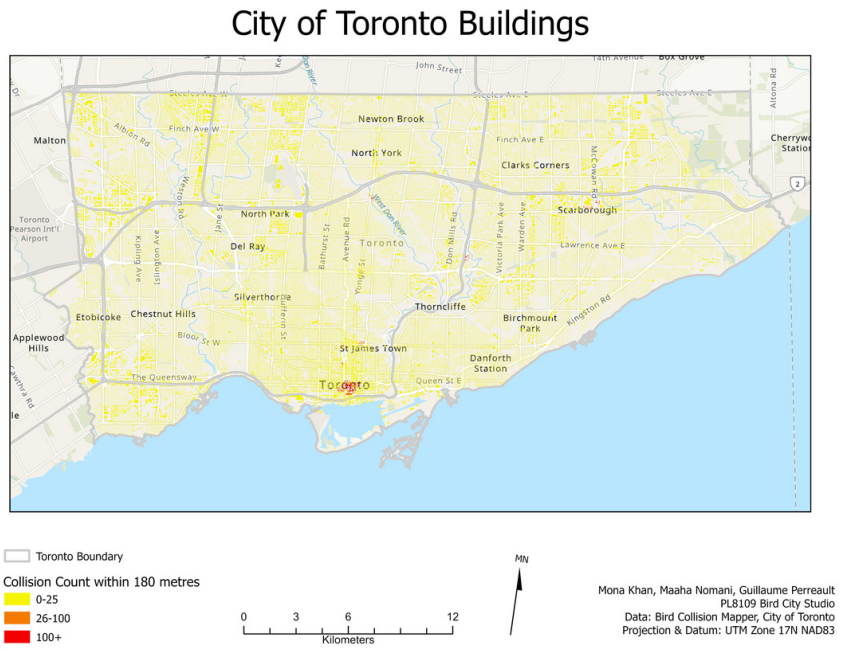


Figure 97: Count of bird collisions (patrolled areas) per building within 180 metres

The polynomial regression results and line shows that the drop off is located at 78 metres, therefore only 11 metres off from our assumed distance of 90 metres. This distance therefore indicates that, for the 2023 user dataset, the buildings in Toronto have the highest average collision counts between 1 and 78 metres, where collision counts drop off closer to 1 per building.

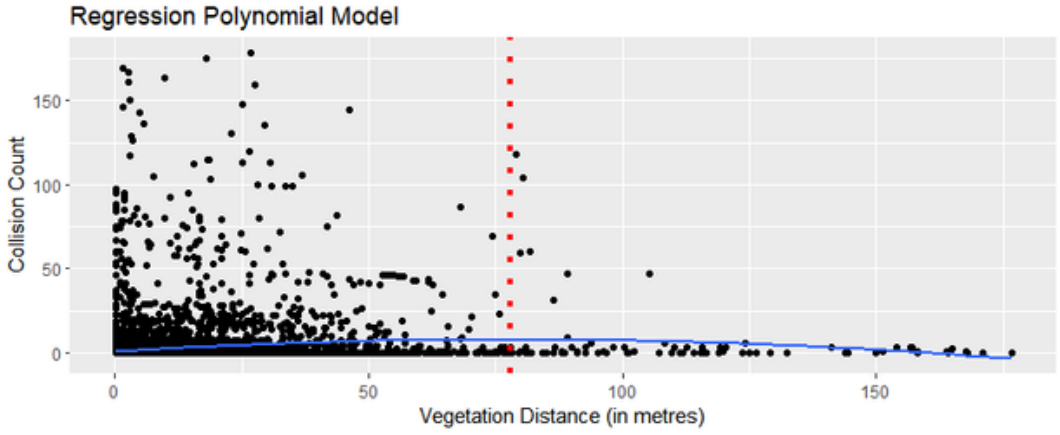


Figure 98: Polynomial Regression Plot for 2023

ACKNOWLEDGEMENTS

Nina-Marie Lister, MCIP, RPP, Hons ASLA
The Bird-Safe Studio team expresses sincere gratitude to our supervisor, Professor Nina-Marie Lister. Professor Lister served as our supervisor, and mentor and provided us with guidance and support throughout this project. Professor Lister took the time to conduct weekly meetings, provide commentary, and guide the development of our work.

Jane Welsh, Project Manager for Environmental Planning, City of Toronto
We would also like to express our gratitude to Jane Welsh, our client, for her invaluable guidance. Jane's expertise and commitment have been instrumental in guiding the Bird-Safe City team through the complexities of the City of Toronto processes to help develop recommendations.

Brendon Samuels, PhD Candidate in Ornithology at The University of Western Ontario
Additionally, the Bird-Safe City team extends our sincere appreciation to Brendon Samuels, our mentor, for generously meeting with us, answering questions and dedicating time to review and comment on our work throughout the semester.

A special thanks is also extended to all the supporters and contributors including ***FLAP Canada field guides, Industry, and cross-disciplinary professionals*** whose valuable insights and assistance throughout the duration of this project greatly enriched the content and quality of this document. Your unwavering support is sincerely appreciated.