



NATIONAL CAPITAL COMMISSION
COMMISSION DE LA CAPITALE NATIONALE

Bird-Safe Design Guidelines



*Female red-winged
blackbird*

Canada



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Black-capped chickadee

1.0

The Issue of Bird– Building Collisions

Natural areas across Canada provide vital breeding habitat for over 400 species of birds. Many birds make impossibly long journeys to reach Canada’s northern breeding grounds. Throughout their journeys, birds come into contact with a large range of human-related stressors, including energy, oil and gas infrastructure; forestry practices; agricultural mowing and pesticides; feral and house cats; highways; communication towers; and urban buildings. Although the populations of some birds, such as birds of prey and waterfowl, have begun to recover after devastating losses, Canada has lost 40 to 60 percent of its shorebird, grassland bird and aerial insectivore populations.¹ Urban development is putting more and more pressure on birds, and it has come to light that collision with glass surfaces on and around buildings is now the second-most common human-related cause of bird mortality. It is estimated that, in North America, as many as one billion birds are killed by colliding with windows each year.²

Birds are unable to recognize glass as an impermeable surface. As a result, birds may strike windows when they attempt to fly through glass to vegetation or habitat on the other side, or when they try to reach the habitat mirrored in the glass. Collisions with glass affect all birds regardless of species, sex, health or age, amplifying the negative impacts of this issue on bird populations.³

The bird collision problem is exacerbated by light emanating from buildings and outdoor lighting at night. Birds use visual cues to help them navigate along their migration routes. Light from buildings and outdoor light fixtures can attract birds into urban areas and disorient them, causing them to change their flight patterns, which can lead to exhaustion, emaciation or death. This situation also increases the likelihood that birds may collide with windows during daylight hours.⁴



Safe Wings Ottawa’s annual bird display illustrates the impact of bird–window collisions. (Safe Wings Ottawa)

The bird collision problem has been intensified by the increased window-to-wall ratio in modern buildings. While pre-1950s buildings tended to have masonry walls with recessed windows making up less than 40 percent of the overall facade, recent advances in glass technology, production, cost and energy efficiency have increased demand for modern buildings to contain more glass. Some modern buildings have walls made entirely of mirrored glass.

Despite the gravity of this issue, protecting birds from window collisions is relatively simple. There are many steps that can be taken to ensure that buildings are designed to be safe for birds. These include reducing the window-to-wall ratio, applying frit patterns to glass, and using louvres or shades to reduce reflected light. It is also possible to retrofit buildings to make them bird-safe without requiring extensive and costly renovations. Usually, windows can be treated with visual markers that are easily applied post-construction. Several other simple steps can be taken to protect birds from hitting windows that do not require any retrofits, such as relocating bird feeders and bird baths, moving indoor plants away from windows, and turning off lights at night.

*Some modern buildings
are made almost
entirely of glass.*



Bird-safe windows at the Confederation Pavilion at 7 Clarence Street.



2.0

The NCC Context

The National Capital Commission (NCC) owns over 1,200 buildings and structures. Up to 485 of the buildings managed by the NCC have the potential for bird–window collisions. (Buildings not considered harmful to birds are those with no or few windows such as barns, silos, boat houses, outdoor toilets, sheds, gazebos, electrical vaults, warehouses and so on.) According to research, houses may kill up to 15.7 birds per year and low-rise buildings may kill up to 55 birds per year.⁵ Given that around 330 NCC-owned buildings with the potential for bird collisions are single-family dwellings or other home-like structures, and the other 155 are low-rise buildings, window strikes with NCC buildings have the potential to kill or injure over 13,000 birds per year. NCC buildings may be particularly hazardous to birds, because many of them are within five kilometres of the Ottawa River (a major migratory route for nearly 150 bird species) or other important habitats that support bird species, including migratory birds and species at risk. These habitats include rivers and lakes, wetlands (such as Mud Lake and Mer Bleue), meadows and agricultural lands (such as in the Greenbelt), dense woodlots (such as in Gatineau Park), ravines and escarpments (such as the Eardley Escarpment), and lush gardens (such as at Rideau Hall).

The NCC’s role as steward of federal lands in the national capital under the *National Capital Act*, including its role in the federal land use, design and transaction approval process, its commitment under the Plan for Canada’s Capital to protect and enhance the region’s ecological integrity, and its Sustainable Development Strategy all commit the NCC to addressing the issue of bird collisions. These bird-safe guidelines were created in response to action 7.1 of the NCC’s Sustainable Development Strategy, 2018–2023, which states that the NCC will adopt bird-friendly standards by 2020 and that all new projects will apply these standards by 2023.

The NCC also has a legal responsibility to address the issue of bird collisions. In a 2013 court case, an Ontario judge ruled that daylight that reflects off or radiates from a building and kills or injures birds constitutes a contaminant under section 14 of the *Environmental Protection Act* (EPA) of Ontario, and that allowing such light emissions, if they harm or kill species at risk, contravenes section 32 of the federal *Species at Risk Act* (SARA). The *Migratory Bird Convention Act* (MBCA) also prohibits the incidental take of migratory birds and the deposit of substances harmful to birds in areas frequented by migratory birds. Owners or managers of buildings where the design results in the death of or injury to birds may be found guilty of an offence under SARA, the MBCA or the EPA, as applicable, if they fail to take reasonable preventative measures to reduce the risk of their buildings to birds.⁶

3.0

Application of the Guidelines

3.1. Policy Statement

The NCC will apply bird-safe design guidelines to all projects on NCC lands, and all projects on federal buildings and lands in the National Capital Region subject to federal land use, design and transaction approval, that involve glass or lighting and to all projects that involve landscaping adjacent to buildings or other structures containing glass or reflective surfaces.

3.2. Goal

The goal of these guidelines is to reduce bird–building collisions on NCC lands. These guidelines provide best practices for building and lighting design that can minimize or eliminate the risk posed by glass associated with buildings and structures and by lighting projects on NCC lands and on federal buildings and lands in the National Capital Region subject to the federal land use, design and transaction approval process. Other strategies to conserve bird populations, such as the creation and protection of bird-friendly habitat, are contained in other NCC planning and operational documents, and are not provided in these guidelines.

4.0

Bird-Safe Guidelines for Building Design, Retrofits, Renovations, and Landscaping and Lighting Projects

The following guidelines draw from current bird-friendly standards, and are in line with the Canadian Standards Association’s standard on Bird-Friendly Building Design (A460:19), which is Canada’s first national standard on bird-safe design for buildings, and the City of Ottawa’s Bird-Safe Design Guidelines.⁷ These guidelines were developed in consultation with a core team of staff from various NCC divisions, FLAP Canada and Safe Wings Ottawa. In addition to standards for building site, architectural, lighting and landscape design, these NCC-specific guidelines also contain recommendations for heritage buildings.



Many buildings on NCC lands are in close proximity to natural areas.

4.1. Overall site and building design for new buildings and structures must limit risks to bird safety.

The first step toward limiting bird–window collisions is to ensure that building site design does not pose inherent risks to birds. While windows are important features that allow building occupants to feel a connection to nature, it is important to anticipate where birds will be in relation to the glass in the structures on-site. For example, vegetation around buildings attracts birds to the area, increasing the likelihood of collisions, and glass that reflects trees and shrubs causes more collisions than glass that reflects concrete or grass.⁸ Certain types of building design and glass-containing architectural features are also inherently risky for birds. However, with thoughtful design and window placement, buildings can be designed to reduce the risks to birds, while also maintaining connections with nature and maximizing energy efficiency.

4.1.1. To the extent possible, and consistent with NCC master plans, building should be limited in existing natural areas, including migratory bird routes, shorelines, green spaces, wetlands and ecological corridors, to minimize impacts on birds and other wildlife.

4.1.2. Where buildings are located in proximity to a natural area, the building and windows should be oriented in a way as to limit reflection of habitat (trees, shrubs, hedges, water and wetlands) on glass surfaces and to limit fly-through conditions, whereby birds can see the habitat on the other side of a building through two panes of glass.

4.1.3. All buildings should be designed to minimize bird collisions by minimizing or eliminating the use of the following design elements:

- large expanses of undistinguished glass, including spandrel glass, or other reflective material, such as polished stone or steel (ideally, the total surface area of glass should be no more than 40 percent of the overall facade);
- parallel or angled glass elements where birds can see through to the other side of the building (common in linkways, lobbies, corners, alcoves, atriums and alleyways);
- open-topped atriums, which can trap birds;
- glass balustrades;
- transparent wind and sound barriers;
- free-standing glass architectural elements.

Parallel glass should be avoided near wooded areas. This building was later treated with appropriately spaced, high-contrast visual markers.



4.2. High-risk glass must be treated with high-contrast visual markers to render it bird-safe.

The properties of glass that pose a risk to birds are transparency (because birds do not recognize the glass as a physical barrier and try to fly through it) and reflectivity (because birds see habitat reflected in the glass). Both issues must be addressed in order to reduce the risk that glass surfaces pose to birds. However, due to bird behaviour, some glass surfaces pose a higher threat to birds than others do. The guidelines below show which glass surfaces are the most important to treat and how they should be treated to render them visible to and safe for birds.

4.2.1. In the areas listed below, a minimum of 90 percent of all glazed (glass) surfaces must be treated with the application of high-contrast visual markers:

- up to the greater of 16 m above grade or the height of the surrounding vegetation at maturity (which may be up to 45 m in the National Capital Region)
- on a green roof, up to the greater of 4 m above the surface of the green roof/rooftop garden or the height of the surrounding vegetation at maturity.



Spacing requirements for visual markers.
(Safe Wings Ottawa)

4.2.2. In the areas listed below, 100 percent of all glazed (glass) surfaces must be treated with the application of high-contrast visual markers:

- all glazed surfaces that create fly-through conditions, such as parallel glass, glass balustrades and glass corners, which must be treated for 5 m in each direction
- all glazed surfaces up to the greater of the first 16 m above grade or the height of the surrounding vegetation at maturity, where the structure is located directly adjacent to a shoreline, woodlot or wetland.

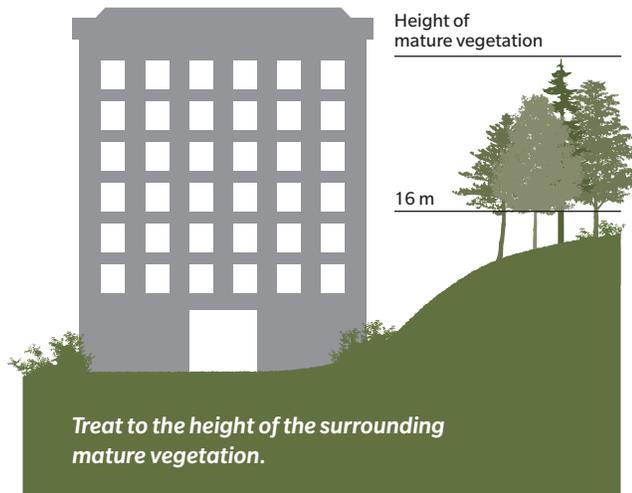
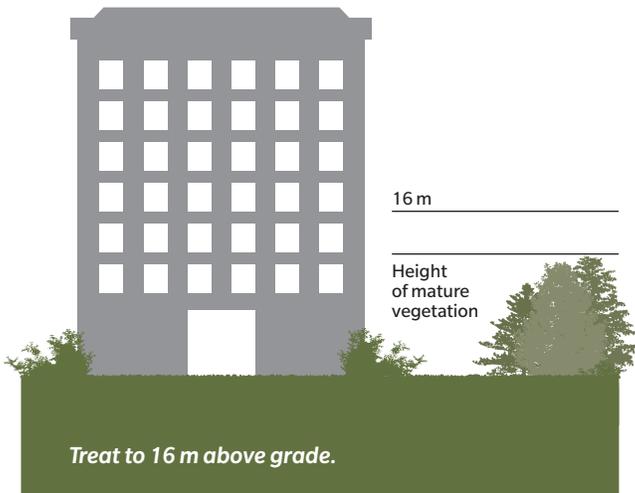
4.2.3. Visual markers must be applied to the first surface (outside) of the glass, and must be at least 4 mm in diameter and spaced no further than 50 mm apart.

4.2.4. Non-vision glass (such as spandrel glass and privacy glazing) should be treated with a full surface treatment on the first surface that renders the glass visible to birds (opaque and non-reflective).

4.2.5. Visual markers applied according to the specifications in subsections 4.2.1 and 4.2.2 may consist of but are not limited to the following:

- muntins, mullions or grilles (bars that divide the pane of glass),
- grates and screens,
- commercial films and adhesives,
- patterns created by acid etching, silk screening or ceramic frit.

Source: Clause 3, *CSA A460:19, Bird-Friendly Building Design*. © 2019 Canadian Standards Association. Please visit store.csagroup.org.



A large glass window with a dark frame. The window reflects a potted plant with long, feathery leaves in the foreground. Outside the window, a white car is parked on a paved area. The background shows trees and a building. The text is overlaid on the upper left portion of the window.

Birds fly into glass corners to reach the vegetation they see through the windows.

Visual markers can be easily applied post construction.



4.3. Building-associated structures that pose a risk to birds must meet bird-safe criteria.

Some structures associated with buildings, including ventilation grates, free-standing glass elements and antennas, may pose a risk to birds, and must adhere to the following bird-safe criteria.

4.3.1. Glass structures associated with buildings, such as glass railings or balustrades and free-standing glass architectural elements, including wind and sound barriers, must be treated as per guideline 4.2 above.

4.3.2. Outdoor art installations with expanses of transparent glass or highly reflective surfaces should be avoided or treated as per guideline 4.2 above.

4.3.3. All ventilation grates must have a porosity of no more than 20 mm × 20 mm or 40 mm × 10 mm.

4.3.4. Vents and pipes with an opening greater than 400 mm² must be covered with a screen or cap.

4.3.5. The use of guy wires should be avoided, and antennas should be consolidated into one tower.



Glass structures associated with buildings, such as glass railings, must be treated.

4.4. Building-integrated structures may be used to reduce bird collisions, but must meet bird-safe criteria.

Some building-integrated structures, such as external shades, screens (including architectural sunscreens), grilles, shutters and louvres, can be effective at deterring bird collisions while adding to the architectural design detail of the building and increasing building energy efficiency. Building-integrated structures may be used to deter bird collisions, provided they follow the guidelines below.

4.4.1. When building-integrated structures are used to reduce bird collisions, they must be permanently fixed to the building and non-movable. If removable or movable structures, such as exterior shades, are used, they must be used in concert with the glazing treatments specified in Section 4.2.

4.4.2. Shades and louvres used to deter bird collisions must be parallel or angled to the glass surface, not more than one metre from the parallel pane of glass, have gaps no greater than 50 mm, and have a solid to void ratio of 50 percent or more.

4.4.3. Screens or grilles used to deter bird collisions must have a maximum gap of 19 mm x 19 mm, and must be installed at least 50 cm from the glass, on the exterior.

4.4.4. Exterior, stationary shutters used to deter bird collisions must have gaps no larger than 50 mm.

4.5. Building interior lighting should be limited from sunset to sunrise.

Interior lighting from buildings draws birds into urban areas where they are at an increased risk of colliding with windows. Light from high-rise buildings emanating up into the sky can attract and disorient birds, causing them to congregate around buildings in urban areas and become exhausted. These birds may collide with windows at ground level when they try to reach vegetation inside the building or reflected in the windows. Reducing lighting in buildings from sunset to sunrise helps to alleviate this problem and is simple to do, according to the following guidelines.



Although above-window sun shades can help reduce window reflections, these shades do not meet the requirements of a permanent bird collision mitigation strategy, and should be used in concert with high-contrast visual markers.

4.5.1. In cases where interior lighting is visible from the outside of the building, it should be reduced from sunset to sunrise using any or all of the following:

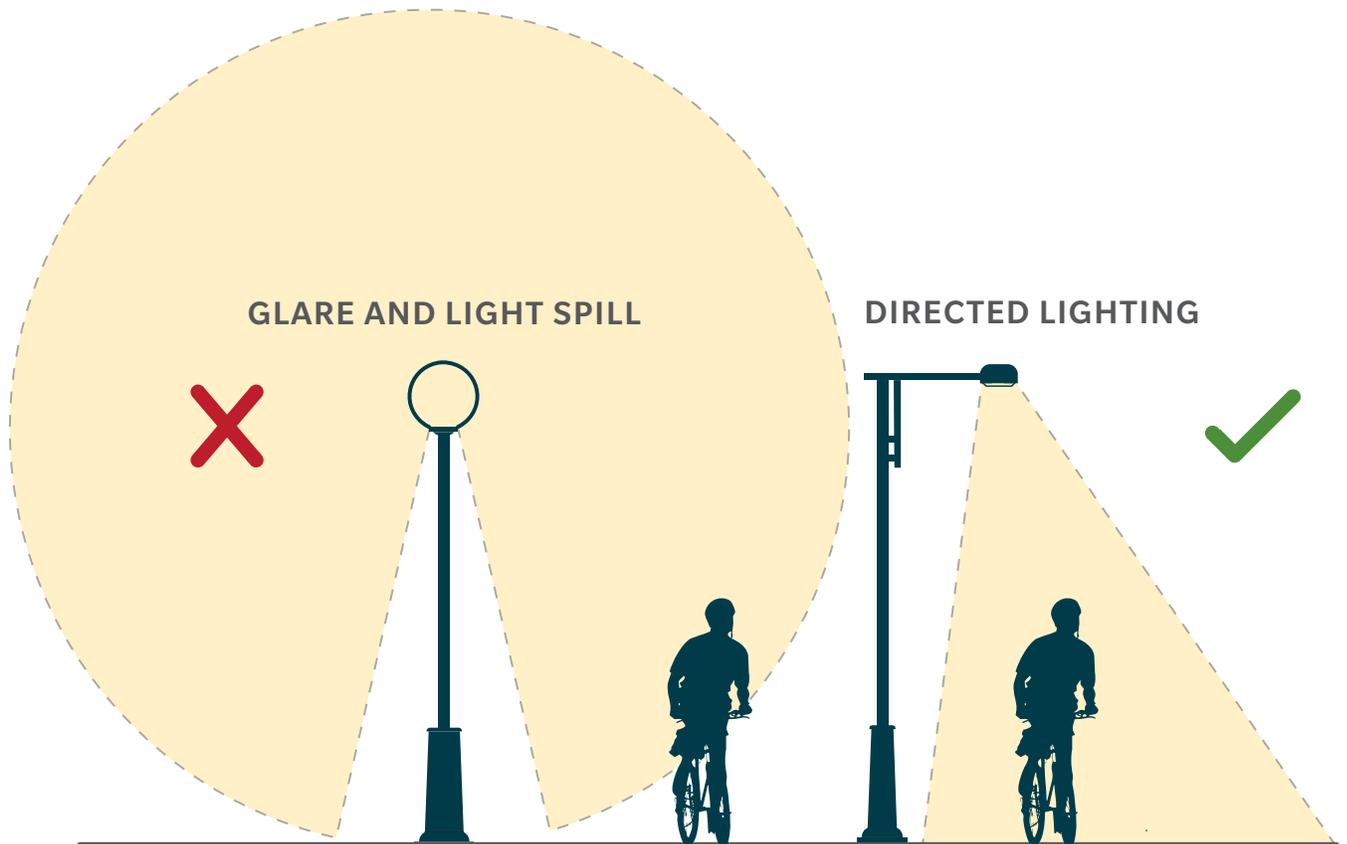
- installing motion detectors and/or timers to automatically extinguish lights in unoccupied spaces
- making task lighting options available to reduce lighting in unoccupied spaces
- installing blackout shades or blinds that can be drawn at night
- installing dimmer switches to reduce light intensity in occupied spaces.

4.6. Outdoor lighting on NCC lands should be dark-sky-compliant.

Outdoor lighting directed up at the sky contributes to sky glow (the brightness of the night sky in a built-up area as a result of light pollution) and may pose a threat to birds. Fortunately, there are ways to preserve the natural “dark sky” that birds are accustomed to by following the guidelines below. These guidelines should be applied to all lighting on NCC lands, whether in relation to a building or not. Lighting projects completed under the Capital Illumination Plan will be reviewed on a case-by-case basis to weigh various factors, and should follow the guidelines below to the extent possible.

4.6.1. In general, outdoor lighting, whether associated with a building or not, should follow dark-sky-compliant best practices according the following criteria.

- Lighting should be on only when required for nighttime visibility, wayfinding, or to highlight elements of heritage, historical, cultural, architectural or social value (this can be achieved through the use of motion sensors and automatic timers).
- Only the areas that require lighting for nighttime visibility, wayfinding, or to highlight elements of heritage, historical, cultural, architectural or social value should be lit (this precludes the use of flood lighting).
- To reduce over-lighting and limit blue light transmissions, all outdoor lights should have a colour temperature of no more than 3,000 Kelvin (ideally, LED lighting should be amber, not white).⁹
- Full cut-off fixtures should be used to limit spill light (light that falls outside the area which is meant to be lit).



4.6.2. Where non-dark-sky-compliant lighting is required for special events or light shows, the impact of lighting on birds should be limited by avoiding the use of uplights and by not using spotlights, lasers or searchlights, especially during migratory bird season (March to May and August to October).

4.6.3. Where rooftop, facade and monument architectural illumination are required under the Capital Illumination Plan or to showcase heritage characteristics, it should be directed downward toward the structure and should be turned off, or at a minimum, dimmed, between 11 pm and 6 am.

4.7 Landscaping around buildings should be designed to reduce the risk of bird collisions with windows.

The landscaping adjacent to a building has an impact on bird–window collisions by affecting how many birds will be in the direct vicinity of the building and how much vegetation is reflected in the windows of the building. While it is important and encouraged to provide habitat for birds in urban areas, and it is not generally necessary to deter birds from buildings that have been made bird-safe, there are some landscaping guidelines that increase bird safety. The following landscaping guidelines should always be used in concert with bird-safe building design guidelines. It should be noted that these landscaping guidelines are specific to reducing bird collisions with glass and do not include other guidelines for bird conservation, such as mowing regimes that reduce impacts on nesting birds. Landscape maintenance guidelines for NCC lands are included in the environmental guidelines for NCC maintenance contracts.

4.7.1. Landscaping adjacent to buildings and structures should be designed to minimize reflections of vegetation in windows and other reflective surfaces. (Trees and shrubs planted within one metre of glass surfaces, even if they do not produce reflections in the glass, have not been shown to be effective at preventing bird collisions in all cases. Where trees and shrubs are planted within one metre of glass surfaces, these areas should be monitored for bird collisions using a protocol such as in Annex D of the CSA standard on Bird-Friendly Building Design and/or treated as per the guidelines in Section 4.2, as necessary.)

4.7.2. Landscape designs that channel birds toward windows, such as tree-lined walkways leading toward windowed entrances, should be avoided.

4.7.3. Species known to attract birds, such as those with abundant nectar, seeds or fruit, should be avoided within 20 metres of glass or reflective surfaces, even if those surfaces have been treated with high-contrast visual markers.

4.7.4. Bird feeders and other features, such as bird baths, should be located less than 50 cm OR more than nine metres from glass surfaces.

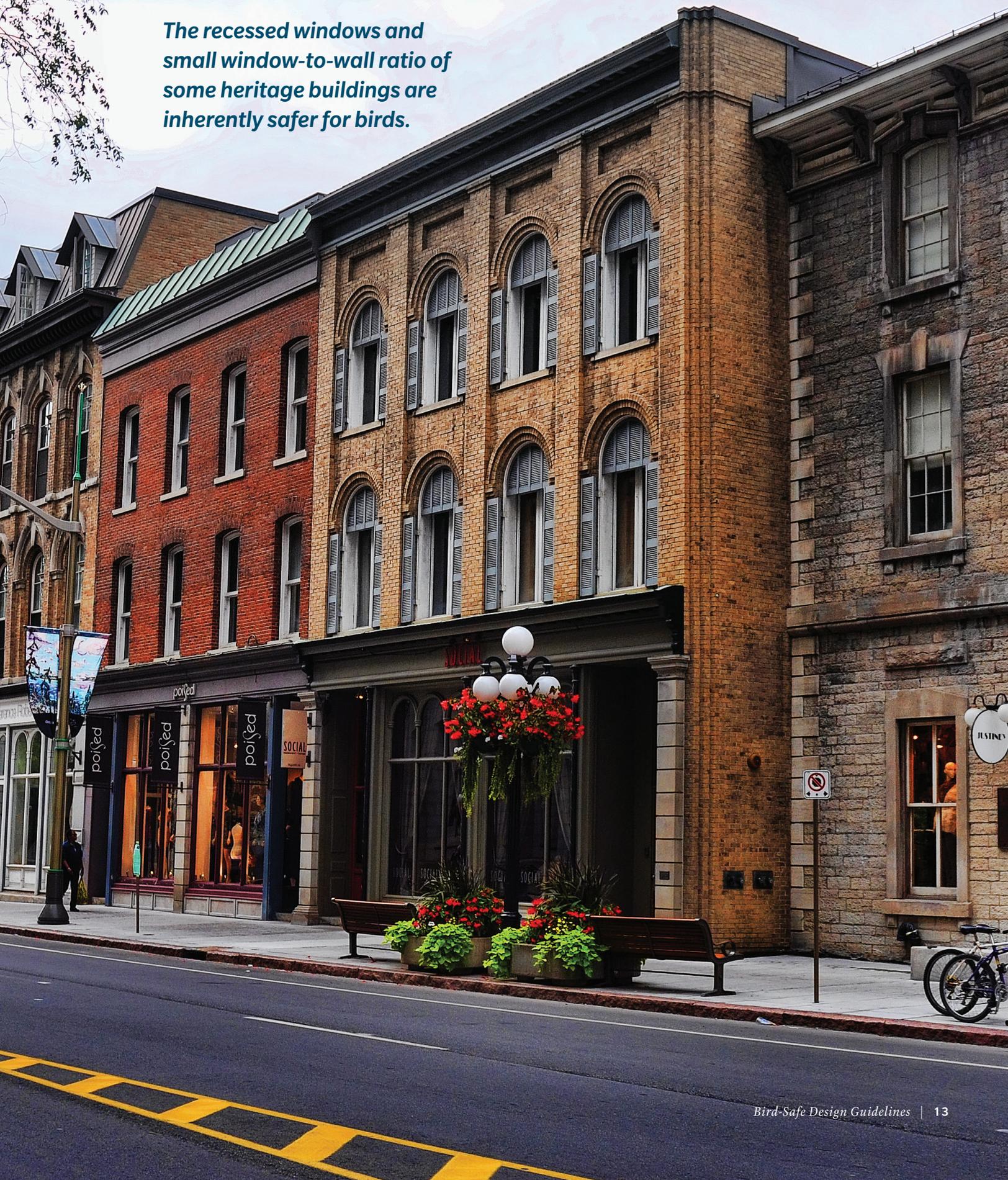
4.7.5. Features with open water, such as fountains, ponds, stormwater retention infrastructure and engineered wetlands, should be located in areas where they will not be reflected in windows or other reflective surfaces. If this is not possible, the bird collision mitigation strategies in Section 4.2 must be implemented.

4.7.6. Indoor plants and landscaping features should be located so they are not visible through building windows. Where plants are visible from outside the building, the bird collision mitigation strategies in Section 4.2 must be implemented.



Bird feeders and bird baths should be located less than 50 cm or more than 9 m from building windows.

The recessed windows and small window-to-wall ratio of some heritage buildings are inherently safer for birds.



4.7.7. Existing vegetation must NOT be removed for the sole purpose of reducing the threat of bird collisions. Where bird collisions are a problem, the bird collision mitigation strategies in Section 4.2 must be implemented.

4.8. Heritage characteristics must be considered in conjunction with bird-safe design.

When making any intervention in heritage and historic buildings and sites (i.e. buildings and sites with heritage value and character-defining elements), decisions should be guided by the Standards and Guidelines for the Conservation of Historic Places in Canada. All proposed bird collision mitigation strategies should be seen in the context of the heritage elements present within the building and site. As each building and site is unique, each intervention must be dealt with on a case-by-case basis, with careful consideration for the integration of these bird collision mitigation strategies into the heritage context.

Heritage buildings vary widely in age and character, and some are inherently more bird-friendly than others. For instance, many 19th century buildings have small windows divided by mullions, muntins or transoms, while other more modern heritage buildings may have vast expanses of reflective glass. It is important to understand the heritage values and character-defining elements of the building in order to design the most appropriate bird collision mitigation strategies. For example, historic windows can be important character-defining elements which should be conserved. In many cases, the bird collision mitigation strategies in sections 4.2 to 4.7 can be implemented without impacting heritage considerations. The Standards and Guidelines for the Conservation of Historic Places in Canada provide guidance for interventions to historic places, advocating for a minimal intervention approach wherever possible.¹⁰ The following guidelines should be applied to bird-safe design projects on existing buildings where heritage designations may apply.

4.8.1. Before applying bird collision mitigation strategies, all documentation with respect to the heritage values of the historic place, including any heritage designations, must be reviewed to determine if there are heritage conservation considerations that must be implemented on-site.

4.8.2. If a heritage designation exists, appropriate heritage experts must be engaged in all stages of review, selection and approval of potential bird collision mitigation strategies and must approve the selected strategies.



Non-character-defining elements, such as glass railings added for safety, should be treated with high-contrast visual markers.

4.8.3. All character-defining elements of a heritage-designated building and site must be identified BEFORE any approved bird collision mitigation strategies are implemented, to ensure that these elements are appropriately conserved during project implementation.

4.8.4. Where character-defining elements may pose a risk to birds, a qualified bird collision mitigation expert should be engaged in a site assessment to determine which elements pose a lethal, high, moderate or low risk to birds. Those elements that are determined to pose the highest risk to birds (lethal or high) should be treated with bird collision mitigation strategies.

4.8.5. Where character-defining elements are determined to pose a high or lethal risk to birds, bird collision mitigation strategies that do not require changes to the building (such as those in sections 4.5 and 4.7) should be implemented first, and monitored for their effectiveness using a protocol such as in Annex D of the CSA standard on Bird-Friendly Building Design. If the risk to birds is not mitigated by these interventions, the guidelines in sections 4.2 to 4.4 and 4.6, or other appropriate and effective bird collision mitigation strategies, as verified by a bird collision mitigation expert and approved by heritage experts, should be implemented.

5.0

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Great grey owl

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