Waterdown Road Widening Detailed Design
Wildlife Crossing Safety Plan

March 3, 2017

Report Prepared For:
Conservation Halton and Region of Halton

Report Prepared By:
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Hatch Project #156842
**Issue and Revision Record**

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1. Introduction

The City of Burlington (CoB) retained Hatch to prepare a Wildlife Crossing Safety Plan for the Waterdown Road Widening Detailed Design Project as required to address the Class Environmental Assessment (EA) conditions of approval posed by the Minister of the Environment and Climate Change. The Waterdown Road Widening Detailed Design Project extends from Craven Avenue north to Mountain Brow Road. Refer to Figure 1 for the Project location and limits.

The recommended improvements to Waterdown Road include the ultimate widening to four (4) lanes, with design of three (3) lanes to be provided initially, along with a 3-4m wide multi-use pathway running along the west side. Recommendations for design were identified during the EA completed in April 2012 by Dillon Consulting Limited (DCL). The EA provided a summary of Phase 1 and Phase 2 of the Waterdown/Aldershot Transportation Master Plan, whereby both Phase 1 and 2 confirmed the need for additional east-west and north-south capacity in the Waterdown/Aldershot area due to the projected residential growth in the Waterdown urban area (DCL, 2012). The projected increase is expected in three main expansion areas outlined in the City of Hamilton Official Plan Amendment (OPA) 28; Waterdown North, Waterdown South and Upcountry Lands, which consist of 240 hectares of gross developable residential land (DCL, 2012). With this increase in land development, and a projected marginal growth of 1% per year to 2021, the transportation system would need to accommodate an additional 572 vehicles and move an additional 15,000 + people (DCL, 2012). As such the EA noted there was a clear conclusion that a deficiency existed, which facilitated the need to complete Phases 3 and 4 of the Municipal Class EA process to identify alternatives for the east-west and north-south capacities (DCL, 2012).

This Project (Waterdown Road) focuses on the north-south deficiency documented in the 2012 EA completed by DCL, and will be undertaken by the CoB with Project Partners consisting of the City of Hamilton and Region of Halton. At the present time, within the Project limits, Waterdown Road is a two (2) lane arterial road under the jurisdiction of the CoB. The profile of the new road will essentially match the existing road elevation, due to the need to minimize impacts to residential properties throughout the corridor and/or to avoid and minimize encroachment into Sassafras Woods Environmentally Sensitive/Significant Area (ESA)\(^1\). Plans for the roadway widening will also

\(^1\) In the City of Hamilton, the natural areas are termed Environmentally Significant Areas and in the Region of Halton natural areas are identified as Environmentally Sensitive Areas. For the purposes of this Plan, the Region of Halton terminology Environmental Sensitive Areas will be used as the Project is within the City of Burlington’s jurisdiction (Wong, 2009).
include the addition of curb and gutters and a storm sewer, with urbanized cross sections to further minimize property encroachments and result in a road that is at grade.

1.1 Background and Purpose

An assessment of wildlife crossing treatments was completed in the EA, and documented within the April 2012 Environmental Study Report (ESR). During the preparation of the ESR, Conservation Halton recommended three (3) potential wildlife movement corridors where an ecopassage (i.e. an underpass or overpass structure) could be beneficial. The locations of these three (3) corridors are illustrated on Figure 2. Crossing #1 is located across a hydro corridor near the northern limit of the Project; Crossing #2 is located just north of the farm field (north of Flatt Road) that connects a hedgerow on the west side of Waterdown Road with Sassafras Woods ESA and, Crossing #3 is also located within a hydro corridor towards the southern limit of the Project. Further to this assessment, the proponents facilitated discussions between Conservation Halton, and Hydro One Networks Inc. (Hydro One). Hydro One (Mr. Richard Schatz, Senior Real Estate Coordinator) identified accessibility concerns associated with construction of an overpass structure at the northern hydro corridor (Crossing #1), and as such was not in favour of this proposal. Additionally, the land along the west side of Crossing #2 is owned by Palletta International Corporation and is slated for land development (Eagle Heights). Therefore, the location of this crossing is also not favourable.

Following these discussions and assessment, as documented within the Commitments for Future Work within the ESR, the inclusion of any type of wildlife crossing structure was deemed impractical and cost-prohibitive due to constraints posed by the existing hydro corridor, future land development, geometric challenges and the presence of existing underground infrastructure. As such, the CoB committed to continue further discussions with Conservation Halton during the Detailed Design.

Following submission of the ESR, a Part II Order was issued, and additional conditions of approval as posed by the Minister of the Environment and Climate Change were issued in a letter dated December 17, 2014 to Ms. Melanie Anderton (City of Hamilton), Mr. Vito Tolone (CoB) and Mr. Jeffrey Reid (Region of Halton). A series of four (4) items was identified, with one (1) pertaining to completion of a Wildlife Crossing Safety Plan. The request stated:

“During detailed design the Proponents shall consult with Conservation Halton to determine wildlife road crossing safety measures to be
implemented as part of the Project. A Wildlife Road Crossing Safety Plan for this Project shall be developed by the proponents and submitted to Conservation Halton for information prior to construction.” (Personal communication, Letter to Ms. Melanie Anderton (City of Hamilton), Mr. Vito Tolone (CoB) and Mr. Jeffrey Reid (Region of Halton), from Minister of the Environment and Climate Change Glen Murray, December 17, 2014).

Additional evaluation by the Minister of the Environment and Climate Change was summarized in a letter to Conservation Halton also dated December 17 2014 to Ms. Jane Devito. Within the letter, the Minister indicated that he (Glen Murray) has considered the information set out in the ESR and with further discussion with the Proponents and review of strategies (e.g., The Cootes to Escarpment Park System Conservation and Land Management Strategy), that:

“although the ecopassage could potentially provide benefits to deer and perhaps other terrestrial species in the area, there is not adequate justification to require the Proponents to install an ecopassage as part of the Project” (Personal communication, Letter to Ms. Jane Devito Conservation Halton, from Minister of the Environment and Climate Change Glen Murray, December 17, 2014).

In keeping with the above, the CoB, City of Hamilton and Hatch (Design Consultant) convened a meeting, and had further discussions with Conservation Halton on September 14, 2015 regarding wildlife crossing safety measures. It was noted that the main concern for wildlife in relation to the Project location was deer, and deer movement in general. Following discussion of the wide range of wildlife crossing safety measures, it was agreed to work together to develop a solution to address wildlife movement and safety within the Waterdown Road Project limits.

Hatch convened additional discussions with Hydro One in early 2016 to ascertain the possibility of an ecopassage in the south corridor. Based upon a preliminary review, Hydro One indicated that the construction of a structure is possible, however, a number of criteria would be required to be met in order to facilitate construction and ensure there are no impacts to future maintenance activities. Criteria identified by Hydro One include: easement requirements, fence access and materials, loading, equipment, fill material, vertical clearance, health and safety, storm water management, and liability.

Following this, additional discussions were had with Conservation Halton at a meeting held on October 26, 2016. The results of these discussions concluded that the focus of the Wildlife Crossing Safety Plan would be on
measures that would be implemented along the roadway, which based on previous correspondence, would not include an ecopassage. Therefore, the purpose of this Plan is to identify the options that the CoB and City of Hamilton will impose to address wildlife movement and safety along Waterdown Road. In addition, this Plan will clearly define the approach for incorporation of the preferred measures into the Detailed Design for the proposed road widening.
Figure 1. Waterdown Road Widening Detailed Design Project: Project Location

Key
- Red: Project Location
- Gray: Wooded Area
- Yellow: Beginning of Curb
- Green: Edge of Pavement
- Gray dashed: Rounding

*The information displayed is derived from sources with varying accuracies and all boundaries should therefore be considered approximate.

Sources: Esri, HERE, DeLorme, USGS, Intermap, Increment P Corp., NRCAN, Esri Japan, METI, Esri China

Coordinate System: NAD 1983 UTM Zone 17N
Figure 2. Waterdown Road Widening Detailed Design Project: Potential Wildlife Corridor Ecopassage Locations

Key

- Potential Wildlife Corridor Ecopassage Locations
- Wooded Area

*The information displayed is derived from sources with varying accuracies and all boundaries should therefore be considered approximate.*
1.2 **Wildlife Movement and Habitat Fragmentation**

It is acknowledged that wildlife move for several different reasons, but mainly due to seasonal habitat requirements. For example, amphibians tend to use vernal pools or wetlands for breeding and then migrate to surrounding upland forest for the remainder of their life cycle needs (Ministry of Natural Resources and Forestry (MNRF), 2014). Larger mammals such as White-tailed deer (*Odocoileus virginianus*), will tend to move over larger areas and use different habitat types such as fields for foraging and forested areas comprised of conifers for winter congregation (or deer yard areas) (MNRF, 2014). Deer will also migrate seasonally between summer and winter ranges and tend to use the same migration route or corridor year after year (MNRF, 2014; Yagi and Timmerman, 2009).

Any form of development, whether it is a road or residential development, will have some effect on the connectivity between forest patches and fragment the existing movement corridors (MNRF, 2014). Habitat fragmentation can be described as the splitting of natural habitats and ecosystems into smaller isolated patches. As such, it is recommended that mitigation measures to minimize impacts associated with habitat fragmentation be incorporated into the overall design of any development type (i.e. residential, road, or bridge).

2. **Policy Framework**

Several provincial and municipal policy frameworks incorporate policies associated with natural heritage features as well as wildlife habitat and linkages. A summary of those policies in provided in the following Sections.

2.1 **City of Burlington Official Plan**

As part of the Cities Natural Heritage System – the CoB Official Plan indicates that where specific connections do not currently exist, the City will seek out areas for future improvement (CoB, 2008). However, the City identifies that private land must be respected, and the identification of a natural heritage system does not imply the lands are available or open to use. During the 2012 EA, the assessment for wildlife crossings was assessed, and again during the Detailed Design phase. As the majority of the area within the Project location is private (largely zoned as infill residential), connectivity across the road proved difficult combined with geotechnical constraints (CoB, 2011).
2.2 City of Hamilton Official Plan
As part of the City's Natural Heritage policy goals, restoring and enhancing connections, quality and amount of natural habitat is important (City of Hamilton, 2013). The City aims to reduce the adverse effects associated with habitat fragmentation by restoring natural habitat where appropriate on its own properties (inclusive of road right-of-way (ROW)) utilities, and stormwater management ponds (City of Hamilton, 2013). As the majority of this Project is situated within the CoB, most of the planning policies within the City of Hamilton Official Plan do not apply. However, strategies along the road corridor for inclusion of native plant species along the road ROW as well as additional pockets in natural areas are being incorporated into the design for Waterdown Road. This will provide for enhancement to areas currently lacking in vegetative cover and/or which have been colonized by non-native invasive species.

2.3 Niagara Escarpment Plan
The Niagara Escarpment Plan (2005 as amended), provides protection to natural heritage systems within the Province of Ontario (Ministry of Municipal Affairs and Housing (MMAH), 2005). It aims to limit developmental impacts of new development on natural features including wildlife habitat, promoting a need to maintain wildlife corridors and linkages within adjacent areas and enhance wildlife habitat where possible. Due to private land ownership and space restrictions associated with the ROW and Project limits, enhancement strategies for wildlife are being explored within the woodlots adjacent to the road. The placement of these enhancement strategies will be identified under a separate cover in addition to placement of additional native plant material. Details of these strategies will be documented within an Edge Management Plan, with further details for construction outlined in a Tree Preservation Plan.

2.4 Greenbelt Plan
The Greenbelt Plan (2005), which encompasses the Niagara Escarpment Plan area aims to protect agricultural land and ecological features from urbanization (MMAH, 2005). In doing so, this Plan also focuses on the protection of natural heritage and water resource systems and the ecological linkages within each of those systems (MMAH, 2005). As noted previously, during construction the natural heritage system will be protected, with additional enhancement and protection identified within the Edge Management Plan to limit the negative impacts of encroachment and forest edge clearing.
2.5 Waterdown-Sassafras Woods Heritage Lands Management Plan

The Project location is located within the Waterdown – Sassafras Woods Heritage Lands as part of the Cootes to Escarpment EcoPark System (CEES). The CEES is a collaborative initiative of ten local government and non-profit organizations in the Burlington-Hamilton area and the southwestern end of Lake Ontario. The CEES has prepared a Management Plan to assist with future management actions for protection, enhancement and monitoring (CEESP, 2016).

Within the Management Plan, wildlife crossing locations have been identified, as wildlife and public safety has been identified as a concern within the Grindstone Creek Valley due to the large population of White-tailed Deer. As part of the Cootes to Escarpment Management Plan, a wildlife crossing has been proposed in connection with the McNally property (Bruce Trail Conservancy land), although across from this feature is residential land use (CEESP, 2016).

As part of the Ecosystem Management and Restoration Recommendations, the Management Plan has identified a series of management strategies for wildlife crossing which includes:

- Maintaining the integrity of the existing natural features (i.e. Waterdown-Sassafras Woods Heritage Lands, Niagara Escarpment, and Tributaries of Grindstone Creek and Falcon Creek);
- Continue the annual closure of Kind Road for salamander (dominantly for endangered Jefferson Salamander) crossing;
- Include the need for investigating ecopassages during the EA process;
- Include municipal road management personnel in management discussions;
- Develop ways to upgrade existing infrastructure (e.g. culverts) that may help improve wildlife passage; and,
- Contribute to longer term monitoring for wildlife crossing and road mortality.

In connection with the Project and the associated management recommendations, the design is looking to maintain the integrity of the natural features as much as possible during construction, with additional enhancement plantings of native species in pockets proposed into the design. Although an ecopassage is not proposed for this Project, it was assessed during both the EA and Detailed Design process. The existing culvert along Waterdown Road (CSP) is being replaced with a larger box culvert that will be...
embedded into the ground with substrate material placed inside, which may facilitate wildlife passage for smaller mammals in the future. Lastly, both the CoB and City of Hamilton are looking into potential ways at assisting with road wildlife mortality tracking.

2.6 **Provincial Policy Statement**

The Provincial Policy Statement (2014) provides the management and protection of natural features including the long-term ecological function and linkages of these features. Significant Wildlife Habitat is protected under the Provincial Policy Statement which encompasses wildlife habitat as well as movement corridors (MMAH, 2014). With respect to deer movement corridors and deer wintering areas, those are mapped by the MNRF, and in relation to the Project, none of these habitats are present along the road corridor, or mapped within 120 metres.

3. **Local Wildlife Management Strategies**

3.1 **Jefferson Salamander**

In proximity to the Project location, is King Road. King Road, from the base of the Escarpment to Mountain Brow Road, is closed annually every year and has been since 2012 from March 15 to April 6 to allow for safe passage for the Jefferson Salamander during the spring migration (Gregory, 2016). Jefferson Salamanders are nationally and provincially endangered species and the CoB has worked closely with Conservation Halton and MNRF to provide protection to this species during its migration period from wintering to breeding habitats. Although no traffic studies have been completed, The CoB has indicated that the increase in traffic associated with Waterdown Road during this closure is likely minimal during this time.

3.2 **White-tailed Deer**

In relation to the Project location, there are no deer wintering areas mapped by the MNRF, but are identified within Dundas Valley in Hamilton Ontario (Yagi and Timmerman, 2009). As deer wintering areas are considered a component of significant wildlife habitat, they are provided protection under the Provincial Policy Statement made under the Planning Act (Yagi and Timmerman, 2009).

A research study was completed by Yagi and Timmerman, 2009, to identify deer concentration areas and the relative abundance of deer in the Hamilton Conservation Authority area due to the number of complaints in Dundas Valley and Iroquoia Heights. This study aimed to compare urban (non-
hunting) population dynamics with those in non-urban (hunting) population dynamics in the Niagara region.

During the winter surveys completed in 2009 for both Ancaster and Niagara Region, it was identified that deer were most abundant in natural areas, and areas where hunting was not allowed (e.g. conservation authority properties) (Yagi and Timmerman, 2009).

The study concluded that without reducing deer wintering areas, and due to the lack of areas where recreational gun hunting is acceptable, the number of deer is expected to increase (Yagi and Timmerman, 2009). In the short-term, a managed cull of problem areas when public access can be controlled may serve to help mitigate complaints, with a longer-term solution focusing on City of Hamilton by-law restrictions to allow archery hunting (Yagi and Timmerman). Overall, Yagi and Timmerman (2009) conclude that deer have well adapted to human areas and will be part of these communities no matter the management strategy implemented, and indicate that developments should consider the need for wildlife movement. Most mammals will move rapidly through the path of least resistance (wide open areas) compared to habitats that are complex (fences, highways and culvert) (Yagi and Timmerman, 2009).

4. Existing Wildlife and Habitat Information

The Project is located in southern Ontario, within Ecoregion 7E. Two (2) large expansive woodlands (Sassafras Woods ESA and Waterdown Escarpment Woods ESA) are located to the east of the existing roadway, as shown on Figure 1. Both of these ESAs are part of the Sassafras-Waterdown Woods Life Science Area of Natural and Scientific Interest (ANSI).

4.1 Landscape Elements

Just north of Flatt Road, landscape elements exist that provide an opportunity for wildlife movement. Specifically, a large expansive farm field that has been left fallow and is currently comprised of various grasses and forbs is situated immediately north of Flatt Road along the west side of Waterdown Road. This fallow field (landscape element) would be considered a feeding ground for wildlife such as deer, which may be attracted from areas within the ANSI, or Sassafras Woods. As such, this section of Waterdown Road would be considered a transition area between two habitat types. In addition, this area may also be considered a wildlife conflict zone, as it demonstrates an area where wildlife is more likely to come in contact with the roadway (Ministry of Transportation (MTO), 2006).
Additional land uses adjacent to the east and west side of Waterdown Road consist of residential homes, farm fields, hedgerows, wetlands and woodlands. Highway 403 is located just south of the Project location, with additional residential communities to the north. It is important to note that the CoB has received applications to amend the City’s Official Plan and Zoning Bylaw and approve plans of subdivision for the lands on the west side of Waterdown Road, (Eagle Heights) which include the existing farm field just north of Flatt Road. The Eagle Heights development received draft plan approval in a 1996 OMB decision. A new application which proposes increased residential density was received by the City in 2004 and further revised in 2010. The applications have been appealed to the Ontario Municipal Board by the applicants. Though the applications have been appealed, if planning approval is received, these existing fallow fields may be eliminated in the future, thus significantly reducing a known food source for migrating wildlife such as deer.

4.2 Collision Reports

According to information provided by the CoB, there have been a total of 19 incidents involving wildlife between 2005 and June 2016, sixteen (16) were associated with deer and the other three (3) incidents involved a raccoon. A summary of reported collisions along Waterdown Road within the Project limits is provided in Table 1, and illustrated on Figure 3.

Table 1: Reported animal collision data along Waterdown Road from Craven Avenue, north to Mountain Brow Road (2005 to June 2016)

<table>
<thead>
<tr>
<th>Accident Date</th>
<th>Location of the Incident within Project Limits</th>
<th>Environmental Weather Condition</th>
<th>Light Visibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>June 9, 2005</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Dawn</td>
</tr>
<tr>
<td>April 28, 2007</td>
<td>Between Horning Road and Mountain Brow Road East</td>
<td>Clear</td>
<td>Daylight</td>
</tr>
<tr>
<td>February 11, 2009</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Dark</td>
</tr>
<tr>
<td>August 9, 2009</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Dark, artificial</td>
</tr>
<tr>
<td>October 20, 2009</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Dark, artifical</td>
</tr>
<tr>
<td>November 6, 2009</td>
<td>Between Horning Road and Mountain Brow Road East</td>
<td>Clear</td>
<td>Dark</td>
</tr>
<tr>
<td>Accident Date</td>
<td>Location of the Incident within Project Limits</td>
<td>Environmental Weather Condition</td>
<td>Light Visibility</td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------------------------------------------</td>
<td>---------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>November 11, 2009</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Dark</td>
</tr>
<tr>
<td>January 13, 2010¹</td>
<td>Mountain Brow Road E and Waterdown Road</td>
<td>N/A</td>
<td>Daylight</td>
</tr>
<tr>
<td>June 5, 2011</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Dark</td>
</tr>
<tr>
<td>January 26, 2012</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Dusk</td>
</tr>
<tr>
<td>June 18, 2012</td>
<td>Between Craven Avenue and Flatt Road</td>
<td>Clear</td>
<td>Dark</td>
</tr>
<tr>
<td>November 29, 2012</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Daylight</td>
</tr>
<tr>
<td>January 3, 2013</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Dark</td>
</tr>
<tr>
<td>January 26, 2013</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Daylight</td>
</tr>
<tr>
<td>February 24, 2013¹</td>
<td>Horning Road and Waterdown Road</td>
<td>Clear</td>
<td>Dark</td>
</tr>
<tr>
<td>April 28, 2014</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Daylight</td>
</tr>
<tr>
<td>August 21, 2014¹</td>
<td>Between Craven Avenue and Flatt Road</td>
<td>Clear</td>
<td>Dark</td>
</tr>
<tr>
<td>December 3, 2014</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Dark, artificial</td>
</tr>
<tr>
<td>December 19, 2014</td>
<td>Between Flatt Road and Ireson Road</td>
<td>Clear</td>
<td>Dark</td>
</tr>
</tbody>
</table>

¹: Collision with raccoons; N/A: no data available; Source: City of Burlington, 2016

Based on a review of the existing data, higher collisions tend to occur in January, June and November, with the next highest reported collisions in April and December. Thirteen (13) of the sixteen (16) reported deer collisions occurred between Flatt Road and Ireson Road. As noted previously, this stretch of Waterdown Road can be considered a wildlife conflict zone, due to the existing farm field just north of Flatt Road and Sassafras Woods along the east side of the roadway, and the occurrence of the hydro corridor just south of Ireson Road (MTO, 2006). The presence of farm field, woodlands, and thicket habitats may attract wildlife such as deer to cross Waterdown Road in seek of food or winter and summer refuge. Overall, the average deer
collisions reported over this 11.5 year period is approximately 1.4 collisions per year, with an average wildlife (all wildlife including deer) reported collision at 1.7. It is well understood that this data only reflects reported collisions and does not reflect those which may not have been reported or detected, including collisions with smaller wildlife such as squirrels, rabbits, or chipmunks etc.
Figure 3. Waterdown Road Widening Detailed Design Project: City of Burlington Reported Deer Collisions

Key

- Project Limit

Number of Reported Deer Collisions

- 1
- 2
- 13

Note: Deer Collision Data from 2005 to 2014. No Collisions occurred in years 2006, 2008, 2010, 2015 and none were reported from January to June 2016.

*The information displayed is derived from sources with varying accuracies and all boundaries should therefore be considered approximate.
4.3 Deer Survey Results

Additional deer surveys were undertaken during the winter of 2016. A total of three (3) surveys were completed after snow-fall events in order to identify deer tracks and movement. The information collected during the deer surveys will be further integrated into the final design for the Project. Survey results obtained by Conservation Halton from February 2015 will also be taken into consideration, along with any subsequent data shared. A summary of survey results carried out is provided in Table 2.

Table 2: Deer track observations winter 2016 along Waterdown Road from Craven Avenue, north to Mountain Brow Road

<table>
<thead>
<tr>
<th>Date</th>
<th>Weather Conditions</th>
<th>Time of Day</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 13, 2016</td>
<td>Snowfall previous day ~5 cm; temperature was -8°C</td>
<td>1:30PM - 4:00PM</td>
<td>One set of deer tracks was observed just north of Flatt Road, snow depth in the area was measured at 12 cm.</td>
</tr>
<tr>
<td>February 17, 2016</td>
<td>Snowfall previous day ~8-15 cm; temperatures was -1°C</td>
<td>10:30AM-12:30PM</td>
<td>Duel tracks observed crossing Flatt Road (snow depth in the area was measured at 10cm). One set of deer tracks was observed just north of Flatt Road (along Waterdown Road on the east side), snow depth in the area was measured at 9cm. Again, there were no observed tracks across the road adjacent to this area. Duel set of deer tracks observed along the north hydro corridor. Duel tracks crossed the corridor, as tracks were observed on both east and west sides of Waterdown Road heading west. Snow depth on the east was measured at 11cm and 10cm on the west.</td>
</tr>
<tr>
<td>March 2, 2016</td>
<td>Snowfall previous day ~14 cm; temperature was -5°C</td>
<td>11:00AM-12:45PM</td>
<td>No deer tracks were observed along the Waterdown Road corridor.</td>
</tr>
</tbody>
</table>
Based upon the results obtained from the winter 2016 surveys along with survey results provided by Conservation Halton, it is apparent that deer movement is associated with the south and north hydro corridor, and the area just north of Flatt Road adjacent to the large vacant farmlands along the west side of the Waterdown Road corridor. As such, Hatch recommends that these three (3) areas contain wildlife warning signage, with the understanding that exact placement of signage will be determined in the overall design process for the road corridor.

Information collected during the surveys is similar to information provided by several residents that live along Waterdown Road and side roads, whereby deer presence is most noted along the north hydro corridor, which too reflects the proposal for wildlife crossing within the Cootes to Escarpment Waterdown-Sassafras Woods Heritage Lands Management Plan (CEES, 2016).

5. **Wildlife Safety Strategies**

In Ontario, a case study was completed by Elzohairy et al., (2004) that assessed the varying characteristics associated with motorist and wildlife collisions along Highways and varying sized roadways (e.g. single lane, two lane). For example, approximately one (1) out of every 21 collisions occurring on Ontario highways involves an animal venturing onto the highway (Elzohairy et al., 2004). At the Town of Oakville Road Ecology Symposium (2013), the MTO reported statistics identified 14,482 collisions in 2006, with 13,954 wildlife collisions reported in 2007 (Town of Oakville, 2013a, 2013b). Based upon general statistics, is it evident how varied they can be, not including those collisions that go unreported.

Elzohairy et al., 2004, reports that the increases in wildlife-vehicle collisions can be attributed to the number of licenced drivers, the number of kilometres driven each day (longer commuting distances) and the existing wildlife population. In addition, it is important to note that most wildlife-vehicle collisions occur under good weather conditions, suggesting that inclement weather may not play an important role (Elzohairy, et al., 2004; Town of Oakville, 2013b). Reasons behind these statistics have been attributed to general animal activity changes during inclement weather, driving speeds, and reduced hunting activities (Elzohairy et al., 2013).

With respect to deer, and their involvement in wildlife-vehicle collision rates in Ontario, the Ministry of Natural Resources (now MNRF) reports that the Ontario deer population has increased which has caused increased crop damage as well as a higher number of deer-vehicle collisions in some areas (Elzohairy et al., 2004). As the human population continues to encroach on
wildlife habitat, the number of collisions with wildlife is likely to increase (Elzohairy et al., 2004). Studies reviewed by Elzohairy et al., (2004) have noted that there was a higher frequency of deer-vehicle collisions between the months of October to December and occurred in areas within three (3) miles (~5km) from a river or stream (Elzohairy et al., 2004). Higher reported collisions during October to December can be attributed to hunting season, daylight savings, and standard winter migration (Elzohairy et al., 2004). Subsequently, a high number of collisions may also occur during fawning season (May – June) (Elzohairy et al., 2004).

Most wildlife-vehicle collisions occur during the early morning (5am to 7am) or after sunset (5pm to 11pm) due to increased traffic volume, poor visibility and general deer movement (Elzohairy et al., 2004).

In Ontario, 88.7% of wildlife-vehicle collisions occurred along undivided two-way road type compared to any other road category (e.g. express lane, transfer lane, divided roadway, divided with restraining barrier) (Elzohairy et al., 2004).

In order to reduce the number of wildlife-vehicle collisions, modification of the motorist’s or wildlife’s behaviour or both are needed (Mastro et.al, 2008). These types of collisions affect both wildlife and motorist safety, and can also result in property damage. It is known that the number of collisions, especially those associated with large wildlife has increased in North America over the last decade (Huijser et al., 2006). Historical methods such as signs have been used, with the addition of reflectors, mirrors and fences (Huijser et al., 2006; Huijser & McGowen, 2003). Newer methods have used a combination of wildlife fencing and a wildlife crossing structure, but due to high costs, the structures are often limited in size, which may deter wildlife usage, or the fences may act to isolate varying populations (Huijser et al., 2006). Limited knowledge exists on the effectiveness (or success) of the wide range of strategies. These are due to the limited number of studies that have actually monitored the effectiveness of a specific strategy after it has been installed (Huijser et al., 2006).

Most systems used have found that depending on the road and weather conditions, the use of reduced posted speed limits and warning signs can result in reduced driver speed (Huijser et al., 2006). The addition of warning lights attached to signs has also been found to result in more alert drivers which can lead to a stopping distance that is much longer, thereby reducing the number of wildlife (e.g., ungulate) vehicle collisions (Huijser, 2006).
5.1 Fencing

Another wildlife safety strategy is fencing. Fencing can include typical fencing (e.g. chain-link, wood) or electric fencing. Typically fencing is often used interchangeably with ecopassage structures in order to funnel wildlife towards the structure, and to prevent wildlife from completely by-passing the structure and possibly making their way into the road or highway ROW. As reported by Mastro et al. (2008), several studies have been completed which assess the effectiveness of fencing without structures or some form of escape route, with results being inconclusive. One main factor that appeared to be consistent across the studies is that it is important that fencing is regularly maintained, as wildlife (e.g., deer) will exploit gaps (Mastro et al., 2008). Fencing also needs to be the proper height (i.e., 2.4m to 3.0m in height) and consist of the proper materials, as some wildlife may charge the fence and eventually push it down (Mastro et al., 2008; MTO, 2006). Fencing with appropriate length has also proven effective, as wildlife are typically discouraged from going around fences into the ROW (Mastro et al., 2008).

According to Mastro et al. (2008), studies have been completed to assess the effectiveness of electric fencing at excluding wildlife from the roadway. A study completed by Leblond et al. (2007), assessed the effectiveness of electric fencing in relation to the number of moose within the ROW. The study noted that the number of moose tracks within the ROW decreased 77% after the installation, and that the areas with an electric fence had 76% fewer tracks in the ROW compared to areas without fences (Mastro et al., 2008; Leblond et al., 2007). In addition, there were no moose-vehicle collisions after the electric fence was erected where the average collisions in areas the year prior ranged between 1.4 and 5.4 (Mastro et al., 2008; Leblond et al., 2007). Although moose are not reported within the Project limit, this data can be used to help ascertain the effectiveness of electric fencing in relation to larger mammals that are present in the Project limit, such as deer.

Deer exclusion fencing as noted in the study by Yagi and Timmerman (2009), can be 100% effective at keeping deer out of an area provided it is the proper type and is properly maintained. Those fences that are non-electric (electric may be inappropriate in an urban area), must be a minimum of 3 metres in height, well maintained with no gaps or spaces for deer to crawl through or underneath (Yagi and Timmerman, 2009).

Although there are some advantages to wildlife fencing, there are a number of factors that need to be considered before developing and installing such a system. Fencing, and fences in general, will cause wildlife to change their travel behaviour, thus shifting the movement of wildlife to a new location (Elzohairy, 2004). The cost of constructing fencing may be high, especially
on landscapes with steeper slopes, or undulating topography (Elzohairy, 2004). Fences require regular inspection and maintenance, as holes will need to be repaired immediately in order to prevent any wildlife from entering the ROW (Elzohairy, 2004). Fences need to be high enough in order to discourage wildlife such as deer from jumping over the fence, especially in instances where there is an abundant food source adjacent to the road (Elzohairy, 2004). Fences are considered more effective when they extend an additional 0.8km beyond areas where high wildlife concentrations exist in order to prevent “end runs” by deer (Elzohairy, 2004). Fences should also have a means of exit (or escape) for wildlife so they do not become trapped (Elzohairy, 2004).

5.2 Signage and Warning Signals

Conventional signage and or warning signals/interactive signs have been used along numerous roads across North America and in Europe. Signs are relatively easy to install and maintain, and can be installed in multiple areas (MTO, 2006). They can accommodate a broad range of wildlife species, and they are very economical compared to crossing structures. Signs can be used to raise awareness to alert motorists of specific areas where wildlife may cross a road (OREG, 2010). It is important that data is collected to support the need and type of signage in a given area. The effect of conventional warning signs appears to have only limited success as some studies indicate that drivers are likely to become accustomed to them, and eventually ignore them overtime (Huijser & McGowen, 2003).

Additional strategies for effective signage may involve placement only during known seasonal movement activities, flashing beacons, or interactive wildlife warning signals (MTO, 2006). In the study completed by Hammond et al. (2004), the stimulus of a warning light flashing in the presence of deer along the highway does play a role in reducing road speed. Interactive warning signals typically include a series of solar powered or battery operated heat sensors or infrared motion detection systems that can detect wildlife as they approach the ROW and display digital messages to the driver (MTO, 2006).

This type of technology is being developed for ungulates (e.g., deer, elk and moose), however their effectiveness is not well understood. The advantage of these systems is that they are portable, and increase driver awareness, compared to a static sign. However, they can be costly, and different factors may limit their effectiveness, such as weather conditions, or battery and solar power malfunction (MTO, 2006). Additional warning signs can be used seasonally and placed along the roadway during times of increased movement and removed similar to signs used to alert motorists during temporary construction activities. Hardy et al. (2006) found that these types
of portable signs were effective at reducing speed in the area of installation, and they were found to have a more significant impact on average speed than messages on permanent signs.

5.3 Sight Lines and Lighting

Improvements to motorist’s field of view (or sight lines) in order to better visualize roadside wildlife and vice versa can help limit wildlife and motorist interactions. The degree of roadside vegetation will also affect whether views are blocked (MTO, 2006). In instances where road improvements cannot be avoided, and they are located within a wildlife movement corridor, the road should be constructed at a perpendicular angle rather than parallel to the migration corridor (MNRF, 2014).

Additional lighting along a roadway is another way to increase motorist visibility, however, there has been limited research on whether there is a direct correlation between increased lighting and a reduction in wildlife-vehicle collisions (MTO, 2006). Despite the non-conclusive evidence, the number of deer-vehicle interactions has been documented to decrease with increased artificial lighting (Knapp et al., 2004). Overall, further research is needed to ascertain the effects of artificial lighting before their effectiveness is well understood.

In the interim, when considering increasing lighting along a roadway, they should only be installed when required to address human safety or other road safety needs (MTO, 2006). Installation of lighting adjacent to wildlife habitat areas such as forests should be avoided unless for reasons related to driver safety (MTO, 2006). If increased lighting is required for safety reasons, the following measures should be considered (MTO, 2006):

- avoid installing lighting adjacent to wildlife habitat areas (such as forest) unless unavoidable for reasons above;
- if required adjacent to wildlife habitat areas, design lighting to emit down and away from the natural area;
- consider measures that are feasible to reduce intensity and amount of light reaching natural areas;
- track and implement new technologies dealing with light pollution mitigation as they become available and tested.

5.4 Traffic Volume and Speed

Reduction of posted speed limits on roads that will intersect a wildlife movement corridor is a viable alternative to lower the number of wildlife-vehicle interactions. Temporary or seasonal posted speed limit reductions
are an option to help reduce wildlife collisions, especially in wildlife mortality zones (e.g., amphibian migration movement corridors) (MTO, 2006). However, the effectiveness of lowering posted speed limit signs in reducing wildlife-vehicle collisions is still unclear (MTO, 2006; Knapp et al., 2004). Overall studies have not shown whether decreasing the posted speed limit actually decreases the frequency of wildlife-vehicle collisions. This is especially true if traffic volumes increase, whereby an increase in volume may counteract a decrease in the posted speed limit in mitigating the number of collisions (Mastro et al., 2008).

5.5 Public Awareness and Education

Public awareness and education can also help improve wildlife safety. Public announcements, posters and even educational campaigns have been found to help reduce wildlife-vehicle collisions (MTO, 2006). These measures however work best when combined with other mitigation measures such as fencing or signage in order to maximize potential efficiency (MTO, 2006). Additional studies have shown that campaigns prove to be most effective when providing specific information such as migration times, and locations of higher deer movements, for example, than simply providing general education (Mastro et al., 2008). Suggested recommendations by Yagi and Timmerman (2009) to the Hamilton Conservation Authority and City of Hamilton to help manage deer also included initiation of public education and communication plan regarding deer herbivory, public safety and biodiversity. While education and public awareness may help improve safety it is understood that directly identifying its success at reducing vehicle collisions is not well studied, similar to other success rates of additional management strategies.

5.6 Vegetation and Measures to Modify Wildlife Behaviour

As noted above, clearing vegetation from the ROW can help to increase driver visibility (Mastro et al., 2008). Studies documented within Mastro et al. (2008) found that clearing a 20m zone along each side of the highway decreased moose-vehicle collisions by almost 20%. However, with reduction in forested or treed landscapes come additional costs associated with ongoing maintenance and potential ecological impacts (Mastro et al., 2008). Wildlife such as deer tend to prefer clearings adjacent to forest cover, and prefer areas that are often groomed and contain easily digestible forbs and grasses along with areas susceptible to salt (i.e., ROWs) (Lobo & Miller, 2013). Intercept feeding to divert wildlife such as deer has also proven to be effective (Mastro et al., 2008). This method, along with reducing the amount of salt along the roadway has been found to decrease wildlife-vehicle collisions especially in relation to moose (Mastro et al., 2008). Again, although moose are not reported within the Project limits, this data can be
used to help ascertain measures that can be useful in mitigating behaviour in relation to larger mammals that are present in the Project limits such as deer. Reflectors along the ROW, or use of chemical repellents have also been used to alter wildlife behaviours with the intent to improve wildlife and road safety. Mastro et al. (2008) reports that deer reflectors have been used to scare deer from approaching the ROW in order to mimic headlights. However, results of these studies are inconclusive at identifying the effectiveness of this measure, with most finding it ineffective at reducing deer-vehicle collisions. Similarly, the use of pesticides along roadside vegetation, or applying predator scents along the ROW is not a fully understood method for reducing deer-vehicle collisions (Mastro et al., 2008; Knapp et al., 2004).

6. **Waterdown Road Wildlife Crossing Safety Plan**

An assessment and evaluation of viable wildlife safety strategies was completed by Hatch for Waterdown Road within the Project limits. This assessment will identify the proposed Plan the CoB and subsequent Project partners will undertake in order to satisfy the conditions of approval made by the Minister of the Environment and Climate Change as outlined in Section 1.1 of this Plan.

6.1 **Retaining Wall**

Based on the Preliminary Design developed to date, there will be a series of nine retaining walls along the eastern side of Waterdown Road. The majority of the walls (7) will be constructed using armor stone and will range from 1 to 4m in height. A larger concrete wall will be constructed approximately 80m south of Mountain Brow Road along the eastern side near the Bruce Trail Crossing, with a vegetative Terrafix wall that will range from 2.5 to 7m in height and would extend from approximately 250m north of Craven Avenue northerly to the south limit of Flatt Road. These retaining walls will serve to minimize impacts associated with the road and cars in relation to property, trees, property access, protection of the Sassafras Woods and Waterdown Escarpment Woods ESAs. The presence of each of these retaining walls may also deter some wildlife from crossing the road.

6.2 **Sight Lines, Lighting, and Vegetation**

Currently, Waterdown Road is comprised of a series of bends and rolling topography as it extends north from Craven Avenue towards Mountain Brow Road. As part of the Detailed Design, an alignment assessment was completed and concluded that improvements to the existing horizontal alignment can be made by implementing larger curve radii and vertical alignment adjustments by dropping the profile between 0.5m to 0.7m. These
changes will improve the overall sight lines (or field of view) for motorists. The sight distances will primarily be improved for the corridor from Craven Ave to Flatt Road. The improved centerline radii through the successive curves in this area along with the construction of boulevards on both sides of the road will enhance driver visibility by about 20 to 25m.

Additionally, increased lighting along the roadway is planned. A light pollution study will be completed to assess lighting impacts on Sassafras Woods ESA. The use of Light Emitting Diodes (LED) lighting and flat lens fixtures will be incorporated, which will help reduce the harshness of light into the woodlands, and provide light to enhance motorists’ visibility. While there are approximately 29 low pressure sodium street lights along the road presently, the spacing of the lights is irregular. The proposed design will have well-spaced street lights continuously along both sides of the roadway.

An Edge Management Plan was also prepared (and submitted under separate cover) in relation to the eastern edge of Waterdown Road to provide for protection and management of the Sassafras Woods and Waterdown Escarpment Woods ESAs. Within the Edge Management Plan, and subsequently within the landscape plans for the roadway, details on maintaining vegetation within the ROW are explored. For example, the potential for incorporation of shrubs or herbaceous plants with spines and thorns such as Pasture rose (Rosa carolina), and Field Thistle (Cirsium discolor) that may deter wildlife from the ROW will be included.

### 6.3 Signage

To help lower wildlife-vehicle interactions, this alternative involves an increase in the roadside signage along Waterdown Road, with variation from standard conventional signage to signs with additional aspects such as warning lights or display messages. It is recommended that all signs either have a flashing beacon, or some form of LED light tubing around the edges of the sign to make them more visible, and separate them from other conventional signs (i.e., posted speed limit signs). Placement of additional signs will focus on areas considered to be wildlife movement corridors based on information provided by Conservation Halton, the Waterdown-Sassafras Woods Heritage Lands Management Plan and consideration of the winter 2016 deer survey results as documented in Section 4.3.

This alternative also includes erection of road signs with a display message during peak times for wildlife crossing. As such, deer crossing warning display messages will be activated from April 1 to June 30, and again from October 1 to December 31, each year to warn motorists using Waterdown Road.
6.4 Reduction of Posted Speed Limit and Lane Width

As documented within the ESR (2012), it was recommended that the lane widths be reduced to 3.3m wide, which is the minimum lane width for the CoB. It was also recommended in the ESR (2012) that the normal arterial road posted speed limit be reduced from 60km/h to 50km/h to address traffic impacts, and preserve the character of the area. It is envisioned that these narrower lane widths will cause drivers to reduce their speed, especially around slight bends in the road, while the lowering of the posted speed limit is expected to increase motorist alertness, thereby reducing wildlife-vehicle interactions.

6.5 Public Awareness and Education

As mitigation measures go hand in hand with public awareness and education, this alternative entails using various means of communication to alert drivers of peak wildlife migration times. Methods could include social media, and updating City websites which would identify information such as fawning season and amphibian/reptile migration (April-June), and seasonal migration periods for Deer from October to December (OREG, 2010). The intent is to alert drivers about road-side safety as it relates to deer movements and migration of wildlife such as amphibians and reptiles during their routine breeding seasons. Both the CoB and City of Hamilton will be creating a wildlife and public safety webpage which will provide details associated with deer movement, safety, and reporting means. Additionally the City of Hamilton has initiated a Wildlife Committee which may look at additional ways to address wildlife and public safety as well as monitoring strategies along road corridors.

7. Summary

Based on the assessment outlined in Section 4 of this Plan Hatch believes a multi-varied approach to address wildlife crossing safety will be most successful. For this reason, a number of various crossing safety strategies will be incorporated along Waterdown Road (from Craven Avenue north to Mountain Brow Road) that will include:
• Improved sight lines due to changes in the vertical profile and straightening of the horizontal alignment;

• Improved visibility along the eastern edges, and increased lighting of the road ROW;

• Reduced lane widths of 3.3m;

• Reduced speed limit from 60km/h to 50km/h;

• Incorporation of plants along the eastern edge that may deter deer and other wildlife from foraging;

• Incorporation of retaining walls along the east side of Waterdown Road that may limit crossing of some wildlife;

• Incorporation of increased conventional signage with flashing beacon or LED lighting throughout the Waterdown Road Project limits;

• Incorporation of seasonal deer crossing warning signs with display messages at potentially higher deer crossing locations; and,

• Increased public awareness and education (e.g. posting of additional public awareness and educational materials on the CoB and City of Hamilton Website).

Based on these strategies, Hatch is in the opinion that this Plan satisfies the condition of approval posed by the Minister of the Environment and Climate Change. This Plan documents the viable measures that will be incorporated into the Detailed Design which will help to improve wildlife safety and reduce wildlife-vehicle interactions along Waterdown Road within the Project limits.
8. References:


Personal communication, Letter to Ms. Melanie Anderton (City of Hamilton), Mr. Vito Tolone (CoB) and Mr. Jeffrey Reid (Region of Halton), from Minister of the Environment and Climate Change Glen Murray, December 17, 2014.


