

# Recovery Strategy for the Louisiana Waterthrush (*Parkesia motacilla*) in Canada

## Louisiana Waterthrush



2024



Government  
of Canada

Gouvernement  
du Canada

Canada

**Recommended citation:**

Environment and Climate Change Canada. 2024. Recovery Strategy for the Louisiana Waterthrush (*Parkesia motacilla*) in Canada. *Species at Risk Act Recovery Strategy Series*. Environment and Climate Change Canada, Ottawa. vii + 68 pp.

**Official version**

The official version of the recovery documents is the one published in PDF. All hyperlinks were valid as of date of publication.

**Non-official version**

The non-official version of the recovery documents is published in HTML format and all hyperlinks were valid as of date of publication.

For copies of the recovery strategy, or for additional information on species at risk, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, residence descriptions, action plans, and other related recovery documents, please visit the [Species at Risk \(SAR\) Public Registry](#)<sup>1</sup>.

**Cover illustration:** Sandra and Frank Horvath

Également disponible en français sous le titre  
« Programme de rétablissement de la Paruline hochequeue (*Parkesia motacilla*) au Canada »

© His Majesty the King in Right of Canada, represented by the Minister of Environment and Climate Change, 2024. All rights reserved.

ISBN 978-0-660-72832-2

Catalogue no. En3-4/371-2024E-PDF

*Content (excluding the illustrations) may be used without permission, with appropriate credit to the source*

---

<sup>1</sup> [www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html](http://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html)

## Preface

The federal, provincial, and territorial government signatories under the [Accord for the Protection of Species at Risk \(1996\)](#)<sup>2</sup> agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada<sup>3</sup>. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Louisiana Waterthrush and has prepared this recovery strategy, as per section 37 of SARA. To the extent possible, it has been prepared in cooperation with the provinces of Ontario and Quebec as per section 39(1) of SARA.

Success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Environment and Climate Change Canada and the Parks Canada Agency, or any other jurisdiction alone. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Louisiana Waterthrush and Canadian society as a whole.

This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment and Climate Change Canada, the Parks Canada Agency, and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

The recovery strategy sets the strategic direction to arrest or reverse the decline of the species, including identification of critical habitat to the extent possible. It provides all Canadians with information to help take action on species conservation. When critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

In the case of critical habitat identified for terrestrial species including migratory birds SARA requires that critical habitat identified in a federally protected area<sup>4</sup> be described

---

<sup>2</sup> [www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2](http://www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2)

<sup>3</sup> The Province of Quebec is not signatory of the Accord for the Protection of the Species at Risk (1996). It does, however, cooperate with the federal government in the conservation of species at risk of common interest.

<sup>4</sup> These federally protected areas are: a national park of Canada named and described in Schedule 1 to the *Canada National Parks Act*, The Rouge National Park established by the *Rouge National Urban Park*

in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

For critical habitat located on other federal lands, the competent minister must either make a statement on existing legal protection or make an order so that the prohibition against destruction of critical habitat applies.

If the critical habitat for a migratory bird is not within a federal protected area and is not on federal land, within the exclusive economic zone or on the continental shelf of Canada, the prohibition against destruction can only apply to those portions of the critical habitat that are habitat to which the *Migratory Birds Convention Act, 1994* applies as per SARA ss. 58(5.1) and ss. 58(5.2).

For any part of critical habitat located on non-federal lands, if the competent minister forms the opinion that any portion of critical habitat is not protected by provisions in or measures under SARA or other Acts of Parliament, or the laws of the province or territory, SARA requires that the Minister recommend that the Governor in Council make an order to prohibit destruction of critical habitat. The discretion to protect critical habitat on non-federal lands that is not otherwise protected rests with the Governor in Council.

---

*Act*, a marine protected area under the *Oceans Act*, a migratory bird sanctuary under the *Migratory Birds Convention Act, 1994* or a national wildlife area under the *Canada Wildlife Act* see ss. 58(2) of SARA.

## Acknowledgments

This recovery strategy was prepared by John Brett, building on the *Management Plan for Louisiana Waterthrush in Canada* by Christian Friis and John Brett (Environment Canada 2012), with contributions from François Shaffer, Michel Robert, Sylvain Giguère, Mattieu Allard (ECCC-CWS - Quebec Region), Juliana Galvis-Amaya, Kevin Hannah, Marie-Claude Archambault, John Viengkone, and Jessica Harriott (ECCC-CWS - Ontario Region), Véronique Connolly, and Al Harris (Northern Bioscience). This document benefited from comments provided by Parks Canada (Tammy Dobbie and Sarah Rupert), the Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (Mike Burrell), and the Ontario Ministry of the Environment, Conservation and Parks (Carling Dewar, Glenn Desy, Lucy Ellis, and Leanne Jennings),

Acknowledgment and thanks is given to all other parties that provided advice and input used to help inform the development of this recovery strategy including Indigenous organizations and individuals, individual citizens, and stakeholders who provided input and/or participated in consultation meetings.

## Executive Summary

The Louisiana Waterthrush (*Parkesia motacilla*) is an area-sensitive bird that breeds in mature riparian forests of eastern North America and winters in similar habitat in Mexico south to northern South America and the Caribbean.

The Louisiana Waterthrush was assessed as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1991, 1996, and 2006 and was listed as Special Concern on Schedule 1 of the *Species at Risk Act* in December 2007. In 2015, status was re-examined by COSEWIC and it was designated as Threatened due to its small population size. The Louisiana Waterthrush is protected under the *Migratory Birds Convention Act, 1994*.

The Louisiana Waterthrush is widespread in the eastern United States, but its small Canadian breeding range is limited to southern Ontario and southwestern Quebec. In Ontario, it is found in highest abundance along the north shore of Lake Erie in Elgin and Norfolk counties. While breeding has been confirmed at only one location in Quebec, there are several recent breeding-season occurrences at sites in the Outaouais and Cantons-de-l'Est regions.

Although not well-sampled by the Breeding Bird Survey, data suggest that the continental population of the Louisiana Waterthrush may be relatively stable. The Canadian population is small, probably consisting of fewer than 500 adults. While local declines have occurred in some parts of its Canadian range, the estimated number of pairs suggest a stable national population consistent with the continental trend.

While there is no single primary threat to the Louisiana Waterthrush in Canada, the cumulative effect of various threats operating at different scales and stages of its annual life cycle are of concern for the survival of the species. Known and potential threats to this species in Canada include residential development, logging and wood harvesting, agricultural and forestry effluents, water diversion for agriculture, and other ecosystem modifications from a variety of sources. The Louisiana Waterthrush is dependent on large areas of uninterrupted forest and the loss of canopy cover accompanied by water pollution has had a negative impact on the population. Habitat degradation due to the Hemlock Woolly Adelgid (*Adelges tsugae*), an exotic forest pest, has been identified as an emerging threat. Deforestation and resource development are suspected to be a threat to this species on its wintering grounds.

The population and distribution objective identified in this recovery strategy is to maintain or increase the size and distribution of the Louisiana Waterthrush population in Canada. Broad strategies and approaches to address the threats to the survival and recovery of the Louisiana Waterthrush are outlined in this recovery strategy.

Critical habitat is identified in this recovery strategy, and a schedule of studies has been developed to provide the information necessary to complete the identification of critical habitat that will be sufficient to meet the population and distribution objectives.

One or more action plans for this species will be posted on the Species at Risk Public Registry within 5 years of the posting of this recovery strategy.

## Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, recovery of the Louisiana Waterthrush has been deemed technically and biologically feasible.

### **1. Individuals of the wildlife species that are capable of reproduction are available now or in the foreseeable future to sustain the population or improve its abundance.**

Yes. Individuals capable of reproduction are available now, however some local populations in Canada may currently be dependent on immigration to persist. Although not well sampled by the Breeding Bird Survey, data suggest that the continental population of the Louisiana Waterthrush may be relatively stable or increasing, which suggests that source individuals may be available to sustain the population through immigration. However, as the small Canadian population of Louisiana Waterthrush occurs at the northern part of its continental range, and the vast majority of its continental distribution and population occurs further south in the United States, it is important to note that population changes at the continental level may have a significant effect on the availability of individuals in Canada. If the continental population of the Louisiana Waterthrush experiences a downward population trend, its range may contract away from the current periphery, and immigration to Canada may decrease.

### **2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.**

Yes. Sufficient suitable habitat may be available to maintain the current population size, and habitat management and restoration could increase habitat quantity and quality at currently unoccupied sites. In Canada, many areas of potentially suitable habitat are not consistently occupied, likely owing to a small population that may be reliant on immigration from neighbouring states. However, the Louisiana Waterthrush occupies specialized habitat, showing a strong preference for nesting along relatively pristine, headwater streams and associated wetlands situated in large tracts of mature forest, so opportunities for large-scale habitat restoration could be limited in the species' Canadian range.

### **3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.**

Yes. There is no single primary threat to the survival of the Canadian population; instead the Louisiana Waterthrush in Canada is threatened by the cumulative effects of various threats (including habitat loss and changes in water quality due to agricultural

intensification and suburban residential development). Addressing at least some of these threats in Canada (through protection, habitat restoration, and management) is possible, though increasing development pressure in the species' Canadian range may increase or exacerbate these threats. However, as this species also faces threats outside of Canada in its migration and wintering range, maintaining a stable Canadian population and distribution will require collaboration of multiple organizations and governments at both regional and continental scales.

**4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.**

Yes. While the primary threats to this species in Canada appear to be those related to habitat loss and degradation, techniques for restoring and improving habitat exist or are being developed (e.g. in the case of Hemlock Woolly Adelgid control).

However, as the small Canadian population of Louisiana Waterthrush occurs at the northern part of its continental range, and the vast majority of its continental distribution and population occurs further south in the United States, it is important to note that population changes at the continental level may have a significant effect on recovery feasibility in Canada. If the continental population of the Louisiana Waterthrush experiences a downward population trend, its range may contract away from the current periphery, and immigration to Canada may decrease. The persistence of the small Canadian population may be dependent upon immigration from the United States (COSEWIC 2015). In such a case, despite best efforts described in this strategy to ensure that sufficient suitable habitat is available and key threats are mitigated, the numbers of Louisiana Waterthrush in Canada may decline.



## Table of Contents

Preface.....	i
Acknowledgments.....	iii
Executive Summary.....	iv
Recovery Feasibility Summary.....	v
1. COSEWIC* Species Assessment Information.....	1
2. Species Status Information.....	1
3. Species Information.....	2
3.1 Species Description.....	2
3.2 Species Population and Distribution.....	2
3.3 Needs of the Louisiana Waterthrush.....	5
4. Threats.....	7
4.1 Threat Assessment.....	7
4.2 Description of Threats.....	9
5. Population and Distribution Objectives.....	13
6. Broad Strategies and General Approaches to Meet Objectives.....	14
6.1 Actions Already Completed or Currently Underway.....	14
6.2 Strategic Direction for Recovery.....	17
6.3 Narrative to Support the Recovery Planning Table.....	21
7. Critical Habitat.....	21
7.1 Identification of the Species' Critical Habitat.....	21
7.2 Schedule of Studies to Identify Critical Habitat.....	24
7.3 Activities Likely to Result in the Destruction of Critical Habitat.....	24
8. Measuring Progress.....	28
9. Statement on Action Plans.....	28
10. References.....	29
Appendix A: Critical Habitat for the Louisiana Waterthrush.....	35
Appendix B: Subnational Conservation Ranks of the Louisiana Waterthrush in Canada and the United States.....	65
Appendix C: Effects on the Environment and Other Species.....	66
Appendix D: Breeding Evidence.....	68

## 1. COSEWIC\* Species Assessment Information

**Date of Assessment:** November 2015

**Common Name (population):** Louisiana Waterthrush

**Scientific name:** *Parkesia motacilla*

**COSEWIC Status:** Threatened

**Reason for COSEWIC Designation:** During the breeding season in Canada, this songbird nests along clear, shaded, coldwater streams and forested wetlands in southern Ontario and southwestern Quebec. It occupies a similar habitat niche in Latin America during the winter. The Canadian population is small, probably consisting of fewer than 500 adults, but breeding pairs are difficult to detect. Population trends for the Canadian population are uncertain. Declines have been noted in some parts of the Canadian range, particularly in its stronghold in southwestern Ontario, while new pairs have been found in others. Immigration of individuals from the northeastern U.S. is thought to be important to maintaining the Canadian population. However, while the U.S. source population currently appears to be fairly stable, it may be subject to future population declines due to emerging threats to habitat.

**Canadian Occurrence:** Ontario and Quebec

**COSEWIC Status History:** Designated Special Concern in April 1991. Status re-examined and confirmed in April 1996 and April 2006. Status re-examined and designated Threatened in November 2015.

\* COSEWIC (Committee on the Status of Endangered Wildlife in Canada)

## 2. Species Status Information

Globally, Louisiana Waterthrush (*Parkesia motacilla*) is ranked G5 (Secure), with national ranks of N5B (Secure, Breeding population) in the United States and N3B (Vulnerable, Breeding population) in Canada (NatureServe 2021). This species is ranked subnationally as S3B (Vulnerable, Breeding population) in Ontario and in S1B (Critically Imperiled, Breeding population) in Quebec (NatureServe 2021; Appendix B).

Louisiana Waterthrush is listed as Threatened under schedule 1 of the *Species at Risk Act* and on schedule 3 of Ontario's *Endangered Species Act, 2007*. In Quebec, the species is listed on the *Liste des espèces susceptibles d'être désignées menacées ou vulnérables* (list of wildlife species likely to be designated threatened or vulnerable). This list is produced according to the *Loi sur les espèces menacées ou vulnérables* (RLRQ, c. E-12.01 [Act respecting threatened or vulnerable species]; CQLR, c E-12.01). Louisiana Waterthrush is not listed under the U.S. *Endangered Species Act*.

### 3. Species Information

#### 3.1 Species Description

The Louisiana Waterthrush is a member of the wood-warbler family (Parulidae). It is about 15 cm in length and has a brown back and white belly adorned in brown spots, while its throat is generally unspotted and white. It has a broad, white stripe above the eye that widens behind the eye toward the nape. It has a rather large bill for a wood-warbler and also appears rather large bodied for this family of birds. Its flanks can be tinged buff or can be clean white. Its legs are bright pink in colour (Pyle 1997, Mattsson et al. 2009).

This species closely resembles a more common and widespread wood-warbler species, the Northern Waterthrush (*Parkesia noveboracensis*; Chesser et al. 2010). The Northern Waterthrush is slightly smaller and has a smaller bill than Louisiana Waterthrush. The Northern Waterthrush is typically tinged yellowish on its belly (where it has darker, more densely-arranged spots which appear to form streaks), its throat tends to be spotted, and its legs are typically not as bright pink as those of the Louisiana Waterthrush. The waterthrushes are perhaps most reliably separated by song, with the 3-4 groups of notes from the Northern Waterthrush lacking the “clear, ringing introductory notes and weak, jumbled ending” (Dunn and Garrett 1997) of the Louisiana Waterthrush.

#### 3.2 Species Population and Distribution

Globally, the Louisiana Waterthrush breeds in eastern North America, including parts of southeastern Canada (Figure 1), with the majority of the population concentrated in Bird Conservation Region<sup>5</sup> 28 throughout the Appalachian Mountains (Mattsson et al. 2009).

The species winters from northern Mexico south to central Panama, and throughout the Greater Antilles and some smaller Caribbean islands (COSEWIC 2006, Mattsson et al. 2009). There have also been casual sightings outside this range (Mattsson et al. 2009). Migration routes are poorly understood, although sightings and specimen collections suggest that migration occurs through the southeastern

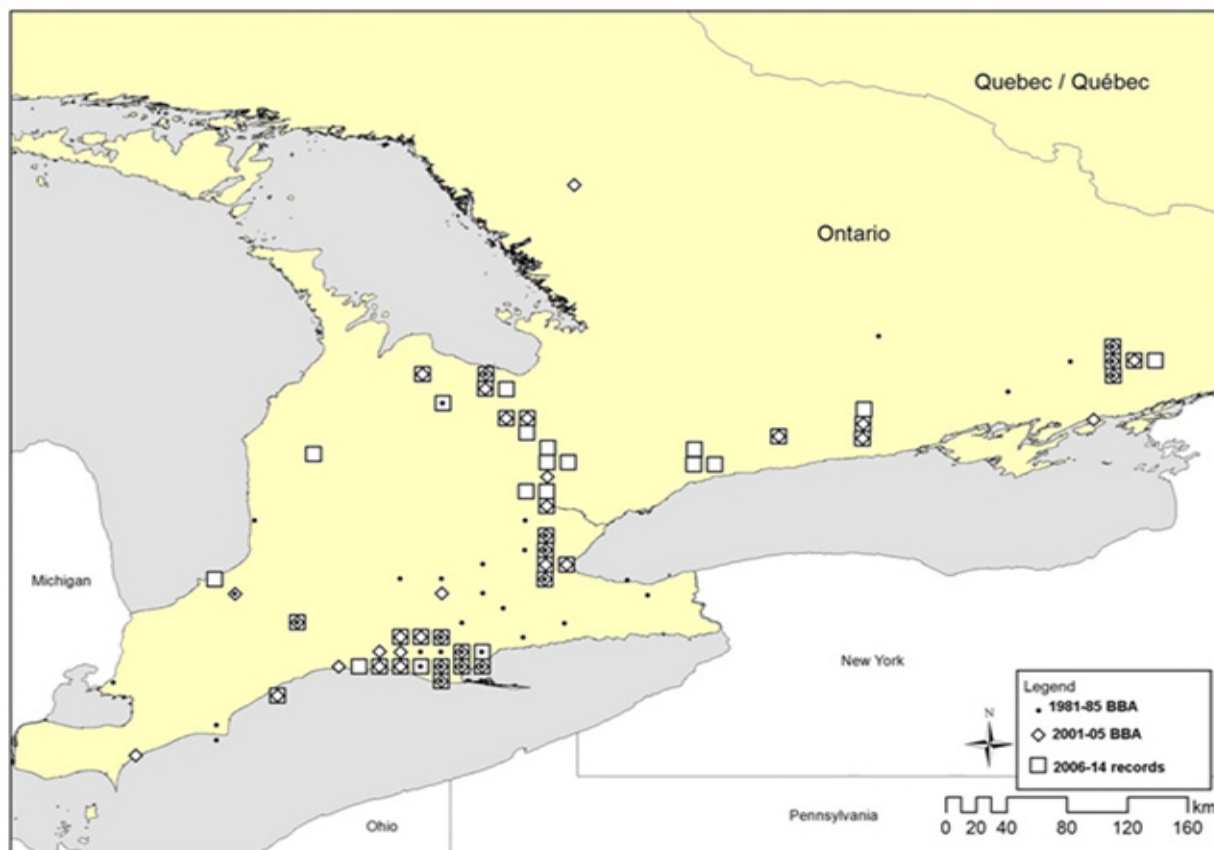


**Figure 1.** Global range of the Louisiana Waterthrush (Modified from Ridgely et al. 2007).

<sup>5</sup> Bird Conservation Regions are “a set of 66 ecoregions across North America that have similar biophysical elements, such as soil type, vegetation and associated bird species, and are used as the basis for planning and evaluation of integrated bird conservation” (Ontario Partners in Flight 2008).

United States, with many migrants flying across the Gulf of Mexico and some following the Central American coast (COSEWIC 2006, Mattsson et al. 2009).

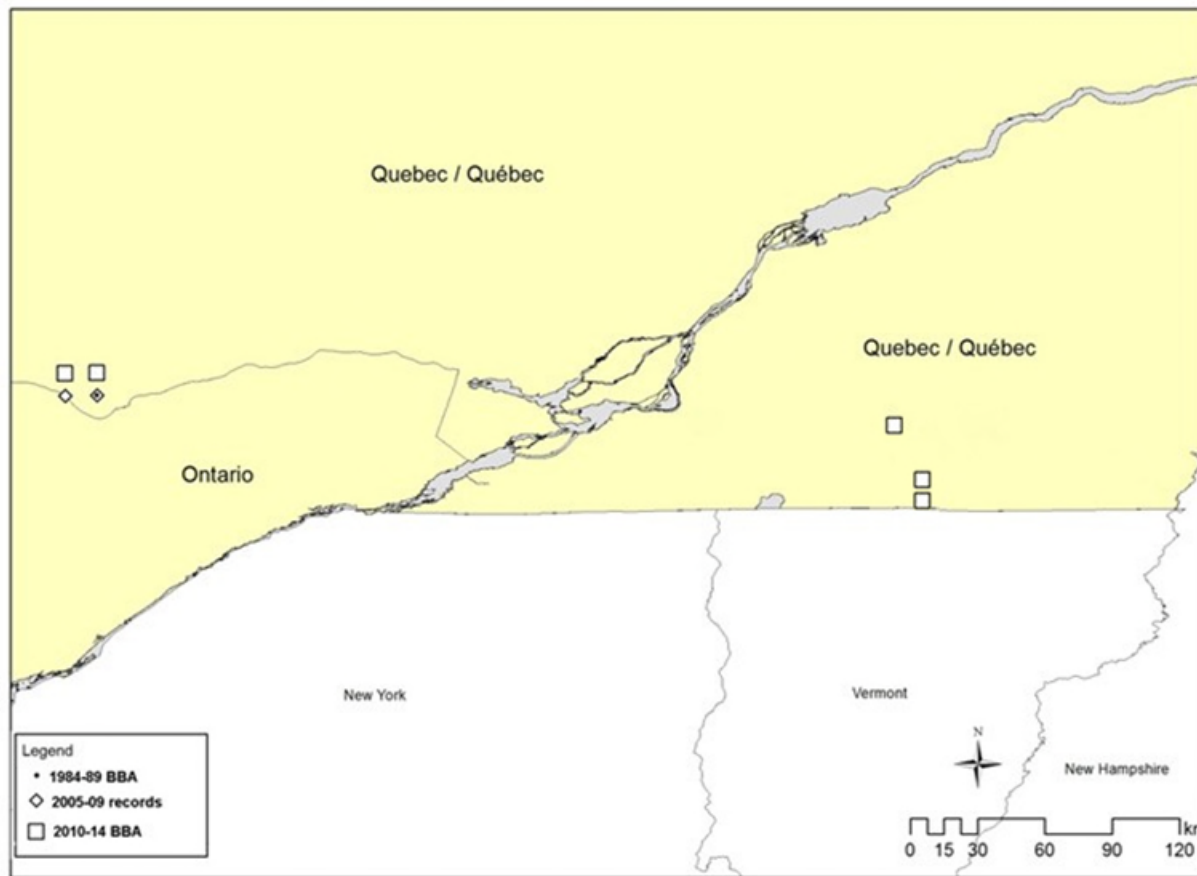
In Canada, breeding records for this species are limited to southern Ontario (Figure 2), where it is found in highest abundance along the north shore of Lake Erie in Elgin and Norfolk counties, and southwestern Quebec in the Cantons-de-l'Est and Outaouais regions. Nesting has been confirmed at only one location in Quebec (Figure 3; Dendroica Environnement et Faune 2006, 2007), although other observations without confirmed breeding have been made elsewhere in the province (Yank and Aubry 1984, David 1996, St-Hilaire and Dauphin 1996, Dendroica Environnement et Faune 2005, Robert 2019).



**Figure 2.** Distribution of the Louisiana Waterthrush in Ontario during three time periods (COSEWIC 2015). Data collection referred to in the legend was : 1981-1985 for the (first Ontario Breeding Bird Atlas ([Cadman et al. 1987]), 2001-2005 for the second (2nd Ontario Breeding Bird Atlas [Cadman et al. 2007]) and 2006-2014 (compiled records). Squares are 10 km x10 km.

There are difficulties in determining accurate population estimates or trends for Louisiana Waterthrush in Canada, as intermittent site occupancy is common throughout the Canadian range. Although meaningful estimates have been made for Ontario through the Ontario Breeding Bird Atlas (OBBA; Cadman et al. 2007), local targeted surveys, and other information sources, no consistent range-wide surveys exist to

capture robust abundance estimates and trends for Louisiana Waterthrush in Canada over time.



**Figure 3.** Breeding distribution of the Louisiana Waterthrush in Quebec. during three time periods (COSEWIC 2015): 1984-1989 (1st Quebec Breeding Bird Atlas [Gauthier and Aubry 1996]), 2005-2009 (compiled records) and 2010-2014 (2nd Quebec Breeding Bird Atlas [Robert 2019]) (COSEWIC 2015). Squares are 10 km x10 km.

Although broad-scale programs such as the Breeding Bird Survey (BBS) document this species, insufficient data are gathered for Louisiana Waterthrush in Canada using this methodology for three main reasons: i) its rarity in Canada, ii) roadside BBS surveys do not adequately survey the forest interior habitat preferred by this species, and iii) Canadian BBS routes are run between 28 May until 7 July (with early to-mid June being the preferred window), while the peak of Louisiana Waterthrush singing occurs before this period, and is markedly reduced through June in Ontario (McCracken 2007). Targeted surveys have occurred for Louisiana Waterthrush at key locations in Ontario and Quebec (COSEWIC 2015).

Despite the limitations of existing broad-scale surveys, the global population has been estimated at 360,000 mature individuals (180,000 pairs; PIFSC 2013 *in* COSEWIC 2015). The Canadian population is estimated between 100 and 245 pairs (COSEWIC 2015), which represents less than one percent of the global population. The Louisiana Waterthrush is estimated to occur in Canada over an areal extent of 110 000 km<sup>2</sup>

(COSEWIC 2015). Within this extent of occurrence, it is estimated to have an area of occupancy of 356 to 500 km<sup>2</sup> (COSEWIC 2015).

The global breeding population appears to be stable, and there is even some indication from BBS results that the U.S. population increased by an average rate of 0.747% annually in the period of 1970 to 2019 (Smith et al. 2020). A 34% positive change in population size from 1970 to 2014 was reported in the recent Partners in Flight Landbird Conservation Plan (Rosenberg et al. 2016). The overall Canadian population, although small, appears to be stable (McCracken 2007; COSEWIC 2015). It is likely that the Canadian population is supported by immigration from U.S. populations (COSEWIC 2006; COSEWIC 2015), however threats on the U.S. breeding grounds could reduce immigration into the Canadian population (COSEWIC 2015).

### **3.3 Needs of the Louisiana Waterthrush**

#### **Habitat and biological needs**

The Louisiana Waterthrush is typically found in riparian zones in mature tracts of deciduous and mixed forests (COSEWIC 2006, 2015; Mattsson et al. 2009), and it shows a preference for streams below steep-sided slopes (Eaton 1958) in forests containing deciduous trees, often with a hemlock component (Craig 1985; COSEWIC 2006). Nest sites are found along stream banks and swamp edges, under mossy logs and in roots of fallen trees (Prosser and Brooks 1998; Mattsson et al. 2009). Nest sites are normally well concealed by over-hanging vegetation or roots (Bent 1953; Eaton 1958; Peck and James 1987). Clear headwater streams and associated wetlands are preferred sites, but this species will also inhabit the heavily-wooded swamps more typically associated with Northern Waterthrush (Craig 1984, 1985; Curson et al. 1994; Dunn and Garrett 1997).

The Louisiana Waterthrush is often described as an area-sensitive forest interior bird (Robbins 1979 *in* COSEWIC 2006, OMNR 2011) that requires non-fragmented forest (i.e. continuous, uninterrupted forest; Prosser and Brooks 1998), suggesting that a contiguous patch of mature forest is an important habitat feature to this species. Robbins (1979 *in* COSEWIC 2006) estimated that the minimum size of contiguous forest to support a viable population is about 100 ha, based on studies in Maryland. A recent landcover analysis of survey locations on the Niagara Escarpment in southern Ontario found nearly total mixed/deciduous forest cover within 200 m of the majority of detection locations from 1981 to 2013, suggesting that forest cover at that scale may be important for this species (Lebrun-Southcott and Campomizzi 2014). More study is needed to confirm the importance of patch size and configuration on occupancy and productivity of Louisiana Waterthrushes in Canada.

In Georgia, Mattsson (2006) found that Louisiana Waterthrush occupancy approached 99% when the buffer around a stream was at least 120 m (i.e. on one side of a stream, not total riparian zone width), but cautioned that presence and abundance alone may be poor indicators of reproductive success and habitat quality.

Breeding territories on streams follow the length of the stream, although the reported length used by Louisiana Waterthrush pairs during the breeding season is variable (Table 1), and may reflect the local food availability or mating system (Mattsson et al. 2009). Territories for both swamp- and stream-nesting pairs are estimated to be about 2 ha in area (COSEWIC 2006), with the estimate for the latter based on the territory length average (400 m) from a northern New York study (Eaton 1958) and an estimated 50 m territory width.

**Table 1. Reported territory lengths used by breeding Louisiana Waterthrushes.**

Location	Range (m)	Average (m)	Source
Northern New York	Not reported	400	Eaton 1958
Connecticut	188 to 538	358	Craig 1981 <i>in</i> Mattsson et al. 2009
Southern Illinois	375 - 1200	930	Robinson 1990 <i>in</i> Mattsson et al. 2009
Northern Georgia	90 - 1440	520	Mattsson and Cooper 2009
Northeast Pennsylvania	120 - 650	283	Mattsson et al. 2009
Southwest Pennsylvania	250 - 400	Not reported	Mattsson et al. 2009

As one of the first neotropical migrants to arrive in Canada in April, the Louisiana Waterthrush probably relies on foraging in streams and the surrounding leaf litter for most of its diet until trees leaf out later in the spring, as has been observed elsewhere in its range (Craig 1984). This species relies primarily on aquatic insect prey throughout most of its lifecycle, but other invertebrates (molluscs, crustaceans, and earthworms), small fish, and amphibians may also be taken (Craig 1984; Mattsson et al. 2009).

The species breeds in Canada from time of arrival in April and early May into July. Eggs are typically laid between 1 May and 8 July and are incubated for 12-14 days (COSEWIC 2015). After fledging, young are cared for by adults up to four weeks, as observed elsewhere in the species' range (Mattsson et al. 2009), and will remain along natal streams for about a month (COSEWIC 2006). It is estimated that the Louisiana Waterthrush uses up to 25 ha of habitat within a larger forest patch over the course of the breeding season to successfully raise young (COSEWIC 2006).

Louisiana Waterthrushes are early southward migrants in the fall and tend to be solitary at this time (Dunn and Garrett 1997). They occupy similar habitat to that used during breeding, but will also utilize wet areas such as swamps. They migrate at night through the south-eastern U.S. and Mexico following the Mississippi flyway towards their wintering grounds in Central and northern South America and the West Indies (Curson et al. 1994). Once on the wintering grounds, they prefer habitat that is similar to their breeding habitat (Master et al. 2005) – mature forest with steep-sided ravines near flowing water or mature swamp forest with standing pools of water – and are noted as being territorial (Eaton 1958, Master et al. 2005).

## Limiting Factors

A strong dependence upon clear, medium to high-gradient, lower order streams (e.g., headwaters) through deeply incised ravines<sup>6</sup> in contiguous, mature tracts of deciduous and mixed forest is a significant limiting factor for Louisiana Waterthrush in Canada, as this type of habitat is not abundant across much of the Louisiana Waterthrush's Canadian breeding range.

## 4. Threats

### 4.1 Threat Assessment

The Louisiana Waterthrush threat assessment is based on the IUCN CMP (World Conservation Union-Conservation Measures Partnership) unified threats classification system. Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. For purposes of threat assessment, only present and future threats are considered. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in the Description of Threats section.

**Table 2. Threat Assessment for Louisiana Waterthrush**

Threat # <sup>a</sup>	Threat Description	Impact <sup>b</sup>	Scope <sup>c</sup>	Severity <sup>d</sup>	Timing <sup>e</sup>
<b>1</b>	<b>Residential &amp; commercial development</b>	<b>Low</b>	<b>Small</b>	<b>Extreme</b>	<b>High</b>
1.1	Housing & urban areas	Low	Small	Extreme	High
1.2	Commercial and industrial areas	Negligible	Negligible	Extreme	High
1.3	Tourism & recreation areas	Negligible	Negligible	Extreme	Moderate
<b>2</b>	<b>Agriculture &amp; aquaculture</b>	<b>Negligible</b>	<b>Negligible</b>	<b>Slight</b>	<b>High</b>
2.1	Annual & perennial non-timber crops	Negligible	Negligible	Slight	High
<b>4</b>	<b>Transportation &amp; service corridors</b>	<b>Low</b>	<b>Small</b>	<b>Slight</b>	<b>High</b>
4.2	Utility & service lines	Low	Small	Slight	High
<b>5</b>	<b>Biological resource use</b>	<b>Low</b>	<b>Restricted</b>	<b>Slight</b>	<b>High</b>
5.3	Logging & wood harvesting	Low	Restricted	Slight	High

<sup>6</sup> Deeply incised ravines are narrow steep-sided valleys that are cut into the landscape.



Threat # <sup>a</sup>	Threat Description	Impact <sup>b</sup>	Scope <sup>c</sup>	Severity <sup>d</sup>	Timing <sup>e</sup>
<b>6</b>	<b>Human intrusions &amp; disturbance</b>	<b>Negligible</b>	<b>Negligible</b>	<b>Negligible</b>	<b>High</b>
6.1	Recreational activities	Negligible	Negligible	Negligible	High
6.3	Work & other activities	Negligible	Negligible	Negligible	High
<b>7</b>	<b>Natural System Modifications</b>	<b>Medium – Low</b>	<b>Restricted – Small</b>	<b>Serious</b>	<b>High – Moderate</b>
7.2	Dams & water management use	Low	Restricted	Slight	High
7.3	Other ecosystem modifications	Medium - Low	Restricted - Small	Serious	High – Moderate
<b>9</b>	<b>Pollution</b>	<b>Medium - Low</b>	<b>Restricted - Small</b>	<b>Serious - Slight</b>	<b>High</b>
9.3	Agricultural & forestry effluents	Medium - Low	Restricted - Small	Serious - Slight	High
9.5	Air-borne pollutants	Low	Restricted	Moderate	High
<b>11</b>	<b>Climate change &amp; severe weather</b>	<b>Unknown</b>	<b>Unknown</b>	<b>Unknown</b>	<b>Unknown</b>
11.1	Habitat shifting & alteration	Unknown	Unknown	Unknown	Unknown

<sup>a</sup> **Threat #** - Threats are numbered using the IUCN Classification System. Only those threats relevant to Louisiana Waterthrush are presented in this table and in Section 4.2 Description of Threats.

<sup>b</sup> **Impact** – The degree to which a species is observed, inferred, or suspected to be directly or indirectly threatened in the area of interest. The impact of each threat is based on Severity and Scope rating and considers only present and future threats. Threat impact reflects a reduction of a species population or decline/degradation of the area of an ecosystem. The median rate of population reduction or area decline for each combination of scope and severity corresponds to the following classes of threat impact: Very High (75% declines), High (40%), Medium (15%), and Low (3%). Unknown: used when impact cannot be determined (e.g., if values for either scope or severity are unknown); Not Calculated: impact not calculated as threat is outside the assessment timeframe (e.g., timing is insignificant/negligible or low as threat is only considered to be in the past); Negligible: when scope or severity is negligible; Not a Threat: when severity is scored as neutral or potential benefit.

<sup>c</sup> **Scope** – Proportion of the species that can reasonably be expected to be affected by the threat within 10 years. Usually measured as a proportion of the species' population in the area of interest. (Pervasive = 71–100%; Large = 31–70%; Restricted = 11–30%; Small = 1–10%; Negligible < 1%).

<sup>d</sup> **Severity** – Within the scope, the level of damage to the species from the threat that can reasonably be expected to be affected by the threat within a 10-year or three-generation timeframe. Usually measured as the degree of reduction of the species' population. (Extreme = 71–100%; Serious = 31–70%; Moderate = 11–30%; Slight = 1–10%; Negligible < 1%; Neutral or Potential Benefit  $\geq$  0%).

<sup>e</sup> **Timing** – High = continuing; Moderate = only in the future (could happen in the short term [ $<$  10 years or 3 generations]) or now suspended (could come back in the short term); Low = only in the future (could happen in the long term) or now suspended (could come back in the long term); Insignificant/Negligible = only in the past and unlikely to return, or no direct effect but limiting.

## 4.2 Description of Threats

While there is no single primary threat to the Louisiana Waterthrush in Canada, the cumulative effect of various threats operating at different scales and stages of its annual life cycle are of concern to the survival of the species. The cumulative effect of combinations of these threats is expected to have a high to medium overall impact on the population (see Table 2) (Master et al. 2012).

### **IUCN Threat 1. Residential and Commercial Development (*Low Impact*)**

*1.1 Housing & urban areas; 1.2 Commercial & industrial areas; 1.3 Tourism and recreation areas*

Habitat conversion has already affected southern Ontario to the extent that much of the forested habitat that once existed has been converted and now exists as agricultural land or urbanized areas, which is not used by Louisiana Waterthrush for breeding. However, many of the areas now occupied by this species are on lands that are managed for conservation, so residential and commercial development is expected to affect a relatively small number of birds, and is consequently estimated to have a low overall impact.

The Louisiana Waterthrush is sensitive to flash-flooding<sup>7</sup> caused by development within watersheds (Ontario Partners in Flight 2008). The impervious surfaces typical of an urban environment contribute to downstream flooding (Environment Canada 2004), which can result in degradation of Louisiana Waterthrush breeding habitat and damage to nests and nesting areas.

Development and the resulting fragmentation of suitable forest habitat results in an increase of forest edge, which may decrease the suitability of the habitat for this area-sensitive species, and could exacerbate the risk of other threats including the introduction of invasive species, increased predation/parasitism, pollution, and human disturbance. A fragmented landscape increases the exposure of nesting Louisiana Waterthrush to nest parasites and predators that occupy edge habitats (COSEWIC 2015). Peck and James (1987) documented nest parasitism of breeding Louisiana Waterthrushes by Brown-headed Cowbirds (*Molothrus ater*) at a rate of 25% in Ontario, but with only a sample of eight nests. Cowbirds lay their eggs in host species' nests during the breeding season, where they are then cared for by the host adults. However, despite relatively high rates of cowbird parasitism in the fragmented landscape of southwestern Ontario, evidence of reduced productivity due to cowbirds in this area is lacking (COSEWIC 2015).

Louisiana Waterthrush spends the non-breeding portion of its life cycle on its wintering grounds where it is described as a habitat specialist (Master et al. 2005), and is

---

<sup>7</sup> Flash-flooding is the sudden rush of water caused by heavy rainfall that may be exacerbated by impermeable surfaces on a landscape

suspected to be vulnerable to degradation and habitat loss in these areas. Deforestation rates in South and Central America, where the Louisiana Waterthrush winters, are among the highest in the world (FAO 2006).

## **IUCN Threat 2. Agriculture & aquaculture (*Negligible Impact*)**

### *2.1 Annual & perennial non-timber crops*

The conversion of mature deciduous forest into agricultural lands is largely a historical threat to this species in Canada, and its current/future impact is expected to be negligible (COSEWIC 2015). The physical characteristics typical of Louisiana Waterthrush breeding habitat (e.g. steep-sloped ravines) generally preclude most kinds of agricultural activities (COSEWIC 2015).

Habitat loss and degradation due to agricultural activities in the wintering range are ongoing threats (COSEWIC 2015). Deforestation rates in South and Central America, where the Louisiana Waterthrush winters, are among the highest in the world (FAO 2006).

Water diversion for irrigation is discussed under *7.2 Dams & water management/use*, and pollution related to agricultural activities is discussed under *9.3 Agricultural & forestry effluents*.

## **IUCN Threat 4. Transportation & service corridors (*Low Impact*)**

### *4.2 Utility & service lines*

During migration, this species is at risk from collision with communication towers and tall buildings (COSEWIC 2015), though the impact of this threat in Canada is likely low.

## **IUCN Threat 5. Biological resource use (*Low Impact*)**

### *5.3 Logging & wood harvesting*

Louisiana Waterthrush responds negatively to some wood harvesting regimes, including clear-cutting, shelterwood, and diameter-limit harvests<sup>8</sup> (COSEWIC 2015). Forested land used by Louisiana Waterthrush may be threatened by thinning of forests (COSEWIC 2006), which can increase the amount of sunlight that reaches streams used as foraging areas. This can cause an increase in stream temperatures, which can decrease the aquatic invertebrate populations found therein (Eaton 1988) and reduce the food availability to Louisiana Waterthrush. Furthermore, thinned forests can lead to erosion and run off along steep-sided slopes, which can cause increased sedimentation

---

<sup>8</sup> Diameter-limit harvesting is a forest harvesting regime where specific size thresholds (diameter-limits) are set and only trees above the threshold are harvested.

and siltation in nearby streams and rivers (Environment Canada 2001), which can in turn reduce the abundance and diversity of certain aquatic invertebrates. Logging operations are relatively uncommon in southern Ontario, and most individuals occur on lands managed for conservation. The impact of this threat may be higher for individuals that occur in the northern part of the Ontario range where more logging occurs.

## **IUCN Threat 6. Human intrusions & disturbance (*Negligible Impact*)**

### *6.1 Recreational activities*

The use of all-terrain vehicles (ATVs) to ford rivers and streams increases stream siltation<sup>9</sup>, which is recognized as one of the most important current threats to Louisiana Waterthrushes in Canada (COSEWIC 2006). An increase in siltation can change the aquatic invertebrate community (Environment Canada 2004), reducing the amount of food available to feed developing young, and likely negatively affecting breeding populations. This source of the siltation threat has been most notable in the Norfolk Sand Plain (COSEWIC 2006), a Canadian breeding strong hold. A number of other potential sources of increased siltation in Ontario, including urban development, road construction, and agriculture, are summarized by Kerr (1995).

Disturbance is a potential threat in situations where Louisiana Waterthrush breeding territory overlaps with areas of high human use for recreational activities. Louisiana Waterthrushes breeding near hiking trails are vulnerable to disturbance by hikers, dog-walkers, and birders interested in observing the species (Dendroica Environnement et Faune 2006, 2007).

### *6.3 Work & other activities*

This threat category includes scientific research activities, which is expected to have a negligible effect on the species in Canada (COSEWIC 2015).

## **IUCN Threat 7. Natural system modifications (*Medium – Low Impact*)**

### *7.2 Dams & water management/use*

Irrigation activities and other water use that drains swamps or reduces the flow of streams or rivers are a threat to Louisiana Waterthrush. A reduction in the amount of water available to aquatic invertebrates and insects that require water for part of their life cycle could compromise the food resources available to breeding pairs. This in turn could affect the breeding potential of Louisiana Waterthrush using areas near or affected by irrigation activities. Similarly, nesting becomes less desirable in areas where

---

<sup>9</sup> Stream siltation is type of water pollution caused by the increase of floating particulate or sediment in the stream. This in turns makes the water less transparent and the floating sediment can have negative impacts on native species. Driving ATVs into rivers and streams may increase siltation by disturbing the river and stream beds and bringing sediment into suspension.

resources are scarce. This threat occurs most often during the growing season, or during periods of drought, and is most common in habitat adjacent or near to agriculture-dominated landscapes like those found in southwestern Ontario.

### 7.3 Other ecosystem modifications

Hemlock mortality due to Hemlock Woolly Adelgid (*Adelges tsugae*), an exotic invasive insect first reported in the eastern United States in 1951, is described as an emerging threat for forest and stream ecosystems in the region (Trotter et al. 2013). Louisiana Waterthrush is closely associated with hemlock in its core breeding range in the Appalachian Mountains, where high hemlock mortality would result in adverse impact to Louisiana Waterthrush immigration into Canada. Additionally, hemlock mortality leads to increased light penetration of aquatic systems resulting in an increase in water temperature and a shift in aquatic insect communities (COSEWIC 2015). Similarly, the Asian Long-horned Beetle (*Anoplophora glabripennis*) and Emerald Ash Borer (*Agilus planipennis*) could have an impact on eastern deciduous forest ecosystems by attacking and killing broadleaved trees (COSEWIC 2015).

Stream bank stabilization activities may also threaten Louisiana Waterthrush, though the overall impact of this threat in Canada is unknown. Stream bank stabilization may include removal of coarse woody debris, stumps, and native vegetation, which can eliminate features necessary for breeding. Shoreline hardening or changes to stream morphology associated with stabilization could lead to changes in water flow and sediment deposition necessary for vegetation succession on the stream bank, and may change downstream water quality and nutrient loads (Cooper et al. 2000, Pracheil 2010), which could impact the prey species used by Louisiana Waterthrush.

## **IUCN Threat 9. Pollution (Medium – Low Impact)**

### 9.3 Agricultural & forestry effluents

Neonicotinoid insecticides are a potential emerging threat to Louisiana Waterthrush (COSEWIC 2015). Neonicotinoids have a propensity to spread in the environment and have been shown to negatively affect insectivorous bird species through a reduction in invertebrate prey abundance (Hallmann et al. 2014). Mineau and Palmer (2013) suggested that the effects of neonicotinoids on birds may not be limited to the farm scale, but likely expand to the watershed or regional scale; therefore, neonicotinoids could be impacting insect and bird species found outside of the target farms. Some aquatic insects that are part of the Louisiana Waterthrush's diet (e.g. Ephemeroptera and Trichoptera) are particularly vulnerable to pesticides (e.g. neonicotinoids; COSEWIC 2015). Reductions in insect prey availability through the use of neonicotinoids and other insecticides in Canada could potentially affect Louisiana Waterthrush, since this species often occurs in a landscape dominated by agricultural land.

### 9.5 Air-borne pollutants

Acidification has been shown to affect the water quality of streams in some regions of the eastern United States, and thus have effects on the food resources available to Louisiana Waterthrush (Mulvihill 1999, Mulvihill et al. 2008). In a Georgia study, territories were larger and nesting densities were lower on acidified streams, which resulted in a lower number of young produced compared to circum-neutral streams (Mulvihill et al. 2008). While stream acidification has not been demonstrated to be a direct threat to populations in Canada, there is concern that a reduction of Louisiana Waterthrush populations in adjacent states due to stream acidification would be expected to reduce immigration from those areas.

## **IUCN Threat 11. Climate change & severe weather (*Unknown Impact*)**

### 11.1 Habitat shifting & alteration

In its threats assessment, COSEWIC noted that “the effects of climate change are not expected to affect this bird in the next 10 years. The effect is unknown and could potentially benefit the species” (COSEWIC 2015). There is potential for climate-related shifts in habitat and invertebrate prey phenology to impact Louisiana Waterthrush, though it is unknown whether any such shifts would pose a threat to the species in Canada (COSEWIC 2015). It is possible that changes may facilitate a northeast shift in the species’ continental range, which could result in a population increase in Canada. However, such changes may be accompanied by a northward spread of forest pest species that are otherwise limited by cold winter temperatures (COSEWIC 2015). More research is needed to determine how climate change may impact the Louisiana Waterthrush in Canada.

## **5. Population and Distribution Objectives**

The population and distribution objective for the Louisiana Waterthrush in Canada is to:

- **Maintain or increase the size and distribution<sup>10</sup> of the Louisiana Waterthrush population in Canada**

The Louisiana Waterthrush was designated as Threatened in Canada by COSEWIC (2015) on the basis of its small population size (i.e. fewer than 1000 individuals), and local population declines and emerging threats to its habitat were identified as contributing factors in its assessment. The population and distribution objective, which mirrors the management objective identified in the posted management plan for Louisiana Waterthrush (Environment Canada 2012), focuses on maintaining or improving

---

<sup>10</sup> Measured using the number of occupied 10 km x 10 km breeding bird atlas squares across its range in Ontario and Quebec.

resiliency and stability of the population by targeting a stable or increasing population size and distribution in Canada. The Canadian population is estimated to be 235-575 adults, and achieving the population and distribution objectives will require maintaining a minimum of 235 breeding adults. However, as 235 is the low end of the population estimate, maintaining the current population size is likely to require a population that is larger than this.

As the historic stronghold for the species in Canada, returning the southwestern Ontario population to, at a minimum, the condition it was in before the recent decline (i.e. when the species was assessed as Special Concern by COSEWIC) will be an important component of achieving these objectives. COSEWIC noted local population declines in southwestern Ontario, where the current population is estimated to be between 50 to 109 pairs, lower than the 2005 estimate of 93 to 165 pairs (COSEWIC 2015). Efforts to achieve and maintain a minimum of 93 pairs in southwestern Ontario<sup>11</sup> should be targeted to support recovery of this species in Canada.

As the small Canadian population of Louisiana Waterthrush occurs at the northern part of its continental range, and the vast majority of its continental breeding distribution and population occurs further south in the United States, it is important to note that population changes at the continental level are likely to have a significant effect on management of this species in Canada. If the continental population of Louisiana Waterthrush experiences an ongoing downward or upward population trend, its range may correspondingly contract towards the centre of its range or expand near the periphery. In these cases, the size of the Canadian population, and the rate of achievement of recovery objectives, may reflect both these continental range changes and local response to the provision of suitable habitat and mitigation of key threats.

## **6. Broad Strategies and General Approaches to Meet Objectives**

A number of high-priority recovery approaches have been identified in this recovery strategy in an effort to meet the population and distribution objective. Maintaining or increasing the size and distribution of the Louisiana Waterthrush population in Canada is expected to require three broad approaches: habitat conservation and management, monitoring and research, and outreach and communication.

### **6.1 Actions Already Completed or Currently Underway**

#### **Ontario**

- Louisiana Waterthrush has been monitored as part of several broad bird

---

<sup>11</sup> As defined by COSEWIC: Essex, Chatham-Kent, Lambton, Middlesex, Huron, Perth, Bruce, Elgin, Norfolk, Oxford, Haldimand, Brant, Waterloo, Wellington counties.

monitoring initiatives, including the second Ontario Breeding Bird Atlas (Cadman et al. 2007) and the Ontario Forest Bird Monitoring Program; the third Ontario Breeding Bird Atlas is currently underway ([www.birdsontario.org](http://www.birdsontario.org));

- Targeted surveys for the species have been conducted throughout southern Ontario by Birds Canada, Frontenac Bird Studies, and the Canadian Wildlife Service;
- The Ontario Natural Heritage Information Centre collects and maintains a database that includes Louisiana Waterthrush occurrence records from a wide variety of sources;
- Birds Canada works closely with landowners with Louisiana Waterthrush habitat as part of its Ontario Forest Birds at Risk program, including surveys and working with landowners to maintain riparian forest habitat;
- The *Frontenac Forests Important Bird and Biodiversity Area* was established by Bird Studies Canada (now Birds Canada) and Nature Canada;
- The Ontario Ministry of Natural Resources developed and published *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* and *A Land Manager's Guide to Conserving Habitat for Forest Birds in Southern Ontario*, which include guidelines to direct land and forest management operations that could affect breeding habitat for Louisiana Waterthrush (OMNR 2010, OMNR 2011);
- Bird Studies Canada (now Birds Canada) developed *Beneficial Management Practices for Southwestern Ontario Forest Birds at Risk: A Guide for Woodlot Owners and Forest Practitioners*, which includes beneficial management practices for the Louisiana Waterthrush in southwestern Ontario (Stewart 2017);
- Parks Canada published the *Multi-species Action Plan for Point Pelee National Park of Canada and Niagara National Historic Sites of Canada* (Parks Canada Agency 2016), which includes actions targeting Louisiana Waterthrush.

## Quebec

- Targeted Louisiana Waterthrush surveys have been conducted in the Outaouais (including Gatineau Park), Montérégie, and Cantons-de-l'Est regions in Quebec;
- Sites with past occurrences of Louisiana Waterthrush in southern Quebec are visited periodically as part of the avian species at risk yearly breeding site monitoring;
- The second Quebec Breeding Bird Atlas (Robert et al. 2019) provided updated distribution and breeding evidence information in the province.

## Range-wide

- Provincial, territorial, municipal and federal governments work together through the National Forest Pest Strategy to reduce the risk of damage to Canada's forests from insects including the Hemlock Woolly Adelgid; Natural Resources Canada published the *Hemlock Woolly Adelgid Management Plan for Canada* (Emilsson et al. 2018);



- Louisiana Waterthrush occurrence and monitoring data are collected and documented by several initiatives, including the Breeding Bird Survey<sup>12</sup>, eBird<sup>13</sup>, and Project NestWatch<sup>14</sup>.

---

<sup>12</sup> [www.canada.ca/en/environment-climate-change/services/bird-surveys/landbird/north-american-breeding/overview.html](http://www.canada.ca/en/environment-climate-change/services/bird-surveys/landbird/north-american-breeding/overview.html)

<sup>13</sup> <https://ebird.org/canada/home>

<sup>14</sup> [anadarg/bird-science/project-nestwatch/](http://anadarg/bird-science/project-nestwatch/)

## 6.2 Strategic Direction for Recovery

Recovery planning table for Louisiana Waterthrush in Canada. Threats are according to the IUCN-CMP classification (refer to Table 2). The Broad Strategies to Recovery are from the Conservation Measures Partnership’s (2016) Conservation Actions Classification v 2.0.

**Table 3.** Recovery Planning Table

Broad Strategy	Threat or limiting factor	Priority <sup>a</sup>	General description of research and management approaches
Awareness Raising	1.1, 1.2, 1.3, 2.1, 4.2, 5.3	High	3.1 Outreach & Communication <ul style="list-style-type: none"> <li>• Promote Louisiana Waterthrush-compatible harvesting regimes and forest management recommendations on public and private woodlots, especially in southwestern Ontario</li> <li>• Promote the use of the riparian and forest guidelines found in <i>How Much Habitat is Enough?</i> (Environment Canada 2013) to local and regional planners</li> <li>• Promote adherence to Integrated Pest Management principles, in particular the use of insecticides with the lowest toxicity to birds and non-target insects, and avoidance of insecticide application to field edges and forests occupied by Louisiana Waterthrush</li> </ul>
Conservation Designation & Planning	1.1, 1.2, 1.3, 2.1, 4.2, 5.3, 7.3, 9.3	High	6.1 Protected Area Designation &/or Acquisition <ul style="list-style-type: none"> <li>• Facilitate further conservation of key breeding sites in Canada (e.g. through protected area designation or acquisition, easements, stewardship actions, partnerships with conservation organizations, etc.), where possible</li> </ul>
Conservation Designation & Planning	1.1, 1.2, 1.3, 2.1, 4.2, 5.3, 7.3, 9.3	High	6.4 Conservation Planning <ul style="list-style-type: none"> <li>• Identify opportunities to slow/halt further loss of deciduous forest cover in landscapes where Louisiana Waterthrush is known to breed and upstream from breeding locations</li> </ul>

Broad Strategy	Threat or limiting factor	Priority <sup>a</sup>	General description of research and management approaches
Conservation Designation & Planning	5.3, 6.1, 7.2, 9.3	Medium	<p>6.4 Conservation Planning</p> <ul style="list-style-type: none"> <li>• Work with landowners and other stakeholders to further develop and refine forest management recommendations for Louisiana Waterthrush into management plans for public and private forests in varying landscapes throughout the Canadian breeding range</li> <li>• Address Louisiana Waterthrush habitat requirements in any new (or updated) management plans for public lands in Canada (protected areas, parks, etc.) that support populations, and incorporate appropriate forest management recommendations where appropriate</li> <li>• Incorporate Louisiana Waterthrush habitat needs in landscape-scale habitat initiatives that consider and balance the requirements of multiple at-risk species</li> <li>• Work with landowners and municipalities to limit or restrict off-road vehicle use at streams with breeding Louisiana Waterthrushes</li> </ul>
Land / Water Management	1.1., 1.2, 1.3, 2.1, 7.3, 9.3	High	<p>1.2 Ecosystem &amp; Natural Process (Re)Creation</p> <ul style="list-style-type: none"> <li>• Promote and implement deciduous reforestation, where feasible and appropriate, to a) increase the size of existing forest patches and riparian forest, b) increase forest cover in landscapes where Louisiana Waterthrush is known to breed, and c) improve downstream water quality through upstream riparian zone reforestation (especially in southwestern Ontario and locations with compromised water quality or invertebrate prey abundance)</li> </ul>
Land / Water Management	7.3	High	<p>1.2 Ecosystem &amp; Natural Process (Re)Creation</p> <ul style="list-style-type: none"> <li>• Work with partners through the National Forest Pest Strategy to reduce the risk of damage to Canada's forests from insects including the Hemlock Woolly Adelgid</li> <li>• Promote Integrated Pest Management practices including the implementation of the <i>Hemlock Woolly Adelgid Management Plan for Canada</i> (Emilson et al. 2018), especially in areas with Louisiana Waterthrush occurrences</li> </ul>

Broad Strategy	Threat or limiting factor	Priority <sup>a</sup>	General description of research and management approaches
Institutional Development	All	Medium	<p>10.3 Alliance &amp; Partnership Development</p> <ul style="list-style-type: none"> <li>• Ensure Canadian participation on international working groups that target Louisiana Waterthrush conservation actions on its breeding, migration, and wintering grounds</li> <li>• Work with researchers and international organizations to evaluate and mitigate threats facing Canadian populations of Louisiana Waterthrush, including those on wintering grounds and migration routes. Establish and continue communication with international entities (e.g. Partners in Flight, North American Bird Conservation Initiative), other countries’ government agencies, researchers, or non-government organizations to be informed on and maintain dialogue about issues related to Louisiana Waterthrush conservation outside of Canada.</li> </ul>
Research and Monitoring	Knowledge gaps	High	<p>8.1 Basic Research &amp; Status Monitoring</p> <ul style="list-style-type: none"> <li>• Continue breeding bird atlas projects and periodic/ongoing range-wide surveys outside of atlas projects, incorporating existing programs (e.g. Forest Bird Monitoring Program and targeted Louisiana Waterthrush projects) where feasible and appropriate, to a) increase the precision of the Canadian and regional population size estimates, b) ensure that changes in population status and distribution can be evaluated using shorter time periods (e.g. every five or ten years), c) ensure sufficient information is available for future updates to critical habitat (see Table 4 in Section 7.2), and d) direct conservation efforts needed to achieve national and regional population targets; include monitoring of land cover and habitat availability where feasible</li> <li>• Refine and compile geographical knowledge of Canadian populations, habitat, and land tenure</li> </ul>
Research and Monitoring	Knowledge gaps	Medium	<p>8.1 Basic Research &amp; Status Monitoring</p> <ul style="list-style-type: none"> <li>• Conduct research to identify relative importance of existing and emerging threats to Louisiana Waterthrush in Canada, so that conservation resources for this species can be focused effectively and efficiently</li> </ul>

Broad Strategy	Threat or limiting factor	Priority <sup>a</sup>	General description of research and management approaches
Research and Monitoring	Knowledge gaps	High	8.1 Basic Research & Status Monitoring <ul style="list-style-type: none"> <li>• Conduct invertebrate prey and water quality surveys in historically occupied suitable habitat to identify potential limiting factors preventing ongoing occupancy; use results from these surveys to identify priority locations for habitat restoration, where feasible</li> </ul>
Research and Monitoring	Knowledge gaps	Medium	8.1 Basic Research & Status Monitoring <ul style="list-style-type: none"> <li>• Research landscape-scale and forest patch size effects on Louisiana Waterthrush occupancy, productivity, and survival in Canada; the results of these studies can be used to inform future conservation initiatives and updates to critical habitat; where available, incorporate Monitoring Avian Productivity and Survivorship (MAPS<sup>15</sup>) data into analyses</li> </ul>
Research and Monitoring	All threats, Knowledge gaps	Medium	8.2 Evaluation, Effectiveness Measures & Learning <ul style="list-style-type: none"> <li>• Research the response of breeding populations (distribution, density, and productivity) to conservation activities and silviculture practices in varying landscapes in Canada; review and incorporate results from other areas/existing studies where feasible</li> </ul>

<sup>a</sup> “Priority” reflects the degree to which the broad strategy contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species

<sup>15</sup> [www.birdpop.org/pages/maps.php](http://www.birdpop.org/pages/maps.php)

## 6.3 Narrative to Support the Recovery Planning Table

Louisiana Waterthrush recovery will require commitment and collaboration among international, federal and provincial jurisdictions, Indigenous people, local communities, landowners, industry and other interested parties. The recovery planning table identifies approaches that fall under three broad strategies (habitat conservation and management, monitoring and research, and outreach and communication), which together aim to improve the condition of the regional/continental population and increase productivity in Canadian populations.

Given that the Canadian population of the Louisiana Waterthrush may be reliant on immigration (COSEWIC 2015), the ability to achieve a stable Canadian population is likely decreased without an improved regional/continental population. Improving the condition of the regional/continental population will increase the chance that local Canadian populations can be maintained through immigration while efforts to address local threats take place. Approaches that support regional or continental scale conservation efforts should be undertaken where feasible.

In addition to these broad approaches, research and monitoring will be required to ensure that knowledge gaps that limit the ability to direct and evaluate conservation measures are addressed.

## 7. Critical Habitat

### 7.1 Identification of the Species' Critical Habitat

Section 41(1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction. Under Section 2(1) of SARA, critical habitat is "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species."

Critical habitat identified in this recovery strategy includes stream segments and wetlands associated with occurrences and well as the contiguous forest or wetland habitat adjacent to these features. Critical habitat for the Louisiana Waterthrush in Canada is identified as the extent of biophysical attributes (see Section 7.1.2) wherever they occur within the areas containing critical habitat described in Section 7.1.1 (Appendix A – Overview; Figures A-1 to A-28).

It is recognized that the critical habitat identified for Ontario and Quebec below is insufficient to achieve the population and distribution objectives for the species. A Schedule of Studies (section 7.2; Table 4) has been developed and outlines the activities required for identification of additional critical habitat necessary to support the population and distribution objectives. If new or additional information becomes available, refinements to current critical habitat or additional critical habitat may be identified in an amendment to this recovery strategy. For more information on critical

habitat identification, contact Environment and Climate Change Canada – Canadian Wildlife Service at [RecoveryPlanning-Planificationduretablissement@ec.gc.ca](mailto:RecoveryPlanning-Planificationduretablissement@ec.gc.ca).

### 7.1.1 Areas Containing Critical Habitat

Recovery of the Louisiana Waterthrush in Canada depends on the persistence of the species in an area greater than that which is currently occupied by individuals of the species. The areas containing critical habitat are based on the criteria described for stream-based and wetland-based<sup>16</sup> records below, and are mapped in Appendix A. In Ontario, available aerial imagery was used to exclude areas of non-suitable habitat (e.g. roads and other built-up areas) from the areas containing critical habitat, where feasible.

- 1) Stream segments<sup>17</sup> with an associated confirmed breeding<sup>18</sup> stream-based record in any single year from 2001 to 2019 or demonstrated multi-year occupancy<sup>19</sup> (i.e. with stream-based records in two separate years from 2001 to 2019<sup>20</sup>), and
- 2) Wetlands<sup>21</sup> with a confirmed breeding wetland-based record in any single year from 2001 to 2019 or demonstrated multi-year occupancy (i.e. with wetland-based records in two separate years from 2001 to 2019<sup>17</sup>), and
- 3) The adjacent terrestrial habitat within 200 m of the stream segments and wetlands described in 1 and 2<sup>22</sup>.

There are currently unknowns in the amount, type, and configuration of habitat that is needed to support productive local populations in varying Canadian landscapes. Research to explore landscape-scale and forest patch size effects on Louisiana Waterthrush occupancy, productivity, and survival in Canada is included in section 6.2,

---

<sup>16</sup> Wetland-based records are those with adjacent wetlands where no adjacent streams are visible in available imagery/mapping. Records that could not be reliably associated with a stream segment or wetland based on geographic analysis were excluded from critical habitat identification.

<sup>17</sup> Stream segments are defined as the distance 400 m upstream and downstream from stream-based records. The 400 m follows the upstream and downstream distances used in the Louisiana Waterthrush breeding habitat description included in Ontario's *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scale* (OMNR 2010) and the distance used in beneficial management practices for the species (Stewart 2017), and aligns with average territory lengths reported elsewhere in the species' range (see Table 1).

<sup>18</sup> Breeding evidence categories are defined in Appendix D.

<sup>19</sup> Multiple-year occupancy is determined using observations within 400 m of each other.

<sup>20</sup> This temporal window incorporates recent data records including data collected as part of the second breeding bird atlases in both Ontario and Quebec.

<sup>21</sup> Includes portions of wetlands up to 300 m from wetland-based records, which aligns with the lowest average territory length reported in Table 1 (i.e. 283 m in Northeast Pennsylvania), but is less than the 400 m distance used for records associated with linear stream features.

<sup>22</sup> In Ontario, aerial imagery was used to exclude areas of unsuitable habitat (e.g. agricultural fields, roads, and other built-up areas) from the delineated areas containing critical habitat; in addition, isolated patches of treed habitat that are separated from occupied streams/wetlands by areas of unsuitable habitat were similarly excluded.

and may be used to inform future updates to critical habitat. In the interim, the area within 200 m of the stream segments and wetlands is included to provide a forest matrix to support productive local populations. In Canada, the persistence of the Louisiana Waterthrush likely depends on an area greater than that occupied by individuals of the species. It requires ecological or landscape features that promote and maintain the biophysical attributes<sup>23</sup> used by the bird and allow for natural processes related to population dynamics and reproduction to occur. As noted in section 3.3, Louisiana Waterthrush is often described as an area-sensitive forest interior bird that requires non-fragmented forest (i.e. continuous, uninterrupted forest), suggesting that a contiguous patch of mature forest adjacent to breeding streams and wetlands is an important habitat feature to this species. A recent landcover analysis of Louisiana Waterthrush survey locations on the Niagara Escarpment in southern Ontario found nearly total mixed/deciduous forest cover within 200 m of the majority of detection locations from 1981 to 2013, suggesting that forest cover at that scale may be important (Lebrun-Southcott and Campomizzi 2014).

### 7.1.2 Biophysical Attributes of Critical Habitat

Within the areas containing critical habitat, critical habitat is identified where the following biophysical attributes occur. Biophysical attributes are grouped into 1) Breeding Habitat and 2) Forest Matrix, both of which support local breeding populations of Louisiana Waterthrush.

#### 1) **Breeding Habitat** (includes courtship, territory defence, nesting and foraging)

- Streams, wetlands, and adjacent (within 50 m of stream or wetland edges) features that may include the following characteristics:
  - Fast-moving, cold, clear streams
  - Treed swamps
  - Water capable of supporting sufficient invertebrate prey
  - Stream banks and wetland edges with coarse woody debris, including but not limited to mossy logs and the roots of fallen trees, stumps, and over-hanging vegetation
  - Coarse woody debris, including but not limited to mossy logs and the roots of fallen trees, stumps, and over-hanging vegetation
  - Forest with a closed or near-closed canopy, open understory, and often with an Eastern Hemlock (*Tsuga canadensis*) component

#### 2) **Forest Matrix**

- Deciduous or mixed forest, including treed swamps

---

<sup>23</sup> Suitable biophysical attributes are those habitat features (Section 7.1.2) that provide individuals of the species the necessary conditions (e.g. soil and moisture, light penetration, species composition and species interactions) to carry out essential life processes.



## 7.2 Schedule of Studies to Identify Critical Habitat

**Table 4. Schedule of Studies to Identify Critical Habitat**

Description of Activity	Rationale	Timeline
Conduct targeted surveys at locations where observation records for the 2001 to 2019 period exist but are not sufficient to include in the identification of critical habitat; align survey efforts with the Ontario Breeding Bird Atlas (2021-2025) and other projects where feasible	Critical habitat has not been identified for occurrences that only provided possible or probable nesting evidence in a single year or had poor spatial accuracy. This activity is required such that sufficient critical habitat is identified to meet the population and distribution objectives	2021-2028

## 7.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single activity or multiple activities at one point in time or from the cumulative effects of one or more activities over time.

Activities described in Table 5 are examples of those likely to cause destruction of critical habitat for the species; however, destructive activities are not necessarily limited to those listed.

**Table 5. Examples of activities likely to result in the destruction of critical habitat.**

<b>Description of Activity</b>	<b>Description of effect in relation to function loss</b>	<b>Details of effect</b>
Removal of forested areas (e.g. residential or commercial development, road construction, clearing for agriculture, etc.)	The removal of a forested area eliminates, either in whole or in part, the ecosystem/landscape upon which individuals rely for basic survival, including the elements of the habitat that are used for breeding and foraging.	If this activity occurs within critical habitat, at any time of year, the effects will be direct, and are certain to result in the destruction of critical habitat.
Forest harvesting that results in unsuitable forest/stand conditions.	The modification of a forested area eliminates, either in whole or in part, the ecosystem features upon which individuals rely for basic survival, including the elements of the habitat that are used for breeding and foraging.	Harvesting activities in Louisiana Waterthrush critical habitat should be assessed on a case-by-case basis. Light selective harvesting of trees using best management practices for this species (e.g. Stewart 2017) may not result in the destruction of critical habitat.  Any harvesting should ensure that the overall canopy cover is not reduced.  Any harvest within 50 m of streams or wetlands, at any time of the year, would result in the destruction of critical habitat.
Removal of coarse woody debris (including logs and uprooted trees), stumps, or native vegetation (including, but not limited to, trees, shrubs, and ground cover) from within 50 m of streams or wetlands.	Removal of coarse woody debris, stumps, and native vegetation can eliminate structures necessary for nesting activities.	Any removal of coarse woody debris, stumps, or native vegetation (including ground cover) from an area within 50 m of streams or wetlands, at any time of the year, would result in the destruction of critical habitat.  Any pruning or cutting activities within 50 m of streams should ensure that the availability of nesting structures (e.g. woody debris, stumps, and native vegetation) and overall canopy cover are not reduced.
Shoreline/stream bank stabilization activities.	Stream bank stabilization may include removal of coarse woody debris, stumps, and native vegetation, which can eliminate structures necessary for nesting activities.  Stream bank stabilization that	Any removal of coarse woody debris, stumps, or native vegetation from an area within 50 m of streams or wetlands, at any time of the year, would result in the destruction of critical habitat. Stream bank stabilization that negatively affects hydrology (including stream flow characteristics) would likely result in the destruction of critical habitat.

Description of Activity	Description of effect in relation to function loss	Details of effect
	<p>changes stream morphology could reduce the amount of habitat available to Louisiana Waterthrush through a change in water flow leading to an overall loss of aquatic habitat, changes to shoreline vegetation, changes to natural patterns of sediment accumulation, changes to temperature regimes and decreasing water quality by concentrating contaminants.</p>	<p>Destruction will be determined on a case-by-case basis.</p>
<p>Creation/maintenance of hard edges within forests, such as the creation or maintenance of trails, skid roads, utility line construction etc. that results in unsuitable forest/stand conditions.</p>	<p>The modification of a forested area eliminates, either in whole or in part, the ecosystem features upon which individuals rely for basic survival, including the elements of the habitat that are used for breeding and foraging. The creation/maintenance of hard edges can increase patch fragmentation, and increase predation/parasitism pressure.</p>	<p>If this activity occurs within critical habitat, at any time of year, the effects will be direct. Destruction will be determined on a case by case basis.</p> <p>Since existing trails, roads, and utility lines are not included in the biophysical attributes described in section 7.1.2, maintenance of existing trails, roads, and utility lines is not considered an activity that is likely to result in the destruction of critical habitat, as long as the density of trees and overall canopy cover are not reduced.</p>

Description of Activity	Description of effect in relation to function loss	Details of effect
Alteration of topography or hydrological regime that alter water levels, flow rates, or groundwater (e.g. stream diversion, channelization, water taking, water control structures, or conversion to impervious surfaces).	The alteration of hydrology associated with residential development and agricultural development or agricultural activities would likely reduce the amount of groundwater reaching the watercourses. This could happen either through increased impermeable surfaces or loss of groundwater recharge through use for row crops. These changes could reduce the amount of habitat available to Louisiana Waterthrush through a reduction of water flow leading to an overall loss of aquatic habitat, changes to shoreline vegetation, changes to natural patterns of sediment accumulation, changes to temperature regimes and decreasing water quality by concentrating contaminants.	If this activity were to happen at any time of year, particularly in spring or summer, within, adjacent to or upstream of critical habitat it is likely to result in destruction of critical habitat.
Contamination of groundwater and surface water (e.g. large scale agricultural activities, use of road salt or urban contaminants).	Contamination (e.g. pesticides and herbicides) of ground and surface water could reduce prey abundance.	If this activity were to occur at any time of the year, within or adjacent to critical habitat, it would be likely to result in the destruction of critical habitat.
Crossing of streams and other water features with vehicles	Crossing of streams can increase siltation and decrease water quality, which can compromise the available invertebrate prey community and reduce foraging success and efficiency.	If this activity were to happen in spring or summer within or upstream of critical habitat, it is likely to result in destruction of critical habitat.

## **8. Measuring Progress**

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. Specific progress towards implementing the recovery strategy will be measured against indicators outlined in subsequent action plans.

Success of recovery strategy implementation will be periodically measured against the following performance indicators:

- Population size has been increased or maintained (i.e. a minimum of 235 breeding adults).
- The species' Canadian range (i.e. number of occupied 10 km x 10 km breeding bird atlas squares) has increased or been maintained.

## **9. Statement on Action Plans**

One or more action plans will be completed for the Louisiana Waterthrush by December 2027.

## 10. References

- Bent, A.C. 1953. Life Histories of North American Wood Warblers. Part II. Dover Publ., New York.
- Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706 pp.
- Cadman, M.D., P.F.J. Eagles, and F.M. Helleiner. 1987. Atlas of the breeding birds of Ontario. Univ. of Waterloo Press, Waterloo, Ontario. 617pp
- Chesser, R.T., R.C. Banks, F.K. Barker, C. Cicero, J.L. Dunn, A.W. Kratter, I.J. Lovett, P.C. Rasmussen, J.V. Remsen, J.D. Rising, D.F. Stotz, and K. Winker. 2010. Fifty-First Supplement to the American Ornithologists' Union *Check-List of North American Birds*. The Auk 127(3):726–744.
- Conservation Measures Partnership. 2016. [Classification of Conservation Actions and Threats](http://cmp-openstandards.org/tools/threats-and-actions-taxonomies/). Version 2.0. Available at: <http://cmp-openstandards.org/tools/threats-and-actions-taxonomies/>.
- Cooper, C. M., F. D. Jr. Shields, S.I. Testa, and S.S. Knight. 2000. Sediment retention and water quality enhancement in disturbed watersheds. *International Journal of Sediment Research*, 15(1), 121–134.
- COSEWIC. 2006. COSEWIC assessment and update status report on the Louisiana Waterthrush *Seiurus motacilla* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 26 pp. ([www.sararegistry.gc.ca/status/status\\_e.cfm](http://www.sararegistry.gc.ca/status/status_e.cfm)).
- COSEWIC. 2015. COSEWIC assessment and status report on the Louisiana Waterthrush *Parkesia motacilla* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xi + 58 pp. ([http://www.registrelep-sararegistry.gc.ca/default\\_e.cfm](http://www.registrelep-sararegistry.gc.ca/default_e.cfm)).
- Craig, R.J. 1981. Comparative ecology of Louisiana and Northern Waterthrushes. PhD thesis, University of Connecticut, Storrs, Ct.
- Craig, R.J. 1984. Comparative foraging ecology of Louisiana and Northern Waterthrushes. *Wilson Bulletin* 96:173-183.
- Craig, R.J. 1985. Comparative habitat use by Louisiana and Northern Waterthrushes. *Wilson Bulletin* 97:347-355.

- Curson, J., D. Quinn and D. Beadle. 1994. Warblers of the Americas: an identification guide. Houghton Mifflin Co.: Boston, MA.
- David, N. 1996. Liste commentée des oiseaux du Québec. Association québécoise des groupes d'ornithologues, Montréal, QC.
- Dendroica Environnement et Faune. 2005. Inventaire de la Paruline hochequeue (*Seiurus motacilla*) en Outaouais, printemps et été 2005. Final prepared for Canadian Wildlife Service. Val-des-Monts, Québec. 35p.
- Dendroica Environnement et Faune. 2006. Inventaire de la Paruline hochequeue (*Seiurus motacilla*) et de la Paruline azurée (*Dendroica cerulea*) en Outaouais, dans la région de l'Outaouais, 2006. Final report prepared for Canadian Wildlife Service. Val-des-Monts, Quebec. 48p.
- Dendroica Environnement et Faune. 2007. Inventaire de la Paruline hochequeue (*Seiurus motacilla*), de la Paruline azurée (*Dendroica cerulea*) ainsi que la Paruline à ailes dorées (*Vermivora chrysoptera*) en Outaouais et dans le parc de la Gatineau, 2007. Final report prepared for Canadian Wildlife Service. Val-des-Monts, Quebec. 44p.
- Dunn, J.L. and K.L. Garrett. 1997. A field guide to the warblers of North America. Houghton Mifflin Co.: New York, NY.
- Eaton, S.W. 1958. A life history study of the Louisiana Waterthrush. Wilson Bulletin 70:210-236.
- Eaton, S.W. 1988. Louisiana Waterthrush. *in*: Andrie, R.F. and J.R. Carroll. The Atlas of Breeding Birds of New York State. Cornell Univ. Press, Ithaca, New York. 410-411 pp.
- Emilson C., E. Bullas-Appleton, D. McPhee, K. Ryan, M. Stastny, M. Whitmore, and C.J.K. MacQuarrie. 2018. Hemlock Woolly Adelgid Management Plan for Canada. Natural Resources Canada, Canadian Forest Service, Sault Ste. Marie.
- Environment Canada. 2001. Threats to Sources of Drinking Water and Aquatic Ecosystem Health in Canada. National Water Research Institute, Burlington, Ontario. NWRI Scientific Assessment Report Series No. 1. 72 pp.
- Environment Canada. 2004. How much habitat is enough? A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern (Second Edition). Environment Canada. Downsview, Ontario. 80 pp.
- Environment Canada. 2012. Management Plan for the Louisiana Waterthrush (*Seiurus motacilla*) in Canada. Species at Risk Act Management Plan Series. Environment Canada, Ottawa. iii + 18 pp.

Environment Canada. 2013. How Much Habitat is Enough? Third Edition. Environment Canada. Toronto, Ontario. ii + 128 pp.

FAO. 2006. Global forest resources assessment 2005. FAO Forestry Paper 147, Rome.

Gauthier, J. and Y. Aubry (eds.). 1996. The Breeding Birds of Southern Québec: Atlas of the Breeding Birds of Southern Québec. L'Association québécoise des groupes d'ornithologues, Province of Québec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada Québec Region. Montréal, Québec. 1302 pp.

Hallmann, C.A., R.P.B. Foppen, C.A.M. van Turnhout, H. de Kroon, and E. Jongejans. 2014. Declines in insectivorous birds are associated with high neonicotinoid concentrations. *Nature* 511: 341–343

Kerr, S.J. 1995. Silt, turbidity and suspended sediments in the aquatic environment: an annotated bibliography and literature review. Ontario Ministry of Natural Resources, Southern Region Science & Technology Transfer Unit Technical Report TR-008. 277pp.

Lebrun-Southcott, Z.M. and A.J. Campomizzi. 2014. Habitat metrics and water quality at Louisiana Waterthrush detections along the Niagara Escarpment. Report prepared for Environment Canada. 27 pp.

Master, L.L., D. Faber-Langendoen, R. Bittman, G.A. Hammerson, B. Heidel, L. Ramsay, K. Snow, A. Teucher, and A. Tomaino. 2012. NatureServe conservation status assessments: factors for evaluating species and ecosystem risk. NatureServe, Arlington, VA.

Master, T. L., R. S. Mulvihill, R. C. Leberman, J. Sanchez, and E. Carman. 2005. A preliminary study of riparian songbirds in Costa Rica, with emphasis on wintering Louisiana Waterthrushes. USDA Forest Service General technical report PSW-GTR-191.

Mattsson, B.J., 2006. Louisiana waterthrush ecology and conservation in the Georgia piedmont (Doctoral dissertation, University of Georgia).

Mattsson, B. J. and R. J. Cooper. 2009. Multiscale analysis of the effects of rainfall extremes on reproduction by an obligate riparian bird in urban and rural landscapes. *Auk* 126:64-76.

Mattsson, B.J., T.L Master, R.S. Mulvihill and W.D. Robinson. 2009. Louisiana Waterthrush (*Seiurus motacilla*). In A. Poole (ed.) *The Birds of North America Online*. Cornell Lab of Ornithology, Ithaca, NY.  
<http://bna.birds.cornell.edu/bna/species/151>



- McCracken, J.D. 2007. Louisiana Waterthrush, pp. 514-515 in Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier (eds.). 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706 pp.
- Mineau, P. and C. Palmer. 2013. The impact of the nation's most widely used insecticides on birds. The Plains, VA : American Bird Conservancy. Available at <https://extension.entm.purdue.edu/neonicotinoids/PDF/TheImpactoftheNationsMostWidelyUsedInsecticidesonBirds.pdf>
- Mulvihill, R.S. 1999. Effects of stream acidification on the breeding biology of an obligate riparian songbird, the Louisiana Waterthrush (*Seiurus motacilla*), in: The effects of acidic deposition on aquatic ecosystems in Pennsylvania (W. E. Sharpe and J. R. Drohan, eds.). Proc. 1998 PA Acidic Deposition Conf., Vol. 2, Environmental Resources Research Institute, University Park, PA. 51-61 pp.
- Mulvihill, R.S., F.L. Newell, and S.C. Latta. 2008. Effects of acidification on the breeding ecology of a stream-dependent songbird, the Louisiana Waterthrush (*Seiurus motacilla*). *Freshwater Biology* 53:2158-2169.
- NatureServe. 2021. NatureServe Explorer: An online encyclopedia of life [web application]. Version 7.1. NatureServe, Arlington, Virginia. Available <http://www.natureserve.org/explorer>.
- OMNR (Ontario Ministry of Natural Resources). 2010. Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales. Toronto: Queen's Printer for Ontario. 211 pp.
- OMNR (Ontario Ministry of Natural Resources). 2011. A Land Manager's Guide to Conserving Habitat for Forest Birds in Southern Ontario. Ministry of Natural Resources, Southern Science and Information Section. 136 pp.
- Ontario Partners in Flight. 2008. Ontario Landbird Conservation Plan: Lower Great Lakes/St. Lawrence Plain, North American Bird Conservation Region 13. Ontario Ministry of Natural Resources, Bird Studies Canada, Environment Canada.
- Parks Canada Agency. 2016. Multi-species Action Plan for Point Pelee National Park of Canada and Niagara National Historic Sites of Canada. Species at Risk Act Action Plan Series. Parks Canada Agency, Ottawa. iv + 39 pp.
- Peck, G.K and R.D. James. 1987. Breeding Birds of Ontario Nidology and Distribution, Volume 2: Passerines. Royal Ontario Museum, Toronto, ON.
- Pracheil, C. 2010. Ecological Impacts of Stream Bank Stabilization in a Great Plains River. Ph.D. Thesis, University of Nebraska, Lincoln, NE, USA, 2010.

- Prosser, D.J. and R.P. Brooks. 1998. A Verified habitat suitability index for the Louisiana Waterthrush. *Journal of Field Ornithology* 69(2):288-298.
- Pyle, P. 1997. *Identification Guide to North American Birds, Part 1*. Slate Creek Press, Bolinas, CA.
- Ridgely, R. S., T. F. Allnutt, T. Brooks, D. K. McNicol, D. W. Mehlman, B. E. Young, and J. R. Zook. 2007. *Digital Distribution Maps of the Birds of the Western Hemisphere, version 3.0*. NatureServe, Arlington, Virginia, USA.
- Robbins, C.S. 1979. Effect of forest fragmentation on bird populations. pp. 198-212 In: *Workshop proceedings: Management of northcentral and northeastern forests for nongame birds*. Compiled by R.M. DeGraaf and K.E. Evans. USDA Forest Service General Technical Report NC-51. *Cited in* COSEWIC. 2006. COSEWIC assessment and update status report on the Louisiana Waterthrush *Seiurus motacilla* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 26 pp. ([www.sararegistry.gc.ca/status/status\\_e.cfm](http://www.sararegistry.gc.ca/status/status_e.cfm)).
- Robert, M. 2019. Louisiana Waterthrush, p. 522-523 in *Second Atlas of the Breeding Birds of Southern Québec* (M. Robert, M.-H. Hachey, D. Lepage and A.R. Couturier, eds.). Regroupement QuébecOiseaux, Canadian Wildlife Service (Environment and Climate Change Canada) and Bird Studies Canada, Montréal, xxv + 694 p.
- Robert, M., M-H. Hachey, D. Lepage and A.R. Couturier (eds.). 2019. *Second atlas of the breeding birds of Southern Quebec*. Regroupement QuébecOiseaux, Canadian Wildlife Service (Environment and Climate Change Canada) and Bird Studies Canada, Montreal, xxv + 694 p.
- Robinson, W. D. 1990. Louisiana Waterthrush foraging behavior and microhabitat selection in southern Illinois. Master's Thesis. Southern Illinois Univ. Carbondale.
- Rosenberg, K.V., J.A. Kennedy, R. Dettmers, R.P. Ford, D. Reynolds, J.D. Alexander, C. J. Beardmore, P.J. Blancher, R.E. Bogart, G.S. Butcher, A.F. Camfield, A. Couturier, D.W. Demarest, W.E. Easton, J.J. Giocomo, R.H. Keller, A.E. Mini, A.O. Panjabi, D.N. Pashley, T.D. Rich, J.M. Ruth, H. Stabins, J. Stanton, and T. Will. 2016. *Partners in Flight Landbird Conservation Plan: 2016 Revision for Canada and Continental United States*. Partners in Flight Science Committee. 119 p.
- Smith, A.C., Hudson, M-A.R. Aponte, V.I., and Francis, C.M. 2020. *North American Breeding Bird Survey - Canadian Trends Website, Data-version 2019*. Environment and Climate Change Canada, Gatineau, Quebec, K1A 0H3

Stewart, B. 2017. Beneficial Management Practices for Southwestern Ontario Forest Birds at Risk: A Guide for Woodlot Owners and Other Forest Practitioners. Published by Bird Studies Canada, Port Rowan. 21 pp.

St-Hilaire, D. and D. Dauphin. 1996. Louisiana Waterthrush, pp. 1180-1181 *in* J. Gauthier and Y. Aubry, eds. The Breeding Birds of Quebec: Atlas of the Breeding Birds of Southern Quebec. Association québécoise des groupes d'ornithologues, Province of Quebec Society for the Protection of Birds, Canadian Wildlife Service, Environment Canada, Quebec Region, Montréal, 1302 pp.

Trotter III, R.T., R.S. Morin, S.N. Oswalt, and A. Liebhold. 2013. Changes in the regional abundance of hemlock associated with the invasion of hemlock woolly adelgid (*Adelges tsugae* Annand). *Biological Invasions* 15: 2667-2679.

Yank, R. and Y. Aubry. 1984. The nesting season: Quebec region. *American Birds* 38(6): 1000-1001.

## Appendix A: Critical Habitat for the Louisiana Waterthrush

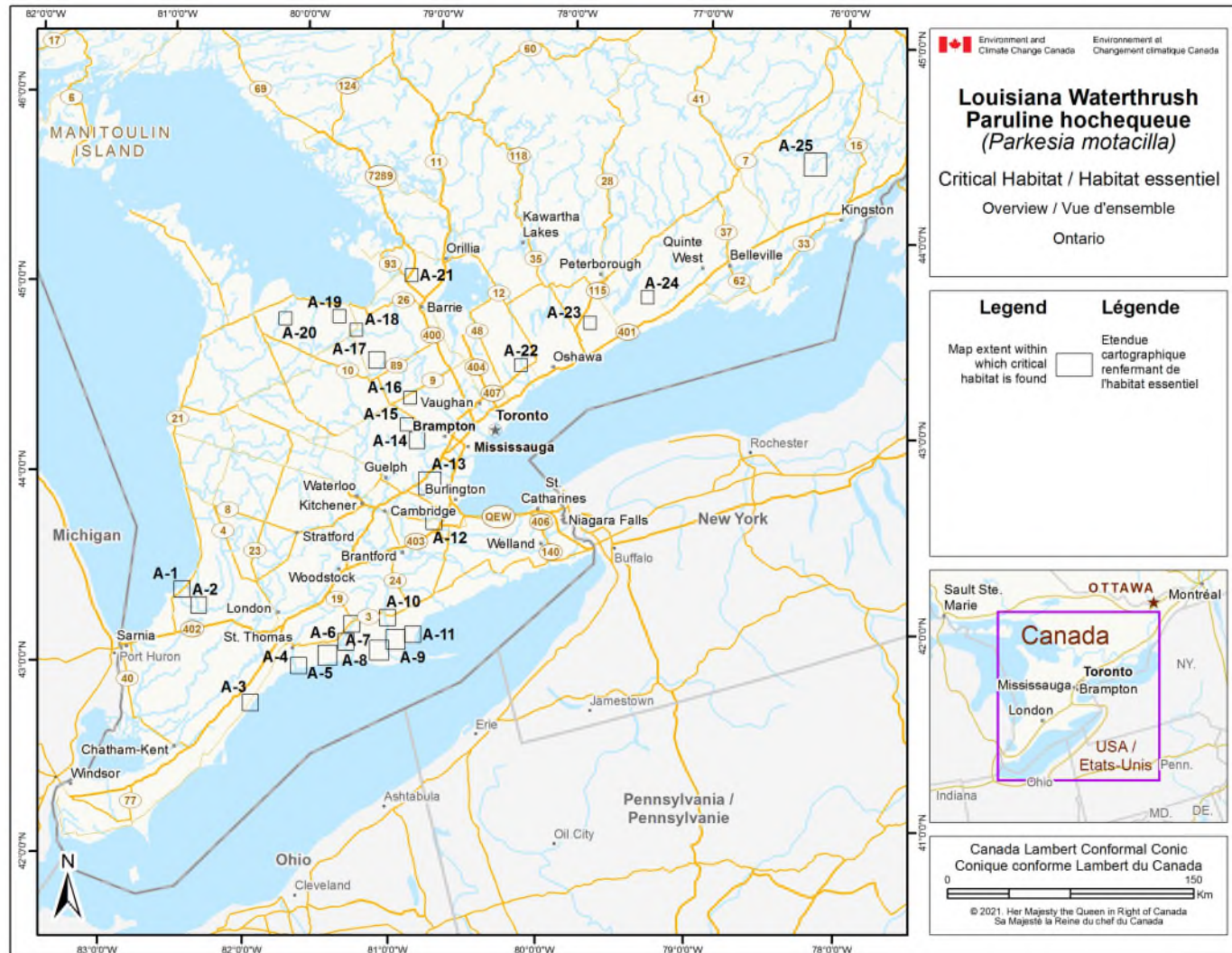


Figure A-Overview (Ontario). Map extent for critical habitat for the Louisiana Waterthrush in Ontario as depicted in Figures A-1 to A-25.



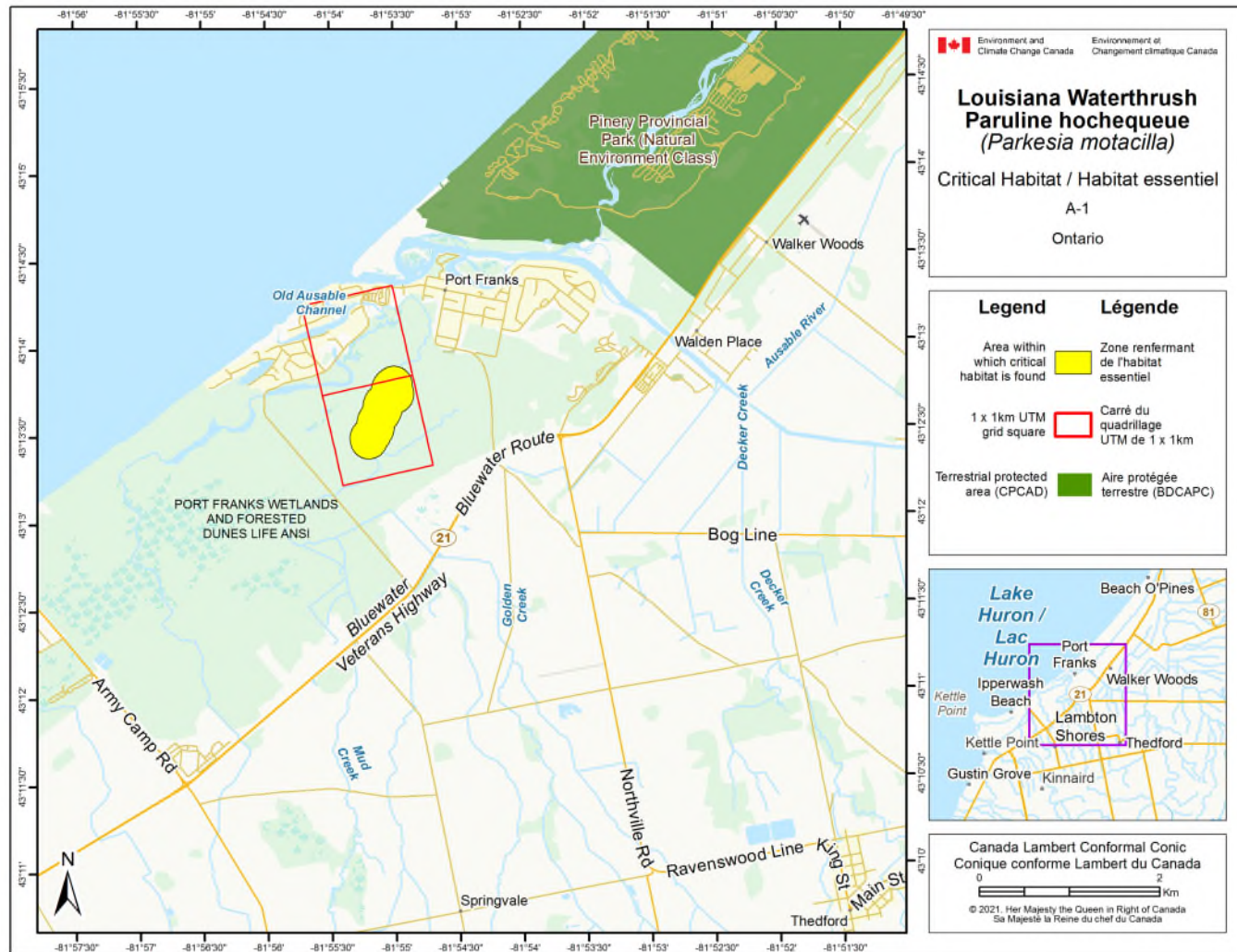


Figure A-1. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

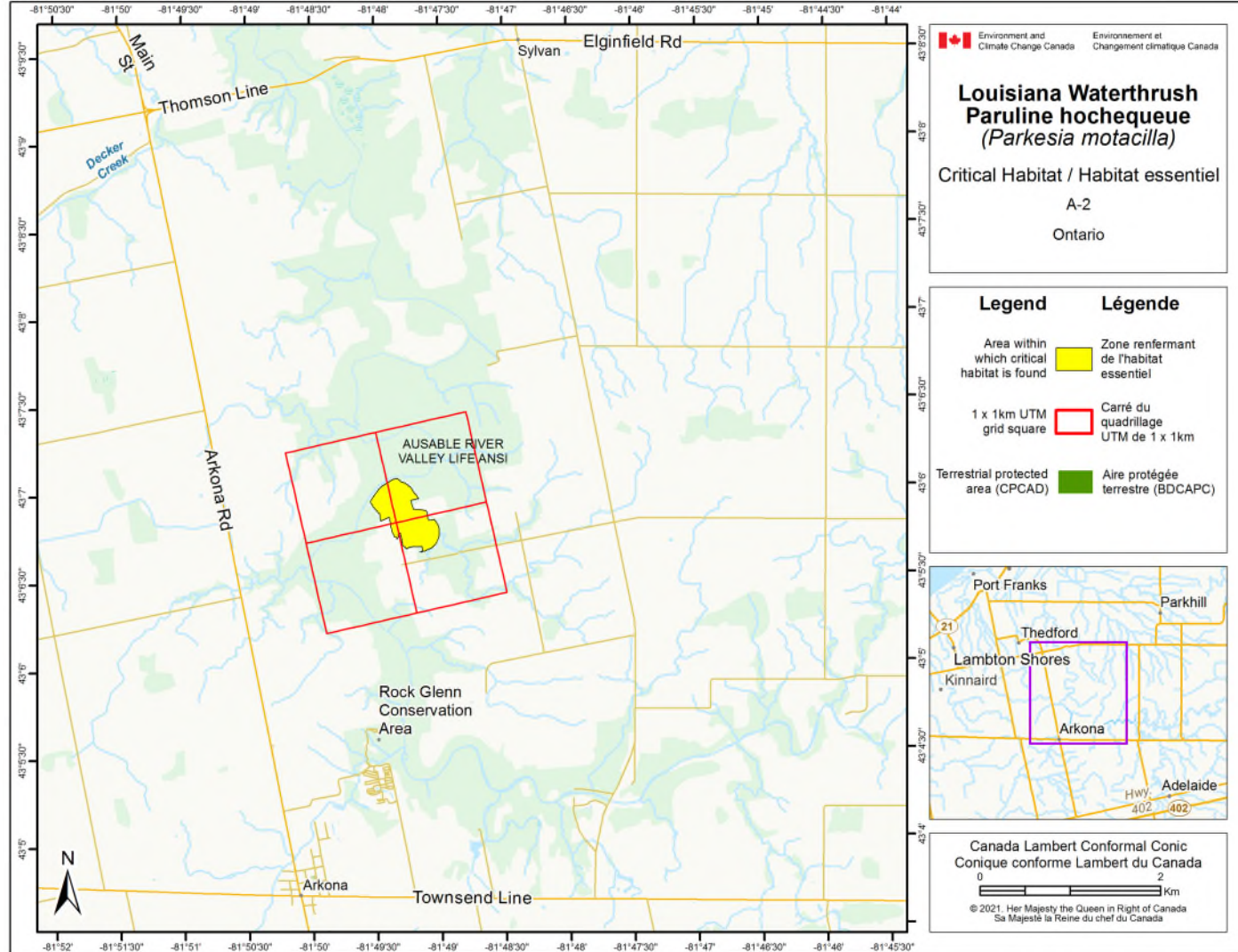


Figure A-2. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



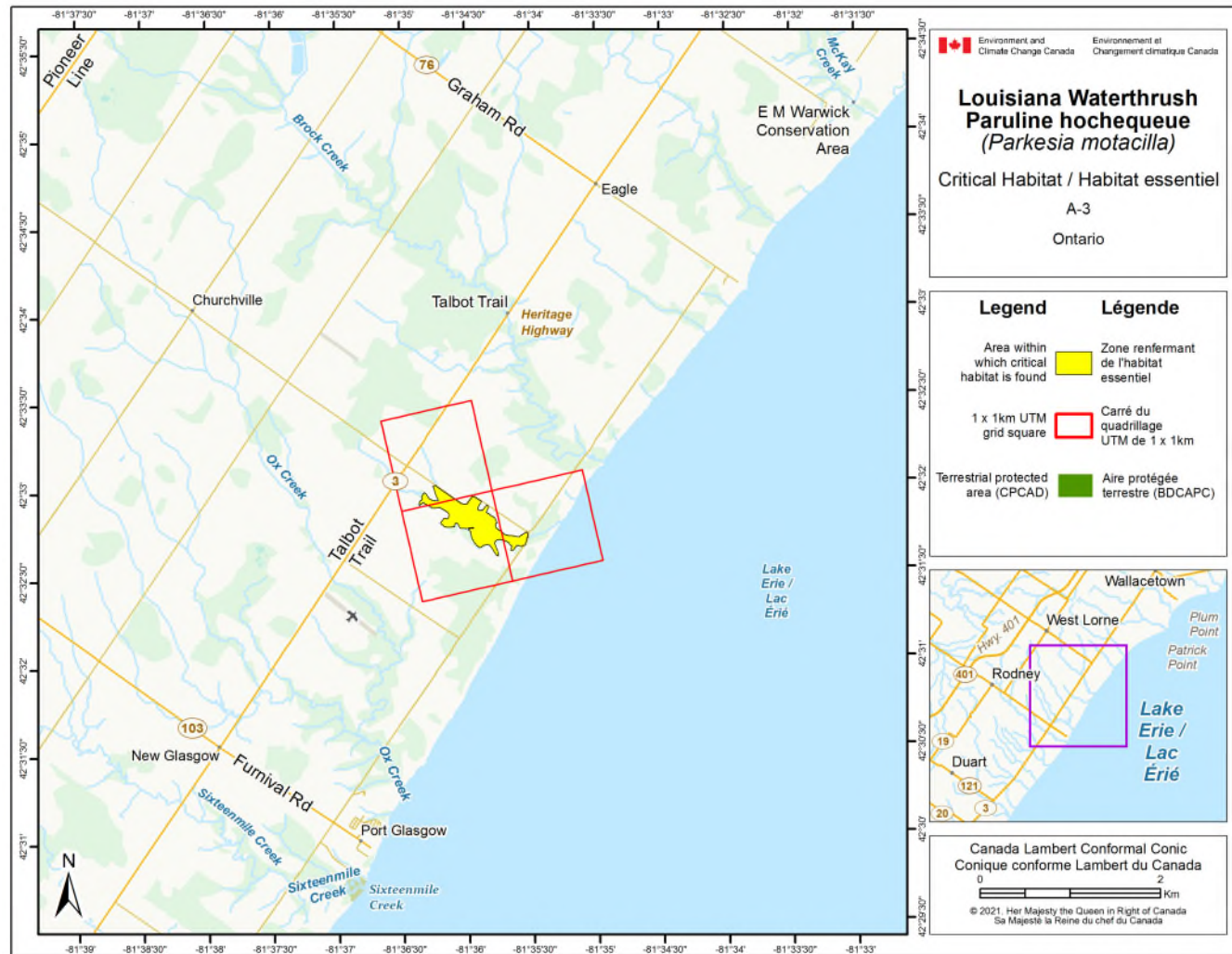


Figure A-3. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

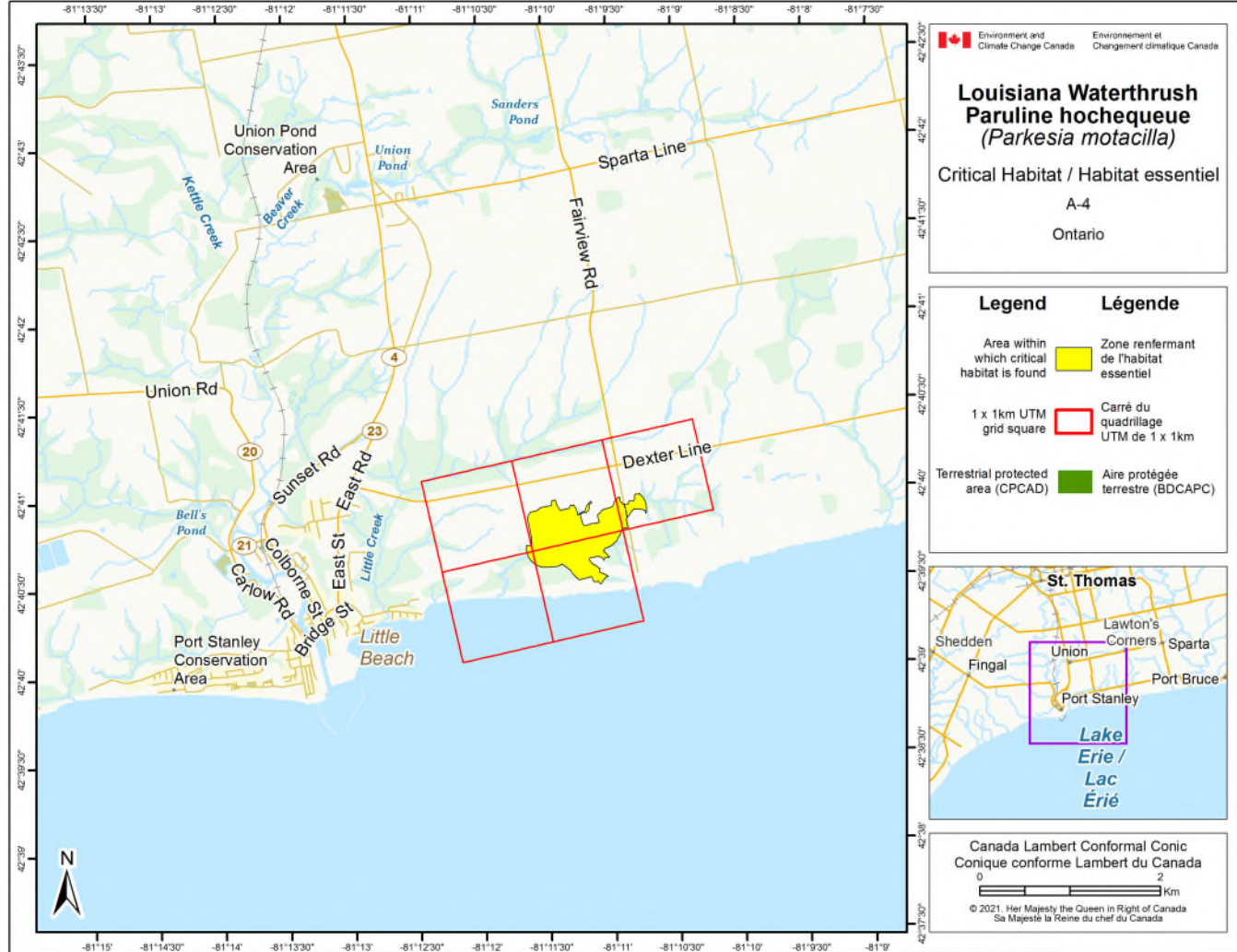


Figure A-4. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



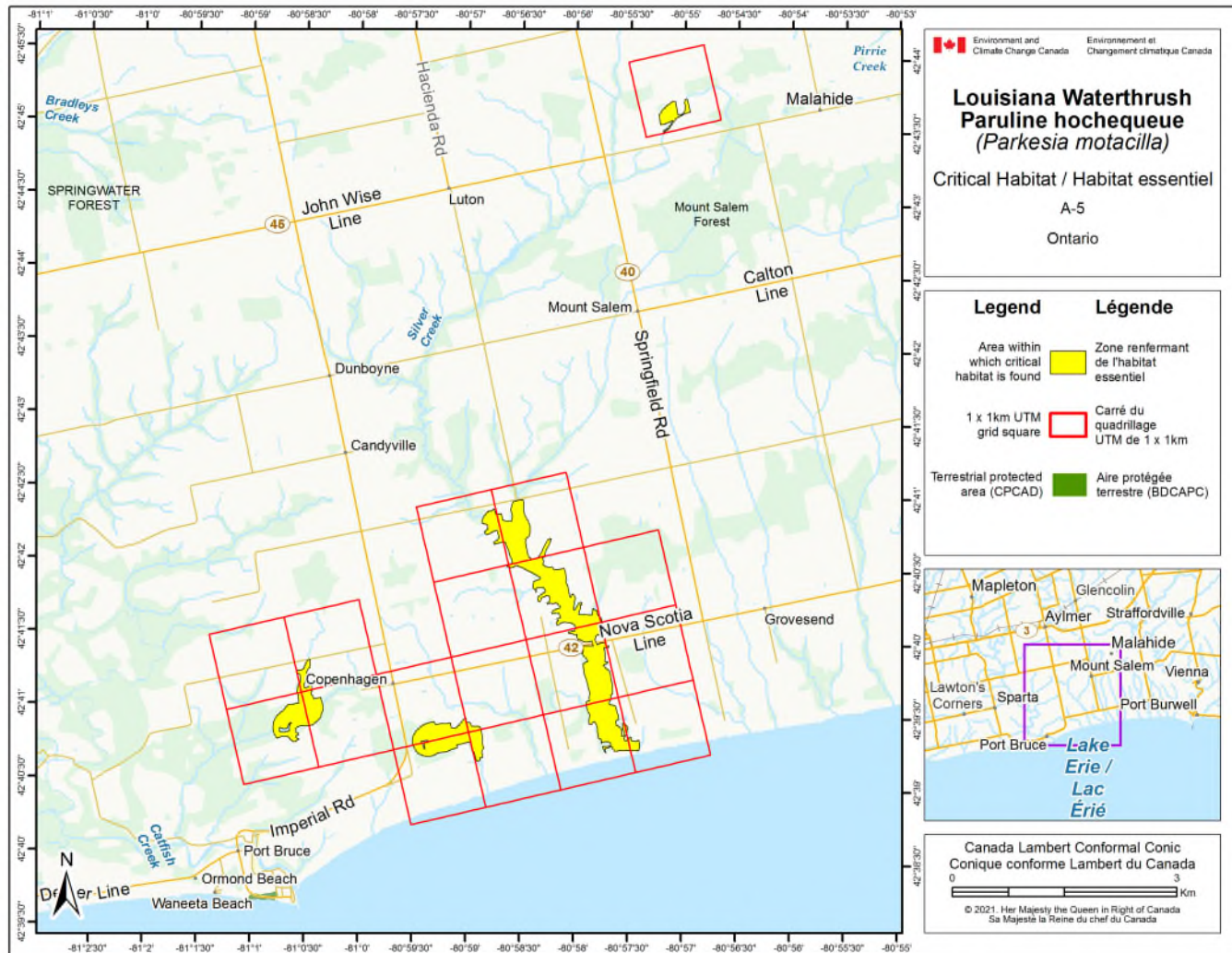


Figure A-5. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

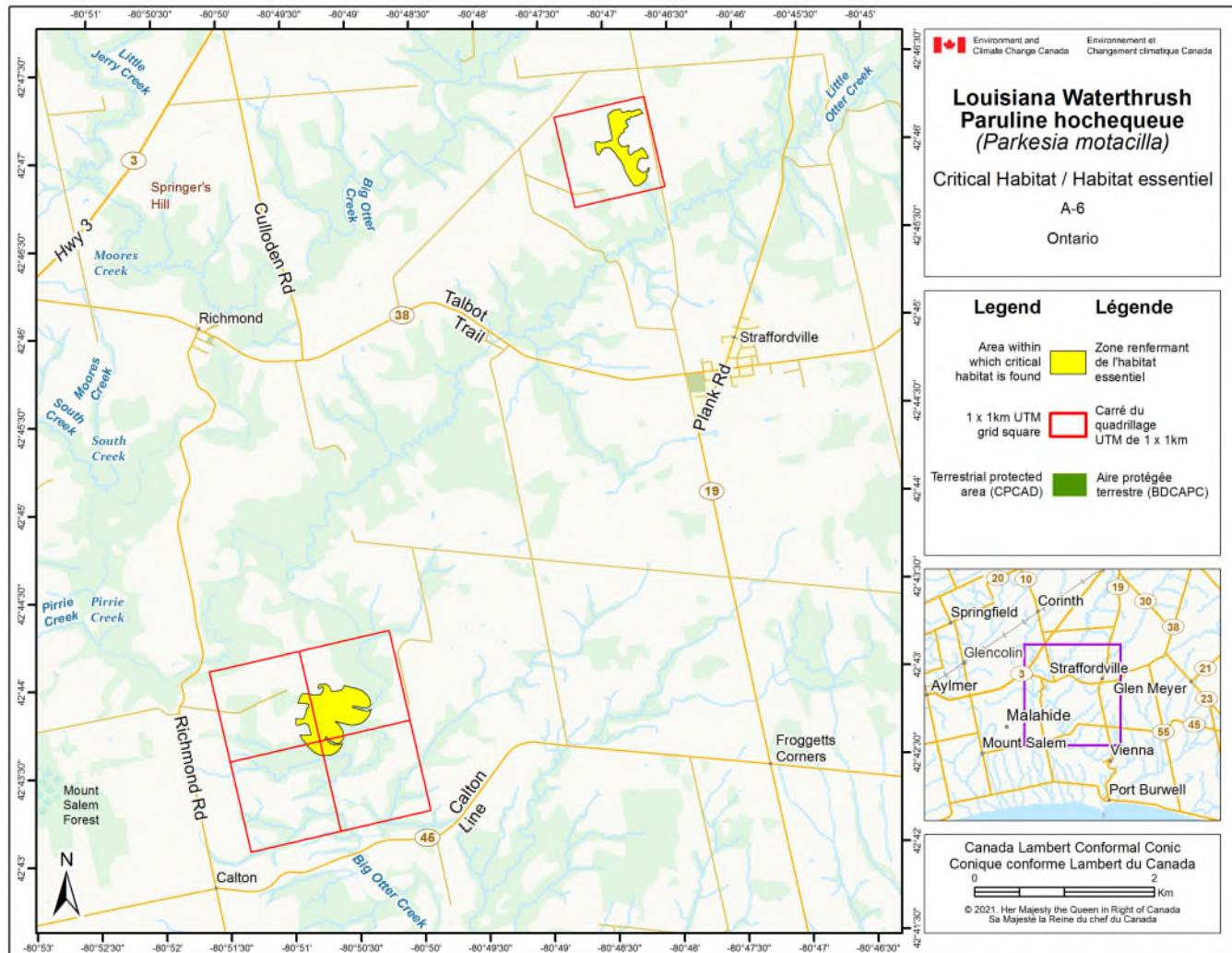


Figure A-6. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



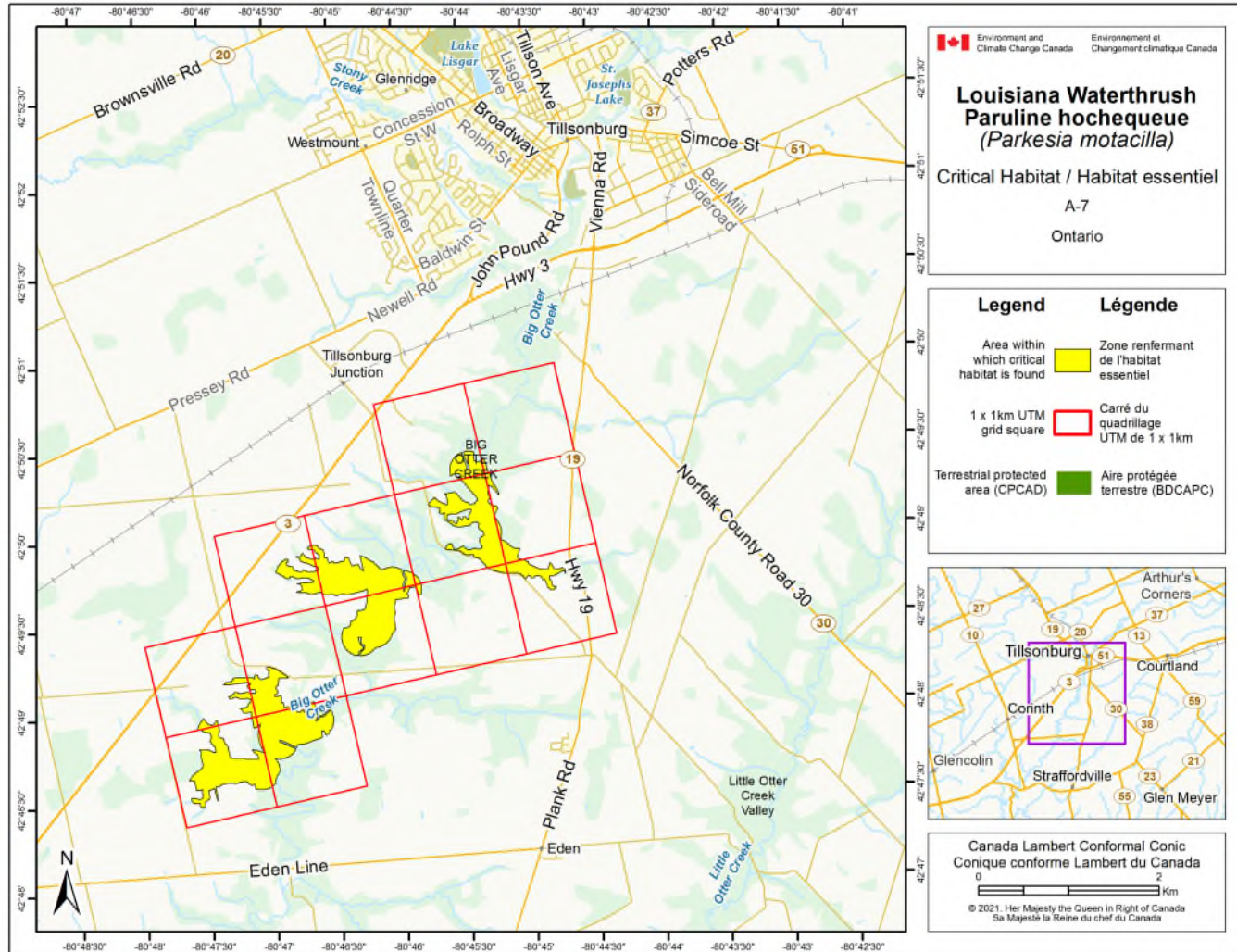


Figure A-7. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

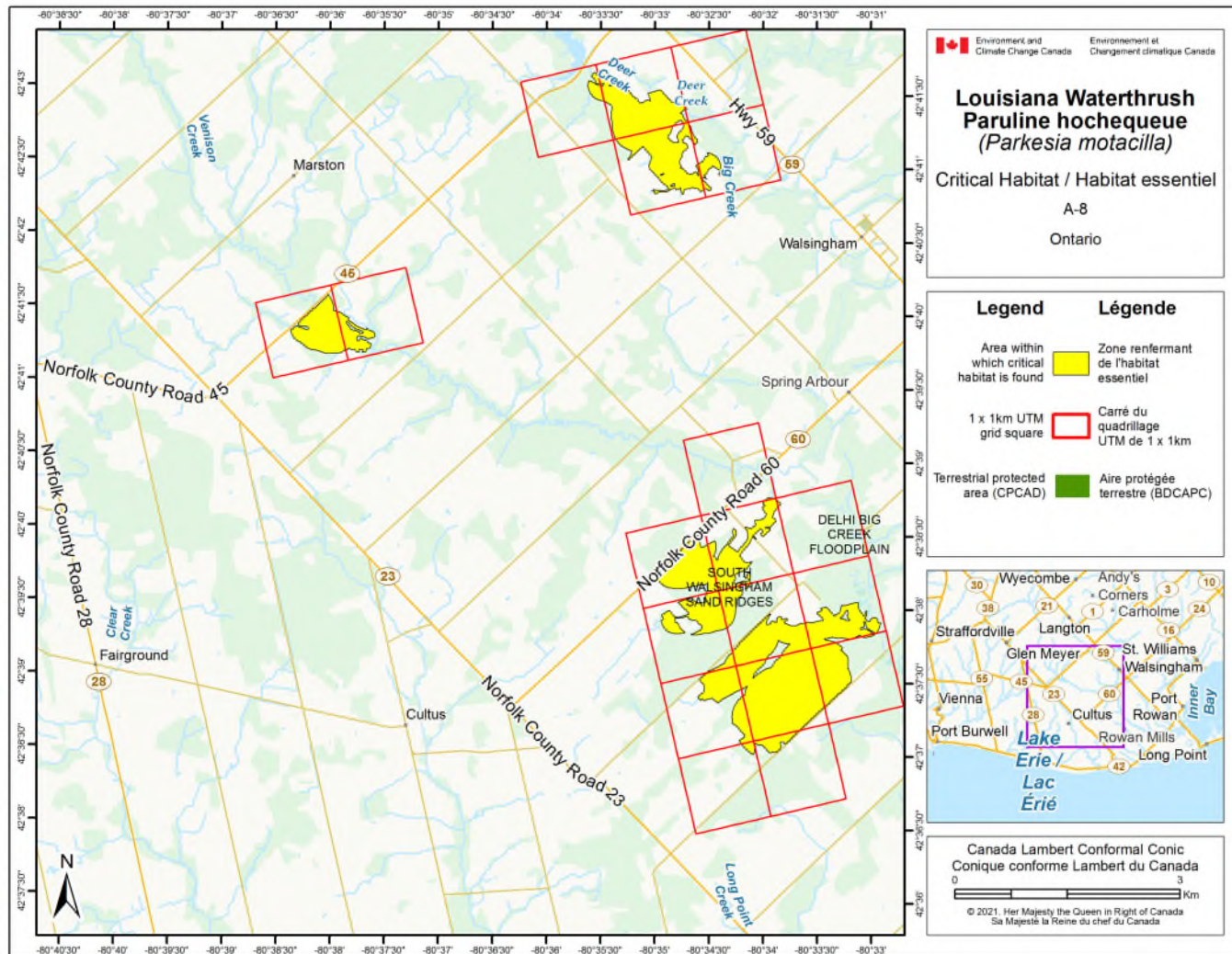


Figure A-8. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



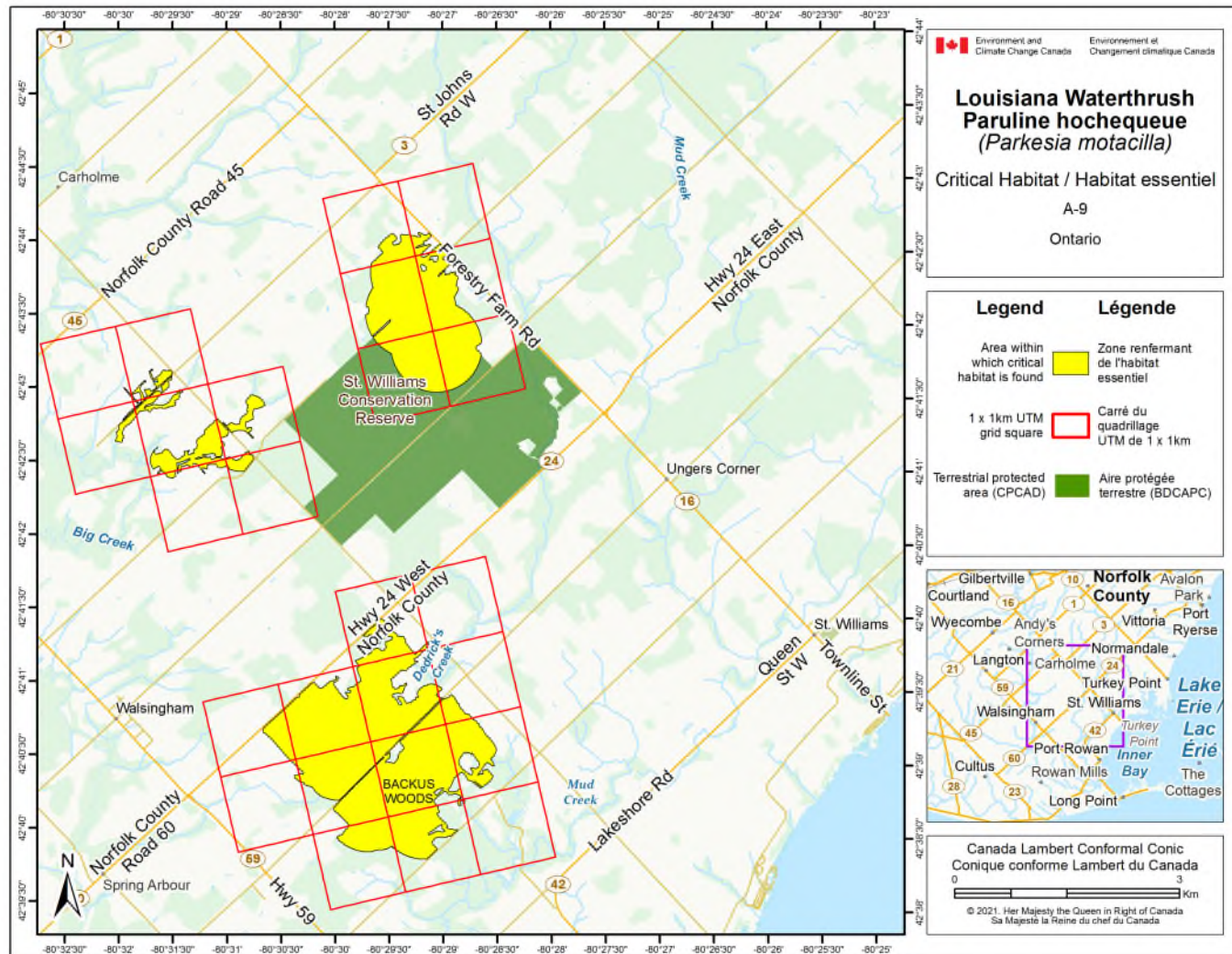


Figure A-9. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

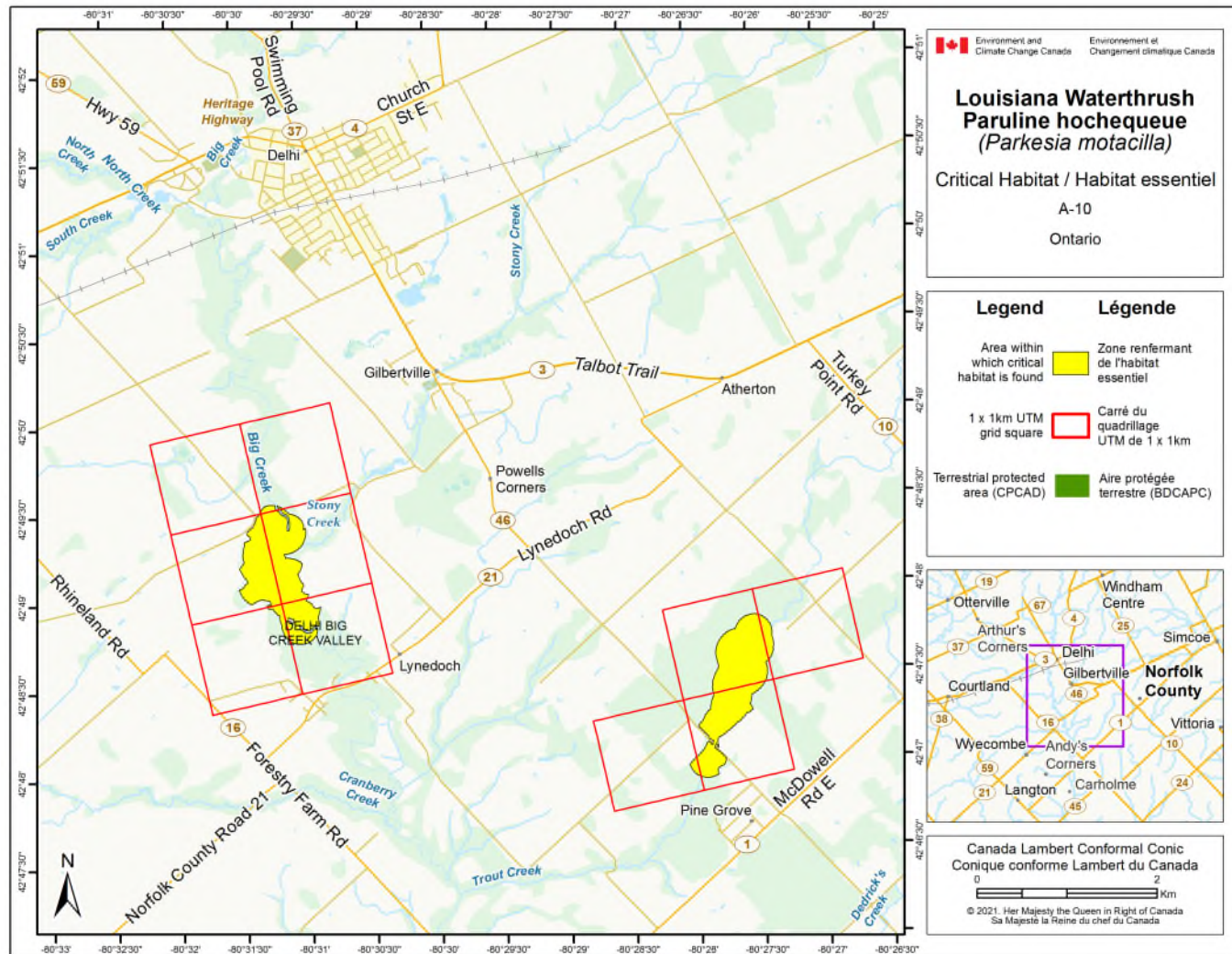


Figure A-10. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



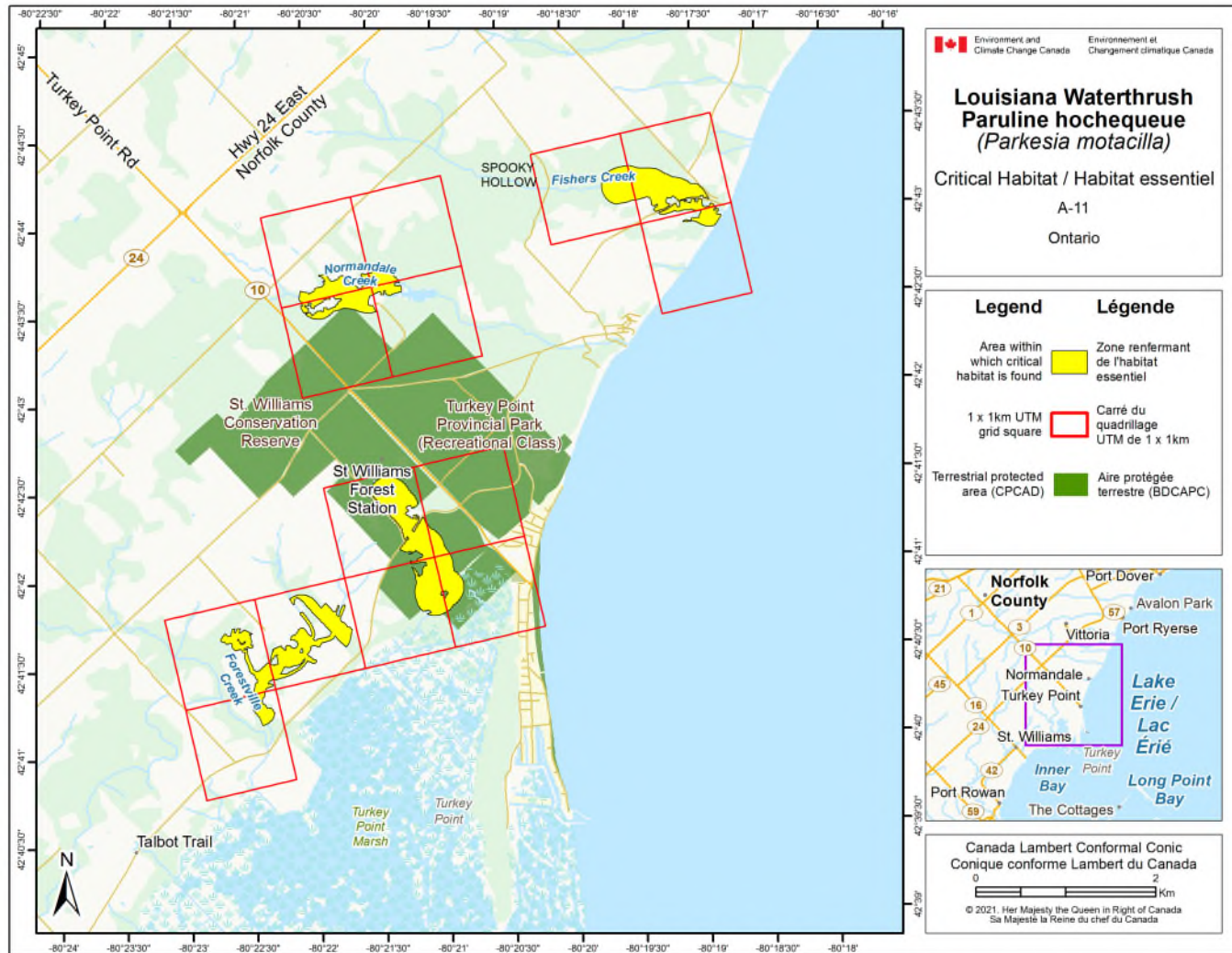


Figure A-11. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

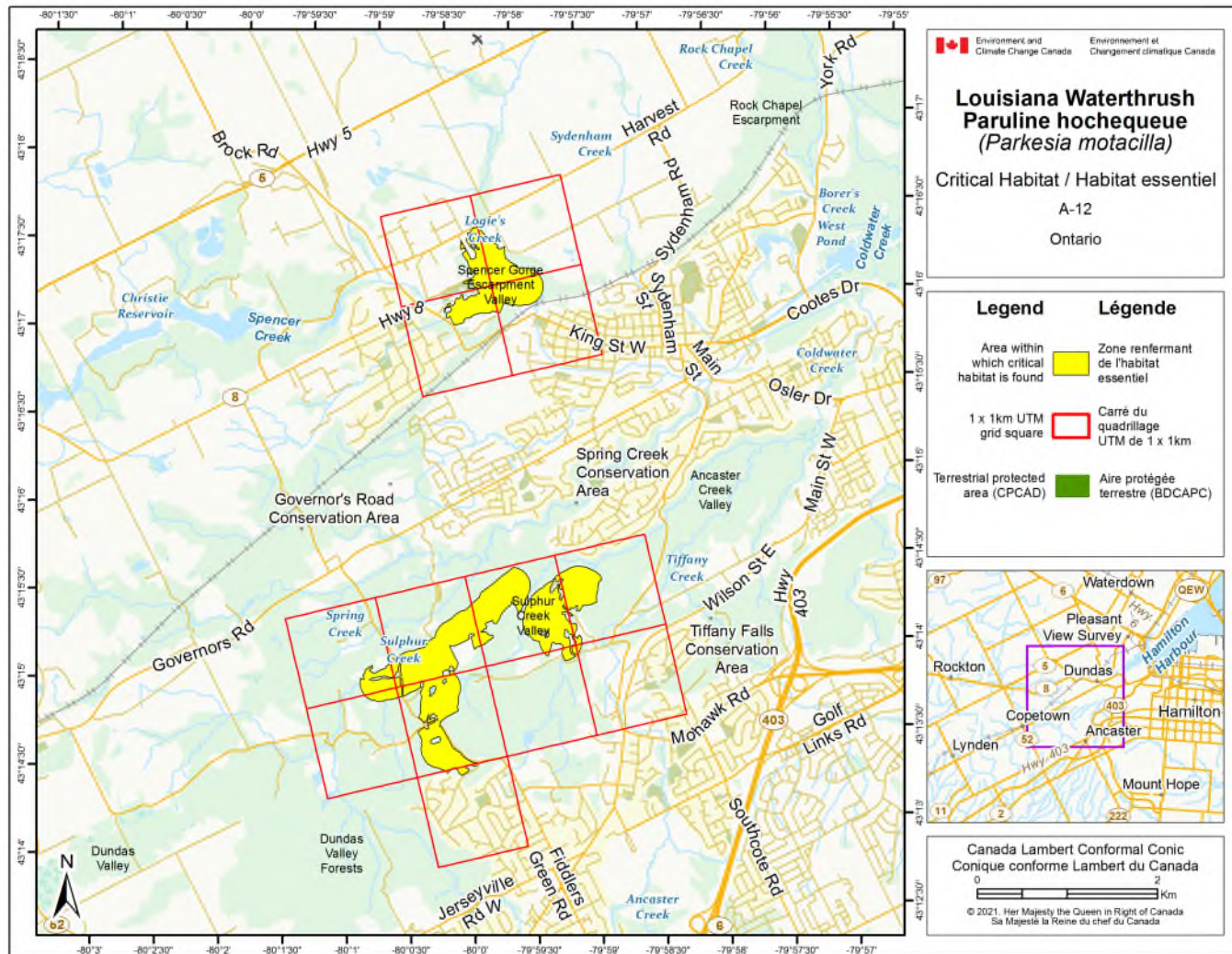


Figure A-12. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



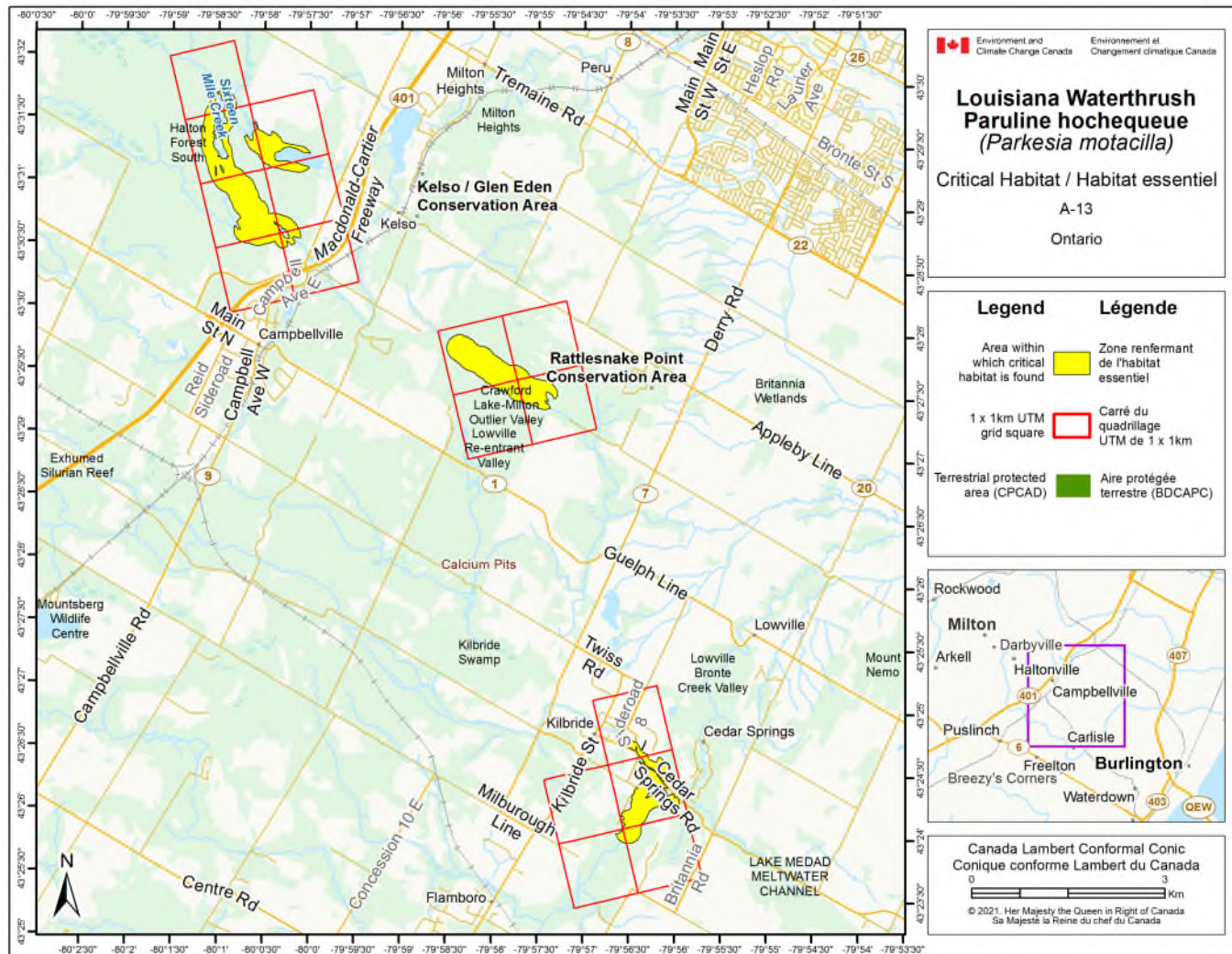


Figure A-13. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

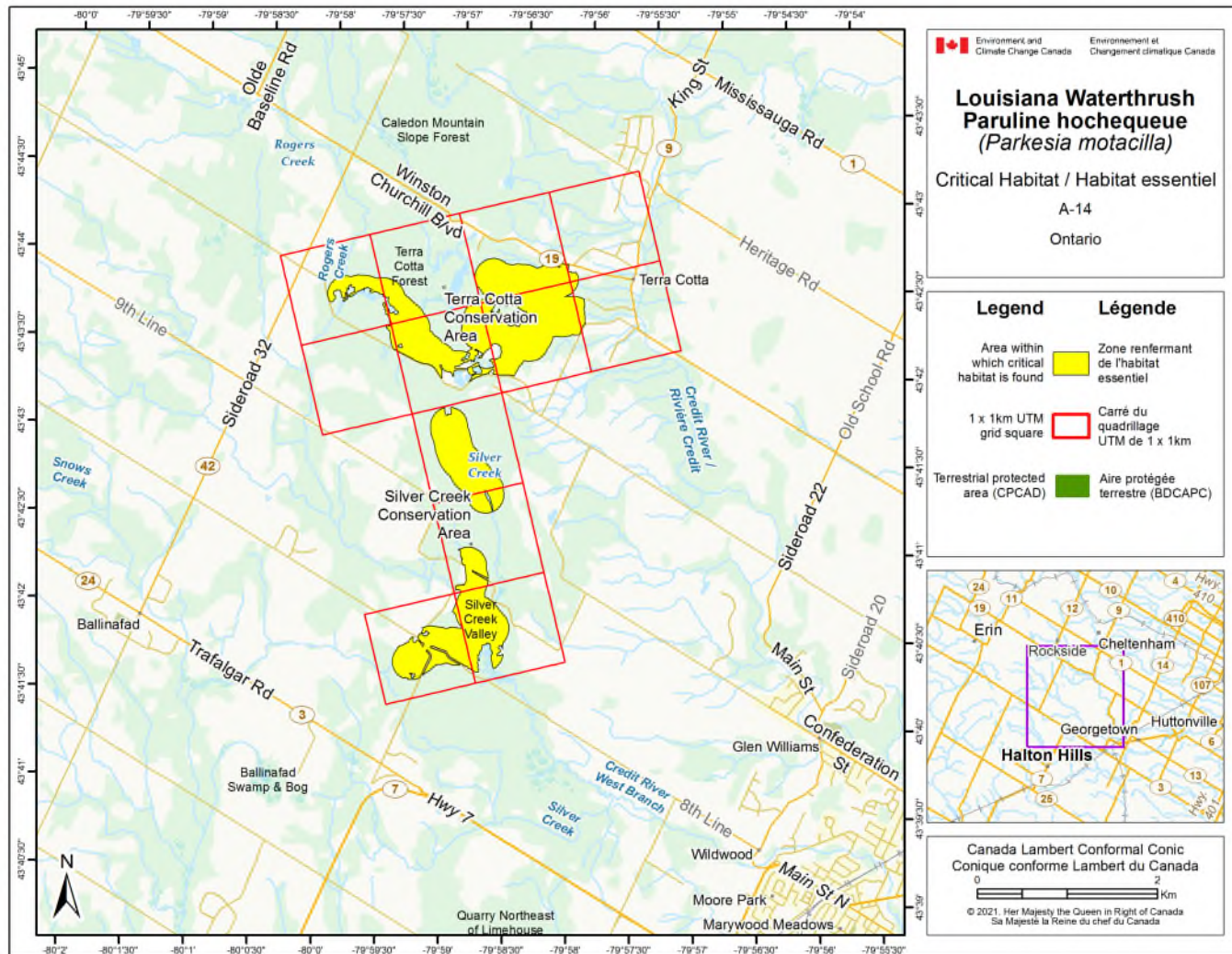


Figure A-14. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



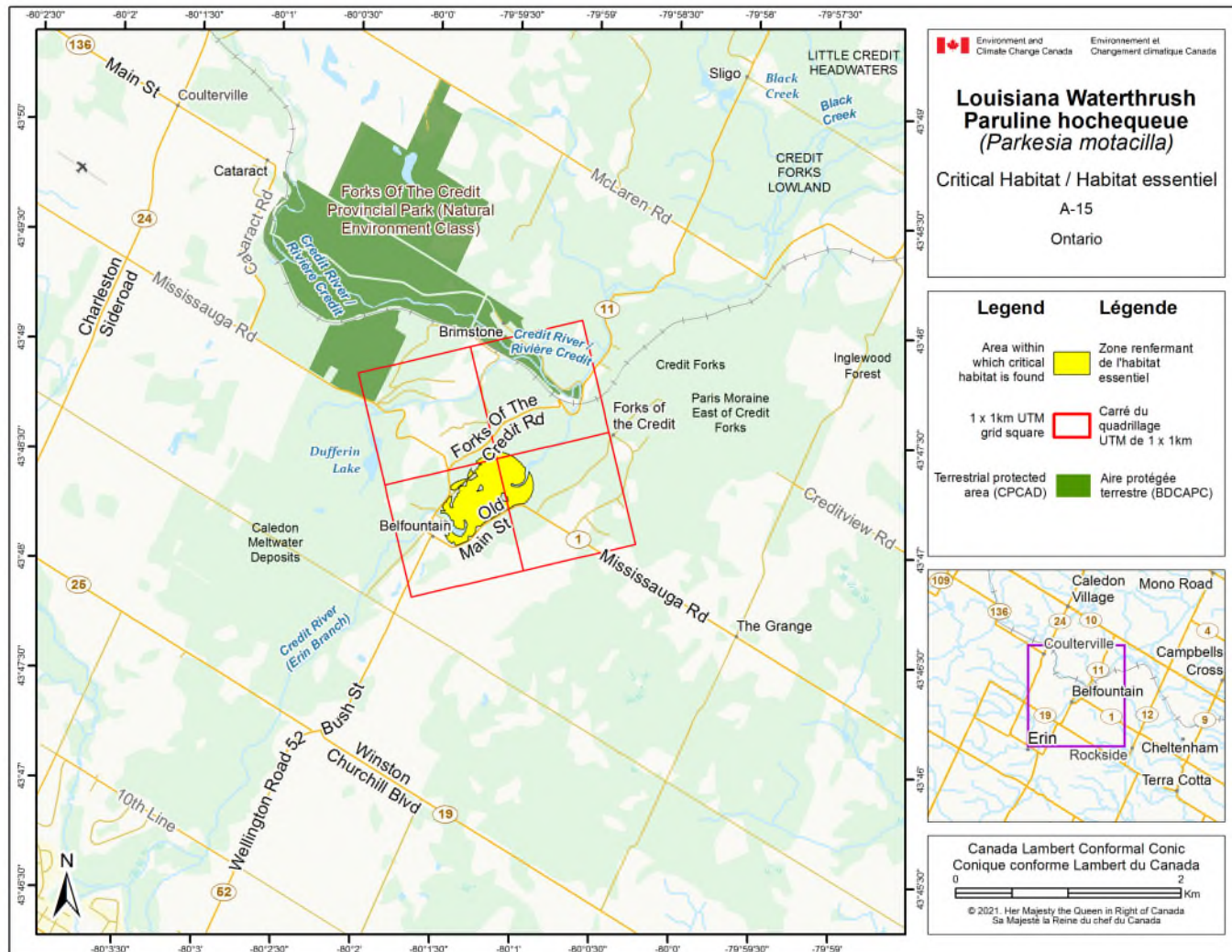


Figure A-15. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

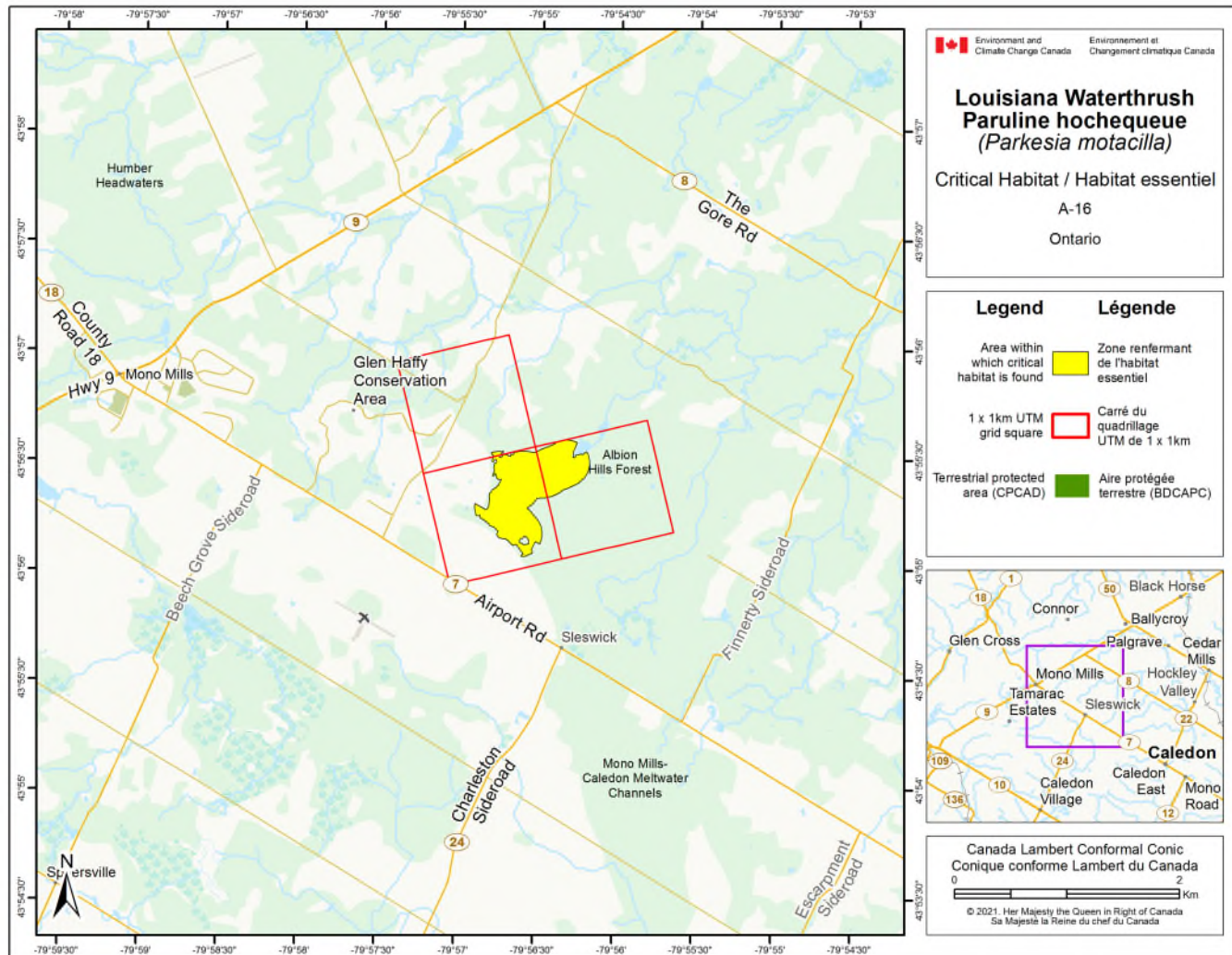


Figure A-16. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



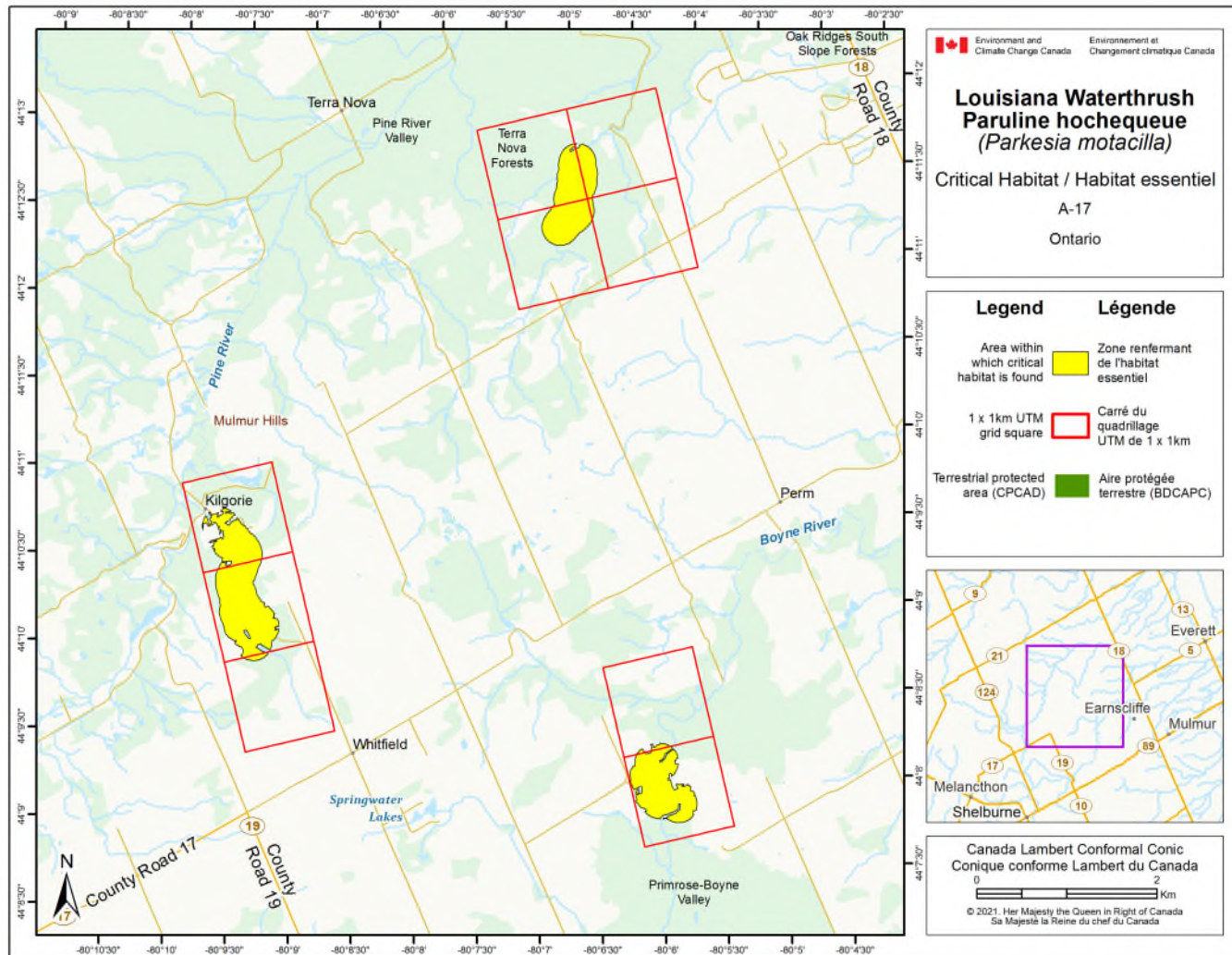


Figure A-17. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

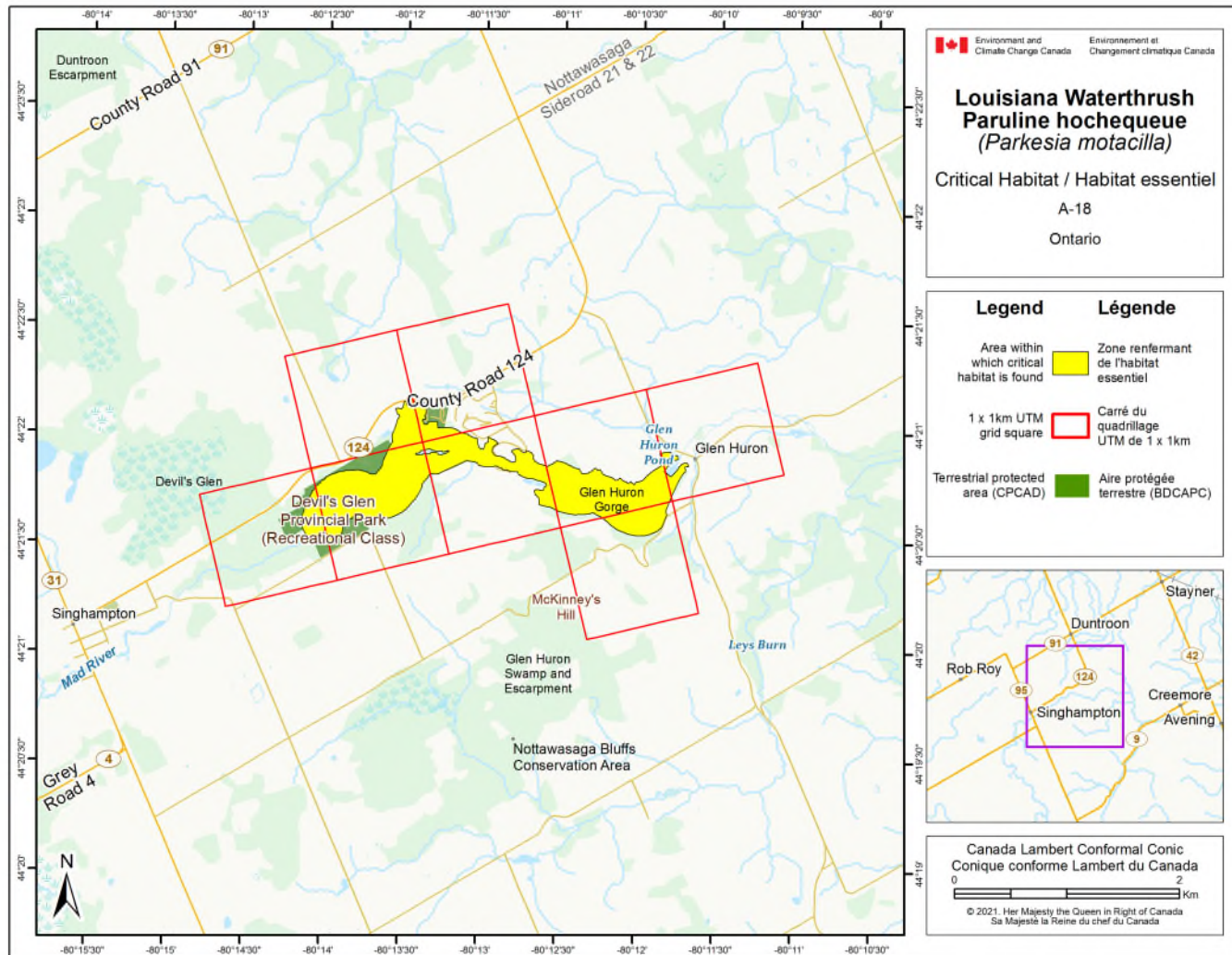


Figure A-18. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



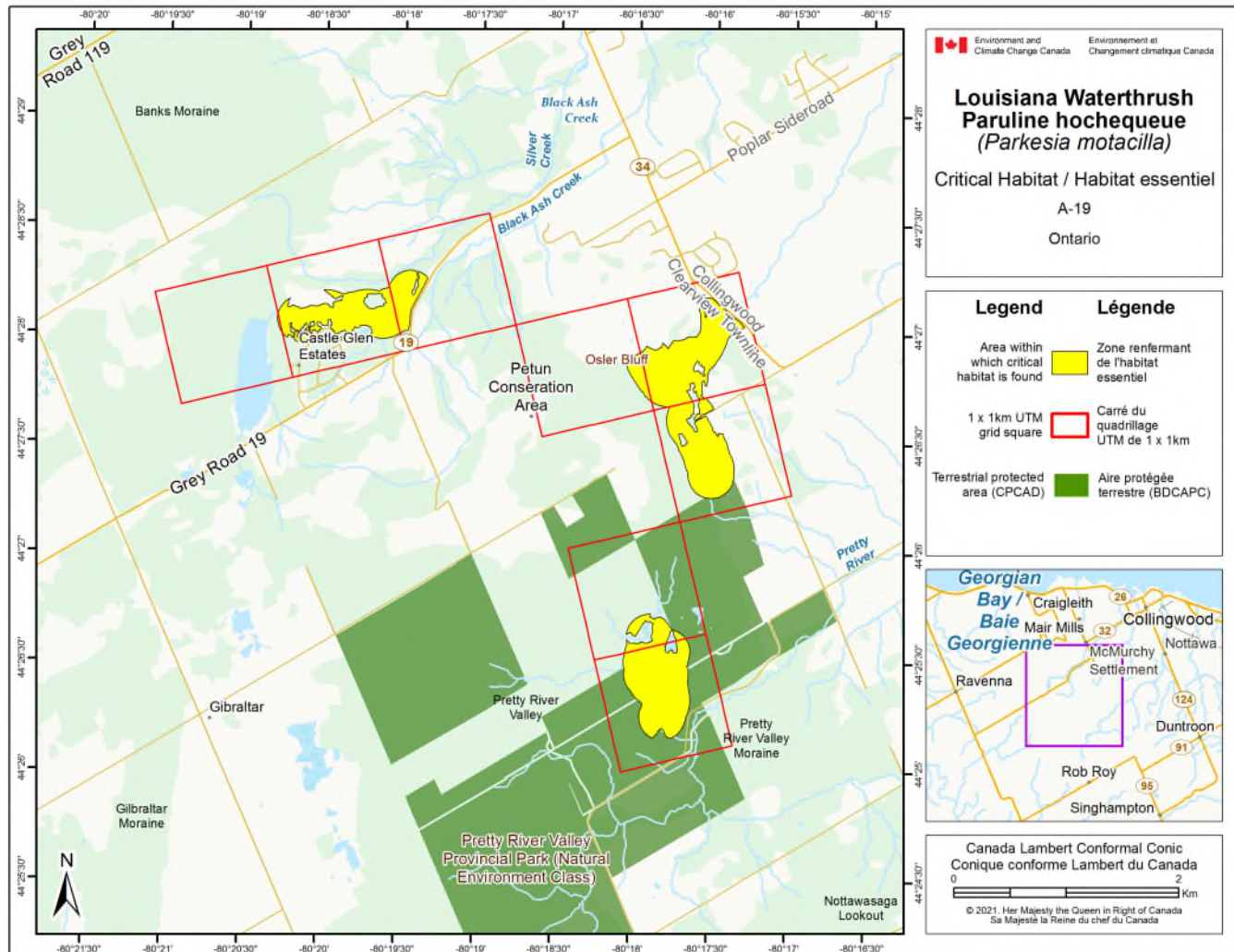


Figure A-19. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

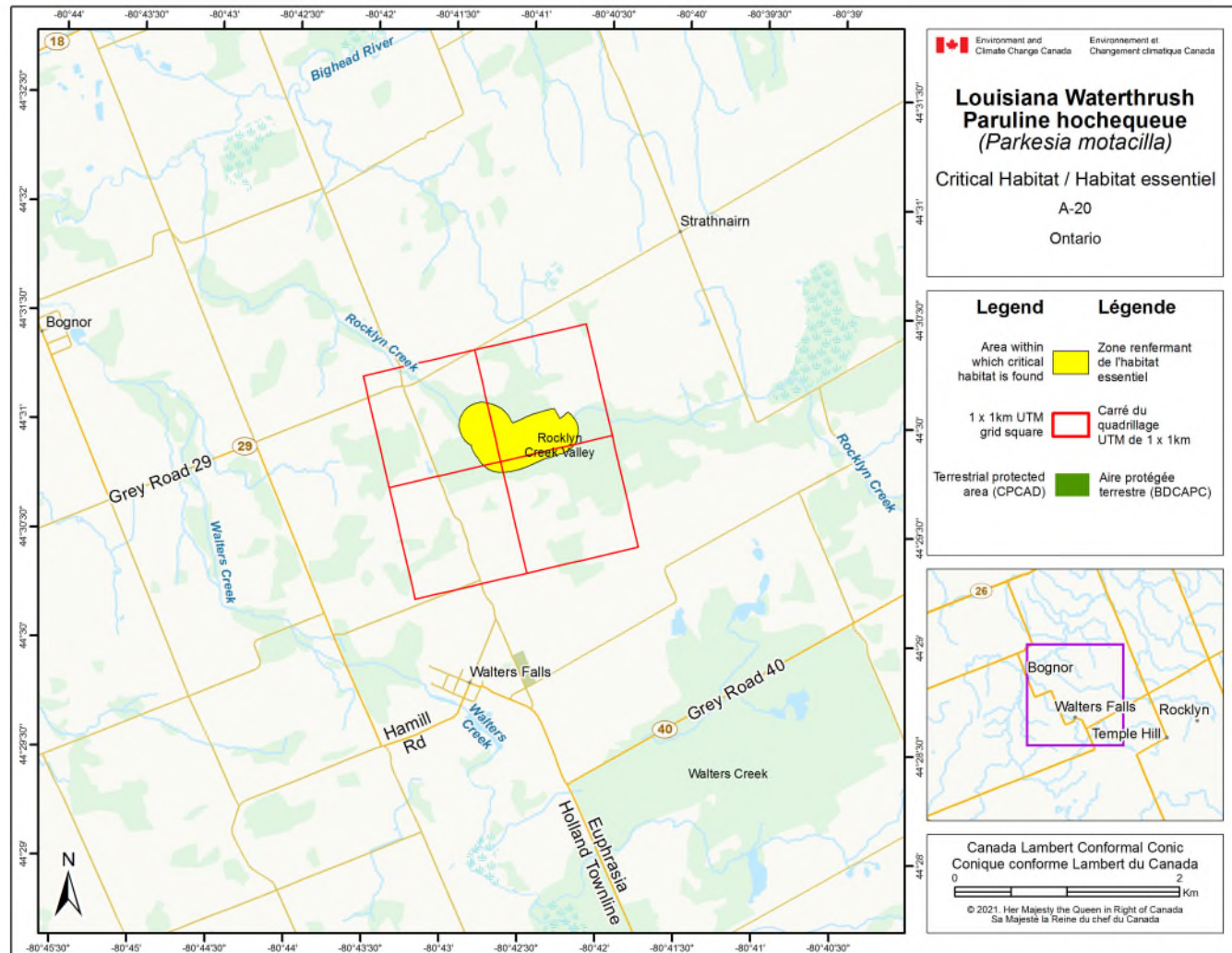


Figure A-20. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



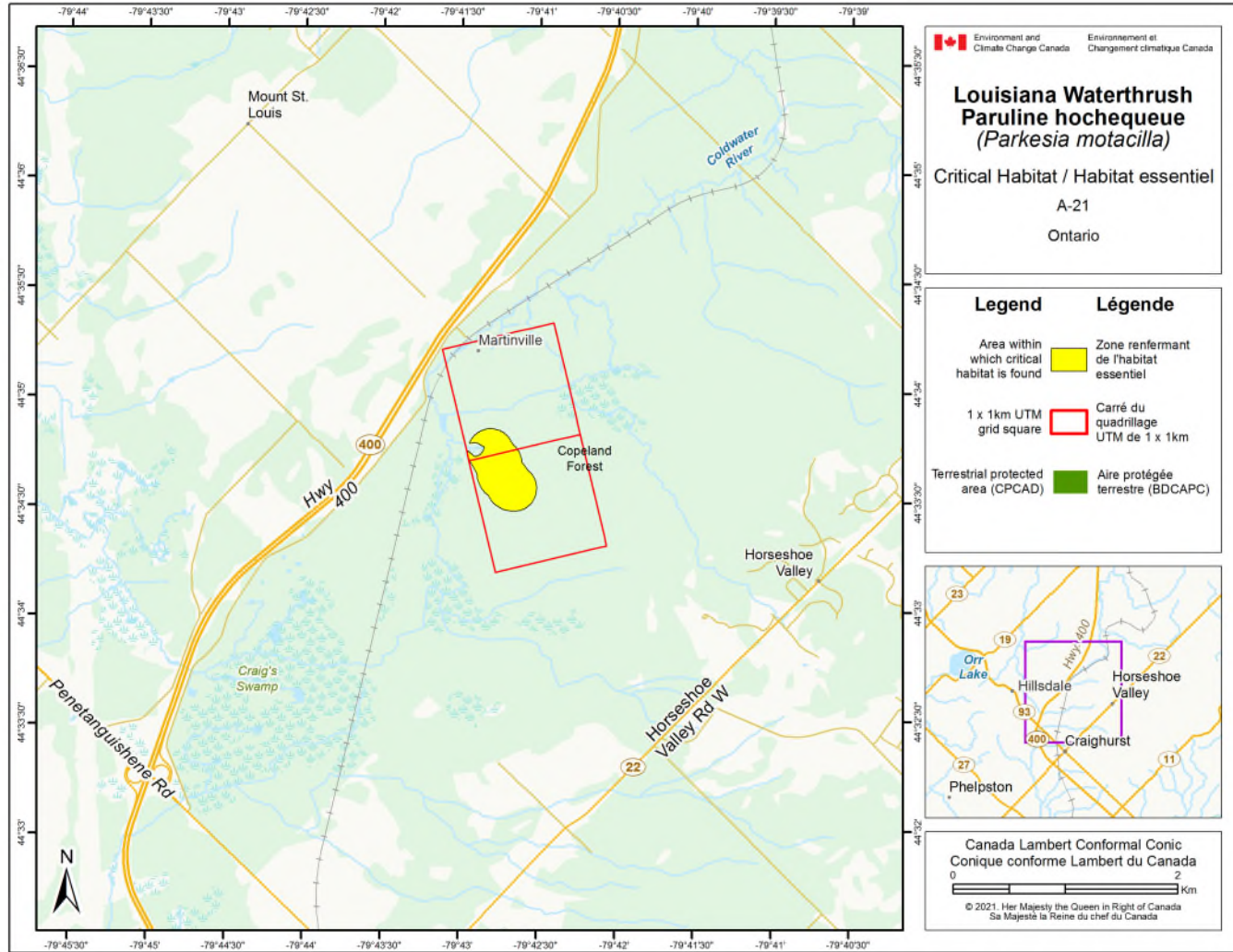


Figure A-21. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

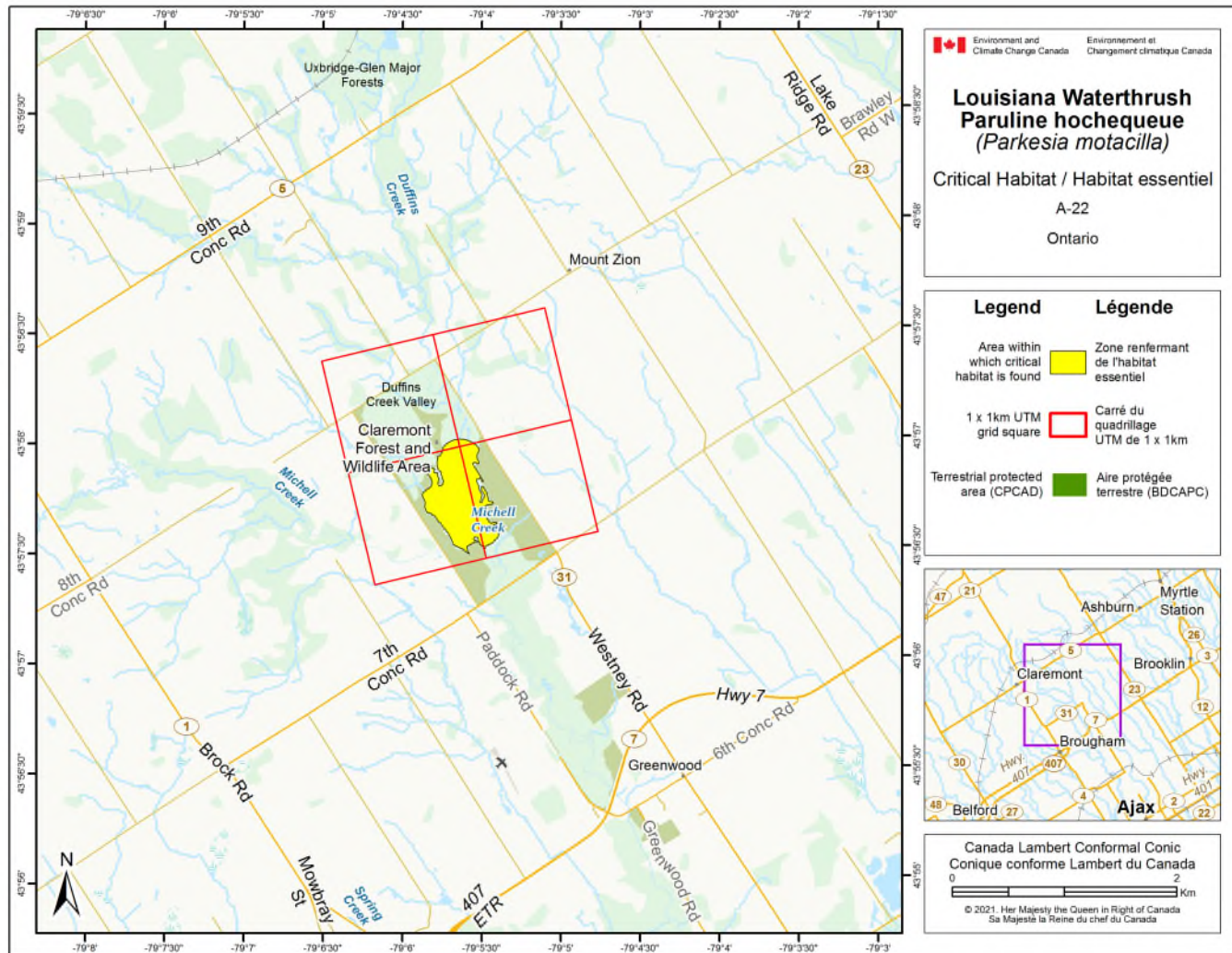


Figure A-22. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



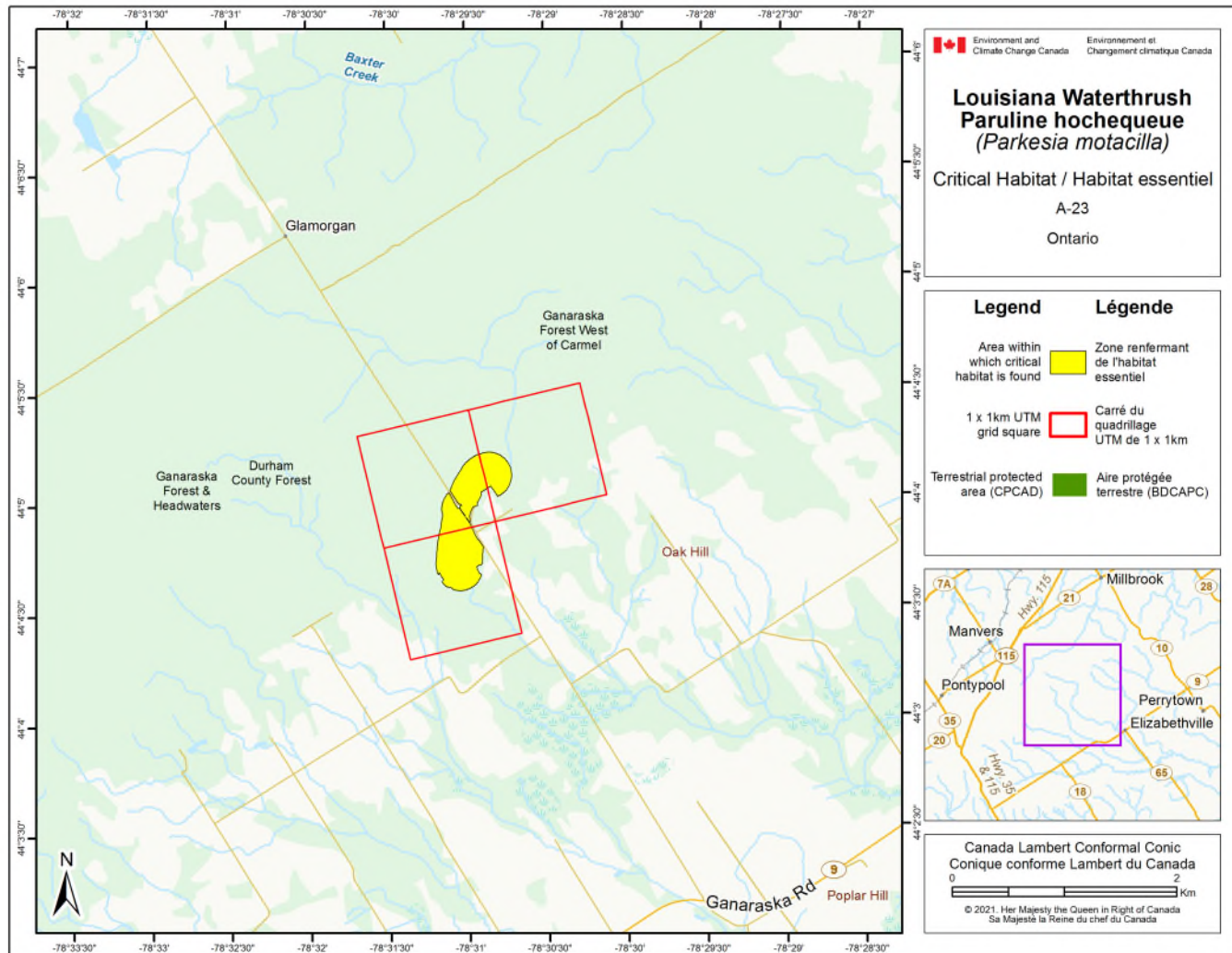


Figure A-23. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

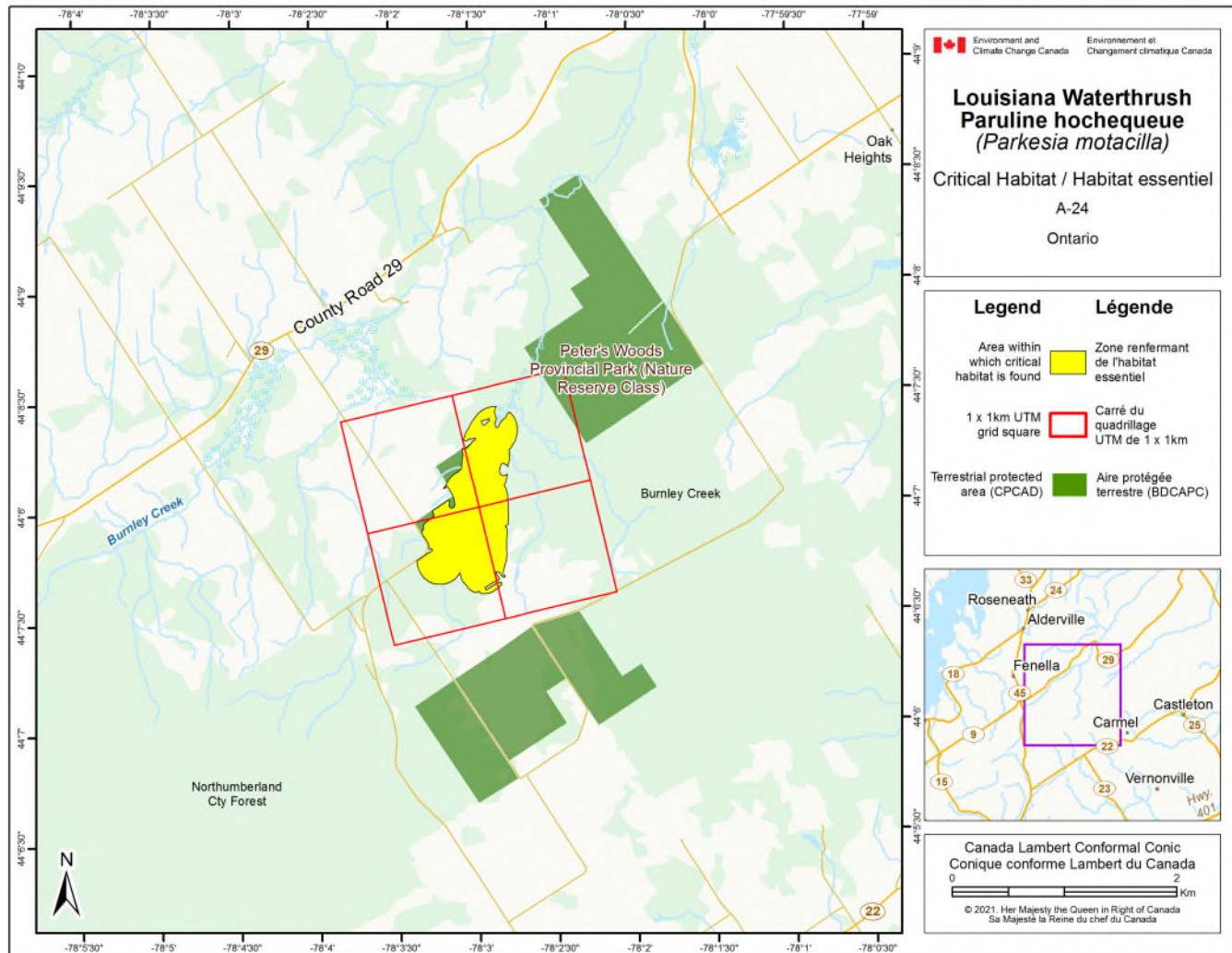


Figure A-24. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



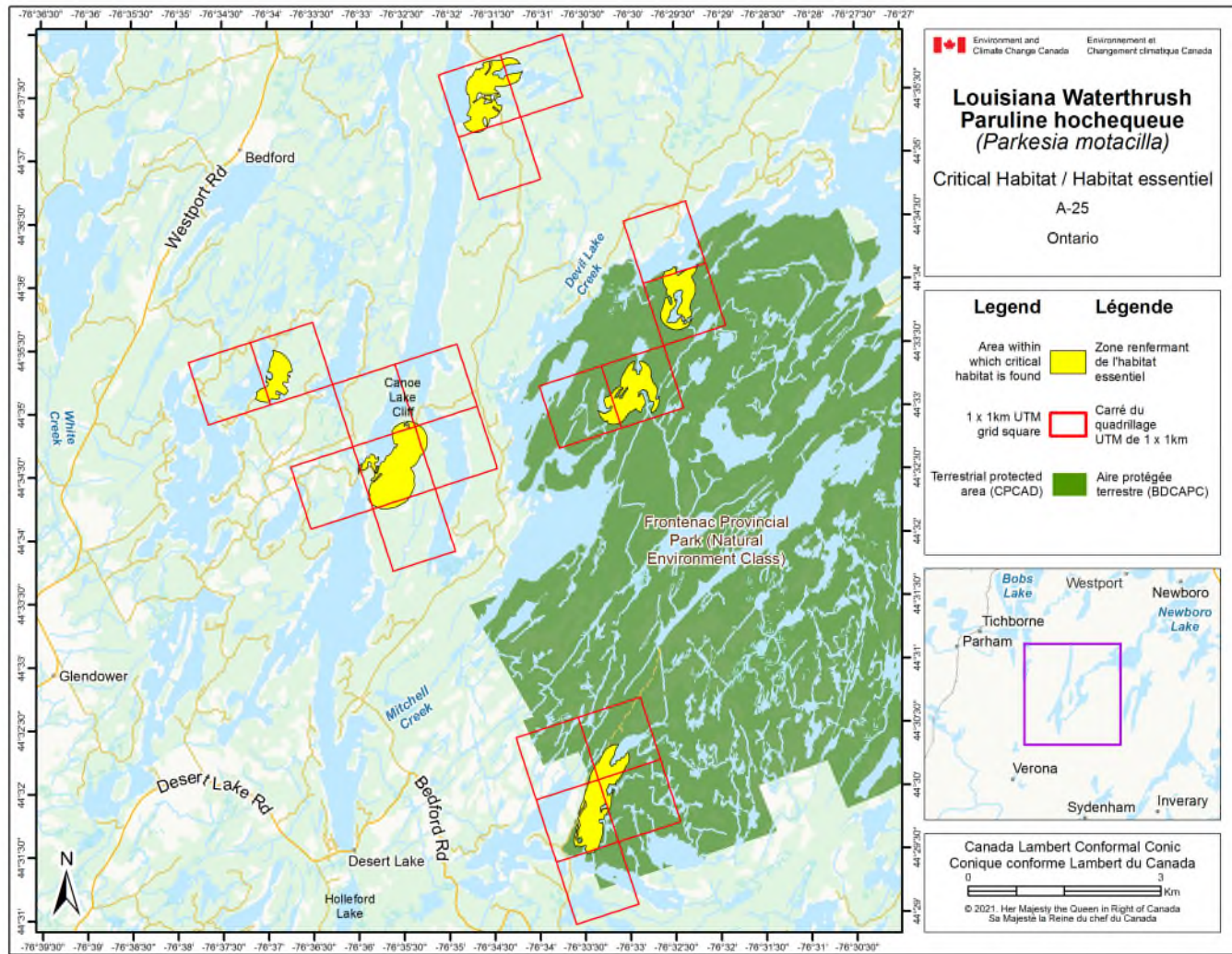


Figure A-25. Critical habitat for the Louisiana Waterthrush in Ontario per extent as in Figure A-Overview. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km × 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

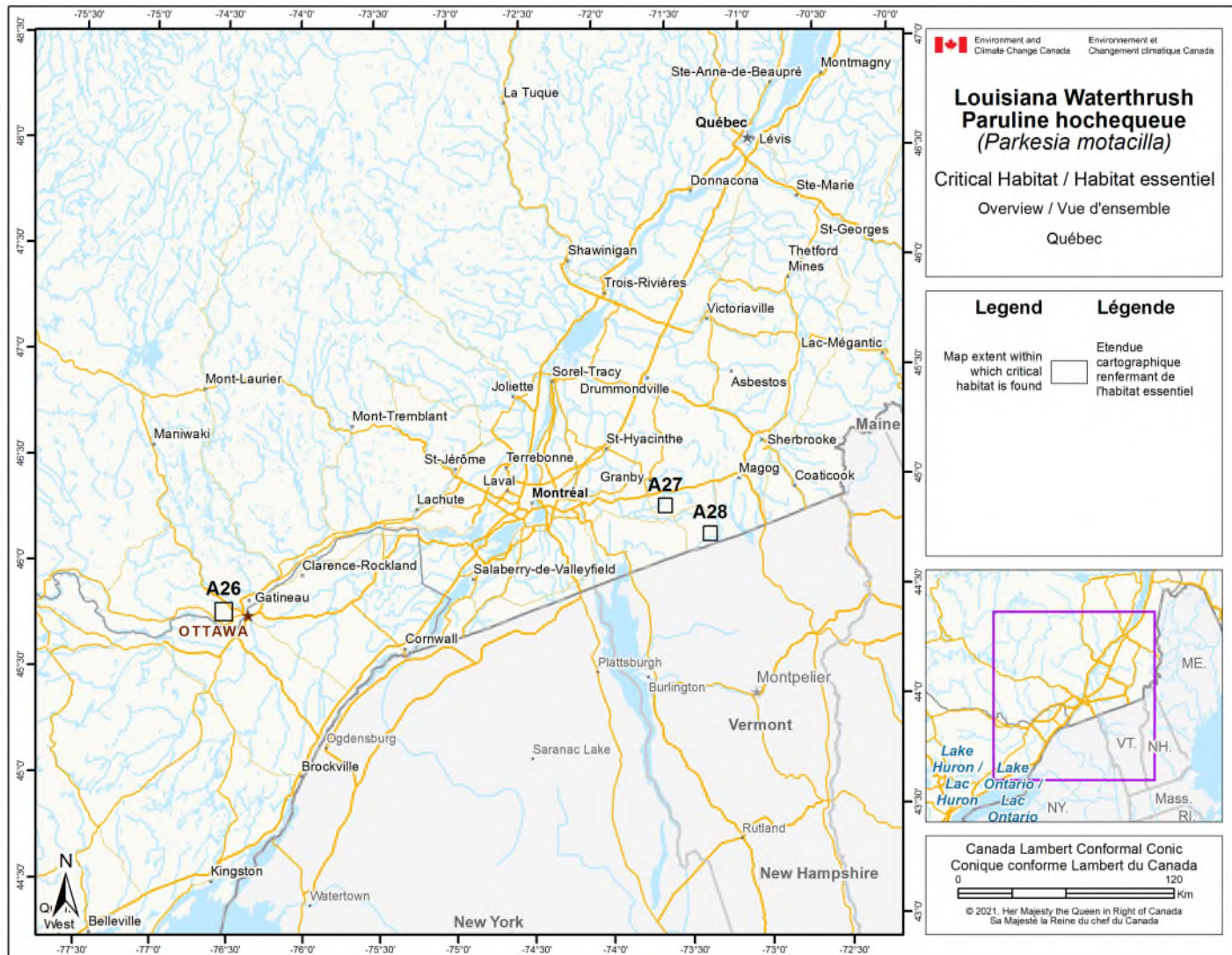


Figure A-Overview (Quebec). Map extent for critical habitat for the Louisiana Waterthrush in Quebec as depicted in Figures A-26 to A-28.



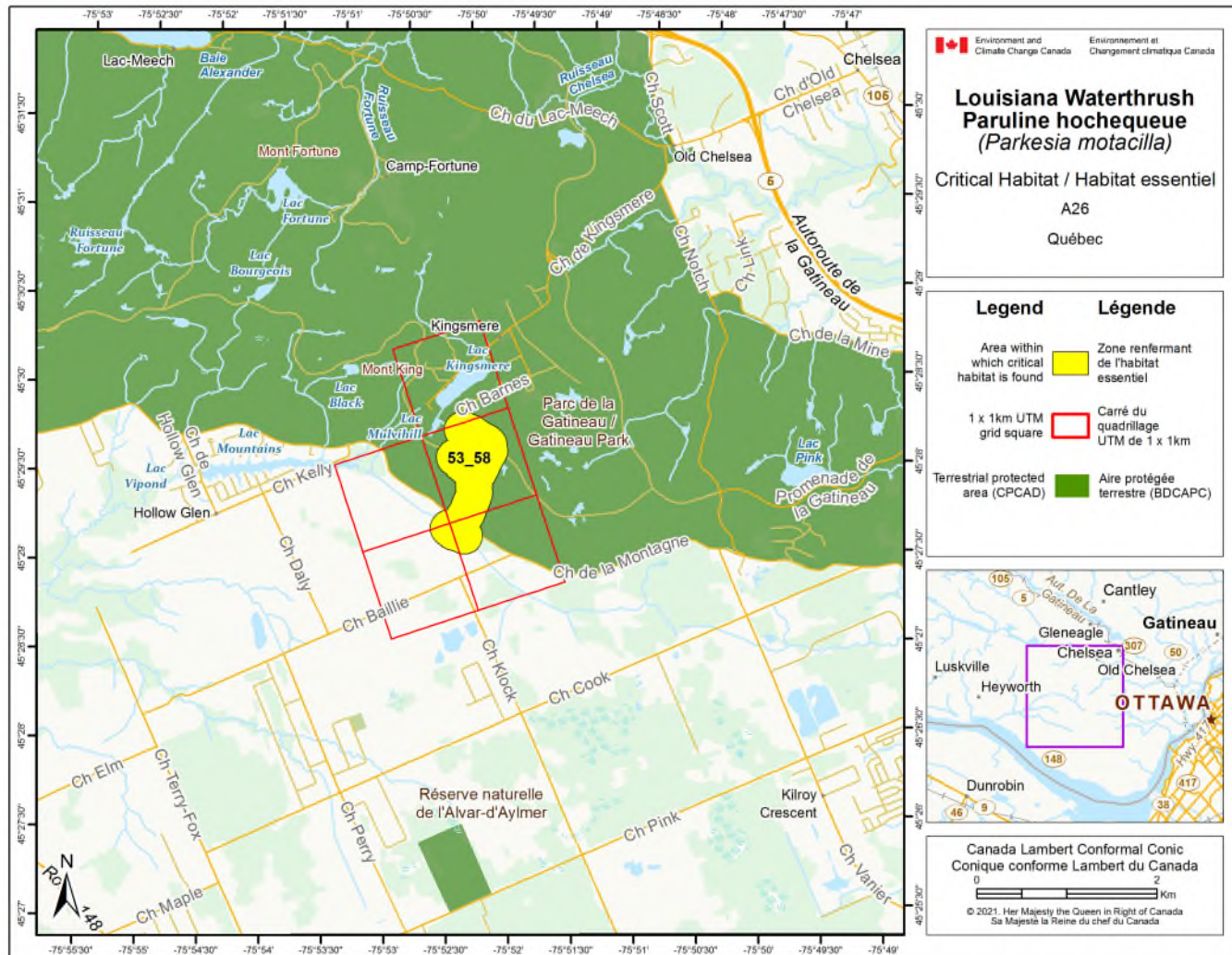


Figure A-26. Critical habitat for the Louisiana Waterthrush in Quebec. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

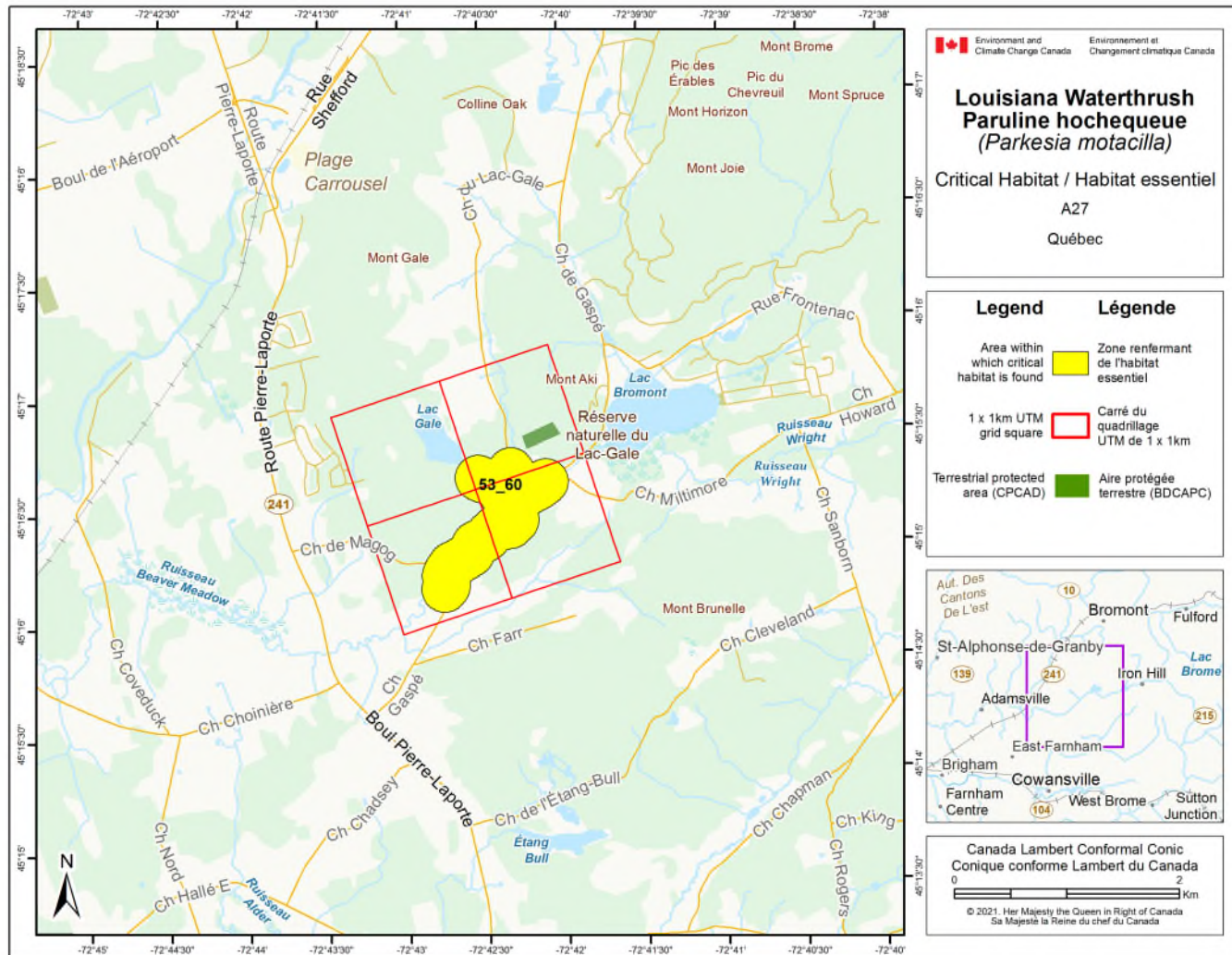


Figure A-27. Critical habitat for the Louisiana Waterthrush in Quebec. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.



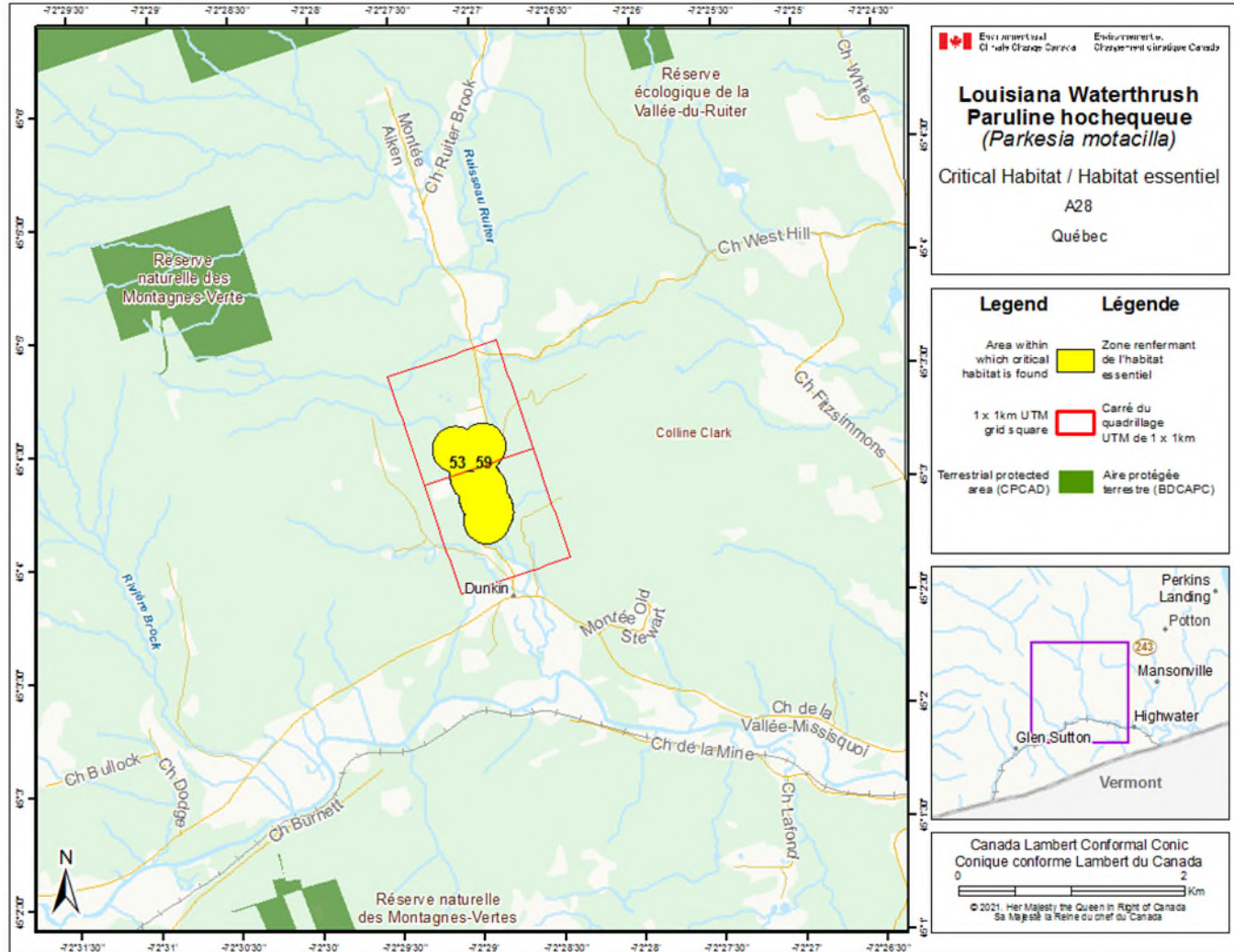


Figure A-28. Critical habitat for the Louisiana Waterthrush in Quebec. The area containing critical habitat for the Louisiana Waterthrush, as described in section 7.1, is represented by the yellow shaded unit. Within this area, critical habitat occurs where the biophysical attributes described in section 7.1.2 are found. The 1 km x 1 km UTM grid overlay (red outline) shown on this figure is a standardized national grid system used to indicate the general geographic area within which critical habitat is found.

## Appendix B: Subnational Conservation Ranks of the Louisiana Waterthrush in Canada and the United States

Table B-1 – Conservation ranks for the Louisiana Waterthrush in North America (NatureServe 2021).

Louisiana Waterthrush ( <i>Parkesia motacilla</i> )				
Global (G) Rank	National (N) Rank (Canada)	Sub-national (S) Rank (Canada)	National (N) Rank (United States)	Sub-national (S) Rank (United States)
G5	N3B, NUM	Quebec (S1B) Ontario (S2B)	N5B	Alabama (S5B), Arizona (S1N), Arkansas (S4B), Connecticut (S5B), Delaware (S3B), District of Columbia (S2B,S3S4N), Florida (S2), Georgia (S5), Illinois (S4), Indiana (S4B), Iowa (S3B,S4N), Kansas (S3B), Kentucky (S5B), Louisiana (S3B), Maine (S2B), Maryland (S5B), Massachusetts (S4B), Michigan (S2), Minnesota (S3B), Mississippi (S2S3B), Missouri (SNRB), Nebraska (S1), New Hampshire (S4B), New Jersey (S4B), New York (S5B), North Carolina (S4B), Ohio (S5), Oklahoma (S4B), Pennsylvania (S5B), Rhode Island (S4B), South Carolina (S4B), Tennessee (S4), Texas (S3B), Vermont (S4B), Virginia (S5), West Virginia (S3B), Wisconsin (S3B)

**S1: Critically Imperiled:** At very high risk of extirpation in the jurisdiction due to very restricted range, very few populations or occurrences, very steep declines, severe threats, or other factors.

**S2: Imperiled:** At high risk of extirpation in the jurisdiction due to restricted range, few populations or occurrences, steep declines, severe threats, or other factors.

**N3/S3: Vulnerable:** At moderate risk of extirpation in the jurisdiction due to a fairly restricted range, relatively few populations or occurrences, recent and widespread declines, threats, or other factors.

**S4: Apparently Secure:** At a fairly low risk of extirpation in the jurisdiction due to an extensive range and/or many populations or occurrences, but with possible cause for some concern as a result of local recent declines, threats, or other factors.

**G5/N5/S5: Secure:** At very low risk of extinction or elimination due to a very extensive range, abundant populations or occurrences, and little to no concern from declines or threats).

**NU: Unrankable:** Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

**SNR: Unranked:** Subnational conservation status not yet assessed.

**B:** Breeding population

**N:** Non-breeding population

**M:** Migrant population

## Appendix C: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)<sup>24</sup>. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or any of the [Federal Sustainable Development Strategy](#)'s<sup>25</sup> (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that strategies may also inadvertently lead to environmental effects beyond the intended benefits. The planning process based on national guidelines directly incorporates consideration of all environmental effects, with a particular focus on possible impacts upon non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below in this statement.

While implementation of this recovery strategy is expected to benefit the environment and native species that favour stream, wetland, and mature forest habitats, especially those that would benefit from increased landscape-scale forest cover (e.g. Cerulean Warbler [*Setophaga cerulea*] or stream/wetland water quality (e.g. fish, amphibians, some reptiles, and Riverine Clubtail, Great Lakes Plains population [*Stylurus amnicola*]), potentially adverse effects were also considered. These adverse effects relate to species whose specific requirements may differ from those of the Louisiana Waterthrush. For example, habitat management approaches that favour the Louisiana Waterthrush in Canada may not favour species that require open country habitats such as the Bobolink (*Dolichonyx oryzivorous*) or Eastern Meadowlark (*Sturnella magna*) or early successional habitats such as the Golden-winged Warbler (*Vermivora chrysoptera*). Even species that use mature forest habitat may have specific requirements that conflict with the specific needs of the Louisiana Waterthrush.

Consequently, it is important that habitat management activities for the Louisiana Waterthrush be planned and implemented from an ecosystem perspective through the development, with input from responsible jurisdictions, stakeholders, Indigenous peoples, and landowners, of multi -species plans, ecosystem-based recovery programs, or area management plans that take into account the needs of multiple species, including other species at risk. Many of the stewardship and habitat improvement activities to benefit the Louisiana Waterthrush will be implemented through ecosystem-based conservation programs that have already taken into account the needs of other species at risk.

---

<sup>24</sup> [www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html](http://www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html)

<sup>25</sup> [www.fsds-sfdd.ca/index.html#/en/goals/](http://www.fsds-sfdd.ca/index.html#/en/goals/)

**Table C-1. Species expected to benefit from recovery techniques directed at Louisiana Waterthrush.**

<b>Common Name</b>	<b>Scientific Name</b>	<b>SARA Status</b>
Acadian Flycatcher	<i>Empidonax virescens</i>	Endangered
American Beech	<i>Fagus grandifolia</i>	
Barred Owl	<i>Strix varia</i>	
Blanding's Turtle, Great Lakes / St. Lawrence population	<i>Emydoidea blandingii</i>	Threatened
Cerulean Warbler	<i>Setophaga cerulea</i>	Endangered
Downy Woodpecker	<i>Picoides pubescens</i>	
Eastern Hemlock	<i>Tsuga canadensis</i>	
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>	Threatened
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	
Hairy Woodpecker	<i>Picoides villosus</i>	
Laura's Clubtail	<i>Stylurus laurae</i>	
Northern Waterthrush	<i>Parkesia noveboracensis</i>	
Prothonotary Warbler	<i>Protonotaria citrea</i>	Endangered
Riverine Clubtail, Great Lakes Plains population	<i>Stylurus amnicola</i>	Endangered
Wood Thrush	<i>Hylocichla mustelina</i>	Threatened

## Appendix D: Breeding Evidence<sup>26</sup>

### **Category: Possible Breeding**

#### **Code Description of behaviour**

- H Species observed in its breeding season in suitable nesting habitat.
- S Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat.

### **Category: Probable Breeding**

#### **Code Description of behaviour**

- P Pair observed in their breeding season in suitable nesting habitat.
- T Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart, at the same place.
- D Courtship or display between a male and a female or 2 males, including courtship feeding or copulation.
- V Visiting probable nest site.
- A Agitated behaviour or anxiety calls of an adult.
- B Brood patch on adult female or cloacal protuberance on adult male.
- N Nest-building or excavation of nest hole.

### **Category: Confirmed Breeding**

#### **Code Description of behaviour**

- DD Distraction display or injury feigning.
- NU Used nest or egg shell found (occupied or laid within the period of the study).
- FY Recently fledged young or downy young, including young incapable of sustained flight.
- AE Adults leaving or entering nest site in circumstances indicating occupied nest.
- FS Adult carrying faecal sac.
- CF Adult carrying food for young.
- NE Nest containing eggs.
- NY Nest with young seen or heard.

---

<sup>26</sup> Adapted from Cadman et al. 2007 and Robert et al. 2019.