PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Western Chorus Frog (*Pseudacris triseriata*), Great Lakes/ St. Lawrence – Canadian Shield Population, in Canada

Western Chorus Frog

2014

Canada

Recommended citation:

Environment Canada. 2014. Recovery Strategy for the Western Chorus Frog (*Pseudacris triseriata*), Great Lakes / St. Lawrence – Canadian Shield Population, in Canada [Proposed], *Species at Risk Act* Recovery Strategy Series, Environment Canada, Ottawa, v + 46 pp

For copies of the recovery strategy, or for additional information on species at risk, including COSEWIC Status Reports, residence descriptions, action plans and other related recovery documents, please visit the Species at Risk (SAR) Public Registry (www.sararegistry.gc.ca).

Cover illustration: © Raymond Belhumeur

Également disponible en français sous le titre
« Programme de rétablissement de la rainette faux-grillon de l'Ouest (*Pseudacris triseriata*), population des Grands Lacs et Saint-Laurent et du Bouclier canadien, au Canada [Proposition] »

ISBN
Catalogue no.

PREFACE

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. 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 of the publication of the final document on the Species at Risk Public Registry.

The Minister of the Environment and the Minister responsible for Parks Canada Agency are the competent ministers for the recovery of the Western Chorus Frog (*Pseudacris triseriata*), Great Lakes / St. Lawrence – Canadian Shield population, and have prepared this strategy, as per section 37 of SARA. It has been prepared in cooperation with the Government of Quebec (Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs; Ministère des Ressources naturelles and the Government of Ontario (Ontario Ministry of Natural Resources) under subsection 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 Canada, 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 Western Chorus Frog (*Pseudacris triseriata*), Great Lakes / St. Lawrence – Canadian Shield population, and for 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 Canada, Parks Canada Agency and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to the appropriations, priorities and budgetary constraints of the participating jurisdictions and organizations.

ACKNOWLEDGMENTS

This recovery strategy was prepared by Vincent Carignan (Environment Canada, Canadian Wildlife Service – Quebec Region) in collaboration with Krista Holmes, Marie-Claude Archambault, Carollynne Smith (Environment Canada, Canadian Wildlife Service – Ontario Region) and Barbara Slezak (formerly with Environment Canada, Canadian Wildlife Service – Ontario Region) on the basis of an earlier draft by Sébastien Rioux and Michel Saint-Germain (formerly with Environment Canada, Canadian Wildlife Service – Quebec Region). This strategy was reviewed by the current members of the Western Chorus Frog recovery team in Quebec: Vincent Carignan (Chair), Yohann Dubois, Simon Pelletier and Harold Ericksen (MDDEFP), Daniel Toussaint, Lyne Bouthillier and Nathalie Tessier (MRN); Pierre-André Bernier (consulting biologist); Caroline Gagné (Nature Conservancy of Canada); Nicole Desroches (Agence des bassins versants des 7); Tommy Montpetit (Centre d'information en environnement de Longueuil); Véronique Michaud (Hydro-Québec) and Karine Lehoux (Nature-Action Québec). Former members of the team (Claude Daigle [MRN]; Geneviève Ouimet [MDDEFP], François Durand [formerly with Hydro-Québec]; Andrée Gendron [Environment Canada, Water Science and Technology Directorate – Quebec Region]) as well as many other collaborators have contributed to the document: Alain Branchaud, Matthew Wild and Karine Picard (Environment Canada, Canadian Wildlife Service – Quebec Region), Madeline Austen, Lesley Dunn, Elizabeth Rezek (Environment Canada, Canadian Wildlife Service – Ontario Region), Manon Dubé (Environment Canada, Canadian Wildlife Service – National Capital Region), Valéry Hamel (formerly with the Centre d'information en environnement de Longueuil), and Marie-José Ribeyron (consultant).

EXECUTIVE SUMMARY

The Western Chorus Frog is a small amphibian that breeds in temporary wetlands located in open habitats or discontinuous forests. The species is considered globally secure. However, the Great Lakes / St. Lawrence – Canadian Shield (GLSLCS) population, found at the northern limit of the species' range, was assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2008 and was listed as such on Schedule 1 of the *Species at Risk Act* (SARA) in 2010.

The abundance of the Western Chorus Frog (GLSLCS) is unknown, although it is thought to fluctuate considerably from year to year according to hydrological conditions, among other factors. However, recent data from 1995 to 2006 show a decrease of more than 40% in the occupancy of breeding wetlands in eastern Ontario, while the destruction, from 2004 to 2009, of 14% to 28% of the known breeding wetlands in Quebec indicate a probable decline in abundance.

The main threats to the species are habitat loss and degradation through urban development, intensification of agriculture, climate change, fertilizers and pesticides in wetlands, the expansion of the road and trail network, and plant succession.

There are unknowns regarding the feasibility of recovery of the Western Chorus Frog (GLSLCS). Nevertheless, in keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA as would be done when recovery was determined to be feasible.

The short-term population and distribution objective is to maintain the area of occupied habitat and the abundance of local populations of the Western Chorus Frog (GLSLCS) in Canada. The long-term objective is to ensure the viability of local populations by increasing the area of occupied habitats and their connectivity throughout the Canadian range. Broad recovery strategies and approaches to achieve these objectives are presented in the Strategic Direction for Recovery section.

Critical habitat for the Western Chorus Frog (GLSLCS) is partially identified in this recovery strategy. It corresponds to the areas of suitable habitat within minimum convex polygons drawn around breeding wetlands that have been used on at least 2 occasions in the past 20 years (including at least once in the past 10 years), the adjacent terrestrial habitats up to 300 m, and the dispersal corridors that connect them. A total of 260 critical habitat parcels have been identified, 211 of which are located in Ontario and 49 in Quebec. A schedule of studies has been developed to complete the identification of critical habitat necessary to meet the population and distribution objectives.

One or more action plans will be posted on the Species at Risk Public Registry before the end of 2019.

RECOVERY FEASIBILITY SUMMARY

In considering the criteria established by the SARA policies (Government of Canada 2009), unknowns remain as to the recovery feasibility of the Western Chorus Frog (GLSLCS). Nevertheless, in keeping with the precautionary principle, this recovery strategy has been prepared as per section 41(1) of SARA as would be done when recovery is determined to be feasible. This recovery strategy addresses the unknowns surrounding the feasibility of recovery.

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. Monitoring activities conducted in Quebec and Ontario show that, despite significant declines in the number of occupied sites, breeding individuals remain in a number of locations within the range.

2. **Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.**
   Yes. However, the availability of suitable habitat is rapidly declining in urban landscapes and surrounding areas. This habitat needs to be protected, and the rehabilitation of degraded wetlands or the creation of new ones must be considered.

3. **The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.**
   Unknown. Given the important pressure to develop residual habitats in urban landscapes, opportunities for conservation and restoration are seriously compromised. In agricultural landscapes, these opportunities still exist but are increasingly difficult to implement as agricultural practices are becoming more intensive. Questions remain as to the possibility of ensuring the survival of isolated local populations.

4. **Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.**
   Unknown. While the establishment of protected areas, land acquisition, and private or municipal stewardship can be effective, it is not known whether these measures alone will suffice to ensure the viability of local populations (long-term distribution and population objectives) owing to external threats. Restoration techniques are currently being tested, but their effectiveness is unknown in Canada.

TABLE OF CONTENTS

1. COSEWIC[1] SPECIES ASSESSMENT INFORMATION

Date of Assessment: April 2008

Common Name (population): Western Chorus Frog (Great Lakes / St. Lawrence – Canadian Shield population)

Scientific Name: *Pseudacris triseriata*

COSEWIC Status: Threatened

Reason for Designation: Ongoing losses of habitat and breeding sites for this small frog due to suburban expansion and alteration in farming practices have resulted in losses of populations and isolation of remaining habitat patches. Populations in Quebec are documented to have declined at a rate of 37% over 10 years and are expected to continue to decline. Despite there being some areas where chorus frogs remains evident, surveys of populations in Ontario indicate a significant decline in abundance of 30% over the past decade.

Canadian Occurrence: Ontario, Quebec

COSEWIC Status History: The species was considered a single unit and designated Not at Risk in May 2001. Split into two populations in April 2008. The Great Lakes / St. Lawrence – Canadian Shield population was designated Threatened in April 2008.

2. SPECIES STATUS INFORMATION

About 9% of the global range of the Western Chorus Frog is in Canada (COSEWIC 2008). The Great Lakes / St. Lawrence – Canadian Shield (GLSLCS) population was listed as Threatened in Schedule 1 to the *Species at Risk Act* (SARA) (S.C. 2002, c. 29) in 2010. In Quebec, this population has been listed as Vulnerable under the *Act Respecting Threatened or Vulnerable Species* (R.S.Q., c. E-12.01) since 2001, and its status is under review. The *Act Respecting the Conservation and Development of Wildlife* in Quebec (R.S.Q., c. C-61.1) also prohibits capturing, selling and keeping individuals of a listed species in captivity. In Ontario, the species is not listed under the *Endangered Species Act, 2007* (S.O. 2007, c. 6).

Globally, NatureServe (2012) considers the Western Chorus Frog to be Secure (G5). The GLSLCS population has not been assessed at the global or national levels. However, a subnational status of Apparently Secure (S4) was assigned in Ontario, while in Quebec it is considered Imperiled (S2).

[1] Committee on the Status of Endangered Wildlife in Canada.

3. SPECIES INFORMATION

3.1 Species Description

The COSEWIC (2008) status report describes the Western Chorus Frog as a small amphibian, ranging in colour from brown to olive grey, that weighs about 1 g and measures about 2.5 cm long as an adult. It has three dark lines along its back, one wider line on each flank, and a broad line that runs across the eyes. It can be distinguished from other frogs in Canada by its call, a long *cre-ee-ee-ee-eek*, similar to the sound of running a fingernail across the teeth a metal comb. It is, however, possible to confuse the territorial trill of the Spring Peeper (*Pseudacris crucifer*) with the call of the Western Chorus Frog. Spring Peepers breed in early spring, yet are much more widespread and abundant. The life expectancy of adult Western Chorus Frogs is usually one year (a single reproductive event), although some have been known to live up to two or three years (Whiting 2004). After mating and egg laying occurs, the eggs generally hatch in 3 to 27 days, depending on water temperature. Tadpoles take between 40 and 90 days to complete their metamorphosis into adults (Whitaker 1971; Whiting 2004).

3.2 Population and Distribution

The range of the Western Chorus Frog extends from southwestern to northeastern North America (Figure 1). In the United States, the species occupies a vast area stretching from Kansas and Oklahoma to northern New York and Michigan. In Canada, the Western Chorus Frog is found in the lowlands of southern Ontario and southern Quebec. Within this area, COSEWIC (2008) defines two designatable units (Figure 2): the Great Lakes / St. Lawrence – Canadian Shield population, discussed in this recovery strategy, and the Carolinian population, which has been designated as Not at Risk. A high degree of morphological resemblance, along with recent genetic analyses of mitochondrial DNA, indicates that individuals of the GLSLCS population are actually Boreal Chorus Frogs (*Pseudacris maculata*) rather than Western Chorus Frogs (ConservAction ACGT Inc. 2011; Tessier et al. in prep.). Whatever the outcome, the status of chorus frog populations remains precarious in southern Ontario and Quebec.

Figure 1. Global range of the Western Chorus Frog
(adapted from COSEWIC 2008).

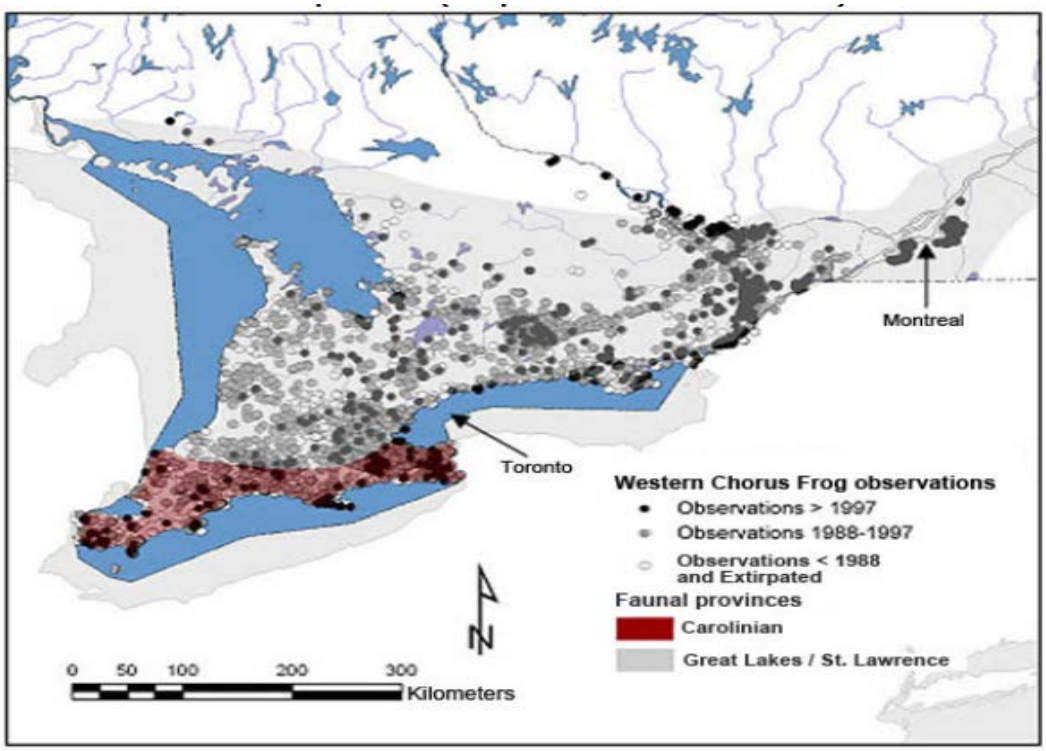

Figure 2. Canadian observations of the Western Chorus Frog in the faunal provinces. Observations to the north of the grey shaded area fall within the Canadian Shield faunal province (adapted from COSEWIC 2008).

In Quebec, the Western Chorus Frog (GLSLCS) was historically present in the southern part of the province, from the Ottawa Valley to the foothills of the Appalachians and west of the Richelieu River (Bonin and Galois 1996; Picard and Desroches 2004;

Figure 3). Currently, the species is estimated to occupy only 10% of this former distribution (Bonin and Galois 1996). In the Montérégie region, the species is thought to have been reduced to just over 800 highly fragmented sites within a narrow 20-km-wide band between the municipalities of Beauharnois to the south and Contrecoeur to the north (Bonin and Galois 1996; COSEWIC 2008; Rioux 2008). The presence of the species is also confirmed in slightly more than 220 sites[2] in the Outaouais region along a band 10 km wide and 100 km long that stretches east to west along the Ottawa River between Gatineau and Île-du-Grand-Calumet (St-Hilaire and Belleau 2005; COSEWIC 2008). The Western Chorus Frog recovery team in Quebec (WCFRTQ 2010) estimates that the species occupies a total of at least 102 km^2 of habitat (60 km^2 in the Montérégie region and 42 km^2 in the Outaouais region).

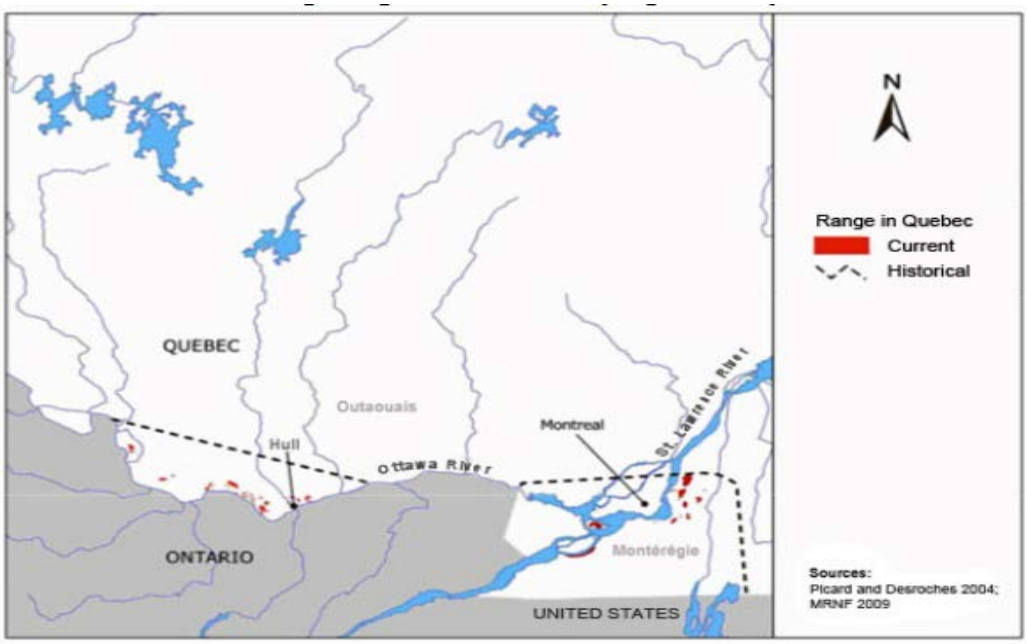

Figure 3. Historical and current ranges of the Western Chorus Frog (GLSLCS) in the Outaouais and Montérégie regions of Quebec (Gagné 2010).

In Ontario, the Western Chorus Frog (GLSLCS) is much more widespread, extending from the United States border to Georgian Bay, south of Algonquin Park in the Frontenac Axis, and up the Ottawa Valley to Eganville (Oldham and Weller 2002). No systematic surveys specific to the species and its habitat have been conducted in this province (COSEWIC 2008; but see Cook 1992); therefore, no estimates of the number of occupied sites are available. However, a few studies in eastern Ontario report a decrease in the number of sites where the species has historically been present (−30% near Ottawa: Seburn and Gunson 2011; −95% near Cornwall: Seburn et al. 2008). These two studies were conducted in the wildland-urban interface and are good examples of the trend of loss of habitat due to housing developments in this type of

[2] As a site may represent a single or multiple wetlands, it is not possible to compare the number of sites in the Outaouais and Montérégie regions.

context. They do not, however, take into account the fact that some adjacent breeding sites have been more recently colonized.

Western Chorus Frog surveys are usually conducted via auditory surveys, which cannot be used to determine population abundance (COSEWIC 2008). The abundance of Canadian and global populations is therefore unknown; however, it is known that abundance fluctuates considerably and can double from one year to the next (COSEWIC 2008). In addition to limitations related to the survey methodology, the identification of trends is complicated by the temporary nature of occupied wetlands and the possibility of cyclic variations in populations (Skelly et al. 2003; Crewe et al. 2009). Nevertheless, according to an analysis of the Marsh Monitoring Program[3] data for the period of 1995–1996 to 2005–2006, the number of sites with observations of the Western Chorus Frog (GLSLCS) decreased by 42.6% in Ontario (Crewe et al. 2009 – supplement to the 2008 COSEWIC[4] status report). In Quebec, the nature of the collected data does not allow for the quantitative establishment of the decline in abundance. However, the WCFRTQ (2010) notes that a decline is likely, given that 14% of breeding wetlands in the Montérégie region and 28% in the Outaouais region were destroyed between 2004 and 2009.

3.3 Needs of the Western Chorus Frog (GLSLCS)

The Western Chorus Frog (GLSLCS) occupies a variety of lowland habitats with an open or discontinuous canopy (e.g. clearings, damp meadows, wildlands, shrubland), where scattered slight depressions may allow the formation of wetlands (e.g. marshes, swamps, ponds) that generally dry out in summer (Ouellet and Leheurteux 2007; COSEWIC 2008). The vegetation in these habitats is mainly herbaceous (e.g. cattails [*Typha* spp.], sedges [*Carex* spp.], Reed Canary Grass [*Phalaris arundinacea*]), but also includes shrubs (e.g. Red Osier Dogwood [*Cornus stolonifera*], willows [*Salix* spp.], Speckled Alder [*Alnus incana ssp. rugosa*]) and partially submerged trees (e.g. Black Ash [*Fraxinus nigra*], Red Maple [*Acer rubrum*]).

The specific needs of individuals vary according to the life cycle stages.

Breeding

From late March to late August, individuals generally occupy temporary rather than permanent wetlands, likely because of lower predation pressure (COSEWIC 2008). Skelly (1995, 1996) showed that the number, size and diversity of predators increased with the degree of permanence of a wetland. The reduced influence or absence of predators is a characteristic of smaller wetlands that are generally physically isolated

[3] The Marsh Monitoring Program is a wildlife monitoring program for coastal and inland marshes based on the efforts of volunteers who collect data on marsh birds, habitat, frogs and toads. It should be noted that the permanent wetlands (e.g. marshes) monitored by this program are not the most representative of habitats used by the Western Chorus Frog and that reported trends should be interpreted accordingly.
[4] The data available at the time of preparation of the status report suggested a 30% decline (see Section 1).

from the hydrologic network. In agricultural landscapes in the Outaouais region (western Quebec), Gagné (2011) found that breeding wetlands averaged 0.27 ha (up to 6.12 ha), 68% were not connected to a stream, and only 9% were within 50 m of a wetland large enough to be mapped by current geospatial tools.

The temporary nature of breeding habitats increases susceptibility to premature drying due to climate variations or other causes (e.g. high temperatures, low precipitation, drainage). This explains, in part, why large inter-annual fluctuations in abundance may occur. The persistence of local populations depends, at a minimum, on the availability of a sufficient number of wetlands having a long enough hydroperiod (presence of water) to allow tadpoles to metamorphose into their adult form.

Foraging and movements within a local population

Owing to the species' limited movement capability—average of 3.5 m per day, maximum of 42 m per day (Kramer 1973)—foraging and other summer activities (e.g. rest) usually occur in terrestrial habitats within a 250- to 300-m radius of breeding sites (Desroches et al. 2002; Semlitsch and Bodie 2003; Ouellet and Leheurteux 2007). Accordingly, the home range of an individual may contain multiple breeding sites (Mann et al. 1991), promoting the survival of the local population (a rescue effect in the event of extirpation in a given wetland; Hanski et al. 1995) and genetic exchanges.

The limited movement capability of this species and its small size make it susceptible to dehydration when it has to cross dry environments (e.g. roads, agricultural fields; Picard and Desroches 2004; Whiting 2004; Mazerolle and Desrochers 2005). The type of habitat that connects breeding grounds is therefore likely to influence the distances an individual can travel. Gagné (2011) also showed that sites where the Western Chorus Frog (GLSLCS) is present include less land planted with intensive annual crops (3% versus 8%) and more open, uncultivated land (31% versus 13%) within a 300-m radius. However, individuals of the species can also often occupy sites with significant agricultural cover (up to 86% according to Seburn et al. 2011) or urban land uses if vegetation characteristics are suitable.

Hibernation

Western Chorus Frogs hibernate in the terrestrial portion of their home range, in soft soil substrates, under rocks, dead trees or dead leaves or in existing burrows (Froom 1982). Whiting's study (2004) in the Montérégie region (Quebec) indicates that almost all individuals hibernate less than 100 m from breeding grounds, since proximity to such sites affords a reproductive advantage during the spring thaw.

Dispersal between local populations

Given that adults are thought to breed only once in their lifetime and that the mortality rate is high at all life-cycle stages (e.g. 81% to 99% for adults: Smith 1987; Whiting 2004), the survival of each local population is dependent on annual recruitment through

breeding (i.e. produced within the local population) or through immigration of individuals from adjacent local populations (long-distance dispersal). Collectively, these interconnected local populations form what is known as a metapopulation.

In Western Chorus Frog populations, the genetic diversity found at landscape scale suggests that dispersal can reach 750 m on occasion (Spencer 1964). A limited number of immigration events is sufficient to result in local populations remaining functionally connected, thereby acting as a metapopulation. As is the case for movements within local populations, long-distance dispersal depends on a high level of connectivity and ease of movement across the habitats.

4. THREATS

4.1 Threat Assessment

Table 1. Threat Assessment

Threat	Level of Concern[1]	Extent	Occurrence	Frequency	Severity[2]	Causal Certainty[3]
Habitat loss and degradation						
Urban development	High	Widespread	Current	Continuous	High	High
Intensification of agriculture	High	Widespread	Current	Continuous	High	High
Expansion of the road and trail network	Moderate	Localized	Current	Continuous	Unknown	Unknown
Plant succession	Moderate	Localized	Current	Continuous	Unknown	Moderate
Pollution						
Fertilizers and pesticides	Moderate	Widespread	Current	Seasonal	Moderate	Moderate
Climate and natural disasters						
Climate change	Moderate/High	Widespread	Current	Continuous	Unknown	Unknown

[1] *Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives. This criterion considers the assessment of all the information in the table.*

[2] *Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).*

[3] *Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g. expert opinion; Low: the threat is assumed or plausible).*

4.2 **Description of Threats**

Urban development

A number of Western Chorus Frog (GLSLCS) populations occupy lands that are highly sought after for residential, commercial and industrial development. The loss and degradation of suitable habitat resulting from these activities are presumably responsible for the bulk of the observed decline (COSEWIC 2008; WCFRTQ 2010).

In the Montérégie region of Quebec, 14% of known breeding habitats were destroyed between 2004 and 2009 (WCFRTQ 2010). During the same period, on Île Perrot (west of Montréal), filling for residential development resulted in the destruction of 27 of the 80 known breeding wetlands, and an additional 14 are considered threatened in the short term (WCFRTQ 2010). In the Boisé de la Commune in La Prairie, 44 of the 99 known breeding wetlands have been destroyed, and 13 more are threatened in the short term (Lyne Bouthillier, pers. comm.).

In the Outaouais region of Quebec, the species disappeared from 28% of the breeding sites surveyed between 2004 and 2009, a decline largely concentrated in urban areas (COSEWIC 2008; WCFRTQ 2010). Similar results have been observed in eastern Ontario where suitable habitat in the wildland-urban interface is affected in the same way as in Quebec (Sanders 1970; Seburn et al. 2008, 2011).

In addition to habitat loss and degradation, urban development also leads to habitat fragmentation, which further isolates the populations. The resulting decrease in immigration increases the likelihood of a local population becoming extinct (Hanski et al. 1995), namely by the absence of a rescue effect. In the longer term, there may also be a decrease in genetic diversity and in the survival rate of individuals (Hitchings and Beebee 1997).

The negative effects of human presence within or near suitable Western Chorus Frog habitats also include changes to hydrology caused by soil impermeability and drainage, increased sedimentation and pollution (including the deposit of waste), increased interactions with introduced animal and plant species or with native animals that benefit from contact with humans (e.g. raccoons), and effects on the local micro-climate (Hamer and McDonnell 2008). Collectively, these edge effects can have a sustained negative impact on habitats and individuals, particularly in urban landscapes.

Intensification of agriculture

Intensive agriculture has led to filling, land drainage (including land levelling) and forest clearing in the St. Lawrence Lowlands, resulting in habitat loss and degradation and reduced connectivity (COSEWIC 2008). The situation is particularly dire in the Montérégie region, where natural habitats covered only 33% of the landscape in 2001 (Latendresse et al. 2008).

In the Outaouais region, although half of the local Western Chorus Frog populations are in agricultural areas (COSEWIC 2008), the prevalence of landscapes that are better suited for less-intensive agriculture (e.g. perennial crops, livestock; Jobin et al. 2004) has resulted in fewer changes to natural drainage patterns (Bonin and Galois 1996). On cultivated land, 86% of fields are used to grow perennial crops, and the crop rotation cycle is generally longer (6 to 16 years) than the provincial average of 5 years (François Biron, MAPAQ, pers. comm. – in Gagné 2011). However, high market prices may be adding pressure to convert these fields to more intensive farming (Daniel Toussaint, MDDEFP, pers. comm.).

There is very little data that could establish a link between agricultural land-use changes and Western Chorus Frog (GLSLCS) populations in Ontario. In their Ottawa study, despite a 35% reduction in the occupancy of sites surveyed repeatedly since the 1970s, Seburn et al. (2011) observed no significant changes in land-use variables within a 1-km radius.

Climate change

Climate change can impact Western Chorus Frog habitat by affecting the duration of flooding (hydroperiod) of the temporary ponds in which the species breeds (Bonin and Galois 1996). Reduced accumulations of snow, faster spring snowmelt, and prolonged periods of drought would cause ponds to dry up more quickly and reduce the breeding success of the Western Chorus Frog (Bonin and Galois 1996; Barnett et al. 2005). More generally, changes in weather patterns (precipitation, drought) can alter the population dynamics of a number of amphibian species, including the Western Chorus Frog (Walls et al. 2013). A recent study has indicated that the Boreal Chorus Frog, a closely related species, has limited potential to adapt to reduced hydroperiods (Amburgey et al. 2012). Climate change could also influence vegetation structure and composition, including plant succession patterns (Blaustein et al. 2010). The magnitude of this threat remains unknown.

Fertilizers and pesticides

In certain areas of intensive agriculture with few riparian buffer strips, the concentration of nitrates from fertilizers reaches levels recognized as problematic for the hatching and growth of amphibians, including the Western Chorus Frog (Hecnar 1995; COSEWIC 2008). Furthermore, laboratory studies have revealed that certain pesticides (organochlorides) used in Canada have toxic effects on Western Chorus Frog tadpoles (Berril et al. 1997). These chemicals appear to have mutagenic effects (e.g. deformities, feminization of males), in addition to changing habitat characteristics and reducing prey abundance (Bishop 1992).

The use of the pesticide BTi to control West Nile Virus is on the rise, owing to considerations related to the comfort of urban residents and to public health. Although the effects of spraying pesticides in or near wetlands occupied by chorus frogs are known (Mazzacano and Black 2013), few studies showing the impact on the Western Chorus Frog exist. However, it is probable that this activity can currently be considered a threat.

Expansion of the road and trail network

The increase in the density of the road and trail network and in the number of vehicles that use it is a threat to the species throughout its range. In addition to resulting in direct mortality of individuals and the spread of invasive plant species, roads and trails can act as barriers to dispersal and thus contribute to habitat fragmentation (COSEWIC 2008). In Quebec, many breeding wetlands that became isolated because of anthropogenic structures were abandoned after a few years, despite the continued presence of suitable habitat (Picard and Desroches 2004). Maintenance of roadside ditches may also threaten the species by rendering the habitat unsuitable, e.g. creating slopes that are too steep (WCFRTQ 2000).

With respect to trails, frogs sometimes use puddles in ruts created by off-road vehicles. These ruts act as ecological traps because there is an increased risk that individuals will be crushed (Galois and Ouellet 2005). In some cases, these puddles could also dry up prematurely, thereby preventing the metamorphosis of tadpoles into adults. The magnitude of this threat remains unknown.

Plant succession

Although the Western Chorus Frog (GLSLCS) sometimes breeds in mature forests, it prefers open habitats such as herbaceous or shrub grassland, wildlands, and young forests with a discontinuous canopy (Bonin and Galois 1996). When agriculture is abandoned on marginal land, succession towards more mature forests begins (COSEWIC 2008). This may affect the hydroperiod, particularly when species such as cattail and Reed Canary Grass (which grow quickly in spring, thereby creating shade, and leave persistent herbaceous residues) prolong the thawing and raise the temperature of wetlands (Skelly and Meir 1997; Whiting 2004). Such changes in some of the breeding sites appear to have caused the extirpation of some local populations of the Western Chorus Frog (GLSLCS) in Quebec and Ontario (Bonin and Galois 1996; Seburn and Gunson 2011). The importance of this threat is unknown and may be site-specific.

5. POPULATION AND DISTRIBUTION OBJECTIVES

The short-term population and distribution objectives are to maintain the area of occupied habitat[5] and the abundance[6] of local populations of the Western Chorus Frog (GLSLCS) in Canada. The long-term objective is to ensure the viability[7] of local populations by increasing the area of occupied habitat and their connectivity throughout the Canadian range. These objectives are in line with those of the provincial recovery plan and action plan for the Western Chorus Frog in Quebec (WCFRTQ 2000; update in prep.), which are to maintain the remaining suitable habitat, restore degraded habitat and develop new habitat or structures (e.g. amphibian crossings) to promote the viability of local populations by increasing their abundance and connectivity. There is no equivalent document for the province of Ontario since the species is not listed.

6. BROAD STRATEGIES AND GENERAL APPROACHES TO MEET OBJECTIVES

6.1 Actions Already Completed or Currently Underway

Quebec

- Targeted surveys (1993–2013 in the Outaouais region; 1992–2013 in the Montérégie region) and a survey of all known breeding sites in 2004–2005; volunteer surveys through the Marsh Monitoring Program (since 2004)
- Creation of the Western Chorus Frog recovery team (1998)
- Publication of a provincial recovery plan in 2000 and the 1999–2009 recovery assessment report (WCFRTQ 2000, 2010)
- Publication and implementation of 11 regional conservation plans (Bouthillier and Léveillé 2002; Centre d'information sur l'environnement de Longueuil and WCFRTQ 2006; Angers et al. 2007, 2008a, b, c, d, e, f, g; Bernard 2010; Gagné 2010; Tanguay et al. 2012)
- Publication and implementation of a standardized population monitoring protocol (Daigle et al. 2011)
- Publication of a protocol for the creation of temporary wetlands (Montpetit et al. 2010)
- Completion of a number of studies on habitat requirements and genetic characterization of populations (Ouellet and Leheurteux 1997; Whiting 2004)
- *Ex situ* breeding program at the Montréal Biodôme and the Ecomuseum from 2008 to 2011

[5] See sections 7.1.1 and 7.1.3 for the description of suitable habitat and how it is delineated.
[6] Estimated from the number of occupied breeding sites and, when available, from the index of abundance attributed to choruses and the index of metapopulation viability (see WCFRTQ 2000, 2010).
[7] A viable population is one that, because of the quality of the environment it inhabits and possible genetic exchanges with other local populations (i.e. a functional metapopulation), is very likely to survive in the medium and long term (WCFRTQ 2000).

- Outreach activities for landowners, farmers, municipalities, residents and students and the signing of stewardship agreements since the early 2000s
- Signing of a biodiversity conservation agreement between MRN and Hydro-Québec (2001)
- Preservation of significant habitats (e.g. Boisé du Tremblay, which is home to about 25% of the Western Chorus Frog population in the Montérégie region; Bois de Brossard, ~ 530 ha; Bois de Boucherville, ~ 188 ha; Breckenridge)

Ontario

- Population monitoring through the Marsh Monitoring Program (since 1994)
- Collection of information on amphibians through Frogwatch Ontario (amphibian monitoring project)
- The Ontario Herpetofaunal Summary Atlas made it possible to collect information on various amphibian and reptile sightings throughout Ontario (also see Oldham and Weller 2000)
- The new Ontario Reptile and Amphibian Atlas has improved knowledge of the distribution and status of various species through the collection of information on known sightings throughout the province, the implementation of field surveys and the amalgamation of existing databases

6.2 **Strategic Direction for Recovery**

Table 2: Recovery planning

Threat or Limiting Factor	Broad Recovery Strategy	Priority	General Description of Research and Management Approaches
Urban development Intensification of agriculture Fertilizers and pesticides Expansion of the road and trail network Plant succession	Stewardship and management of the species and its suitable habitat	High	– Implement legal or stewardship measures in suitable habitat and in adjacent areas to reduce the impact of threats – Continue or implement management approaches that are designed to increase species abundance and occupancy of suitable habitat
Knowledge gaps	Surveys and monitoring	Medium	– Conduct surveys to more precisely identify the area occupied by the GLSLCS population – Implement a standardized monitoring protocol for Ontario and Quebec – Periodically monitor habitat occupancy (e.g. every 10 years)
		Low	– Conduct a periodic survey of the historical range
Knowledge gaps	Research	Medium	– Specify the attributes of suitable habitat and how individuals react to variations in them in space and time – Determine population viability criteria – Study and predict the impact of climate change on the hydroperiod of breeding ponds
All	Communication and outreach	Medium	– Develop and implement a communications strategy targeting partner agencies, groups interested in the species, private landowners and the general public

7. CRITICAL HABITAT

7.1 Identification of the Western Chorus Frog (GLSLCS)'s Critical Habitat

SARA defines critical habitat as "the habitat that is necessary for the survival or recovery of a listed wildlife species." For the Western Chorus Frog (GLSLCS), critical habitat is partially identified in this recovery strategy to the extent possible using the best available information. The schedule of studies (Section 7.2) outlines the activities required to complete the identification of critical habitat to meet the population and distribution objectives. As new information becomes available, more precise boundaries may be established and additional critical habitat may be identified.

The identification of critical habitat for the Western Chorus Frog (GLSLCS) is based on three criteria: habitat suitability, habitat occupancy, and connectivity between local populations.

7.1.1 Habitat suitability

This criterion refers to the biophysical attributes of habitats where individuals can meet the needs associated with the various stages of their life cycle (e.g. mating, egg-laying, tadpole metamorphosis, foraging, hibernation, dispersal) in Canada (see Table 3). For stages taking place in wetlands, all areas of suitable habitat are incorporated into critical habitat. For stages taking place on land, areas of suitable habitat are incorporated up to 300 m from the boundaries of breeding wetlands to allow for the completion of the species' annual life cycle, as suggested by the literature (Desroches et al. 2002; Ouellet and Leheurteux 2007).

Table 3. Description of the biophysical attributes of suitable habitat for specific life cycle stages of the Western Chorus Frog (GLSLCS)

Life Cycle Stage	Habitat Type	Biophysical Attributes
Breeding	Wetlands (including ponds, basins, marshes, swamps, drainage ditches)	• Temporary wetlands[8] or shallow portions of permanent wetlands **AND** • Vegetation structure and composition: generally herbaceous (e.g. cattails, sedges, Reed Canary Grass) with occasional shrubby wildlands (e.g. Speckled Alder, Red Osier Dogwood, willows) or partially submerged trees forming an open or discontinuous canopy (e.g. Black Ash, Red Maple, Silver Maple), although some local populations breed in heavily canopied habitat (e.g. Silver Maple swamps) **AND** • Absence or limited presence of fish and other aquatic predators
Foraging and movements within a local population	Terrestrial (lowlands such as pastures, clearings, meadows, wildlands, shrublands)	• Vegetation structure and composition correspond to those of breeding sites
Hibernation	Terrestrial (lowlands)	• Vegetation structure and composition correspond to those of wetlands used as breeding and foraging habitat **AND** • Availability of soft substrate with dead leaves, woody debris or burrows
Dispersal between local populations	Wetlands and/or Terrestrial (lowlands)	• Vegetation structure and composition correspond to those of wetlands used as breeding and foraging habitat **AND** • Mosaic of interconnected wetlands and terrestrial environments

[8] This type of habitat, largely used by the Western Chorus Frog (GLSLCS), is not typically mapped in an accurate or consistent way in current land-use classification frameworks because of limitations due to minimum mappable units (e.g. occupied wetlands are often very small), discernability of elements (e.g. difficulty of detecting suitable features under tree canopies), or frequency of updating (e.g. hydroperiod variability from year to year results in occupied habitat not being static in space).

7.1.2. Habitat occupancy

This criterion refers to areas of suitable breeding habitat (and adjacent foraging and hibernating habitat up to 300 m away) where there is a reasonable degree of certainty of recurrent use by the species (an indicator of habitat suitability) and of their contribution to the exchange of individuals between adjacent local populations (an indicator of sustained metapopulation processes).

The habitat occupancy criterion is established by selecting the data obtained from point counts conducted during the breeding period:

- dating from the year 1992 or later; **AND**
- covering at least two separate years within a 20-year period, with at least 1 of the observations dating from the last decade.

The period starting in 1992 corresponds to the first systematic surveys of breeding wetlands in Quebec (1992–1993), but also to the threshold beyond which an observation is considered historical in conservation data centres (i.e. 20 years for the Ontario Natural Heritage Information Centre (NHIC) and the Centre de données sur le patrimoine naturel du Québec (CDPNQ)). Owing to the dynamic nature of the habitat, a more recent observation increases the confidence that the suitable habitat is still available. The data used to designate essential habitat in this recovery strategy are from 1992 to 2012.

Mann et al. (1991) have reported that there is a positive relationship between the probability of occurrence of various amphibian species and the number of breeding ponds available to a local population. A local population that has access to multiple breeding wetlands will therefore have higher chances of survival. The minimum threshold to establish recurrent occupancy of suitable habitat within a local population is set at two observations of breeding, from point counts, separated by a maximum distance of 600 m (i.e. twice the 300 m of suitable terrestrial habitat that may be used to complete the annual life cycle).

7.1.3. Connectivity between local populations

The main purpose of connectivity between local populations, referred to here as dispersal corridors, is to sustain metapopulation processes that are essential for their persistence. Dispersal corridors increase the chances of a rescue effect should a local population (or wetland) become extinct. They also maintain genetic diversity on a larger scale than what is observed within local populations. Dispersal corridors could also allow individuals to adapt to pressures exerted by environmental conditions (e.g. reduced hydroperiod, pollution, anoxic environment) by progressively moving to areas within or outside of their home range that may have more suitable biophysical attributes. These functions are even more essential for a species that has limited dispersal abilities and is confined to highly fragmented agricultural and urban landscapes.

A dispersal corridor is an area of habitat connecting 2 breeding sites that meet the habitat occupancy criteria (Section 7.1.2) and that are separated by a maximum distance of 900 m. This is 3 times the average maximum distance travelled by the species within its annual life cycle (300 m; Desroches et al. 2002; Semlitsch and Bodie 2003; Ouellet and Leheurteux 2007) and is suggested by NatureServe (2002) as a precautionary value for linking habitats together on the basis of individuals' movements. It is also in the same order of magnitude as the 750-m distance for long-distance dispersal reported by Spencer (1964). As for corridor width, habitats suitable to dispersal encompass areas up to a maximum of 300 m on each side of the feature used to connect 2 adjacent local populations (e.g. a creek).

7.1.4 Application of the critical habitat criteria

Critical habitat for the Western Chorus Frog (GLSLCS) is partially identified in this recovery strategy. It corresponds to the areas of suitable habitat within minimum convex polygons drawn around habitats selected by applying the criteria in sections 7.1.1 to 7.1.3. In Appendix A, tables A-1 and A-2 and figures A-1 to A-7 present the 10×10-km standardized UTM grids[9] (red outlines) and the critical habitat parcels[10] (yellow polygons) for the Western Chorus Frog (GLSLCS) in Canada. A total of 260 critical habitat parcels covering approximately 33 048 ha are identified, including 211 parcels in Ontario (16 793 ha) and 49 parcels in Quebec (16 275 ha). Although individuals may only occupy a small portion of suitable habitat within a parcel at any given time, the entire suitable habitat complex is identified as critical habitat. This consideration is particularly important, given that the data used to map critical habitat provide only a snapshot of the situation in time and that the location of local populations have been observed to shift over a relatively short period of time (Nathalie Tessier, 2013, pers. comm.). It also takes into account the fact that physical barriers (e.g. housing developments, highways) adjacent to breeding wetlands result in home ranges of varying sizes and shapes. Lastly, it provides the necessary space to restore or create habitats within or between neighbouring local populations, thereby increasing the area of occupied habitat and connectivity (long-term population and distribution objective).

Any anthropogenic structures (e.g. houses, paved surfaces) and any areas (e.g. drained agricultural fields, sewage treatment/settling ponds) that do not have the characteristics of suitable habitat for the Western Chorus Frog (GLSLCS) are not identified as critical habitat. Any significant disruption in the continuity of the habitat that results in a dispersal barrier (e.g. multi-lane highway, large watercourse) would be considered a boundary edge for critical habitat in that site (i.e. two separate critical habitat parcels would result if the habitat occupancy criteria are still met).

[9] This standardized national grid system indicates the general geographic area containing critical habitat and can be used for various purposes, including land-use planning and environmental assessment.
[10] To respect provincial data-sharing agreements, detailed polygon information (in yellow in the figures for Quebec's critical habitat) is not provided in Ontario figures. However, this information is available and may be requested on a need-to-know basis by contacting Environment Canada – Canadian Wildlife Service at RecoveryPlanning_PI@ec.gc.ca.

7.2 Schedule of Studies to Identify Critical Habitat

Table 4: Schedule of studies

Description of the Activity	Rationale	Schedule
Conduct surveys of habitat for which limited information is available (e.g. only one observation), particularly habitat adjacent to parcels containing critical habitat	Addition of parcels containing critical habitat to consolidate local populations (connectivity) and reach the long-term population and distribution objective	2014–2019
Monitor created or restored habitats to establish whether there is a recurrent use by the Western Chorus Frog (GLSLCS)	Addition of parcels containing critical habitat to consolidate local populations (connectivity) and reach the long-term population and distribution objective	2014–2024

7.3 Activities Likely to Result in the Destruction of Critical Habitat

Habitat destruction is determined on a case-by-case basis. Destruction occurs if an element of the critical habitat has permanently or temporarily deteriorated to the point where the habitat can no longer serve its purpose when the species needs it. Destruction can result from one or more activities occurring at a given time or from the cumulative effects of one or more activities over time (Government of Canada 2009; see Table 5 for examples).

Table 5. Examples of Activities Likely to Result in the Destruction of Critical Habitat for the Western Chorus Frog (GLSLCS)

Description of Activity	Description of Effect (biophysical attributes or other)	Scale of Activity Likely to Cause Destruction[1]			Occurrence Relative to Critical Habitat Boundaries	Timing Considerations
		Site	Area	Landscape		
Construction and maintenance of linear features (e.g. roads, pipelines, energy corridors)	Loss or degradation of suitable habitat for all life stages (e.g. removal of vegetation cover all the way to the ground, conversion to paved surfaces); changes to the habitat resulting in barriers to dispersal (e.g. steep slopes, multi-lane roads, concrete lane dividers) and increasing the risk of mortality (e.g. roads across wetlands can funnel movements towards high-risk zones if these are not fenced); dumping of snow containing minerals (e.g. salts) that affect water quality	x	x		Can occur within or outside critical habitat boundaries	Applicable at all times if the effect is permanent (e.g. paving of natural habitat) If conducted when individuals are not using the targeted biophysical attributes and in a manner that does not prevent future use, the maintenance of linear features (e.g. cutting shrubs under power lines) may not be considered habitat destruction

Construction of housing units and other urban infrastructure (e.g. commercial and industrial buildings, playgrounds)	Loss or degradation of suitable habitat for all life-cycle stages (e.g. filling of wetlands; removal of vegetation used used for foraging); changes to the habitat resulting in barriers to dispersal; changes to the habitat from edge effects and increased recreational use of habitat	x	x		Must occur within critical habitat boundaries	Applicable at all times
Description of Activity	**Description of Effect (biophysical attributes or other)**	**Scale of Activity Likely to Cause Destruction[1]**			**Occurrence Relative to Critical Habitat Boundaries**	**Timing Considerations**
		Site	**Area**	**Landscape**		
Reshaping (levelling and/or filling), drainage or channelization of wetlands (temporary and permanent)	Loss or degradation of suitable breeding habitat (e.g. draining of adjacent areas leading to drop in the water table level, increased water depth, steep slopes); connecting a predator-free wetland to a fish habitat (e.g. via drainage ditches) resulting in the introduction of predators	x	x		Can occur within or outside critical habitat boundaries	Applicable at all times

Intensification of agricultural practices	Loss or degradation of suitable habitat for all life-cycle stages (e.g. conversion from perennial crops to more intensive crops, such as corn; reduced foraging opportunities through the removal of vegetation); changes to the habitat resulting in barriers to dispersal; reduced water quality and prey availability owing to increased runoff of pesticides and fertilizers	x	x	x	Can occur within or outside critical habitat boundaries	Applicable at all times

[1] Site: effect anticipated within a 1×1-km area;
Area: effect anticipated within a 10×10-km area;
Landscape: effect anticipated within a 100×100-km area.

8. MEASURING PROGRESS

The performance indicators presented below provide a way to define and measure progress in achieving the population and distribution objectives.

- In the short term (5 years), the area of occupied habitat and the local population abundance are maintained in Canada.
- In the long term (20 years), local population viability is achieved and the area of occupied habitat and connectivity are increased throughout the Canadian range.

9. STATEMENT ON ACTION PLANS

One or more action plans for the Western Chorus Frog (GLSLCS) will be posted on the Species at Risk Public Registry by the end of 2019.

10. REFERENCES

Amburgey, S., W. C. Funk, M. Murphy and E. Muths. 2012. Effects of Hydroperiod Duration on Survival, Developmental Rate, and Size at Metamorphosis in Boreal Chorus Frog Tadpoles (*Pseudacris maculata*). Herpetologica 68: 456–467.

Angers, V.-A., L. Bouthillier, A. Gendron and T. Montpetit. 2007. Plan de conservation de la rainette faux-grillon en Montérégie – Ville Longueuil, Arrondiss**e**ment Le Vieux Longueuil. Centre d'information sur l'environnement de Longueuil and Western Chorus Frog Recovery Team in Quebec, 38 pp.

Angers, V.-A., L. Bouthillier, A. Gendron and T. Montpetit. 2008a. Plan de conservation de la rainette faux-grillon en Montérégie – Ville de La Prairie. Centre d'information sur l'environnement de Longueuil and Western Chorus Frog Recovery Team in Quebec, 39 pp.

Angers, V.-A., L. Bouthillier, A. Gendron and T. Montpetit. 2008b. Plan de conservation de la rainette faux-grillon en Montérégie – Ville de Notre-Dame-de-l'île-Perrot. Centre d'information sur l'environnement de Longueuil and Western Chorus Frog Recovery Team in Quebec, 34 pp.

Angers, V.-A., L. Bouthillier, A. Gendron and T. Montpetit. 2008c. Plan de conservation de la rainette faux-grillon en Montérégie – Arrondissement de Saint-Hubert. Centre d'information sur l'environnement de Longueuil and Western Chorus Frog Recovery Team in Quebec, 44 pp.

Angers, V.-A., L. Bouthillier, A. Gendron and T. Montpetit. 2008d. Plan de conservation de la rainette faux-grillon en Montérégie – Ville de Brossard. Centre d'information sur l'environnement de Longueuil and Western Chorus Frog Recovery Team in Quebec, 36 pp.

Angers, V.-A., L. Bouthillier, A. Gendron and T. Montpetit. 2008e. Plan de conservation de la rainette faux-grillon en Montérégie – Ville de Carignan. Centre d'information sur l'environnement de Longueuil and Western Chorus Frog Recovery Team in Quebec, 34 pp.

Angers, V.-A., L. Bouthillier, A. Gendron and T. Montpetit. 2008f. Plan de conservation de la rainette faux-grillon en Montérégie – Ville de Saint-Bruno-de-Montarville. Centre d'information sur l'environnement de Longueuil and Western Chorus Frog Recovery Team in Quebec, 34 pp.

Angers, V.-A., L. Bouthillier, A. Gendron and T. Montpetit. 2008g. Plan de conservation de la rainette faux-grillon en Montérégie – MRC de Beauharnois-Salaberry. Centre d'information sur l'environnement de Longueuil and Western Chorus Frog Recovery Team in Quebec, 36 pp.

Barnett, T. P., J. C. Adam and D. P. Lettenmaier. 2005. Potential impacts of a warming climate on water availability in snow-dominated regions. Nature 438: 303–309.

Bernard, M.-C. 2010. Plan de conservation de la rainette faux-grillon en Outaouais – Ville de Gatineau (secteur Aylmer). Nature Conservancy of Canada and Western Chorus Frog Recovery Team in Quebec. 40 pp.

Berrill, M., S. Bertram and B. Pauli. 1997. Effects of pesticides on amphibian embryos and larvae. Herpetological Conservation 1: 233–245.

Bider, J. R. and S. Matte. 1996. Atlas of Amphibians and Reptiles of Quebec. St. Lawrence Valley Natural History Society and Ministère de l'Environnement et de la Faune du Quebec, Direction de la faune et des habitats, Quebec. 106 pp.

Bider, J. R., S. Matte and J. Bonin. 1991. Conservation des sites à haut potentiel herpétofaunique, St. Lawrence Valley Natural History Society 18 pp + appendices.

Bishop, C. A. 1992. The effects of pesticides on amphibians and the implications for determining causes of declines in amphibian populations. In Bishop, C. A. and K. E. Pettit (Eds). Declines in Canadian amphibian populations: designing a national monitoring strategy. Environment Canada, Canadian Wildlife Service, Occasional Paper 76: 67–70.

Blaustein, A. R., S. C. Walls, B. A. Bancroft, J. J. Lawler, C. L. Searle, and S. S. Gervasi. 2010. Direct and Indirect Effects of Climate Change on Amphibian Populations. Diversity 2: 281–313.

Bonin, J. and P. Galois. 1996. Rapport sur la situation de la rainette faux-grillon (*Pseudacris triseriata*) au Québec. Ministère de l'Environnement et de la Faune, Direction de la faune et des habitats, Quebec, 39 pp.

Bouthillier, L. 2013. Personal communication during a meeting of the Western Chorus Frog Recovery Team in Quebec. Ministère de Ressources naturelles – direction de l'expertise sur la faune – région de la Montérégie et de l'Estrie.

Bouthillier, L. and M. Léveillé. 2002. Plan de conservation des habitats de la rainette faux-grillon de l'Ouest (*Pseudacris triseriata*) à La Prairie, Québec – Société de la faune et des parcs du Québec. Direction de l'aménagement de la faune de Montréal, de Laval et de la Montérégie. 38 pp.

Centre d'information sur l'environnement de Longueuil and Western Chorus Frog Recovery Team in Quebec. 2006. Plan de conservation de la rainette faux-grillon de l'Ouest en Montérégie – Ville de Boucherville. 48 pp.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2008. COSEWIC Assessment and Update Status Report on the Western Chorus Frog *Pseudacris triseriata* in Canada – Carolinian population – Great Lakes / St. Lawrence – Canadian Shield population. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 54 pp. (http://www.registrelep.gc.ca/default_e.cfm)

ConservAction ACGT Inc. 2011. Caractérisation génétique des populations de la rainette faux-grillon de l'ouest (*Pseudacris triseriata*). Report submitted to Environment Canada, Canadian Wildlife Service. Université de Montréal. 19 pp.

Cook, F. R. 1992. Pitfalls in quantifying amphibian populations in Canada. In Bishop, C. A. and K. E. Pettit (Eds.). Declines in Canadian amphibian populations: designing a national monitoring strategy. Environment Canada, Canadian Wildlife Service, Occasional Paper 76: 60–62.

Crewe, T. L., P. D. Taylor and D. S. Badzinski. 2009. Trend in Chorus Frog occurrence indices using Marsh Monitoring Program data (1995–2006). Supplement to the COSEWIC Status Report on the Western Chorus Frog. 9 pp.

Daigle, C., L. Bouthillier and D. Toussaint. 2011. Protocole de suivi des populations de rainettes faux-grillon de l'Ouest au Québec. Ministère des Ressources naturelles et de la Faune, Direction de l'expertise sur la faune et ses habitats, Direction de l'expertise Faune-Forêts-Mines – Territoires de l'Estrie-Montréal-Montérégie, et de Laval-Lanaudière-Laurentides, Direction de l'expertise Faune-Forêts-Mines-Territoire de l'Outaouais. Quebec. 32 pp.

Desroches, J.-F., D. Pouliot and S. Côté. 2002. Évaluation de l'efficacité de différentes méthodes de capture pour la rainette faux-grillon de l'Ouest (*Pseudacris triseriata*) au Québec. In collaboration with Comité du marais de Kingsbury (MAKI). Report submitted to the Société de la faune et des parcs du Québec.

Froom, B. 1982. Amphibians of Canada. McClelland and Stewart Limited. 120 pp.

Gagné, C. 2010. Plan de conservation de la rainette faux-grillon en Outaouais – Ville de Gatineau (secteur Gatineau). Environment Canada and Western Chorus Frog Recovery Team in Quebec. 52 pp.

Gagné, C. 2011. Analyse des caractéristiques du paysage en lien avec la présence de la rainette faux-grillon de l'Ouest en milieu agricole en Outaouais, incluant le parc de la Gatineau. Report submitted to the National Capital Commission. 54 pp.

Galois, P. and M. Ouellet. 2005. Le Grand Bois de Saint-Grégoire, un refuge pour l'herpétofaune dans la plaine Montérégienne. Le Naturaliste Canadien 129(2): 37-43.

Government of Canada. 2009. *Species at Risk Act* Policies [Draft]. *Species at Risk Act,* Policies and Guidelines Series. Ottawa, Ontario: Environment Canada. 48 pp.

Hamer, A. J. and M. J. McDonnell. 2008. Amphibian ecology and conservation in the urbanising world: A review. Biological Conservation 141: 2432–2449.

Hanski, I., J. Pöyry, T. Pakkala and M. Kuussaari. 1995. Multiple equilibria in metapopulation dynamics. Nature 377: 618–621.

Hecnar, S. J. 1995. Acute and chronic toxicity of ammonium nitrate fertilizer to amphibians from southern Ontario. Environmental Toxicology and Chemistry 14: 2131–2137.

Hitchings, S. P. and T. J. C. Beebee. 1997. Genetic substructuring as a result of barriers to gene flow in urban *Rana temporaria* (common frog) populations: implications for biodiversity conservation. Heredity 79: 117–127.

Jobin, B., J. Beaulieu, M. Grenier, L. Bélanger, C. Maisonneuve, D. Bordage and B. Filion. 2004. Les paysages agricoles du Québec méridional. Le Naturaliste Canadien 128(2): 92–98.

Kramer, D. C. 1973. Movements of Western Chorus Frogs *Pseudacris triseriata* Tagged with Co60. Journal of Herpetology 7(3): 231–235.

Latendresse, C., B. Jobin, A. Baril, C. Maisonneuve, A. Sebbane and M. Grenier. 2008. Changements de l'occupation du sol dans le Québec méridional entre 1993 et 2001. Le Naturaliste Canadien 132(1): 14–23.

Mann, W., P. Dorn and R. Brandl. 1991. Local Distribution of Amphibians: The Importance of Habitat Fragmentation. Global Ecology and Biogeography Letters 1(2): 36–41.

Mazzacano, C., and S. H. Black. 2013. Ecologically Sound Mosquito Management in Wetlands. An Overview of Mosquito Control Practices, the Risks, Benefits, and Nontarget Impacts, and Recommendations on Effective Practices that Control Mosquitoes, Reduce Pesticide Use, and Protect Wetlands. The Xerces Society for Invertebrate Conservation, Portland, Oregon. 63 pp.

Mazerolle, M. J. and A. Desrochers. 2005. Landscape resistance to frog movements. Canadian Journal of Zoology 83(3): 455–464.

Montpetit T., L. Tanguay and N. Roy. 2010. Protocole et principes d'aménagement et de suivi de nouveau habitats pour la rainette faux-grillon. Centre d'information sur l'environnement de Longueuil. 23 pp.

NatureServe. 2002. Element Occurrence data standard. NatureServe and the Network of Natural Heritage Programs and Conservation Data Centers. 201 pp. www.natureserve.org/prodServices/eodraft/all.pdf.

NatureServe. 2012. NatureServe Explorer: An online encyclopedia of life [Web application]. Version 7.1. NatureServe, Arlington, Virginia. http://www.natureserve.org/explorer (accessed October 2012).

Oldham, M. J. and W. F. Weller. 2002. Ontario Herpetofaunal Atlas. Natural Heritage Information Centre, Ontario Ministry of Natural Resources. http://nhic.mnr.gov.on.ca/MNR/nhic/herps/ohs.html (updated January 15, 2010). Weblink: http://nhic.mnr.gov.on.ca/herps/about.html.

Ouellet, M. and C. Leheurteux. 2007. Principes de conservation et d'aménagement des habitats de la rainette faux-grillon de l'Ouest (*Pseudacris triseriata*) : revue de littérature et recommandations. Amphibia-Nature and Ministère des Ressources naturelles et de la Faune, Direction du développement de la faune, Quebec. 52 pp.

Picard, I. and J.-F. Desroches. 2004. Situation de la rainette faux-grillon de l'Ouest (*Pseudacris triseriata*) en Montérégie – Inventaire printanier 2004. Centre d'information sur l'environnement de Longueuil (CIEL), Longueuil (Quebec), 50 pp.

Rioux, S. 2008. Découverte d'une population isolée de rainettes faux-grillon de l'Ouest dans la municipalité de Contrecoeur. Le Naturaliste Canadien 132(2): 46–48.

Saint-Hilaire, D. and P. Belleau. 2005. Plan de protection des sites et métapopulations de la rainette faux-grillon de l'Ouest (*Pseudacris triseriata*) en Outaouais. Ministère des Ressources naturelles – direction de l'aménagement de la faune, région de l'Outaouais. 45 pp.

Sanders, H. O. 1970. Pesticide toxicities to tadpoles of the western chorus frog *Pseudacris triseriata* and Fowler's toad *Bufo woodhousii fowleri*. Copeia 1970: 246–251.

Seburn, D. C., C. N. L. Seburn and W. F. Weller. 2008. A localized decline in the Western Chorus Frog, *Pseudacris triseriata*, in eastern Ontario. Canadian Field-Naturalist 122(2): 158–161.

Seburn, D. C. and K. Gunson. 2011. Has the Western Chorus Frog (*Pseudacris triseriata*) declined in western Ottawa, Ontario? Canadian Field-Naturalist 125(3): 220–226.

Semlitsch, R. D. and J. R. Bodie. 2003. Biological criteria for buffer zones around wetlands and riparian habitats for amphibians and reptiles. Conservation Biology 17(5): 1219–1228.

Skelly, D. K. 1995. A behavioral tradeoff and its consequences for the distribution of *Pseudacris* treefrog larvae. Ecology 76: 150–164.

Skelly, D. K. 1996. Pond drying, predators, and the distribution of *Pseudacris* tadpoles. Copeia 1996: 599–605.

Skelly, D. K., and E. Meir. 1997. Rule-based models of distributional change. Conservation Biology 11: 531–539.

Skelly, D. K., K. L. Yurewicz, E. E. Werner and R. A. Relyea. 2003. Estimating decline and distributional change in amphibians. Conservation Biology 17: 744–751.

Smith, D. C. 1987. Adult recruitment in Chorus Frogs: effects of size and date at metamorphosis. Ecology 68: 344–350.

Spencer, A. W. 1964. The relationship of dispersal and migration to gene flow in the Boreal Chorus Frog. PhD Dissertation, Colorado State University, Fort Collins. 232 pp.

Tanguay, L., L. Bouthillier and A. Gendron. 2012. Plan de conservation de la rainette faux-grillon, métapopulation de Beauharnois-Salaberry – 2e édition. Centre d'information sur l'environnement de Longueuil and Équipe de rétablissement de la rainette faux-grillon de l'Ouest au Québec. 43 pp.

Tessier, N., S. Noël and F.-J. Lapointe. In preparation. Characterization of the population genetic structure of the endangered Boreal chorus frog (*Pseudacris maculata*) formerly known under the name of *P. triseriata* in Quebec and Ontario.

Toussaint, D. 2013. Personal communication during a meeting of the Western Chorus Frog Recovery Team in Quebec. Ministère de Développement durable, de l'Environnement, de la Faune et des Parcs – région de l'Outaouais.

Walls, S. C., W. J. Barichivich and M. E. Brown. 2013. Drought, Deluge and Declines: The Impact of Precipitation Extremes on Amphibians in a Changing Climate. Biology 2: 399–418.

Western Chorus Frog Recovery Team in Quebec (WCFRTQ). 2000. Plan de rétablissement de la rainette faux-grillon (*Pseudacris triseriata*) au Québec. J. Jutras, Ed. Société de la faune et des parcs du Québec, Quebec, 42 pp.

Western Chorus Frog Recovery Team in Quebec (WCFRTQ). 2010. Bilan du rétablissement de la rainette faux-grillon l'Ouest (*Pseudacris triseriata*) pour la période 1999–2009. Ministère des Ressources naturelles et de la Faune, Faune Québec. 42 pp.

Western Chorus Frog Recovery Team in Quebec (WCFRTQ). In preparation. Plan de rétablissement de la rainette faux-grillon de l'Ouest (*Pseudacris triseriata*) au Québec – 2014-2024. Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs, Faune Québec.

Whitaker, J. O., Jr. 1971. A study of the western chorus frog *Pseudacris triseriata*, in Vigo County, Indiana Journal of Herpetology 15(3–4): 127–150.

Whiting, A. 2004. Population ecology of the Western Chorus Frog, *Pseudacris triseriata*. Master's Thesis, McGill University, Montreal, Quebec, Canada. 106 pp.

Appendix A. Critical Habitat for the Western Chorus Frog (GLSLCS)

Table A-1. Description of the 10×10-km standardized UTM squares and critical habitat parcels for the Western Chorus Frog (GLSLCS) in Quebec.

10×10-km UTM Square ID[1]	UTM Square Coordinates[2]		Number of Critical Habitat Parcel Centroids within the UTM Square[3]	Total Critical Habitat Parcel Area (ha) within the UTM Square[4]	Land Tenure[5]	Municipality
	Easting	Northing				
18WR60	560000	5000000	0	41	Federal and non-federal	Saint-Stanislas
18WR70	570000	5000000	1	1,727	Federal and non-federal	Saint-Louis-de-Gonzague
18WR71	570000	5010000	0	1	Federal and non-federal	Salaberry-de-Valleyfield
18WR72	570000	5020000	0	7	Non-federal	Ile-Perrot
18WR80	580000	5000000	0	201	Federal and non-federal	Saint-Louis-de-Gonzague
18WR81	580000	5010000	2	758	Federal and non-federal	Beauharnois
18WR82	580000	5020000	3	1,610	Non-federal	Ile-Perrot
18XR12	610000	5020000	1	627	Non-federal	Candiac
18XR14	610000	5040000	1	38	Non-federal	Longueuil
18XR22	620000	5020000	0	865	Non-federal	La Prairie
18XR23	620000	5030000	2	1,135	Non-federal	Brossard
18XR24	620000	5040000	3	1,569	Non-federal	Longueuil
18XR25	620000	5050000	1	1,381	Non-federal	Boucherville
18XR33	630000	5030000	1	140	Non-federal	Carignan
18XR34	630000	5040000	1	344	Federal and non-federal	Saint-Basile
18XR37	630000	5070000	1	101		Contrecoeur

10×10-km UTM Square ID[1]	UTM Square Coordinates[2]		Number of Critical Habitat Parcel Centroids within the UTM Square[3]	Total Critical Habitat Parcel Area (ha) within the UTM Square[4]	Land Tenure[5]	Municipality
18VR04	400000	5040000	2	475	Federal and non-federal	Pontiac
18VR13	410000	5030000	0	13	Non-federal	Pontiac
18VR14	410000	5040000	4	1,205	Federal and non-federal	Pontiac
18VR22	420000	5020000	0	13	Non-federal	Gatineau
18VR23	420000	5030000	8	915	Federal and non-federal	Pontiac
18VR24	420000	5040000	1	166	Federal and non-federal	Pontiac
18VR32	430000	5020000	1	34	Non-federal	Gatineau
18VR33	430000	5030000	2	693	Federal and non-federal	Gatineau
18VR43	440000	5030000	5	465	Federal and non-federal	Gatineau
18VR53	450000	5030000	3	557	Non-federal	Gatineau
18UR66	360000	5060000	0	84	Non-federal	Grand-Calumet
18UR76	370000	5060000	2	411	Non-federal	Grand-Calumet
18UR84	380000	5040000	2	496	Non-federal	Bristol
18UR94	390000	5040000	0	6	Non-federal	Bristol
18UR95	390000	5050000	2	197	Federal and non-federal	Bristol
			Total of 16 275 ha in 49 critical habitat parcels			

[1] Square ID is based on the standard UTM Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098), where the first two digits represent the UTM Zone, the following two letters indicate the 10×10-km standardized UTM grid, and the final two digits represent the 10×10-km standardized UTM grid containing all or a portion of the critical habitat parcel. This unique alphanumeric code is based on the methodology used for the Breeding Bird Atlases of Canada (see http://www.bsc-eoc.org/ for more information on breeding bird atlases).
[2] The listed coordinates represent the southwest corner of the 10×10-km standardized UTM grid containing all or a portion of the critical habitat parcel. The coordinates may not fall within critical habitat and are provided as a general location only.
[3] A value of "0" means the grid square contains a portion of (a) critical habitat parcel(s) but not the parcel centroid.

[4] The area presented corresponds to the sum of critical habitat parcels falling within the UTM square (rounded up to the nearest 1 ha). It is an approximation obtained by incorporating 300 m of wetland and terrestrial habitats (suitable or not) around each observation meeting the habitat occupancy criteria (Section 7.1.2.). The actual area of critical habitat may be much less, depending on where the criteria for critical habitat are met (see Section 7.1). Field verification may be required to determine the precise area of critical habitat.

[5] Land tenure is provided as an approximation of the types of land ownership that exist within the critical habitat parcels and should be used for guidance purposes only. Accurate land tenure will require cross-referencing critical habitat boundaries with surveyed land parcel information.

Figures of the
Western Chorus Frog (GLSLCS) Critical Habitat in Quebec

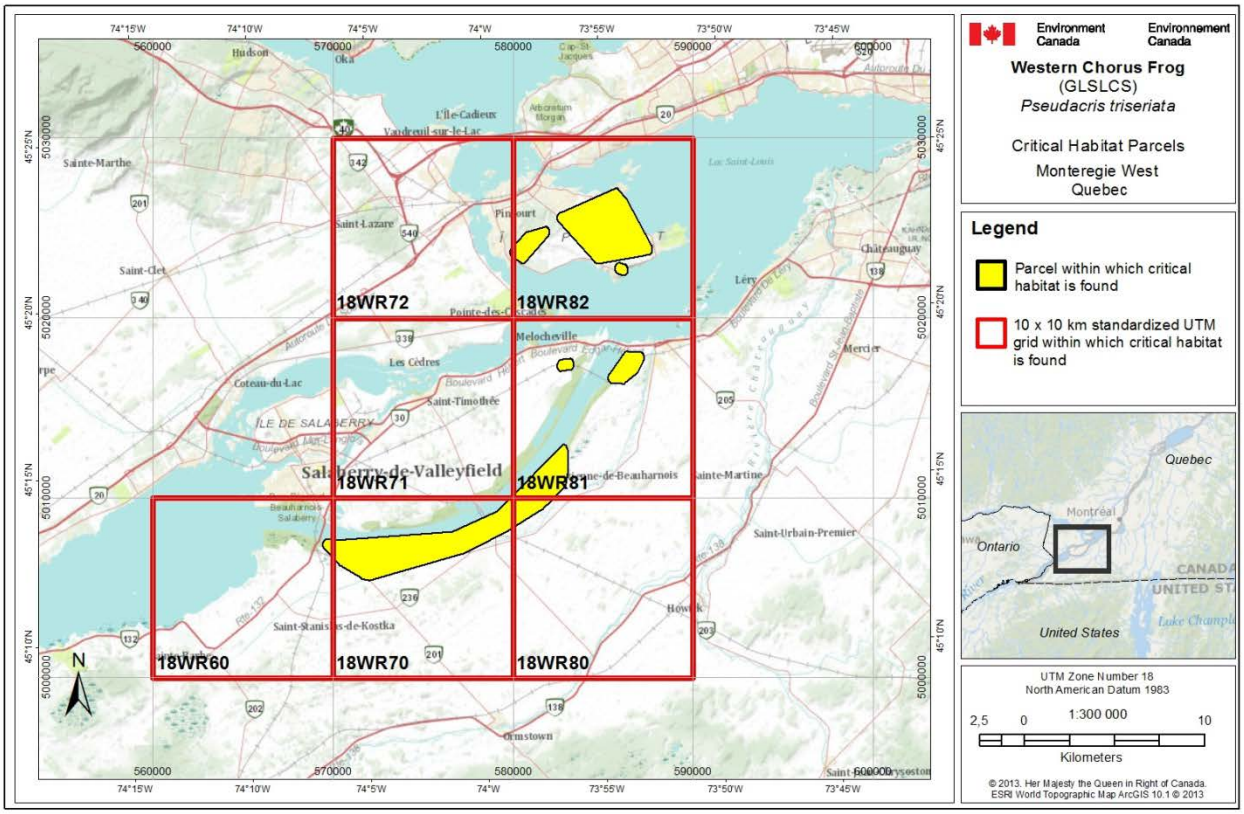

Figure A-1. Critical habitat for the Western Chorus Frog (GLSLCS) in the Montérégie Ouest sector of Quebec. Critical habitat occurs within the 10×10-km standardized UTM squares (red outlines). Critical habitat parcels (yellow) show the approximate extent of areas that meet the criteria set out in Section 7.1.

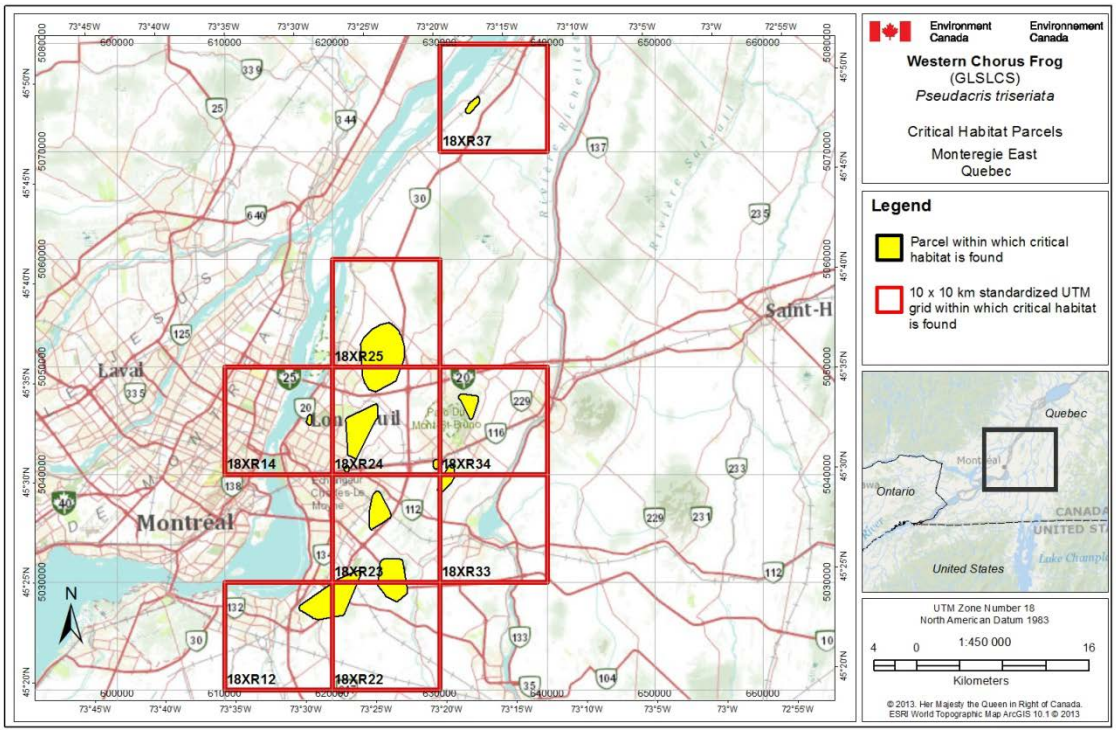

Figure A-2. Critical habitat for Western Chorus Frog (GLSLCS) in the Montérégie East sector of Quebec. Critical habitat occurs within the 10×10-km standardized UTM squares (red outlines). Critical habitat parcels (yellow) show the approximate extent of areas that meet the criteria set out in Section 7.1.

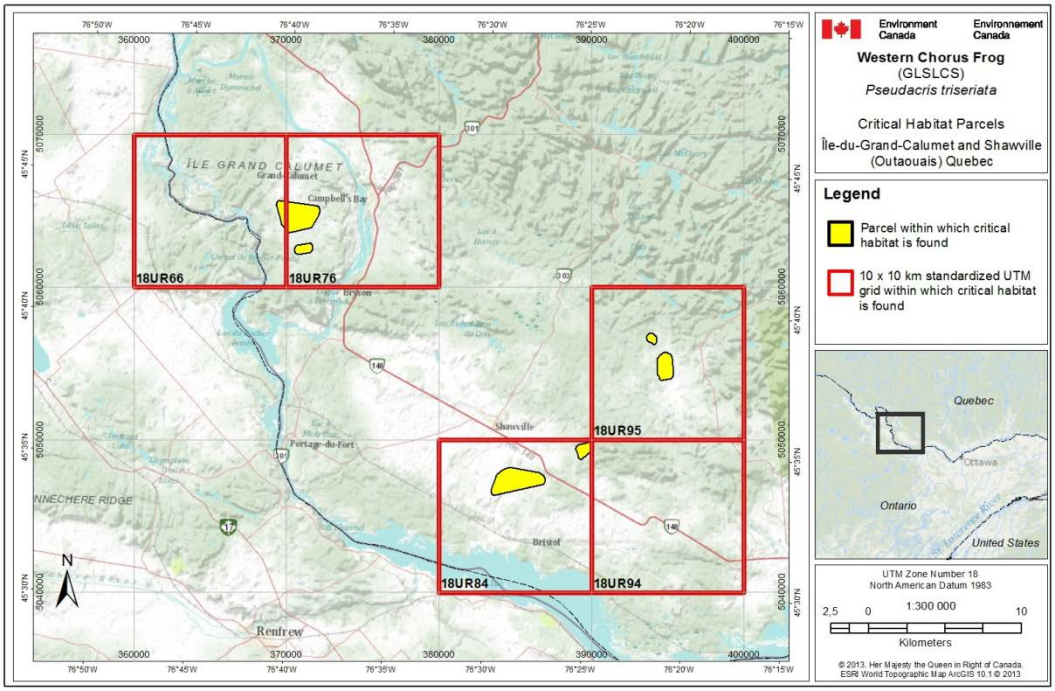

Figure A-3. Critical habitat for Western Chorus Frog (GLSLCS) in the Île-du-Grand-Calumet and Shawville sectors of Quebec. Critical habitat occurs within the 10×10-km standardized UTM squares (red outlines). Critical habitat parcels (yellow) show the approximate extent of areas that meet the criteria set out in Section 7.1.

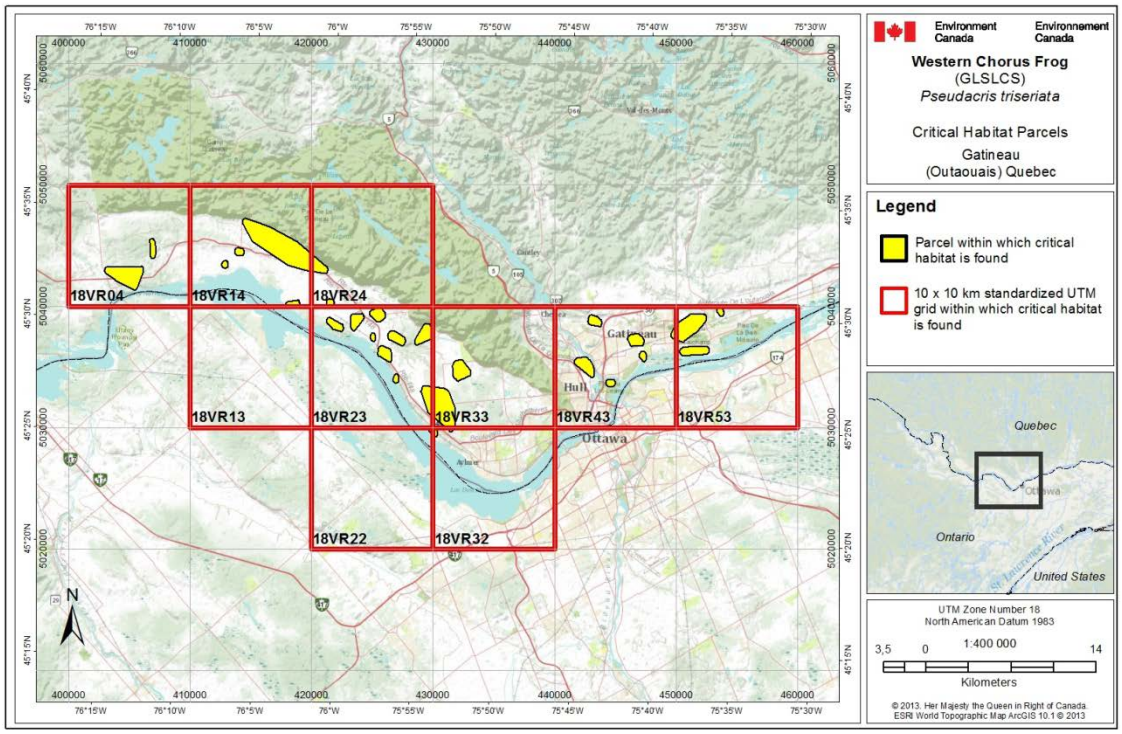

Figure A-4. Critical habitat for Western Chorus Frog (GLSLCS) in the Gatineau (Outaouais) sector of Quebec. Critical habitat occurs within the 10×10-km standardized UTM squares (red outlines). Critical habitat parcels (yellow) show the approximate extent of areas that meet the criteria set out in Section 7.1.

Table A-2. Description of the 10×10-km standardized UTM squares and critical habitat parcels for the Western Chorus Frog (GLSLCS) in Ontario.

10×10-km UTM Square ID[1]	UTM Square Coordinates[2]		Number of Critical Habitat Parcel Centroids within the UTM Square[3]	Total Critical Habitat Parcel Area (ha) within the UTM Square[4]	Land Tenure[5]
	Easting	Northing			
17LM82	380000	5120000	1	29	Non-federal
17MH37	430000	4770000	1	30	Non-federal
17MH65	460000	4750000	1	39	Non-federal
17MH76	470000	4760000	1	30	Non-federal
17MH85	480000	4750000	1	30	Non-federal
17MJ63	460000	4830000	1	30	Non-federal
17NH46	540000	4760000	2	64	Non-federal
17NH56	550000	4760000	1	26	Non-federal
17NH57	550000	4770000	1	49	Non-federal
17NH58	550000	4780000	1	30	Non-federal
17NH59	550000	4790000	2	59	Non-federal
17NH89	580000	4790000	1	208	Non-federal
17NH99	590000	4790000	1	56	Non-federal
17NJ41	540000	4810000	1	30	Non-federal
17NJ51	550000	4810000	1	30	Non-federal
17NJ52	550000	4820000	1	30	Non-federal
17NJ62	560000	4820000	2	59	Non-federal
17NJ71	570000	4810000	1	43	Non-federal
17NJ81	580000	4810000	2	59	Non-federal
17NJ90	590000	4800000	0	9	Non-federal
17NJ91	590000	4810000	2	325	Non-federal
17NK12	510000	4920000	1	29	Non-federal
17PJ01	600000	4810000	0	15	Non-federal
17PJ04	600000	4840000	1	344	Non-federal
17PJ05	600000	4850000	1	1,023	Non-federal
17PJ06	600000	4860000	1	66	Non-federal
17PJ07	600000	4870000	1	45	Non-federal
17PJ11	610000	4810000	1	46	Non-federal
17PJ13	610000	4830000	0	22	Non-federal
17PJ14	610000	4840000	1	57	Non-federal
17PJ15	610000	4850000	2	85	Non-federal
17PJ28	620000	4880000	1	44	Non-federal
17PJ47	640000	4870000	2	181	Non-federal
17PJ59	650000	4890000	1	37	Non-federal
17PJ68	660000	4880000	1	29	Non-federal
17PJ69	660000	4890000	0	7	Non-federal
17PK36	630000	4960000	1	29	Non-federal
17PK41	640000	4910000	1	29	Non-federal
17PK49	640000	4990000	1	29	Non-federal
17PK50	650000	4900000	0	22	Non-federal
17PK52	650000	4920000	1	29	Non-federal
17PK60	660000	4900000	4	181	Non-federal
17PK88	680000	4980000	1	29	Non-federal
17QJ17	710000	4870000	1	29	Non-federal
17QJ19	710000	4890000	1	29	Non-federal
17QJ39	730000	4890000	1	29	Federal

10×10-km UTM Square ID[1]	UTM Square Coordinates[2]		Number of Critical Habitat Parcel Centroids within the UTM Square[3]	Total Critical Habitat Parcel Area (ha) within the UTM Square[4]	Land Tenure[5]
17QK02	700000	4920000	4	518	Federal and non-federal
17QK03	700000	4930000	5	1,365	Federal and non-federal
17QK04	700000	4940000	2	423	Non-federal
17QK06	700000	4960000	2	148	Non-federal
17QK11	710000	4910000	4	693	Federal and non-federal
17QK13	710000	4930000	3	304	Federal and non-federal
17QK15	710000	4950000	1	67	Non-federal
17QK20	720000	4900000	1	135	Non-federal
17QK21	720000	4910000	4	535	Non-federal
17QK22	720000	4920000	5	562	Non-federal
17QK23	720000	4930000	4	427	Non-federal
17QK24	720000	4940000	1	121	Non-federal
17QK30	730000	4900000	2	85	Non-federal
17QK31	730000	4910000	6	809	Non-federal
17QK32	730000	4920000	0	64	Non-federal
17QK33	730000	4930000	3	162	Non-federal
17QK34	730000	4940000	1	211	Non-federal
17QK35	730000	4950000	1	180	Non-federal
18TP87	280000	4870000	2	128	Non-federal
18TP96	290000	4860000	0	14	Non-federal
18TP97	290000	4870000	1	29	Non-federal
18TP98	290000	4880000	1	30	Federal and non-federal
18TQ61	260705	4910000	1	71	Non-federal
18TQ63	261440	4930000	2	195	Non-federal
18TQ72	270000	4920000	3	208	Non-federal
18TQ74	270000	4940000	2	171	Federal and non-federal
18TQ75	270000	4950000	1	359	Non-federal
18TQ80	280000	4900000	1	29	Non-federal
18TQ91	290000	4910000	1	29	Non-federal
18UP06	300000	4860000	1	16	Non-federal
18UP08	300000	4880000	2	68	Non-federal
18UP16	310000	4860000	1	29	Non-federal
18UP18	310000	4880000	4	190	Non-federal
18UP19	310000	4890000	2	112	Non-federal
18UP28	320000	4880000	1	29	Non-federal
18UP36	330000	4860000	2	64	Non-federal
18UP37	330000	4870000	1	25	Non-federal
18UP39	330000	4890000	1	29	Non-federal
18UP46	340000	4860000	1	29	Non-federal
18UP49	340000	4890000	1	29	Non-federal
18UP59	350000	4890000	1	29	Non-federal
18UP69	360000	4890000	1	29	Non-federal
18UP79	370000	4890000	1	82	Federal and non-federal
18UQ00	300000	4900000	1	29	Non-federal
18UQ02	300000	4920000	1	29	Non-federal
18UQ03	300000	4930000	1	29	Non-federal
18UQ10	310000	4900000	1	29	Non-federal
18UQ30	330000	4900000	1	25	Non-federal
18UQ31	330000	4910000	0	4	Non-federal
18UQ36	330000	4960000	1	29	Non-federal

10×10-km UTM Square ID[1]	UTM Square Coordinates[2]		Number of Critical Habitat Parcel Centroids within the UTM Square[3]	Total Critical Habitat Parcel Area (ha) within the UTM Square[4]	Land Tenure[5]
18UQ55	350000	4950000	1	29	Non-federal
18UQ60	360000	4900000	0	1	Non-federal
18UQ61	360000	4910000	1	28	Non-federal
18UQ70	370000	4900000	4	175	Non-federal
18UQ86	380000	4960000	1	29	Non-federal
18UQ87	380000	4970000	2	214	Non-federal
18UQ91	390000	4910000	1	25	Non-federal
18UQ92	390000	4920000	0	5	Non-federal
18UR90	390000	5000000	1	75	Non-federal
18UR93	390000	5030000	1	29	Non-federal
18VQ17	410000	4970000	1	31	Federal and non-federal
18VQ21	420000	4910000	3	162	Federal and non-federal
18VQ23	420000	4930000	1	29	Non-federal
18VQ28	420000	4980000	1	48	Non-federal
18VQ29	420000	4990000	0	65	Non-federal
18VQ31	430000	4910000	1	29	Federal and non-federal
18VQ32	430000	4920000	4	186	Federal and non-federal
18VQ34	430000	4940000	4	299	Non-federal
18VQ35	430000	4950000	6	328	Non-federal
18VQ36	430000	4960000	2	58	Non-federal
18VQ37	430000	4970000	3	257	Non-federal
18VQ38	430000	4980000	3	298	Non-federal
18VQ39	430000	4990000	0	1	Non-federal
18VQ43	440000	4930000	1	32	Non-federal
18VQ44	440000	4940000	2	105	Non-federal
18VQ46	440000	4960000	6	364	Non-federal
18VQ47	440000	4970000	5	272	Non-federal
18VQ48	440000	4980000	1	45	Non-federal
18VQ57	450000	4970000	1	169	Non-federal
18VQ65	460000	4950000	1	29	Non-federal
18VQ67	460000	4970000	1	29	Non-federal
18VQ97	490000	4970000	1	30	Non-federal
18VQ98	490000	4980000	0	7	Non-federal
18VR01	400000	5010000	1	103	Non-federal
18VR03	400000	5030000	2	90	Non-federal
18VR10	410000	5000000	3	133	Non-federal
18VR11	410000	5010000	1	77	Non-federal
18VR31	430000	5010000	1	69	Non-federal
18WQ09	500000	4990000	1	73	Non-federal
18WR15	510000	5050000	1	29	Non-federal
			Total 16 793 ha in 211 critical habitat parcels		

[1] Square ID is based on the standard UTM Military Grid Reference System (see http://www.nrcan.gc.ca/earth-sciences/geography-boundary/mapping/topographic-mapping/10098), where the first two digits represent the UTM Zone, the following two letters indicate the 100×100-km standardized UTM grid, and the final two digits represent the 10×10-km standardized UTM grid containing all or a portion of the critical habitat parcel. This unique alphanumeric code is based on the methodology used for the Breeding Bird Atlases of Canada (see http://www.bsc-eoc.org/ for more information on breeding bird atlases).

[2] The listed coordinates represent the southwest corner of the 10×10-km standardized UTM grid containing all or a portion of the critical habitat parcel. The coordinates may not fall within critical habitat and are provided as a general location only.
[3] A value of "0" means the grid square contains a portion of (a) critical habitat parcel(s) but not the parcel centroid.
[4] The area presented corresponds to the sum of critical habitat parcels falling within the UTM square (rounded up to the nearest 1 ha). It is an approximation obtained by incorporating 300 m of wetland and terrestrial habitats (suitable or not) around each observation meeting the habitat occupancy criteria (Section 7.1.2.). The actual area of critical habitat may be much less depending on where the criteria for critical habitat are met (see Section 7.1). Field verification may be required to determine the precise area of critical habitat.
[5] Land tenure is provided as an approximation of the types of land ownership that exist within the critical habitat parcels and should be used for guidance purposes only. Accurate land tenure will require cross-referencing critical habitat boundaries with surveyed land parcel information.

Figures of the
Western Chorus Frog (GLSLCS) Critical Habitat in Ontario

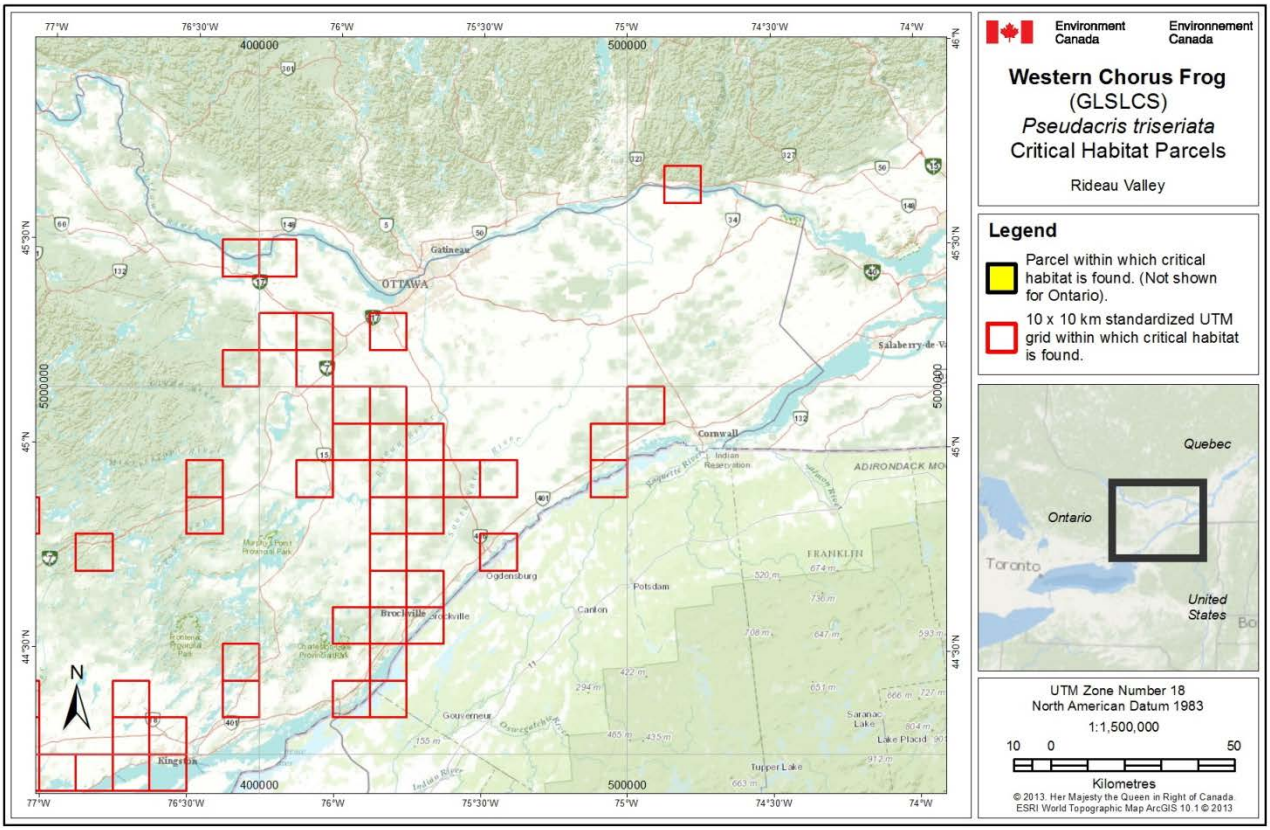

Figure A-5. Critical habitat for the Western Chorus Frog (GLSLCS) in the Rideau Valley, Ontario. Critical habitat occurs within the 10×10-km standardized UTM squares (red outlines), where the criteria described in Section 7.1 are met. To respect provincial data-sharing agreements, critical habitat parcels (yellow) are not mapped in Ontario.

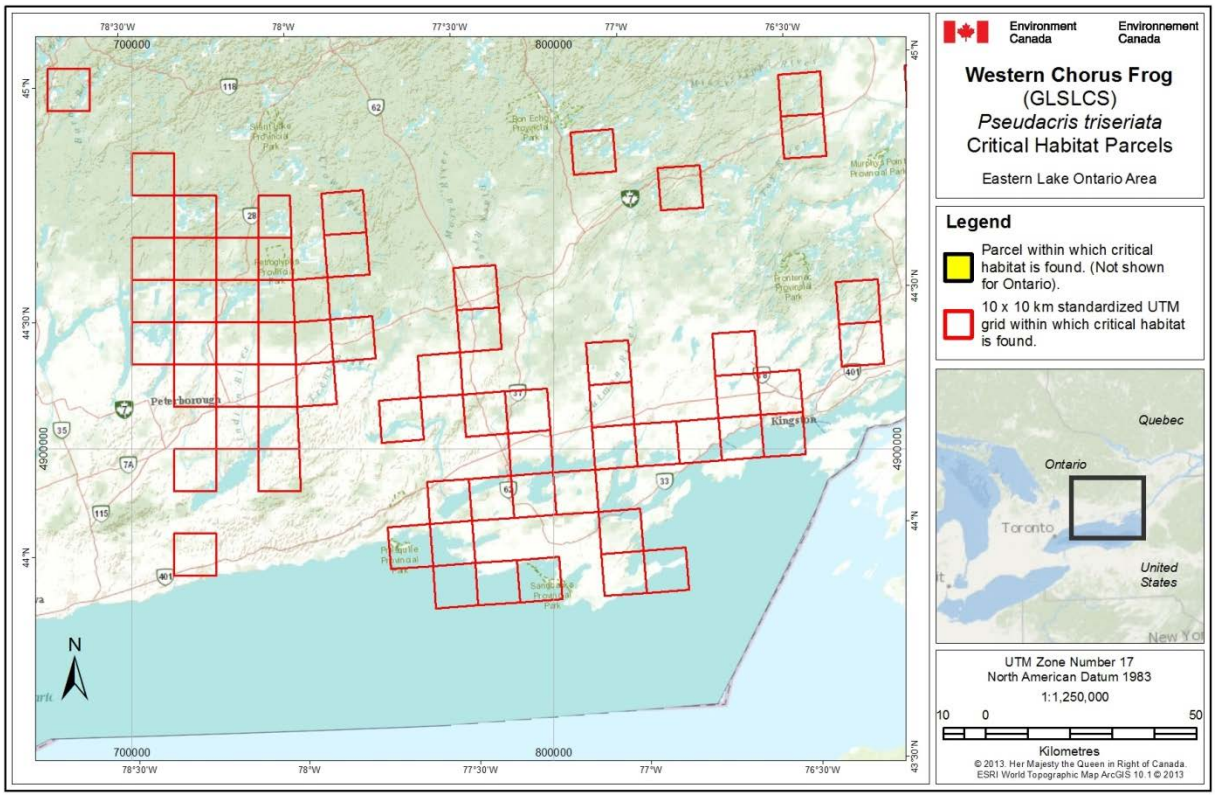

Figure A-6. Critical habitat for the Western Chorus Frog (GLSLCS) in the Eastern Lake Ontario Area, Ontario. Critical habitat occurs within the 10×10-km standardized UTM grid indicated by the red outlines, where the criteria described in Section 7.1 are met. To respect provincial data-sharing agreements, detailed parcels (yellow) are not mapped in Ontario. Due to the different projection between UTM zones, all squares do not have the same dimension.

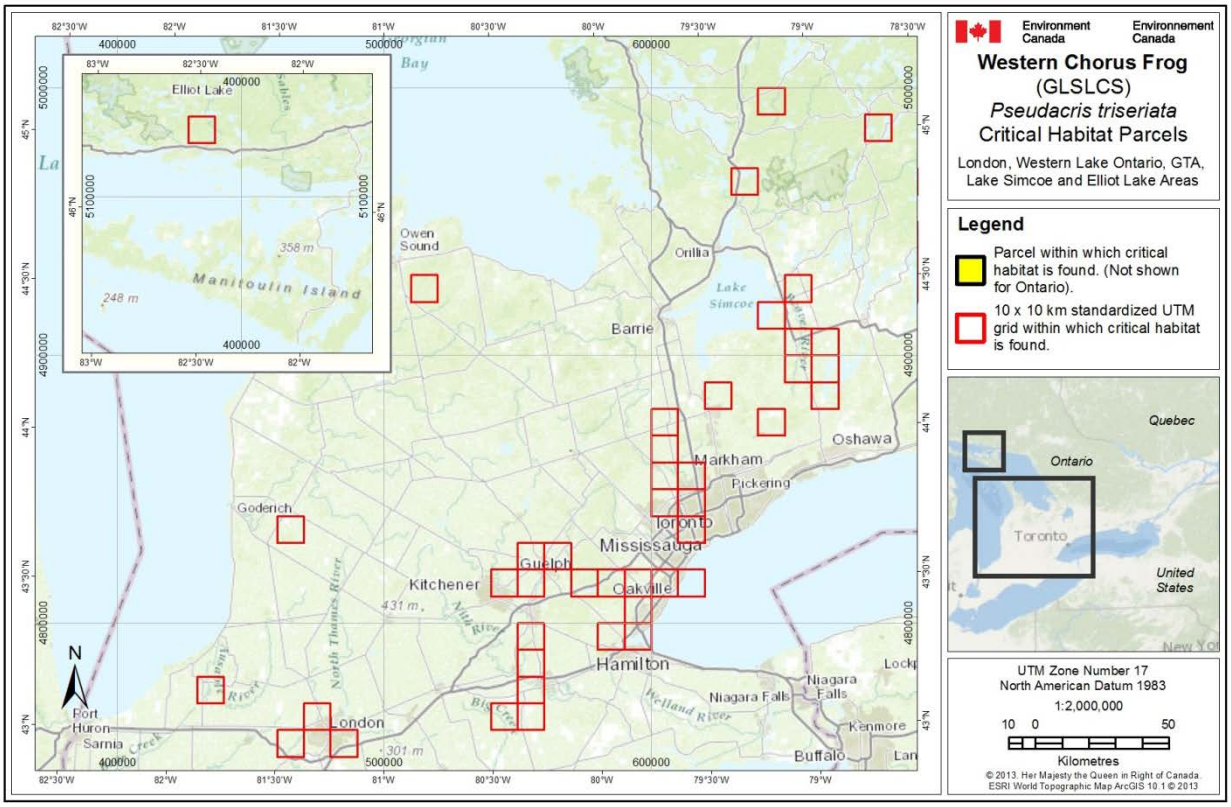

Figure A-7. Critical habitat for the Western Chorus Frog (GLSLCS) in the London, Western Lake Ontario, GTA, Lake Simcoe and Elliot Lake areas, Ontario. Critical habitat occurs within the 10×10-km standardized UTM grid indicated by the red outlines, where the criteria described in Section 7.1 are met. To respect provincial data-sharing agreements, detailed parcels (yellow) are not mapped in Ontario.

Appendix B: 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*. 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 determine whether the outcomes of a recovery planning document could affect any component of the environment or any of the goals or targets in the Federal Sustainable Development Strategy.[11]

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.

A number of amphibian and reptile species are likely to benefit from conservation efforts for the Western Chorus Frog, including the Grey Treefrog (*Hyla versicolor*), Northern Spring Peeper (*Pseudacris crucifer*), Green Frog (*Lithobates clamitans melanota*), Leopard Frog (*Lithobates pipiens*) and American Toad (*Anaxyrus americanus*). In permanent marshes, the Least Bittern (*Ixobrychus exilis*), King Rail (*Rallus elegans*), Blanding's Turtle (*Emydoidea blandingii*) and Snapping Turtle (*Chelydra serpentina*) may also share similar habitats. No adverse effects on other species or the environment are anticipated.

[11] www.ec.gc.ca/dd-sd/default.asp?lang=En&n=F93CD795-1.