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Recovery Strategy Series

Recovery Strategy for the Bank Swallow (*Riparia riparia*) in Canada

Bank Swallow

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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[1].

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[1] 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)[2] and the Cooperation Agreement for the Protection and Recovery of Species at Risk in Quebec[3] 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 after the publication of the final document on the SAR Public Registry.

The Minister of Environment and Climate Change Canada and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Bank Swallow 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 British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador, Yukon, the Northwest Territories, the Inuvialuit Game Council, the Gwich'in Renewable Resources Board, the Wek'eezhii Renewable Resources Board, and the Wildlife Management Advisory Council (Northwest Territories) 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 Bank Swallow 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. Once critical habitat is identified, either in a recovery strategy or an action plan, SARA requires that critical habitat then be protected.

[2] www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2
[3] www.registrelep-sararegistry.gc.ca/virtual_sara/files/agreements/aa_canada_quebec_0513_e.pdf

In the case of critical habitat identified for terrestrial species including migratory birds, SARA requires that critical habitat identified in a federally protected area[4] be described 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.

[4] 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 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 Marc-André Cyr (Environment and Climate Change Canada, Canadian Wildlife Service [ECCC-CWS] – National Capital Region) based on a draft by David Anthony Kirk (Aquila Applied Ecologists – Ottawa, ON). Advice, expertise and document reviews were provided by a technical working group consisting of the following members:

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Additional comments were provided by Marie-Claude Archambault (ECCC-CWS – Ontario Region), Catherine Geoffroy, Kim Borg and Kella Sadler (ECCC-CWS – National Capital Region), Joanne Tuckwell (Parks Canada Agency), Véronique Connolly (private consultant), Kimberly Dohms (ECCC-CWS – Pacific Region), Kevin Kardynal (ECCC-S&T – Prairie Region) and Margaret Eng (ECCC-S&T – Atlantic Region).

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Executive Summary

The Bank Swallow (*Riparia riparia*) was listed as a threatened species in Schedule 1 of the *Species at Risk Act* (SARA) in 2017.

The Bank Swallow is an aerial insectivorous bird that nests in colonies on steep bank faces along waterbodies and human-made habitats. The species predominantly winters in the Southern Cone Grasslands of Chile, Argentina, Paraguay and Uruguay. In Canada, the Bank Swallow population has shown severe long-term declines, with slower declines in recent years.

The causes of Bank Swallow population declines are unclear. Multiple factors likely have a cumulative impact on the species. The most likely primary threat to Bank Swallow are the broad-scale ecosystem modifications, including pesticide use, in the breeding, migration, and wintering areas of the species resulting in less abundant invertebrate prey. The loss of natural nesting sites from erosion control measures and a reduction in prey availability as a result of climate change may create further pressure on the species.

There are unknowns regarding the feasibility of recovery of the Bank Swallow. 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.

The population and distribution objectives for the Bank Swallow are as follows:

- maintain the extent of occurrence (the area that encompasses the known geographic distribution of the species) in Canada as identified from a minimum convex polygon based on critical habitat presented in this recovery strategy;
- in the short term (2021–2033), achieve a reduced rate of decline while ensuring that the population index remains above 80% of the 2021 level;
- in the long term (by 2053), achieve a stable 10-year trend while ensuring that the population index remains above 90% of the 2021 level.

The broad strategies to be taken to address the threats to the survival and recovery of the species are presented in the section “Strategic Direction for Recovery”. Broad strategies aim to reverse the loss of nesting, foraging and roosting habitats. Further research and monitoring on the demographic parameters and migratory connectivity of the Bank Swallow are required to prioritize conservation measures.

The critical habitat identified in this recovery strategy is insufficient to meet the population and distribution objectives. The number of confirmed nesting records was insufficient to fully identify the nesting and foraging components of critical habitat. The identification of critical habitat is based on confirmed nesting occurrences in natural settings observed between 2001 and 2017. A schedule of studies outlines the key activities that are required to complete the identification of critical habitat. Examples of activities likely to result in the destruction of critical habitat are also outlined.

One or more action plans for the Bank Swallow will be posted on the Species at Risk Public Registry within five years after the final version of this recovery strategy is posted. Action plans provide the detailed recovery planning that supports the strategic direction set out in the recovery strategy for the species.

Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Bank Swallow. 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 technically and biologically 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. The Bank Swallow is still a relatively common and widespread species despite its long-term population declines. The Canadian population of the Bank Swallow is estimated from 2.4 million individuals (Partners in Flight Science Committee 2020) to 3.46 million individuals (Boreal Avian Modelling Project 2020). There are currently adequate numbers of individuals of the species to sustain the population or improve its abundance.

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

Unknown. It is unknown if sufficient nesting habitat in natural settings remains to support the recovery of the species. Measures to control hydrological regimes and shoreline erosion continue to be implemented, likely resulting in a net loss of natural nesting habitat. The Bank Swallow is opportunistic in its use of nesting habitat. The proportions of the breeding population found in natural or human-made habitats likely depend on availability of nesting features and regional density of Bank Swallows. The suitability of human-made nesting habitats may have declined in Canada due to changes in quarry operation standards and roadcut design. Human-made settings that maintain nesting habitat may slow the overall rate of decline.

The loss of natural habitats that produce insect prey, such as wetlands and natural grasslands, is ubiquitous over the Bank Swallow's range. The quality of foraging habitats in "functional landscapes"[5] might be degraded due to agricultural intensification or release of contaminants, such as pesticides. Foraging habitat requirements for the Bank Swallow are well known, although insect prey availability at critical periods of the annual cycle requires further investigation. Sufficient foraging habitat can be made available to support the species through restoration of ecosystem features that produce insects.

[5] Landscapes where natural features have been modified to provide services to humans, such as food production or water purification.

On the breeding grounds, Bank Swallows congregate at nocturnal roosts before fall migration. Some roost sites hosting large numbers of Bank Swallows are known, but the location of many smaller roosts remain undocumented. Historically, the Bank Swallow may have roosted in smaller wetlands, but a large proportion of those habitats have been lost in southern Canada. Despite the key importance of roost sites for Bank Swallow, the location, size and availability of those habitats are mostly unknown.

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

Unknown. Multiple factors on the breeding, migration, and wintering range are likely having a cumulative impact on the species, with possible carry-over effects from one region to the other. Broad-scale ecosystem modifications reducing the abundance or quality of insects consumed by Bank Swallow and climate change resulting in phenological changes in abundance of insects during the breeding period may be important threats to the species. The degradation of ecosystem functions that support the production of insects may be avoided following important changes in agricultural production systems and land use policies. Impacts of climate change may be mitigated following drastic changes in agricultural production systems, consumption of goods, and emissions of greenhouse gases.

In Canada, erosion control and water level management have been implemented widely along rivers and lakes resulting in loss of nesting habitat. Natural hydrological regimes can be implemented in cooperation with hydroelectricity producers and dam operators. Most provincial, territorial and municipal jurisdictions have strong legislation in place to protect shorelines. Climate change may create an increasing risk to coastal infrastructure, which may accelerate efforts to stabilize shorelines. Further loss of nesting habitat may be avoided by sound land-use planning and better knowledge of the impacts of climate change. When alternative natural habitat cannot be created to offset habitat loss from development, surrogate nesting structures might be considered while ensuring that foraging habitat is available.

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

Unknown. Mitigating threats to the Bank Swallow represents considerable challenges. The broad-scale ecosystem modifications on the breeding, migration and wintering areas largely result from market forces driving land use policies and production systems. Strong international collaboration will be required to develop and implement sustainable agricultural production systems and land use policies. In Canada, market-based incentives and certification schemes can be implemented to drive the adoption of sustainable agricultural systems that maintain ecosystem services and reduce emissions of greenhouse gases. Restoration of ecosystem processes and sustainable development along shorelines, also known as nature-based solutions, can be implemented to mitigate the risk and severity of erosion and flooding. Strong collaboration with provincial, territorial and municipal jurisdictions will be required for

climate change adaptations that will co-benefit the Bank Swallow. Further research on migratory connectivity, wintering habitat use, and demographic rates (such as survival and recruitment) of the Bank Swallow may help to prioritize conservation measures for the species.

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1. COSEWIC* Species Assessment Information

Date of Assessment: May 2013

Common Name (population): Bank Swallow

Scientific Name: *Riparia riparia*

COSEWIC Status: Threatened

Reason for Designation: This widespread species has shown a severe long-term decline amounting to a loss of 98% of its Canadian population over the last 40 years. As with many other aerial insectivores, the decline continues, albeit at a slower rate since the 1980s. Breeding Bird Survey data from 2001-2011 indicate a potential loss of 31% of the population during that 10-year time period. The reasons for these declines are not well understood, but are likely driven by the cumulative effects of several threats. These include loss of breeding and foraging habitat, destruction of nests during aggregate excavation, collision with vehicles, widespread pesticide use affecting prey abundance, and impacts of climate change, which may reduce survival or reproductive potential.

Canadian Occurrence: Yukon, Northwest Territories, British Columbia, Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador

COSEWIC Status History: Designated Threatened in May 2013.

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

2. Species Status Information

The Bank Swallow is listed as threatened in Schedule 1 of the *Species at Risk Act* (SARA) since 2017. The Bank Swallow is protected under the *Migratory Birds Convention Act, 1994*, which protects all individuals of the species as well as its nest and eggs on federal and non-federal lands.

In addition to federal protection, the Bank Swallow is listed as threatened under Ontario's *Endangered Species Act* since 2014, and as endangered under Nova Scotia *Endangered Species Act* since 2017. The species is not listed under legislation for species at risk in the Northwest Territories, Alberta, Saskatchewan, Manitoba, Quebec, New Brunswick, or Newfoundland and Labrador. The provinces of Prince Edward Island and British Columbia, and the Yukon and the Nunavut territories do not have legislation for species at risk. Provincial and territorial legislation and policies on the Bank Swallow

support the conservation and protection of the species and its habitats on non-federal lands.

The NatureServe national status ranking in Canada and the United States are listed in Table 1 in addition to the Canadian sub-national conservation ranks.

Table 1. Conservation status ranks for the Bank Swallow (NatureServe 2017).

Global (G) Rank	National (N) Ranks	Sub-national (S) Ranks
G5	Canada: N5B, N5M United States: N5B	Yukon Territory (S4B) Northwest Territories (S2?B) British Columbia (S4B) Alberta (S4B) Saskatchewan (S4B, S5M) Manitoba (S4B) Ontario (S4B) Quebec (S2S3B) New Brunswick (S2S3B, S2S3M) Nova Scotia (S2S3B) Prince Edward Island (S2S3B) Newfoundland Island (S1S2B, SUM) Labrador (S2B, SUM)

Conservation Status ranks (G-Global, N-National, S-Sub-National); 1: Critically Imperilled, 2: Imperilled; 3: Vulnerable, 4: Apparently Secure, 5: Secure, ?: Inexact Numeric Rank; U: Unrankable; B: Breeding; M: Migrant.

3. Species Information

3.1 Species Description

The Bank Swallow has an average body length of 12 cm and a typical weight of 12.7 to 15 g, making it the smallest swallow in Canada. Its upperparts are a dark brown that extends to the top of the head and it has a large brown band across the upper part of the chest. The rest of the body, including the chin and throat, are white. Both sexes are similar in appearance. Bank Swallows can be distinguished from other swallows by the brown band that crosses their chest. The nominate subspecies *R. r. riparia* is the only subspecies found in Canada (Turner and Rose 1989).

The Bank Swallow is an aerial insectivorous bird that nests in colonies. Nesting Burrows are excavated in vertical or near-vertical faces, primarily along waterways (Garrison and Turner 2020). In Canada, the species nests from mid-May to late August. Estimates of generation time (“average age of parents in a cohort”) range from 1.7 to 2 years (COSEWIC 2013).

3.2 Species Population and Distribution

Distribution

The Bank Swallow has an extensive global distribution, being present on almost every continent except Antarctica and Australia (Garrison and Turner 2020). In North America, it nests in Canada and the northern half of the United States (Winkler 2006). The species has an extensive distribution on its wintering grounds in Central and South America (Figure 1), with higher concentrations in the Southern Cone Grasslands of Chile, Argentina, Paraguay and Uruguay (Fink et al. 2020). The species also winters in Ecuador, Peru, Colombia and Central America. In Canada, the Bank Swallow breeding range includes all provinces, Yukon and the Northwest Territories (Garrison and Turner 2020). The species rarely occurs in Nunavut. In 2013, the COSEWIC estimated the extent of occurrence (the area that encompasses the known breeding range) of the Bank Swallow to 9.95 million km^2 in Canada. The area of occupancy[6] of the Bank Swallow expanded after Europeans settled in North America due to the creation of transportation corridors, sandpits, and clearing of forests for agriculture, which created suitable conditions for nesting and foraging (Erskine 1979; Cadman et al. 1987; Erskine 1992; Federation of Alberta Naturalists 1992; Bols 2017).

The Bank Swallow is found across all three Maritime provinces (Stewart et al. 2015). The species is known to breed in both Newfoundland and Labrador (P. Thomas, pers. comm. 2021; see Appendix E). In Ontario and Quebec, a large portion of the population is found in the southern regions of the provinces (Cadman et al. 2007; Quebec Breeding Bird Atlas 2017). In Manitoba, the highest densities occur in the Prairie Potholes region and along the Hayes, Owl, and lower Nelson Rivers in the Hudson Bay Lowlands, where long sections of steep, exposed banks provide nesting habitat (Artuso et al. 2017; T. Poole, pers. comm. 2021). Preliminary data from the Saskatchewan Breeding Bird Atlas indicates most nesting evidence in the Prairie Potholes region, although survey effort is currently limited north of this region (Birds Canada, 2020). In Alberta, data from the first Breeding Bird Atlas showed that more than 85% of these swallows nested in the southern half of the province (Federation of Alberta Naturalists 1992), with few reports in the Canadian Shield. In British Columbia, the Bank Swallow is generally restricted to areas below 750 m of altitude (W. Easton, pers. comm.) in the southern interior and the boreal taiga plains regions (Howie 2015). Bank Swallow colonies are commonly found along the coastline of Atlantic Provinces, but seldom occur along the coastline of British Columbia. The species is common in Yukon, particularly in the southern part of the territory, and has been confirmed nesting as far north as the Babbage River near the Beaufort Sea coast (Sinclair et al. 2003). It has not been surveyed extensively in the Northwest Territories, but large colonies exist on the the Mackenzie and Arctic Red River (Gwich'in Renewable Resources Board, unpubl. data).

[6] The area within 'extent of occurrence' that is occupied by a taxon, excluding cases of vagrancy. (COSEWIC 2015)

Figure 1. Breeding, migrating and wintering distribution of Bank Swallow (adapted from BirdLife International 2016).

Comparisons of first and second breeding bird atlases in the Maritimes, Quebec, Ontario and Alberta show a decrease in the area of occupancy of this species, shown by a reduction in the number of atlas squares with confirmed breeding evidence (Table 2). The Bank Swallow shows a decrease in its area of occupancy despite the increase survey effort from first to second atlases.

Table 2. Number of Atlas squares with reported confirmed breeding in first and second atlases.

Region	Number of 10 x10 km Atlas squares with confirmed breeding		Percent Change (%)
	First Atlas	Second Atlas	
Maritimes[a]	792	433	-45.3
Quebec[b]	804	416	-48.3
Ontario[c]	1421	987	-30.5
Alberta[d]	227	76	-66.5

[a] First Atlas period: 1986–1990 (Erskine 1992); Second Atlas period: 2006–2010 (Stewart et al. 2015).

[b] First Atlas period: 1984–1989 (Gauthier and Aubry 1995); Second Atlas period: 2010–2014 (Quebec Breeding Bird Atlas 2017).

[c] First Atlas period: 1981–1985 (Cadman et al. 1987); Second Atlas period: 2001–2005 (Cadman et al. 2007).

[d] First Atlas period: 1987–1991 (Federation of Alberta Naturalists 1992); Second Atlas period: 2000–2005 (Federation of Alberta Naturalists 2007).

The Bank Swallow is opportunistic in its choice of nesting sites, readily using both natural and human-made habitats (Erskine 1979; Burke 2017; Garrison and Turner 2020). Bank Swallow distribution is influenced regionally by geomorphological and hydrological conditions needed to create nesting habitat, which are relatively fixed in the landscape and persistent over time. Locally, the location of erodible banks used as nesting substrate may change over time following erosion and accretion processes, and re-vegetation. In human-made settings, nesting habitat may become available following bank excavation, then rapidly become unsuitable following grading of the bank or colony disturbance from industrial activities. The reduction in the area of occupancy in the last two decades might be explained, in part, by changes in the design of transportation corridors, aggregate, and shoreline management practices (COSEWIC 2013; section 4.2 Description of threats). In Ontario, colonies found in road-cuts have not been reported since the 1990s (COSEWIC 2013), which is attributed to changes in road-cut design that has become less suitable for nesting. Road-cuts suitable for nesting are also becoming less common in Yukon (P.H. Sinclair, pers. comm. 2020) and in Labrador (P. Thomas, pers. comm. 2021).

The locations and sizes of breeding, post-fledging and pre-migratory roosts are poorly known for Bank Swallow, despite the important conservation value that these sites are believed to have for these diurnal migrants (Falconer et al. 2016a; Saldanha 2016; Kelly and Pletschet 2017; Saldanha et al. 2019; Imlay et al. 2020). Some roost sites hosting tens to hundreds of thousands of Bank Swallows are known, such as Whitewater Lake, Manitoba and Long Point, Ontario, but the location of many smaller roosts remain undocumented.

Population

The Bank Swallow remains common in North America despite long-term declines, with an estimated population of 7.9 million adults (Partners in Flight Science Committee 2020). The breeding population of the Bank Swallow in Canada, based on Breeding Bird Survey (BBS) results, is estimated at 2.4 million adults (95% confidence interval:

1.6–3.4 million), of which approximately 18% breed in Quebec, 17% in British Columbia, 16% in Manitoba, 12% in Alberta, 12% in the Northwest Territories, 10% in Saskatchewan, 7% in Ontario, with the remainder in relatively small numbers in Yukon, Nunavut and Atlantic provinces (Partners in Flight Science Committee 2020). The proportion assigned to Ontario likely does not account for the large nesting colonies on the shore of Lake Erie, which are not well surveyed by BBS routes (Falconer et al. 2016a). The highest figures of relative abundance of Bank Swallows estimated from BBS routes are found in the Maritimes, southern Quebec and Ontario, Manitoba and Yukon (Figure 2). In the United States, the species is most abundant in the states north of Oregon, Illinois and New Jersey, as well as in Alaska.

The Boreal Avian Modelling (BAM) Project estimates the breeding population at 3.46 million adults[7] (Confidence Interval: 2.91–4.27 million; Boreal Avian Modelling Project 2020). The predicted highest densities of the species can be found in Quebec, Ontario, and the Prairie Potholes Region. The predicted high densities in the Boreal Softwood Shield of Manitoba and Saskatchewan should be interpreted with caution as they are not supported by observations from the Manitoba Breeding Bird Atlas (Artuso et al. 2017) and preliminary data from the Saskatchewan Breeding Bird Atlas (Birds Canada, 2020). The BAM predictive model can under- or over-predict species densities in regions with sparse data (Boreal Avian Modelling Project 2020).

The BAM Project provides population estimates based on models of species density in relation to environmental variables. Environmental variables include tree species biomass (local and landscape scale), forest age, topography, land use, and climate, but not surficial geology or hydrology, likely important predictors of nesting habitat occurrence and Bank Swallow density. Species observations include a combination of the BAM database of point-count surveys (through 2018), the Breeding Bird Survey, and provincial Breeding Bird Atlases. In addition, the use of environmental covariates in the BAM population estimate model reduces sampling effort bias and attenuates the low detection rate of Bank Swallows during the BBS roadside counts.

Both Partners in Flight and BAM population estimation methods have limitations and biases when applied to Bank Swallow. More precise population estimates can be obtained from local colony surveys. For example, the best available information in Ontario obtained from surveys of colony sites on the Great Lakes, along rivers, and at human-made habitats indicates a Bank Swallow breeding population of more than 400,000 adults (Falconer et al. 2016a). This estimate differs markedly from the 180,000 adults in Ontario derived from the BBS (Partners in Flight Science Committee 2020).

[7] The BAM population estimate represents both sexes of the Bank Swallow (P. Sólymos, pers. comm. 2021), rather than only males as indicated on the BAM website.

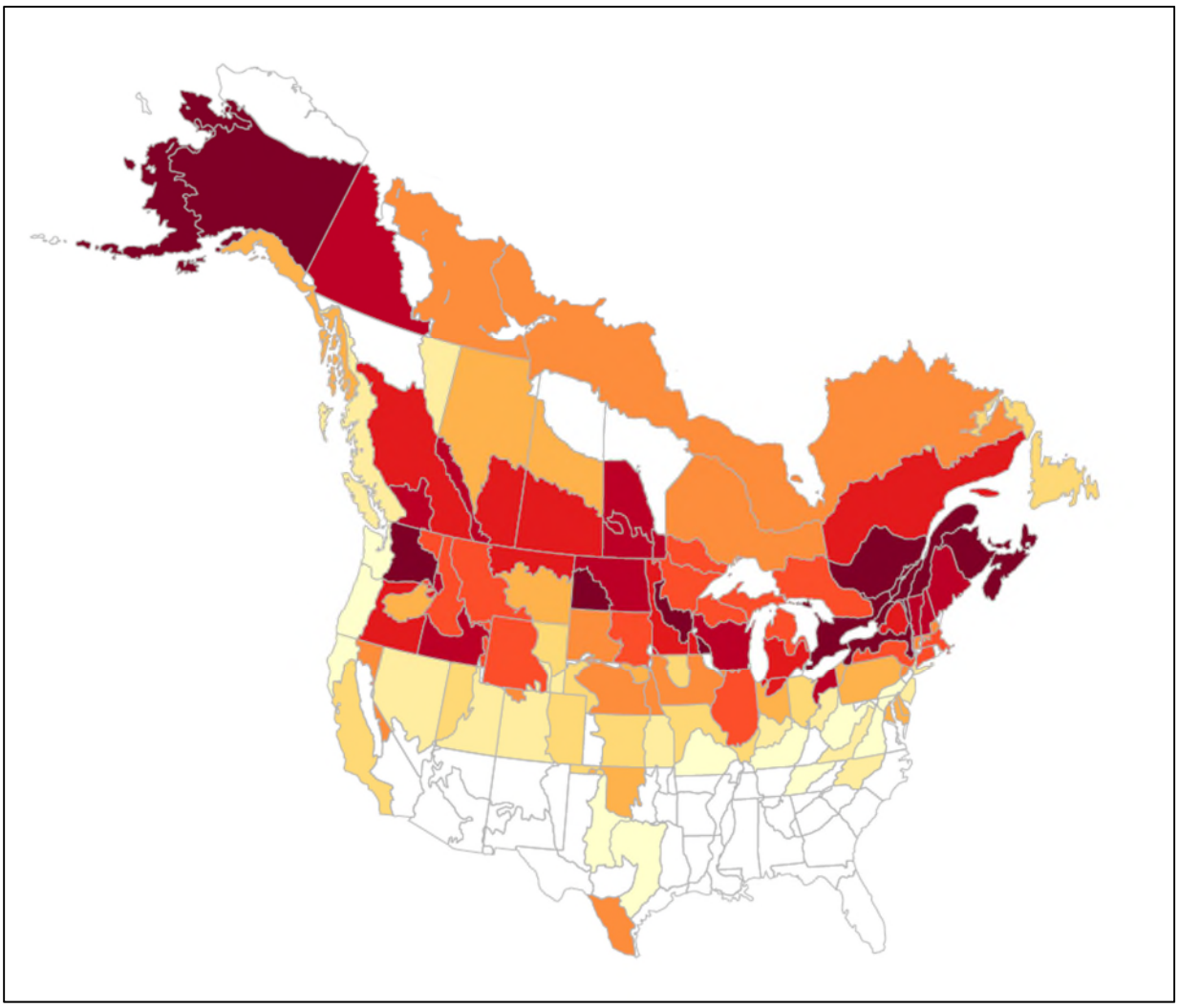

Figure 2. Map of relative abundance (average number of birds counted/route/year; 1979-2019) of Bank Swallow in Canada and the United States from the North American Breeding Bird Survey (BBS). Areas in dark red indicate higher relative abundance and areas in pale yellow indicate areas of lower relative abundance. White areas indicate regions were data was insufficient, although nesting occurrences might occur sparsely.
Source: Smith et al. 2020.

In Canada, the Bank Swallow population has shown a 5.3% annual decline in abundance between 1970 and 2019 based on BBS data (Table 3). Aerial insectivores, including swifts, swallows and nightjars, began declining in the 1980s with Bank Swallow showing the steepest decline (Smith et al. 2015). In the early 1990s, the Bank Swallow population declined by more than 10% annually, but recent declines have slowed or stabilized (Figure 3). Nationally, the latest short-term trend indicates an average 1.3% annual increase for the 2009-2019 period. However, this trend should be interpreted with caution since it is accompanied by a wide confidence interval. In other words, there is limited certainty that the Bank Swallow population is showing a positive trend. Both over the long and short term, the Bank Swallow population has shown the

largest annual declines in Yukon, Ontario, Quebec and the Maritime provinces, with less severe declines in the Prairie Provinces (Table 3). In Saskatchewan, a positive trend can be observed on the short-term and long-term, although the latter is not statistically significant. The causes for this positive trend, also observed in other jurisdictions of the Prairie Potholes (Bird Conservation Region 11), remain unexplained but may be related to increased development and availability of human-made nesting habitat. In the Northwest Territories and in Newfoundland and Labrador, a positive, but not statistically significant trend is observed over the short-term.

Despite the short-term, positive population trend in Canada, steep declines continue to occur west and east of the Prairie Provinces. The short-term positive trend in Canada must be interpreted with caution and may not indicate an improved condition of the Bank Swallow population. Excluding BBS data of Saskatchewan from national estimates, the Bank Swallow population shows a 10 year population decline of more than 30 percent. It is currently unknown whether the different trends observed across Canada are the result of local conditions on the breeding grounds, non-breeding grounds, or a combination of factors across the range of the species.

As with population estimates, targeted colony counts may provide more accurate population trends. In Ontario, numbers of breeding Bank Swallows along the shore of Lake Erie were at an all-time low in 2020, continuing the downward trend from 2019 (Ontario Bank Swallow Working Group meeting, November 2020). Important declines in areas that have historically supported high numbers of Bank Swallows might be indicative of population declines at a broader scale.

Table 3. National and regional annual average estimates of percent population change (including 95% Confidence Limit [CL]) for the Bank Swallow in Canada over the long and short terms, based on Breeding Bird Survey results.

Geographic area	Long-term Trend (1970–2019)				Short-term Trend (2009–2019)			
	%/year	Lower CL	Upper CL	Overall reliability	%/year	Lower CL	Upper CL	Overall reliability
Canada	-5.3	-8.0	-3.4	Medium	1.3	-5.2	9.5	Low
Newfoundland and Labrador	-3.3	-10.9	4.7	Low	1.7	-15.7	22.6	Low
Nova Scotia and Prince Edward Island[a]	-8.6	-10.9	-6.6	Medium	-8.3	-18.2	-1.0	Low
New Brunswick	-10.1	-12.4	-7.8	Medium	-12.6	-22.2	-1.8	Low
Quebec	-9.5	-11.8	-6.6	Medium	-9.8	-18.1	1.8	Low
Ontario	-6.6	-9.1	-4.9	Medium	-9.4	-14.7	-3.9	Low
Manitoba	-3.4	-6.4	-1.0	Medium	-3.3	-8.5	2.8	Low
Saskatchewan	2.0	-0.5	4.2	Medium	17.1	8.9	26.5	Low
Alberta	-4.5	-9.8	-1.3	Low	-2.6	-9.6	4.8	Low

British Columbia	-4.5	-7.2	-1.7	Medium	-4.6	-13.8	5.9	Low
Yukon	-7.5	-12.2	-2.5	Low	-11.9	-22.8	1.7	Low
Northwest Territories	-1.7	-11.1	8.0	Low	2.1	-18.9	27.6	Low

[a] Nova Scotia and Prince Edward Island each have too small of a sample size of Breeding Bird Survey routes to allow for the calculation of reliable trends, and are thus grouped together when reporting results. Source: Smith et al. 2020.

The BBS provides moderately reliable long-term population trends at national and provincial scales for the Bank Swallow, as the survey covers areas where the species is likely most abundant (COSEWIC 2013). The Bank Swallow may be over-represented in areas with roadcut habitat and aggregate pits compared to natural habitats, where the species is less likely to be detected (COSEWIC 2013). Changes in availability of human-made nesting habitats may influence detection rates of Bank Swallows during BBS road-side surveys, and ultimately influence estimated population trends at the regional and national scales. BBS data remain the best available information for assessing the population trends and status of the Bank Swallow at a national level because of their broad coverage.

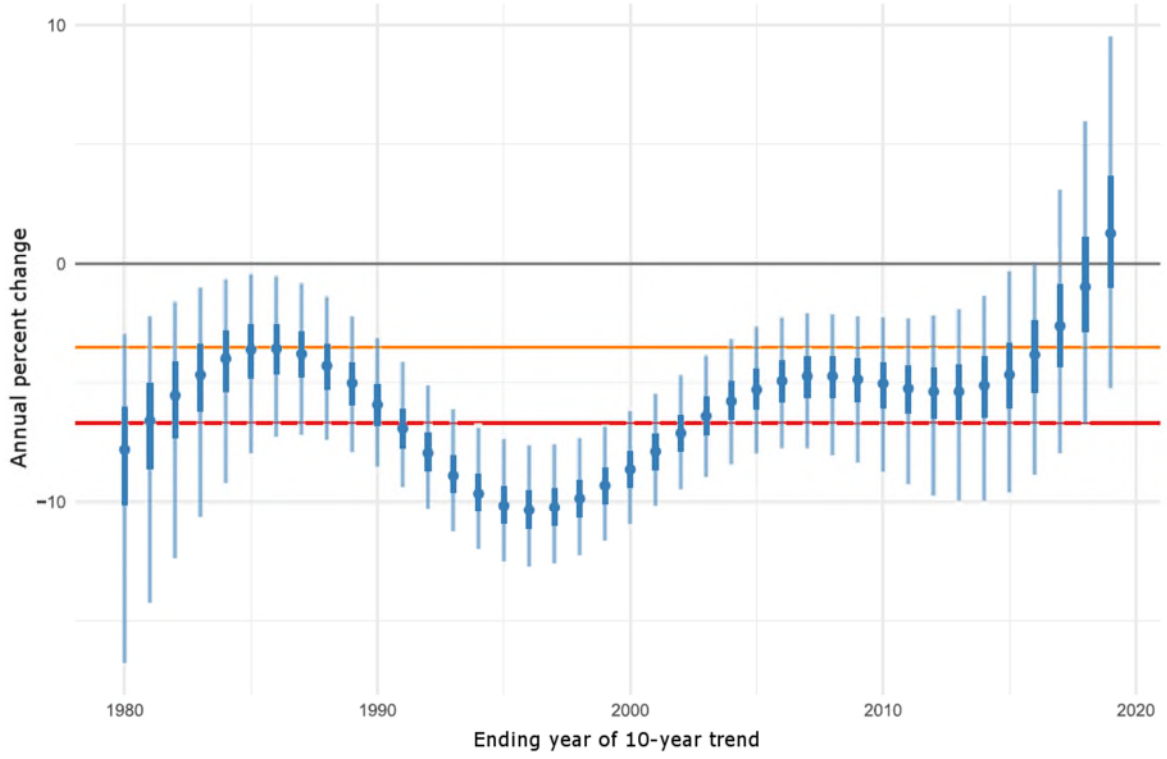

Figure 3. Annual percent change by 10 year periods of the Bank Swallow population in Canada. The most recent 10 year trend period ending in 2019 represents a 14% population increase over ten years. The orange and red horizontal lines represent 10 year population declines of 30 and 50 percent, respectively. Ten-year population declines of 30 and 50 percent correspond respectively to thresholds for threatened and endangered designations by COSEWIC. Light and dark vertical bars represent 50% and 95% confidence intervals, respectively. Trends are based on Breeding Bird Survey data. Source: Smith et al. 2020.

3.3 Needs of the Bank Swallow

Nesting habitat

Bank Swallows excavate burrows within which a rudimentary nest is built from grasses, feathers and twigs. These nesting burrows are generally excavated each year, although a small proportion of old burrows may be re-occupied (Garrison and Turner 2020); frequency of re-use of burrows varies regionally (Sinclair et al. 2020). Nesting colonies are found in vertical or near-vertical structures composed of exposed and sufficiently consolidated silt or sand deposits (Falconer et al. 2016a). Attributes of a bank include the talus and the face, also referred to as “vertical bank” or “nesting face” (John 1991; Burke 2017). Burke (2017) defines the talus as the “sloped accumulation of rock and soil debris at the base of cliff or bank” and the bank face as the “vertical portion of bank situated above talus”. The bank face represents the suitable portion of a bank where Bank Swallows can nest. In Saskatchewan, the heights of vertical banks at nesting colonies averaged 1.8 m (range 0.5–6.6; n = 60; Hjertaas 1984). A bank face height of 0.5 m is used in this recovery strategy as the minimum height of a suitable nesting site.

In natural settings, nesting colonies are generally located along river bluffs, lakeshores or coastlines where regular erosion keeps the bank suitable for burrow excavation (Falconer et al. 2016a; Garrison and Turner 2020). Nesting burrows are aggregated into colonies of variable sizes, ranging from a few nesting pairs to several thousand (COSEWIC 2013; Garrison and Turner 2020).

Bank Swallows opportunistically establish nesting colonies in human-made habitats. Burrows can be found in vertical or near-vertical faces in aggregate pits, along road-cuts, in piles of sand, gravel, or sawdust, and in holes of retaining walls (COSEWIC 2013; Falconer et al. 2016a; Garrison and Turner 2020). Human-made settings may become unsuitable for nesting within a few years without regular sediment excavation (Ghent 2001; Lind et al. 2002; Burke 2017). In both human-made and natural settings, banks lose their nesting quality when they are not regularly refreshed, resulting in hardening of the sediments, or after collapsing, resulting in a slope lower than 70 degrees (Burke 2017). Nesting habitat created from human intervention have persisted over several decades (Campbell et al. 1997), likely as a result of wind or rain erosion (R. Darvill, pers. comm.). Recent human-made structures built as surrogate nesting habitat have been rapidly colonized by Bank Swallows where natural conditions suitable for nesting have previously existed (Laberge and Houde 2015). In Ontario and California, surrogate nesting locations showed mixed results such that the structure was either removed or maintenance was ceased (OMNRF 2017). In these human-made structures, excavation or addition of material may create or maintain suitable conditions for the birds to excavate burrows.

The accumulation of sediments and the subsequent growth of vegetation on the talus slope (below the bank face) can limit the erosion process of banks supporting nesting

colonies and result in the hardening of the nesting substrate. This natural, long-term process on rivers, larger lakes and coastlines may lead to the abandonment of the nesting location and contribute to the spatiotemporal changes of colony locations. Colony locations might be further restricted by the presence of vegetation at the top of the colony face, where roots can create an obstacle to burrow excavation (Garrison and Turner 2020).

Changes in human practices are also associated with changes in colony locations. In aggregate pits, banks maintained at less than 70 degrees do not provide adequate nesting sites for Bank Swallows. Over the last decades, changes in the design of roadcuts (the steep banks alongside roads that pass through hilly terrains) to lower grades have reduced the suitability of this artificial nesting habitat compared to older designs (COSEWIC 2013). In forested areas, expansion of logging activities require sand extraction from burrow pits, which creates nesting habitat. Forestry operators are generally required to rehabilitate burrow pits by grading slopes. Overall, such changes in habitat availability might have inflated the declining trends detected by roadside surveys such as the Breeding Bird Survey.

Foraging habitat

The Bank Swallow is an aerial insectivore that forages over open country and aquatic habitats that support insect populations (Moffatt et al. 2005; Garrison and Turner 2020). Open country includes habitat with perennial cover such as natural grasslands, pastures, hayfields, and croplands (Moffatt et al. 2005; Falconer et al. 2016a; Saldanha 2016; Garrison and Turner 2020). In agricultural landscapes, hedgerows and shelterbelts enhance the richness and abundance of flying invertebrates by providing shelter; that is, refuge from perturbations of farming practices and perches for predatory insects (Griffiths et al. 2008). Aquatic habitats include rivers, creeks, lakes, wetlands and sewage lagoons, as well as coastal waters. In Ontario, Bank Swallows nesting along the shore of Lake Erie were observed foraging along the lakeshore, and over hay and pasture fields instead of cropland (G. Mitchell, pers. comm.). Croplands are often either prophylactically (as a preventive measure) or heavily treated with pesticides and typically represent low vegetation heterogeneity, which may reduce insect availability for Bank Swallows (Moffatt et al. 2005; Saldanha 2016).

Bank Swallows are “central-place foragers” meaning that the species forages in a radial pattern from the nest. The distance travelled for catching prey is influenced by environmental factors and time of breeding (Turner 1980; Saldanha 2016). The most important environmental factors are insect abundance and weather; Bank Swallows have been found to travel 80% farther to forage during cold or rainy weather (Turner 1980). By installing field markers and noting at which field markers Bank Swallows started feeding, Turner (1980) estimated the minimum travel distances between nest and feeding sites at a sand pit colony in the United Kingdom. Mean travel distance was

600 m during nest building[8], 439.2 m during egg laying[9], 388.5 m during incubation[10], 216.0 m during rearing of 1st brood[11], and 143.6 m during rearing of 2nd brood[12]. In poor weather conditions (temperature lower than 16 degrees Celcius), Bank Swallows foraged 501.8 m from the colonies (SD of 197.1; Turner 1980). In New Brunswick, Saldanha (2016) monitored presence or absence of radio tagged birds in 300 m radius plots within 2 km of colonies using manual tracking radio antenna. Swallows were detected more frequently within 300 to 600 m from colonies and seldomly detected in outer plots. Foraging trips greater than 2 km from the colonies were monitored using automated telemetry towers. While the most foraging occurred near the colonies, foraging trips greater than 2 km were frequent, with one individual travelling over 15 km from the colony (Saldanha 2016). In Ontario, radio-tagged Bank Swallows generally foraged close to colonies, with few flights detected beyond 1,000 m (Falconer et al. 2016a). Consistent with Turner's (1980) observation of travel distances in poor weather conditions and recent observations that most foraging occurs near colonies, a 500 m distance is hereby used to define the scale of foraging habitat.

There is limited knowledge of Bank Swallow foraging habitat and foraging distances outside of the breeding season, although most accounts point towards the use of a variety of open terrestrial and aquatic habitats (Falconer et al. 2016a; Garrison and Turner 2020; K. Kardynal, pers. comm. 2021). During periods of cold or rainy weather, large numbers of swallows converge to forage over habitats that support high concentrations of insects.

Roosting habitat

Roosts are the places where any number of Bank Swallows regularly settle or congregate to rest. Communal roosting of various swallow species occurs all year between dusk and dawn, although less frequently during the breeding period (COSEWIC 2013; Falconer et al. 2016a; Saldanha 2016).

During fall migration, flocks consisting of several hundred Bank Swallows mixed with other swallow species congregate at stopover roost sites (Winkler 2006; COSEWIC 2013; Garrison and Turner 2020). During the nesting period, both adults can leave the nest site and roost overnight, travelling up to 14 km in New Brunswick (Saldanha 2016; Saldanha et al. 2019) and more than 30 km in Ontario (Falconer et al. 2016b). Adults appear to frequently switch between roost locations (Saldanha 2016), suggesting that the presence of multiple roost locations in proximity to nesting colonies could have biological significance for Bank Swallows (Falconer et al. 2016b). Bank Swallows usually roost in wetlands of cattail, Phragmites or other tall vegetation (COSEWIC 2013; Falconer et al. 2016a,b; Saldanha 2016).

[8] 25 observations; standard deviation (SD) of 224.5.
[9] 60 observations; SD of 233.4.
[10] 26 observations; SD of 235.0.
[11] 59 observations; SD of 185.3.
[12] 34 observations; SD of 56.2.

During the post-fledging period, adults and young roost communally, perching on a wide variety of natural and human made structures. In Barn Swallows (*Hirundo rustica*), a species with similar communal behaviour, post-fledging occurs generally within 20 km of the nest site (C. Boynton, pers. comm. 2021). Characteristics of post-fledging habitat are not well known, despite the presumed importance of that period for recruitment of individuals into the population. Structures used for perching, such as exposed roots, tall grasses, bushes, hedgerows, trees, telephone wires and clotheslines, located close to an insect-producing habitat may be used as roosts by large numbers of swallows.

Overall, Bank Swallow roost locations and habitat characteristics are poorly known. Large swallow roosts have been detected using weather radar, but validating roost locations and species composition of roosting flocks is made difficult due to the low lighting conditions when birds enter or leave sites.

Limiting factors

Colonial nesting and communal roosting provide advantages such as protecting against predation, helping in thermoregulation, and providing an indication of habitat quality to prospecting individuals (Laughlin et al. 2016; Saldanha et al. 2019). Despite these advantages, colonial nesting and communal roosting may expose large numbers of individuals to random natural events. Bank slumping resulting in the loss of eggs, nestlings, fledglings or adults, limited food availability in adverse weather or depredation of nests can reduce the overall productivity or survival of the population. Local colony sizes can decrease within the nesting season due to erosion, bank collapse, predation, and burrow slumping, then increase due to re-nesting after erosion (Cadman and Lebrun-Southcott 2013).

Depredation of eggs, nestlings, fledglings or adults may reduce the productivity of the population. However, burrow nesting offers relative protection against predators (COSEWIC 2013; Burke 2017). Predators include raccoons, foxes, chipmunks, badgers, skunks, weasels, coyotes, snakes, hawks, falcons, crows, gulls, ravens and grackles (COSEWIC 2013; Falconer et al. 2016a; Burke 2017). Mammalian predators may depredate a large proportion of nests within a colony over a short period. Burke (2017) observed lower predation rates at aggregate pit colonies in relation to lakeshore colonies.

Several flea species (order Siphonaptera) are known to inhabit Bank Swallow burrows (Hass et al. 1980) and can reduce nestling weights by about 5% (Alves 1997). Several larval blowfly species (order Diptera) frequently infest colonies, and at least one species, *Protocalliphora chrysorrhoea*, is restricted almost entirely to inhabiting the nests of Bank Swallows and parasitizing nestlings (Sabrosky et al. 1989). Although *P. chrysorrhoea* infestations may cause physiological stresses in nestlings, nestling mortality rates are unaffected (Whitworth and Bennett 1992). Burke (2017) observed that fledglings at aggregate pit sites had fewer ectoparasites than fledglings at lakeshore sites, possibly because of a higher number of old burrows along lakeshores containing parasites from the previous year.

4. Threats

4.1 Threat Assessment

The Bank Swallow threat assessment is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system (version 2.0). This threat assessment was conducted in May 2018. 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. 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 4. Threat calculator assessment.

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
1	Residential & commercial development	Negligible	Negligible (<1%)	Extreme (71-100%)	High (continuing)
1.1	Housing & urban areas	Negligible	Negligible (<1%)	Extreme (71-100%)	High (continuing)
1.2	Commercial & industrial areas	Negligible	Negligible (<1%)	Extreme (71-100%)	High (continuing)
2	Agriculture & aquaculture	Negligible	Negligible (<1%)	Slight (1-10%)	High (continuing)
2.1	Annual & perennial non-timber crops	Negligible	Negligible (<1%)	Slight (1-10%)	High (continuing)
2.3	Livestock farming & ranching	Negligible	Negligible (<1%)	Slight (1-10%)	High (continuing)
2.4	Marine & freshwater aquaculture	Not Calculated	-	-	-
3	Energy production & mining	Negligible	Large (31-70%)	Negligible (<1%)	High (continuing)
3.2	Mining & quarrying	Not a Threat	Large (31-70%)	Neutral or Potential Benefit	High (continuing)
3.3	Renewable energy	Negligible	Restricted (11-30%)	Negligible (<1%)	High (continuing)

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
4	Transportation & service corridors	Low	Pervasive (71-100%)	Slight (1-10%)	High (continuing)
4.1	Roads & railroads	Low	Pervasive (71-100%)	Slight (1-10%)	High (continuing)
4.3	Shipping lanes	Not a Threat	Negligible (<1%)	Neutral or Potential Benefit	High (continuing)
4.4	Flight paths	Not Calculated	-	-	-
5	Biological resource use	Negligible	Negligible (<1%)	Negligible (<1%)	High (continuing)
5.1	Hunting & collecting terrestrial animals	Negligible	Negligible (<1%)	Negligible (<1%)	High (continuing)
6	Human intrusions & disturbance	Negligible	Negligible (<1%)	Slight (1-10%)	High (continuing)
6.1	Recreational activities	Negligible	Negligible (<1%)	Slight (1-10%)	High (continuing)
6.3	Work & other activities	Negligible	Negligible (<1%)	Negligible (<1%)	High (continuing)
7	Natural system modifications	Medium	Pervasive (71-100%)	Moderate (11-30%)	High (continuing)
7.1	Fire & fire suppression	Unknown	Unknown	Unknown	Unknown
7.2	Dams & water management/use	Low	Small (1-10%)	Serious (31-70%)	High (continuing)
7.3	Other ecosystem modifications	Medium	Pervasive (71-100%)	Moderate (11-30%)	High (continuing)
7.4	Removing / Reducing human maintenance	Low	Small (1-10%)	Moderate (11-30%)	High (continuing)
8	Invasive & problematic species, pathogens & genes	Low	Restricted (11-30%)	Slight (1-10%)	High (continuing)
8.1	Invasive non-native/alien plants and animals	Negligible	Negligible (<1%)	Negligible (<1%)	High (continuing)
8.2	Problematic native plants and animals	Low	Restricted (11-30%)	Slight (1-10%)	High (continuing)

Threat #	Threat description	Impact[a]	Scope[b]	Severity[c]	Timing[d]
9	Pollution	Unknown	Large (31-70%)	Unknown	High (continuing)
9.2	Industrial & military effluents	Unknown	Unknown	Unknown	High (continuing)
9.3	Agricultural & forestry effluents	Unknown	Large (31-70%)	Unknown	High (continuing)
9.5	Air-borne pollutants	Unknown	Large (31-70%)	Unknown	High (continuing)
11	Climate change & severe weather	Unknown	Pervasive (71-100%)	Unknown	High (continuing)
11.1	Ecosystem encroachment	Unknown	Small (1-10%)	Unknown	High (continuing)
11.3	Changes in temperature regimes	Unknown	Pervasive (71-100%)	Unknown	High (continuing)
11.4	Changes in precipitation & hydrological regimes	Unknown	Pervasive (71-100%)	Unknown	High (continuing)
11.5	Severe / Extreme Weather Events	Unknown	Pervasive (71-100%)	Unknown	High (continuing)

[a] **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.

[b] **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%).

[c] **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 ≥ 0%).

[d] **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

The causes of Bank Swallow population declines are unclear. Multiple factors are likely having a cumulative impact on the species; it is unknown if a specific threat limits the Bank Swallow somewhere on its range or during part of its annual cycle. This recovery strategy considers the declines in aerial insect-prey populations resulting from the broad-scale ecosystem modifications in the breeding, migration, and wintering areas of the species, as the most likely primary threat to Bank Swallow (Table 4). It is unknown if climate change is inducing net gains or losses in nesting habitat and insect-prey availability. However, climate change likely induces a mismatch in timing between nest initiation and insect prey emergence, which may have an impact on nestling survival. Several other threats, described below, likely have a lower, but cumulative impact on the species. Threats might have a lower or higher impact on the Bank Swallow in certain parts of its breeding range in Canada, depending on the landscape composition and the proportion of natural or human-made habitats used by the species for nesting or foraging. Threats likely to affect the species within the next ten years are described below from highest to lowest impact and certainty.

In this section, information that is not accompanied by a reference, such as estimations of scope and severity and the resulting level of impact, has been obtained from expert opinion during the assessment of IUCN-CMP threats to the Bank Swallow in May 2018.

IUCN-CMP Threat 7.3 Other ecosystem modifications (Medium impact)

Insect populations are exhibiting significant declines worldwide (Conrad et al. 2006; Collen et al. 2012; Dirzo et al. 2014; Sánchez-Bayo and Wyckhuys 2019). A review of global faunal population trends noted that 33% of all insects with available IUCN-documented population trends were declining and many also exhibited range contractions (Dirzo et al. 2014). Ecosystem modifications that have the highest level of impact to the Bank Swallow include those associated with declines in aerial insect-prey diversity and abundance. These threats, described below, result from the loss or degradation of ecosystem functions supporting insect production, possibly the primary limiting factor to the recovery of the Bank Swallow and other aerial insectivores. Populations of aerial insectivores are showing dramatic declines, particularly in northeastern North America (Nebel et al. 2010; Michel et al. 2015; Smith et al. 2015). The common diet of this diverse group of species implies a reduction in available insect prey in breeding, migratory, or wintering areas as a probable contributing factor in the declining population trends of aerial insectivores (Nebel et al. 2010, Hallman et al. 2014; Rioux Paquette et al. 2014; Smith et al. 2015; Imlay et al. 2018a).

Ecosystem modifications that have a lower level of impact on the Bank Swallow include those associated with the loss or degradation of nesting habitat in the breeding range in Canada. These threats are prevalent in the southern part of the species' Canadian range where humans have extensively modified shorelines and coastlines to prevent or control erosion and have altered hydrological regimes. Cumulatively, the scope of ecosystem modifications on the species is considered pervasive.

Loss of natural habitat supporting insect production

The ongoing loss of ecosystem functions that support insect production, including the conversion of natural habitats and farmland for residential and commercial developments, and for intensive agriculture is an important threat throughout the species' range. Aquatic habitats, such as wetlands, ponds and sewage lagoons, likely provide higher-quality prey for Bank Swallows compared to terrestrial habitats and aggregate pits (Twining et al. 2016, 2018; Génier et al. 2021). Across southern Canada, wetlands are especially vulnerable to drainage and land conversion (Kennedy and Mayer 2012). By 2002, in Southern Ontario, over 85% of wetlands that existed prior to European settlement (early 1800s) had been permanently converted to other land types (Ducks Unlimited Canada 2010). Similarly, about 25% of the original wetlands of the prairie potholes region of southwestern Manitoba remain (ECCC 2016) and more than 90% of remaining wetlands have been negatively impacted from agriculture (Bartzen et al. 2010). In the United States, where the species is both a passage migrant and where a large proportion of its population nests, about half of natural wetlands have been lost since European settlement (Dahl 2000, 2011). Despite a significant reduction in the loss of wetland area in Canada and in the United States due to "no net loss" policies, natural wetlands and their ecological functions continue to be lost from agricultural and urban expansion (Quigley and Harper 2006). The loss of insect-producing habitats is ubiquitous over the Bank Swallow's range and likely has cumulative effects with other threats resulting in projected population declines.

Changes in agricultural practices

Agricultural practices and the expansion of agricultural lands associated with European settlement in North America likely contributed to an increase in the extent of open habitat types that supported considerable insect production and Bank Swallow foraging habitat. From European settlement until the mid-twentieth century, landscapes in southern Canada have changed dramatically with the expansion of agriculture (Neave and Baldwin 2011, cited in Falconer et al. 2016a). In provinces east of the Prairies, forested lands have been converted to open habitat and urban areas, while most natural grassland have been converted to arable land, likely increasing the available foraging habitat for Bank Swallow and other aerial insectivore birds foraging in open habitats. In the grasslands and parklands regions of the Canadian Prairies, natural grasslands have largely been converted to arable land following European settlement.

In the last century, afforestation of agricultural land has reduced open country habitats used as foraging habitat by the Bank Swallow in Ontario and Quebec (Latendresse et al. 2008; Neave and Baldwin 2011, cited in Falconer et al. 2016a). However, in the last 40 years, the amount of open country habitat in North America has not changed extensively (Latendresse et al. 2008; Neave and Baldwin 2011, cited in Falconer et al. 2016a). The increasing rate of agricultural intensification is expected to reduce the rate of afforestation over the long term in Quebec (Latendresse et al. 2008) and likely in other provinces east of the Prairies. In the Prairies, agriculture remains the dominant

land use, with frequent changes in types of crops between years (ESTR Secretariat 2014; PHJV 2014).

Since the 1960s, the agricultural sector has been changing dramatically. There has been widespread adoption of intensive agricultural practices in many areas; however, other areas have seen a reduction in land area used for crops, especially in the northeast of Canada (Neave and Baldwin 2011, cited in Falconer et al. 2016a). Agricultural intensification includes the increasing extent of monocultures over mixed crops; the amalgamation of small farms into larger farms; the removal of hedgerows between crops; the removal of riparian buffers; the drainage or filling of seasonal wetlands; and the abandonment of set-aside fallows (Jobin et al. 1996; Matson et al. 1997; Donald et al. 2001; Benton et al. 2003; Murphy 2003; Tscharntke et al. 2005; Latendresse et al. 2008; Watmough et al. 2017; Statistics Canada 2020).

Agricultural intensification results in the loss of non-crop land cover, such as pastures, wetlands, old fields and field margin vegetation including hedgerows, and shelterbelts (Benton et al. 2003; Latendresse et al. 2008; Watmough et al. 2017), which constitute insect producing habitat. These changes have generally resulted in agroecosystems supporting lower levels of invertebrate prey (Benton et al. 2003; Donald et al. 2006; Ghilain and Bélisle 2008) especially later during the breeding season (Rioux Paquette et al. 2013). Lower prey abundance in agricultural landscapes has been associated with lower reproductive success (Ghilain and Bélisle 2008; Rioux Paquette et al. 2014) and reduced breeding adult body condition in Tree Swallows (*Tachycineta bicolor*; Stanton et al. 2016).

Overall, agricultural intensification reduces the availability of insect-rich, open habitats (Benton et al. 2003; ESTR Secretariat 2014; Falconer et al. 2016a) leading to declines in avian populations and farmland biodiversity (Chamberlain et al. 2000). The effects of insect-producing habitat loss are likely twofold: by reducing the reproductive output of breeding Bank Swallows, as observed in other aerial insectivores (Ghilain and Bélisle 2008; Rioux Paquette et al. 2014); and by limiting the suitability of potential nesting habitat adjacent to insect-rich, open habitats (Moffat et al. 2005).

Use of pesticides

Insecticide use in agricultural or forested landscapes can have indirect effects on insectivorous birds through reductions in abundance of insects on which the Bank Swallow feeds (Boatman et al. 2004; Stanton et al. 2018). In addition, insecticide use has been associated with long-term changes in invertebrate species composition and reduction in diet quality in aerial insectivores (Nocera et al. 2012; Pomfret et al. 2014).

Introduced in the 1990s, neonicotinoid insecticides are currently the most widely used class of insecticides globally and their use continues to increase. Neonicotinoids are ubiquitous in many landscapes where crop agriculture is the dominant land use (Sparks 2013; Douglas and Tooker 2015; Malaj et al. 2020). In Canada, the three major neonicotinoids (thiamethoxam, clothianidin, and imidacloprid) are all in the top 5 most

frequently applied insecticides in the Prairie Pothole Region, where about 85% of the country's pesticides are applied (Malaj et al. 2020). Neonicotinoids are highly soluble in water and are used as systemic insecticides, meaning that they are absorbed and distributed through all parts of the plant. They are most commonly applied as seed treatments, and it is estimated that twenty percent or less of the seed treatment goes into the plant, with the remainder entering the environment through the soil, water, and as dust (Goulson 2014). Neonicotinoids can persist in soil for years. Due to their solubility, they readily move into aquatic environments (Environment Canada 2011; Main et al. 2014) and disperse to untreated areas, resulting in chronic exposures in non-target organisms (Goulson 2013; Jones et al. 2014; Krupke and Tooker 2020). Neonicotinoids were detected in wetlands located near cultivated crops over one year following seeding, and watercourses away from application areas (Environment Canada 2011; Xing et al. 2013; Main et al. 2014; Morrissey et al. 2015; Struger et al. 2017).

Neonicotinoids have been found to impair aquatic habitat function, including the production of insects used as prey by insectivorous birds (Pisa et al. 2014, 2021; Cavallaro 2019). Some of the most sensitive species are emergent aquatic insects, which are a group that comprises a large proportion of the swallow diet (Morrissey et al. 2015; Maloney et al. 2018). Reduced prey availability could potentially result in reduced reproductive rates (Ghilain and Bélisle 2008; Rioux Paquette et al. 2014).

Recently, in Canada, some mitigation measures have been put in place to reduce the risk of the neonicotinoids thiamethoxam and clothianidin to aquatic invertebrates (Health Canada 2021a,b). However, neonicotinoids will continue to be used on large areas of Canada on cereal, oilseed, vegetable crops, forestry, and in greenhouses. In addition, there are several systemic insecticides being used as alternatives or in combination with neonicotinoids, such as butenolides and diamides, which are increasing in use and are being detected in wildlife and the environment (e.g., Bishop et al. 2020). Those products share many characteristics with neonicotinoids, including neurotoxicity, water solubility, and environmental persistence. There is evidence that diamides are more toxic than neonicotinoids to aquatic invertebrates (EFSA 2013, Lavtizar et al 2015, Maloney et al 2019), but effects in birds are still largely unknown.

Various types of insecticides are used in livestock production against nuisance insects and parasites. Insecticides provided to livestock as feed additives or boluses are released in cattle manure to control growth of pest insects (Townsend 2016). Presence of livestock and associated pastures are generally considered beneficial habitats for flying insect on which aerial insectivores prey on (Musitelli et al. 2016). Manure provides good egg laying environment for flies, beetles and other insects that are potential prey species for Bank Swallows found in or near livestock pastures. While insecticide residues in manure could result in lower insect abundance (Buijs and Mantingh, 2019) or contaminated preys, effects on breeding aerial insectivores remain to be investigated as they are not cited in reviews of scientific literature (see Stanton et al. 2018; Berzins 2020).

In Canada, microbial insecticides are commonly used since the 1980s for controlling populations of biting insects, such as mosquitoes and flies. The larvicide *Btk* (*B.t. var. kurstaki*), which occurs naturally in soils, is used extensively in southern Ontario for the control of gypsy moths in woodlots and in urban areas. The larvicide *Bti* (*Bacillus thuringiensis var. israelensi*) is commonly used in rural areas for biting mosquito control. In a study in France, *Bti* application was found to impact non-target invertebrates and ultimately reduce the Common House Martin (*Delichon urbicum*), an aerial insectivore bird (Poulin et al. 2010; Jakob and Poulin 2016). A review of risks related to *Bti* application identified negative, indirect effects on food chains, wildlife populations, and ecosystem services (Gouvernement du Québec 2019).

Direct evidence between pesticide use and Bank Swallow reproductive success are lacking (Stanton et al. 2018). However, various studies demonstrated the effects of pesticides on population trends of swallows and other species (Hallmann et al. 2014; Stanton et al. 2018; Li et al. 2020). Finally, warmer temperatures have increased the abundance of pest insects in cereal crops, suggesting that climate change may ultimately result in increased pesticide use in agricultural systems (Ewald et al. 2015). The effect of pesticides on foraging habitat quality is considered pervasive in scope, given that the foraging habitat of Bank Swallows is often associated with waterbodies and agricultural landscapes.

Use of fertilizers

Limited information is available on the indirect effects of fertilizer application on invertebrate and bird communities in agricultural landscapes (Stanton et al. 2018, but see Yosef and Deyrup 1998); despite high fertilizer input typically being associated with intensive agriculture (Hole et al. 2005). Despite limited gains in crop productivity, over-application of phosphorus fertilizers may result in persistent accumulation in soils and leaching to waterbodies (AAFC 2018).

Nutrient leaching from terrestrial systems to waterbodies result in increased blooms of cyanobacteria (blue-green algae) and hypoxic conditions. The compounded effects of nutrient leaching, pesticide contamination, and climate change in the Great Lakes have been associated with long-term declines in *Hexagenia* mayflies (Stepanian et al. 2017, 2020). Another indirect, negative effect of fertilizer use on avian species includes contamination by cyanotoxins during harmful cyanobacteria blooms. Cyanotoxin contamination was detected throughout a riparian food-chain, but no detrimental effects were detected in the nestlings of Prothonotary Warblers (*Protonotaria citrea*), an insectivorous bird (Moy et al. 2016). Potential effects of fertilizer application on the Bank Swallow foraging habitat are likely pervasive, but more information is needed to determine impacts at population-level.

Erosion-control measures

Erosion control measures have been implemented widely along shorelines where human settlements occur or where they reduce the risk of damage to infrastructure (COSEWIC 2013). Erosion control includes shoreline stabilization using hard structures (groynes, seawalls, breakwaters, and rock embankments) and soft structures (vegetation and beach nourishment). Boyer-Villemaire et al. (2016) reviewed the cost-benefit analysis of erosion control measures in coastal settings against no intervention scenarios. This analysis concluded that hard structures were optimal in 15% of scenarios, whereas soft structures or non-intervention was optimal in 85% of scenarios.

Bank stabilization can result in direct nesting habitat loss for Bank Swallows either by replacing the bank's unconsolidated sediments with hard structures or by changing the bank slope angle making the site unsuitable for burrow excavation (Bank Swallow Technical Advisory Committee 2013; Silver and Griffin 2009; Falconer et al. 2016a). Bank stabilization can indirectly result in nesting habitat loss when the natural erosion processes are eliminated by stabilizing the base of the bank or removing wave action (Silver and Griffin 2009; Chassiot et al. 2020). In California, the loss of nesting habitat from shoreline stabilization along the Sacramento River was directly related to local colony extirpation (Bank Swallow Technical Advisory Committee 2013). Removal of shoreline stabilization structures along the Sacramento River was identified as a key measure for the recovery of Bank Swallow in California (Girvetz 2010).

In addition to water level fluctuations, wave action from shipping vessels and recreational boating can contribute to excessive rates of shoreline erosion that threaten ecosystems and infrastructures (ECCC 2018a). Since 2000, a voluntary speed reduction of shipping vessels reduced shoreline erosion resulting from wave action. However, wave action remains an important driver of erosion in narrow portions of the St. Lawrence Seaway, such as in the Îles de Contrecoeur National Wildlife Area (ECCC 2018a).

The expected increase in coastal erosion from rising sea levels and ice scouring associated with climate change (see threats 11.3 and 11.1), as well as the expansion of human developments along coasts may accelerate efforts to stabilize shorelines (Environment Canada 2006; Lemmen et al. 2016) and further nesting habitat loss. Along inland waterbodies, the expected increase in water level fluctuations and extreme events such as spring runoff and ice scouring may also result in increased efforts to stabilize shorelines (M. Cadman, pers. comm.).

IUCN-CMP Threat 7.2 Dams & Water management (Low impact)

Fluctuations in water levels and peak discharge rates in creeks, rivers and lakes throughout inhabited areas of North America are now widely controlled by the use of flood control and hydroelectricity dams (Graf 2006; Monk et al. 2010). The loss of natural hydrological processes on dammed rivers is considered to have reduced bank

erosion rates, which led to lower nesting site availability (Moffat et al. 2005; Falconer et al. 2016a). New hydroelectricity developments are scarce[13] on the species' Canadian breeding range, but may impact large colonies in otherwise undisturbed areas. New constructions of hydroelectricity dams may result in various positive or negative impacts until a new hydrological regime stabilizes (Silver and Griffin 2009). Short-term effects are considered to have an extreme severity on the species if existing nesting sites are lost during reservoir flooding. Upstream from dams, reservoir flooding is expected to create bank instability for some time after water levels stabilize, potentially resulting in the creation of nesting sites. On altered watercourses, long-term effects are associated with the absence of natural water flow regimes such as seasonal flooding and high precipitation events. Stabilization of hydrological regimes may reduce bank erosion processes necessary to expose unconsolidated sediments where Bank Swallows can excavate burrows (Falconer et al. 2016a). Furthermore, impoundment and fast release of water by hydroelectric dams can flood occupied nest burrows causing mortality of adults, eggs, nestlings or fledglings (CEAA 2009; COSEWIC 2013). Changes in hydrological regimes are also expected to alter upstream and downstream habitats used by Bank Swallows for roosting or foraging. Overall, changes in hydrological regimes are considered to have localized, but extreme effects on the species.

Some of the largest Bank Swallow colonies in Canada occur on the Great Lakes, where water levels are controlled extensively for water consumption, navigation, and electricity production (IJC 2012). Control of water levels on the Great Lakes and the St. Lawrence River have reduced extreme water level fluctuations (IJC 2012). Rising water levels over the last two decades (Gronewold et al. 2013) is considered to have accelerated lakeshore erosion (G. Mitchell, pers. comm., see Bain et al. 2008), which may lead to higher erosion-control efforts from artificial bank stabilization. However, there is a great amount of uncertainty in projections of Great Lakes water levels (IJC 2012), therefore future impacts on nesting site availability and distribution for Bank Swallow cannot be well predicted (COSEWIC 2013).

IUCN-CMP Threat 4.1 Roads & railroads (Low impact)

Exposure of Bank Swallows to roads is widespread within the species' range. Collision with moving vehicles is considered a minor issue relative to other threats, but regularly occurs with Bank Swallow (Mead 1979a; Ashley and Robinson 1996). Time of year, road configuration, traffic volume and traffic speed influence risk of bird collision with vehicles (Bishop and Brogan 2013). Construction of new roads encroaching on waterbodies, as well as maintenance of existing roads and roadcuts may result in the loss of natural nesting sites. In some regions of the breeding grounds, Bank Swallows have nested extensively on roadcuts when road design created suitable nesting conditions (COSEWIC 2013). Modern standards for road and railroad construction likely do not create suitable nesting habitat, but new habitat might be created in the aggregate pits that provide construction material for those transportation corridors. In areas where the species still nest on roadcuts, the widening of rights-of-way, straightening of roads,

[13] As of December 2020, the Canadian Impact Assessment Registry lists two hydroelectricity projects for which an environmental impact assessment is in progress.

and sloping of roadside banks might result in the removal or reduction of nesting habitat. In Canada, the number of colonies found on roadcuts have declined overall, which may partially explain regional population trends obtained from Breeding Bird Survey data.

IUCN-CMP Threat 7.4 Removing / Reducing Human Maintenance (Low)

Closure of aggregate pits

In the Prairie Provinces, Ontario and Quebec, most Bank Swallow colonies are found in sand or gravel extraction sites, generally referred to as aggregate pits. Bank Swallows nest opportunistically in these artificial nesting sites maintained by extraction activities. The majority of those sites are owned by the industry, or municipal, provincial or territorial governments. In Ontario, 85% of aggregate production takes place in the southern part of the province, following demand where urban expansion and development have been the most extensive (Binstock and Carter-Whitney 2011). Although historical industry practices promoted the operation of extraction sites close to urban centers (Yundt and Messerschmidt 1979), the reliance on aggregate reserves located further from these areas is expected to increase (Binstock and Carter-Whitney 2011).

The aggregate extraction industry was largely unregulated until the 1970s (COSEWIC 2013). Provincial regulations have been implemented to increase licensing and rehabilitation requirements (COSEWIC 2013; Falconer et al. 2016a). Extraction methods and safety policies have limited the occurrence of steep or vertical faces, which have been replaced by gentler or tapered banks that are largely unsuitable for nesting Bank Swallows (COSEWIC 2013). The ongoing rehabilitation of smaller aggregate pits reduces the availability of nesting sites. Several studies from Europe have linked declines in Bank Swallows to changes in the aggregate industry practices (Heneberg 2013).

In Ontario, demand of aggregate material is expected to increase over the next 20 years based on economic and population growth (OMNR 2010). Newly created aggregate pits that provide and maintain nesting habitat will contribute to the regional persistence of the Bank Swallow. Although sand and gravel currently are important sources of aggregate, crushed stone is expected to occupy a larger proportion of the aggregate needs (OMNR 2010). This type of aggregate does not present characteristics for burrow excavation, so crushed stone quarries will likely not provide suitable habitat for Bank Swallow.

Sandpits contribute to the regional persistence of Bank Swallows in areas where riverbanks have become unsuitable for nesting (Burke 2017, 2019; Masoero et al. 2019). However, compared to natural nesting sites, increased mortality occurs as a result of predation or excavation (Williams 2010; Cadman and Lebrun-Southcott 2012; Calvert et al. 2013) and adults show poorer body condition at the end of the breeding season (Burke 2019). Despite those hazards, high reproductive success in aggregate

pits of southern Ontario suggests that those habitats are at least equivalent in quality to natural nesting sites (Burke 2019). Overall, closure or reduced maintenance of aggregate pits reduces the availability of nesting habitat for the Bank Swallow (Lind et al. 2002; Heneberg 2013), but likely impacts a small proportion of the population.

IUCN-CMP Threat 8.2 Problematic native plants & animals (Low impact)

Increasing abundance of ravens (*Corvus corax*), coyotes (*Canis latrans*), foxes (mostly *Vulpes vulpes*), raccoons (*Procyon lotor*), skunks (*Mephitis mephitis*) and gulls (*Larus sp.*) above background levels due to increased urbanization may be leading to increased depredation of eggs or nestlings at colonies. Depredation during the nesting period may reduce the reproductive success of the population. For example, raccoons have greatly expanded their range northwards over the course of the last century, possibly due to an increase in food availability related to the expansion of agriculture (Larivière 2004). They are now widespread in the Canadian Prairies and even in the boreal forest (Larivière 2004; Latham 2008) and their distribution overlaps that of Bank Swallow. The impact of this threat is low relative to other threats.

IUCN-CMP Threat 3.2 Mining & Quarrying (Not a threat)

The destruction of nests, eggs or birds during legitimate operations at aggregate pits, known as incidental take, is a threat to the Bank Swallow (COSEWIC 2013; Falconer et al. 2016a). Extraction of aggregate material provides nesting opportunities for the species, while exposing birds that are nesting to disturbance or mortality when avoidance measures are not properly applied by aggregate pit operators. Across Canada, a large proportion of Bank Swallows use human-made nesting habitat (see section 7.1 Identification of the Species' Critical Habitat), a proportion that greatly varies by province and territory. The severity of aggregate pit operations is considered "Neutral or Potential Benefit" but must be considered on the balance that creation of nesting habitat positively outweighs the negative impacts of incidental take. The severity ranges from negligible (estimate of 58,000 eggs or nestlings destroyed annually by pit operations in Canada; see Williams 2010 in Calvert et al. 2013) to moderate-large when extrapolating the loss of 32% of all burrows in aggregate pits surveyed in Wellington County, ON (COSEWIC 2013).

IUCN-CMP Threat 11.3 Changes in temperature regimes (Unknown impact)

Changes in temperature regimes are defined as broad-scale changes in mean temperatures and temperature extremes as a result of climate change. These changes are expected to affect Bank Swallows negatively, although the magnitude of population declines from this threat are unknown. In Canada, spring temperatures are generally increasing, which results in the earlier emergence of insects consumed by aerial insectivores.

Some insectivorous bird species have capitalized on these environmental changes by arriving earlier on their breeding grounds and expanding the duration of their breeding

season (Newton 2007; Vafidis et al. 2016; Iron et al. 2017). Some species of aerial insectivores, especially long-distance migrants such as the Bank Swallow, face an increasing temporal mismatch between food availability and energy requirements during the breeding season (Both et al. 2010; Ambrosini et al. 2011; Saino et al. 2011; Calvert 2012; Imlay et al. 2018b; 2019). Bank Swallows rely on abundant prey to recover from migration to accumulate energy reserves to produce offspring. In the Maritimes, nest-monitoring information suggests that clutch initiation date of Bank Swallows in the 2006–2016 decade was similar to the 1960s, despite earlier spring insect abundance peaks (Imlay et al. 2018b). Productivity declines observed there (-46% fledglings/pair) may be related to a mismatch between food supply and breeding phenology (Imlay et al. 2018b), possibly in addition to carry-over effects from conditions on the wintering grounds (Imlay et al. 2019). It is unknown if the species has shown similar changes in breeding performance elsewhere within its breeding range, thus the severity of this threat remains unknown.

Other effects of changes in temperature regimes include reduced ice cover on large waterbodies and oceans (Lemmen et al. 2016). Reduced ice cover is likely to increase wave action during winter storms and thus increase the frequency of erosion events (Lemmen et al. 2016; Chassiot et al. 2020). Although increased shoreline erosion might create potential nesting habitat for Bank Swallow in the short term, erosion-control efforts may also be deployed to protect infrastructure, leading to a net loss in nesting habitat on the long term.

IUCN-CMP Threat 11.4 Changes in precipitation and hydrological regimes (Unknown impact)

Environmental conditions, such as precipitation and temperatures during winter and spring, influence insect abundance in the spring. Spring insect abundance is an important factor in the breeding performance of insectivorous birds (Williams et al. 2015; Imlay et al. 2018b). In early spring, lower amounts of precipitation can reduce the extent of insect-producing habitats, such as wetlands. Projected changes in precipitation vary by region and by season. Across the species' breeding range in Canada and especially in the Prairies, more precipitation in the winter and spring is expected over the next 30 years (Representative Concentration Pathway 4.5 scenario; Prairie Climate Centre 2019). Bank Swallow survival and, through carry-over effects, breeding productivity, will also be influenced by changes in precipitation and hydrological regimes in the non-breeding grounds. A better understanding of migratory connectivity between breeding and non-breeding grounds is necessary to estimate the effects of these changes on regional Bank Swallow population trends observed in Canada.

IUCN-CMP Threat 11.5 Severe / extreme weather events (Unknown impact)

Severe weather events, such as high winds, heavy precipitation or extreme temperatures, can disrupt the ability of aerial insectivores to forage or temporarily reduce the availability of air-borne invertebrate prey (Grüebler et al. 2008; Møller 2013; Cox et al. 2019). During cold or rainy weather, aerial insectivores may need to travel

longer distances before returning to the nest (Turner 1980), therefore reducing on a daily basis the amount of food provided to nestlings. Severe weather events, such as hurricanes, can also increase mortality rates during migration or delay arrival date on breeding grounds. Heavy precipitation events that occur during the breeding period can result in bank slumping and cause nest failures. However, those weather events can also create new banks (Chassiot et al. 2020) with suitable nesting habitat characteristics. Climate change is expected to increase the frequency and magnitude of severe weather events encountered by Bank Swallows throughout their annual life cycle.

Projected changes in precipitation patterns vary by region. Over the next 30 years, the Pacific coast, Quebec and Atlantic provinces are likely to see more days of heavy precipitation events, with limited change elsewhere in Canada (Representative Concentration Pathway 4.5 scenario; Prairie Climate Centre 2019). The effects of these changes on the Bank Swallow's breeding performance and on local population trends have not been assessed.

During breeding and non-breeding periods, increased frequency and severity of storms and flooding could increase shoreline erosion rates (creating nesting habitat). During the breeding period, rapid changes in water levels associated with flash rainstorms can potentially increase bank or cliff collapse or flooding. Higher erosion rates could lead to increased artificial bank stabilization, contributing to permanent loss of nesting habitat. While this threat will affect Bank Swallows across their breeding range, there is no information on the balance between loss and replacement of nesting habitat.

IUCN-CMP Threat 9.3 Agricultural & forestry effluents (Unknown impact)

In addition to the indirect effects of pesticides on birds discussed above, direct contact with pesticides can cause mortality and sub-lethal effects that may contribute to bird population declines in North America, especially for those species that breed, winter, or migrate through agricultural areas (Mineau and Whiteside 2013). Direct exposure could be through inhalation, absorption through the skin, or consumption of contaminated prey or water. Although direct effects of pesticides on Bank Swallow are largely undocumented, pesticide use on both breeding and non-breeding grounds has been implicated in direct mortality and habitat degradation for many avian species (e.g., Goldstein et al. 1999; Mineau et al. 2005; Rogers et al. 2019).

Most organochlorine pesticides (compounds such as DDT[14]) have been banned for decades in North America. However, those products are still in use in Central and South America (Klemens et al. 2000; Lebbin et al. 2010; Nebel et al. 2010) for mosquito control and in agricultural practices. In addition, they are highly persistent and bioaccumulative; chronic exposure to organochlorine insecticides will likely continue to occur for decades in areas of historic use. Little is known about the extent to which Bank Swallows and other neotropical migrant passerines are exposed to organochlorine pesticides throughout their lifetime, but there is some indication that neotropical migrant

[14] DDT – dichlorodiphenyltrichloroethane.

insectivores are still being exposed to organochlorine pesticides in North America (Kesic 2021) and during the non-breeding period (Maldonado et al. 2017).

Acutely neurotoxic organophosphorus and carbamate compounds were used increasingly since the majority of organochlorine pesticides were restricted in North America in the 1970s and banned in the 1980s (Commission for Environmental Cooperation of North America 2003). Several of these compounds, such as monocrotophos and carbofuran, have been banned in multiple jurisdictions due to their high toxicity to vertebrates including humans. However, other products are still commonly used in Canada, such as chlorpyrifos and malathion (Malaj et al 2020).

In the Netherlands, the presence of neonicotinoids in surface waters have been correlated with declines in insectivorous birds (Hallmann et al. 2014). In North America, higher neonicotinoid use is associated with steeper declines of aerial insectivores and grassland birds (Li et al. 2020). Declines may be in relation to a reduction of insect prey, but direct effects on birds from exposure to low, sub-lethal concentrations are possible (Lopez-Antia et al. 2015; Eng et al. 2017, 2019; English et al. 2021). The exposure of Bank Swallows to neonicotinoid pesticides is unknown but, given the species' habitat preferences, it is probably widespread on its breeding and non-breeding grounds. Recent assessments have demonstrated that neonicotinoids are routinely detected in birds, including species that do not eat seeds (e.g., Bishop et al. 2018, 2020; Graves et al. 2019; Elgin et al. 2020). Neonicotinoids are metabolized by birds within hours to days (Eng et al. 2021); their detection in non seed-eating birds is an indication of widespread environmental contamination. Notably, in Tree Swallows breeding in Canada's Prairie Pothole Region, all nestlings and adults measured (n = 56) had detectable concentrations of neonicotinoids in their blood, which indicates that aerial insectivores are directly exposed to neonicotinoids, including through insect prey provisioned to nestlings (Elgin 2020). A major knowledge gap is how chronic exposure to very low sub-lethal concentrations of neonicotinoids affects bird populations. Overall, effects of agricultural contaminants on breeding success and population trends of Bank Swallow remain unknown (Berzins 2020).

IUCN-CMP Threat 9.5 Air-borne pollutants (Unknown impact)

Acidification of freshwater ecosystems is a phenomenon that is particularly marked in the northeastern part of the continent (Lacoul et al. 2011), where the soil of the Precambrian Shield offers a limited capacity to neutralize acid. Lakes and soils found in areas of the Canadian Shield in northeastern Alberta, northern Saskatchewan and Manitoba, and parts of western British Columbia, are also sensitive to acid deposition (ECCC 2018b).

Passerines must obtain calcium from their food during the egg-laying period (Hames et al. 2002). Calcium deficiency during this time may lead to breeding failure due to birds laying eggs with thin, weak and more porous shells (St. Louis and Barlow 1993). Tree Swallows, an aerial insectivore sharing a similar diet with Bank Swallow, showed lower reproductive success when nesting and foraging near acidified experimental lakes

(St. Louis and Barlow 1993). Bank Swallows are likely affected by acidification on a large portion of their Canadian range; however, there is limited evidence that acidification has impacts on the species' population.

IUCN-CMP Threat 11.1 Ecosystem encroachment (Unknown impact)

Rising sea levels are expected to increase erosion rates of coastal habitat (Prince Edward Island Department of the Environment, Labour and Justice 2011; Lemmen et al. 2016). Bank Swallows mostly nest in coastal habitats in the eastern portion of their range; a large proportion of the species population could be affected by the effects of rising sea levels and increasing coastal erosion rates (Savard et al. 2016; see 7.1.3 Application of critical habitat identification criteria). Increased erosion rates might increase the availability of nesting habitat along coastlines in the short term. However, in inhabited areas, higher erosion rates could lead to increased artificial bank stabilization (Savard et al. 2016), contributing to permanent loss of nesting habitat over the long term. Coastal salt marshes are an important foraging habitat for Bank Swallows in the Atlantic region (Saldanha 2016). Rising sea levels are expected to flood these habitats and lead to a reduction in insect-prey availability.

IUCN-CMP Threat 9.2 Industrial and Military Effluents (Unknown impact)

Mercury exposure may be a potential threat to the Bank Swallow by contamination of its food supply, especially in areas of the breeding or non-breeding grounds with higher availability of emergent aquatic insects (Kardynal et al. 2020). Studies on Tree Swallows have shown high mercury concentrations in insect prey and adult swallows at sites contaminated by mercury in the northeastern United States (Cristol et al. 2008). Insectivorous birds have higher mercury concentrations than birds feeding on seeds or nectar (Keller et al. 2014). Birds foraging over water show higher mercury concentrations, which are also typically higher in birds nesting east of Manitoba (Kardynal et al. 2020; Ma et al. 2021; Twining et al. 2021). Mercury has been implicated in a wide range of negative effects on Tree Swallows and other bird species. These include detrimental alterations of the immune and endocrine systems (Hawley et al. 2009; Wada et al. 2009), reduced productivity and survival rates (Brasso and Cristol 2008; Hallinger et al. 2011) and skewing offspring sex ratios towards females (Bouland et al. 2012). Various studies have also suggested negative effects from organochloride compounds (polychlorinated biphenyls or PCBs), mercury and chlorinated hydrocarbons on Tree Swallows (Bishop et al. 1998a, b, 1999, 2000; Hawley et al. 2009). These effects are expected to also occur in Bank Swallows given the similar diet between the two species, although sub-lethal effects associated with mercury contamination in Bank Swallows require further studies (Kardynal et al. 2020).

IUCN-CMP Threat 7.1 Fire & fire suppression (Unknown impact)

The occurrence of major forest fires will likely increase in the northern portion of the Bank Swallow's range as a result of climate change (Natural Resources Canada 2020). Fire is the main natural disturbance of the boreal forest north of the commercial forest

area (Payette et al. 1989; Environment Canada 2013, 2014). The impacts of forest fires on aerial insectivores has been studied in relation to availability of breeding and foraging habitat (Farrell et al. 2017; Berzins 2020). However, other impacts of forest fires, such as air quality or insect availability, on the Bank Swallow have not been assessed, but could be an emerging threat as the species' breeding range expands north.

IUCN-CMP Threat 6.1 Recreational Activities (Negligible impact)

Sandy banks and unattended quarries are attractive locations for recreational activities such as mountain biking, dirt biking, riding all-terrain vehicles, climbing, or walking dogs. Recreational boating activities, such as boating, canoeing, kayaking or paddle boarding, allow access to river banks that would otherwise be difficult to access from land. At active colonies, a single source of disturbance can elicit a large group response, where birds flush from nests and nestlings become exposed to predation or cold temperatures. Disturbance of the bank face can result in slumping of the bank and subsequently in the loss of nests, eggs or nestlings. Colonies in unattended quarries, in coastal settings and along rivers suitable for recreational activities are likely more exposed to disturbance from recreational activities, but most colonies occur in locations difficult to access.

5. Population and Distribution Objectives

This recovery strategy defines recovery of the Bank Swallow as a reduced risk of extinction relative to the conditions that led COSEWIC to designate the Bank Swallow as threatened. The Bank Swallow faces an increased extinction risk due to its steep population declines. At a national scale, the species does not show large fluctuations in the number of mature individuals (COSEWIC 2013). Before human-influenced landscape changes became important drivers of Bank Swallow distribution and abundance in Canada (pre-1800s), the species was likely locally abundant over a large range, showing long-term population stability. Therefore, a reduced risk of extinction for the Bank Swallow is defined by widespread, locally abundant in natural settings, and stable population in Canada. Various factors influence regional population trends such as habitat quality, composition, and availability, and conditions on wintering grounds.

Distribution objective:

- The distribution objective for Bank Swallow is to maintain the extent of occurrence in Canada as identified from a minimum convex polygon[15] based on critical habitat presented in this recovery strategy.

[15] A minimum convex polygon is the smallest shape, drawn with straight line segments, which will surround all critical habitat units. As an analogy, picture an elastic stretched around a group of pegs on a peg board. Following standards of the IUCN, the area calculation of the extent of occurrence must not exclude any areas, discontinuities or disjunctions, regardless of whether the focal species can occur in those areas or not.

The extent of occurrence was deemed appropriate to assess the degree of extinction risk amongst the Canadian portion of the Bank Swallow population against the multiple, cumulative threats to the species. The distribution objective aims to maintain a widespread distribution of the species in Canada, known as redundance, a key characteristic of species survival[16]. The Bank Swallow is surveyed extensively, which is a requirement for appropriate measure of extent of occurrence (Gaston and Fuller 2009). The area encompassing the minimum convex polygon delineated from the outermost critical habitat units presented in this recovery strategy establishes a baseline for the distribution objective. This area is representative of the breeding range of the Bank Swallow from 2001 to 2017 in Canada and estimated at 9.51 million km^2 (Appendix E – Figure E).

Numerous species of birds have exhibited northern range expansions as a result of climate change, although this pattern has not been observed in some aerial insectivorous birds (Michel et al. 2015). This recovery strategy recognizes that a longitudinal (southward or northward) shift in the Bank Swallow breeding range might occur as a result of climate change (Langham et al. 2015) and create a confounding effect when measuring progress toward the distribution objective. Despite the predicted expansion of the northern limit of its breeding range (Langham et al. 2015, see also National Audubon Society 2021), ongoing declines in the Bank Swallow population could result in fewer birds colonizing the North. Therefore, the extent of occurrence, in addition to reliable estimates of population size and trend, is an important metric for measuring the degree of extinction risk because the larger the extent of occurrence, the less likely that all locations of the Bank Swallow will undergo simultaneous extinction as a consequence of common threats (Gaston and Fuller 2009).

Short-term population objective:

- By 2033, the population objective is to achieve a reduced rate of decline while ensuring that the population index remains above 80% of the 2021 level.

The 12 year period was deemed appropriate for the short-term population objective because determining if a population has stabilized or is increasing will take multiple years of data acquisition. The BBS provides the best available estimates of the direction and magnitude of population trends nationally; as such, the short-term population objective will be assessed based on the 10 year population trend for the period ending in 2033. Short-term (10-year) population trends are produced every year by the Canadian Wildlife Service (Table 3). Over the years, those trends can help understanding whether the conservation status of species is degrading or improving (Figure 3). This population objective aligns with the COSEWIC criteria for species assessment that includes reviewing population change within 10 year windows. It is

[16] The Policy on Recovery and Survival identifies five factors and characteristics that contribute to a species likelihood of survival, including redundancy (ECCC 2021). Redundance provides that “a species that has multiple (sub) populations or locations, or a distribution that is very widespread, is more likely to survive over the long term because of reduced risk of catastrophic loss or extirpation from a single, local event”.

estimated that a period of 12 years should allow for understanding the primary threats to the species and other aerial insectivores, and to begin implementation of conservation measures. During this period, known factors likely to influence the decline of the species must be mitigated (see section 6: Broad Strategies and General Approaches to Meet Objectives).

This recovery strategy recognizes that the population size of Bank Swallows in Canada will continue to decline until the population trend stabilizes. In achieving the short-term population objective, conservation measures should be put in place so that the population size in Canada declines by no more than 20% between 2021 and 2033.

Long-term population objective:

- By 2053, the population objective is to achieve a stable[17] 10-year trend while ensuring that the population index remains above 90% of the 2021 level.

A 20-year period following the short-term objective was deemed appropriate to set a long-term population objective to allow conservation measures aimed at stabilizing and supporting recovery of the Bank Swallow population to act. Multiple years of data acquisition are necessary to determine accurate population trends. The BBS provides the best available estimates of the direction and magnitude of population trends; as such, the long-term population objective will be assessed annually based on 10 year population trend periods from the BBS. This population objective aligns with the COSEWIC criteria for species assessment that includes reviewing population change within 10 year windows.

Achieving the long-term population and distribution objectives will require implementation of conservation measures that remove or mitigate the threats to Bank Swallows identified during the first 10 years of recovery. Strong international collaboration will be required to recover Bank Swallow, as the species spends a short period of the year in Canada. Threats and limiting factors in the United States, where about 70% of the North American population of Bank Swallows breeds, might strongly influence the population trend observed in Canada. Following a 93% decline since 1970, the Bank Swallow shows a positive, but non-statistically significant trend over the 2009-2019 period (Smith et al. 2020). The degree to which the Bank Swallow population can be stabilized and recovered is uncertain given the limited knowledge on the nature and irreversibility of the threats affecting the species (see Recovery Feasibility Summary). The degree to which the Bank Swallow population will be able to recover is partially dependent upon the impacts of climate change on the species. These impacts are currently unknown and cannot be projected with certainty.

This recovery strategy recognizes that the population size of Bank Swallows in Canada will continue to decline until the population trend is anticipated to stabilize. In achieving the long-term population objective, conservation measures should be put in place to

[17] A trend will be considered stable when the 95% confidence/credible intervals around the estimate include zero.

partially recover losses to the Bank Swallow population so that the population size in Canada remains above 90% of its 2021 level.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

Numerous activities have been initiated since the latest COSEWIC assessment in 2013. The following list is not exhaustive, but is meant to illustrate the main areas where work is already underway to give context to the broad strategies to recovery outlined in section 6.2. Actions completed or underway include the following:

Conservation plans

- Nature Québec (2014) published an action plan for the conservation of Bank Swallow nesting sites in important bird areas of Quebec.
- A General Habitat Description for the Bank Swallow was published in July 2015 by the Province of Ontario[18], followed by the publication in June 2016 of a Recovery Strategy for the Bank Swallow in Ontario (Falconer et al. 2016a) and a Government Response Statement in March 2017.
- In 2017, the Government of Ontario published guidelines on “Best Management Practices for the Protection, Creation and Maintenance of Bank Swallow Habitat in Ontario” (OMNRF 2017).
- In November 2020, the Nova Scotia Department of Lands and Forestry published a recovery plan for the Bank Swallow by adopting the Recovery Strategy for the Bank Swallow (*Riparia riparia*) in Ontario and Environment and Climate Change Canada’s Description of residence for Bank Swallow (*Riparia riparia*) in Canada.
- In January 2021, an Atlantic Canada Bank Swallow Working Group was formed to identify strategies for improving the conservation outcome of Bank Swallow in Atlantic Canada, through improved monitoring, public engagement and compliance promotion.
- A guide for the protection of the Bank Swallow is currently being developed by the Government of Quebec, in order to protect colonies through the supervision of forest management activities.

Conservation measures

- Surrogate nesting habitats for the Bank Swallow have been built on the shore of the St. Lawrence River in 2015 (Quebec City; Laberge and Houde 2015) and 2019 (Montreal; Montreal Port Authority 2020). Bank Swallows have successfully nested at those locations in following years.

[18] Please refer to Best Management Practices for the Protection, Creation and Maintenance of Bank Swallow Habitat in Ontario (OMNRF 2017).

- Environment and Climate Change Canada published beneficial practices for sandpit and quarry owners on reducing disturbance to Bank Swallow colonies (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/related-information/bank-swallow-sandpits-quarries.html).

Monitoring

Several community-science and conservation-oriented monitoring projects have been implemented in Canada that include Bank Swallow in the framework of activities. These include the following groups and/or projects:

- Nature Canada's multi-species roost monitoring in southern Ontario during the Save Our Swallows campaign
- The Breeding Bird Survey (BBS)
- Breeding Bird Atlases (and associated colonial species reports)
- The Boreal Avian Monitoring Project (BAM)
- eBird
- Project NestWatch, which provides information on the nesting phenology of the species (Rousseu and Drolet 2015)
- The Canadian Migration Monitoring Network
- The SOS-POP program [in French only] in Quebec.

Research

- A Bank Swallow Working Group in Ontario made of governmental and non-governmental organizations and led by Ontario Power Generation provides a forum on research and conservation measures for the species.
- Year-round connectivity between nesting sites in New Brunswick and Nova Scotia and the South American wintering grounds have been studied using stable isotopes (Imlay et al. 2018a).
- A review of research progress on aerial insectivores and of hypothesized threats to aerial insectivore populations was conducted during a workshop in March 2020 (Berzins 2020).
- An analysis of Canadian weather radar images has been conducted by Nature Canada to identify potential roosting locations across Canada.
- Nesting densities, year-to-year persistence and re-use of nesting colonies and burrows were investigated in the Yukon River valley (Sinclair et al. 2020).
- Targeted efforts to survey Bank Swallow colonies have recently been completed on the Mackenzie and Arctic Red rivers (Gwich'in Renewable Resources Board unpublished data), in Ontario's human-made and natural nesting habitats (Browning and Cadman in prep.) and on Prince Edward Island (Island Nature Trust and PEI Watershed Alliance).

- Targeted efforts to survey Bank Swallows colonies are ongoing (summer 2021) in the Centre-du-Québec region by the Waban-Aki First Nation (Bureaux Environnement et Terre d'Odanak et de Wôlinak).
- Surveys on the non-breeding grounds in South America and Cuba were recently completed to determine habitat use and occupancy (K. Kardynal, pers. comm. 2021).
- Birds Canada is working with ECCC and Western University to collect and identify samples of flying insects from pit and natural sites. The goal of this work is to help determine the influence of food availability on Bank Swallow body condition on the breeding grounds.

6.2 Strategic Direction for Recovery

The threats contributing to Bank Swallow population declines remain unclear, driving the need for investigation on the species' migratory ecology and habitat use, especially at migration stopovers and on wintering grounds. Despite those uncertainties, building international partnerships that will address common drivers of aerial insectivore declines and maintain important habitat for the species should be prioritized. A recent workshop on aerial insectivores identified research, conservation and outreach priorities related to aerial insectivores in Canada (Berzins 2020). Research and management approaches that may benefit the recovery of Bank Swallow have been included in the recovery planning table and grouped by broad strategies and conservation action classification[19] (Table 5).

[19] The broad strategy categories follow the International Union for Conservation of Nature – Conservation Measures Partnership (IUCN-CMP) Conservation Actions Classification v 2.0 (https://conservationstandards.org/library-item/threats-and-actions-taxonomies/).

Table 5. Recovery Planning Table

Threat or limiting factor	Priority[a]	General description of research and management approaches
Broad Strategy: Awareness Raising		
2.3 Livestock farming & ranching 3.2 Mining & quarrying 6.1 Recreational activities	High	3.1 Outreach & Communication • Promote habitat stewardship and compliance to the *Species at Risk Act*, the *Migratory Birds Convention Act, 1994* and its regulations at Bank Swallow colonies found in natural or in anthropogenic settings.
Broad Strategy: Livelihood, Economic & Moral Incentives		
2.1 Annual & perennial non-timber crops 2.3 Livestock farming & ranching 7.3 Other ecosystem modifications	High	5.2 Better Products & Management Practices • Identify and implement incentives aimed at municipalities, landowners, and farmers for limiting pesticide use and promoting Integrated Pest Management practices. • Provide incentives aimed at farm operations for considering Bank Swallow's habitat needs when developing and implementing environmental farm plans.
3.2 Mining & quarrying	High	5.2 Better Products & Management Practices • Promote to operators of pit and quarry beneficial management practices that avoid or reduce disturbance to nesting colonies, such as setting buffer zones near active colonies, tapering bank slope outside of the nesting season, and creating nesting substrate in areas that will not be disturbed during the nesting season (see OMNRF 2017).
1.1 Housing & urban areas 7.3 Other ecosystem modifications	Moderate	5.5 Non-Monetary Values • Identify and implement incentives aimed at landowners to maintain native and perennial vegetation cover that benefit flying insects, such as pollinators.

Threat or limiting factor	Priority[a]	General description of research and management approaches
Broad Strategy: Conservation Designation & Planning		
1.1 Housing & urban areas 1.2 Commercial & industrial areas 2.1 Annual & perennial non-timber crops	High	6.1 Protected Area Designation &/or Acquisition • On breeding grounds, protect wetlands used as roosting habitat, especially those that play a critical role for the recovery of Bank Swallow
6.1 Recreational activities	Moderate	6.5 Site Infrastructure • Reduce human disturbance by designating exclosure zones and installing signage around nesting colonies where appropriate
Broad Strategy: Land / Water Management		
1.1 Housing & urban areas 1.2 Commercial & industrial areas 2.1 Annual & perennial non-timber crops	High	1.2 Ecosystem & Natural Process (Re)Creation • Restore lost or severely degraded wetlands, especially in areas with nesting habitat.

Threat or limiting factor	Priority[a]	General description of research and management approaches
1.1 Housing & urban areas 1.2 Commercial & industrial areas 2.1 Annual & perennial non-timber crops 7.3 Other ecosystem modifications	High	1.2 Ecosystem & Natural Process (Re)Creation • Restore shorelines into nesting habitat in areas with low risk of future damage to infrastructure where erosion-control measures have been implemented (Boyer-Villemaire et al. 2016). • Replace aging erosion-control measures by natural solutions adapted to the risks of climate change (planting vegetation and natural features to reduce bank erosion). • Consider restoration of fluvial systems using a “freedom space” approach which strengthens resilience to extreme meteorological events and optimizes availability of natural nesting habitat for the Bank Swallow (see Biron et al. 2013a,b). • Revegetate top of nesting cliffs and banks that have been cleared to promote cliff stability and protection of burrows from heavy surface water runoff.
Broad Strategy: Legal & Policy Frameworks		
7.3 Other ecosystem modifications 9.3 Agricultural & forestry effluents	High	7.1 Laws, regulations & codes • Create or amend regulations based on an assessment on the potential risks of pesticides to aquatic insects.
7.3 Other ecosystem modifications 9.3 Agricultural & forestry effluents	High	7.1 Laws, regulations & codes • Create or amend federal regulations based on an assessment on the potential risks of pesticides to aerial insectivore populations with a focus on prey availability and prey contaminant load.

Threat or limiting factor	Priority[a]	General description of research and management approaches
Broad Strategy: Institutional Development		
7.3 Other ecosystem modifications	High	10.3 Alliance & Partnership Development • On breeding grounds, engage with provincial and territorial governments to encourage sustainable land-use planning and restoration of ecosystem processes, also known as nature-based solutions that mitigate shoreline erosion and maintain natural nesting habitat. • Support non-governmental organizations in the delivery of nesting, foraging and roosting habitats stewardship programs to private landowners.
3.2 Mining & quarrying 4.1 Roads & railroads 7.4 Removing / Reducing human maintenance	High	10.3 Alliance & Partnership Development • Engage with land owners to develop appropriate stewardship, voluntary measures, mitigation or other appropriate measures in order to protect occupied nests in human-made habitat.
7.3 Other ecosystem modifications 9.3 Agricultural & Forestry Effluents	Moderate	10.3 Alliance & Partnership Development • Work with international partners within the Bank Swallow's range to develop and implement sustainable production systems and land use policies.
7.2 Dams & water management/use	Moderate	10.3 Alliance & Partnership Development • At a watershed scale, engage with water level regulation agencies, dam operators and hydroelectricity producers to maintain natural hydrological processes and create Bank Swallow habitat.
Knowledge gap	Moderate	10.3 Alliance & Partnership Development • Develop new international partnerships and maintain existing partnerships to collaborate on roost detection using weather radar

Threat or limiting factor	Priority[a]	General description of research and management approaches
4.1 Roads & railroads	Low	10.3 Alliance & Partnership Development • Engage with the appropriate government level to reduce vehicle speed limits on roads adjacent to Bank Swallow colonies and roosts.
Broad Strategy: Research and Monitoring		
Knowledge gap	High	8.1 Basic Research & Status Monitoring • Collaborate with international partners to determine wintering distribution and habitat association with goals of identifying priority areas for conservation and of understanding historical changes in wintering habitats availability and quality.
Knowledge gap	High	8.1 Basic Research & Status Monitoring • Estimate demographic parameters and possible carry-over effects throughout the annual cycle with goal of identifying the limiting period of the annual cycle.
Knowledge gap	Moderate	8.1 Basic Research & Status Monitoring • Conduct surveys at nesting colonies in natural and human-made settings to determine the between-year dispersal distances of juveniles and breeding adults; determine how individuals respond to regional changes in nesting habitat availability; and determine dispersal patterns between natural and human-made settings. • Conduct surveys at natural nesting colonies to determine the within-year dispersal distances of breeding adults and determine how individuals respond to disturbances.

Threat or limiting factor	Priority[a]	General description of research and management approaches
Knowledge gap	Moderate	8.1 Basic Research & Status Monitoring • Develop a predictive model of Bank Swallow population size that includes hydrology and surficial geology as environmental variables, and incorporate data from colony surveys in order to improve population estimates.
Knowledge gap	Moderate	8.1 Basic Research & Status Monitoring • Monitor insect biomass and availability at key times and locations during the annual cycle and determine main drivers of insect abundance.
7.3 Other ecosystem modifications 9.3 Agricultural & forestry effluents	Moderate	8.1 Basic Research & Status Monitoring • Collaborate with international partners to examine levels of exposure to pesticides and other contaminants during the wintering and migration periods.
11.1 Ecosystem encroachment 11.4 Changes in precipitation & hydrological regimes 11.5 Severe / Extreme Weather Events	Low	8.1 Basic Research & Status Monitoring • Conduct projections of shoreline erosion-accretion processes related to climate change and assess potential for creation or loss of nesting habitat.
Knowledge gap	Low	8.2 Evaluation, Effectiveness Measures & Learning • Evaluate the effectiveness of different designs of surrogate nesting structures based on the nesting requirements of the species, species breeding productivity, and co-benefits provided by the structure such as erosion control.

Threat or limiting factor	Priority[a]	General description of research and management approaches
7.1 Fire & fire suppression	Low	8.1 Basic Research & Status Monitoring • Conduct projections of breeding and foraging habitat suitability in the northern portion of the species' range, with a focus on emerging threats and changes in the breeding range of Bank Swallow.

[a] "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

6.3 Narrative to Support the Recovery Planning Table

As indicated in the Recovery Feasibility Summary section, mitigating threats to the Bank Swallow represents considerable challenges. Recovery of the Bank Swallow will require commitment and collaboration among federal, provincial and territorial jurisdictions, Indigenous peoples, local communities, landowners, and industry to reverse the loss of nesting, foraging and roosting habitats. Concurrently, further research on migratory connectivity, wintering habitat use, and demographic rates (such as survival and recruitment) of the Bank Swallow may help prioritizing conservation measures for the species.

Conservation measures for nesting habitat

The loss of nesting habitat is prevalent in the southern part of the species' range where humans have extensively altered hydrological regimes and modified shorelines and coastlines to prevent or control erosion. Sea level rises, more frequent flooding events, and increased ice scouring associated with climate change may accelerate efforts to control erosion along shorelines. Where technically feasible and required to support recovery, shorelines should be restored to create nesting habitat for Bank Swallow. Natural nesting habitat may be provided when adaptation to climate change involves removing structures threatened by erosion or by not replacing structures that have reached the end of their useful life.

Any new residential, commercial or industrial development should avoid removing nesting habitat in natural settings. Risks of damage to infrastructure related to climate change, such as erosion and flooding, may be reduced by avoiding new developments along shorelines where Bank Swallow nesting habitat occurs. Outside of designated critical habitat units, natural nesting habitat should be created before the following nesting season when removing existing nesting habitat cannot be avoided. Nesting habitat compensation should result in an increase of available nesting habitat that persists over the long-term. Foraging habitat should be available or created near the vertical banks to ensure effectiveness of nesting habitat compensation (Moffatt et al. 2005). Bank Swallows should have occupied the replacement nesting habitat before existing habitat is removed. When self-sustaining, natural nesting habitat cannot be created to offset habitat loss, surrogate nesting structures might be considered (e.g., Laberge and Houde 2015) while ensuring that foraging habitat is available. However, surrogate nesting structures might provide limited long-term support for the recovery of the species as they become unsuitable without annual maintenance (Bank Swallow Technical Advisory Committee 2013). Therefore, surrogate nesting structures must be maintained until self-sustaining natural nesting habitat is created or restored.

On breeding grounds, water level regulation agencies, dam operators and hydroelectricity producers should maintain flow regimes that promote natural hydrological processes and create Bank Swallow habitat. Release of large volumes of water from reservoir during the nesting period should be avoided to reduce the risk of bank collapse and loss of nestlings. However, controlled releases before the beginning

of the breeding season have the potential for increasing available nesting habitat by eroding banks (Moffatt et al. 2015).

Disturbance to active colonies must be avoided to minimize the risk of nesting failure and bird mortality. Bank Swallow colonies are commonly found in human-made habitats and nesting success in those habitats will contribute to the recovery of the species. Quarry operators should adopt beneficial management practices that avoid or reduce disturbance to nesting colonies, such as setting buffer zones near active colonies or tapering bank slope outside of the nesting season. Where appropriate, human disturbance should be prevented by designating exclosure zones and installing signage around nesting colonies. In addition, vehicle speed limits should be reduced on roads adjacent to Bank Swallow colonies and roosts, especially where those habitats and prime foraging habitat are separated by a road. Law enforcement authorities should conduct surveillance in areas identified as critical habitat in this recovery strategy with high levels of recreational activities.

Conservation measures for foraging habitat

The broad-scale ecosystem modifications on the breeding, migration and wintering grounds associated with the loss of ecosystem services largely result from market forces driving land use policies and production systems. In Canada, market-based incentives and certification schemes can be implemented or improved to drive the adoption of sustainable agricultural systems that maintain ecosystem services, such as support of wildlife habitat. New evaluations or reevaluations of pesticide registration should include an assessment of their potential risks to non-target insects and indirect effects on other wildlife. Strong international collaboration will be required to develop and implement sustainable production systems and land use policies.

Wetlands and grasslands play a significant role in the production of insects consumed by the Bank Swallow, but continue to be lost or degraded at an alarming rate in North America. The availability of foraging habitat near nesting habitat increases the likelihood of recovering the species (Moffatt et al. 2005). On breeding grounds, land owners should continue to protect and restore wetlands used as foraging or roosting habitats to ensure no net loss. Governmental agencies should identify and implement incentives aimed at landowners to ensure no net loss of native and perennial vegetation cover which act as source and shelter for insects. Government agencies should provide incentives aimed at farm operations for considering Bank Swallow’s habitat needs when developing and implementing environmental farm plans. Any new residential, commercial or industrial development should avoid removing foraging habitat near or in areas of critical habitat. In addition, lost or degraded wetlands should be restored, especially in areas of critical habitat.

Conservation measures for roosting habitat

In addition to supplying insects consumed by the Bank Swallow, wetlands are commonly used as roosting habitats when the species is present in Canada. During the

breeding period, wetlands may be used as nocturnal roost by a large number of Bank Swallows, with individuals travelling 30 km from their colony (Falconer et al. 2016b). After the breeding period, the Bank Swallow uses wetlands to roost at night before the fall migration. Very little is known about the location and number of Bank Swallows at roosting sites. The proximity of nocturnal roosting habitat to nesting habitat likely is an important landscape characteristic for the conservation of Bank Swallows (Falconer et al. 2016b; Saldanha et al. 2019). Conservation measures to foraging habitat may be applied to roosting habitat, but within a larger area from nesting sites.

Research and Monitoring

Further research on habitat use on the Canadian range, demographic parameters and migratory connectivity of the Bank Swallow are required to prioritize conservation measures. On the Canadian range, the designation of critical habitat will protect the nesting and foraging habitats required to recover the species. Communal roosts play an important role during the breeding, post-fledging, and pre-migratory periods, but their characteristics, location and availability for swallows are poorly known. Completing the research activities described in the Schedule of Studies section will inform the designation of critical habitat.

Survival, productivity and recruitment rates are demographic parameters that may indicate whether recovery of the Bank Swallow is limited by factors on the breeding, migration or wintering grounds. Monitoring at nesting colonies can provide data which inform the demographic parameters of the species. Further studies are needed on the differences in demographic parameters and between-year dispersal between natural and human-made nesting sites. Monitoring at nesting sites must be done over multiple years and at multiple colonies across the species' breeding range, as portions of the breeding populations might winter in different areas of South America and be affected by different levels of threats.

Monitoring on the breeding range must be complemented by migratory connectivity studies, such as with stable isotopes or Global Positioning System (GPS) units. Collaboration with international partners is required to determine the wintering distribution and habitat use of the species. Overall, information on the limiting factors and habitat use will help prioritize conservation efforts and identify priority areas required for the recovery of Bank Swallows.

7. Critical Habitat

Critical habitat is the habitat that is necessary for the survival or recovery of the species. 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.

This recovery strategy recognizes human-made nesting habitat, such as sandpits and quarries, as anthropogenic structures as defined under the *Policy Regarding the Identification of Anthropogenic Structures as Critical Habitat* (2019). Sufficient natural habitat is likely available to support the recovery of the Bank Swallow and human-made nesting habitat are not required to meet the population and distribution objectives following section 4.2.3 of the Policy. Therefore, human-made nesting habitats are not identified as critical habitat. Although sufficient natural habitat is likely available, the application of the critical habitat identification criteria in this recovery strategy does not identify sufficient natural habitat required to support the population objectives.

7.1 Identification of the Species' Critical Habitat

The critical habitat identified in this recovery strategy is insufficient to meet the population objectives. The areas of critical habitat is based on confirmed nesting occurrences in natural settings observed between 2001 and 2017 and is identified where the biophysical attributes of nesting or foraging habitat occur within those areas. The number of confirmed nesting records was insufficient to fully identify the nesting and foraging components of critical habitat. The types of habitat that may be required for the recovery of the species but not identified at this time as critical habitat are described at the end of section 7.1. As new information becomes available, the boundaries of the critical habitat should be revised and new critical habitat units should be identified. A schedule of the studies necessary to complete the identification of critical habitat of the species (section 7.2) is also included.

In Canada, Bank Swallows require nesting habitat associated with foraging habitat to support the breeding, nesting and brood-rearing portions of their life history. In natural settings, nesting colonies are generally located along river bluffs, lakeshores or coastlines where regular erosion keeps the bank suitable for burrow excavation (Falconer et al. 2016a; Garrison and Turner 2020). At natural sites along rivers, colonies generally tend to be found in the same location from year to year, although the habitat may be unoccupied some years. Larger colonies are more likely to be found at the same location (Freer 1979; Garrison and Turner 2020) and are more frequently reused than smaller ones (Garcia 2009; Cadman and Lebrun-Southcott 2013; Sinclair et al. 2020). The location of colony sites might change because of the dynamic nature of nesting habitat, while various factors can make previous nesting locations unsuitable for nesting between years. In areas where the Bank Swallow has been found to nest, continuous segments of shoreline where nesting habitat may be formed by natural processes are required to support the regional persistence of the species over the long term.

Bank Swallows show high nest site fidelity rates where they have successfully bred in previous years (Stoner 1941; Freer 1979; Falconer et al. 2016a; Garrison and Turner 2020). However, adults experiencing major nest mortality events, such as predation or bank collapse, do not appear to recolonize the same nesting location, although new birds may recolonize these sites in successive years (Freer 1979; Falconer et al.

2016a). Between 55% and 92% of surviving adults return to breeding sites used in previous years (Falconer et al. 2016a).

After fledging from the nest, young explore and assess the quality of existing colonies or potential nesting habitat, where they may return for nesting during the following breeding season. In the United Kingdom, adults and juveniles were recaptured within 3 and 6 km (median distance) from their natal colonies, respectively (Mead 1979b). In the northeastern United States, a long-term study (1923–1940) found that most birds, especially adults, (66.8%) were recaptured at the same colony in the following year (Stoner 1941). Adults and young that dispersed were recaptured most frequently between 1.6 and 7.9 km (1 to 4 miles, distance class as reported in the study) from their home colony. The upper bracket of this class (7.9 km) is probably more representative of actual dispersal distances of young, given that dispersal to the next distance class (8 to 14 km) was three times more frequent than dispersal within 0.4 to 1.6 km from the natal site. Another long-term study (1959–1972) in Wisconsin (United States) found that 70.2% and 50.0% of adults and young returned to the original nesting location, respectively (MacBriar Jr. and Stevenson 1976). Twenty-four percent of recaptured adult Bank Swallows dispersed within 6.5 km of the original nesting location. Young dispersed to farther nesting locations; 20% were recaptured within 6.5 km and 30% were recaptured within 6.6 and 14.5 km of the original nesting site. The three studies cited above found greater dispersal distance of young than of adults, which is likely an important evolutionary trait for the Bank Swallow given the dynamic and fragile nature of the nesting habitat. These dispersal movements allow for colonization of new nesting sites, or recolonization of sites that are not available each year. Critical habitat is delineated within a distance of 5 km from known colonies to capture the dynamic nature of nesting habitat and based on between-year dispersal distances of the Bank Swallow. This approach provides a variety of occupied and unoccupied nesting sites that are required to maintain long-term persistence and gene flow among the population.

While historical nest record scheme data indicated that human-made habitats supported a large proportion (about 60%) of the Bank Swallow population in Canada (Erskine 1979), the exhaustive compilation of Bank Swallow nesting records for this recovery strategy suggests that the proportion of colonies in human-made habitats may have been much lower in recent years (about 44% of colonies). Proportions of colony records must be further assessed against potential sampling bias and changes in habitat availability (Pelletier et al. in prep.). Burrows can be found in bank faces in aggregate pits, along road-cuts, and in piles of sand, gravel, or sawdust (COSEWIC 2013; Falconer et al. 2016a; Garrison and Turner 2020). Bank Swallows may also build nests in holes in human-made structures or occupy artificial faces built as surrogate habitat (Laberge and Houde 2015). Human-related excavation of material or maintenance of surrogate habitat can refresh the bank face and make those sites suitable for nesting (Falconer et al. 2016a). Human-made nesting habitats require ongoing maintenance to preserve the characteristics of nesting habitat for Bank Swallows. This type of habitat does not possess the biophysical attributes required to maintain the long-term

persistence of Bank Swallows (Bank Swallow Technical Advisory Committee 2013); as such, human-made habitat is not identified as critical habitat[20] in this recovery strategy.

During the nesting season, Bank Swallows forage over open country and aquatic habitats where flying insects are available (Moffatt et al. 2005; Saldanha 2016; Garrison and Turner 2020). The amount of food adults can provide to nestlings is closely related to the abundance, quality and availability of insect prey. During the breeding period, Bank Swallows can forage beyond 2 km from the nest (Saldanha 2016; see section 3.3), but most foraging activity occurs within 600 m (Turner 1980; Saldanha 2016). Open country and aquatic environments suitable for the production of insects found within 500 m from nesting habitat are required to support the reproductive success and the long-term persistence of the species.

The confirmed nesting records used to determine the location of critical habitat might point towards locations that are not currently occupied by Bank Swallows for nesting. Critical habitat is identified at those locations only if the biophysical attributes of nesting or foraging habitat are found. Habitat that has been used in the past for nesting or newly-created habitat are deemed necessary for the recovery of the species, in order to provide a range of nesting locations where the species can return in different years. Although human-made habitats are expected to contribute in supporting the breeding population of the species given appropriate stewardship measures, the availability of human-made habitat has likely declined over the past 50 years (COSEWIC 2013; Falconer et al. 2016a; Pelletier et al. in prep.). Nesting habitat in natural settings should be maintained, whether it is occupied or not, to ensure sufficient nesting habitat is available for the Bank Swallow population given the reduction human-made habitat availability. The following section provides the methodology used in this recovery strategy for the identification of critical habitat for Bank Swallow.

7.1.1 Areas containing critical habitat

All available records (Appendix B) of documented nest locations, standardized survey data, as well as incidental observations of Bank Swallow in Canada were assigned a breeding evidence code and category from the Saskatchewan Breeding Bird Atlas (Appendix C). Critical habitat is determined on the basis of all confirmed breeding occurrences with a spatial accuracy of 700 m or less[21], observed between 2001 and 2017 in a natural setting.

[20] Bank Swallows and their nests found in human-made habitat or elsewhere are protected by the *Migratory Birds Convention Act, 1994*. In addition, the occupied burrow of the Bank Swallow is protected as a residence under the *Species at Risk Act*. Please consult the Species at Risk Public Registry for more information on the residence of the Bank Swallow.

[21] When not available in the original dataset, spatial accuracy of an occurrence was determined from the type of survey and whether a GPS-enabled device was used to record coordinates.

The delineation process of areas containing critical habitat is presented in Figure 4. On waterbodies where a colony occurs[22], shorelines[23] of the waterbody are selected within 5 km of the colony occurrence's spatial accuracy distance. The critical habitat unit (polygon) is delineated from a 500-m buffer around the selected shorelines. When more than one polygon overlap, they are merged into a single critical habitat unit.

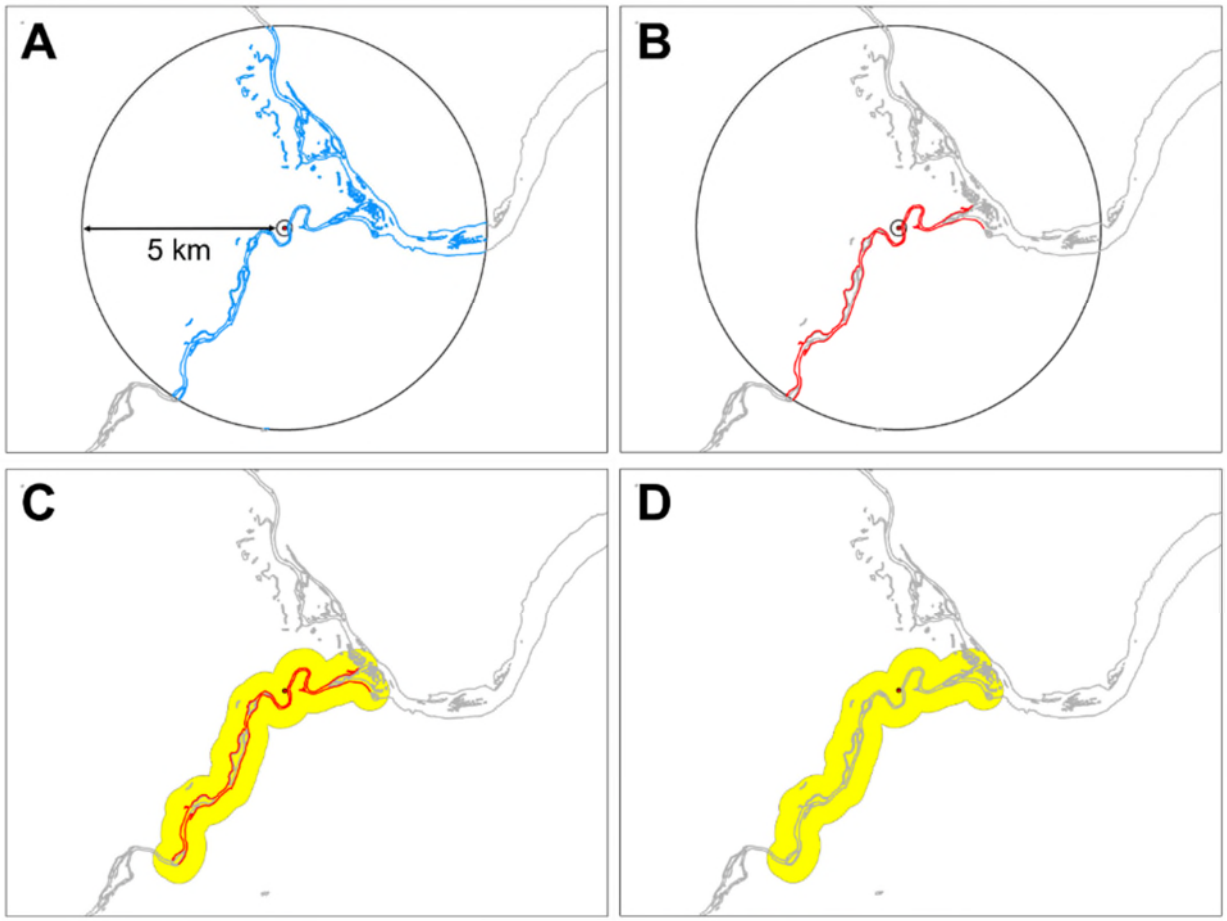

Figure 4. Delineation process of areas containing critical habitat for the Bank Swallow. Step 1) Nesting colonies (red dot) trigger the extraction of shorelines within 5 km (outer black circle) from a record's spatial uncertainty distance (inner black circle; A); Step 2) Selection of shorelines (red lines) that intersect a radius made of the nesting records' spatial accuracy distance (up to 700 m) and a 100 m search distance. (B); Step 3) Application of a 500 m radial distance around selected shorelines to create the detailed critical habitat unit (yellow polygon) (C). Critical habitat occurs in detailed polygons (critical habitat units) where biophysical attributes are found (D).

[22] Shorelines were selected when they intersected a radius made of the nesting records' spatial accuracy distance (up to 700 m) and a 100 m search distance. The width of a waterbody determined if a single or both sides of the waterbody were selected towards critical habitat.
[23] Shorelines were selected from the National Hydrographic Network (NHN), also known as Natural Resources Canada CanVec Hydro Features dataset, suite of data which includes waterbodies, watercourses and shorelines at a resolution of 1:50,000.

7.1.2 Biophysical features and attributes of critical habitat

This criterion for identifying critical habitat refers to the biophysical attributes of the various habitats in which the species can engage in activities associated with nesting (e.g., territory defense, nest building, brood rearing) and foraging in Canada (Table 6). The biophysical attributes of nesting habitat required by the Bank Swallow are generally defined by the presence of a bank face made of erodible material. During the breeding period, the biophysical attributes of foraging habitat are generally defined by the presence of open habitats that produce insects, such as wetlands, salt marshes, grasslands and hayfields. Seasonal wetlands or ponds that are flooded in the spring provide important insect prey to Bank Swallows at the onset of the breeding season.

Land covers unsuitable for foraging such as cropland, manicured lawns, golf courses, or hard surfaces (paved roads, exposed bedrock, etc.) and any hedgerow adjacent to those land covers hold limited value for sustaining insects consumed by Bank Swallows, and they are not identified as critical habitat even when they occur within the critical habitat unit.

Table 6. Essential functions, biophysical features and key attributes of nesting and foraging habitat for Bank Swallow.

Life stage	**Function**	**Biophysical Feature(s)**	**Attributes**
Adults and juveniles	Nesting	Natural bank structure such as stream bank, river bank, bluffs, cliffs, eskers, or dunes	• Morphological attributes: - Vertical or near-vertical face (portion of the bank above the talus with a slope of at least 70 degrees) structure - Minimum height of bank face of 0.5 metres • Composition of erodible material that would include any proportions of the following substrates: - Sand - Silt - Loose clay - Fine gravel - Organic soils
OR, within areas containing critical habitat			
Adults and juveniles	Foraging	Waterbodies producing insects	• Rivers and creeks • Lakes • Wetlands • Salt marshes
		OR	

Life stage	Function	Biophysical Feature(s)	Attributes
		Open country with vegetated cover producing insects, including hedgerows and shelterbelts in agricultural lands, excluding croplands.	• Grasslands • Shrublands • Pastures • Hayfields • Dunes

7.1.3 Application of critical habitat identification criteria

The application of criteria described in section 7.1.1 identifies 289 critical habitat units for the Bank Swallow in Canada (critical habitat units may overlap between two jurisdictions resulting in a total higher than 289; Appendix D): 4 in Yukon, 6 in the Northwest Territories, 41 in British Columbia, 18 in Alberta, 6 in Saskatchewan, 32 in Manitoba, 50 in Ontario, 52 in Quebec, 37 in New Brunswick, 28 in Nova Scotia, 16 in Prince Edward Island, and 5 in Newfoundland and Labrador. Confirmed nesting records were not available in Nunavut, therefore no critical habitat units have been identified in that territory.

The application of the criteria described in section 7.1.1 identifies 8,274 km of shorelines. In inland settings, segments of shorelines that correspond to the biophysical attributes of nesting habitat described in section 7.1.2 likely amount to one hundredth to one tenth of the total extent of shorelines (for example 82 km to 827 km, respectively). In coastal settings, this proportion increases up to 45% of the total extent of shorelines. Those estimations are based on a visual assessment of the presence of biophysical attributes in a subset of identified shorelines, using aerial images. The extent of nesting habitat within the critical habitat identified in this recovery strategy is insufficient to support the population objectives for Bank Swallow.

The distribution of critical habitat units (Appendix E – Figure E) closely represents the known distribution (Figure 1) and extent of occurrence of 9.95 million km^2 (COSEWIC 2013) of the species in Canada, suggesting that the critical habitat units identified in this recovery strategy might ensure that redundance is maintained. The critical habitat presented in this recovery strategy defines the benchmark for the distribution objective. As such, the critical habitat identification will need to be replicated with more recent Bank Swallow occurrences over a similar number of years (e.g., 17 years) to determine whether the distribution objective for the species is achieved.

Reference to the general areas containing critical habitat is provided in Appendix D and presented in Appendix E. Detailed maps that illustrate the critical habitat units can be requested by contacting Environment and Climate Change Canada – Canadian Wildlife Service at ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

7.2 Schedule of Studies to Identify Critical Habitat

A schedule of studies has been developed to provide the information necessary to complete the identification of critical habitat (Table 7). By 2027, knowledge on the location, characteristics and relative importance of nesting and roosting habitats should inform the need for identifying new critical habitat units for Bank Swallow in order to achieve the short-term and long-term population objectives.

Table 7. Schedule of studies to identify critical habitat.

Description of Activity	Rationale	Timeline
Conduct Bank Swallow colony surveys, especially in the northern portion of the species' range.	The presence of Bank Swallow colonies should be confirmed for occurrences records that only provided possible or probable nesting evidence. This activity is required such that sufficient critical habitat is identified to meet the population objectives.	2022–2027
Determine the biophysical attributes, location, extent and contribution to population processes of post-fledging roost and foraging habitats near natural nesting colonies.	Bank Swallow fledglings require roosting and foraging habitat near their natal site but the characteristics, location, quantity and quality of post-fledging habitat are unknown. This activity is required to complete the identification of critical habitat.	2022–2027
Determine the biophysical attributes, location, extent and contribution to population processes of nocturnal roosting sites used during the breeding period or the pre-migratory period.	Bank Swallows roost communally during the breeding period and before the fall migration, but the characteristics, location, quantity and quality of roosting habitats are unknown. This activity is required to complete the identification of critical habitat.	2022–2027

Several habitat types are required by the Bank Swallow to accomplish its essential functions when the species is in Canada. Those habitats are the nocturnal roosts used during the breeding period, the post-fledging roosting sites near nesting sites, and pre-migratory roosting sites. More information is needed on the availability, characteristics, location and relative importance of those habitats to the recovery of the species.

Nocturnal roosts used during the breeding period

During the nesting period, Bank Swallows may require roosting habitat at night. Nocturnal roosting during the breeding period is difficult to study because birds can travel 10–35 km from the colony (Falconer et al. 2016b; Saldanha 2016) and frequently switch between roost locations (Saldanha 2016; Saldanha et al. 2019). The frequency of nocturnal roosting events during the breeding season suggest that those habitats may play an important role to support the recovery of the species (Falconer et al.

2016b; Saldanha et al. 2019). However, the availability, habitat characteristics, location and relative importance of those habitats are mostly unknown.

Post-fledging foraging and roosting sites near nesting sites

In addition to nesting habitat, Bank Swallows require post-fledging foraging and roosting sites near nesting habitat to support the post-fledging portion of their life history. In Barn Swallows, another aerial insectivore, the quality of post-fledging roosting sites appear to play an important role in the survival of fledglings and the recruitment of new individuals into the population (T. Imlay, pers. comm.). However, the availability, habitat characteristics, location and relative importance of those habitats are mostly unknown.

Pre-migratory roosting sites

Following the breeding season, Bank Swallow congregate in hundreds to tens of thousands of individuals at roosting sites until the fall migration (Winkler 2006; COSEWIC 2013). Pre-migratory roosts generally form from late July to early September. Swallows generally roost at night in wetlands, which provide food, heat and shelter. The presence of large flocks of swallows before sunrise and after sunset near large wetlands is indicative of the presence of a roost site. These movements can be observed using Doppler weather surveillance radar (Winkler 2006; Laughlin et al. 2016; Kelly and Pletschet 2017). Despite the key importance of roosting sites for Bank Swallow, the availability, habitat characteristics, location and relative importance of those habitats are mostly unknown.

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 occurs when part of the critical habitat is degraded, either permanently or temporarily, such that it can no longer serve its function when needed by the species. Destruction may result from a single activity at one point in time or from the cumulative effects of one or more activities over time.

Examples of activities likely to result in destruction of critical habitat for the Bank Swallow include, but are not limited to, activities that eliminate or damage nesting or foraging sites, modify the natural processes that maintain or create nesting sites, or modify the natural processes that maintain productive foraging sites. Examples are presented in Table 8.

Due to the dynamic nature of Bank Swallow nesting habitat, it is recognized that some activities listed in Table 8 can either destroy or create habitat. Nesting habitat is considered destroyed when the activity results in a permanent loss of critical habitat, or when the activity permanently removes the natural processes that maintain or create

nesting habitat[24]. Loss or alteration are deemed permanent when the biophysical attributes of the habitat are not available to the species at the beginning of the nesting season in the second calendar year following the activity[25].

It is recognized that some activities listed in Table 8 can contribute to create or maintain foraging habitat for Bank Swallows. On one hand, agricultural practices that diversify types and reduce areas of crops or restore natural habitats within existing farmlands can contribute to more diverse and abundant communities of insects consumed by Bank Swallow (Fahrig et al. 2011; Monck-Whipp et al. 2018). On the other hand, agricultural practices that result in large, monoculture fields (agricultural intensification), rather than smaller, more diverse fields, can degrade foraging habitat used by Bank Swallow. As such, agricultural intensification includes activities that remove the biophysical attributes of the foraging habitat, such as merging adjacent fields into a single culture by the removal of hedgerows.

[24] Any activity that is likely to result in the destruction of critical habitat may require a permit regardless if effects are deemed temporary or permanent.
[25] For example, for an activity that occurs in April 2022, the second calendar year starts on January 1, 2024. As such, effects would be considered temporary if biophysical attributes were not available during the 2022 and 2023 breeding seasons, but restored before the start of the 2024 breeding season.

Table 8. Examples of Activities Likely to Result in the Destruction of Critical Habitat for the Bank Swallow.[26]

Description of Activity	Description of Effect	Details of Effect
Nesting habitat (human-made sites are excluded from critical habitat identification)		
Alteration of the topography, composition or erosion processes of the bank or bluff, or permanently blocking access to nesting habitat Activities include, but are not limited to, erosion control measures by the installation of groynes, seawalls, breakwaters, rock embankments, beach nourishment, or removal of vegetation at the top of the bank. Related threat: 1.1 Housing & urban areas 1.2 Commercial & industrial areas 3.2 Mining & quarrying 4.1 Roads & railroads 7.2 Dams & water management/use 7.3 Other Ecosystem Modifications	Destruction of critical habitat by replacing the bank's unconsolidated sediments with hard structures or by changing the bank slope angle to less than 70 degrees. Destruction of critical habitat by eliminating or limiting the natural processes required for the stability or erosion of the bank or bluff.	Timing: Activities can result in the destruction of critical habitat at any time of year, if habitat is no longer available when needed by the species. Removal or conversion of habitat during the breeding season can be particularly detrimental because a variety of nesting habitat within 5 km of colonies is required by breeding individuals for relocation. Extent: Activities that occur within the bounds of a critical habitat unit will likely result in destruction of critical habitat. Erosion control measures that occur outside of the bounds of the critical habitat unit can change sediment flow and transport and have an impact on suitability of nesting habitat. Type: Activities can directly destroy critical habitat by altering the morphological attributes or composition of the bank or bluff. Activities can indirectly destroy critical habitat by altering the natural processes of erosion that maintain or create nesting habitat. Activities can indirectly destroy critical habitat by removing protection against nest predation afforded by steep and tall banks of bluffs. Thresholds: A bank slope of at least 70 degrees is required to maintain nesting habitat. Altering the topography or composition of all or part of a bank may result in destruction of critical habitat. The erosion or sedimentation rates associated with nesting habitat are variable given different hydrological regimes and surficial geology (the erodible material) across the species' range. All nesting habitat within a critical habitat unit is important for the colonization of that unit. Therefore, the removal of any nesting habitat within a critical habitat unit may destroy the critical habitat unit.

[26] Definition of extent: Activities that occur within the bounds of critical habitat must overlap with an area that contains the biophysical attributes of critical habitat. Activities that occur within the bounds of the critical habitat unit might occur anywhere within the area defined by the application of the criteria described in section 7.1.1.

Description of Activity	Description of Effect	Details of Effect
Activities that result in a direct loss of bank or bluff habitat through its conversion to an incompatible land-use (e.g., housing, urban, commercial, industrial, tourism, recreation, mining, transportation, energy production). Related threats: 1.1 Housing & urban areas 1.2 Commercial & industrial areas 1.3 Tourism & recreation areas 4.2 Roads & railroads 7.2 Dams & water management/use	Destruction of critical habitat by replacing the bank's unconsolidated sediments with hard structures or by changing the bank slope angle to less than 70 degrees.	Timing: Activities can result in the destruction of critical habitat at any time of year, if habitat is no longer available when needed by the species. Removal or conversion of nesting habitat during the breeding season can be particularly detrimental in the short-term because a variety of nesting habitat within 5 km of colonies is required by breeding individuals for relocation. Extent: Activity must occur within the bounds of critical habitat to cause its destruction. Type: Activities can directly destroy critical habitat if biophysical attributes are removed or modified. Thresholds: Removal or conversion of all or part of nesting habitat may result in destruction of critical habitat.
Changes in hydrological regime that alter water levels or flow rates. Activities include, but are not limited to, creation of reservoirs used in hydroelectricity production, construction of dams or channelization to control downstream water discharge. Related threat: 7.2 Dams & water management/use 7.3 Other Ecosystem Modifications	Destruction of critical habitat through the removal of biophysical attributes of nesting habitat. Destruction of critical habitat through the removal or alteration of erosion processes that maintain the morphological attributes of nesting habitat.	Timing: Activities can result in the destruction of critical habitat at any time of year, if habitat is no longer available when needed by the species or if activities result in a permanent reduction in water level that isolates the bank from natural erosion processes. It is recognized that once a new water level regime has stabilized, new nesting habitat may be created. However, a new water level regime might not provide an equivalent amount of nesting habitat or provide similar bank refreshment rate as before the activity was conducted. Such activity can still result in the destruction of critical habitat. During the nesting period of the Bank Swallow, a temporary increase of the water flow rate or water level can result in slumping of the bank and result in the loss of nests, eggs or nestlings, yet might not immediately or ultimately result in the destruction of critical habitat. The nesting period can be determined regionally using nesting calendars. The absence of the birds in August is a good indicator that the nesting season is over. Dam operators and water management agencies

Description of Activity	Description of Effect	Details of Effect
		should consider the presence of critical habitat of the Bank Swallow when conducting activities. Extent: Activities that occur within or outside the bounds of the critical habitat unit can result in destruction of critical habitat. Type: Activities can directly destroy critical habitat if biophysical attributes are removed or modified. Activities can indirectly destroy critical habitat if erosion processes that maintain the morphological attributes of nesting habitat are removed or altered. Thresholds: Permanent changes in hydrology that result in conditions outside of the seasonal fluctuations of water level may result in destruction of critical habitat.
Foraging habitat		
Activities that result in the removal of biophysical attributes of foraging habitat. Activities include, but are not limited to, development of residential, commercial, industrial, or recreational areas; intensification of agricultural activities within existing farmlands; greenhouse agriculture; mining or quarrying; construction of roads or railroads. Related threat: 1.1 Housing & urban areas 1.2 Commercial & industrial areas 1.3 Tourism & recreation areas 2.1 Annual & perennial non-timber crops 3.2 Mining & quarrying 4.2 Roads & railroads 7.3 Other ecosystem modifications	Destruction of critical habitat through permanent loss of ecosystem functions or habitats that produce or provide shelter to aerial insects.	Timing: Activities can result in the destruction of critical habitat at any time of year, if habitat is no longer available when needed by the species. Extent: Activity must occur within the bounds of critical habitat to cause destruction. The Bank Swallow requires foraging habitat near potential nesting habitat to meet energetic requirements of nest building, egg-production and brood rearing. Type: Activities can directly destroy critical habitat if biophysical attributes are removed. Thresholds: Information available at this time does not allow for the development of thresholds.

Description of Activity	Description of Effect	Details of Effect
Activities that result in the degradation of foraging habitat. Activities are restricted to: • application of insecticides without consideration of Integrated Pest Management practices; • application of insecticides for controlling populations of biting insect (such as mosquitoes); and • application of pesticides for landscaping or cosmetic purposes. Related threat: 7.3 Other ecosystem modifications 9.3 Agricultural & forestry effluents	Destruction of critical habitat through the contamination of soil, waters or vegetation that result in the removal or reduction in abundance of insect prey used by Bank Swallows for foraging or feeding young.	Timing: Applicable predominantly during the nesting period and post-fledging period of the Bank Swallow, including the post-fledging period. The nesting period can be determined regionally using nesting calendars. The absence of the birds in August is a good indicator that the nesting season is over. A single application of pesticide during the brood-rearing period can be particularly detrimental to the growth and development of young by reducing prey availability. Repeated events (within or between years) are likely to be more detrimental and have long-term impacts on the quality of foraging habitat as neonicotinoids have been found to accumulate in soils. Extent: Activities must occur within the bounds of critical habitat to cause destruction. Type: Activities can directly destroy critical habitat if biophysical attributes are degraded from pesticide application during the nesting or post-fledging periods. Activities can indirectly destroy critical habitat if foraging habitat remains degraded from one nesting season to the other as a result of repeated pesticide application. Thresholds: Repeated applications of pesticides both within and between years increase the risk of destroying critical habitat. Information available at this time does not allow for the development of thresholds.

Description of Activity	Description of Effect	Details of Effect
Permanent removal of hedgerows, shelterbelts, grassy field margins, riparian vegetation, wetlands, marshes, or ponds adjacent to arable land that provide a source of and shelter for insect prey. Related threat: 2.1 Annual & perennial non-timber crops	Destruction of critical habitat through the removal or reduction of terrestrial, aquatic or riparian vegetation that support insect prey used by Bank Swallows for foraging or feeding young.	Timing: Activities can result in the destruction of critical habitat at any time of year, if habitat is no longer available when needed by the species. Extent: Activities must occur within the bounds of critical habitat to cause destruction. Type: Activities can directly destroy critical habitat if biophysical attributes of the foraging habitat are removed. Thresholds: The risk of degrading critical habitat depends on multiple factors such as the extent of edge removal within the bounds of critical habitat, the species composition of hedgerows, and the overall habitat configuration and species richness within the area where critical habitat has been identified. Information available at this time does not allow for the development of thresholds.

8. Measuring Progress

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

- By 2033, the population trend of the Bank Swallow is declining at a slower rate than the 2009–2019 period as measured by the Breeding Bird Survey over a 10 year period;
- By 2033, the population size remains above 80% of the 2021 level as measured by a population index derived from the Breeding Bird Survey;
- By 2053, the population trend of the Bank Swallow is stable as measured by the Breeding Bird Survey over a 10 year period;
- By 2053, the population size remains above 90% of the 2021 level as measured by a population index derived from the Breeding Bird Survey;
- By 2050, the extent of occurrence of the Bank Swallow is maintained in reference to the 2001-2017 period as calculated by the area of a minimum convex polygon of confirmed breeding occurrences observed in the latest 17-year period (e.g. 2034-2050).

9. Statement on Action Plans

One or more action plans for the Bank Swallow will be posted on the Species at Risk Public Registry within five years of the final posting of the recovery strategy. This/these will be in addition to the multi-species action plans that have been developed by the Parks Canada Agency that include Bank Swallow.

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Appendix A: 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*[27]. 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[28] (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.

Several of the recommended activities may benefit the following aerial insectivore birds also listed as species at risk: Common Nighthawk (*Chordeiles minor*), Eastern Whip-poor-will (*Antrostomus vociferus*), Olive-sided Flycatcher (*Contopus cooperi*), Acadian Flycatcher (*Empidonax virescens*), Barn Swallow and Chimney Swift (*Chaetura pelagica*). The proposed measures may also benefit several other aerial insectivores that are not at risk, such as other swallow and flycatcher species. The protection afforded to Bank Swallow critical habitat might benefit other migratory bird species that nest in banks, such as Northern Rough-winged Swallow (*Stelgidopteryx serripennis*) and Belted Kingfisher (*Megaceryle alcyon*).

Recovery activities could have consequences to those species whose habitat requirements differ from the Bank Swallow. Therefore, it is important that stewardship and habitat management activities for the Bank Swallow be considered from an ecosystem perspective through the development, with input from responsible jurisdictions, 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, and other biodiversity goals (e.g., increasing forest cover).

[27] www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html
[28] www.fsds-sfdd.ca/index.html#/en/goals/

Appendix B: Acquisition Dates of Best Available Data

Biodiversity datasets are regularly updated with new or historical occurrences. Critical habitat is based on all suitable occurrence records available to Environment Climate Change Canada as of November 2020. The following list indicates acquisition dates of datasets that are susceptible to be regularly updated with new or historical occurrences and therefore is not an exhaustive list of datasets that constitute the best available data. Datasets from which data was retained towards critical habitat were acquired on the following dates:

October 2017
Newfoundland and Labrador Conservation Data Centre

November 2017
Alberta Fisheries and Wildlife Management Information System

January 2018
eBird Canada

October 2018
Saskatchewan Conservation Data Centre

February 2019
Ontario Natural Heritage Information Centre
SOS-POP (Quebec) – January 27, 2019 version.

August 2019
Atlantic Canada Conservation Data Centre
Project NestWatch

November 2020
British Columbia Conservation Data Centre

Appendix C: Breeding Evidence Categories and Codes

Occurrence records were assigned a standardized breeding evidence code and category used in Breeding Bird Atlases, with the exception of breeding bird atlas data, where codes were already provided, following the description of codes in the Saskatchewan Breeding Bird Atlas (sk.birdatlas.ca/jsp/codes.jsp). The following list provides possible observations of breeding evidence under three categories: possible, probable, and confirmed. The identification of critical habitat for Bank Swallow was restricted to records providing a confirmed breeding evidence.

Possible breeding:

- Species observed in its breeding season in suitable nesting habitat
- Singing male(s) present, or breeding calls heard, in suitable nesting habitat in breeding season

Probable breeding:

- Pair observed during the breeding season in suitable nesting habitat
- Permanent territory presumed through registration of territorial song on at least two days, a week or more apart, at the same place
- Courtship or display between a male and a female or two males, including chasing, flight displays, feeding or copulation
- Visiting probable nest site
- Agitated behaviour or repeated anxiety calls of an adult
- Brood patch on adult female or cloacal protuberance on adult male
- Adult carrying nest material
- Nest building or excavation of a nest hole
- At least seven individuals singing or producing other sounds associated with breeding (e.g., calls or drumming), heard during the same visit to a single square in suitable nesting habitat during the species' breeding season

Confirmed Breeding:

- Distraction display or injury feigning
- Used nest or egg shells found
- Recently fledged young, including young incapable of sustained flight
- Adult leaving or entering nest sites in circumstances indicating occupied nest
- Adult carrying faecal sac
- Adult carrying food for young
- Nest containing eggs or young, or a recently used empty nest
- Nest with young seen or heard

Appendix D: Locations of Critical Habitat for the Bank Swallow

Table D-1. Nesting critical habitat locations in Newfoundland and Labrador. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km) [a]	10 x 10 km Standardized UTM Grid Square Identification[b]	Land Tenure[c]
		Latitude	Longitude			
1233_NL_1	Larkin Point	47.7794	-59.3079	15	21TUN29, 21TUN39	Federal Land, Non-federal Land
1233_NL_2	Parsons Pond	50.0225	-57.6999	30	21UVR43, 21UVR44, 21UVR53, 21UVR54	Federal Land, Non-federal Land
1233_NL_3	Little Wabush Lake	52.9408	-66.8783	28	19UFU36, 19UFU46, 19UFU47	Federal Land, Non-federal Land
1233_NL_4	Smallwood Reservoir	53.8325	-64.0166	2	20UME36	Non-federal Land
1233_QCNL_1	Lac Bau	52.7868	-66.3190	21	19UFU75, 19UFU84, 19UFU85	Non-federal Land

[a] The length presented is that of the shoreline(s) that intersect a nesting colony (rounded up to the nearest 1 km) used in delimiting critical habitat polygons.

[b] Based on the standard UTM Military Grid Reference System, where the first 3 characters represent the UTM Zone, the following 2 letters indicate the 100 x 100 km standardized UTM grid. The last 2 digits represent the 10 x 10 km standardized UTM grid containing all or a portion of the critical habitat unit. This unique alphanumeric code is based on the methodology produced from the Breeding Bird Atlases of Canada (See Birds Canada for more information on breeding bird atlases).

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

Table D-2. Nesting critical habitat locations in Prince Edward Island. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_PE_1	Northumberland Strait - Wood Islands Area	45.9595	-62.7323	23	20TNR18, 20TNR19, 20TNR28, 20TNR29	Federal Land, Non-federal Land
1233_PE_2	Cameron Island	46.0617	-62.9911	20	20TMR99, 20TMS90, 20TNR09, 20TNS00	Federal Land, Non-federal Land
1233_PE_3	Hillsborough Bay - Jardines Point	46.1875	-63.0180	29	20TMS91, 20TNS01	Federal Land, Non-federal Land

1233_PE_4	Skmaqn-Port-la-Joye-Fort Amherst National Historic Site	46.1868	-63.1623	21	20TMS81, 20TMS91	Federal Land, Non-federal Land
1233_PE_5	Northumberland Strait - DeSable Area	46.1788	-63.4077	38	20TMS51, 20TMS61, 20TMS70, 20TMS71, 20TMS80	Federal Land, Non-federal Land
1233_PE_6	Launching Bay	46.2199	-62.4424	13	20TNS31, 20TNS41, 20TNS42	Federal Land, Non-federal Land
1233_PE_7	Northumberland Strait - Howe Bay	46.2960	-62.3634	25	20TNS42, 20TNS43, 20TNS52, 20TNS53	Federal Land, Non-federal Land
1233_PE_8	Sevenmile Bay	46.3206	-63.7667	38	20TMS32, 20TMS33, 20TMS42, 20TMS43	Federal Land, Non-federal Land
1233_PE_9	Black Pond Bird Sanctuary	46.3720	-62.1359	15	20TNS63, 20TNS73	Federally Protected Area, Non-federal Land
1233_PE_10	Prince Edward Island National Park Of Canada (A)	46.4257	-63.1025	27	20TMS74, 20TMS84, 20TMS93, 20TMS94, 20TNS03, 20TNS04	Federal Land, Federally Protected Area, Non-federal Land
1233_PE_11	Northumberland Strait - Maximeville Area	46.4336	-64.1160	28	20TMS13, 20TMS14	Federal Land, Non-federal Land
1233_PE_12	Prince Edward Island National Park Of Canada (B)	46.4653	-62.4888	58	20TNS14, 20TNS24, 20TNS34, 20TNS44, 20TNS54, 20TNS64	Federal Land, Federally Protected Area, Non-federal Land
1233_PE_13	Prince Edward Island National Park Of Canada (C)	46.4930	-63.3681	18	20TMS64, 20TMS65, 20TMS74, 20TMS75	Federal Land, Federally Protected Area, Non-federal Land
1233_PE_14	Malpeque Bay	46.5047	-63.6846	111	20TMS34, 20TMS44, 20TMS45, 20TMS55, 20TMS65	Federal Land, Non-federal Land
1233_PE_15	Cascumpec Bay	46.7487	-64.0959	25	20TMS17, 20TMS18	Non-federal Land
1233_PE_16	West Cape - Anglo Tignish	46.8747	-64.2074	76	20TLS96, 20TLS97, 20TLS98, 20TMS08, 20TMS09, 20TMS19, 20TMT10, 20TMT20, 20TMT21	Federal Land, Non-federal Land

Table D-3. Nesting critical habitat locations in Nova Scotia. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_NS_1	Kejimkujik National Park And National Historic Site Of Canada	43.8427	-64.8433	20	20TLP45, 20TLP55	Federal Land, Federally Protected Area, Non-federal Land
1233_NS_2	Cape St. Mary's	44.0492	-66.1734	13	19TGJ27, 19TGJ28	Federal Land, Non-federal Land
1233_NS_3	Kingsburg	44.2877	-64.2771	46	20TLP99, 20TLQ90, 20TLQ91, 20TMQ00	Federal Land, Non-federal Land
1233_NS_4	Rafuse Island	44.4539	-64.2367	3	20TMQ02	Non-federal Land
1233_NS_5	Martinique Beach	44.7028	-63.1388	44	20TMQ84, 20TMQ85, 20TMQ94, 20TMQ95	Non-federal Land
1233_NS_6	Annapolis River	44.7932	-65.3999	48	20TLQ05, 20TLQ06, 20TLQ16	Federal Land, Non-federal Land
1233_NS_7	Shubenacadie River	45.0072	-63.4479	25	20TMQ67, 20TMQ68	Non-federal Land
1233_NS_8	Bay of Fundy - Blomidon Peninsula	45.2190	-64.3577	21	20TLR90, 20TLR91	Federal Land, Non-federal Land
1233_NS_9	Bay of Fundy - Cobequid Bay	45.3048	-63.7614	41	20TMR31, 20TMR41	Non-federal Land
1233_NS_10	Bay of Fundy - The Brothers	45.3826	-64.2123	1	20TMR02	Non-federal Land
1233_NS_11	Bay of Fundy - Highland Village Area	45.3899	-63.6274	26	20TMR42, 20TMR52	Federal Land, Non-federal Land
1233_NS_12	Ouetique Island	45.6100	-60.9574	1	20TPR55	Federal Land, Non-federal Land
1233_NS_13	Big Island	45.6595	-62.4286	20	20TNR45	Non-federal Land
1233_NS_14	Northumberland Strait - Lismore Area	45.7012	-62.2882	14	20TNR45, 20TNR55, 20TNR56, 20TNR66	Federal Land, Non-federal Land
1233_NS_15	Bay of Fundy - Lower Cove	45.7224	-64.4379	16	20TLR85, 20TLR86, 20TLR96	Federal Land, Non-federal Land
1233_NS_16	Northumberland Strait - Waterside	45.7650	-62.7810	12	20TNR16, 20TNR26	Non-federal Land
1233_NS_17	Bras d'Or Lake	45.8051	-60.7686	3	20TPR77	Non-federal Land
1233_NS_18	Northumberland Strait - Cape John	45.7837	-63.0330	39	20TMR87, 20TMR96, 20TMR97, 20TNR06, 20TNR07	Federal Land, Non-federal Land

1233_NS_19	Pictou Island	45.8126	-62.5713	12	20TNR37	Federal Land, Non-federal Land
1233_NS_20	Northumberland Strait - Livingstone Cove	45.8671	-61.9711	12	20TNR77, 20TNR78, 20TNR88	Federal Land, Non-federal Land
1233_NS_21	Northumberland Strait - Heather Beach	45.8760	-63.7739	25	20TMR38, 20TMR47, 20TMR48	Federal Land, Non-federal Land
1233_NS_22	Baie Verte	45.9793	-63.9263	18	20TMR29, 20TMR38, 20TMR39	Non-federal Land
1233_NS_23	Livingstones Pond	45.9601	-61.5249	22	20TPR18, 20TPR19	Federal Land, Non-federal Land
1233_NS_24	Victoria Mines	46.2404	-60.1610	12	20TQS12, 20TQS22	Federal Land, Non-federal Land
1233_NS_25	Spanish Bay	46.2604	-60.2360	18	20TQS02, 20TQS03, 20TQS12, 20TQS13	Federal Land, Non-federal Land
1233_NS_26	Northumberland Strait - Gillis Cove	46.2952	-61.2556	13	20TPS32, 20TPS33	Non-federal Land
1233_NS_27	Cape Breton Highlands National Park Of Canada	46.8387	-60.3440	34	20TPS99, 20TQS08, 20TQS09	Federal Land, Federally Protected Area, Non-federal Land
1233_NS_28	Cape Breton Island - Polletts Cove	46.9175	-60.6984	12	20TPS79, 20TPT70	Non-federal Land

Table D-4. Nesting critical habitat locations in New Brunswick. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_NB_1	Grand Manan Island	44.7115	-66.7519	25	19TFK74, 19TFK75, 19TFK85	Federal Land, Non-federal Land
1233_NB_2	Bay of Fundy - Sand Cove Area	45.2227	-66.1220	20	19TGL20, 19TGL21, 19TGL31	Federal Land, Non-federal Land
1233_NB_3	Bay of Fundy - Quaco Bay	45.3473	-65.5253	17	20TKR92, 20TLR02	Federal Land, Non-federal Land
1233_NB_4	Nerepis River	45.4456	-66.3201	32	19TGL03, 19TGL04, 19TGL13, 19TGL14	Federal Land, Non-federal Land
1233_NB_5	Bay of Fundy - Rocher Bay	45.6184	-64.8094	17	20TLR55, 20TLR64, 20TLR65	Federal Land, Non-federal Land

1233_NB_6	Kennebecasis River	45.6070	-65.7304	23	20TKR84, 20TKR85, 20TKR95	Federal Land, Non-federal Land
1233_NB_7	Shepody Bay	45.8077	-64.5087	12	20TLR86, 20TLR87	Federal Land, Non-federal Land
1233_NB_8	Tintamarre National Wildlife Area	45.8810	-64.3418	66	20TLR97, 20TLR98, 20TLR99, 20TMR07	Federal Land, Federally Protected Area, Non-federal Land
1233_NB_9	Sugar Island	45.9813	-66.7987	13	19TFL69, 19TFL79	Non-federal Land
1233_NB_10	Nashwaak River - Penniac Area	46.0225	-66.5874	30	19TFL89, 19TFM80	Federal Land, Non-federal Land
1233_NB_11	Petitcodiac River	46.0631	-64.8389	14	20TLS50, 20TLS60	Federal Land, Non-federal Land
1233_NB_12	Cape Spear	46.0822	-63.8334	12	20TMS30, 20TMS40	Federal Land, Non-federal Land
1233_NB_13	Nashwaak River - Durham Bridge Area	46.1238	-66.6103	27	19TFM80, 19TFM81	Federal Land, Non-federal Land
1233_NB_14	Cap-Pelé - Little Shemogue Harbour	46.1827	-64.1473	85	20TLS91, 20TLS92, 20TMS01, 20TMS02, 20TMS10, 20TMS11, 20TMS21	Federal Land, Non-federal Land
1233_NB_15	Shediac Bay	46.2393	-64.5221	33	20TLS71, 20TLS72, 20TLS81, 20TLS82	Federal Land, Non-federal Land
1233_NB_16	Cap-des-Caissie	46.3296	-64.5291	12	20TLS73, 20TLS82, 20TLS83	Federal Land, Non-federal Land
1233_NB_17	Baie-de-Bouctouche	46.4466	-64.6660	14	20TLS64, 20TLS74	Federal Land, Non-federal Land
1233_NB_18	Saint John River - Florenceville	46.4596	-67.5978	13	19TFM04, 19TFM05, 19TFM14	Federal Land, Non-federal Land
1233_NB_19	Cap-Lumière	46.6499	-64.7146	12	20TLS66, 20TLS67	Federal Land, Non-federal Land
1233_NB_20	Saint John River - Lower Perth	46.7103	-67.7129	13	19TEM96, 19TEM97, 19TFM07	Federal Land, Non-federal Land
1233_NB_21	Kouchibouguac National Park Of Canada (A)	46.8064	-64.8913	16	20TLS58	Federal Land, Federally Protected Area, Non-federal Land
1233_NB_22	Little Southwest Miramichi	46.9480	-65.8710	21	20TKT70, 20TKT80	Federal Land, Non-federal Land
1233_NB_23	Kouchibouguac National Park Of Canada (B)	46.9521	-64.8477	14	20TLS59, 20TLT50, 20TLT60	Federal Land, Federally Protected Area, Non-federal Land

1233_NB_24	Bay du Vin River	47.0575	-65.1022	11	20TLT31, 20TLT41	Federal Land, Non-federal Land
1233_NB_25	Point aux Carr	47.0644	-65.2297	17	20TLT21, 20TLT31	Non-federal Land
1233_NB_26	Escuminac	47.0667	-64.8401	16	20TLT51, 20TLT60, 20TLT61	Federal Land, Non-federal Land
1233_NB_27	Pointe Morin	47.2241	-65.1105	17	20TLT33, 20TLT43	Federal Land, Non-federal Land
1233_NB_28	Tabusintac Bay	47.2922	-64.9761	28	20TLT43, 20TLT53, 20TLT54	Non-federal Land
1233_NB_29	Green River	47.4026	-68.1814	29	19TEN55, 19TEN64, 19TEN65	Non-federal Land
1233_NB_30	Val-Comeau	47.4542	-64.8785	6	20TLT55, 20TLT56	Federal Land, Non-federal Land
1233_NB_31	Baie de Tracadie	47.5326	-64.8658	11	20TLT56, 20TLT66	Non-federal Land
1233_NB_32	Green Point	47.6205	-64.8085	10	20TLT67, 20TLT68	Non-federal Land
1233_NB_33	Little Main Restigouche River	47.6629	-67.5006	15	19TFN07, 19TFN17, 19TFN18	Non-federal Land
1233_NB_34	Chiasson	47.7448	-64.6319	18	20TLT78, 20TLT79, 20TLT88, 20TLT89	Federal Land, Non-federal Land
1233_NB_35	Lac Chenière	47.9638	-64.5389	3	20ULU81	Non-federal Land
1233_QCNB_1	Patapedia River	47.8437	-67.3810	31	19TFN19, 19TFN29, 19UFP10, 19UFP20	Non-federal Land
1233_QCNB_2	Restigouche River	47.9940	-66.8641	12	19UFP51, 19UFP61	Federal Land, Non-federal Land

Table D-5. Nesting critical habitat locations in Quebec. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_QC_1	Rivière des Prairies	45.6839	-73.5393	4	18TXR15, 18TXR16	Non-federal Land
1233_QC_2	Île Beauregard	45.7520	-73.4095	4	18TXR26	Non-federal Land
1233_QC_3	Île aux Prunes	45.8133	-73.3327	1	18TXR27, 18TXR37	Federal Land, Non-federal Land
1233_QC_4	Île Saint-Ours	45.9144	-73.2226	6	18TXR38	Federal Land, Federally Protected Area, Non-federal Land

1233_QC_5	Rivière Yamaska - Secteur de Massueville	45.8801	-72.9344	33	18TXR57, 18TXR58, 18TXR67, 18TXR68, 18TXR69	Non-federal Land
1233_QC_6	Rivière Richelieu - Secteur de Sorel-Tracy	46.0101	-73.1339	21	18TXR49, 18TXS40	Federal Land, Non-federal Land
1233_QC_7	Rivière Yamaska - Secteur de Yamaska	46.0207	-72.9208	27	18TXR59, 18TXR69, 18TXS50, 18TXS60	Non-federal Land
1233_QC_8	Rivière Bulstrode	46.0592	-72.2190	28	18TYS10, 18TYS20	Non-federal Land
1233_QC_9	Rivière Saint-François - Secteur de Pierreville	46.0757	-72.8440	11	18TXS60, 18TXS70	Federal Land, Non-federal Land
1233_QC_10	Rivière Rouge - Secteur de La Conception	46.1940	-74.7084	50	18TWS20, 18TWS21, 18TWS22	Non-federal Land
1233_QC_11	Bras Saint-Victor	46.2519	-70.8373	15	19TCM51, 19TCM52	Non-federal Land
1233_QC_12	Rivière Bécancour - Secteur de Bécancour	46.3106	-72.4006	45	18TXS93, 18TYS02, 18TYS03	Federal Land, Non-federal Land
1233_QC_13	Rivière Désert - Secteur de Kitigan Zibi	46.3846	-76.0101	27	18TVS13, 18TVS14, 18TVS23, 18TVS24	Federal Land, Non-federal Land
1233_QC_14	Rivière Rouge - Secteur de Rivière-Rouge	46.4399	-74.8870	36	18TWS03, 18TWS04, 18TWS13, 18TWS14	Federal Land, Non-federal Land
1233_QC_15	Île du Village - Réservoir Taureau	46.7384	-73.7933	4	18TWS97	Non-federal Land
1233_QC_16	St. Lawrence River - Saint-Vallier Area	46.9111	-70.7846	14	19TCM59, 19TCM69, 19TCN60	Federal Land, Federally Protected Area, Non-federal Land
1233_QC_17	Riviere du Sud	46.9177	-70.6481	31	19TCM79, 19TCN70	Non-federal Land
1233_QC_18	St. Lawrence River - Montmagny Area	46.9956	-70.5501	13	19TCN70, 19TCN80	Federal Land, Federally Protected Area, Non-federal Land
1233_QC_19	L'Isle-aux-Grues	47.1039	-70.5025	13	19TCN81, 19TCN82	Federal Land, Non-federal Land
1233_QC_20	Îles-de-la-Madeleine - Secteur de Cap-aux-Meules	47.3817	-61.9008	63	20TNT74, 20TNT75, 20TNT84, 20TNT85	Federal Land, Non-federal Land
1233_QC_21	Îles-de-la-Madeleine - Secteur de Havre aux Maisons	47.4148	-61.7689	14	20TNT84, 20TNT85, 20TNT94, 20TNT95	Federal Land, Non-federal Land
1233_QC_22	Îles-de-la-Madeleine - Secteur de Grande-Entrée	47.5750	-61.4806	18	20TPT16, 20TPT17	Federal Land, Federally Protected Area, Non-federal Land

1233_QC_23	Chaleur Bay - New Carlisle Area	48.0116	-65.3673	22	20ULU11, 20ULU12, 20ULU21, 20ULU22, 20ULU31, 20ULU32	Federal Land, Non-federal Land
1233_QC_24	Rivière Verte	48.0083	-69.3444	46	19UDP61, 19UDP71, 19UDP72	Federal Land, Federally Protected Area, Non-federal Land
1233_QC_25	Chaleur Bay - Saint-Godefroi Area	48.0731	-65.1118	17	20ULU32, 20ULU42, 20ULU43	Federal Land, Non-federal Land
1233_QC_26	Chaleur Bay - Carleton-sur-Mer Area	48.1078	-66.0862	22	19UGP12, 19UGP13, 19UGP23	Federal Land, Non-federal Land
1233_QC_27	Chaleur Bay - Port-Daniel-Gascons Area	48.1921	-64.8588	14	20ULU53, 20ULU63, 20ULU64	Federal Land, Non-federal Land
1233_QC_28	St. Lawrence River - Les Bergeronnes Area	48.2386	-69.5524	6	19UDP54, 19UDP64	Federal Land, Non-federal Land
1233_QC_29	Chaleur Bay - Chandler Area	48.3667	-64.5962	16	20ULU75, 20ULU85, 20ULU86	Federal Land, Non-federal Land
1233_QC_30	Rivière du Moulin	48.4114	-71.0340	13	19UCP46, 19UCP56	Federal Land, Non-federal Land
1233_QC_31	Rivière Cascapédia	48.4433	-66.0264	25	19UGP16, 19UGP17, 19UGP26, 19UGP27, 20UKU76	Non-federal Land
1233_QC_32	Île Bonaventure	48.4952	-64.1624	10	20UMU17	Non-federal Land, Federally Protected Area
1233_QC_33	Gulf of St. Lawrence - Percé Area	48.4634	-64.3122	37	20ULU96, 20UMU06, 20UMU07, 20UMU17	Federal Land, Federally Protected Area, Non-federal Land
1233_QC_34	Gulf of St. Lawrence - Pointe-Saint-Pierre Area	48.6340	-64.2123	21	20UMU08, 20UMU09, 20UMU18, 20UMU19	Federal Land, Non-federal Land
1233_QC_35	Estuaire du Saint-Laurent - Secteur de Baie-des-Sables	48.7308	-67.8753	11	19UEP79, 19UEP89, 19UEQ80	Federal Land, Non-federal Land
1233_QC_36	Gulf of St. Lawrence - Rivière-au-Renard Area	49.0016	-64.3936	12	20ULV92, 20ULV93, 20UMV02	Federal Land, Non-federal Land
1233_QC_37	Lac de la Main	49.0315	-69.4468	12	19UDQ62, 19UDQ63	Non-federal Land
1233_QC_38	Estuaire du Saint-Laurent - Secteur de Pointe-aux-Outardes	49.0634	-68.4055	23	19UEQ33, 19UEQ43	Non-federal Land
1233_QC_39	Estuaire du Saint-Laurent - Pointe-Lebel	49.1099	-68.2067	12	19UEQ53, 19UEQ54, 19UEQ63, 19UEQ64	Federal Land, Non-federal Land
1233_QC_40	Gulf of St. Lawrence - Marsoui Area	49.2108	-66.1224	20	19UGQ05, 19UGQ15, 20UKV85	Federal Land, Non-federal Land

1233_QC_41	Gulf of St. Lawrence - Mont-Saint-Pierre Area	49.2310	-65.8069	12	20UKV95, 20ULV05	Federal Land, Non-federal Land
1233_QC_42	Gulf of St. Lawrence - Baie-Trinité Area	49.4856	-67.2365	15	19UFQ27, 19UFQ28	Non-federal Land
1233_QC_43	Rivière Sainte-Marguerite	50.1455	-66.6328	12	19UFR65, 19UFR66, 19UFR75	Non-federal Land
1233_QC_44	Île aux Perroquets	50.2209	-64.2060	1	20UMA16	Federal Land, Federally Protected Area, Non-federal Land
1233_QC_45	Rivière Moisie	50.2345	-66.0632	39	19UGR06, 19UGR07, 19UGR16, 19UGR17	Federal Land, Non-federal Land
1233_QC_46	Rivière Saint-Jean	50.2998	-64.3223	13	20UMA07, 20UMA17	Federal Land, Non-federal Land
1233_QC_47	Rivière Mistassibi	50.4361	-72.1864	7	18UXA98, 18UYA08, 18UYA09	Non-federal Land
1233_QC_48	Rivière au Chien Rouge	59.3149	-69.7600	19	19VDF57	Non-federal Land
1233_QCNL_1	Lac Bau	52.7868	-66.3190	21	19UFU75, 19UFU84, 19UFU85	Non-federal Land
1233_QCNB_1	Patapedia River	47.8437	-67.3810	31	19TFN19, 19TFN29, 19UFP10, 19UFP20	Non-federal Land
1233_QCNB_2	Restigouche River	47.9940	-66.8641	12	19UFP51, 19UFP61	Federal Land, Non-federal Land
1233_QCON_1	Île Kettle	45.4706	-75.6517	10	18TVR43, 18TVR53	Federal Land, Non-federal Land

Table D-6. Nesting critical habitat locations in Ontario. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_ON_1	Long Point National Wildlife Area	42.5462	-80.0881	54	17TNH70, 17TNH71	Federal Land, Federally Protected Area, Non-federal Land
1233_ON_2	Lake Erie shoreline - Duttona Beach, Lake Erie shoreline - Port Glasgow	42.5607	-81.5240	23	17TMH40, 17TMH50, 17TMH51, 17TMH61	Non-federal Land
1233_ON_3	Thames River (B)	42.6403	-81.7578	30	17TMH31, 17TMH32, 17TMH42	Federal Land, Non-federal Land

1233_ON_4	Lake Erie shoreline - Port Stanley to Big Creek National Wildlife Area	42.6342	-80.8722	75	17TMH72, 17TMH82, 17TMH92, 17TNH02, 17TNH11, 17TNH12, 17TNH21, 17TNH22, 17TNH31, 17TNH41	Federal Land, Federally Protected Area, Non-federal Land
1233_ON_5	St. Clair River	42.7981	-82.4687	13	17TLH73, 17TLH74, 17TLH83, 17TLH84	Federal Land, Non-federal Land
1233_ON_6	Lake Erie shoreline - Point Abino	42.8590	-79.1076	20	17TPH44, 17TPH54	Non-federal Land
1233_ON_7	Thames River (A)	42.8908	-81.4158	59	17TMH64, 17TMH65	Federal Land, Non-federal Land
1233_ON_8	Highland Glen	43.0984	-82.1216	12	17TMH06, 17TMH07, 17TMH17	Non-federal Land
1233_ON_9	Nith River	43.1999	-80.4440	58	17TNH48, 17TNH58	Federal Land, Non-federal Land
1233_ON_10	Grand River (B)	43.4100	-80.4069	34	17TNJ40, 17TNJ41, 17TNJ50	Federal Land, Non-federal Land
1233_ON_11	Lake Ontario shoreline - Oakville	43.4580	-79.6479	23	17TPJ00, 17TPJ01, 17TPJ11, 17TPJ12	Federal Land, Non-federal Land
1233_ON_12	Grand River (A)	43.5107	-80.4784	46	17TNJ32, 17TNJ41, 17TNJ42	Non-federal Land
1233_ON_13	Etobicoke Creek, Lake Ontario shoreline - Port Credit	43.6013	-79.5626	48	17TPJ12, 17TPJ13, 17TPJ22	Federal Land, Non-federal Land
1233_ON_14	Humber River (B)	43.6937	-79.5226	55	17TPJ13, 17TPJ14, 17TPJ23	Federal Land, Non-federal Land
1233_ON_15	Lake Ontario shoreline - Toronto	43.6914	-79.2556	69	17TPJ32, 17TPJ33, 17TPJ43, 17TPJ44, 17TPJ54, 17TPJ55	Federal Land, Non-federal Land
1233_ON_16	Highland Creek	43.7896	-79.2283	46	17TPJ34, 17TPJ35, 17TPJ44, 17TPJ45	Federal Land, Non-federal Land
1233_ON_17	Rouge River	43.8269	-79.1964	42	17TPJ45, 17TPJ55	Federal Land, Non-federal Land
1233_ON_18	Humber River (A), East Humber River	43.8182	-79.6156	92	17TPJ05, 17TPJ14, 17TPJ15	Federal Land, Non-federal Land
1233_ON_19	Lake Ontario shoreline - Frenchman's Bay, Duffins Creek	43.8427	-78.9966	43	17TPJ55, 17TPJ65, 17TPJ75	Federal Land, Non-federal Land
1233_ON_20	Sandbanks Provincial Park	43.9234	-77.3120	19	18TUP06, 18TUP16, 18TUP26	Federal Land, Non-federal Land
1233_ON_21	Lake Ontario shoreline - Huycks Bay	43.9379	-77.4887	13	18TTP96, 18TTP97, 18TUP06	Non-federal Land
1233_ON_22	Black Creek	43.9466	-77.0627	16	18TUP36, 18TUP37	Federal Land, Non-federal Land

1233_ON_23	Lake Ontario shoreline - Cobourg	43.9620	-78.0946	21	17TQJ26, 17TQJ27, 17TQJ37, 17TQJ47, 18TTP57, 18TTP67	Federal Land, Non-federal Land
1233_ON_24	Wellers Bay National Wildlife Area	44.0052	-77.6118	15	18TTP87, 18TTP97	Federal Land, Federally Protected Area, Non-federal Land
1233_ON_25	Saugeen River (C)	44.1767	-80.9590	31	17TMJ98, 17TMJ99, 17TNJ08, 17TNJ09	Non-federal Land
1233_ON_26	Saugeen River (B)	44.1795	-81.1570	107	17TMJ88, 17TMJ89, 17TMJ98, 17TMK80	Federal Land, Non-federal Land
1233_ON_27	Nottawasaga River (B)	44.2705	-79.8403	101	17TNJ98, 17TNJ99, 17TNK80, 17TNK81, 17TNK90, 17TNK91	Federal Land, Non-federal Land
1233_ON_28	Saugeen River (A)	44.4832	-81.3336	32	17TMK62, 17TMK72	Federal Land, Non-federal Land
1233_ON_29	Nottawasaga Bay Shoreline - Wasaga Beach, Nottawasaga River (A)	44.5069	-80.0198	54	17TNK72, 17TNK73, 17TNK82, 17TNK83	Federal Land, Non-federal Land
1233_ON_30	Park Head Creek	44.6009	-81.1264	15	17TMK83, 17TMK93	Non-federal Land
1233_ON_31	Moira River	44.5816	-77.5782	28	18TTQ93, 18TTQ94	Non-federal Land
1233_ON_32	Nottawasaga Bay Shoreline - Nottawasaga Beach	44.7128	-80.0337	14	17TNK74, 17TNK75, 17TNK84	Non-federal Land
1233_ON_33	Burnt River	44.6880	-78.6876	49	17TPK74, 17TPK84, 17TPK85	Non-federal Land
1233_ON_34	Kawpagwakog River	45.1091	-79.1324	33	17TPK49, 17TPL40	Federal Land, Non-federal Land
1233_ON_35	Georgian Bay shoreline - Bruce Peninsula	45.1406	-81.3185	12	17TMK79, 17TML70	Federal Land, Non-federal Land
1233_ON_36	Big East River	45.3788	-79.1978	62	17TPL32, 17TPL42, 17TPL43	Non-federal Land
1233_ON_37	Goulais River (A)	46.7219	-84.3739	62	16TFS97, 16TGS07	Non-federal Land
1233_ON_38	Goulais River (B)	46.7593	-84.0802	39	16TGS17, 16TGS18, 16TGS28	Non-federal Land
1233_ON_39	Sturgeon River	46.9352	-80.4371	39	17TNM49, 17TNN30, 17TNN40	Non-federal Land
1233_ON_40	Magpie River	48.0425	-84.7832	35	16UFU61, 16UFU62	Non-federal Land
1233_ON_41	Wilson Creek (B)	48.8099	-94.6495	11	15UUQ70, 15UUQ80	Non-federal Land
1233_ON_42	Knox Creek	51.2203	-94.4418	8	15UUS97, 15UVS07	Non-federal Land
1233_ON_43	Albany River (A)	51.8070	-83.0482	18	17ULT53, 17ULT54, 17ULT64	Non-federal Land

1233_ON_44	Albany River (B)	51.9288	-82.7045	11	17ULT75, 17ULT85	Non-federal Land
1233_ON_45	Ekwan River	53.3157	-82.5214	14	17ULV90, 17ULV91, 17UMV00	Non-federal Land
1233_ON_46	Severn River (B)	55.0681	-88.9706	25	16UCF79, 16UCG60, 16UCG70	Non-federal Land
1233_ON_47	Severn River (A)	55.1455	-88.6979	26	16UCG81, 16UCG91	Non-federal Land
1233_ON_48	Severn River (C)	56.0093	-87.5317	12	16VDH60, 16VDH70	Non-federal Land
1233_ON_49	Black Duck River	56.3814	-89.3814	41	16VCH44, 16VCH54, 16VCH55	Non-federal Land
1233_QCON_1	Île Kettle	45.4706	-75.6517	10	18TVR43, 18TVR53	Federal Land, Non-federal Land

Table D-7. Nesting critical habitat locations in Manitoba. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_MB_1	Cypress Creek (A)	49.0295	-98.9452	4	14UNV02, 14UNV03	Non-federal Land
1233_MB_2	Cypress Creek (B)	49.0447	-98.9936	2	14UMV93, 14UNV03	Non-federal Land
1233_MB_3	Gainsborough Creek	49.0837	-101.3414	1	14ULV23	Non-federal Land
1233_MB_4	Long River	49.1391	-99.5402	32	14UMV54, 14UMV64	Non-federal Land
1233_MB_5	Pembina River (A)	49.0932	-98.5421	152	14UNV23, 14UNV24, 14UNV33, 14UNV34, 14UNV43	Non-federal Land
1233_MB_6	Roseau River	49.1939	-96.8953	44	14UPV45, 14UPV54, 14UPV55	Federal Land, Non-federal Land
1233_MB_8	Rock Lake	49.2180	-99.2390	20	14UMV75, 14UMV84, 14UMV85	Non-federal Land
1233_MB_9	Graham Creek	49.2536	-101.1564	0	14ULV45	Non-federal Land
1233_MB_10	Pembina River (B)	49.2253	-99.0406	48	14UMV94, 14UMV95, 14UNV05	Non-federal Land
1233_MB_11	Medora Creek (A)	49.3347	-100.8265	0	14ULV66	Non-federal Land
1233_MB_12	Medora Creek (B)	49.3409	-100.7237	0	14ULV76	Non-federal Land
1233_MB_13	Cypress River	49.5194	-98.6672	0	14UNV28	Non-federal Land
1233_MB_14	Stephenfield Lake	49.5258	-98.3070	16	14UNV48, 14UNV58	Non-federal Land

1233_MB_15	Souris River	49.6062	-100.2525	46	14UMV09, 14UMV19	Federal Land, Non-federal Land
1233_MB_16	Assiniboine River (A)	49.6667	-99.2539	90	14UMA70, 14UMA80, 14UMV79, 14UMV89	Federal Land, Non-federal Land
1233_MB_17	Red River (A)	49.7826	-97.1335	26	14UPA31	Federal Land, Non-federal Land
1233_MB_18	Red River (B)	49.9422	-97.0937	26	14UPA32, 14UPA33, 14UPA43	Federal Land, Non-federal Land
1233_MB_19	Little Saskatchewan River	49.9560	-100.2304	46	14UMA03, 14UMA13	Non-federal Land
1233_MB_20	Assiniboine River (B)	50.0093	-97.7697	44	14UNA83, 14UNA84, 14UNA93, 14UNA94	Non-federal Land
1233_MB_21	Assiniboine River (C)	50.4102	-101.2743	48	14ULA38, 14ULA39, 14ULA48	Non-federal Land
1233_MB_22	Big Grass River	50.4811	-98.9382	12	14UNA09	Non-federal Land
1233_MB_23	Winnipeg River	50.5192	-96.1188	18	14UQA09, 14UQB00	Non-federal Land
1233_MB_24	Woody River	52.1466	-101.4721	43	14ULC27, 14ULC28, 14ULC37, 14ULC38	Non-federal Land
1233_MB_25	Gods River	56.1405	-92.4914	13	15VWC22, 15VWC31, 15VWC32	Non-federal Land
1233_MB_26	Owl River	57.3684	-94.1951	42	15VVD25, 15VVD26, 15VVD35, 15VVD36	Non-federal Land
1233_MB_27	Wapusk National Park Of Canada (A)	57.4986	-93.7881	32	15VVD46, 15VVD47, 15VVD56, 15VVD57	Federal Land, Federally Protected Area
1233_MB_28	Wapusk National Park Of Canada (B)	57.5849	-93.5467	26	15VVD67, 15VVD68, 15VVD78	Federal Land, Federally Protected Area
1233_MB_29	Wapusk National Park Of Canada (C)	57.6466	-93.3948	26	15VVD78, 15VVD79	Federal Land, Federally Protected Area
1233_MB_30	Wapusk National Park Of Canada (D)	57.7801	-93.1246	29	15VVE80, 15VVE90	Federal Land, Federally Protected Area
1233_MB_31	Wapusk National Park Of Canada (E)	57.8287	-92.8184	17	15VWE00, 15VWE10, 15VWE11	Federal Land, Federally Protected Area, Non-federal Land
1233_MB_32	Seal River	58.9948	-95.4154	5	15VUF64	Non-federal Land
1233_MB_33	Nueltin Lake	59.8317	-100.0500	30	14VMM33, 14VMM43	Non-federal Land

Table D-8. Nesting critical habitat locations in Saskatchewan. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_SK_1	Swift Current Creek	50.4471	-107.6331	1	13UCR19	Non-federal Land
1233_SK_2	South Saskatchewan River	51.3525	-106.9840	12	13UCS68, 13UCS69	Non-federal Land
1233_SK_3	North Saskatchewan River (A)	52.5684	-107.9389	22	12UYD02, 13UBU92, 13UCU02	Federal Land, Non-federal Land
1233_SK_4	Duck Lake	52.7893	-106.2751	42	13UDU14, 13UDU15	Federal Land, Non-federal Land
1233_SK_5	North Saskatchewan River (B)	52.9463	-108.5716	26	12UXD56, 12UXD57, 12UXD66, 12UXD67, 12UXD76	Non-federal Land
1233_SK_6	North Saskatchewan River (C)	53.1680	-108.9878	25	12UXD38, 12UXD39	Non-federal Land

Table D-9. Nesting critical habitat locations in Alberta. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_AB_1	Castle River	49.3969	-114.3426	27	11UPQ87, 11UPQ97, 11UPQ98	Non-federal Land
1233_AB_2	Crowsnest River	49.5720	-114.2357	30	11UPQ99, 11UQQ09	Non-federal Land
1233_AB_3	Willow Creek (A)	49.9256	-113.6024	37	12UUA03, 12UUA12, 12UUA13	Non-federal Land
1233_AB_4	Oldman River	49.9269	-111.7118	21	12UVA42, 12UVA43, 12UVA53	Non-federal Land
1233_AB_5	Clear Lake	50.1478	-113.4171	12	12UUA25, 12UUA26	Non-federal Land
1233_AB_6	Little Bow River	50.2175	-112.8919	22	12UUA56, 12UUA66, 12UUA76	Non-federal Land
1233_AB_7	Matzhiwin Creek	50.8378	-111.9361	47	12UVB23, 12UVB33	Non-federal Land

1233_AB_8	Inglewood Bird Sanctuary	51.0047	-114.0908	98	11UPS95, 11UQS04, 11UQS05, 11UQS15, 12UTB85, 12UTB95	Federal Land, Federally Protected Area, Non-federal Land
1233_AB_9	Rosebud	51.3125	-112.9015	55	12UUB68, 12UUB78	Non-federal Land
1233_AB_11	Red Deer Bird Sanctuary	52.1682	-113.9728	205	11UPT86, 11UPT87, 11UPT96, 11UPT97, 11UQT07, 12UTC97, 12UTC98, 12UUC08, 12UUC09, 12UUC19, 12UUD00, 12UUD10	Federal Land, Federally Protected Area, Non-federal Land
1233_AB_10	Red Deer River	52.2665	-113.5784	22	12UUC19, 12UUC29	Non-federal Land
1233_AB_12	North Saskatchewan River (D)	53.4098	-114.3528	46	11UPV71, 11UPV72, 11UPV82	Non-federal Land
1233_AB_13	North Saskatchewan River (E)	53.4679	-113.6158	15	12UUE22, 12UUE23	Non-federal Land
1233_AB_14	Peace River (D)	56.2637	-118.9769	11	11VLC73, 11VLC83	Non-federal Land
1233_AB_15	Banff National Park Of Canada	51.2552	-115.4654	15	11UPS07, 11UPS08, 11UPS17, 11UPS18	Federal Land, Federally Protected Area
1233_AB_16	Jasper National Park Of Canada (A)	52,9926	-118.0607	46	11UMU26, 11UMU27, 11UMU28, 11UMU36, 11UMU2637	Federal Land, Federally Protected Area
1233_AB_17	Jasper National Park Of Canada (B)	53.1163	-117.9924	29	11UMU38, 11UMU39	Federal Land, Federally Protected Area
1233_BCAB_1	Peace River (A)	56.1133	-120.3001	60	10VFH42, 10VFH51, 10VFH52, 10VFH61, 10VFH62, 10VFH71, 10VFH72, 10VFH82, 11VLC12	Non-federal Land

Table D-10. Nesting critical habitat locations in British Columbia. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_BC_1	Pend d'Oreille River	49.0264	-117.5023	64	11UMQ52, 11UMQ53, 11UMQ62, 11UMQ63, 11UMQ72, 11UMQ73	Federal Land, Non-federal Land
1233_BC_2	Flathead River	49.0276	-114.4965	19	11UPQ83	Federal Land, Non-federal Land
1233_BC_3	Six Mile Slough	49.1672	-116.6135	42	11UNQ23, 11UNQ24, 11UNQ25, 11UNQ33, 11UNQ34	Federal Land, Non-federal Land
1233_BC_4	Columbia River (A)	49.2202	-117.6821	12	11UMQ44, 11UMQ45, 11UMQ55	Federal Land, Non-federal Land
1233_BC_5	Kootenay River	49.3838	-117.5542	11	11UMQ56, 11UMQ57, 11UMQ66, 11UMQ67	Non-federal Land
1233_BC_6	Elk River	49.4086	-115.0342	12	11UPQ37, 11UPQ46, 11UPQ47	Non-federal Land
1233_BC_7	Lake Koocanusa	49.4385	-115.4298	11	11UPQ08, 11UPQ17, 11UPQ18	Non-federal Land
1233_BC_8	St. Mary River	49.5942	-115.8254	42	11UNQ79, 11UNQ89, 11UNQ99	Federal Land, Non-federal Land
1233_BC_9	Okanagan Lake	49.5890	-119.5941	13	11ULQ19, 11ULR10	Federal Land, Non-federal Land
1233_BC_10	Wild Horse River	49.6081	-115.6168	11	11UNQ99, 11UPQ09	Federal Land, Non-federal Land
1233_BC_11	Slocan River	49.6768	-117.5140	16	11UMQ69, 11UMR60	Non-federal Land
1233_BC_12	Lower Arrow Lake (A)	50.0114	-117.9284	12	11UMR23, 11UMR33, 11UMR34	Federal Land, Non-federal Land
1233_BC_13	Lower Arrow Lake (B)	50.0056	-117.9085	13	11UMR33, 11UMR34	Non-federal Land
1233_BC_14	Findlay Creek	50.1269	-115.9937	18	11UNR65, 11UNR75	Non-federal Land
1233_BC_15	Columbia Lake	50.2693	-115.8805	12	11UNR76, 11UNR77, 11UNR86, 11UNR87	Non-federal Land
1233_BC_16	Columbia River (B)	50.3514	-115.8819	20	11UNR77, 11UNR87	Federal Land, Non-federal Land
1233_BC_17	Lillooet River	50.3627	-122.8503	32	10UEA07, 10UEA08, 10UEA17, 10UEA18	Non-federal Land

1233_BC_18	Columbia National Wildlife Area	50.5900	-116.0890	91	11UNR69, 11UNS50, 11UNS60, 11UNS61	Federal Land, Federally Protected Area, Non-federal Land
1233_BC_19	South Thompson River	50.6760	-120.2440	23	10UFB81, 10UFB91, 10UGB01	Federal Land, Non-federal Land
1233_BC_20	Columbia River (C)	50.7156	-116.1712	24	11UNS51, 11UNS52, 11UNS61	Non-federal Land
1233_BC_21	Shuswap Lake	50.8564	-118.9866	22	11ULS53, 11ULS63	Federal Land, Non-federal Land
1233_BC_22	Kootenay National Park Of Canada (A)	50.9196	-115.9975	27	11UNS63, 11UNS64, 11UNS73, 11UNS74	Federal Land, Federally Protected Area
1233_BC_23	Adams Lake	51.2271	-119.5440	11	11ULS17, 11ULS27, 11ULS28	Non-federal Land
1233_BC_24	Fraser River	51.5263	-122.2860	23	10UEC40, 10UEC41, 10UEC50	Federal Land, Non-federal Land
1233_BC_25	Chilcotin River	52.0926	-123.4080	12	10UDC67, 10UDC76, 10UDC77	Non-federal Land
1233_BC_26	Williams Lake River	52.1637	-122.2209	1	10UEC57, 10UEC58	Non-federal Land
1233_BC_27	West Road (Blackwater) River	53.2187	-123.5052	33	10UDD69, 10UDE60	Federal Land, Non-federal Land
1233_BC_28	Chilako River	53.7858	-123.0049	36	10UDE95, 10UDE96, 10UEE05, 10UEE06	Non-federal Land
1233_BC_29	Fraser River	53.8833	-122.7301	14	10UEE16, 10UEE17, 10UEE27	Federal Land, Non-federal Land
1233_BC_30	Nechako River	53.9480	-122.9354	38	10UEE07, 10UEE08	Federal Land, Non-federal Land
1233_BC_31	Sukunka River	55.4181	-121.6798	15	10UEG83, 10UEG84	Non-federal Land
1233_BC_32	Pine River	56.0041	-121.2022	14	10VFH00, 10VFH10, 10VFH11	Non-federal Land
1233_BC_33	Peace River (B)	56.1001	-121.7615	97	10VEH60, 10VEH61, 10VEH70, 10VEH71, 10VEH72, 10VEH81, 10VEH82, 10VEH92	Federal Land, Non-federal Land
1233_BC_34	Peace River (C)	56.1797	-120.8592	106	10VFH22, 10VFH23, 10VFH32, 10VFH33, 10VFH42	Non-federal Land
1233_BC_35	Peace River (E)	56.2449	-121.3240	60	10VEH92, 10VEH93, 10VFH03, 10VFH13	Non-federal Land
1233_BC_36	Williston Lake	56.6364	-124.7164	15	10VCH97, 10VCH98	Non-federal Land
1233_BC_37	Stikine River	58.0194	-130.9778	27	09VUE72, 09VUE73, 09VUE82, 09VUE83	Federal Land, Non-federal Land

1233_BC_38	Kechika River	59.0443	-127.4350	17	09VWF84, 09VWF85, 09VWF94	Non-federal Land
1233_BC_39	Kootenay National Park Of Canada (B)	50.7096	-115.8848	45	11UNS71, 11UNS72, 11UNS81	Federal Land, Federally Protected Area, Non-federal Land
1233_BCAB_1	Peace River (A)	56.1133	-120.3001	60	10VFH42, 10VFH51, 10VFH52, 10VFH61, 10VFH62, 10VFH71, 10VFH72, 10VFH82, 11VLC12	Non-federal Land
1233_BCYT_1	Tatshenshini River	59.9833	-137.2218	28	08VLM74, 08VLM75	Federal Land, Non-federal Land

Table D-11. Nesting critical habitat locations in Yukon. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_YT_1	Yukon River (A)	60.7051	-134.9833	139	08VMN84, 08VMN92, 08VMN93, 08VMN94, 08VMN95, 08VNN01, 08VNN02, 08VNN11, 08VNN12, 08VNN21	Federal Land, Non-federal Land
1233_YT_2	Yukon River (B)	61.8176	-134.9571	173	08VMP86, 08VMP94, 08VMP95, 08VMP96, 08VNP02, 08VNP03, 08VNP04, 08VNP05, 08VNP06	Non-federal Land
1233_YT_3	Yukon River (C)	61.9967	-135.4554	25	08VMP77, 08VMP87	Non-federal Land
1233_BCYT_1	Tatshenshini River	59.9833	-137.2218	28	08VLM74, 08VLM75	Federal Land, Non-federal Land

Table D-12. Nesting critical habitat locations in the Northwest Territories. Critical habitat occurs where the criteria described in section 7.1 are met.

Critical Habitat Unit	Site Name (Waterbody or other feature)	Centroid of Critical Habitat Unit		Nesting Shoreline Length (km)	10 x 10 km Standardized UTM Grid Square Identification	Land Tenure
		Latitude	Longitude			
1233_NT_1	Mackenzie River (A)	67.2848	-133.2701	18	08WNV66, 08WNV75, 08WNV76, 08WNV86	Non-federal Land
1233_NT_2	Arctic Red River	67.3227	-133.7072	69	08WNV55, 08WNV56, 08WNV57, 08WNV58, 08WNV65	Federal Land, Non-federal Land
1233_NT_3	Mackenzie River (B)	67.6538	-134.3420	11	08WNA20, 08WNA30	Non-federal Land
1233_NT_4	Mackenzie River (C)	67.6757	-134.2034	47	08WNA30, 08WNA31	Non-federal Land
1233_NT_5	Mackenzie River (D)	67.6700	-134.1303	11	08WNA30, 08WNV39, 08WNV49	Federal Land, Non-federal Land
1233_NT_6	Caribou Creek	68.0901	-133.4768	39	08WNA64, 08WNA65	Non-federal Land

Appendix E: Maps of Critical Habitat for the Bank Swallow in Canada

Figure E. Critical habitat for Bank Swallow in Canada. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. The Extent of Occurrence is delineated from a minimum convex polygon (purple outline). Detailed critical habitat maps are available upon request.

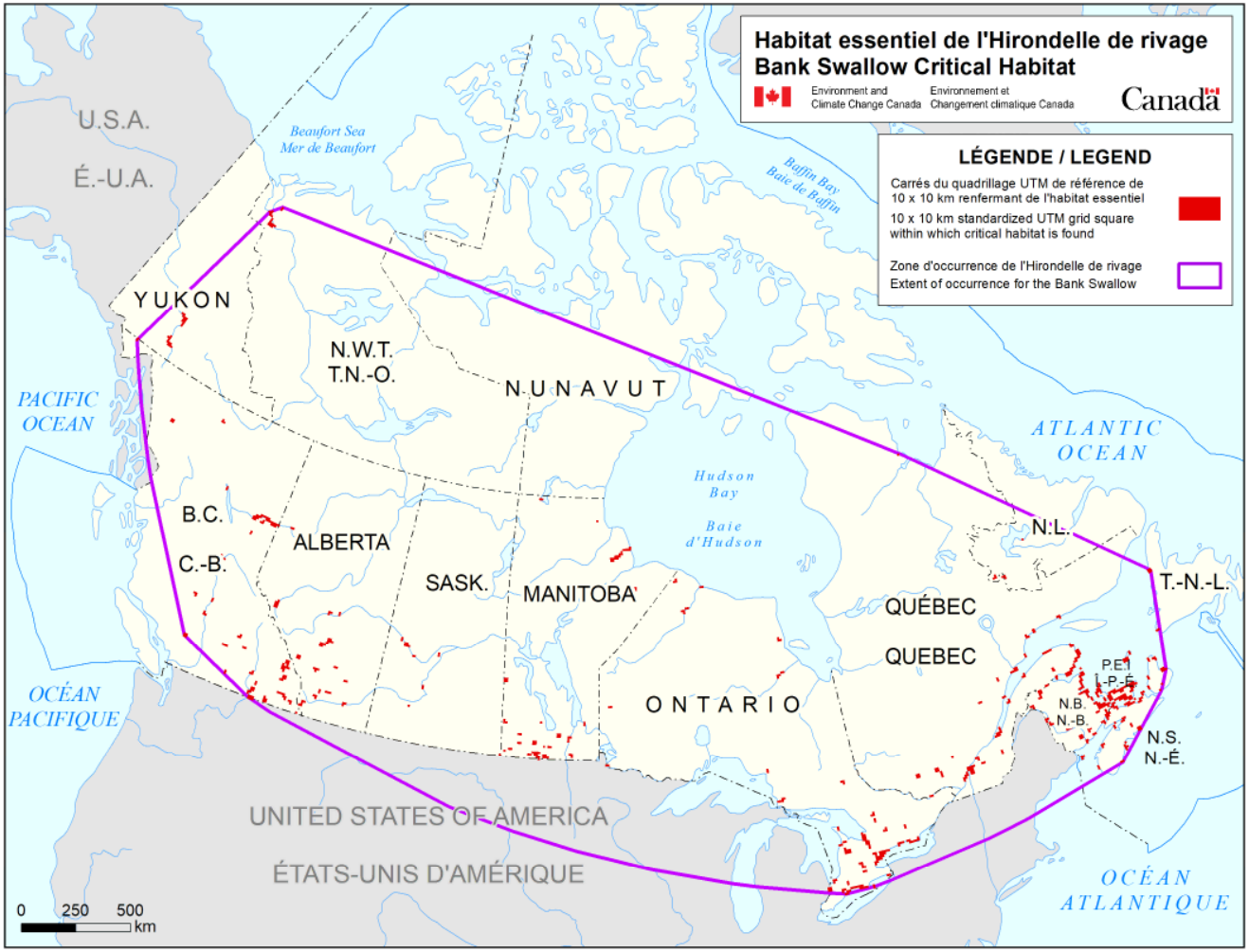

Figure E-1. Critical habitat for Bank Swallow in Newfoundland is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

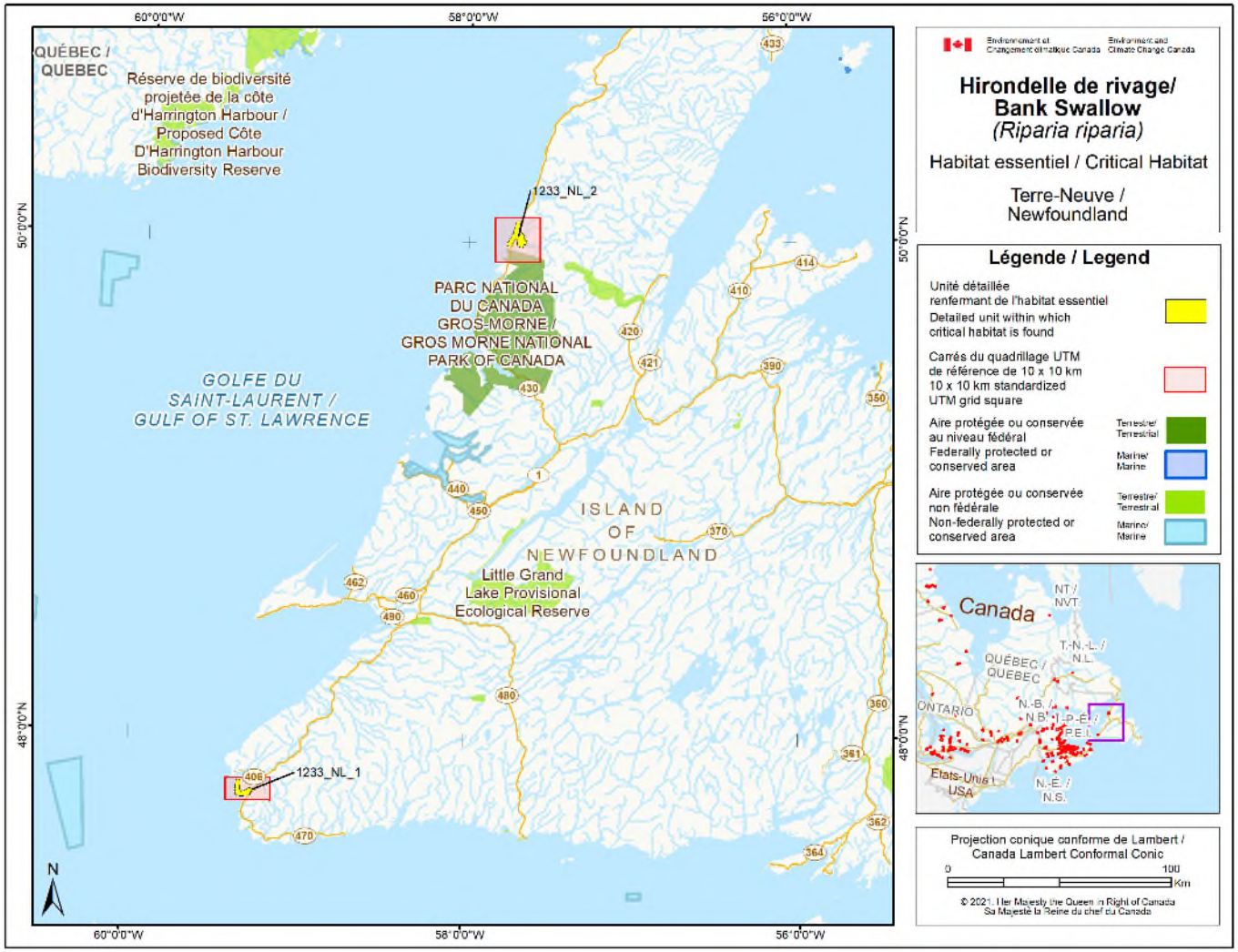

Figure E-2. Critical habitat for Bank Swallow in Labrador is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

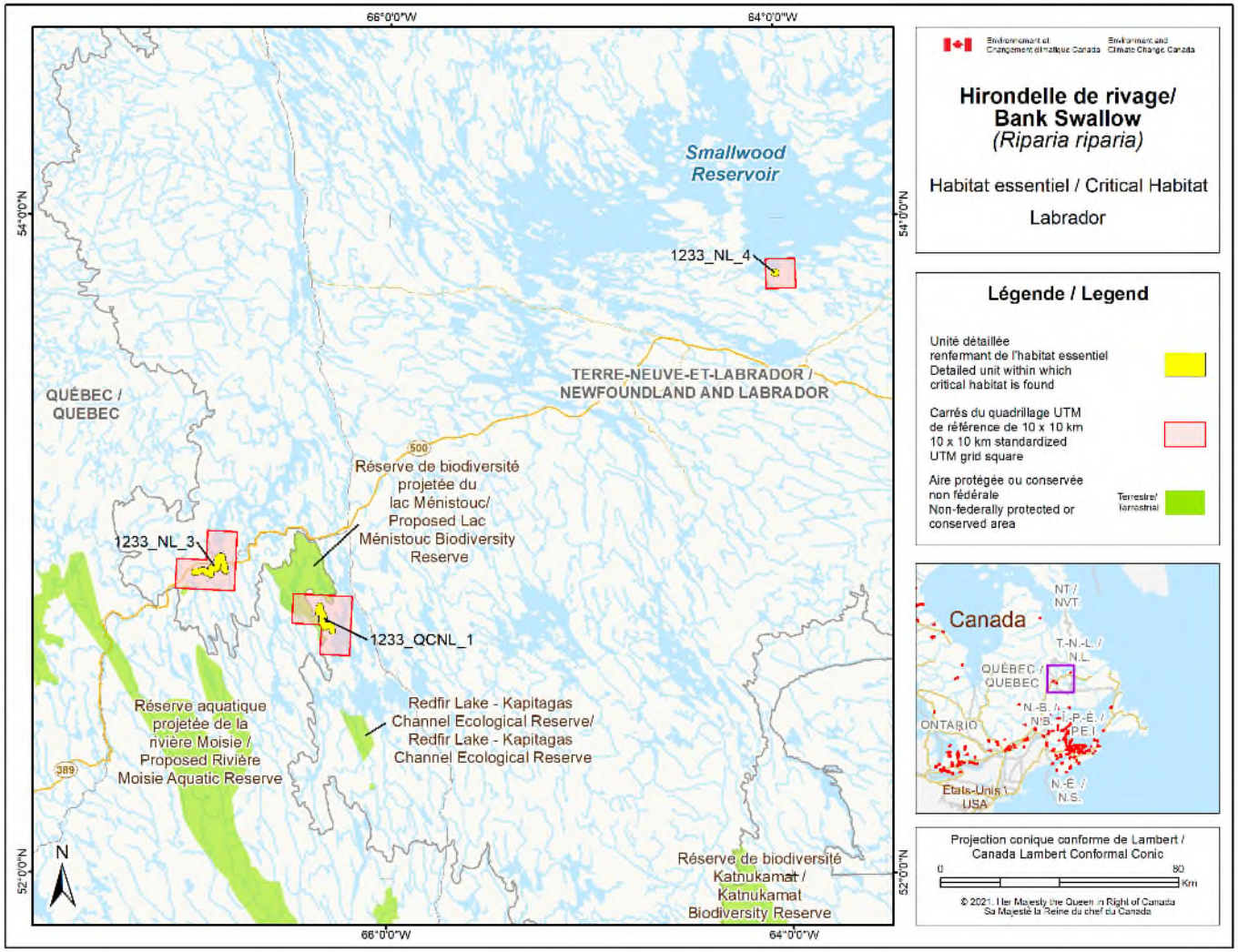

Figure E-3. Critical habitat for Bank Swallow in Prince Edward Island and Quebec is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

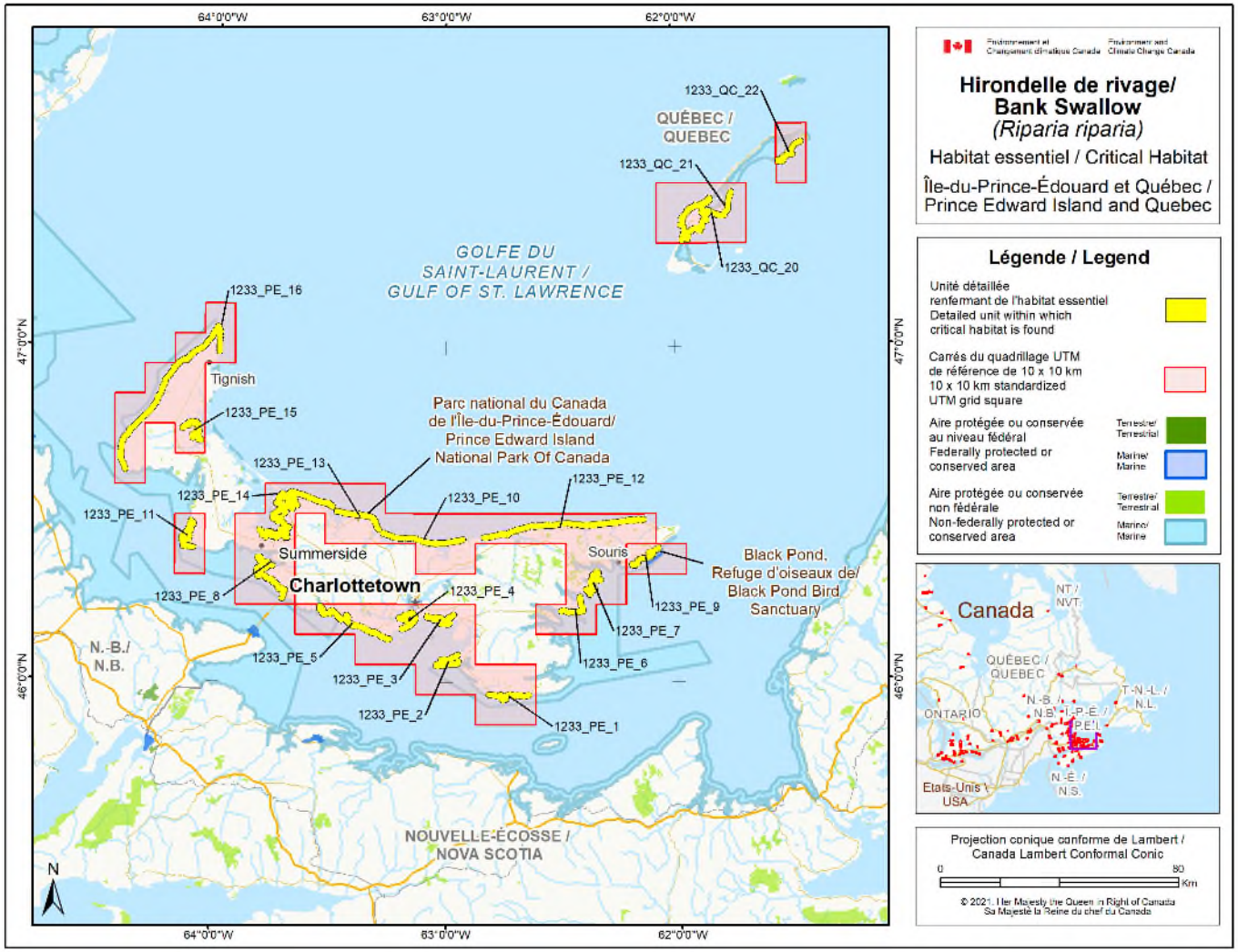

Figure E-4. Critical habitat for Bank Swallow in Nova Scotia is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

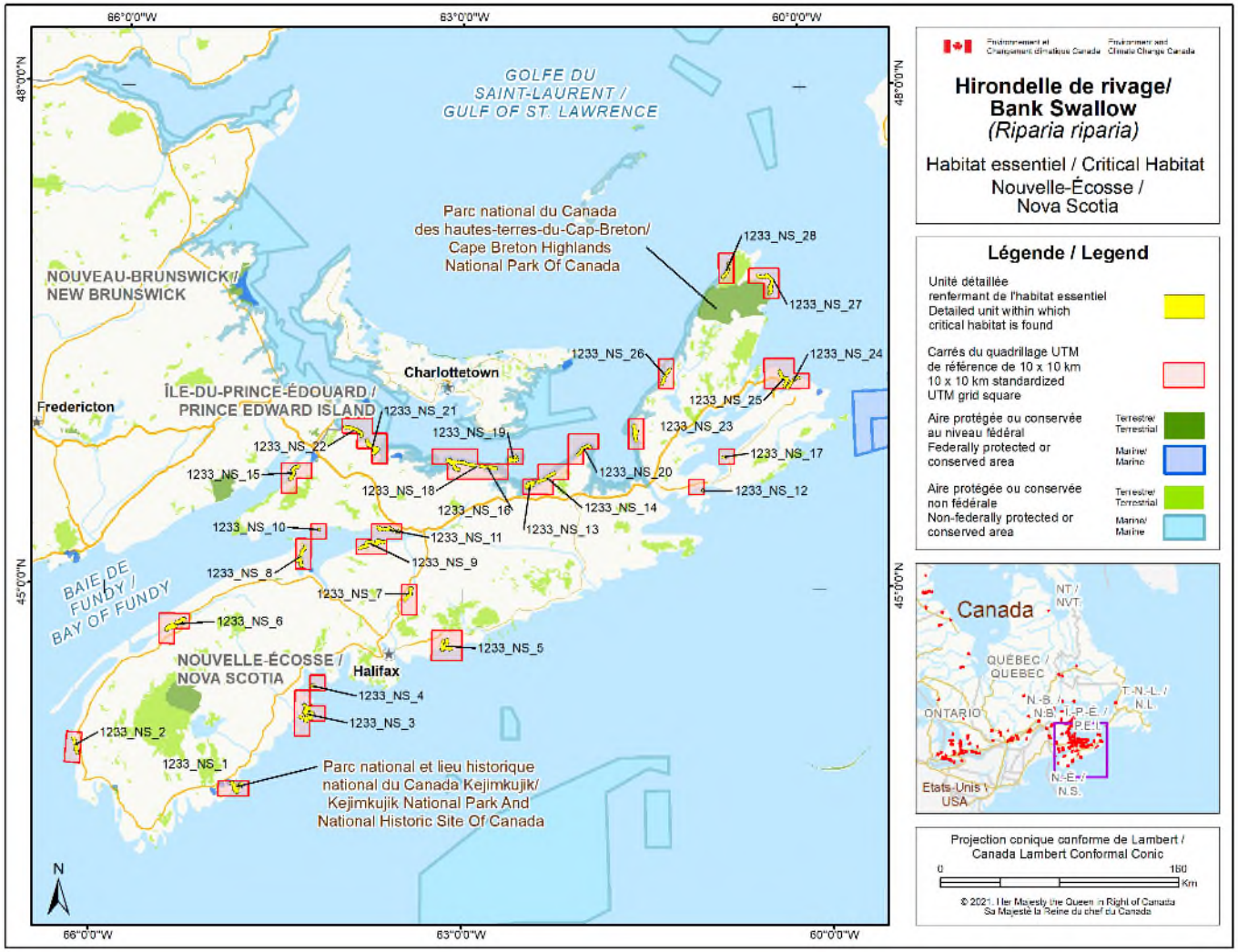

Figure E-5. Critical habitat for Bank Swallow in New Brunswick is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

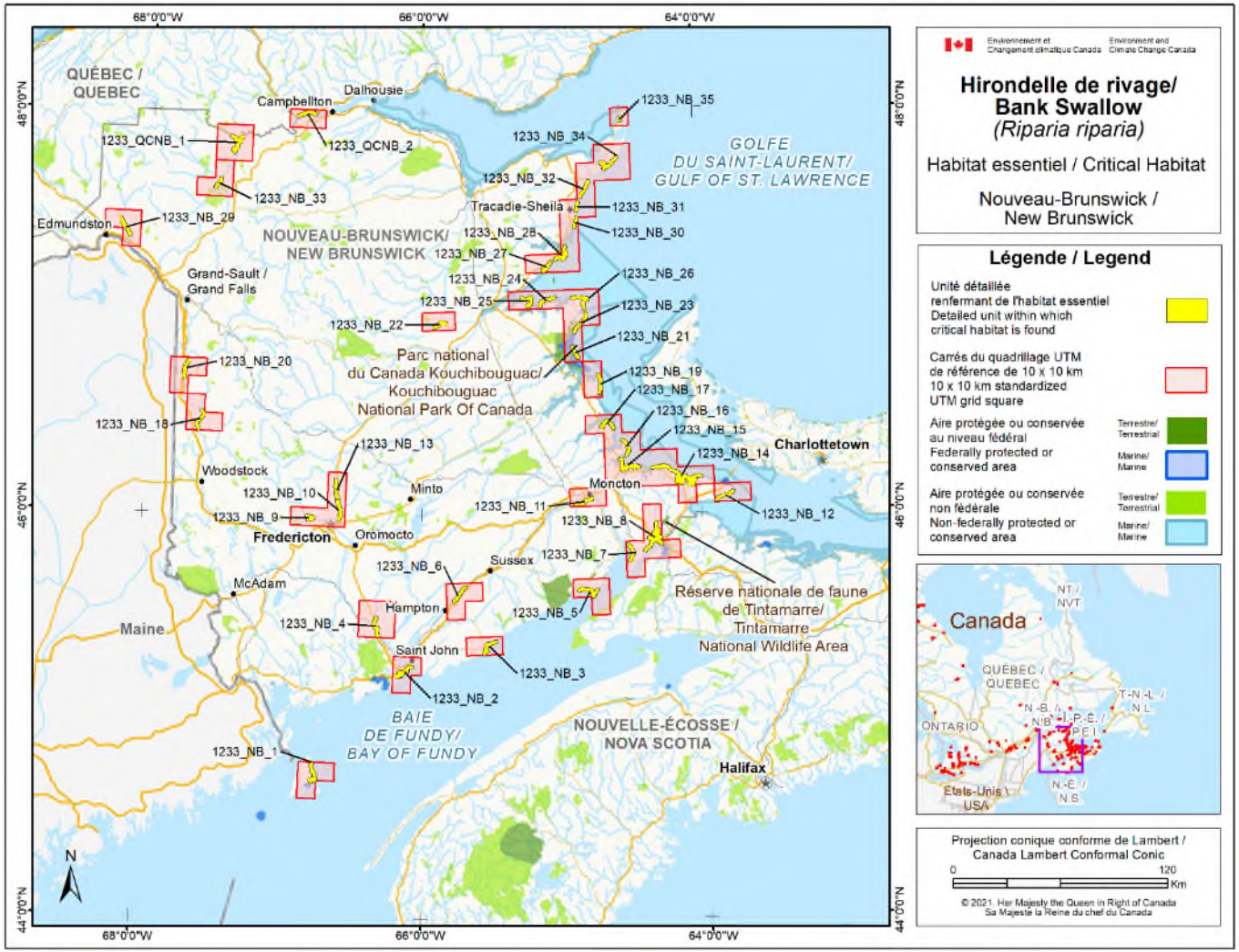

Figure E-6. Critical habitat for Bank Swallow in Southeastern Quebec is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

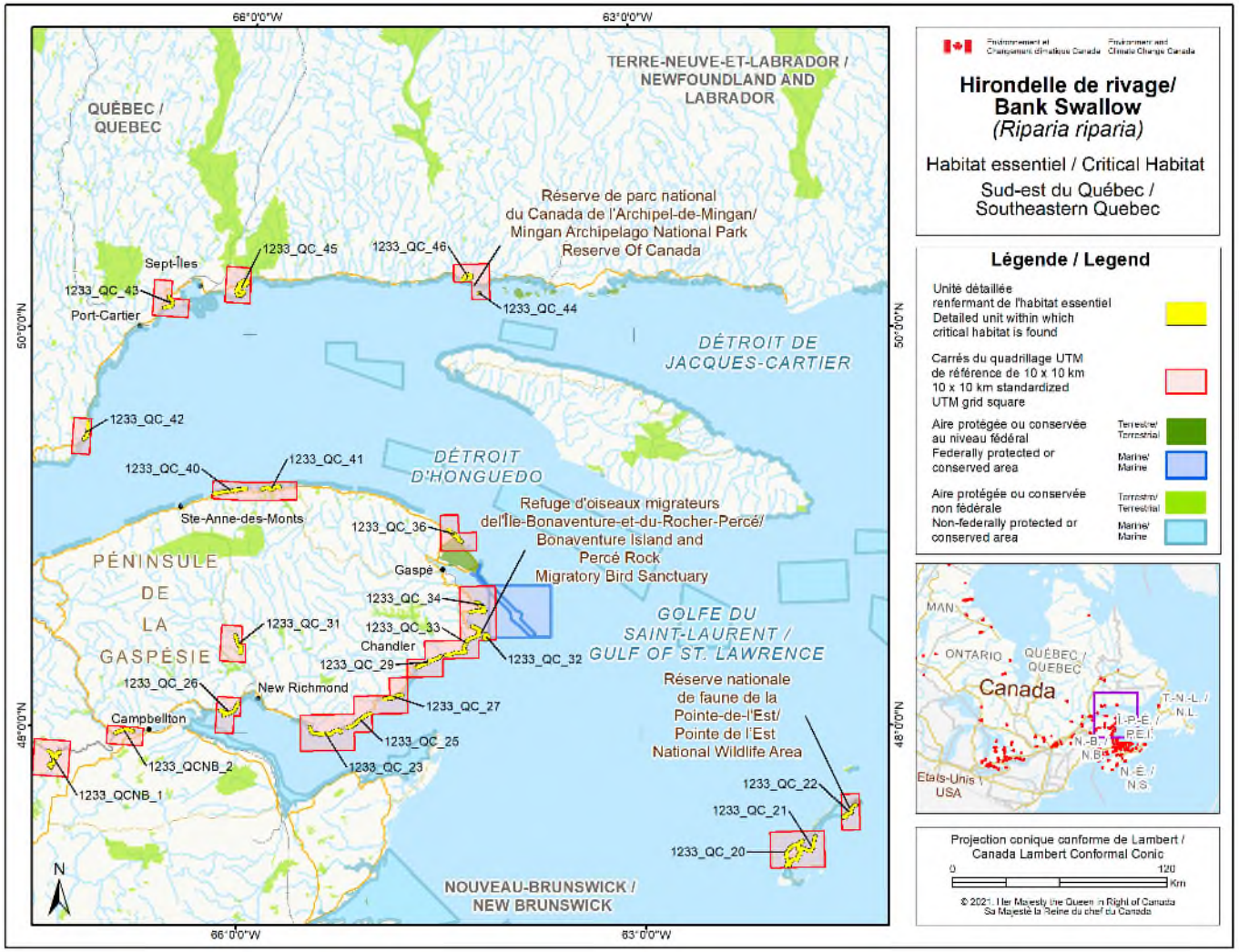

Figure E-7. Critical habitat for Bank Swallow in Northern Quebec is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

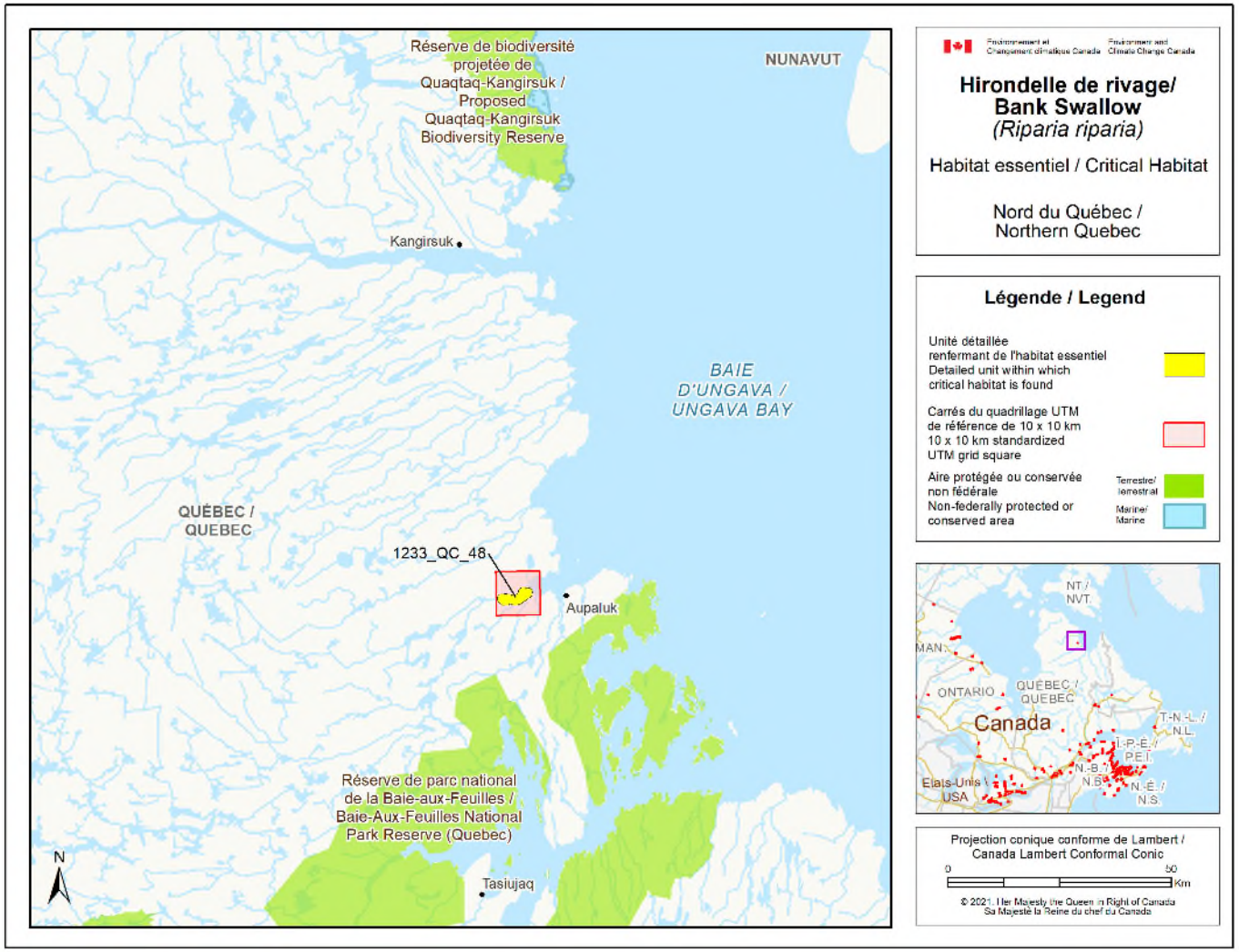

Figure E-8. Critical habitat for Bank Swallow in Southwestern Quebec is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

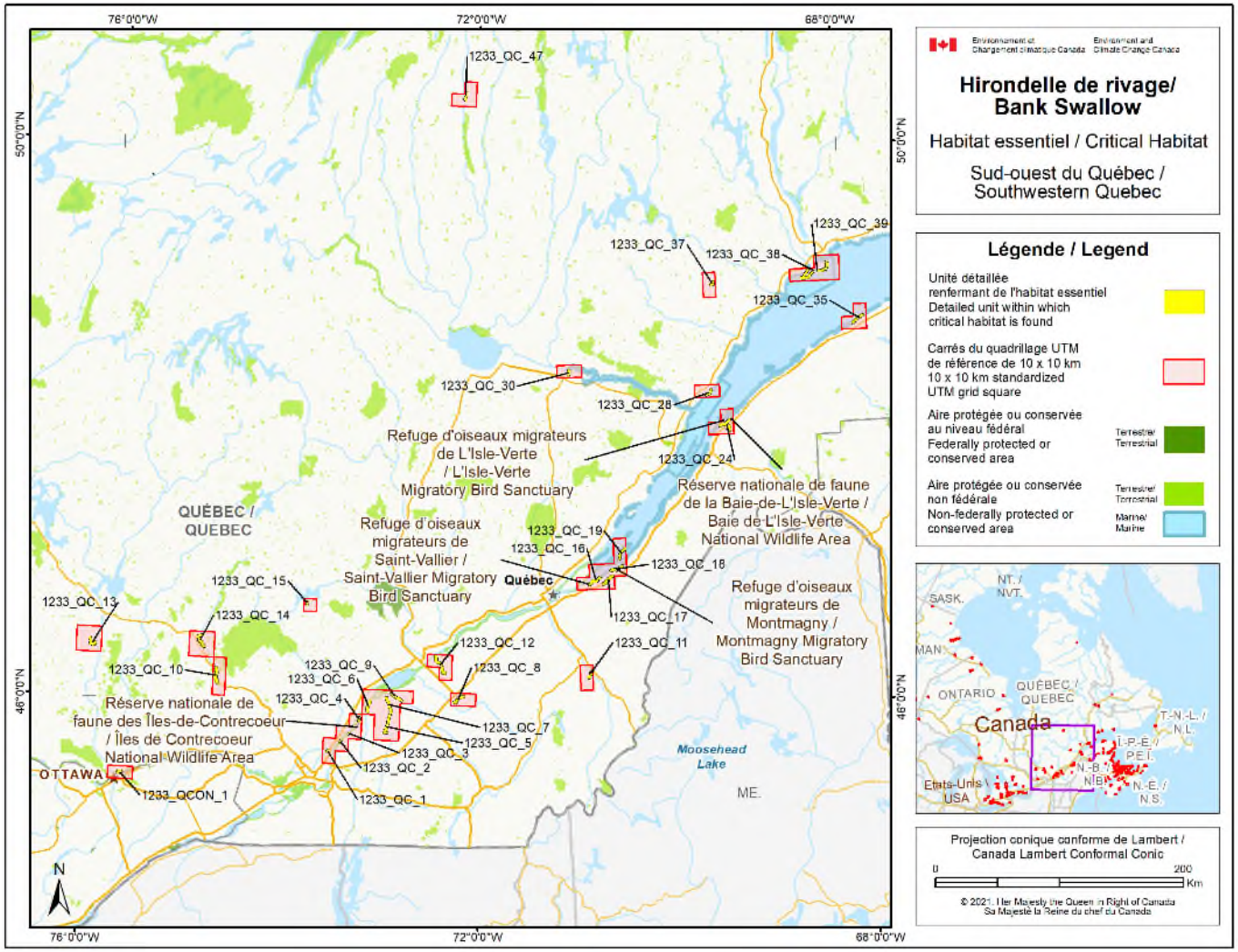

Figure E-9. Critical habitat for Bank Swallow in Southeastern Ontario is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

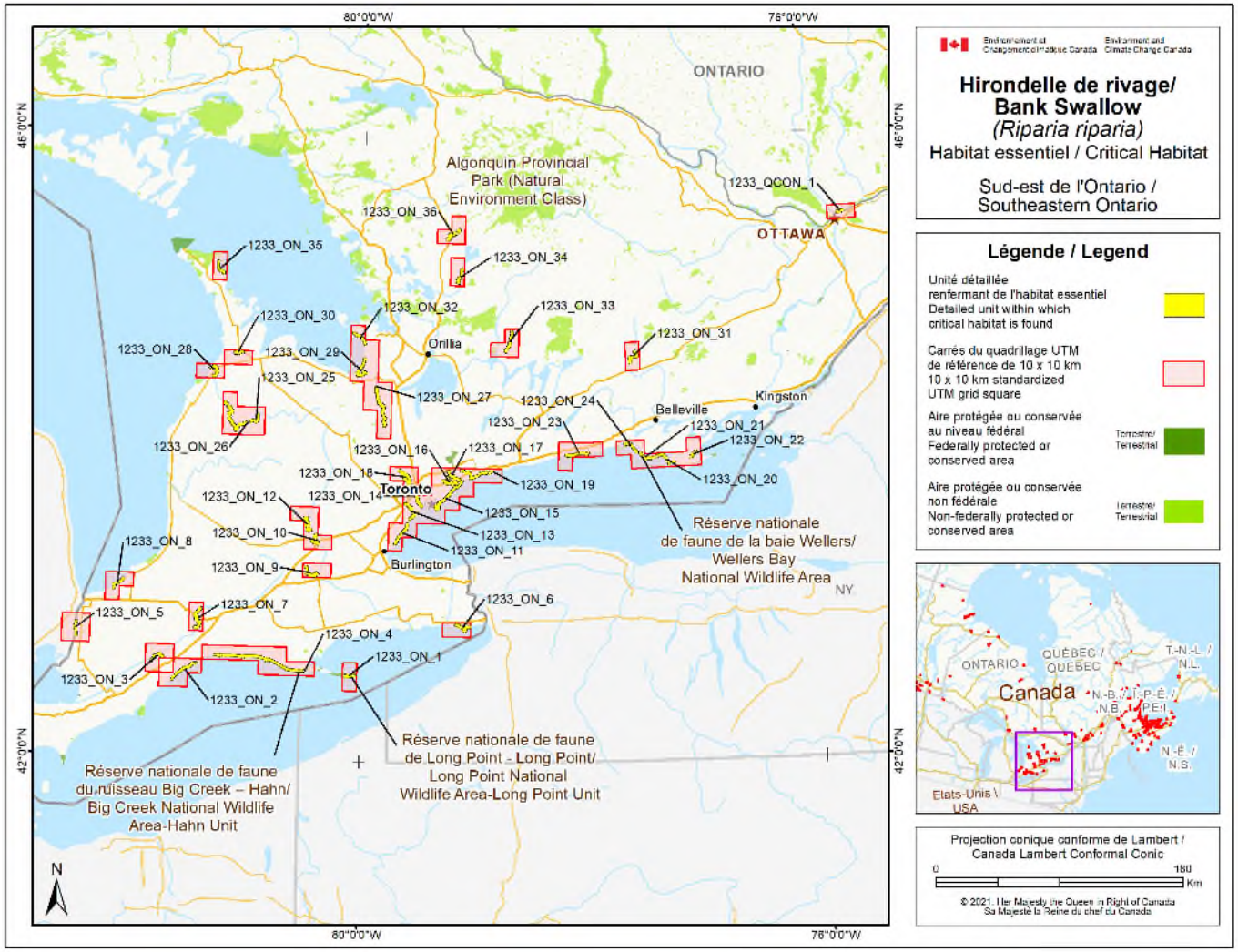

Figure E-10. Critical habitat for Bank Swallow in Northern Ontario is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

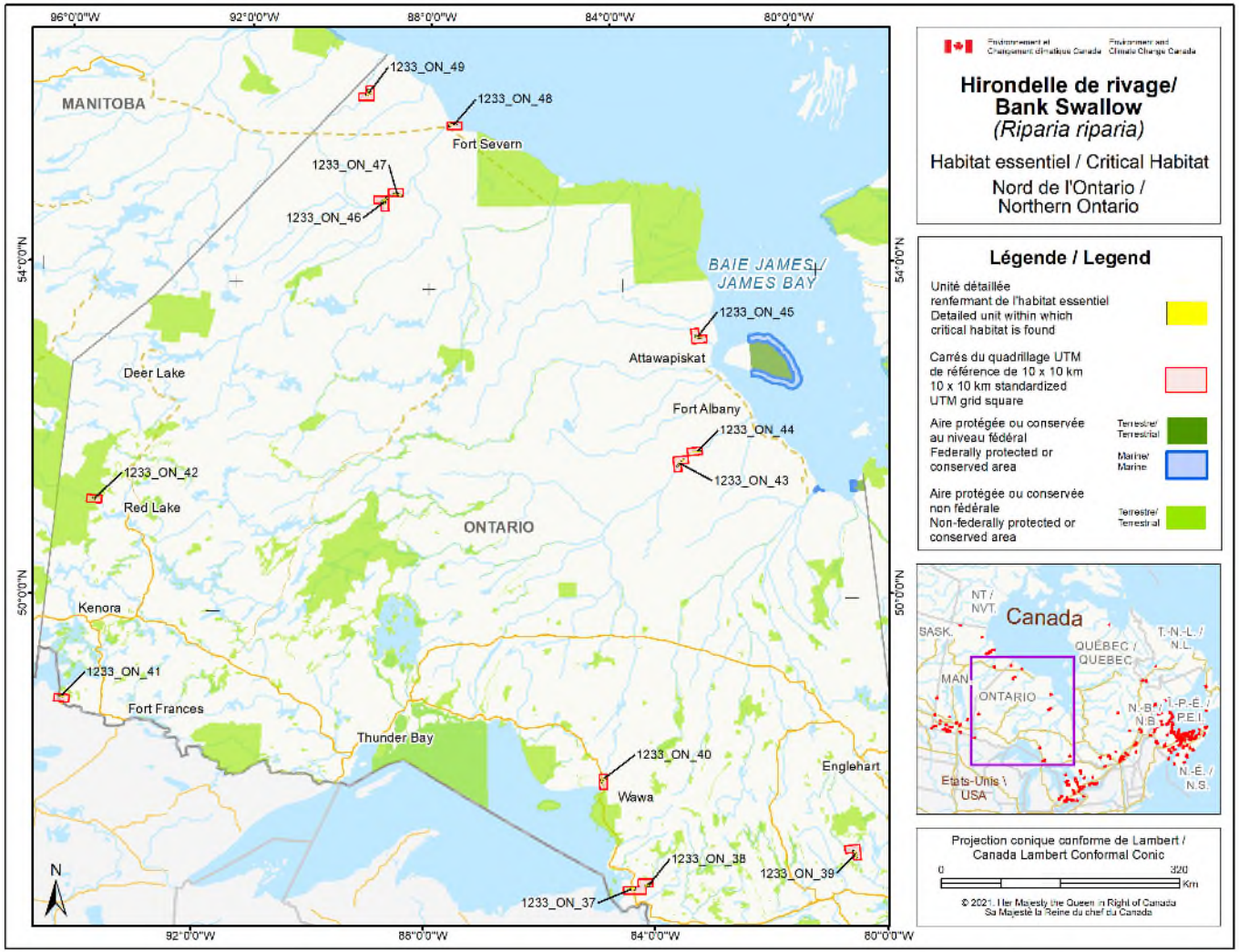

Figure E-11. Critical habitat for Bank Swallow in Southern Manitoba is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

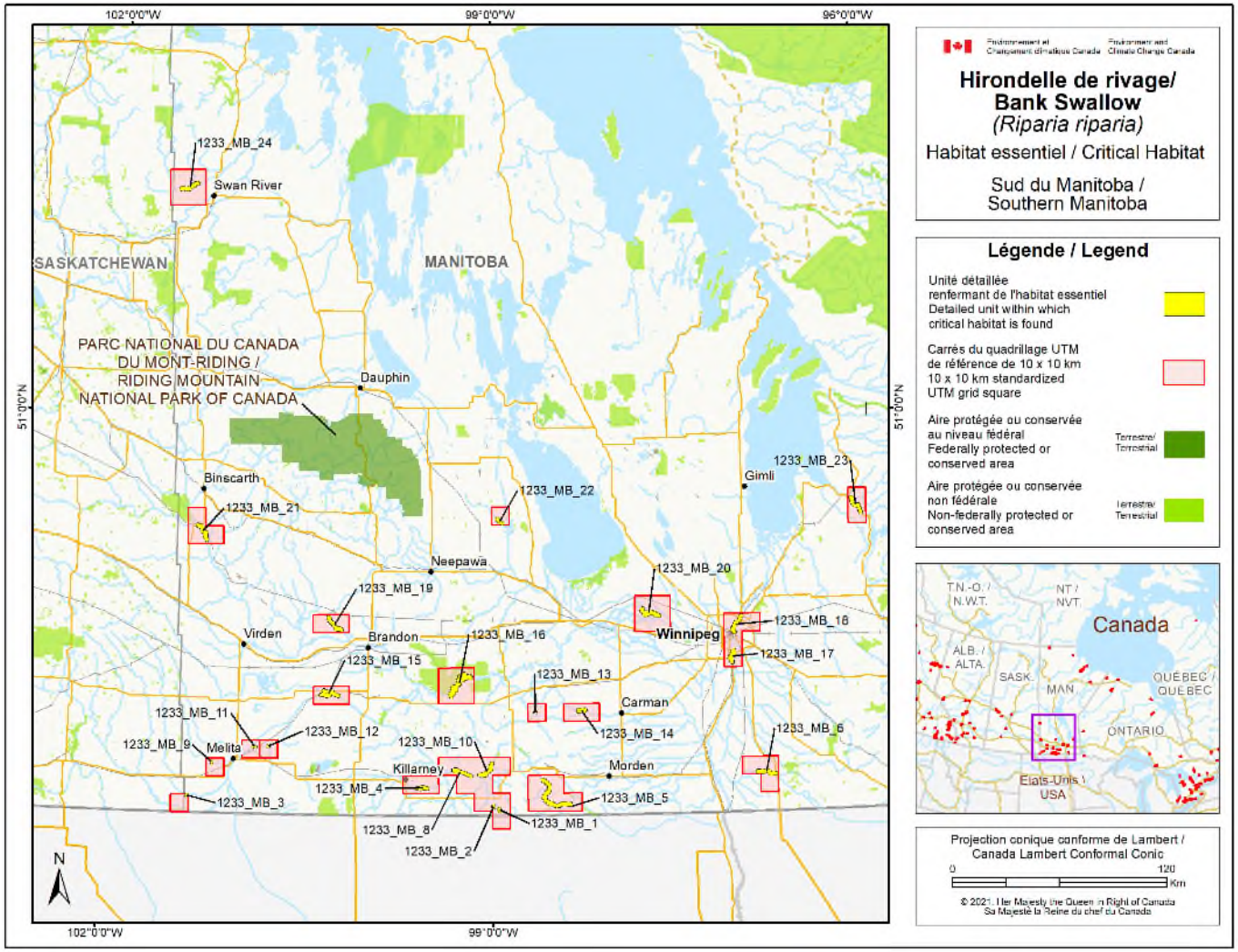

Figure E-12. Critical habitat for Bank Swallow in Northern Manitoba is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

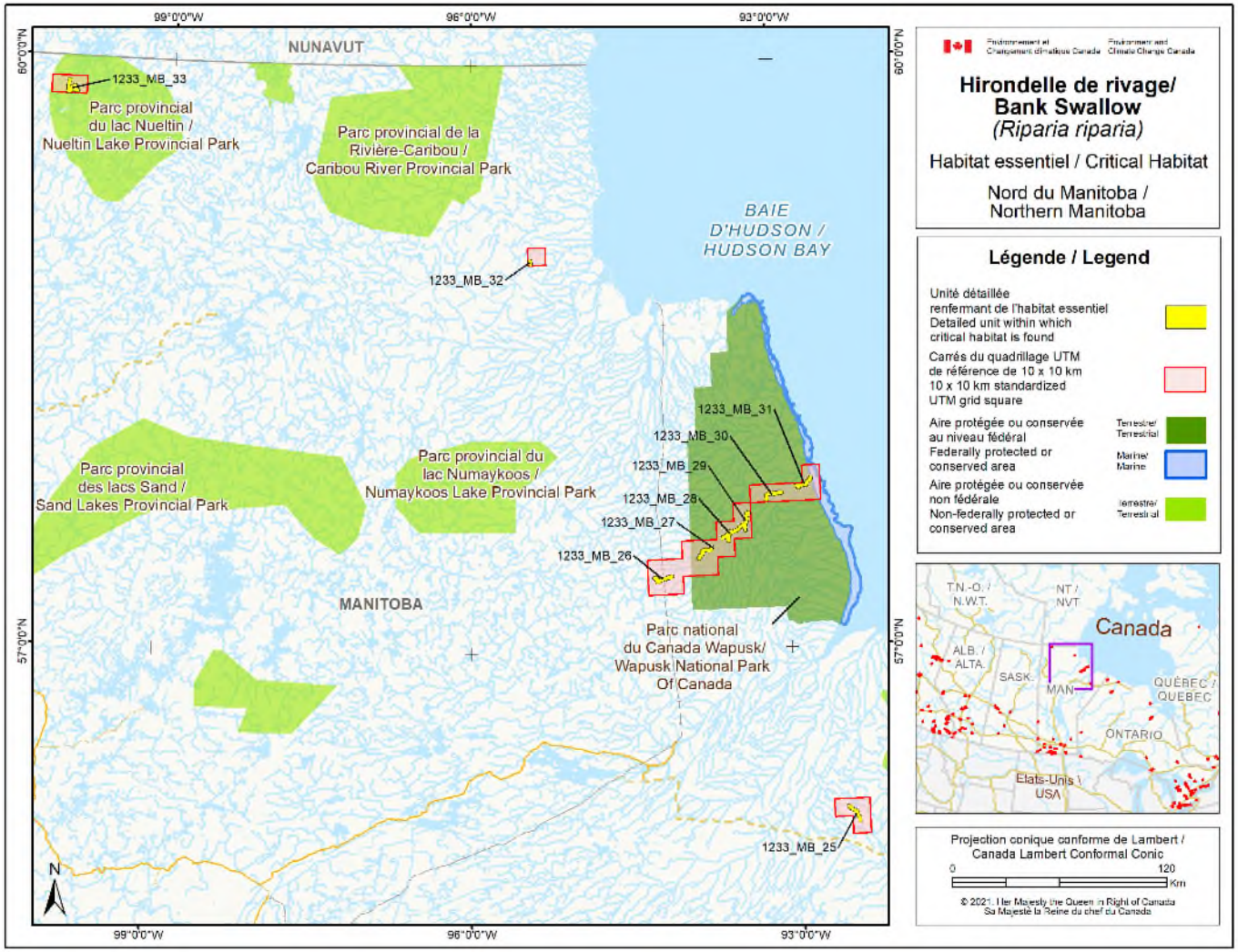

Figure E-13. Critical habitat for Bank Swallow in Saskatchewan is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

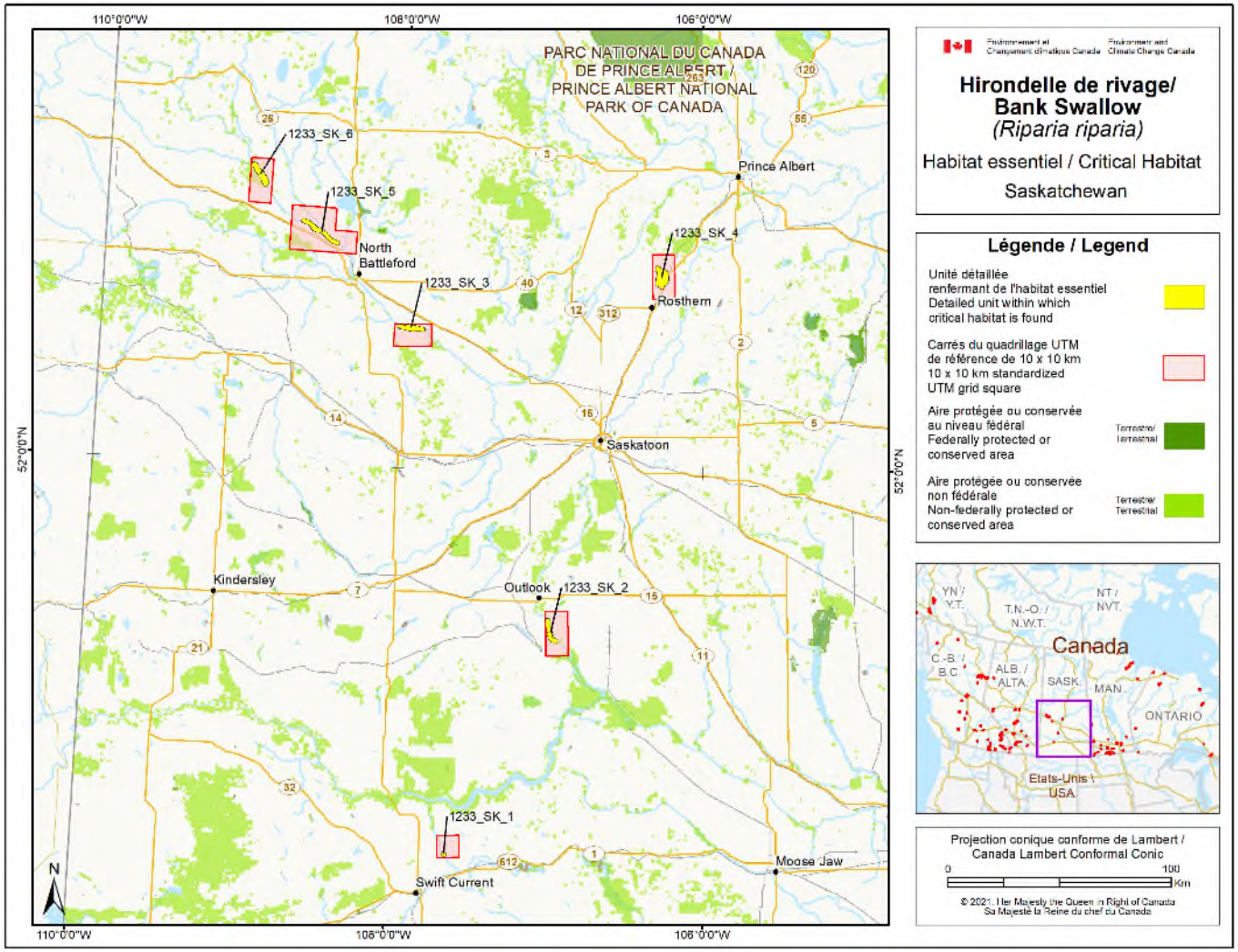

Figure E-14. Critical habitat for Bank Swallow in Southern Alberta is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

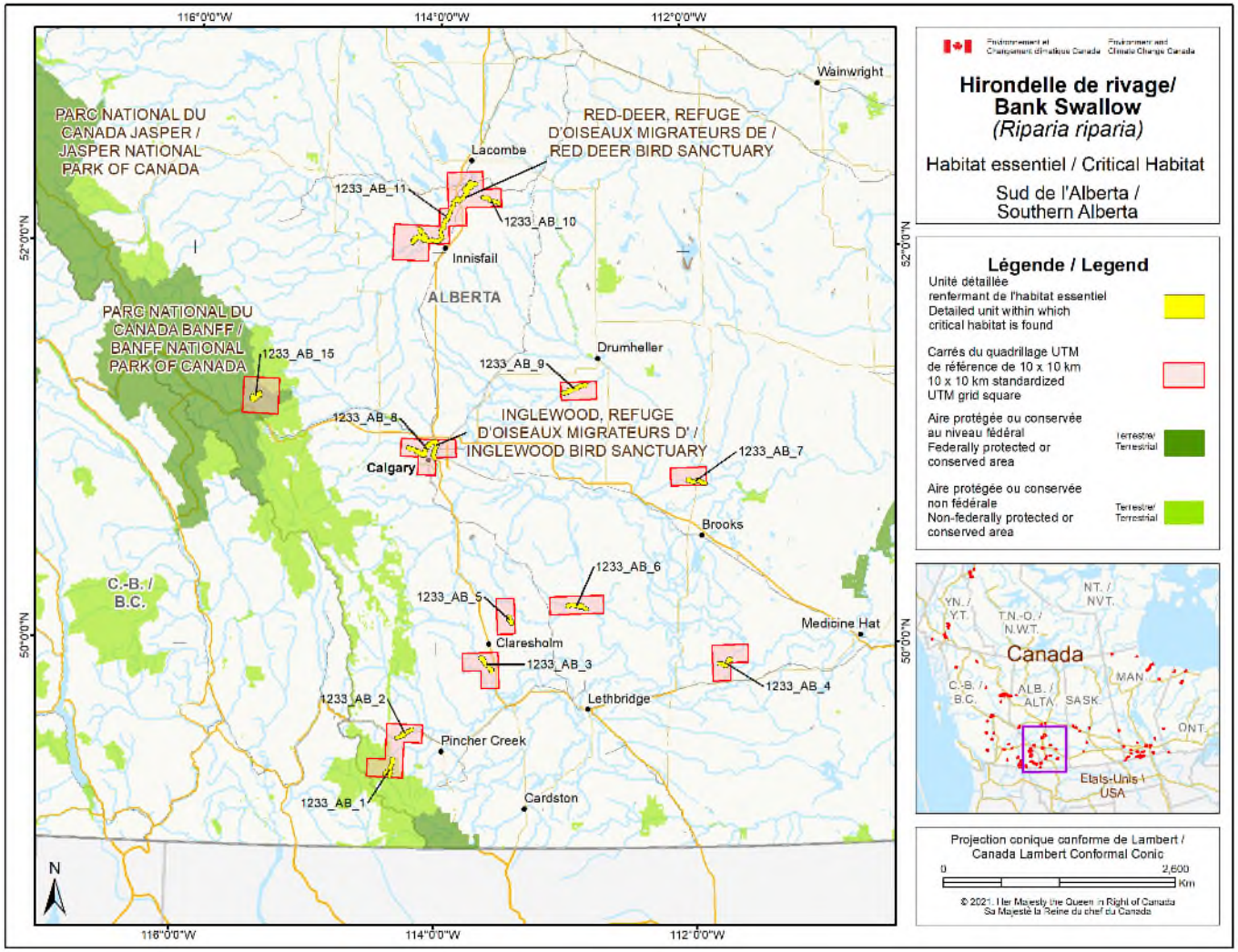

Figure E-15. Critical habitat for Bank Swallow in Northern Alberta is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

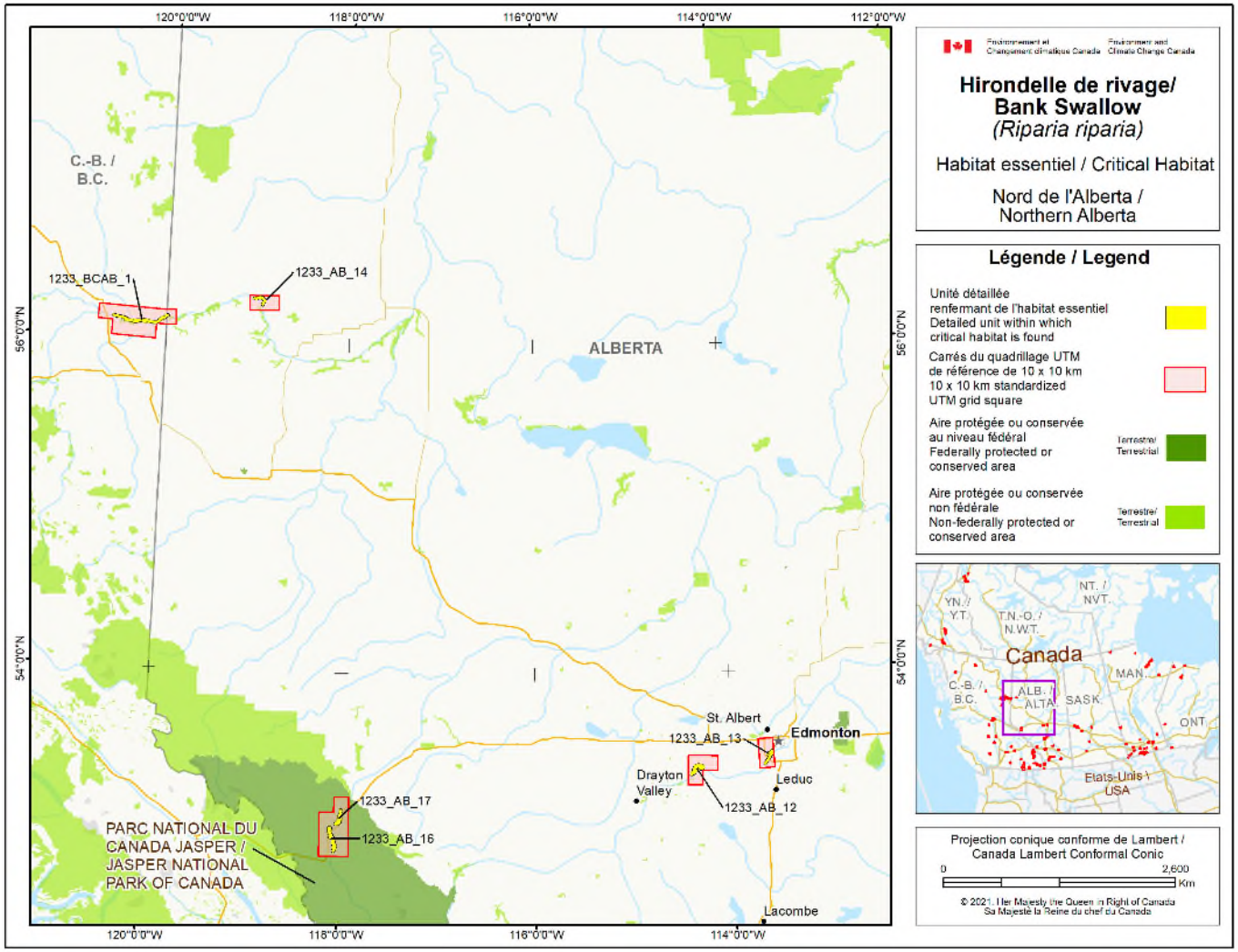

Figure E-16. Critical habitat for Bank Swallow in Southern British Columbia is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

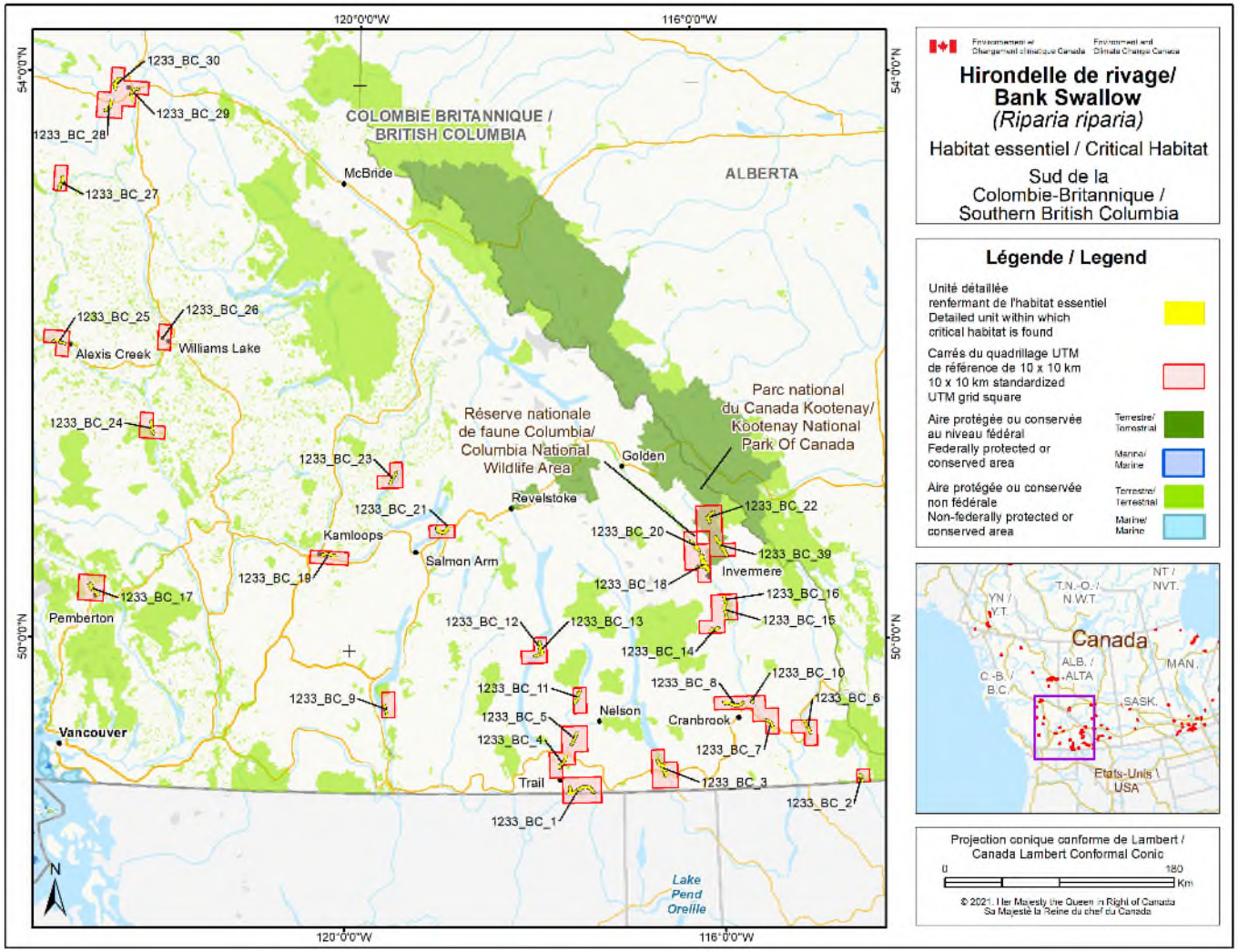

Figure E-17. Critical habitat for Bank Swallow in Northern British Columbia is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

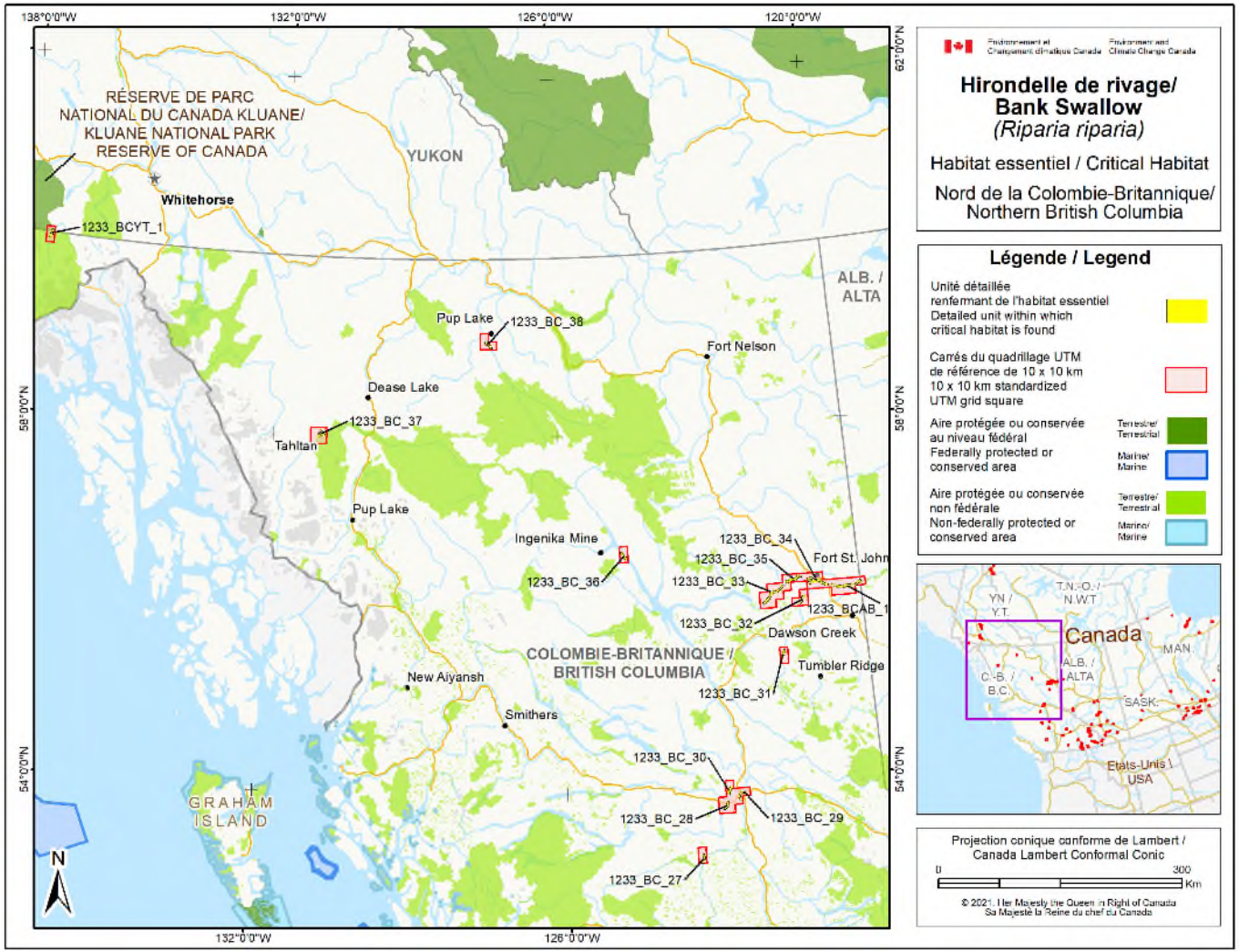

Figure E-18. Critical habitat for Bank Swallow in Yukon is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.

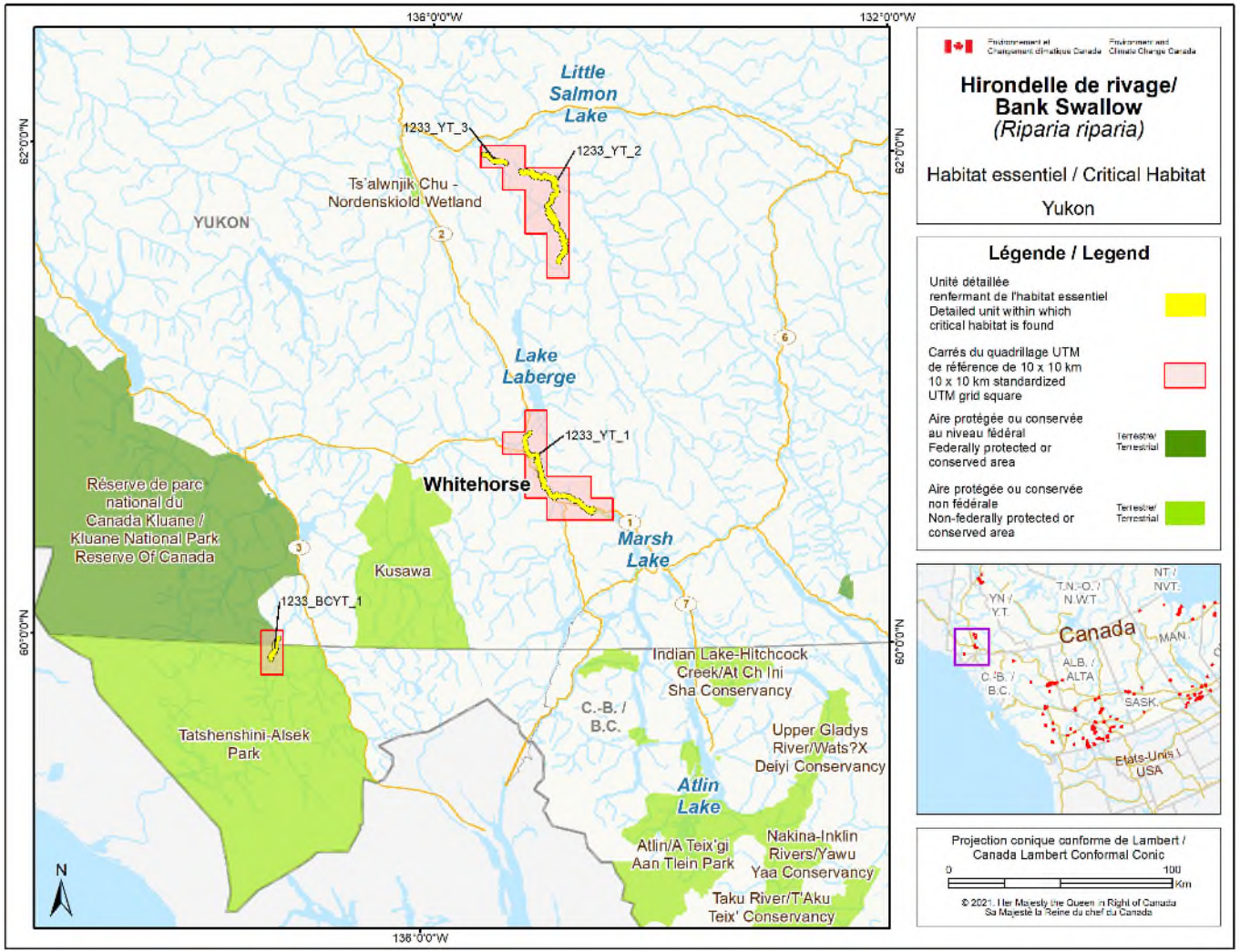

Figure E-19. Critical habitat for Bank Swallow in the Northwest Territories is represented by the yellow shaded polygons, where the criteria and methodology set out in Section 7.1 are met. The 10 x 10 km Standardized UTM grid overlay (red outline) shown on this figure is a Standardized national grid system that indicates the general geographic area within which critical habitat is found. Detailed critical habitat maps are available upon request. Labels (1233_XX_YY) indicate the critical habitat units described in Appendix D.