PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Bobolink (*Dolichonyx oryzivorus)* in Canada

Bobolink

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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 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] 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 and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Bobolink 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, Prince Edward Island, Nova Scotia and Newfoundland and Labrador as per section 39(1) of SARA.

Success in the recovery of the 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 Bobolink 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 and the Parks Canada Agency and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy is subject to appropriations, priorities, and budgetary constraints of the participating jurisdictions and organizations.

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

In the case of critical habitat identified for terrestrial species, including migratory birds, SARA requires that critical habitat identified in a federally protected area[3] 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

[2] www.canada.ca/en/environment-climate-change/services/species-risk-act-accord-funding.html#2

[3] 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

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.

Acknowledgments

This recovery strategy was prepared by Kathy St. Laurent (Environment and Climate Change Canada, Canadian Wildlife Service [ECCC-CWS] - Atlantic Region). Advice, expertise and document reviews were provided by a technical working group consisting of the following members:

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- Nicky Koper – University of Manitoba
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We would also like to acknowledge and thank all the organizations and individuals that provided species' occurrence data for across Canada: Birds Canada, the Nature Conservancy of Canada, National Capital Commission, Parks Canada Agency, Department of National Defence, Agriculture and Agri-food Canada and the various provincial Conservation Data Centres. A thank you goes to the team with CWS Data Management Operations for creating the critical habitat maps multiple times over. In addition, we would like to acknowledge and thank the individuals and organizations that reviewed and provided constructive comments on draft versions of this document.

Environment and Climate Change Canada would like to acknowledge the contribution of the thousands of volunteers who generously donate their time and expertise to bird monitoring programs throughout North America, as well as the many professional biologists and technicians working for various government agencies and non-government organizations in Canada and the United States who helped to

establish, design, run and analyze the Breeding Bird Survey and Breeding Bird Atlas results.

Executive Summary

The Bobolink is a North American insectivorous and granivorous bird, predominantly feeding on insects during the breeding season and on grains and seeds during other periods of the year. In Canada, it breeds in open grassland habitats including native grasslands and agricultural fields. The breeding range of the species in Canada extends from British Columbia in the west to the island of Newfoundland in the east. The species overwinters in South America, primarily in Bolivia, Paraguay and Argentina. The Bobolink was designated as threatened by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC) in 2010 and was listed as threatened under Schedule 1 of the *Species at Risk Act* (SARA) in November 2017.

There are unknowns regarding the feasibility of recovery for the Bobolink in Canada. 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.

Primary threats identified for the species include annual & perennial non-timber crops (agricultural intensification and conversion, mowing of hayfields) and agricultural & forestry effluents (pesticides - herbicides and insecticides). Other threats considered to have a lower impact on the species are housing & urban areas, commercial & industrial areas, livestock farming & ranching, energy production & mining, hunting & collecting terrestrial animals, fire & fire suppression, removing/reducing human maintenance and problematic native species (predation).

The population objective to recover the Bobolink in Canada is to stabilize the Canada-wide population trend within 10 years (by 2031), and thereafter, at a minimum, maintain it. The distribution objective to recover the Bobolink in Canada is to maintain the representation of the species in all provinces across the species' known range in Canada (Figure 1). The short-term (within 10 years) statement for the recovery of the Bobolink is to stabilize the declining Canada-wide population trend by achieving the population trend objectives within each Province x Bird Conservation Region (BCR) unit specified in Appendix A (Table A1).

Broad strategies aimed at supporting the survival and recovery of the Bobolink are presented in section 6.2: Strategic Direction for Recovery.

The critical habitat that is identified for the Bobolink is not sufficient to meet the population and distribution objectives. A schedule of studies has been developed to provide the information necessary to complete the identification of critical habitat.

One or more action plans for the Bobolink, in addition to the multi-species action plans that the Parks Canada Agency has developed, will be posted on the Species at Risk Public Registry within five years following the final posting of this recovery strategy.

Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery of the Bobolink. In keeping with the precautionary principle, a recovery strategy has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be feasible. This recovery strategy addresses the unknowns surrounding the feasibility of recovery.

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

   Yes. The Bobolink is still relatively common in Canada and breeding individuals are currently distributed throughout the Canadian range, as well as in the United States. The Canadian population of the Bobolink is estimated to be 2.6 million or 24.9 million individuals, depending on source (Boreal Avian Modelling Project 2020, Partners in Flight Science Committee 2020). There are currently adequate numbers of individuals of the species available 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.*

   Yes. Bobolinks use open habitats, including native grasslands as well as human-modified “surrogate” agricultural grasslands such as planted hayfields and pastures. These habitats are known to be in decline in many regions, largely due to conversion to other land uses (e.g., residential and commercial development) and changes in agricultural practices (e.g., conversion from pasture land or hayfield to field crops). The components and characteristics of suitable habitat are fairly well-understood and it would be possible to create suitable habitat through management, restoration or creation.

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

   Unknown. Many of the threats on the breeding grounds in Canada can be avoided or mitigated through targeted recovery and stewardship actions. However, because this species predominantly uses agricultural lands on private land, there are some unpredictable factors that might influence the ability to mitigate or avoid threats, such as economic considerations of agricultural producers, political will, and market forces driving agricultural land use and practices. In addition, the extent, feasibility and population-level impact of mitigating threats on the South American wintering grounds are unknown at this time.

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

Unknown. Habitat management and habitat stewardship could be effective recovery techniques for this species on the breeding grounds in Canada, though it will be challenging to implement changes in land use practices on private land that will benefit the species. For example, mitigating losses by delaying the cutting of hayfields is a practical conservation measure that could improve rates of reproductive success towards achieving population objectives; however, the feasibility of implementing such a measure is much more complicated due in part to economic losses incurred by livestock industries and hay/silage producers (e.g., reduced hay quality or quantity and a corresponding reduction in meat/milk production, costs associated with obtaining livestock feed from alternate sources). Mitigating threats on the wintering grounds in South America will be a continuing challenge, including conducting the research to understand the importance of habitat conditions on survival and recovery and the work towards the protection of the species from threats such as pesticide exposure and persecution. It is unknown whether recovery techniques implemented for the species in Canada can mitigate threats that are occurring on wintering grounds in South America, to the extent that the population and distribution objective can be met.

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1. COSEWIC* Species Assessment Information

Date of Assessment: April 2010

Common Name: Bobolink

Scientific Name: *Dolichonyx oryzivorus*

COSEWIC Status: Threatened

Reason for Designation: Over 25% of the global population of this grassland bird species breeds in Canada, which is the northern portion of its range. The species has suffered severe population declines since the late 1960's and the declines have continued over the last 10 years**, particularly in the core of its range in Eastern Canada. The species is threatened by incidental mortality from agricultural operations, habitat loss and fragmentation, pesticide exposure and bird control at wintering roosts.

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

COSEWIC Status History: Designated Threatened in April 2010.

* COSEWIC – Committee on the Status of Endangered Wildlife in Canada

** 1998-2008

2. Species Status Information

The Bobolink is listed as Threatened in Canada under Schedule 1 of SARA. Provincially, it is listed as Threatened in Ontario and New Brunswick and Vulnerable in Nova Scotia and Newfoundland and Labrador. The species is not currently listed under formal legislation for species at risk in any of the other provinces where it occurs. Approximately 26% of the global breeding population (Partners in Flight Science Committee 2020) and 33% of the global breeding range (P. Blancher, pers. comm. in COSEWIC 2010) is in Canada.

Table 1. Conservation status ranks for the Bobolink (NatureServe 2021).

Species	Global (G) Rank	National (N) Rank	Canadian Sub-national (S) Ranks[a]
Bobolink	G5 (secure)	Canada: N5B, N4N5M (secure - breeding; apparently secure to secure - migration) United States: N5B (secure - breeding)	British Columbia (S3B) Alberta (S2B) Saskatchewan (S4B, S4M) Manitoba (S3S4B) Ontario (S4B) Quebec (S3B) New Brunswick (S3B,S3M) Nova Scotia (S3S4B) Prince Edward Island (S2B) Newfoundland Island (S1B, SUM)

[a] Conservation Status Ranks: S1: Critically Imperilled; S2: Imperilled; S3: Vulnerable; S4: Apparently Secure; S5: Secure; S#S# or N#N#: range rank indicating range of uncertainty; U: Unrankable. B: Conservation status refers to the breeding population of the species in the nation or state/province; M: Migrant species occurring regularly on migration at particular staging areas or concentration spots; conservation status refers to the aggregating transient population of the species in the nation or state/province.

3. Species Information

3.1 Species Description

The Bobolink is a medium-sized songbird of the Icteridae family that includes blackbirds, orioles, grackles, cowbirds and meadowlarks. Breeding males are a visually-striking bird, distinctly patterned while in breeding plumage (Martin and Gavin 1995a). They are mostly black when observed from the front but with a white to light grey back and shoulders and a buff or yellow nape. Females are drabber with generally buff-coloured plumage streaked with beige and dark brown. The sexes resemble each other when the males are not in their breeding plumage; juveniles resemble the females but are yellower. This makes it difficult for the casual observer to distinguish males from females during the non-breeding season and female from juveniles during the breeding season. Distinguishing characteristics, regardless of plumage, include rigid, sharply pointed tail feathers and long hind toenails.

3.2 Species Population and Distribution

The breeding range of the Bobolink in North America includes southern Canada, extending from southern British Columbia to Newfoundland, and south of the border to the northwestern, north-central and northeastern United States (Figure 1). The Bobolink is one of the only grassland bird species that winters entirely in South America. Historically, they wintered in the Pampas grasslands of South America (eastern Argentina and Uruguay) which have now been largely converted to unsuitable habitat (León et al. 1984, Di Giacomo and Krapovickas 2005). The current wintering range includes eastern Bolivia, Paraguay and northern Argentina (Renfrew et al. 2015). It is suggested that the wintering range may have expanded in response to increases in rice production areas (Renfrew and Saavedra 2007).

Figure 1. Global Distribution of the Bobolink. Data adapted from NatureServe (Ridgely et al. 2003).

The breeding population of the Bobolink in Canada, from the Partners in Flight (PIF) Population Estimates database based on Breeding Bird Survey (BBS) data, is estimated to be 2.6 million adults (95% confidence interval[4] [CI]: 2.1 million to 3.3 million), of which approximately 39% breed in Ontario, 22% in Quebec, 22% in Manitoba and 12% in Saskatchewan, with the remainder in relatively small numbers in the other western and Atlantic provinces (Partners in Flight Science Committee 2020).

The Boreal Avian Modelling (BAM) Project provides population estimates based on models of species density in relation to environmental variables. They estimate the Canadian population of Bobolink at 24.9 million individuals[5] (95% CI 23.5 to 26.3 million), of which approximately 40% breed in Ontario, 27% in Quebec, 16% in Saskatchewan and 12% in Manitoba and Alberta, with the remainder in relatively small numbers in the other provinces (Boreal Avian Modelling Project 2020). Based on the BAM model, the highest densities of the species can be found in southern Manitoba, southern Ontario, southwestern Quebec and Prince Edward Island.

Trend results based on BBS surveys indicate a long-term (1970-2019) decline of 2.6% per year (95% credible limit [CL] -3.0 to -2.3%) and a short-term (2009-2019) decline of 2.9% per year (CL: -4.1% to -1.5%) (Figure 2) (Smith et al. 2020). The long-term annual change indicates that the population declined by approximately 73% between 1970 and 2019. In the United States, trends results based on BBS surveys indicate a long-term (1970-2019) decline of 1.5% per year (95% credible limit [CL] -1.8 to -1.2%) and a short-term (2009-2019) decline of 2.8% per year (CL: -3.7% to -1.6%) (Smith et al. 2020). The long-term annual change indicates that the population in the United States declined by approximately 52% between 1970 and 2019. The reliability of both trends and population estimates varies across the country based on a number of factors (e.g., survey coverage, the number of survey routes and survey conditions); however, these data sources (PIF, BAM and BBS) provide the most comprehensive and up-to-date information on North American landbirds.

In Alberta, Bobolink distribution contracted in the northern portion of the species' range between the first (1987-1991) and second (2000-2005) atlas though the sample size was too small to detect a statistically significant decline in abundance (FAN 2007). In Ontario, the probability of detecting a Bobolink between the first (1981-1985) and second (2001-2005) breeding bird atlas declined by 28% (Gahbauer 2007). In Quebec, Bobolinks were observed in 39% of the squares sampled in the first (1984-1989) atlas, and in 25% of the squares sampled in the second (2010-2014) atlas (Robert et al. 2019). The probability of detecting a Bobolink declined by 40% between the two atlases (B. Jobin, pers. comm. 2021). In the Maritimes, they were recorded in 51% of the

[4] The 95% confidence interval (CI) means there is a 95% probability that the true estimate falls between the lower and upper limit. Credible limit (CL), while having a similar interpretation, describes the probability of a posterior condition in Bayesian statistics.

[5] The BAM population estimate model assumes that only breeding males are being counted during surveys, and hence provide estimates as number of males. The PIF population estimates incorporate an adjustment factor to account for the undetected member of the breeding pair (Stanton et al. 2019). Therefore, a pair adjustment factor of 1.75 for Bobolink was applied to the BAM population estimate to allow comparison of both estimates in number of individuals.

squares sampled in the first (1986-1990) atlas, and in 35% of the squares sampled in the second (2006-2010) atlas (Stewart et al. 2015). It is important to note that the change in number of squares in which a species was observed is not necessarily an indication of an increase or decrease in the population; population trend data is presented in Figure 2. British Columbia, Manitoba and Saskatchewan have each completed a single atlas which doesn't allow for comparisons while Newfoundland has not yet completed an atlas. Saskatchewan's second breeding bird atlas is currently underway (due to be completed in 2021), as is Newfoundland's first (due to be completed in 2024) and Ontario's third (due to be completed in 2026).

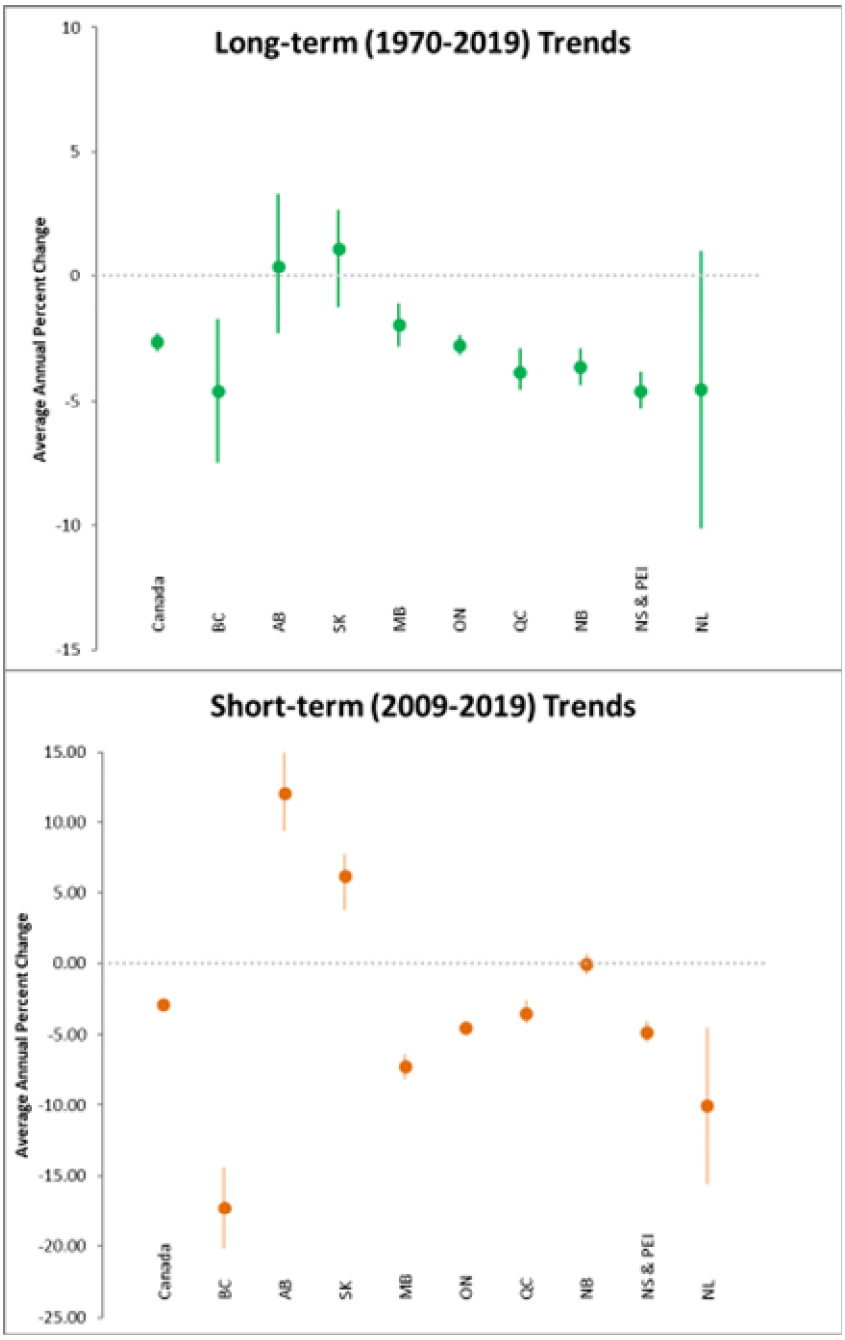

Figure 2. Breeding Bird Survey long- (1970-2019) and short-term (2009-2019) population trends for the Bobolink in Canada (Smith et al. 2020). The lines through the points represent the upper and lower 95% credible limits; longer lines represent more uncertainty in the estimate.

Historical Influence of Human Activity

As their original native prairie habitats were altered or destroyed, grassland species have either adapted by exploiting newly-created agricultural habitats, shifting to other habitat types, or have disappeared (Sample and Mossman 2007). In Canada, it is well understood that the Bobolink expanded its range and likely increased in abundance

following large-scale clearing of forests for agriculture and settlement following European arrival (Martin and Gavin 1995a, Brewer et al. 2000, Gahbauer 2007, Leckie 2007). Prior to European settlement, Bobolinks were probably most common in tall-grass prairies, and to a lesser extent in the mixed-grass prairies, in Canada and the United States (Askins et al. 2007, COSEWIC 2010, Renfrew et al. 2015). In the east, expansion was facilitated by forest clearing, while in the west expansion was driven by irrigation, diking and cultivation (Van Damme 1999). It should be noted, however, that Bobolinks likely existed (though probably only in small numbers) in the east prior to European settlement, even though the region was mainly forested (Askins 1999). For example, Riley (2013) suggests Bobolinks were found in fens and wet prairies of the Great Lakes region. Areas of open habitat in the east prior to European settlement would have been available as the result of wildfire, wind, disease, beaver (*Castor canadensis*) activity, flooding and insect damage (Askins et al. 2007, Riley 2013). In addition, Indigenous communities cleared the forests for firewood and other uses, used fire to enhance hunting areas and practised farming, creating open grassland habitats suitable for the species (Askins 1999, Riley 2013). Bobolinks expanded their range into the northwest in the late 1800s and into British Columbia in the early 1900s (Van Damme 1999).

Reconstructing the distribution and abundance of the Bobolink prior to European settlement would be challenging. Most accounts state that Bobolinks were associated with the tall-grass prairies and would have therefore been relatively rare in Canada (COSEWIC 2010). Other accounts state that they were likely associated with both the tall-grass and mixed-grass prairies (Bent 1958, Askins et al. 2007) while still other accounts state the Great Plains region (Brewer et al. 1991). Hamilton (1962) believed that the Bobolink populations in the west were relicts from an earlier period of wetter climate and that established populations enlarged and expanded locally with the advent of irrigation and cultivation. Populations have likely declined in areas where suitable prairie habitat has been lost, and increased (accompanied by shifts in distribution) in areas where activities such as agriculture and forest clearing have increased the availability of agricultural habitat. Even with the dramatic declines observed since the 1970s, it is presumed that Bobolinks were much less common and more scattered in Canada prior to European settlement than they are currently (McCracken et al. 2013).

3.3 Needs of the Bobolink

Breeding Ground Habitat

Breeding Ground Habitat – General Description

Bobolinks are breeding birds in Canada and establish multipurpose breeding territories that are used for mating, nesting, foraging and raising young (Renfrew et al. 2015). They arrive on the breeding grounds in Canada in early May. The nesting season[6] for the Bobolink in Canada extends from mid-May to the end of July (Rousseu and Drolet

[6] The period from when the first egg is laid to the when the young have vacated the nest.

2015). Family groups with fledged young can remain at breeding sites until the end of August. The Bobolink is considered a grassland obligate species; grassland obligate species are exclusively adapted to, and entirely dependent on, grassland habitats and make little or no use of other habitat types (Vickery et al. 1999). Grassland habitats can be described by vegetation association (e.g., grass) as well as by land use (e.g., pasture[7]); in all cases, they are open habitats where the combined coverage of trees and tall shrubs (over 1 m) is less than 60% (Beacon Environmental 2009).

Prior to European settlement, Bobolinks nested in native grassland habitats including prairies, meadows, alvars[8], salt marshes and savannahs (McCracken et al. 2013). These habitats were maintained by ecological processes such as fire (both natural as well as fires set by Indigenous people), grazing and drought in the western prairies and by fires and beaver activity in the northeast (Askins et al. 2007). As European settlement progressed, much of these habitats were converted for agricultural uses while at the same time additional open habitat suitable for the species was being created with the clearing of the forests in the east and irrigation in the west (COSEWIC 2010). These newly created open habitats mimicked the structure of native grassland habitats, thus acting as "surrogate" habitats for this species and indicating the opportunistic nature of the species' reliance on habitat structure, rather than particular plant species (Sample and Mossman 1997). "Surrogate" agricultural grasslands include planted hayfields and pastures which generally contain non-native species such as Timothy (*Phleum pretense*), Kentucky Bluegrass (*Poa pratensis*), Smooth Brome (*Bromus inermis*), wild rye and wheatgrasses (*Elymus* spp. and *Thinopyrum* spp.) and clover (*Trifolium* spp.). In Canada, the species now primarily nests in hayfields and pastures (both native and cultivated), as little of its native tall- and mixed-grass prairie habitat remains (COSEWIC 2010, McCracken et al. 2013). As with native grasslands, periodic disturbance (e.g., mowing, burning or grazing) is often required to maintain these open habitats in a suitable condition (e.g., limiting the encroachment of woody vegetation, maintaining vegetation height and structure).

Bobolinks are generally absent from woodland, shrubland and row crops, only occasionally nest in small-grain fields and avoid areas with high shrub density (Sample and Hoffman 1989, Jobin et al. 1996, Renfrew and Ribic 2002). Across the Prairie region, the abundance of the Bobolink decreases markedly from Manitoba to Alberta (Robbins et al. 1986, Smith 1996, Partners in Flight Science Committee 2020). Across their Canadian range, Bobolinks prefer moderate to tall vegetation (18 cm to 70 cm) that is moderately-dense to dense with moderate litter[9] depth (3.2 to 9.1 cm) and without the presence of woody vegetation (Sample and Hoffman 1989, Bollinger and Gavin 1992, Bollinger 1995, Dechant et al. 1999 [revised 2001]). Annual field crops and dry mixed-grass prairie do not generally provide these characteristics.

[7] Pastures can be native grasslands that are used for grazing cattle as well as areas seeded with non-native grasses or forbs, or a mix of both (e.g., seeded pasture).
[8] Alvars are mostly level expanses of limestone with a patchy mosaic of exposed limestone "pavement" and scant soil which mainly accumulates in cracks. There is seasonal inundation of water alternating with extreme drought in the summer (Lee et al. 1998).
[9] Litter is dead plant material on the ground.

The age at which fields begin to exhibit the characteristics of suitable habitat is highly dependent on local and regional site conditions, including soil moisture, plant species composition and soil fertility. In planted grasslands in Saskatchewan and Manitoba, Davis et al. (2017) found that some form of management (burning or mowing) should occur every four to six years to maintain habitat for a number of grassland species, including Bobolink. However, as fields age they become less productive for livestock forage and are routinely reseeded or rotated to other crop types making them less suitable as breeding habitat (McCracken et al. 2013). Also, in some areas, fields left unmanaged (e.g., not burned or mowed) may become invaded by woody vegetation (e.g., shrubs) and accumulate deep litter that can eventually render older fields unsuitable for nesting (Roseberry and Klimstra 1970, Johnson 1997).

Bobolinks may respond positively to appropriately-timed mowing (Bollinger and Gavin 1992, Herkert 1994b, Dale et al. 1997). Generally, infrequent mowing (intervals of two to eight years) can improve nesting habitat by maintaining dense cover and preventing encroachment of woody vegetation. Optimal mowing intervals to promote Bobolink suitable habitat will depend on local and regional site conditions (e.g., soil moisture, species composition, soil fertility).

Bobolinks' response to fire is variable across the range and depends on factors such as site characteristics (e.g., soil and vegetation type), climate and fire characteristics (e.g., frequency and intensity). Burning every two to five years (depending on site characteristics) can prevent the encroachment of woody vegetation and remove deep litter (Dechant et al. 1999 [revised 2001]).

As with fire and mowing, the response to grazing varies across the range, and across habitats and site conditions. Bobolinks may respond positively to grazing in taller vegetation but negatively to grazing in shorter vegetation (Bock et al. 1993). Generally, the species will tolerate grazing in areas where grass height averages about 20 to 30 cm (Skinner 1975) but, at least in some cases, the best method to improve the reproductive success of the Bobolink on livestock farms is to leave some hayfields and pastures undisturbed until nesting is complete (MacDonald and Nol 2017).

In general, continued suitability of open grasslands used for breeding by the Bobolink requires some form of habitat management or disturbance at regular intervals. Bobolink response to disturbance varies across the range depending on local environmental conditions in a given region or year (Davis et al. 2017), and in all cases requires appropriate timing to be beneficial. Disturbances such as mowing, haying or prescribed fire during the breeding season can be detrimental; mowing or hay cutting during the breeding season results in a nearly 100% loss of nests and recently-fledged young (Bollinger et al. 1990).

Breeding Ground Habitat – Territory Size and Placement

Bobolink territories are often found further from woody edges where reproductive success has been shown to be higher, presumably due to reduced rates of predation and parasitism by Brown-headed Cowbirds (*Molothrus ater*) in areas of the range where both species occur (Johnson and Temple 1990, Helzer and Jelinski 1999, Fletcher and Koford 2003, Winter et al. 2004). In a Wisconsin study, average territory size ranged from 0.7 ha (n= 78) in high quality habitat to 2.0 ha (n=8) in suboptimal habitat (Wiens 1969); Wittenberger (1978) reported an average territory size of 0.74 ha (n= 66) in high quality habitat and 1.45 ha (n=93) in suboptimal habitat. In New York, average territory size was 0.49 ha (n=>250) (Bollinger 1988). In Ontario, territories ranged in size from 0.38 to 1.67 ha (Diemer and Nocera 2014). Territory size is suggested to vary with habitat quality; Nocera et al. (2009) found older males held smaller territories clustered in areas of optimal habitat while younger, inexperienced males tended to have territories around the periphery in suboptimal habitat. From a study in Ontario (Diemer and Nocera 2014), the smallest territories had the highest abundance of potential prey items, taller and denser vegetation, deeper litter and more ground cover.

Breeding Ground Habitat – Nest Site Description

Nests are constructed on the ground within breeding habitat, often at the base of forbs[10] (e.g., Meadow Rue [*Thalictrum dasycarpum*] and clover [*Trifolium spp.*]) (Renfrew et al. 2015). The nest is composed of two distinct parts: an exterior wall formed of coarse dead grass leaves and weed stems, and an interior lining of very fine grasses or sedges (Renfrew et al. 2015). Nests are typically open above though Joyner (1978) found all nests observed in Ontario to have canopies of dead grasses (n=10). The general nesting period in Canada is from late-May to late-July (refer to Birds Canada Nesting Calendar Query Tool for more precise dates by region).

Breeding Ground Habitat – Field Size and Landscape Context

Bobolink presence, abundance and productivity is influenced by habitat characteristics (i.e., composition and configuration) at multiple spatial scales. Bobolinks are a noted area-sensitive species, having higher rates of occupancy and increased densities in larger grassland patches (Bollinger et al. 1988, Bollinger et al. 1990, Herkert 1994a, b, Johnson and Igl 2001). When looking only at studies that accounted for passive-sampling issues (see Johnson 2001 for a review), most found a positive relationship between area and density and/or occurrence (8 of 10) while one found a negative relationship and another a variable response (Ribic et al. 2009). However, a study from Ontario suggests that field size is not as limiting as habitat quality. Diemer and Nocera (2014) found that small fields (<3 ha) of high quality habitat supported several small territories while larger fields of lower quality habitat contained larger territories at a much lower density; field sizes examined ranged in size from 3.0 to 13.5 ha (mean 6.0 ha). Minimum area reported from other studies differs for regions; greater than 10-30 ha in

[10] A non-woody, broad-leaved herbaceous plant that is not a grass.

the east and Midwest to greater than 40 ha in the Great Plains (Bollinger et al. 1990, Dechant et al. 1999 [revised 2001]), though Herkert (1994b) estimated the minimum area required in the Midwest as 50 ha.

In addition to field size, Bobolink habitat selection may also be influenced by habitat openness (how visually open a habitat is). From a study in Vermont, Bobolinks avoided placing their nests in habitats that were less open and near edges, compared to random placement (Keyel et al. 2013). However, improved reproductive success or body condition did not appear to be influenced by these choices (Keyel et al. 2012, Keyel et al. 2013).

In the Canadian prairies, Bobolink abundance in planted grassland increased when these parcels were surrounded by native grassland (Davis et al. 2013). Bobolink relative abundance was not positively correlated with area when the amount of wooded area in the landscape, at the 1200 m scale, was low (Renfrew and Ribic 2008). When the amount of wooded area in the landscape was high however, there was a positive correlation between Bobolink relative abundance and grassland core area (Renfrew and Ribic 2008).

Breeding Ground Habitat – Food Resources

The Bobolink is both insectivorous and granivorous, feeding in breeding habitat primarily while on the ground or in lower levels of vegetation; invertebrates (57%) and vegetable matter (43%) are consumed (young are fed almost exclusively invertebrates, e.g., caterpillars) during the breeding season (Wittenberger 1980, Renfrew et al. 2015). A variety of adult and larval insects, spiders and snails comprise the invertebrate portion while weed seeds (e.g., dandelions [*Taraxacum* spp.] and Canada Thistle [*Cirsium arvense*]) make up the vegetable matter consumed during the breeding season.

Migration and Staging Grounds Habitat

Prior to southward migration, mixed-sex and –age flocks begin to form on the breeding grounds (Renfrew et al. 2015). In some locations flocks leave nesting locations by late July while others remain at breeding sites until late August. Freshwater marshes and coastal areas are used by some individuals at this time of year to molt before migration (Pettingill 1983).

During southward and northward migration, Bobolinks primarily use agricultural fields including rice fields, hayfields, corn fields and small grain fields to feed, fueling up for the long upcoming migration. Marshes and other wetlands are used for roosting (i.e., for resting and sleeping at night). Historically, Bobolinks were associated with wild rice (*Zizania* spp.) and marshes along large rivers in the United States (Pennsylvania, New Jersey, New York City and along the Delaware River) though the availability of the former is now limited (Renfrew et al. 2015). During migration, the diet is primarily granivorous including rice, barley, sorghum, wheat and corn (Renfrew et al. 2015).

Wintering Ground Habitat

Bobolinks use open habitats on their South American wintering grounds, loosely following major waterways and wetland systems. Here, they are found on ranchlands, ungrazed grasslands, marshes and in crops, reaching largest flock sizes in inundated rice paddies (Renfrew et al. 2015). Similar to migration, marshes and other wetlands are used for roosting and the diet is primarily granivorous including rice, barley, sorghum, wheat and corn (Renfrew et al. 2015).

3.4 Limiting Factors

Female Bobolinks normally produce one brood per season (Renfrew et al. 2015). Outside of the breeding season, particularly during the winter while the birds are in South America, Bobolinks congregate in large flocks (>1000 birds); such large concentrations of individuals increases their vulnerability to localized incidents (e.g., weather events, lethal control programs) which can lead to rapid declines in abundance.

4. Threats

The Bobolink threat assessment is based on the IUCN-CMP (World Conservation Union–Conservation Measures Partnership) unified threats classification system (version 2.0). Threats are defined as the proximate activities or processes that have caused, are causing, or may cause in the future the destruction, degradation, and/or impairment of the entity being assessed (population, species, community, or ecosystem) in the area of interest (global, national, or subnational). Limiting factors are not considered during this assessment process. For purposes of threat assessment, only present and future threats are considered. Historical threats, indirect or cumulative effects of the threats, or any other relevant information that would help understand the nature of the threats are presented in the Description of Threats section.

Threats for the species were assessed at a national scale for Canada; threats that occur outside of Canada that impact the Canadian population are also included (Table 2). Each threat listed below has been identified as occurring either on the breeding grounds or in non-breeding locations (i.e., during winter or migration), depending on where the primary impacts on the species' population are thought to occur. Due to the large geographic range of the species in Canada and the non-random spatial distribution of the threats themselves, it invariably follows that the impacts on local populations vary across the country. Based on these factors, it may be of value for regions or jurisdictions to conduct a threat calculator at a more local scale to obtain a finer resolution on the threats for management purposes.

4.1 Threat Assessment

Table 2. Threat Assessment Table

Threat #	Threat Description	Impact[a]	Scope[b]	Severity[c]	Timing[d]	Detailed Threats
1	**Residential & commercial development**	**Low**	**Small**	**Moderate**	**High**	
1.1	Housing & urban areas	Low	Small	Moderate	High	Urban, suburban and rural development; window collisions
1.2	Commercial & industrial areas	Low	Small	Moderate	High	Collisions with tall buildings and lighted structures; commercial development associated with urban sprawl
1.3	Tourism & recreation areas	Negligible	Negligible	Slight	High	Golf courses, etc.
2	**Agriculture & aquaculture**	**High**	**Pervasive**	**Serious**	**High**	
2.1	Annual & perennial non-timber crops	High	Pervasive	Serious	High	Increased mechanization and intensification; field crop monocultures; haying or mowing operations
2.2	Wood & pulp plantations	Negligible	Negligible	Moderate	High	Tree and shelterbelt planting; Christmas tree farms
2.3	Livestock farming & ranching	Low	Small	Slight	High	Overgrazing; trampling of nests

Threat #	Threat Description	Impact[a]	Scope[b]	Severity[c]	Timing[d]	Detailed Threats
3	**Energy production & mining**	**Low**	**Small**	**Moderate**	**High**	
3.1	Oil & gas drilling	Low	Small	Moderate	High	Oil wells and pads; noise
3.2	Mining & quarrying	Low	Small	Moderate	High	Rock pits and quarries
3.3	Renewable energy	Low	Small	Moderate	High	Wind farms
4	**Transportation & service corridors**	**Negligible**	**Pervasive**	**Negligible**	**High**	
4.1	Road & railroads	Negligible	Pervasive	Negligible	High	Road construction; traffic noise; collisions
4.2	Utility & service lines	Negligible	Pervasive	Negligible	High	Collisions with power lines and towers
5	**Biological resource use**	**Low**	**Small**	**Slight**	**High**	
5.1	Hunting & collecting terrestrial animals	Low	Small	Slight	High	Blackbird control programs; hunting; pet trade
6	**Human intrusions & disturbance**	**Negligible**	**Negligible**	**Negligible**	**High**	
6.1	Recreational activities	Negligible	Negligible	Negligible	High	Off-road vehicles, hikers, bird watchers, etc.
6.2	War, civil unrest & military exercises	Negligible	Negligible	Negligible	High	Training exercises and ranges; tanks and other military vehicles
6.3	Work & other activities	Negligible	Negligible	Negligible	High	Scientific research

Threat #	Threat Description	Impact[a]	Scope[b]	Severity[c]	Timing[d]	Detailed Threats
7	**Natural system modifications**	**Low**	**Restricted**	**Moderate**	**High**	
7.1	Fire & fire suppression	Low	Small	Moderate	High	Absence of fire and fire suppression (woody encroachment)
7.3	Other ecosystem modifications	Unknown	Pervasive	Unknown	High	Pesticides (indirect on habitat and food availability); invasive species
7.4	Removing/reducing human maintenance	Low	Restricted	Moderate	High	Abandonment of managed lands (woody encroachment)
8	**Invasive & problematic species, pathogens & genes**	**Low**	**Restricted**	**Slight**	**High**	
8.1	Invasive non-native/alien plants & animals	Unknown	Large	Unknown	High	Predation by cats and dogs
8.2	Problematic native plants & animals	Low	Restricted	Slight	High	Nest parasitism by Brown-headed Cowbirds; native predators (subsidized)
8.4	Pathogens & microbes	Unknown	Unknown	Unknown	High	Avian malaria, West Nile virus
9	**Pollution**	**Medium-Low**	**Pervasive**	**Moderate-Slight**	**High**	
9.1	Household sewage & urban waste water	Negligible	Pervasive	Negligible	High	Road run-off (salts, sediments)
9.3	Agricultural & forestry effluents	Medium-Low	Pervasive	Moderate-Slight	High	Pesticides (direct toxicity)

Threat #	Threat Description	Impact[a]	Scope[b]	Severity[c]	Timing[d]	Detailed Threats
11	**Climate change & severe weather**	**Unknown**	**Pervasive**	**Unknown**	**High**	
11.3	Changes in temperature regimes	Unknown	Pervasive	Unknown	High	Insect prey emergence mismatch
11.4	Changes in precipitation and hydrological regimes	Unknown	Pervasive	Unknown	High	Increased precipitation events, flooding
11.5	Severe/extreme weather events	Unknown	Pervasive	Unknown	High	Hurricanes, late frost

[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 $\geq$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 Threat

The overall Canada-wide threat impact for the species is High[11]. The overall threat impact considers the cumulative impacts of multiple threats. The primary threat to the Bobolink is Annual & perennial non-timber crops (Table 2). Threats are discussed below in decreasing order of Level 1 threat impact.

IUCN-CMP Level 1 Threat 2 - Agriculture & aquaculture (High)

2.1 Annual & perennial non-timber crops (High) – Breeding and Non-breeding Grounds

To date, it is estimated that over 80% of native grassland ecosystems in North America have disappeared, including 99% of native tall-grass prairie and savannah habitats in Canada (COSEWIC 2011). For Bobolinks, these losses were offset by the large-scale conversion of forested land to pastures and hayfields in the northeast and irrigation and cultivation in the west, which allowed them to expand their distribution and increase their abundance in those regions post European settlement (Cadman et al. 1987, COSEWIC 2010). Recent declines (i.e., related to current and ongoing threats) in eastern Canada appear to be primarily associated with decreasing habitat availability as a result of agricultural intensification, as well as reduced reproductive success from certain agricultural practices (COSEWIC 2010, McCracken et al. 2013).

Agricultural intensification includes trends such as the conversion of existing open habitats (e.g., hayfield and pastures) to field crop monocultures, increased use of pesticides and other agrochemical inputs, increased mechanization and increased rates of mowing or haying (Tews et al. 2013, Hill et al. 2014). Cumulatively and individually, these changes to how agricultural systems are managed have been blamed for the decline in a large suite of grassland birds in Canada, the United States and Europe over the last few decades (Chamberlain et al. 2000, Donald et al. 2001, Benton et al. 2002, Tews et al. 2013, Hill et al. 2014).

On the wintering grounds, Bobolink habitat has also declined, largely due to agricultural development and urbanization (Di Giacomo et al. 2005, Renfrew and Saavedra 2007). While little empirical information exists for the overwintering area, over 90% of native grasslands in Argentina have been converted (Di Giacomo et al. 2005). For the Bobolink, these declines in native grassland have been somewhat offset by increases in areas planted to rice (Bobolinks' main winter diet). However, more research is needed on the potential trade-offs of feeding on abundant cultivated rice, including its nutritional value and associated risks and conflicts from foraging in an agricultural setting (Renfrew et al. 2017).

Most farmland (85%) in Canada between 1986 and 2011 maintained its wildlife habitat capacity (a general index of suitable habitat for vertebrate species), though 14% has experienced a decrease in capacity (Javorek et al. 2016). Decreases were driven

[11] The overall threat impact was calculated following Master et al. (2012) using the number of Level 1 Threats assigned to this species where Timing = High or Moderate.

primarily by conversion of pastures and forage to annual crops, coincident to the decline in livestock production since 2006, particularly within the Mixedwood Plains Ecozone (southwestern Ontario extending along the St. Lawrence shoreline to Quebec City) (Javorek et al. 2016). Between 2011 and 2017, there was an overall decline in wildlife habitat capacity in eastern Canada, associated with the expansion of agricultural fields, and again mostly within the Mixedwood Plains Ecozone (Environment and Climate Change Canada 2019). Furthermore, conversion of native grasslands and drainage of wetlands for agricultural purposes continues (Watmough and Schmoll 2007, Federal Provincial and Territorial Governments of Canada 2010, Koper et al. 2010, Galatowitsch 2012, Doherty et al. 2018, World Wildlife Fund 2020).

Conversion of Hayfields and Pasture to Field Crop Monocultures – Breeding Grounds

Reduction in the availability of breeding habitat is regarded as one of the primary threats for the Bobolink in Canada (COSEWIC 2010, McCracken et al. 2013). In Canada, activities that contribute to the declining trends in breeding habitat availability include not only the conversion of native grassland habitats but also the conversion of existing agricultural grasslands (e.g., hayfields and pastures) to field crops, including corn, soybeans, fruit-producing crops and vinelands in British Columbia (Drapeau et al. 2019). Available breeding habitat also becomes increasingly fragmented through these activities. Field and row crops are rarely used by the species because they do not offer the required characteristics of breeding habitat (see section 3.3), though these crop types are important for the economic viability of many farming operations.

Declines in hay and pasture in eastern Canada can be partly linked to changes in the livestock industry, particularly the beef and dairy sectors. A decline in the number of beef and dairy farms has been the trend since 2001 (Statistics Canada 2017d). While the total number of farms (all types) declined by nearly 6% between 2011 and 2016, the average area per farm increased by 5% (Statistics Canada 2017a). During this same period, the land in crops increased by nearly 7% (Statistics Canada 2017a)

The number of cattle in Canada declined strongly between the mid-70s and mid-80s, and again since 2006 (Statistics Canada 2017d). A similar declining trend is seen in Ontario, Quebec and Manitoba since 2006, and a more marked decline around the mid-1970s occurred in Ontario when beef production shifted to western Canada (AAFC 1997). Decreases since 2006 are related to the bovine spongiform encephalopathy (BSE) outbreak (and subsequent regulations), rising costs of feed, stronger Canadian dollar and weakening exports (Statistics Canada 2012). A shift to raising dairy cattle in indoor enclosures has also contributed to the loss of pasture in Quebec (Ruiz and Domon 2005).

Across Canada, the amount of seeded pasture[12] and hay showed a slightly increasing trend, particularly between 1991 and 2006 and particularly in the three Prairie provinces; however, declines are evident in Ontario and Quebec (Statistics Canada

[12] Pasture lands that have been sown with non-native forage species, usually grasses in combination with legumes; they may be fenced and/or fertilized.

2012, 2017c). From 2006 onwards, declines in hay area and pasture across Canada are seen for Ontario, Quebec and Manitoba, coincident with the decrease in the number of cattle as well as through conversion to field crop production (Statistics Canada 2017c). Stronger prices for certain crops, such as corn and soybeans in the east and canola in the west, drove the changes in land use from beef and dairy production to field crop production (Wang et al. 2002, Statistics Canada 2012). More than 1.3 million hectares of corn for grain[13] was reported in the 2011 Census of Agriculture which is more than double the amount reported in 1971 (Hamel and Dorf 2014). The bulk (98%) of Canadian corn production occurs in Ontario, Manitoba and Quebec (Statistics Canada 2012). The breeding population of Bobolink in Canada is found primarily in Ontario, Quebec and Manitoba, comprising the bulk (83%) of the Canadian population.

A potential emerging threat is the production of biomass for biofuels production that could lead to additional habitat loss and degradation of Bobolink breeding habitat. Bioenergy currently accounts for approximately 6% of Canada's total energy supply (NRCan 2018). Several federal and provincial initiatives and regulations have been implemented to support and grow this industry, driven largely by climate change targets to reduce greenhouse gas emissions (Littlejohns et al. 2018). Agricultural biomass products used in biofuel production in Canada include soy and canola (for biodiesel), and corn and wheat (for ethanol). Increased production of these products will increase pressure to convert Bobolink breeding habitat and will add to degradation of habitat through the reduction of field sizes, thereby adding to habitat fragmentation.

Hay-cutting and Mowing Practices – Breeding Grounds

Since the 1950s, the intensification and mechanization of agricultural practices has had consequences for the nesting success of the Bobolink (Bollinger et al. 1990, Askins et al. 2007). Hay-cutting or mowing during the breeding period results in the destruction of nests and the direct mortality of eggs, young and adult birds, and also may reduce the nesting cover available the following year (Emery et al. 2005). Bollinger et al. (1990) found 94% mortality rates for Bobolink young (eggs and nestlings combined) following mowing: 51% directly destroyed, 24% abandoned after mowing, 10% from raking or baling operations and 9% from predation. Tews et al. (2013) estimated that ~667,000 Bobolink young are killed by mechanical disturbance from agricultural practices each year in Canada. Of these 667,000 individuals, ~321,000 were predicted to have fledged successfully in the absence of the disturbance. Spring surface tillage to control weedy plants can also negatively affect Bobolink breeding success through loss of nests, young and adults (Rodgers 1983, Tews et al. 2013).

In some areas of the range, earlier and more frequent hay-cutting has become standard practice to maximize nutritional content and to facilitate second and third cuttings (Herkert 1997, Nocera et al. 2005, Troy et al. 2005). This exposes active nests to additional pressure and can eliminate any chance of successful nesting or re-nesting

[13] 'Corn for grain' refers to corn grown for the kernels, which are ground to produce both human food and animal feed, in addition to being used as industrial feedstock (raw material for an industrial process).

attempts. If haying is done prior to when the birds begin breeding, the resulting habitat no longer provides suitable nesting cover for the species.

In western parts of the Canadian range (Saskatchewan and Manitoba), haying occurs later in the season and most producers cut their fields only once during a growing season (Ducks Unlimited Canada and Saskatchewan Ministry of Agriculture pers. comm. as cited in Davis et al. 2016). This is in part due to the dominance of the beef cattle industry in western Canada, and the different dietary needs of beef cattle versus dairy cattle (the former able to utilize hay cut later in the season with lower nutritional content). Cutting the fields later in the season and only once allows for some successful breeding but may reduce the success of late nests and re-nesting attempts. However, this practice may not be a viable economic option for a farming operation. Whether hayfields act as sinks depends on moisture conditions (McMaster et al. 2005) and the timing, frequency and extent of haying operations relative to the breeding period (Davis et al. 2016).

2.2 Wood & pulp plantations (Negligible) – Breeding Grounds

Tree-planting programs within existing grassland habitats contribute to habitat loss and degradation, including habitat fragmentation. In some localized areas of Quebec, tree-planting programs have occurred where lands considered suboptimal for agriculture have been converted to tree plantations. Treelines and woody cover can have a negative influence on the occurrence of several grassland birds, including the Bobolink (Roseberry and Klimstra 1970, Sample and Hoffman 1989, Bollinger and Gavin 1992, O'Leary and Nyberg 2000). In addition, proximity of woody cover has been shown to increase the rates of predation and parasitism of tall-grass prairie birds, including the Bobolink (Johnson and Temple 1990).

2.3 Livestock farming & ranching (Low) – Breeding Grounds

Bobolinks may respond positively to appropriately timed grazing in tall vegetation, provided it occurs at a level (e.g., intensity and frequency) that helps to maintain breeding habitat by preventing the encroachment of woody vegetation into grassland habitat (Bock et al. 1993). Grazing can help to reduce litter build-up and can facilitate feeding and travelling along the ground. Grazing can also help to control the establishment and spread of non-native species. However, continued heavy grazing that exceeds the capacity of the vegetation community to recover can impact the quality of grassland bird nesting and foraging habitat (Roseberry and Klimstra 1970). Grazing can also lead to degradation of riparian areas and wet pastures, field and prairies. High rates of nest trampling are noted in moderately grazed habitats (Renfrew et al. 2005). Furthermore, reduced vegetation height and density from grazing may increase predator access to the pasture interior (Saab et al. 1995). Grazing can also contribute to the establishment and spread of non-native invasive species in native and agricultural grassland habitats (Fleischner 1994); some of these non-native invasive species may create habitat that is structurally unsuitable for the species. Though negative impacts may be incurred as a result of livestock management, the species is primarily

dependent upon the agricultural grasslands (e.g., hayfields and pastures) that are required to sustain the beef and dairy industries.

IUCN-CMP Level 1 Threat 9 – Pollution (Medium-Low)

9.1 Household sewage & urban waste water (Negligible) – Breeding Grounds

Bobolinks can be exposed to road salts and sediment as most breeding areas are surrounded by road networks. However, most run-off is directed towards ditches and the impacts to the population are considered to be negligible.

9.3 Agriculture & forestry effluents (Medium-Low) – Breeding and Non-breeding Grounds

Pesticides, including herbicides and insecticides, can have both direct (e.g., toxicity and mortality) and indirect (e.g., reduction of food resources, changes to habitat) effects on birds, although little direct study has been done on Bobolinks on the breeding grounds. Declines in grasslands birds in Canada and the United States have been linked to insecticide exposure, particularly the granular form of cholinesterase-inhibiting carbamate and organophosphorus compounds (e.g., carbofuran) used in agriculture (Potts 1986, Mineau et al. 2005, Mineau and Whiteside 2006, Tews et al. 2013 but see Hill et al. 2014). At the height of its popularity, the granular form of carbofuran was conservatively estimated to have caused the mortality of 17 to 91 million birds annually from the Midwest United States corn belt alone (Mineau and Whiteside 2006). From a study conducted in the Canadian Prairies on a similar grassland nesting bird, Western Meadowlarks (*Sturnella neglecta*) were found to be highly susceptible to the impacts of these insecticides, where granules are mistakenly ingested as grit or food (Mineau et al. 2005). The granular form of carbofuran has been banned in Canada and for most uses in the United States, though the liquid form is not (COSEWIC 2010). Impacts of the liquid form of carbofuran on the Bobolink are largely unknown. The use of granular carbofuran in Latin American countries continues (Mineau et al. 2005, COSEWIC 2011) where it could affect migrating Bobolinks.

Bobolinks are also exposed to pesticides during the migration and wintering period. Bobolinks are highly gregarious in the non-breeding season, forming large flocks of up to thousands of birds (Renfrew and Saavedra 2007, Renfrew et al. 2015). They are often found feeding in large numbers during winter in rice fields that are treated with highly toxic pesticides (e.g., monocrotophos). In Bolivia, Renfrew and Saavedra (2007) found approximately 40% of Bobolinks captured had lethal and sub-lethal levels of cholinesterase activity in their blood. This is likely an underestimate as aside from direct mortality, impacts from exposure to this pesticide includes impaired motor skills and an inability to fly (Goldstein et al. 1999). There is uncertainty in the severity of direct effects of exposure to various pesticides on the non-breeding grounds, as is reflected in slight to moderate range rank in Table 2.

IUCN-CMP Level 1 Threat 1 – Residential & commercial development (Low)

1.1 Housing & urban areas (Low) – Breeding and Non-breeding Grounds

Urban expansion and associated commercial and industrial development has encroached upon a large amount of Canada's best agricultural land and continues to lead to permanent habitat loss and habitat degradation, including habitat fragmentation. Urban development is a major contributing factor in Canada's diminishing supply of dependable agricultural land (classes 1 through 3 of the Canada Land Inventory) (Hofmann et al. 2005). In 2001, nearly half of the urban land in Canada was located on formerly dependable agricultural lands (Hofmann et al. 2005).

Urbanization in Canada is concentrated in four major regions: Ontario's extended Golden Horseshoe (an area encompassing the western end of Lake Ontario and stretching roughly to Barrie and Lake Simcoe in the north, Lake Erie in the south, Peterborough in the northeast and Guelph to the east); Montreal and adjacent regions in Quebec; British Colombia's Lower Mainland and Vancouver Island and the Calgary-Edmonton corridor (Hofmann et al. 2005, Statistics Canada 2017b).The largest increases in urban and rural landscapes from 2000 to 2011 occurred in Ontario and Quebec (Statistics Canada 2013). Ontario has the highest concentration of urban land in Canada. More than 10% of the province's prime agricultural land was permanently removed by urban growth between 1971 and 2001, representing a nearly 80% increase in the amount of urban land in Ontario (Hofmann et al. 2005). Quebec now has the second largest area of urban land in Canada (Hofmann et al. 2005), and urban sprawl is occurring in part at the expense of Bobolink breeding habitat (Jobin et al. 2010). Since 2006, the highest population growth rates in Canada have been observed in Nunavut, Alberta and Yukon (Statistics Canada 2017b). All three Prairie Provinces population growth rates were above the national average with Alberta more than double the national average (Statistics Canada 2017b). Population growth in eastern Canada is lower than in the west with the Atlantic Provinces (New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland) being the most slowly growing in all of Canada (Statistics Canada 2017b). However, the proportion of the Bobolink population in Atlantic Canada is low (<7%) with the bulk (>80%) of the population occurring in Manitoba, Ontario and Quebec.

Some development can also create habitat through the clearing of forested land, or land otherwise unsuitable for the species, and the practice of letting it sit idle for several years before construction. This could offset some of the negative impacts, however, because this newly-created habitat largely represents only a temporary increase as development eventually proceeds or the habitat eventually becomes unsuitable, on balance housing and urban development has an overall negative impact.

On the wintering grounds, habitat continues to be lost and fragmented due to conversion to agriculture and urbanization with over 90 percent of native grassland habitats in Argentina having been converted due to these activities (Di Giacomo et al. 2005, Renfrew and Saavedra 2007). As a result, there have been noticeable declines in

grassland bird diversity and abundance within these now agroecosystems (Azporiz et al. 2012, Weyland et al. 2014).

1.2 Commercial & industrial areas (Low) – Breeding and Non-breeding Grounds

As a nocturnal migrant, Bobolinks are susceptible to collisions with tall, lighted structures such as communication towers, lighthouses and tall buildings (Long Point Bird Observatory, unpubl. data, Bright et al. 2008). Most birds killed at these types of structures are neotropical, migratory songbirds which migrate between North America and Central and South America; the birds' navigation systems seem to be confused by the tower lights (and other artificial lights), particularly in bad weather (Shire et al. 2000). It is estimated that total annual mortality from communication towers in the United States is about 4–5 million (all species) to an order of magnitude greater (U.S. Fish and Wildlife Service 2000, revised 2010, Erickson et al. 2005). In Canada, it is estimated that about 25 million (range 16 – 42 million) birds (all species) are killed by colliding with windows annually; however, tall buildings only account for approximately 1% of the mortality (Calvert et al. 2013). The population-level impact of mortality resulting from tall, lighted structures is considered low though it is expected to increase with the continued development of cellular telephone and digital television networks (Shire et al. 2000).

1.3 Tourism & recreation areas (Negligible) – Breeding Grounds

The continued development of tourism and recreation areas (e.g., golf courses) in suitable habitat can also be a source of habitat loss or degradation (e.g., fragmentation) for the Bobolink. Bobolink breeding habitat can be converted to recreational and tourism areas resulting in direct removal of suitable habitat. These activities can contribute to degradation of habitat through the reduction of field sizes thereby adding to habitat fragmentation, and through operational activities such as mowing grassy areas of campgrounds or golf courses. However, the impact of this threat is considered to be negligible.

IUCN-CMP Level 1 Threat 3 – Energy production & mining (Low)

3.1 Oil & gas drilling (Low) – Breeding Grounds

While not listed as threat in the COSEWIC report, oil and gas development in the western portion of the species' range can be a source of habitat loss and habitat degradation (e.g., fragmentation). Effects can stem from numerous mechanisms, including the physical removal of habitat, habitat fragmentation, increased noise, increased predation rates and direct mortality due to heavy equipment and increased vehicular traffic (Thompson et al. 2015, Nenninger and Koper 2018). It has been found that other grassland birds had significantly lower abundances near oil and gas infrastructure and lowered nest success nearby some forms of oil and gas development (within 400 m); effects of wells were caused by the physical footprint of the above-ground infrastructure and were exacerbated by the presence of linear features

such as roads and the associated power lines that provided perch sites for potential nest predators (Bernath-Plaiser and Koper 2016, Nenninger and Koper 2018). While Bobolinks were not a target species of this specific study it is likely some of the same impacts apply. A study in southeastern Saskatchewan found Bobolink abundance to decrease closer to wells and this effect was greater in native pastures versus planted ones (Unruh 2015). In addition, they found Bobolink abundance decreased with increased cumulative disturbance associated with oil development (e.g., well density, oil roads, pipelines) (Unruh 2015). As Bobolink densities are quite low in the areas with the highest oil and gas development (e.g., Alberta), and oil and gas development is largely concentrated in the west, this threat is considered to be Low impact Canada-wide.

3.2 Mining & quarrying (Low) – Breeding Grounds

Native alvar grasslands in Ontario continue to be adversely affected by the creation and expansion of rock quarries (McCracken et al. 2013). Pits and quarries established in existing grassland habitats are additional sources of breeding habitat loss and degradation (e.g., fragmentation) for the species.

3.3 Renewable energy (Low) – Breeding Grounds

While also not noted as a threat in the COSEWIC status report for the species, the Ontario recovery strategy states that collisions with wind turbines are a source of mortality of Bobolinks, likely due to the aerial displays performed by the birds that would bring them into contact with the blades (McCracken et al. 2013). Bobolinks are among the top ten species that are found killed at wind turbines when situated in grassland habitats (Anonymous 2012 in McCracken et al. 2013). Construction associated with wind turbines is also a potential source of habitat loss and degradation (e.g., fragmentation), thus reducing the carrying capacity or productivity of a site in the longer term (Zimmerling et al. 2013).

IUCN-CMP Level 1 Threat 5 – Biological resource use (Low)

5.1 Hunting & collecting terrestrial animals (Low) – Non-breeding Grounds

Bobolinks are impacted either directly or incidentally in control programs designed to reduce crop damage. This threat is primarily a concern during migration and on the wintering grounds. Bobolinks form large flocks during the non-breeding season and are often found feeding in rice fields on their South American wintering grounds. They are viewed as a pest of rice crops and are intentionally poisoned with pesticides to control seed predation (Renfrew et al. 2015). In Bolivia, intentional poisoning using pesticides in the late 1900’s caused high mortality and this practice is still commonly undertaken in Argentina (Renfrew and Saavedra 2007, Blanco and López-Lanús 2008). Given the Bobolink’s tendency to form very large flocks during winter within relatively restricted geographic areas, control methods have the potential to significantly impact population levels.

Historically, Bobolinks were hunted in large numbers for market and sustenance purposes. It is estimated that over 700,000 individuals were killed for market in a single year in South Carolina (Bent 1958). This is no longer a threat to the species in Canada or the United States but the extent to which Bobolinks continue to be hunted in South America and the Caribbean is unknown (McCracken et al. 2013).

Male Bobolinks are also collected for illegal sale in the pet trade in South America and the Caribbean (Bent 1958, Di Giacomo et al. 2005). Several thousand are believed to be trapped and traded each year in Cuba for both domestic and international markets (E. Iñigo-Elias, pers. comm. in Renfrew et al. 2015). While information is lacking from some areas of South America where these activities may be occurring, the overall impact of this threat is considered to be low.

IUCN-CMP Level 1 Threat 7 – Natural system modifications (Low)

7.1 Fire & fire suppression (Low) – Breeding Grounds

Grasslands in pre-European settlement times were both created and maintained by natural (e.g., lightning) fires and fires used by Indigenous people (Askins 1993, Vickery et al. 2000). Natural wildfires in tall-grass prairies are now rare as a consequence of deliberate fire suppression, and remnant native grasslands continue to be lost through succession and encroachment in the absence of wildfires (Patterson and Sassaman 1988, Vickery et al. 2005, Askins et al. 2007).

7.3 Other ecosystem modifications (Unknown) – Breeding Grounds

This threat category is intended to capture indirect effects of ecosystem modifications, such as invasive species impacting the suitability of Bobolink habitat or human-caused reductions in their food resources from pesticide use. Direct effects of these threats to the species are captured under their corresponding threat categories (e.g., invasive & problematic species, pathogens & genes – Threat 8 and pollution – Threat 9).

Pesticide use, largely associated with agricultural intensification, can potentially affect grassland birds indirectly through impacts to their food resources, both seeds and insects. The reduction of weed seeds due to herbicide use has been reported in the United Kingdom as well as elimination of host plants important for insect reproduction (Bright et al. 2008). Occupancy of some breeding grassland birds has been shown to correlate with the availability of insect prey (Nocera et al. 2007). As the use of organophosphate and carbamate insecticides over the past decade has declined, the use of neonicotinoids has increased dramatically (Hladik et al. 2014). Insect groups targeted by neonicotinoids are primarily Hemiptera (aphids, whiteflies and planthoppers) and Coleoptera (beetles), though recent studies show that they are also having adverse effect on many non-target invertebrates (Nauen and Denholm 2005, Hallmann et al. 2014). In the Netherlands, neonicotinoid concentrations in surface waters were correlated with the declines in farmland insectivorous birds (Hallmann et al. 2014). They

suggested the declines were caused by a reduction of insect prey as a result of insecticide use.

In Canada, neonicotinoid insecticides were previously approved for use as seed treatments, soil applications, and foliar sprays on a wide variety of agricultural crops such as oilseeds, grains, corn, soybeans, fruits, vegetables, greenhouse crops (food and ornamental), ornamental plants, and Christmas trees (Health Canada 2014). Within Canada, they are used extensively on canola crops in the Prairies and in corn and soybean growing areas of Manitoba, Ontario and Quebec (Health Canada 2014). In response to concerns about pollinator health, Health Canada undertook a re-evaluation of the three mostly widely-used neonicotinoids, which has resulted in cancellation of some uses (e.g., foliar and soil application on certain crops) and additional mitigative measures (e.g., timing restrictions) (Health Canada 2019b, c, a). The Government of Ontario introduced regulations to reduce the number of acres planted with neonicotinoid-treated seeds (Government of Ontario 2021). The indirect effects of insecticides and herbicides have not been studied for the Bobolink in much detail, and further research is needed.

Herbicides are also known to affect bird populations through changes to breeding habitat. Over an 8-year period in Maine, the incidence of Bobolinks was low in grassland habitats where herbicides were used to improve blueberry (*Vaccinium* spp.) production (Vickery 1993, Vickery et al. 1994). The herbicide used dramatically reduced both grass and forb cover as well as induced changes to the types of vegetation found within sites (Yarborough and Bhowmik 1993, Vickery et al. 1994).

In areas where native grassland habitat still exists, invasive species such as Crested Wheatgrass (*Agropyron cristatum*) and Smooth Brome (*Bromus inermis*), can threaten grassland integrity (e.g., through the modification of fire and soil regimes) and can outcompete native species (Brooks et al. 2004, Jordan et al. 2008, SWA n.d.). In addition, invasive species can also render agricultural grassland habitats unsuitable for the species. For example, buckthorn (*Rhamnus* spp.), a woody shrub, can be reduce habitat quality and is notoriously difficult to control. However, as Bobolinks are predominantly found in agricultural grassland types primarily containing non-native species, this component of the threat is considered to be negligible for the species.

7.4 Removing/reducing human maintenance (Low) – Breeding Grounds

The encroachment of woody vegetation into open habitats due to the abandonment of marginal, non-productive farmland and dairy farms has resulted in declines of native and agricultural grassland habitats for the Bobolink (Askins 1993). Agricultural grassland habitats throughout northeastern Canada, previously maintained by activities such as mowing of hayfields and grazing by cattle to support dairy and beef production, are being abandoned and reverting back to forest (Jobin et al. 2014). Such lands often occur on marginal soils, where opportunities to rotate to other crops are limited by poor drainage, stoniness, shallow soils, low natural fertility, steep slopes, or susceptibility to erosion (J. Bagg, pers. comm. 2011 in McCracken et al. 2013). Costs of maintaining

fencing and limited access to water for grazing beef cattle are additional limitations that contribute to land abandonment (J. Bagg, pers. comm. 2011 in McCracken et al. 2013). In the St. Lawrence Lowlands of Quebec the number of dairy farms fell by half between 1971 and 1988 (Jobin et al. 1996).

IUCN-CMP Level 1 Threat 8 – Invasive & problematic species, pathogens & genes (Low)

8.1 Invasive non-native/alien plants & animals (Unknown); 8.2 Problematic native plants & animals (Low) – Breeding Grounds

Bobolinks nest on the ground and their nests are vulnerable to predation by a variety of species, both native and non-native. Known native predators of the Bobolink include various raptor species, foxes, coyotes, snakes, skunks, raccoons, ground squirrels, crows, gulls and other small mammals; non-native predators include domestic cats and dogs (COSEWIC 2010). Habitat patch size, distance to edge and the configuration of the surrounding landscape matrix (i.e., fragmentation effects) may affect predation and nest parasitism rates (Johnson and Temple 1990, Herkert et al. 2003, Benson et al. 2013).

It is difficult to differentiate mortality due to native predator populations that have been influenced by human activities on the landscape (e.g., subsidized predators[14]) from levels of predation that would have occurred naturally within a population. However, all predation by non-native species can be considered additive[15] because the non-native predator would not have been present under natural conditions. Bobolinks are associated with working landscapes and human settlements increasing their exposure to predation by both native and non-native predators. While there is no information available that is specific to Bobolinks, Calvert et al. (2013) found cats alone kill more birds (all species) in Canada than all other threats examined combined; areas of high mortality were associated with areas of high human population and activity (i.e., southern Ontario and Quebec and the five major prairie cities).

Similar to subsidized native predators, it's difficult to know whether rates of Brown-headed Cowbird (a problematic native species) nest parasitism[16] on Bobolink are above levels that would have occurred naturally. Prior to European settlement, Brown-headed Cowbirds were limited to open grasslands of central North America; they underwent a range expansion, spreading east in the early 1800s as forests were cleared (Lowther 2020). It's likely that historically the ranges of these two species

[14] A subsidized predator is one which has survived, and perhaps grown, in part, due to food, water or other limiting resources (e.g., nest sites) provided by or associated with human activities or settlements.
[15] Compensatory mortality in wildlife population dynamics refers to the number of deaths that would occur naturally in a population from sources such as disease, predation and starvation; mortality is considered additive when the number of deaths are above the compensatory level because it adds to the existing sources of mortality that would have occurred naturally (i.e., if the individuals killed would have otherwise survived).
[16] Brown-headed Cowbirds are nest parasites and lay their eggs in the nests of other bird species which then hatch and raise the cowbird young, often at the expense of their own young.

overlapped. Brown-headed Cowbird parasitism rates appears to vary geographically with low rates reported from the eastern parts of the breeding range, low to moderate rates from the Midwest and higher rates from the west (Renfrew et al. 2015). In New York, Ontario and Vermont, 0 of 422 (0%) nests, 8 of 136 (5.9%) nests and 1 of 1,025 (<1%) nests were parasitized, respectively (Peck and James 1987, Renfrew et al. 2015). In the Midwest (Illinois and Wisconsin), 0 of 57 (0%) nests, 1 of 62 (1.6%) nests and <5% to 20% of nests were parasitized (Renfrew et al. 2015). The highest rates are reported farther west; North Dakota, Nebraska and Minnesota reported 42 of 108 (39%) nests, 430 of 839 (51%) nests and 16 of 47 (34%) nests as parasitized, respectively (Johnson and Temple 1990, Renfrew et al. 2015).

Both adults of a mated pair regularly attack or chase Brown-headed Cowbirds entering their territory but do not appear to distinguish or remove cowbirds eggs from the nest (Renfrew et al. 2015). From a study in Minnesota, nests that had been parasitized fledged fewer young than non-parasitized nests (Johnson and Temple 1990), however, another study found that parasitized Bobolink nests had greater survival rates than non-parasitized nests (Kerns et al. 2010). Population-level effects range-wide are probably minor (Renfrew et al. 2015).

8.4 Pathogens & microbes (Unknown) – Breeding Grounds

Little research has been conducted on pathogens or diseases in the Bobolink. There is a report of a single female Bobolink from a study in Vermont that displayed male-like plumage. The development of the male-like plumage may have potentially been due to the effect of a pathogen that damaged the ovary and appears to have rendered the female infertile for that season (Perlut 2008). Bobolinks are known carriers of avian malaria but it is uncertain if there are negative impacts (Levin et al. 2013, Perlut et al. 2018). West Nile Virus may also be a concern.

IUCN-CMP Level 1 Threat 4 – Transportation & service corridors (Negligible)

4.1 Roads & railroads (Negligible) – Breeding Grounds

The construction of roads and railroads results in removal of habitat as well as mortality from collisions. Road construction also contributes to habitat fragmentation. Birds can also be affected by the noise associated with these features. Road mortality has been documented in Canada for the Bobolink, but is not considered to result in population level declines (Bishop and Brogan 2013). Removal of habitat from these activities is also minimal and limited in scope. The effect of noise is dependent on traffic volume, distance from road and openness of the land; Bobolink presence was correlated with increased distance from high-volume roads (>15,000 and >30,000 vehicles per day) but effects on reproductive success were not studied (Forman et al. 2002).

IUCN-CMP Level 1 Threat 6 – Human intrusions & disturbance (Negligible)

6.1 Recreational activities (Negligible); 6.2 War, civil unrest & military exercises (Negligible); 6.3 Work & other activities (Negligible) – Breeding Grounds

Female Bobolinks will occasionally abandon nests visited by researchers during early incubation (i.e., <3 days); however, they will rarely abandon three or more days after the onset of incubation (Renfrew et al. 2015). In Nebraska and Vermont, 13 of 24 males and 2 of 16 females returned with geolocators that had been attached using leg-loop harnesses the previous year (Renfrew et al. 2013). In Vermont, two of eight females abandoned nests immediately after geolocator deployment (Renfrew et al. 2015). Across the species range in Canada, recreational (e.g., hikers, ATVers, bird watchers), military (training exercises) and research activities, among others, can all cause disturbances at the nest and may contribute to abandonment. However, the impact of these activities on the population level is considered to be negligible.

IUCN-CMP Level 1 Threat 11 – Climate change & severe weather (Unknown)

11.3 Changes in temperature regimes (Unknown); 11.4 Changes in precipitation and hydrological regimes (Unknown); 11.5 Severe/extreme weather events (Unknown) – Breeding and Non-breeding Grounds

Bobolink nests, in some habitat types (e.g., lowland meadows and sedge fields), are sensitive to heavy rains or periods of frost which can cause mortality of eggs and nestlings and cause flooding of nests (Martin and Gavin 1995b). Nest exposure to adverse weather and flooding is a significant mortality factor (Martin and Gavin 1995a). During migration, tropical storms and severe weather events could presumably have negative effects on migrating birds, exacerbated by the species' flocking behaviour (COSEWIC 2010). Thogmartin et al. (2006) found Bobolinks to be strongly associated with variation in annual precipitation; thus, higher frequency of droughts and other changes in precipitation patterns, as predicted by climate change models, will likely impact the species presumably through effects such as quality of seed crops (i.e., forage quality), vegetation cover (i.e., nesting habitat quality) and emergence of insect food resources (i.e., prey availability) (COSEWIC 2010). Bobolink are considered to be moderately vulnerable to climate change under warming scenarios of +1.5 and +2° C, and strongly vulnerable to a warming scenario of +3° C (National Audubon Society n.d.). Under these scenarios, the species' North American breeding range is predicted to contract by 1%, 15% and 32%, respectively (National Audubon Society n.d.). Significant loss in range (43 to 88% across warming scenarios) along the southern extent is partially offset by range gain (42 to 56%) in the north (i.e., Canada) (National Audubon Society n.d.). Further research is required to understand the mechanisms driving possible positive, neutral or negative effects that climate change may have on this species, and where those effects are most likely to be seen across the species' range and life cycle.

5. Population and Distribution Objectives

Recovery is defined as a return to a state in which the risk of extinction for a species is within the normal range of variability it would have had prior to the impact of the human activities that led it to be listed under SARA. The COSEWIC reason for designating the species as threatened was based on declines (i.e., only indicator A2b[17] was met). It is understood that declines in the species population over the long- (1970-2019) and short-term (2009-2019) are related to changes in land use practices that converted agricultural grassland types (and to a lesser extent native grasslands) to incompatible land uses (e.g., urban development, roads) or unsuitable habitat types (e.g., row crops, forest), and the direct mortality of individuals, nests and eggs from certain agricultural operations.

Following initial increases in habitat related to European settlement, declines in agricultural habitat types were driven by market shifts within the agricultural sector that promoted increased mechanization and conversion of forage crops to cereal and row crops (Herkert 1991, Martin and Gavin 1995a, Granfors et al. 1996, Jobin et al. 1996, Corace et al. 2009). The risk of extinction prior to this period can be assumed to be low (i.e., Not at Risk) because the species was thought to be more widespread and possibly more numerous in Canada than it is now, and it is not thought that the species population was undergoing any precipitous declines in Canada at that time (i.e., prior to the result of human activity that led to it being listed under SARA).

Population objective

The population objective to recover the Bobolink in Canada is to stabilize the Canada-wide population trend within 10 years (by 2031), and thereafter, at a minimum, maintain a stable trend.

Distribution objective

The distribution objective to recover the Bobolink in Canada is to maintain the representation of the species in all provinces across the species' known range in Canada (Figure 1).

Short-term statement Towards Meeting the Population and Distribution Objectives

The short-term (within 10 years) statement for the recovery of the Bobolink is to stabilize the declining Canada-wide population trend by achieving the population trend targets within each Province x Bird Conservation Region (BCR) unit specified in Appendix A (Table A1).

[17] A2b: A reduction of ≥30% in the total number of mature individuals over the10 year period previous to the assessment (in the case of Bobolink, from 1998-2008).

Rationale

Population Objective and Short-term Statement

The population objective addresses the species' declining population trend, which was the reason for its designation as Threatened in 2010 (COSEWIC 2010). At the time, the species did not meet other criterion assessed by COSEWIC. Achieving a stable population of the Bobolink in Canada is projected to take up to 10 years, owing to response times (in both habitat and demographic rates in the birds) to stewardship and conservation efforts. Together with the short-term statement, the population objective aligns with range-wide objectives (i.e., Canada and the United States) proposed in the Full Life Cycle Conservation Plan for Bobolink (Renfrew et al. 2019). The short-term statement is set out accordingly to support the overarching population objective.

While stewardship and conservation efforts work toward stabilization of the Canadian population trend, the short-term statement (within 10 years) is to stabilize the population trend and limit any further decline to less than 15% (in other words, the population will not drop below 85% of 2017[18] levels). This is supported by the population trend targets established for each Province x BCR (Appendix A). The short-term trend targets were established using a tool that was developed for the Full Life Cycle Conservation Plan for Bobolink (Renfrew et al. 2019). The trend-based tool apportions responsibility for reaching the Canadian objective among BCRs and provinces comprising the Bobolink's Canadian range; multiple iterations were considered and evaluated for feasibility.

Provided other population parameters that are assessed by COSEWIC remain stable over the short-term, the species would no longer meet the threshold for Threatened status based on declines after 10 years.

The 10-year timeframe for the short-term statement was deemed appropriate to assess population change of the Bobolink. This timeframe was selected due to the fact that influencing population trends is challenging, takes time, and because COSEWIC species' assessments occur every 10 years. The criteria for assessment include reviewing population change within 10-year windows and BBS trends are now calculated according to this timeframe. These objectives should be reviewed on a similar basis to develop new short-term trend targets for each Province x BCR unit that would support achieving the population objective stated here. It is important to note that there are uncertainties regarding achieving the population and distribution objectives because of the challenges posed by reducing the threats to the species and its habitat on both the breeding and wintering grounds.

The basis for the short-term statements is the provincial portion of each BCR within the species' range. These geographic units were chosen to ensure representation is maintained while facilitating management and conservation actions that will be implemented on the ground, as both threats and trends vary amongst these units

[18] 2017 is used because population objective and short-term statement were developed using trends and abundance estimates current to 2017, which were the most recent set of analyses available at the time.

nationally. BCRs are ecologically-distinct regions with similar bird communities, habitat and resource management issues that were developed in order to plan, implement and evaluate conservation actions across North America. BCRs function as the primary units within which biological planning is undertaken (NABCI n.d.). The Province x BCR units within the centre of the species historical range (i.e., Manitoba and Saskatchewan), carry added weight in achieving a stable Canada-wide population trend. Additionally, deviations in the short-term population targets amongst Province x BCR units can be accommodated provided the overall goal of achieving the Canadian population and distribution objectives are met. This means that if the population increases in some Province x BCR units, it can alleviate the targets in other units.

It is unclear whether stabilizing the population at 85% of 2017 levels within the species known range in Canada represents a viable, self-sustaining population of the Bobolink. This knowledge gap further highlights the need to re-assess population trends and short-term population objectives on a regular basis (i.e., every ten years or less).

Distribution Objective

Most accounts state that Bobolinks were historically associated with the tall-grass and mixed-grass prairies of Canada and the United States. These ecosystems are some of the most altered in Canada and less than 1% of the tall-grass prairie in Canada remains today. There is also evidence that the species existed historically in central and eastern Canada in pockets of suitable habitat. Given the nature of human impacts, it is unknown whether the primary threats to the species and its habitat can be mitigated or avoided, and there are also uncertainties about projected impacts such as climate change. While these knowledge gaps are being addressed, it is considered appropriate to maintain the representation of the species in all provinces across its known range in Canada, to the extent possible.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

To date, recovery actions for the Bobolink, or grassland birds in general, have largely been driven by provincial or regional efforts. 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:

- An Ontario Recovery Strategy for the Bobolink and Eastern Meadowlark was published in May 2013 along with a General Habitat Description in July 2013 and a Government Response Statement (GRS) in December 2015. The GRS is the Government of Ontario's species-specific policy direction on the protection and recovery of a species at risk (Government of Ontario 2015). It states the following:

  - The Government of Ontario has established targets to slow the current average annual rates of population decline in Ontario to 0% for the Bobolink by 2036; this is meant to achieve stabilization at population level of 302,000 birds in Ontario.
  - The Government of Ontario aims to establish a grassland stewardship initiative to create, maintain and enhance 30,000 ha of grassland habitat over the next 20 years (beginning in 2016) and report on its success in slowing population declines and progress towards stabilizing population levels in Ontario.

- Several non-government organizations (e.g., Tallgrass Ontario, Tallgrass Prairie Preserve in Manitoba and the Nature Conservancy of Canada) are involved with the promotion of restoration, rehabilitation and creation of native prairie and savannah habitat.

- The Island Nature Trust in Prince Edward Islands runs a farmland birds program, which engages small-scale farmers in monitoring and stewardship of grassland bird species, including Bobolink.

- Bobolinks have benefitted from restoration activities undertaken by Ducks Unlimited Canada (e.g., Revolving Land Conservation Program) and other Prairie Habitat Joint Venture partners through the conversion of annual cropland to perennial cover.

- Several Indigenous communities have undertaken habitat protection and restoration projects (e.g., Alderville First Nation and Walpole Island First Nation).

- Several government-supported programs are available that can benefit the Bobolink, including: Habitat Stewardship Program for Species at Risk, Aboriginal Fund for Species at Risk, Conservation Land Tax Incentive Program and Species at Risk Farm Incentive Program.

- The Environmental Farm Plan is a voluntary, whole-farm, self-assessment tool available in all ten provinces and Yukon that helps farmers and ranchers identify and build on environmental strengths, as well as mitigate risks on their operations. Delivered at the provincial and territorial level, the program spreads awareness through environmental education, practical and proven beneficial management practices, regulation and cost-sharing incentives.

- Environment and Climate Change Canada's Species at Risk Partnerships on Agricultural Lands (SARPAL) initiative is focused on working with the agricultural community to facilitate recovery of species at risk on agricultural lands through voluntary stewardship actions related to critical habitat for species at risk.

  - The SARPAL initiative in Ontario provides funding to producers whose actions support healthy farm habitat for the Bobolink and other grassland birds.
  - In Prince Edward Island, the SARPAL initiative was set up to fill knowledge gaps in Bobolink habitat use and distribution which has enabled the implementation of a delayed harvest under the province's Alternative Land Use Services (ALUS) program.
  - In Saskatchewan, SARPAL operates in the areas covered by the Action Plan for Multiple Species at Risk in Southwestern Saskatchewan: South of the Divide (Environment and Climate Change Canada 2017) to engage the agricultural sector in preserving key wildlife habitat through habitat management and restoration and conservation easements. While the Bobolink is not specifically included as a species in this document due to low densities in the area, activities undertaken through this program will benefit Bobolinks in this area.
  - In Manitoba, SARPAL is focussing on delivering information and incentive programs (e.g., "Keep Grazing") to cattle producers to enhance pastureland with the goal to improve grass quality and maintain healthy habitats. While Bobolinks aren't specifically included as a target species, the program is targeting native prairie grasslands in areas where Bobolinks are known to occur in high densities.

- The ALUS program serves as a useful conceptual model for stewardship and restoration of marginal agricultural lands and for the adoption of other beneficial farmland practices.

- The Ontario Soil and Crop Improvement Association (OSCIA) piloted the 'Grassland Habitat Farm Incentive Program' in 2012 and 2013 with support from Ontario Ministry of Natural Resources and Forestry.

- In Ontario, a roundtable panel for the Eastern Meadowlark and the Bobolink was formed to provide input into stewardship and management approaches and represents the interests of conservation organizations, agricultural organizations, the wind industry, the aggregate industry, developers, and municipalities.

- Guidelines that incorporate grassland priorities have been developed for species at risk associated with rehabilitation projects on lands affected by the aggregate industry (Savanta Inc. 2008).

- Recent monitoring efforts have occurred or are on-going, documenting species' occurrences and habitat associations (e.g., Quebec Breeding Bird Atlas, Maritime Breeding Bird Atlas, Ontario Grassland Bird Survey, Manitoba Breeding Bird Atlas, Saskatchewan Breeding Bird Atlas, Newfoundland Breeding Bird Atlas).

- Several resources are available pertaining to beneficial management practices for grassland bird conservation. A subset of these are listed below:

    - Projet Goglu: Guide du propriétaire (Project Bobolink: Owner's Guide – available in French only) (SCIRBI 2015)
    - Recommendation Guide – Habitat Management Practices for the Protection of Farmland Birds – 2nd Edition (Lamoureux and Dion 2019)
    - Farming with Grassland Birds: A Guide to Making Your Hay and Pasture Bird Friendly (Kyle and Reid 2016)
    - Managing Hay and Pasture to Benefit Grassland Birds: A Preliminary Guide for Carden Landowners (The Couchiching Conservancy n.d.)
    - Agricultural Practices That Conserve Grassland Birds (Hyde and Campbell 2012)
    - Hayfield Management and Grassland Bird Conservation (Ochterski 2006)
    - Managing Habitat for Farmland (Grassland) Birds (Audubon New York 2009)
    - Management Considerations for Grassland Birds in Northeastern Haylands and Pasturelands (USDA-NRCS 2010)
    - A Land Manager's Guide to Grassland Birds of Saskatchewan (Saskatchewan Watershed Authority 2002)
    - Best Management Practices for Grassland Birds: Why they need vegetation mosaic (Operation Grassland Community and Parkland Stewardship Program n.d.)

6.2 Strategic Direction for Recovery

Table 3. Recovery Planning Table

Threat or Limitation Addressed	Broad Strategy to Recovery[a]	Priority[b]	General Description of Research and Management Approaches
5.1 Hunting & collecting terrestrial animals 7.3 Other ecosystem modifications 9.1 Household sewage & urban waste water 9.3 Agricultural & forestry effluents	1. Land / Water Management *1.1 Site/Area Stewardship*	Medium	Encourage adherence to the principles of Integrated Pest Management and encourage use of environmentally benign pesticides at small scales; implement policies and programs for the reduction of pesticides and other pollutants
1.1 Housing & urban areas 1.2 Commercial & industrial areas 1.3 Tourism & recreation areas 2.1 Annual & perennial non-timber crops 2.2 Wood & pulp plantations 2.3 Livestock farming & ranching 3.1 Oil & gas drilling 3.2 Mining & quarrying 3.3 Renewable energy 4.1 Roads & railroads 6.2 War, civil unrest & military exercises 7.1 Fire & fire suppression 7.3 Other ecosystem modifications 7.4 Removing/reducing human maintenance 11.3 Changes in temperature regimes 11.4 Changes in precipitation & hydrological regimes	1. Land / Water Management *1.2 Ecosystem & Natural Process (Re)Creation*	High	Restore habitat and natural processes (e.g., prescribed burns) that provide suitable breeding habitat for the species in appropriate landscapes (e.g., areas with high density of birds, areas with high quality habitat or potential for high quality habitat)
		High	Create suitable habitat for the species in appropriate landscapes (e.g., areas with high density of birds, areas with high quality habitat or potential for high quality habitat)

Threat or Limitation Addressed	Broad Strategy to Recovery[a]	Priority[b]	General Description of Research and Management Approaches
8.1 Invasive non-native/alien species 8.2 Problematic native plants & animals	2. Species Management *2.1 Species Stewardship*	Low	Manage predators (e.g., cats in rural areas) primarily through outreach and awareness, and other approaches as deemed feasible and necessary
1.1 Housing & urban areas 1.2 Commercial & industrial areas 1.3 Tourism & recreation areas 2.1 Annual & perennial non-timber crops 2.2 Wood & pulp plantations 2.3 Livestock farming & ranching 3.1 Oil & gas drilling 3.2 Mining & quarrying 3.3 Renewable energy 4.1 Roads & railroads 6.2 War, civil unrest & military exercises 7.1 Fire & fire suppression 7.3 Other ecosystem modifications 7.4 Removing/reducing human maintenance 11.3 Changes in temperature regimes 11.4 Changes in precipitation & hydrological regimes	5. Livelihood, Economic & Moral Incentives *5.3 Market-Based Incentives* *5.4 Direct Economic Incentives*	High	Explore and support development or expansion of incentive programs to conserve, maintain, create and enhance grassland habitat and mitigate threats (e.g., incidental mortality from agricultural operations).
	5. Livelihood, Economic & Moral Incentives *5.2 Better Products & Management Practices*	High	Develop, implement and evaluate the effectiveness of regionally appropriate Beneficial Management Practices (BMPs) and conservation practices to mitigate threats (e.g., incidental mortality and habitat loss and degradation from agricultural activities)

Threat or Limitation Addressed	Broad Strategy to Recovery[a]	Priority[b]	General Description of Research and Management Approaches
1.1 Housing & urban areas 1.2 Commercial & industrial areas 1.3 Tourism & recreation areas 2.1 Annual & perennial non-timber crops 2.2 Wood & pulp plantations 2.3 Livestock farming & ranching 3.1 Oil & gas drilling 3.2 Mining & quarrying 3.3 Renewable energy 4.1 Roads & railroads 6.2 War, civil unrest & military exercises 7.1 Fire & fire suppression 7.3 Other ecosystem modifications 7.4 Removing/reducing human maintenance 11.3 Changes in temperature regimes 11.4 Changes in precipitation & hydrological regimes	6. Conservation Designation & Planning *6.1 Protected Area Designation &/or Acquisition* *6.2 Easement & Resource Rights* *6.3 Land/Water Use Zoning & Designation*	High	Protect, conserve and maintain habitat for the species in appropriate landscapes (e.g., areas with high density of birds and/or high habitat quality) through stewardship and legal tools
All threats	6. Conservation Designation & Planning *6.3 Land/Water Use Zoning & Designation*	Medium	Plan land use and develop policy that supports habitat and species conservation (e.g., mitigate impacts of rural housing development, aggregate and renewable energy development and collisions with tall buildings and lighted structures)

Threat or Limitation Addressed	Broad Strategy to Recovery[a]	Priority[b]	General Description of Research and Management Approaches
Knowledge gaps	8. Research & Monitoring *8.1 Basic Research & Status Monitoring*	High	Investigate factors affecting abundance, distribution, reproduction and survival to determine the demographic parameters that support a viable, self-sustaining population in Canada; develop full life-cycle population model to determine where regional populations are most limited
		High	Investigate source-sink dynamics at a regional scale and determine the need to manage the population at such a scale
		Medium	Determine habitat use and quantify threats to the species and its habitat outside the breeding season
		Medium	Develop regionally appropriate protocols for collection and analysis of population and habitat data for areas not well monitored by other programs (e.g., BBS, Joint Ventures)
		Medium	Determine to what extent predation, nest parasitism by Brown-headed Cowbirds and pesticides (both direct and indirect effects) is limiting recovery
		Medium	Determine the potential positive, neutral and negative impacts of climate change on the species and its habitat
All threats	10. Institutional Development *10.3 Alliance & Partnership Development*	High	Foster cooperative relationships with provincial governments, Indigenous organizations, landowners, farmers, pet owners, and others to mitigate threats to the species and its habitat in Canada
		High	Promote international cooperation and collaboration with conservation groups, government organizations and others across the species range to fill knowledge gaps, mitigate threats and promote ecosystem conservation outside of the breeding season

[a] The Broad Strategy for Recovery 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/).

[b] "Priority" reflects the degree to which the approach 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

Recovery planning is mainly directed at strategies to mitigate, cease or avoid threats (e.g., pesticides, predation, incidental mortality), manage habitat (e.g., create, restore and maintain suitable habitat), fill knowledge gaps (e.g., full life-cycle and source-sink dynamics) and foster stewardship with partners and stakeholders (e.g., incentive programs, beneficial management practices). As the species is primarily associated with agricultural habitats on private land, Environment and Climate Change Canada encourages and supports a stewardship-first approach to the recovery of the Bobolink.

Habitat loss, habitat degradation and incidental mortality is projected to continue due to threats such as agricultural intensification, agricultural development, urban development, and the encroachment of woody vegetation. The species is associated with habitats managed for the production of livestock or other resources on private land. The main factors driving habitat availability and quality are related to economic and market forces in the agricultural sector. The cooperation and engagement of agricultural land managers is essential to achieving objectives; stewardship programs and beneficial management practices that allow for both species conservation and farm economic viability are needed.

High priority approaches related to habitat management include restoring habitat and natural processes, creating habitat and maintaining and protecting existing habitat. It is important that the areas within which these activities occur consider local conditions where benefits to the species would be optimized (e.g., areas with high habitat quality or potential, areas with high relative species density). It is also important when considering habitat restoration or creation approaches to select appropriate contexts that balance the need of multiple species and ecosystem types (e.g., restoring old, abandoned fields or creating habitat in brownfields or cropland as opposed to clearing forests or other natural ecosystem types). Additional high priority approaches include developing regionally-appropriate Beneficial Management Practices (BMPs) that outline: recommendations to reduce habitat loss and degradation; recommendations to reduce impacts related to the agricultural practices that result in mortality of adults and young and the destruction of nests and eggs (e.g., delayed haying); prescribed burning and grazing practices to maintain habitat; and managing abandoned farmland. It should be noted that challenges exist with modifying some agricultural practices due to economic losses that could be incurred, and therefore exploration and support of incentive programs is identified as a high priority recovery approach. It will be necessary to work with provincial governments, Indigenous organizations, individual landowners, municipalities, and others to ensure the adoption of BMPs in habitat management and land use planning. Several provinces have established Environmental Farm Plan programs that could be used to deliver incentive programs and promote the use of BMPs.

High priority approaches related to research and monitoring include developing a full life-cycle population model will allow for a better understanding of the seasonal demographic and environmental processes that limit and regulate the population. The

demographic parameters (e.g., survival, reproductive rates, migratory connectivity) that are needed to develop the model will help to inform the population and distribution required to achieve a viable, self-sustaining population of the Bobolink in Canada (i.e., assess the appropriateness of the population and distribution objective). Monitoring and surveying are needed in areas not well covered by existing programs to determine the size and distribution of the Bobolink population and associated habitat, as well as during migration and wintering to determine migration routes and identify threats outside the breeding season. As staging, migration and wintering habitats are largely outside of Canada, it will be necessary to foster international partnerships and support the efforts of other jurisdictions in mitigating threats, as this will be a key component to recovery in Canada.

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 the recovery strategy 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.

The identification of critical habitat for the Bobolink is based on the following criteria: habitat occupancy and biophysical attributes. The critical habitat identified in this recovery strategy is insufficient to meet the population and distribution objectives. A better understanding of the amount and location of critical habitat required to meet short-term population trend targets (and ultimately the long-term objectives) is necessary to complete the identification of critical habitat. This information is lacking for both the units that currently have some critical habitat identified (e.g., Saskatchewan BCR 11) as well as in units that do not have any critical habitat identified (e.g., Alberta BCR 11, British Columbia BCRs 9 and 10). Additionally, information to identify stand-alone staging[19] or migration areas (i.e., not also used for breeding) is also lacking. A schedule of studies (section 7.2) has been developed to provide the information necessary to complete the identification of critical habitat.

7.1 Identification of the Species' Critical Habitat

Areas Containing Critical Habitat

The areas containing critical habitat is assessed using habitat occupancy. Habitat occupancy is intended to identify, with a reasonable degree of certainty, areas used for breeding by the species. Habitat occupancy can be an appropriate indicator of habitat suitability (Bock and Jones 2004).

Habitat occupancy is based on standardized survey data, documented nest locations and incidental observations from various sources (North American Breeding Bird Survey, provincial breeding bird atlases, academic studies, monitoring programs, eBird,

[19] Staging occurs when birds concentrate to rest and refuel prior to migration.

etc.). Confirmed breeding records constitute the strongest indication of use; however, because breeding is both difficult to confirm (e.g., finding the actual nest) and can cause disturbance to nesting birds, other levels of breeding evidence are used (i.e., probable and possible breeding; see Appendix B). In addition to individual occurrence records, relative abundance measures are also used to inform habitat occupancy. The two main sources of data for this species are the BBS and provincial breeding bird atlases (where available). Both of these programs provide relative abundance mapping for their respective survey coverage areas (i.e., Canada for the BBS; Manitoba, Ontario, Quebec and the Maritimes for the provincial breeding bird atlases). The areas showing congruence of high breeding evidence and high relative abundance are considered to be occupied by the species for the purpose of critical habitat identification. It is noted, however, that this is a partial identification based on the currently available information and additional critical habitat will be identified in other areas of the species' range following completion of the schedule of studies (Table 4).

Habitat occupancy was evaluated at two scales: nationally and within each Province x BCR unit separately. Occupancy was based on either meeting the national criteria or the regional criteria. The following three sources of occupancy data were used: breeding evidence score (2000-2017; see Appendix B), relative abundance based on BBS (2011-2015) and relative abundance based on atlas data (2001-2014), where available. Assessing occupancy at the regional scale (i.e., Province x BCR) supports achieving the distribution objective, and short-term statement which aims to meet certain population trend targets within each Province x BCR (see Appendix A), while assessing occupancy at the national scale supports the population objective of stabilizing the national population trend. Critical habitat is identified within 10 x 10 km grid squares that meet the occupancy criteria defined below.

The area containing critical habitat is delineated based on the selection of 10 x 10 km grid squares that meet:

<u>National Occupancy Criteria</u>

Critical habitat is identified within 10 x 10 km grid squares with:

- breeding evidence score of ≥9 (see Appendix B) between 2000 and 2017, and
- relative abundance of ≥13.3 birds per route per year between 2011 and 2015 based on BBS data[20], and
- relative abundance of ≥7.2 birds per 15 point counts[21] between 2001 and 2014 based on atlas data[22].

[20] Relative abundance estimates are calculated and available across the species' Canadian range. While the estimates are based on BBS data, they are not restricted to areas that have BBS routes.

[21] A point count is a method of surveying birds where the observer stands in one place for a specified amount of time, recording the birds seen and heard during the duration of the survey. Surveys can be limited to the birds observed within a certain distance (e.g., within a 100m of the observer) or can be unlimited distance.

[22] Relative abundance estimates are calculated and available within the species' range in British Columbia and from Manitoba to Prince Edward Island. While the estimates are based on atlas data, they are not restricted to atlas squares that had point counts performed, though estimates are available only for provinces that had an atlas completed at the time.

OR,

Regional (Province x BCR) Occupancy Criteria

Critical habitat is identified within 10 x 10 km grid squares with:

- breeding evidence score ≥9 between 2000 and 2017, and
- region-specific relative abundance values[23] for each Province x BCR based on BBS, and
- region-specific relative abundance values for each Province x BCR based on atlas data (where available).

Biophysical Attributes of Critical Habitat

Bobolinks establish multipurpose breeding territories that are used for mating, nesting, foraging and raising young (Renfrew et al. 2015). Within the areas identified as containing critical habitat, critical habitat is found wherever the biophysical attributes of breeding habitat described below are found.

The biophysical attributes listed below are found within open habitat types generally described as:

- native grasslands (e.g., tall-grass prairie, alvar grasslands, beaver-created meadows, native pasture, grassland restoration sites, salt marshes and grassy peatlands)
- agricultural (or surrogate) grasslands (e.g., hayfields, seeded pastures, and cultural meadows[24] and abandoned fields[25]).

The description of biophysical attributes below is based on published literature (Vickery 1993, Dechant et al. 1999 [revised 2001], COSEWIC 2010, Renfrew et al. 2015, Renfrew et al. 2019). However, variation in these attributes occurs across the species' range, and seasonally. The description of attributes represent critical habitat characteristics that would typically be observed during the nesting period (from mid-May to late-July). The biophysical attributes of critical habitat required by the Bobolink for breeding include:

- combined coverage of trees and tall shrubs (over 1 m) is less than 25%, AND
- dense grass of moderate height (between 18 and 70 cm) with abundant litter (litter depth of up to 15 cm), AND
- high proportion of grass cover (>80% preferred, and not <20%), AND

[23] Values for the relative abundance cut-offs for each Province x BCR differed for each unit (see Appendix C) and were calculated from natural breaks in the data using the Jenks optimization method (Jenks 1967); the optimal number of classes was determined by calculating the Goodness of Variance Fit. Six classes were selected and the two classes containing the highest values were used for determining occupancy.

[24] Open habitats (tree and shrub cover is ≤25%) dominated by grasses and herbs that are a result of human disturbance.

[25] Fields that were once under agricultural production (e.g., livestock grazing or cultivated) or other uses (e.g., industrial, commercial, residential) that have been abandoned of its former use(s) and left to natural succession.

- moderate forb density (10-40%), AND
- low shrub and woody vegetation cover (<5% preferred, and not >25%), AND
- little bare ground (<1%), not including exposed limestone/rock outcrops naturally characteristic of alvars AND
- presence of song perches for territory defense and advertisement (e.g., scattered trees, shrubs, telephone poles and fence posts), AND
- where the above list of attributes is present in contiguous patches ≥10 ha in size.

Breeding habitats that are rarely or only occasionally used by the Bobolink include annual field crops (e.g., winter wheat, rye, oats, barley). These habitat types are not considered to be necessary for the survival or recovery of the Bobolink and are not identified as critical habitat. Similarly, row crops, such as corn and soybeans, are not used by the species and are not identified as critical habitat. Unsuitable areas that do not possess any of the attributes required by the Bobolink, at any time, are excluded from identification as critical habitat. Examples of these excluded areas include (but are not limited to): running surfaces of existing roads, parking lots and gravel pits, waterbodies, and active aerodrome areas that are, and will continue to be, actively managed to dissuade the Bobolink for aviation and public safety purposes.

Critical habitat is identified within 291 – 10 x 10 km grid squares within Canada (Appendix D). An overview map of the areas containing critical habitat for the Bobolink is presented in Figure 3, and detailed maps are included in Appendix E (Figures EA-EH). Critical habitat for the Bobolink in Canada occurs within the shaded yellow grid squares shown on each map where the critical habitat criteria described in this section are met. Within these grid squares, critical habitat used by the Bobolink is dynamic and its location may change annually as affected by the natural and human disturbance mechanisms that create and maintain it. Because of this, Bobolinks are not expected to use the exact same locations for breeding year after year, nor is it expected that they will fully saturate available habitat (i.e., more habitat is needed than, for example, 2 ha per breeding pair). Using the precautionary approach, all habitat meeting the biophysical attribute description within occupied grid squares is considered critical habitat. More information on critical habitat to support protection of the species and its habitat may be requested by contacting Environment and Climate Change Canada's Recovery Planning section at: ec.planificationduretablissement-recoveryplanning.ec@canada.ca.

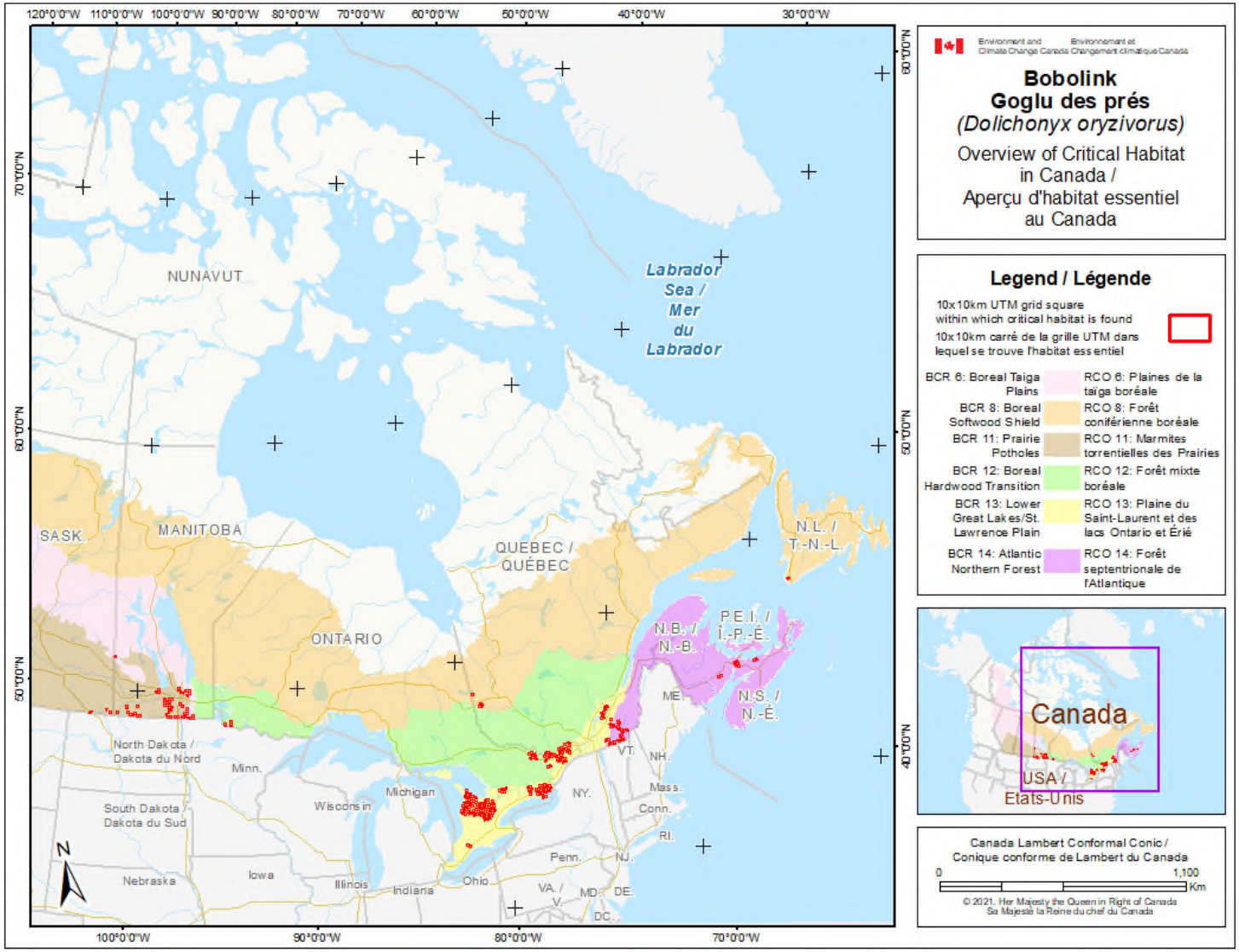

Figure 3. Overview of the area containing critical habitat for the Bobolink in Canada. Critical habitat is represented by the red-outlined 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

7.2 Schedule of Studies to Identify Critical Habitat

Table 4. Schedule of Studies to Identify Critical Habitat

Description of Activity	Rationale	Timeline
Determine the amount and configuration of habitat within each Province x BCR unit that supports the population and distribution objective through approaches such as habitat-density models, population growth models, landscape simulations and conservation planning tools (i.e., determine the range of habitat conditions that support the population and distribution objective and short-term statement).	It is currently not known how much critical habitat is needed, and where or how it should optimally be configured to support the population and distribution objective (e.g., areas of high species' densities, quality of suitable habitat, Province x BCR habitat thresholds).	2022-2027
Determine the areas and biophysical attributes required by the species for staging and migration in Canada.	Maintaining habitat for all life history functions will be important for long-term stabilization of the population. Current information is inadequate to identify critical habitat for staging and migration areas in Canada.	2022-2024

7.3 Activities Likely to Result in the Destruction of Critical Habitat

This subsection of a recovery strategy identifies activities that are likely to cause the destruction of critical habitat and provides information on how these activities impact critical habitat. Destruction of critical habitat is determined on a case-by-case basis. Destruction would result if part of the critical habitat was degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from single or multiple activities at one point in time or from the cumulative effects of one or more activities over time. Activities described below include those likely to cause destruction of critical habitat for this species; however, destructive activities are not limited to those listed.

Bobolinks use native and agricultural grassland habitats to complete their life history functions in Canada. An important component of managing critical habitat for the Bobolink in Canada in order to meet the population and distribution objectives will be ensuring there is no further loss of native grasslands, and no net loss in area of agricultural grassland habitats, that are required by the species (i.e., within areas identified as critical habitat). The estimated amount of habitat where the biophysical attributes could be present within grid squares for each Province x BCR unit is presented in Appendix F. This amount is estimated based on the Grassland and Pastures/Forages land cover types from the 2019 Annual Crop Inventory (AAFC 2019).

Agricultural grassland habitats used by Bobolinks are dynamic and part of a working agricultural landscape. Conversion (temporary or permanent) of existing agricultural grassland habitat (e.g., hayfields) can be replaced or offset within the same or other

10 x 10 km grid squares containing critical habitat in the same Province x BCR unit, ensuring there is no net loss and that the habitat is able to serve its function when required by the species (i.e., habitat is made available prior to the destructive activity). Although an individual or pair may have some fidelity to a particular field over the course of their lifespan, it may not be necessary or feasible (without intense management) for breeding habitat to remain in the same location over time. Activities that result in permanent removal of agricultural grassland habitat may have more effect on the availability of critical habitat than activities that result in a temporary removal of critical habitat; activities that result in a temporary removal of critical habitat have the potential to contribute to the future supply of critical habitat, given proper management.

Periodic disturbance (e.g., mowing, burning or grazing) is often required to maintain open habitats in a suitable condition (e.g., limiting the encroachment of woody vegetation, maintaining vegetation height and structure) and it is recognized that some activities listed in Table 5 can both destroy and promote the biophysical attributes of both native and agricultural grassland habitats.

1764 **Table 5. Activities likely to result in the destruction of critical habitat.**

Description of Activity	Description of effect	Details of effect
Conversion of native grassland habitat (e.g., agricultural development, urban/commercial development, oil and gas drilling, mining and quarrying, renewable energy development, recreational/tourism development, road building, tree plantations).	Direct loss of critical habitat through the removal or conversion of the biophysical attributes of breeding habitat.	Related threats: 1.1 Housing & urban areas; 1.2 Commercial & industrial areas; 1.3 Tourism & recreation areas; 2.1 Annual & perennial non-timber crops; 2.2 Wood & pulp plantations; 3.1 Oil & gas drilling; 3.2 Mining & quarrying; 3.3 Renewable energy; 4.1 Roads & railroads Timing: applicable at all times. Extent: activity must occur within the bounds of critical habitat to cause its destruction. Type (direct, cumulative or both): direct - a single event within critical habitat will result in its destruction. Likelihood of destruction: if the activity occurs there is a high likelihood of destruction (direct removal of biophysical attributes). Likelihood of occurring: this activity is likely to occur in Saskatchewan, Manitoba and Ontario BCR 13 where remaining native grassland exists. Thresholds: information available at this time does not allow for the development of thresholds.
Conversion of agricultural grassland habitat that results in a net loss in its availability (e.g., agricultural development, urban/commercial development, oil and gas drilling, mining and quarrying, renewable energy development, recreational/tourism development, road building, tree plantations).	Direct loss of critical habitat through the removal or conversion of the biophysical attributes of breeding habitat. These activities also contribute to habitat fragmentation and resulting edge effects can increase predation and Brown-headed Cowbird nest parasitism rates. This can result in unsuitable habitat conditions in which the species can't successfully breed.	Related threats: 1.1 Housing & urban areas; 1.2 Commercial & industrial areas; 1.3 Tourism & recreation areas; 2.1 Annual & perennial non-timber crops; 2.2 Wood & pulp plantations; 3.1 Oil & gas drilling; 3.2 Mining & quarrying; 3.3 Renewable energy; 4.1 Roads & railroads Timing: an activity will contribute to the net loss of agricultural grassland habitat if the habitat is not available when the species requires it (i.e., during the breeding season). Extent: activity must occur within the bounds of critical habitat to cause its destruction. Type (direct, cumulative or both): both - a single event of these activities could result in the destruction of critical habitat as could multiple or concurrent events within a Province x BCR unit that cumulatively bring the amount of agricultural grassland below identified targets; multiple events over time can cumulatively contribute to habitat fragmentation. Likelihood of causing destruction: this activity is likely to result in the destruction of critical habitat when there is a net loss in the amount of agricultural grassland habitat identified in Appendix F in a Province x BCR unit. Likelihood of occurring: these activities are likely to occur in critical habitat across the species' range and are pervasive in scope when combined. Thresholds: minimum field size (i.e., ≥10 ha) must be maintained to result in no net loss.

Description of Activity	Description of effect	Details of effect
Inappropriate livestock grazing practices	Grazing and overuse during the breeding season can significantly reduce grass cover and plant diversity, which can impact breeding habitat (nest cover); reduced vegetation height and density from grazing may increase predator access and can also contribute to the establishment and spread of non-native invasive species in native grasslands. **Note**: Depending on the location, timing and frequency of the activity, grazing of grassland habitats can help to maintain the habitat in a suitable, open condition by limiting natural succession and the encroachment of woody vegetation. Appropriate grazing practices (i.e., in line with regionally-appropriate beneficial management practices, and with consideration of the species' life history) is essential to avoid destruction.	Related threat: 2.3 Livestock farming & ranching Timing: applicable predominantly during the grass reproductive season; grasses are most negatively affected when grazed during periods of reproductive growth and least affected during periods of dormancy and vegetative growth. Extent: activity must occur within the bounds of critical habitat to cause its destruction. Type (direct, cumulative or both): cumulative - overuse may occur in a single event that could remove vegetation that would otherwise be used to build nests, provide concealment of the nest from predators and protect it from weather, though destruction is most likely to occur after repeated events over time that do not allow sufficient time between grazing bouts for the vegetation to recover (overgrazing). Likelihood of destruction: if the activity occurs there is a moderate likelihood of causing destruction (depends on frequency and intensity of activity and site conditions); if this activity occurs in agricultural grassland habitat, it is more likely to result in destruction if it contributes to the net loss of agricultural grassland habitat. Likelihood of occurring: this activity is equally likely to occur within critical habitat but is small in scope. Thresholds: site conditions dictate how much grazing can occur before it would be detrimental for this species. Generally, grazing practices that lead to unhealthy rangeland/field conditions, assessed following rangeland health assessment protocols[26], would be considered destruction.

[26] For example, Rangeland Health Assessment for Grassland, Forest & Tame Pasture (Adams et al. 2016). Other regional products exist (e.g., Saskatchewan, Manitoba and British Columbia) and where they don't, concepts from these and other available resources (e.g., Pasture Assessment in the Northeast United States (Sanderson et al. 2005)) could be applied to determine grassland or pasture health. While these resources place emphasis on grazing disturbances, any disturbance could be evaluated, and are thus also being suggested for use with other destructive activities.

Description of Activity	Description of effect	Details of effect
Indiscriminate pesticide use	Reduction or loss of vegetation used for nest building and concealment (herbicides); reduction in local prey availability for foraging and raising young (insecticides). Pesticides believed to be of concern for the Bobolink include herbicides such as glyphosate and insecticides such as neonicotinoids. **Note**: Depending on the location, timing and frequency of application, in some very specific circumstances (e.g., invasive plant removal, or restoration of habitat for the species), the targeted application of herbicides may result in a neutral or potential net benefit. Appropriate application (i.e., in line with regionally-appropriate beneficial management practices, and with consideration of the species' life history) is essential to avoid destruction.	Related threat: 7.3 Other ecosystem modifications Timing: destruction of critical habitat is more likely to occur if this activity occurs between mid-May and late-July. Extent: activity could occur within the bounds of critical habitat or the surrounding area (e.g., drift from adjacent areas) to cause its destruction. Type (direct, cumulative or both): both - a single application of herbicide during the breeding season could remove vegetation that would otherwise be used to build nests, provide concealment of the nest from predators and protect it from weather (herbicides also reduce seed availability); a single application of an insecticide during the brood-rearing period could be detrimental to the growth and development of young by reducing prey availability; repeated events are likely to have more detrimental and long-term impacts to habitat and food. Likelihood of destruction: if the activity occurs there is a moderate likelihood of causing destruction (depends on frequency and intensity of activity); if this activity occurs in agricultural grassland habitat, it is more likely to result in destruction if it contributes to the net loss of agricultural grassland habitat. Likelihood of occurring: this activity is equally likely to occur within critical habitat and is pervasive in scope. Thresholds: information available at this time does not allow for the development of thresholds. Generally, pesticide use that leads to unhealthy rangeland/field conditions, assessed following rangeland health assessment protools, would be considered destruction.

Description of Activity	Description of effect	Details of effect
Mowing or cutting	Reduction or loss of vegetation used for nest building and concealment. **Note**: Depending on the location, timing and frequency of the activity, mowing or cutting grassland habitats may be required to maintain the habitat in a suitable, open condition by limiting natural succession and the encroachment of woody vegetation. Appropriate implementation (i.e., in line with regionally-appropriate beneficial management practices, and with consideration of the species' life history) is essential to avoid destruction.	Related threat: 2.1 Annual & perennial non-timber crops Timing: destruction of critical habitat is more likely to occur if this activity occurs between mid-May and late-July. Extent: activity must occur within the bounds of critical habitat to cause destruction. Type (direct, cumulative or both): direct - a single event during the breeding season would remove vegetation that would otherwise be used to build nests, provide concealment of the nest from predators and protect it from weather. Likelihood of destruction: if the activity occurs there is a high likelihood of causing destruction (direct removal of biophysical attributes); if this activity occurs in agricultural grassland habitat, it is more likely to result in destruction if it contributes to the net loss of agricultural grassland habitat. Likelihood of occurring: this activity is equally likely to occur within most critical habitat though less likely to occur in Saskatchewan and Manitoba where fields are often cut later in the breeding season and only once. Thresholds: information available at this time does not allow for the development of thresholds. Generally, mowing or cutting that leads to unhealthy rangeland/field conditions, assessed following rangeland health assessment protocols, would be considered destruction.

Description of Activity	Description of effect	Details of effect
Prescribed burning	Reduction or loss of vegetation used for nest building and concealment; reduction in local prey availability for foraging and raising young. **Note**: Depending on the location, timing and frequency of the activity, burning of grassland habitats may be required to maintain the habitat in a suitable, open condition by limiting natural succession and the encroachment of woody vegetation. Appropriate implementation (i.e., in line with regionally-appropriate beneficial management practices, and with consideration of the species' life history) is essential to avoid destruction.	Related threat: 7.1 Fire & fire suppression Timing: destruction of critical habitat is more likely to occur if this activity occurs between mid-May and late-July. Extent: activity must occur within the bounds of critical habitat to cause destruction. Type (direct, cumulative or both): direct - a single event during the breeding season would remove vegetation that would otherwise be used to build nests, provide concealment of the nest from predators and protect it from weather; a single event during the brood-rearing period could reduce prey availability for raising young. Likelihood of destruction: if the activity occurs there is a high likelihood of causing destruction (direct removal of biophysical attributes); if this activity occurs in agricultural grassland habitat, it is more likely to result in destruction if it contributes to the net loss of agricultural grassland habitat. Likelihood of occurring: this activity is equally likely to occur within critical habitat but is small in scope. Thresholds: information available at this time does not allow for the development of thresholds. Generally, prescribed burning that leads to unhealthy rangeland/field conditions, assessed following rangeland health assessment protocols, would be considered destruction.

8. Measuring Progress

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

Population Objective

By 2031, a stable[27] Canada-wide population is achieved for the Bobolink in Canada, and thereafter, supporting a population size at 85% of 2017 levels. Thereafter, at a minimum, a stable population trend is maintained.

Distribution Objective

The representation of the species in all provinces across the species' known range in Canada (Figure 1) is maintained.

Short-term Statement

By 2031, the Canada-wide population trend for the species is stabilized by achieving the population trend targets within each Province x BCR unit specified in Appendix A (Table A1), supporting a population size at 85% of 2017 levels.

The best long-term dataset for monitoring the population trend of landbirds in Canada is the BBS. BBS data is assessed annually by Environment and Climate Change Canada and will be used to determine the short-term and long-term population trends of breeding Bobolinks in Canada. The BBS trends will thus be used for measuring progress towards the population objective and short-term statement. It is recognized that there are short-comings with using the BBS dataset; however, the BBS has the most comprehensive monitoring coverage of the country, as well as a long history stretching back to the late 1960s in some areas of the country. The Bobolink's range in Canada is well-covered by BBS sampling. Population estimates will follow the Partners in Flight (PIF) Population Estimates database and subsequent updates (Partners in Flight Science Committee 2020).

9. Statement on Action Plans

One or more action plans for the Bobolink will be posted on the Species at Risk Public Registry within the five years following the 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 Bobolink.

[27] A trend will be considered stable when the probability that the trend is zero is 80%.

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Appendix A: Short-term Population Trend Stabilization Targets for Province x BCR Units

Table A1: Population trend targets for each Province x BCR unit required to achieve the short-term population objective.

Province	BCR Name (BCR Number)	BBS Trend (2007-2017)[a]	Target Trend for Short-term Statement[b]
British Columbia	Great Basin (9)	-7.23	-3.00
British Columbia	Northern Rockies (10)	-0.19	-1.50
Alberta	Prairie Potholes (11)	11.10	0.50
Saskatchewan	Boreal Taiga Plains (6)	6.74	3.76
Saskatchewan	Prairie Potholes (11)	8.49	2.84
Manitoba	Boreal Taiga Plains (6)	-4.79	0.00
Manitoba	Prairie Potholes (11)	-3.95	0.00
Manitoba	Boreal Hardwood Transition (12)	-2.57	-0.93
Ontario	Boreal Softwood Shield (8)	-5.04	-1.29
Ontario	Boreal Hardwood Transition (12)	-3.08	-1.80
Ontario	Lower Great Lakes/St. Lawrence (13)	-3.76	-2.33
Quebec	Boreal Softwood Shield (8)	-0.69	-0.20
Quebec	Boreal Hardwood Transition (12)	-4.84	-2.30
Quebec	Lower Great Lakes/St. Lawrence (13)	-6.08	-3.20
Quebec	Atlantic Northern Forest (14)	-5.89	-1.40
New Brunswick	Atlantic Northern Forest (14)	-1.73	-0.43
Nova Scotia & PEI	Atlantic Northern Forest (14)	-6.50	-1.00
Newfoundland & Labrador	Boreal Softwood Shield (8)	-4.29	-1.00
Canada	**All**	**-1.65**	**0.00**

[a] Breeding Bird Survey trend estimates are from the 2007-2017 period (Smith et al. 2019), which was the most recent set of analyses available at the time the objectives were developed.

[b] Deviations to the population trend targets can be accommodated within and among each province provided the overall objective of achieving a stable Canada-wide population trend is maintained.

Appendix B: Breeding Evidence Score

Breeding evidence score was calculated by assigning a value of 1, 2 or 3 to each occurrence record representing possible, probable or confirmed breeding, respectively, within a breeding season. Occurrence records used spanned the time period from 2000 to 2017. Values were summed within each 10 x 10 km atlas grid square to generate a breeding evidence score for each square. Records from the same location and date were removed as duplicates. Only records from the month of June were used to improve the likelihood that observations represented breeding activity. In some cases, dependence among samples was considered; for example, two possible breeding records from the same location, a week or more apart, were able to be assigned as a single probable breeding record through application of the permanent territory (T) code.

For the purposes of evaluating habitat occupancy to support critical habitat identification, a grid square with a breeding evidence score of nine or greater between 2000 and 2017 was used. At its base, a score of nine represents three confirmed breeding records, which was supported by the technical working group as an indication of areas used for breeding over time. A breeding evidence score of nine could also be represented by the following combination of records, as examples:

- Nine possible breeding records (9 records x 1)
- Four probable breeding records (4 records x 2) and one possible breeding record (1 record x 1)
- Two confirmed breeding records (2 records x 3), one probable breeding record (1 record x 2) and one possible breeding record (1 record x 1)
- Three confirmed breeding records (3 records x 3)

The level of evidence needed to establish breeding occupancy is based on standards used for the Ontario and Quebec Breeding Bird Atlases (Cadman et al. 1987, Robert et al. 2019), as identified below:

Possible Breeding:

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

Probable Breeding

- Pair observed during the breeding season in suitable nesting habitat (P)
- Permanent territory presumed through registration of territorial song on at least two days, a week or more apart (in the same breeding season), at the same place (T)
- Courtship or display between a male and a female or two males, including chasing, flight displays, feeding or copulation (D)
- Visiting probable nest sited (V)
- Agitated behaviour or repeated anxiety calls of an adult (A)

- Brood patch on adult female or cloacal protuberance on adult male (B)
- Nest building or excavation of a nest hole (N)
- 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 (M)

Confirmed Breeding

- Adult carrying nest material (NB)
- Distraction display or injury feigning (DD)
- Used nest or egg shells found (NU)
- Recently fledged young, including young incapable of sustained flight (FY)
- Adult leaving or entering nest sites in circumstances indicating occupied nest (AE)
- Adult carrying faecal sac (FS)
- Adult carrying food for young (CF)
- Nest containing eggs or young, or a recently used empty nest (NE)
- Nest with young seen or heard (NY)

Appendix C: Regional Relative Abundance Cut-offs

Table C1: Relative abundance cut-offs for each BCR x Province used to determine occupancy at the regional scale.

Province	BCR Name (number)	BBS (birds/route/year)	Atlas (birds/15 point counts)
British Columbia	Great Basin (9)	0.20	N/A
British Columbia	Northern Rockies (10)	0.29	N/A
Alberta	Prairie Potholes (11)	0.33	N/A
Saskatchewan	Boreal Taiga Plains (6)	0.48	N/A
Saskatchewan	Prairie Potholes (11)	7.11	N/A
Manitoba	Boreal Taiga Plains (6)	5.92	3.72
Manitoba	Prairie Potholes (11)	12.59	5.38
Manitoba	Boreal Hardwood Transition (12)	9.51	4.04
Ontario	Boreal Softwood Shield (8)	0.60	0.40
Ontario	Boreal Hardwood Transition (12)	8.87	6.58
Ontario	Lower Great Lakes/St. Lawrence (13)	17.81	9.51
Quebec	Boreal Softwood Shield (8)	0.88	0.92
Quebec	Boreal Hardwood Transition (12)	6.23	7.35
Quebec	Lower Great Lakes/St. Lawrence (13)	7.34	5.95
Quebec	Atlantic Northern Forests (14)	6.10	8.87
New Brunswick	Atlantic Northern Forests (14)	3.85	3.17
Nova Scotia & PEI	Atlantic Northern Forests (14)	4.88	2.39
Newfoundland & Labrador	Boreal Softwood Shield (8)	0.32	N/A

Appendix D: Grid Squares Containing Critical Habitat for the Bobolink in Canada

Table D1: Grid squares containing critical habitat for the Bobolink in Canada, with land tenure identified (at the 10 x 10 km grid square level)

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
13UFQ63	Prairie Potholes (11)	SK	49.0458	-102.7420	Non-federal Land
14UKV95	Prairie Potholes (11)	SK	49.2135	-101.8150	Non-federal Land
14ULV14	Prairie Potholes (11)	SK	49.1300	-101.5360	Non-federal Land
14ULB29	Boreal Taiga Plains (6)	MB	51.3792	-101.5147	Non-federal Land
14ULV44	Prairie Potholes (11)	MB	49.1383	-101.1251	Non-federal Land
14ULV86	Prairie Potholes (11)	MB	49.3269	-100.5827	Non-federal Land
14ULV87	Prairie Potholes (11)	MB	49.4168	-100.5856	Non-federal Land
14ULV94	Prairie Potholes (11)	MB	49.1488	-100.4399	Non-federal Land
14UMV03	Prairie Potholes (11)	MB	49.0605	-100.3004	Non-federal Land
14UMV13	Prairie Potholes (11)	MB	49.0620	-100.1636	Non-federal Land
14UMV24	Prairie Potholes (11)	MB	49.1532	-100.0286	Non-federal Land
14UMV33	Prairie Potholes (11)	MB	49.0644	-99.8898	Non-federal Land
14UMV37	Prairie Potholes (11)	MB	49.4242	-99.8963	Non-federal Land
14UMV42	Prairie Potholes (11)	MB	48.9755	-99.7516	Non-federal Land
14UMV43	Prairie Potholes (11)	MB	49.0654	-99.7529	Non-federal Land
14UNA14	Prairie Potholes (11)	MB	50.0571	-98.7905	Non-federal Land
14UNA24	Prairie Potholes (11)	MB	50.0568	-98.6508	Non-federal Land
14UNA25	Prairie Potholes (11)	MB	50.1467	-98.6501	Non-federal Land
14UNA50	Prairie Potholes (11)	MB	49.6950	-98.2374	Non-federal Land
14UNA51	Prairie Potholes (11)	MB	49.7849	-98.2360	Non-federal Land
14UNA60	Prairie Potholes (11)	MB	49.6940	-98.0987	Non-federal Land
14UNA70	Prairie Potholes (11)	MB	49.6929	-97.9601	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
14UNA71	Prairie Potholes (11)	MB	49.7828	-97.9582	Non-federal Land
14UNA81	Prairie Potholes (11)	MB	49.7815	-97.8193	Non-federal Land
14UNV58	Prairie Potholes (11)	MB	49.5151	-98.2402	Non-federal Land
14UNV59	Prairie Potholes (11)	MB	49.6051	-98.2388	Non-federal Land
14UNV64	Prairie Potholes (11)	MB	49.1544	-98.1086	Federal Land, Non-federal Land
14UNV68	Prairie Potholes (11)	MB	49.5141	-98.1020	Non-federal Land
14UNV69	Prairie Potholes (11)	MB	49.6041	-98.1004	Non-federal Land
14UNV72	Prairie Potholes (11)	MB	48.9734	-97.9751	Federal Land, Non-federal Land
14UNV73	Prairie Potholes (11)	MB	49.0633	-97.9733	Non-federal Land
14UNV75	Prairie Potholes (11)	MB	49.2432	-97.9696	Non-federal Land
14UNV76	Prairie Potholes (11)	MB	49.3331	-97.9677	Non-federal Land
14UNV77	Prairie Potholes (11)	MB	49.4231	-97.9658	Non-federal Land
14UNV78	Prairie Potholes (11)	MB	49.5130	-97.9639	Non-federal Land
14UNV83	Prairie Potholes (11)	MB	49.0620	-97.8364	Non-federal Land
14UNV86	Prairie Potholes (11)	MB	49.3318	-97.8301	Non-federal Land
14UNV87	Prairie Potholes (11)	MB	49.4217	-97.8279	Non-federal Land
14UPA15	Prairie Potholes (11)	MB	50.1361	-97.3908	Non-federal Land
14UPA16	Prairie Potholes (11)	MB	50.2260	-97.3878	Non-federal Land
14UPA24	Prairie Potholes (11)	MB	50.0442	-97.2542	Federal Land, Non-federal Land
14UPA34	Prairie Potholes (11)	MB	50.0420	-97.1146	Non-federal Land
14UPA45	Prairie Potholes (11)	MB	50.1295	-96.9712	Federal Land, Non-federal Land
14UPA53	Prairie Potholes (11)	MB	49.9472	-96.8395	Federal Land, Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
14UPA55	Boreal Taiga Plains (6)	MB	50.1270	-96.8314	Non-federal Land
14UPA64	Boreal Taiga Plains (6)	MB	50.0344	-96.6959	Non-federal Land
14UPA65	Boreal Taiga Plains (6)	MB	50.1243	-96.6916	Non-federal Land
14UPV02	Prairie Potholes (11)	MB	48.9690	-97.5653	Federal Land, Non-federal Land
14UPV03	Prairie Potholes (11)	MB	49.0589	-97.5627	Non-federal Land
14UPV13	Prairie Potholes (11)	MB	49.0571	-97.4259	Non-federal Land
14UPV29	Prairie Potholes (11)	MB	49.5947	-97.2703	Non-federal Land
14UPV33	Prairie Potholes (11)	MB	49.0531	-97.1523	Non-federal Land
14UPV38	Prairie Potholes (11)	MB	49.5026	-97.1354	Non-federal Land
14UPV43	Prairie Potholes (11)	MB	49.0508	-97.0155	Non-federal Land
14UPV44	Prairie Potholes (11)	MB	49.1407	-97.0119	Non-federal Land
14UPV45	Prairie Potholes (11)	MB	49.2306	-97.0083	Non-federal Land
14UPV55	Boreal Taiga Plains (6)	MB	49.2282	-96.8710	Non-federal Land
14UPV56	Boreal Taiga Plains (6)	MB	49.3180	-96.8672	Non-federal Land
14UPV57	Boreal Taiga Plains (6)	MB	49.4079	-96.8633	Non-federal Land
14UPV63	Boreal Taiga Plains (6)	MB	49.0458	-96.7420	Federal Land, Non-federal Land
14UPV73	Boreal Taiga Plains (6)	MB	49.0430	-96.6053	Non-federal Land
14UPV83	Boreal Taiga Plains (6)	MB	49.0401	-96.4685	Non-federal Land
14UPV84	Boreal Taiga Plains (6)	MB	49.1300	-96.4640	Non-federal Land
15UUP89	Boreal Hardwood Transition (12)	ON	48.6974	-94.5629	Federal Land, Non-federal Land
15UUQ80	Boreal Hardwood Transition (12)	ON	48.7874	-94.5656	Non-federal Land
15UVP19	Boreal Hardwood Transition (12)	ON	48.7022	-94.1553	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
15UVQ10	Boreal Hardwood Transition (12)	ON	48.7922	-94.1573	Non-federal Land
15UVQ11	Boreal Hardwood Transition (12)	ON	48.8821	-94.1594	Non-federal Land
17TMH44	Lower Great Lakes/St. Lawrence (13)	ON	42.8556	-81.6732	Non-federal Land
17TMH53	Lower Great Lakes/St. Lawrence (13)	ON	42.7662	-81.5500	Non-federal Land
17TMJ58	Lower Great Lakes/St. Lawrence (13)	ON	44.1168	-81.5624	Non-federal Land
17TMJ59	Lower Great Lakes/St. Lawrence (13)	ON	44.2068	-81.5632	Non-federal Land
17TMJ67	Lower Great Lakes/St. Lawrence (13)	ON	44.0273	-81.4368	Non-federal Land
17TMJ68	Lower Great Lakes/St. Lawrence (13)	ON	44.1174	-81.4374	Non-federal Land
17TMJ69	Lower Great Lakes/St. Lawrence (13)	ON	44.2074	-81.4381	Non-federal Land
17TMJ79	Lower Great Lakes/St. Lawrence (13)	ON	44.2078	-81.3129	Non-federal Land
17TMJ87	Lower Great Lakes/St. Lawrence (13)	ON	44.0280	-81.1872	Non-federal Land
17TMJ88	Lower Great Lakes/St. Lawrence (13)	ON	44.1180	-81.1875	Non-federal Land
17TMJ89	Lower Great Lakes/St. Lawrence (13)	ON	44.2081	-81.1878	Non-federal Land
17TMJ97	Lower Great Lakes/St. Lawrence (13)	ON	44.0281	-81.0624	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
17TMK60	Lower Great Lakes/St. Lawrence (13)	ON	44.2974	-81.4387	Non-federal Land
17TMK61	Lower Great Lakes/St. Lawrence (13)	ON	44.3874	-81.4394	Non-federal Land
17TMK70	Lower Great Lakes/St. Lawrence (13)	ON	44.2978	-81.3134	Non-federal Land
17TMK71	Lower Great Lakes/St. Lawrence (13)	ON	44.3879	-81.3139	Non-federal Land
17TMK72	Lower Great Lakes/St. Lawrence (13)	ON	44.4779	-81.3144	Federal Land, Non-federal Land
17TMK81	Lower Great Lakes/St. Lawrence (13)	ON	44.3881	-81.1883	Non-federal Land
17TMK82	Lower Great Lakes/St. Lawrence (13)	ON	44.4782	-81.1886	Non-federal Land
17TMK84	Lower Great Lakes/St. Lawrence (13)	ON	44.6582	-81.1892	Federal Land, Non-federal Land
17TMK85	Lower Great Lakes/St. Lawrence (13)	ON	44.7482	-81.1895	Non-federal Land
17TMK91	Lower Great Lakes/St. Lawrence (13)	ON	44.3883	-81.0628	Non-federal Land
17TMK92	Lower Great Lakes/St. Lawrence (13)	ON	44.4783	-81.0629	Non-federal Land
17TMK93	Lower Great Lakes/St. Lawrence (13)	ON	44.5683	-81.0630	Non-federal Land
17TMK94	Lower Great Lakes/St. Lawrence (13)	ON	44.6584	-81.0631	Non-federal Land
17TMK95	Lower Great Lakes/St. Lawrence (13)	ON	44.7484	-81.0632	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
17TMK96	Lower Great Lakes/St. Lawrence (13)	ON	44.8384	-81.0633	Non-federal Land
17TMK97	Lower Great Lakes/St. Lawrence (13)	ON	44.9284	-81.0634	Federal Land, Non-federal Land
17TNJ06	Lower Great Lakes/St. Lawrence (13)	ON	43.9381	-80.9377	Non-federal Land
17TNJ07	Lower Great Lakes/St. Lawrence (13)	ON	44.0281	-80.9376	Non-federal Land
17TNJ08	Lower Great Lakes/St. Lawrence (13)	ON	44.1182	-80.9375	Non-federal Land
17TNJ16	Lower Great Lakes/St. Lawrence (13)	ON	43.9380	-80.8131	Non-federal Land
17TNJ17	Lower Great Lakes/St. Lawrence (13)	ON	44.0280	-80.8128	Non-federal Land
17TNJ18	Lower Great Lakes/St. Lawrence (13)	ON	44.1180	-80.8125	Non-federal Land
17TNJ26	Lower Great Lakes/St. Lawrence (13)	ON	43.9377	-80.6885	Non-federal Land
17TNJ27	Lower Great Lakes/St. Lawrence (13)	ON	44.0277	-80.6880	Federal Land, Non-federal Land
17TNJ29	Lower Great Lakes/St. Lawrence (13)	ON	44.2078	-80.6871	Non-federal Land
17TNJ35	Lower Great Lakes/St. Lawrence (13)	ON	43.8473	-80.5646	Non-federal Land
17TNJ36	Lower Great Lakes/St. Lawrence (13)	ON	43.9373	-80.5639	Non-federal Land
17TNJ37	Lower Great Lakes/St. Lawrence (13)	ON	44.0273	-80.5633	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
17TNJ38	Lower Great Lakes/St. Lawrence (13)	ON	44.1174	-80.5626	Non-federal Land
17TNJ39	Lower Great Lakes/St. Lawrence (13)	ON	44.2074	-80.5619	Non-federal Land
17TNJ43	Lower Great Lakes/St. Lawrence (13)	ON	43.6666	-80.4418	Non-federal Land
17TNJ44	Lower Great Lakes/St. Lawrence (13)	ON	43.7567	-80.4410	Non-federal Land
17TNJ45	Lower Great Lakes/St. Lawrence (13)	ON	43.8467	-80.4402	Non-federal Land
17TNJ46	Lower Great Lakes/St. Lawrence (13)	ON	43.9368	-80.4393	Non-federal Land
17TNJ47	Lower Great Lakes/St. Lawrence (13)	ON	44.0268	-80.4385	Non-federal Land
17TNJ48	Lower Great Lakes/St. Lawrence (13)	ON	44.1168	-80.4376	Non-federal Land
17TNJ49	Lower Great Lakes/St. Lawrence (13)	ON	44.2068	-80.4368	Non-federal Land
17TNJ53	Lower Great Lakes/St. Lawrence (13)	ON	43.6660	-80.3178	Non-federal Land
17TNJ55	Lower Great Lakes/St. Lawrence (13)	ON	43.8460	-80.3158	Non-federal Land
17TNJ56	Lower Great Lakes/St. Lawrence (13)	ON	43.9361	-80.3147	Non-federal Land
17TNJ57	Lower Great Lakes/St. Lawrence (13)	ON	44.0261	-80.3137	Non-federal Land
17TNJ58	Lower Great Lakes/St. Lawrence (13)	ON	44.1161	-80.3127	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
17TNJ59	Lower Great Lakes/St. Lawrence (13)	ON	44.2062	-80.3116	Non-federal Land
17TNJ63	Lower Great Lakes/St. Lawrence (13)	ON	43.6652	-80.1938	Non-federal Land
17TNJ64	Lower Great Lakes/St. Lawrence (13)	ON	43.7552	-80.1926	Non-federal Land
17TNJ65	Lower Great Lakes/St. Lawrence (13)	ON	43.8452	-80.1914	Non-federal Land
17TNJ66	Lower Great Lakes/St. Lawrence (13)	ON	43.9353	-80.1901	Non-federal Land
17TNJ67	Lower Great Lakes/St. Lawrence (13)	ON	44.0253	-80.1889	Non-federal Land
17TNJ68	Lower Great Lakes/St. Lawrence (13)	ON	44.1153	-80.1877	Federal Land, Non-federal Land
17TNJ69	Lower Great Lakes/St. Lawrence (13)	ON	44.2053	-80.1865	Non-federal Land
17TNJ74	Lower Great Lakes/St. Lawrence (13)	ON	43.7543	-80.0684	Non-federal Land
17TNJ75	Lower Great Lakes/St. Lawrence (13)	ON	43.8443	-80.0670	Non-federal Land
17TNJ76	Lower Great Lakes/St. Lawrence (13)	ON	43.9343	-80.0656	Non-federal Land
17TNJ77	Lower Great Lakes/St. Lawrence (13)	ON	44.0243	-80.0642	Non-federal Land
17TNJ78	Lower Great Lakes/St. Lawrence (13)	ON	44.1144	-80.0627	Non-federal Land
17TNJ79	Lower Great Lakes/St. Lawrence (13)	ON	44.2044	-80.0613	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
17TNJ85	Lower Great Lakes/St. Lawrence (13)	ON	43.8432	-79.9426	Non-federal Land
17TNJ87	Lower Great Lakes/St. Lawrence (13)	ON	44.0232	-79.9394	Non-federal Land
17TNJ88	Lower Great Lakes/St. Lawrence (13)	ON	44.1133	-79.9378	Non-federal Land
17TNJ96	Lower Great Lakes/St. Lawrence (13)	ON	43.9320	-79.8164	Non-federal Land
17TNJ97	Lower Great Lakes/St. Lawrence (13)	ON	44.0220	-79.8146	Non-federal Land
17TNJ98	Lower Great Lakes/St. Lawrence (13)	ON	44.1120	-79.8128	Non-federal Land
17TNJ99	Lower Great Lakes/St. Lawrence (13)	ON	44.2020	-79.8110	Federal Land, Non-federal Land
17TNK00	Lower Great Lakes/St. Lawrence (13)	ON	44.2982	-80.9373	Non-federal Land
17TNK02	Lower Great Lakes/St. Lawrence (13)	ON	44.4783	-80.9371	Non-federal Land
17TNK03	Lower Great Lakes/St. Lawrence (13)	ON	44.5683	-80.9370	Federal Land, Non-federal Land
17TNK04	Lower Great Lakes/St. Lawrence (13)	ON	44.6584	-80.9369	Federal Land, Non-federal Land
17TNK05	Lower Great Lakes/St. Lawrence (13)	ON	44.7484	-80.9368	Federal Land, Non-federal Land
17TNK12	Lower Great Lakes/St. Lawrence (13)	ON	44.4782	-80.8114	Non-federal Land
17TNK13	Lower Great Lakes/St. Lawrence (13)	ON	44.5682	-80.8111	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
17TNK14	Lower Great Lakes/St. Lawrence (13)	ON	44.6582	-80.8108	Federal Land, Non-federal Land
17TNK20	Lower Great Lakes/St. Lawrence (13)	ON	44.2978	-80.6866	Non-federal Land
17TNK21	Lower Great Lakes/St. Lawrence (13)	ON	44.3879	-80.6861	Non-federal Land
17TNK23	Lower Great Lakes/St. Lawrence (13)	ON	44.5679	-80.6852	Non-federal Land
17TNK40	Lower Great Lakes/St. Lawrence (13)	ON	44.2969	-80.4359	Non-federal Land
17TNK50	Lower Great Lakes/St. Lawrence (13)	ON	44.2962	-80.3106	Non-federal Land
17TNK60	Lower Great Lakes/St. Lawrence (13)	ON	44.2954	-80.1852	Non-federal Land
17TNK61	Lower Great Lakes/St. Lawrence (13)	ON	44.3854	-80.1840	Non-federal Land
17TNK70	Lower Great Lakes/St. Lawrence (13)	ON	44.2944	-80.0599	Non-federal Land
17TNK71	Lower Great Lakes/St. Lawrence (13)	ON	44.3844	-80.0584	Non-federal Land
17TNK90	Lower Great Lakes/St. Lawrence (13)	ON	44.2921	-79.8092	Federal Land, Non-federal Land
17TPK34	Lower Great Lakes/St. Lawrence (13)	ON	44.6457	-79.2976	Non-federal Land
17TPK43	Lower Great Lakes/St. Lawrence (13)	ON	44.5538	-79.1744	Federal Land, Non-federal Land
17TPK44	Lower Great Lakes/St. Lawrence (13)	ON	44.6437	-79.1716	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
17TPK53	Lower Great Lakes/St. Lawrence (13)	ON	44.5517	-79.0485	Federal Land, Non-federal Land
17TPK54	Lower Great Lakes/St. Lawrence (13)	ON	44.6416	-79.0455	Non-federal Land
17TPK64	Lower Great Lakes/St. Lawrence (13)	ON	44.6394	-78.9195	Federal Land, Non-federal Land
18TTP89	Lower Great Lakes/St. Lawrence (13)	ON	44.1766	-77.6896	Non-federal Land
18TTQ80	Lower Great Lakes/St. Lawrence (13)	ON	44.2665	-77.6937	Federal Land, Non-federal Land
18TTQ81	Lower Great Lakes/St. Lawrence (13)	ON	44.3564	-77.6978	Federal Land, Non-federal Land
18TTQ82	Lower Great Lakes/St. Lawrence (13)	ON	44.4463	-77.7020	Non-federal Land
18TTQ91	Lower Great Lakes/St. Lawrence (13)	ON	44.3593	-77.5725	Non-federal Land
18TTQ92	Lower Great Lakes/St. Lawrence (13)	ON	44.4492	-77.5764	Non-federal Land
18TUP18	Lower Great Lakes/St. Lawrence (13)	ON	44.0948	-77.3111	Federal Land, Non-federal Land
18TUP19	Lower Great Lakes/St. Lawrence (13)	ON	44.1848	-77.3147	Federal Land, Non-federal Land
18TUP28	Lower Great Lakes/St. Lawrence (13)	ON	44.0973	-77.1863	Non-federal Land
18TUP29	Lower Great Lakes/St. Lawrence (13)	ON	44.1872	-77.1896	Non-federal Land
18TUP36	Lower Great Lakes/St. Lawrence (13)	ON	43.9196	-77.0552	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
18TUP37	Lower Great Lakes/St. Lawrence (13)	ON	44.0096	-77.0583	Non-federal Land
18TUP38	Lower Great Lakes/St. Lawrence (13)	ON	44.0996	-77.0615	Non-federal Land
18TUP39	Lower Great Lakes/St. Lawrence (13)	ON	44.1896	-77.0646	Federal Land, Non-federal Land
18TUP46	Lower Great Lakes/St. Lawrence (13)	ON	43.9218	-76.9307	Federal Protected Area (Prince Edward Point National Wildlife Area), Non-federal Land
18TUP48	Lower Great Lakes/St. Lawrence (13)	ON	44.1018	-76.9366	Non-federal Land
18TUP49	Lower Great Lakes/St. Lawrence (13)	ON	44.1918	-76.9395	Non-federal Land
18TUP58	Lower Great Lakes/St. Lawrence (13)	ON	44.1038	-76.8117	Non-federal Land
18TUP59	Lower Great Lakes/St. Lawrence (13)	ON	44.1938	-76.8145	Federal Land, Non-federal Land
18TUP68	Lower Great Lakes/St. Lawrence (13)	ON	44.1057	-76.6868	Non-federal Land
18TUP69	Lower Great Lakes/St. Lawrence (13)	ON	44.1957	-76.6894	Federal Land, Non-federal Land
18TUP79	Lower Great Lakes/St. Lawrence (13)	ON	44.1975	-76.5643	Federal Land, Non-federal Land
18TUQ10	Lower Great Lakes/St. Lawrence (13)	ON	44.2747	-77.3182	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
18TUQ20	Lower Great Lakes/St. Lawrence (13)	ON	44.2772	-77.1930	Non-federal Land
18TUQ30	Lower Great Lakes/St. Lawrence (13)	ON	44.2795	-77.0677	Non-federal Land
18TUQ31	Lower Great Lakes/St. Lawrence (13)	ON	44.3695	-77.0709	Non-federal Land
18TUQ40	Lower Great Lakes/St. Lawrence (13)	ON	44.2817	-76.9425	Non-federal Land
18TUQ41	Lower Great Lakes/St. Lawrence (13)	ON	44.3717	-76.9455	Non-federal Land
18TUQ50	Lower Great Lakes/St. Lawrence (13)	ON	44.2838	-76.8172	Non-federal Land
18TUQ51	Lower Great Lakes/St. Lawrence (13)	ON	44.3738	-76.8200	Federal Land, Non-federal Land
18TUQ60	Lower Great Lakes/St. Lawrence (13)	ON	44.2857	-76.6920	Federal Land, Non-federal Land
18TUQ70	Lower Great Lakes/St. Lawrence (13)	ON	44.2875	-76.5667	Federal Land, Non-federal Land
18TUQ98	Lower Great Lakes/St. Lawrence (13)	ON	45.0107	-76.3325	Non-federal Land
18TUR34	Boreal Hardwood Transition (12)	ON	45.5390	-77.1134	Non-federal Land
18TUR36	Lower Great Lakes/St. Lawrence (13)	ON	45.7189	-77.1202	Non-federal Land
18TUR44	Boreal Hardwood Transition (12)	ON	45.5413	-76.9854	Non-federal Land
18TUR45	Lower Great Lakes/St. Lawrence (13)	ON	45.6312	-76.9886	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
18TUR46	Lower Great Lakes/St. Lawrence (13)	ON	45.7212	-76.9918	Non-federal Land
18TUR53	Boreal Hardwood Transition (12)	ON	45.4535	-76.8544	Non-federal Land
18TUR54	Lower Great Lakes/St. Lawrence (13)	ON	45.5434	-76.8574	Non-federal Land
18TUR55	Lower Great Lakes/St. Lawrence (13)	ON	45.6334	-76.8604	Non-federal Land
18TUR91	Boreal Hardwood Transition (12)	ON	45.2807	-76.3388	Non-federal Land
18TVQ08	Lower Great Lakes/St. Lawrence (13)	ON	45.0121	-76.2056	Federal Protected Area (Mississippi Lake Migratory Bird Sanctuary), Non-federal Land
18TVQ49	Lower Great Lakes/St. Lawrence (13)	ON	45.1063	-75.6991	Federal Land, Non-federal Land
18TVQ59	Lower Great Lakes/St. Lawrence (13)	ON	45.1070	-75.5720	Federal Land, Non-federal Land
18TVQ68	Lower Great Lakes/St. Lawrence (13)	ON	45.0176	-75.4442	Non-federal Land
18TVQ69	Lower Great Lakes/St. Lawrence (13)	ON	45.1076	-75.4449	Non-federal Land
18TVQ78	Lower Great Lakes/St. Lawrence (13)	ON	45.0180	-75.3173	Non-federal Land
18TVQ79	Lower Great Lakes/St. Lawrence (13)	ON	45.1080	-75.3178	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
18TVR02	Lower Great Lakes/St. Lawrence (13)	ON	45.3721	-76.2132	Non-federal Land
18TVR03	Lower Great Lakes/St. Lawrence (13)	ON	45.4621	-76.2152	Federal Land, Non-federal Land
18TVR12	Lower Great Lakes/St. Lawrence (13)	ON	45.3734	-76.0855	Non-federal Land
18TVR13	Lower Great Lakes/St. Lawrence (13)	ON	45.4634	-76.0873	Non-federal Land
18TVR22	Lower Great Lakes/St. Lawrence (13)	ON	45.3745	-75.9579	Federal Land, Non-federal Land
18TVR32	Boreal Hardwood Transition (12)	ON	45.3755	-75.8302	Federal Land, Non-federal Land
18TVR41	Lower Great Lakes/St. Lawrence (13)	ON	45.2864	-75.7013	Federal Land, Non-federal Land
18TVR50	Lower Great Lakes/St. Lawrence (13)	ON	45.1971	-75.5729	Federal Land, Non-federal Land
18TVR51	Lower Great Lakes/St. Lawrence (13)	ON	45.2871	-75.5738	Federal Land, Non-federal Land
18TVR60	Lower Great Lakes/St. Lawrence (13)	ON	45.1976	-75.4456	Non-federal Land
18TVR61	Lower Great Lakes/St. Lawrence (13)	ON	45.2876	-75.4463	Non-federal Land
18TVR62	Lower Great Lakes/St. Lawrence (13)	ON	45.3776	-75.4470	Federal Land, Non-federal Land
18TVR63	Lower Great Lakes/St. Lawrence (13)	ON	45.4677	-75.4477	Federal Land, Non-federal Land
18TVR72	Lower Great Lakes/St. Lawrence (13)	ON	45.3781	-75.3193	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
18TVR73	Lower Great Lakes/St. Lawrence (13)	ON	45.4681	-75.3198	Federal Protected Area (Beckett Creek Migratory Bird Sanctuary), Non-federal Land
18TVR74	Lower Great Lakes/St. Lawrence (13)	ON	45.5581	-75.3203	Federal Protected Area (Beckett Creek Migratory Bird Sanctuary), Non-federal Land
18TVR83	Lower Great Lakes/St. Lawrence (13)	ON	45.4684	-75.1919	Non-federal Land
18TVR92	Lower Great Lakes/St. Lawrence (13)	ON	45.3785	-75.0639	Non-federal Land
18TVR93	Lower Great Lakes/St. Lawrence (13)	ON	45.4685	-75.0640	Non-federal Land
18TWR01	Lower Great Lakes/St. Lawrence (13)	ON	45.2885	-74.9362	Non-federal Land
18TWR02	Lower Great Lakes/St. Lawrence (13)	ON	45.3785	-74.9361	Non-federal Land
18TWR03	Lower Great Lakes/St. Lawrence (13)	ON	45.4685	-74.9360	Non-federal Land
18TWR14	Lower Great Lakes/St. Lawrence (13)	ON	45.5584	-74.8078	Non-federal Land
17UPP18	Boreal Softwood Shield (8)	QC	48.6075	-79.4399	Non-federal Land
17UPP32	Boreal Softwood Shield (8)	QC	48.0640	-79.1880	Non-federal Land
17UPP42	Boreal Softwood Shield (8)	QC	48.0618	-79.0538	Non-federal Land
17UPP43	Boreal Softwood Shield (8)	QC	48.1517	-79.0504	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
18TUR93	Boreal Hardwood Transition (12)	QC	45.4606	-76.3430	Federal Land, Non-federal Land
18TVR04	Boreal Hardwood Transition (12)	QC	45.5521	-76.2171	Federal Land, Non-federal Land
18TVR14	Boreal Hardwood Transition (12)	QC	45.5534	-76.0890	Federal Land, Non-federal Land
18TVR23	Boreal Hardwood Transition (12)	QC	45.4645	-75.9594	Federal Land, Non-federal Land
18TVR64	Boreal Hardwood Transition (12)	QC	45.5577	-75.4484	Non-federal Land
18TVR95	Lower Great Lakes/St. Lawrence (13)	QC	45.6485	-75.0642	Non-federal Land
18TWR15	Lower Great Lakes/St. Lawrence (13)	QC	45.6484	-74.8075	Non-federal Land
18TXQ89	Atlantic Northern Forest (14)	QC	45.0843	-72.6493	Non-federal Land
18TXQ99	Atlantic Northern Forest (14)	QC	45.0816	-72.5223	Non-federal Land
18TXR71	Lower Great Lakes/St. Lawrence (13)	QC	45.2667	-72.7692	Federal Land, Non-federal Land
18TXR81	Lower Great Lakes/St. Lawrence (13)	QC	45.2642	-72.6419	Non-federal Land
18TXS81	Lower Great Lakes/St. Lawrence (13)	QC	46.1635	-72.6037	Federal Protected Area (Nicolet Migratory Bird Sanctuary), Federal Land, Non-federal Land
18TXS91	Lower Great Lakes/St. Lawrence (13)	QC	46.1607	-72.4743	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
18TXS92	Lower Great Lakes/St. Lawrence (13)	QC	46.2506	-72.4702	Non-federal Land
18TXS93	Lower Great Lakes/St. Lawrence (13)	QC	46.3405	-72.4660	Non-federal Land
18TYQ08	Atlantic Northern Forest (14)	QC	44.9888	-72.3995	Federal Land, Non-federal Land
18TYQ09	Atlantic Northern Forest (14)	QC	45.0788	-72.3954	Non-federal Land
18TYQ29	Atlantic Northern Forest (14)	QC	45.0727	-72.1416	Non-federal Land
18TYQ39	Atlantic Northern Forest (14)	QC	45.0696	-72.0391	Non-federal Land
18TYR16	Atlantic Northern Forest (14)	QC	45.7052	-72.2380	Non-federal Land
18TYR17	Lower Great Lakes/St. Lawrence (13)	QC	45.7951	-72.2336	Non-federal Land
18TYR26	Atlantic Northern Forest (14)	QC	45.7020	-72.1097	Non-federal Land
18TYR29	Lower Great Lakes/St. Lawrence (13)	QC	45.9717	-72.0957	Non-federal Land
18TYS03	Lower Great Lakes/St. Lawrence (13)	QC	46.3375	-72.3362	Federal Land, Non-federal Land
18TYS14	Lower Great Lakes/St. Lawrence (13)	QC	46.4243	-72.2019	Non-federal Land
18TYS15	Lower Great Lakes/St. Lawrence (13)	QC	46.5142	-72.1972	Non-federal Land
18TYS25	Lower Great Lakes/St. Lawrence (13)	QC	46.5109	-72.0671	Non-federal Land
19TBK79	Atlantic Northern Forest (14)	QC	45.0727	-71.8584	Non-federal Land
19TBL60	Atlantic Northern Forest (14)	QC	45.1596	-71.9632	Non-federal Land
19TBL61	Atlantic Northern Forest (14)	QC	45.2495	-71.9655	Non-federal Land
19TBL65	Atlantic Northern Forest (14)	QC	45.6091	-71.9748	Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
19TBL71	Atlantic Northern Forest (14)	QC	45.2525	-71.8674	Non-federal Land
19TBL74	Atlantic Northern Forest (14)	QC	45.5222	-71.8811	Non-federal Land
19TBL82	Atlantic Northern Forest (14)	QC	45.3455	-71.7445	Federal Land, Non-federal Land
19TBL83	Atlantic Northern Forest (14)	QC	45.4354	-71.7488	Federal Land, Non-federal Land
19TBL86	Atlantic Northern Forest (14)	QC	45.7052	-71.7620	Non-federal Land
19TBL87	Atlantic Northern Forest (14)	QC	45.7951	-71.7665	Non-federal Land
19TCL02	Atlantic Northern Forest (14)	QC	45.3514	-71.4894	Non-federal Land
20TLR07	Atlantic Northern Forest (14)	NB	45.8010	-65.5094	Non-federal Land
20TLR17	Atlantic Northern Forest (14)	NB	45.8038	-65.3808	Non-federal Land
20TLR98	Atlantic Northern Forest (14)	NB	45.9106	-64.3538	Federal Protected Area (Tintamarre National Wildlife Area), Federal Land, Non-federal Land
20TLR99	Atlantic Northern Forest (14)	NB	46.0005	-64.3560	Federal Protected Area (Tintamarre National Wildlife Area), Non-federal Land
20TMR08	Atlantic Northern Forest (14)	NB	45.9120	-64.2249	Federal Protected Area (Tintamarre National Wildlife Area), Federal Land, Non-federal Land

Grid Square ID	Bird Conservation Region Name (Number)	Province*	Grid Square Centroid Coordinates - Latitude	Grid Square Centroid Coordinates - Longitude	Land Tenure (Grid-level)
20TMR09	Atlantic Northern Forest (14)	NB	46.0020	-64.2269	Federal Protected Area (Tintamarre National Wildlife Area), Non-federal Land
20TMR07	Atlantic Northern Forest (14)	NS	45.8220	-64.2230	Federal Protected Area (John Lusby Marsh National Wildlife Area, Chignecto National Wildlife Area), Federal Land, Non-federal Land
20TMR76	Atlantic Northern Forest (14)	NS	45.7381	-63.3214	Federal Land, Non-federal Land
20TMR86	Atlantic Northern Forest (14)	NS	45.7384	-63.1928	Non-federal Land
21UUP30	Boreal Softwood Shield (8)	NL	47.8771	-59.2067	Non-federal Land

* For grid squares that overlap provincial borders, province is assigned to the province with the greater proportion of the square.

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Appendix E: Critical Habitat Maps for the Bobolink in Canada

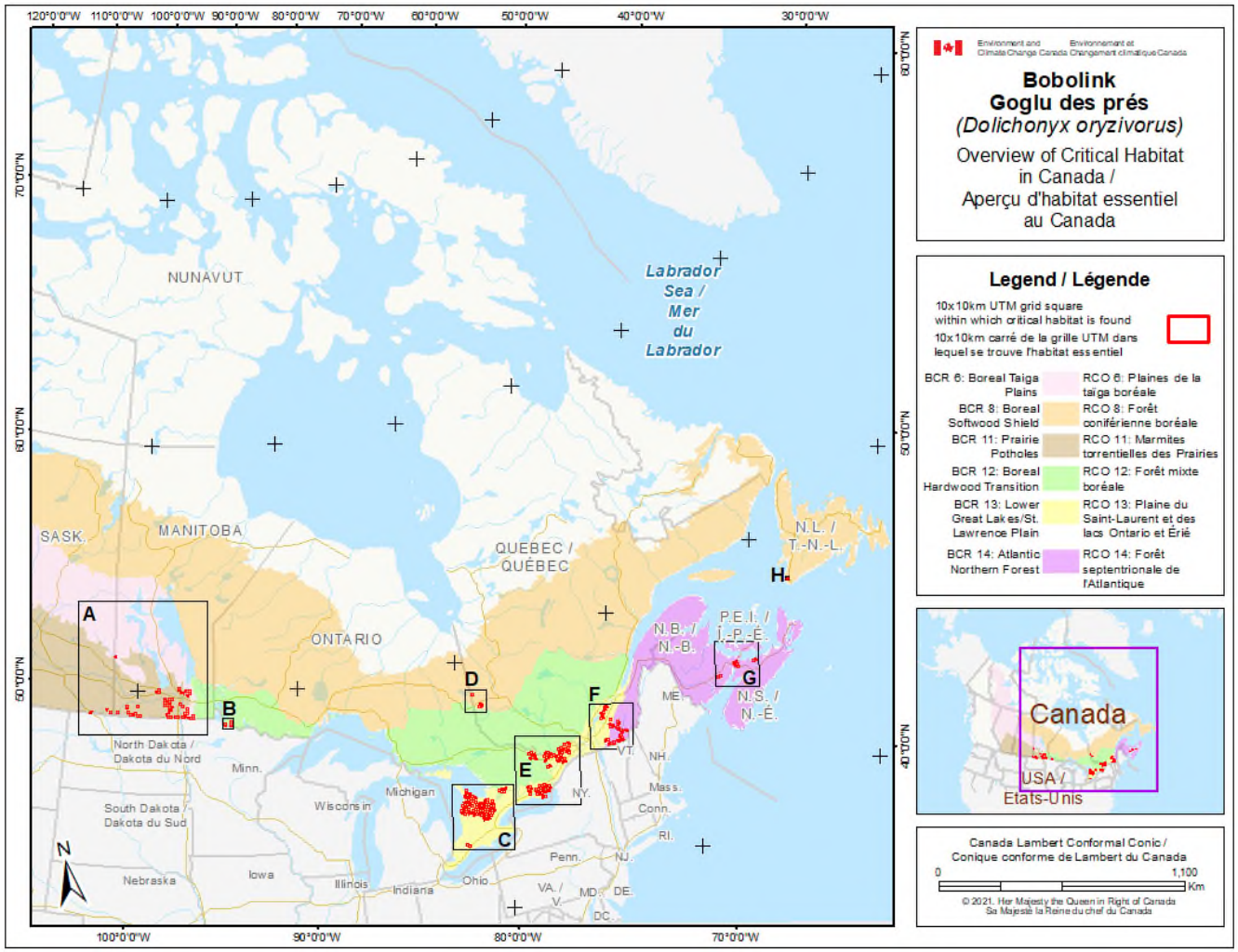

Figure E. Indexed overview of the area containing critical habitat for the Bobolink in Canada (same as Figure 3 but with black index blocks that correspond to the following series of maps). Critical habitat is represented by the red-outlined 10 x 10 km UTM grid square unit(s); critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

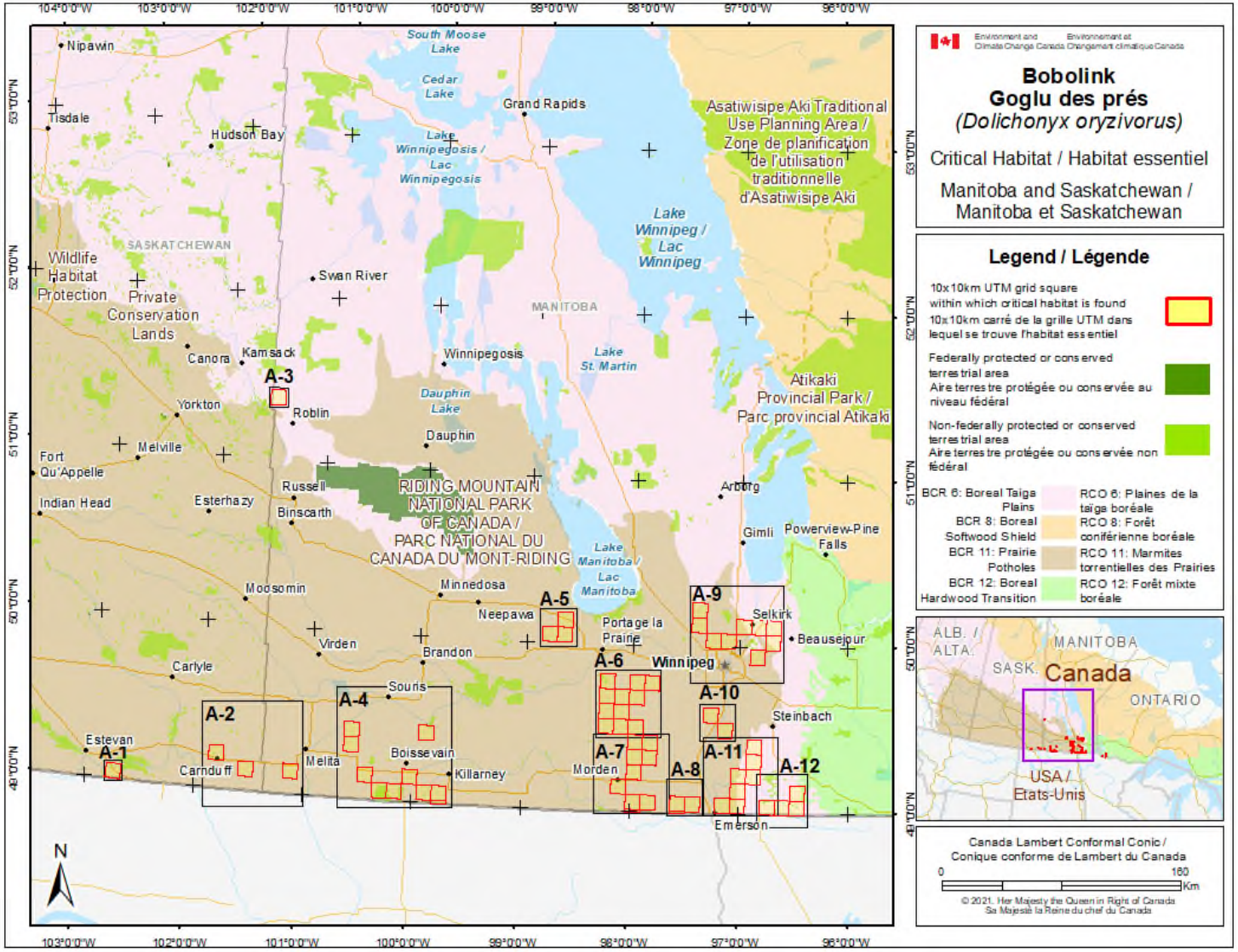

Figure EA. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 6 and 11 in southeastern Saskatchewan and southwestern Manitoba is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

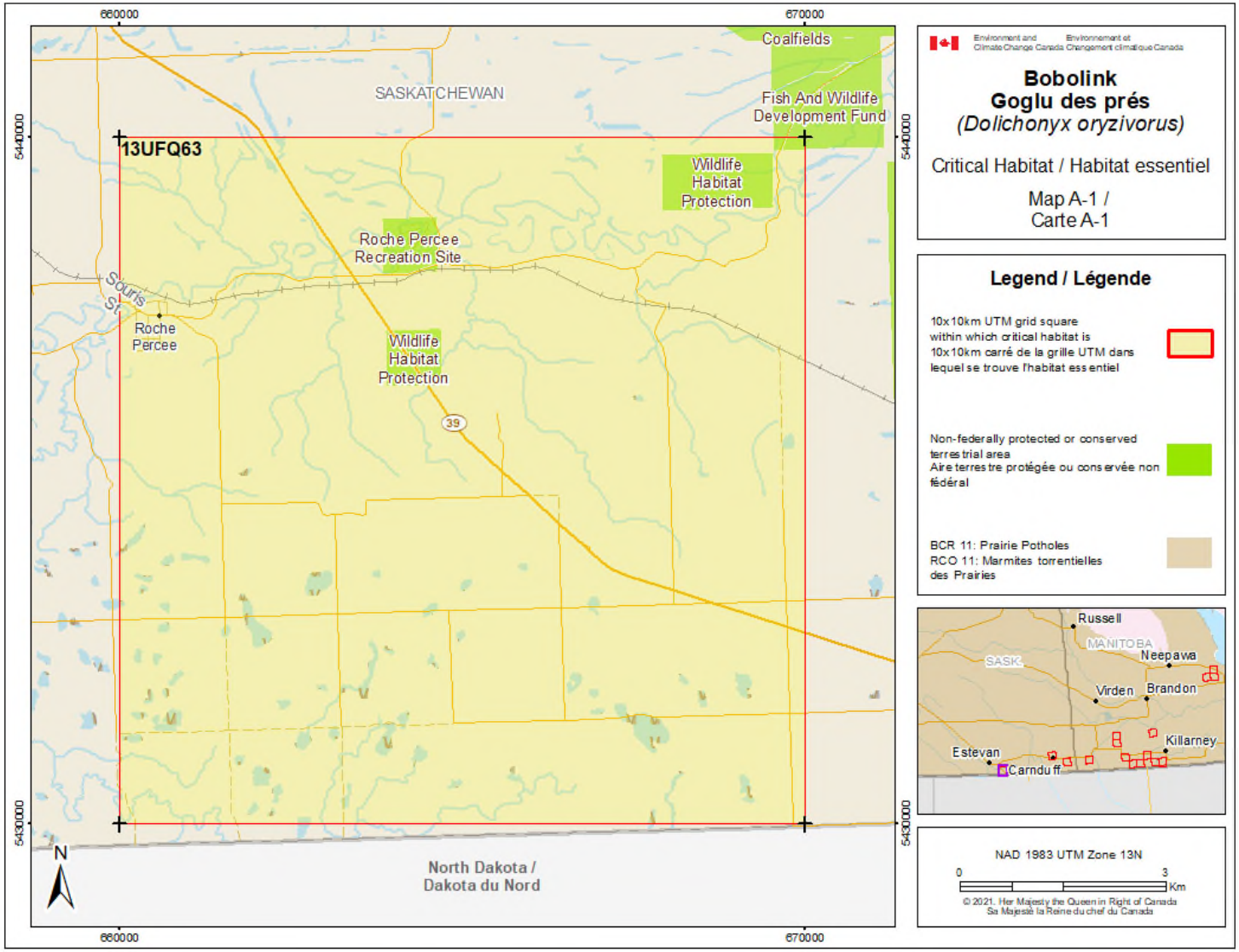

Figure EA-1. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 11 in southeastern Saskatchewan is represented by the shaded yellow 10 x 10 km UTM grid square unit; critical habitat occurs within this unit where the biophysical attributes described in section 7.1 are met.

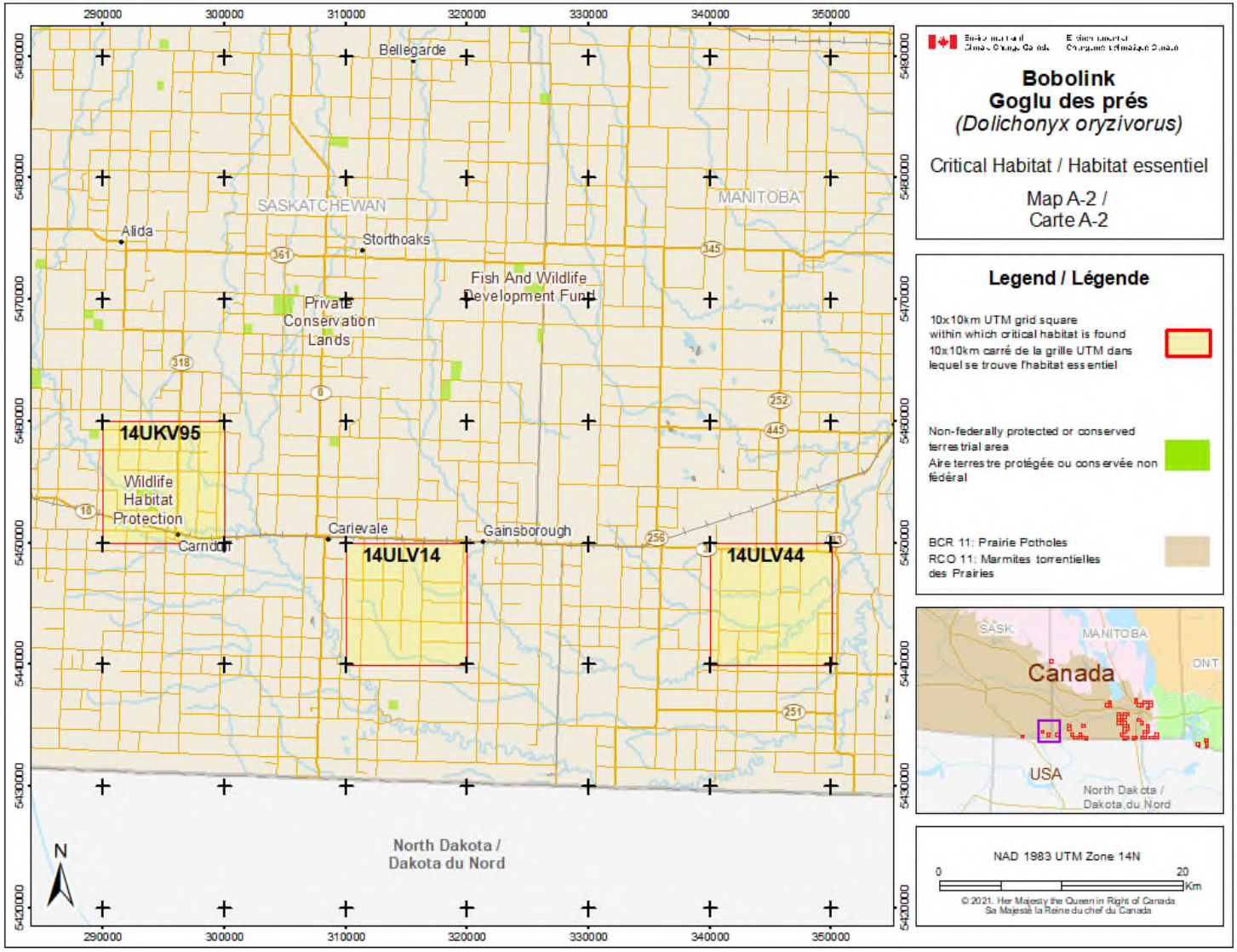

Figure EA-2. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 11 in southeastern Saskatchewan is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

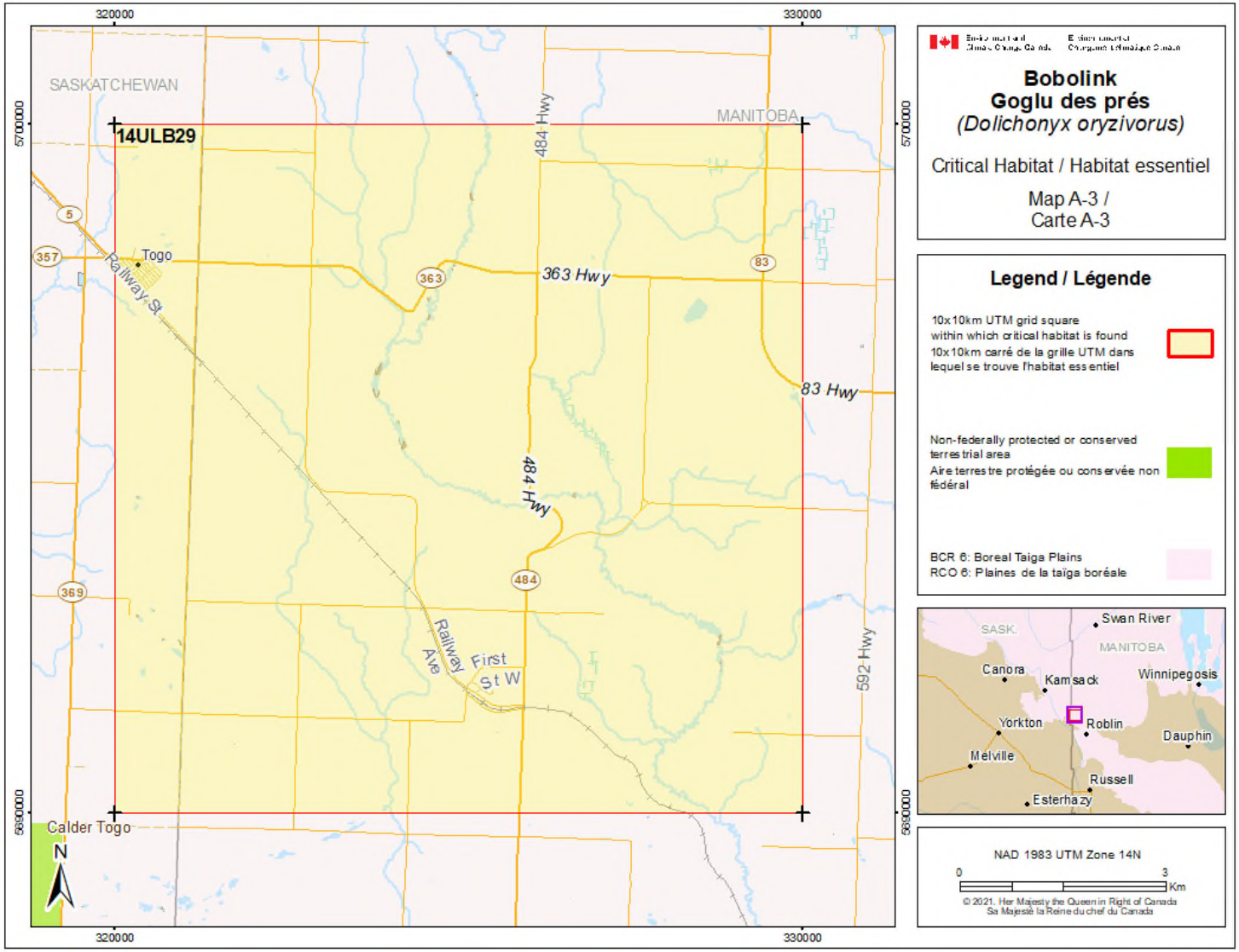

Figure EA-3. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 6 along the Saskatchewan/Manitoba border is represented by the shaded yellow 10 x 10 km UTM grid square unit; critical habitat occurs within this unit where the biophysical attributes described in section 7.1 are met.

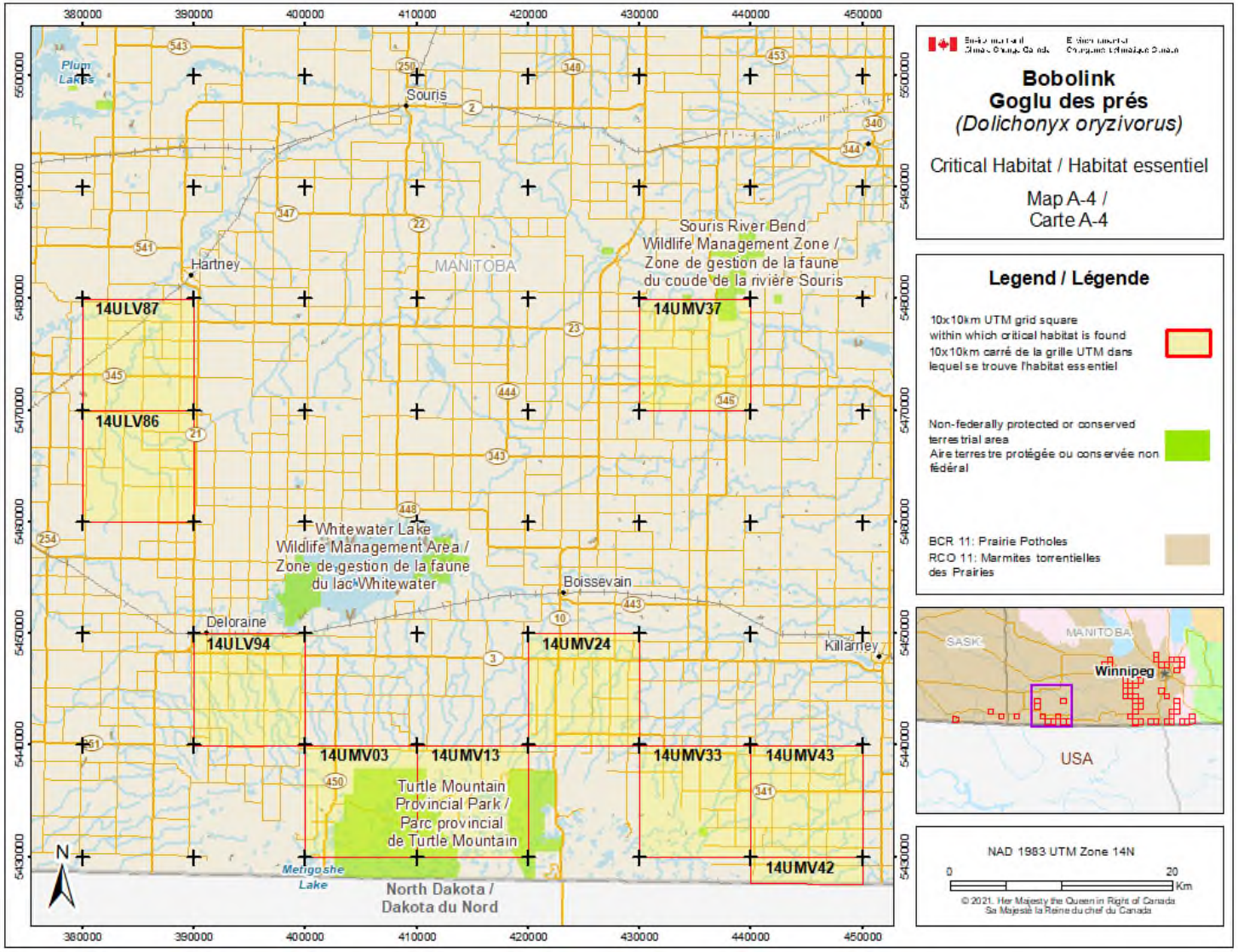

Figure EA-4. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 11 in southwestern Manitoba is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

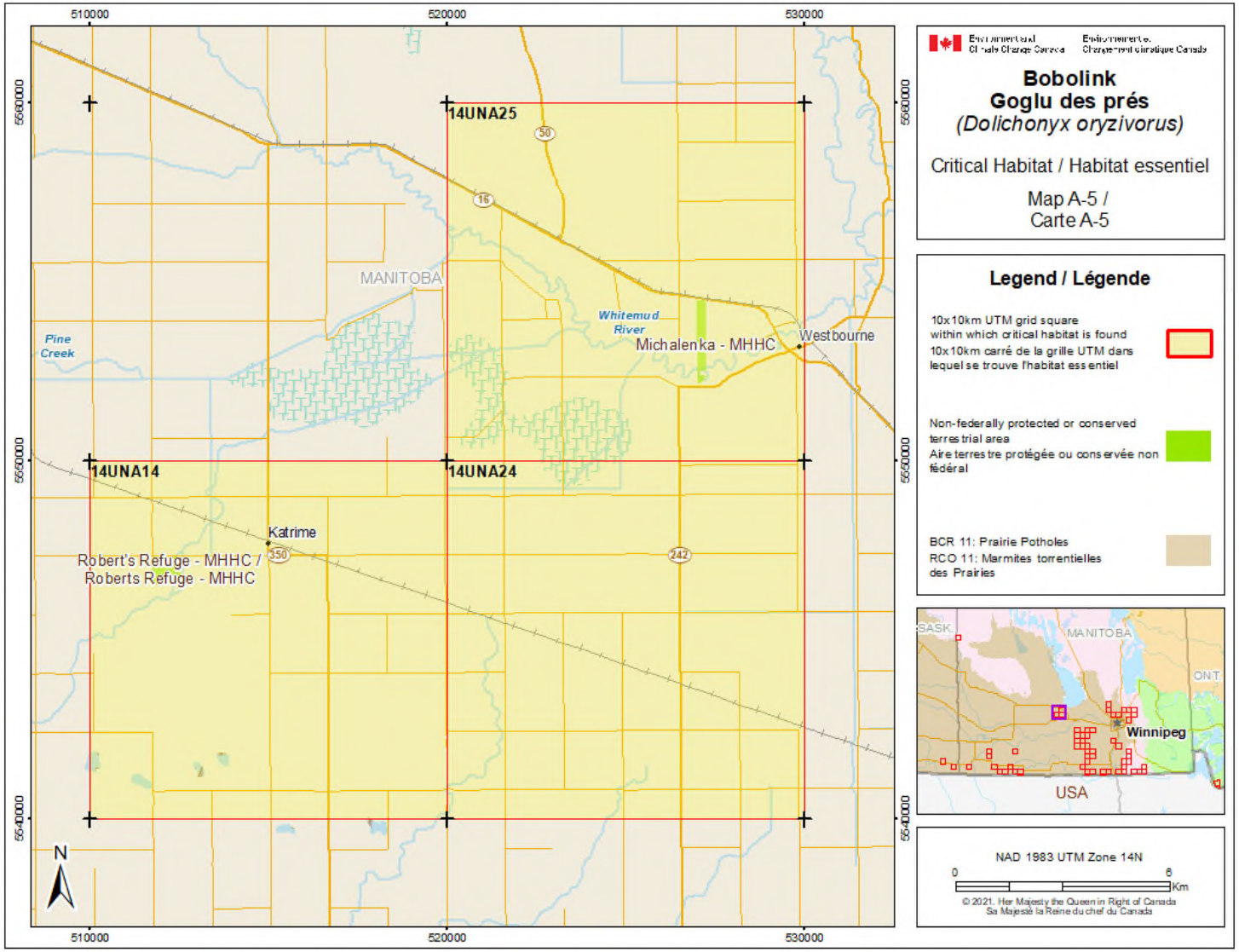

Figure EA-5. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 11 in southcentral Manitoba is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

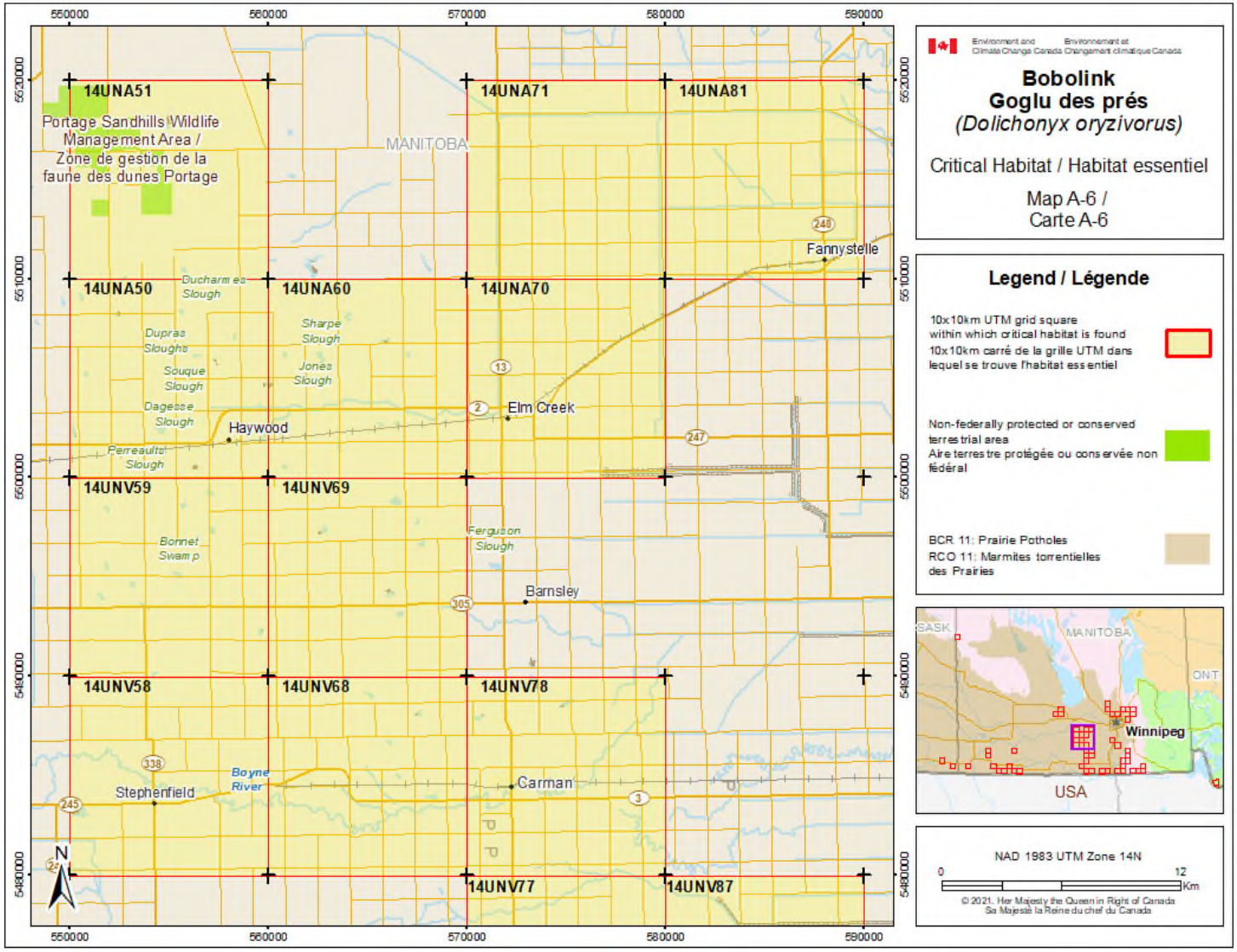

Figure EA-6. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 11 in southcentral Manitoba is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

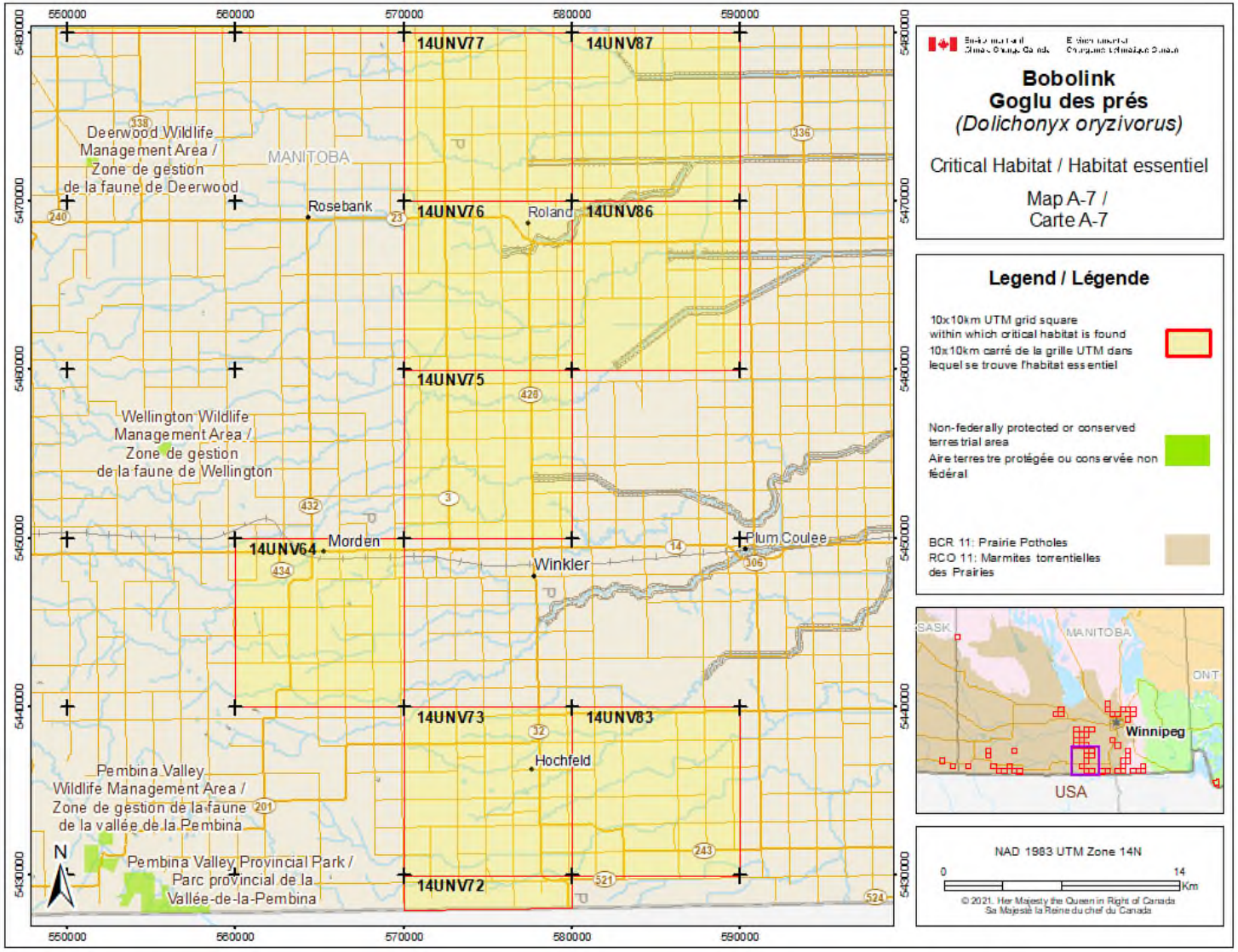

Figure EA-7. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 11 in southcentral Manitoba is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

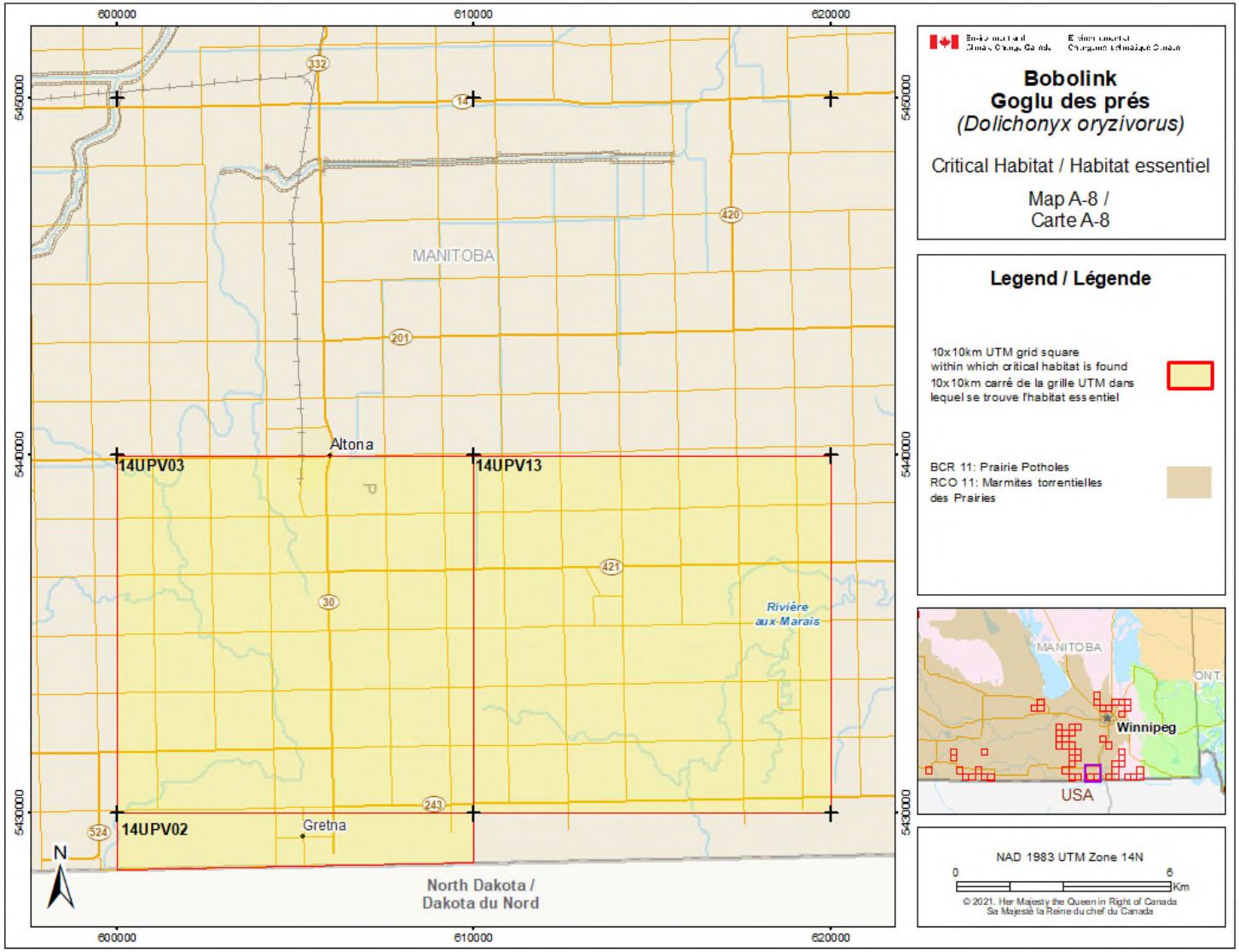

Figure EA-8. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 11 in southcentral Manitoba is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

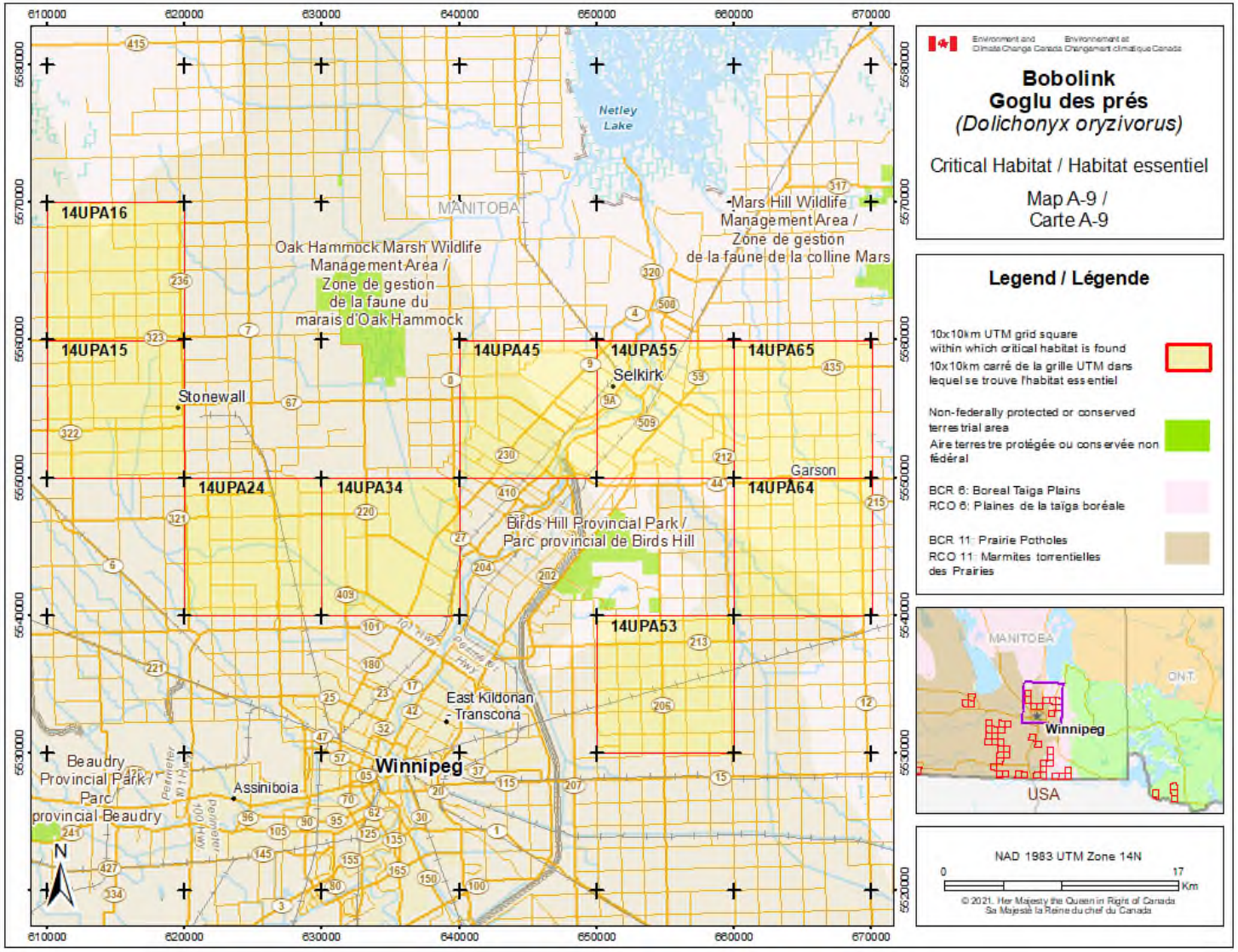

Figure EA-9. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 11 in southcentral Manitoba is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

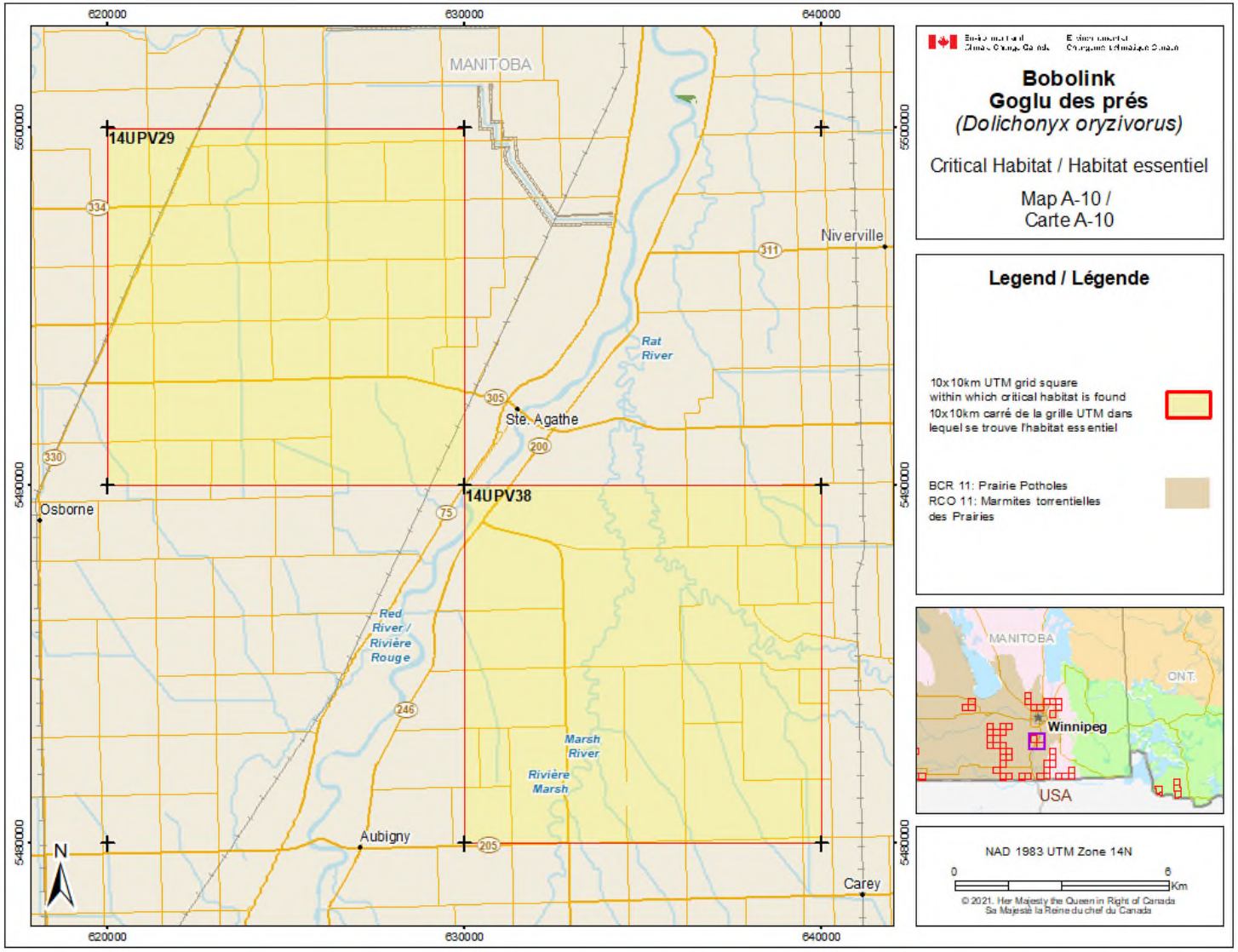

Figure EA-10. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 11 in southcentral Manitoba is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

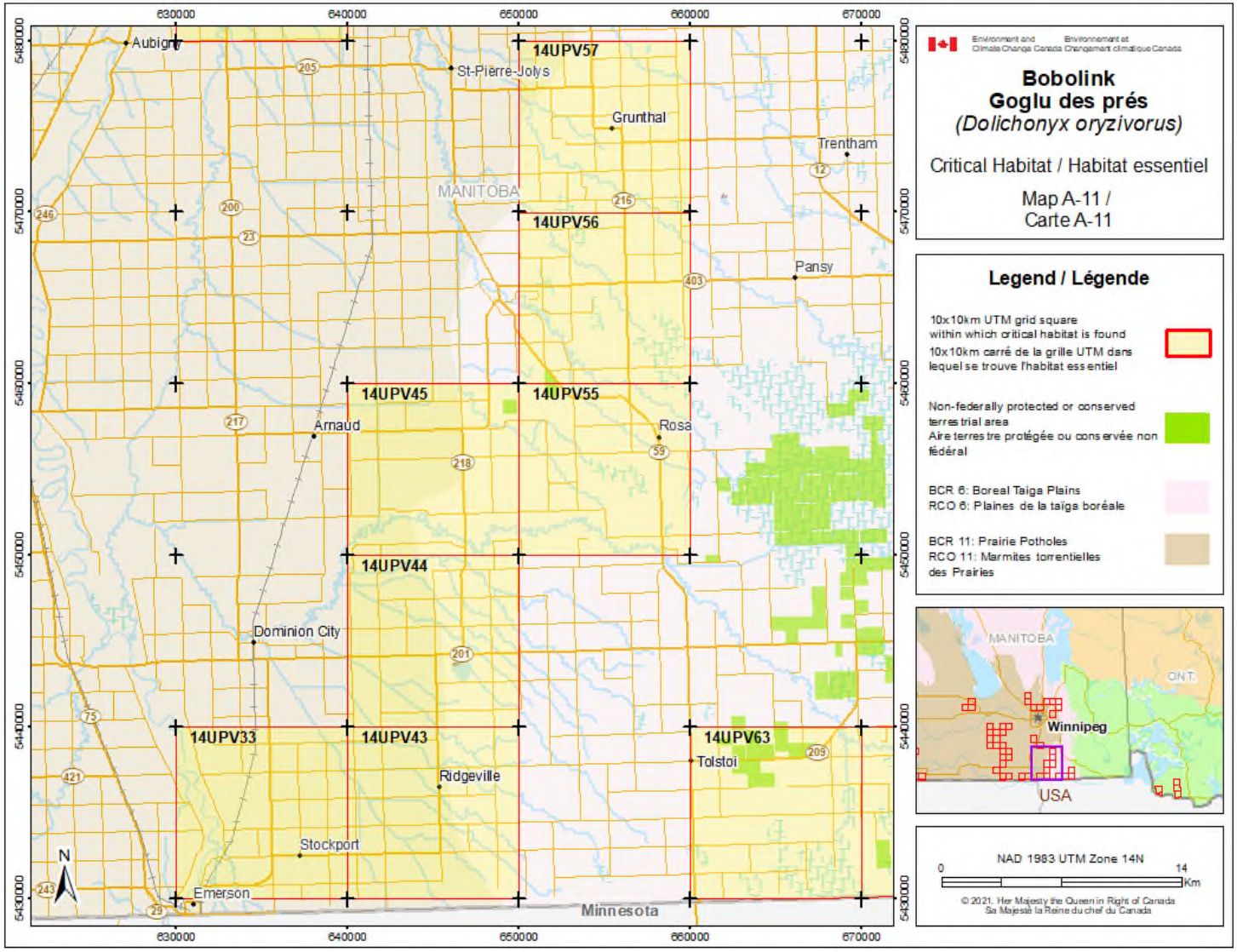

Figure EA-11. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 11 in southeastern Manitoba is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

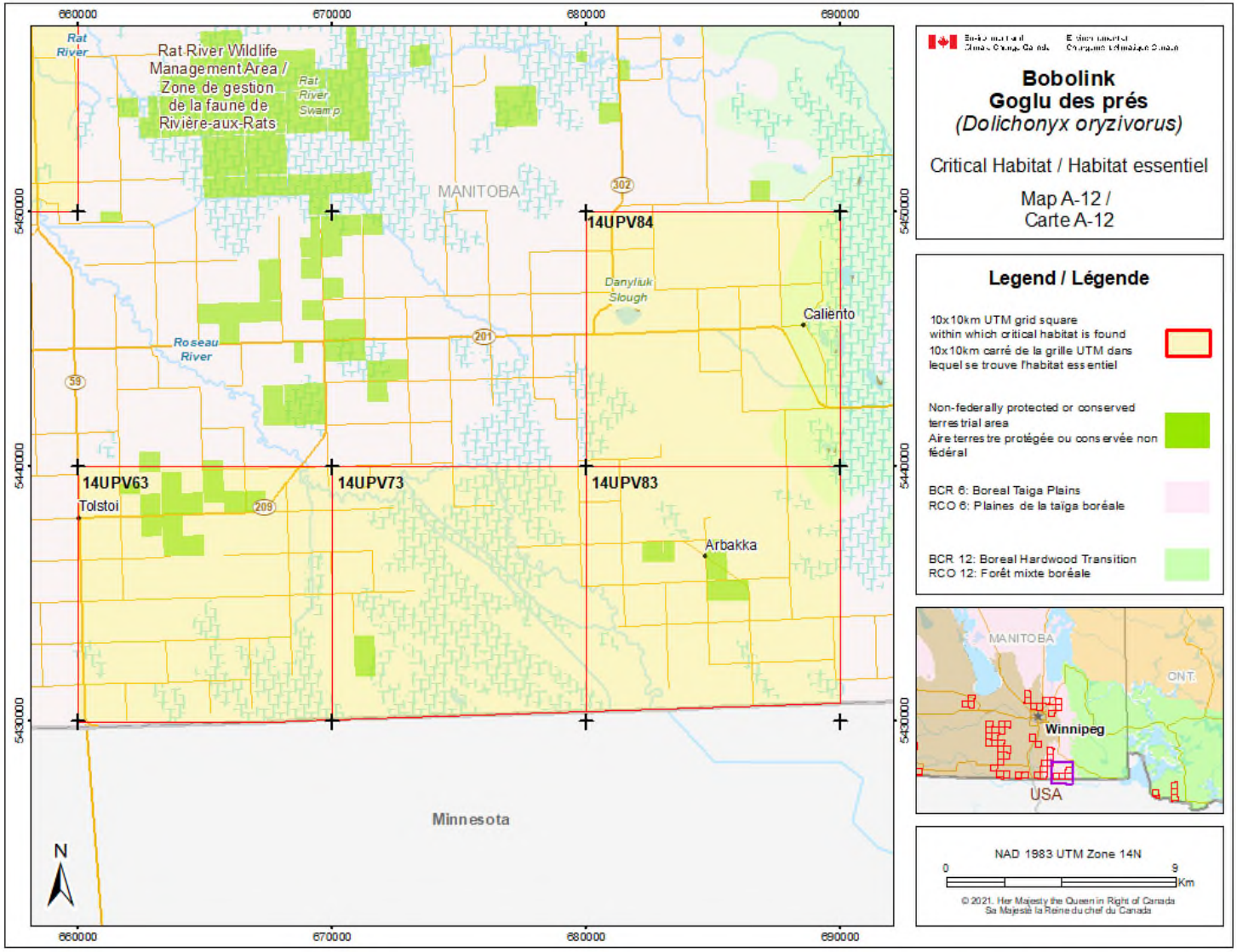

Figure EA-12. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 6 and 11 in southeastern Manitoba is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

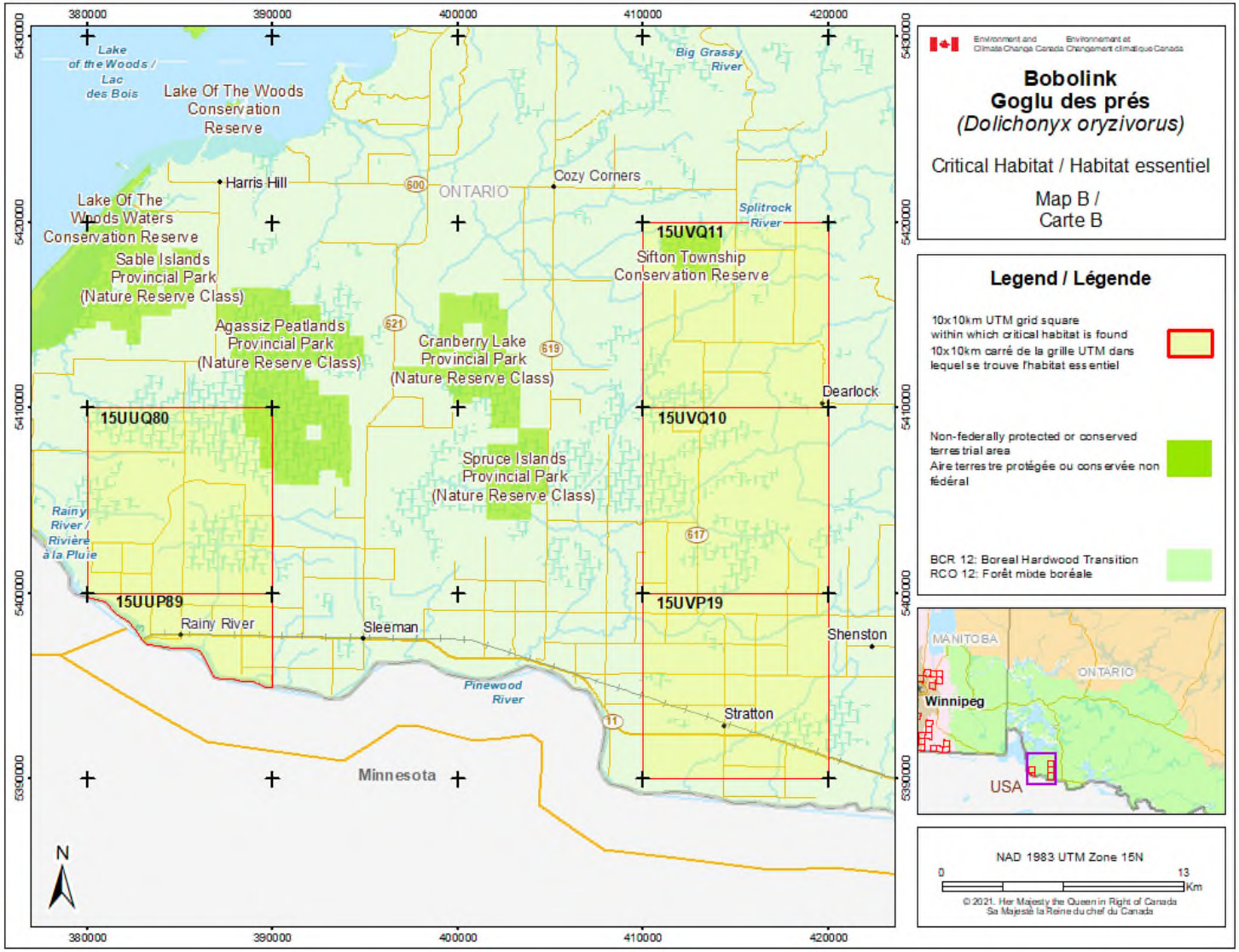

Figure EB. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 12 in northwestern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

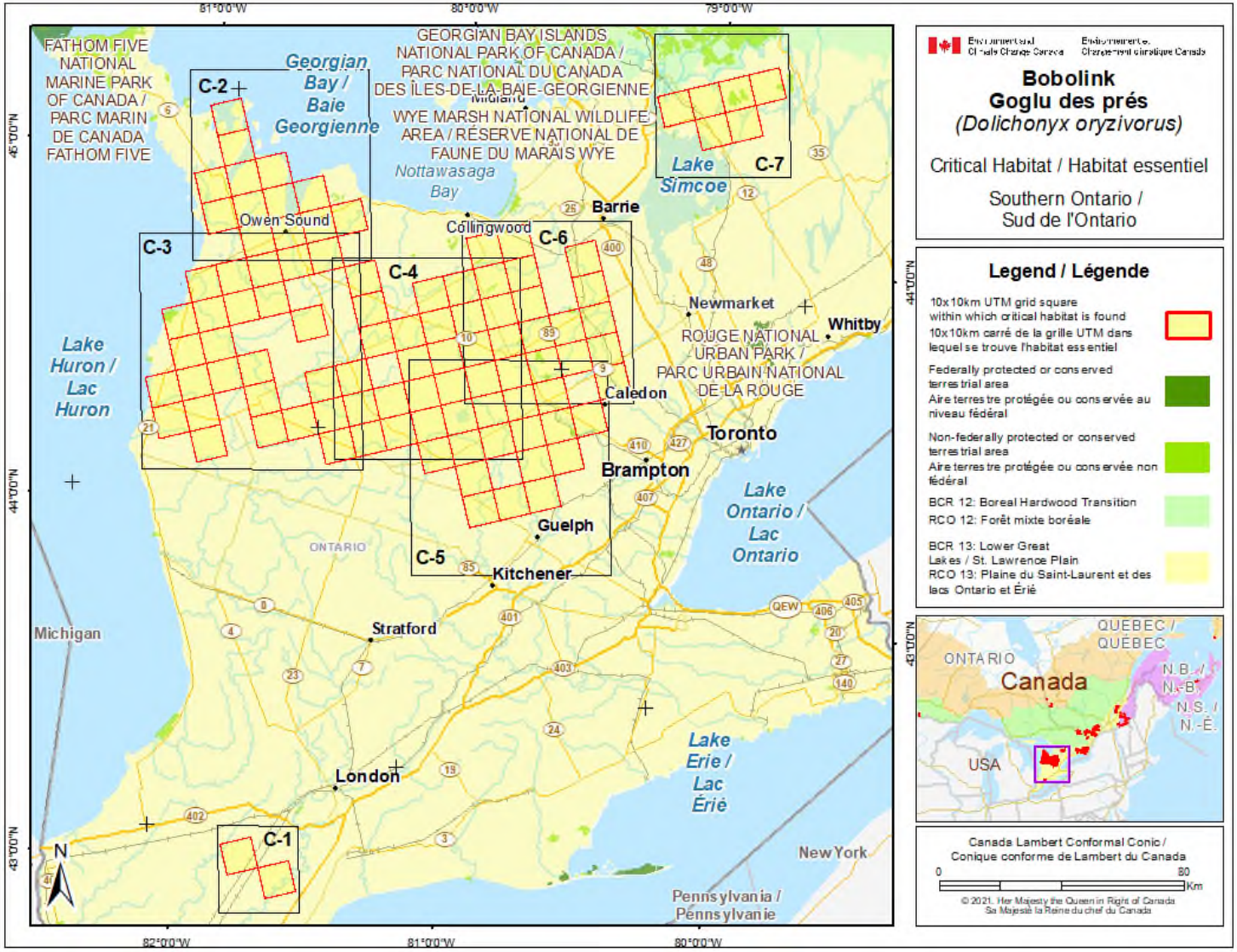

Figure EC. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 12 and 13 in southwestern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

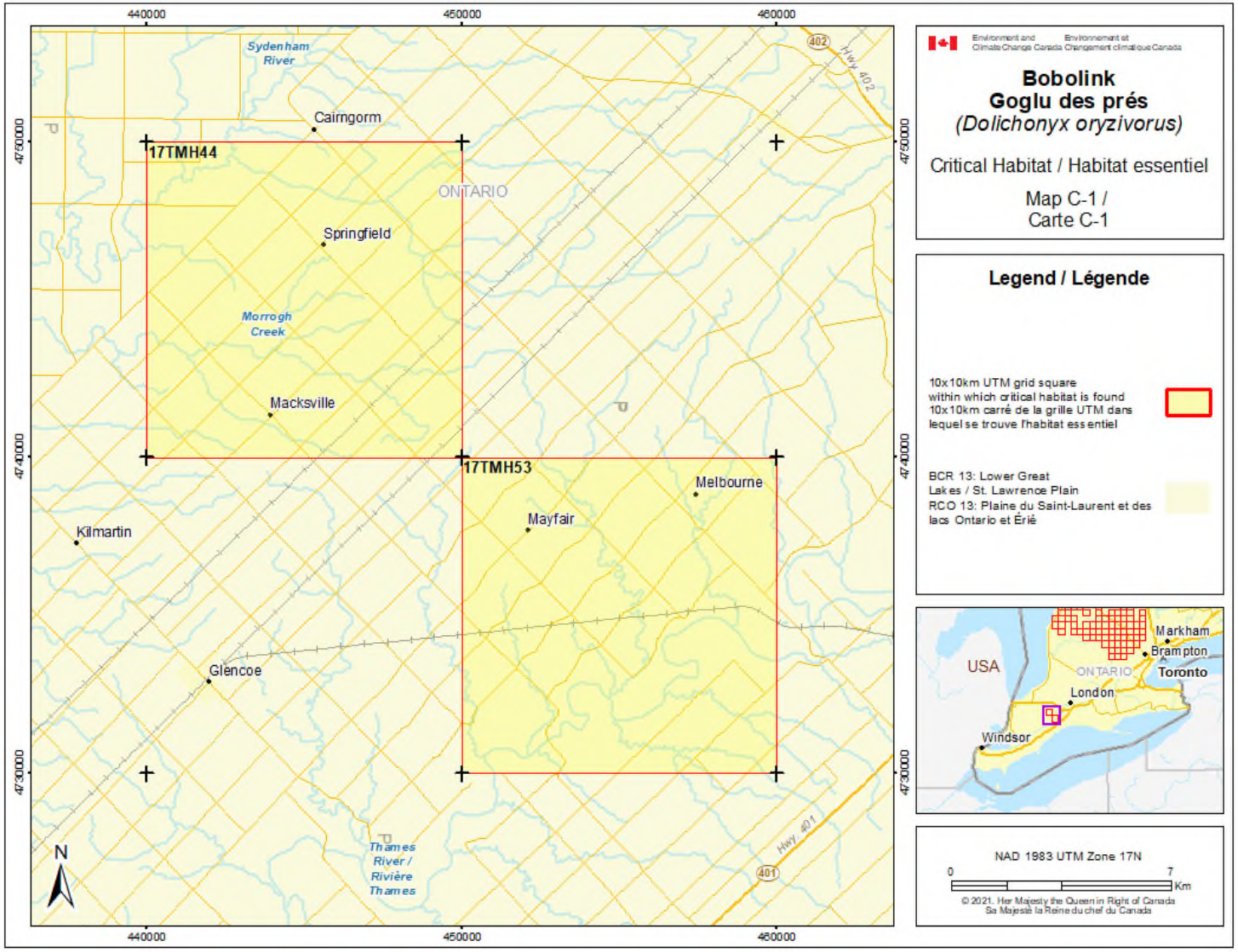

Figure EC-1. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 13 in southwestern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

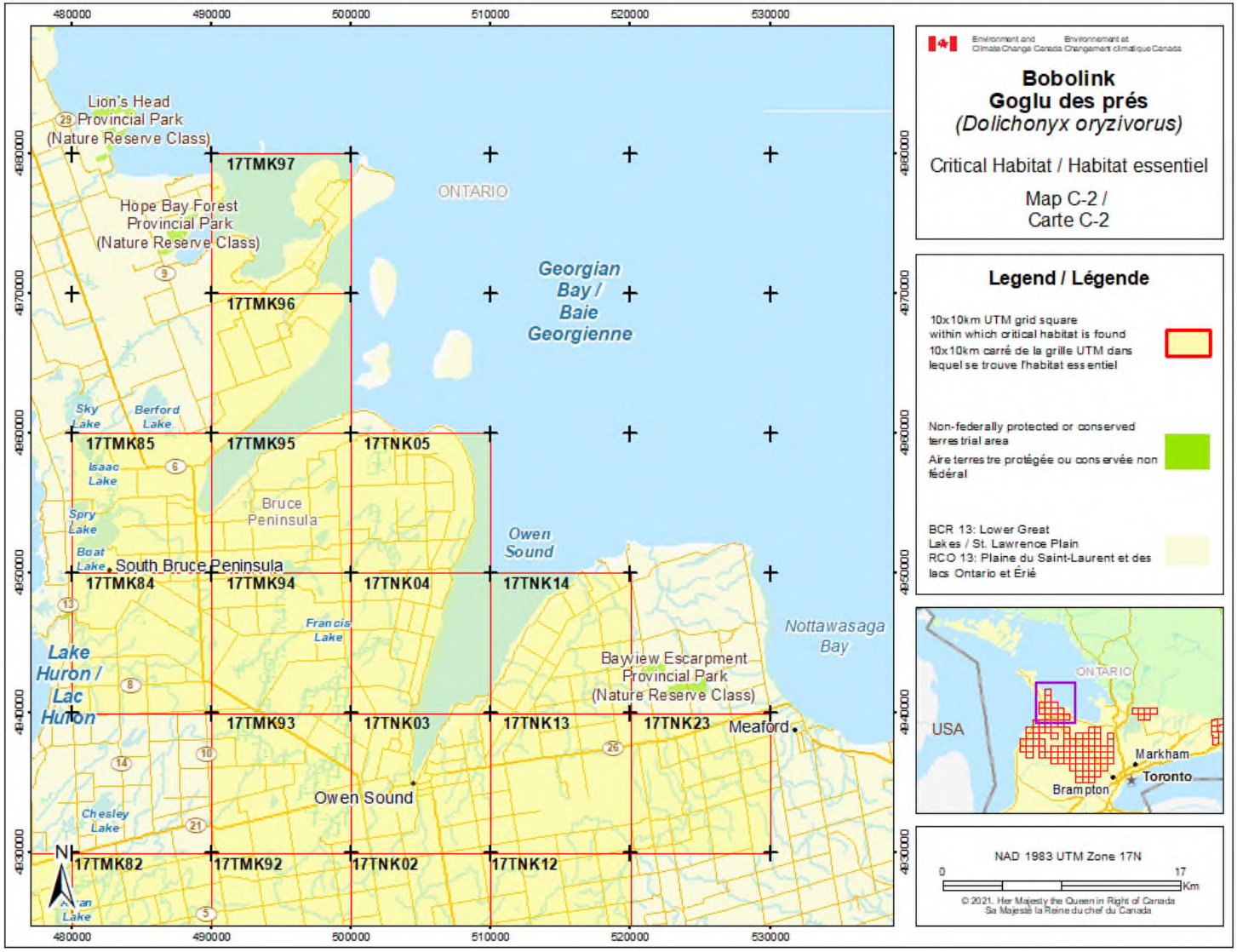

Figure EC-2. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 13 in southwestern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

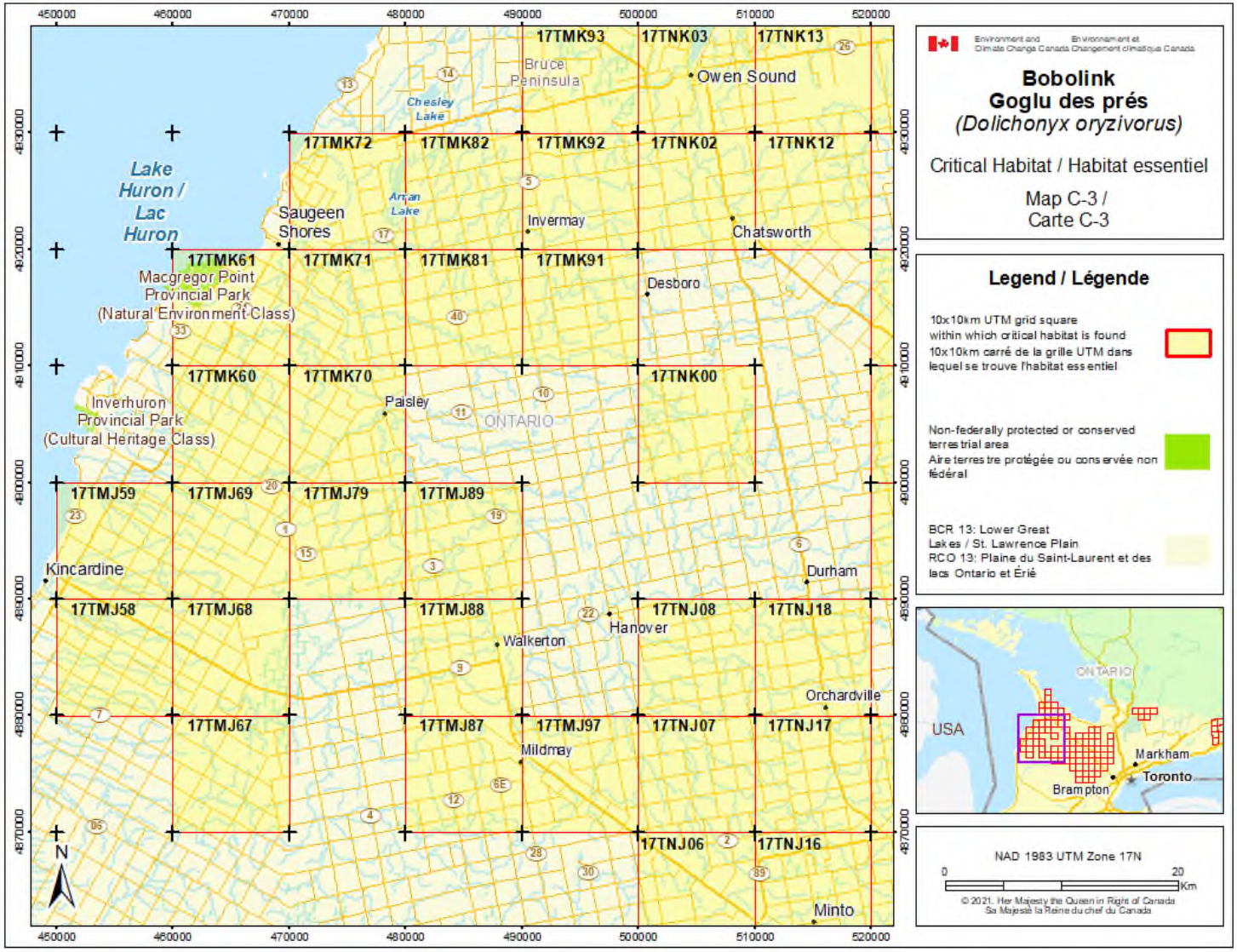

Figure EC-3. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 13 in southwestern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

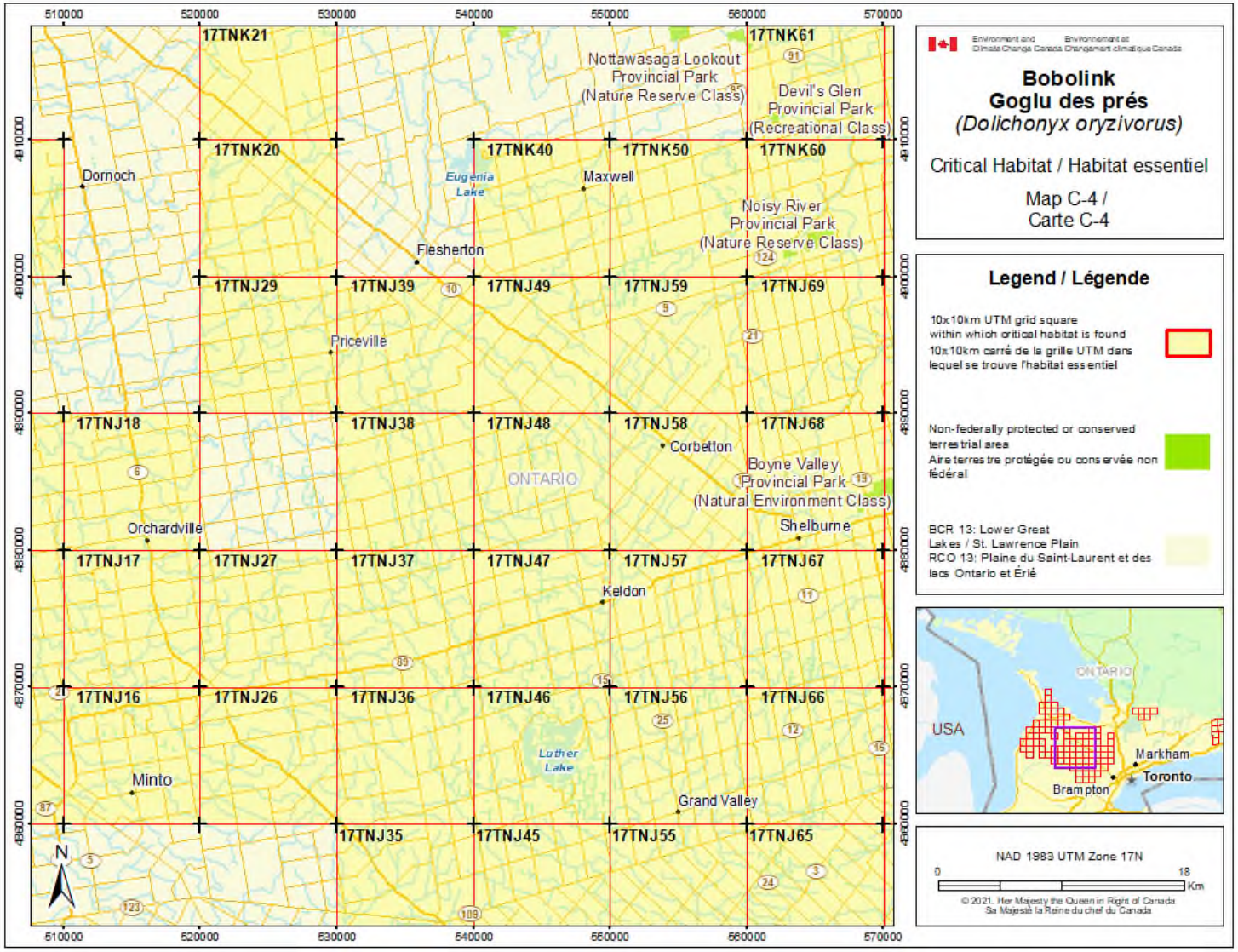

Figure EC-4. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 13 in southwestern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

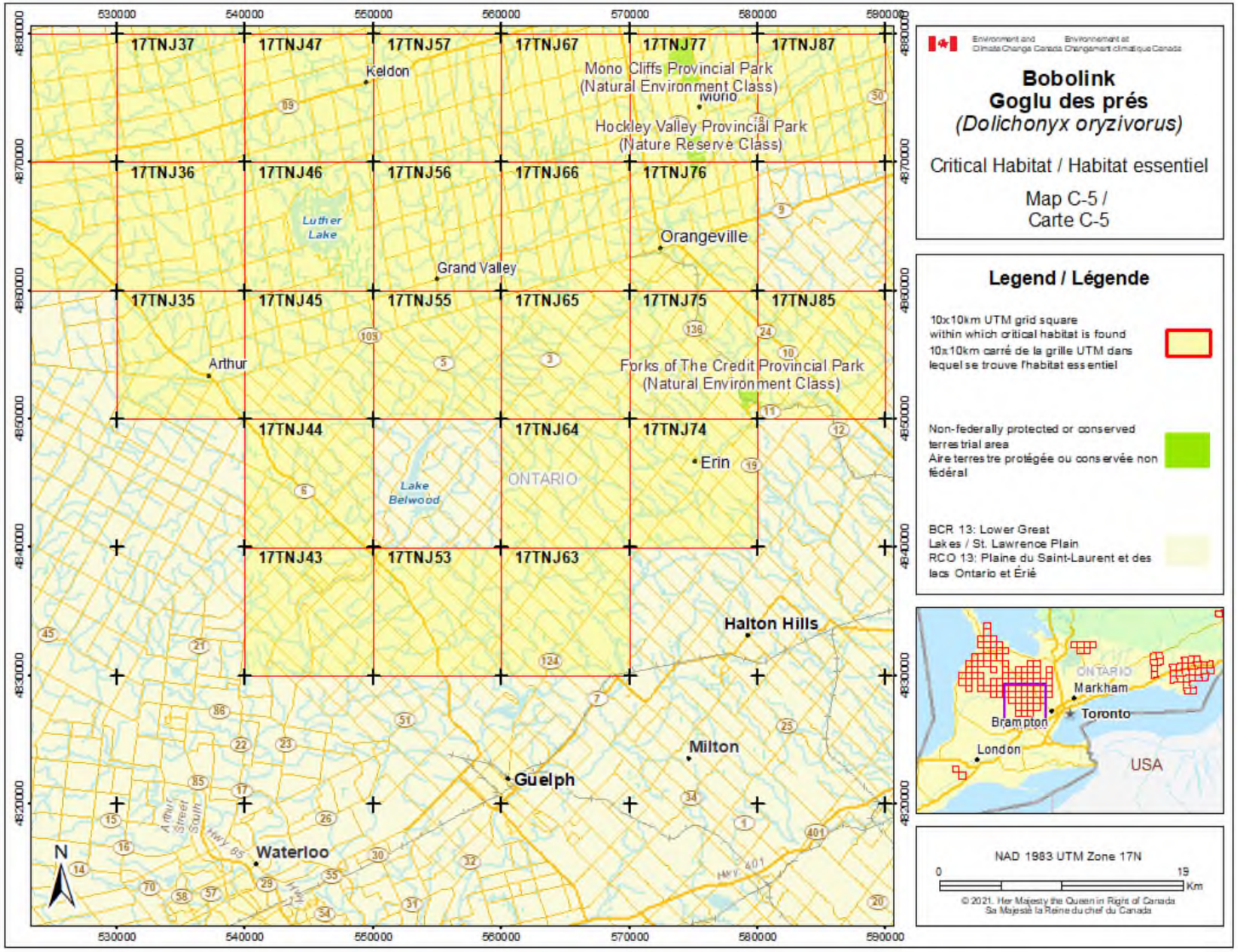

Figure EC-5. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 13 in southwestern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

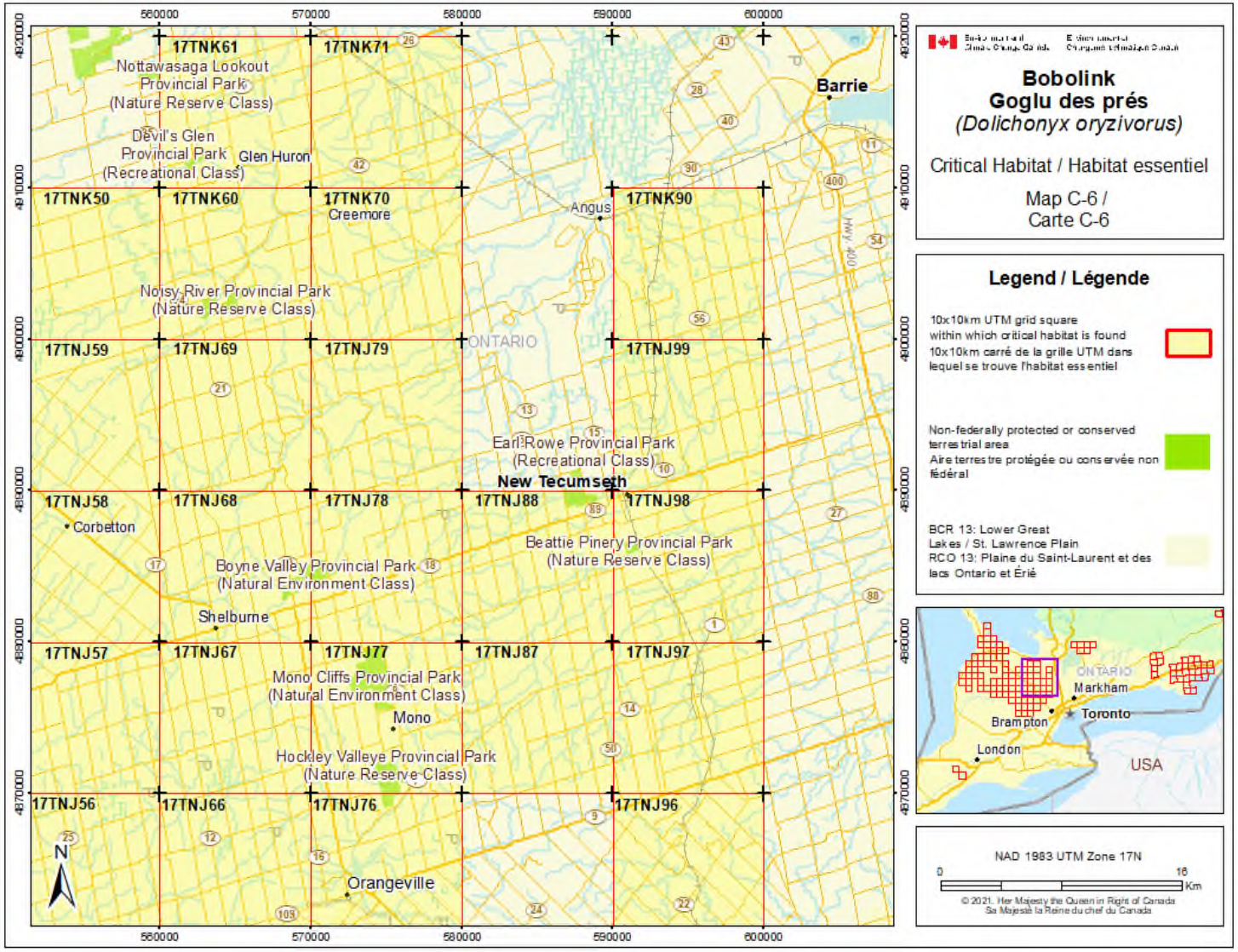

Figure EC-6. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 13 in southwestern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

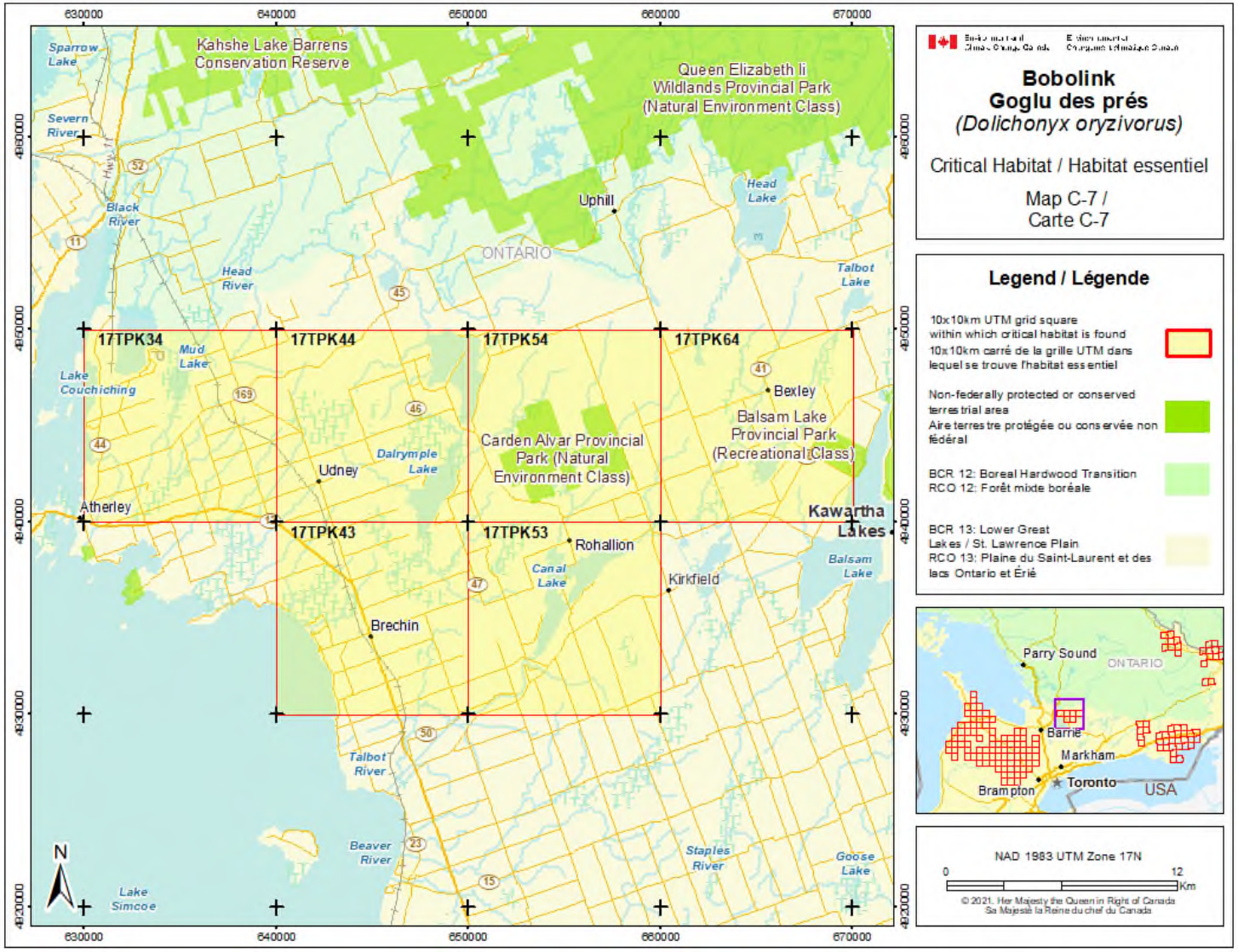

Figure EC-7. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 12 and 13 in southwestern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

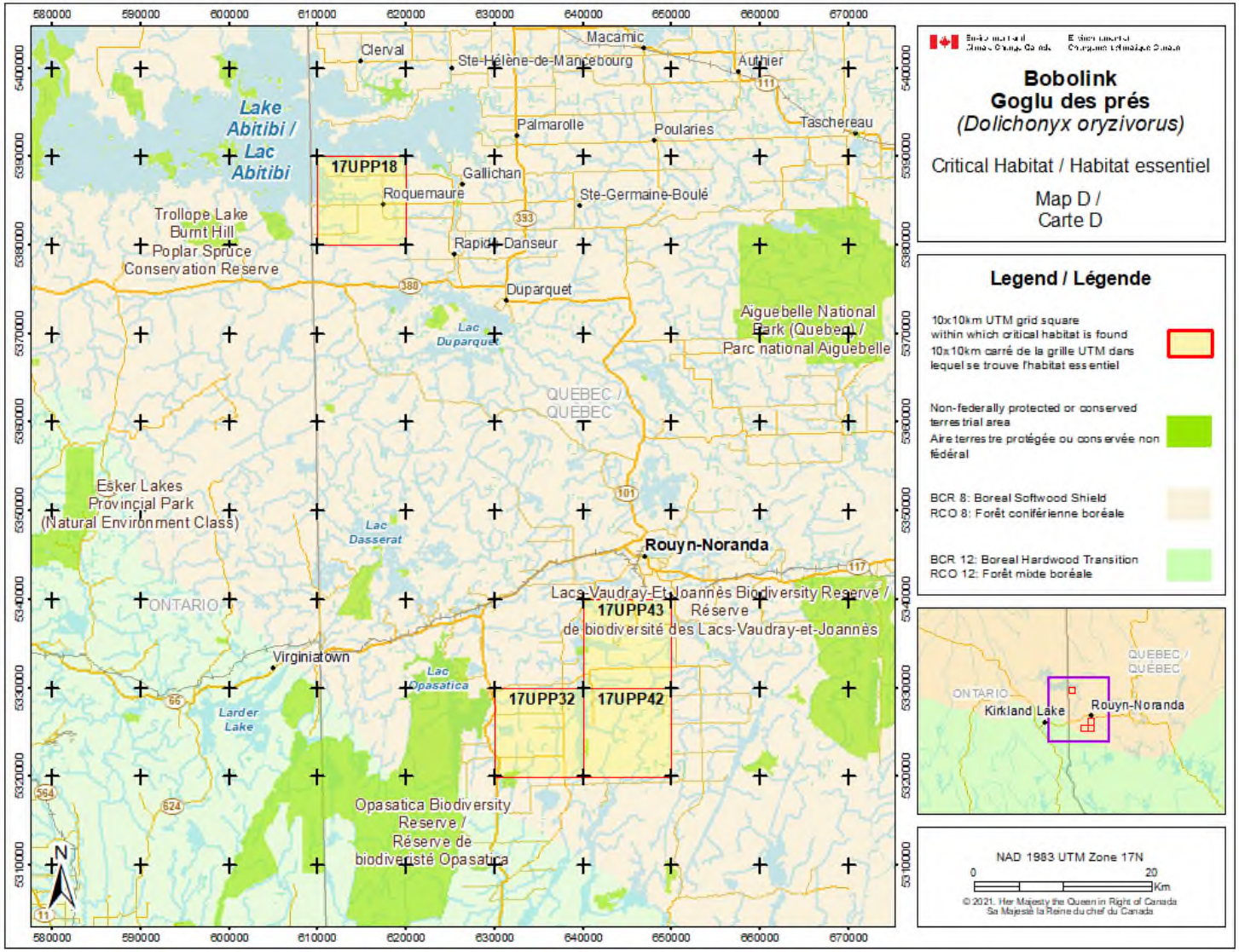

Figure ED. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 8 along the Ontario/Quebec border is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

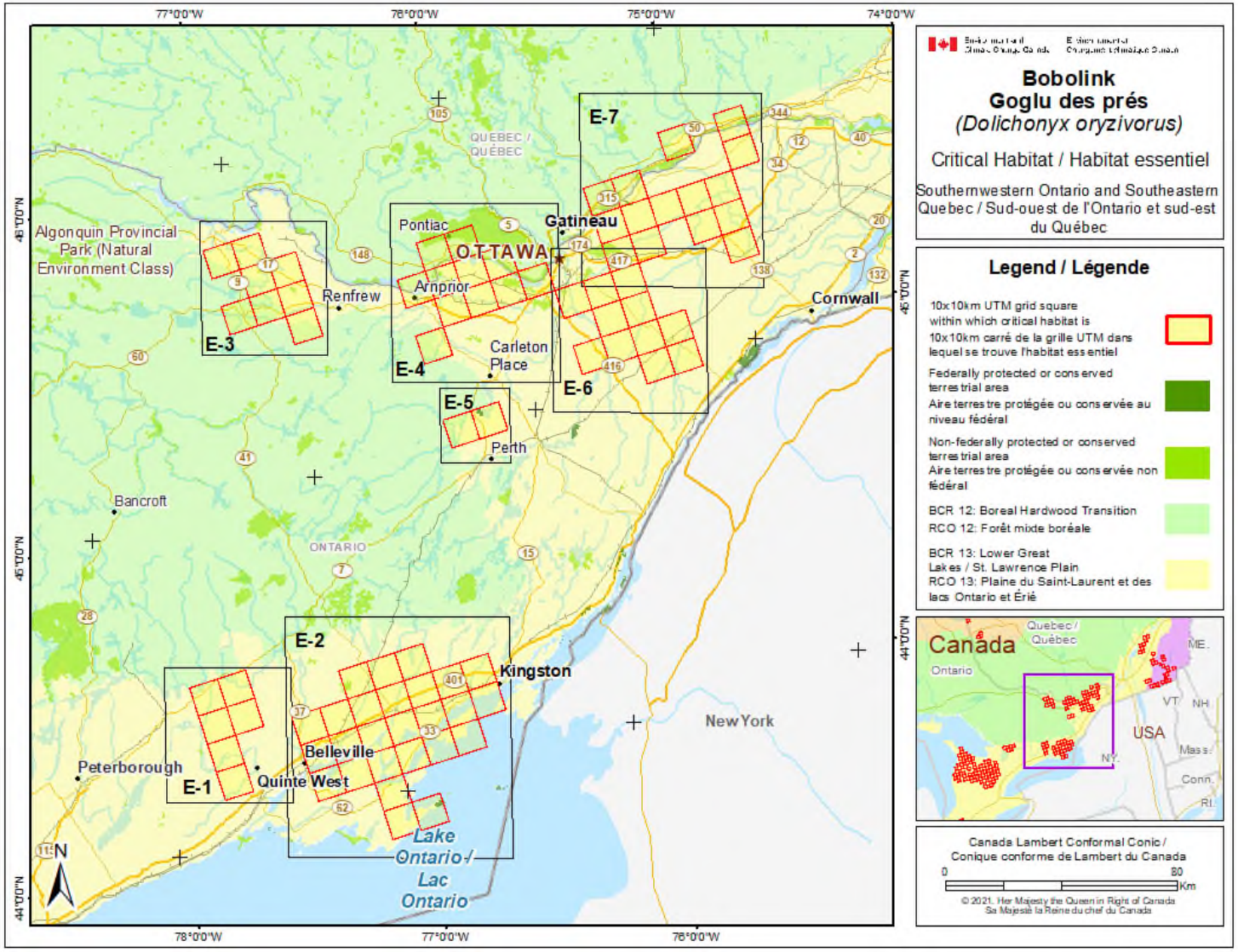

Figure EE. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 12 and 13 in eastern Ontario and southwestern Quebec is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

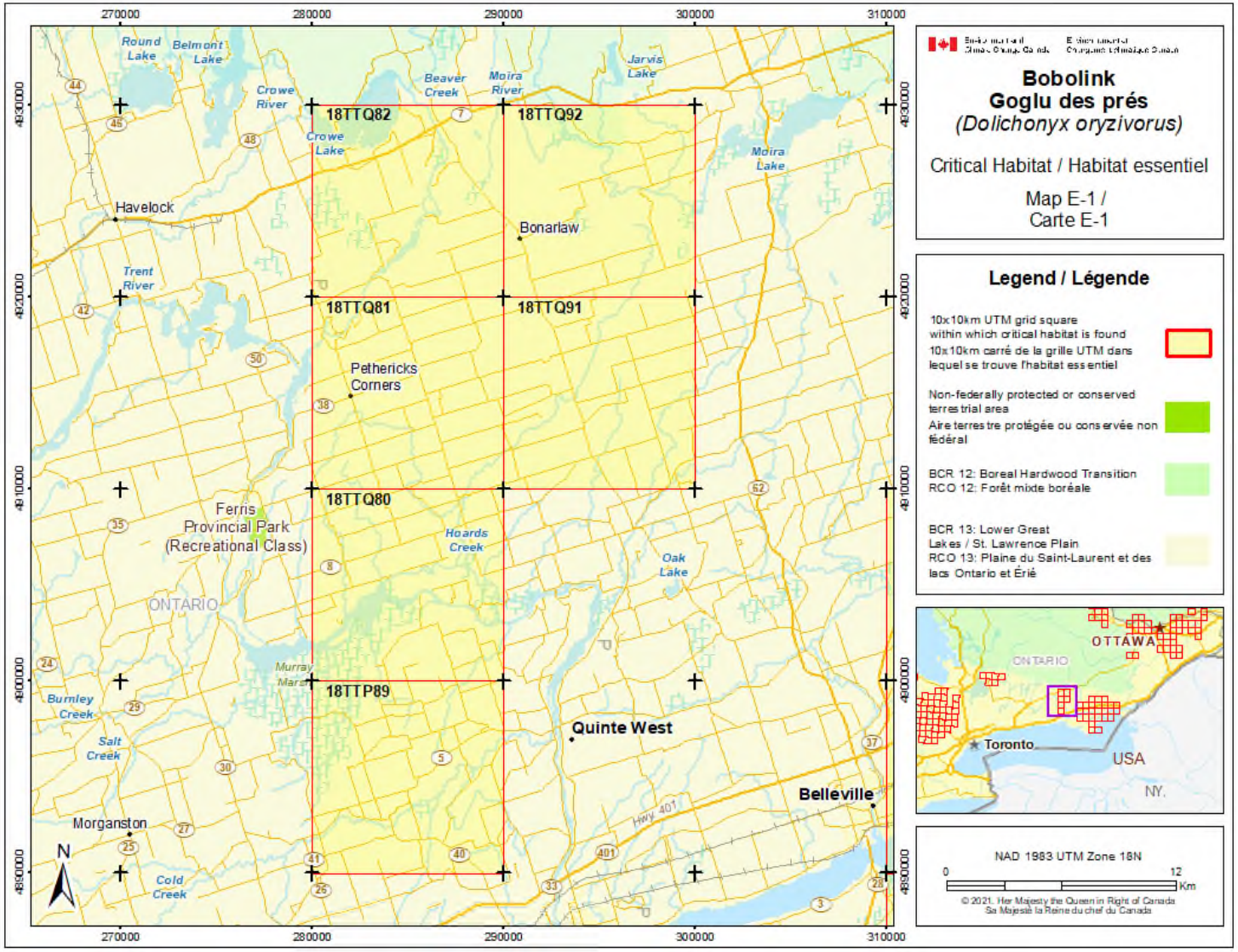

Figure EE-1. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 12 and 13 in eastern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

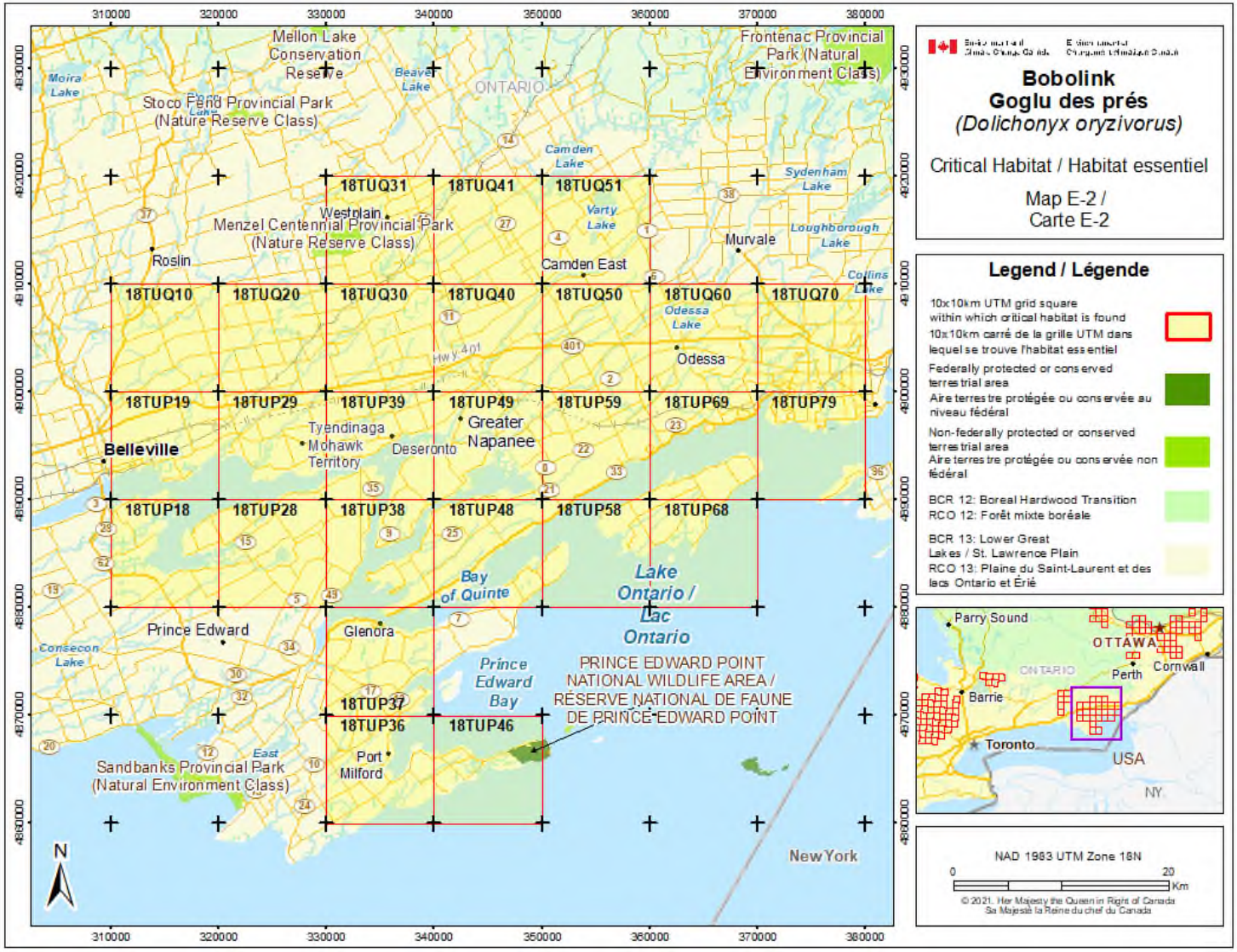

Figure EE-2. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 13 in eastern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

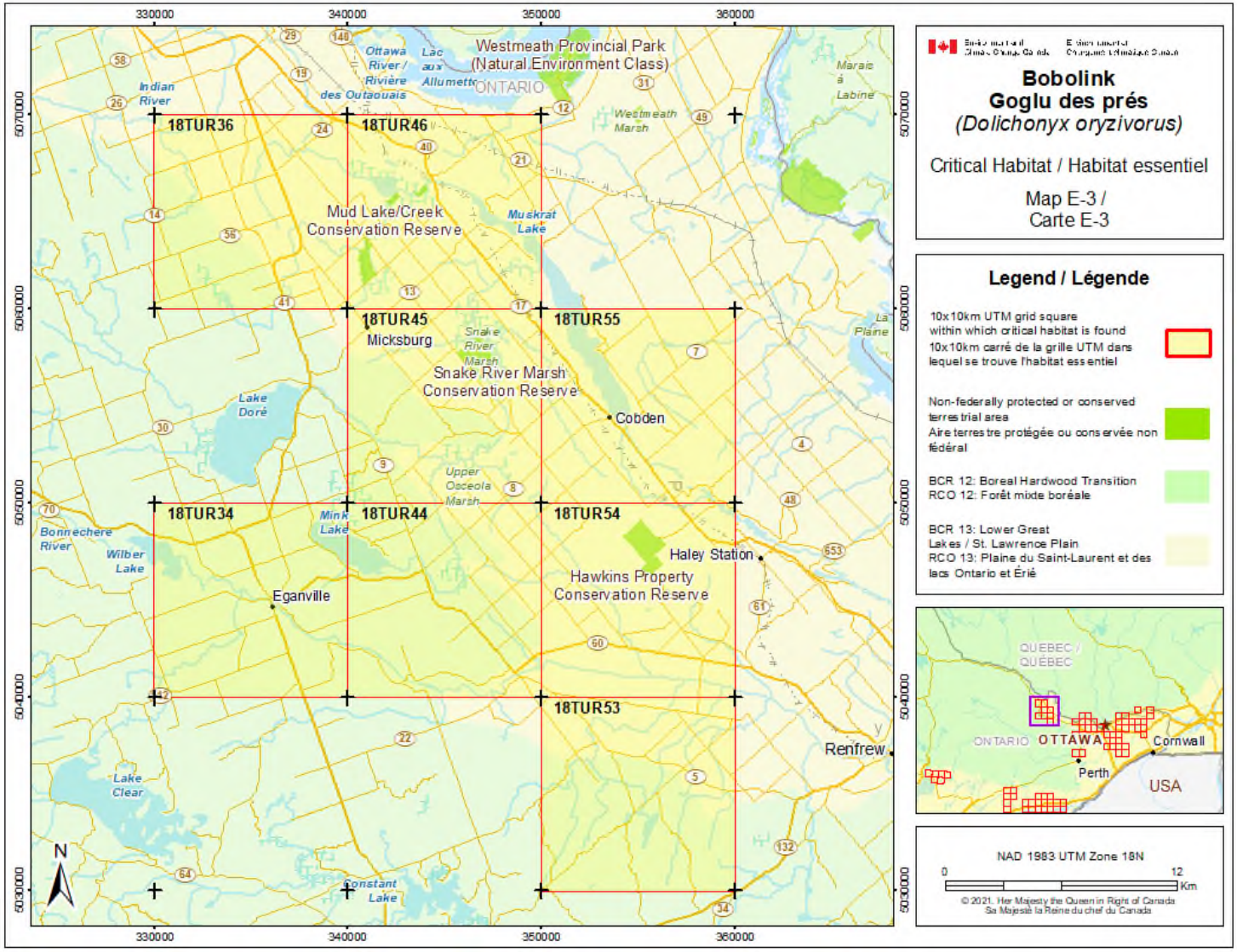

Figure EE-3. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 12 and 13 in eastern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

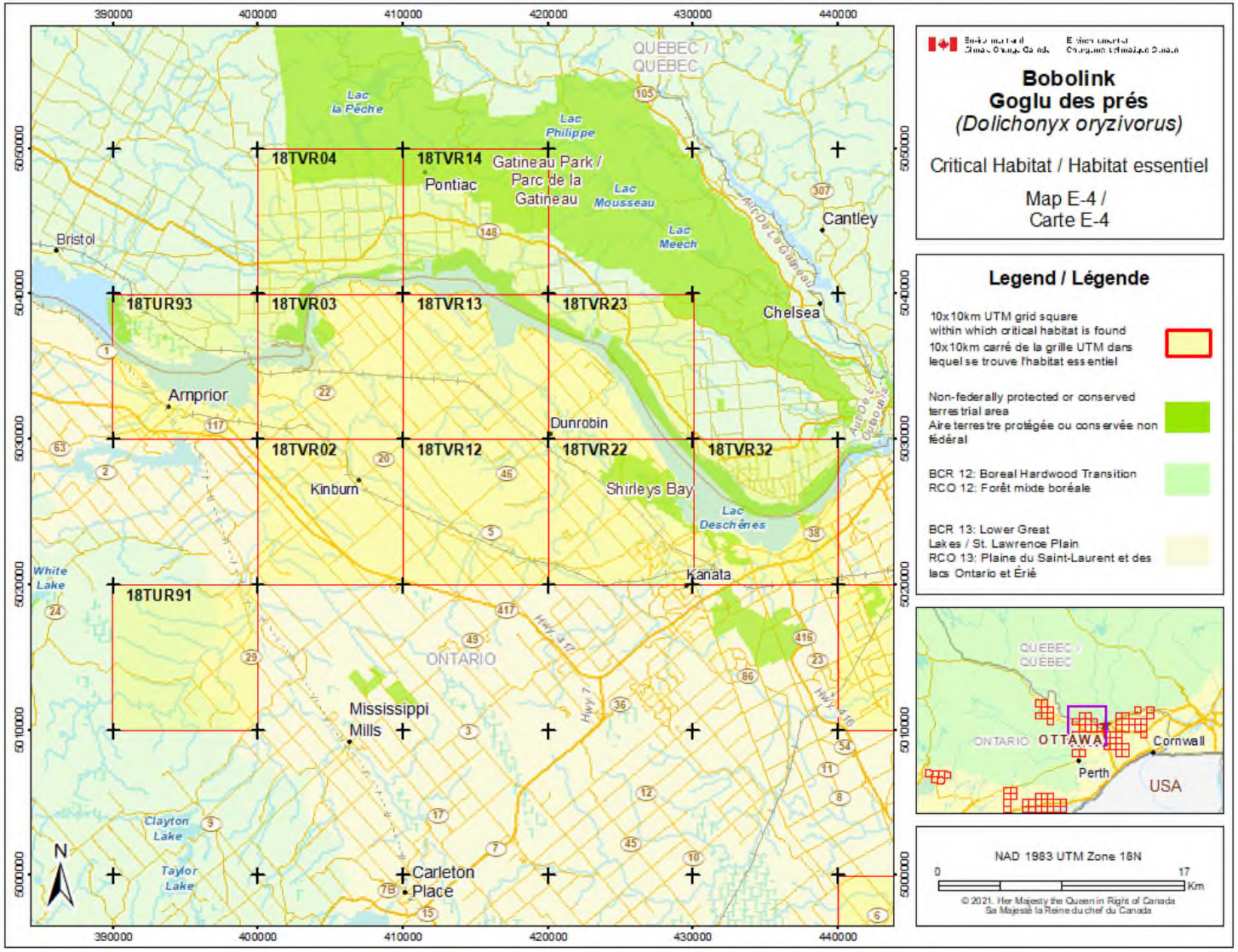

Figure EE-4. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 12 and 13 along the Ontario /Quebec border is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

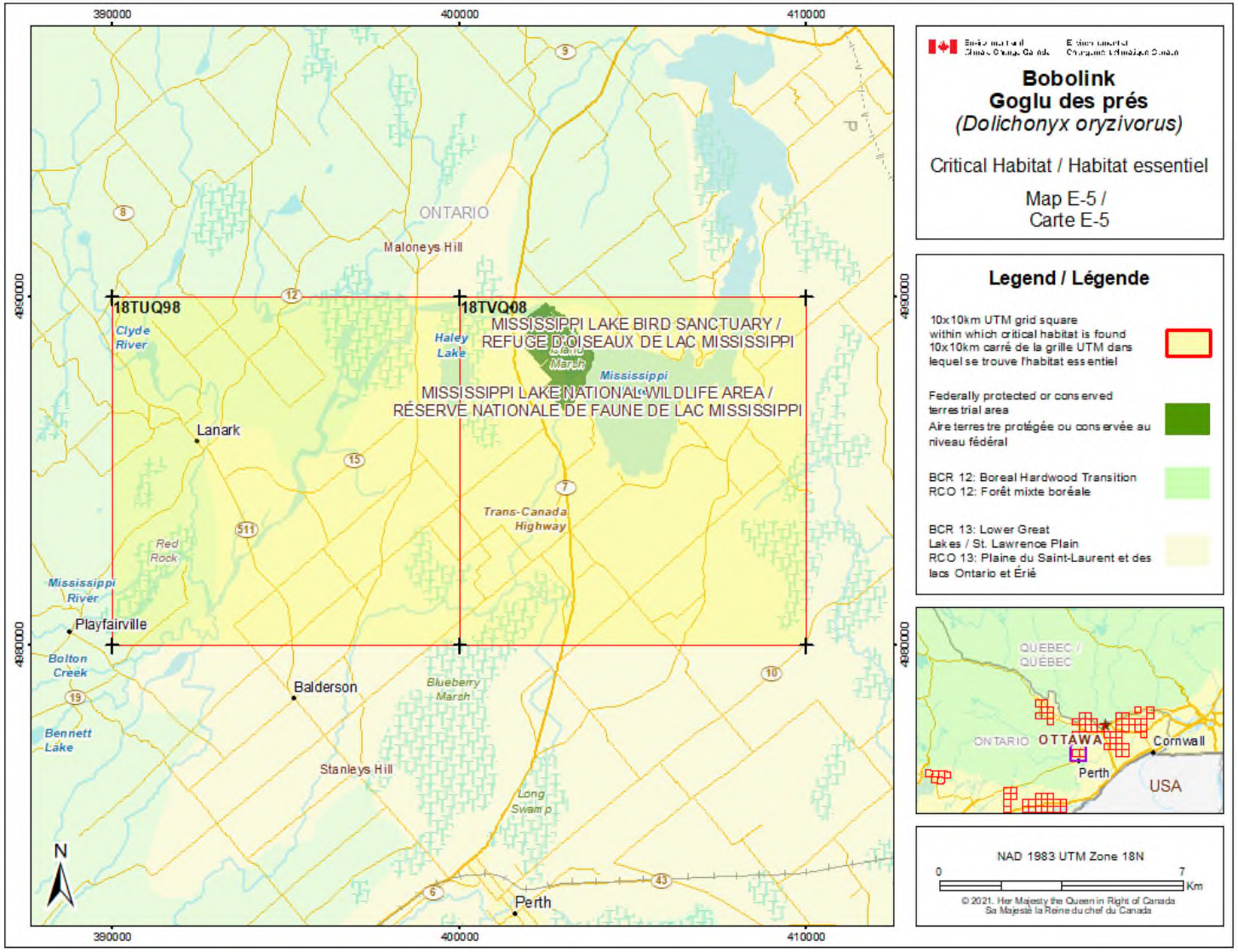

Figure EE-5. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 12 and 13 in eastern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

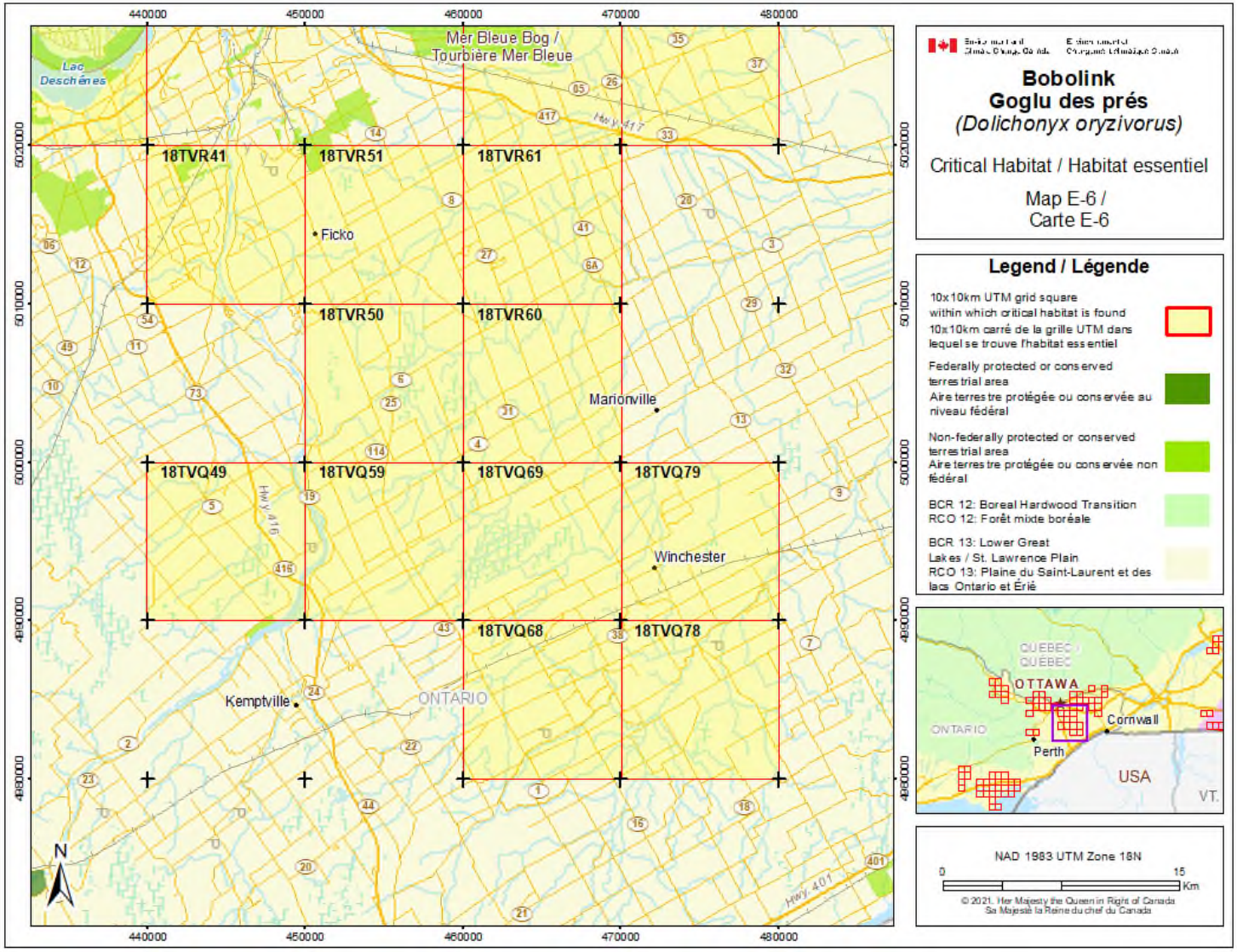

Figure EE-6. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 13 in eastern Ontario is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

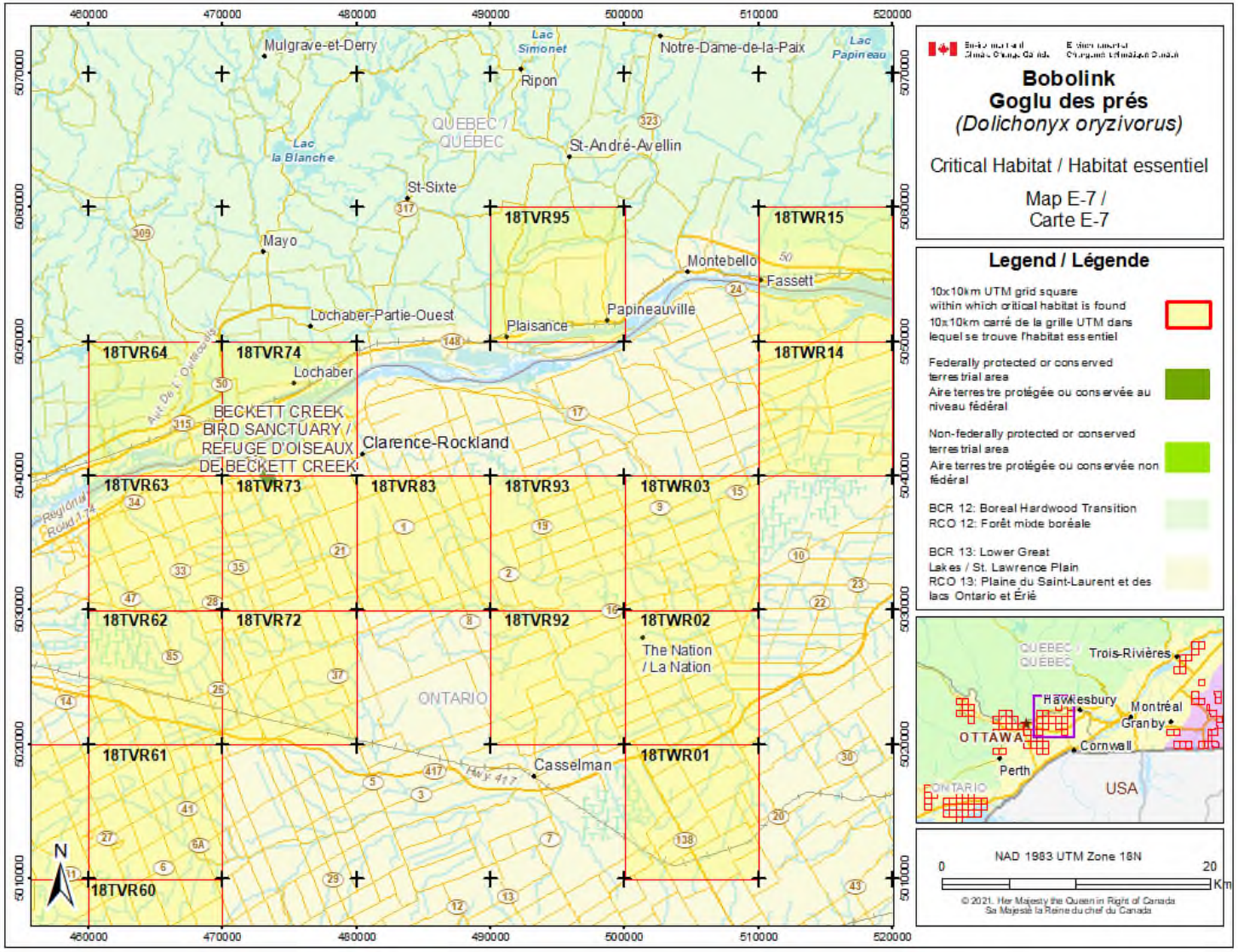

Figure EE-7. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 12 and 13 along the Ontario/Quebec border is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

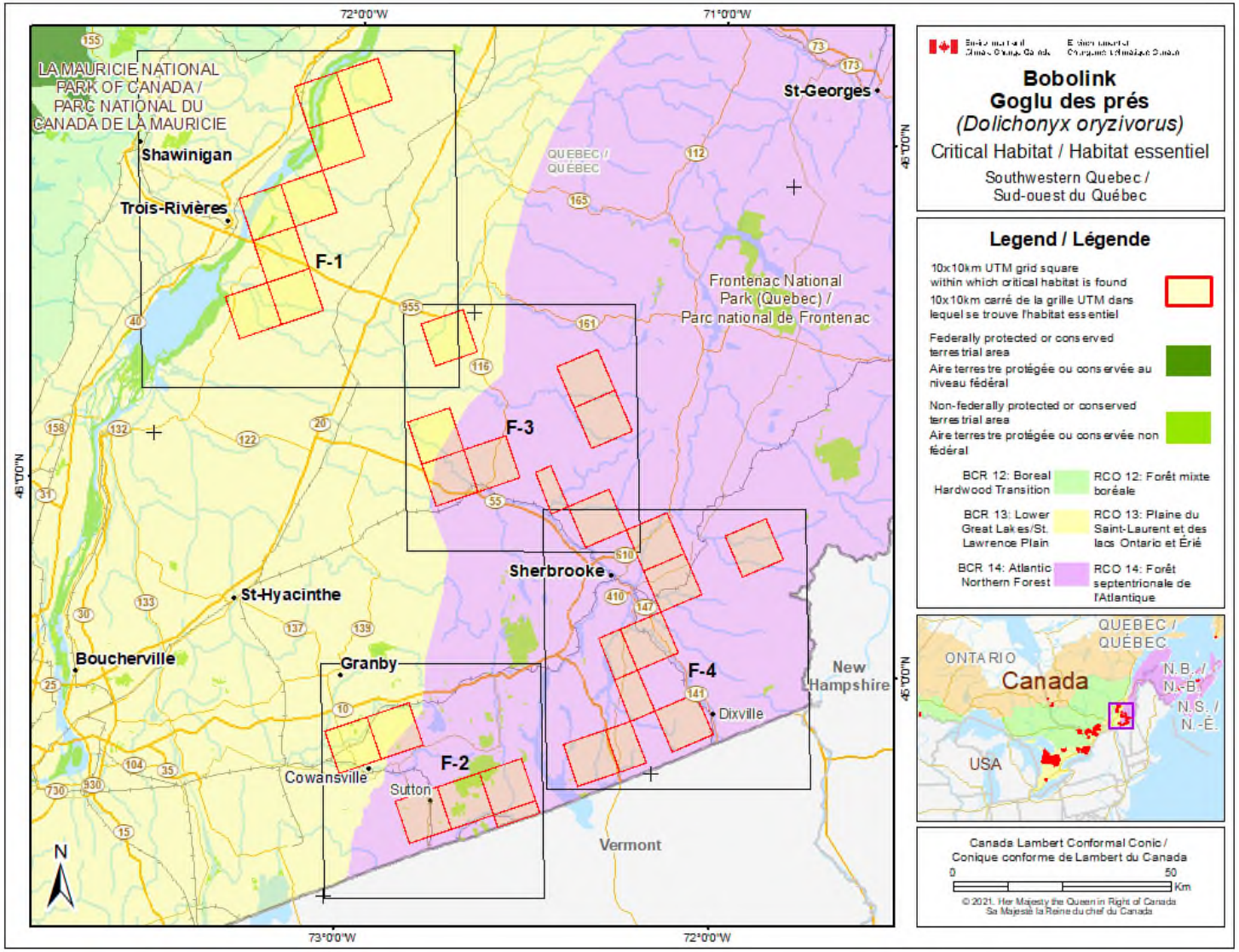

Figure EF. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 13 and 14 in southwestern Quebec is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

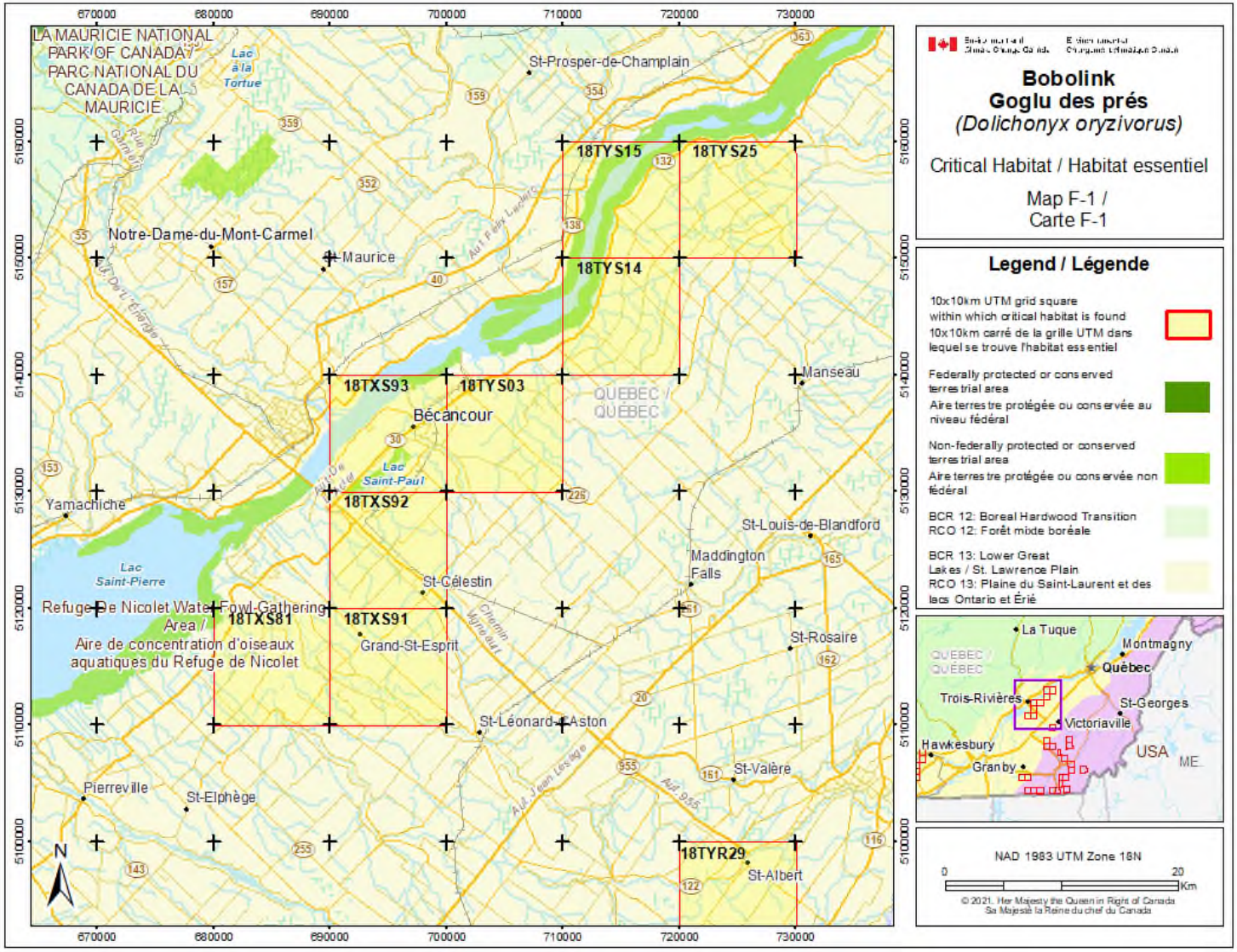

Figure EF-1. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 13 in southwestern Quebec is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

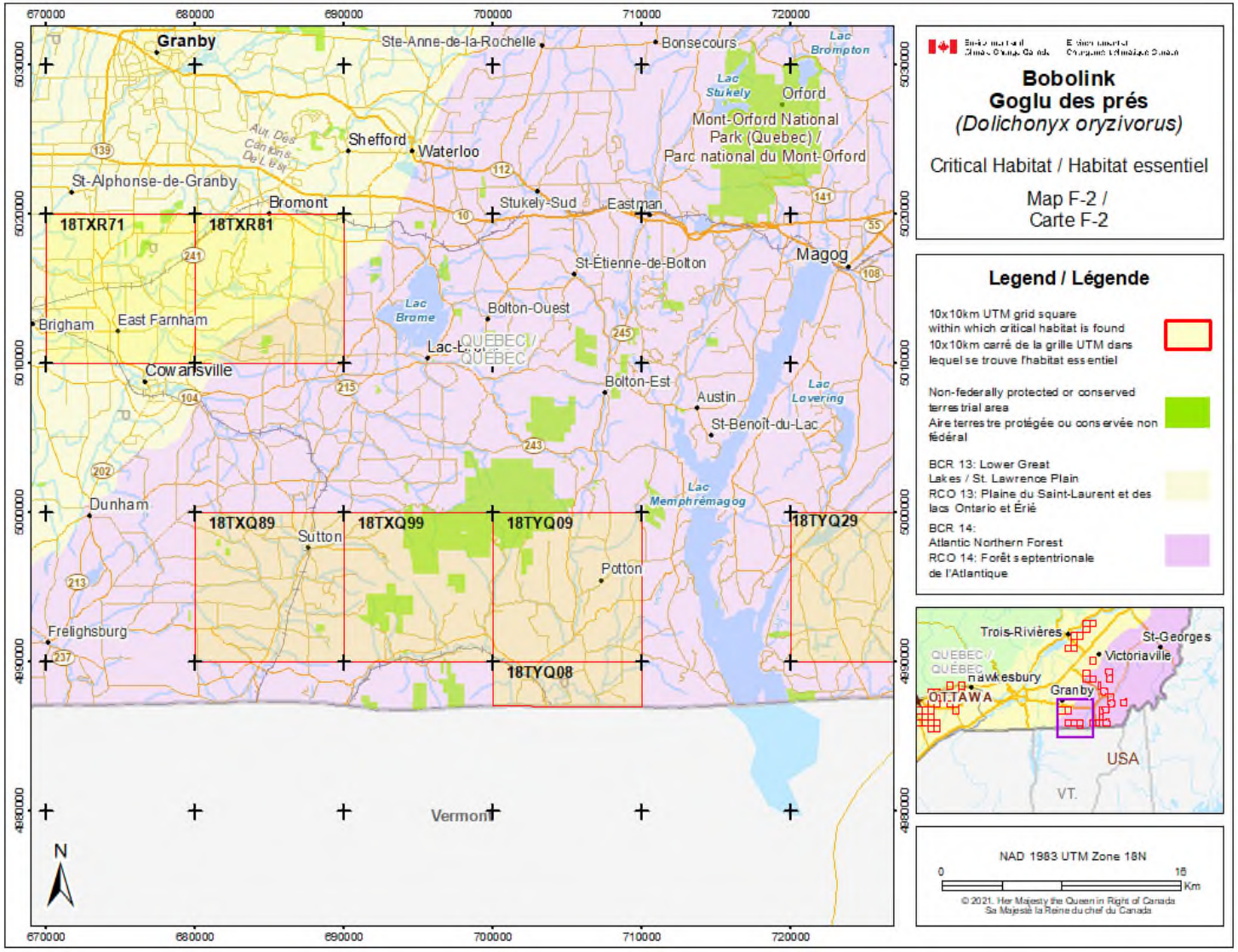

Figure EF-2. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 13 and 14 in southwestern Quebec is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

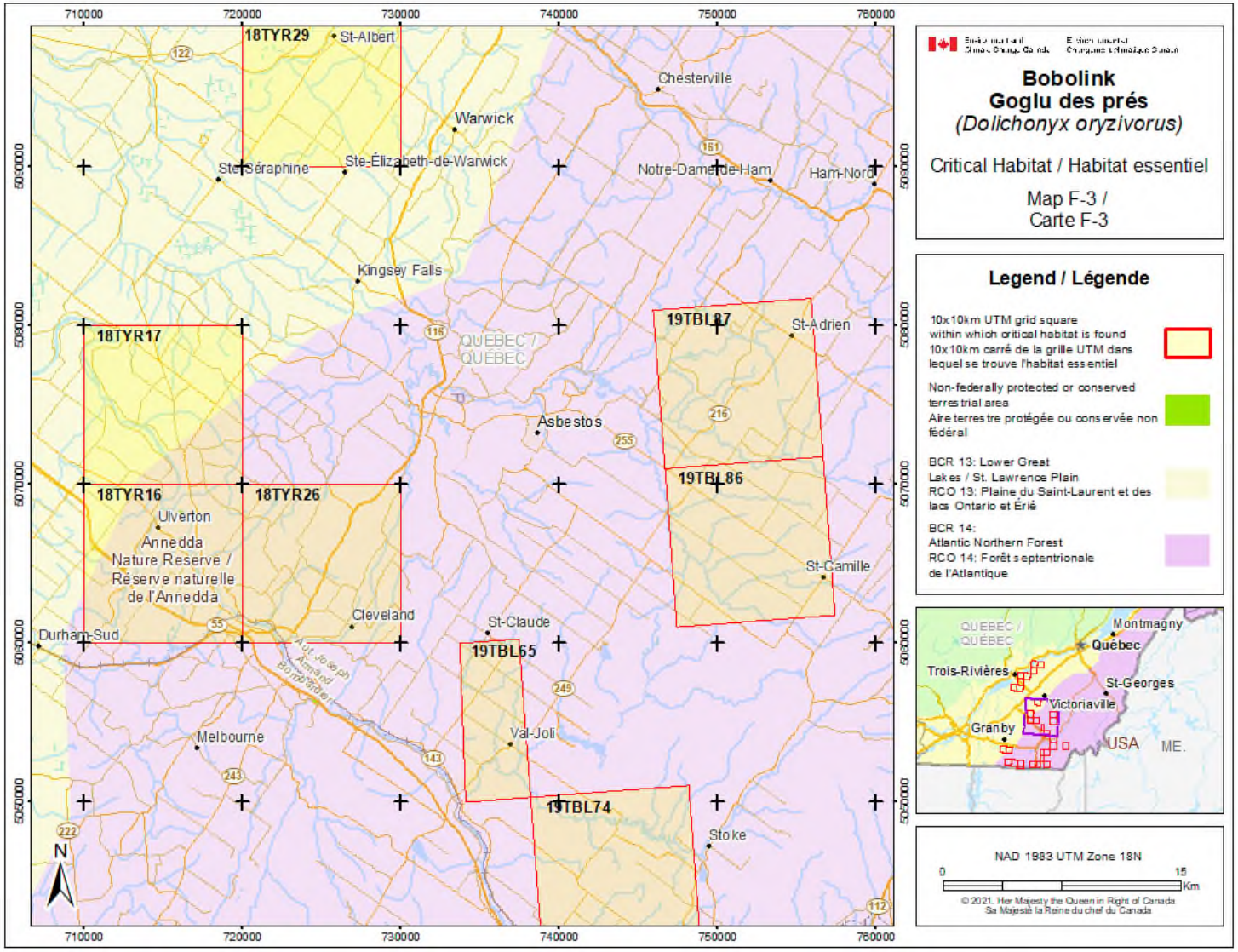

Figure EF-3. Critical habitat for the Bobolink in Bird Conservation Regions (BCR) 13 and 14 in in southwestern Quebec is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

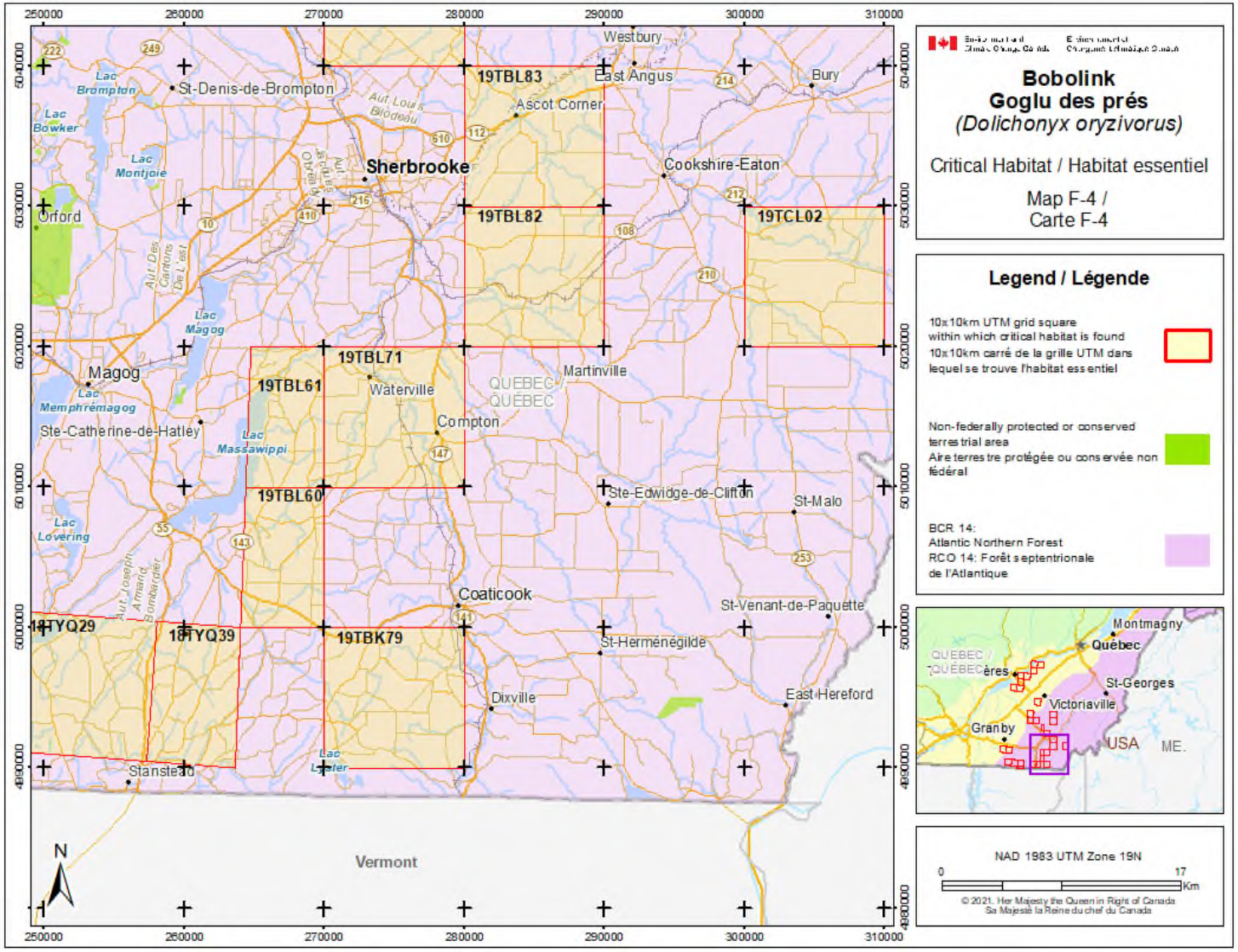

Figure EF-4. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 14 in southwestern Quebec is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

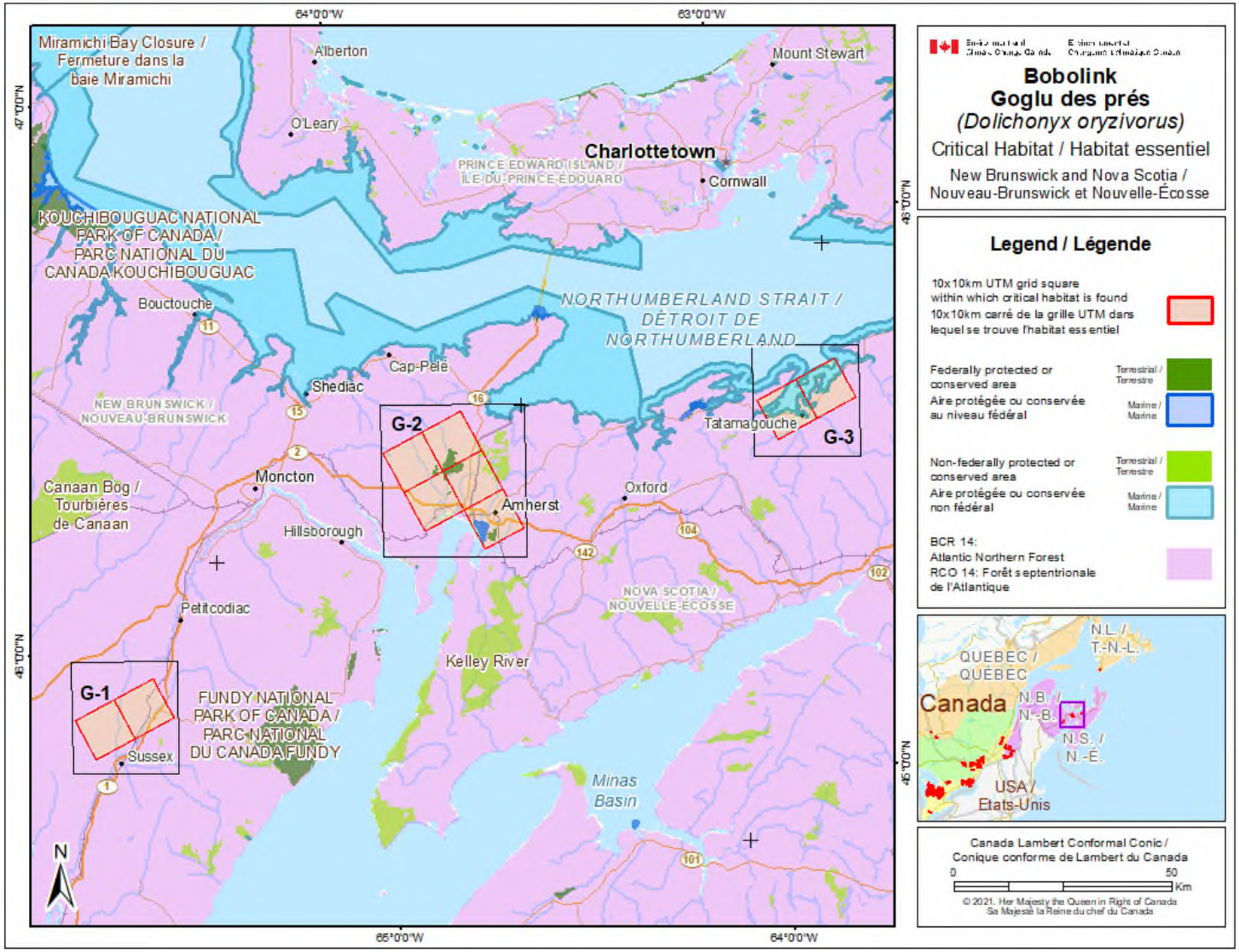

Figure EG. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 14 in New Brunswick and Nova Scotia is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

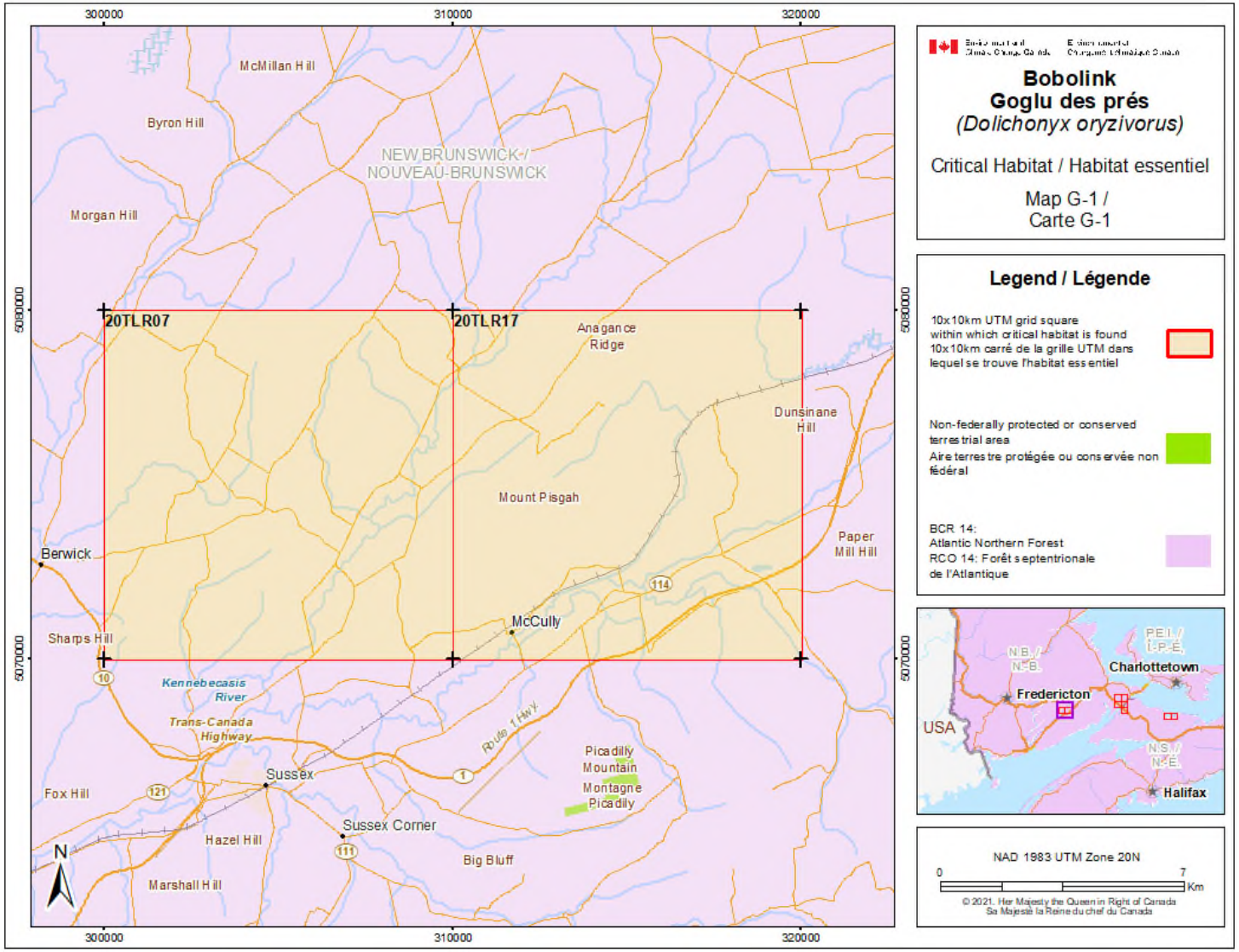

Figure EG-1. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 14 in New Brunswick is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

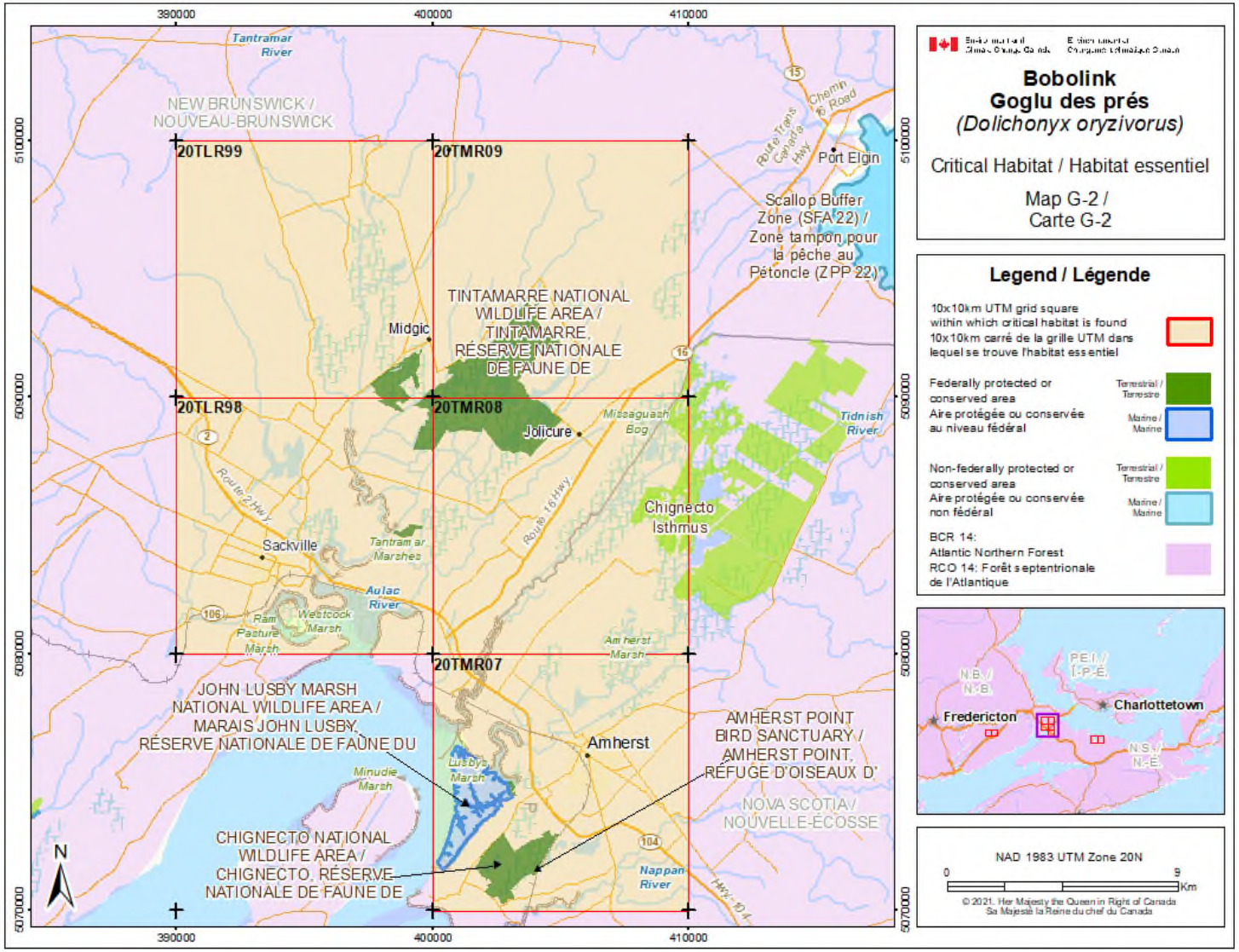

Figure EG-2. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 14 along the New Brunswick/Nova Scotia border is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

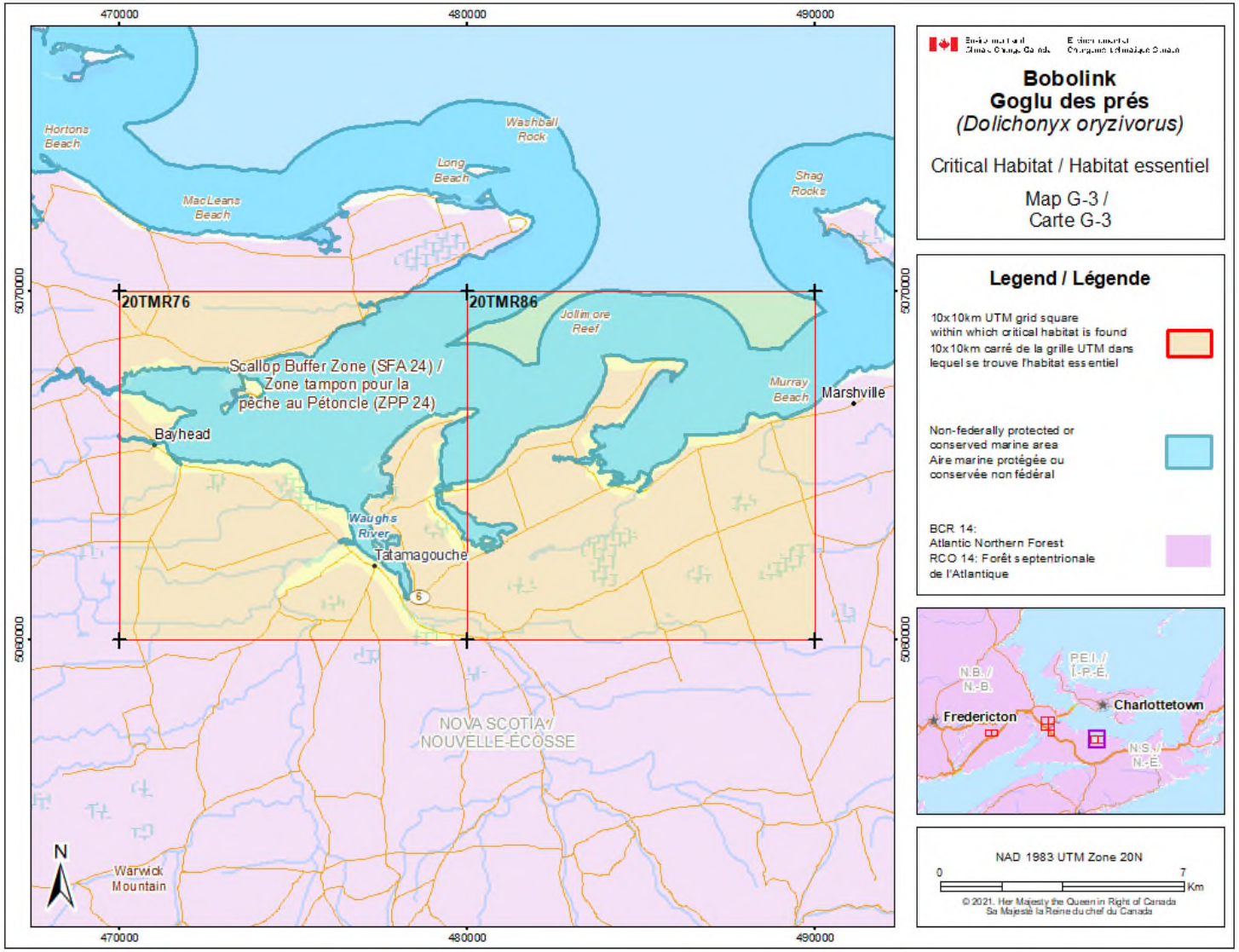

Figure EG-3. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 14 in Nova Scotia border is represented by the shaded yellow 10 x 10 km UTM grid square units; critical habitat occurs within these units where the biophysical attributes described in section 7.1 are met.

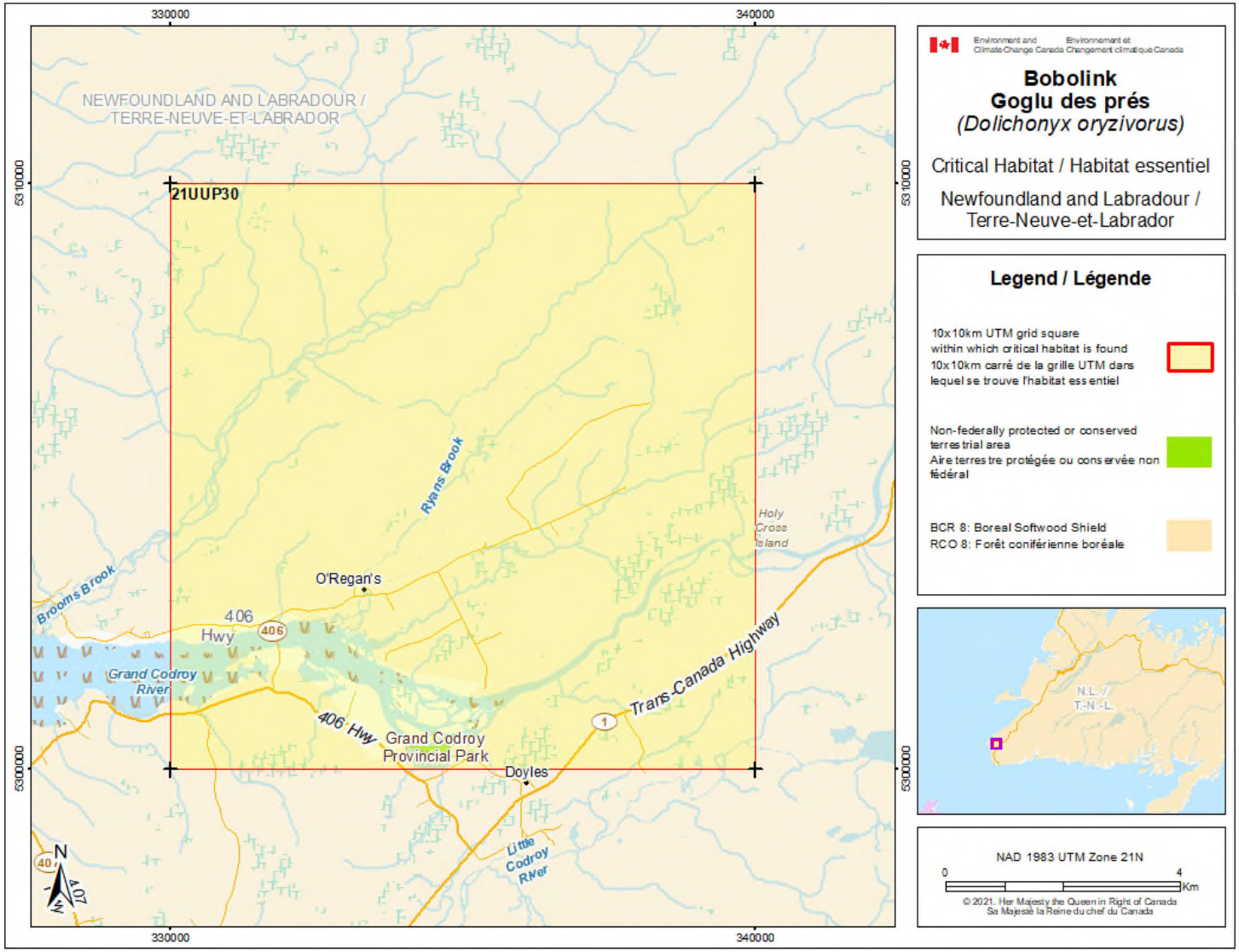

Figure EH. Critical habitat for the Bobolink in Bird Conservation Region (BCR) 8 in Newfoundland and Labrador is represented by the shaded yellow 10 x 10 km UTM grid square unit; critical habitat occurs within this unit where the biophysical attributes described in section 7.1 are met.

Appendix F: Estimated Amount of Habitat within Province x BCR Units with Critical Habitat Identified

Table E1. Estimated amount of habitat where the biophysical attributes of critical habitat could be present within Province x BCR units with critical habitat identified for the Bobolink in Canada. These amounts are estimated based on the Grassland and Pastures/Forages land cover types from the 2019 Annual Crop Inventory (AAFC 2019).

Province x BCR Name (BCR Number)	Estimated amount of native grassland habitat (ha)	Estimated amount of agricultural grassland habitat (ha)	Total estimated amount of grassland habitat (ha)
Saskatchewan – Prairie Potholes (11)	5,566	12,549	18,114
Manitoba – Boreal Taiga Plains (6)	12,259	7,808	20,067
Manitoba - Prairie Potholes (11)	15,665	14,335	30,000
Manitoba – Boreal Hardwood Transition (12)	326	82	407
Ontario - Boreal Hardwood Transition (12)	172	12,934	13,106
Ontario – Lower Great Lakes/ St. Lawrence (13)	3,722	363,854	367,576
Quebec – Boreal Softwood Shield (8)	-	4,744	4,744
Quebec – Boreal Hardwood Transition (12)	-	7,807	7,807
Quebec - Lower Great Lakes/ St. Lawrence (13)	-	18,345	19,804
Quebec – Atlantic Northern Forest (14)	-	31,589	33,267
New Brunswick - Atlantic Northern Forest (14)	21	11,179	11,200
Nova Scotia - Atlantic Northern Forest (14)	44	5,177	5,222
Newfoundland & Labrador - Boreal Softwood Shield (8)	43	277	320

Appendix G: 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*[28]. 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[29] (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.

Recovery activities that protect large tracts of native and agricultural grassland for the Bobolink will benefit the environment in general and are expected to positively affect a number of other species from a variety of taxa requiring similar habitats, including many species at risk (Table F1). However, there could be consequences to those species whose habitat requirements differ from the Bobolink (e.g., forest bird species). Therefore, it is important that stewardship and habitat management activities for the Bobolink 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).

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

2854 **Table F1. List of species at risk that are expected to benefit from recovery**
2855 **activities for the Bobolink**
2856

Common Name	Scientific Name	COSEWIC Status	SARA Status
American Badger, *jacksoni* subspecies	*Taxidea taxus jacksoni*	Endangered	Endangered
American Badger, *jeffersonii* subspecies	*Taxidea taxus jeffersonii*	Endangered	Endangered
American Badger, *taxus* subspecies	*Taxidea taxus taxus*	Special Concern	Special Concern
Barn Owl, Western population	*Tyto alba*	Threatened	Threatened
Barn Owl, Eastern population	*Tyto alba*	Endangered	Endangered
Burrowing Owl	*Athene cunicularia*	Endangered	Endangered
Baird's Sparrow	*Ammodramus bairdii*	Special Concern	Special Concern
Barn Swallow	*Hirundo rustica*	Special Concern	Threatened
Chestnut-collared Longspur	*Calcarius ornatus*	Endangered	Threatened
Climbing Prairie Rose	*Rosa setigera*	Special Concern	Special Concern
Colicroot	*Aletris farinosa*	Endangered	Endangered
Common Nighthawk	*Chordeiles minor*	Special Concern	Threatened
Dense Blazing Star	*Liatris spicata*	Threatened	Threatened
Eastern Foxsnake, Carolinian population	*Pantherophis gloydi*	Endangered	Endangered
Eastern Foxsnake, Great Lakes / St. Lawrence population	*Pantherophis gloydi*	Endangered	Endangered
Eastern Meadowlark	*Sturnella magna*	Threatened	Threatened
Eastern Persius Duskywing	*Erynnis persius persius*	Endangered	Endangered
Ferruginous Hawk	*Buteo regalis*	Threatened	Threatened
Gattinger's Agalinis	*Agalinis gattingeri*	Endangered	Endangered

Common Name	Scientific Name	COSEWIC Status	SARA Status
Golden-winged Warbler	*Vermivora chrysoptera*	Threatened	Threatened
Grasshopper Sparrow, *pratensis* subspecies	*Ammodramus savannarum pratensis*	Special Concern	Special Concern
Henslow's Sparrow	*Ammodramus henslowii*	Endangered	Endangered
Hill's Thistle	*Cirsium hillii*	Threatened	Threatened
Loggerhead Shrike, *migrans* subspecies	*Lanius ludovicianus migrans*	Endangered	Endangered
Loggerhead Shrike, Prairie subspecies	*Lanius ludovicianus excubitorides*	Threatened	Threatened
Massasauga, Carolinian population	*Sistrurus catenatus*	Endangered	Endangered
Massasauga, Great Lakes / St. Lawrence population	*Sistrurus catenatus*	Threatened	Threatened
Eastern Milksnake	*Lampropeltis triangulum*	Special Concern	Special Concern
Monarch	*Danaus plexippus*	Endangered	Special Concern
Northern Bobwhite	*Colinus virginianus*	Endangered	Endangered
Pink Milkwort	*Polygala incarnata*	Endangered	Endangered
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Endangered	Endangered
Rusty-patched Bumble Bee	*Bombus affinis*	Endangered	Endangered
Short-eared Owl	*Asio flammeus*	Threatened	Special Concern
Skinner's Agalinis	*Agalinis skinneriana*	Endangered	Endangered
Slender Bush-clover	*Lespedeza virginica*	Endangered	Endangered
Small White Lady's-slipper	*Cypripedium candidum*	Threatened	Threatened
Small-mouthed Salamander	*Ambystoma texanum*	Endangered	Endangered
Sprague's Pipit	*Anthus spragueii*	Threatened	Threatened

Common Name	Scientific Name	COSEWIC Status	SARA Status
Western Silvery Aster	*Symphyotrichum sericeum*	Threatened	Threatened
White Prairie Gentian	*Gentiana alba*	Endangered	Endangered
Willowleaf Aster	*Symphyotrichum praealtum*	Threatened	Threatened

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