

Recovery Strategy (Amended) and Action Plan for the Piping Plover *melodus* subspecies (*Charadrius melodus melodus*) in Canada

Piping Plover *melodus* subspecies



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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 and action plans (for species for which recovery has been deemed feasible) for species listed as Extirpated, Endangered and Threatened species. They are also required to report on progress within five years after the publication of the final document on the Species at Risk Public Registry.

This document has been prepared to meet the requirements under SARA of both a recovery strategy and an action plan. As such, it provides both the strategic direction for the recovery of the species, including the population and distribution objectives for the species, as well as the more detailed recovery measures to support this strategic direction, outlining what is required to achieve the objectives. SARA requires that an action plan also include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation. It is important to note that the setting of population and distribution objectives and the identification of critical habitat are science-based exercises and socio-economic factors were not considered in their development. The socio-economic evaluation only applies to the more detailed recovery measures. The recovery strategy and action plan are considered part of a series of documents that are linked and should be taken into consideration together, along with the COSEWIC status report.

The Minister of Environment and Climate Change and Minister responsible for the Parks Canada Agency is the competent minister under SARA for the Piping Plover *melodus* subspecies and has prepared this recovery strategy and action plan, as per sections 37 and 47 of SARA. To the extent possible, it has been prepared in cooperation with the Provinces of Quebec, New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland and Labrador. It was developed in cooperation and consultation with the Eastern Canadian Piping Plover Recovery Team, non-governmental organizations, Indigenous organizations and other stakeholders as per section 39(1) and 48(1) of SARA.

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

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

Implementation of this recovery strategy and action plan 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 area³ be described in the *Canada Gazette* within 90 days after the recovery strategy or action plan that identified the critical habitat is included in the public registry. A prohibition against destruction of critical habitat under ss. 58(1) will apply 90 days after the description of the critical habitat is published in the *Canada Gazette*.

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

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

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.

Acknowledgments

This recovery document was prepared by Julie McKnight (Environment and Climate Change Canada, Canadian Wildlife Service (ECCC-CWS) – Atlantic Region) with significant input from François Shaffer, ECCC-CWS Atlantic and other Quebec Region Biologists. Critical Habitat maps were produced by Matt Mahoney (ECCC-CWS – Atlantic Region). Acknowledgement and thanks are extended to other parties that provided advice and input to help inform the development of this document including relevant Indigenous Organizations and individuals, provincial and territorial governments, other federal departments (e.g., PCA), landowners, citizens and stakeholders. Much thoughtful input and advice was provided by the Eastern Canadian Piping Plover Recovery Team and associated working groups.

Executive Summary

This recovery strategy updates and replaces the Recovery Strategy for the Piping Plover (*Charadrius melodus melodus*) in Canada (Environment Canada 2012) which was published as final on the Species at Risk Public Registry in August 2012.

Under Section 45 of the *Species at Risk Act* (SARA), the competent Minister may amend a recovery strategy at any time. This Recovery Strategy (Amended) and Action Plan for the Piping Plover *melodus* subspecies (*Charadrius melodus melodus*) in Canada is for the purposes of:

- updating information in most sections of the Recovery Strategy for Piping Plover (*Charadrius melodus melodus*) in Canada (Environment Canada 2012); especially the following sections:
 - Recovery Feasibility Summary;
 - Needs of Piping Plover; and
 - Population and Distribution Objectives
- updating and refining the Critical Habitat Section 7 of the Recovery Strategy for Piping Plover (*Charadrius melodus melodus*) in Canada (Environment Canada 2012) to provide clarity on the specific locations of critical habitat; and
- concurrently adding an action plan to the document based on the amended recovery strategy and in turn meeting requirements of SARA s. 49.

In some cases, additional changes have been made to the Recovery Strategy (Amended) and Action Plan for the Piping Plover *melodus* subspecies (*Charadrius melodus melodus*) in Canada (hereafter, “amended recovery document”) to align the document with current guidelines and templates for recovery documents.

This amended recovery document is being posted on the Species at Risk Public Registry for a 60-day comment period. At the time of final posting, the Recovery Strategy (Amended) and Action Plan for the Piping Plover *melodus* subspecies (*Charadrius melodus melodus*) in Canada will replace the 2012 Recovery Strategy for Piping Plover (*Charadrius melodus melodus*) in Canada (Environment Canada 2012).

Piping Plover is a small, stocky shorebird that depends on its cryptic coloration to avoid predators. The species only nests in North America and occurs in two populations in Canada, each with subspecies status: the *melodus* subspecies breeds along the Atlantic coast of Canada and the *circumcinctus* subspecies breeds inland, in the prairie provinces and Great Lakes region.

This recovery document applies only to the *melodus* subspecies of Piping Plover. There are unknowns regarding the feasibility of recovery for the species as presented in the recovery feasibility summary section. In keeping with the precautionary principle, this recovery strategy and action plan has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be technically and biologically feasible.

Piping Plover *melodus* subspecies, hereafter Piping Plover or plover, was listed on Schedule 1 of SARA, at proclamation, in June 2003. In Quebec, Piping Plover is listed as a threatened species according the Loi sur les espèces menacées ou vulnérables (RLRQ, c E-12.01) (Act respecting threatened or vulnerable species) (CQLR, c E-12.01). The species is listed as Endangered under provincial legislation in New Brunswick, Nova Scotia and Newfoundland and Labrador. The Province of Prince Edward Island is reviewing the status of species to establish its list of species at risk.

This document has been prepared to meet the requirements under SARA of both a recovery strategy and an action plan. As such, it provides both the strategic direction for the recovery of the species as well as the more detailed recovery measures to support this strategic direction, outlining what is required to achieve the objectives.

Factors which directly threaten the survival of individuals include residential & commercial development (housing and urban areas), human intrusions and disturbance (e.g., motorized vehicles, beach users), problematic native species/diseases (predators), natural system modifications (e.g., beach nourishment, shoreline stabilization, beach cleaning or raking), pollution, climate change and severe weather (e.g., storms and flooding) and energy production and mining (e.g., sand and beach sediments).

The short-term population objectives are to achieve a minimum of 250 year-end pairs of Piping Plover and an annual productivity of 1.65 chicks fledged per pair. Long-term, the objectives are to increase to and maintain the population at 310 pairs; proportionally represented in each province to meet historical estimates.

Broad strategies to be taken to address the threats to the recovery of Piping Plover are presented in section 6.2: Recovery Planning Table and Implementation Schedule. An implementation schedule is included as part of the action plan requirements (s. 49) and prioritizes each recovery measure and delineates timelines.

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. Critical habitat is fully identified for Piping Plover in this document to the extent possible given the best available information.

The direct and societal costs of implementing the recovery measures contained in this document (as part of the action plan content) are expected to be low (between \$0 and \$5 million) over the short term (five years) and will have limited socio-economic impact and constraints to human land use. Indirect costs are expected to be minimal and resulting benefits relate to the value of biodiversity to Canadians, ecosystem services, and conservation of other species.

Recovery Feasibility Summary

Based on the following four criteria that Environment and Climate Change Canada uses to establish recovery feasibility, there are unknowns regarding the feasibility of recovery for Piping Plover *melodus* subspecies. In keeping with the precautionary principle, this recovery document has been prepared as per section 41(1) of SARA, as would be done when recovery is determined to be technically and biologically feasible. This recovery strategy and action plan 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. In 2016, 174 pairs of Piping Plovers *melodus* subspecies were observed in Quebec, New Brunswick, Prince Edward Island, Nova Scotia and insular Newfoundland.
2. Sufficient suitable habitat is available to support the species or could be made available through habitat management or restoration.
 - Yes. Nearly 200 beaches were used by breeding Piping Plovers *melodus* subspecies between 1991 and 2016. Many sites accommodate more than one pair of plovers per year.
3. The primary threats to the species or its habitat (including threats outside Canada) can be avoided or mitigated.
 - Unknown. The Science & Technology Branch of Environment and Climate Change Canada reviewed the species' recovery program in 2013 (Gratto-Trevor et al. 2013) and determined that the most significant factors affecting Piping Plovers *melodus* subspecies appear to relate to conditions encountered in nonbreeding areas, particularly on wintering grounds. It is unclear if threats during the nonbreeding areas (e.g., extreme weather events) can be mitigated.
4. Recovery techniques exist to achieve the population and distribution objectives or can be expected to be developed within a reasonable timeframe.
 - Yes. Agencies in Quebec, New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland and Labrador implement approaches similar to those in other jurisdictions (e.g., habitat enhancement, control of unleashed pets, motorized vehicle control) and these have resulted in tremendous population increases elsewhere. Between 1991 and 2006, the U.S. Atlantic coast population of plovers increased by 95%. The success of similar programs elsewhere suggests that meeting population objectives is feasible. Although conservation efforts elsewhere have achieved positive results, Piping Plover *melodus* subspecies is considered to be management-dependent on the Atlantic coast (USFWS 1996). Formal and informal partnerships with industry, scientists, municipal governments,

federal/provincial governments, conservation organizations, property owners and the public will help achieve the long-term conservation and recovery of Piping Plover *melodus* subspecies.

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1. COSEWIC* Species Assessment Information

Date of Assessment: November 2013

Common Name (population): Piping Plover - *melodus* subspecies

Scientific Name: *Charadrius melodus melodus*

COSEWIC Status: Endangered

Reason for Designation: Numbers of the eastern subspecies of this small shorebird remain extremely low and the population continues to decline, despite concerted conservation efforts. Threats from predation, human disturbance, and declines in habitat extent and quality also continue.

Canadian Occurrence: Quebec, New Brunswick, Prince Edward Island, Nova Scotia, Newfoundland and Labrador

COSEWIC Status History: The species was considered a single unit and designated Threatened in April 1978. Status re-examined and designated Endangered in April 1985. In May 2001, the species was re-examined and split into two groups according to subspecies. The *melodus* subspecies was designated Endangered in May 2001 and November 2013.

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

2. Species Status Information

Piping Plover *melodus* subspecies, hereafter Piping Plover or plover, is listed as Endangered in Canada under Schedule 1 of the *Species at Risk Act* (SARA). The subspecies also occurs along the Atlantic coast of the United States, where it is listed as Threatened under the United States' Endangered Species Act. In Quebec, Piping Plover *melodus* subspecies is listed as a threatened species under the *Loi sur les espèces menacées ou vulnérables* (RLRQ, c E-12.01) (*Act respecting threatened or vulnerable species*) (CQLR, c E-12.01) and is listed as Endangered under provincial legislation in New Brunswick, Nova Scotia and Newfoundland and Labrador. Prince Edward Island is currently reviewing the status of the species. In 2011, the Canadian breeding range accounts for approximately 25% of the global breeding range (Elliott et al. 2015).

Table 1. Conservation ranks for Piping Plover *melodus* subspecies (NatureServe 2017)

	G- Rank^a	N-Rank^b	S-Rank^c	COSEWIC Status
Piping Plover (<i>Charadrius melodus melodus</i>)	G3T3	N3B	Breeding occurrences: Quebec: S1B New Brunswick: S1B Prince Edward Island: S1B Nova Scotia: S1B Insular Newfoundland: S1B	Endangered

^a G-Rank — Global Conservation StatusRank: G3 = species is vulnerable, T = statusrank of subspecies (T3 = vulnerable).

^b N-Rank — National Conservation StatusRank: N3B = breeding population within the nation is Vulnerable.

^c S-Rank —sub-national (provincial or territorial) ranks (B = breeding): S1 = Critically Imperiled; S2 = Imperiled.

Despite active conservation programs throughout Atlantic Canada and Quebec, the number of Piping Plover pairs declined more than 30% between 2006 and 2016 (Canadian Wildlife Service (CWS), unpublished data).

3. Species Information

More detailed information about the species and its habitats is available in the status report (COSEWIC 2013).

3.1 Species Description

Piping Plovers nest only in North America and occur in two populations in Canada, each with subspecies status: the *melodus* subspecies breeds along the Atlantic coast and the *circumcinctus* subspecies breeds inland, in the prairie provinces and Great Lakes region. This recovery document applies only to the *melodus* subspecies.

Piping Plover is a small, stocky shorebird that depends on its cryptic coloration (adults, chicks and eggs) to avoid predators. Their backs resemble the colour of dry sand with plumage varying between light grey and pale brown. Their underparts are white and, in breeding plumage, a black band runs completely or partially across the breast. They have a second (also partial or complete) band across their forehead, between the eyes. Their short bill is orange with a black tip. Adults weigh 43-63 g and are 17-18 cm long. Piping Plovers are capable of breeding at one year of age.

Plovers normally arrive on the breeding grounds from the end of March to early May. Nest initiation may occur any time after the birds arrive (but usually late May onwards) until mid-July. Nests are only occasionally initiated after this time. Young may hatch starting in late May or early June onwards, depending on when nesting was initiated. Migration back to the wintering grounds begins in early to mid-July. The bulk of the population has left Canada by early September.

Adults normally produce a clutch of four eggs; however, fewer eggs may be produced, often with re-nesting attempts. Young hatch after 26 to 28 days of incubation and are able to fly after 25 to 28 days. Chicks are precocial⁴ and usually leave the nest within hours of hatching. Young plovers forage independently shortly after leaving the nest. One brood is normally produced per year; however, re-nesting is possible if a clutch is lost. The normal lifespan of birds once they reach adulthood is 8-11 years (Haig 1992).

3.2 Species Population and Distribution

Population numbers of Piping Plovers have fluctuated since the early 1900s when uncontrolled hunting had greatly decreased numbers (Bent 1929). Populations began to recover by about 1925 (Haig and Oring 1985) due to increased protection (e.g., Migratory Birds Convention Acts in the United States and Canada). Numbers rose in the 1930s, but decreased again by 1945, due to increased recreational use of beaches and other factors. Breeding populations continued to decline in Atlantic Canada, Quebec and the Atlantic Coast of the United States (Cairns and McLaren 1980) until management efforts were initiated in the 1980s. Since then, numbers have increased significantly along the Atlantic Coast of the United States, but not in Atlantic Canada and Quebec.

The first complete survey for breeding Piping Plovers was conducted as part of the International Piping Plover Census in 1991. Since 1991, and most consistently since 2000, annual surveys of breeding habitat are conducted. Beaches are surveyed at the beginning of the breeding season (during a standard window count in June), and those with plovers are visited regularly throughout the breeding season. Year-end counts are the total number of pairs observed at the end of the breeding season. Between 2000 and 2016, numbers of pairs have varied between a high of 272 pairs in 2002 and a low of 174 pairs in 2016 (Figure 1). The population has remained relatively stable, albeit at a low level, since 2012.

⁴ A young bird hatched in an advanced state and able to feed itself almost immediately

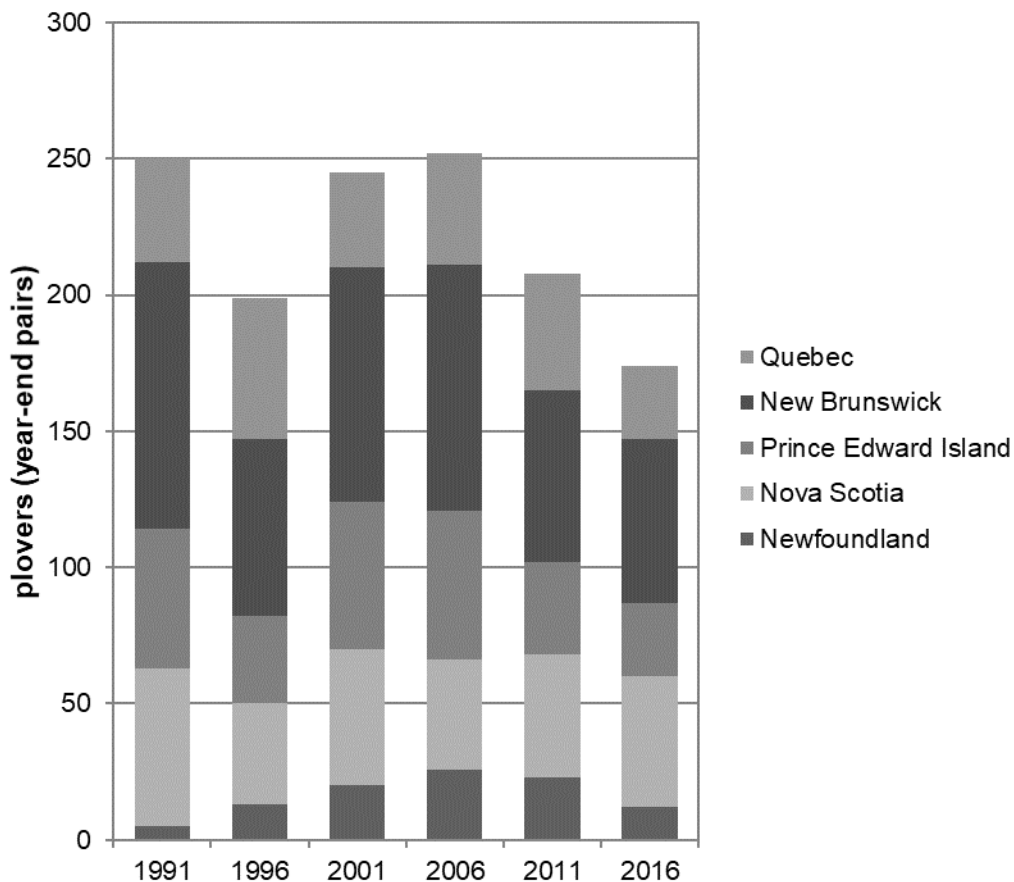


Figure 1. Piping Plovers (year-end pairs) by province observed during International Piping Plover Census years.

Plovers nests in coastal areas of Québec (Magdalen Islands), New Brunswick (the Gulf of St. Lawrence and Northumberland Strait coast), Prince Edward Island, Nova Scotia (southern Atlantic coast, beaches along the Northumberland Strait and Cape Breton Island) and insular Newfoundland (Figure 2).

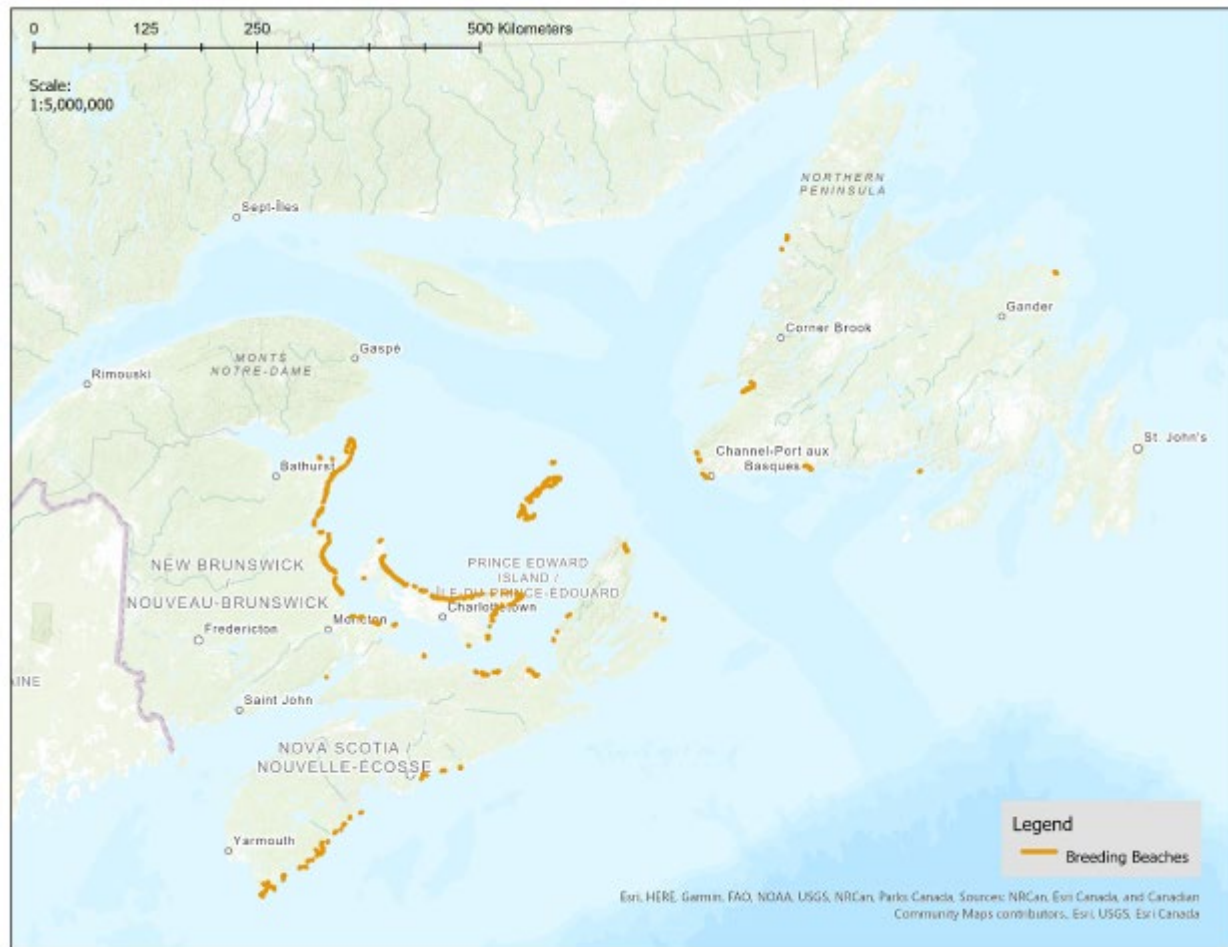


Figure 2. Canadian breeding distribution of Piping Plovers (1991-2016)

Piping Plovers winter primarily on the Atlantic coast of the United States from North Carolina to Florida, along the Gulf coast of Florida and on islands of the West Indies (Gratto-Trevor et al. 2012).

3.3 Needs of the Piping Plover

All species need food, water, shelter and space to reproduce and rest to survive and thrive. Piping Plover food items primarily include marine worms, insects (e.g., fly larvae, beetles), tiny crustaceans, mollusks and other small marine invertebrates. Foraging areas must be in close proximity to nest sites so flightless chicks can access them. Plovers obtain water from their food and by drinking (often while bathing). Piping Plovers need shelter from harsh weather (e.g., wind, blowing sand, rain, excessive heat from the sun), predators and humans. In general, Piping Plovers use sand, gravel, or cobble-dominated open ocean-front beaches, pocket beaches and barriers (islands, beaches, spits and bars) in marine coastal areas for most life processes.

Breeding habitat⁵

Piping Plover generally selects the widest section of a beach for nesting. Plovers rarely nest in areas of pure sand and dense dune grass, but instead select sandy areas with sparse vegetation or gravel, pebble, cobble, shell fragments, wrack (dry macroalgae/seaweed normally deposited by storms or by tidal or wave action above the mean high tide mark), or other debris to provide camouflage (Cohen et al. 2009, Flemming et al. 1992). The level of human disturbance may influence site suitability.

Early successional habitat, most often free of dense vegetation, is preferred for breeding. Natural ecological processes such as ice scour, storms and extreme high tides promote the maintenance of habitat in early succession. The tips of sandspits or sites near channels are particularly vulnerable to the extreme natural events that keep areas free of vegetation and redistribute nesting substrate onto beach areas and are preferred nesting locations. These habitats are important since they allow adults and young access to foraging sites along ephemeral pools, lagoons, or flats where rich food resources are located. The maintenance of natural ecological processes along coastal areas is therefore essential for conservation of breeding habitat.

Foraging habitat

Adults and young feed in marine and bayside foreshore⁶ and backshore⁷ zones above and below the mean high water mark including along foredunes⁸ and beach ridges⁹. Ephemeral pools and areas of wrack are excellent foraging areas. Adult birds are able to gain access to foraging sites beyond the immediate breeding or brood-rearing area and are often seen flying across channels or gullies to use nearby foraging areas. Sites used by young must be located within walking distance of the nest because young are flightless until approximately 25 days of age. Young birds may travel a considerable distance to gain access to prime foraging areas.

Resting habitat

Piping Plovers generally rest (i.e., roost) in areas adjacent to nest sites and/or in close proximity to foraging habitats. Plovers use clumps of vegetation, driftwood, wrack and large rocks for shelter from harsh weather and rely on natural elements to camouflage their appearance and blend in with their surroundings to avoid predators and humans. Resting habitat must provide refuge from the highest tides.

⁵ This includes habitat used for pair formation, nest building, copulation, egg-laying, incubation and hatching.

⁶ The area of the shore between high- and low-water marks.

⁷ The area of the shore lying between the mean high tide mark and the line of permanent (often dense) vegetation. This area is dry under normal conditions and affected by waves only during extreme storms.

⁸ The seaward-most vegetated sand dune formed by wind-blown sediments along the backshore of beaches.

⁹ An elevated ridge along the beach consisting of sand or other beach material and is linear and parallel to the shoreline. Beach ridges are primarily formed by wave action usually at, or above normal spring high tide level.

Brood-rearing habitat

Brood-rearing habitat provides the necessary elements for both foraging and resting mentioned above and must be present within an appropriate distance of breeding sites because young are flightless until approximately 25 days of age. Broods are known to move a considerable distance from their nest location. Observations from various studies in the United States show that broods may move several hundred metres from the nest location (USFWS 1996). Preliminary information suggests that this is also the case in Atlantic Canada and Quebec (CWS, unpublished data). In Quebec, Piping Plovers were observed using between 67 and 762 m of shoreline for feeding and brood rearing (Shaffer et Laporte 1989; Shaffer et Laporte 1992). Enhanced survival rates of young plovers were found in areas with access to interior or bayside flats (Cohen et al. 2009, Loegering and Fraser 1995). Access to these sites can be created by waves that sometimes overwash barriers during winter storms. Young plovers rely on brooding by adult birds for warmth during cold and shelter from heat; however, older juveniles that spend less time being brooded may increasingly utilize shelter (see resting habitat above). Young plovers also rely on sparsely vegetated dunes as refuges during high tides or to escape from potential predators and human disturbance. Densely vegetated dunes are ineffective since young birds have limited mobility and cannot penetrate these areas.

4. Threats

4.1 Threat Assessment

The threats considered in the original recovery strategy for the species (Environment Canada 2012) are still valid and are reproduced below. Terminology has been revised to follow the threat lexicon developed by the International Union for Conservation of Nature-Conservation Measures Partnership (2006) (IUCN-CMP). Threats are ranked by level of concern and the table below provides some insight as to which threats should be targeted for the recovery of Piping Plover.

Table 2. Threat assessment table

Threat ^a	Level of Concern ^b	Extent	Occurrence	Frequency	Severity ^c	Causal Certainty ^d
1. Residential & Commercial Development						
1.1 Housing & Urban Areas	High	Widespread	Continuous	Continuous	High	High
3. Energy Production & Mining						
3.2 Mining & Quarrying (e.g., mining sand and beach sediments)	Low	Localized	Historic	Continuous	High (local) Low (range-wide)	Low
6. Human Intrusions & Disturbance						
6.1 Recreational Activities (e.g., motorized vehicles and other beach users)	High	Widespread	Historic, Current, Anticipated	Seasonal	High	High
7. Natural System Modifications						
7.3 Other Ecosystem Modifications (e.g., beach nourishment, shoreline stabilization, beach cleaning or raking)	High	Localized	Historic, Current, Anticipated	Continuous	Moderate	Medium
8. Invasive & Other Problematic Species, Genes & Diseases						
8.2 Problematic Native Species/Diseases (e.g., American Crow, Red Fox, Common Raven, gulls, Merlin, Raccoon, Coyote, Striped Skunk, Short-tailed Weasel, American Mink, dogs, cats)	High	Widespread	Historic, Current, Anticipated	Seasonal	High	High
9. Pollution						
9.2 Industrial & Military Effluents	Medium	Widespread	Anticipated	One-time	High (local) Low (range-wide)	High
11. Climate Change & Severe Weather						
11.4 Storms & Flooding	Medium	Widespread	Historic, Current, Anticipated	Seasonal	Moderate	High

^a Classification of Threats adopted from IUCN-CMP (Salafsky et al. 2008)

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

^c Severity: reflects the population-level effect (High: very large population-level effect, Moderate, Low, Unknown).

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

4.2 Description of Threats

Current and anticipated issues and activities that directly threaten the survival of Piping Plover are detailed below. The threats may not be distributed equally across the range and the threat level may vary within provinces and jurisdictions.

1.1 Housing & Urban Areas

Coastal developments (e.g. residential or commercial developments, construction of wharves and jetties) may physically destroy or alter the function of a site and render it unsuitable for plovers.

6.1 Recreational Activities (e.g., motorized vehicles and other beach users)

Many human activities result in disturbance to Piping Plovers. Disturbance generally causes changes in normal breeding, foraging, resting and/or brood-rearing behaviour. Human disturbance includes pedestrian traffic, unleashed pets, camping and campfires, sunbathing, collection (of driftwood, shells or wrack), horseback riding, fishing, kite flying, kite bugging, fireworks and motorized vehicle traffic (e.g., cars, trucks, off-road and all-terrain vehicles).

The degree of severity, frequency of disturbance and proximity to breeding habitat and foraging areas within any specific component of the habitat will dictate how plovers are affected. Severe disturbance (e.g., vehicular traffic, unleashed pets, horseback riding, fireworks, camping and campfires, kite bugging) affects site use, increases the likelihood of breeding failure and potentially results in adult and young mortality. Moderate and minor disturbance factors (e.g., walking, swimming, sunbathing, collecting driftwood or other natural beach components, surf fishing, flying kites) increase the likelihood of lower productivity due to increased energy expenditures to avoid the activity or a decrease in efficiency in conducting normal activities. Even though some activities such as walking on the beach may be considered low disturbance, nests are highly camouflaged and pedestrians may inadvertently trample them. There have also been several confirmed instances of children removing chicks from breeding beaches.

Operation of off-road vehicles, all-terrain vehicles, kite buggies, or other vehicles on beaches used by plovers may result in chick mortality, destruction of the eggs or nest and, in some cases, nest abandonment (Ryan 1996, Flemming et al. 1988, Loegering and Fraser 1995, Melvin et al. 1994). Compaction of substrate caused by vehicle traffic may reduce invertebrate abundance and therefore local prey availability (Wolcott and Wolcott 1984).

A number of predators benefit from association with humans (Prugh et al. 2009, Gratto-Trevor and Abbott 2011), which can result in higher populations in areas frequented by people, and many are attracted to garbage left behind at beaches. Domestic and feral pets also prey on plover chicks and adults and destroy nests.

7.3 Other Ecosystem Modifications (e.g., beach nourishment, shoreline stabilization, beach cleaning or raking)

Beach nourishment¹⁰ projects may be beneficial and/or detrimental to plovers, depending on a number of factors. The reuse of clean, appropriately-sized and otherwise compatible, sediments (e.g., from a nearby dredging project) to increase the width or length of a beach or dune may be minimally disruptive to natural sediment transport processes and to plovers if project proposals are well designed (e.g., timing allows prey resources time to recover, slope of beach is maintained, sediments are not compacted, associated disturbance is minimized) (Haney et al. 2007). Poorly designed beach nourishment projects may negatively affect Piping Plover habitat and their prey (e.g., if provisioned sediment grain size is not compatible with beach sediments, disturbance is high, compaction of sediments occurs, slope is too steep and prevents natural beach processes over time, timing is incompatible for prey resources to recover) (Wooldridge et al. 2016).

Invasive vegetation, wrack removal and shoreline stabilization activities (e.g., planting dune vegetation, placing Christmas trees or snow fencing, armoring with riprap and construction of seawalls, groins, jetties) all contribute to cumulative beach habitat loss. Shoreline stabilization¹¹ blocks the natural processes by which coastal habitats respond to storms, while accelerating sea level rise further reduces beach suitability for Piping Plovers (USFWS 2012). Continuing loss and degradation of habitat is one of the key threats to Piping Plovers in their non-breeding range (USFWS 2012).

Beach wrack provides important resting, shelter, camouflage and food for plover adults and chicks. They may be negatively impacted by the removal of wrack by raking activities (Dugan et al., 2003). Beach raking may also lead to the destabilization of the beach and loss of sand (erosion). However, with proper planning and timing and without disturbing plovers, the removal of human-created debris by hand removes human food items that could be attractive to predators and also removes debris which plovers could become entangled in (e.g., monofilament line).

8.2 Problematic Native Species/Diseases (e.g., American Crow, Red Fox, Common Raven, gulls, Merlin, Raccoon, Coyote, Striped Skunk, Short-tailed Weasel, American Mink, dogs, cats)

Depredation has been identified as one of the most important factors limiting populations across the North American breeding range (Goossen et al. 2002). Current predation rates appear to be higher than they were in the past probably as a result of changes in human activity and land-use practices. Current estimates from Atlantic Canada and Quebec suggest that hatch success is approximately 57% and predators

¹⁰ Beach nourishment (also referred to as beach replenishment or “soft” armoring or “soft” stabilization), is the addition of large quantities of sand to the shore to increase the beach width or quality, and/ or to secure the shore against erosion.

¹¹ Shoreline stabilization (also known as armoring or “hard” stabilization) refers to any method of altering the natural beach system to stabilize it.

are confirmed or suspected in at least one-third of all nests lost (CWS, unpublished data). There are many known or suspected predators of adults, chicks and eggs, including American Crow (*Corvus brachyrhynchos*), Red Fox (*Vulpes vulpes*), Common Raven (*Corvus corax*), gulls (*Larus* spp.), Merlin (*Falco columbarius*), Raccoon (*Procyon lotor*), Coyote (*Canis latrans*), Striped Skunk (*Mephitis mephitis*), Short-tailed Weasel (*Mustela erminea*), American Mink (*Neovison vison*), dogs and cats. Human activities and land use practices have resulted in artificially high predator populations (Raithel 1984 in Melvin et al. 1991). These predators may hunt or opportunistically take adult Piping Plovers, chicks, or eggs. Increasing predation pressure can have a negative impact on populations of Piping Plover (Burger 1987, USFWS 1996).

9.2 Industrial & Military Effluents

Pollutants such as oil pose a risk to foraging adults and chicks. Oil affects birds through physical contact, physiological changes and acute toxic poisoning. Oiled birds may be affected by the disruption in the natural water-repellency of feathers, affecting their thermo-regulatory capacity (Leighton 1994), or there may be reduced hatching success if oil is transferred to the eggs during incubation (McGill and Richmond 1979, Lewis and Malecki 1984). Ingestion of toxic compounds while preening also commonly occurs. Ingested toxins can lead to severe internal damage and organ failure (Peakall et al. 1983). Three cases of oiled adult Piping Plovers have been recorded in Canada (Amirault-Langlais et al. 2007).

Oil spills not only have the potential to impact the birds and their habitat but also their invertebrate prey. The greatest impact may be experienced by flightless chicks which are unable to access alternative foraging grounds.

Several oil spills have affected Piping Plovers in the United States. There is a similar risk along the coastline in Canada.

11.4 Storms & Flooding

Extreme weather events (e.g., hurricanes, flooding, storms) may cause localized erosion and loss of habitat. Conversely, when unimpeded by coastal development or activities required for maintenance of infrastructures, severe weather events may create new habitat through accretion/deposition of sand and other sediments. Severe weather may also maintain the early successional stage habitat required for breeding.

Extreme high tides may flood nests above the mean high water mark. This can result in considerable nest loss if high tides coincide with the peak breeding season. Long periods of intense rain following hatching can decrease chick survival rates. Hurricanes, periods of cold weather and storms may contribute to adult mortality.

5. Population and Distribution Objectives

Short-term population objective 1

Achieve and maintain a minimum of 250 year-end pairs of Piping Plover. This reflects maintenance of the population at levels observed in 1991 (the first year of complete survey coverage – see Figure 1).

Short-term population objective 2

Achieve and maintain an annual productivity greater than 1.65 chicks fledged per territorial pair. This is the minimum productivity rate calculated to maintain the population at its current level (Calvert 2004).

Long-term population and distribution objectives

Increase the population, and maintain it for the long-term¹², to a minimum of 310 year-end pairs; proportionally represented in each province (as per Table 3) to meet historical maximum estimates.

Table 3. Long-term population and distribution objectives for Piping Plover.

Province	Population objective (pairs)
Québec	55
New Brunswick	105
Prince Edward Island	60
Nova Scotia	60
Newfoundland and Labrador	30
Total	310

Short-term and long-term objectives are specified because there is a high uncertainty about whether the long-term objective can be achieved. Increases observed since listing in the United States (i.e., nearly tripling of population size from 1986 to 2008 (USFWS 2009)) suggest that reaching long-term objectives in Atlantic Canada and Quebec should be feasible. Long-term population objectives for each province (identified in Table 3) are based on the maximum number of pairs documented in each province between 1991 and 2016 and, where known, closely approximate historical estimates (e.g., Cairns and McLaren 1980).

¹² Over at least three consecutive international censuses, which occur every five years.

6. Broad Strategies and General Approaches to Meet Objectives

6.1 Actions Already Completed or Currently Underway

Recovery programs for Piping Plover were initiated in 1985, with many conservation techniques having been developed and implemented since this time to address human-induced and natural threats. A National Recovery Plan for Piping Plover (Goossen et. al. 2002) outlining the approach recommended to recover the population was published in 2002. That recovery plan expired in 2004. Approaches to conservation that have been implemented to help achieve the recovery objectives include targeted outreach (beach visitors), public education, volunteer and landowner involvement in protecting breeding plovers, protection of key breeding habitats through acquisition and minimizing human disturbance (e.g., symbolic fencing¹³, signage, beach closures in National Parks of Canada), reduction of predation (e.g., beach clean-up programs, litter management and localized predator management), increased enforcement in coastal areas, research on factors affecting the species and its habitat (including in non-breeding areas), the discouragement of beach developments and population monitoring.

Recent federal and provincial cooperation for endangered species conservation via legislation and other measures has enhanced efforts to protect the subspecies and its habitat. In Quebec, Piping Plover is listed as a threatened species under the *Loi sur les espèces menacées ou vulnérables* (RLRQ, c E-12.01) (*Act respecting threatened or vulnerable species*) (CQLR, c E-12.01). The species is listed as Endangered under provincial legislation in New Brunswick, Nova Scotia and Newfoundland and Labrador. The Province of Prince Edward Island is reviewing the status of species to establish its list of species at risk.

Substantive involvement on the part of many agencies occurs every year to protect the species. The Eastern Canadian Piping Plover Recovery Team and Working Group meet annually to discuss progress made during the previous year and to plan future efforts. The team includes representatives from CWS (Atlantic and Québec regions) of Environment and Climate Change Canada (ECCC), Parks Canada Agency (PCA), the five provincial wildlife agencies and non-governmental organizations. Numerous non-governmental organizations have had much success in protecting sensitive coastal features and Piping Plover: Attention Fragîles of the Îles-de-la-Madeleine, Nature NB, Island Nature Trust, Bird Studies Canada, Eskasoni Fish and Wildlife Commission Inc., Qalipu Mi'kmaq First Nation Band, Miawpukek First Nation (MFN), Halifax Field Naturalists, the Nova Scotia Bird Society, the Canadian Parks and Wilderness Society, Intervale Associates, Codroy Valley Area Development Association, Nova Scotia Nature Trust and Nature Conservancy Canada.

¹³ This measure refers to signage, with or without string or rope, used only to inform people that access is forbidden and to deter behaviour.

Environmental assessment reviews of projects that may pose a risk to plovers are conducted frequently. Identification of measures to mitigate potential negative impacts of projects has been an important activity to ensure the maintenance of habitat. Measures are recommended that ensure the risk to breeding plovers is eliminated or reduced, while also addressing public safety issues.

6.2 Recovery Planning Table and Implementation Schedule

The recovery measures outlined below are arranged by both the broad strategies to recover the species and the general descriptions of research and management approaches.

Table 4. Implementation Schedule

Approach	#	Recovery Measure	Priority ^a	Threats or concerns addressed	Timeline
Broad Strategy: Reduce human disturbance					
Outreach and Stewardship	1	Ensure the continuation of Piping Plover conservation projects throughout the breeding and nonbreeding range of Piping Plover (e.g., Guardian programs).	High	1.1 Housing & Urban Areas 6.1 Recreational Activities (e.g., motorized vehicles and other beach users)	Ongoing
	2	Encourage volunteer and community engagement in Piping Plover conservation projects (e.g., training, volunteer toolkit) throughout the breeding and nonbreeding range of Piping Plover.	High		Ongoing
	3	Educate and engage beach visitors, landowners, local business owners, tourism industry experts, youth, coastal industries and all-terrain vehicle groups in conservation activities that benefit Piping Plovers.	High		Ongoing
	4	Regularly evaluate outreach and stewardship programs to assess their effectiveness.	Medium		Ongoing
Compliance promotion	5	Implement appropriate techniques for reducing human disturbance to breeding Piping Plovers (e.g., signage and symbolic fencing).	High	1.1 Housing & Urban Areas 6.1 Recreational Activities (e.g., motorized vehicles and other beach users)	Ongoing
	6	Encourage compliance with existing laws and regulations.	High		Ongoing
	7	Work with enforcement agencies to address threats and priorities.	High		Ongoing
Broad Strategy: Ensure enough suitable habitat to meet long-term population objectives					
Address plovers in comprehensive coastal planning and management strategies	8	Develop and implement Piping Plover “best management practices” and wherever possible, integrate them into coastal planning and management strategies throughout the breeding and nonbreeding range of Piping Plover.	High	1.1 Housing & Urban Areas 7.3 Other Ecosystem Modifications (e.g., beach nourishment, shoreline stabilization, beach cleaning or raking)	Ongoing
	9	Engage in existing coastal planning and management initiatives at provincial, municipal and site scales, identify regions where no such initiatives exist and encourage their development.	Medium		Ongoing

Approach	#	Recovery Measure	Priority ^a	Threats or concerns addressed	Timeline
Protect habitat	10	Determine appropriate protection measures for habitat throughout Piping Plover's breeding and nonbreeding range, and work towards implementation.	High		Ongoing
Outreach and Stewardship	11	Inform coastal landowners, land managers and developers about the role and value of natural coastal processes and the negative impacts of dwellings, boardwalks and other structures very near or in dunes, as well as erosion control structures.	High		Ongoing
	12	Mitigate negative impacts of development by providing project alternatives.	High		Ongoing
	13	Discourage beach cleaning or raking efforts that remove natural elements such as macroalgae, eel grass, driftwood, cobble and other natural debris from plover habitat.	High		Ongoing
Consider plovers in environmental assessments	14	Provide input to project proposals through federal and provincial governments, as well as local planning authorities to consider project implications/impacts on the species and its habitat.	High	1.1 Housing & Urban Areas 7.3 Other Ecosystem Modifications (e.g., beach nourishment, shoreline stabilization, beach cleaning or raking) 9.2 Industrial & Military Effluents	Ongoing
Enhance habitat	15	Explore options for habitat management, where warranted, to optimize breeding potential in areas where suitable protected habitat is limited.	Low	1.1 Housing & Urban Areas 7.3 Other Ecosystem Modifications (e.g., beach nourishment, shoreline stabilization, beach cleaning or raking) 11.4 Storms & Flooding	As necessary
Broad Strategy: Reduce predation					
Appropriate use of recovery techniques	16	Evaluate population-level impacts of management techniques.	High	8.2 Problematic Native Species/Diseases (predators)	Ongoing
Waste management	17	Work in cooperation with federal, provincial and municipal park and land managers to ensure effective waste management programs at plover beaches.	Medium		Ongoing
Predator management	18	Summarize the impact of predation on Piping Plover and review predator management techniques.	Medium	8.2 Problematic Native Species/Diseases (predators)	As necessary

Approach	#	Recovery Measure	Priority ^a	Threats or concerns addressed	Timeline
Broad Strategy: Address key knowledge gaps to recovery					
Research	19	Facilitate partnerships and opportunities to undertake research on key knowledge gaps that will lead to recovery. See Appendix B for details.	High	Knowledge gaps	Ongoing
	20	Implement a research program to determine movements and areas used by nonbreeding birds, and to better understand factors affecting survival throughout their range.	High		Ongoing thru to 2024
Form and maintain partnerships	21	Partner with governments, non-government organizations and academics to understand and address nonbreeding range issues.	High		Ongoing
Evaluate environmental assessments	22	Work with environmental assessment review practitioners to complete follow-up evaluations regarding the effectiveness of proposed mitigation.	High		Ongoing
Broad Strategy: Monitor the population					
Count adults	23	Conduct annual counts of breeding birds.	High	Knowledge gaps	Annually
	24	Census the population throughout the breeding and nonbreeding range every five years as part of the International Piping Plover Census.	High		Every 5 years
	25	Provide training and mentoring (where necessary) to standardize monitoring efforts and survey known Piping Plover beaches.	High		When necessary
Measure productivity	26	Monitor and calculate productivity for every pair in southern Nova Scotia and a minimum of 70 pairs (ideally 100 pairs) in the Gulf of St. Lawrence region distributed representatively throughout the area.	High		Annually
Evaluate habitat	27	Monitor availability and suitability of habitat every five years as part of the International Piping Plover Census.	High		Every 5 years
	28	Identify and document threats to Piping Plovers and their habitat on the breeding and nonbreeding grounds.	High		Ongoing
Broad Strategy: Minimize impacts of adverse weather conditions					
Maintain habitat	29	Ensure sufficient high-quality habitat is maintained to minimize the overall impact of negative weather events.	Medium	11.4 Storms & Flooding	Ongoing
Mitigate nest flooding	30	On a case-by-case basis and when feasible, reduce impacts of flooding by using appropriate management tools (e.g., sandbagging and nest translocation).	Low	11.4 Storms & Flooding	When necessary

Approach	#	Recovery Measure	Priority ^a	Threats or concerns addressed	Timeline
Broad Strategy: Minimize impacts of poorly understood mortality factors					
Oil spill contingency planning	31	Liaise with the Regional Environmental Emergencies Team (e.g., provide data, input and report oiled birds).	Low	9.2 Industrial & Military Effluents	Ongoing
Remain vigilant for population-level threats	32	Consider threats related to toxic chemicals and react where warranted by collecting and analyzing specimens (eggs, deceased or incapacitated adults and/or chicks)	Low	9.2 Industrial & Military Effluents	Ongoing

^a "Priority" reflects the degree to which the broad strategy contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species.

6.2.1 Monitoring

Monitoring measures for Piping Plover were reviewed by the Science & Technology Branch of Environment Canada in 2013 (Gratto-Trevor et al. 2013). Recommendations for monitoring the recovery of the species and its long-term viability were provided. All monitoring protocols are currently followed by Piping Plover stewardship organizations, ECCC, PCA and provincial counterparts. Specifically, the review recommended that:

- a survey of all potential breeding habitat continue to be conducted as part of the international Piping Plover Census every five years;
- productivity be monitored annually for:
 - 70 - 100+ pairs in the Gulf region (distributed in a representative way across Quebec, New Brunswick, Prince Edward Island, northern Nova Scotia and Newfoundland and Labrador); and
 - All pairs (30+) in the southern Nova Scotia region; and
- a mark-recapture study be implemented to determine movements and areas used by nonbreeding birds, and to better understand factors affecting adult and juvenile survival in both breeding and nonbreeding areas.

7. Critical Habitat

Section 41 (1)(c) of SARA requires that recovery strategies include an identification of the species' critical habitat, to the extent possible, as well as examples of activities that are likely to result in its destruction.

Critical habitat for Piping Plover is based on habitat occupancy and habitat suitability and is fully identified for Piping Plover in this document, to the extent possible, given the best available information. Additional critical habitat may be added in the future if new information supports the inclusion of areas beyond those currently identified (e.g., additional sites occupied in response to creation of habitat by winter storms, ice scour, tidal surges and other natural or anthropogenic events).

Critical habitat was fully identified for Piping Plover in the original recovery strategy with data encompassing 1991-2010. Five sites (Appendix D) were removed from those identified in the original recovery strategy because they did not meet habitat occupancy criteria and as a result, those sites are no longer identified as critical habitat. This recovery document contains 24 new critical habitat sites (i.e., added as a result of findings during inventories conducted from 2011-2016) for the species and replaces critical habitat identified in the original recovery strategy (Environment Canada 2012).

7.1 Identification of the Species' Critical Habitat

Critical habitat for the Piping Plover *melodus* subspecies is identified as all areas of suitable habitat (Table 5) within the defined 1 x 1 grid squares (Appendix C). Suitable habitat relates to areas possessing a specific set of biophysical attributes required for

Piping Plover's life processes as summarized in Table 5. Note that not all attributes in Table 5 must be present in order for an area to be identified as critical habitat. If the area is capable of supporting Piping Plover, it is considered critical habitat for the species, even though some of the associated attributes might be missing.

Table 5. The area and associated biophysical attributes required for Piping Plover to carry out its life processes.

Life stage	Life process	Area or type of site	Biophysical attributes
adults, eggs, young	<ul style="list-style-type: none"> reproduction: pair formation, nest building, copulation, egg-laying, incubation, hatching; growth: brood-rearing, fledging; rest: sleeping, roosting 	<ul style="list-style-type: none"> backshore¹⁴, foredunes¹⁵ (including wave washover features and wind-formed blowouts) and beach ridges¹⁶ of Atlantic coastal beaches (e.g., ocean-front beaches, pocket beaches) and barriers (beaches, islands, spits and bars). 	<ul style="list-style-type: none"> sand, gravel and/or cobble substrate with elevated areas safe from highest tides; gently sloping foredune (< 9% Boyne et al. 2014); sparsely vegetated¹⁷; and relatively wide backshore; with one or more natural elements that provide shelter and/or camouflage (e.g., small clumps of vegetation, stones, logs, driftwood, pebbles, dried macroalgae, shells).
adults, young	<ul style="list-style-type: none"> nutrition 	foreshore ¹⁸ , backshore, foredunes (including wave washover features and wind-formed blowouts) and beach ridges of Atlantic coastal beaches and barriers in close proximity to breeding sites.	<ul style="list-style-type: none"> presence of suitable invertebrate prey resources; sand, gravel, or cobble substrate; with one or more natural elements that enhance foraging potential (e.g., dried macroalgae, driftwood, ephemeral pools, tidal flats, sparsely vegetated dunes).

7.1.1 Information and methods used to identify critical habitat

The first complete survey for breeding Piping Plovers was conducted as part of the International Piping Plover Census in 1991. Since then, sites are surveyed at the beginning of the breeding season (during a standard window count in June), and those

¹⁴ The area of the shore lying between the mean high tide mark and the line of permanent (often dense) vegetation. This area is dry under normal conditions and affected by waves only during extreme storms. In the case of barriers, this applies to both the landward and seaward shores.

¹⁵ The seaward-most vegetated sand dune formed by wind-blown sediments along the backshore of beaches.

¹⁶ An elevated ridge along the beach consisting of sand or other beach material and is linear and parallel to the shoreline. Beach ridges are primarily formed by wave action usually at, or above normal spring high tide level.

¹⁷ having areas containing continuous vegetation density <20% within at least 25 m² (Gieder et al. 2014)

¹⁸ The area of the shore between high- and low-water marks. In the case of barriers, this applies to both the landward and seaward shores.

with plovers are visited regularly throughout the breeding season. On the Magdalen Islands in Quebec, these surveys include georeferencing each nest.

Atlantic Canada

Nest location data from 1991 - 2016 is not available for plovers in Atlantic Canada. In the absence of this data, any beach occupied by at least one breeding pair of Piping Plovers in at least one year between 1991 and 2016 where suitable habitat criteria (Table 5) are met is identified as critical habitat under SARA. The 1x1 km grid representations were drawn to encompass entire stretches of ocean-front and pocket beaches and the entirety of barriers (islands, beaches, spits and bars) to accommodate the shifting nature of coastal habitats. These areas are necessary to meet the long-term population and distribution objectives.

Quebec

In Quebec, the Magdalen Islands contain over 300km of beaches. To reflect what areas are required to meet the species' long-term objective, sites are further refined by habitat use using available nest location data from 1991-2016. The 1x1 km grid representations were superimposed on known nest locations, including a 500 m distance on either side of each nest to capture adjacent areas of suitable habitat (Table 5) necessary for feeding and brood rearing. The 500 m is based on both field observations and published data (e.g., Loegering 1992, USFWS 1996). In Quebec, Piping Plovers were observed using between 67 and 762 m of shoreline for feeding and brood rearing (Shaffer et Laporte 1989; Shaffer et Laporte 1992). Melvin et al. (1994) observed chicks at distances ranging between 10 and 900 m from their nests and in Ontario, 500 m of contiguous suitable habitat on either side of a breeding pair is used to approximate the areas used by Piping Plovers during their breeding cycle (Environment Canada. 2013).

In both regions, suitable habitat (Table 5) within the 1x1 km grid representations is identified as critical habitat under SARA and provides enough habitat to meet the long-term population and distribution objectives.

Due to the dynamic nature of coastal ecosystems, critical habitat mapping is represented by 1 x 1 km grid squares where the habitat occupancy criteria (above) and suitable habitat (Table 5) are met. Grid representation is created based on the site scale (1 x 1 km) and best characterizes the extent and nature of critical habitat. In Quebec, New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland and Labrador there are 163, 313, 223, 180 and 75 grid square units, respectively, identified as critical habitat (totaling 954 grid square units). These are presented in Appendix C.

Breeding pairs in non-critical habitat

Although sometimes used by Piping Plovers, nests in clearly unsuitable habitats that do not contain the biophysical attributes are not identified as critical habitat. Unsuitable features such as existing anthropogenic infrastructure (e.g., existing small craft harbours, wharves, boardwalks, parking lots), dredge spoils and steep embankments within a site are not necessary for the survival or recovery of the species and are

therefore not critical habitat. These sites likely do not contribute to recovery because some key attribute is often missing (e.g., access to foraging areas for chicks).

One site in Atlantic Canada that met the occupancy criteria was not included in the identification of critical habitat since the site was considered too small and isolated to successfully support a breeding pair and their young (S. Abbott 2017, personal communication). Similarly, 4 sites (2 in Atlantic Canada and 2 in Quebec) met the occupancy criteria but were not in an area supporting the necessary biophysical attributes as described in Table 5 since these nest sites were below the high water mark (outside of the area defined as the backshore) and likely not viable (S. Mader and F. Shaffer 2017, personal communication).

Although these known nest sites are not identified as critical habitat under SARA, the sections 32 and 33 (general prohibitions) of SARA apply to the species and its residence.

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: RecoveryPlanning-Planificationduretablissement@ec.gc.ca.

7.2 Schedule of Studies to Identify Critical Habitat

The information currently available is sufficient to fully identify critical habitat under SARA; therefore, a schedule of studies is not required.

7.3 Activities Likely to Result in the Destruction of Critical Habitat

Understanding what constitutes destruction of critical habitat is necessary for the protection and management of critical habitat. Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of one or more activities over time. Activities described in Table 6 include those likely to cause destruction of critical habitat for the species; however, destructive activities are not limited to those listed.

Table 6: Examples of activities likely to result in the destruction of critical habitat

Description of Activity	Description of Effect	Details of Effect
Use of any motorized vehicle (e.g., off-road, all-terrain, motorcycles.)	<ul style="list-style-type: none"> • Wrack may be crushed into the sand, making it unavailable as shelter and/or camouflage, or as foraging substrate; • Sediments may be compacted and invertebrate prey within them may be killed; • Dangerous habitat may be created. Vehicle ruts appear to provide shelter and/or camouflage but flightless plovers may become trapped in ruts and may be run over by vehicles; • Vegetation can be damaged by the regular use of paths causing dune blow-outs and increased erosion. This may alter the width, slope and length of the beach 	<p>Related IUCN-CMP Threat: 6.1 Recreational Activities (e.g., off-road vehicles).</p> <p>This activity would likely result in the destruction of critical habitat if it occurred within the bounds of critical habitat.</p> <p>This activity could cause destruction at all times of the year.</p>
Coastal development in critical habitat or in closely associated areas (e.g., construction of homes, vacation homes and associated infrastructure such as roads, boardwalks and trails)	<ul style="list-style-type: none"> • Natural landward migration processes (e.g., overwash and sand migration) are impeded by development; • Development may physically destroy or alter breeding habitat and/or the function of a site 	<p>Related IUCN-CMP Threat: 1.1 Housing & Urban Areas (e.g., construction of cottages or homes).</p> <p>This activity would likely result in the destruction of critical habitat if it occurred within the bounds of, or very near, critical habitat.</p> <p>This activity could cause destruction at all times of the year.</p>

Description of Activity	Description of Effect	Details of Effect
Beach nourishment (also referred to as beach replenishment or “soft” armouring or “soft” stabilization)	<ul style="list-style-type: none"> • Natural beach dynamics may be impeded; • Beach slope may be altered; • Substrate provided may be unsuitable (e.g., inappropriate grain size or sediment mix); • The grain size of introduced substrate can influence how fast the beach erodes, leading to changes in beach slope and shape; • Non-native vegetation species may be introduced; • Natural elements that provide shelter and/or camouflage may be removed/buried or if provided, may be unsuitable; • Invertebrate prey densities may be reduced 	<p>Related IUCN-CMP Threat: 7.3 Other Ecosystem Modifications (e.g., beach nourishment, shoreline stabilization, beach cleaning or raking).</p> <p>This activity would likely result in the destruction of critical habitat if it occurred within the bounds of critical habitat.</p> <p>This activity could cause destruction at all times of the year.</p> <p>Of note in exceptional circumstances, the reuse of clean; appropriately-sized and otherwise compatible; sediments (e.g., from a nearby dredging project) to increase the width or length of a beach or dune may be minimally disruptive to natural sediment transport processes and to plovers if project proposals are well designed (e.g., timing allows prey resources time to recover, slope of beach is maintained, sediments are not compacted, associated disturbance is minimized).</p>
Shoreline stabilization (also known as armouring or “hard” stabilization)	<ul style="list-style-type: none"> • Natural processes by which coastal habitats respond to storms may be impeded while foreshore erosion is accelerated; • Non-native vegetation species may be introduced; • Natural elements that provide shelter and/or camouflage may be removed/buried or if provided, may be unsuitable; • Amount and quality of intertidal foraging habitat for shorebirds may be reduced; • Natural transport of sand may be restricted leading to erosion of shorelines elsewhere 	<p>Related IUCN-CMP Threat: 1.1 Housing & Urban Areas.</p> <p>This activity would likely result in the destruction of critical habitat if it occurred within the bounds of critical habitat.</p> <p>Outside of critical habitat, this activity may likely result in the destruction of adjacent critical habitat if natural processes by which coastal habitats respond to storms are impeded.</p> <p>This activity could cause destruction at all times of the year.</p>

Description of Activity	Description of Effect	Details of Effect
Sand mining (removal of sand, gravel and/or cobble substrate)	<ul style="list-style-type: none"> • Substrate and natural elements that provide shade and/or camouflage may be removed; • Beach slope may be altered 	<p>Related IUCN-CMP Threat: 3.2 Mining & Quarrying (e.g., sand and beach sediments).</p> <p>This activity would likely result in the destruction of critical habitat if it occurred within the bounds of critical habitat.</p> <p>This activity could cause destruction at all times of the year.</p>
Beach cleaning or raking (e.g., mechanical raking, sifting/screening)	<ul style="list-style-type: none"> • Natural elements that enhance foraging potential and provide shade and/or camouflage may be removed 	<p>Related IUCN-CMP Threat: 7.3 Other Ecosystem Modifications (e.g., beach nourishment, shoreline stabilization, beach cleaning or raking).</p> <p>This activity would likely result in the destruction of critical habitat if it occurred within the bounds of critical habitat.</p> <p>This activity could cause destruction at all times of the year.</p> <p>Of note, removing garbage or other human-created debris by hand would not likely result in the destruction of critical habitat and should generally be positive for Piping Plovers as long as disturbance to the birds is minimized.</p>
Deliberate or accidental discharge of oil and toxic chemicals	<ul style="list-style-type: none"> • Invertebrate prey may be killed; • Functionality of foreshore and backshore of beaches for breeding, resting and/or foraging may be removed depending on timing and location; • All biophysical attributes of critical habitat may be impacted by clean-up operations 	<p>Related IUCN-CMP Threat: 9.2 Industrial & Military Effluents.</p> <p>The effects of this activity would likely result in the destruction of critical habitat; recognizing that the spills may occur within or outside the bounds of critical habitat.</p> <p>This activity could cause destruction at all times of the year.</p>

7.4 Scope of the Action Plan

The original recovery strategy for the Piping Plover in Canada was posted on the Species at Risk Registry in 2012 (Environment Canada 2012) and is replaced and amended by this document. This recovery document (amended recovery strategy and action plan) should be considered along with The Multi-species Action Plan for Kejimikujik National Park and National Historic Site of Canada (Parks Canada Agency 2017), The Multi-species Action Plan for Kouchibouguac National Park of Canada and associated National Historic Sites of Canada (Parks Canada Agency 2016b), The Multi-species Action Plan for Prince Edward Island National Park of Canada (Parks Canada Agency 2016c) and The Multi-species Action Plan for Gros Morne National Park (Parks Canada Agency 2016).

As in the original recovery strategy (Environment Canada 2012), this amended recovery strategy and action plan includes critical habitat in three PCA National Parks (Kouchibouguac National Park of Canada, Prince Edward Island National Park of Canada and Kejimikujik National Park of Canada Seaside). The critical habitat identified in these National Parks is included in the scope of this action plan. However, additional critical habitat was identified by PCA in Gros Morne National Park through their park-based Action Plan in 2016 and therefore it is not included in the scope of this action plan but the document should also be considered.

7.5 Proposed Measures to Protect Critical Habitat

As part of the species' action plan, the information below outlines proposed measures to be taken to protect critical habitat for Piping Plover.

Measures Proposed to Protect Critical Habitat on Federal Lands

Gazette statements are available on the Species at Risk Public Registry (the Registry). There are currently three gazette statements published on the Registry. In January 2013 and in December 2017, two gazette statements associated with the original recovery strategy (Environment Canada 2012) were posted on the Registry and describe a number of federally protected areas. An additional gazette statement associated with the Multi-species Action Plan for Gros Morne National Park of Canada (Parks Canada Agency 2016) describing critical habitat at Western Brook Beach in Gros Morne National Park of Canada was posted on the Registry in June 2016. An additional gazette statement is required for Pointe de l'Est National Wildlife Area to complete the description of federal properties with critical habitat.

Critical habitat for Piping Plover also occurs on federal lands that are not federally protected areas. Under the provisions of subsection 58(5) of SARA, the competent minister shall, after consulting with every other competent minister, make an order for any portion of critical habitat that is not legally protected by provisions in or measures under SARA or any other Act of Parliament. If the minister does not make the order, the minister shall include in the Registry a statement setting out how the critical habitat or

portions of it are legally protected. ECCC will continue to work with applicable federal departments to ensure that critical habitat on other federal lands is protected.

Measures Proposed to Protect Critical Habitat on Non-federal Lands

With regard to the portions of critical habitat on non-federal lands, ECCC will assess the protection currently in place. This involves first working with the Governments of Quebec, New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland and Labrador to determine which provincial laws and legal instruments are in place to prevent destruction of critical habitat. If there are gaps in the protection of critical habitat, provisions or measures in place under SARA or other federal legislation will be reviewed to determine whether they prevent destruction of critical habitat. Conservation measures, including stewardship initiatives, that contribute to preventing critical habitat destruction will also be considered and monitored. The laws, legal agreements and conservation measures in place that protect critical habitat will be monitored for efficacy at least every five years.

If it is determined that any portions of critical habitat are not protected, and steps are being taken to protect those portions, those steps will be communicated via the Registry through the reports referred to in section 63 of SARA.

8. Evaluation of Socio-economic Costs and Benefits

SARA requires that an action plan include an evaluation of the socio-economic costs of the action plan and the benefits to be derived from its implementation (SARA 49(1)(e), 2002). This evaluation addresses only the incremental socio-economic costs of implementing this action plan from a national perspective as well as the social and environmental benefits that would occur if the action plan were implemented in its entirety, recognizing that not all aspects of its implementation are under the jurisdiction of the federal government. It does not address cumulative costs of species recovery in general nor does it attempt a cost-benefit analysis. Its intent is to inform the public and to guide decision making on implementation of the action plan by partners.

The protection and recovery of species at risk can result in both benefits and costs. The Act recognizes that *“wildlife, in all its forms, has value in and of itself and is valued by Canadians for aesthetic, cultural, spiritual, recreational, educational, historical, economic, medical, ecological and scientific reasons”* (SARA 2002). Self-sustaining and healthy ecosystems with their various elements in place, including species at risk, contribute positively to the livelihoods and the quality of life of all Canadians. A review of the literature confirms that Canadians value the preservation and conservation of species in and of themselves. Actions taken to preserve a species, such as habitat protection and restoration, are also valued. In addition, the more an action contributes to the recovery of a species, the higher the value the public places on such actions (Loomis and White 1996, Fisheries and Oceans Canada 2008). Furthermore, the conservation of species at risk is an important component of the Government of Canada's commitment to conserving biological diversity under the *International*

Convention on Biological Diversity. The Government of Canada has also made a commitment to protect and recover species at risk through the [Accord for the Protection of Species at Risk](#). The specific costs and benefits associated with this action plan are described below.

8.1 Policy Baseline

The policy baseline consists of the protection under SARA for Piping Plover, along with other legislation that may provide direct or indirect habitat protection for the species. The provinces of Quebec, New Brunswick, Prince Edward Island, Nova Scotia and Newfoundland and Labrador have access to many legislative, regulatory and management tools for the conservation and stewardship of Piping Plover.

For example,

- in Quebec: Threatened or Vulnerable Species Act, Conservation and Development of Wildlife Act, Environment Quality Act, Provincial Parks Regulations, Off-Highway Vehicles Act and regulations;
- in New Brunswick: Endangered Species Act, Off-Road Vehicle Act, Clean Environment Act, Crown Lands and Forests Act, Parks Act regulations;
- in Prince Edward Island: Environmental Protection Act, Off-Highway Vehicle Act Regulations;
- in Nova Scotia: Endangered Species Act, Beaches Regulations, Off-Highway Vehicles Act, Environment Act, Wildlife Act, Provincial Parks Regulations; and
- in Newfoundland and Labrador: Endangered Species Act, Environmental Protection Act, Wild Life Regulations, Motorized Snow Vehicles and All-Terrain Vehicles Regulations, Provincial Parks Regulations.

The baseline also includes any recovery measures already undertaken, such as those carried out by recovery practitioners funded by federal or provincial species at risk programs, in-kind contributions by recovery biologists and/or universities.

The critical habitat located on federally protected areas (i.e., National Parks, National Wildlife Areas and a Migratory Bird Sanctuary) is (or will be) protected under section 58(3) of SARA.

8.2 Socio-economic Profile and Baseline

Key stakeholders that may be impacted by the implementation of this action plan include federal and provincial landowners/ land managers, municipal planners and planning authorities, private landowners and beach managers, private land conservation organizations, those in the fishing and tourism industries, all-terrain vehicle associations and users, academics focused on shorebirds, environmental emergencies teams and beach visitors and users.

Two Indigenous groups were involved with past Piping Plover initiatives in Prince Edward Island and Nova Scotia because their lands are in close proximity to beaches

identified as critical habitat. Two Indigenous groups are actively involved with Piping Plover conservation initiatives in Newfoundland and Labrador.

Many recovery measures will be implemented with the assistance of federal or provincial species at risk funding programs, in-kind contributions by recovery biologists, or research by universities.

8.3 Socio-economic Costs of Implementing this Action Plan

Implementation of the recovery measures identified in Table 4 may generate direct costs as well as societal costs. These costs are reported in this section only if they result in incremental expenditures or constraints in land uses (including foregoing or modifying current and future activities) compared to measures already in place (see ongoing measures in Table 4).

The direct and societal costs of implementing the recovery measures contained in this action plan are expected to be low (between \$0 and \$5 million) over the short term (five years). These anticipated costs include salary, volunteer time, travel, materials, equipment and other related costs. Indirect costs are those resulting from implementing the action plan, which may have an impact on various stakeholders.

There are a number of activities currently taking place at sites where Piping Plovers breed including beach recreation (e.g., pedestrian traffic, sunbathing, camping and campfires, kite buggies and surfing and unleashed pets) and off-road vehicle (ORV) use. In Newfoundland and Labrador, ORV use on beaches is a legal activity unless otherwise designated by a ministerial directive. Ministerial directives are now in place for most critical habitat sites, but not all sites. On the Magdalen Islands in Quebec, ORV use on beaches during the Piping Plover breeding season is illegal, except where an off-road trail is located. It is assumed that ORV use will be restricted on lands identified as critical habitat during the Piping Plover breeding season (May-August), resulting in an impact to ORV users. Restrictions on other recreational activities may be required to protect breeding plovers and their habitat.

Coastal development activities such as operation and maintenance of wharves, dredging of small craft harbours, jetties, creation of erosion control structures and activities associated with cottages/homes may occur in areas on, or near, Piping Plover critical habitat. Coastal development activities may need to be regulated through federal, provincial and municipal processes if they are likely to destroy critical habitat. For example, dredging occurs regularly in harbour entrances and channels to allow local fishers access to the open seas. In a small number of cases this occurs on or near Piping Plover critical habitat. Dredging activities usually occur in early spring, coinciding with the arrival of Piping Plovers and the species' breeding season. As a result, modifications to dredging operations may be required at some small craft harbours.

Other coastal development activities, such as shoreline stabilization, may be impacted as a result of the protection of critical habitat. However, there may be ways to mitigate

activities to prevent the destruction of critical habitat. At this time, specific development activities and any modifications that may be required are unknown, and therefore it is difficult to estimate the impact.

8.4 Benefits of Implementing this Action Plan

Value of Biodiversity to Canadians

Biodiversity is essential for healthy ecosystems, human health, prosperity, security and well-being. For these reasons, globally, society invests between US\$ 8B and US\$ 10B annually in biodiversity conservation (TEEB 2008).

Canadians derive many benefits from biodiversity including recreational, aesthetic, educational and cultural benefits, as well as ecological goods and services essential to human survival. Care for the environment is consistently ranked as one of Canadian's top priorities in public opinion polls¹⁹. A 2011 opinion poll found that three-quarters of Canadian respondents feel that preserving natural areas and the diversity of native plant and animal life in Canada is important to them²⁰.

The total value of species at risk includes non-consumptive-use values (such as recreation, spiritual/cultural, research and education), indirect-use values (value of the ecological role of a species in an ecosystem) and non-use values (i.e., preserving the benefits of nature for future generations)²¹. Implementing the recovery measures of this action plan will have a positive impact on society. The direct value of recovering these species, for the preservation or the enhancement of biodiversity, is not easily estimated.

Eco-tourism and Cultural Values

Eco-tourism is the fastest-growing area of the tourism industry (Mastny 2001). In 2004, this market grew three times faster than the industry as a whole and the World Tourism Organization estimates that global spending on eco-tourism is increasing by 20% a year, about six times the industry-wide rate of growth (TEEB 2008). In 1996, the Importance of Nature to Canadians Survey estimated that 6.2% of Canadians (1.5 million) watched, photographed, studied, or fed wildlife and spent close to \$488M on these activities. There may be an increase in eco-tourism activity, as a result of achieving the population and distribution objectives for Piping Plover, which would then lead to spin-offs to local business and enhanced cultural value of local communities.

Protection of Other Species

Efforts to protect plover critical habitat will benefit other species of flora and fauna including these Species at Risk: Red Knot (*Calidris canutus rufa*), Gulf of St. Lawrence

¹⁹ Canada's Fourth National Report to the United Nations Convention on Biological Diversity, 2010. Available online <http://www.cbd.int/doc/world/ca/ca-nr-04-en.pdf> Accessed December 3, 2010.

²⁰ Ipsos Reid Opinion Poll "Nine in Ten (87%) Canadians Say That When Connected to Nature They Feel Happier." Released January 7, 2011, www.ipsos.ca

²¹ Non-use values include bequest value (satisfaction of knowing that future generations will have access to nature's benefits), altruist value (satisfaction of knowing that other people have access to nature's benefits) and existence value (satisfaction of knowing that a species or ecosystem exists).

Aster (*Symphotrichum laurentianum*), “Ipswich” Sparrow (*Passerculus sandwichensis princeps*) and Beach Pinweed (*Lechea maritima*). Activities within this action plan may lead to positive impacts for *rufa* Red Knot, Gulf of St. Lawrence Aster, “Ipswich” sparrow and the Beach Pinweed and may decrease the direct cost of future conservation and protection actions for these species.

Ecosystem Services

Sand dune systems act as a natural coastal defence against erosion, waves and flooding and buffer against extreme weather events (Spurgen 1998). They also provide other important ecosystem services including water filtration and purification, nutrient cycling and water storage in dune aquifers (Defeo et al. 2009).

8.5 Distributional Impacts

Piping Plovers occur on federal, provincial and private lands and it is expected that responsibility for the species’ recovery will be shared amongst those landowners as well as all beach users. Implementation of this action plan will require contributions from, and collaboration among, various levels of government, non-governmental organizations, universities, individuals and others. Non-governmental organizations are active in Piping Plover conservation where the species occurs, and an approach of this action plan is to foster cooperative relationships with landowners and others to maintain critical habitat.

9. Measuring Progress

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

New information may be integrated to reflect new knowledge, challenges and opportunities. An evaluation of the recovery strategy will be based upon the performance measures listed below.

Annually, success of the recovery strategy implementation will be measured against the following performance indicators:

- The population is increased to 250 pairs;
- Productivity target of 1.65 chicks fledged per territorial pair is achieved

Over three consecutive international censuses, which occur every five years, success of the recovery strategy implementation will be measured against the following performance indicators:

- The population is increased to 310 pairs
- The population distribution is unchanged from the 1991 International Census

The competent minister must report on the implementation of the recovery strategy (section 46 of SARA) and action plan (section 55 of SARA) and the progress towards meeting its objectives within five years. Reporting on *implementation* of the action plan, under section 55 of SARA, will be done by assessing progress towards implementing broad strategies. Reporting on the ecological and socio-economic impacts of the action plan, under section 55 of SARA, will be done by assessing the results of monitoring the recovery of the species and its long-term viability and by assessing the implementation of the action plan.

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Appendix A: Effects on the Environment and Other Species

A strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents, in accordance with the [Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals](#)²². 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](#)'s²³ (FSDS) goals and targets.

Recovery planning is intended to benefit species at risk and biodiversity in general. However, it is recognized that implementation of action plans may 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 action plan itself, but are also summarized below in this statement.

The SEA concluded that this plan will clearly benefit the environment and will not entail any significant adverse effects. Piping Plovers require relatively undisturbed, undeveloped coastal beach habitats and the maintenance of natural coastal processes, all of which will benefit co-occurring species.

²² www.canada.ca/en/environmental-assessment-agency/programs/strategic-environmental-assessment/cabinet-directive-environmental-assessment-policy-plan-program-proposals.html

²³ www.fsds-sfdd.ca/index.html#/en/goals/

Appendix B: Summary of the Assessment of Research Needs

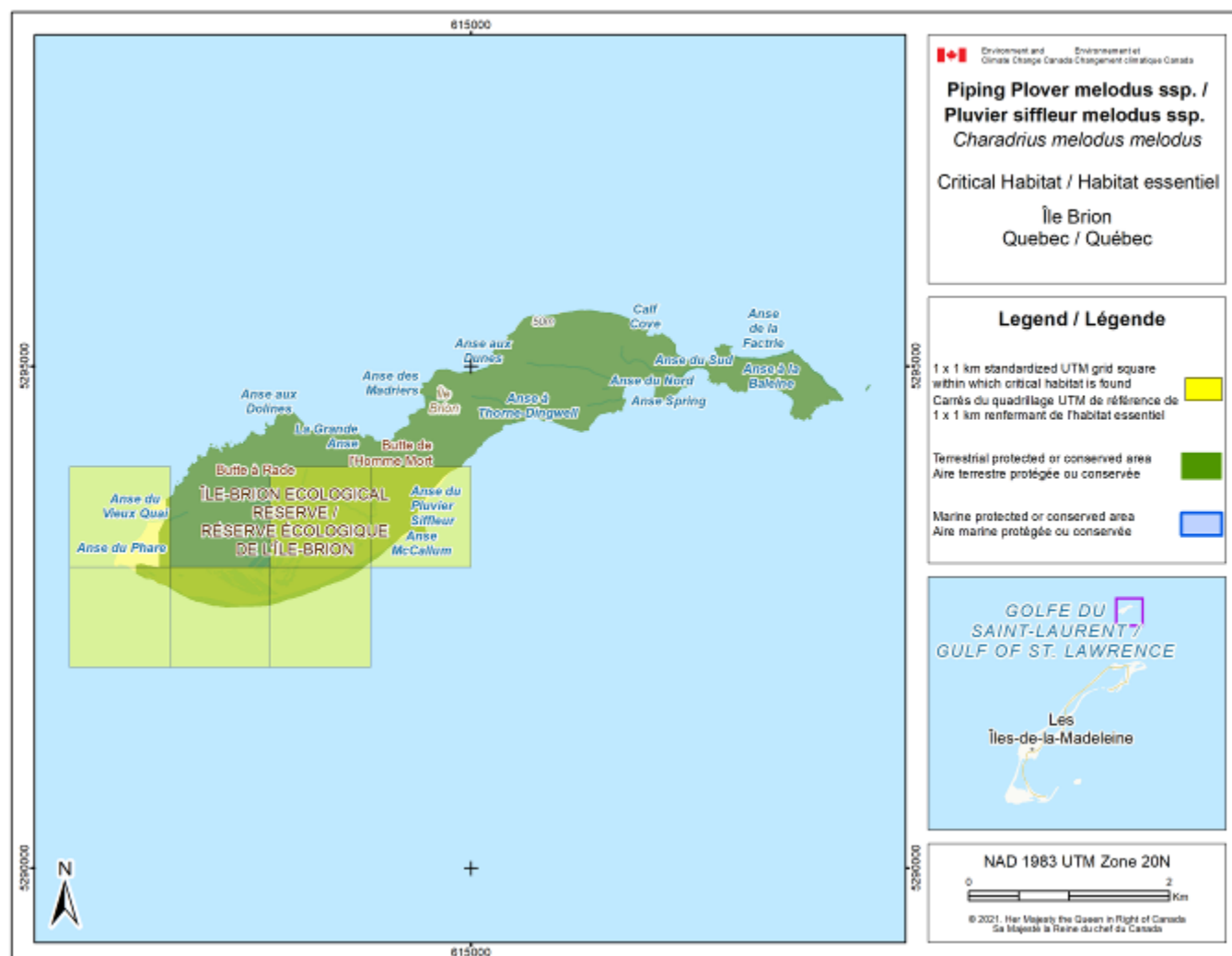
Knowledge gaps related to the recovery of Piping Plover were reviewed and prioritized based on the ability of the research to provide knowledge immediately essential for directing effective future conservation actions (Gratto-Trevor et al. 2013). The prioritization of these knowledge gaps are summarized in Table B.1. Additional descriptions of the knowledge gaps and justification for the priority ratings can be found in Appendix V of Gratto-Trevor et al. (2013).

Table B.1. A summary of the prioritization of research needs / knowledge gaps identified in the amended recovery strategy, based on the findings from Gratto-Trevor et al. (2013).

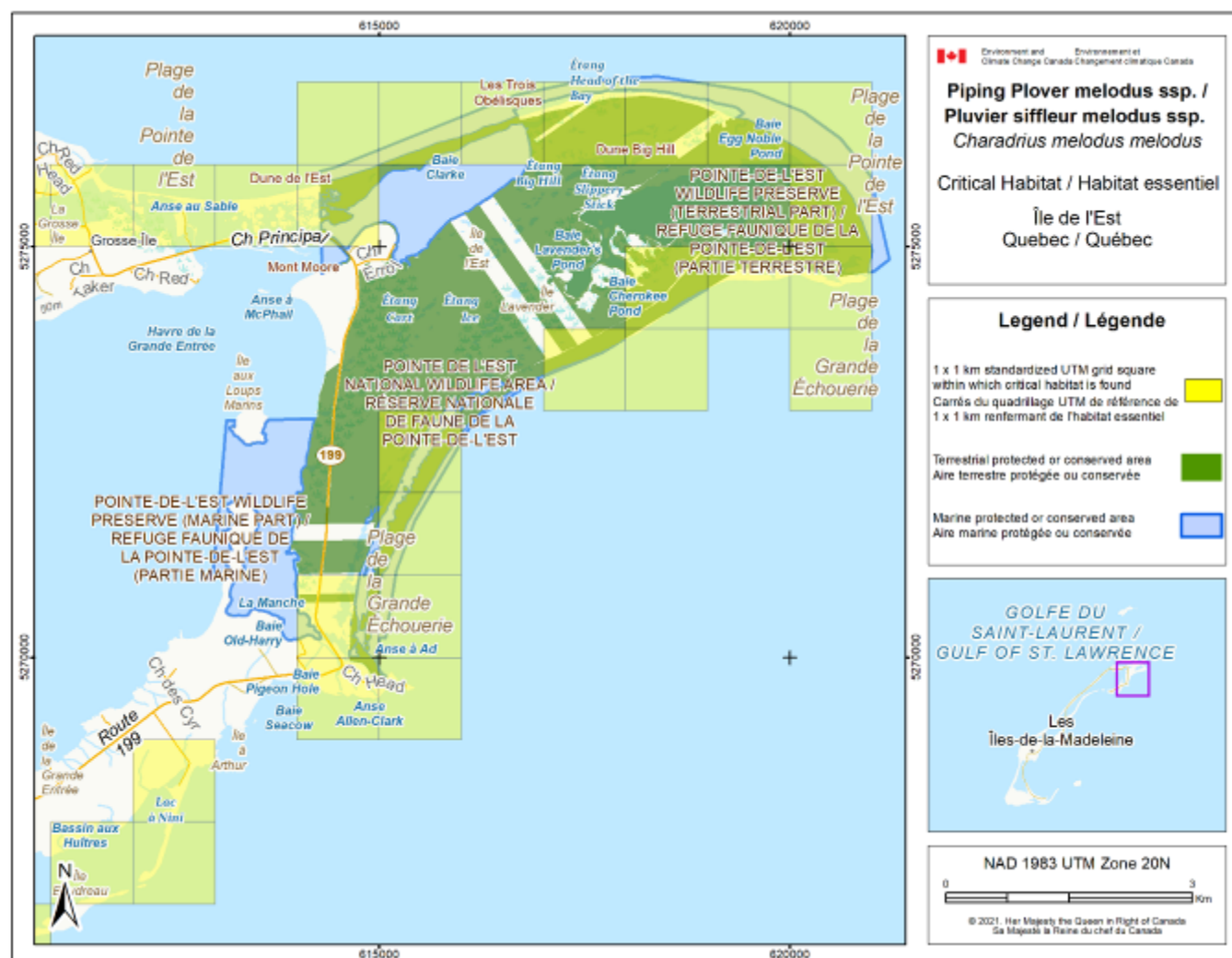
Research need	Priority
Knowledge gaps to recovery presented in the amended recovery strategy and prioritized by Gratto-Trevor et al. (2013):	
Identification of nonbreeding grounds (i.e., staging, migration and wintering).	High
Identification of threats to plovers on nonbreeding grounds.	High
Analyses of population viability so that the probability of population persistence can be calculated and the possible outcomes of different management scenarios can be explored.	High
Evaluate recovery management techniques (e.g., predator management and vegetation manipulation).	High
Factors affecting juvenile and adult survival, including invertebrate prey availability.	High – survival analysis; Low – prey availability
The effectiveness of mitigation measures required under environmental assessments.	Medium
Identification of the predators of adults, eggs and young and an assessment of their population-level impacts. This must be done in advance, if any predator control activities are proposed.	Medium - in specific cases only
Increase understanding of stressors in the coastal zone that affect plover habitat, survival and productivity, to enable effective input into coastal planning.	Medium
Movement of adults and young between breeding areas.	Medium-Low
Conservation genetics to determine population links within the Atlantic provinces and Quebec and with populations outside the region.	Medium-Low
Factors affecting reproductive success and survival.	Medium-Low

Research need	Priority
Knowledge gaps to recovery presented in the amended recovery strategy and prioritized by Gratto-Trevor et al. (2013):	
Accuracy of fledgling rate estimates.	Medium-Low
The influence of invertebrate population, distribution and abundance on habitat selection by plovers.	Low
Assess the carrying capacity of habitats in Atlantic Canada and Quebec and whether there is a need to protect currently unoccupied sites to meet population recovery objectives.	No longer a priority
Assess the impact of sea level rise as a result of climate change on critical habitat designated under SARA.	No longer a priority
Additional knowledge gaps to recovery identified by Gratto-Trevor et al. (2013), but not presented in the amended recovery strategy:	
Identify the season and areas where most juvenile and adult mortality occurs.	High
Document the size of the areas used by adults and broods near the nest to refine core use areas within critical habitat.	Medium
Knowledge gaps to recovery presented in the amended recovery strategy, not prioritized by Gratto-Trevor et al. (2013), but prioritized in this action plan:	
Assess the response of plovers to disturbance, harassment and habitat management.	Medium
Compare characteristics of occupied habitat to apparently suitable, but unoccupied habitat.	Low

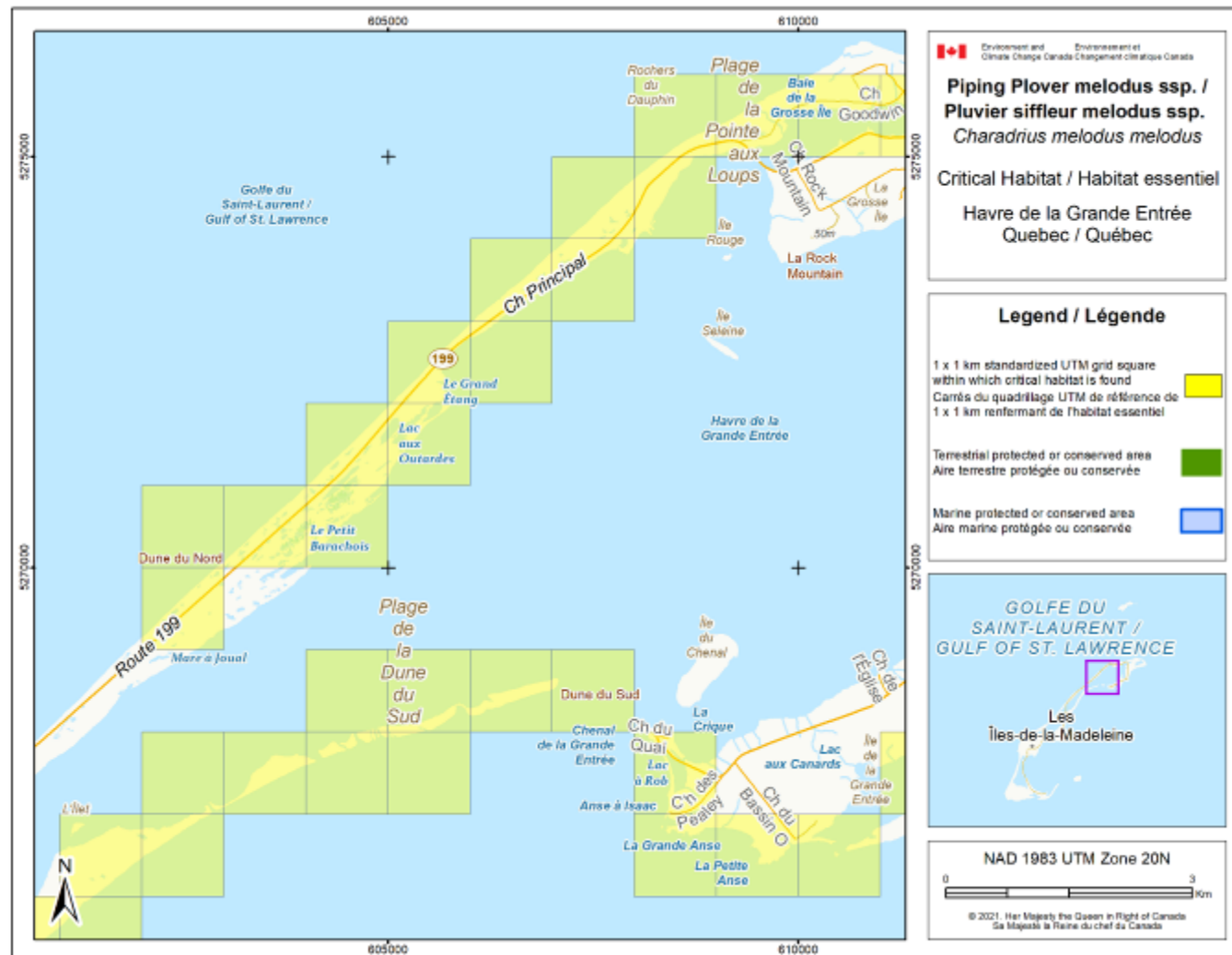
Appendix C: Geographic Location of Areas Containing Critical Habitat



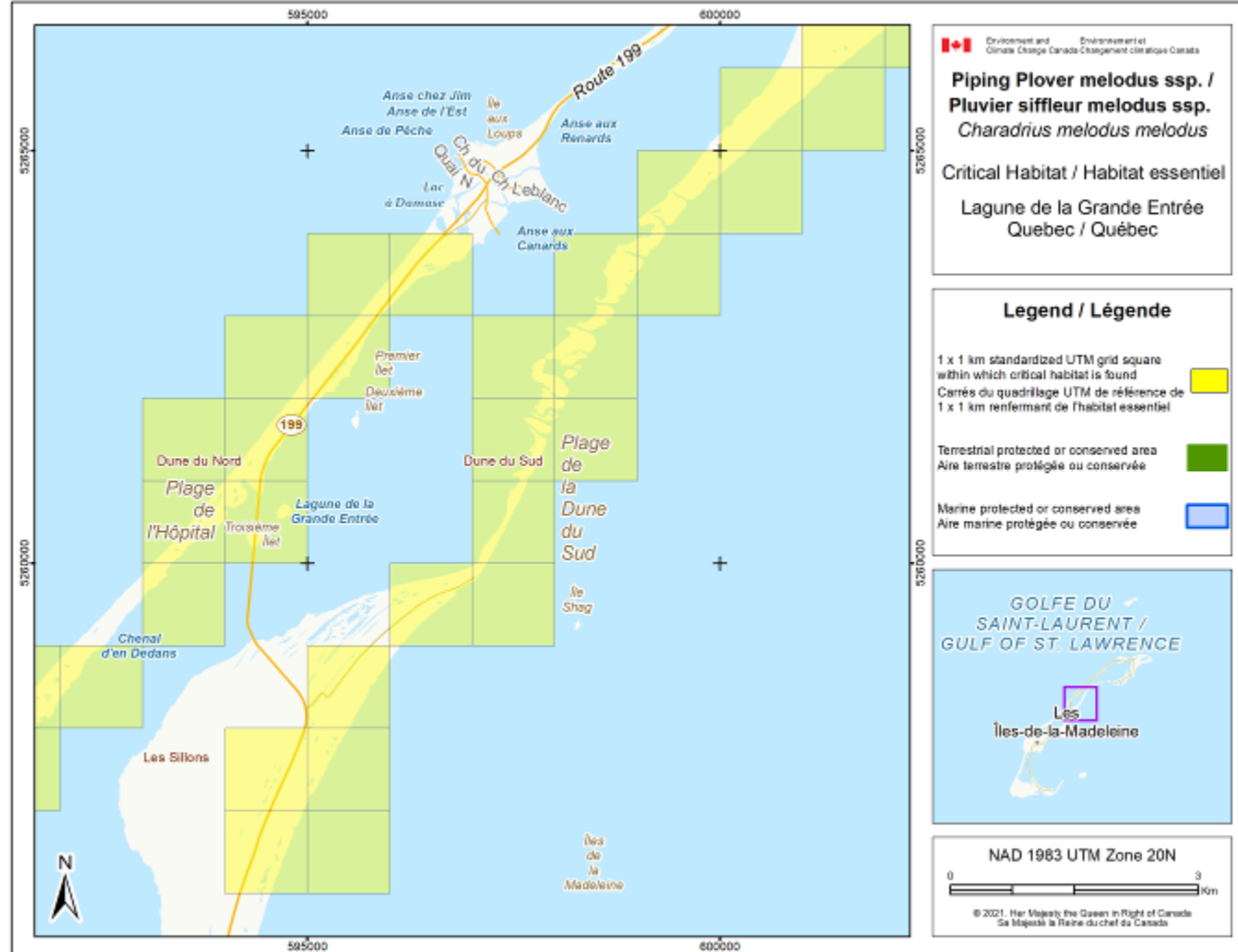
C-1. Grid squares containing critical habitat for Piping Plover in Île Brion, Quebec. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



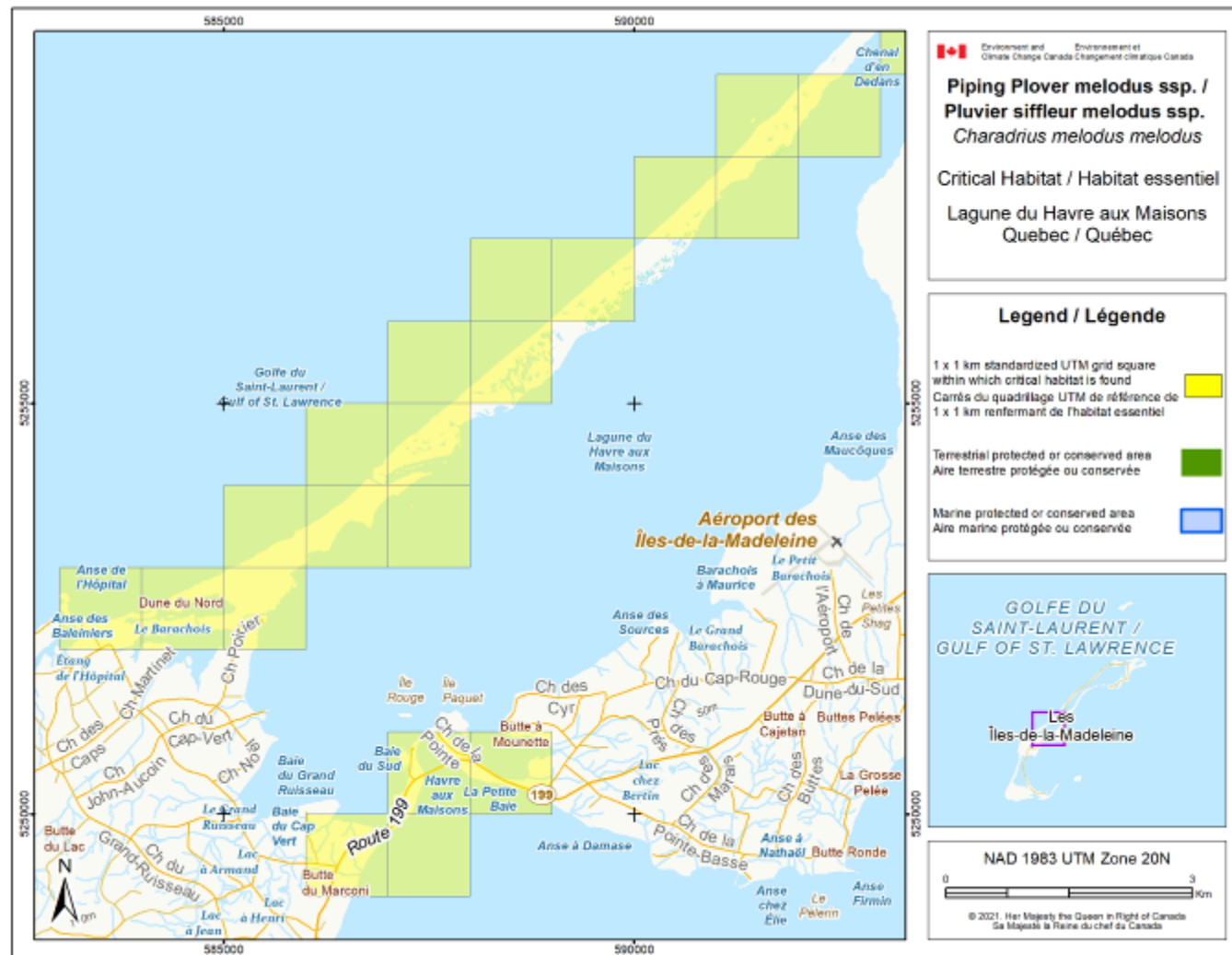
C-2. Grid squares containing critical habitat for Piping Plover in Île de l'Est, Quebec. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



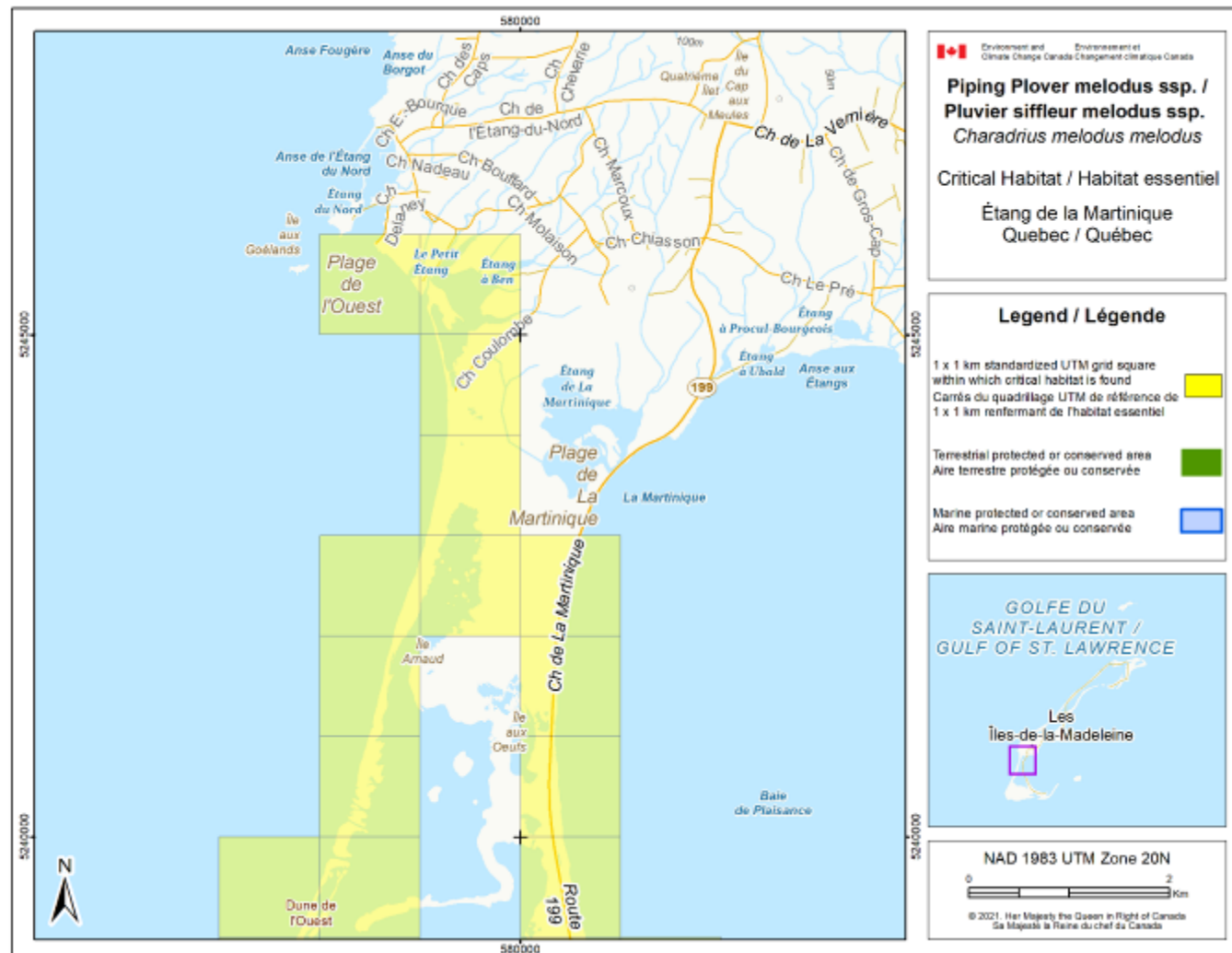
C-3. Grid squares containing critical habitat for Piping Plover in Havre de la Grande Entrée, Quebec. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



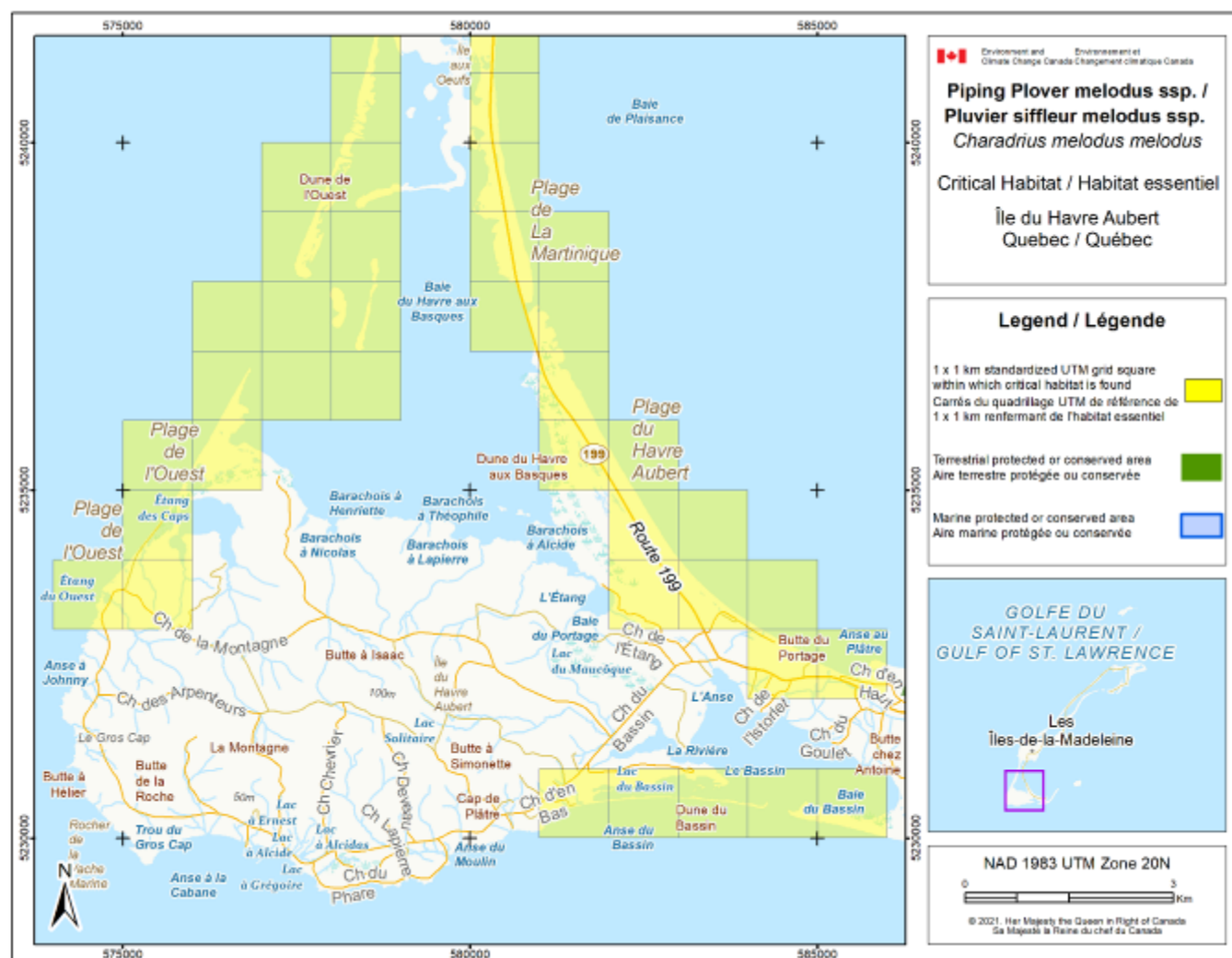
C-4. Grid squares containing critical habitat for Piping Plover in Lagune de la Grande Entrée, Quebec. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



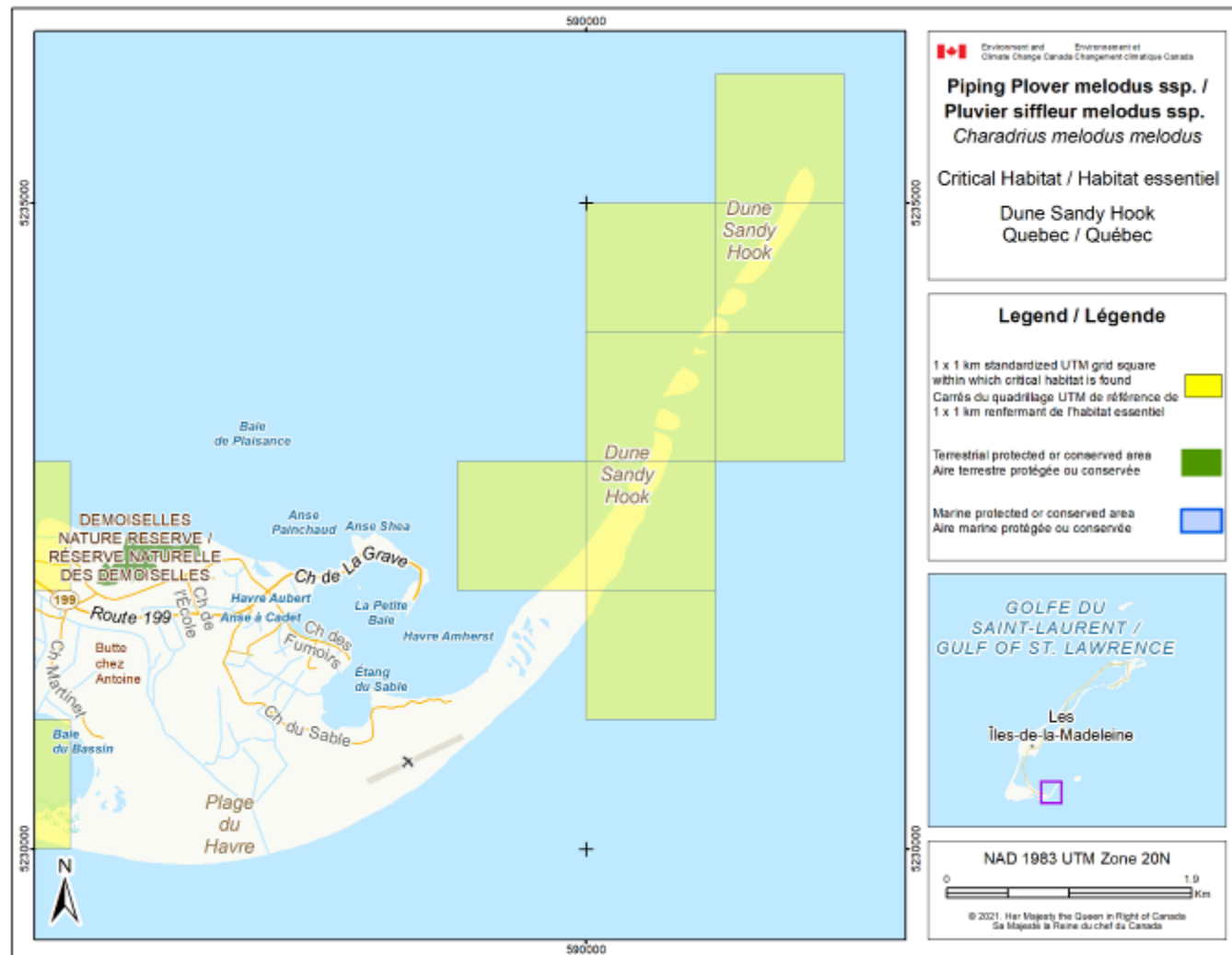
C-5. Grid squares containing critical habitat for Piping Plover in Lagune du Havre aux Maisons, Quebec. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



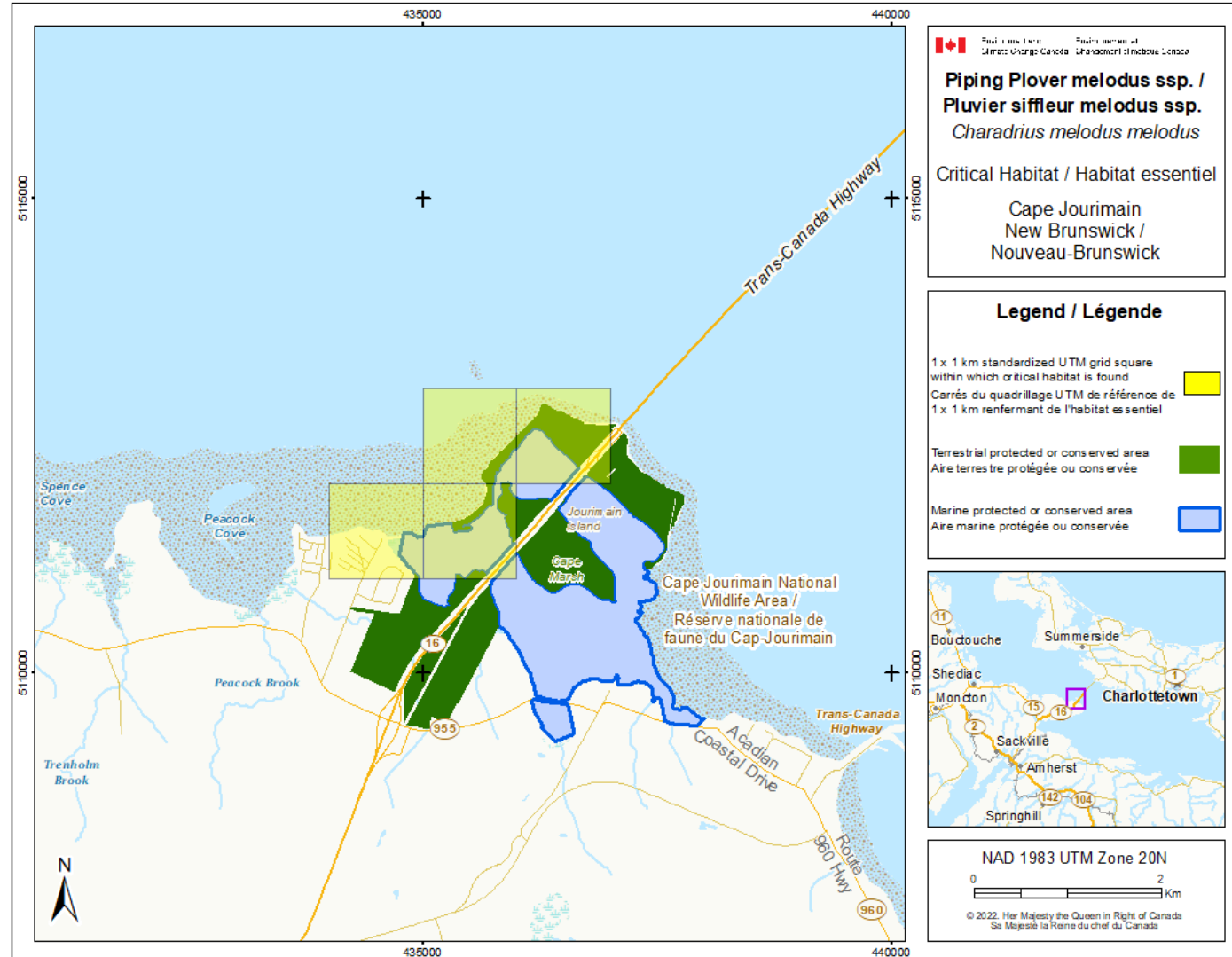
C-6. Grid squares containing critical habitat for Piping Plover in Étang de la Martinique, Quebec. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



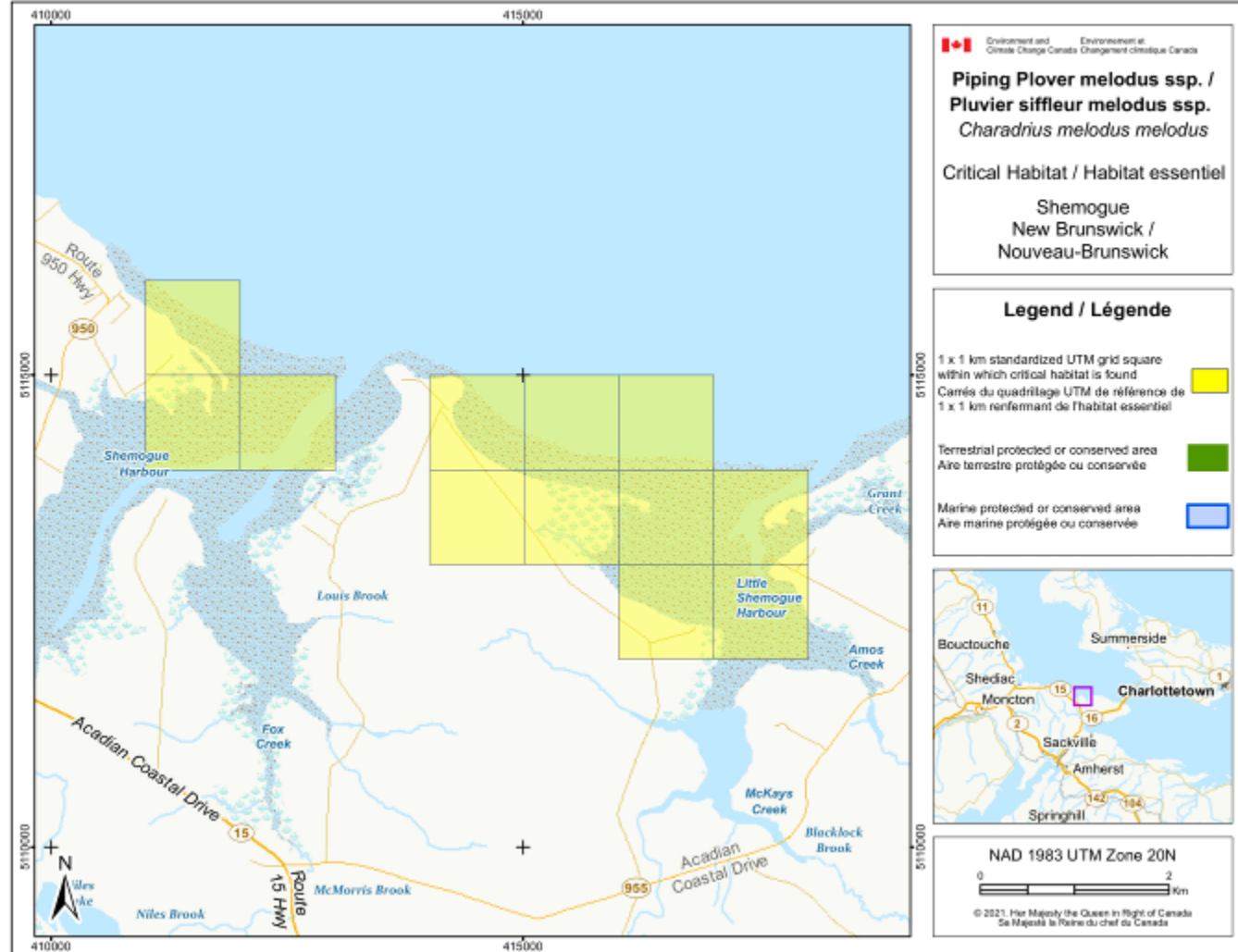
C-7. Grid squares containing critical habitat for Piping Plover in Île du Havre Aubert, Quebec. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



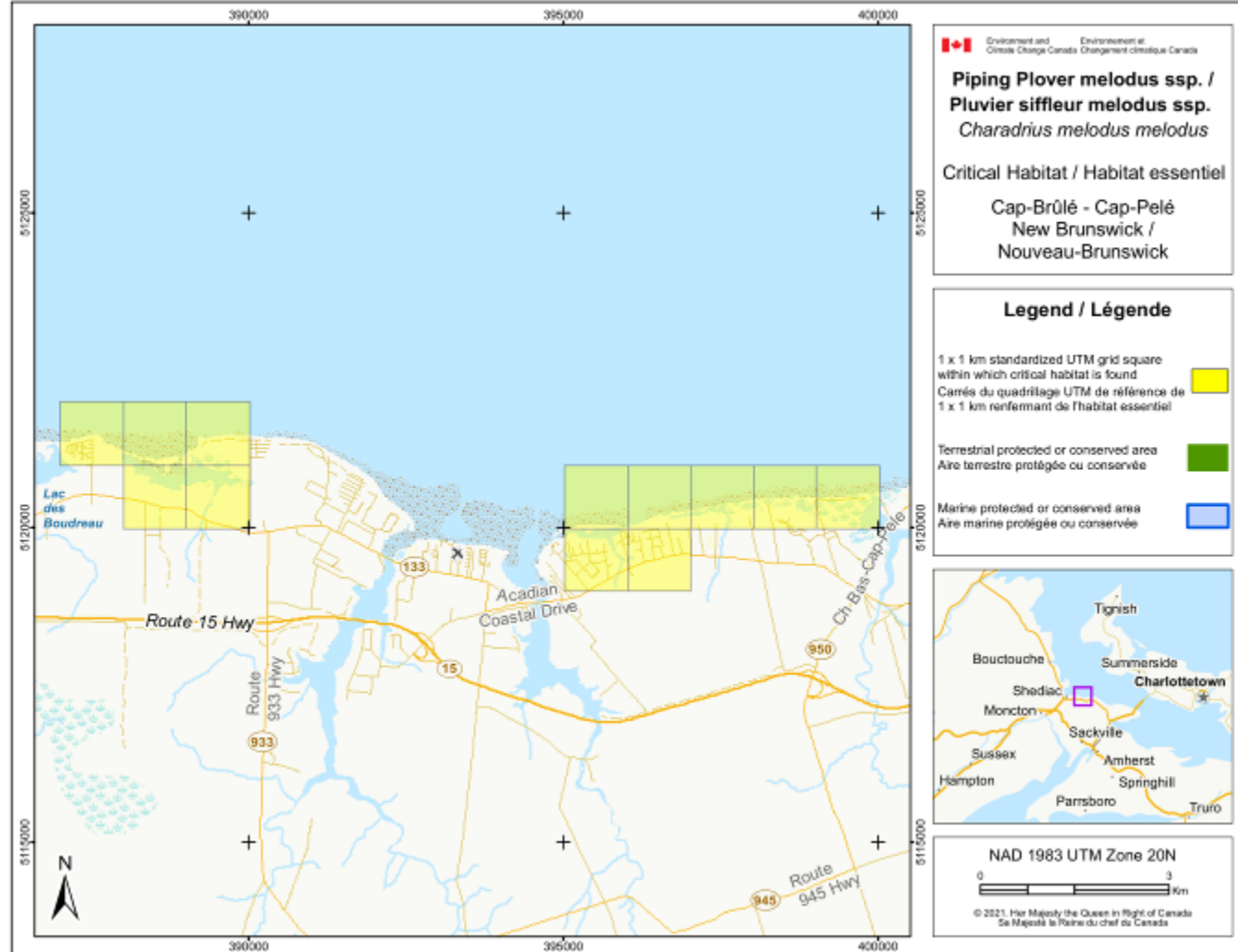
C-8. Grid squares containing critical habitat for Piping Plover in Dune Sandy Hook, Quebec. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



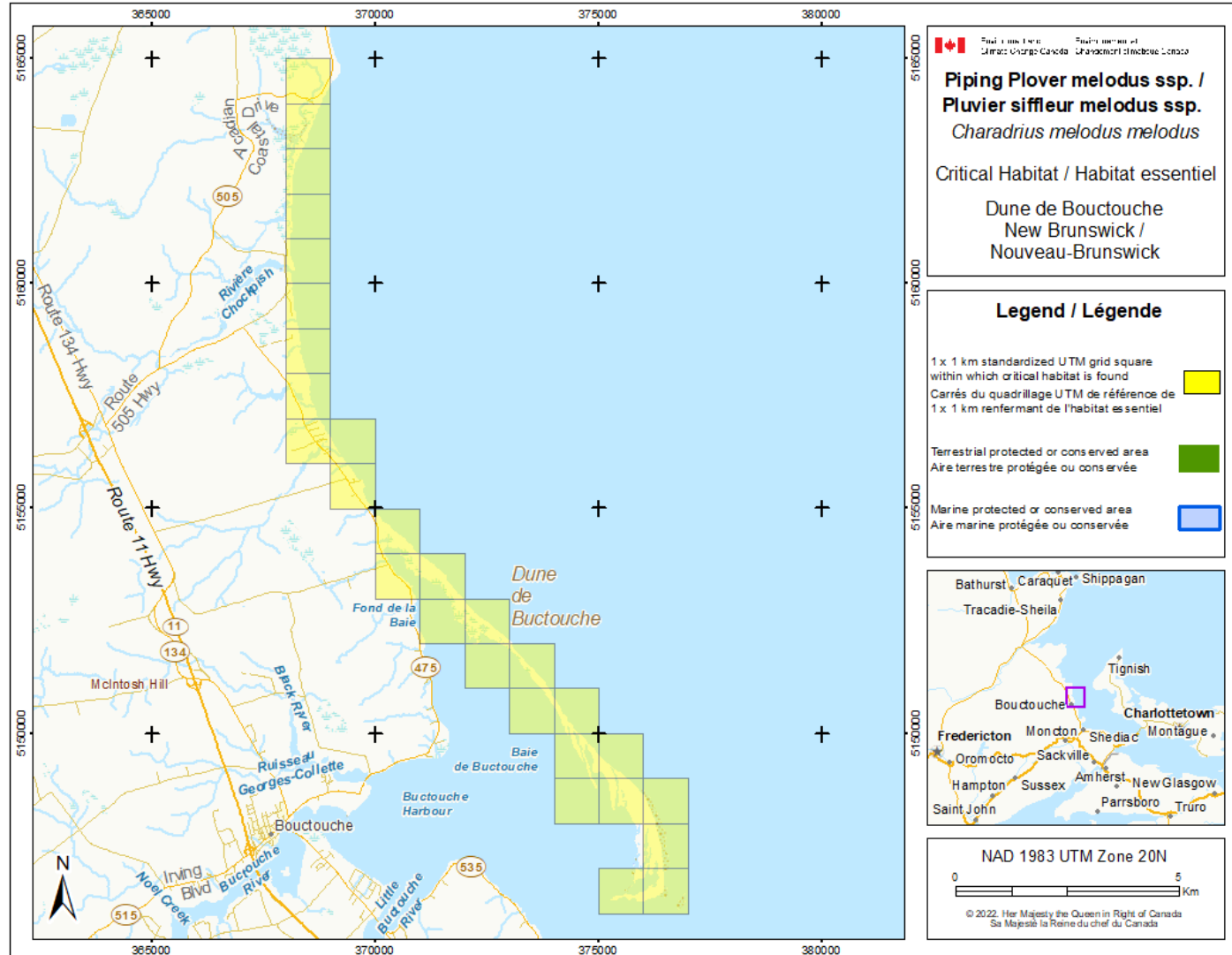
C-9. Grid squares containing critical habitat for Piping Plover in Cape Jourimain, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



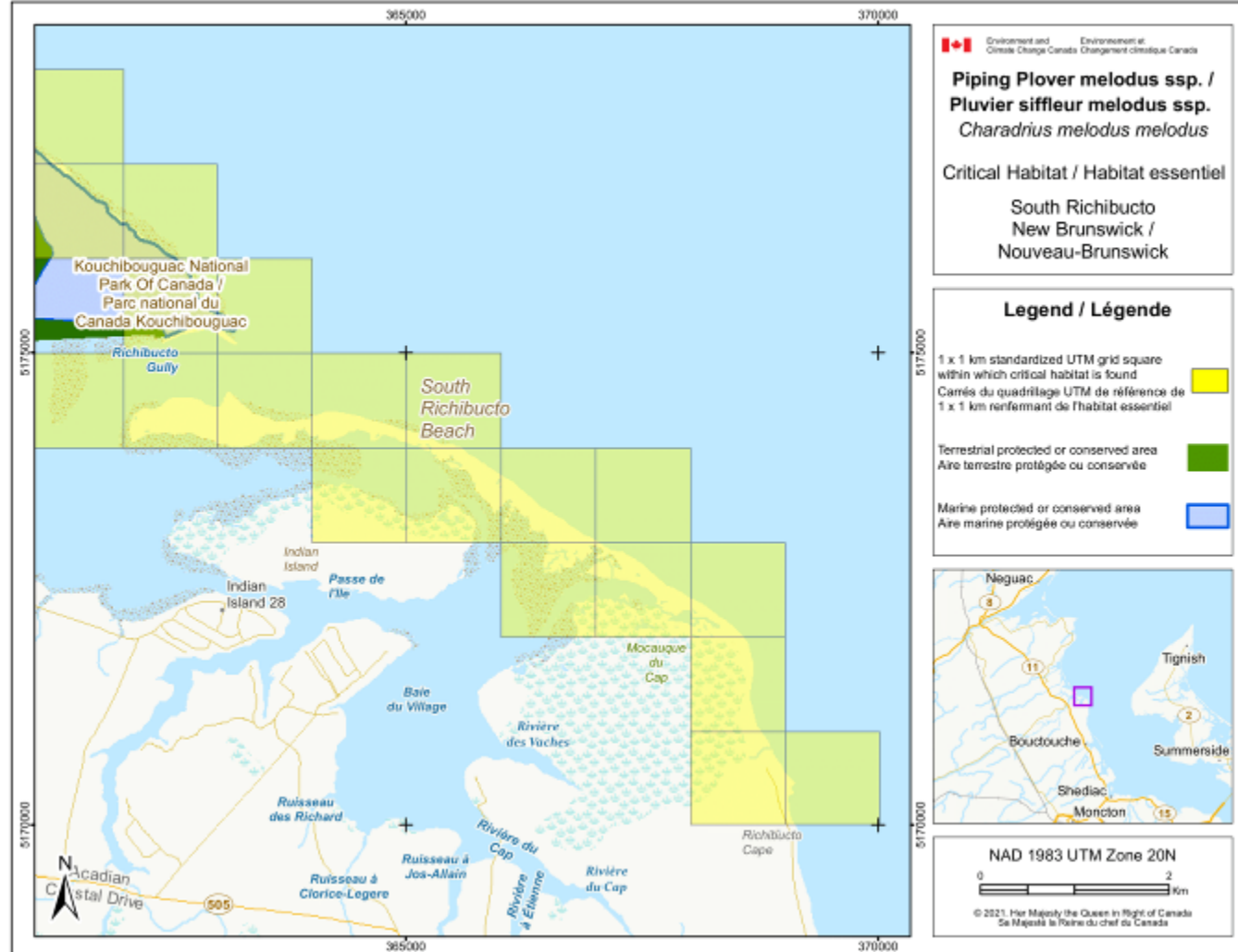
C-10. Grid squares containing critical habitat for Piping Plover in Shemogue, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



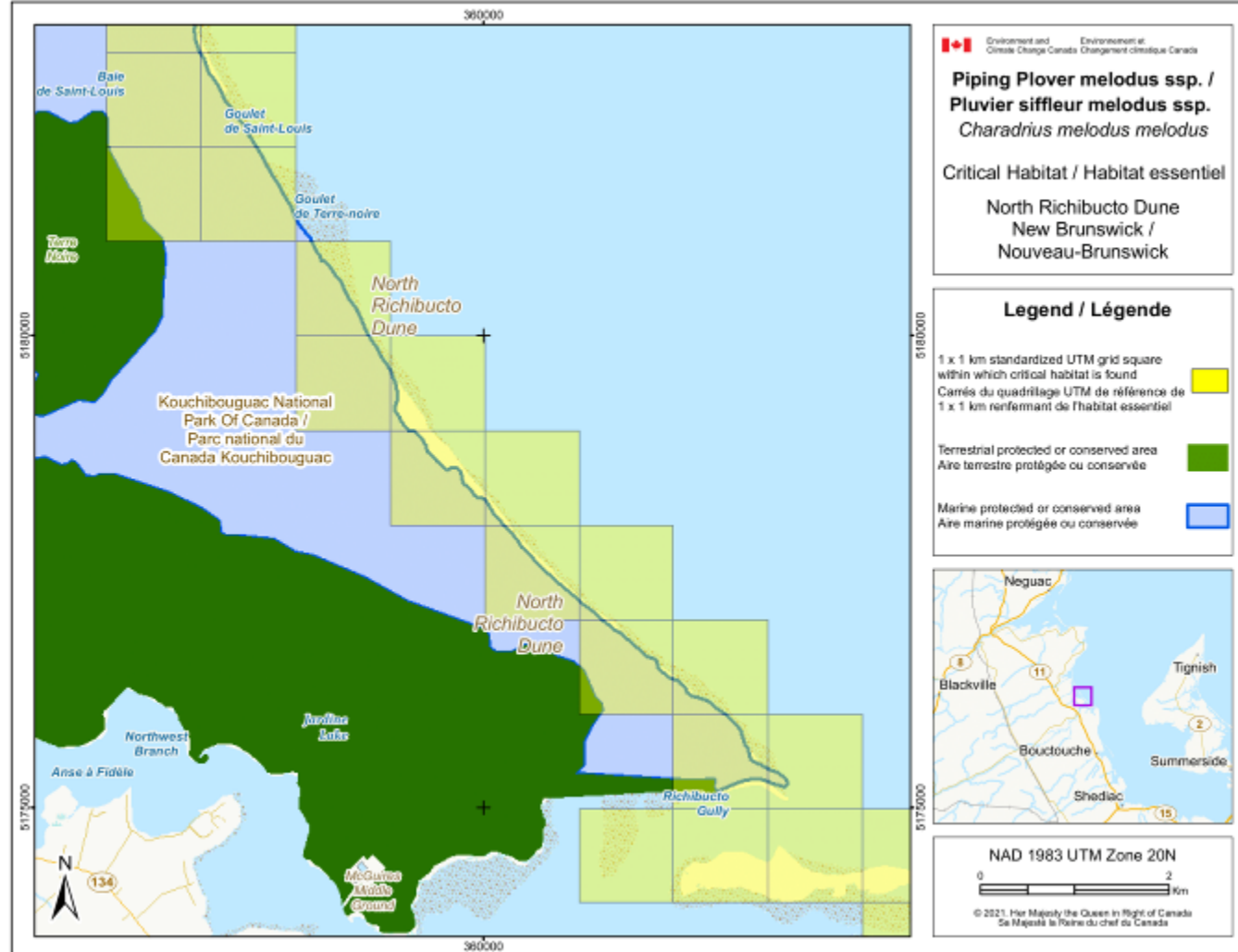
C-11. Grid squares containing critical habitat for Piping Plover in Cap-Brûlé – Cap-Pelé, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



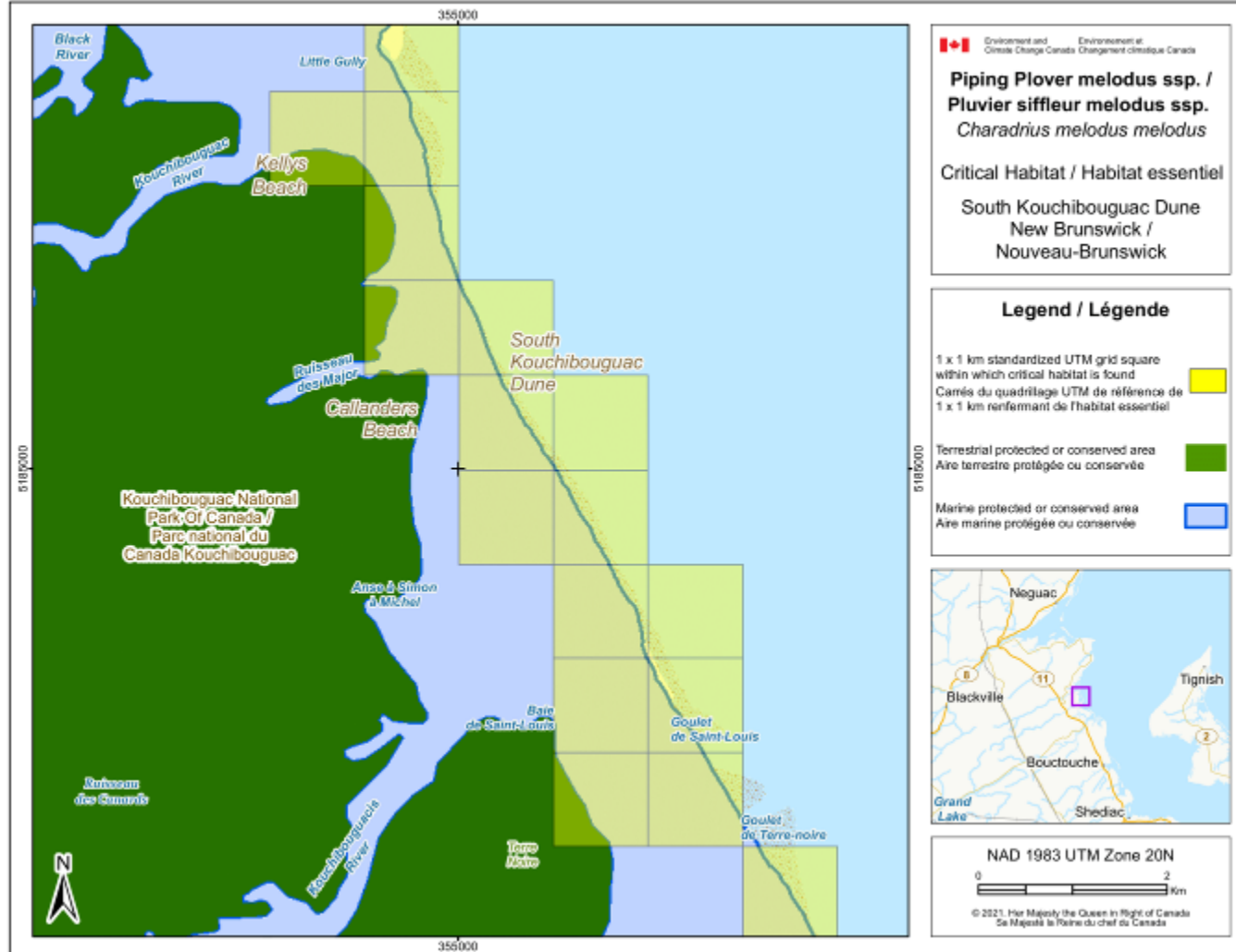
C-12. Grid squares containing critical habitat for Piping Plover in the Dune de Bouctouche, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



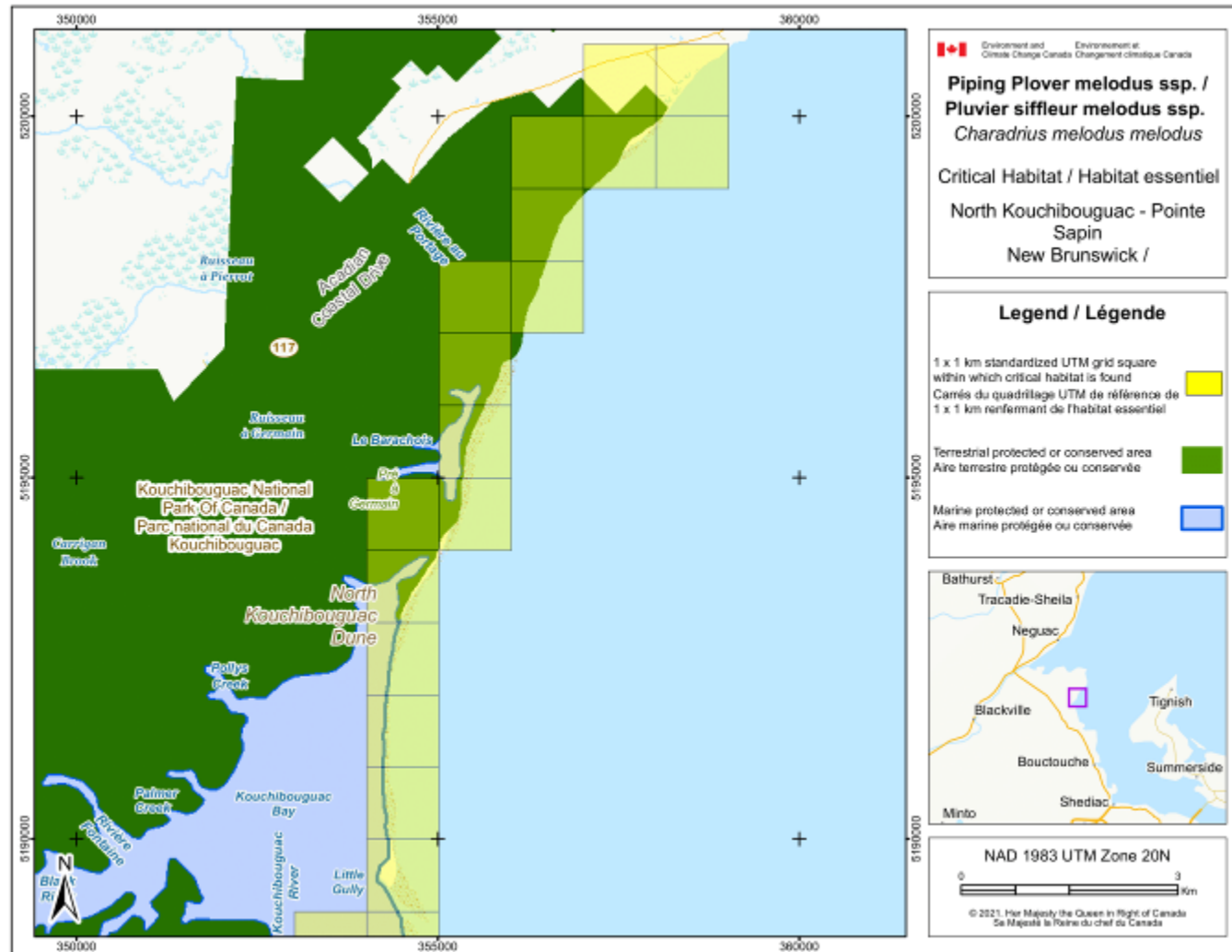
C-13. Grid squares containing critical habitat for Piping Plover in South Richibucto, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



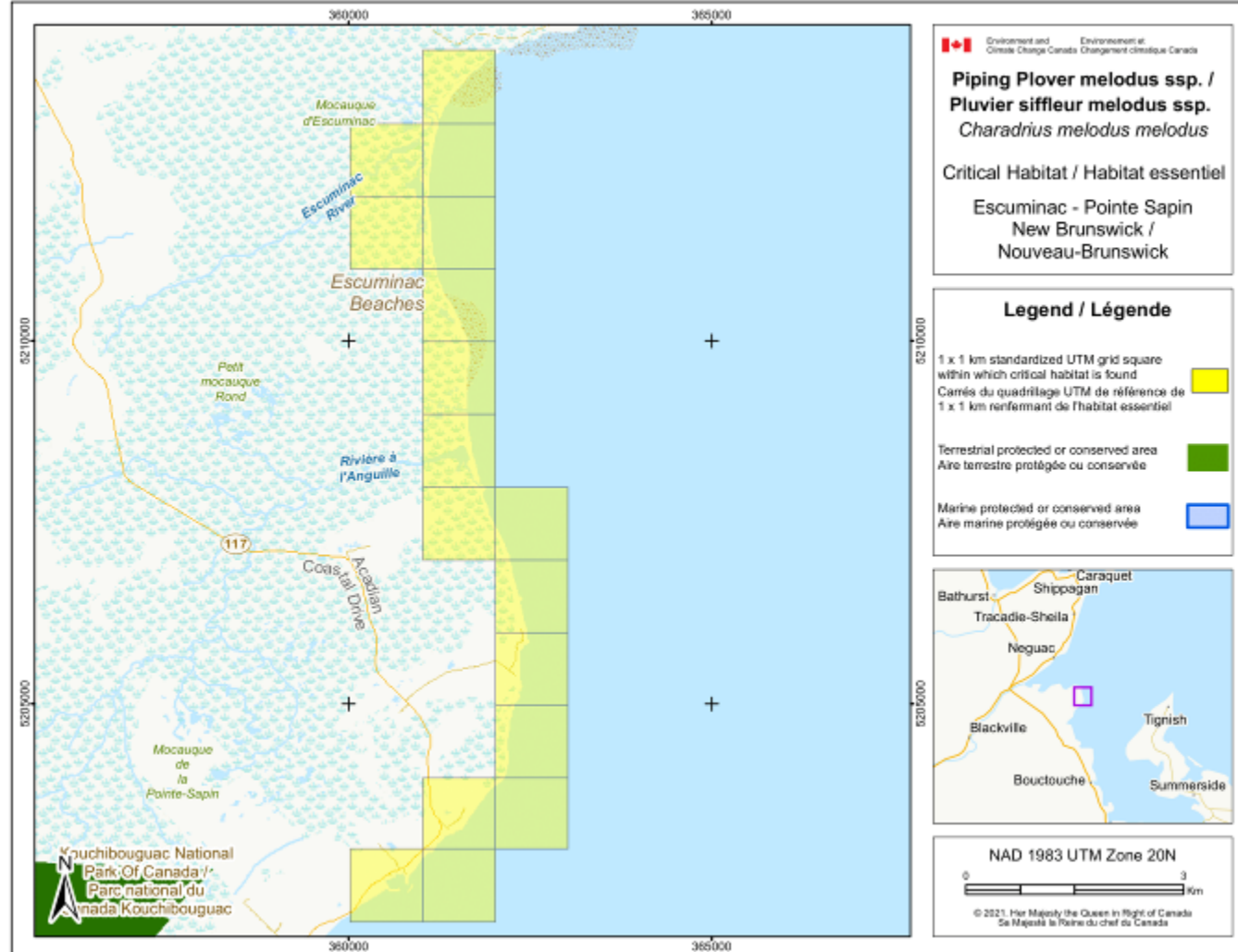
C-14. Grid squares containing critical habitat for Piping Plover in North Richibucto Dune, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



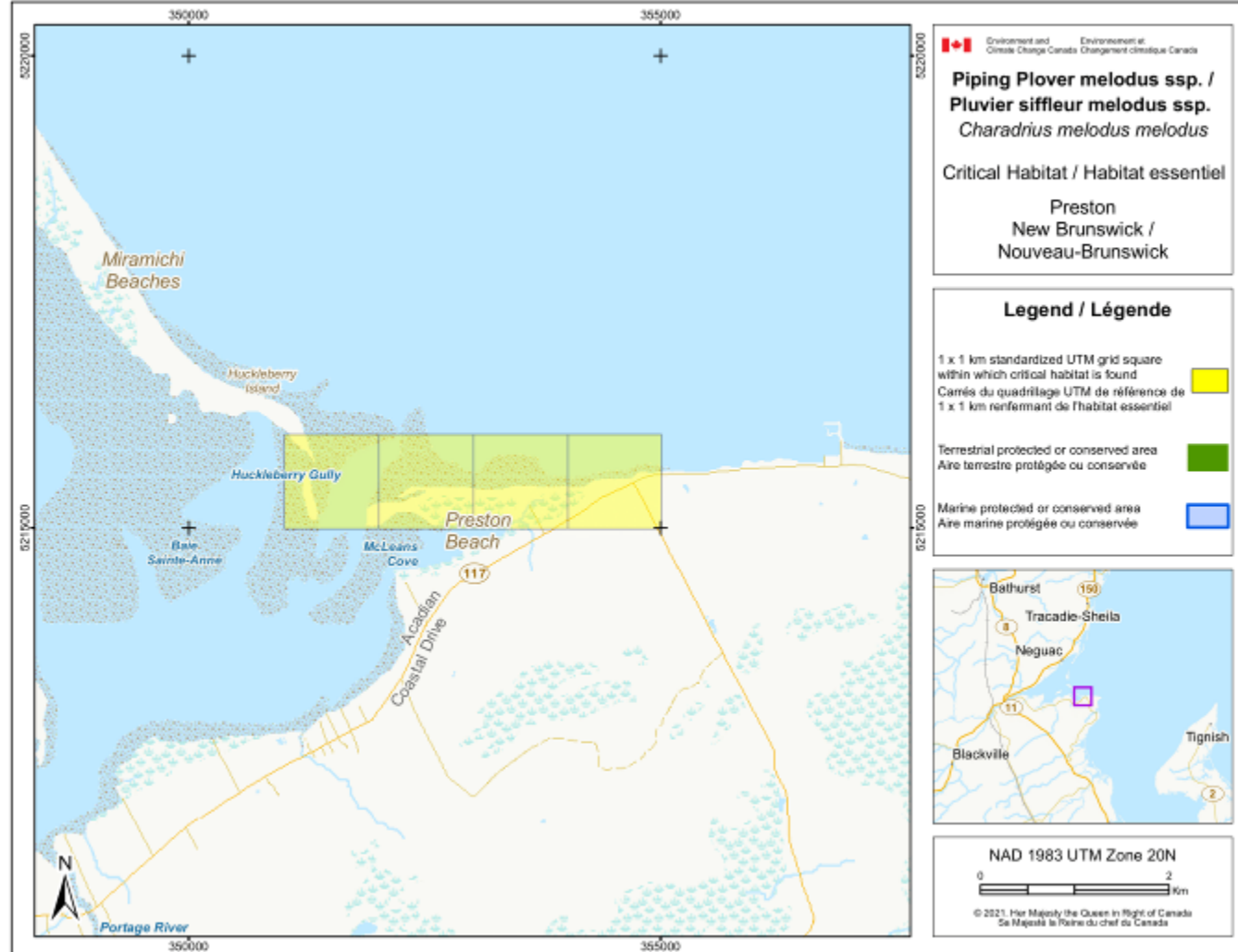
C-15. Grid squares containing critical habitat for Piping Plover in South Kouchibouguac Dune, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



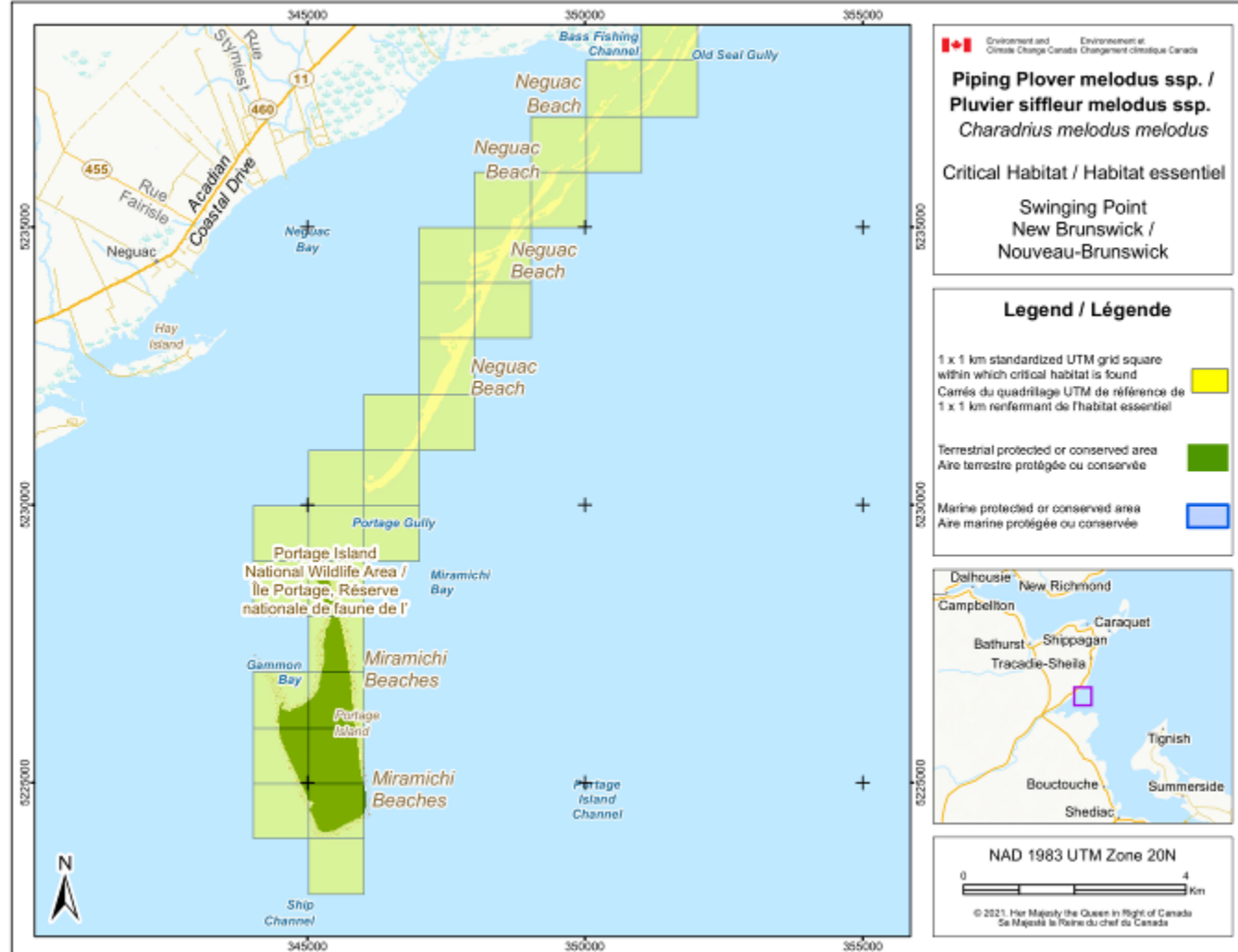
C-16. Grid squares containing critical habitat for Piping Plover in North Kouchibouguac – Pointe Sapin, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



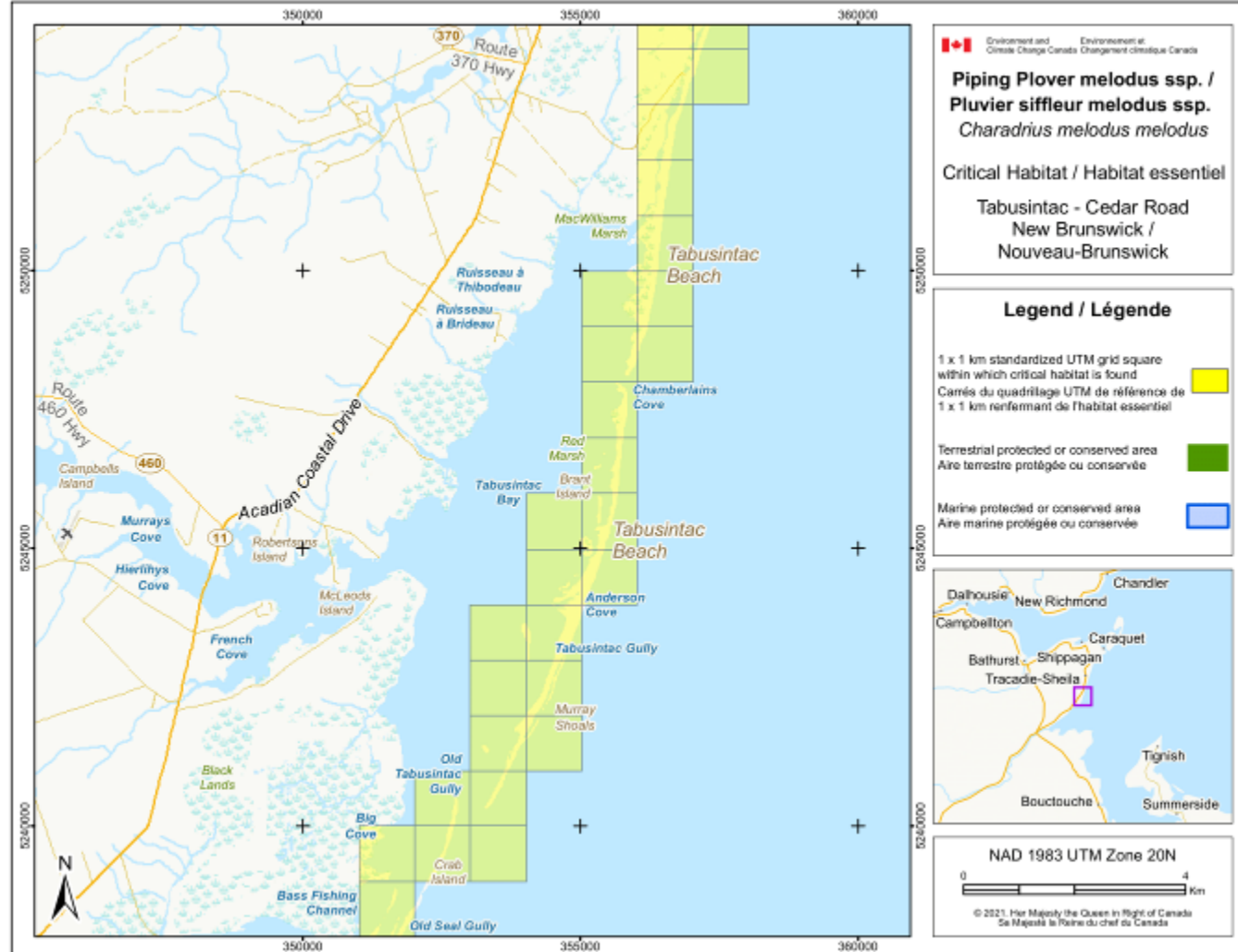
C-17. Grid squares containing critical habitat for Piping Plover in Escuminac – Pointe Sapin, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



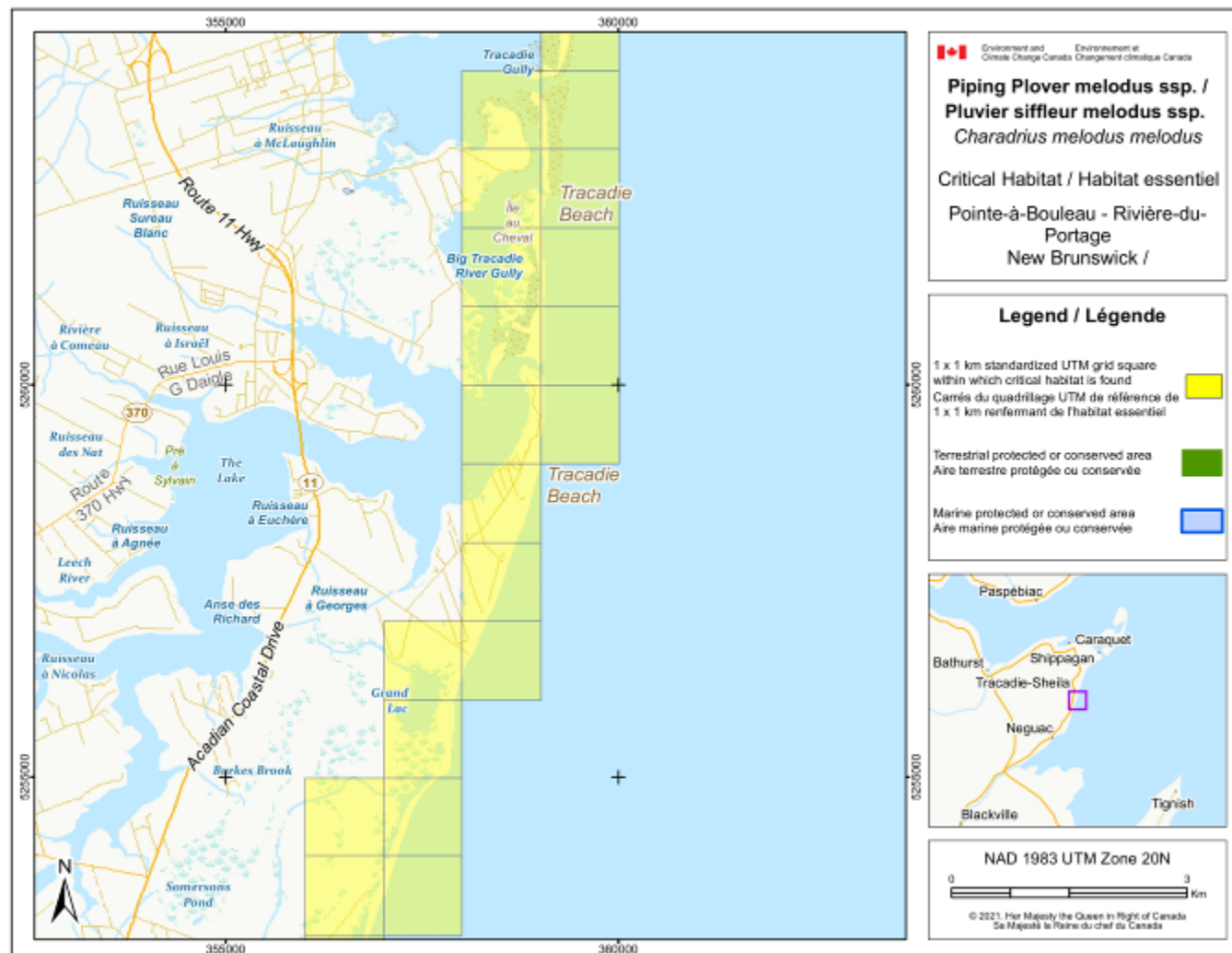
C-18. Grid squares containing critical habitat for Piping Plover in Preston, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



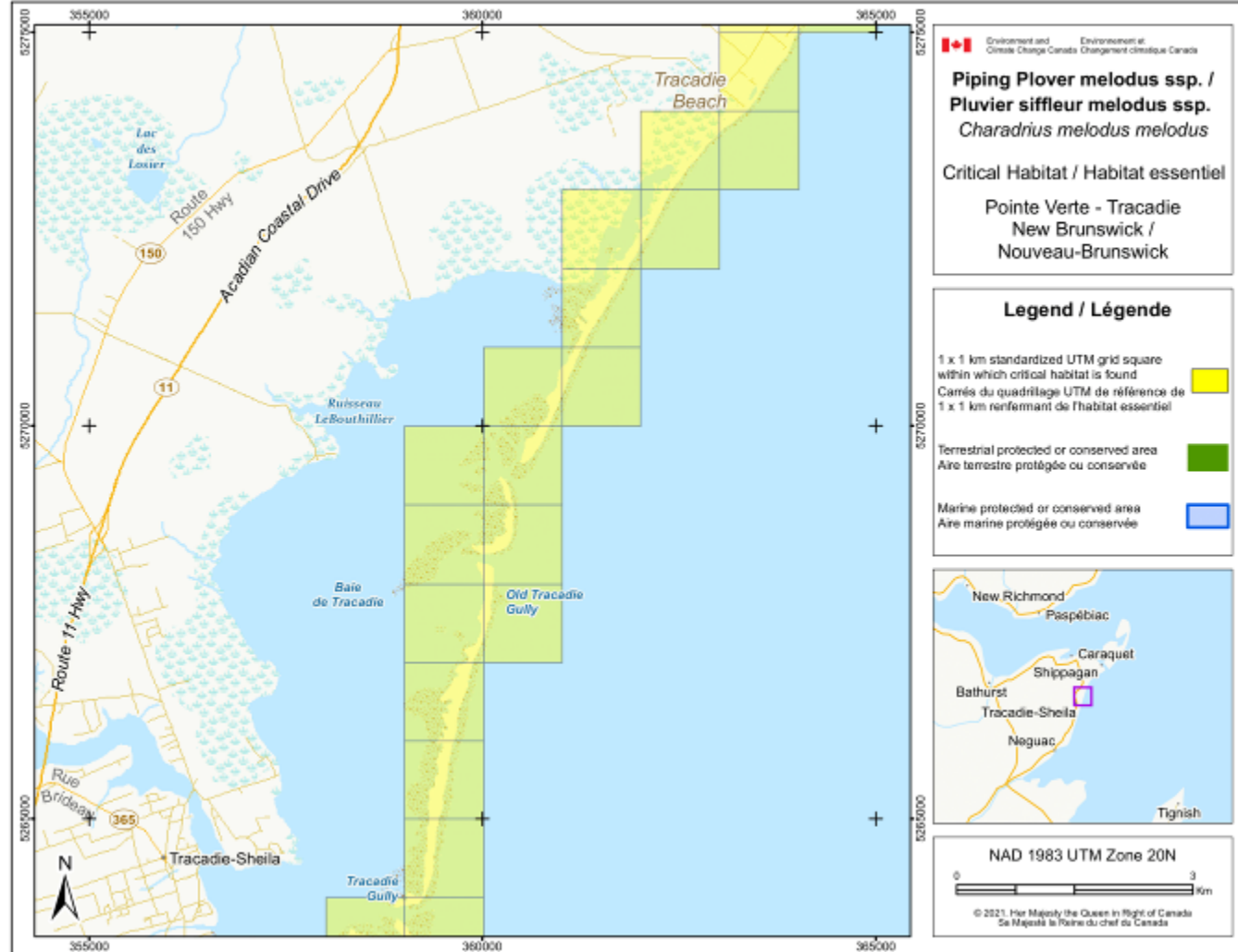
C-19. Grid squares containing critical habitat for Piping Plover in Swinging Point, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



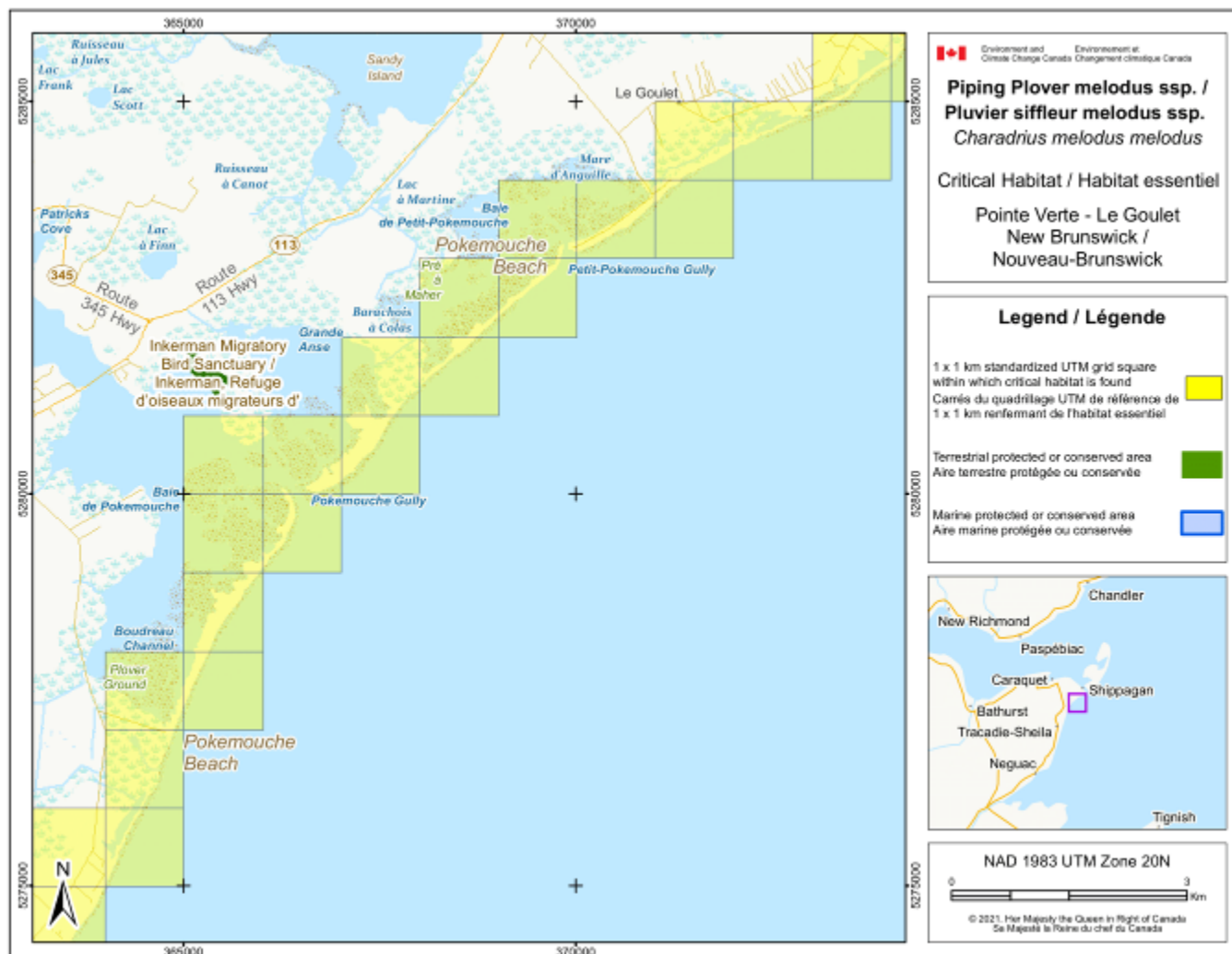
C-20. Grid squares containing critical habitat for Piping Plover in Tabusintac – Cedar Road, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



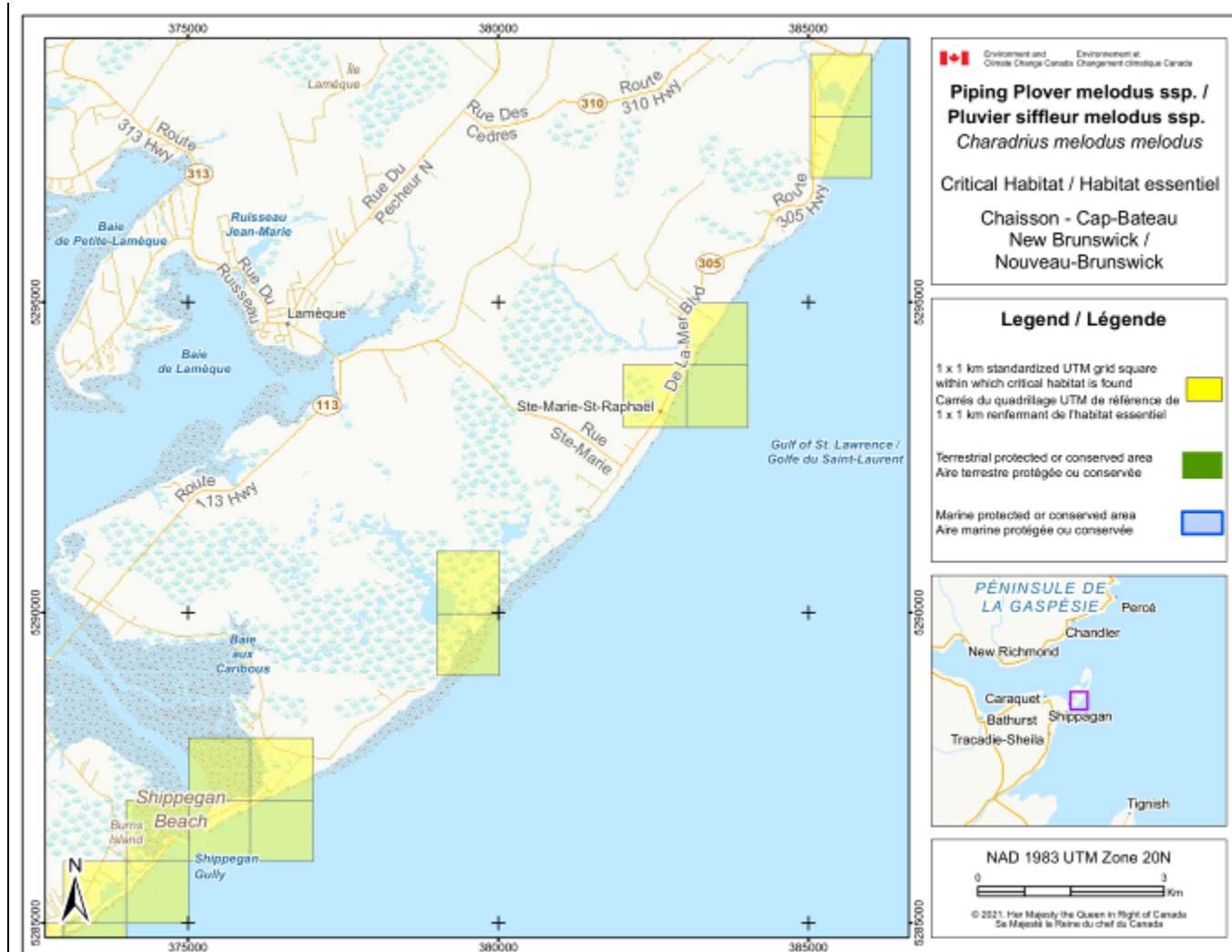
C-21. Grid squares containing critical habitat for Piping Plover in Pointe-à-Boulevard – Rivière-du-Portage, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



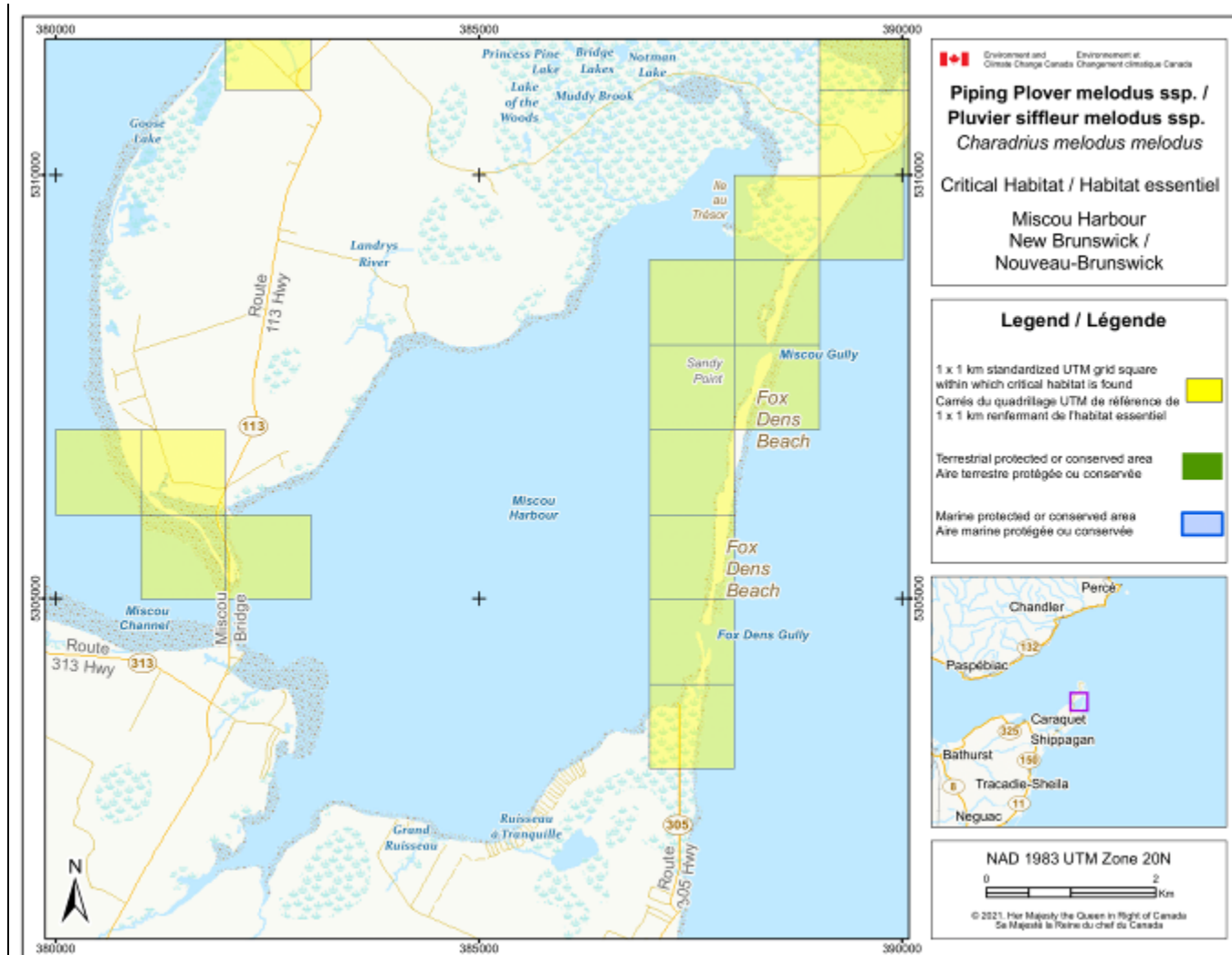
C-22. Grid squares containing critical habitat for Piping Plover in Pointe-Verte - Tracadie, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



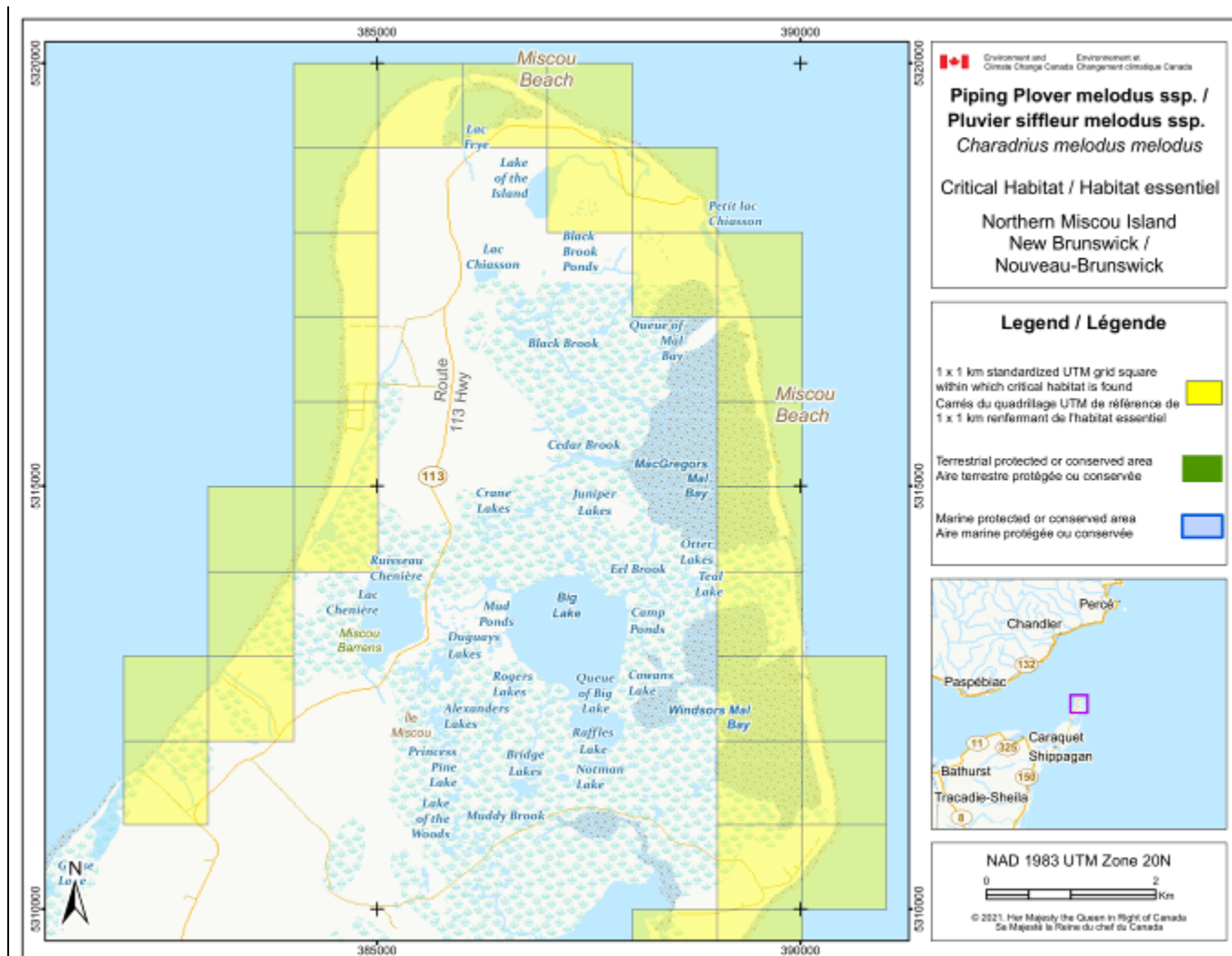
C-23. Grid squares containing critical habitat for Piping Plover in Pointe Verte – Le Goulet, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



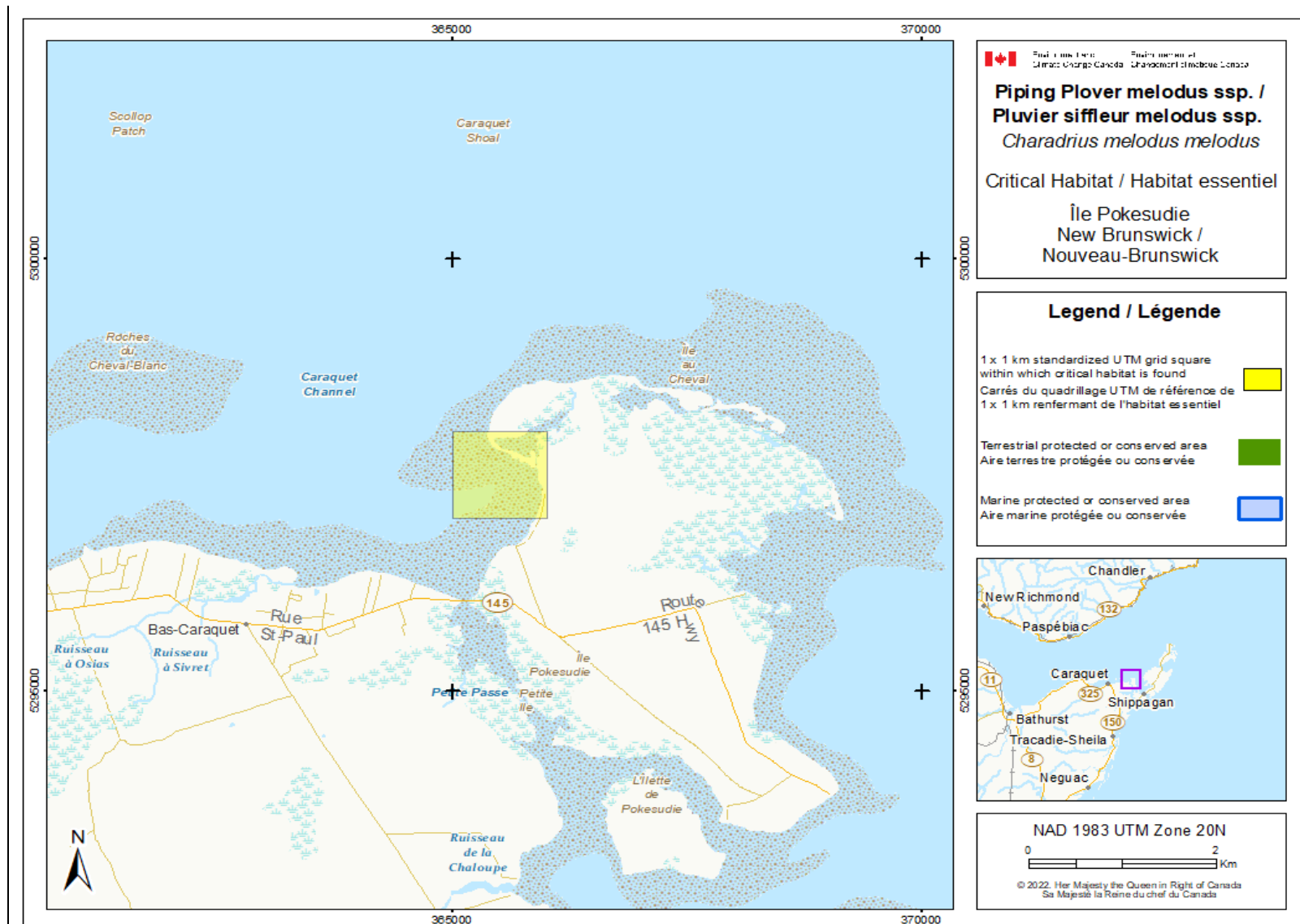
C-24. Grid squares containing critical habitat for Piping Plover in Chiasson – Cap-Bateau, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



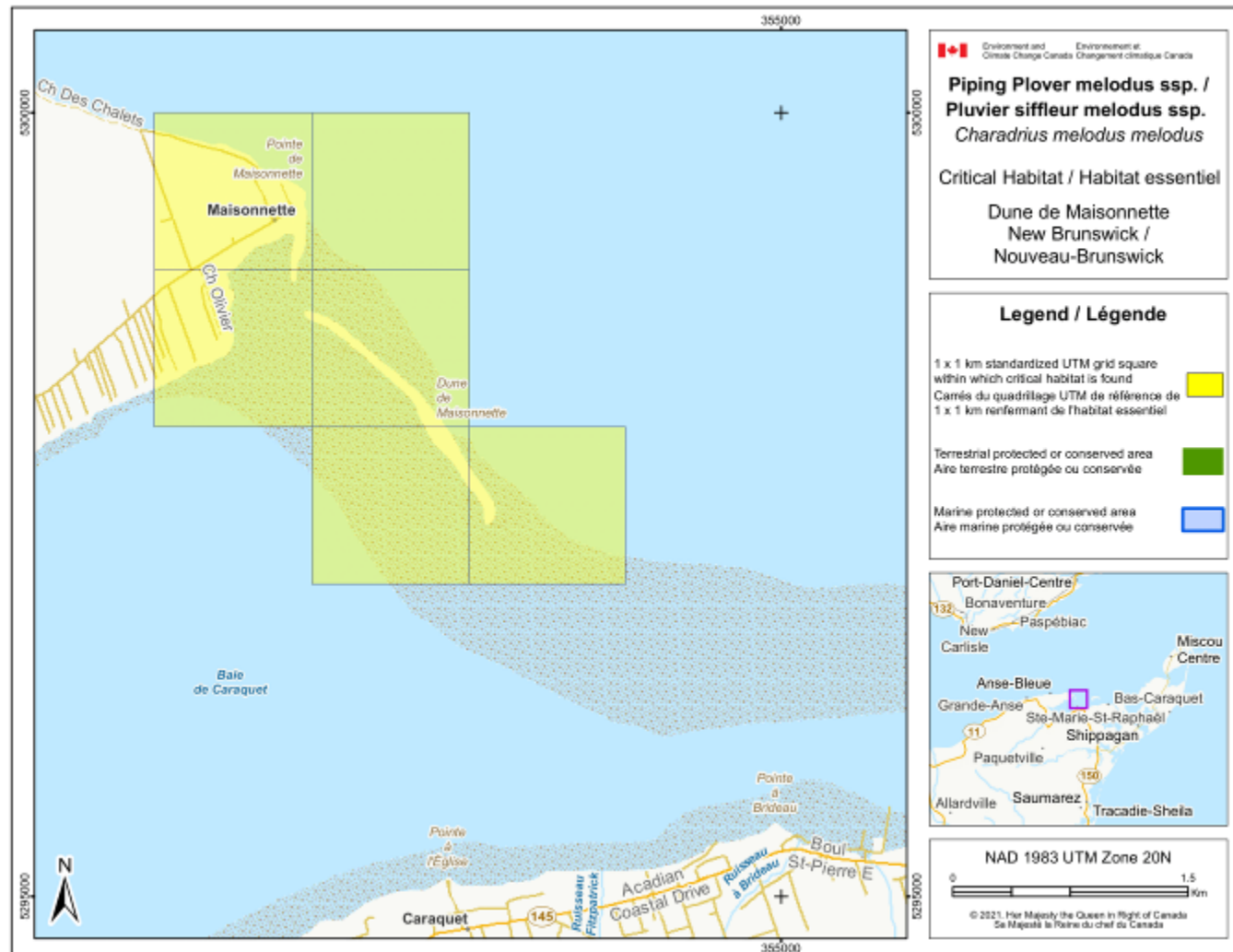
C-25. Grid squares containing critical habitat for Piping Plover in Miscou Harbour, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



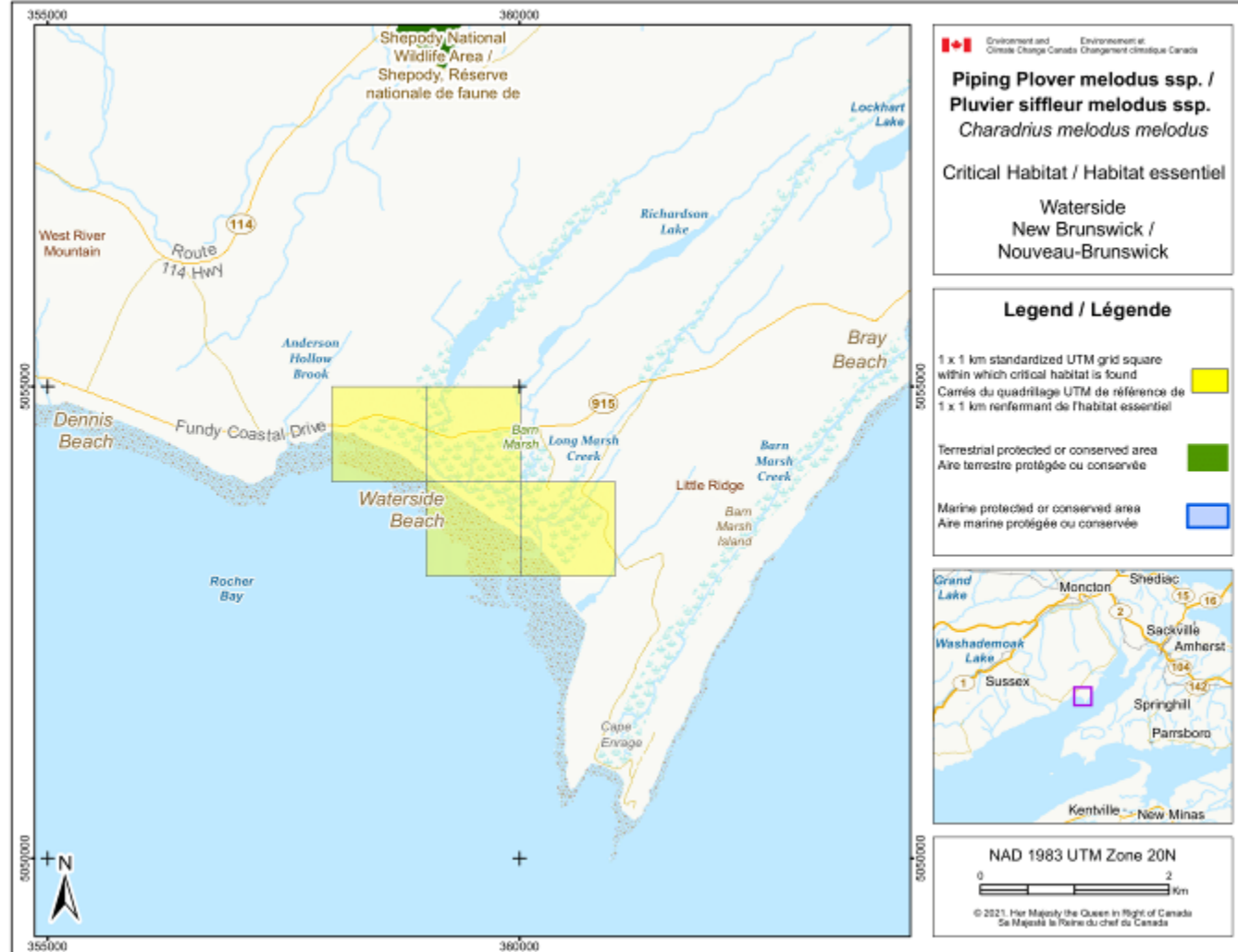
C-26. Grid squares containing critical habitat for Piping Plover in Northern Miscou Island, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



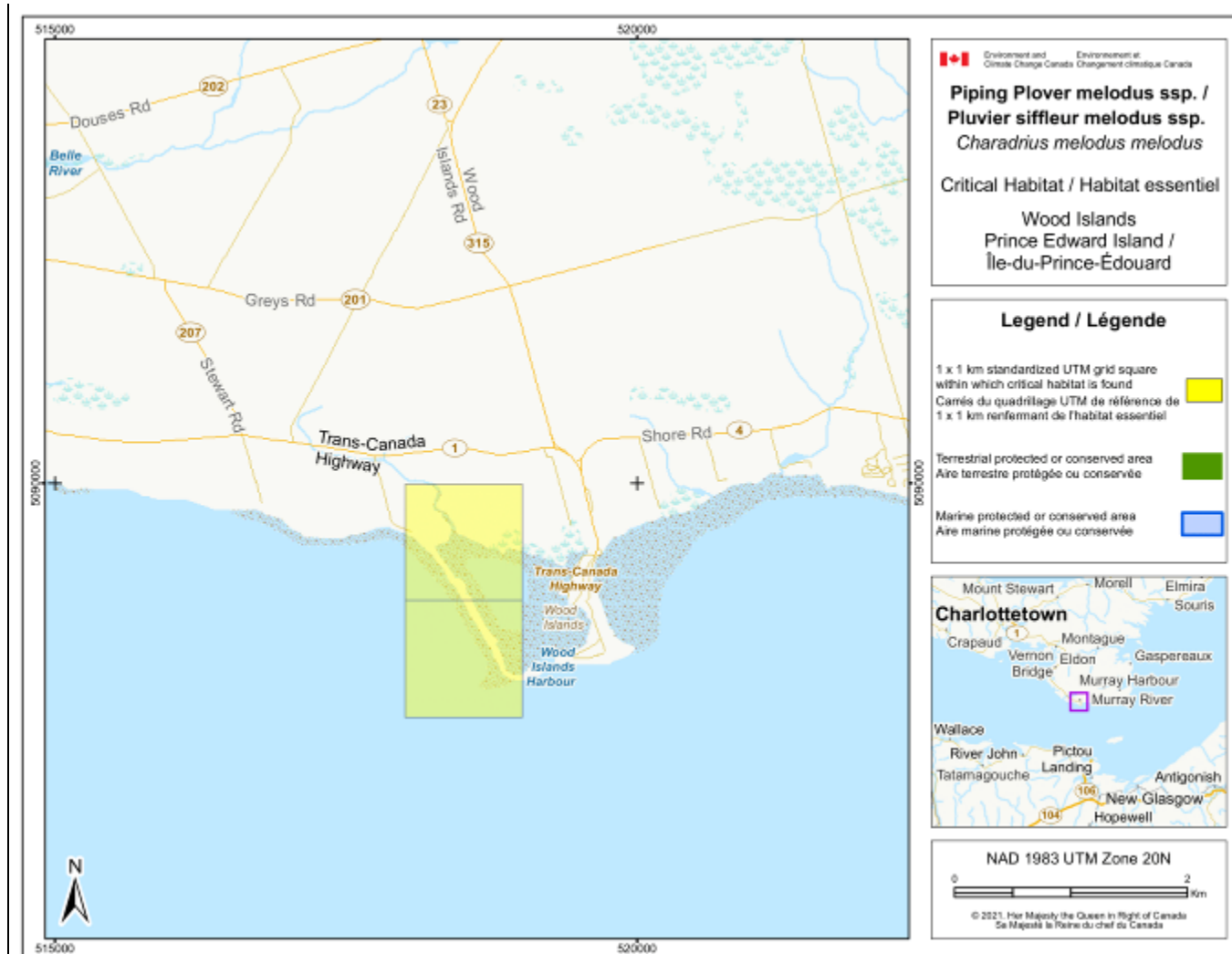
C-27. Grid squares containing critical habitat for Piping Plover in Île Pokesudie, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



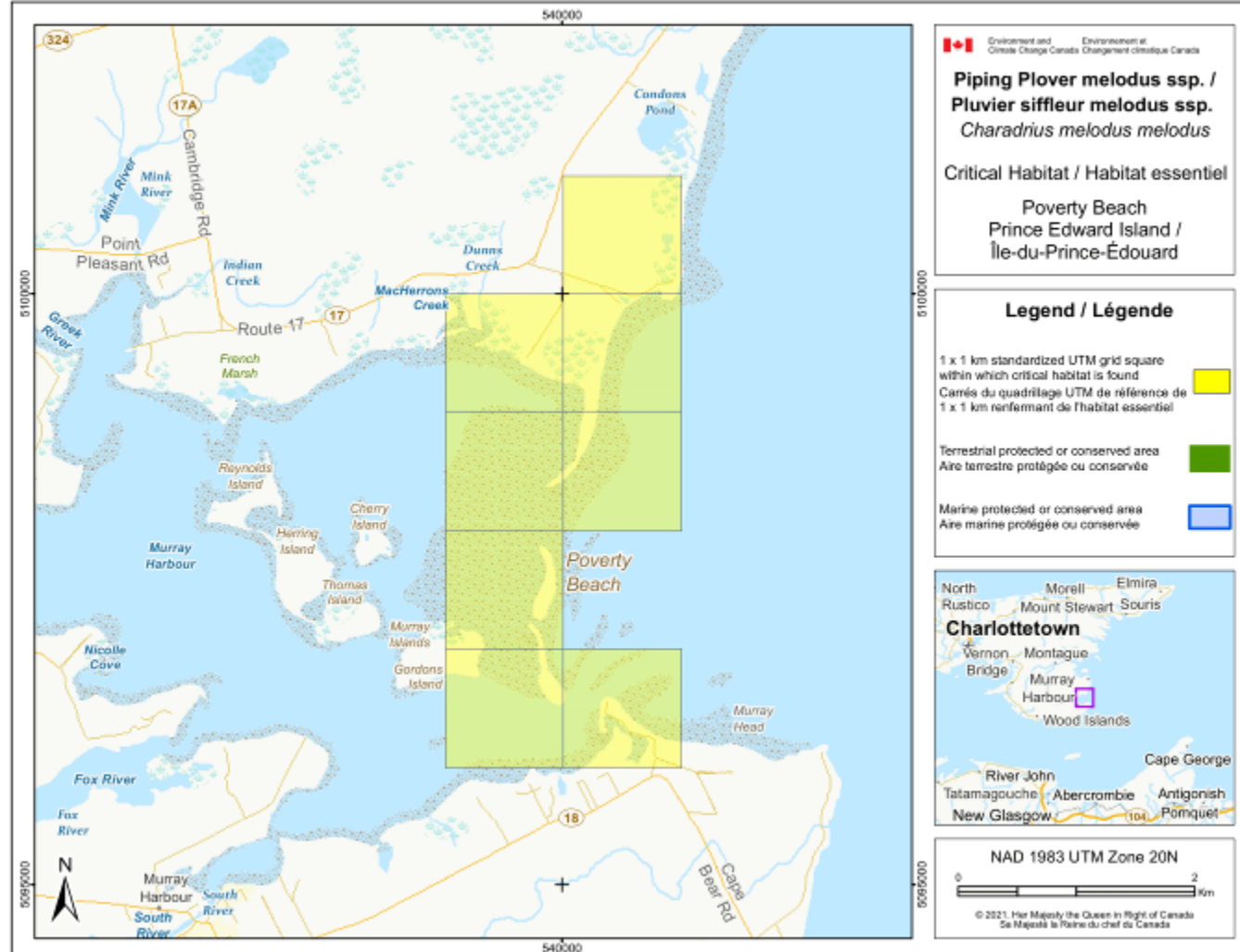
C-28. Grid squares containing critical habitat for Piping Plover in Dune de Maisonnnette, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



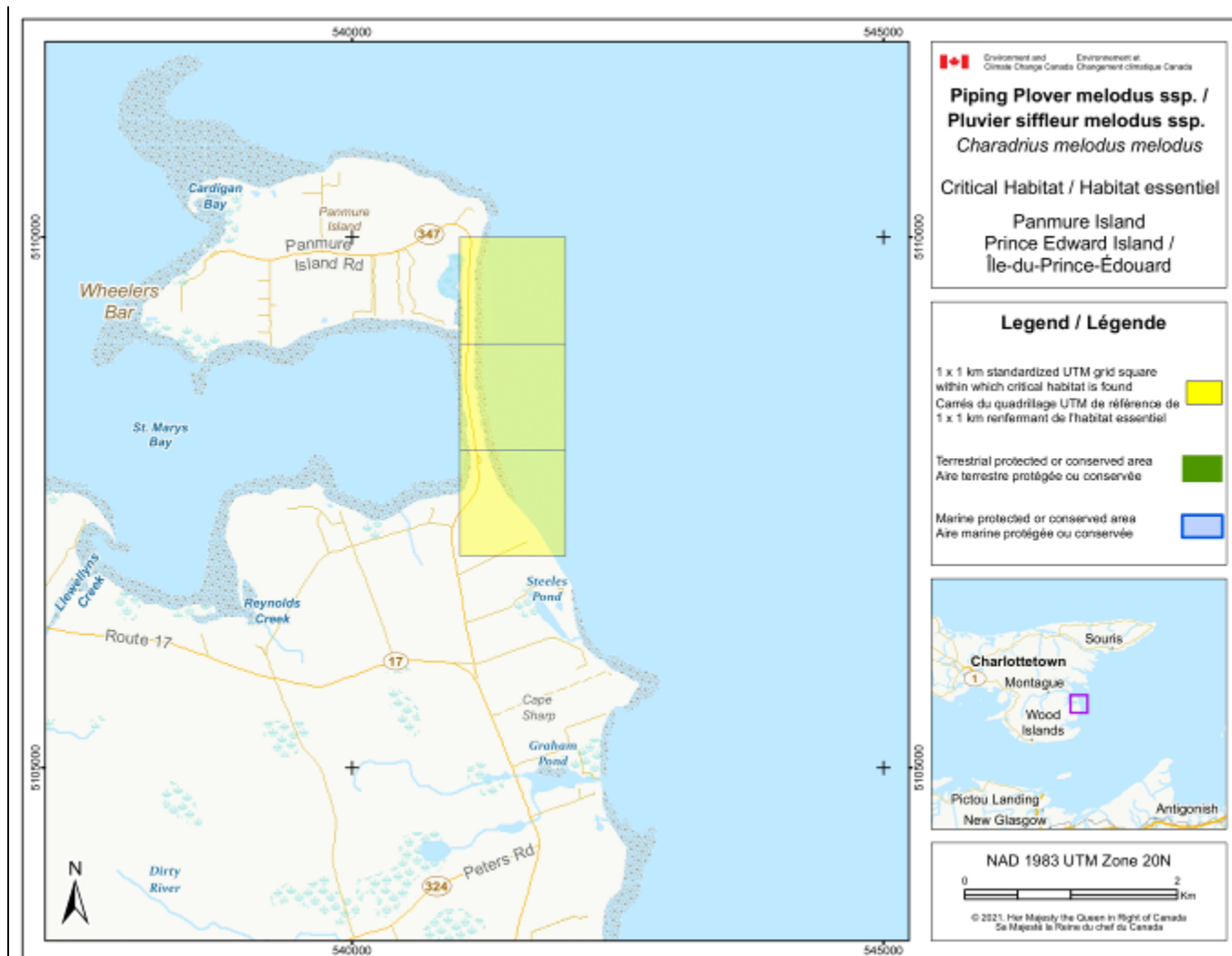
C-29. Grid squares containing critical habitat for Piping Plover in Waterside, New Brunswick. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



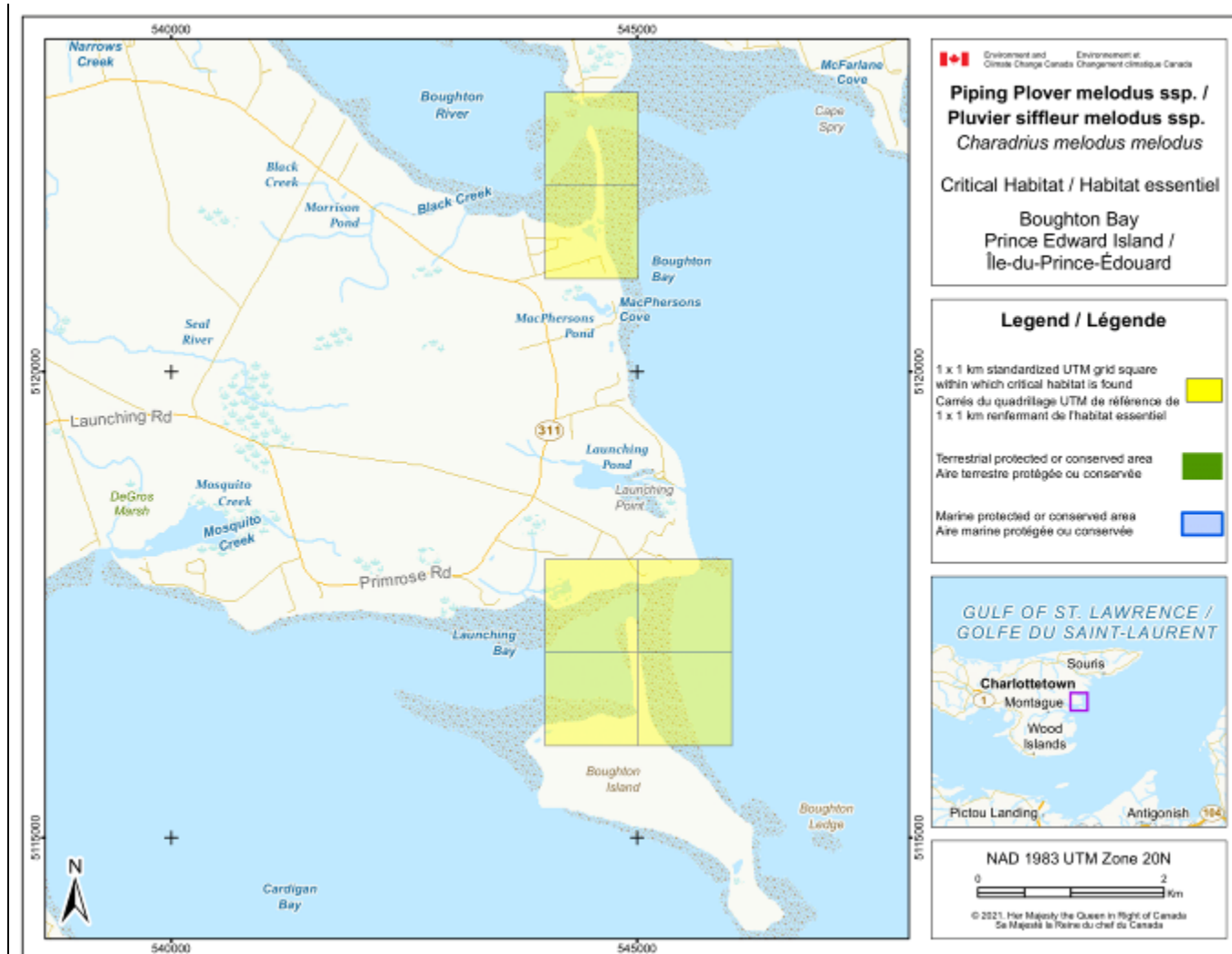
C-30. Grid squares containing critical habitat for Piping Plover in Wood Islands, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



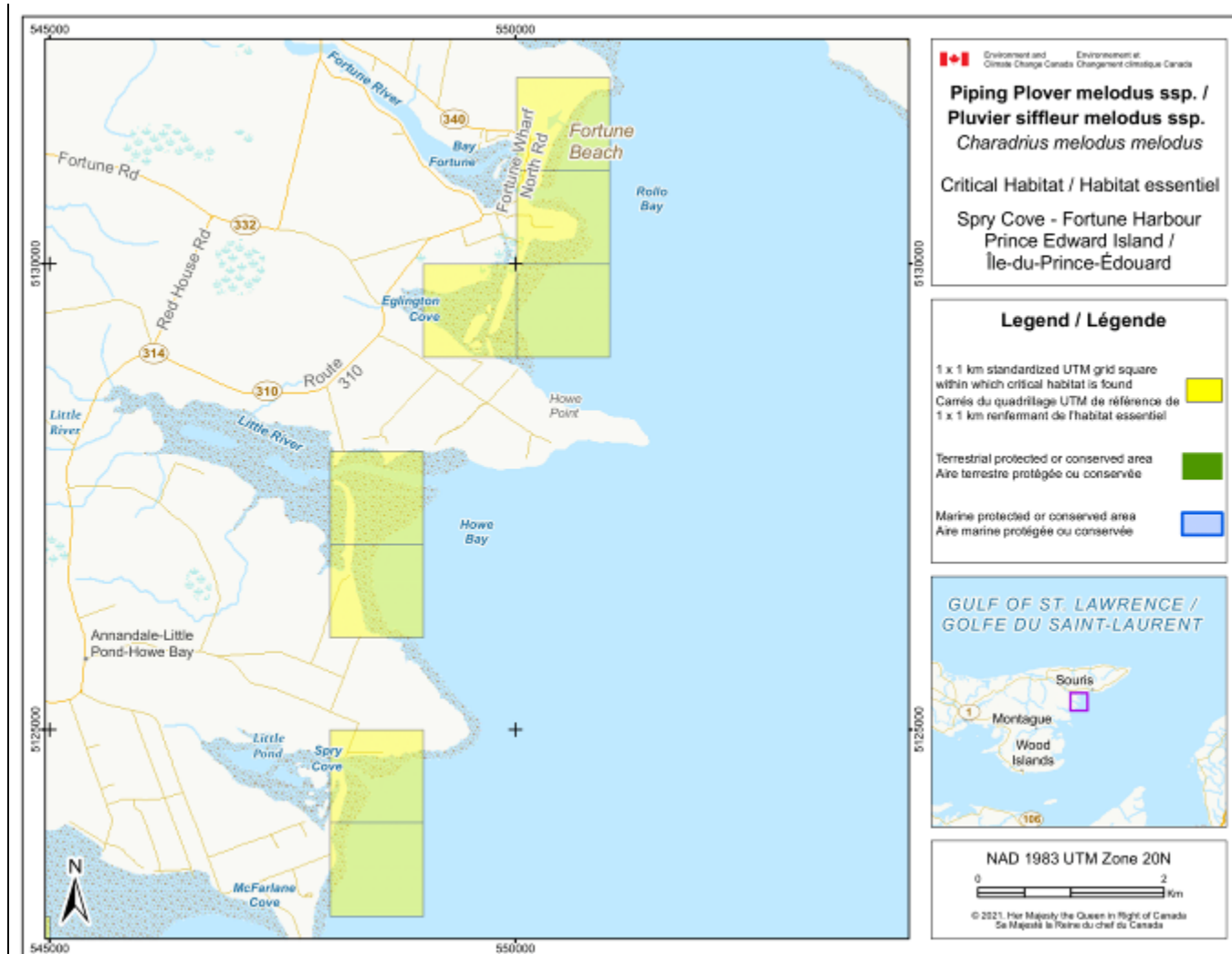
C-31. Grid squares containing critical habitat for Piping Plover in Poverty Beach, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



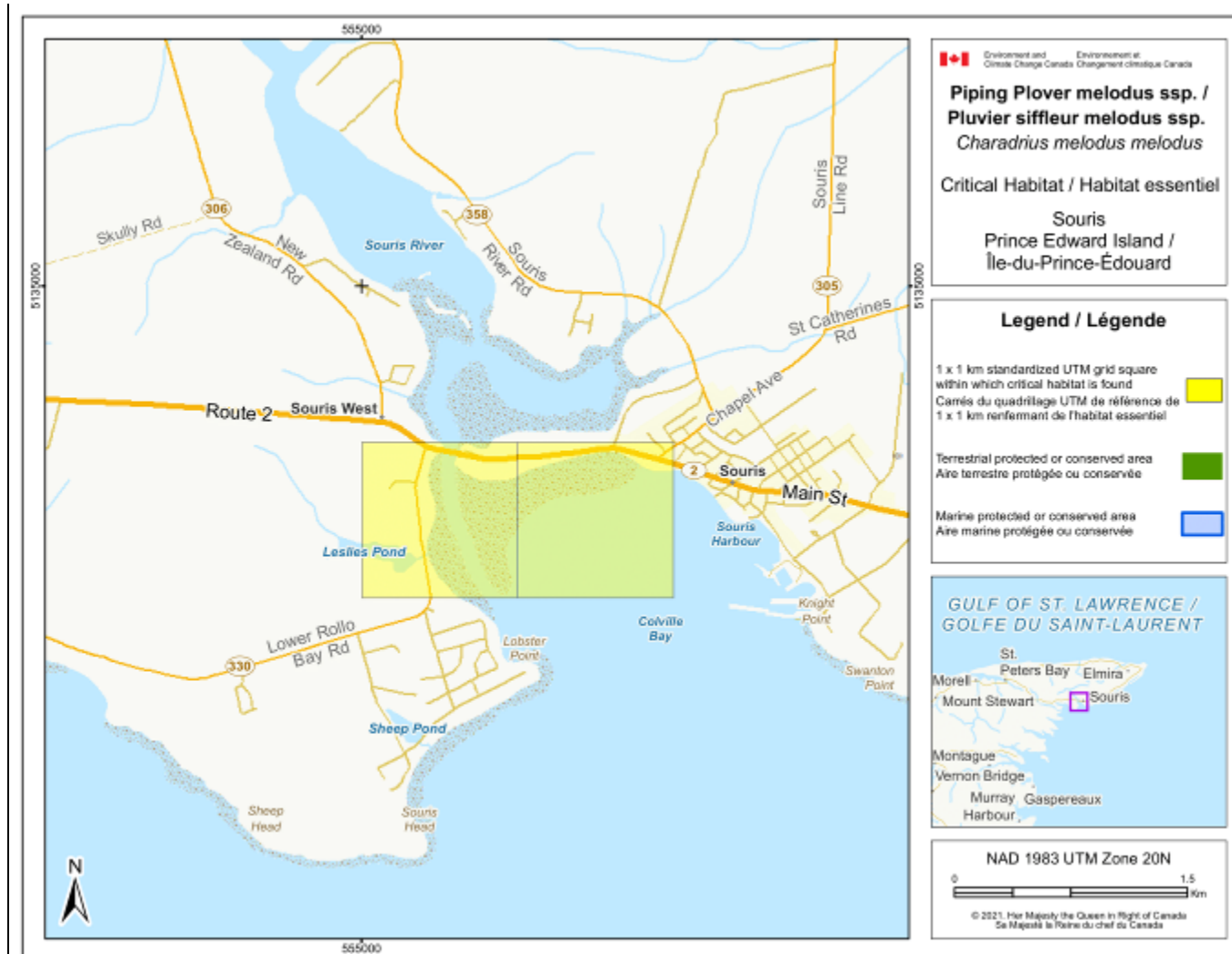
C-32. Grid squares containing critical habitat for Piping Plover in Panmure Island, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



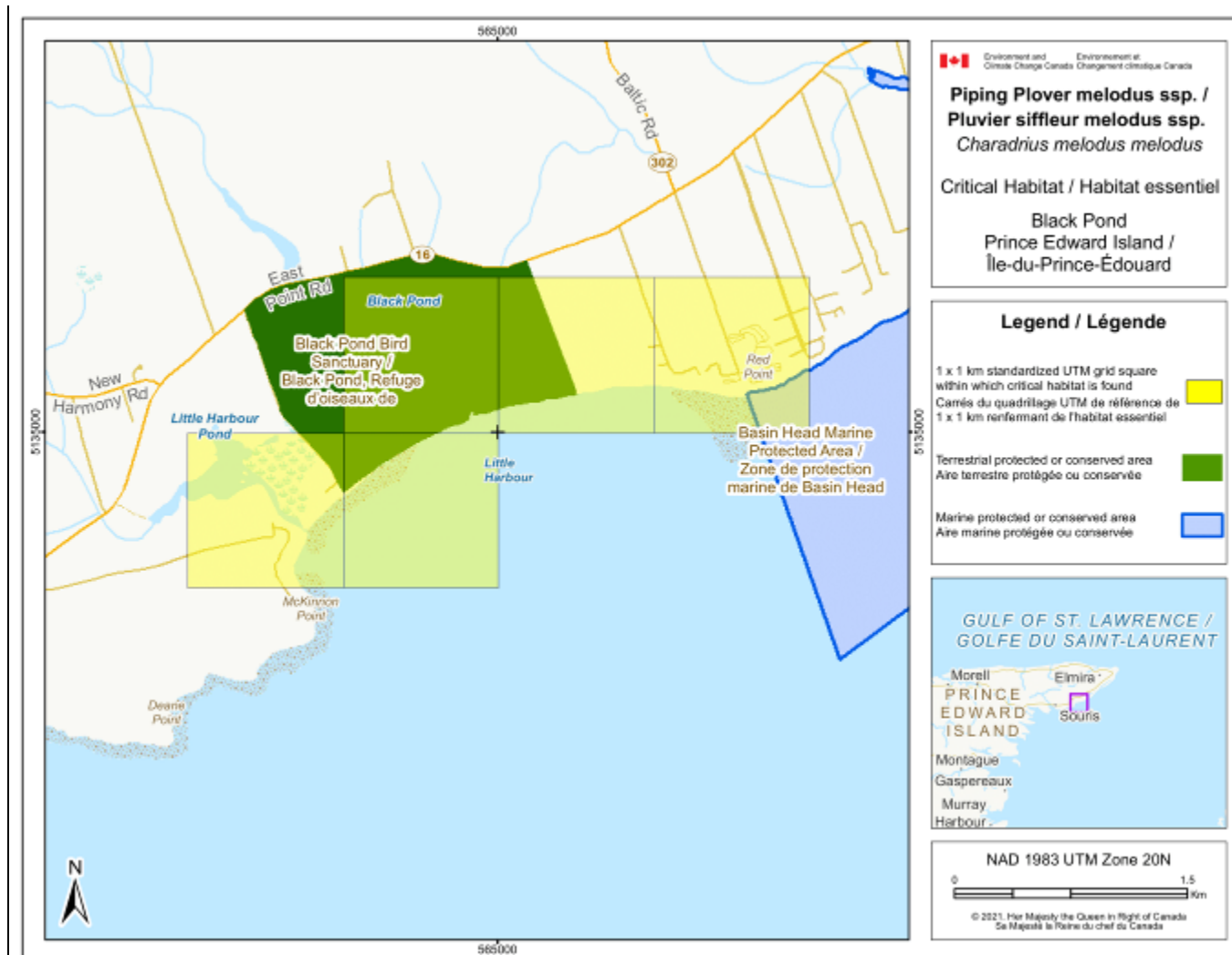
C-33. Grid squares containing critical habitat for Piping Plover in Boughton Bay, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



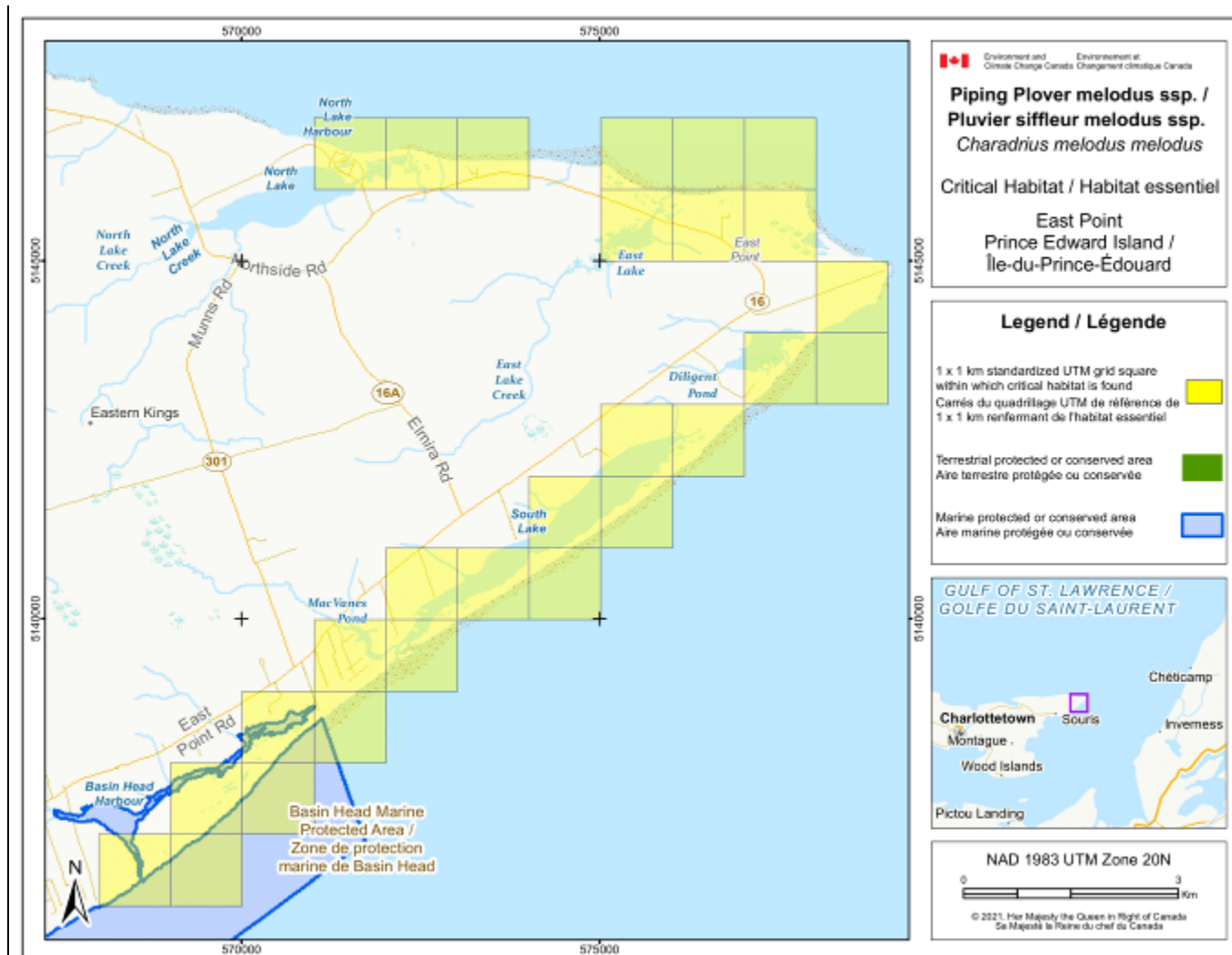
C-34. Grid squares containing critical habitat for Piping Plover in Spry Cove – Fortune Harbour, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



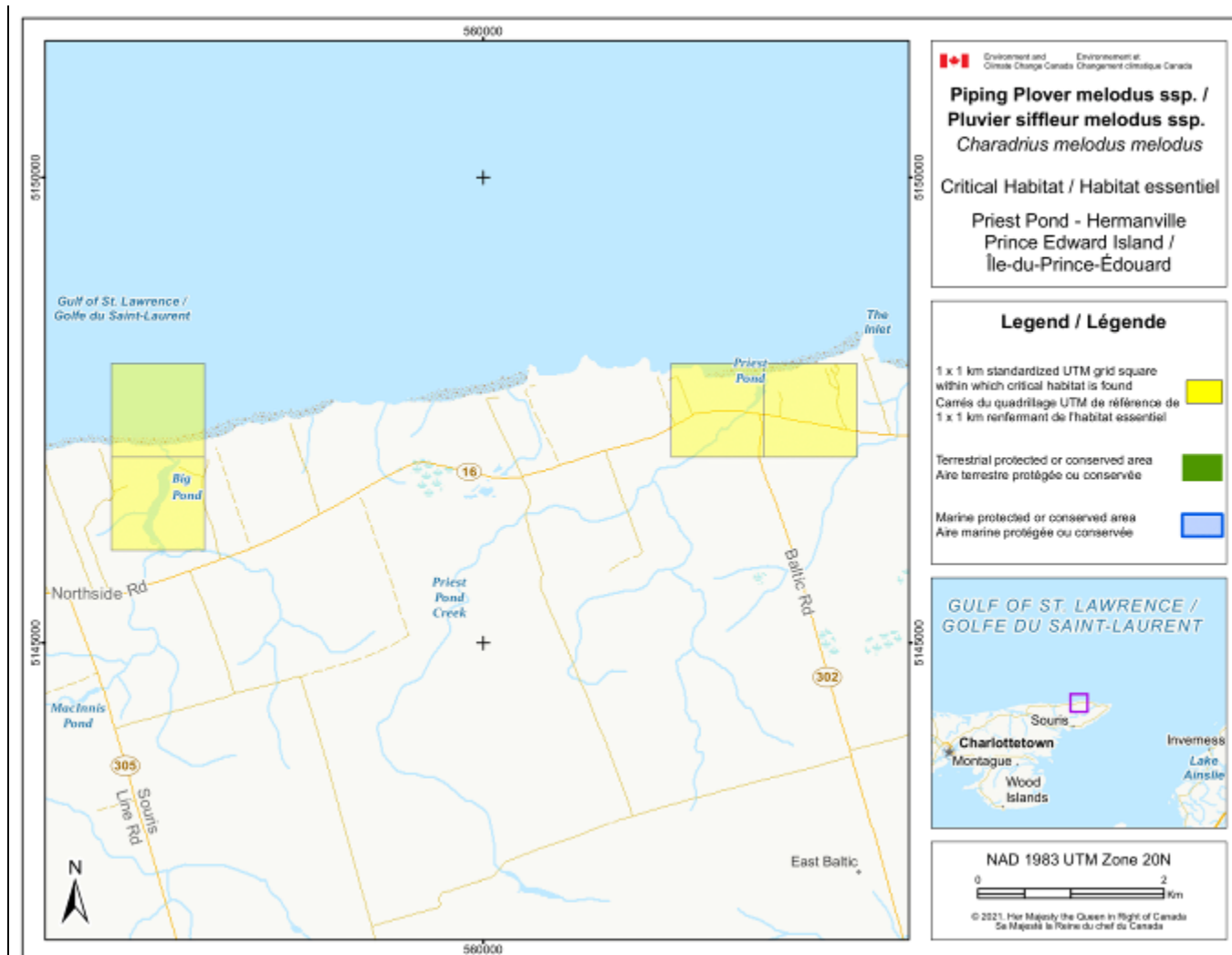
C-35. Grid squares containing critical habitat for Piping Plover in Souris, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



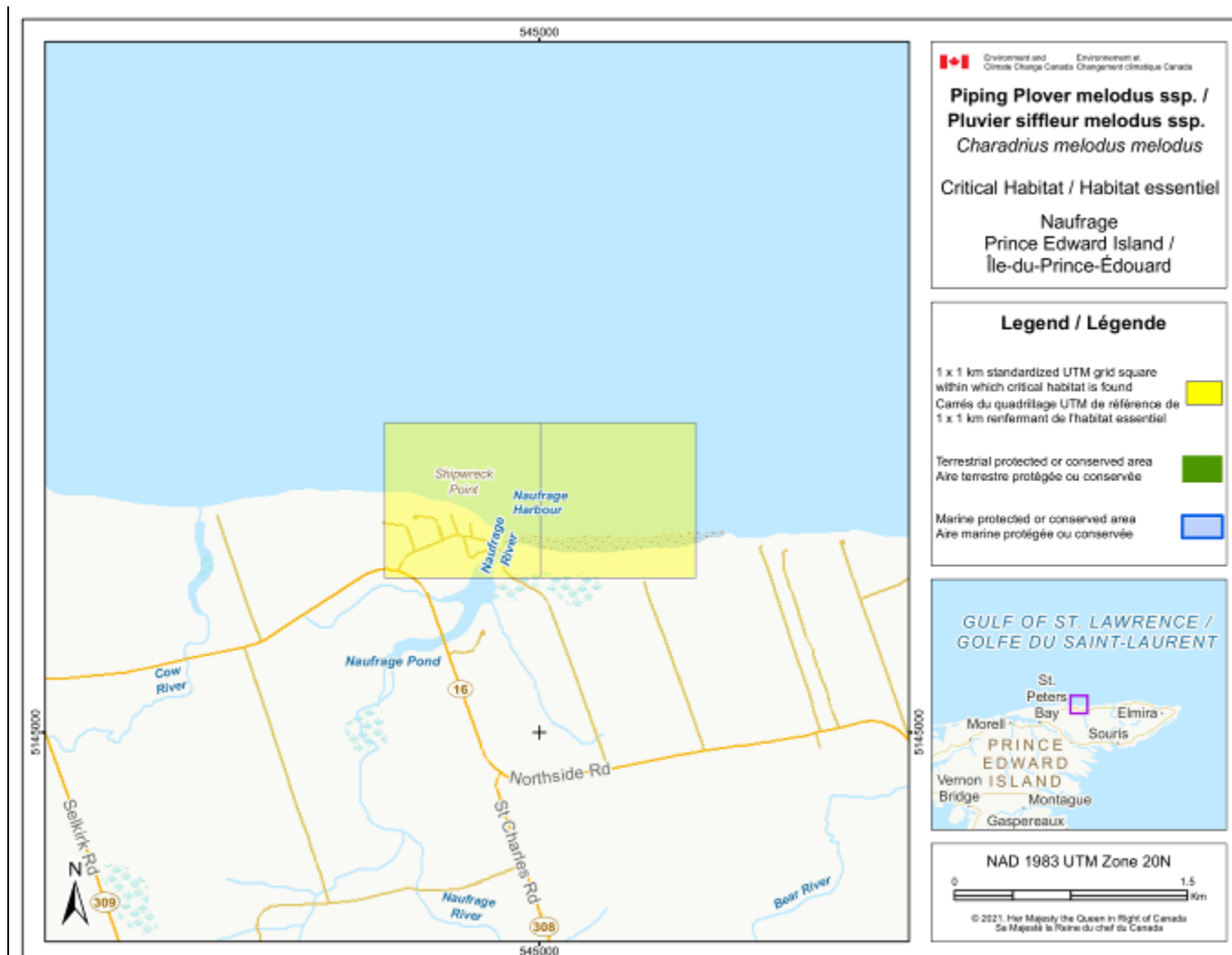
C-36. Grid squares containing critical habitat for Piping Plover in Black Pond, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



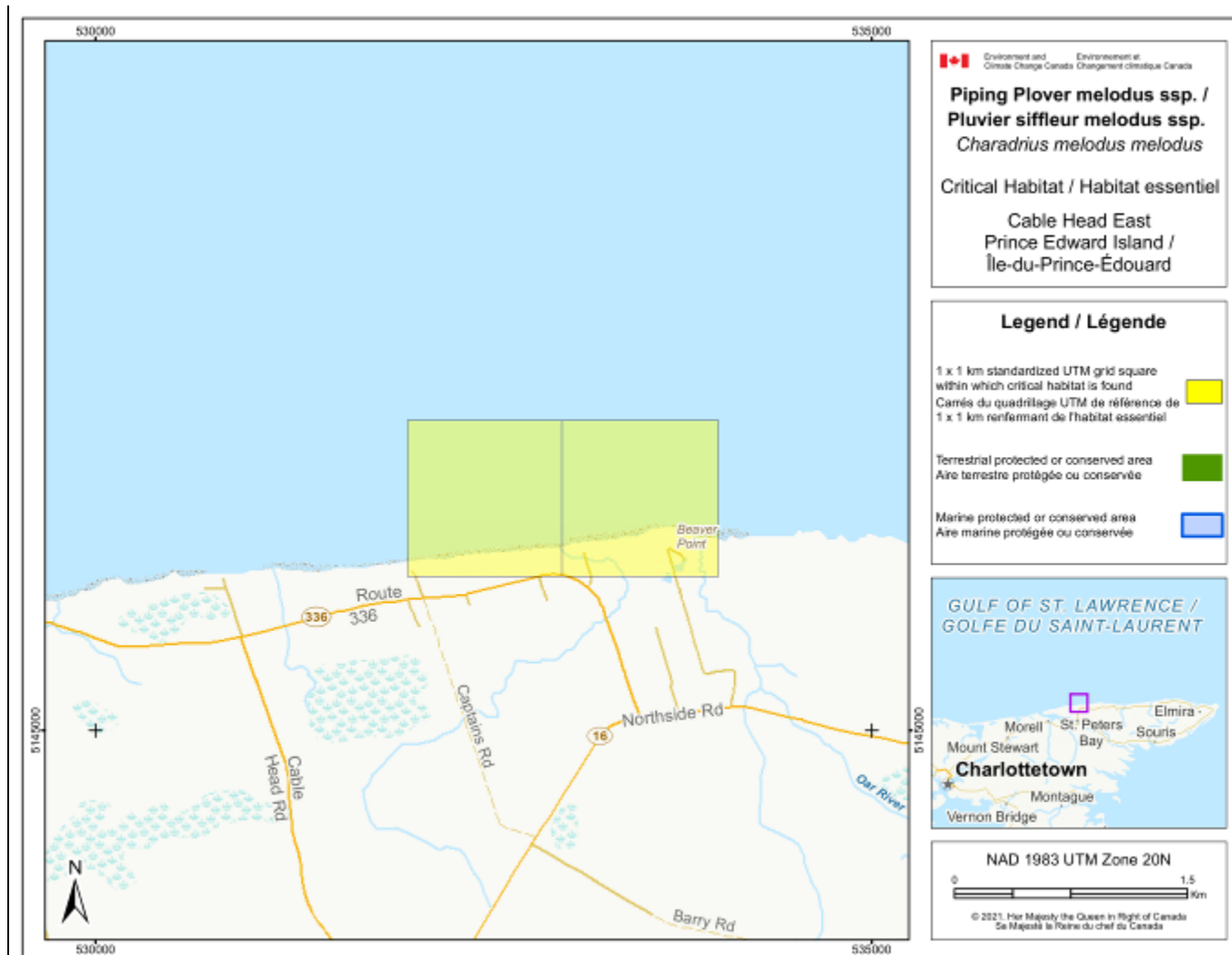
C-37. Grid squares containing critical habitat for Piping Plover in East Point, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



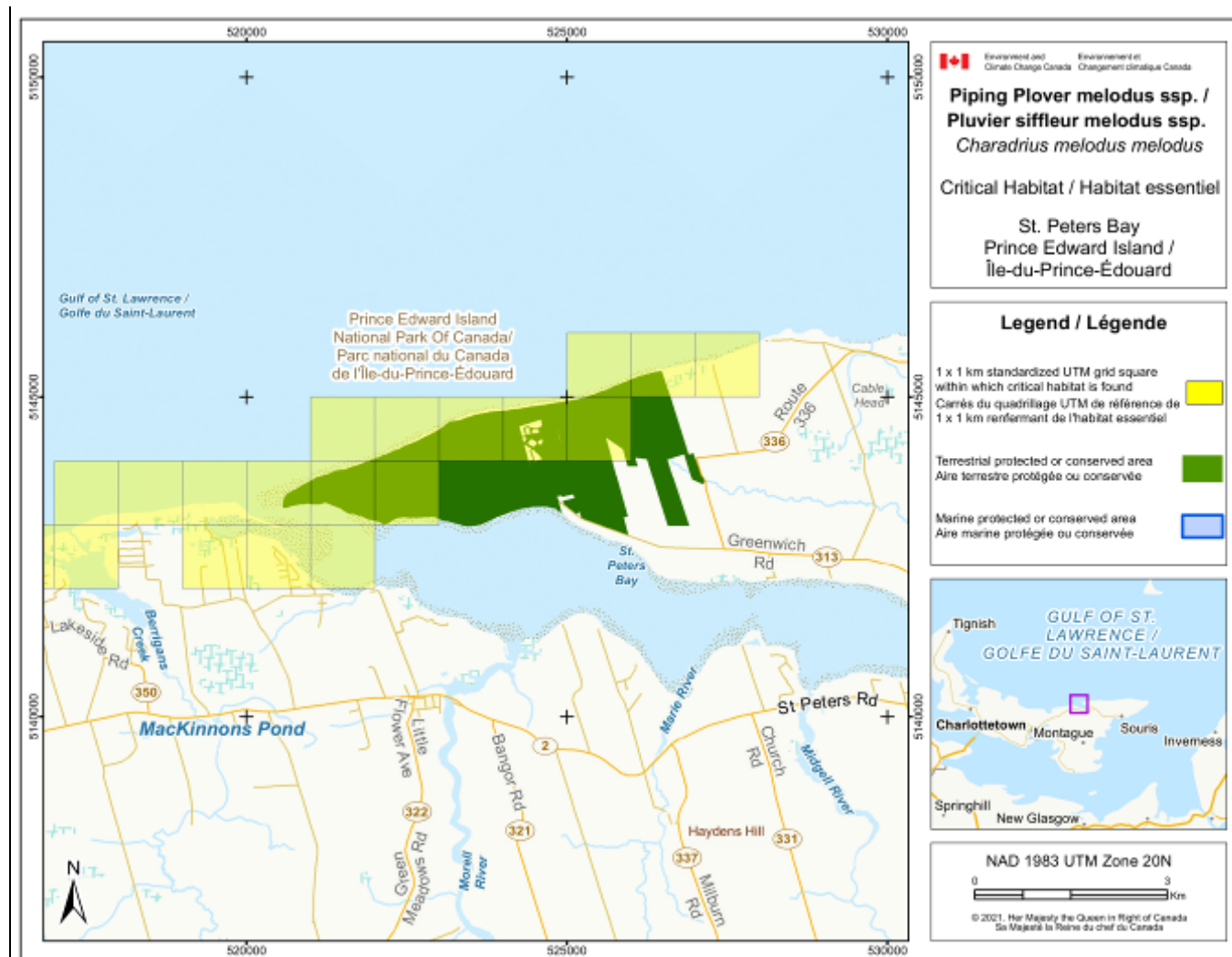
C-38. Grid squares containing critical habitat for Piping Plover in Priest Pond – Hermanville, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



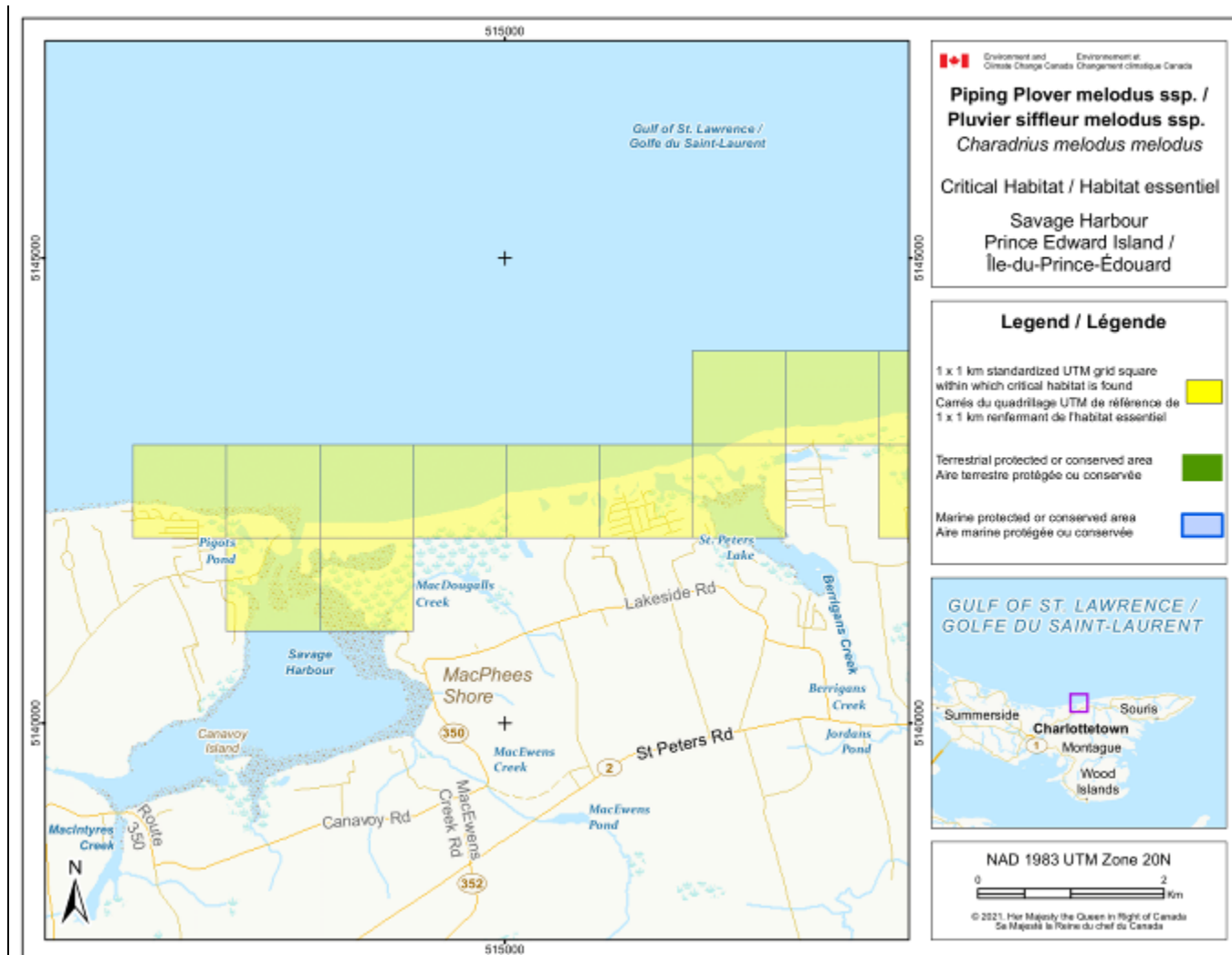
C-39. Grid squares containing critical habitat for Piping Plover in Naufrage, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



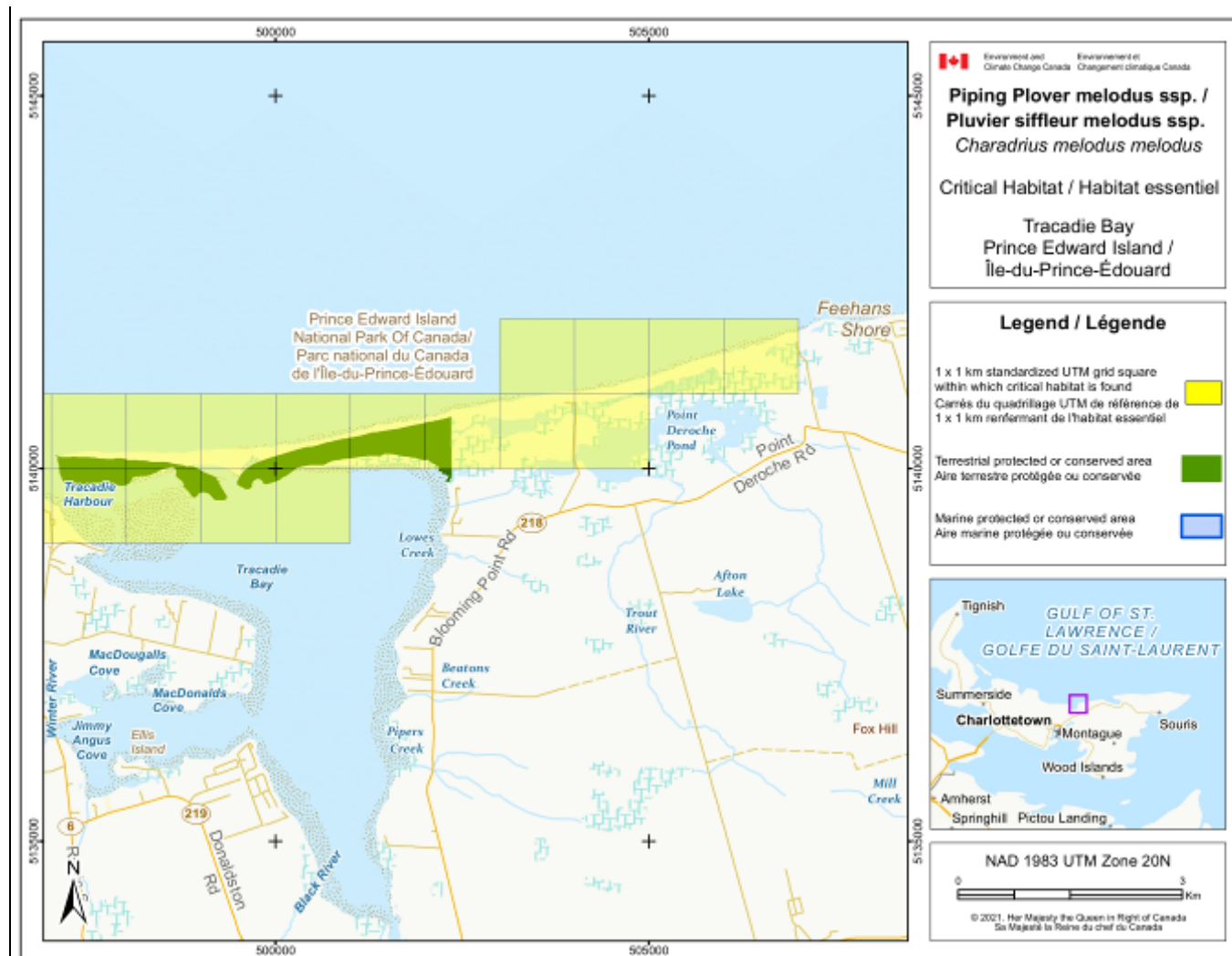
C-40. Grid squares containing critical habitat for Piping Plover in Cable Head East, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



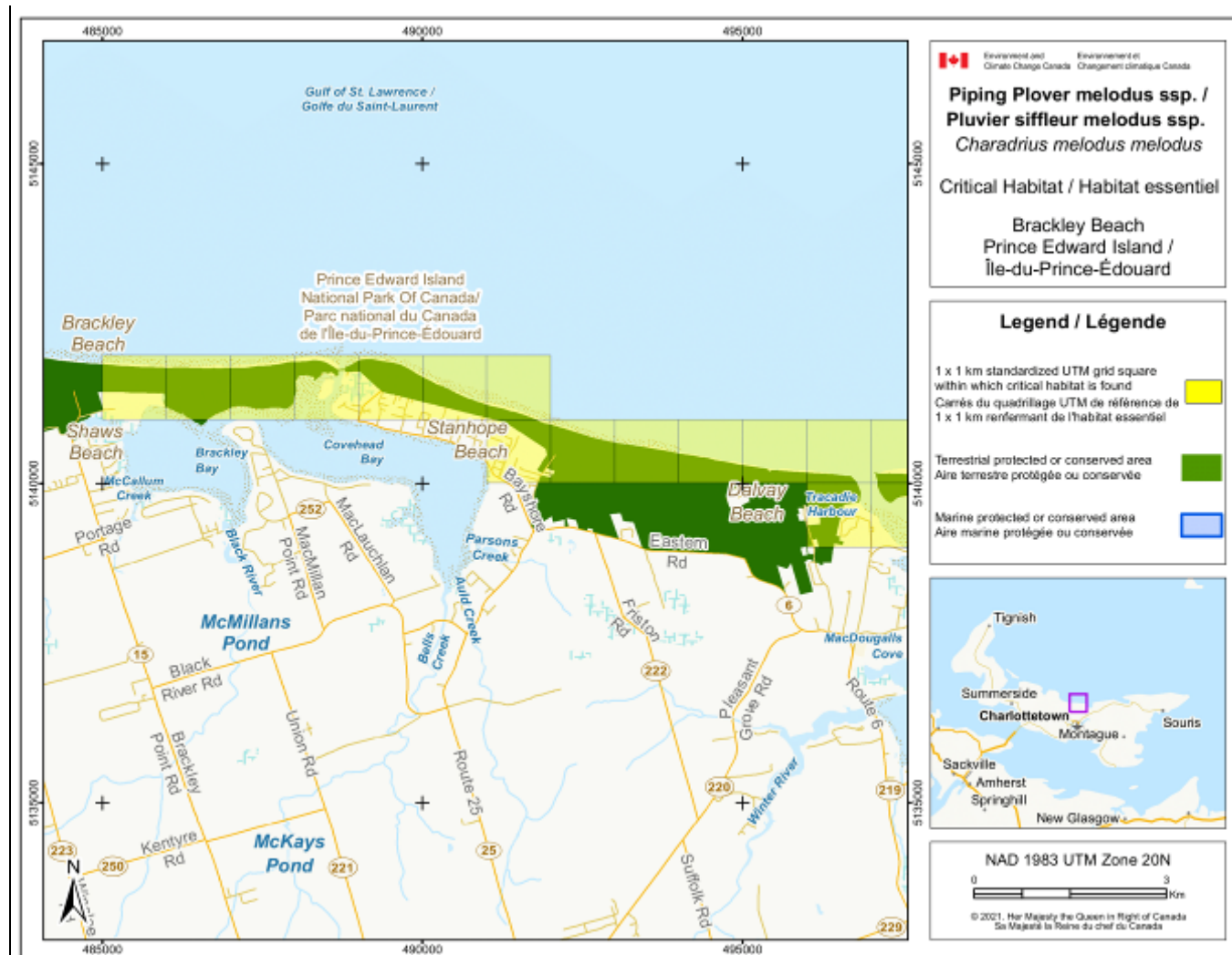
C-41. Grid squares containing critical habitat for Piping Plover in St. Peters Bay, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



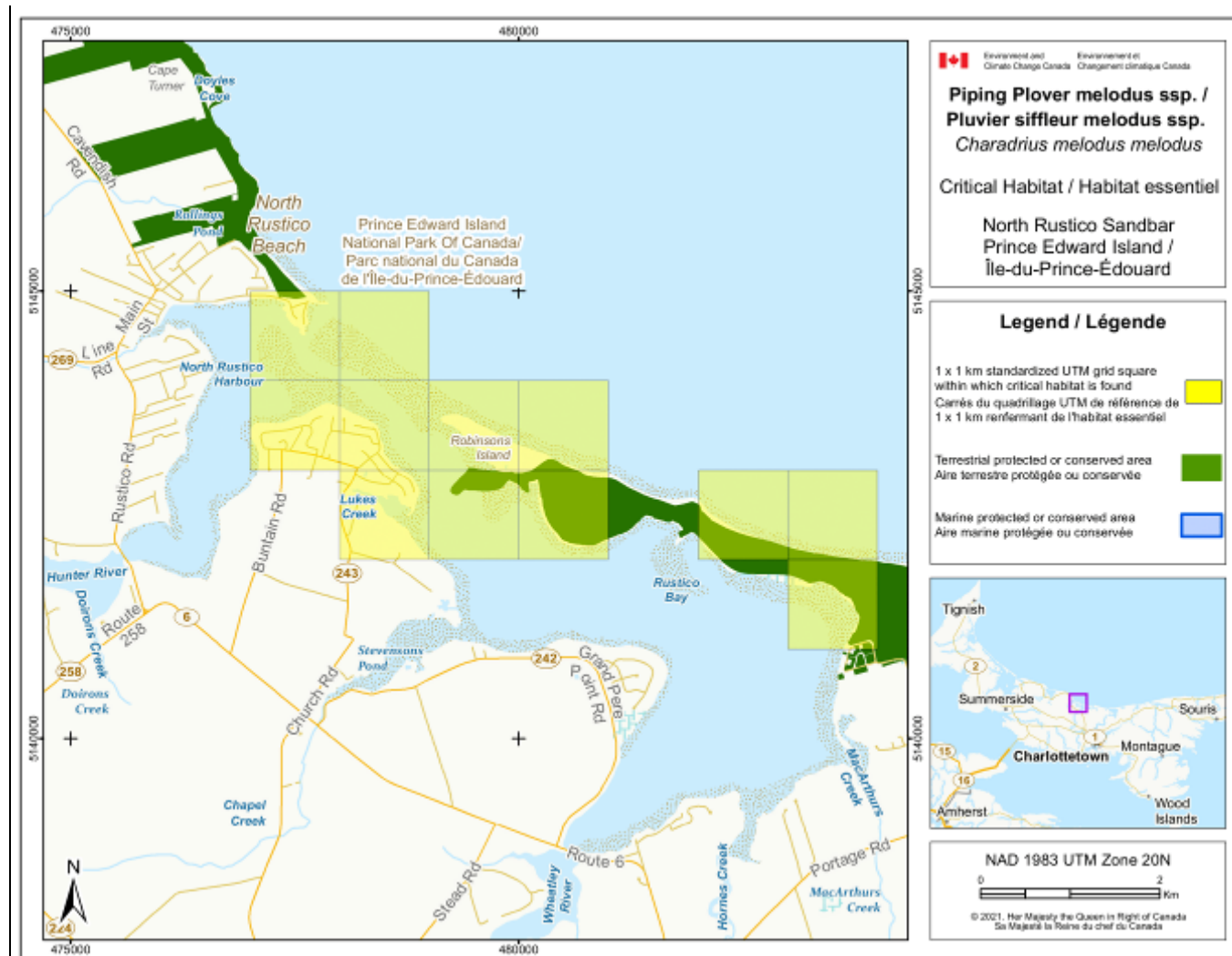
C-42. Grid squares containing critical habitat for Piping Plover in Savage Harbour, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



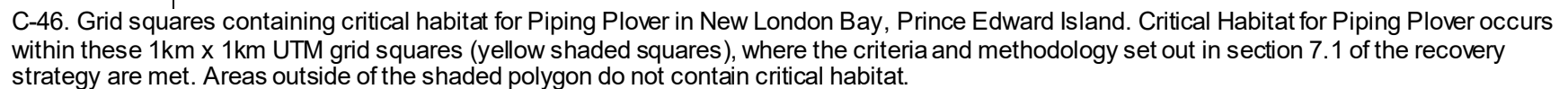
C-43. Grid squares containing critical habitat for Piping Plover in Tracadie Bay, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.

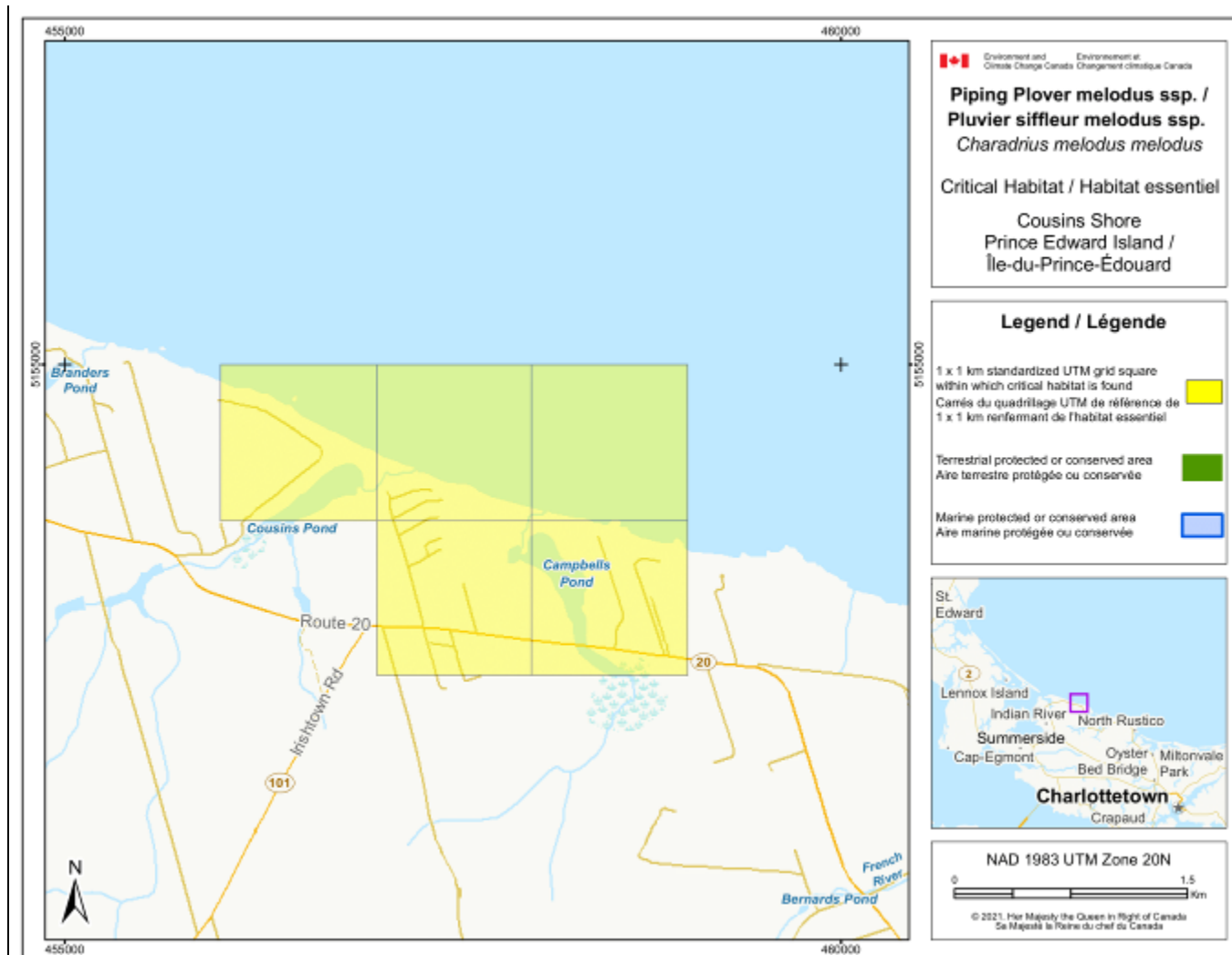


C-44. Grid squares containing critical habitat for Piping Plover in Brackley Beach, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.

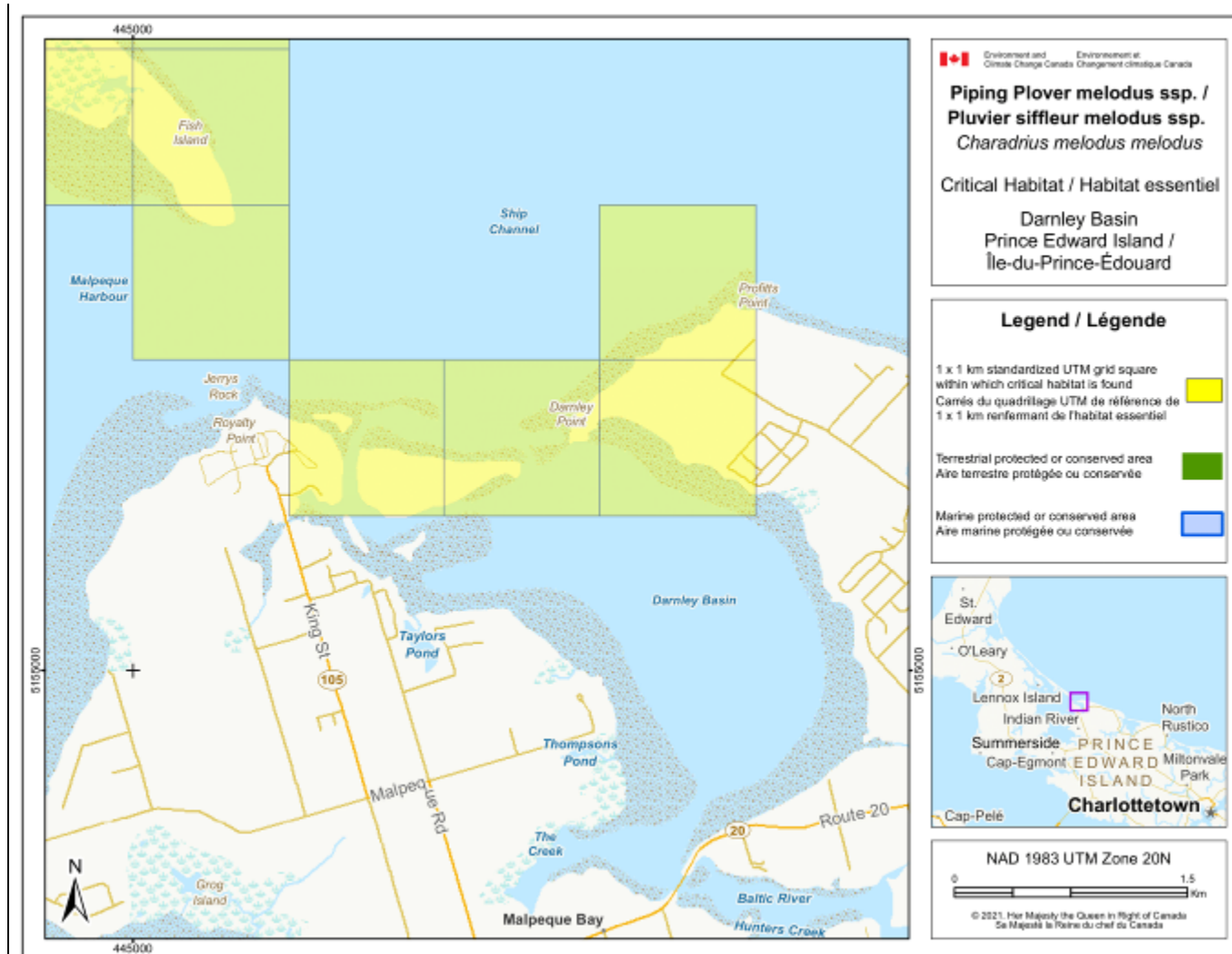


C-45. Grid squares containing critical habitat for Piping Plover in North Rustico, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.

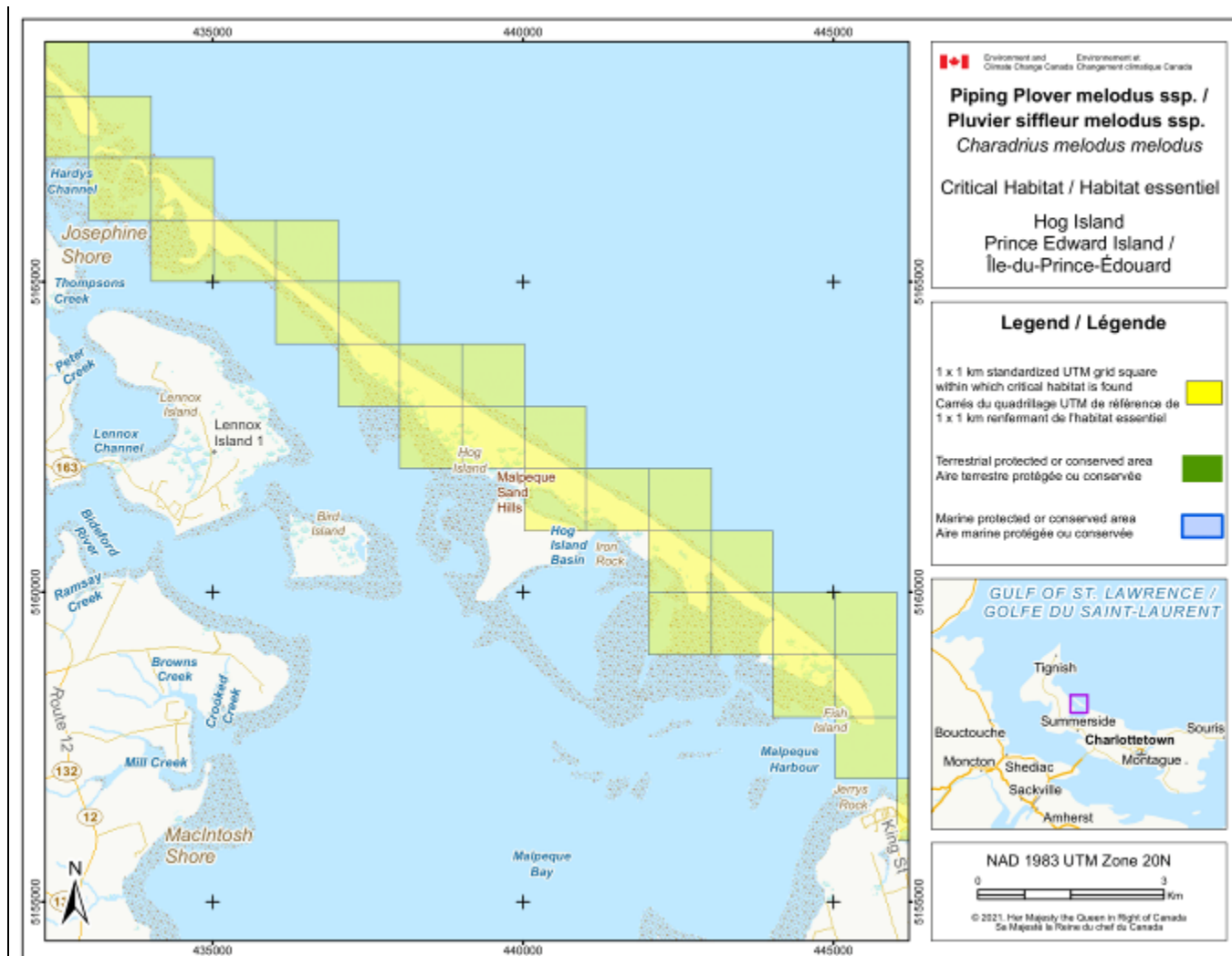




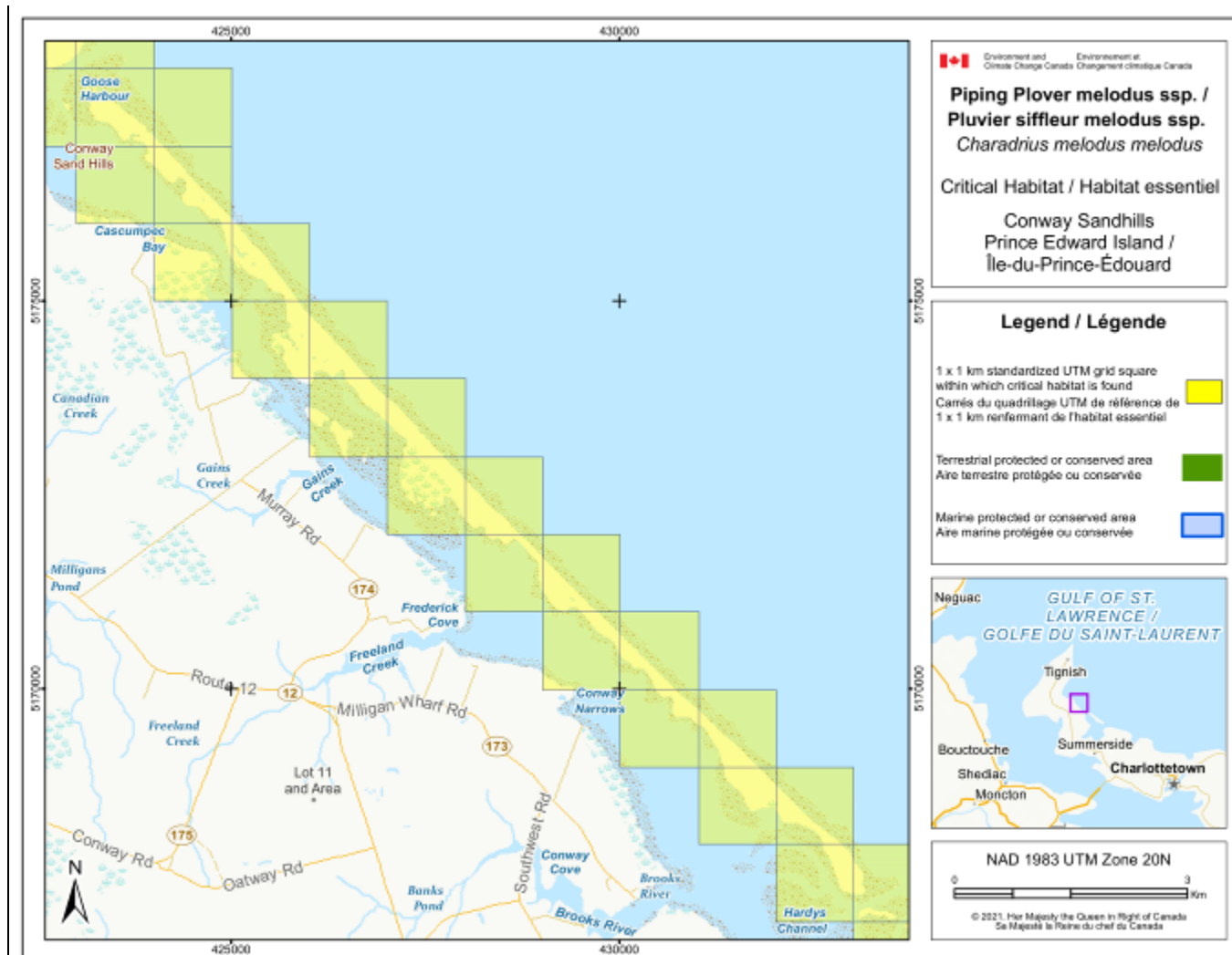
C-47. Grid squares containing critical habitat for Piping Plover in Cousins Shore, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



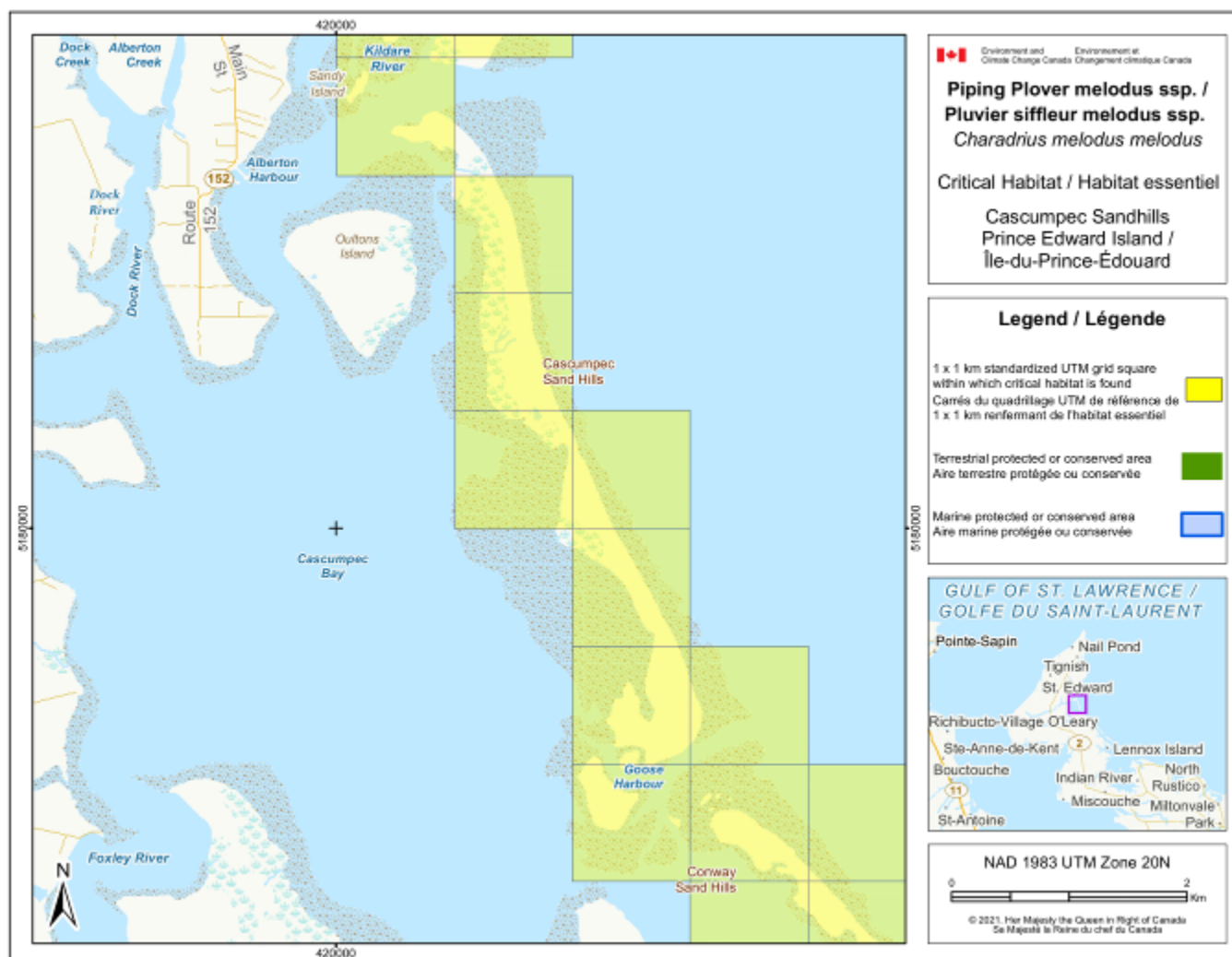
C-48. Grid squares containing critical habitat for Piping Plover in Darnley Basin, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



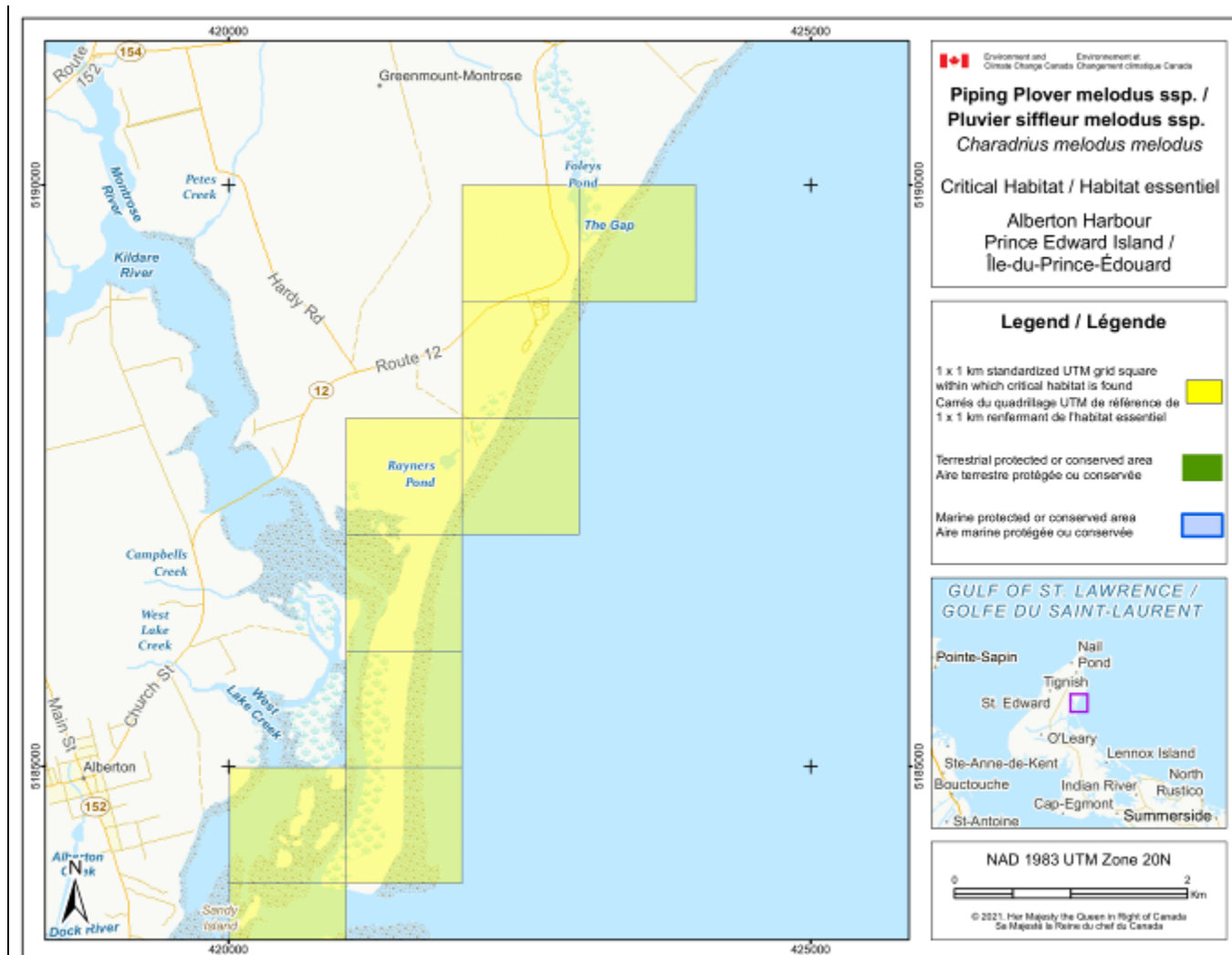
C-49. Grid squares containing critical habitat for Piping Plover in Hog Island, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



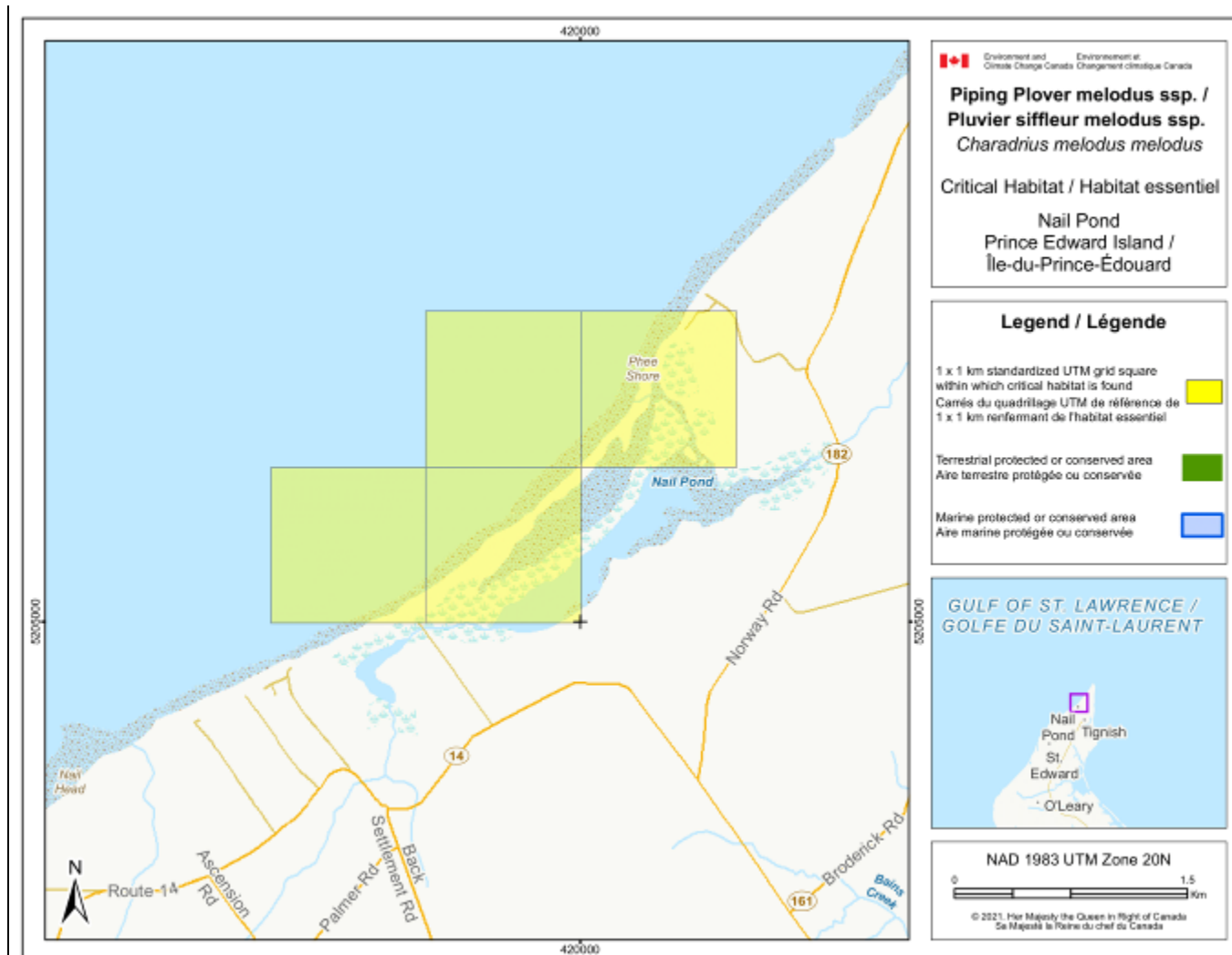
C-50. Grid squares containing critical habitat for Piping Plover in Conway Sandhills, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



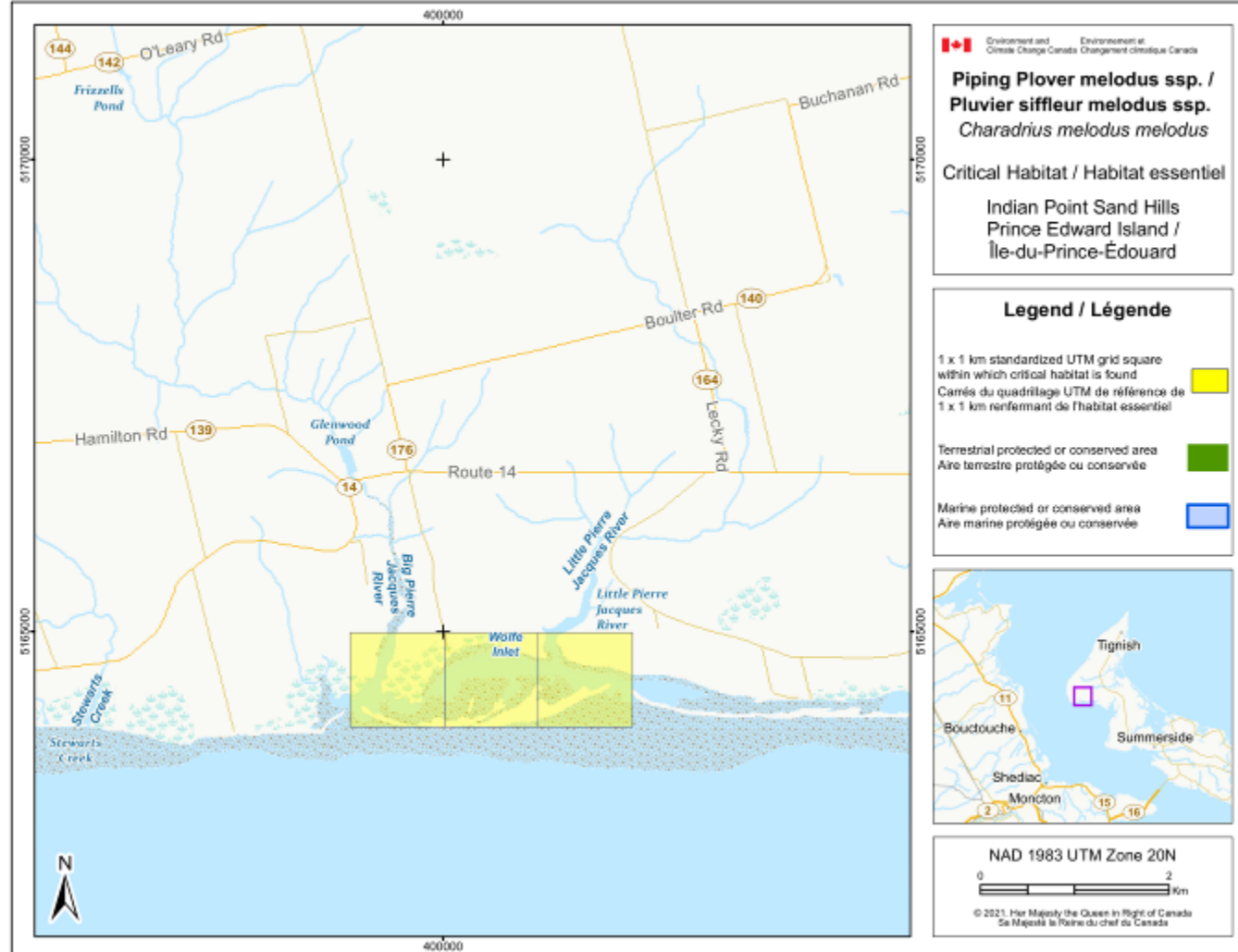
C-51. Grid squares containing critical habitat for Piping Plover in Cascumpec Sandhills, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



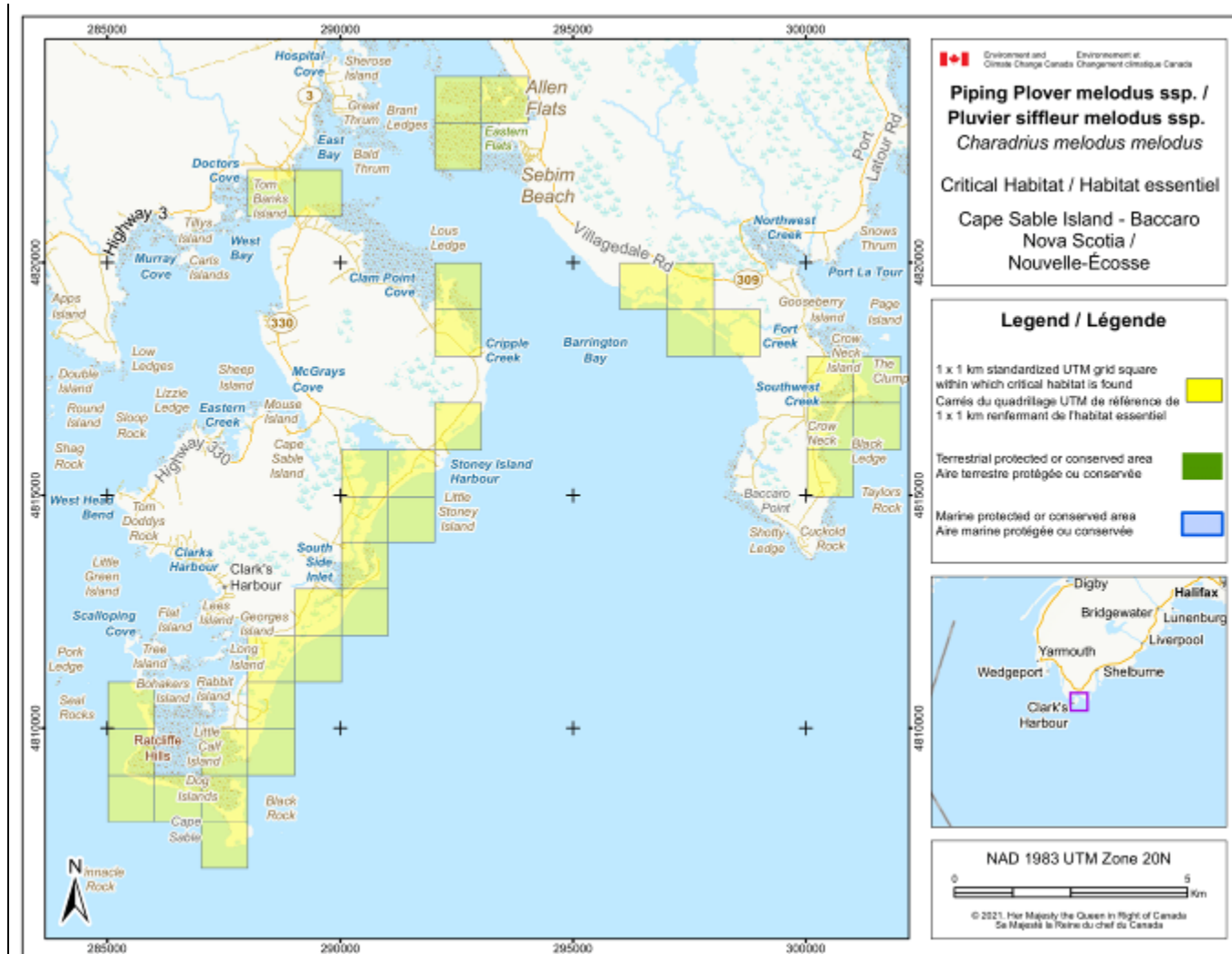
C-52. Grid squares containing critical habitat for Piping Plover in Alberton Harbour, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



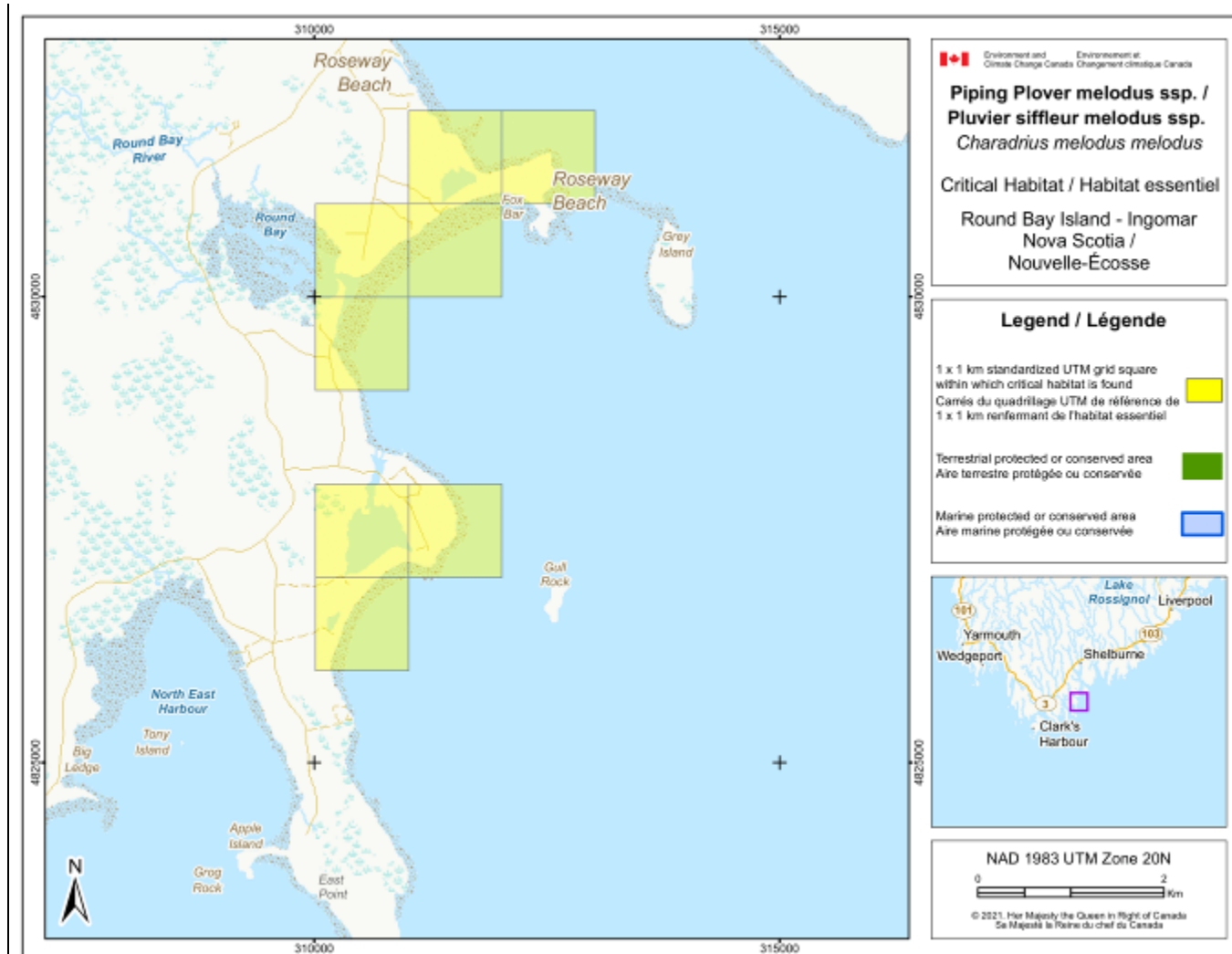
C-53. Grid squares containing critical habitat for Piping Plover in Nail Pond, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



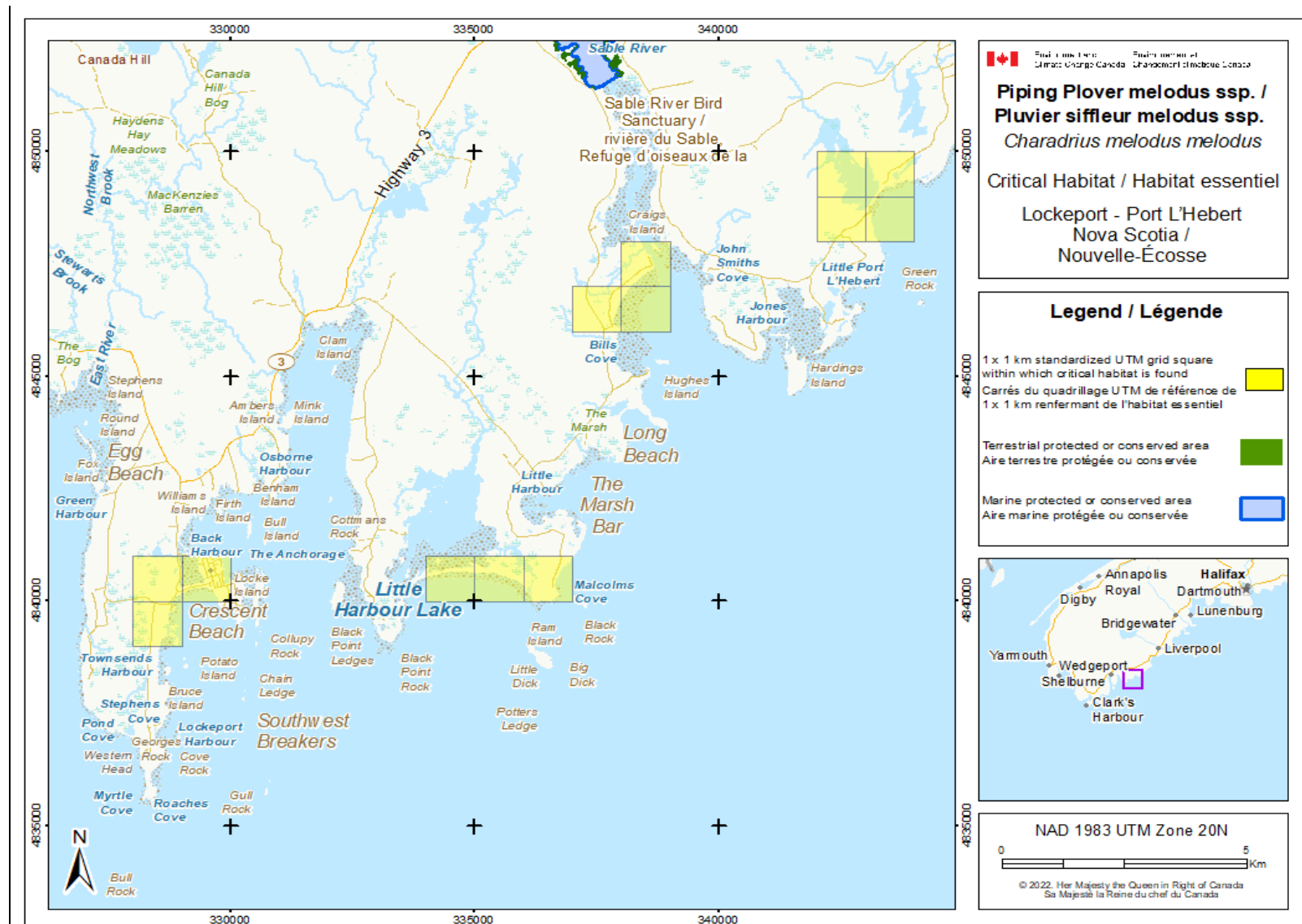
C-54. Grid squares containing critical habitat for Piping Plover in Indian Point Sand Hills, Prince Edward Island. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



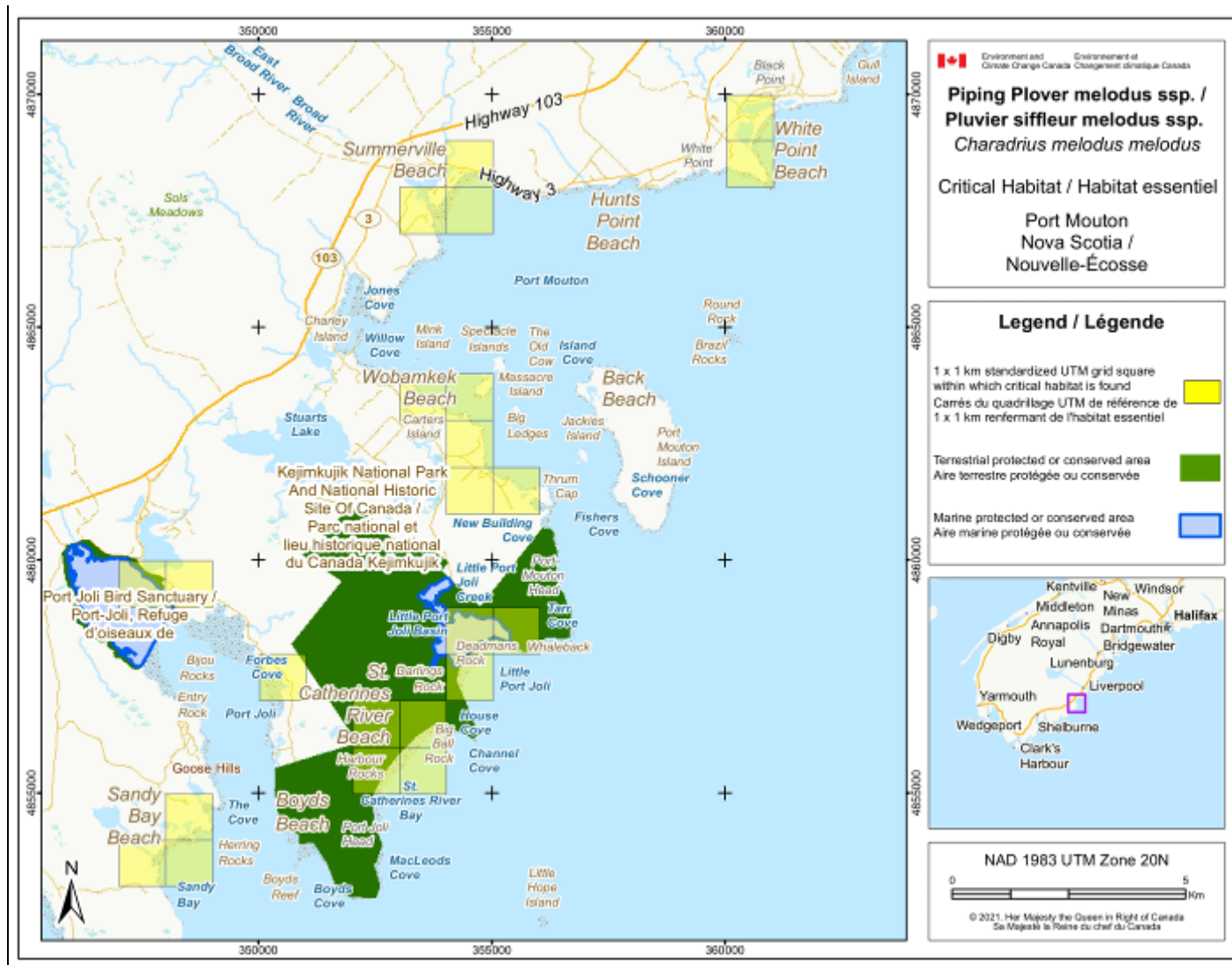
C-55. Grid squares containing critical habitat for Piping Plover in Cape Sable Island – Baccaro, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



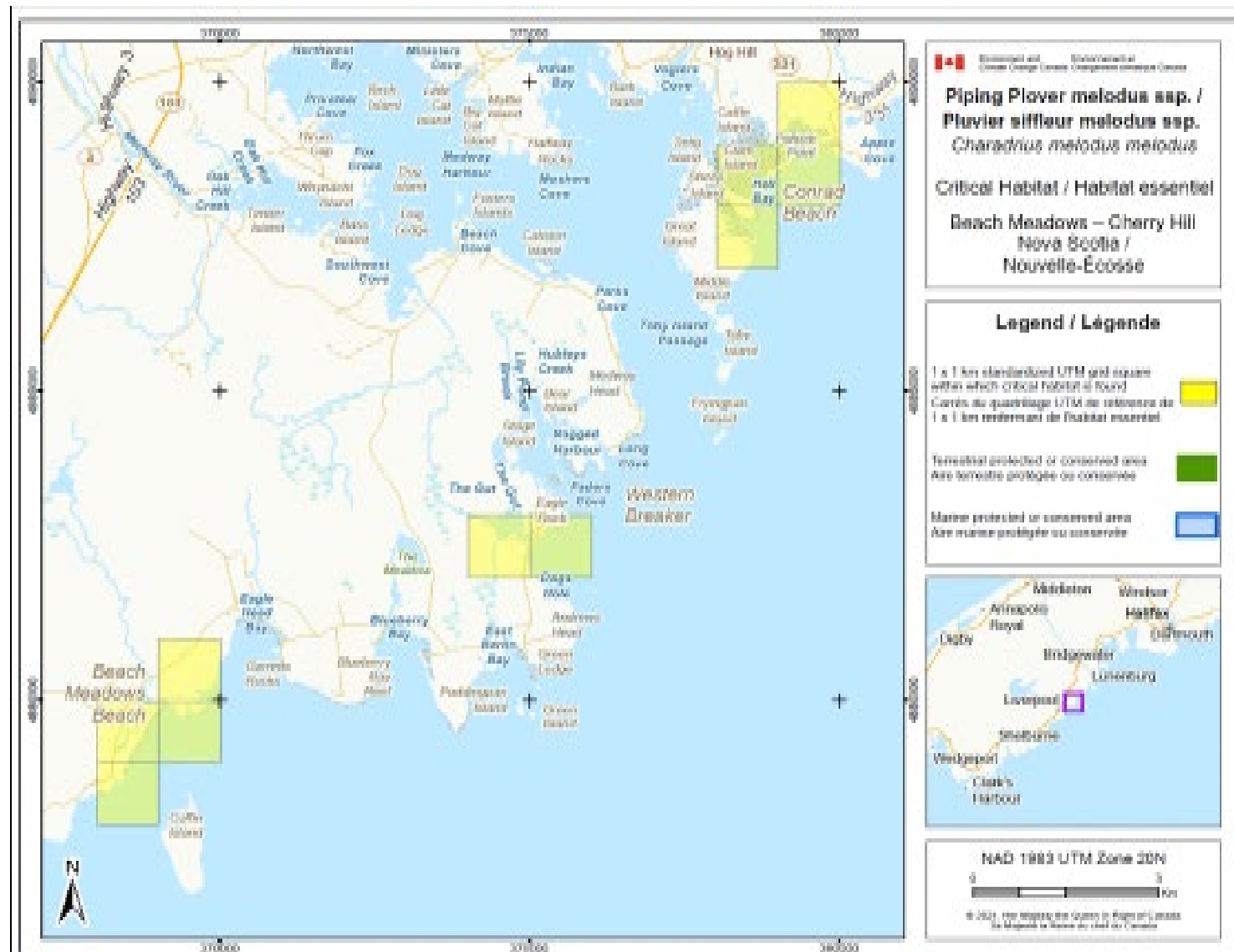
C-56. Grid squares containing critical habitat for Piping Plover in Round Bay Island – Ingomar, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



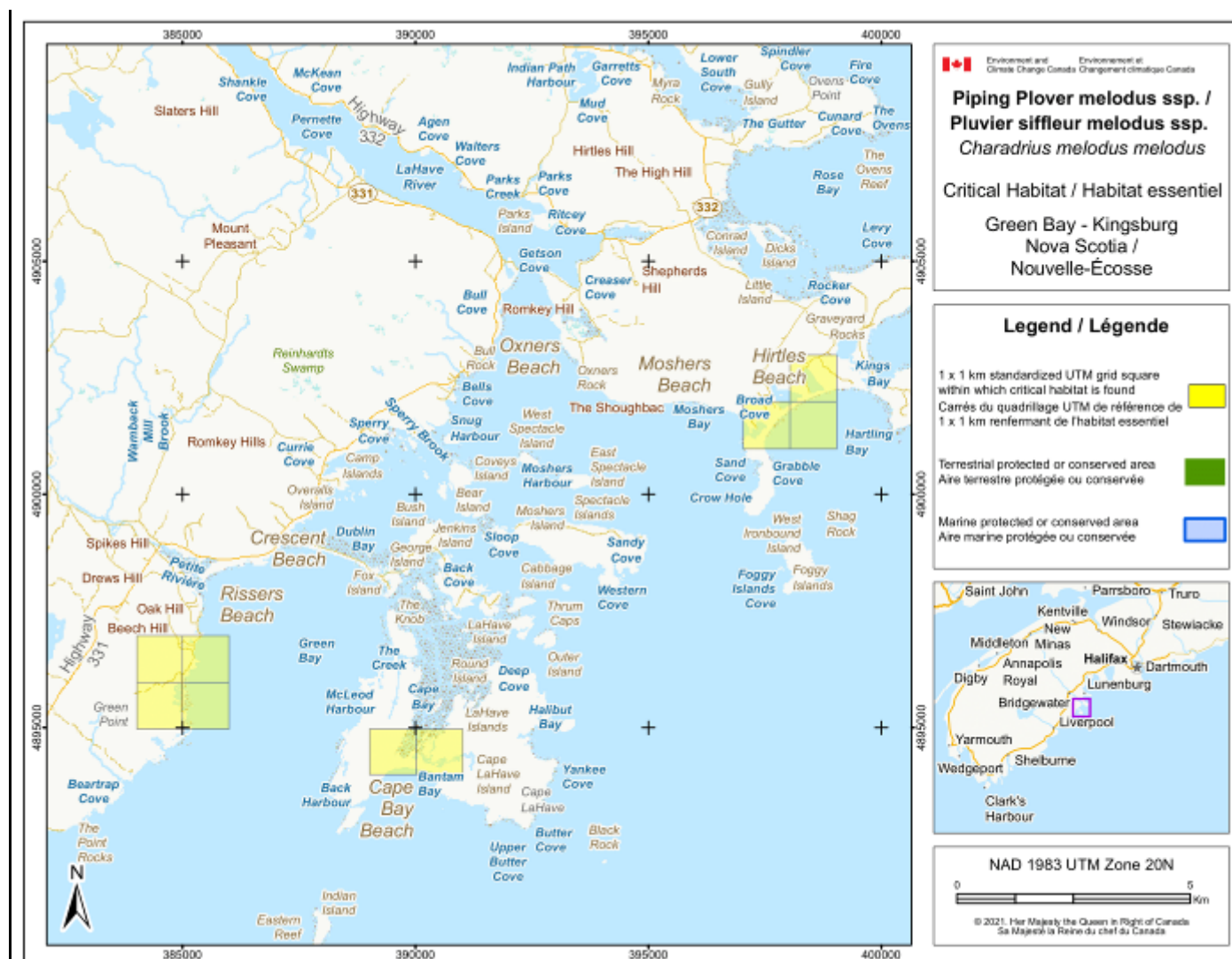
C-57. Grid squares containing critical habitat for Piping Plover in Lockeport – Port L'Hebert, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



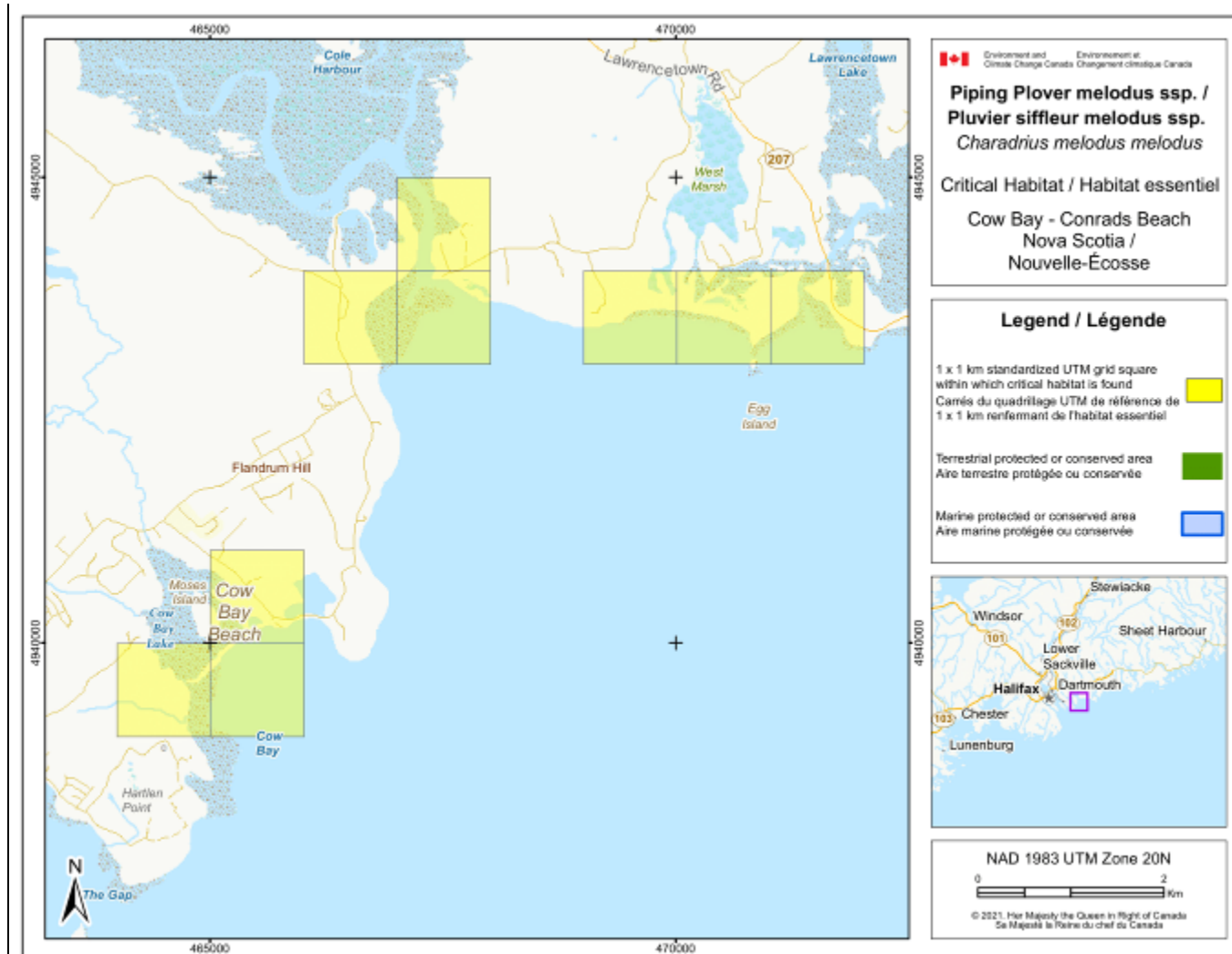
C-58. Grid squares containing critical habitat for Piping Plover in Port Mouton, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



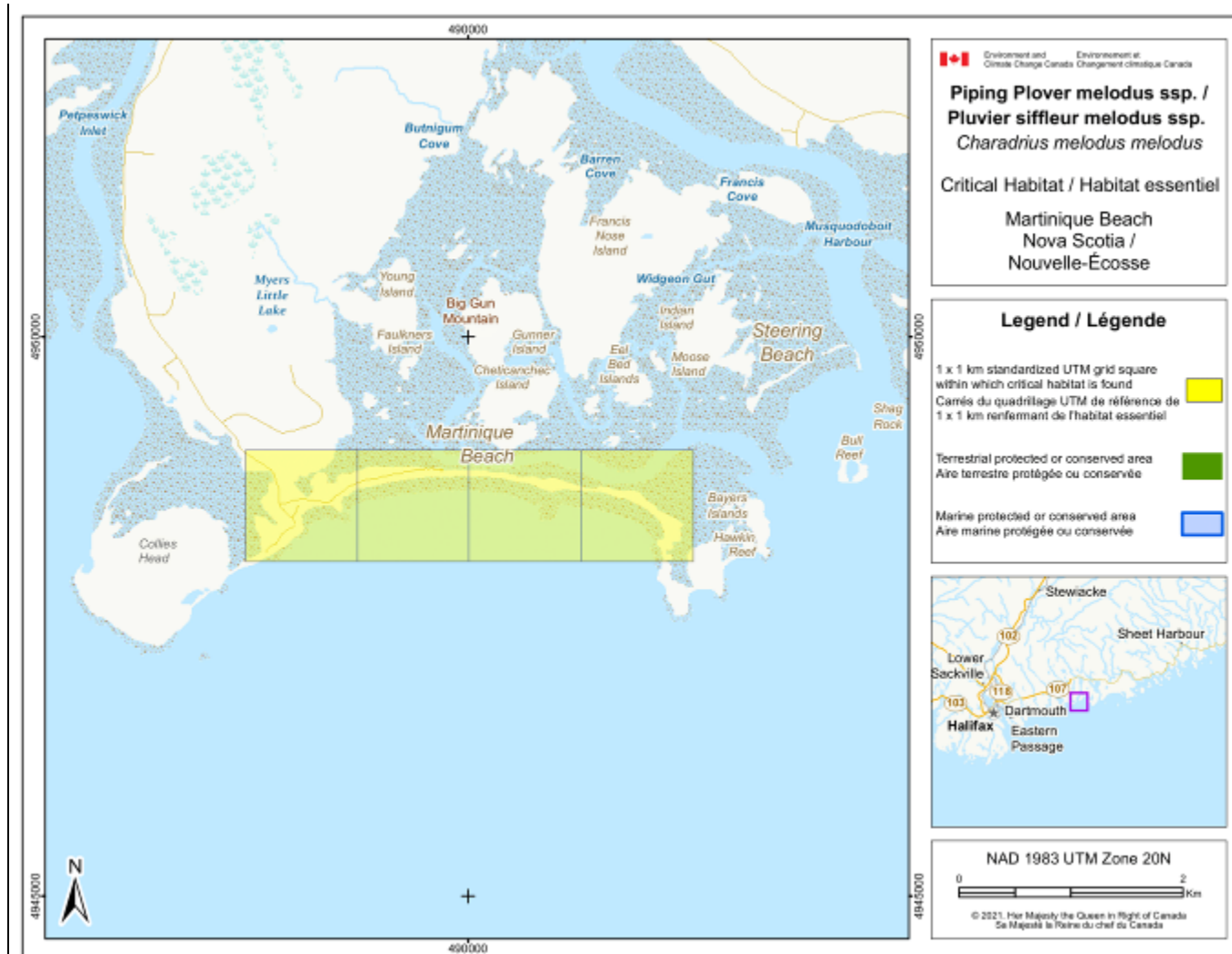
C-59. Grid squares containing critical habitat for Piping Plover in Sandy Bay – White Point, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



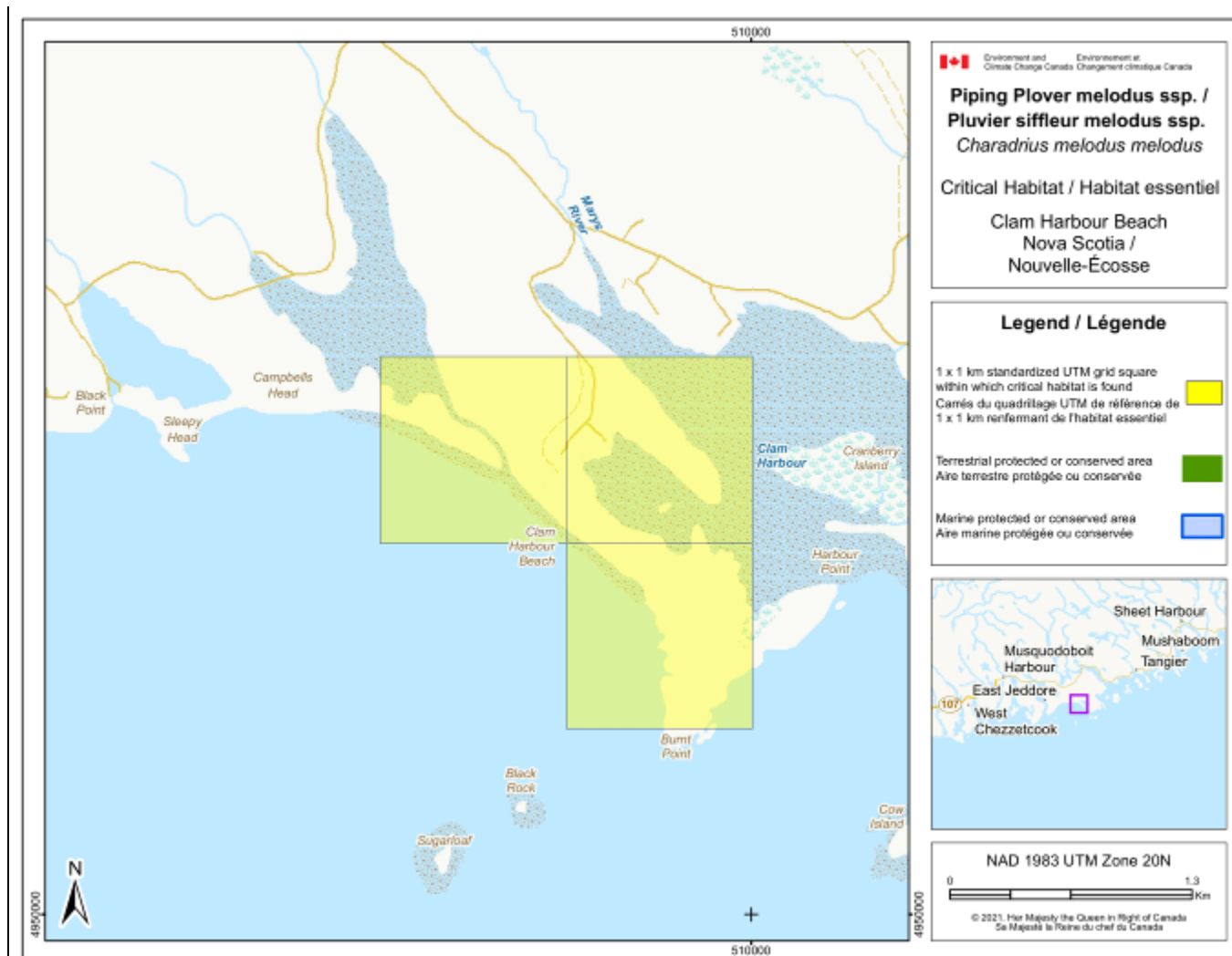
C-60. Grid squares containing critical habitat for Piping Plover in Green Bay – Kingsburg, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



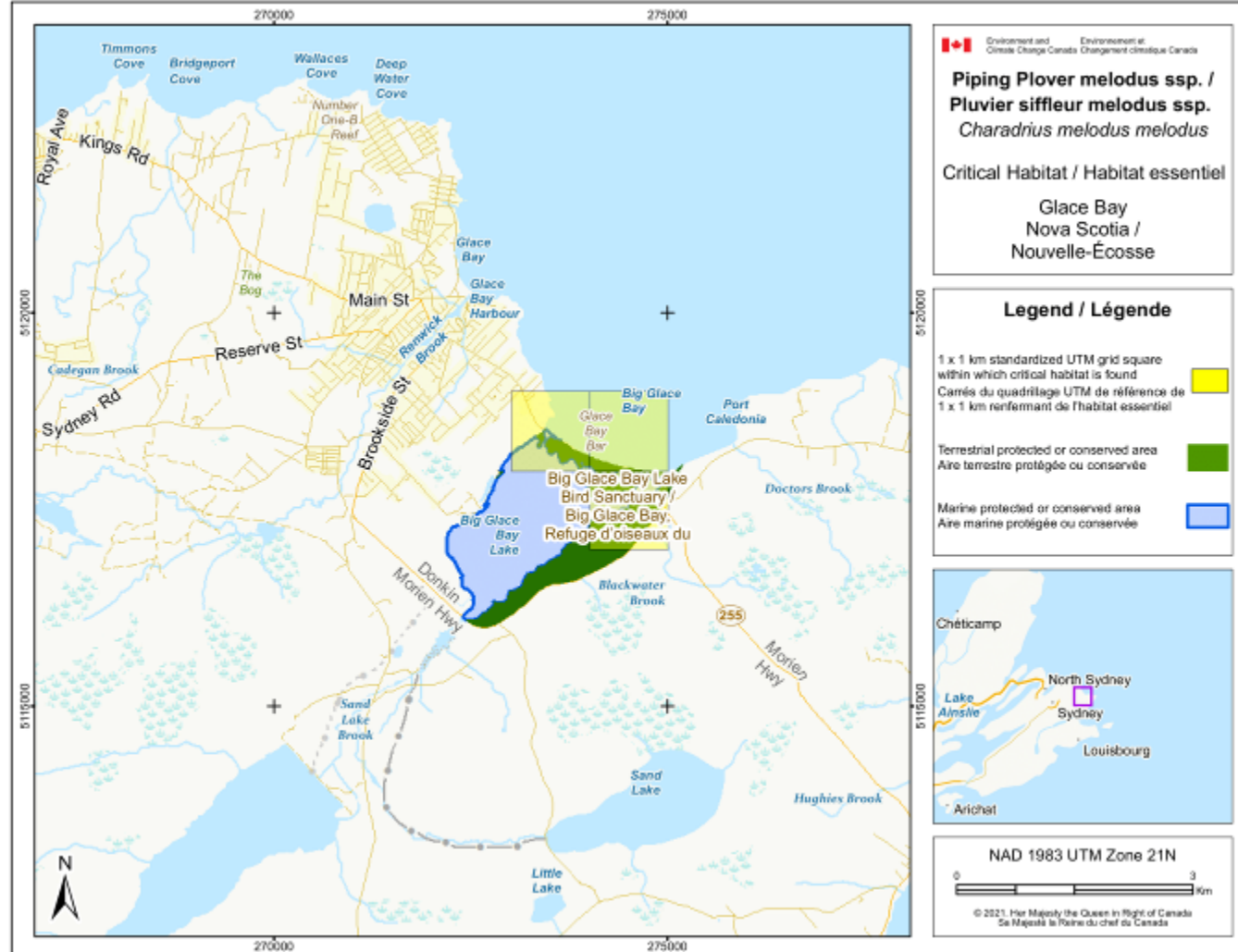
C-61. Grid squares containing critical habitat for Piping Plover in Cow Bay – Conrads Beach, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



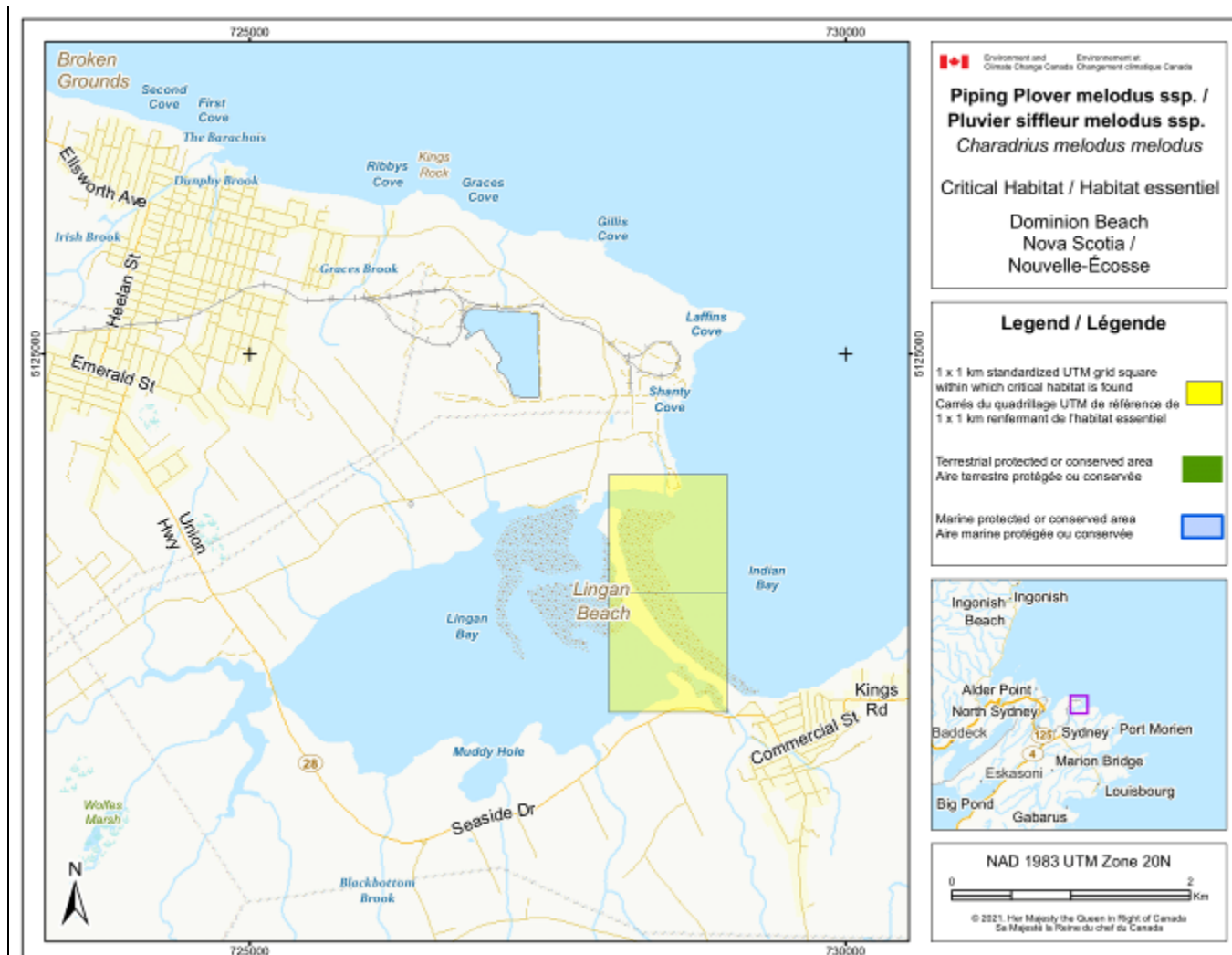
C-62. Grid squares containing critical habitat for Piping Plover in Martinique Beach, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



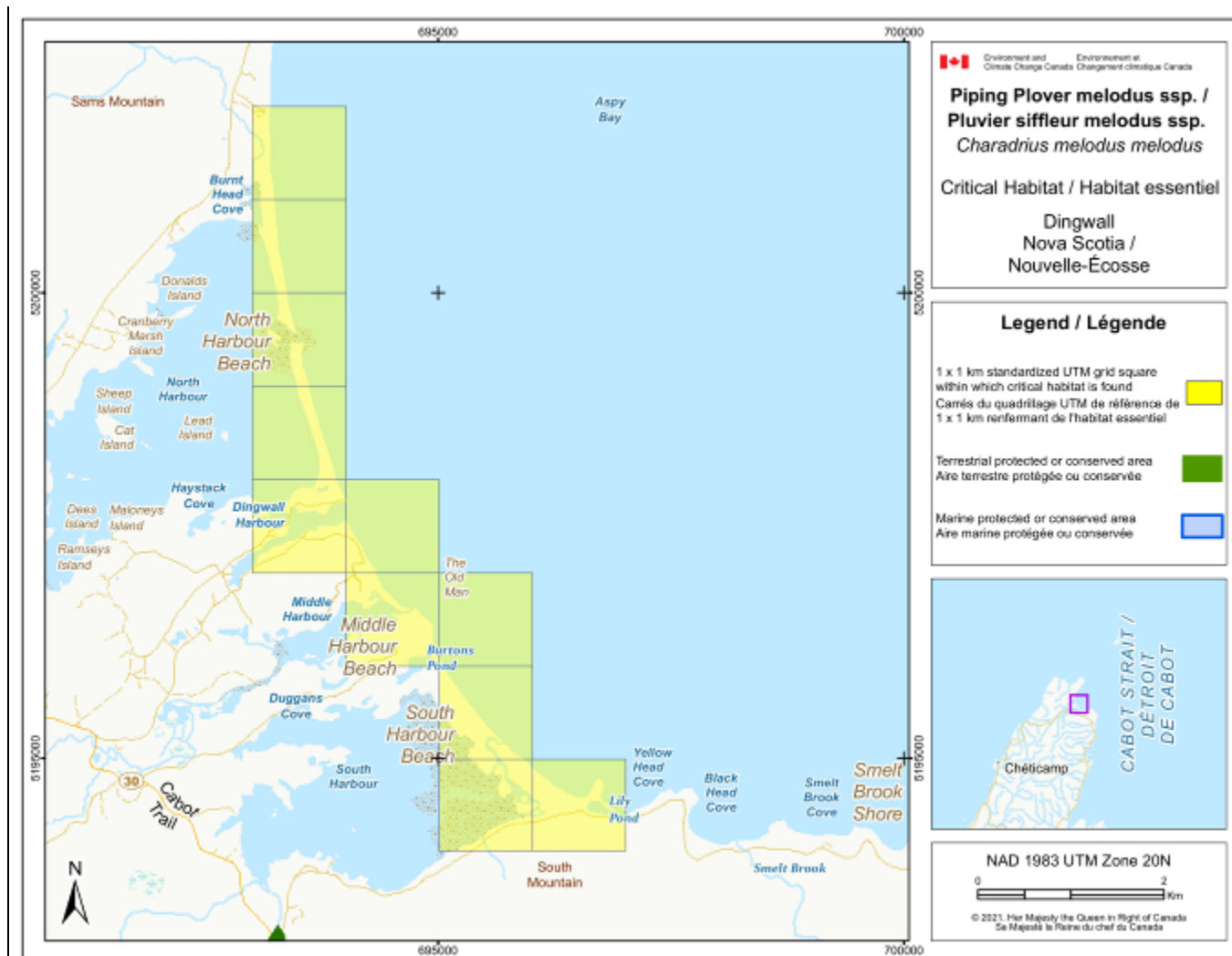
C-63. Grid squares containing critical habitat for Piping Plover in Clam Harbour Beach, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



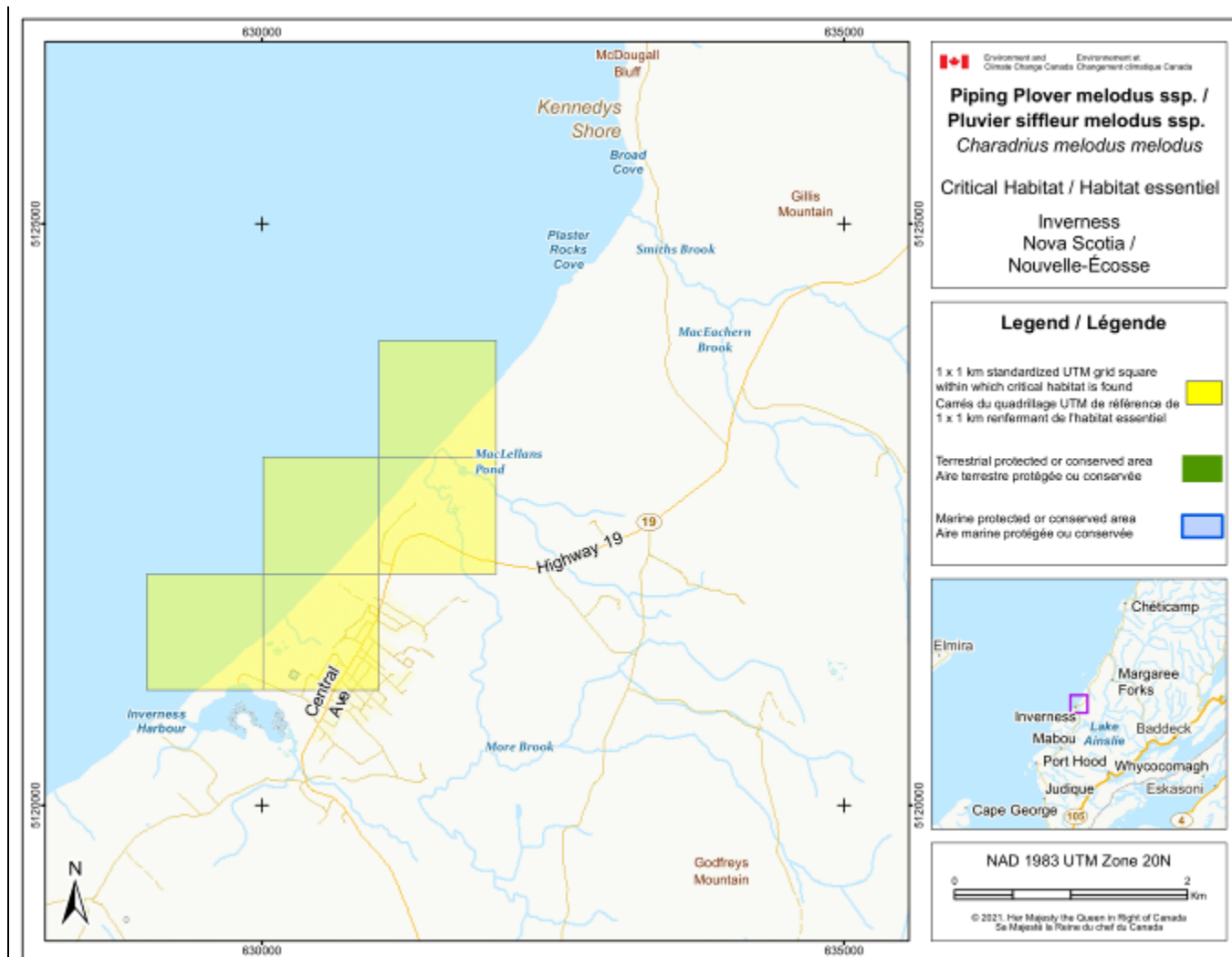
C-64. Grid squares containing critical habitat for Piping Plover in Glace Bay, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1 km x 1 km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



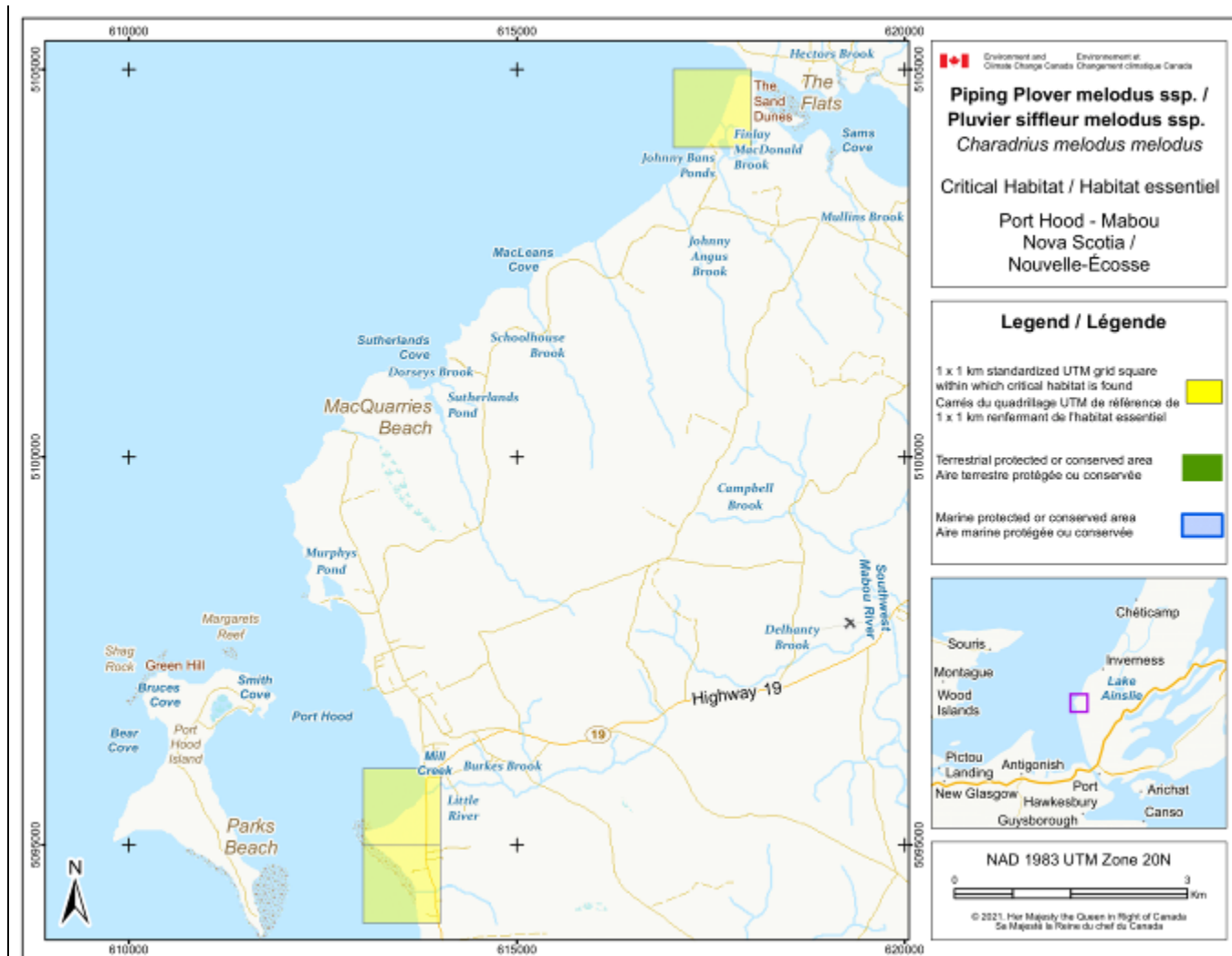
C-65. Grid squares containing critical habitat for Piping Plover in Dominion Beach, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



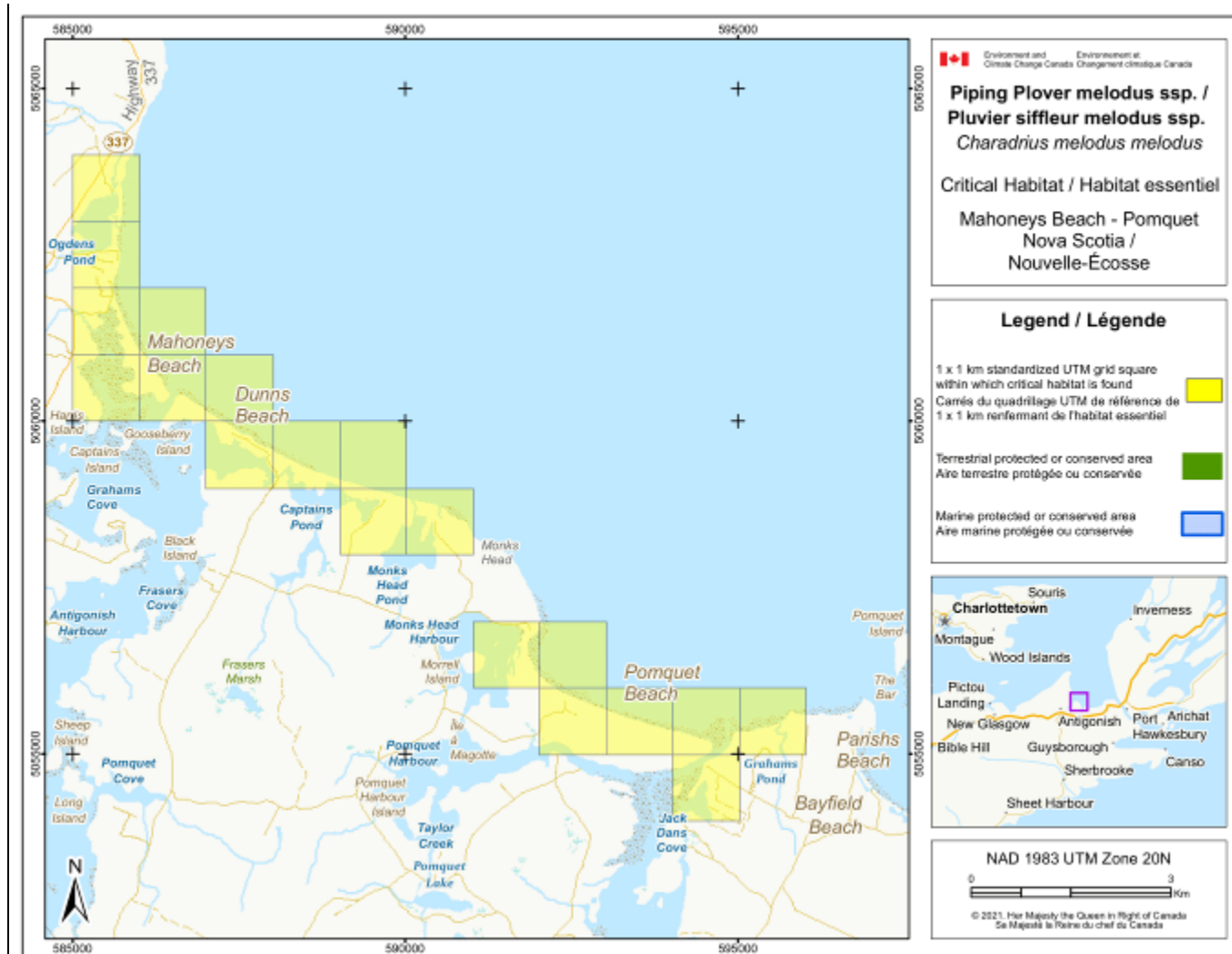
C-66. Grid squares containing critical habitat for Piping Plover in Dingwall, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



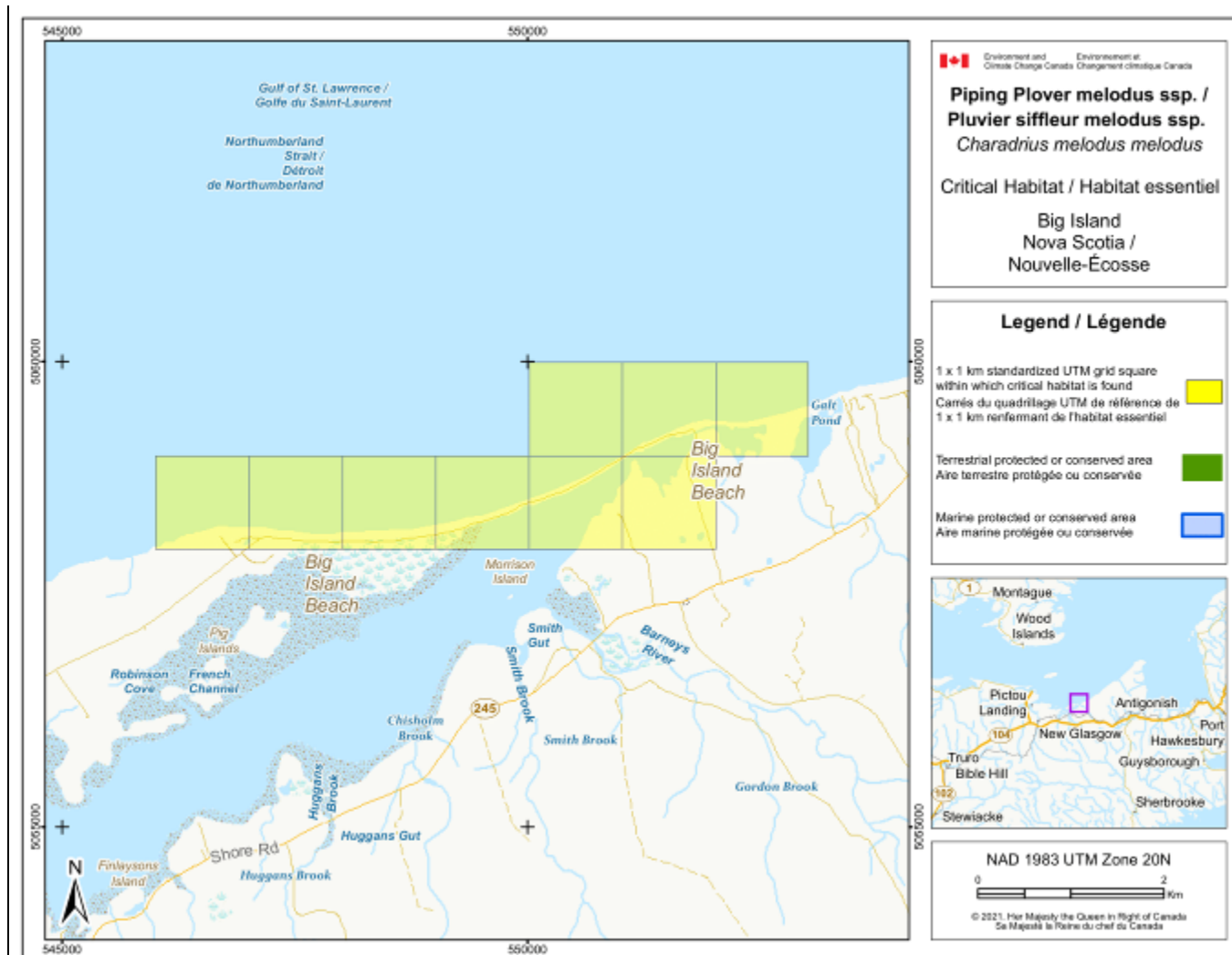
C-67. Grid squares containing critical habitat for Piping Plover in Inverness, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1 km x 1 km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



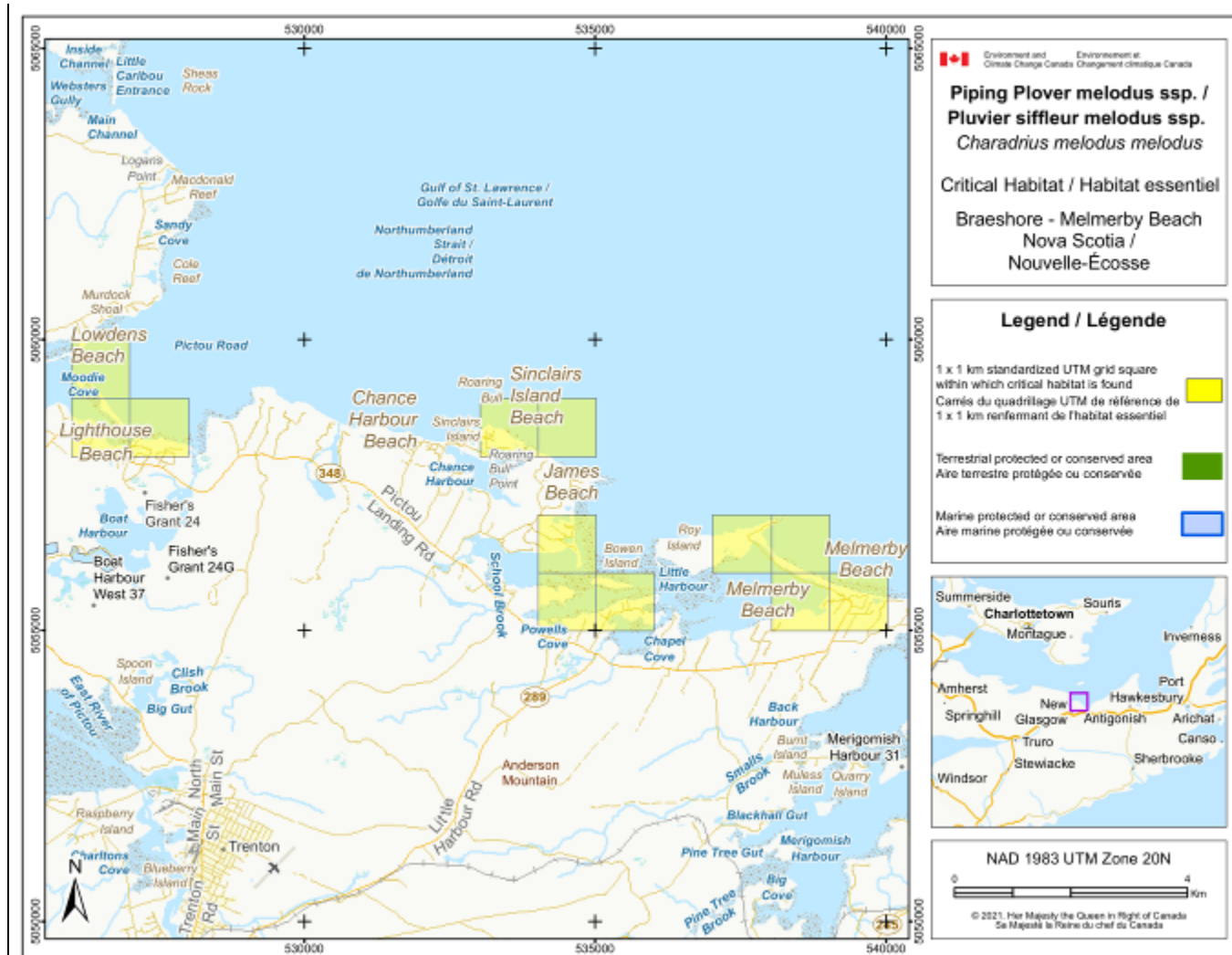
C-68. Grid squares containing critical habitat for Piping Plover in Port Hood – Mabou, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



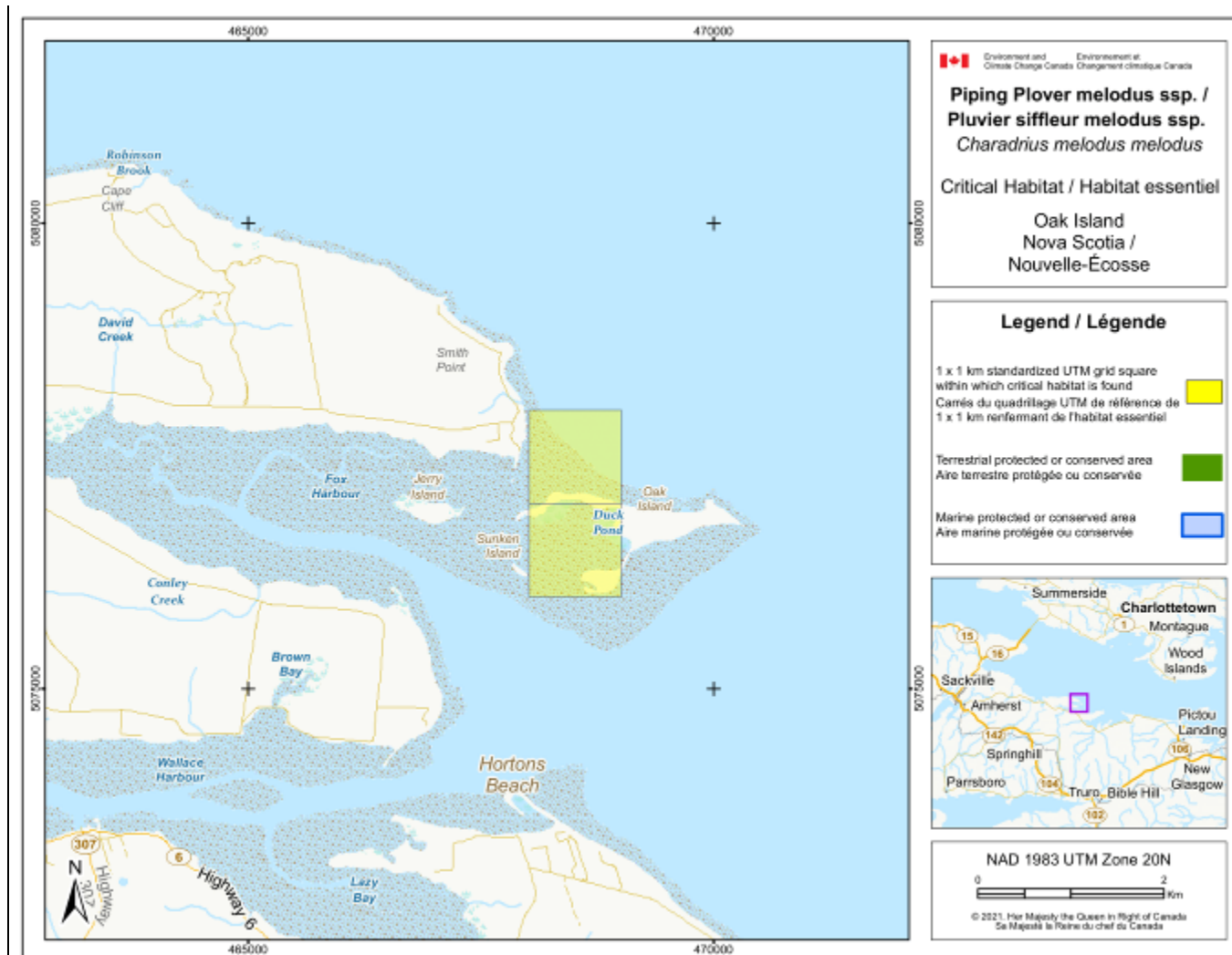
C-69. Grid squares containing critical habitat for Piping Plover in Mahoneys Beach – Pomquet, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



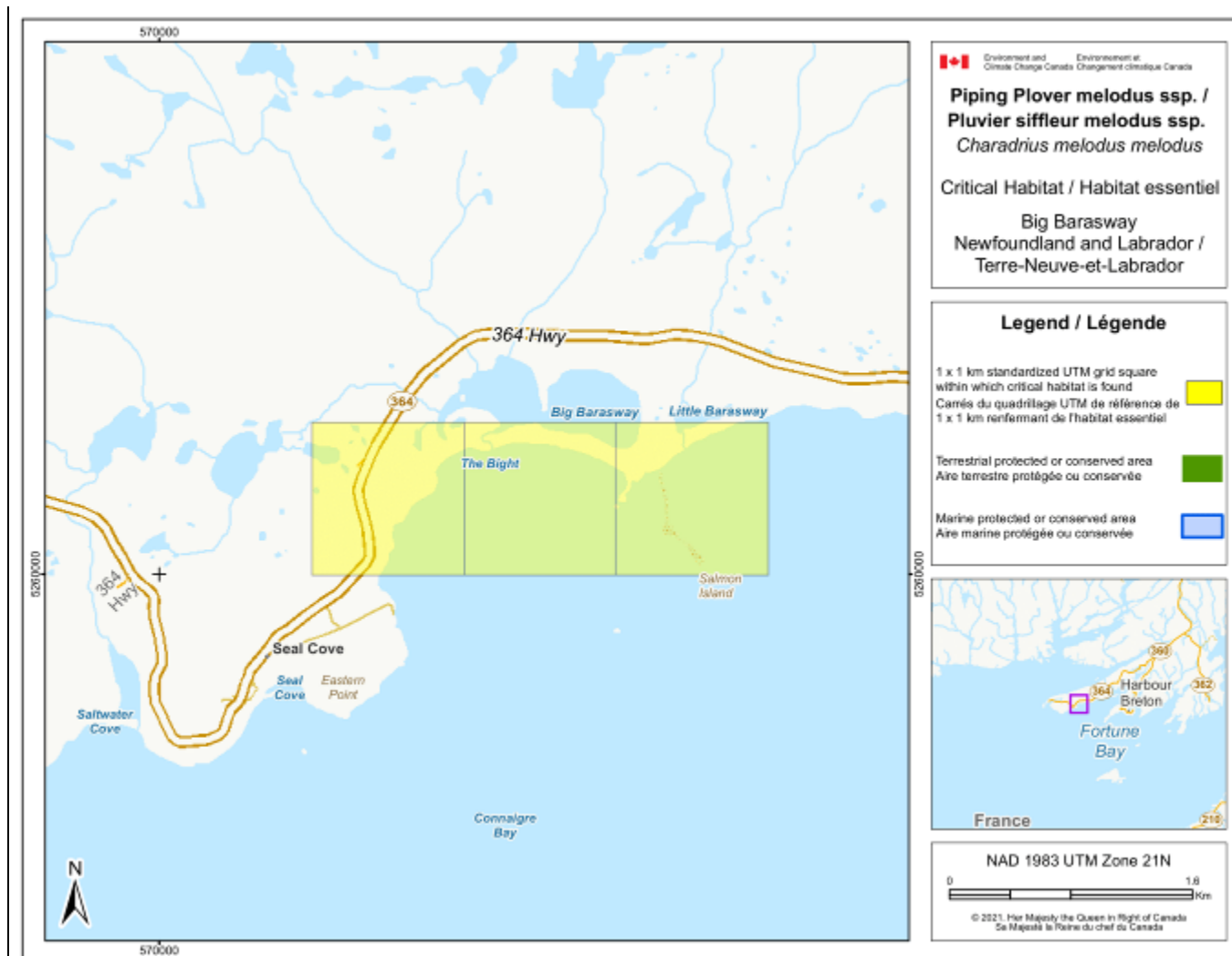
C-70. Grid squares containing critical habitat for Piping Plover in Big Island, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



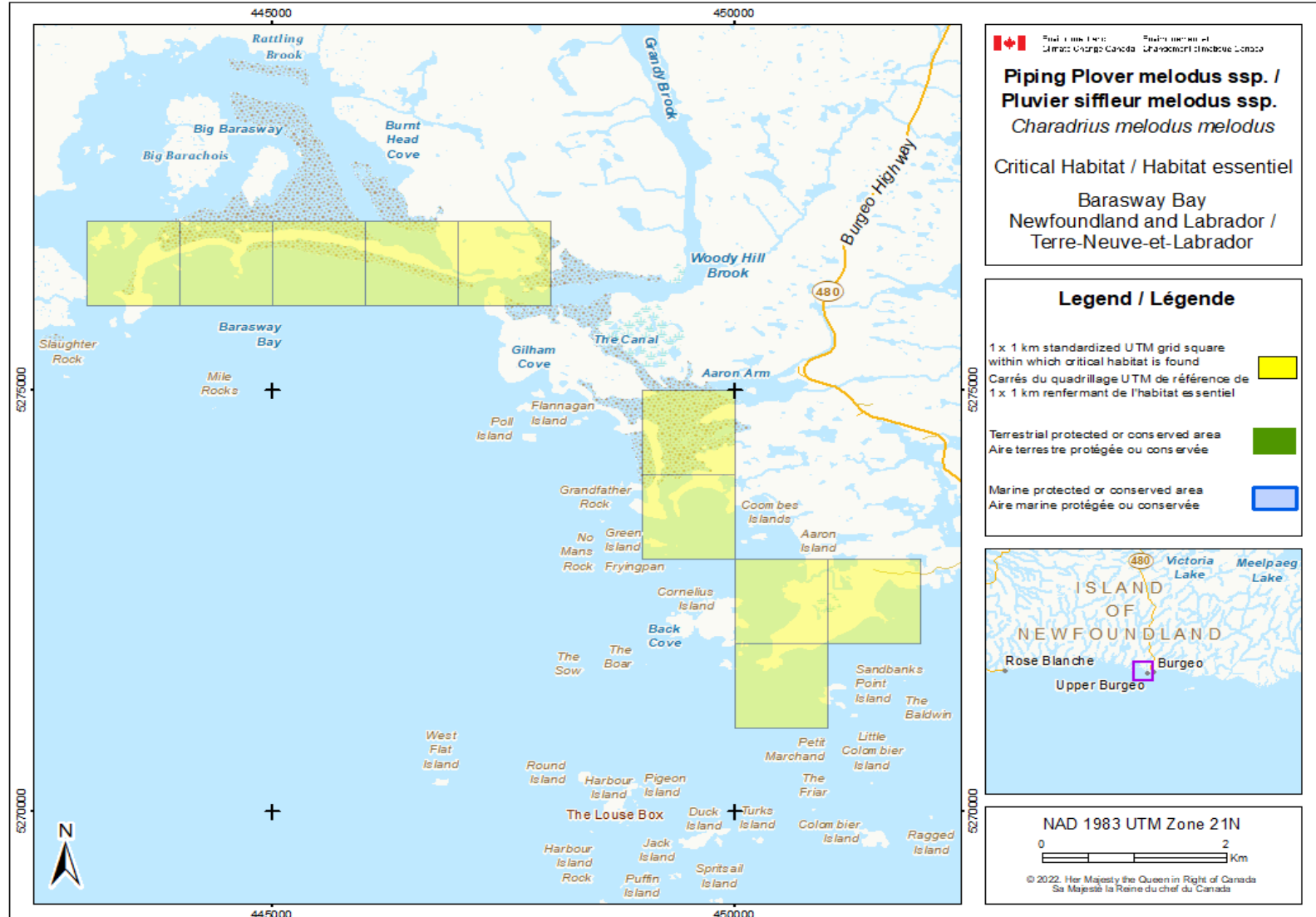
C-71. Grid squares containing critical habitat for Piping Plover in Braeshore – Melmerby Beach, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



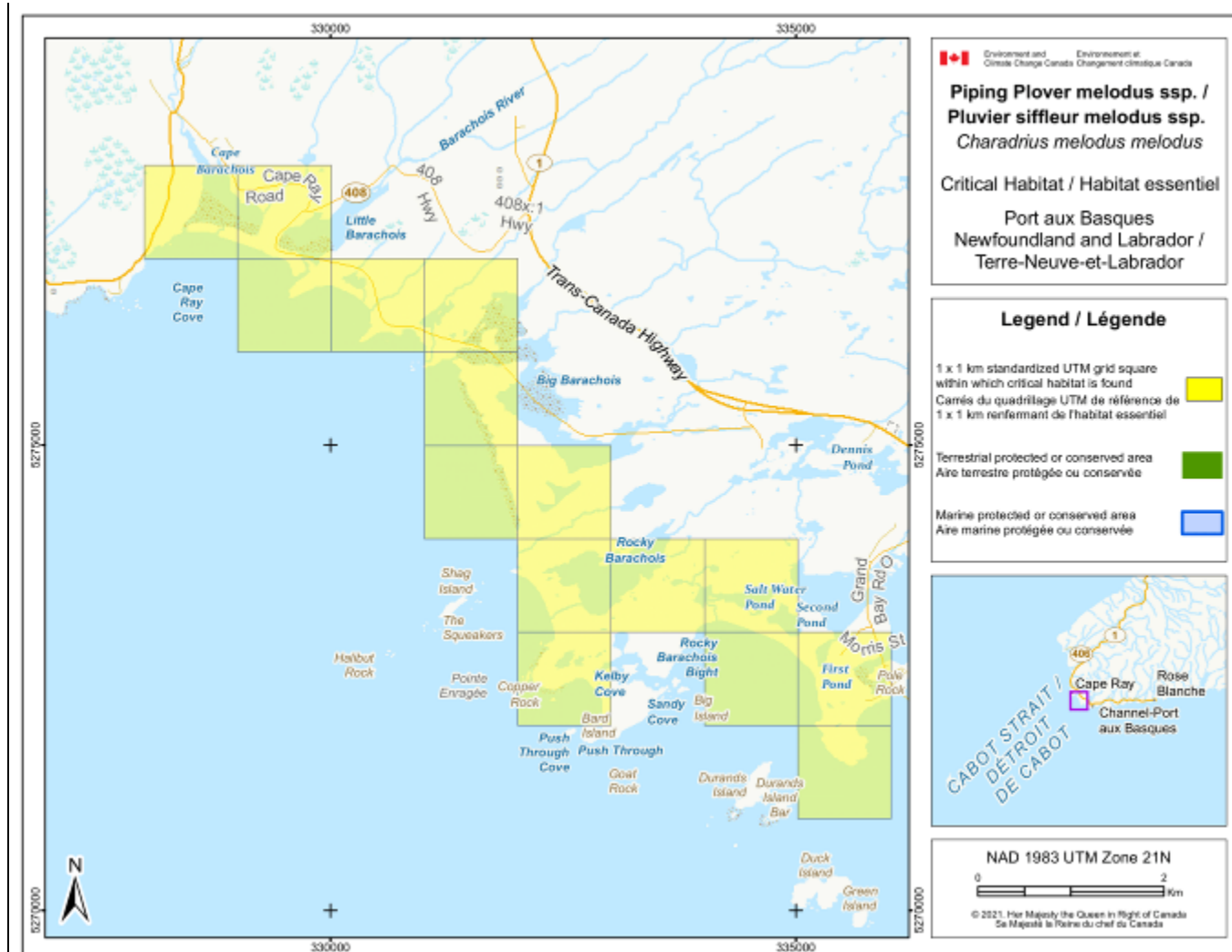
C-72. Grid squares containing critical habitat for Piping Plover in Oak Island, Nova Scotia. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



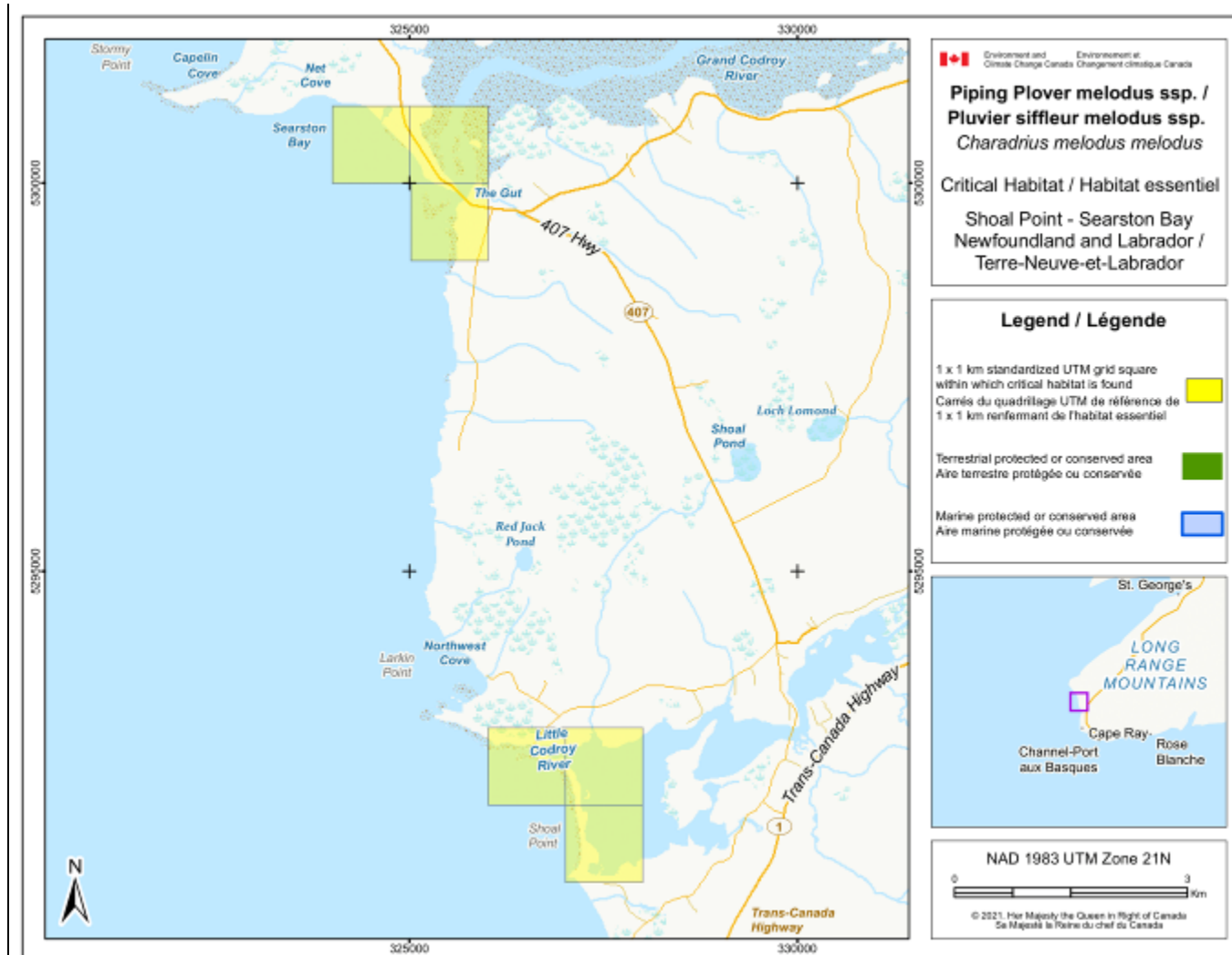
C-73. Grid squares containing critical habitat for Piping Plover in Big Barasway, Newfoundland and Labrador. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



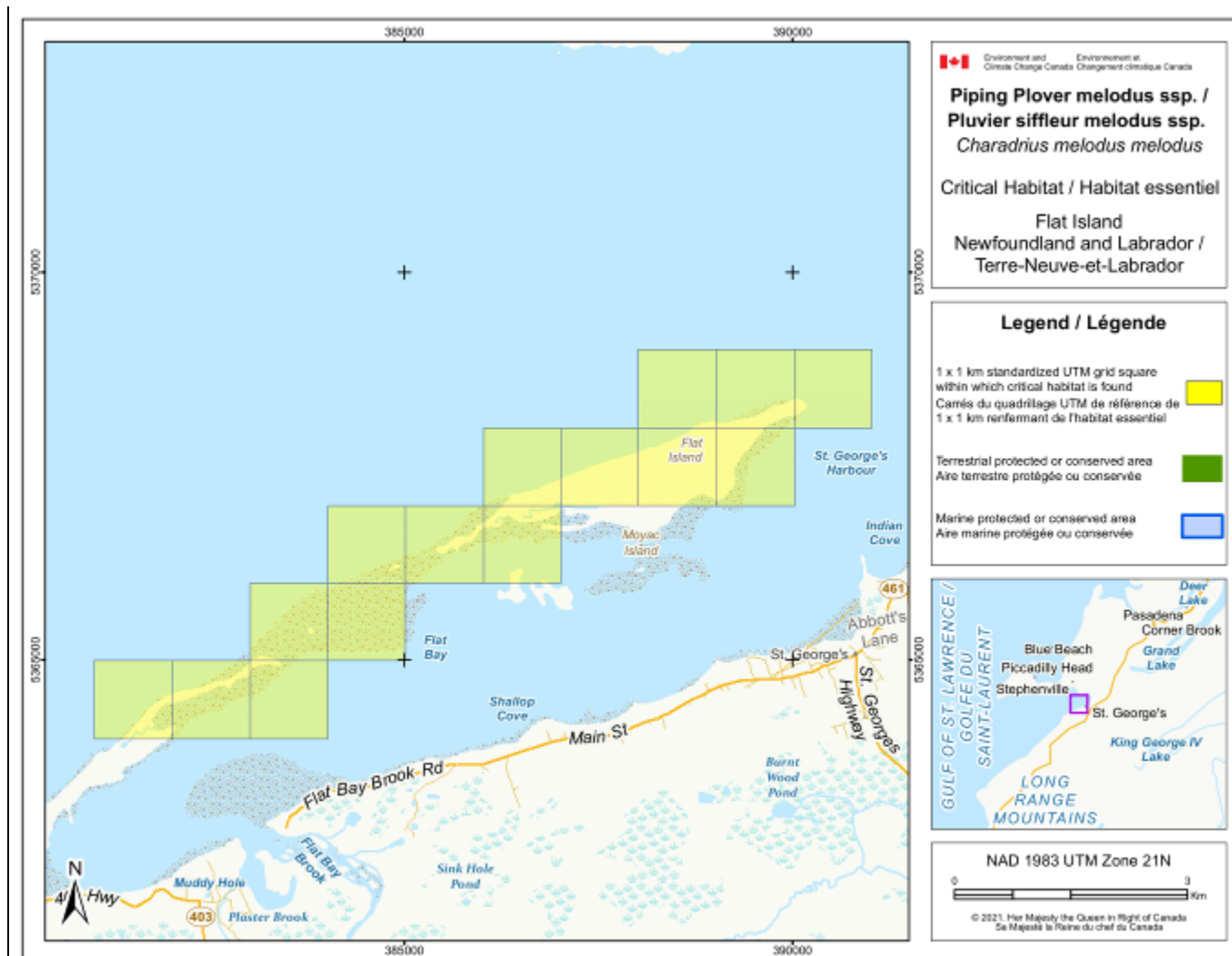
C-74. Grid squares containing critical habitat for Piping Plover in Newfoundland and Labrador. Critical Habitat for Piping Plover occurs within these 1 km x 1 km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



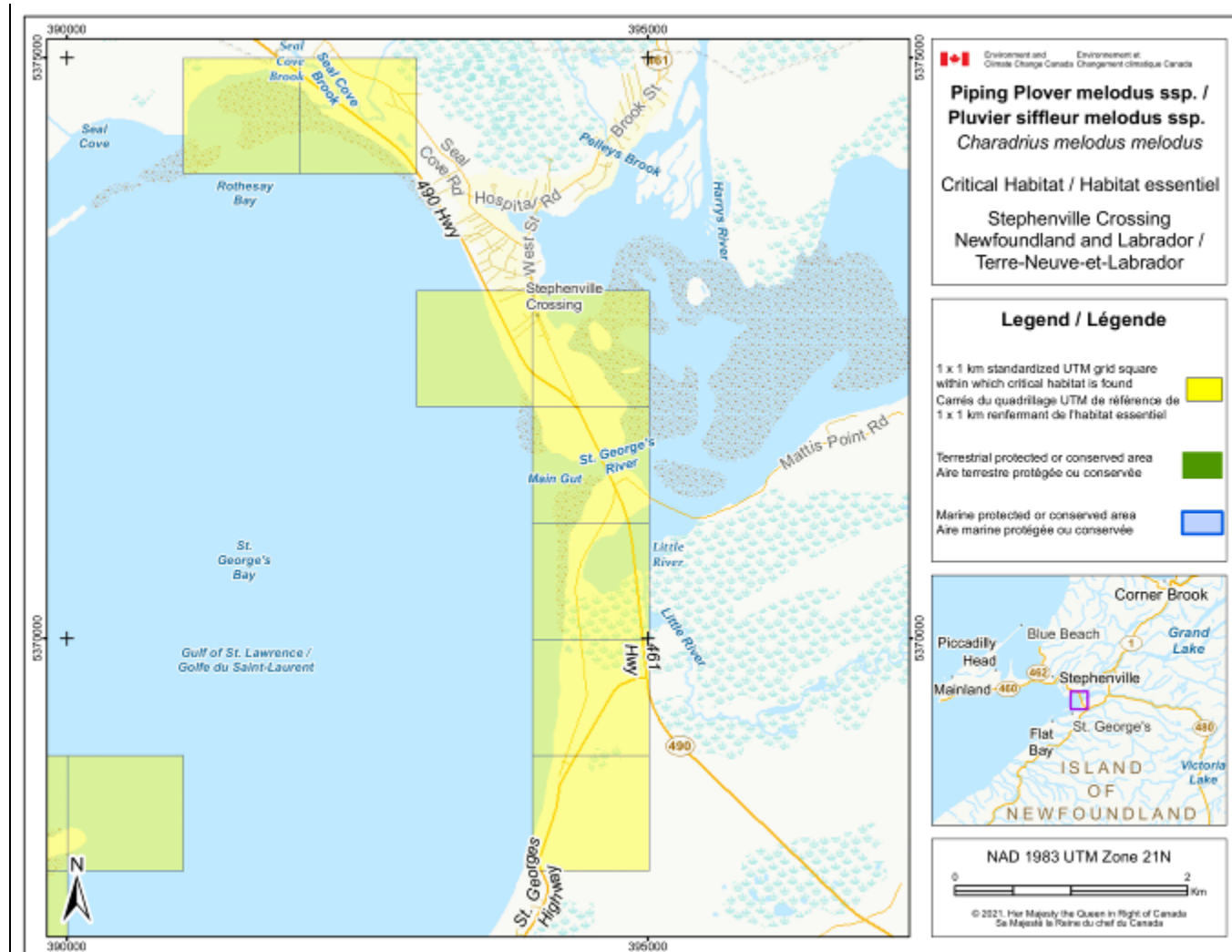
C-75. Grid squares containing critical habitat for Piping Plover in Port aux Basques, Newfoundland and Labrador. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



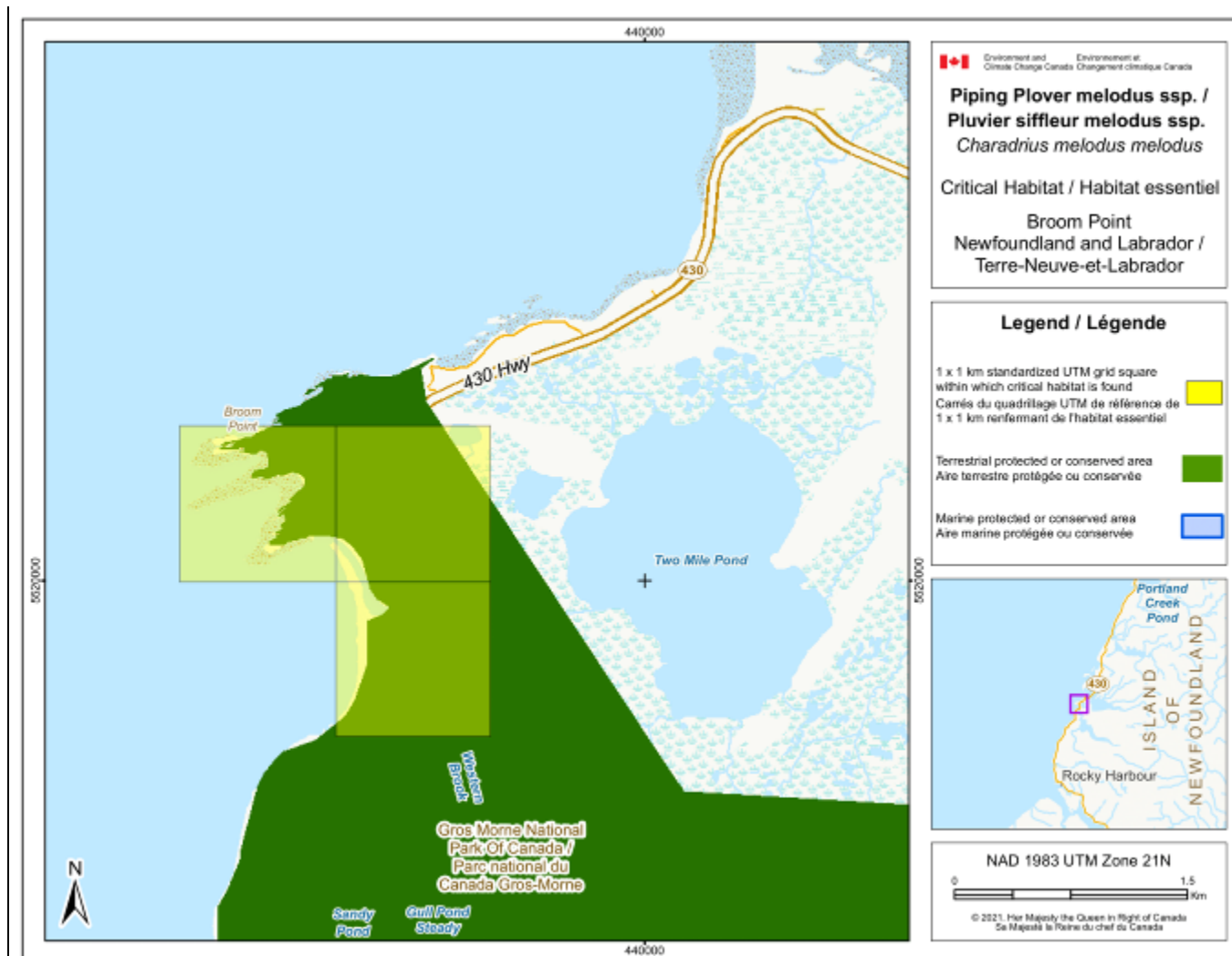
C-76. Grid squares containing critical habitat for Piping Plover in Shoal Point – Searston Bay, Newfoundland and Labrador. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



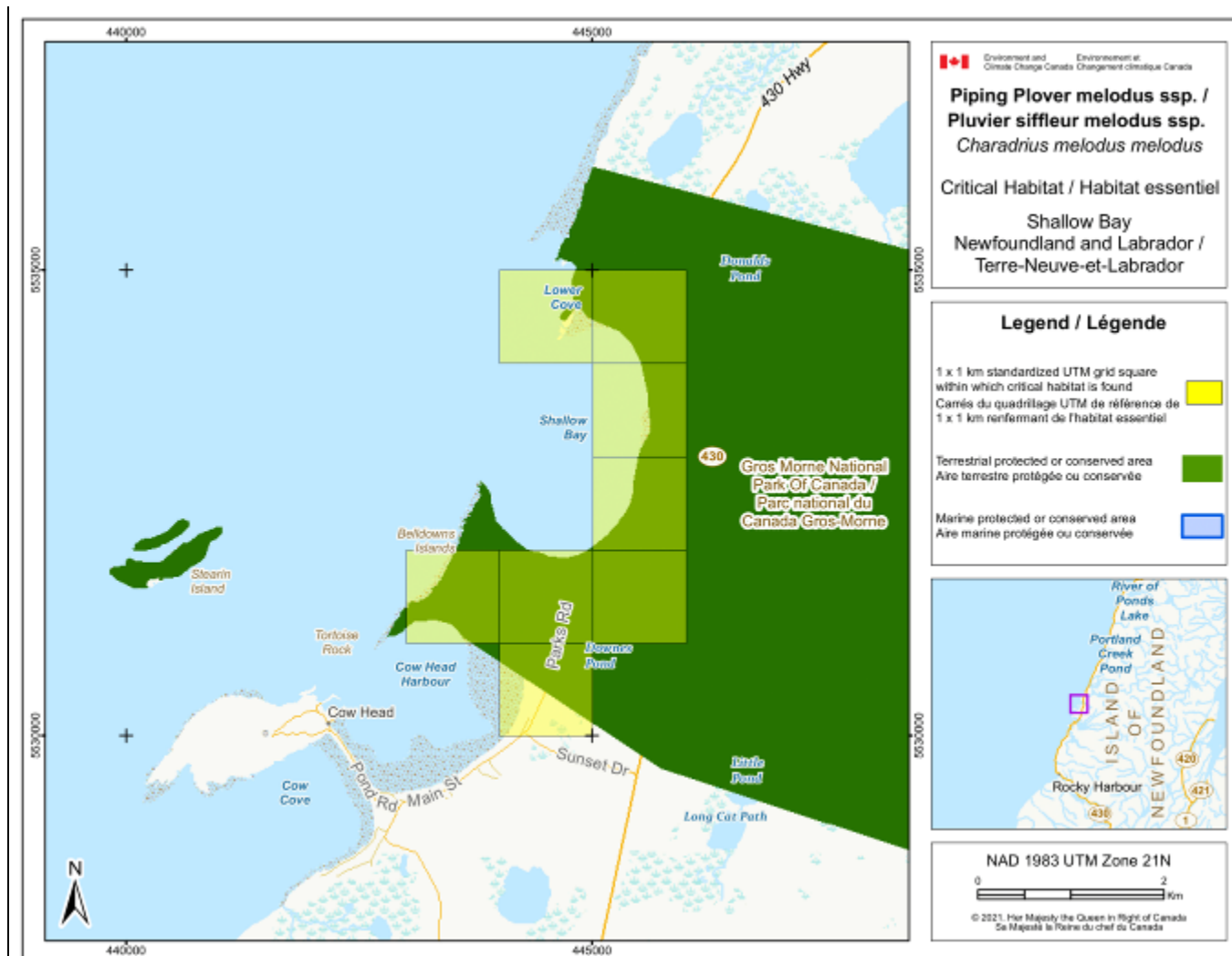
C-77. Grid squares containing critical habitat for Piping Plover in Flat Island, Newfoundland and Labrador. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



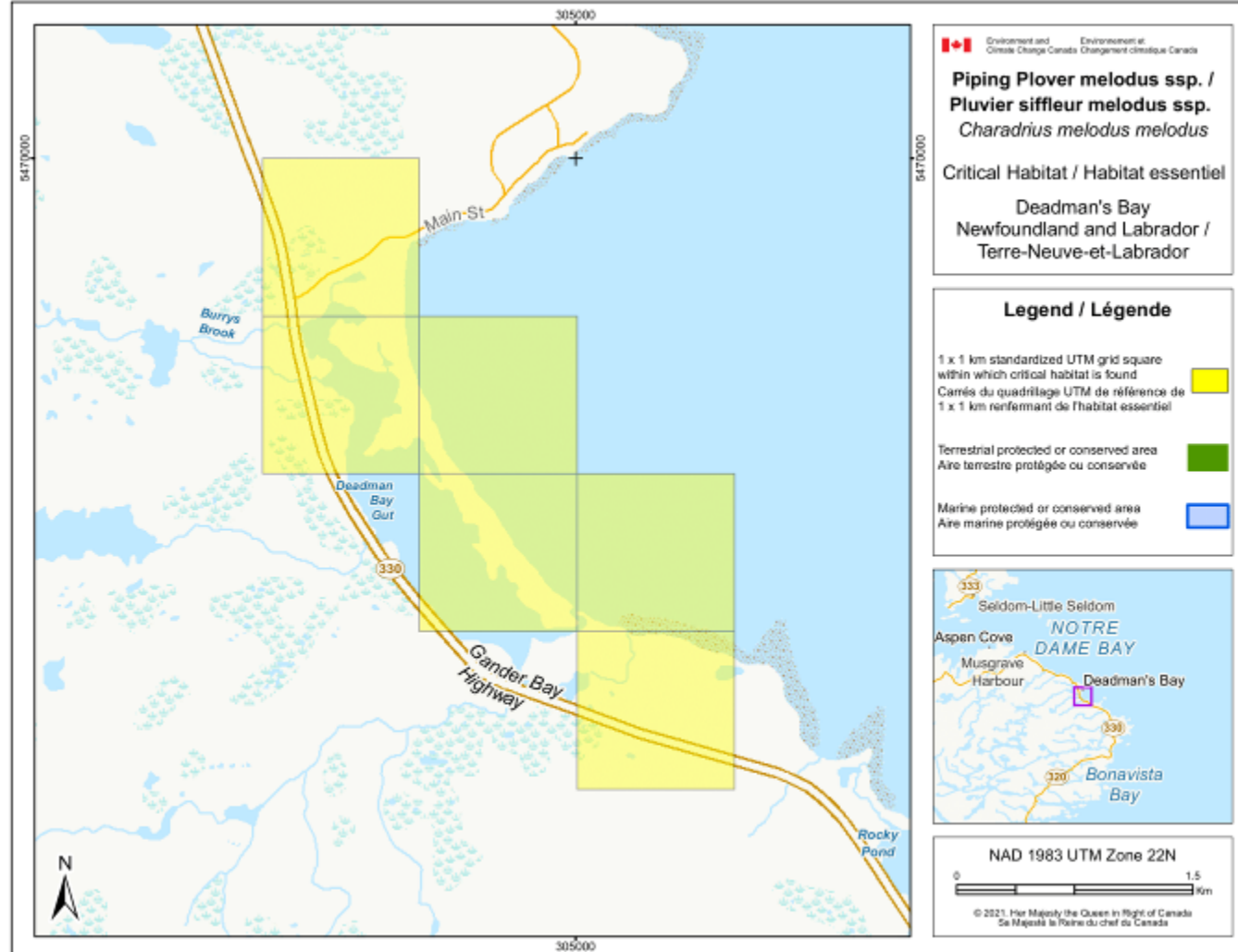
C-78. Grid squares containing critical habitat for Piping Plover in Stephenville Crossing, Newfoundland and Labrador. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



C-79. Grid squares containing critical habitat for Piping Plover in Broom Point, Newfoundland and Labrador. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



C-80. Grid squares containing critical habitat for Piping Plover in Shallow Bay, Newfoundland and Labrador. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.



C-81. Grid squares containing critical habitat for Piping Plover in Deadman's Bay, Newfoundland and Labrador. Critical Habitat for Piping Plover occurs within these 1km x 1km UTM grid squares (yellow shaded squares), where the criteria and methodology set out in section 7.1 of the recovery strategy are met. Areas outside of the shaded polygon do not contain critical habitat.

Appendix D: Summary of Critical Habitat Changes

Province	Site Name	2012 Critical Habitat	2017 Critical Habitat	Suitability
New Brunswick	Cap-Pelé		Yes	New site; meets occupancy and habitat criteria
New Brunswick	Dune de Maisonnnette	No	Yes	New site; habitat deemed not suitable in 2012, habitat now meets critical habitat criteria
New Brunswick	Petit Barachois	No	Yes	New site; habitat deemed not suitable in 2012, habitat now meets critical habitat criteria
New Brunswick	Preston		Yes	New site; meets occupancy and habitat criteria
Newfoundland and Labrador	Crow Head Beach	Yes	No	Site removed; no nesting pairs between 1991 and 2016. Did not and does not meet criteria
Newfoundland and Labrador	Deadman's Bay		Yes	New site; meets occupancy and habitat criteria
Newfoundland and Labrador	Little Barasway		Yes	New site; meets occupancy and habitat criteria
Newfoundland and Labrador	Stephenville Crossing – Black Bank		Yes	New site; meets occupancy and habitat criteria
Newfoundland and Labrador	Western Brook, GMNP		Yes	New site; meets occupancy and habitat criteria
Nova Scotia	Port Joli (Goose Haven)	Yes	No	Site removed; insufficient suitable habitat (2017)
Nova Scotia	Cow Bay		Yes	New site; meets occupancy and habitat criteria
Nova Scotia	Durham Lane Beach, Port Joli		Yes	New site; meets occupancy and habitat criteria
Nova Scotia	Green Bay		Yes	New site; meets occupancy and habitat criteria
Nova Scotia	Harbour Breeze, Port Joli		Yes	New site; meets occupancy and habitat criteria
Nova Scotia	Hirtles		Yes	New site; meets occupancy and habitat criteria
Nova Scotia	Inverness Beach		Yes	New site; meets occupancy and habitat criteria
Nova Scotia	Middle Harbour		Yes	New site; meets occupancy and habitat criteria
Nova Scotia	Ogdens Pond		Yes	New site; meets occupancy and habitat criteria
Nova Scotia	Roaring Bull Point	No	Yes	New site; insufficient suitable habitat in 2012, now deemed to meet critical habitat criteria
Nova Scotia	White Point Beach		Yes	New site; meets occupancy and habitat criteria
Prince Edward Island	Adams Pond, Darnley	Yes	No	Site removed; insufficient suitable habitat (2017)
Prince Edward Island	East Point	Yes	No	Site removed; insufficient suitable habitat (2017)

Recovery Strategy (Amended) and Action Plan for the Piping Plover *melodus* subspecies

Province	Site Name	2012 Critical Habitat	2017 Critical Habitat	Suitability
Prince Edward Island	Cable Head		Yes	New site; meets occupancy and habitat criteria
Prince Edward Island	Cabot Provincial Park	No	Yes	New site; insufficient suitable habitat in 2012, now deemed to meet critical habitat criteria
Prince Edward Island	Cross River		Yes	New site; meets occupancy and habitat criteria
Prince Edward Island	Indian Point Sand Hills		Yes	New site; meets occupancy and habitat criteria
Prince Edward Island	Naufrage	No	Yes	New site; insufficient suitable habitat in 2012, now deemed to meet critical habitat criteria
Prince Edward Island	North Lake		Yes	New site; meets occupancy and habitat criteria