PROPOSED

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Lindley's False Silverpuffs (*Uropappus lindleyi*) in Canada

Lindley's False Silverpuffs


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Canada

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

Cover illustration: Lindley's False Silverpuffs photograph by Matt Fairbarns

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PREFACE

The federal, provincial, and territorial government signatories under the *Accord for the Protection of Species at Risk* (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of recovery strategies for listed Extirpated, Endangered, and Threatened species and are required to report on progress within five years.

The Minister of the Environment and the Minister responsible for the Parks Canada Agency is the competent minister for the recovery of the Lindley's False Silverpuffs and has prepared this strategy, as per section 37 of SARA. It has been prepared in cooperation with the provincial government of British Columbia.

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

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

The recovery of Lindley's False Silverpuffs will be coordinated with the recovery of other species inhabiting Garry Oak woodlands (Parks Canada Agency 2006a).

RECOMMENDATION AND APPROVAL STATEMENT

The Parks Canada Agency led the development of this federal recovery strategy, working together with the other competent minister(s) for this species under the Species at Risk Act. The Chief Executive Officer, upon recommendation of the relevant Park Superintendent(s) and Field Unit Superintendent(s), hereby approves this document indicating that Species at Risk Act requirements related to recovery strategy development have been fulfilled in accordance with the Act.

Recommended by:

Helen Davies
Field Unit Superintendent, Coastal BC, Parks Canada Agency

Approved by:

Alan Latourelle
Chief Executive Officer, Parks Canada Agency

ACKNOWLEDGMENTS

Thank you to Matt Fairbarns for writing the draft recovery strategy. The Garry Oak Ecosystems Recovery Team (GOERT) is the recovery team for the Lindley's False Silverpuffs and was involved in the development of this recovery strategy. Further revisions were the result of comments and edits provided by a number of organizations including the Province of British Columbia, Department of National Defence, and Natural Resources Canada.

EXECUTIVE SUMMARY

The Canadian population of the Lindley's False Silverpuffs (*Uropappus lindleyi*) was assessed as Endangered in 2008 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and in February 2010, the species was listed as Endangered under Canada's *Species at Risk Act* (SARA).

Lindley's False Silverpuffs is a flowering plant approximately 10-70 cm tall with a simple stem growing from a slender taproot and terminating with a single flower head. Flower heads contain strap-shaped, yellow flowers that bear seeds on a tuft of five bright, silvery scales. This species' range extends from southwestern British Columbia to California and east to Texas and Utah; it occurs as a disjunct population in Idaho and central Washington. In Canada, Lindley's False Silverpuffs is known from six isolated populations, one site on southeastern Vancouver Island and five sites on the Gulf Islands. The Canadian population of Lindley's False Silverpuffs comprises <1% of the species' global range.

Key factors which limit the survival of Lindley's False Silverpuffs populations in Canada are its habitat specificity, limited dispersal abilities, weak competitive ability, predisposition to demographic failure, small area of physical occupancy, and small, highly fragmented populations that constrain genetic diversity. The Lindley's False Silverpuffs populations are threatened by land conversion caused by urban development, encroachment of native and alien plants, and grazing by vertebrates such as feral goats and deer.

In the short term, recovery activities for Lindley's False Silverpuffs will focus on the maintenance of populations and habitat and exploring the feasibility of establishing and/or augmenting populations to increase abundance & distribution. Broad strategies to be taken to address the threats to the survival and recovery of the Lindley's False Silverpuffs are presented in section 6 Broad Strategies and General Approaches to Meet Objectives.

Critical habitat for the recovery of Lindley's False Silverpuffs is identified in this recovery strategy. The best available information has been used to identify critical habitat; additional work needed to fully identify critical habitat in upcoming planning documents is identified in a schedule of studies.

Further recovery actions for Lindley's False Silverpuffs will be incorporated into one or more action plans by 2017.

RECOVERY FEASIBILITY SUMMARY

Recovery of this species is considered feasible based on the criteria outlined by the Government of Canada (2009).

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. All of the known populations produce flowering individuals (COSEWIC 2008; Fairbarns pers. obs. 2009).

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

Yes. While some extant populations face strong habitat limitations and may thus be unviable in the long term, there is sufficient habitat available to support most of the larger populations on their existing sites. Furthermore, in some areas (but not all) there may be additional areas of habitat that are suitable for restoration and recovery of this species. The current range of Lindley's False Silverpuffs includes many areas of sandstone cliffs, steep grassy slopes, and xeric, open deciduous or evergreen forests; it is thus likely that additional suitable habitat could be made available through active habitat stewardship or restoration, if needed.

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

Yes. With the participation of all responsible jurisdictions and those stewarding the land, the most significant threats to this species can be addressed and at least partially mitigated through recovery actions. There are no unavoidable threats to the species or its habitat that preclude recovery.

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

Yes. Recovery success will be tied primarily to threat reduction through habitat stewardship, in combination with long-term population monitoring and inventory. The feasibility of introducing/re-introducing populations at the northern edge of the range is still unknown; however, over the long term recovery techniques for population establishment and augmentation are likely to be developed.

TABLE OF CONTENTS

1. COSEWIC Species Assessment Information

Date of Assessment: April 2008

Common Name (population): Lindley's False Silverpuffs

Scientific Name: *Uropappus lindleyi*

COSEWIC Status: Endangered

Reason for Designation: An annual flowering plant of British Columbia restricted to only five extant locations in the Gulf Islands. The species is no longer known to occur on Vancouver Island. There are extremely small numbers of individuals known in Canada. The species is also at continued risk from habitat loss and degradation from such factors as home building and spread of invasive plants.

Canadian Occurrence: British Columbia

COSEWIC Status History: Designated Endangered in April 2008. Assessment based on a new status report.

2. Species Status Information

The Canadian population of Lindley's False Silverpuffs (*Uropappus lindleyi*) was assessed as Endangered in 2008 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and in February 2010, the population was listed as Endangered under Canada's *Species at Risk Act* (SARA). Conservation ranks for Lindley's False Silverpuffs in other jurisdictions where it occurs are provided in Table 1.

The Lindley's False Silverpuffs population in Canada comprises <1% of the species' global range.

Table 1. Conservation ranks for Lindley's False Silverpuffs. Sources: B.C. Conservation Data Centre 2011, NatureServe 2010.

Location	Rank1	Rank description
Global	G5	Secure
Canada	N1	Critically imperilled
British Columbia	S1	Critically imperilled
United States	NNR	Not ranked
Arizona	SNR	Not ranked
California	SNR	Not ranked
Idaho	SNR	Not ranked
Nevada	SNR	Not ranked
New Mexico	SNR	Not ranked
Oregon	SNR	Not ranked
Texas	SNR	Not ranked
Utah	S1	Critically imperilled
Washington	SNR	Not ranked

3. Species Information

3.1. Species Description

Lindley's False Silverpuffs, a member of the aster family, is approximately 10-70 cm tall and usually has a simple stem growing from a slender taproot. The long leaves at the base of the plant are linear and pointed at the tip. The stem leaves are usually linear and occur on the bottom half of the stems. The flowering stems emerge from the base or from the axils of the stem leaves. The solitary, terminal flowering heads have strap-shaped, yellow flowers. The seeds bear a tuft of five bright, silvery scales which make the species easy to spot when it is in fruit (Figure 1). Each scale ends in a short, hair-like bristle which arises from a distinct notch. A detailed description of the species is provided in the status report (COSEWIC 2008).

Figure 1. Different stages of Lindley's False Silverpuffs flowering stem. Flower (left), between flowering and fruit dispersal periods (center), dispersing seeds (right). Photos by Matt Fairbarns.

[1] NatureServe Conservation ranks are based on a one to five scale, ranging from critically imperilled (1) to demonstrably secure (5). Status is assessed and documented at three distinct geographic scales global (G), national (N), and state/province (S).

3.2. Population and Distribution

Lindley's False Silverpuffs occurs from southwestern British Columbia south to California and east to Texas and Utah; it occurs as disjunct populations in Idaho and central Washington (Figure 2). A historic occurrence is known in the San Juan Islands of northwestern Washington. In Canada, Lindley's False Silverpuffs is known only from southeastern Vancouver Island and the adjacent Gulf Islands.

In total, six Lindley's False Silverpuffs populations have been documented in Canada and all are assumed to be extant (Table 2; Figure 3). Populations have been confirmed extant at Nanoose Hill, Galiano Island, Saturna Beach, and Elliot Bluff; the Nanoose Hill population, reported as extirpated in the status report, has been rediscovered (Fairbarns pers. obs. 2009; McIntosh and Sadler 2011). Surveys at Oaks Bluff could not locate Lindley's False Silverpuffs individuals but confirmed the habitat still exists to support a population. Ruxton Island has not been surveyed recently for Lindley's False Silverpuffs so this population and its habitat could not be confirmed extant, but there is no evidence to presume it has been extirpated. Canadian Lindley's False Silverpuffs populations range from approximately 20 to 1,200 plants for a total Canadian population of approximately 1,900 to 3,100 individuals. Individual populations can cover less than 1 m^2 up to 1 ha.

Since this is an annual plant species it may be subject to high levels of annual variation in population size. Natural fluctuations in the number of individuals observed may hinder estimates of long term population trends. Results from field surveys conducted in 2009 indicate that both the abundance and extent of the Canadian population may be greatly diminished in some years (Fairbarns pers. obs. 2009). Populations may be underestimated because individuals are hard to detect except during two brief seasonal windows: first when the flowers are open and later when the fruits are dispersing (Figure 1).

There is little information on population trends apart from the fact that the Oaks Bluff population, observed as recently as 1996, was not found by detailed surveys in 2004 or 2009. While there is currently no evidence to indicate that a substantial range contraction has occurred on Vancouver Island or the Gulf Islands, it is quite possible that some populations have been unknowingly extirpated since the advent of urban and agricultural development. An historical contraction in range is plausible given that the species is restricted to habitats associated with Garry Oak ecosystems, over 90% of which have been destroyed since European contact (Lea 2006). Much of the remaining suitable habitat has been badly degraded by invasive alien plants; competition with invasive alien plants could have driven some populations to extinction.

Figure 2. Distribution of Lindley's False Silverpuffs in North America (from COSEWIC 2008). Grey regions indicate species native range.

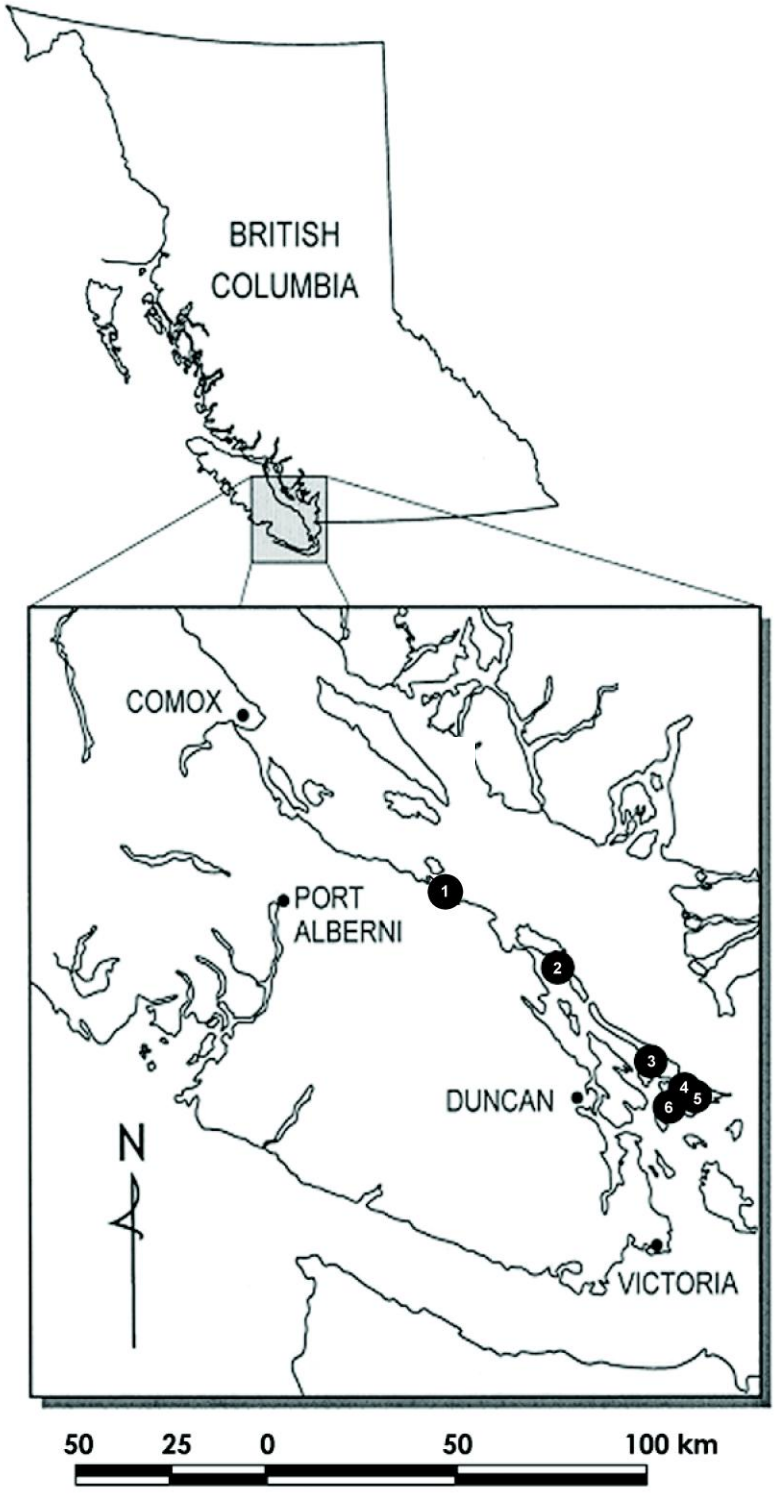

Figure 3. Range of Lindley's False Silverpuffs in Canada (from COSEWIC 2008).Closed circles indicate known populations and the numbers refer to the populations listed in Table 2.

Table 2. General location, population size[2] and land tenure for Lindley's False Silverpuffs sites in Canada with population number corresponding to numbers on map in Figure 3.

Population	General location	Population size (last observation)	Land Tenure
1	Nanoose Hill (Vancouver Island)	900 (2011)	Federal land
2	Ruxton Island	800 (2003)	Non-federal land
3	Galiano Island (two subpopulations: Matthews Point and Bluffs Park)	1,250 (2009)	Non-federal land
4	Saturna Beach (Saturna Island)	154 (2009)	Non-federal land
5	Elliot Bluff (Saturna Island)	22 (2003)	Non-federal land
6	Oaks Bluff (North Pender Island)	0-20 (1996)	Non-federal land

3.3. Needs of the Lindley's False Silverpuffs

Populations in British Columbia are found in, or near, Garry Oak and associated ecosystems in the dry Coastal Douglas-fir Biogeoclimatic Zone of southeastern Vancouver Island and adjacent Gulf Islands. This area is in a rain shadow belt created by the Olympic Mountains to the southwest and the Vancouver Island Ranges to the west, resulting in a relatively warm and dry Mediterranean-like climate. Lindley's False Silverpuffs prefer sandstone cliffs, steep grassy slopes, steep slopes with loose rocks, and xeric, open deciduous or evergreen forests (COSEWIC 2008; McIntosh and Sadler 2011).

On Vancouver Island, Lindley's False Silverpuffs is generally found in shallow and well drained soils along the coastline at elevations less than 75 m. The sites are open and sunny with few trees or shrubs (Figure 4).

Prior to European settlement, frequent fires were the norm in Garry Oak and associated ecosystems. The annual life cycle of Lindley's False Silverpuffs may have enabled it to persist and spread under a frequent fire regime. Fire exclusion in the last century has led to widespread encroachment of trees and invasive alien and native shrubs into many Garry Oak and associated ecosystems. This may have significantly reduced the amount of habitat available to Lindley's False Silverpuffs.

[2] Population sizes are the range in values reported for each site across all survey years including 2009 (Fairbarns pers. obs. 2009)

Figure 4. Habitat of Lindley's False Silverpuffs at Nanoose Hill. Photo by Matt Fairbarns.

A number of factors may limit the survival and recovery of Lindley's False Silverpuffs in Canada:

- Dependence on specific habitat types (e.g., dry, open habitats and possible dependence on vernally moist conditions), most of which have been lost or damaged by habitat conversion (the loss of suitable habitat, often as a result of urban development), shrub and forest encroachment, and/or a shift to ecosystem dominance by invasive alien plants.
- Apparently weak competitive ability, especially with respect to invasive alien plants.
- Potential demographic failure if there are extended dry periods in the late winter and early spring, before plants can reproduce and replenish the seed bank.
- Very small area of physical occupancy which leaves the species susceptible to chance events including those which operate at a small scale.
- Small, highly fragmented populations which may constrain the species' genetic diversity and limit the potential for local rescue effects.

4. Threats

4.1. Threat Assessment

Table 3. Threat Assessment Table

Threat	Level of Concern[1]	Extent	Occurrence	Frequency	Severity[2]	Causal Certainty[3]
Alien, invasive or introduced species						
Encroachment by invasive alien plants	High	Widespread	Current	Continuous	High	Medium
Habitat Loss or Degradation						
Habitat conversion	Medium	Localized	Anticipated	Unknown	High	Medium
Changes in Ecological Dynamics or Natural Processes						
Encroachment of native and alien woody vegetation	Medium	Widespread	Current	Continuous	Medium	Medium
Natural processes or activities						
Grazing by vertebrates	Low	Localized	Current	Recurrent	Low	Medium

[1] Level of Concern: signifies that managing the threat is of (high, medium or low) concern for the recovery of the species, consistent with the population and distribution objectives and relative to other threats in the table).
[2] Severity: reflects the population-level effect (High: very large population-level effect, Medium, Low, Unknown).
[3] Causal certainty: reflects the degree of evidence that is known for the threat (High: available evidence strongly links the threat to stresses on population viability; Medium: there is a correlation between the threat and population viability e.g., expert opinion; Low: the threat is assumed or plausible).

4.2. Description of Threats

4.2.1. Alien, invasive or introduced species

The most serious and immediate threat to Lindley's False Silverpuffs is posed by the encroachment of invasive alien plants. A wide variety of alien shrubs, grasses, and forbs have entered into the ecosystems favoured by Lindley's False Silverpuffs. Scotch Broom (*Cytisus scoparius*) is the most serious shrub competitor, being abundant in some areas where only small populations of Lindley's False Silverpuffs persist. Invasive alien grasses dominate the herb layer at many sites; the most threatening grasses include Barren Brome (*Bromus sterilis*), Ripgut Brome (*Bromus rigidus*), Cheatgrass (*Bromus tectorum*), Barren Fescue (*Vulpia bromoides*), Hedgehog Dogtail Grass (*Cynosurus echinatus*), and Crested Dogtail Grass (*Cynosurus cristatus*). The abundance of invasive alien forbs varies considerably among sites and in some places they are more abundant than invasive alien grasses. The most serious invasive alien forbs are Rose Campion (*Lychnis coronaria*), Hairy Cat's-ear (*Hypochaeris radicata*), Bur-chervil (*Anthriscus cacaulis*), Cleavers (*Galium aparine*), and Wall Lettuce (*Lactuca muralis*). Rose Campion is absent from many sites, but where it occurs it appears capable of dominating the vegetation. Invasive alien plants compete strongly for moisture and nutrients, which disadvantages small annuals such as Lindley's False Silverpuffs which possess much shallower and smaller root systems. As invasive alien plants are widespread, compete directly with Lindley's False Silverpuffs, and can potentially alter the habitat, this threat is of high concern.

4.2.2. Habitat loss and degradation

Habitat conversion appears to present a considerably lower threat to the habitat of extant populations of Lindley's False Silverpuffs and potential suitable habitat in Canada than initially stated in the status report (COSEWIC 2008). The reason for lowering this threat is that some populations (e.g., Elliot Bluff and parts of Saturna Beach) occur on steep slopes unsuited to development, while others (e.g., Nanoose Hill and Matthews Point/Bluffs Park) are in areas where no current or future human development is planned. Nevertheless, some sites (e.g., Oaks Bluff, Nanoose Hill, and Elliot Bluff) have seen considerable residential development which may have reduced or eliminated known populations; further, residential development on suitable ocean view properties continues. If habitat conversion does occur it can disrupt life cycle processes and cause physiological stress to the plant populations. This threat is a medium level of concern.

4.2.3. Changes in Ecological Dynamics or Natural Processes

First Nations in the area used fire to stimulate the growth of food species and possibly to improve forage for game species (e.g., elk and deer) (Turner 1999; Gedalof *et al.* 2006). The annual life cycle of Lindley's False Silverpuffs may have enabled it to persist and spread under a frequent fire regime. Fire effects change in a wide variety of habitat characteristics including the amount of organic matter, nutrient cycling, soil moisture, and soil biota (Barbour *et al.* 1999). In general, when fire is a common occurrence, it maintains the availability of resources which would otherwise be limiting for some plants, e.g., early successional species. For example, a lack of fire allows organic matter to build up and cover the ground, leaves nutrients trapped in organic matter and unavailable for use, and enables woody species to invade and suppress herbaceous species or alter hydrological regimes. Fire suppression in most areas has allowed native and alien woody species to become abundant, although invasive alien plants may continue to flourish even if natural fire regimes were restored. Encroaching woody species also tend to occur along the periphery of populations rather than within areas where Lindley's False Silverpuffs itself grows. Encroachment could occur in the future and existing patches of plants may have been historically larger, under lower encroachment levels then currently observed. In addition, it is difficult to estimate historic and/or future effects of encroachment because it is unknown how fast edge successional processes act or how effective natural biotic restrictions (e.g., drought cycles, soil qualities, etc.) are on vegetation development at the sites where Lindley's False Silverpuffs exists. Consequently, encroachment by native and alien woody species is considered a medium level of concern.

4.2.4. Natural processes or activities

Vertebrate herbivory appears to present a modest threat to existing populations. The flower heads are occasionally clipped off, likely by Columbian Black-tailed Deer (*Odocoileus hemionus columbianus*), which may also cause trampling damage. Feral goats (*Capra hircus*) also appear to feed on Lindley's False Silverpuffs at Saturna Beach. The consequences of vertebrate herbivory, particularly on seed production, are unknown; although frequent losses of small numbers of seeds are likely to have less demographic impact than larger more infrequent grazing events (Menges *et al.* 2004). The feral goats appear to exacerbate bank slumping, thereby

reducing the capacity of the Saturna Beach habitat to support the population. This threat is considered a low level of concern.

5. Population and Distribution Objectives

In Canada, Lindley's False Silverpuffs is generally found in shallow and well drained soils along coastlines in, or near, Garry Oak ecosystems. As such, the species has a naturally highly restricted range. Within this range, significant habitat loss since European settlement (Lea 2006) has likely resulted in population reductions. Encroachment of vegetation and development continue to exacerbate the situation (COSEWIC 2008). Given the permanent loss of most of the original habitat, it is not possible to recover the species to its natural area of occupancy or to its original probability of persistence. There are six recorded populations; four are confirmed to be extant, one did not contain individuals during the most recent survey but did still contain habitat, and one has not been surveyed recently.

In general, it is believed that multiple populations and thousands of individuals are likely required to attain a high probability of long-term persistence for a species (Reed 2005, Brook *et al.* 2006, and Traill *et al.* 2009). In an analysis of several published estimates of minimum viable population (MVP) sizes, Traill *et al.* (2007) found that the median population size required for plants to achieve a 99% probability of persistence over 40 generations was approximately 4,800 individuals (but see Flather *et al.* 2011, Garnett and Zander 2011, and Jamieson and Allendorf 2012 for critical evaluations of the analyses and the applicability of the results). Such information provides a useful guide, but developing specific quantitative and feasible objectives must consider more than just generalized population viability estimates, including the historical number of populations and individuals, the carrying capacity of extant (and potential) sites, the needs of other species at risk that share the same habitat, and whether it is possible to establish and augment populations of the species (Parks Canada Agency 2006, Flather *et al.* 2011, Jamieson and Allendorf 2012). Because not enough of this information is available for Lindley's False Silverpuffs, it is currently not possible to determine to what extent recovery is feasible and therefore it is not possible to establish quantitative long-term objectives. Recovery planning approaches (see Section 6) are designed to respond to knowledge gaps so that long-term, feasible, and quantitative recovery objectives regarding size and number of populations can be set in the future. At this time it is possible to set short-term objectives that focus on maintaining the four confirmed populations and the habitat at the Elliot Bluff and Oaks Bluff populations, while exploring the feasibility of restoring populations and establishing new populations to increase abundance and distribution:

Objective 1: Maintain the Nanoose Hill, Ruxton Island, Galiano Island, and Saturna Beach populations of Lindley's False Silverpuffs.

Objective 2: Maintain the habitat at the Elliot Bluff and Oaks Bluff sites while the feasibility of population restoration is assessed for Lindley's False Silverpuffs.

Objective 3: Establish and/or augment populations to increase abundance and distribution[3] if determined to be feasible and biologically appropriate for Lindley's False Silverpuffs.

[3] The intent is to increase the area of occupancy and maintain the extent of occurrence.

6. Broad Strategies and General Approaches to Meet Objectives

Broad strategies and approaches to meet the population and distribution objectives for Lindley's False Silverpuffs include the following:

- Habitat and species protection: protect existing populations and their habitat from destruction by developing mechanisms/instruments for protection;
- Stewardship: engage and involve landowners and land managers in recovery activities and decisions for Lindley's False Silverpuffs;
- Public education and outreach: increase public awareness of the species, its needs, and conservation value;
- Monitoring and inventory: conduct population and habitat inventories and monitor population trends, habitat attributes, and threats;
- Population restoration: develop and test population establishment/augmentation techniques to recovery the species;
- Research: address knowledge gaps pertaining to genetic diversity, threats, and habitat requirements.

6.1. Strategic Direction for Recovery

Table 4. Recovery Planning Table

Threat or Limitation	Priority	Broad Strategy to Recovery	General Description of Research and Management Approaches
Habitat conversion	High	Habitat and species protection	• Identify protection mechanisms/instruments for the species and its critical habitat.
Encroachment by invasive alien plants Encroachment by native and alien woody vegetation Grazing by vertebrates	High	Stewardship	• Prepare Best Management Practices for Lindley's False Silverpuffs to support landowners, and land managers in stewardship activities. • Engage landowners, and land managers in recovery decisions and activities. • Develop appropriate restoration techniques and site-specific management/restoration plans (including prescribed burn and invasive alien plant management) for Lindley's False Silverpuffs and their habitat. • Use information gained from demographic research to manage habitat so as to enable critical life stages (e.g., recruitment, growth, and survival) necessary for population growth.
	Medium	Public education & outreach	• Engage landowners with the development and delivery of public education and outreach concerning Lindley's False Silverpuffs and their management. • Increase public awareness of the existence and conservation value of Lindley's False Silverpuffs and associated species at risk.
	Medium	Research	• Investigate different treatments (e.g., mowing, burning, and herbicide application) to control invasive alien plants. • Identify the demographic criteria that would trigger immediate re-evaluation of recovery priorities and activities, and incorporate them into the management plans.
Knowledge gaps concerning population and habitat trends	High	Population monitoring	• Design and implement an inventory and monitoring program to track population and habitat trends for 10 years, with subsequent monitoring as required. • Monitor impacts of recovery activities on non-target species, communities, and ecological processes. • Report on population trends, area of occupancy, and habitat condition every 2 years.
Knowledge gaps on propagation techniques and reproductive mechanisms, and genetic diversity Limitations of demographic failure and small area of occupancy	Medium	Population restoration	• Identify and prioritize areas for inventory, conduct inventory of suitable habitat for both undetected populations and space for population introductions; rank unoccupied habitat for introduction suitability. • Determine total number of populations required to maintain a suitable chance of survival in Canada. • Determine suitable population targets/thresholds at each extant site. • Develop population establishment/augmentation plans (including monitoring of success and effects on non-target species). • Determine conditions necessary for germination, establishment, growth and reproduction.
	Low	Research	• Investigate pollination mechanism and limitations. • Assess and conserve genetic diversity of extant populations of Lindley's False Silverpuffs in Canada. • Investigate potential herbivory effects by insects or vertebrate grazers on the population.

6.2. Narrative to Support the Recovery Planning Table

Given the extreme rarity of Lindley's False Silverpuffs in Canada, and uncertainties regarding the potential for introducing the species into unoccupied areas, conservation of existing populations and their habitat is clearly a first priority of recovery. Diligence must be exercised in preventing extirpations due to preventable causes. A top priority of recovery will be to steward the land and ensure proper environmental conditions for Lindley's False Silverpuffs growth and establishment as this is the most straightforward and cost-effective way of ensuring the species persistence. Population restoration through augmentation will only be considered if population and distribution objectives cannot be met through stewardship.

Successful stewardship will involve the voluntary cooperation of private landowners and agencies to protect species at risk and the ecosystems they rely on. Recovery of the Lindley's False Silverpuffs will depend greatly on public involvement as most populations occur on private property or in community parks.

Regular population monitoring is needed to assess the ongoing viability of the species and its response to threats and management activities. Monitoring might consist of annual plant counts, records of density and area, and/or more intensive demographic studies (e.g., repeat measurements of marked individuals within permanent plots). If there is any intentional or unintentional manipulation of the area in which a population occurs, the effects of the manipulation will be monitored and recorded.

Design of the monitoring program is an important consideration, especially for rare annual plants which are likely to exhibit population fluctuations or rely on seed banks (Bush and Lancaster 2004). Data should be collected regularly over several years to account for population fluctuations. Further, data should be collected in years when plants are absent as well as when they are present to provide information on the species responses to environmental conditions. When seed banks are involved, they are an important part of the lifecycle and must be considered in estimates of population size—the presence of even one individual may indicate a viable seed bank is present (Bush and Lancaster 2004).

Population monitoring will also yield valuable information on background levels of population fluctuation, current rates of seedling establishment and mortality, levels of herbivory, and rates of recruitment and survival necessary to sustain a viable population. With this information, threats to populations can be better assessed on a site specific basis. In order to evaluate changes in populations over time, it is important that the chosen inventory and monitoring methods are appropriate for Lindley's False Silverpuffs and are sufficiently robust for application in different areas and different years by different people. They should be accurate enough to detect change (i.e., acceptable levels of error), consistently applied across the range of the species (for among site comparison), practical, and economically feasible and sustainable.

Further inventory will be needed to determine the status of some recorded sites and to locate suitable habitat for new populations. The Oaks Bluff site should be re-examined for up to five successive years to test whether there are Lindley's False Silverpuffs seeds present in the soil that will germinate under conditions different from those prevailing during the unsuccessful

surveys in 2004 and 2009. If such surveys fail to record the presence of Lindley's False Silverpuffs at the site then a replacement population should be established. Since the location of the former population is known to be fundamentally suitable for supporting the species, elimination or mitigation of evident threats such as the presence of invasive woody species may restore its capability to sustain Lindley's False Silverpuffs. Accordingly, it should be the first choice of location for establishment of the replacement population.

Research activities should focus on achieving measurable and sustained control of invasive alien plants. More research is also required to determine the effects of vegetation management. Additional beneficial research includes gene conservation and studies that address other aspects of the species' autoecology.

7. Critical Habitat

Areas of critical habitat for Lindley's False Silverpuffs are identified in this recovery strategy. Critical habitat is defined in the *Species at Risk Act* as "...habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species" (Subsection 2(1)). Habitat for a terrestrial wildlife species is defined in the *Species at Risk Act* as "…the area or type of site where an individual or wildlife species naturally occurs or depends on directly or indirectly in order to carry out its life processes or formerly occurred and has the potential to be reintroduced" (Subsection 2(1)).

7.1. Identification of the Species' Critical Habitat

Critical habitat for Lindley's False Silverpuffs is identified in this recovery strategy to the extent possible based on best available information. It is recognized that the critical habitat identified below is insufficient to achieve the population and distribution objectives. While habitat can be fully identified for the five extant populations, additional information is required to confirm the existence and location of the Ruxton Island population and identify critical habitat for it. The schedule of studies section (Section 7.2) outlines activities required to identify additional critical habitat necessary to support the population and distribution objectives.

The habitat of Lindley's False Silverpuffs in Canada occurs in southeastern Vancouver Island and the Gulf Islands in Garry Oak and associated ecosystems in the dry Coastal Douglas-fir (CDF) zone (Nuszdorfer *et al.* 1991). Habitat characteristics range from dry, open deciduous or evergreen forests to sandstone cliffs and steep grassy slopes within the CDF zone (COSEWIC 2008). Field investigations at Nanoose Hill, Saturna Beach, Elliot Bluff, Galiano Island (Matthew's Point and Bluffs Park), and Oaks Bluff helped to further characterize habitat of Lindley's False Silverpuffs (Fairbarns unpublished data 2009).

The nature of critical habitat for Lindley's False Silverpuffs varies considerably among those Canadian sites which have been described in detail (Figure 5 through Figure 10). Furthermore, there is no reason to believe that the existing Canadian populations occupy the full breadth of habitat conditions suited to the species since many stochastic, non-habitat factors likely underlie the species' current distribution. As well, most of the larger populations occupy a diversity of microhabitats and the site descriptions derived from field visits cannot be expected to reflect the

full spectrum of habitat. In addition, this is an annual species and all plant patches may not be evident each year so the potential seed bank must also be considered when defining critical habitat. Consequently, it is difficult to provide a description of critical habitat attributes for Lindley's False Silverpuffs that is both inclusive and specific.

Lindley's False Silverpuffs likely requires high light to germinate and may depend on canopy openings to provide certain habitat attributes. Although surveys at Nanoose Hill have found Lindley's False Silverpuffs growing under Garry Oak (*Quercus garryana*) canopies (McIntosh and Sadler 2011), it is uncertain if these shaded areas are optimum growing conditions for Lindley's False Silverpuffs. Consequently, until additional studies further refine critical habitat attributes, canopy opening requirements for Lindley's False Silverpuffs will follow light requirements for similar Garry Oak Ecosystem plant species. These openings must be large enough that Lindley's False Silverpuffs plants are not sheltered by surrounding vegetation. The minimum size of the openings can be determined based on the height of vegetation likely to grow in the area and cast shade on the Lindley's False Silverpuffs (Spittlehouse *et al.* 2004). An additional consideration with regards to canopy opening is that when tall vegetation falls it will cover an area of ground for a distance equal to its height.

Critical habitat required for the survival of Lindley's False Silverpuffs populations consists of the minimum canopy opening supporting each recorded Lindley's False Silverpuffs patch[4]. The default minimum canopy opening required for light to reach the plants is the area bounded by a 20 m distance surrounding each Lindley's False Silverpuffs patch (20 m is generally the maximum height attained by trees in the soils surrounding Lindley's False Silverpuffs). It is important to note that while a patch may not be visible all year, or every year, seeds will remain in the seed bank and the recorded location of patches and their associated critical habitat will continue to be critical habitat to protect the seed bank, even if no plants are observed.

All habitat used at any time by each patch of plants in each extant population is required to achieve the population and distribution objectives and is critical habitat; however, due to expected population fluctuations and difficulty in detecting the species, this habitat cannot be completely identified based on data from any single year: a long term data set and additional surveys are required. Recent data (Fairbarns unpublished data 2009) can be used to identify a minimum baseline of critical habitat required by Lindley's False Silverpuffs populations; however, it is expected that this dataset does not capture all critical habitat required by Lindley's False Silverpuffs. Fairbarns (unpublished data 2009) has been used to guide the location of boundaries within which critical habitat is found. It is expected that over time, continued monitoring which documents annual fluctuations in population extent and habitat use along with previously unknown patches will provide data which more confidently characterizes the total habitat needed by this species.

[4] Patch is a term used to refer to a group of several plants in close proximity or a single isolated individual plant. A specific mapping scale and minimum separation distance have not been used to quantitatively define a patch; the identification of patches is based on survey work performed by a biologist familiar with the species. Lacking any detailed information on seed bank extent, the seed bank is assumed to be included within each patch: the only information pertaining to the spatial extent of the Lindley's False Silverpuffs seed bank is derived from the physical characteristics of the seeds, and dispersal distance is probably very limited (COSEWIC 2008).

Within the geographical boundaries identified in Figure 5 (Nanoose Hill), Figure 6 (Mathews Point), Figure 7 (Bluffs Park), Figure 8 (Saturna Beach), Figure 9 (Elliot Bluff), and Figure 10 (Oaks Bluff), critical habitat for the survival of Lindley's False Silverpuffs is the minimum canopy opening supporting each recorded Lindley's False Silverpuffs patch. To date, the location of known location patches has been recorded by Fairbarns (unpublished data 2009). The Oaks Bluff population was not located during field investigations in 2005 or 2009 so the exact location of critical habitat could not be verified. However, there is little reason to conclude that the Oaks Bluff population has been lost because the locations were not described in detail in the 1996 reports, the area consists of extremely steep slopes which are difficult to traverse safely, and the species is only briefly detected with ease. The area within which critical habitat is likely to be found can be identified based on reported locations (Figure 10). This area includes apparently suitable habitat near and between the last two documented sites, and from the high tide line to the top of the steep slope.

Spatial information for the Ruxton Island population is imprecise (B.C. Conservation Data Centre 2011) and neither the presence of Lindley's False Silverpuffs nor suitable habitat for Lindley's False Silverpuffs has been confirmed in over five years. Surveys are required to determine the location of Lindley's False Silverpuffs and/or suitable habitat with better than 100 m accuracy. Therefore, critical habitat is not identified for this location pending further studies.

The following critical habitat attributes for Lindley's False Silverpuffs cover the range of attributes found at studied sites, may not reflect attributes at new or unstudied sites, and may not exclude some habitat types that are unsuited to the species:

- sunny areas with sparse vegetation,
- south to southwest aspects,
- less than 75 m in elevation, and
- dry, well drained, sandy or loamy soil, with moderate or less nutrient availability.

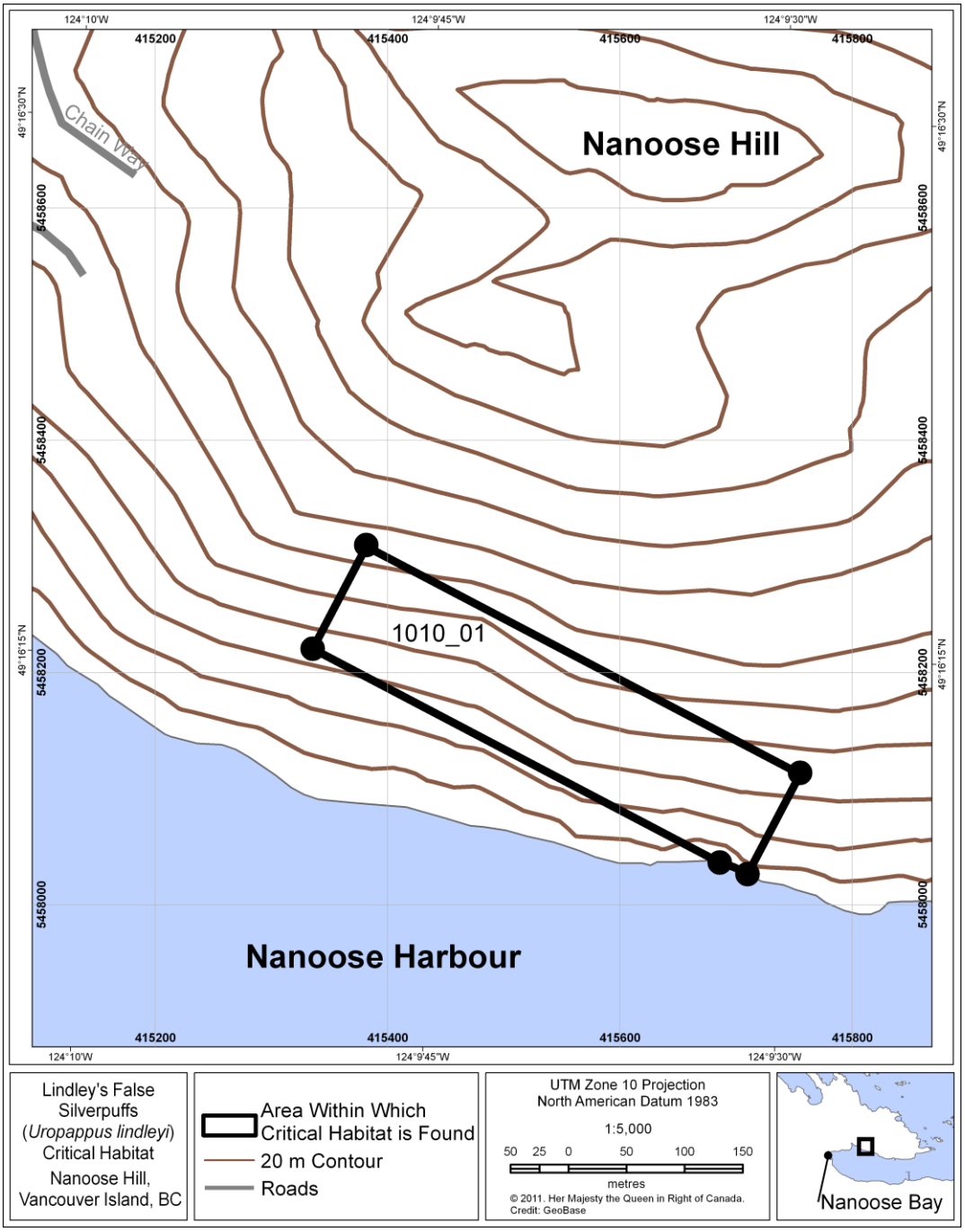

Figure 5. Area (~4.2 ha) within which critical habitat for Lindley's False Silverpuffs found on federal lands. The known critical habitat within this area is ~0.73 ha. Critical habitat parcel 1010_01 commences at 415382, 5458309; thence 117.7° in a straight line to 415755, 5458112; thence 207.7° in a straight line to a point on the high tide line (approximately 415710, 5458026); thence northwest along the high tide line to point 415686, 5458036; thence 297.7° in a straight line to point 415335, 5458220; thence 27.7° in a straight line to the commencement point (UTM Zone 10, NAD 1983, North Azimuth).

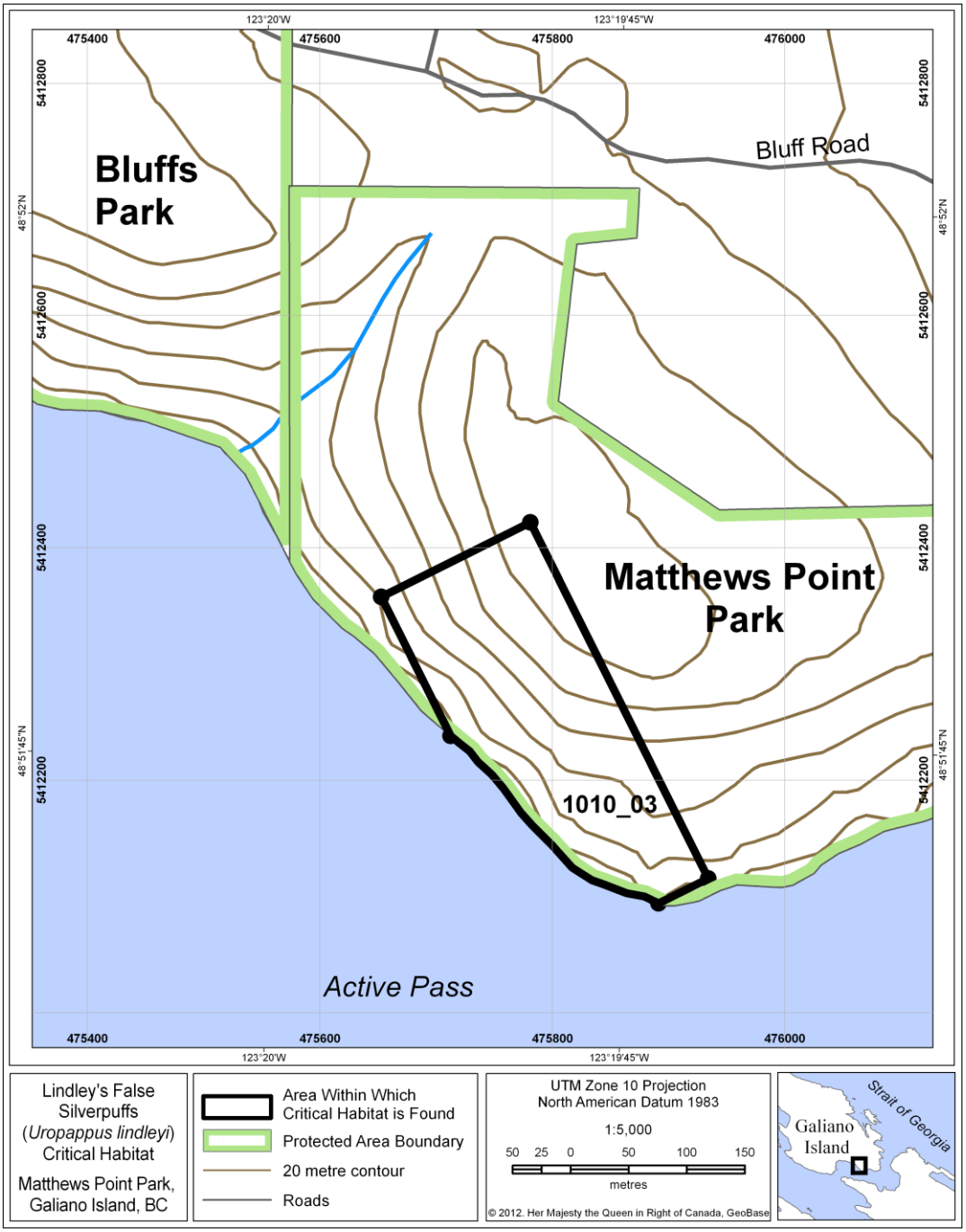

Figure 6. Area (~4.2 ha) within which critical habitat for Lindley's False Silverpuffs found at Matthew's Point on Galiano Island and located on non-federal land. The known critical habitat within this area is ~3.6 ha. The critical habitat parcel 1010_03 commences at point 475653, 5412358; thence 63.5° in a straight line to point 475781, 5412422; thence 153.5° in a straight line to point 475934, 5412116; thence 243° in a straight line to the high tide line (approximately 475902, 5412092); thence northwest along the high tide line to point 475713, 5412238; thence 333.5° in a straight line to the commencement point (UTM Zone 10, NAD 1983, North Azimuth).

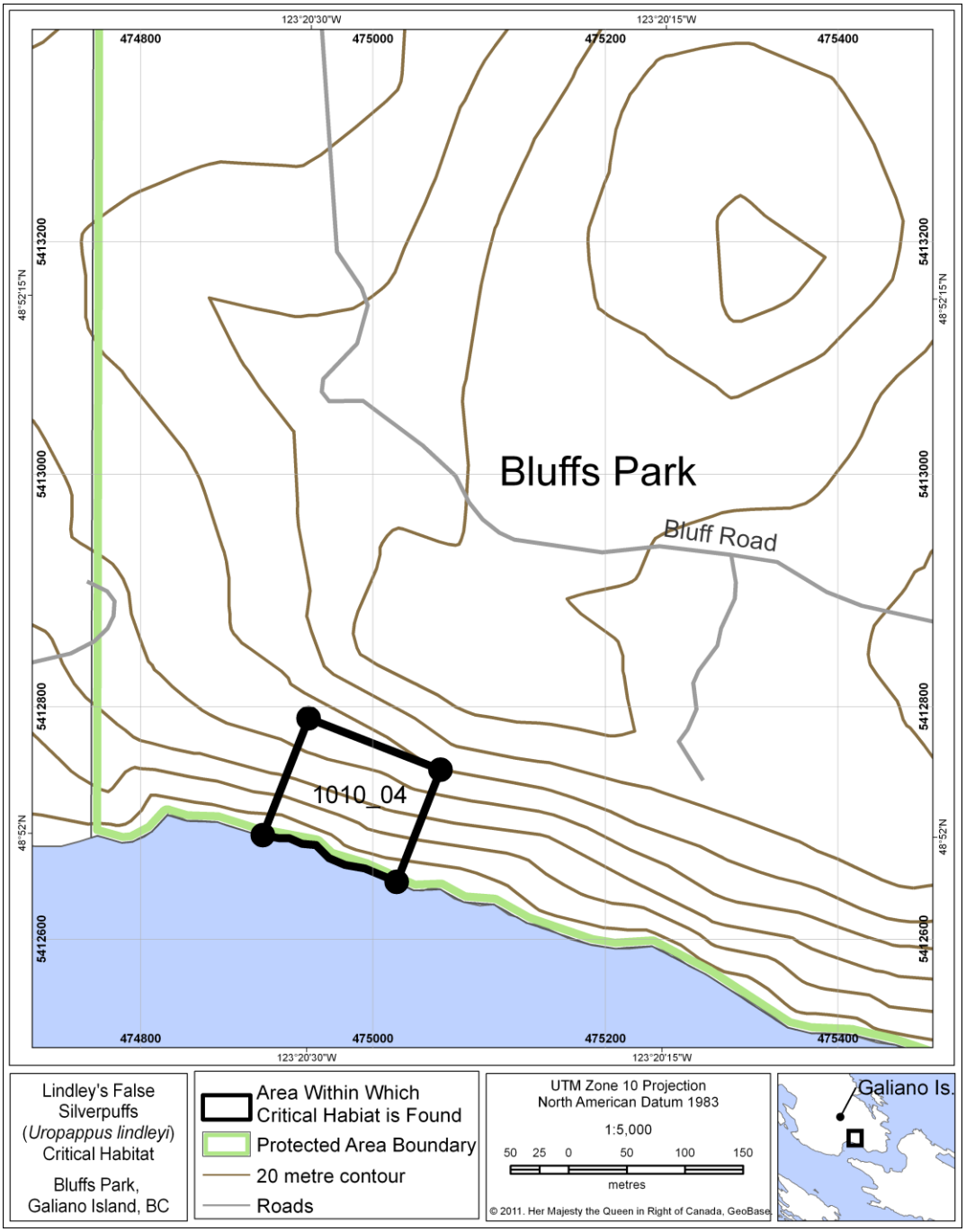

Figure 7. Area (~1.26 ha) within which critical habitat for Lindley's False Silverpuffs is found at Bluffs Park, Galiano Island (non-federal). The known critical habitat within this area is ~0.55 ha. Critical habitat parcel 1010_04 commences at point 474945, 5412790; thence 111.3° in a straight line to point 475058, 5412746; thence 201.3° in a straight line to the high tide line (approximately 475020, 5412649); thence northwest along the high tide line to (approximately 474905, 5412689); thence 21.3° to the commencement point (UTM Zone 10, NAD 1983, North Azimuth).

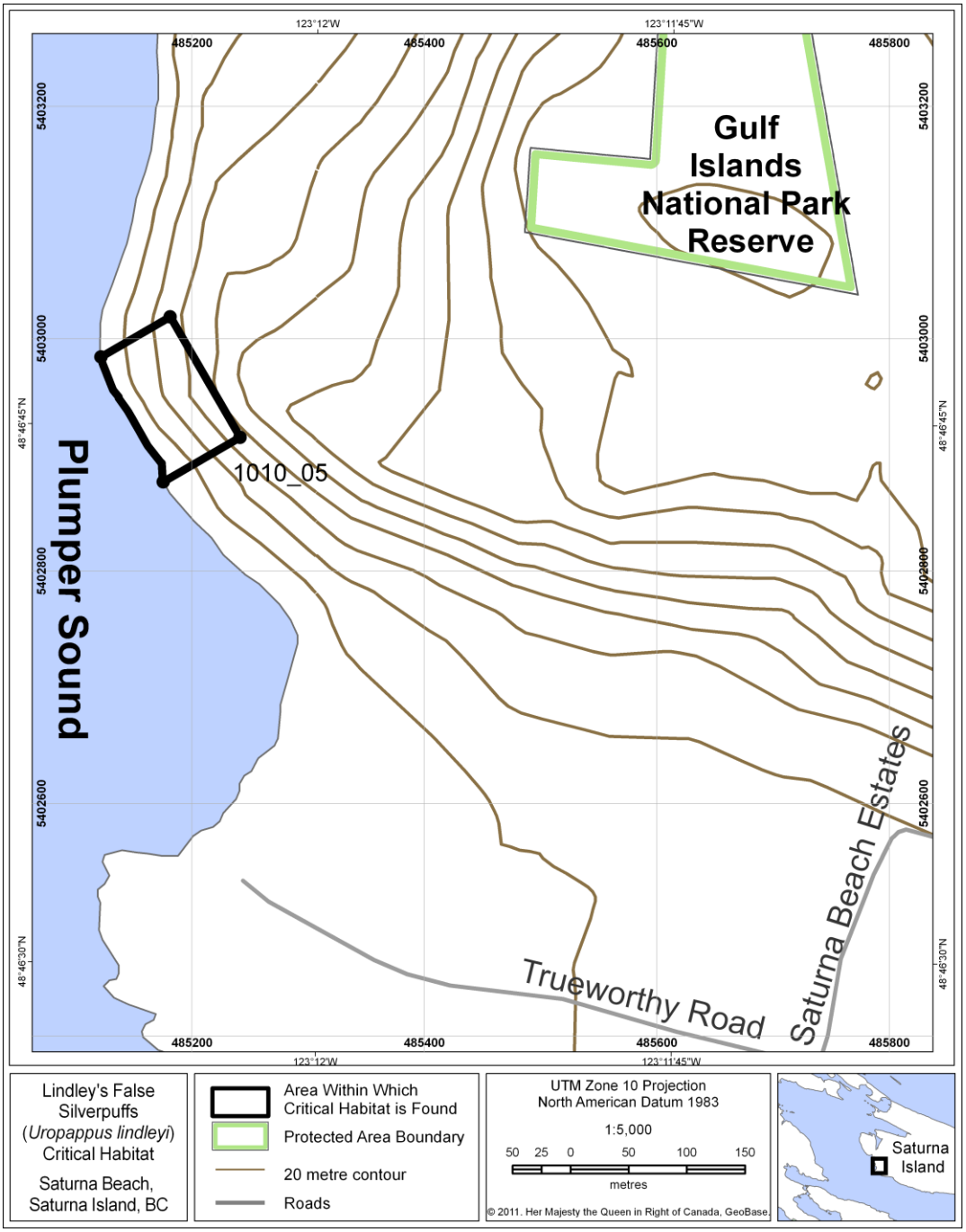

Figure 8. Area (~0.87 ha) within which critical habitat for Lindley's False Silverpuffs found at Saturna Beach on Saturna Island and located on non-federal land. The known critical habitat within this area is ~0.73 ha. The critical habitat parcel 1010_05 commences at 485180, 5402991; thence 149.8° in a straight line to 485242, 5402915; thence 240.7° in a straight line to the high tide line (approximately 485175, 5402878); thence northwest along the high tide line to point approximately 485122, 5402984; thence 59.8° in a straight line to the commencement point (UTM Zone 10, NAD 1983, North Azimuth).

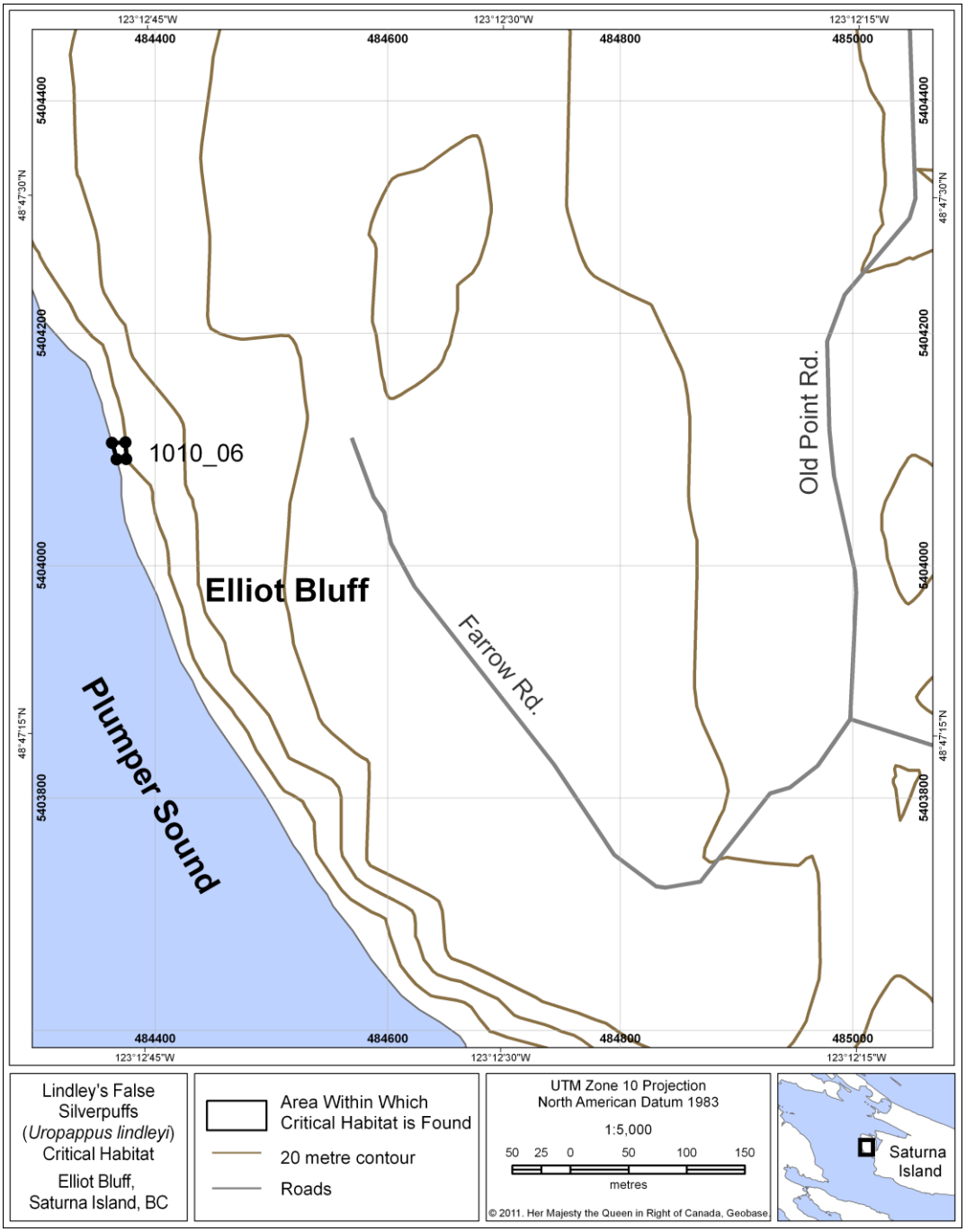

Figure 9. Area (~0.014 ha) within which critical habitat for Lindley's False Silverpuffs is found at Elliot Bluff on Saturna Island and located on non-federal land. The known critical habitat within this area is ~0.01 ha. The critical habitat parcel 1010_06 commences at point 484375, 5404106; thence 177.8° in a straight line to point 484375, 5404092; thence 267.8° in a straight line to the high tide line (484367, 5404091); thence north along the high tide line to approximately 484363, 5404106; thence 87.8° in a straight line to the commencement point (UTM Zone 10, NAD 1983, North Azimuth).

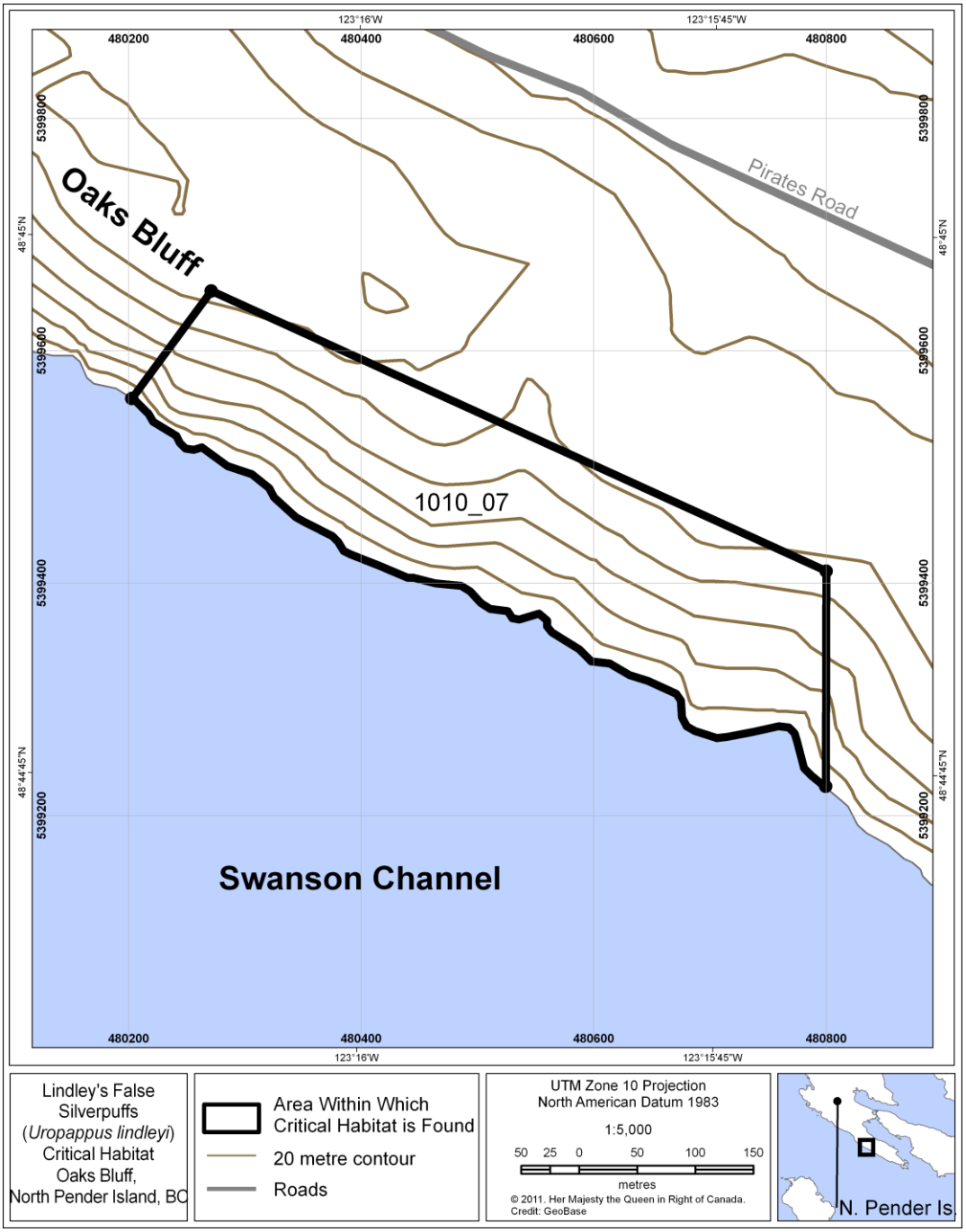

Figure 10. Area (~9.2 ha) within which critical habitat for Lindley's False Silverpuffs found at Oaks Bluff on North Pender Island and is located on non-federal land. No areas of critical habitat within this area have been mapped to date. The critical habitat parcel 1010_07 commences at 480271, 5399652; thence 114.5° in a straight line to 480800, 5399411; thence 180° in a straight line to the high tide line (approximately 480800, 5399225); thence northwest along the high tide line to approximately 480203, 5399559; thence 36.5° in a straight line to the commencement point (UTM Zone 10, NAD 1983, North Azimuth).

7.2. Schedule of Studies to Identify Critical Habitat

Table 5. Schedule of Studies

Description of Activity	Rationale	Timeline
Map and describe the known population on Ruxton Island.	Identification of core critical habitat.	2014
Multi-year surveys to examine suitable habitat in the vicinity (one km radius) of all known populations.	Rediscovery of one subpopulation at Matthews Point (Galiano Island) which was not found in the 2009 surveys. Rediscovery of the population on Oaks Bluff (North Pender Island) which was not found in the 2009 surveys. Identification of full extent of critical habitat for known subpopulations. Identification of critical habitat for unreported subpopulations. Identification of critical habitat suitable for increasing the size of existing populations.	2017
Test the suitability of sites for replacement populations.	Attempt to establish, and maintain Lindley' False Silverpuffs individuals in an experimental manner. If suitability tests are successful, test the potential for establishing new self sustaining populations through introduction of seeds or seedlings into suitable habitats. Undertake analyses to determine the amount and configuration of habitat needed to achieve the recovery objectives.	2017 2018 onwards Dependent upon previous steps

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

Examples of activities likely to destroy critical habitat are provided below (Table 6). Destruction of critical habitat will result if any part of the critical habitat is degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from single or multiple activities at one point in time or from the cumulative effects of one or more activities over time.

Most of the populations occur either in sites which are too isolated or rugged to allow for human activities (e.g., sea cliffs along Elliot Bluff on Saturna Island, and steep slopes of Oaks Bluff on North Pender Island) or where there are policies in place which will prevent activities which might destroy critical habitat (e.g., federal lands at Nanoose Hill, conservation lands at Matthews Point and Bluffs Park on Galiano Island).

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

Activity	Effect of activity on critical habitat	Most likely sites
Direct land conversion for human development	This activity can cause direct land conversion thereby altering biophysical features (e.g., moisture regimes, soil composition) thereby making the habitat unsuitable to for Lindley's False Silverpuffs to grow. Building of nearby structures can directly alter moisture regimes by impounding drainage, or reducing water flow to the plants through ditching or diversion of subsurface water by built structures. Shading caused by buildings or adjacent structures can alter light availability making the habitat unsuitable to plant growth. Introduction of invasive alien plants (e.g., intentional plantings or accidental introduction such as facilitated by unclean machinery) can encroach and monopolize space, alter light and moisture regimes such that they are unsuitable for Lindley's False Silverpuffs plants.	Saturna Beach Ruxton Island

8. Measuring Progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. Progress towards recovering Lindley's False Silverpuffs in Canada will be assessed using the following measures for each of the population and distribution objectives:

Objective 1: Maintain the Nanoose Hill, Ruxton Island, Galiano Island, and Saturna Beach populations of Lindley's False Silverpuffs.

- By 2017 best management practices are developed and implemented at two or more sites.
- The populations remain extant.
- By 2022, all four populations show a stable or increasing trend in population size5.

Objective 2: Maintain the habitat at the Elliot Bluff and Oaks Bluff sites while the feasibility of population restoration is assessed for Lindley's False Silverpuffs.

- By 2017 best management practices are developed and implemented.
- Habitat suitable for Lindley's False Silverpuffs remains extant at Elliot Bluff and Oaks Bluff.

Objective 3: Establish and/or augment populations to increase abundance and distribution if determined to be feasible and biologically appropriate for Lindley's False Silverpuffs.

- By 2017, additional sites have been identified, for establishment or restoration of Lindley's False Silverpuffs population(s).
- By 2022, one or more (re)introduction or augmentationn experiments are underway at suitable site(s).

[5] Note that populations are expected to fluctuate and require long term datasets to estimate (Bush and Lancaster 2004).

9. Statement on Action Plans

One or more action plans will be completed by 2017.

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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*. 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.

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

Lindley's False Silverpuffs overlaps with a suite of rare and at risk plants and invertebrates found in Garry Oak and associated ecosystems (GOERT 2002) (Table 7). Most recovery activities proposed for Lindley's False Silverpuffs (e.g., site protection, and threat mitigation) can be expected to have a net positive effect on the habitat of these other non-target species and communities. Nevertheless, it is possible that specific management actions carried out during the course of Lindley's False Silverpuffs recovery (e.g., weed removal, shrub clearing, population augmentation, and species translocations) could have unforeseen collateral impacts on co-occurring non-target species. While probably slight, the chances of negative impacts accruing due to recovery activities must be duly considered. One method of mitigating such negative effects is to monitor the results of Lindley's False Silverpuffs management. In keeping with the principles of adaptive management, an important component of recovery action planning will be anticipating and monitoring potential collateral impacts (both positive and negative) on non-target species, communities, and ecological processes.

Table 7. Rare species known to occur with Lindley's False Silverpuffs and their provincial and federal status. Sources: B.C. Conservation Data Centre 2011, NatureServe 2010.

Common name	Scientific name	British Columbia provincial rank	COSEWIC designation	SARA status
Erect Pygmyweed	*Crassula connata* var. *connata*	S2 Red	Not assessed	Not assessed
California Hedge-parsley	*Yabea microcarpa*	S1S2 Red	Not assessed	Not assessed
Slender Popcornflower	*Plagiobothrys tenellus*	S1 Red	Threatened	Threatened
Yellow Montane Violet	*Viola praemorsa* ssp. *praemorsa*	S2 Red	Endangered	Endangered
Geyer's Onion	*Allium geyeri*	S2S3 Blue	Not assessed	Not assessed
Nuttall's Quillwort	*Isoetes nuttallii*	S3 Blue	Not assessed	Not assessed
Slimleaf Onion	*Allium amplectens*	S3 Blue	Not assessed	Not assessed
White Meconella	*Meconella oregana*	S1 Red	Endangered	Endangered
Rigid Apple Moss	*Bartramia stricta*	S2 Red	Endangered	Endangered

Potentially negative effects can be mitigated or eliminated at the project level phase through proper field procedures and/or strong collaboration with key conservation partners such as the Garry Oak Ecosystems Recovery Team and appropriate government agencies. Some recovery strategy activities may require project level environmental assessment, as required under the *Canadian Environmental Assessment Act*. Any activities found to require project-level environmental assessments will be assessed at that time pursuant to the provisions of the *Act*.

This recovery strategy benefits the environment by promoting the conservation and recovery of the Lindley's False Silverpuffs, a natural component of biodiversity. Activities required to meet recovery objectives are unlikely to result in any important negative environmental effects as they are limited to habitat rehabilitation, research activities, fostering stewardship, increasing public awareness, improving knowledge on habitat requirements and population threats, and conducting habitat/species mapping, inventory, and restoration. In addition, it is likely that careful habitat restoration for Lindley's False Silverpuffs will benefit other co-occurring native species which occupy the same habitat.

In summary, the SEA process has concluded that this recovery strategy will likely have several positive effects on the environment and other species. There are no obvious adverse environmental effects anticipated with the implementation of this recovery strategy.