Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Coast Microseris (*Microseris bigelovii*) in Canada

Coast Microseris

2013

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: Coast Microseris 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 Coast Microseris and has prepared this strategy, as per section 37 of SARA. It has been prepared in cooperation with the Department of National Defence, and 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 Coast Microseris and Canadian society as a whole.

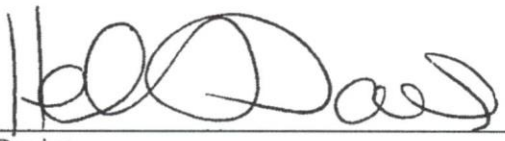
This recovery strategy will be followed by one or more action plans that will provide information on recovery measures to be taken by Environment Canada and/or the Parks Canada Agency and other jurisdictions and/or organizations involved in the conservation of the species. Implementation of this strategy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

The recovery of Coast Microseris will be coordinated with the recovery of rare species inhabiting maritime meadows associated with Garry Oak ecosystems (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:



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Thank you to Matt Fairbarns and Carrina Maslovat for writing the draft recovery strategy. The Garry Oak Ecosystems recovery team is the recovery team for the Coast Microseris and is thanked for their involvement in the development of this recovery strategy. Further revision was the result of comments and edits provided by a number of organizations: the Province of British Columbia, Parks Canada Agency, Environment Canada, the Department of National Defence, and Natural Resources Canada. Thank you to the various landowners who support recovery of this species on their land and provided access for surveys.

EXECUTIVE SUMMARY

The Canadian population of Coast Microseris (*Microseris bigelovii*) was assessed as Endangered in 2006 by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and in 2007 the Canadian population was listed as Endangered under Canada's *Species at Risk Act* (SARA).

Coast Microseris is a small, stemless annual herb measuring 4 to 35 cm in height and bearing a single yellow flower head. It ranges from British Columbia south along the coast to California, but the Canadian population is widely disjunct from the nearest population in Oregon. The Canadian population of Coast Microseris comprises <1% of its global range. In Canada, Coast Microseris is known from 10 to 12 reliable records, of which at least three have been extirpated. The seven known extant populations occur along the southeast coast of Vancouver Island.

Several factors limit the survival of Coast Microseris populations in Canada and include its specificity to rare habitats, limited dispersal abilities, weak competitive ability, predisposition to demographic failure, small area of physical occupancy, and small, highly fragmented populations that constrain genetic diversity. Further, Coast Microseris populations are threatened by the invasion of alien plants, changes in ecological dynamics (e.g., altered fire and nutrient regimes), trampling and soil compaction caused by recreational activities, detrimental weed management programs, land conversion caused by urban development, and grazing by vertebrates.

In the short term, population and distribution objectives for Coast Microseris will focus on the maintenance of the seven extant Canadian populations and exploring the feasibility of restoring population(s) and establishing new populations to increase abundance & distribution. Broad strategies to be taken to address the threats to the survival and recovery of the Coast Microseris are presented in section 6 Broad Strategies and General Approaches to Meet Objectives.

Critical habitat for the recovery of Coast Microseris is identified in this recovery strategy. The best available information has been used to identify critical habitat; however, there are significant knowledge gaps. Additional critical habitat will need to be identified in upcoming planning documents to meet the population and distribution objectives.

Further recovery action for Coast Microseris will be incorporated into one or more action plans by 2018.

RECOVERY FEASIBILITY SUMMARY

The recovery of the Coast Microseris in Canada 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 existing populations produce seeds each year.

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

   Yes. Coast Microseris is extant at seven known locations. Further, while Coast Microseris requires specialized habitat conditions, there may be additional areas of habitat that are suitable for restoration and recovery.

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

   Yes. Threats to the species and its habitat can be mitigated through invasive alien plant management, site restoration, education, and stewardship. 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. Over the short term, recovery techniques consist primarily of threat mitigation techniques. Over the long term, techniques for re-establishing extirpated populations are likely to be developed.

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1. COSEWIC Species Assessment Information

Date of Assessment: April 2006
Common Name (population): Coast Microseris
Scientific Name: *Microseris bigelovii*
COSEWIC Status: Endangered
Reason for Designation: A small annual herb present in a few fragmented sites within a narrow coastal fringe on southeast Vancouver Island in a densely inhabited urbanized region. Development, recreational activities, site management practices and competition from invasive alien plants continue to impact the species.
Canadian Occurrence: British Columbia
COSEWIC Status History: Designated Endangered in April 2006. Assessment based on a new status report.

2. Species Status Information

The Canadian population of Coast Microseris (*Microseris bigelovii*) was assessed as Endangered in 2006 by the Committee on Status of Endangered Wildlife in Canada (COSEWIC), and in December 2007 the population was listed as Endangered under Canada's *Species at Risk Act* (SARA). The Coast Microseris population in Canada comprises <1% of the species' global range. Conservation ranks for Coast Microseris in other jurisdictions where it occurs are provided in Table 1.

Table 1. Conservation ranks for Coast Microseris (B.C. Conservation Data Centre 2011, NatureServe 2010).

Location	Rank1	Rank description
Global	G4	Apparently secure
Canada	N2	Imperilled
British Columbia	S1	Critically imperilled
United States	NNR	Not ranked
Washington	SX	Presumed extirpated
Oregon	S2	Imperilled
California	SNR	Unranked

[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. Species Information

3.1. Species Description

Coast Microseris is a taprooted annual of the aster family approximately 4 to 35 cm tall. It has narrow spoon-shaped basal leaves and an ascending leafless flower stalk bearing a single yellow flower head (Figure 1). When fruiting, it bears a tuft of five hairless or short-hairy scales, each terminating in a long, hair-like bristle which arises from the pointed scale (Figure 1). A detailed description of the species is provided in the status report (COSEWIC 2006).

Figure 1. Photographs of Coast Microseris. Flowering plant (left) and fruiting plant showing distinctive tuft of five scales (right). Photos by Matt Fairbarns.

3.2. Population and Distribution

Globally, Coast Microseris ranges from southeast Vancouver Island in Canada, south along the coast to California (Figure 2). The species has been extirpated from Washington and mainland Oregon; it only persists on some offshore islands in Oregon (COSEWIC 2006).

In Canada, populations of Coast Microseris occur along a narrow coastal strip on southeast Vancouver Island and Hornby Island, British Columbia in moist, open, coastal bluffs without any tall vegetation (Figure 3, Table 2). The Canadian range of Coast Microseris is estimated to be approximately 20 km^2 (COSEWIC 2006), but the recent discovery of additional subpopulations at the Church Point site demonstrates that it may occur farther inland than was previously believed. As a result, its range in Canada should be revised to cover an area of approximately 850 km^2. There are 10 to 12 known populations in Canada, but only 7 are confirmed extant and at least 3 are presumed to have been extirpated over the last fifty years. The Canadian population is now estimated to be 9,100-10,935 flowering plants over about 3,200 m^2. Counts during fruiting season indicate that only 20-50% of flowering plants produce viable seed (many plants wither before seeds are filled); as a result, the population of reproducing plants at each site is probably much lower than the total number of flowering plants. The rate of change in the Canadian population cannot be accurately determined because of between-observer differences

in counting techniques. As well, natural between-year differences may reflect population fluctuations as a result of year-to-year climatic variations rather than longer term trends in population size (Bush and Lancaster 2004).

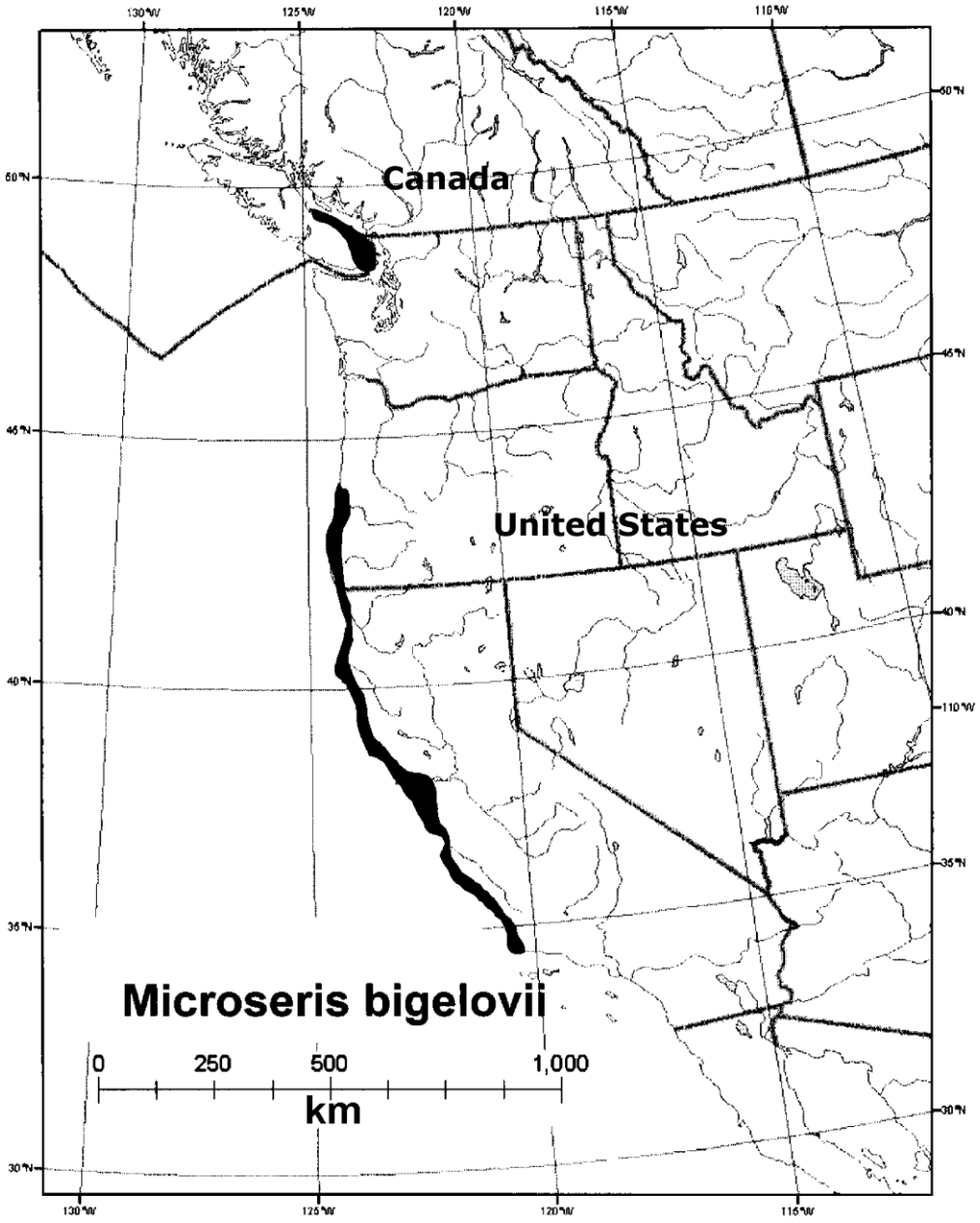

Figure 2. Global distribution of Coast Microseris (from COSEWIC 2006). Black regions indicate species range.

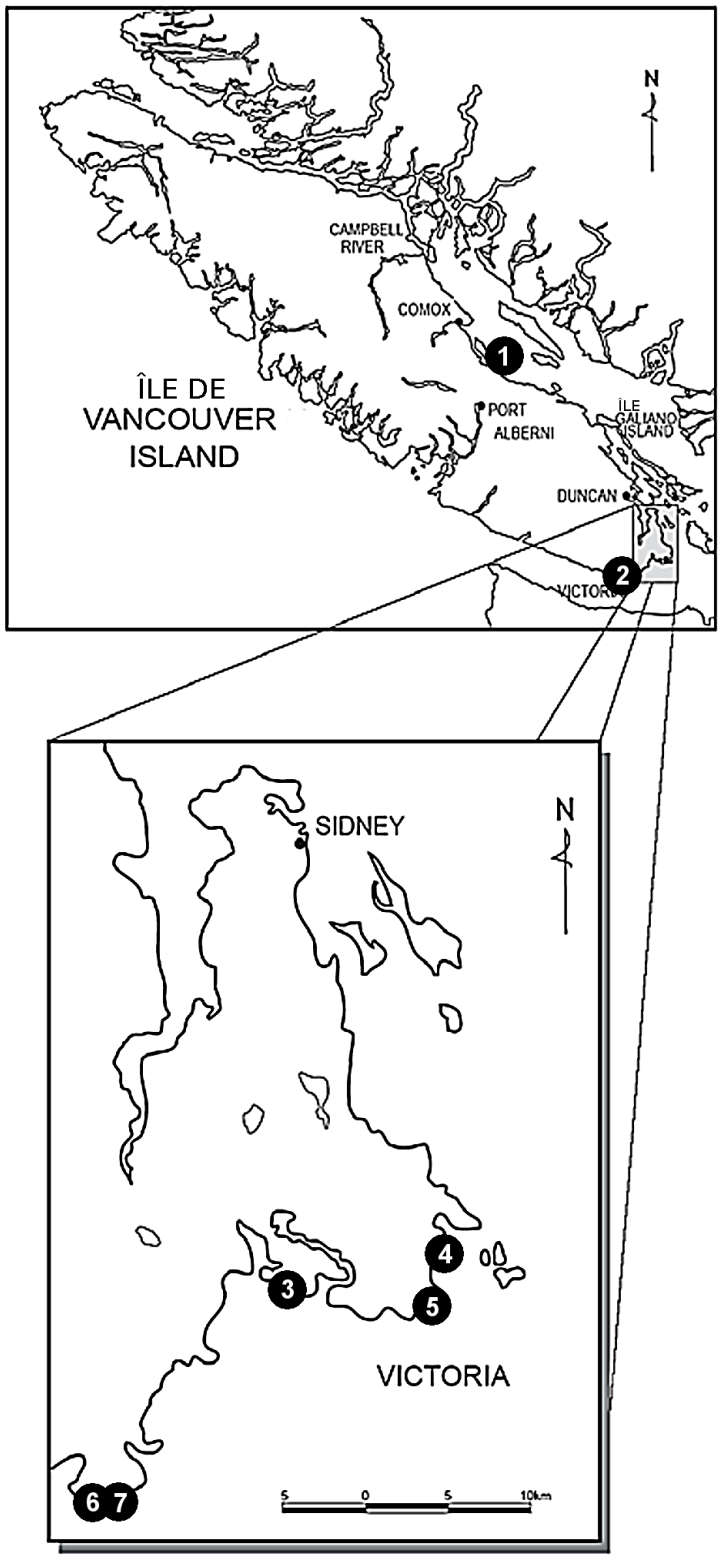

Figure 3. Distribution of Coast Microseris in Canada. Large closed circles indicate extant populations and the numbers refer to site names listed in Table 2.

Table 2. General location, status, most recent population count, and land tenure for extant populations of Coast Microseris in Canada.

Number on map	General location	Population size (year counted)	Land Tenure
1	Helliwell Park (Hornby Island)	400-1,000 (2004)	Non-federal land
2	Pike Creek (East Sooke Regional Park)	500-1000 (2010)	Non-federal land
3	Saxe Point Park (Esquimalt)	400-500 (2006)	Non-federal land
4	Uplands Park (Oak Bay)	1,500-2,000 (2004)	Non-federal land
5	Harling Point (Oak Bay)	200 (2006)	Non-federal land
6	Church Point (Rocky Point inc. Middle Peak)	5,600-5,735 (2010)	Federal land
7	Christopher Point (Rocky Point)	500 (2010)	Federal land

3.3. Needs of the Coast Microseris

In Canada, Coast Microseris is found in Garry Oak and associated ecosystems in the Coastal Douglas-fir Biogeoclimatic Zone and the driest subzone of the Coastal Western Hemlock Biogeoclimatic Zone. The species usually occurs on open rock bluffs and within rock-bound vernal seeps (Figure 4). These sites have negligible tree or shrub cover and are wet in the fall, winter, and spring and dry in the summer months. Coast Microseris appears to tolerate dry sandy soils and may require frequent coastal fogs to protect it from desiccation. It also tolerates high nitrogen/fertility levels that occur where it grows amid guano. The species may be outcompeted on better quality sites (COSEWIC 2006).

Six of the seven extant Canadian Coast Microseris populations are restricted to areas within 50 m of the coast where frequent coastal fogs occur in the autumn and winter and proximity to the ocean provides a buffer against deep winter frosts. A Church Point subpopulation, which was not listed in the status report, occurs further from the coastline in habitat not previously known to harbour the species. Coast Microseris is restricted to sites that have negligible tree or shrub cover, although invasive alien Scotch Broom (*Cytisus scoparius*) sometimes grows in deep soil pockets within populations of Coast Microseris and shades the sites during part of the day.

Figure 4. Coast Microseris habitat at Saxe Point Park in Esquimalt. Photo by Matt Fairbarns.

A number of factors may limit the survival and recovery of Coast Microseris in Canada:

- Dependence on highly specific habitats associated with Garry Oak and associated ecosystems, most of which have been lost or damaged by habitat conversion (i.e., the loss of suitable habitat, often as a result of urban development), forest encroachment, and/or a shift to ecosystem dominance by invasive alien plants.
- A lack of special structures to aid in the long-distance dispersal of seeds or fruits limits the potential for local rescue effects or establishment in unoccupied habitat areas.
- Apparently weak competitive ability, especially with respect to invasive alien species.
- Predisposition to demographic failure because its annual life cycle may result in high juvenile mortality if the late spring/early summer drought arrives early.
- Very small area of physical occupancy, which leaves it susceptible to chance events including those which operate at a small scale.
- Extremely small population sizes, which may constrain the species' genetic diversity, and increase its vulnerability to extirpation due to demographic stochasticity.

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
Disturbance or harm						
Recreational activities	High	Localized	Recurrent	Recurrent	Medium	Medium
Weed management	Medium	Localized	Recurrent	Recurrent	Medium	Medium
Grazing and soil disturbance by vertebrates	Medium	Localized	Historic and current	Unknown	Unknown	Medium
Habitat Loss or Degradation						
Habitat conversion	Medium	Widespread	Historic and anticipated	Unknown	High	Medium
Changes in Ecological Dynamics or Natural Processes						
Fire suppression	Medium	Widespread	Current	Recurrent	Medium	Medium
Altered nutrient regime	Low	Localized	Current	Unknown	Unknown	Low

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

[2] *Severity: reflects the population-level effect (High: very large population-level effect, 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 immediate threat to Coast Microseris is from the influence of invasive alien forbs, and/or grasses, and shrubs which dominate most sites where it occurs (Table 4). Invasive alien plant species compete for space, moisture, and nutrients, which especially disadvantages small annuals such as Coast Microseris that possess shallow, small root systems. Some common invasive alien grass species found at many of the sites include Common Velvet Grass (*Holcus lanatus*), Annual Bluegrass (*Poa annua*), Early Hair Grass (*Aira praecox*), and Silver Hair Grass (*Aira caryophyllea*). Invasive alien perennial forbs, such as Hairy Cat's-ear (*Hypochaeris radicata*), English Plantain (*Plantago lanceolata*), and Dove-foot Crane's Bill (*Geranium molle*) may have established permanent cover in sites that formerly provided a constant supply of bare mineral soil required by Coast Microseris. Some invasive alien annual forb species, such as Subterranean Clover (*Trifolium subterraneum*) Small Hop-clover (*T. dubium*), and Small-flowered catchfly (*Silene gallica*), are capable of growing in the drought-stressed environments where Coast Microseris occurs and present a direct threat by out-competing Coast Microseris for moisture and nutrients and pre-empting germination sites. Scotch Broom (*Cytisus scoparius*) is

the most abundant invasive alien shrub; although it may not be able to survive in the drought-stressed microhabitats where Coast Microseris grows, Scotch Broom can occupy adjacent habitat and may shade out Coast Microseris. Accordingly, this threat is considered to be a high level of concern.

4.2.2. Disturbance or harm

Recreational use and development related to outdoor recreation is a major threat to remaining populations of Coast Microseris. This threat can lead to habitat conversion and altered hydrological regimes, facilitate the establishment of invasive alien species, and can cause direct damage by crushing the plants. All but the Rocky Point populations occur in popular walking areas. Light foot traffic likely favours Coast Microseris by discouraging the growth of competitive species. However, no plants were observed directly on footpaths, so it appears that heavy trampling caused by foot and dog walking traffic threatens the species (COSEWIC 2006). The Church Point and Christopher Point populations have limited public access and are least likely to be affected by recreational activities. Development of recreational structures, such as park benches and interpretive displays, can destroy habitat and/or direct pedestrian traffic to areas where Coast Microseris occurs. Several park benches have already been established on or adjacent to subpopulations of Coast Microseris at Uplands Park and Saxe Point Park (COSEWIC 2006). This threat is considered a high level of concern.

Inappropriate weed management activities threaten Coast Microseris by potentially compacting soil in its habitat and trampling the plants themselves. The soil disturbance associated with invasive alien plant removal may increase invasion by alien plants adapted to colonize disturbed soils (Knops *et al.* 1995; Kotanen 2004); these invasive alien plants may in turn cause long term harm by permanently occupying potential Coast Microseris germination sites. Church Point, Christopher Point, Saxe Point Park, Uplands Park, and Harling Point all have ongoing removal of invasive alien shrubs next to Coast Microseris populations. The invasive alien species, Carpet Burweed (*Soliva sessilis*), has been recently found close to the Coast Microseris population at Harling Point and is present in Uplands Park; it is being managed by applying intense heat to the plants with a propane ‘tiger torch’ (Brown 2006; Polster pers. comm. 2006). Although weed management is necessary at the sites, appropriate techniques must be applied to ensure protection of Coast Microseris and its habitat. Consequently, this threat is considered a medium level of concern.

Past livestock grazing played a major role in the establishment and eventual dominance of invasive alien forage species, which now occupy sites where Coast Microseris would once have grown. However, former livestock grazing may have also benefited Coast Microseris by offsetting the impacts of altered fire regimes and releasing nutrients in a form available for plant growth (COSEWIC 2006). Livestock grazing is a historic threat and does not occur today. In the present day, soil disturbance caused by foraging vertebrates, does pose a threat at some sites. At Church Point, foraging vertebrates (e.g., racoons) heavily modified the site as the shallow moss mat was torn up and the thin soil layer disturbed, exposing bedrock. Soil disturbance caused by foraging vertebrates is considered a medium level of concern to extant Coast Microseris populations.

4.2.3. Habitat loss or degradation

Habitat conversion, caused by urban development and road maintenance, is an anticipated threat to populations of Coast Microseris throughout its range in Canada. The majority of the Coast Microseris populations lie at the heart of one of Canada's fastest growing regions. Coast Microseris habitat is closely associated with Garry Oak ecosystems, which have seen a decline of more than 95% in the Victoria area (Lea 2006). The Victoria Metropolitan Area includes all of the apparently extirpated populations and five of the seven extant populations of Coast Microseris (Uplands Park, Harling Point, Saxe Point Park, Church Point, and Christopher Point). In addition, the Christopher Point population occurs at the base of a roadside sign and road maintenance activities at this site could result in habitat loss. While this threat has high severity, many of the remaining populations are located in parks or on federal land where the risk of urban development is somewhat reduced. Overall, this threat is considered medium concern.

4.2.4. Changes in ecological dynamics or natural processes

Fire suppression has been identified as a threat to Coast Microseris throughout its range. Historically, 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 cessation of First Nations burning may have decreased the supply of suitable habitat for Coast Microseris germination and growth. 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 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. A lack of fire likely limits the number of sites where the small seeds are able to germinate and grow. Fire suppression has also allowed for larger plant species to encroach into the open habitats of Coast Microseris, creating shade and altering hydrological regimes (COSEWIC 2006). This threat is considered a medium level of concern.

Although Coast Microseris is found in association with heavy guano deposits on offshore islands of Oregon State, a change in nutrient regimes, primarily from the addition of dog excrement, may affect populations in Canada. Uplands Park, in Oak Bay, is a popular off-leash area for dogs and there are extremely large amounts of dog excrement in the area next to Coast Microseris plants. However, the impact of altered nutrient regimes on Coast Microseris is not known. Consequently, this threat is considered a low level of concern.

5. Population and Distribution Objectives

In Canada, Coast Microseris is found on open rock bluffs and in rock-bound vernal seeps generally within 50 m of the shoreline, in habitats associated with Garry Oak ecosystems. As such, the species has a naturally, highly restricted range with high fragmentation amongst sites. Within this range, significant habitat loss since European settlement (Lea 2006) has likely resulted in population reductions. Development, encroachment of vegetation, and effects resulting from recreational activities continue to exacerbate the situation (COSEWIC 2006). 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 seven confirmed extant populations of Coast Microseris in Canada, though at least three may now be extirpated.

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 Coast Microseris, 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 seven extant populations while exploring the feasibility of restoring population(s) and establishing new populations to increase abundance and distribution:

Objective 1: Maintain the seven extant populations of Coast Microseris.

Objective 2: Establish and/or augment populations to increase abundance and distribution[2] if determined to be feasible and biologically appropriate for Coast Microseris.

6. Broad Strategies and General Approaches to Meet Objectives

The following are broad strategies and approaches to meet the population and distribution objectives for Coast Microseris:

- Stewardship: engage and involve landowners and land managers in land management to maintain or improve habitat for Coast Microseris;
- Public education and outreach: increase public awareness of the species, its needs and conservation value;
- Research: address knowledge gaps to inform the recovery of Coast Microseris;
- Population monitoring: monitor population trends, habitat condition, and threats to measure success;

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

- Population restoration: develop and test population establishment/augmentation techniques to recover the species; and
- Habitat and species protection: protect existing populations and their habitat from destruction (e.g., from land conversion) though available protection mechanisms.

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
• Encroachment by invasive alien plants • Recreational activities • Weed management • Fire suppression • Grazing and soil disturbance by vertebrates • Altered nutrient regime • Limitation: weak competitive ability	High	Stewardship	• Prepare Best (Beneficial) Management Practices guidelines for Coast Microseris to support landowners, land managers, and First Nations in stewardship activities. • Refine and develop restoration and adaptive management techniques (including the use of fire and grazing). • Engage landowners and land managers in recovery decisions and activities.
	Medium	Public education and outreach	• Increase public awareness of the existence, conservation value, threats, and harm reduction measures for Coast Microseris and associated species at risk.
• Knowledge gaps and limitations regarding population demography and genetic diversity	High	Research	• Determine whether there are bottlenecks affecting pollination/reproduction, dispersal, seed production, recruitment, and recruit survival. • Assess and conserve genetic diversity of extant populations of Coast Microseris in Canada.
• Knowledge gaps concerning population 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. • Report on population trends, area of occupancy, and habitat condition every 2 years.

Threat or Limitation	Priority	Broad Strategy to Recovery	General Description of Research and Management Approaches
• Knowledge gaps on propagation techniques • Limitations of small population sizes and area of occupancy	High	Population restoration	• Develop and implement population restoration plans for locations with existing populations (including a monitoring component). • Develop and implement translocation plans as needed. • Develop population establishment/augmentation techniques to establish and augment populations for population restoration. • Identify the demographic criteria that would trigger immediate re-evaluation of recovery priorities and activities, and incorporate them into management plans. • Improve understanding of conditions necessary for germination, establishment, growth, and reproduction. • Determine total number of populations required to maintain survival in Canada. • Determine long-term species-specific population thresholds and targets.
• Habitat conversion	Medium	Habitat and species protection	• Identify protection mechanisms/instruments for the species and its critical habitat.

6.2. Narrative to Support the Recovery Planning Table

Successful recovery of Coast Microseris will rely on stewardship that involves the voluntary cooperation of private landowners and agencies to protect species at risk and associated ecosystems (Table 4). Stewardship activities include voluntarily protecting important habitat areas that occur on private lands and following best management practices to control invasive alien plants and manage recreational activities. Encroachment of invasive alien plants into the habitats required by Coast Microseris is one of the threats of greatest concern, continued maintenance by land managers will be required to mitigate this ongoing threat. Subpopulations of the Church Point population occur on Indian Reserve land and engagement of First Nations in recovery planning will be a priority. Other portions of this species' habitat are located in municipal and regional parks (i.e., Helliwell Park, Pike Creek, Saxe Point Park, and Uplands Park), where intensive public use means that public education and support will be required to effect changes away from the current damaging land use, to practices that are compatible with the species. Despite uncertainties, the creation of additional populations will be an important component of recovery. Establishment and maintenance of multiple populations will increase the chance of maintaining this species in Canada. Further, the creation of new populations will enable both research to answer knowledge gaps and the development of effective and efficient recovery techniques both of which will have benefits directly applicable to the maintenance of existing populations.

Careful monitoring is an important component of recovery for a number of reasons. First and foremost, monitoring is required to determine whether recovery actions are successful. Monitoring can inform the identification of criteria with respect to rate of population decline (size/distribution) that would trigger immediate re-evaluation of recovery priorities and

activities; these criteria can then be incorporated into management plans. In addition, regular population monitoring is needed to track the current viability of the species, and its response to threats and management activities. There are also significant risks associated with translocations, which is why they must be accompanied by a program to monitor not only the success of translocations, but the impacts of translocation on non-target species, communities, and ecological processes.

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, to provide information on the species responses to environmental conditions, data should be collected in years when plants are absent as well as when they are present. 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 the presence of a viable seed bank (Bush and Lancaster 2004).

7. Critical Habitat

Areas of critical habitat for Coast Microseris 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 Coast Microseris 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. Habitat can be fully identified for five populations (Saxe Point Park, Uplands Park, Harling Point, Church Point, and Christopher Point); additional information to confirm existence and available habitat, is required to identify critical habitat at the two remaining locations (Helliwell Provincial Park and Pike Creek). The schedule of studies section (Section 7.2; Table 5) outlines activities required to identify additional critical habitat necessary to support the population and distribution objectives of the species.

The habitat of Coast Microseris in Canada generally occurs along the southeast coast of Vancouver Island and the Gulf Islands in Garry Oak and associated ecosystems. The habitat is characterized as open areas without tall vegetation, reliant on seasonal seepage, and usually occurring along coastal bluffs with shallow soils over bedrock (COSEWIC 2006). Field investigations at Saxe Point Park, Uplands Park, Church Point, Christopher Point, and Harling Point were used to further characterize the habitat of Coast Microseris (Fairbarns 2009; Fairbarns 2010; DND 2010).

Coast Microseris depends directly on canopy openings to provide high light levels for germination. These openings must be large enough that Coast Microseris plants and seed bank area 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 the Coast Microseris (Spittlehouse *et al.* 2004). An additional consideration with regard to canopy opening is that when tall vegetation falls it covers an area of ground for a distance equal to its height.

In addition to openings, specific hydrological characteristics are critical to the survival of this species. These hydrological characteristics are directly tied to rainfall (Graham 2004). Coast Microseris grows in level or depressional open areas that collect water from the surrounding area, called the catchment area. Surface water flow and subsurface seepage from this catchment area is essential to the survival of the Coast Microseris plants. This area has been mapped at Saxe Point Park, Uplands Park, Christopher Point, Harling Point, and at some Church Point locations (Fairbarns 2009; Fairbarns 2010). These catchment areas are generally small and isolated within landscape scale catchments.

Critical habitat required for the survival of each Coast Microseris patch[3] (includes both plants and seed bank area) is composed of two habitat features: the minimum canopy opening and the catchment area. These features are always connected to the recorded location of a Coast Microseris patch and in all cases will overlap to some degree (no special status is applied to areas of overlapping critical habitat features). The default minimum canopy opening required for light to reach the plants is the area bounded by a 20 m distance surrounding each Coast Microseris patch in all directions (20 m is generally the maximum height attained by trees in the soils surrounding Coast Microseris). The catchment for each patch is delineated by following the upslope high point of land which divides water flowing towards the plants from water flowing away from the plants; these catchment areas are generally relatively small and isolated within landscape catchments. Conceptually these features can be visualized as a "v" shaped seepage draining into an "o" shaped minimum canopy opening—though in reality these features are rarely regularly shaped and it is possible for the catchment to be completely contained within the minimum canopy opening. If the seepage extends beyond the canopy opening the top of the "v" of seepage influence represents the upper limit of the habitat, otherwise the canopy opening represents the limit of the habitat.

Populations of Coast Microseris are likely prone to large annual fluctuations (COSEWIC 2006). While some habitat may not be used every year, the presence of plants in one year indicates that the habitat may be critical for storing seeds and boosting seed production in favourable years. All habitat used at any time (during a year or over multiple years) by each patch of plants in each extant population is required to achieve the population and distribution objectives and is considered critical habitat. However, due to population fluctuations this habitat cannot be completely identified based on data from any single year: a long term data set is required to ensure the full range of population fluctuation and extent of habitat use is captured. Recent data

[3] Patch is a term used to refer to a single plant or group of several plants in close proximity. 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 dispersal distance of most sees is short to moderate (COSEWIC 2006).

(Fairbarns 2010; DND 2010; B.C CDC 2011) can be used to identify a minimum baseline of critical habitat required by Coast Microseris populations. It is expected that these datasets do not represent the maximum extent of annual variation in these populations; and therefore, do not represent the total habitat required for the survival of extant Coast Microseris populations. The studies referred to above have 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 will provide data which more confidently characterizes the total habitat needed by this species.

Within the geographical boundaries identified in Figure 5 through Figure 8, critical habitat for the survival of Coast Microseris populations consists of the minimum canopy opening and any associated catchment areas associated with each recorded Coast Microseris patch. The critical habitat for these locations was mapped in 2009 (Fairbarns 2010).

Within the geographical boundaries identified in Figure 9 and Figure 10, critical habitat for the Church Point population consists of the minimum canopy openings and any catchment areas associated with each recorded Coast Microseris patch. These patches are spread between two locations: Church Hill and Middle Peak. Critical habitat for the Church Hill portion of this population was surveyed in 2009 by Fairbarns (2010). Subsequently additional patches and increased extent of known patches were recorded (DND 2010). Critical habitat was not mapped in 2010 so the default minimum canopy opening area of 20 m has been applied to these data and is critical habitat. The catchments for these new 2010 patches and patch extents are also critical habitat; however there is no default model to apply and they remain to be mapped. The Church Hill surveys in 2009 and 2010 confirmed the continued persistence of the plants and habitat for a portion of the population; since the Church Hill portion of this population remains extant and there is no reason to believe that the Middle Peak portion has been extirpated, the BC CDC (2011) occurrence polygons are accepted as the best available information regarding the extent of Coast Microseris patches at Middle Peak; these patches, their minimum canopy openings, and catchments area all critical habitat.

No recent surveys have been done at Helliwell Park. Plants were last observed over seven years ago and the habitat condition has not been confirmed since. Further study is required to relocate the plants, confirm suitable habitat still exists at the location, and to map the critical habitat features with greater than 100 m precision.

The Pike Creek population was reported during the preparation of the recovery strategy, and critical habitat will be identified for this population in the action plan or updated recovery strategy once the required information is obtained.

The habitat for Coast Microseris varies among Canadian locations and most of the larger populations occur throughout a diversity of microhabitats. Consequently, it is difficult to provide a description of critical habitat attributes for Coast Microseris that is both inclusive and specific. The critical habitat attributes below cover the range of attributes from studied sites, but not all sites have been studied in detail. Further, due to the general nature of these attributes, they may include some habitat types that are unsuited to the species. Therefore, critical habitat identification is based on the recorded Coast Microseris patches not the presence of the following attributes:

- Sunny areas with short or sparse vegetation (trees are absent and the cover of shrubs is never substantial).
- Elevations between 0 to 60 m above sea level usually within 50 m of shoreline, but one population is 300 m inland.
- Terraces and moderate to steep slopes (south, southeast, or southwest facing).
- Shallow soils (up to 10 cm deep) over bedrock with very small amounts of exposed mineral soil and fine litter.
- Moderately well drained soil that is moist early in the growing season (October to March) with water deficits by early summer.

Figure 5. Area (~1.1 ha) within which critical habitat for Coast Microseris is found at Saxe Point Park and located on municipal park land. Approximately 0.2 ha of critical habitat has been identified in three locations within this area.

Figure 6. Area (~2.83 ha) within which critical habitat for Coast Microseris is found at Uplands Park and located on municipal park land. Approximately 0.26 ha of critical habitat has been identified at five locations within this area.

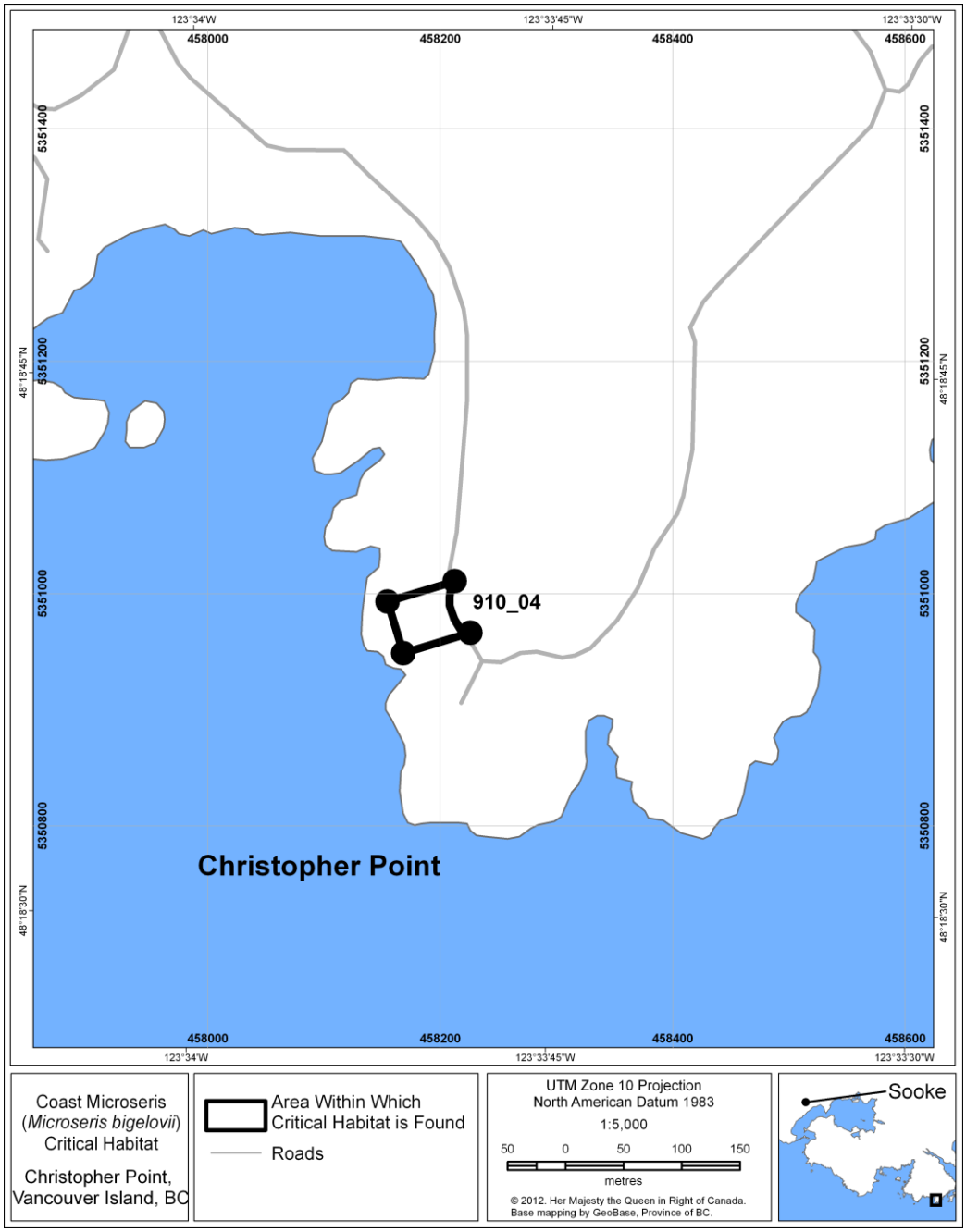

Figure 7. Area (~0.28 ha) within which critical habitat for Coast Microseris is found at Christopher Point and located on federal lands. Approximately 0.04 ha of critical habitat has been identified at one location within this area.

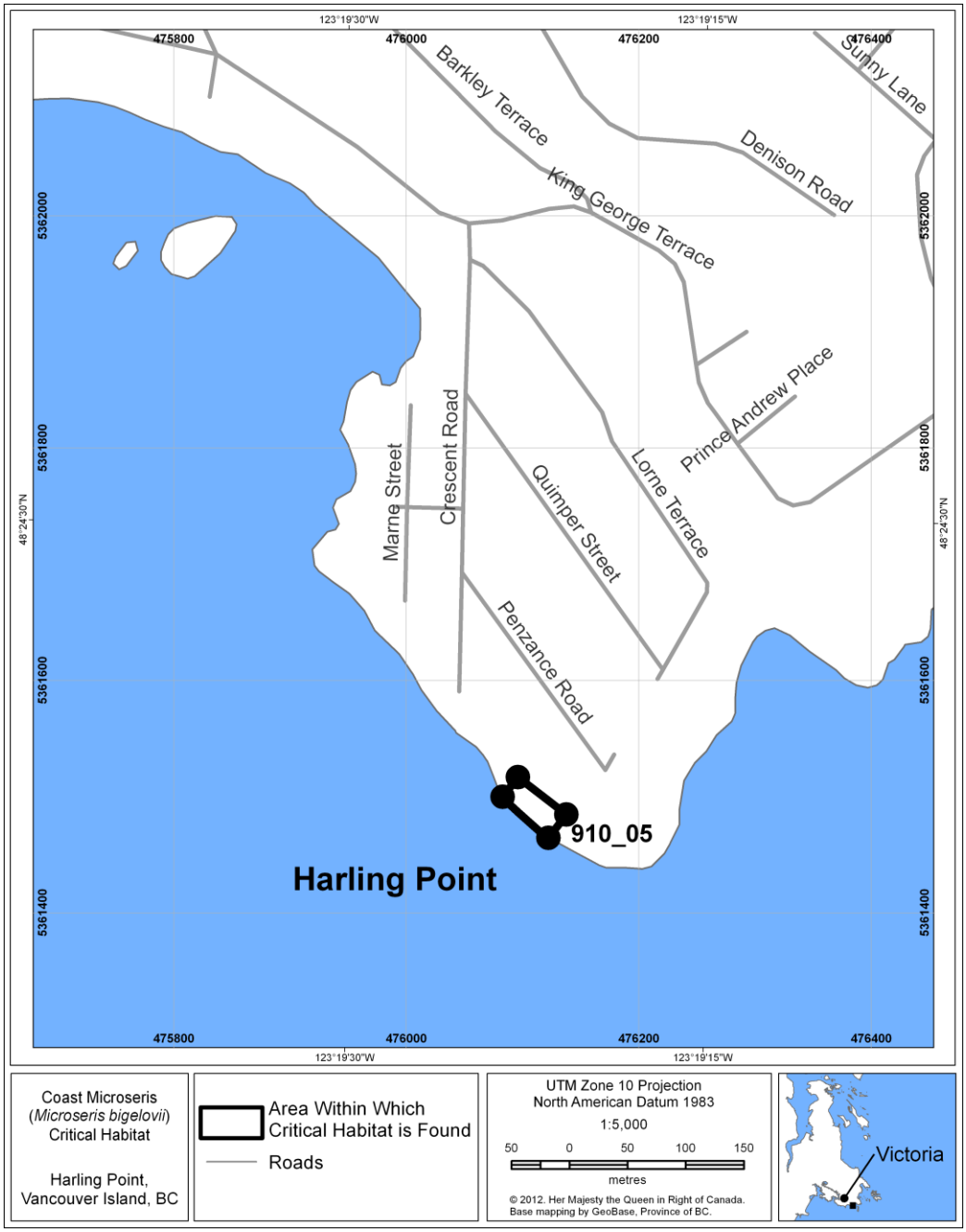

Figure 8.Area (~0.13 ha) within which critical habitat for Coast Microseris is found at Harling Point and located on non-federal land. Approximately 0.02 ha of critical habitat has been identified at one location within this area.

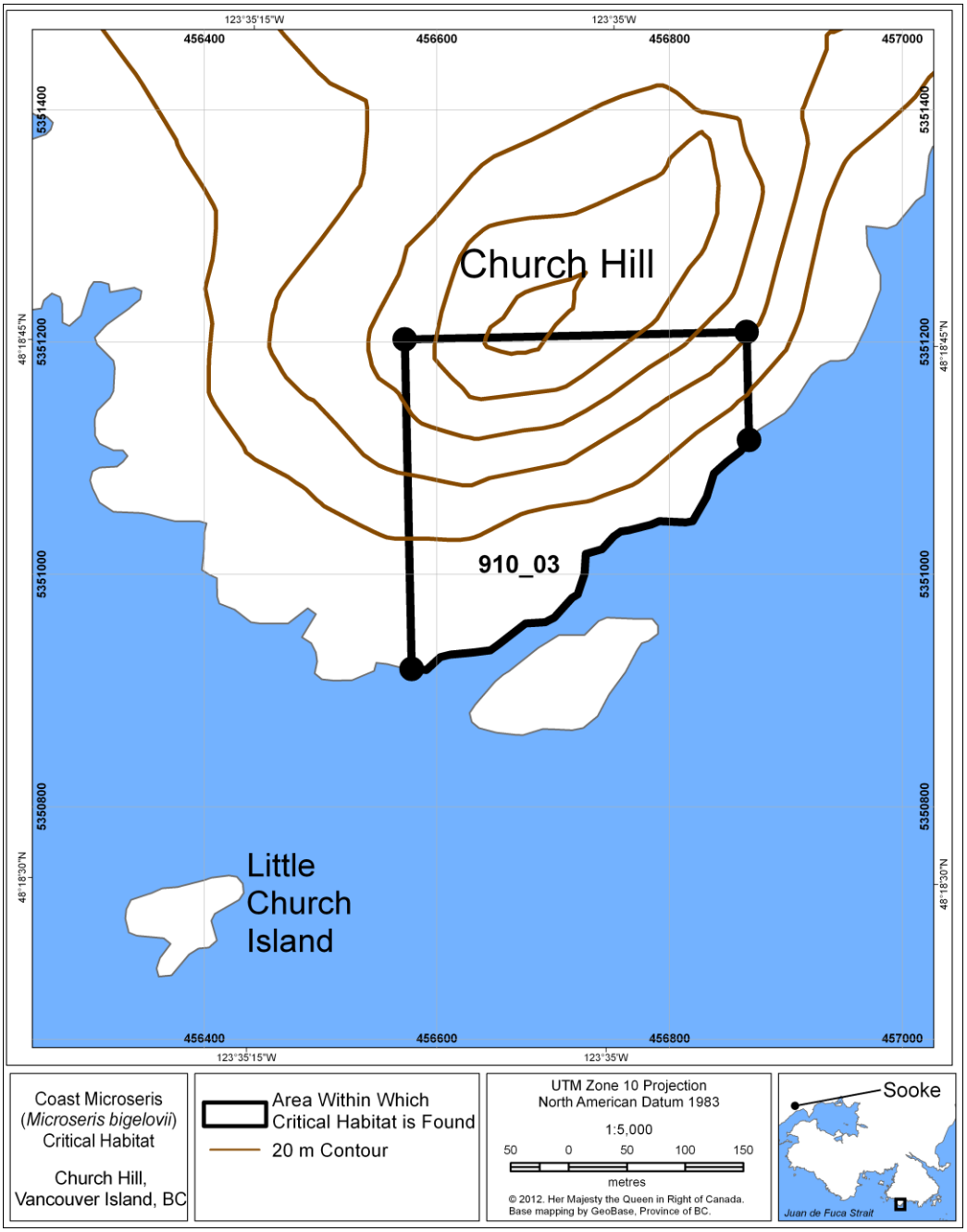

Figure 9. Area (~6.08 ha) within which critical habitat for Coast Microseris is found at Church Point, located on federal land. Approximately 0.83 ha of critical habitat has been identified at four locations within this area.

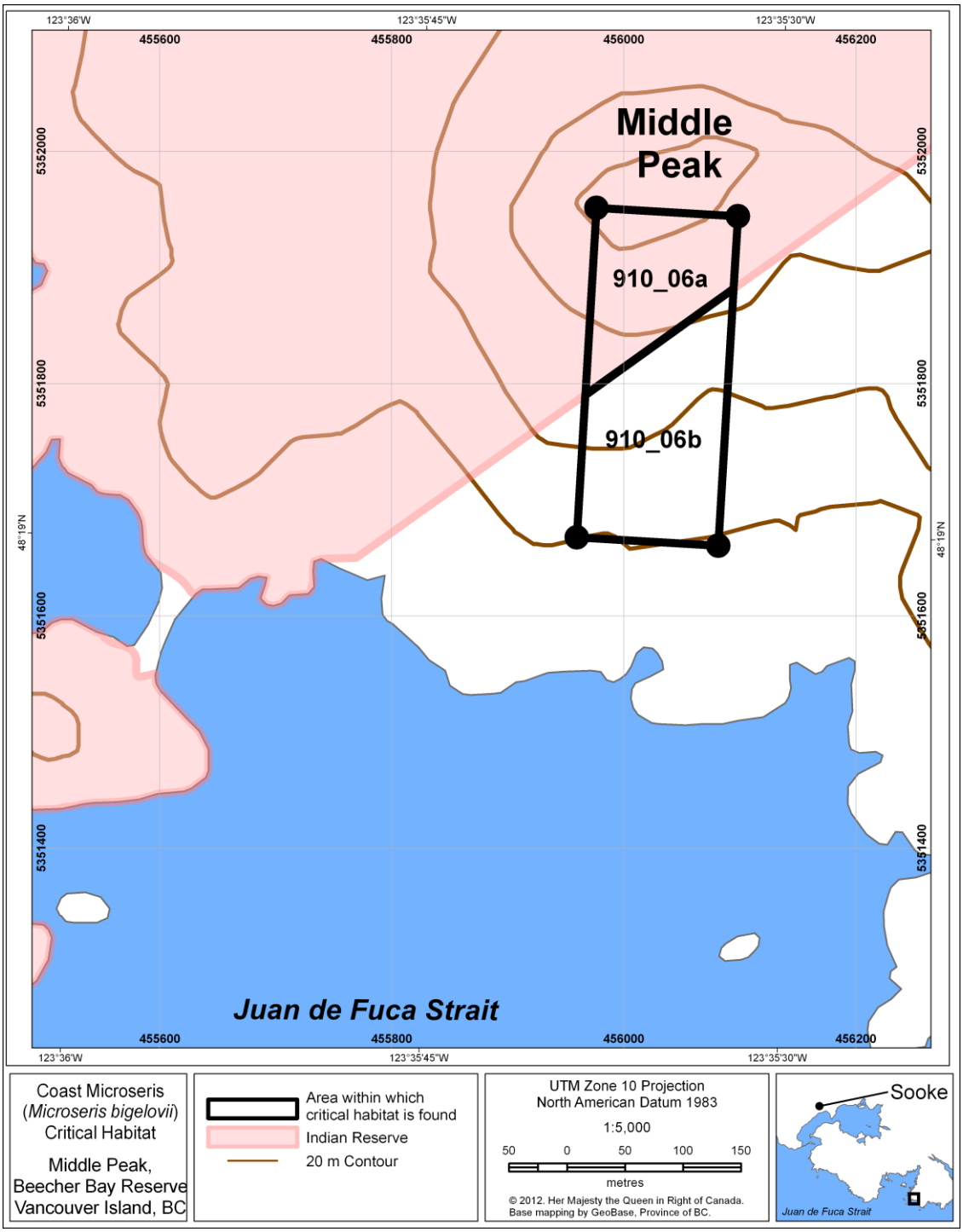

Figure 10. Area (~3.5 ha) within which critical habitat for Coast Microseris is found on Middle Peak located on federal land. Approximately 1.8 ha of critical habitat has been identified at three locations within this area.

7.2. Schedule of Studies to Identify Critical Habitat

Table 5. Schedule of Studies

Description of Activity	Rationale	Timeline
Confirm the existence of Coast Microseris plants and or habitat features with greater than 100 m accuracy at Helliwell Park (Hornby Island) and Pike Creek (East Sooke Regional Park).	Required in order to identify critical habitat at these locations.	2013-2014
To identify sufficient critical habitat for the survival of existing populations, additional monitoring of existing populations is required to refine the maximum patch extent and habitat used.	Large population fluctuations mean that critical habitat cannot be completely identified based on data from a single year (it may have been a poor year with small populations): a long term data set is required to ensure the full range of population fluctuation and habitat use is captured.	Ongoing, until statistical analysis of population fluctuations provides some measure of confidence that major fluctuations have been accounted for.
Identification of sites with potential for establishment of additional populations of Coast Microseris.	Required to determine the feasibility of establishing/augmenting populations to increase abundance and distribution of Coast Microseris.	2015
Attempt to establish, maintain, and monitor Coast Microseris individuals in an experimental manner.	Required to determine the feasibility of establishing/augmenting populations to increase abundance and distribution of Coast Microseris.	2017
If suitability tests are successful, test the potential for establishing new self sustaining populations or expanding existing populations through introduction of seeds or seedlings into suitable habitats. Seed bank viability must be determined to facilitate restoration and introductions.		2018 onwards
Undertake analyses to determine the amount and configuration of habitat needed to achieve the recovery objectives.		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.

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

Activity	Effect of activity on critical habitat	Most likely sites
Damaging recreational use (e.g., bicycle, pedestrian and dog traffic)	Soil compaction leading to altered habitat attributes. Disturbance of seed bank potentially burying seeds. Plants may become stressed and die or be unable to germinate due to impaired ability of the habitat to provide suitable soil moisture or light availability. In addition, this activity is likely to introduce or spread invasive alien plant species. Alien plant species compete with Coast Microseris and alter the availability of light, water, and nutrients in the habitat, such that the habitat would not provide the necessary habitat conditions required by Coast Microseris.	Helliwell Park Pike Creek Saxe Point Park Uplands Park Harling Point
Direct land conversion by human development (e.g., development and maintenance or modification of existing structures, roads or trails)	This activity can cause direct land conversion, soil compaction, shading (e.g., by introduced plants or nearby structures), and altered moisture regime (e.g., impounded drainage, or reduced water flow to the plants through ditching or diversion of subsurface water by built structures).	Helliwell Park Pike Creek Saxe Point Park Uplands Park Harling Point
Deliberate introduction or attempts to control invasive alien plants using chemical or mechanical means	This activity can cause soil compaction, introduction of alien species (e.g., accidental introduction such as facilitated by unclean machinery) and direct trampling of plants. Activities to control invasive alien plants (e.g., herbicides, fire, physical removal of invasive alien plants) can also directly impact Coast Microseris plants and their habitat if inappropriate techniques are applied to areas where plants exist.	Helliwell Park Pike Creek Saxe Point Park Uplands Park Harling Point

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 Coast Microseris in Canada will be assessed using the following measures for each of the population and distribution objectives:

Objective 1: Maintain the seven extant populations of Coast Microseris.

- By 2018 best management practices are developed and implemented at three or more sites.
- The populations remain extant.
- By 2023, all populations show a stable or increasing trend in population size[4].

Objective 2: Establish and/or augment populations to increase abundance and distribution if determined to be feasible and biologically appropriate for Coast Microseris.

- By 2018, additional sites have been identified, for establishment or restoration of Coast Microseris population(s).

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

- By 2023, one or more (re)introduction or augmentation experiments are underway at suitable site(s).

9. Statement on Action Plans

One or more action plans will be completed by 2018

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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 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.

The range of Coast Microseris overlaps with a suite of other rare and at risk plants an invertebrates, the totality of which comprise one of the most unique species assemblages known in Canada (GOERT 2002; Table 7). Actions taken to recover Coast Microseris should also benefit these species by improving habitat for them. Restoration of the habitat of Coast Microseris will be beneficial to species associated with this habitat, which are also affected by encroachment of woody species, competition from invasive alien species, and organic matter build up. Actions taken to aid in the recovery of this species should, if conducted in an appropriate manner (e.g., in an open, informative manner), provide benefits for all at risk species and habitats. This can be accomplished by increasing public awareness of the negative environmental consequences associated with invasive alien species, of the need to maintain natural ecological processes (e.g., if fire is identified as being a component of the management for some locations that Coast Microseris occurs), and of the need to protect natural habitats from the impacts of adjacent developments.

However, actions to assist in the recovery of Coast Microseris could have negative effects other species at risk if the actions result in excessive disturbance of the site (e.g., when removing invasive alien species and planted / encroaching woody species). Any on-site activity has the potential to affect other species at risk through trampling or the inadvertent translocation of invasive alien species seeds; therefore, care must be taken to avoid indirect effects. If fire is identified as being a component of the restoration of specific sites that Coast Microseris occurs, care must be taken to ensure that the natural disturbance is contained within a targeted area and that the fire does not inadvertently promote the growth of an invasive alien species.

These 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*.

Table 7. Rare species known to occur within the Canadian range of Coast Microseris and their provincial and federal status. Sources: B.C. Conservation Data Centre 2011, NatureServe 2010.

Scientific name	Common name	B. C. provincial rank	COSEWIC designation	SARA status
Allium amplectens	Slimleaf Onion	S3 Blue	Not assessed	Not assessed
Anagallis minima	Chaffweed	S3 Blue	Not assessed	Not assessed
Alopecurus carolinianus	Carolina Meadow-foxtail	S2 Red	Not assessed	Not assessed
Callitriche marginata	Winged Water-starwort	S1 Red	Not assessed	Not assessed
Carex pansa	Sand-dune Sedge	S2S3 Blue	Not assessed	Not assessed
Carex tumulicola	Foothill Sedge	S1 Red	Endangered	Endangered
Castilleja victoriae	Victoria owl-clover	S1 Red	Endangered	Not assessed
Centaurium muehlenbergii	Muhlenberg's Centaury	S1 Red	Endangered	Endangered
Crassula connata var. connata	Erect Pygmyweed	S2 Red	Not assessed	Not assessed
Clarkia amoena var. lindleyi	Farewell-to-spring	S3 Blue	Not assessed	Not assessed
Dryopteris arguta	Coastal wood fern	S2S3 Blue	Special Concern	Special Concern
Heterocodon rariflorum	Heterocodon	S3 Blue	Not assessed	Not assessed
Isoetes nuttallii	Nuttall's Quillwort	S3 Blue	Not assessed	Not assessed
Limnanthes macounii	Macoun's Meadow-foam	S2 Red	Threatened	Threatened
Lomatium grayi	Gray's Desert-parsley	S1 Red	Threatened	Threatened
Lotus formosissimus	Seaside Birds-foot Trefoil	S1 Red	Endangered	Endangered
Lotus unifoliolatus var. unifoliolatus	Spanish-clover	S3 Blue	Not assessed	Not assessed
Minuartia pusilla	Dwarf Sandwort	S1 Red	Endangered	Endangered
Navarretia intertexta	Needle-leaved Navarretia	S2 Red	Not assessed	Not assessed
Plagiobothrys figuratus	Fragrant Popcornflower	S1 Red	Endangered	Endangered
Psilocarphus elatior	Tall Woolly-heads	S1 Red	Endangered	Endangered
Sanicula arctopoides	Snake-root Sanicle	S1 Red	Endangered	Endangered
Sanicula bipinnatifida	Purple Sanicle	S2 Red	Threatened	Threatened
Trifolium depauperatum var. depauperatum	Poverty clover	S3 Blue	Not assessed	Not assessed
Triphysaria versicolor ssp. versicolor	Bearded owl-clover	S1 Red	Endangered	Endangered
Coenonympha tullia insulana	Common ringlet insulana subspecies	S1 Red	Not assessed	Not assessed
Erynnis propertius	Propertius Duskywing	S2S3 Blue	Not assessed	Not assessed
Euphydryas editha taylori	Taylor's Checkerspot	S1 Red	Endangered	Endangered

This recovery strategy benefits the environment by promoting the conservation and recovery of the Coast Microseris, 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 habitat restoration for Coast Microseris 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.