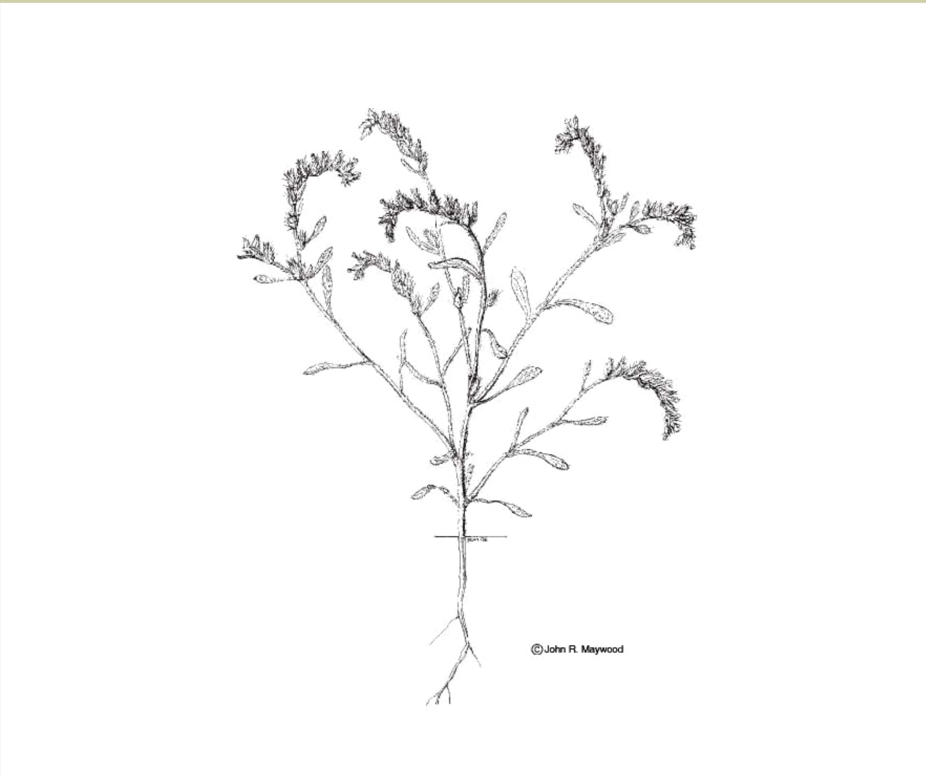
Species at Risk Act
Recovery Strategy Series

Amended Recovery Strategy for the Tiny Cryptantha (*Cryptantha minima*) in Canada

Tiny Cryptantha



2012

Canada

About the *Species at Risk Act* Recovery Strategy Series

What is the *Species at Risk Act* (SARA)?

SARA is the Act developed by the federal government as a key contribution to the common national effort to protect and conserve species at risk in Canada. SARA came into force in 2003, and one of its purposes is *"to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity."*

What is recovery?

In the context of species at risk conservation, **recovery** is the process by which the decline of an endangered, threatened, or extirpated species is arrested or reversed and threats are removed or reduced to improve the likelihood of the species' persistence in the wild. A species will be considered **recovered** when its long-term persistence in the wild has been secured.

What is a recovery strategy?

A recovery strategy is a planning document that identifies what needs to be done to arrest or reverse the decline of a species. It sets goals and objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the action plan stage.

Recovery strategy development is a commitment of all provinces and territories and of three federal agencies — Environment Canada, Parks Canada Agency, and Fisheries and Oceans Canada — under the Accord for the Protection of Species at Risk. Sections 37–46 of SARA (http:/www.sararegistry.gc.ca/the_act/default_e.cfm) outline both the required content and the process for developing recovery strategies published in this series.

Depending on the status of the species and when it was assessed, a recovery strategy has to be developed within one to two years after the species is added to the List of Wildlife Species at Risk. Three to four years is allowed for those species that were automatically listed when SARA came into force.

What's next?

In most cases, one or more action plans will be developed to define and guide implementation of the recovery strategy. Nevertheless, directions set in the recovery strategy are sufficient to begin involving communities, land users, and conservationists in recovery implementation. Cost-effective measures to prevent the reduction or loss of the species should not be postponed for lack of full scientific certainty.

The series

This series presents the recovery strategies prepared or adopted by the federal government under SARA. New documents will be added regularly as species get listed and as strategies are updated.

To learn more

To learn more about the *Species at Risk Act* and recovery initiatives, please consult the Species at Risk (SAR) Public Registry (http://www.sararegistry.gc.ca).

Amended Recovery Strategy for the Tiny Cryptantha (*Cryptantha minima*) in Canada

2012

Recommended citation:

Environment Canada. 2012. Amended Recovery Strategy for the Tiny Cryptantha (*Cryptantha minima*) in Canada. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. vii + 38 pp.

Additional copies:

Additional copies can be downloaded from the SAR Public Registry (http://www.sararegistry.gc.ca).

Cover illustration: Tiny Cryptantha by John R. Maywood ©

Également disponible en français sous le titre
« Programme de rétablissement modifié de la cryptanthe minuscule (*Cryptantha minima*) au Canada »

ISBN 978-1-100-17435-8
Cat. no. En3-4/10-2012E-PDF

DECLARATION

This recovery strategy has been prepared in cooperation with the jurisdictions responsible for the Tiny Cryptantha. Environment Canada has reviewed and accepts this document as its recovery strategy for the tiny cryptantha, as required under the *Species at Risk Act*. This recovery strategy also constitutes advice to other jurisdictions and organizations that may be involved in recovering the species.

The goals, objectives and recovery approaches identified in the strategy are based on the best existing knowledge and are subject to modifications resulting from new findings and revised objectives.

This recovery strategy will be the basis for one or more action plans that will provide details on specific recovery measures to be taken to support conservation and recovery of the species. The Minister of the Environment will report on progress within five years.

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 any other jurisdiction alone.
In the spirit of the Accord for the Protection of Species at Risk, the Minister of the Environment invites all responsible jurisdictions and Canadians to join Environment Canada in supporting and implementing this strategy for the benefit of the tiny criptanthe and Canadian society as a whole.

RESPONSIBLE JURISDICTIONS

Environment Canada (Prairie and Northern Region)
Government of Alberta
Government of Saskatchewan

AUTHORS

This strategy was prepared by Candace Neufeld (Environment Canada, Canadian Wildlife Service – Prairie and Northern Region) and Dean Nernberg (Environment Canada, Canadian Wildlife Service – National Capital Region). Amendments to the strategy were prepared by Candace Neufeld (Environment Canada) and Darcy Henderson (Environment Canada).

ACKNOWLEDGMENTS

The recovery strategy was prepared by Candace Neufeld and Dean Nernberg, and the amendment prepared by Candace Neufeld and Darcy Henderson, on behalf of the Recovery Team for Plants at Risk in the Prairie Provinces. The Recovery Team provided valuable comments on the drafts of this document. Recovery Team members, as of January 2006, included Candace Neufeld (Secretary and Acting Chair; Environment Canada), Jason Greenall (Manitoba Conservation), Robin Gutsell (Alberta Sustainable Resource Development), Lisa Matthias (Alberta Sustainable Resource Development; temporarily acting for Robin Gutsell), Sue McAdam (Saskatchewan Environment), Chris Nykoluk (Agriculture and Agri-Food Canada, Prairie Farm Rehabilitation Administration), and Peggy Strankman (Canadian Cattlemen's Association). Recovery Team participants, as of January 2006, included Cheryl Ann Beckles (Department of National Defence, 17-Wing Detachment Dundurn), Delaney Boyd (Department of National Defence, Canadian Forces Base (CFB) Suffield), Joel Nicholson (Alberta Sustainable Resource Development), and Sherry Lynn Punak (Department of National Defence, CFB Shilo). Dean Nernberg (Environment Canada) was the Recovery Team chair until August 2005. Helpful comments were also provided by Dave Duncan, Renee Franken, Ray Poulin, and staff from Environment Canada, Canadian Wildlife Service, Habitat Conservation Section and Environment Canada, Canadian Wildlife Service, Recovery Section. We thank Cheryl Bradley, who provided her expertise as well as updated information on the species. The Saskatchewan Conservation Data Centre and the Alberta Natural Heritage Information Centre provided updated element occurrences for this species. We would also like to thank all the landowners, lessees, and land managers who allowed us access to their land to do Tiny Cryptantha surveys. The cover illustration was graciously provided by the artist, John Maywood.

STRATEGIC ENVIRONMENTAL ASSESSMENT

In accordance with the *Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals*, a strategic environmental assessment (SEA) is conducted on all SARA recovery planning documents. 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 on non-target species or habitats. The results of the SEA are incorporated directly into the strategy itself, but are also summarized below.

This recovery strategy will clearly benefit the environment by promoting the recovery of Tiny Cryptantha. The potential for the strategy to inadvertently lead to adverse effects on other species was considered. The SEA concluded that this strategy will clearly benefit the environment and will not entail any significant adverse effects. The reader should refer to the following sections of the document in particular: 1.3 Needs of Tiny Cryptantha; 1.5 Threats to the Survival of Tiny Cryptantha and its Habitat; 2.3 Recovery Objectives; 2.4 Research and Management Activities Recommended to Meet Objectives; 2.6 Critical Habitat; and 2.7 Effects on Non-target Species.

RESIDENCE

SARA defines residence as: *a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating* **[Subsection 2(1)]**.

Residence descriptions, or the rationale for why the residence concept does not apply to a given species, are posted on the SAR Public Registry: http://www.sararegistry.gc.ca/plans/residence_e.cfm.

PREFACE[1]

The *Species at Risk Act* (SARA, Section 37) requires the competent minister to prepare recovery strategies for listed Extirpated, Endangered, or Threatened species. Tiny Cryptantha was listed as endangered under SARA in June 2003. Environment Canada, Canadian Wildlife Service – Prairie and Northern Region led the development of this recovery strategy. All responsible jurisdictions (Saskatchewan and Alberta) reviewed and approved the strategy. The strategy meets

[1] Amended March 2011

SARA requirements in terms of content and process (Sections 39–41). It was developed in cooperation or consultation with:

- provincial jurisdictions in which the species occurs — Saskatchewan and Alberta;
- industry stakeholders — Canadian Cattlemen's Association; and
- federal land managers — Department of National Defence (CFB Suffield, 17-Wing Detachment Dundurn), Agriculture and Agri-Food Canada (Prairie Farm Rehabilitation Administration).

The Recovery Strategy for the Tiny Cryptanthe (*Cryptantha minima*) in Canada was posted on the SAR Public Registry in October 2006. This recovery strategy was amended for the purposes of:

- Changing the species name from Tiny Cryptanthe to Tiny Cryptantha, as per the change to Schedule 1 of SARA;
- Identifying Tiny Cryptantha critical habitat; and
- Clarifying Environment Canada's timelines for action planning to the Tiny Cryptantha, which were adjusted to allow for the identification of critical habitat and the finalization of this amendment.

This amendment replaces sections 2.6 and 2.10 of the original recovery strategy as well as revising the Executive Summary, Section 1.2 and Literature Cited and adding Appendices A to E.

EXECUTIVE SUMMARY[2]

- Tiny Cryptantha is a small, bristly-haired annual plant that has minuscule white flowers with yellow centres. It is associated with river valleys and grows on sandy, rolling upland, valley slopes, or terraces in xeric to subxeric environments. In Canada, Tiny Cryptantha has been found in 28 areas in Alberta and four in Saskatchewan.

- Currently identified threats to Tiny Cryptantha include habitat loss and degradation as a result of cultivation, residential development, oil and gas activities, and sand/gravel extraction. Additional threats are modifications to natural processes through altered hydrological regimes and lack of grazing and/or fire, invasion by exotic species, and climate change.

- The overall recovery goal for Tiny Cryptantha is to maintain the persistence of all naturally occurring populations in Canada. The population and distribution objective is to ensure the maintenance or the natural increase of existing populations while maintaining habitat to support their distribution.

- Four objectives have been identified for the recovery of Tiny Cryptantha:
  1) Increase knowledge of the species' distribution and population size by 2008 to the point where critical habitat can be identified and natural population fluctuations are understood (*Priority – Urgent*).
  2) Manage habitat on an ongoing basis, using a landscape approach, to support the distribution of the Canadian population and maintain a minimum of 50% of the largest recorded abundance for each population in at least one in 10 years under the natural range of environmental conditions (*Priority – Urgent*).
  3) Increase knowledge of the biology of Tiny Cryptantha by 2011 to the point where population demographics, reproductive ecology, and genetic variability are understood (*Priority – Necessary*).
  4) On an ongoing basis, increase landowner, land manager, stakeholder, and industry (e.g., oil and gas) awareness of Tiny Cryptantha and its needs so that by 2011, stewardship activities and beneficial management practices are being implemented (*Priority – Beneficial*).

- Research and management activities needed to achieve these objectives include establishing standardized monitoring and surveying guidelines, continuing to monitor and survey for Tiny Cryptantha, evaluating effects of threats, developing beneficial management practices to reduce threats and promoting them to land managers, developing and initiating stewardship agreements with land managers to protect habitat, completing population viability analyses, and initiating additional research to increase knowledge of the biology of this species.

- Owing to a lack of knowledge on the species' abundance, distribution, and habitat requirements/associations, critical habitat is not identified in this recovery strategy. Critical habitat is identified for existing populations of Tiny Cryptantha in Canada.

- One or more action plans will be completed by 2013.

[2] Amended March 2011

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SPECIES ASSESSMENT INFORMATION FROM COSEWIC

Date of Assessment: May 2000

Common Name: Tiny Cryptantha

Scientific Name: *Cryptantha minima*

COSEWIC Status: Endangered

Reason for Designation: Few highly localized, disjunct populations at risk due to extremely low population sizes and occurrence in disturbed areas.

Canadian Occurrence: Alberta, Saskatchewan

COSEWIC Status History: Designated Endangered in April 1998. Status re-examined and confirmed in May 2000. Last assessment based on an existing status report.

1. BACKGROUND

1.1 Description

Tiny Cryptantha (*Cryptantha minima* Rydb.) is an annual species in the Borage family (Boraginaceae). The bristly-haired stems are branched from near the base and grow up to 10–20 cm high. The leaves, also bristly-haired, are spatula-shaped and can be up to 6 cm long by 0.5 cm wide at the base of the plants, but get smaller as they proceed up the stem (Moss 1994). Tiny Cryptantha flowers from late May to early July (Smith 1998; Kershaw *et al*. 2001; Alberta Sustainable Resource Development 2004). The flowers are tube-shaped, with white petals and yellow centres, and are arranged along the top side of the branches (Figure 1). At the base of each flower is a small leaf, or bract. The flowers are up to 2 mm across and 3 mm long. Bristly, green sepals with thickened, whitish midribs surround the flower petals, forming a calyx (Figure 1).

Figure 1. Photo of Tiny Cryptantha plant with flowers.

Within the calyx, four small nutlets (seeds) form, maturing in late July and August; one nutlet is larger and smooth, and three nutlets are smaller and covered by small bumps. The calices turn brown when mature (Figure 2). The plant eventually turns greyish in September before dying.

1.2 Distribution and Abundance[3]

Tiny Cryptantha is native to North America. In Canada, as of 2006, its known locations are 29 extant populations[4] in Alberta and three extant populations in Saskatchewan plus one historic population (Alberta Sustainable Resource Development 2004; C. Bradley pers. comm.; C. Neufeld pers. obs.; D. Nernberg pers. obs.) (Figure 3, Table 1). Tiny Cryptantha is associated with river systems, mainly the South Saskatchewan River valley in the eastern half of Alberta and near the western border of Saskatchewan. Tiny Cryptantha has also been found in the vicinity of the lower Bow and upper Oldman rivers in Alberta and the Red Deer River in Saskatchewan. The nearest location in the United States is in Montana, 450 km from the southernmost Alberta location (Alberta Sustainable Resource Development 2004). The number of populations in the United States is not documented; it is not known what percentage of the species' global distribution and abundance is currently found in Canada, although it is undoubtedly small (Figure 4). There are insufficient historical and long-term data collected for this species to allow a rate of population decline to be determined.

Figure 2. Photo of mature Tiny Cryptantha, showing the brown calices.

[3] Amended May 2011

[4] Using the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) definition, populations are geographically or otherwise distinct groups within a species that have little demographic or genetic exchange (typically one successful breeding immigrant individual or gamete per generation or less) (COSEWIC 2005). This is equivalent to the term "subpopulation" employed by the World Conservation Union (IUCN 2001). NatureServe considers sites within 1 km of each other, or within 2 km if there is appropriate habitat between the sites, to be from the same element occurrence (population) (NatureServe 2004). In the case of annuals, a few hundred metres may constitute separate populations, as long-distance dispersal of seed is rare (Cain *et al.* 2000; Alberta Sustainable Resource Development 2004). As knowledge about the basic ecology and boundaries of Tiny Cryptantha populations increases, this number may change. The Canadian population, or total population, is the total number of mature individuals in Canada (equivalent to the term "population" employed by the World Conservation Union) (COSEWIC 2005).

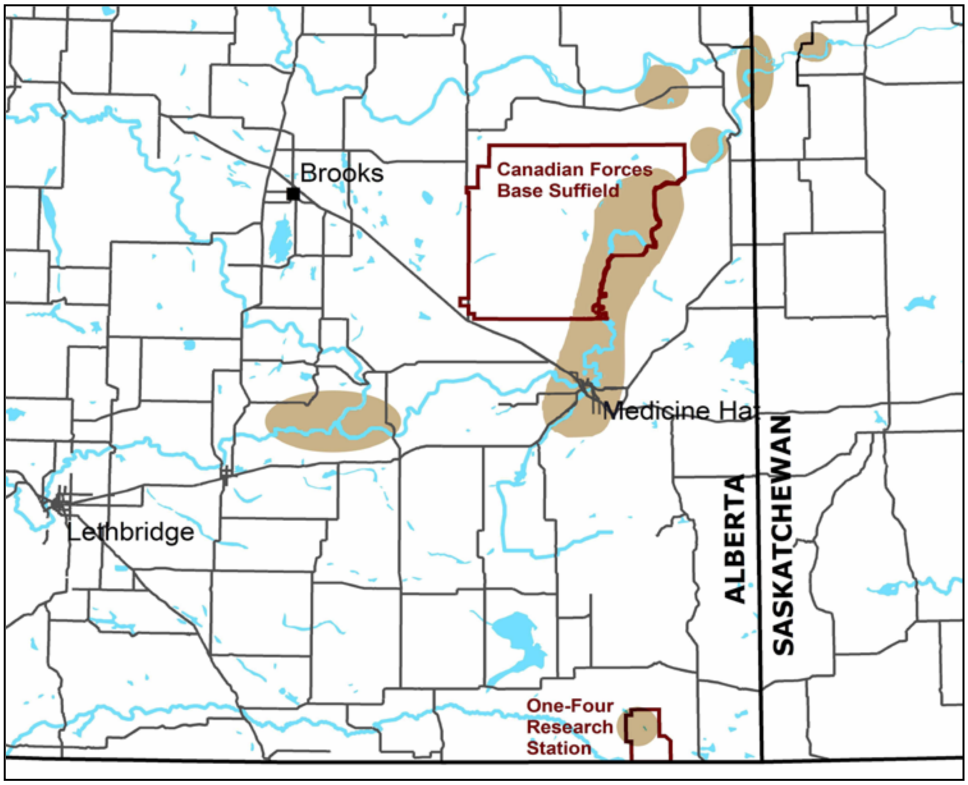

Figure 3. Known range of Tiny Cryptantha in Canada.

In Canada, Tiny Cryptantha is ranked S1 in both Alberta and Saskatchewan and N1 nationally, meaning that it is considered extremely rare, with five or fewer occurrences or very few remaining individuals (Vujnovic and Gould 2002; NatureServe 2004; Saskatchewan Conservation Data Centre 2004).

In the United States, Tiny Cryptantha extends through the central plains (Figure 4), but a rank has not been assigned for its national status. The status of Tiny Cryptantha is not ranked or is under review in Colorado, Kansas, Montana, Nebraska, New Mexico, and Oklahoma. However, it is ranked as vulnerable in Wyoming (S3) and apparently secure in South Dakota (S4).

Globally, Tiny Cryptantha is ranked as demonstrably secure under present conditions (G5) (NatureServe 2004).

Figure 4. Known range of Tiny Cryptantha in North America (adapted from Alberta Sustainable Resource Development 2004).

Table 1. Summary of Tiny Cryptantha populations in Canada[a,b]

Site	Recent population estimate[b]	Land tenure	Threats
ALBERTA			
Onefour	4018	federal land (AAFC-AESB)	oil/gas activity
Oldman River	>500	ditch, private	road maintenance, herbicides, exotics
Bow River			
3–8 km upstream	>568	leased Crown	oil/gas activity, cultivation, invasive exotics
6 km upstream	62[c]		
9 km upstream	5		
11 km upstream	3		
South Saskatchewan River[d]			
Medicine Hat, Seven Persons Creek	9	municipal	oil/gas
Medicine Hat, Gas City Campground	1 100	municipal	habitat degradation
Medicine Hat, Ranchlands	40 000	municipal	urban development
Medicine Hat, Box Springs Road	60	municipal	invasive exotics
km 120–123, east side	450	private	
km 131, west side	>1 000	ditch, private	herbicides, exotics, road maintenance
km 136–141, west side	>2 600	private	oil/gas, cultivation
km 157, east side	11 500[e]	leased Crown	oil/gas, seeding to non-native pasture, cultivation, exotics
km 158, east side	40[f]		
km 160, east side	110		
km 167–169, east side	80[g]		
km 174, east side	0[h]		
km 178, east side	7 500		
km 181, east side	37		
km 190, east side	2		
km 263, west side, valley	20	private	oil/gas
South Empress, east side	900	leased Crown	

Site	Recent population estimate[b]	Land tenure	Threats
South Saskatchewan River, CFB Suffield and CFB Suffield National Wildlife Area			
km 156–175, south Fish Creek[i]	172 174	federal land (Department of National Defence – CFB Suffield)	lack of grazing (some areas), oil/gas (all areas), military activities (some areas)
km 196–198, north Casa Berardi	72 475		
km 200–201, north Nishimoto Flats	16 011		
km 198–200, northwest Koomati	1 390		
km 208, north Mule Deer Springs	1		
km 230, Ypres	399		
SASKATCHEWAN			
South Saskatchewan River			
Estuary	366	leased Crown	
South of Ebenau Island	45	private	cultivation
Red Deer Forks	14 363	leased Crown, private	
Westerham[j]	0	private	

[a] Note that population sizes are difficult to quantify because of yearly fluctuations in population size and the use of different census techniques.
[b] The values in the table are current as of 2006.
[c] 2002 survey.
[d] South Saskatchewan River kilometre values based on Alberta Sustainable Resource Development (2004) and maps from Dickinson and Baresco (1996).
[e] 2003 survey.
[f] >725 found in 2003.
[g] 17 500 found in 2003.
[h] 12 found in 2003.
[i] Site names (e.g. Casa Berardi, Ypres) refer to training area subdivisions in use by CFB Suffield (map: CFB Suffield Reduction – Navaids, Series GSGS 5826-N, Sheet 156, Edition 1-GSGS)
[j] The Westerham site has not been relocated in over 25 years despite numerous surveys and therefore is considered to be historic; it is not considered for inclusion in the population and distribution objectives or critical habitat until it is relocated. In addition, the location provided may be imprecise or inaccurate and it is suspected the specimen may be a misidentification.

1.2.1 Specific Areas in Canada

Alberta

Tiny Cryptantha is found in southeastern Alberta in the vicinity of the upper Oldman River, the lower Bow River, and the South Saskatchewan River from Medicine Hat east to the Saskatchewan border (Table 1).

<u>Onefour</u> – This population is located within the Onefour Agricultural Research Station on Agriculture and Agri-Food Canada land. The population was first found in 2006 and is on the floor of the Lost River Valley on flat to slightly southwest sloping sub-xeric grassland.

Oldman River – The Oldman River site is located 11 km upstream of the confluence with the Bow River in the sandy upland of the Purple Springs dunes in a slightly disturbed area beside a road in sandy soil (Bradley and Ernst 2004).

Bow River – The sites associated with the Bow River are on upland sandy terrain, some associated with side coulees running off the valley, between 3 and 11 km upstream from the confluence with the Oldman River. Sites associated with side coulees appear secure, provided grazing and small patch disturbances from mammals continue with no permanent loss of vegetation.

South Saskatchewan River – The first sighting of Tiny Cryptantha at Medicine Hat was in 1894, with no relocations until large numbers of Tiny Cryptantha were found on valley slopes and sandy uplands within the city limits of Medicine Hat in 2004. Three sites (Seven Persons Creek, Gas City Campground, Box Springs Road) are located along steep coulee slopes and, although near developments (e.g., golf course, campground), are considered secure because the terrain is not suitable for development. In the northern Ranchlands area, plants were on undulating uplands and mid- to upper valley slopes, although over half of the habitat has recently been lost to housing development and road construction (Alberta Sustainable Resource Development 2004; Bradley 2004; Bradley and Ernst 2004).

Additional sites along the South Saskatchewan River, downstream from Medicine Hat, are located on valley benches, upper valley slopes, and adjacent upland areas on both sides of the river in areas used mainly for grazing and some oil/gas activities. These sites are likely secure, particularly the sites on steeper valley slopes, as long as grazing and only small patch disturbances continue and there is no permanent loss of vegetation or major shifts in land use that would negatively affect Tiny Cryptantha (Alberta Sustainable Resource Development 2004).

South Saskatchewan River, CFB Suffield and CFB Suffield National Wildlife Area – The CFB Suffield National Wildlife Area is a federally protected wildlife area comprising 458 km^2 on the east side of CFB Suffield adjacent to the South Saskatchewan River. A small portion of the CFB Suffield training area bisects the CFB Suffield National Wildlife Area and straddles the South Saskatchewan River. Until 2004, only small numbers of Tiny Cryptantha were found in CFB Suffield National Wildlife Area (Macdonald 1997; Alberta Sustainable Resource Development 2004). Surveys in 2004 located large populations of Tiny Cryptantha in both the CFB Suffield National Wildlife Area and the CFB Suffield training area adjacent to the South Saskatchewan River (D. Nernberg pers. obs.). Most of the Tiny Cryptantha sites were located on mid-slope terraces and on the slopes of hills and undulations (D. Nernberg pers. obs.). Although the CFB Suffield National Wildlife Area is a protected area and no motorized military training occurs within its boundaries, other activities occur in the national wildlife area, including cattle grazing and oil and gas activities. Sites outside the CFB Suffield National Wildlife Area in the CFB Suffield training area may be subject to active military operations and oil and gas development; cattle grazing is not allowed in the training areas of CFB Suffield (B. Smith pers. comm.).

Saskatchewan

Until 2004, Tiny Cryptantha had been reported at two locations in Saskatchewan: one near Westerham and one near the border close to Empress, Alberta. Expanded surveys in 2004 relocated one of the historical locations as well as locating new sites for Tiny Cryptantha along the South Saskatchewan River west of Leader to the Alberta border (Table 1). All sites are used for ranching and should be secure as long as there is no major change in land use.

Estuary – The Estuary site is located east of the Estuary ferry on a sandy, undulating, and hummocky valley bottom terrace with stabilized sand dunes.

South of Ebenau Island – The locations that are south of Ebenau Island are on upland habitat near the valley breaks.

Red Deer Forks – This is a large tract of native pasture between the confluence of the Red Deer and South Saskatchewan rivers. Tiny Cryptantha locations are along valley breaks or coulee slopes leading into the river valley.

Westerham – The Westerham site has not been relocated, despite numerous search attempts since it was reported in the 1970s. The site was reported to be an upland area on disturbed, cindery soil adjacent to an old railway bed and elevator. Fendler's cryptanthe (*Cryptantha fendleri*) and Kelsey's cryptanthe (*Cryptantha kelseyana*) currently inhabit the area. The specimen located in the University of Saskatchewan W.P. Fraser herbarium (Accession number 67852) is a young specimen in the flowering stage, and it is difficult to confirm if it is Tiny Cryptantha.

1.3 Needs of Tiny Cryptantha

1.3.1 Environment

Tiny Cryptantha occurs in the Mixed Grassland Ecoregion of the Prairie Ecozone in Saskatchewan and mainly in the Dry Mixedgrass Natural Subregion, with some locations in the Mixedgrass Natural Subregion, of the Grassland Natural Region in Alberta (Alberta Environmental Protection 1994; Acton *et al*. 1998). Tiny Cryptantha grows in a steppe climate, which is characterized as being dry year-round as a result of low annual precipitation levels, high rates of evaporation, and fast surface runoff (Smith 1998; Fung 1999). In Medicine Hat, Alberta, annual precipitation is about 334 mm, with the highest precipitation occurring in June (Environment Canada 2004). In Saskatchewan, annual precipitation at Leader is 360 mm, with the peak precipitation occurring in June. These areas experience warm summers (mean summer temperatures of 18.5°C at Medicine Hat and 17.8°C at Leader) and cold winters (mean winter temperatures of −8.1°C at Medicine Hat and −11.4°C at Leader) (Environment Canada 2004). Soils in the areas where Tiny Cryptantha is growing are Brown and typically formed in sandy fluvial or aeolian materials, described as Orthic Regosols or Rego Chernozems, with coarser soil textures of sandy loam or loamy sand to silty (Kjearsgaard and Pettapiece 1986; Saskatchewan Soil Survey 1990, 1993; Fung 1999; Alberta Sustainable Resource Development 2004; Bradley and Ernst 2004).

1.3.2 Habitat

Tiny Cryptantha appears to occur within a few kilometres of river systems and is typically located in three types of habitat: 1) sandy, level to rolling upland areas, and sand dunes near valley breaks; 2) valley slopes with up to 50% slope; and 3) level or gently sloping terraces in the valley bottom, particularly in meander lobes (Alberta Sustainable Resource Development 2004). On a microhabitat level, Tiny Cryptantha tends to occupy xeric to subxeric sites with slopes most commonly under 20 degrees, with varying aspects, but dominated by southerly to easterly directions. Tiny Cryptantha appears to need habitat with low litter levels and a minimum of 10% bare soil for establishment.

Associated vegetation communities are dominated by needle-and-thread (*Stipa comata*) and blue grama (*Bouteloua gracilis*). They commonly include prickly pear cactus (*Opuntia polyacantha*), Pursh's plantain (*Plantago patagonica*), goosefoot (*Chenopodium pratericola*), pasture sage (*Artemisia frigida*), thread-leaved sedge (*Carex filifolia*), low sedge (*Carex stenophylla*), peppergrass (*Lepidium densiflorum*), Indian rice grass (*Oryzopsis hymenoides*), alkali blue grass (*Poa juncifolia*), and two non-native plants, Russian thistle (*Salsola kali*) and bluebur (*Lappula echinata*) (Alberta Sustainable Resource Development 2004; Bradley and Ernst 2004; C. Neufeld pers. obs.; D. Nernberg pers. obs.).

1.3.3 Limiting Factors

Tiny Cryptantha appears to require some element of disturbance. Habitats that contain Tiny Cryptantha have occasional natural disturbances in the form of deposition, caused by the action of water (terraces in meander lobes), gravity (valley and upland slopes), wind (sandy, upland plains and dunes), and soil-disturbing animals that open up bare soil patches (Alberta Sustainable Resource Development 2004). Areas that have repeated intense disturbances, such as cultivated fields or active sandbars, and areas with actively eroding slopes and cutbanks do not appear to support Tiny Cryptantha populations (Alberta Sustainable Resource Development 2004).

Tiny Cryptantha is an annual plant, with a large portion of its life cycle spent dormant as seed. The continued existence of Tiny Cryptantha populations is reliant on the seed bank. Incorporating seed bank counts with the estimation of population size has not been carried out to date in Canada. Counts of plants and their distribution, if done over a number of years, can give an estimate of the distribution of the seedbed, suitable habitat, and disturbance regimes, as well as weather-related population trends or germination requirements. Numbers of plants can vary greatly from year to year (e.g., zero to over 50 000 plants at one site) because of factors such as the amount of rainfall, the timing of rainfall, seed production from past years, and germination conditions. Different surveying techniques can also result in varying counts within or between years (Alberta Sustainable Resource Development 2004). Therefore, although in some years there may not be any plants growing at a site, these populations should not be considered extirpated, as there is likely viable seed in the seed bank. Similarly, areas that appear to have suitable habitat but no Tiny Cryptantha plants should be resurveyed in years of favourable growing conditions. It is not known how long Tiny Cryptantha seeds remain viable in the seed bank or what proportion of seeds are deposited into the seed bank, but annual plants often depend on seed longevity to buffer against environmental unpredictability (Harper 1977).

Dispersal of Tiny Cryptantha seeds may be limited. The majority of Tiny Cryptantha seed dispersal is likely passive, with seeds falling close to the parent plant, although there may also be dispersal by animals. Bristles on the calyx, which contains the seeds, may catch on fur, or the animals may drag the plants to their burrows for food (Bradley and Ernst 2004). Some seeds may also be dispersed through wind, rain, or snowmelt. Once seeds are on the ground, however, animals, wind, and water do not appear to move seeds significant distances (Primack and Miao 1992). In general, most seeds usually move only a few metres, with anything beyond a few hundred metres being rare (Harper 1977; Primack and Miao 1992; Cain *et al.* 2000). Therefore, seed dispersal to other populations and establishment of new populations may be unlikely. Specific pollinators are unknown, as is the distance between plants for cross-pollination to occur.

1.4 Protection

In addition to the protection afforded to Tiny Cryptantha under the federal *Species at Risk Act*, it is protected by provincial legislation. Tiny Cryptantha was declared endangered in Saskatchewan under Part V of *The Wildlife Act* in 1999, and it is therefore protected on private, provincial, and federal lands. In Alberta, Tiny Cryptantha has been proposed for listing as an endangered species by the provincial Endangered Species Conservation Committee; the development of protective regulations under the provincial *Wildlife Act* is in progress (R. Gutsell, pers. comm.; L. Matthias, pers. comm.).

1.5 Threats to the Survival of Tiny Cryptantha and its Habitat

The threats to Tiny Cryptantha relate ultimately to alteration of habitat, including loss of habitat from changes in land use, such as cultivation or urban development (see Table 1 for site-specific threats). Some proximate causes of habitat alteration include decreased or no grazing, fire control, climate change, and encroachment of invasive vegetation. These are discussed in more detail below.

Adaptive management will be an important component in managing threats to Tiny Cryptantha. In addition, obtaining information on species biology and life history traits will be crucial to understanding where the demographic bottlenecks are, what stages of Tiny Cryptantha are most vulnerable, and the long-term viability of populations.

1.5.1 Habitat Loss or Degradation

Cultivation

In general, the sandy areas and soil type that support Tiny Cryptantha are not considered suitable for agriculture because of low soil moisture, low water-holding capacity, low soil fertility, and susceptibility to wind erosion (Saskatchewan Soil Survey 1993; Geological Survey of Canada 2001). However, some sites may be suitable for cropland, perennial forages, hayfields, or potato crops. In Alberta, some sandy upland areas have been converted to potato crops, and it is possible that areas inhabited by Tiny Cryptantha may be affected in the future (Alberta Sustainable Resource Development 2004; Bradley and Ernst 2004). In addition, areas containing Tiny Cryptantha are often surrounded by mixed prairie grasslands, which are commonly converted for cultivation, creating islands in a landscape dominated by crops. Only 54% of the Dry Mixedgrass Natural Subregion in Alberta and 31.3% of the Mixed Grassland Ecoregion in Saskatchewan are estimated to remain in native vegetation (Alberta Sustainable Resource Development 2000; Gauthier *et al*. 2002). Cultivation is mostly a threat to those populations occurring on the upland habitat or in the river valley terraces that are often seeded to non-native pasture or cultivated and irrigated. Habitat adjacent to valley breaks or on valley slopes is thought to be secure, as the topography of these areas does not facilitate cultivation. However, irrigation and the use of some chemicals (e.g., herbicides, fertilizer, pesticides) on adjacent converted upland areas have the potential to alter the habitat on nearby slopes (e.g., change species composition, canopy cover, hydrology, soil stability, degrade pollinator populations).

Residential Development

In 2004, over 40 000 Tiny Cryptantha plants were found within the municipality of Medicine Hat on valley slopes, upland areas, and benches. Parts of this area have been developed for residential housing and roads since the 2004 survey. Some plants located on steep valley slopes would likely not be disturbed directly by development but could suffer as a result of loss of a large portion of the adjacent population and the seed bank, as well as potentially being affected by invasive species from development and increased vegetation growth resulting from increased water runoff and fertilizer from residential landscapes.

Oil and Gas Activities

Some Tiny Cryptantha habitat has been lost to oil and gas activities, including road building, well sites, pipelines, and other actions related to active exploration and oilfield development. In some areas, these activities occur without any rare plant surveys being conducted. Tiny Cryptantha has not been observed in areas where there are repeated disturbances or heavy compaction, such as on roads. Although some of these disturbances may create temporary habitat for species such as Tiny Cryptantha, these areas are not good quality habitat in the long term, as plants often get destroyed. Moreover, in some areas, non-native plant species are still being used to reclaim disturbed areas along access roads and well-sites, although this is no longer allowed on provincial Crown lands (Saskatchewan Agriculture, Food and Rural Revitalization 2000; Government of Alberta 2004). Nevertheless, even when native seed mixes are used in reclamation, invasive species often still colonize these areas. These non-native species have the potential to invade and outcompete native species (Alberta Sustainable Resource Development 2004).

Sand and Gravel Removal

Sand and gravel removal for road building or personal use and the levelling of dunes are potential threats to Tiny Cryptantha populations. Gravel extraction is known to have occurred at one site and is present at areas that contain potential Tiny Cryptantha habitat (Alberta Sustainable Resource Development 2004). The removal of sand or gravel may destroy portions of the Tiny Cryptantha seed bank, which could have substantial implications for the future survival of the populations at these sites.

Military Activities

It is not clear how military activities may affect Tiny Cryptantha. Tiny Cryptantha occurs in large numbers within CFB Suffield (Bradley and Ernst 2004; D. Nernberg pers. obs.). The potential exists for road creation, use of heavy machinery, and military operations to damage Tiny Cryptantha plants or populations. Some minor disturbance may enhance populations by opening habitat and suppressing competition from other plant species.

1.5.2 Modification of Natural Processes

Altered Hydrological Regimes

Altering the hydrological regime of an area may be detrimental to Tiny Cryptantha. Because Tiny Cryptantha appears to be limited to xeric–subxeric habitat, changes to the moisture regime could adversely affect its growth and survival. Its association with river systems means that any developments that restrict natural periodic floods, cause unnatural flooding, inhibit channel migration, or divert water could alter the disturbance regime beyond the range of natural variability, potentially negatively impacting the creation and maintenance of Tiny Cryptantha habitat (Smith 1998; Alberta Sustainable Resource Development 2004). Dams in general result in numerous impacts to habitat; native rangeland is often converted to irrigated cropland, and floodplains and valley bottoms become flooded from reservoir inundation, both resulting in habitat loss and fragmentation. Downstream of dams there are reduced flooding events, reduced water flow, and reduced sediment deposition on floodplains, resulting in changes to species richness, species composition, and vegetation structure (Golder Associates 2002). Damming of the South Saskatchewan River near Outlook, Saskatchewan, in 1967 resulted in flooding of a considerable area; it is not known if Tiny Cryptantha populations were present in the area (Smith 1998). The Meridian Dam project, proposed to be located along the South Saskatchewan River near the Saskatchewan–Alberta border (Government of Alberta 2002), would have undoubtedly impacted Tiny Cryptantha habitat had it been approved. Other anthropogenic alterations, such as roads, urban developments, and irrigation, can also change the hydrology of habitat by modifying drainage patterns and water flow in an area.

Lack of Grazing and/or Fire

The occurrence of Tiny Cryptantha in habitats that have periodic depositional processes by wind, water, gravity, or animals suggests a reliance on disturbance. These disturbances shift the soil and can open up the canopy and create spaces for germination and establishment. Fire and grazing assist these disturbance processes by destabilizing sand hills, opening up areas of bare soil, and keeping canopy vegetation and litter levels lower (Hayes and Holl 2003). Grazing can also create trails or small blowouts that may be important for Tiny Cryptantha establishment. Studies have shown that grazing can help maintain or increase populations of annual plants in mesic grasslands (Collins 1987; Hayes and Holl 2003). There have been no observations of animals grazing on Tiny Cryptantha.

1.5.3 Invasive Exotic Species

Tiny Cryptantha appears to require an element of shifting soil, relatively low vegetation and litter cover, and open patches of soil for successive germinations and growth. Invasive exotic species such as crested wheat-grass (*Agropyron cristatum*), which can stabilize sand hill areas and produce higher levels of canopy cover and litter, would likely outcompete Tiny Cryptantha and create unsuitable habitat. Tiny Cryptantha has been found only in native pastures and has not been found in pastures converted to, or heavily invaded by, exotic species. Some areas along the South Saskatchewan River valley, particularly the meander lobe terraces, have been converted to crested wheat-grass, while other areas are adjacent to pastures of crested wheat-grass, which can invade native pasture (Bush 2001; Alberta Sustainable Resource Development 2004). There is the potential for Tiny Cryptantha plants to be killed or for the species' habitat to be negatively altered by indiscriminate use of herbicides intended to control invasive species.

1.5.4 Climate and Natural Disasters

Climate Change

Tiny Cryptantha appears to prefer hotter, dry climates in the Canadian prairies, as indicated by its current distribution. If there is a shift towards a warmer climate within its Canadian range as a result of global warming, as predicted by climate change projections (Government of Canada 2004), this may favour Tiny Cryptantha and potentially result in an expansion in its range, provided there is suitable habitat remaining. If there is a shift to a cooler climate within its Canadian range, this could be detrimental to Tiny Cryptantha, decreasing its range and possibly leading to extirpation (Alberta Sustainable Resource Development 2004). However, the potential effects of climate change on this species are only speculative.

2. RECOVERY

2.1 Recovery Feasibility

Historical population sizes and distribution for this species are unknown. There is the potential for the status of this species to be downlisted from Endangered if there are new populations found in Canada. However, this species may inherently have a small area of occupancy in Canada. Any continuing decline in the area of suitable habitat, combined with large population fluctuations from factors such as weather, may keep this a species at risk. Nevertheless, it should be feasible to maintain this species under the normal range of environmental conditions. Therefore, the maintenance of existing populations and their distribution will constitute the recovery of Tiny Cryptantha.

Recovery of Tiny Cryptantha is both biologically and technically feasible. There are activities and actions that can reduce the threats to Tiny Cryptantha, and these can be feasibly implemented. This species is adapted to disturbances such as grazing and fire, which can be communicated as beneficial actions with careful management on appropriate lands. Measures to reduce the threat of exotic species can also be implemented. A number of locations currently occupied by Tiny Cryptantha are areas managed as protected wildlife areas (e.g., CFB Suffield National Wildlife Area). Remaining sites could be secured through stewardship agreements with landowners.

2.2 Recovery Goal

The recovery goal for Tiny Cryptantha is to maintain the persistence of all naturally[5] occurring populations in Canada.

2.2.1 Population and Distribution Objective

The population and distribution objective is to ensure the maintenance or the natural increase of existing populations while maintaining habitat to support their distribution by 2021.

[5] Naturally occurring population refers to any population within the native range on naturally occurring habitat. It excludes horticultural populations or those that are dispersed by humans and establish themselves outside the native range or on unnatural habitats.

2.3 Recovery Objectives

Objective 1: Increase knowledge of the species' distribution and population size by December 2008 to the point where critical habitat can be identified and natural population fluctuations are understood (*Priority – Urgent*).

Objective 2: Manage habitat on an ongoing basis, using a landscape approach, to support the distribution of the Canadian population and maintain a minimum of 50% of the largest recorded abundance for each population in at least one in 10 years under the natural range of environmental conditions. This includes developing an understanding of management techniques, threats, and habitat associations (*Priority – Urgent*).

This objective was developed using the best available expert knowledge and reflects the need to take into account the widely fluctuating annual population levels and the need to set a reasonable trigger for taking action. It is speculated that conditions conducive for germination and growth of this species may occur in at least one out of every 10 years. A 50% target was chosen to create a threshold at which concern for population persistence and viability would be triggered and more intensive investigation initiated. To set the target too high might trigger unnecessary actions. To set the target too low may risk allowing the population to get too small or disappear.

Objective 3: Increase knowledge of the biology of Tiny Cryptantha by 2011 to the point where population demographics, reproductive ecology, and genetic variability are understood (*Priority – Necessary*).

Objective 4: On an ongoing basis, increase landowner, land manager, stakeholder, and industry (e.g., oil and gas) awareness of Tiny Cryptantha and its needs so that by 2011, stewardship activities and beneficial management practices are being implemented (*Priority – Beneficial*).

2.4 Research and Management Activities Recommended to Meet Objectives

As described below, one of the main factors that may impede recovery planning activities, in addition to the threats, is a lack of knowledge about this species. Further research will be an essential component of the overall strategy to recover the species.

Distribution and Abundance

There is a lack of knowledge about the entire distribution of Tiny Cryptantha, as well as its population abundance. Not knowing the locations of all populations of Tiny Cryptantha may result in populations not being protected and being potentially lost. Failing to determine the distribution of the seed bank could result in parts of the population not being protected or managed. As Tiny Cryptantha is an annual species, there can be considerable fluctuation in population abundance and distribution from year to year. Long-term information on population dynamics would help to understand species viability.

Population Viability

There is a lack of information on the natural history and life cycle of Tiny Cryptantha. This includes information about the seeds (production, germination rates, germination requirements, viability, dormancy, seed bank longevity, dispersal, and dispersal distances), pollination (identification of pollinators and distance of pollen dispersal), genetics (metapopulation dynamics and genetic variability within Canadian populations and within North America), and predators. This information is necessary to understand the population viability of the species.

Table 2 provides a general description of the research and management activities that are recommended to meet the objectives and address the threats. The action plan(s) will contain more detailed information on the actions and the implementation schedule.

2.5 Broad Strategies to Address Threats

2.5.1 Habitat Loss or Degradation

The recovery of Tiny Cryptantha will include identifying activities that are detrimental to this species. Habitat protection, while essential to recovery, needs to be used in combination with management to ensure the continued persistence of this species. Effective conservation of this species will require appropriate management practices to be in place. Beneficial management practices will be identified and stewardship or conservation agreements will be developed with landowners and managers to conserve habitat and promote existing supportive management practices for this species. In addition, an education and communication program will be developed for land managers and the general public to minimize habitat deterioration. The effects of military activities on Tiny Cryptantha will be assessed and stewardship agreements will be developed with military bases to manage for Tiny Cryptantha. Recommended guidelines or restrictions of setback distances for various activities will be developed for use by regulatory agencies.

2.5.2 Modification of Natural Processes

More information is needed on the roles of grazing and fire in sand hill environments in the southern prairies and the subsequent effect on Tiny Cryptantha. More information is also needed on the interaction between fire and grazing and its role in shaping vegetation communities in these areas. The recovery of Tiny Cryptantha will include an evaluative and adaptive approach to identifying appropriate beneficial management practices.

2.5.3 Invasive Exotic Species

The recovery of Tiny Cryptantha will include identifying the impacts of invasive species on Tiny Cryptantha establishment and persistence. Beneficial management practices will be identified and stewardship agreements will be developed with land managers to ensure that habitat quality for the Tiny Cryptantha is conserved.

2.5.4 Climate and Natural Disasters

Although it is probably not possible to mitigate this threat, monitoring of populations may elucidate trends. However, to identify trends, long-term data sets are required, and the fluctuating nature of annual plants may make it difficult to draw conclusions. If trends demonstrate that changes are occurring, either negatively or positively, assessment of potential beneficial actions would occur at that time.

Table 2. Strategies to Affect Recovery

Priority	Objective No.	Broad strategy	Threat/concern addressed	Recommended research/management activities
Urgent	1	• Inventory and monitoring	• Lack of knowledge • Climate	• Develop simple guidelines for monitoring, including methods for estimating population size, which should be implemented by all organizations/agencies in both provinces. • Compile all data on Tiny Cryptantha, and map locations and distribution of populations, if not already available. Determining where data will be stored and managed will be important. • Continue surveying and monitoring known locations with Tiny Cryptantha. • Implement a study on habitat suitability and predictability for occurrence within different locations. • Survey similar habitats for potential additional populations. • Identify critical habitat for Tiny Cryptantha. • Complete population viability analyses on known populations to determine population viability under current conditions (unlikely to be completed by 2008).
Urgent	2	• Beneficial management practices and stewardship • Education/ communication • Research	• Habitat loss/ degradation • Modification of natural processes • Invasive exotics	• Continue to monitor populations for trends, abundance, and extent. • Continue to evaluate the effect of threats on the various populations. • Identify the positive and/or negative impacts of grazing (domestic and wild herbivory), idling, brush control, fire, floods, and herbicides using incidental evidence, past observations, and research; identify beneficial management practices for the species based on the outcomes. • Conduct research on the effects of exotic species invasion on the presence of Tiny Cryptantha. Identify and evaluate methods to control the invasion, including biological control, herbicides, and grazing. • Develop a list of the potential effects of resource extraction. Make recommendations for appropriate regulatory agencies (i.e., develop plant species at risk guidelines for set-back distances). • Convey recommendations and beneficial management practices to landowners and land managers through conservation and stewardship agreements. Communicate existing supportive land management practices where appropriate. • Use adaptive management throughout to improve management practices. • Examine the influence of companion vegetation (e.g. impact of canopy cover, litter, amount of bare soil). • Recognize and ensure appropriate conservation and stewardship of Tiny Cryptantha habitat.

Priority	Objective No.	Broad strategy	Threat/concern addressed	Recommended research/management activities
Necessary	3	• Research	• Lack of knowledge	• Examine the life cycle of Tiny Cryptantha, including seed bank longevity, size of the seed banks, seed viability, impacts of rainfall, mechanisms of seed dispersal, seed germination rates, specific germination requirements, establishment requirements, rates of seed and seedling loss, seed production, and establishment success. Knowledge of reproductive ecology and population demographics will be important for assessing population viability. • Investigate seed and pollen dispersal distances and the degree of isolation of populations (metapopulation dynamics). • Investigate genetic variability within and between Canadian and U.S. populations. • Establish a seed gene bank. • Investigate systematics of plants within Canada and between Canada and the United States. This includes examining morphological differences between plants and whether there is hybridization with other *Cryptantha* species, such as Kelsey's cryptanthe and Fendler's cryptanthe. • Determine the pollinators of Tiny Cryptantha.
Beneficial	4	• Education/ communication	• Habitat loss/ degradation • Modification of natural processes • Invasive exotics	• Develop an overall approach to landowner and public communication. This may include factsheets and interpretation programs for the public, recreational users, and land managers. • Develop a web site on Tiny Cryptantha and its threats; encourage people to contribute sightings. • Promote beneficial management practices to landowners and land managers. • Coordinate among government departments and non-government organizations regarding surveying and landowner communication.

2.6 Critical Habitat[6]

2.6.1 Approaches to Identifying Critical Habitat

Critical habitat has been identified using the best available information (up to 2006), and is believed to be sufficient to meet the population and distribution objectives. The identification of critical habitat will be updated periodically to include any new populations or occurrences that meet the specified criteria.

The approach used for identifying critical habitat for the Tiny Cryptantha is based on a decision tree developed by the Recovery Team for Plants at Risk in the Prairie Provinces as a guidance for identifying critical habitat for all terrestrial and aquatic prairie plant species at risk (see Appendix A).

The first decision is regarding the quality of available information on Tiny Cryptantha occurrences in Canada, with the choice of accepting or rejecting any given occurrence for consideration as critical habitat based on three criteria that were used to define the quality of information. The three criteria relate to the number of years since the last known occurrence was relocated and/or revisited, the precision and accuracy of the geographic referencing systems used to locate the occurrence and an evaluation of whether the habitat, in its current condition, remains capable of supporting the species. If the result of this first decision is that a given occurrence is accepted for consideration as critical habitat, then the second decision can be considered. If the result of this first decision is that a given occurrence is not accepted for consideration, then the location of the postulated occurrence is excluded from consideration as critical habitat at this time. However it may be considered in future identification of critical habitat, depending on the outcome of future surveys. Of the 32 recorded populations in Canada, occurrences associated with 1 population were excluded based on this first decision due to being historic (not relocated in more than 25 years) and due to imprecise location information. The potential for the habitat to support occurrences was confirmed between 2004 and 2006 at all of the remaining 31 populations.

The second decision is based on how well the habitat is defined. If habitat is not well defined, as in the case of the Tiny Cryptantha, critical habitat consists of the area encompassing the occurrence (area of occupancy) and all natural landform, soil, and vegetation features within a 300 meter distance of the occurrence.

Tiny Cryptantha habitat is restricted to semi-arid grasslands on coarse-textured soils. These areas are influenced by some level of disturbance and are poorly defined in space and time. Thus, critical habitat for the Tiny Cryptantha is identified at this time as the area encompassing the occurrence (area of occupancy of the population) and all natural landform, soil, and

[6] Amended March 2011

vegetation features within a 300 meter distance of each occurrence[7]. All existing human developments and infrastructure within the area identified as critical habitat are exempt from consideration as critical habitat. The 300 m represents the minimum distance needed to maintain the habitat required for long term survival of the species at this occurrence. This specific distance was based upon a detailed literature review that examined edge-effects of various land use activities that could affect resource availability for native prairie plants generally, and could contribute to negative population growth (see Appendix B).

2.6.2 Identification of the Species' Critical Habitat

Critical habitat for Tiny Cryptantha is identified in this document based on the best available knowledge at this time. A map showing the location of areas containing critical habitat is provided in Appendix C. The total size of the area containing critical habitat is 8298 hectares (83 km^2) which occupies or overlaps into 208 quarter-sections of land in the Dominion Land Survey System. In Saskatchewan, 4 quarter sections that partially contain critical habitat are privately owned, 7 quarter sections are provincially owned, and 3 have both provincial and privately owned portions. In Alberta, 20 quarter sections are privately owned, 15 municipally owned, 53 provincially owned, and 99 federally owned, with 7 having both provincial and federal owned portions (see Appendix D). Out of the total, 66 quarter sections that contain portions of critical habitat are within Canadian Force Base (CFB) Suffield National Wildlife Area. Only the natural landform, soil, and vegetation features within the boundaries displayed in Appendix C are critical habitat.

In accordance with Section 124 of the *Species at Risk Act*, the precise locations of the Tiny Cryptantha occurrences are not presented in this document to protect the species and its habitat. In order to locate this critical habitat, a list of quarter sections is provided (Appendix D). All jurisdictions and landowners who are controlling surface access to the area, or who are currently leasing and using parts of this area, will be provided with Geo-referenced Information System spatial data or large-format maps delineating the critical habitat displayed in Appendix C upon request. No permanent signs have been, or will be, placed in the field to delineate this critical habitat. The location information is housed with Environment Canada, Prairie and Northern Region, Environmental Stewardship Branch, Edmonton, Alberta.

[7] Rivers, wetlands, and forested areas are exempt from the definition of natural landforms and vegetation. In addition, large barriers like river channels or cultivated fields (e.g., greater than 150 m wide) can create a discontinuity in the natural habitat. These barriers effectively overwhelm other edge effects at the distal end of critical habitat, or prevent effective dispersal of the plant at the proximal end closest to the occurrence. In these particular cases, some patches of natural vegetation on natural landforms within a distance of 300 m but discontinuous from the habitat occupied by the plants may be exempt from consideration as critical habitat (see Appendix A).

2.6.3 Examples of Activities Likely to Result in Destruction of Critical Habitat

Destruction is determined on a case by case basis. Destruction would result if part of the critical habitat were degraded, either permanently or temporarily, such that it would not serve its function when needed by the species. Destruction may result from a single or multiple activities at one point in time or from the cumulative effects of one or more activities over time (Government of Canada 2009).

Examples of activities that may result in destruction of the Tiny Cryptantha critical habitat include, but are not limited to:

1) Compression, covering, inversion, or excavation/extraction of soil – Examples of compression include the new creation or expansion of permanent/temporary structures, trails, roads, repeated motorized traffic, and objects that concentrate livestock activity and alter current patterns of grazing pressure such as spreading bales, building new corrals, adding more salting stations, or adding more water troughs. Compression can damage soil structure and porosity, or reduce water availability by increasing runoff and decreasing infiltration, such that the critical habitat is destroyed. Examples of covering the soil include the new creation or expansion of permanent/temporary structures, spreading of solid waste materials, or road bed construction. Covering soil prevents solar radiation and water infiltration needed for germination or survival of plants, such that the critical habitat is destroyed. Examples of soil inversion and/or extraction include new or expanded cultivation, sand and gravel extraction pits, dugouts, road construction, pipeline installation, and stripping of soil for well pads or fireguards. Soil inversion or excavation/extraction can alter soil porosity, and thus temperature and moisture regimes, such that vegetation communities change to those dominated by competitive weedy species, and the habitat is therefore destroyed. Activities required to manage, inspect and maintain existing facilities and infrastructure, which are not critical habitat but whose footprints may be within or adjacent to the identified critical habitat, are not examples of activities likely to result in the destruction of critical habitat due to soil compression, covering, inversion, or excavation/extraction, provided that they are carried out following the most current guidelines aimed at protecting the critical habitat of the Tiny Cryptantha (e.g., Henderson 2010).

2) Alteration to hydrological regimes - Examples include temporary or permanent inundation resulting from construction of impoundments downslope or downstream, and accidental or intentional releases of water upslope or upstream. As the seed bank and plants of Tiny Cryptantha are adapted to semi-arid conditions, flooding or inundation by substances like water or hydrocarbons, even for a short period of time, can be sufficient to render habitat unsuitable for survival and re-establishment. Even construction of a road can interrupt or alter overland water flow, altering the conditions of the habitat required for the long-term survival of the species at this occurrence enough to render it unsuitable for growth.

3) Indiscriminate application of fertilizers or pesticides – Examples of both pesticides and fertilizer effects that change the habitat include increasing soil water and nutrient availability such that species composition of the surrounding community changes. The altered interspecific competition could render the habitat unsuitable for the species at risk. Additional examples are the single or repeated use of broad-spectrum insecticides that may negatively affect pollination rates and reduce reproductive output, such that the functioning of critical habitat may be negatively impacted.

4) Spreading of liquid wastes – Examples include spreading of materials such as manure, drilling mud, and septic fluids. These have the potential to negatively alter soil resource availability, species composition, increase surrounding competitor plants, such that population declines occurs. This effectively destroys the critical habitat. Unlike covering the soil, these liquid or semi-liquid materials can infiltrate the surface in the short-term, but leave little long-term evidence at the surface that could point to the cause of negative changes observed thereafter.

5) Deliberate introduction or promotion of invasive alien species – Examples of deliberate introduction include intentional dumping or spreading of feed bales containing viable seed of invasive alien species, or seeding invasive alien species onto a disturbed area within critical habitat where the invasive alien species did not already occur. Examples of deliberate promotion include use of uncleaned motorized recreational vehicles on existing race courses, where many of the vehicles arrive contaminated from off-site use and represent significant dispersal vectors for invasive alien species. Once established, these invasive alien species can alter soil resource availability and directly compete with species at risk, such that population declines occur. This effectively destroys the critical habitat. The following invasive alien species are not restricted by any other legislation due to their economic value, yet invasion by these species could destroy critical habitat for Tiny Cryptantha: Crested Wheatgrass (*Agropyron cristatum*), Yellow Sweet Clover (*Melilotus officinalis*), White Sweet Clover (*Melilotus alba*), and Baby's Breath (*Gypsophila elegans*). This form of destruction is often a cumulative effect resulting from the first four examples of critical habitat destruction.

While the human activities listed above can destroy critical habitat, there are a number of activities that can be beneficial to Tiny Cryptantha and its habitat. These activities are described in Appendix E.

2.7 Effects on Non-target Species

A number of plant species at risk rely on sandy environments in the prairies, including small-flowered sand verbena (*Tripterocalyx micranthus*), hairy prairie-clover (*Dalea villosa* var. *villosa*), and smooth goosefoot (*Chenopodium subglabrum*). These species will benefit from research on sand hill environments. In addition, there are a number of provincially rare plant species that are found in the same habitat as Tiny Cryptantha. These include stinking goosefoot

(*Chenopodium watsonii*), Kelsey's cryptanthe, nodding umbrella-plant (*Eriogonum cernuum*), false buffalo-grass (*Munroa squarrosa*), narrow-leaved umbrella-wort (*Mirabilis linearis*), and clammyweed (*Polainsia dodecandra*).

There are also a number of rare vertebrate species that use sandy habitat, including Ord's kangaroo rat (*Dipodomys ordii*), olive-backed pocket mouse (*Perognathus fasciatus*), northern grasshopper mouse (*Onychomys leucogaster*) (Pattie and Fisher 1999), Western Hognose Snake (*Heterodon nasicus*) (Russell and Bauer 1993), and Prairie Rattlesnake (*Crotalus viridus*); these species may also benefit from the conservation of Tiny Cryptantha habitat. There are also a number of invertebrate species found in close association with sand dune and sand plain habitats (e.g., tiger beetles, moths, burrowing wolf spiders, etc.; J. Acorn pers. comm.) that may benefit from conservation and management of sandy environments and dune ecosystems.

Sand hill and sand plain communities are very diverse, and management actions will need to maintain a variety of stages of dune stabilization (i.e., stabilized to active) to preserve ecological diversity. Recovery activities for Tiny Cryptantha should be combined with activities for other species occurring in sand hill and sand plain ecosystems in the southern prairies. Efforts should be coordinated with other recovery teams for the most efficient use of resources and to prevent duplication of research. Creation of a multispecies action plan may be beneficial for the species inhabiting this ecosystem (e.g., Multiple Species at Risk, or MultiSAR, in Alberta; Downey *et al*. 2005).

2.8 Evaluation of Success

A number of measures will be used to evaluate the success of the recovery strategy. These include the continued persistence of existing populations and conservation of habitat, which can be measured through a monitoring program. In addition, increased awareness of Tiny Cryptantha can be measured by feedback from landowners, comparing public awareness over time, measurable changes in management practices, and the number of agreements or other forms of protection established over time.

2.9 Additional Information Required

Knowledge gaps for Tiny Cryptantha have been identified in section 2.3 Recovery Objectives, section 2.4 Research and Management Activities Recommended to Meet Objectives, and Table 2 and include:

1) standardized guidelines for inventory and monitoring of Tiny Cryptantha;

2) full extent of population distribution and abundance;

3) population trends of Tiny Cryptantha;

4) habitat preferences and critical habitat of Tiny Cryptantha;

5) effect and extent of factors influencing Tiny Cryptantha habitat (e.g., timing and intensity of grazing, idling, fire control, invasive species);

6) knowledge of the species' life cycle, including mechanisms of seed dispersal and dispersal distances, seed production per plant, seed germination rates and establishment success, germination requirements, seed viability and overwintering success, seed bank longevity, rates of seed germination loss, rates of seed predation and decomposition, importance of seed bank to long-term population viability, population genetics, and identification of pollinators; and
7) degree and effect of isolation from other populations.

2.10 Action Plan Timeline[8]

Completion of an Action Plan has been delayed pending identification of critical habitat and finalization of this amendment to the Recovery Strategy for Tiny Cryptantha. One or more action plans for Tiny Cryptantha will now be completed by 2013. There is a potential for a multispecies or an ecosystem–based action plan that could benefit multiple species at risk inhabiting this ecosystem.

[8] Amended March 2011

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APPENDIX A. Decision Tree for Determining the Type of Critical Habitat Identification Based on Biological Criteria

This decision tree was developed by the Recovery Team for Plants at Risk in the Prairie Provinces, to guide the approach for identifying critical habitat for all terrestrial and aquatic prairie plant species at risk.

The first decision is regarding the quality of available information on the species occurrences in Canada, with the choice of accepting or rejecting any given occurrence for consideration as critical habitat based on three criteria.

The second decision is based on how well the habitat is defined. If habitat is not well defined, critical habitat consist of the area encompassing the occurrence and all natural landform, soil, and vegetation features within a 300 m distance of the occurrence.

For species that occupy well-defined and easily-delineated habitat patches, a third decision relates to the ease of detection of the species and the spatial and temporal variability of their habitat.

Decision Tree:

1a. Occurrences have not been revisited for >25 years, **or** use imprecise and/or inaccurate geographic referencing systems, **or** the habitat no longer exists at that location to support the species (no critical habitat will be defined until more is known about the population and location)
1b. Occurrences have been relocated and revisited in past 25 years, **and** habitat has been revisited in past 5 years to confirm it has the potential to support an occurrence, **and** geographic reference is accurate and precise (go to 2)

2a. Species is a generalist associated with widespread habitats, **or** a specialist that occupies dynamic disturbance regimes difficult to delineate as patches in space, **or** occupies habitat that is otherwise poorly defined (***critical habitat area = occurrences +*** all natural landform, soil, and vegetation features within a 300 meter distance of each occurrence)
2b. Species occupies well-defined and easily delineated habitat patches in space (go to 3)

3a. Habitat patches are spatially static in the medium to long term, **or** species is easy to reliably detect (***critical habitat area = occupied habitat patches +*** all natural landform, soil, and vegetation features within a distance of 300 meters of the habitat patches)
3b. Habitat patches are spatially dynamic in the medium to long term, **or** species is difficult to reliably detect (***critical habitat area = occupied and potentially occupied habitat patches +*** all natural landform, soil, and vegetation features within a distance of 300 meters of the habitat patches).

Notes

Criterion 1a is consistent with NatureServe guidelines for data quality, in that records >25 years old with no subsequent revisit record are least accurate.

Criterion 1b is consistent with SARA Sections 46 and 55 which require reporting on progress towards meeting recovery objectives at five-year intervals.

Criteria 2a, 3a and 3b are consistent with recommendations in Appendix B. In some cases a large barrier exceeding 150 m in width creates a discontinuity in the natural habitat within the 300 m like a major river channel or cultivated field. These barriers effectively overwhelm other edge effects at the distal end of the 300 m, or prevent effective dispersal of the plant at the proximal end closest to the occurrence. In these particular cases, some patches of natural vegetation on natural landforms within a distance of 300 m, but discontinuous from the habitat occupied by the plants, may be exempt from consideration as critical habitat.

Criterion 3 will be applied only if information is sufficient to classify the habitat as spatially static or dynamic and to classify the species' detectibility as easy or difficult. If information is not sufficient, critical habitat will be identified as per 2a until studies are completed to obtain the necessary information.

APPENDIX B. Rationale for Including a Distance of 300 m from Plant Occurrences in Critical Habitat Identification

Terrestrial plants are sessile and their propagules (seeds, rhizomes, or stolons) are more dispersal-limited than the offspring of mobile organisms like vertebrates and invertebrates. Terrestrial plants also compete for the same primary resources of space aboveground for sunlight and gas exchange, and space belowground for water and nutrients. To protect habitat required for survival or recovery of a plant, it is also necessary to protect the current distribution of these resources where the plants are known to occur. Any human activity that could disrupt this otherwise natural distribution of resources could effectively destroy the critical habitat of a plant species at risk. Often human activity may occur at one site but the effects of that activity occur at another site. Alternatively, the effect of human activity may decline with distance from the site where the activity took place, or the effects of human activity could be cumulative over time (Ries *et al.* 2004). The question then becomes, what is a reasonable minimum distance from a plant species at risk that may encompass habitat required for its survival or recovery? The answer will define the area requiring protection as critical habitat under the *Species at Risk Act* (SARA).

Protection of Habitat Subject to Edge-Effects of Human Activities

An area including a distance of 300 m from detectable occurrences will be critical to ensure long-term survival of plant populations.

Edge Effects of Soil Disturbance
The only research to describe edge effects on short-term survival of plant species at risk indicated 40 m was the minimum distance needed to avoid negative impacts of road dust on plant health and population growth (Gleason *et al.* 2007); however, that was also the maximum distance at which measurements were made. In detailed reviews by Forman and Alexander (1998) and Forman *et al.* (2003), most roadside edge effects on plants resulting from construction and repeated traffic have their greatest impact within the first 30 to 50 m. However, salinity, nitrogen and hydrological effects could extend 100 to 200 m from a road, and invasive alien species may spread up to 1 km. Invasive alien species have the potential to competitively exclude plant species at risk, and alter the ecosystem such that the plant species at risk can no longer use the habitat. This particular threat may then destroy critical habitat, without some active restoration.

Hansen and Clevenger (2005) observed no decline in the frequency of invasive alien species up to 150 m away from roads and railways in a grassland environment, although sampling did not extend further than 150 m. Gelbard and Harrison (2005) concluded that edge effects of roads on the plant and soil habitat was such that invasive alien species could more readily establish and survive within 10 m of roads compared with plants up to 1000 m from roads. Of course, not all roads are the same and Gelbard and Belnap (2003) found that paved or graded roads tend to have a higher cover and richness of invasive alien species compared with 4 x 4 vehicle tracks. All classes of road created habitat for the dispersal and establishment of these species in roadside verges and 50 m beyond. The difference was that greater frequency of traffic and intensity of disturbance on improved roads increased the process of invasion.

The road density typical of the Canadian prairies is one road every 1.6 to 3.2 km. As such, it is unlikely that source populations for invasive alien species can be accurately identified beyond 800 m from roadside or cultivated field edges (the center of a 1.6 x 1.6 km section assuming it is surrounded by roads or cultivated lands). Considering that significant effects of invasive alien species can currently be detected up to 150 m from roads and other developed sites, but can occur >800 m from a source population, some compromise distance between 150 and 800 m seems reasonable to ensure the maintenance of critical habitat attributes.

Edge Effects of Atmospheric Industrial Emissions
Atmospheric emissions from industrial activity, including intensive agriculture, can lead to a cumulative deposition of nitrogen on surrounding soils. Elevated concentrations of nitrogen and sulphur become analytically detectable in plants and soils up to 1 to 2 km away (Meshalkina *et al.* 1996, Hao *et al.* 2006). It is not clear if these detectable increases in macronutrients are biologically meaningful, but since most prairie plant species at risk occupy nutrient-poor, early to mid-successional grassland habitats, any increase in soil nutrient availability is likely to intensify competition, speed succession, and eliminate habitat critical for the species survival.

Reich *et al.* (2001) observed an increase in the productivity of hairy prairie clover (*Dalea villosa*) in response to nitrogen fertilizer, but in a mixed community any positive effect would be offset by the greater productivity response of other competing species. Kochy and Wilson (2001) observed nitrogen deposition in Elk Island National Park several kilometers downwind of petroleum refineries and an urban center to be 22 kg ha^{-1} $year^{-1}$, while background rates in the wilderness at Jasper National Park were only 8 kg ha^{-1} $year^{-1}$. These increased deposition rates appeared to promote forest encroachment at the expense of native grasslands at Elk Island, moreso than rates at Jasper. Experiments by Plassmann *et al.* (2008) found that low additions of nitrogen (15 kg ha^{-1} $year^{-1}$) to sand dunes increased germination rates of annual plants from the seedbank, which risks depleting the seedbank and eliminating a species from a low-nitrogen site to which it is adapted.

Similar to the effects of industrial emissions, some invasive alien species like the legume sweet clover (*Melilotus* spp.) can elevate soil nitrogen through biological fixation and facilitate invasions by other invasive alien species (Jordan *et al.* 2008, Van Riper and Larson 2009). This particular plant has become one of the most widespread invasive alien species in the northern Great Plains, due initially to deliberate planting in roadside edges, forage crops, and other reclaimed areas (Lesica and DeLuca 2000). These findings reinforce the idea that an area greater than 150 m to avoid invasive alien legumes, and possibly greater to avoid negative effects of industrial nitrogen and sulphur emissions, is necessary to ensure the maintenance of habitat critical attributes for prairie plant species at risk.

Edge Effects of Fluid Spills
Water, hydrocarbons or other fluids leaking from pipeline ruptures will have edge effects that vary greatly depending upon topography of the site. For example, an Alberta Energy Resources Conservation Board (ERCB) investigation during 2008 at CFB Suffield found a surface leak of crude oil spread 165 m along ungulate trails and ultimately covered 1200 m^2 of native grassland, killing more than 200 migratory birds (ERCB Investigation Report 2009-06-18). A second

incident investigated by ERCB involved a natural gas blowout that released “lower explosive levels” of gas at 100% within 50 m of a wellhead decreasing to 0% at 500 m. This incident also involved a spill of fluids up to 25 m from the wellhead that resulted in excavation and removal of 540 tonnes of soil for remediation (ERCB Investigation Report 2009-06-01). ERCB investigations elsewhere have found oil spills that spread 1.6 km across the surface from rupture points before clean-up could begin (ERCB Investigation Report 2007-05-09).

As plants are not mobile, flooding and inundation for any period of time may be sufficient to destroy critical habitat for several months, years, or decades. The probability of such a rupture is unknown, particularly in proportion to the density of all existing and planned pipelines, and in proportion to habitat availability and species at risk occupancy in the area. The risk of an irreversible change to the habitat is high, so the addition of pipelines within several hundred meters of plant occurrences should not be permitted.

Summary
All of the factors discussed above are potentially cumulative, particularly in the more industrialized parts of southern Alberta and south-western Saskatchewan. Industrial emissions, road construction, and fluid spills are logically co-located land use activities, and land spreading of agricultural wastes can add to the effects. Given the uncertainty regarding the outer distance for possible edge effects exceeding 150 meters, and the difficulty of identifying a point source for effects beyond 800 m, a precautionary approach is to include a distance of 300 m from the plant species at risk occurrences as habitat critical to survival of the species. This value of 300 m is simply twice the 150 m value for which published evidence indicates that significant negative effects can occur to the habitat of plant species at risk. A doubling of the 150 m value is intended to be precautionary to ensure critical habitat attributes are maintained.

Research is needed to more specifically address the edge-effects of major land use activities on habitat critical to survival of prairie plant species at risk. A smaller or larger distance may be suggested based on the results of that research, and changes to the definition of habitat critical to the survival of prairie plant species at risk could result from that work.

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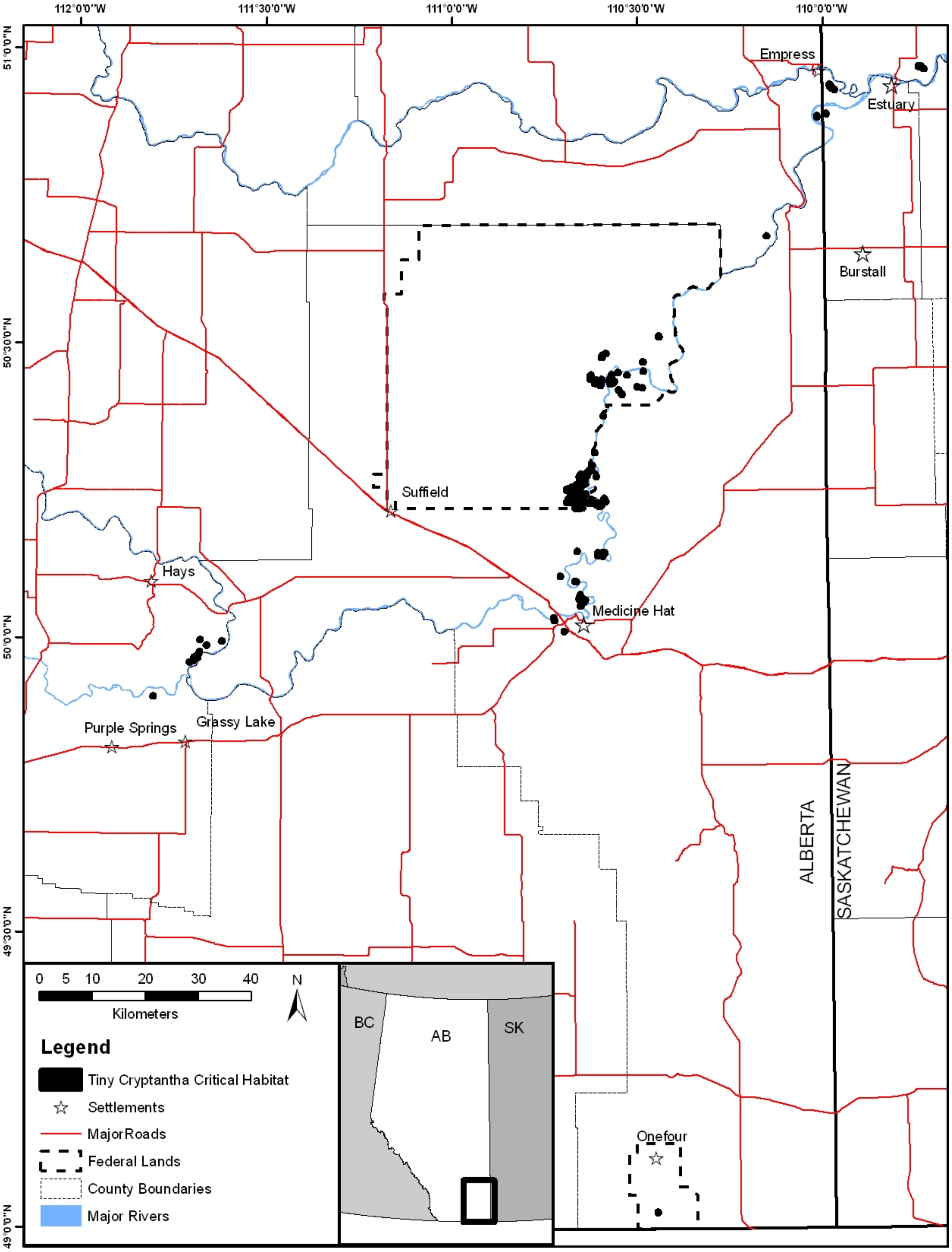
APPENDIX C. MAP OF TINY CRYPTANTHA CRITICAL HABITAT IN CANADA



APPENDIX D. QUARTER-SECTIONS IN CANADA CONTAINING PORTIONS OF CRITICAL HABITAT FOR TINY CRYPTANTHA[10]

SASKATCHEWAN					
Quarter section	**Section**	**Township**	**Range**	**Meridian**	**Tenure**
NE	19	22	29	3	Private
NW	20	22	29	3	Private
NW,NE	17	23	27	3	Provincial
SE	19	23	27	3	Private
SW,SE	20	23	27	3	Provincial
SW, SE	3	23	29	3	Provincial
NE,NW	3	23	29	3	Provincial, Private
NE	4	23	29	3	Provincial
SE	9	23	29	3	Private
SW	10	23	29	3	Provincial, Private

ALBERTA					
Quarter section	**Section**	**Township**	**Range**	**Meridian**	**Tenure**
NE,NW	10	1	4	4	Federal (AAFC)
SE, SW	15	1	4	4	Federal (AAFC)
NE	34	11	13	4	Provincial
NW	35	11	13	4	Provincial
NE,NW	12	11	14	4	Provincial
SE, SW	13	11	14	4	Private
NE,NW	24	12	6	4	Municipal
SW	24	12	6	4	Private
NW	26	12	6	4	Municipal
NE	27	12	6	4	Municipal
SE	34	12	6	4	Municipal
SW	35	12	6	4	Municipal
NE,NW,SE,SW	17	12	12	4	Provincial
NW	1	12	13	4	Provincial
NE,NW,SE,SW	2	12	13	4	Provincial
SE	3	12	13	4	Provincial
SE	11	12	13	4	Provincial
NE, SW	12	12	13	4	Provincial
NW,SE,SW	13	12	13	4	Provincial
NE,SE	14	12	13	4	Provincial
NE,NW,SW	5	13	5	4	Municipal
NE	6	13	5	4	Municipal

[10] Quarter sections identified in this table include those within which are located the boundaries of critical habitat as described in section 2.6.2. The table may include some quarter sections which are, in fact, excluded because they do not contain natural landform, soil, or vegetation features.

ALBERTA					
Quarter section	**Section**	**Township**	**Range**	**Meridian**	**Tenure**
NE,SE	7	13	5	4	Private
NE, NW,SE,SW	8	13	5	4	Municipal
SW	17	13	5	4	Private
SE	18	13	5	4	Private
NE,NW,SE,SW	19	13	5	4	Private
NE	23	13	6	4	Municipal
SW	25	13	6	4	Private
SE	26	13	6	4	Private
NW	2	14	5	4	Private
NE,SE,SW	3	14	5	4	Provincial
NW	3	14	5	4	Private
NE	6	14	5	4	Private
SE	7	14	5	4	Provincial
SE	10	14	5	4	Provincial
SW	10	14	5	4	Private
SW	11	14	5	4	Private
NE,NW	31	14	5	4	Provincial
NE,NW	32	14	5	4	Provincial
NE,NW,SW	2	15	5	4	Provincial
NW,SW	3	15	5	4	Federal (DND-NWA)
NE,SE	3	15	5	4	Federal(DND-NWA), Provincial
SE,SW	4	15	5	4	Federal (DND-NWA)
NE,NW	4	15	5	4	Federal(DND-NWA), Provincial
NE,NW,SE,SW	5	15	5	4	Federal (DND-NWA)
NE,NW,SE,SW	6	15	5	4	Federal (DND-NWA)
NE,NW,SE,SW	7	15	5	4	Federal (DND-NWA)
SW	8	15	5	4	Federal (DND-NWA)
NW,SE	8	15	5	4	Federal(DND-NWA), Provincial
NE	8	15	5	4	Provincial
NW,SE,SW	9	15	5	4	Provincial
SE	10	15	5	4	Provincial
SW	11	15	5	4	Provincial
NE,NW,SW,SE	17	15	5	4	Federal (DND-NWA)
NE,NW,SW,SE	18	15	5	4	Federal (DND-NWA)
NE,NW,SW,SE	20	15	5	4	Federal (DND-NWA)
NW,SW	21	15	5	4	Federal (DND-NWA)
NW	22	15	5	4	Provincial
NE	28	15	5	4	Federal(DND-NWA), Provincial
NW,SE,SW	28	15	5	4	Federal (DND-NWA)
SE,SW	29	15	5	4	Federal (DND-NWA)
SE	33	15	5	4	Provincial
NE	1	15	6	4	Federal (DND-NWA)
NE,SE	12	15	6	4	Federal (DND-NWA)
SE	13	15	6	4	Federal (DND-NWA)
NW,SW	3	16	5	4	Provincial

ALBERTA					
Quarter section	**Section**	**Township**	**Range**	**Meridian**	**Tenure**
NE,SE	4	16	5	4	Provincial
NW	26	16	5	4	Provincial
NW,SW	7	17	4	4	Federal (DND)
NE	8	17	4	4	Federal (DND)
NE,NW	9	17	4	4	Federal (DND)
SE,SW	16	17	4	4	Federal (DND)
SE	17	17	4	4	Federal (DND)
NE,NW,SE	19	17	4	4	Federal (DND)
NW,SW	20	17	4	4	Federal (DND)
NE	21	17	4	4	Federal (DND)
NE,SE	28	17	4	4	Federal (DND-NWA)
SE	33	17	4	4	Federal (DND-NWA)
NE	12	17	5	4	Federal (DND)
NE,NW,SW	13	17	5	4	Federal (DND)
NE,SE	14	17	5	4	Federal (DND)
NW	14	17	5	4	Federal (DND-NWA)
NE,NW,SE,SW	15	17	5	4	Federal (DND-NWA)
NE,NW,SE	16	17	5	4	Federal (DND-NWA)
NE,NW	21	17	5	4	Federal (DND)
SE,SW	21	17	5	4	Federal (DND-NWA)
SE	22	17	5	4	Federal (DND)
SW	22	17	5	4	Federal (DND-NWA)
NE, SE	23	17	5	4	Federal (DND)
SW	23	17	5	4	Federal (DND-NWA)
NE,NW,SW	24	17	5	4	Federal (DND)
SE	25	17	5	4	Federal (DND)
NE,SE	34	17	5	4	Federal (DND)
NE,NW,SW	35	17	5	4	Federal (DND)
NE,NW	11	18	4	4	Federal (DND-NWA)
SE,SW	14	18	4	4	Federal (DND-NWA)
SE,SW	2	18	5	4	Federal (DND)
NE,NW	12	20	2	4	Private
SE,SW	12	20	2	4	Provincial
NE,NW,SE,SW	24	22	1	4	Provincial

APPENDIX E. BENEFICIAL OR BEST RANGELAND MANAGEMENT PRACTICES

Tiny Cryptantha occupies a variety of locations that vary in ecology, land use history, and land tenure in two provinces. For these reasons, it is not possible to propose a general set of beneficial or best rangeland management practices that would be appropriate for all locations of critical habitat. Instead, specific recommendations will be made in multiple Action Plans at scales appropriate for general recommendations and application. At this time only a few general statements can be made regarding on-going activities that benefit Tiny Cryptantha.

Grazing by one or more classes of livestock may help maintain open sandy habitats needed by Tiny Cryptantha, much the way wild ungulates would have historically. Management of these livestock requires occasional and randomly dispersed overland access on-foot, on-horseback, by all terrain vehicle, or on existing trails by vehicles up to 1 tonne. In light of these facts, no changes are recommended at this time to current stocking rates, grazing seasons, classes of livestock, fence, salt, feed or water distribution, or access methods used by property owners of critical habitat.

Integrated weed management to control Crested Wheatgrass or Downy Brome (*Bromus tectorum*) invasion could directly reduce competition with Tiny Cryptantha, or indirectly change ungulate grazing behaviour that would otherwise improve habitat for the species. Approaches used to reduce the occurrence and density of invasive alien species on critical habitat needs to be dealt with on a site-specific basis or in multiple action plans. Until that time, a proponent should apply for a SARA permit or agreement under SARA for activities that may contravene general prohibitions.

Fires resulting from accidental or deliberate ignition by people will not destroy critical habitat nor harm individual plants under most circumstances. In fact, fire is likely to improve habitat by reducing grass litter, insect pests and pathogens from the habitat.

Environment Canada will work with all of its partners to define and improve best practices for conserving the Tiny Cryptantha across its range. In addition, Environment Canada will work with the Department of National Defence to define best practices for managing multiple species at risk at CFB Suffield, that reflect the unique land use activities posed by military training at that site.