Final

Species at Risk Act
Recovery Strategy Series

Recovery Strategy for the Bull Trout (*Salvelinus confluentus*), Saskatchewan-Nelson Rivers populations, in Canada

Bull Trout

2020

Canada

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For copies of the recovery strategy, or for additional information on species at risk, including Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status reports, residence descriptions, action plans, and other related recovery documents, please visit the Species at Risk Public Registry.

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Preface

The federal, provincial, and territorial government signatories under the Accord for the Protection of Species at Risk (1996) agreed to establish complementary legislation and programs that provide for effective protection of species at risk throughout Canada. Under the *Species at Risk Act* (S.C. 2002, c.29) (SARA), the federal competent ministers are responsible for the preparation of a recovery strategy for species listed as extirpated, endangered, or threatened and are required to report on progress five years after the publication of the final document on the Species at Risk Public Registry.

The Minister of Fisheries and Oceans and the Minister responsible for the Parks Canada Agency (PCA) are the competent ministers under SARA for the Bull Trout (*Salvelinus confluentus*), Saskatchewan-Nelson Rivers populations, and have prepared this strategy, as per section 37 of SARA. In preparing this recovery strategy, the competent ministers have considered, as per section 38 of SARA, the commitment of the Government of Canada to conserving biological diversity and to the principle that, if there are threats of serious or irreversible damage to the listed species, cost-effective measures to prevent the reduction or loss of the species should not be postponed for a lack of full scientific certainty. To the extent possible, this recovery strategy has been prepared in cooperation with Alberta Environment and Parks (AEP). The Provincial Bull Trout Advisory Committee struck to draft the Province of Alberta's recovery plan, included representatives from: the forestry industry (Spray Lakes Sawmills and West Fraser); Canadian Association of Petroleum Producers; the Alberta Fish and Game Association and Trout Unlimited Canada; and non-governmental organizations such as the Alberta Wilderness Association, Cows and Fish, and Canadian Parks and Wilderness Society (see appendix B). The draft provincial recovery plan has been incorporated within this recovery strategy, as per section 39(1) of SARA.

As stated in the preamble to SARA, success in the recovery of this species depends on the commitment and cooperation of many different constituencies that will be involved in implementing the directions set out in this strategy and will not be achieved by Fisheries and Oceans Canada (DFO) and PCA, or any other jurisdiction alone. The cost of conserving species at risk is shared amongst different constituencies. All Canadians are invited to join in supporting and implementing this strategy for the benefit of the Bull Trout, Saskatchewan-Nelson Rivers populations, and Canadian society as a whole.

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

Acknowledgments

DFO extends its sincere appreciation to the following organizations for their support in the development of the “Recovery Strategy for the Bull Trout (*Salvelinus confluentus*) Saskatchewan-Nelson Rivers populations), in Canada”:

The Parks Canada Agency (PCA)
Alberta Environment and Parks (AEP)
The Bull Trout Provincial Advisory Committee
DFO’s Canadian Science Advisory Secretariat

Executive summary

The Bull Trout (*Salvelinus confluentus*), Saskatchewan-Nelson Rivers populations, was listed as Threatened under the *Species at Risk Act* (SARA) in 2019. This recovery strategy is considered one in a series of documents for this species that are linked and should be taken into consideration together, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status report (COSEWIC 2012) and a recovery potential assessment (RPA) that determined recovery of the species was biologically and technically feasible (DFO 2017). An action plan for the species will be developed for this species that will cover its range outside areas managed by Parks Canada Agency (PCA; to come). Additionally, PCA multi-species action plans identify recovery measures for species at risk in PCA places. For a list of current documents published for the species, refer to the Species at Risk Public Registry.

Part of the salmonid family of fishes, the Bull Trout derives its name from its large head and jaws. Body size at maturity depends on life history strategy. The Saskatchewan-Nelson Rivers populations of Bull Trout exhibit stream resident, migratory or fluvial (riverine), and adfluvial (riverine-lake migrant) forms. Bull Trout are olive-green to blue-grey in colour and pale round spots on their flanks and back distinguish them from most other similar-looking salmonids. Because of its very specific habitat requirements, particularly cold, clean, well oxygenated water and connected watersheds, this fish is highly sensitive to habitat changes. Bull Trout are, therefore, viewed as an indicator species of general ecosystem health.

Section 33 of SARA prohibits the damage or destruction of a species' residence. A detailed description of the species' residence is provided in section 4 of this recovery strategy and is also available on the Species at Risk Public Registry.

The main threats facing the species are described in section 5 and include:

- habitat fragmentation
- habitat alteration and removal
- human-induced mortality (for example, fishing-related mortality)
- interaction with other species (for example, competition and hybridization)

The population and distribution objective (recovery goal) is:

> To protect, maintain and recover Bull Trout to self-sustaining populations where recovery is likely, within the Recovery Area.

To help achieve the population and distribution objective (recovery goal), four broad strategies are proposed: 1) research, 2) monitoring and habitat assessment, 3) management and regulatory actions, and 4) outreach and education. The recovery strategy takes into consideration the uncertainty associated with current knowledge of Bull Trout and its environment. The proposed objectives to achieve the recovery goal are to:

1. maintain or improve the condition of Core, Potential Core, and Support[1] Hydrologic Unit Code[2] (HUC) 8 (HUC 12 in Banff, Waterton Lakes and Jasper national parks) populations within the recovery area through better understanding and mitigation of threats, and identification and protection of critical habitats

2. improve the condition of at least one HUC 8 or 12 within Core, Potential Core, or Support populations, within each of the Oldman, Bow, Red Deer and North Saskatchewan basins, by increasing the adult abundance or distribution

3. in addition to the four recovery projects associated with Objective 2, initiate at least two more projects for Core or Potential Core populations within each of the Oldman, Bow, Red Deer and North Saskatchewan basins (eight new recovery projects in addition to the four recovery projects initiated for Objective 2, by the end of year 10)

A description of the broad strategies to be taken to address threats to the species' survival and recovery, as well as research and management strategies needed to meet the population and distribution objective, are included in section 7. These will help inform the development of specific recovery measures in one or more action plans.

For the Bull Trout, Saskatchewan-Nelson Rivers populations, critical habitat is identified to the extent possible, using the best available information, and provides the features and attributes necessary to support the species' life-cycle processes and functions to achieve the species' population and distribution objectives.

Critical habitat for the Bull Trout (Saskatchewan-Nelson Rivers populations) is only partially identified at this point in time. Critical habitat identified to date includes parts of forty HUC 8 and HUC 12 watersheds in the Oldman, Bow, Red Deer, and North Saskatchewan river basins in southwestern Alberta. Further studies are required to refine critical habitat to support the population and distribution objectives, to refine knowledge of the biophysical functions, features, and attributes and to determine recoverable habitat and sub-populations. Additional critical habitat will be identified as information becomes available. This recovery strategy identifies critical habitat to the extent possible and lists the examples of activities likely to result in the destruction of critical habitat.

This recovery strategy exempts the incidental capture and immediate release of Bull Trout by angling, as well as, Indigenous harvest and traditional use, from the SARA prohibitions.

An action plan will be completed within five years of posting the final recovery strategy.

[1] "Core" and "Potential Core" and "Support" " populations are defined in section 6.1.2, identified in table 3a and 3b and mapped in figures 4a and 4b.

[2] The Hydrologic Unit Code (HUC) system for watershed identification is a nested, hierarchical approach developed by the United States Geological Service and is used by AEP for fisheries management. See section 4.3.1 for further description.

Recovery feasibility summary

Recovery of the Bull Trout, Saskatchewan-Nelson Rivers populations, is believed to be both biologically and technically feasible (DFO 2017). Recovery feasibility is determined according to four criteria outlined by the Government of Canada (2009)[3]:

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

Yes. Reproducing populations currently exist within the Alberta range of the species and could be used for translocations or artificial propagation if necessary.

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

Yes. Suitable habitat is present at several locations with extant populations. At locations with extirpated or declining populations, suitable habitat may be made available through current and proposed restoration efforts. Efforts to recover other salmonids in the area, such as Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*), benefit Bull Trout in overlapping areas.

3. Can significant threats to the species or its habitat be avoided or mitigated?

Yes. Significant threats such as habitat fragmentation, habitat alteration and removal, human-induced mortality, interactions with other species, and aquatic invasive species can be mitigated through proposed recovery techniques. Through much of the Bull Trout range, recovery efforts are already underway and numerous management actions have been taken to prevent incidental and accidental mortalities through angling.

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

Yes. Techniques to reduce identified threats (for example, best management practices) and restore habitats are well known and proven to be effective. The effort expended to achieve recovery will not be uniform across all populations. Locations with populations thought to be extirpated may require substantial effort to improve habitat and in some cases will not be recoverable, or may take a considerable length of time and commitment.

[3] Government of Canada. 2009. *Species at Risk Act* Policies [Draft]. Species at Risk Act, Policies and Guidelines Series. Ottawa, Ontario. Environment Canada. 48 pp.

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Background

1. Introduction

Bull Trout (*Salvelinus confluentus*), Saskatchewan-Nelson Rivers populations, was listed as Threatened under the *Species at Risk Act* (SARA) in 2019.

This recovery strategy is part of a series of documents regarding Bull Trout that should be taken into consideration together, including the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) status report (COSEWIC 2012), the Science Advisory Report from the Recovery Potential Assessment (RPA) (DFO 2017), and the subsequent action plan(s). 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 objectives and identifies the main areas of activities to be undertaken. Detailed planning is done at the subsequent action plan stage.

The RPA is a process undertaken by Fisheries and Oceans Canada (DFO) Science to provide the information and scientific advice required to implement SARA, relying on the best available scientific information, data analyses and modeling, and expert opinions. The outcome of this process informs many sections of the recovery strategy. For more detailed information beyond what is presented in this recovery strategy, refer to the COSEWIC status report and the RPA Science Advisory Report.

2. COSEWIC species assessment information

Date of assessment: November 2012

Species common name: Bull Trout, Saskatchewan-Nelson Rivers populations

Scientific name: *Salvelinus confluentus*

Status: Threatened

Reason(s) for designation: This freshwater fish is broadly distributed east of the Rocky Mountains. It is a slow-growing and late-maturing species that thrives in cold, pristine waters and often requires long unimpeded migratory routes joining spawning to adult habitat. Historical range contractions now limit the populations to the foothills and east slopes of the Rocky Mountains, likely in response to habitat deterioration and reduced habitat connectivity through damming of the larger rivers. No populations are abundant and more than half show evidence of decline. The primary and persistent threats to these populations include competition and hybridization with introduced Eastern Brook Trout and climate-induced increases in water temperature. Although legal harvest has been eliminated, this species is highly catchable and is therefore likely susceptible to catch-and-release mortality in many areas that are accessible to recreational anglers. Consequently, an aggregate decline in abundance of > 30% over the next three generations is projected.

Canadian occurrence: Alberta

Status history: Designated Threatened in November 2012.

3. Species status information

Table 1. Summary of existing protection or other status designations assigned to Bull Trout (*Salvelinus confluentus*) Saskatchewan-Nelson Rivers populations.

Jurisdiction	Authority/Organization	Year(s) Assessed and/or Listed	Population	Designation Level
Entire range U.S.	U.S. Fish & Wildlife Service, *Endangered Species Act*	1999, 2008	All populations within the contiguous United States (USFWS 2015)	Threatened
Global	NatureServe	2017	Global range	Secure (G5)
Alberta	Government of Alberta, *Alberta Wildlife Act*	2014	Entire province	At Risk
Alberta	Endangered Species Conservation Council	2014	Entire province	Threatened
Canada	Committee on the Status of Endangered Wildlife in Canada (COSEWIC)	2012	Saskatchewan-Nelson Rivers populations	Threatened
Canada	Fisheries and Oceans Canada, *Species at Risk Act* (SARA)	2019	Saskatchewan-Nelson Rivers populations	Threatened

Upon listing as a Threatened species, Saskatchewan-Nelson River populations of Bull Trout became protected wherever they are found by section 32 of SARA:

> “No person shall kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species.” (subsection 32(1))
>
> “No person shall possess, collect, buy, sell or trade an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species, or any part or derivative of such an individual.” (subsection 32(2))

Section 83 of SARA outlines general exceptions to the Act’s protection provisions. Sections 73 and 74 of SARA outline conditions under which an agreement can be entered into or a permit issued authorizing a person to engage in an activity affecting a listed wildlife species, any part of its critical habitat or the residences of its individuals.

4. Species information

4.1 Description

Bull Trout is a salmonid in the char genus. The species is native only to western North America. It is a long slender fish with a comparatively large head and jaws (figure 1), hence the derivation of its common name “bull”. Their body size at maturity depends on life history strategy. The average length (and range) of stream resident is 250 mm (140 to 410 mm), migratory or fluvial (riverine) is >400 mm (240 to 730 mm), and adfluvial (riverine-lake migrant) is >400 mm (330 to 900+ mm) (COSEWIC 2012). Although underreported in the literature, it may be that anadromous (sea run) Bull Trout of Pacific drainages attain the largest sizes of all.

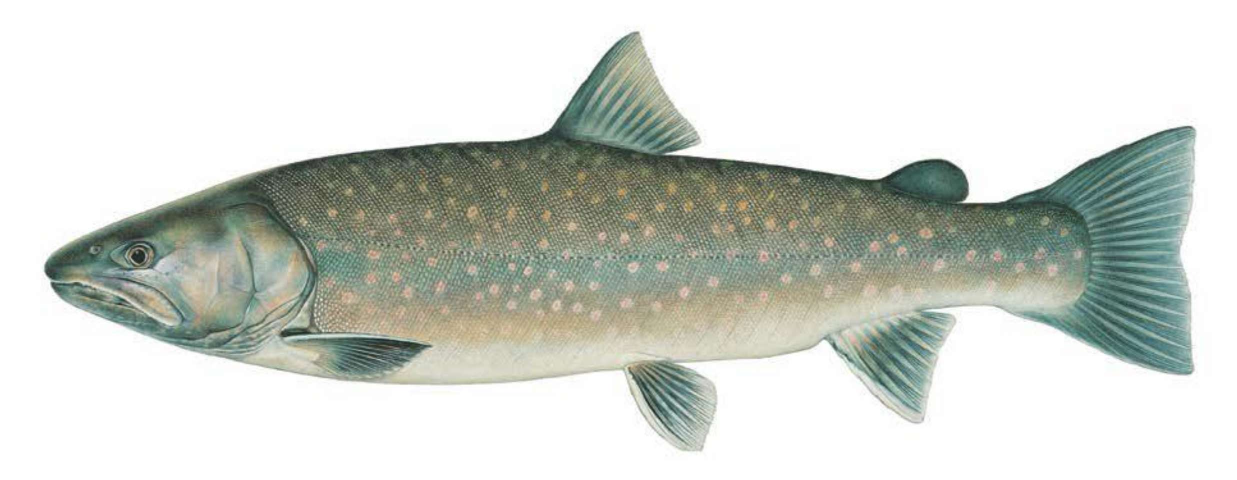

Figure 1. Bull Trout (*Salvelinus confluentus*). Illustration © Joe Tomelleri.

Bull Trout are olive-green to blue-grey in colour, with adfluvial (lake dwelling) fish often displaying silvery sides. Pale round spots along their flanks and backs that are pink, lilac, yellow-orange or red distinguish them from other species: Brook Trout (*Salvelinus fontinalis*) has distinct, light-coloured, worm-like markings on top of the head, back and dorsal fin, while Rainbow Trout (*Oncorhynchus mykiss*), Westslope Cutthroat Trout (*Oncorhynchus clarkii lewisi*), and Brown Trout (*Salmo trutta*) have dark spots (Nelson and Paetz 1992; McPhail 2007). Bull Trout usually have pale bellies, which may turn red or orange in spawning males (Nelson and Paetz 1992). Their tail fin is slightly forked, and pelvic or anal fins may have a leading white edge, but unlike Brook Trout, is not followed by black (Nelson and Paetz 1992). Bull Trout larvae may be distinguished from other larval char by the presence of a prominent fleshy ridge underneath the chin (Gould 1987). Sexual dimorphism is exhibited during the spawning season when males often develop large kypes (hooked lower jaw) and become more brightly coloured than females. Males often have larger adipose fins than females of the same size (McPhail 2007). Bull Trout are largely opportunistic predators and while juveniles mainly forage on drift during the day and benthic insects at night, they switch to a fish diet once reaching 100 to 200 mm in length (Stewart et al. 2007).

4.2 Life history diversity

Within Alberta, Bull Trout exhibit three life history strategies: stream resident, migratory or fluvial (riverine), and adfluvial (riverine-lake migrant) (COSEWIC 2012). There is no evidence of genetic differentiation between life history types (Homel et al. 2008), and offspring may exhibit a different life history type than their parents (Brenkman et al. 2007, Dodson et al. 2013). Migratory and resident life history types may be found occupying the same habitats or residents may be isolated by barriers (McPhail and Baxter 1996; Nelson et al. 2002).

Stream residents are non-migratory, and spend most of their lives in small streams and rivers. They rarely exceed 300 mm in length (McPhail and Baxter 1996). They are strongly associated with pool habitat and instream and overhead cover. They are often isolated by physical (for example, waterfalls, dams), physiological (for example, water temperature) or biological (for example, non-native competitors) barriers from other life history types or adjacent populations (COSEWIC 2012).

Fluvial Bull Trout occupy rivers and major tributaries and move into headwater streams to spawn. Migrations to spawning streams may be up to 500 km and demonstrate the scale, habitat diversity, and connectivity required by fluvial populations. Adult length is typically in the 400 to 600 mm range (approximately 2 kg). The majority of Alberta's eastern slope rivers still contain fluvial Bull Trout populations. In some systems, fluvial Bull Trout exhibit a strong fidelity to spawning tributaries and overwintering areas (Bahr and Shrimpton 2004), but in others they change spawning locations over time (Pratt 1992).

Adfluvial Bull Trout rear in headwater streams and migrate into lakes to mature, returning to their natal streams to spawn at approximately age five and usually every subsequent year if habitat productivity allows (Stelfox 1997; Warnock 2008). Larger adults more often feed and overwinter in lakes (Connor et al. 1997). In high elevation, isolated, low nutrient lakes, spawning habitat is usually located a short distance upstream in the lake inlet or downstream in the outlet (Herman 1997; Wilhelm et al. 1999). Spawning within lakes has not been documented. Lake resident Bull Trout is the least common life history form in Alberta.

4.3 Population abundance and distribution

Bull Trout once occupied a much larger geographic range in North America than they do today. The range has declined over the past century, particularly the southern extent in the U.S. The species is currently distributed from the Oregon-California border and northern Nevada (42°N) to southern Yukon and southwestern Northwest Territories (65°N) and extends from the Pacific Coast in southwestern British Columbia and northwestern Washington (approximately 113°W) in the west, to the eastern slope of the continental divide in western Montana, Alberta and the Northwest Territories in the east.

Approximately 80% of the global range of Bull Trout is within western Canada (British Columbia, Alberta, Yukon and Northwest Territories) (COSEWIC 2012). Within Alberta, the range includes all of the major east slope river drainages: Peace, Athabasca, South Saskatchewan and North Saskatchewan. Historically, Bull Trout were more widely distributed in Alberta. Once occupying reaches further downstream, they are now restricted to upstream reaches with the exception of the northern Peace and Athabasca drainages where they occur in low abundance. In recent decades, the distribution of Bull Trout has also declined in eastern parts of its range in Alberta.

The distribution of Bull Trout in the Saskatchewan-Nelson Rivers populations, also called DU 4, extends from the North Saskatchewan River south to the Canada-U.S. border. The other four DUs are: South Coast British Columbia populations (DU 1), Western Arctic populations (DU 2), Upper Yukon Watershed populations (DU 3), and, Pacific populations (DU 5; COSEWIC 2012). The total extent of occurrence for all DUs is estimated to be greater than 20,000 km^2 and the index of area of occupancy greater than 2,000 km^2.

Within DU 4, Bull Trout occur in four river basins: the North Saskatchewan, Red Deer, Bow, and Oldman River (sometimes referred to as the South Saskatchewan) (figure 2). Bull Trout are no longer found in large areas of the Oldman and the Red Deer River systems.

Figure 2. Distribution of Bull Trout in Designatable Unit (DU) 4 showing Hydrological Unit Code (HUC) 8s for the North Saskatchewan, Red Deer, Bow and South Saskatchewan (Oldman) river basins. HUC 8 data obtained from Alberta Environment and Parks (AEP) (AESRD 2014).

4.3.1 Historic and current abundance and trends

Province of Alberta:

Alberta Environment and Parks (AEP) has assessed the status of Bull Trout populations within spatial units based on 8-digit Hydrologic Unit Codes (HUC 8; figure 2). HUCs are a series of nested, hierarchical watersheds. The HUCs decrease in geographic area as their associated numeric identification code increases. For example, a 4-digit identification code HUC (HUC 4) would represent a basin scale, which would be comprised of several 6-digit identification code HUCs (HUC 6s), each of which would in turn be comprised of several 8-digit identification code HUCs (HUC 8s) that would represent a subwatershed scale. The approach is based on the United States Geological Survey's (USGS) approach to watershed classification and is used by AEP to manage their fisheries. A total of 88 Bull Trout HUC 8s were delineated within Alberta, 45 of which are in DU 4. Several metrics were examined to assess the stocks within the HUCs, including metrics of population integrity, productive potential and threat mitigation, as part of the Alberta Fish Sustainability Index (FSI; McPherson et al. 2014).

Bull Trout populations were assessed at the HUC 8 subwatershed level, which was the smallest spatial scale available at the time of assessment. This scale likely encompasses genetically distinct spawning aggregations that share main stem rivers and exhibit low levels of genetic exchange, and all three life-history strategies may be present (AESRD 2012). Seventeen different population metrics are assessed using the FSI approach. FSI Scoring is described in table 2. FSI scores for adult and immature categories are presented in table 3a with the key metric for Bull Trout recovery planning in the Province of Alberta being adult population FSI. Historic values were derived based on best available information and opinion, including angler interviews, old photos, and reports, spanning the last century.

Using the FSI approach, populations are compared against an observed or theoretical reference population, unaffected by human influences such as fishing mortality, habitat loss, and barriers to fish passage such as dams and "perched" or "hanging" culverts. Differences between the assessed and theoretical reference population are translated to a scale of one to five (table 2) and represent five different risk categories. A score of one corresponds to a population at very high risk, is least sustainable and very different from the reference population; while a five corresponds to a population that is at very low risk of extirpation, most sustainable and very similar to the reference population. A zero represents a functionally extirpated population. The FSI ranking system follows those used by international conservation agencies (for example, NatureServe 2019) and is based on the approach of Fredenberg et al. (2005) used to assess the conservation status of local populations.

Table 2. Fish Sustainability Index (FSI) score and description.

FSI Score	Description
0	Functionally extirpated
1	Very Low (very high risk of extirpation)
2	Low (high risk of extirpation)
3	Moderate (moderate risk of extirpation)
4	High (very low risk of extirpation)
5	Very High (population is in ideal state)

It is important to note that the FSI scores do not imply that the assessed population has declined from high density, nor that they can potentially recover to, or reach a high density. The assessment suggests that lower density populations (perhaps because of natural limitations such as climate) are likely at a higher risk of not being self-sustaining than populations at higher density. To understand how a population has changed through time, and to investigate recovery potential, both historic and current adult densities relative to the theoretical reference condition need to be scored and compared. For example, population A may have a historic adult density score of 4, and a current score of 2, whereas population B may have a historic adult density score of 2 and a current score of 2. Both populations are considered at high risk, but population A may have the potential to recover to a low risk state.

The populations of Bull Trout in DU 4 were compared in terms of their abundance (relative abundance index) using historic adult FSI and current adult and immature FSI (table 3a). Populations in the southern part of the province tend to be at higher risk than northern populations (figure 3a). This difference is attributed to more hydroelectric dams, more access for fishing and higher human footprint (industrial, residential, and recreational). In addition, climate change is predicted to have a greater effect in the southern part of the range of Bull Trout. The difference in COSEWIC assessments for Threatened Bull Trout (Saskatchewan-Nelson Rivers populations) DU 4 and the “less at-risk” Special Concern Bull Trout (Western Arctic populations) DU 2, found immediately north of DU 4, reflect the higher incidence of these impacts in the southern part of the Canadian range of Bull Trout (COSEWIC 2012).

Parks Canada Agency (PCA):

PCA assessed the status of Bull Trout populations within HUC 12 spatial units for Banff, Jasper, and Waterton Lakes national parks (herein referred to as the national parks) waterbodies, within the range of the Saskatchewan-Nelson Rivers populations. Other PCA managed lands, such as Ya Ha Tinda Ranch, Rocky Mountain House National Historic Site and Bar U Ranch National Historic Site, are relatively small and surrounded by provincial jurisdiction, therefore, Bull Trout populations in these areas were assessed by the provincial FSI. Some life histories or individuals of Bull Trout may have home ranges that cross HUC 12 delineations; however, Bull Trout were assessed at a finer scale than HUC 8 because it better matched the scale at which Parks Canada manages and restores native fish populations (see Pacas and Taylor 2015).

PCA used a different approach than the provincial FSI to assess the current status of Bull Trout. PCA’s approach was a reflection of not having historical abundance data and having a different rank order of threats compared to outside of the national parks. Furthermore, because most of the national parks are not accessible by roads, PCA has been using monitoring approaches that focus on species distributions and temporal patterns of occurrence that help overcome many of the high sample size requirement of abundance monitoring (MacKenzie et al. 2006; Steenweg et al. 2016).

Water temperatures in the national parks are generally within the preferred temperatures for Bull Trout with the exception of small areas. Angling pressure is low across wide expanses of backcountry rivers and lakes. The largest threat to aquatic ecosystems of national parks is the legacy of stocking programs earlier in the century, as ten species of non-native fishes now occur in the national parks (Schindler 2000). In addition, hydropower dams have fragmented two large rivers systems in Banff National Park creating downstream habitat that favors non-native trout and the displacement of Bull Trout.

PCA's monitoring assessment captures the threat of non-native fishes using a Distribution Index (DI), based on Banff National Park's Stream Fish Occupancy Monitoring Protocol (Taylor and Mochnacz 2013). The DI scales site-level occupancy estimates to the HUC 12 scale in order to include HUC 12s that have not been sampled extensively. The assessment used electrofishing data with site allocation ranging from a small number of non-random sites (class B) to sites randomly allocated across the entire HUC 12 (class A). The DI scores HUC 12s based on the presence/absence of Bull Trout and co-occurring non-native trout.

HUC 12 units that were both historically and currently occupied by Bull Trout in the absence of non-native trout were coloured green (figure 3b). Green represents a contemporary "reference condition" that assumes Bull Trout are found at abundances as close to historic values as possible in most HUC 12 watersheds that do not have co-occurring non-native trout. HUC 12 units that were both historically and currently occupied by Bull Trout, but in the presence of non-native trout, were coloured yellow, representing a "potential reference condition". The effect of non-native trout on Bull Trout ranges from low to high depending on the waterbody. Bull Trout that co-occur with non-native trout without competition may still experience displacement due to climate change given higher thermal tolerances of non-native trout (McMahon et al. 2007; Selong et al. 2001). Therefore, yellow represents both the current and future threat of non-native trout to Bull Trout. Black represents HUC 12 units that were historically occupied, but are not occupied currently (i.e., are functionally extirpated). Grey indicates HUC 12s that were not historically occupied by Bull Trout. HUC 12 units were colored white when they either have not been sampled or sampling did not meet minimum sample size requirements (figure 3b). These areas may have Bull Trout, but additional data collection is required to apply the DI. Refer to table 3b for a description of the Distribution Index of each watershed within the national parks.

Table 3a. Historic and current Bull Trout Fish Sustainability Index (FSI) based on MacPherson et al. (2014) for Hydrological Unit Code (HUC) 8s within Designatable Unit (DU) 4.

HUC 8	Basin	Watershed	Historic adult FSI	Current adult FSI	Current juvenile FSI	Data reliability[4]
04010101	Oldman River Basin	Upper Oldman River	Very high	Low	Moderate	Moderate
04010102	Oldman River Basin	Crowsnest River	Very high	Very Low	Functionally Extirpated	Moderate
04010103	Oldman River Basin	Castle River	Very high	Moderate	High	Moderate
04010104	Oldman River Basin	Pincher Creek	Moderate	Low	Low	Low
04010105	Oldman River Basin	Oldman River below reservoir	High	Very Low	Functionally Extirpated	Low
04010201	Oldman River Basin	Willow Creek	High	Functionally Extirpated	Functionally Extirpated	Very Low
04010301	Oldman River Basin	Waterton River	High	Very Low	Very Low	Low
04010302	Oldman River Basin	Belly River	High	Very Low	Very Low	Very Low
04010401	Oldman River Basin	St. Mary River	Moderate	Very Low	Very Low	Low

[4] This rating refers to the current adult density and reflects the spatial distribution of sampling sites within a HUC8, the number of sampling locations, and when data were collected (MacPherson et al. 2014). A lower rating is an indication of greater data deficiency in one or more aspects of data reliability.

HUC 8	Basin	Watershed	Historic adult FSI	Current adult FSI	Current juvenile FSI	Data reliability[4]
04020301	Bow River Basin	Spray Lakes[5]	High	Very low	Moderate	Very low
04020401	Bow River Basin	Bow River/Ghost Reservoir	High	Very low	Functionally extirpated	Very low
04020601	Bow River Basin	Kananaskis River	High	Low	Low	Low
04020701	Bow River Basin	Ghost River	High	Moderate	Moderate	Low
04020801	Bow River Basin	Bow River/Bighill Creek	Low	Functionally extirpated	Functionally extirpated	Moderate
04020802	Bow River Basin	Jumpingpound Creek	Moderate	Very low	Low	Low
04021001	Bow River Basin	Elbow River	Moderate	Very low	Low	Moderate
04021101	Bow River Basin	Fish Creek	Very low	Functionally extirpated	Functionally extirpated	Moderate
04021201	Bow River Basin	Highwood River	High	Low	Moderate	Low
04021202	Bow River Basin	Sheep River	High	Very low	Low	Low
11010102	North Saskatchewan River Basin	Siffleur River[6]	High	Moderate	Moderate	Very low
11010103	North Saskatchewan River Basin	Cline River	Very high	High	High	Low
11010201	North Saskatchewan River Basin	N. Saskatchewan below Abraham	High	Low	Moderate	Low
11010202	North Saskatchewan River Basin	Ram River	High	Moderate	Very low	Low
11010203	North Saskatchewan River Basin	Baptiste River	High	Very low	Very low	Low
11010301	North Saskatchewan River Basin	Clearwater River	Very high	Moderate	Moderate	Low
11010302	North Saskatchewan River Basin	Prairie Creek	High	Very low	Very low	Low
11010401	North Saskatchewan River Basin	Brazeau River	Very high	Moderate	Moderate	Very low
11010402	North Saskatchewan River Basin	Cardinal River	Very high	Very low	Very low	Very low

[5] Part of the Hydrological Unit Code (HUC) 8 is managed by Alberta Environment and Parks (AEP) while the other part is managed by Parks Canada.

[6] Part of the HUC 8 is managed by AEP while the other part is managed by PCA.

HUC 8	Basin	Watershed	Historic adult FSI	Current adult FSI	Current juvenile FSI	Data reliability[4]
11010403	North Saskatchewan River Basin	Blackstone River	Very high	Moderate	Very high	Low
11010404	North Saskatchewan River Basin	Elk River	High	Very low	Very low	Very low
11010405	North Saskatchewan River Basin	Brazeau Canal	High	Functionally extirpated	Functionally extirpated	Very low
11010406	North Saskatchewan River Basin	Nordegg River	Very high	Moderate	High	Low
11020101	North Saskatchewan River Basin	N. Saskatchewan above Wabamun	High	Functionally extirpated	Functionally extirpated	Moderate
11020102	North Saskatchewan River Basin	Wolf Creek	High	Functionally extirpated	Functionally extirpated	Moderate
08010103	Red Deer River Basin	Fallentimber Creek	High	Low	Very low	Very low
08010104	Red Deer River Basin	James River	High	Very low	Very low	Very low
08010201	Red Deer River Basin	Red Deer River/ Gleniffer Lake	Moderate	Very low	Functionally extirpated	Very low
08010202	Red Deer River Basin	Raven River	High	Functionally extirpated	Functionally extirpated	Very low
08010203	Red Deer River Basin	Little Red Deer River	Moderate	Very low	Very low	Very low

Table 3b. Parks Canada distribution index, and population status of Bull Trout for Hydrological Unit Code (HUC) 12s within the national parks. Hydrologic units that have not been sampled were also included.

National Park	Basin	Watershed	Distribution index	Predicted recovery category[7]
Waterton Lakes National Park	Belly River Basin	Lower Belly River	Potential reference	Support population
Waterton Lakes National Park	Belly River Basin	Upper Belly River	Potential reference	Potential core
Waterton Lakes National Park	Belly River Basin	North Belly River	Potential reference	Potential core
Waterton Lakes National Park	Belly River Basin	North Mokowan	Data deficient	Data deficient
Waterton Lakes National Park	Waterton River Basin	Lower Waterton Lake	Potential reference	Support population
Waterton Lakes National Park	Waterton River Basin	Galwey Brook	Data deficient	Data deficient

[7] Predicted Recovery Category denotes an approach by Parks Canada, using best available information, to align their watershed classification with Alberta Environment and Parks (AEP) approach of identifying HUCs as Core, Potential Core, Support, and Likely Unrecoverable. See Section 6.1.2 for a description of the AEP classification system.

National Park	Basin	Watershed	Distribution index	Predicted recovery category[7]
Waterton Lakes National Park	Waterton River Basin	Cottonwood Creek	Data deficient	Data deficient
Waterton Lakes National Park	Waterton River Basin	Dungarvan Creek	Data deficient	Data deficient
Waterton Lakes National Park	Waterton River Basin	Yarrow Creek	Data deficient	Data deficient
Waterton Lakes National Park	Waterton River Basin	Indian Springs	Historically unoccupied	Historically unoccupied
Waterton Lakes National Park	Waterton River Basin	Upper Crooked Creek	Data deficient	Data deficient
Waterton Lakes National Park	Waterton River Basin	Lower Sofa Creek	Potential reference	Support population
Waterton Lakes National Park	Waterton River Basin	Upper Sofa Creek	Potential reference	Potential core
Waterton Lakes National Park	Waterton River Basin	Waterton Lakes	Potential reference	Support population
Waterton Lakes National Park	Waterton River Basin	Lower Blakiston Creek	Potential reference	Potential core
Waterton Lakes National Park	Waterton River Basin	Ruby Creek	Potential reference	Potential core
Waterton Lakes National Park	Waterton River Basin	Lost Horse Creek	Data deficient	Data deficient
Waterton Lakes National Park	Waterton River Basin	Middle Blakiston Creek	Potential reference	Potential core
Waterton Lakes National Park	Waterton River Basin	Bauerman Creek	Potential reference	Potential core
Waterton Lakes National Park	Waterton River Basin	Red Rock Creek	Data deficient	Data deficient
Waterton Lakes National Park	Waterton River Basin	Upper Blakiston Creek	Historically unoccupied	Historically unoccupied
Waterton Lakes National Park	Waterton River Basin	Lone Creek	Historically unoccupied	Historically unoccupied
Waterton Lakes National Park	Waterton River Basin	Vimy Creek	Data deficient	Data deficient
Waterton Lakes National Park	Waterton River Basin	Lower Cameron Creek	Historically unoccupied	Historically unoccupied
Waterton Lakes National Park	Waterton River Basin	Carthew Creek	Historically unoccupied	Historically unoccupied
Waterton Lakes National Park	Waterton River Basin	Lineham Creek	Historically unoccupied	Historically unoccupied
Waterton Lakes National Park	Waterton River Basin	Rowe Creek	Historically unoccupied	Historically unoccupied
Waterton Lakes National Park	Waterton River Basin	Upper Cameron Creek	Historically unoccupied	Historically unoccupied
Waterton Lakes National Park	Waterton River Basin	Hell-Roaring Creek	Data deficient	Data deficient
Waterton Lakes National Park	Waterton River Basin	Bertha Creek	Potential reference	Support population
Waterton Lakes National Park	Waterton River Basin	Boundary Creek	Data deficient	Data deficient
Banff National Park	Bow River Basin	Upper Spray River below Canyon Dam	Functionally extirpated	Support population

National Park	Basin	Watershed	Distribution index	Predicted recovery category[7]
Banff National Park	Bow River Basin	Lower Spray River below Canyon Dam	Potential reference	Support population
Banff National Park	Bow River Basin	Cascade Creek	Functionally extirpated	Support population
Banff National Park	Bow River Basin	Lake Minnewanka	Potential reference	Support population
Banff National Park	Bow River Basin	Upper Brewster Creek	Potential reference	Potential core
Banff National Park	Bow River Basin	Middle Brewster Creek	Reference condition	Core
Banff National Park	Bow River Basin	Fatigue Creek	Reference condition	Core
Banff National Park	Bow River Basin	Healy Creek	Reference condition	Core
Banff National Park	Bow River Basin	Forty Mile Creek	Reference condition	Core
Banff National Park	Bow River Basin	Lower Forty Mile Creek	Potential reference	Support population
Banff National Park	Bow River Basin	Lower Bow River Banff	Potential reference	Support population
Banff National Park	Bow River Basin	Altrude Creek	Potential reference	Potential core
Banff National Park	Bow River Basin	Middle Bow River	Potential reference	Support population
Banff National Park	Bow River Basin	Castle Junction	Functionally extirpated	Likely unrecoverable
Banff National Park	Bow River Basin	Moraine	Functionally extirpated	Likely unrecoverable
Banff National Park	Bow River Basin	Paradise	Historically unoccupied	Historically unoccupied
Banff National Park	Bow River Basin	Pulsatilla	Data deficient	Data deficient
Banff National Park	Bow River Basin	Lower Baker	Potential reference	Support population*
Banff National Park	Bow River Basin	Upper Baker	Potential reference	Support population*
Banff National Park	Bow River Basin	Redoubt	Historically unoccupied	Historically unoccupied
Banff National Park	Bow River Basin	Lower Pipestone	Historically unoccupied	Historically unoccupied
Banff National Park	Bow River Basin	Upper Pipestone	Historically unoccupied	Historically unoccupied
Banff National Park	Bow River Basin	Little Pipestone	Historically unoccupied	Historically unoccupied
Banff National Park	Bow River Basin	South Molar	Historically unoccupied	Historically unoccupied
Banff National Park	Bow River Basin	Bath	Potential reference	Potential core
Banff National Park	Bow River Basin	Hector	Functionally extirpated	Likely unrecoverable
Banff National Park	Bow River Basin	Mosquito	Historically unoccupied	Historically unoccupied

National Park	Basin	Watershed	Distribution index	Predicted recovery category[7]
Banff National Park	Bow River Basin	Upper Bow River	Potential reference	Potential core
Banff National Park	Bow River Basin	Bow Glacier	Historically unoccupied	Historically unoccupied
Banff National Park	Bow River Basin	Bow Pass	Functionally extirpated	Likely unrecoverable
Banff National Park	Cascade River Basin	Lower Cascade River	Potential reference	Support population
Banff National Park	Cascade River Basin	Elk Creek	Reference condition	Core
Banff National Park	Cascade River Basin	Lower Stoney Creek	Reference condition	Core
Banff National Park	Cascade River Basin	Middle Cascade River	Potential reference	Support population
Banff National Park	Cascade River Basin	Cutthead Creek	Reference condition	Core
Banff National Park	Cascade River Basin	Upper Cascade	Potential reference	Support population
Banff National Park	Cascade River Basin	Sawback	Potential reference	Potential core
Banff National Park	Red Deer River Basin	Upper Dormer River	Reference condition	Core
Banff National Park	Red Deer River Basin	Lower Dormer River	Reference condition	Core
Banff National Park	Red Deer River Basin	Wigmore Creek	Potential reference	Potential core
Banff National Park	Red Deer River Basin	Snow Creek	Reference condition	Core
Banff National Park	Red Deer River Basin	Lower Panther River	Potential reference	Potential core
Banff National Park	Clearwater River Basin	Indianhead Creek	Potential reference	Support population
Banff National Park	Clearwater River Basin	Malloch Creek	Potential reference	Support population
Banff National Park	Clearwater River Basin	Snarl Creek	Potential reference	Support population
Banff National Park	Clearwater River Basin	Upper Clearwater River within Banff	Potential reference	Support population
Banff National Park	North Saskatchewan River Basin	Murchison	Potential reference	Potential core
Banff National Park	North Saskatchewan River Basin	Owen	Potential reference	Potential core
Banff National Park	North Saskatchewan River Basin	Lower North Saskatchewan	Potential reference	Core
Banff National Park	North Saskatchewan River Basin	Wilson	Functionally extirpated	Likely unrecoverable
Banff National Park	North Saskatchewan River Basin	Mistaya	Historically unoccupied	Historically unoccupied
Banff National Park	North Saskatchewan River Basin	Lower Howse	Potential reference	Potential core
Banff National Park	North Saskatchewan River Basin	Upper North Saskatchewan	Historically unoccupied	Historically unoccupied

National Park	Basin	Watershed	Distribution index	Predicted recovery category[7]
Banff National Park	North Saskatchewan River Basin	Middle Howse	Potential reference	Potential core
Banff National Park	North Saskatchewan River Basin	Howse Pass	Data deficient	Data deficient
Banff National Park	North Saskatchewan River Basin	Glacier Lake	Potential reference	Potential core/core
Jasper National Park	North Saskatchewan River Basin	Lower Brazeau River	Potential reference	Potential core
Jasper National Park	North Saskatchewan River Basin	Brazeau River – Valleyhead	Potential reference	Support population
Jasper National Park	North Saskatchewan River Basin	Brazeau River - Aztec	Potential reference	Support population
Jasper National Park	North Saskatchewan River Basin	Upper Brazeau River	Historically unoccupied	Historically unoccupied
Jasper National Park	North Saskatchewan River Basin	North-West Brazeau	Historically unoccupied	Historically unoccupied
Jasper National Park	North Saskatchewan River Basin	Lower Southesk River	Potential reference	Potential core
Jasper National Park	North Saskatchewan River Basin	Upper Southesk River	Data deficient	Data deficient
Jasper National Park	North Saskatchewan River Basin	Southesk 1	Data deficient	Data deficient
Jasper National Park	North Saskatchewan River Basin	Southesk 2	Data deficient	Data deficient
Jasper National Park	North Saskatchewan River Basin	Southesk 3	Data deficient	Data deficient
Jasper National Park	North Saskatchewan River Basin	Cairn River	Potential reference	Potential core
Jasper National Park	North Saskatchewan River Basin	Isaac Creek	Data deficient	Data deficient
Jasper National Park	North Saskatchewan River Basin	Isaac 1	Data deficient	Data deficient
Jasper National Park	North Saskatchewan River Basin	John-John Creek	Historically unoccupied	Historically unoccupied

* denotes possible regional spawning

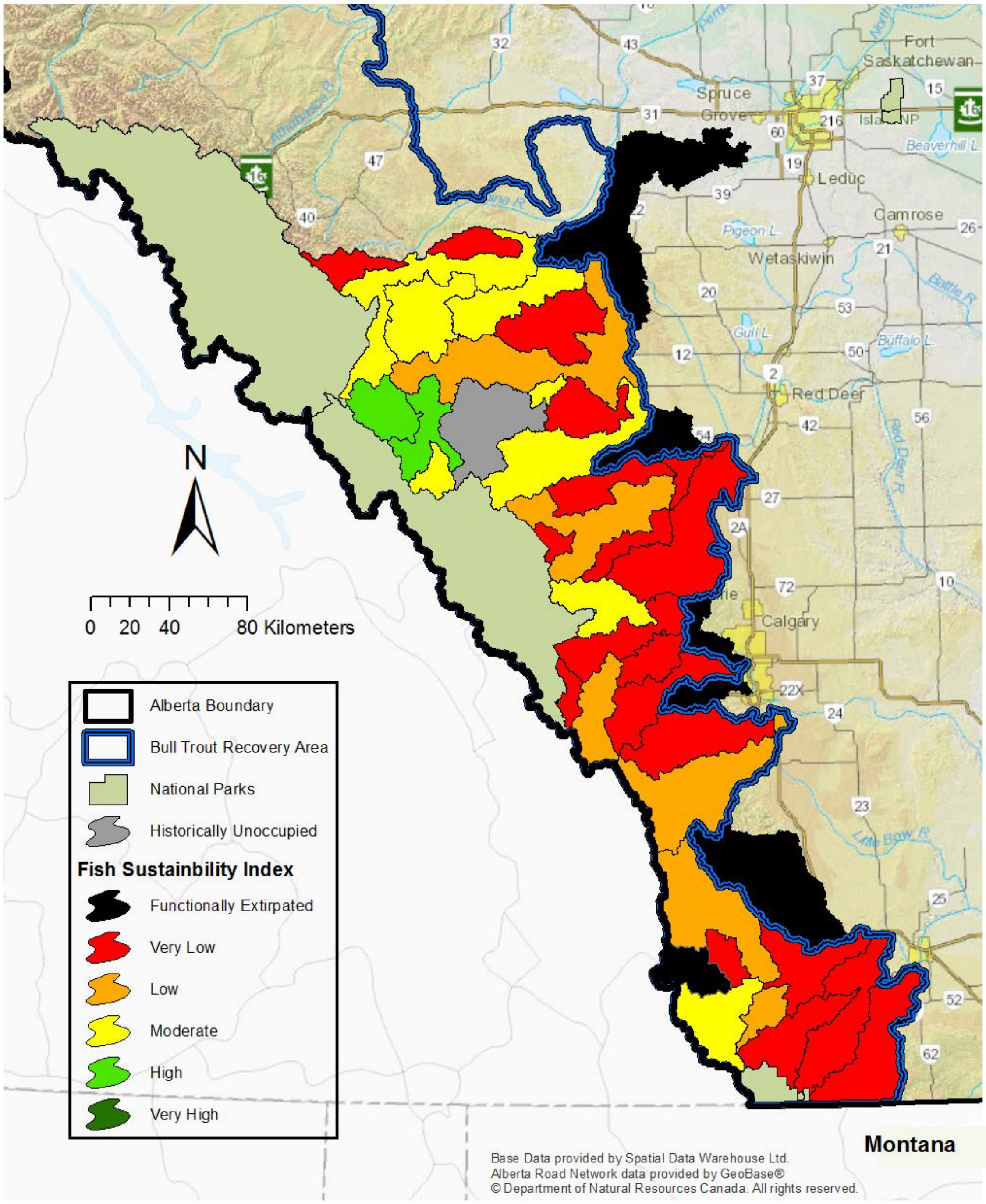

Figure 3a. Current Bull Trout population status in local watersheds at Hydrological Unit Code (HUC) 8 level, within the Recovery Area. Note that the Upper Crowsnest and Upper Ram HUC 8s were split at waterfalls to better characterize Bull Trout population status upstream and downstream of the waterfall

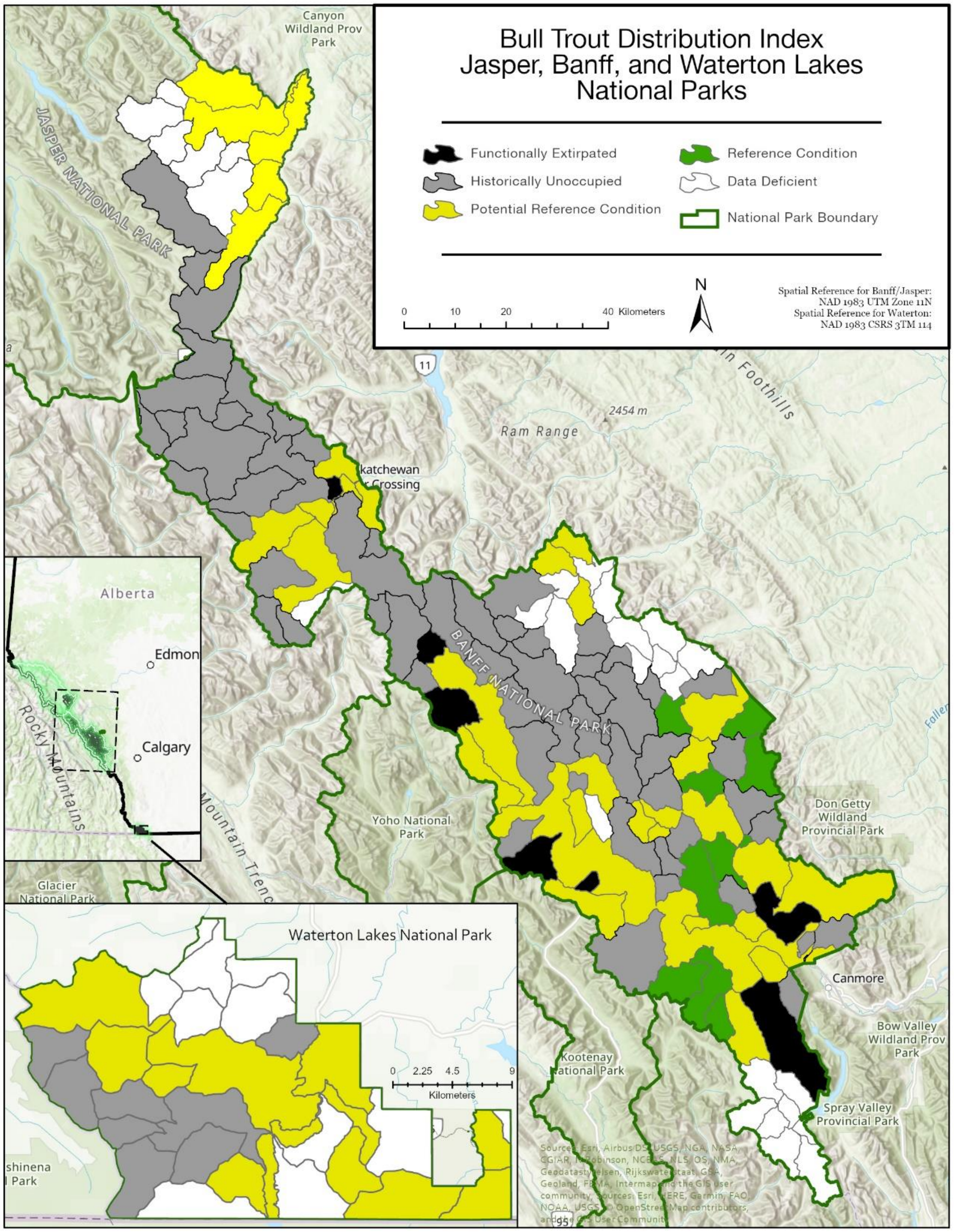

Figure 3b. Current Bull Trout Distribution Index (DI) in national park watersheds at Hydrological Unit Code (HUC) 12 level, within the Recovery Area. The status of populations ranging into the Ya Ha Tinda Ranch, Rocky Mountain House National Historic Site and Bar U Ranch National Historic Site (excluded in this map) are reported in the provincial Bull Trout population status map, Figure 3a.

4.4 Needs of the species

Bull Trout habitat is generally described as cold, clean, complex, and connected, regardless of life history type. Seasonal and perennial groundwater upwellings (areas where groundwater seeps up from below the stream bed) are an important component of Bull Trout habitat for all life history types. The following describes differences between Bull Trout life history types.

4.4.1 Stream resident life history

Stream resident Bull Trout live permanently in small, cold tributary streams and often spawn and overwinter within a 2 km section of river. They are strongly associated with pool habitat and instream and overhead cover. They may be connected to migrant populations or be fully or partially isolated by natural barriers. In the West Castle River (Oldman River basin) resident juveniles and adults overwinter in small, shallow pools with a depth of 0.4m to 1.5 m. These pools are isolated from one another, provide little cover and receive flow from perennial groundwater springs. Seasonal groundwater upwellings provide residents with cold-water refugia in summer and perennial groundwater upwellings provide warm water refugia in winter. Stream resident Bull Trout are active during the night throughout the winter on or above the substrate, even during extreme temperature and ice conditions. Small fish (< 200 mm) seek cover in coarse substrates and large woody debris.

4.4.2 Fluvial life history

Fluvial populations occupy medium sized rivers and major tributaries, and move into high gradient smaller rivers and tributary streams to spawn. In addition to spawning habitat, these small streams provide rearing habitat until approximately age 2, when the fish migrate to occupy large rivers, returning to natal streams to spawn, sometimes in alternate years (Fraley and Shepard 1989; McPhail and Baxter 1996; Warnock 2008). Spawning in the main stems of the rivers and major tributaries occupied by older juveniles and adults has not been documented, although suitable spawning habitat may exist and spawning could be possible. Fluvial adults may undertake extensive seasonal migrations, typically upstream, to spawning tributaries in May to August and downstream to overwintering areas by late September to early October.

The spawning migration may begin early for fish that migrate long distances and gain elevation, or that migrate through systems with low flow or unfavourable temperature conditions. In the upper North Saskatchewan River area, return migrations to spawning and overwintering areas begin in September to the end of October and were completed by early December. Return migrations may be triggered by declining water temperature and low stream flows. In some systems, fluvial Bull Trout exhibit a strong fidelity to spawning tributaries and overwintering areas, but in others they change spawning locations over time. Movements during the winter are typically minimal.

4.4.3 Adfluvial life history

Adfluvial Bull Trout reside in lakes and move into high gradient small rivers and tributary streams to spawn. Spawning within lakes has not been documented. Juvenile rearing begins in the spawning stream and they eventually move downstream into large rivers or lakes to feed, mature and overwinter. Spawning migration distance varies depending on the availability and location of suitable spawning habitat.

In high elevation, isolated, nutrient-limited lakes (for example, Pinto and Harrison lakes, Alberta) spawning habitat is usually located a short distance upstream in a lake inlet or downstream in the outlet. Habitat use within lakes shifts with the season and changing water temperatures. Bull Trout are generally more evenly distributed in lakes where and when water temperatures encountered are more uniform across depths (e.g., in winter or shallower waterbodies), but seek cooler, deeper water in the summer. They typically rest near the substrate during the day and forage in the littoral zone at night.

4.4.4 Habitat requirements by life stage

Natal streams and spawning:

Bull Trout natal streams tend to be shallow, structurally diverse headwater or tributary streams with stable channels found at higher elevations (COSEWIC 2012). Their structural diversity not only meets habitat requirements of spawning adults but also provides for the changing habitat needs of rearing juveniles. These natal habitats occur as discrete patches of suitable habitat in a matrix of the larger stream network (Baxter 1997; Dunham and Rieman 1999; Decker and Hagen 2008). Watershed size appears to be a significant factor in providing essential connectivity between these habitats (Rieman and McIntyre 1995).

Once in their natal streams (following migration for adfluvial and fluvial forms), Bull Trout undergo a behavioural transition in habitat use towards a pattern of daytime concealment and nighttime emergence (Jakober et al. 2000). Concealment cover includes woody debris and substrate crevices.

Because Bull Trout spawn in flowing water and eggs incubate over the winter, incubation sites are particularly vulnerable to anchor ice accumulations, as well as scouring and low flows. Females, therefore, often select spawning sites associated with groundwater sources that stabilise temperatures through the winter (Baxter 1997; Baxter and McPhail 1999; Ripley et al. 2005). Within these areas of upwelling, they tend to select localized spots of strong down welling and high inter-gravel flows (Baxter and Hauer 2000). These occur over coarse gravel-cobble substrates that have low levels of fine sediment, for example, the tail-outs of pools at the heads of riffles (Baxter and Hauer 2000). The specific selection of these characteristics increases aeration of eggs. Successful incubation is dependent on several stream characteristics, including appropriate temperature, gravel composition, permeability and surface flow.

Fry and young juvenile rearing:

The preference of young Bull Trout for coarser substrate than is used by spawning adults appears to be heavily influenced by avoidance of predation and competition. In the spring, newly emerged Bull Trout fry seek cover in shallow, slow-flowing stream margins with coarse cobble-boulder substrate (Pollard and Down 2001; Spangler and Scarnecchia 2001). As these juveniles grow, they tend to shift to deeper, faster flowing water, preferring pools over riffles (Bonneau and Scarnecchia 1998; Pollard and Down 2001; Spangler and Scarnecchia 2001). During the early months and years of life, when juvenile Bull Trout are rearing in their natal streams, microhabitat use shifts both daily and seasonally. Throughout this life stage, juveniles are secretive during the day, remaining close to cover, and disperse more at night (Bonneau and Scarnecchia 1998; Jakober et al. 2000). This pattern of daytime concealment and nighttime emergence is particularly pronounced in winter (Bonneau and Scarnecchia 1998; Jakober et al. 2000). Juveniles tend to shift to deeper, slower-flowing water in the fall, where they stay in contact with coarse substrates and remain closer to cover. This provides ice-free refuges for them throughout winter. Both shallow stream margins and deep water with low velocities provide important rearing areas for growing juveniles.

Older juvenile and adult foraging and overwintering:

Similar to younger fish, maturing and adult Bull Trout use habitat for foraging and overwintering that has the appropriate combination of temperature, shelter, and foraging opportunities. However, while stream habitat use by Bull Trout has been studied in detail, the specifics of habitat use in larger third, fourth and fifth order rivers, and lakes by these fish are poorly understood. Both fluvial and resident Bull Trout prefer low-velocity water, often associating with the downstream end of pools, and tend to remain close to cover (McPhail 2007). For resident forms, spawning habitat is typically found nearby these areas of low velocity at the end of pools.

While radio-telemetry studies undertaken in two headwater streams in Montana indicate Bull Trout only move a few kilometers in the fall to find ice-free overwintering sites (Jakober et al. 1998), Bull Trout in more northern latitudes may move further into larger tributaries. Just as groundwater upwellings are a preferred location for spawning, these sites that have more stable temperature regimes (that is, warmer during winter, colder during summer) than areas of surface-water recharge can also provide resident Bull Trout with suitably cold water throughout the year (Baxter and Hauer 2000). In streams, Bull Trout undergo a behavioural transition in habitat use during winter towards a pattern of daytime concealment and nighttime emergence. This is negatively correlated to temperature and fish size (Jakober et al. 2000).

Migratory forms (fluvial and anadromous) seek out suitable habitat in larger streams and rivers (or even the sea) that they both migrate through and eventually settle into forage and overwinter (Burrows et al. 2001; Muhlfield and Marotz 2005). Based on fishing patterns, adfluvial adult Bull Trout appear to remain in deeper, cooler water during the day (mostly resting on the bottom) and then move to littoral areas for foraging at night (McPhail 2007).

During spawning, female Bull Trout excavate a nest, or redd, by turning on their side, arching their body and forcefully beating their caudal fin. Males position themselves alongside the female in the redd. Over winter, the eggs remain in the substrate.

4.5 Residence of the species

4.5.1 Location of the species' residence

SARA states that "No person shall damage or destroy the residence of one or more individuals of a wildlife species that is listed as an endangered species or a threatened species, or that is listed as an extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild in Canada." [section 33]

Also, 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)]

The following (the residence statement) is a description of a residence for Bull Trout (Saskatchewan-Nelson rivers populations):

A spawning nest, or "redd" is considered to be the residence for Bull Trout. Similar to all salmonids that spawn within rivers, Bull Trout construct redds in locations that contain gravel substrates and exhibit groundwater upwelling. The female digs a redd in the gravel to deposit the eggs and males fertilize the eggs. Once fertilization has occurred, the female moves upstream to dig again resulting in coverage of the fertilized eggs by gravel. This coverage provides protection from predation and keeps eggs from being washed downstream to less suitable habitats in higher flows. Groundwater upwelling is important to ensure that there is a constant supply of freshwater flowing over the eggs so that the eggs do not become desiccated during low water events and so that the locations where eggs are deposited are resistant to anchor ice (a winter time occurrence where ice freezes to the streambed).

4.5.2 Structure, form and investment

During spawning, female Bull Trout excavate a nest, or redd, by turning on their side, arching their body and forcefully beating their caudal fin. Males position themselves alongside the female in the redd where eggs and sperm are released and the fertilized eggs fall into the depression created by the female. The female deposits eggs over several spawning events, each time moving upstream and digging an area, displacing gravel that covers eggs downstream. Redds are typically excavated to a depth of 10 to 20 cm and may range from 40 to 350 cm in length and 15 to 200 cm in width.

4.5.3 Occupancy and life-cycle function

Spawning activity can occur at any time between September and late October. Over winter, the eggs remain in the substrate hatching into alevins (the hatchlings) between March and April. Alevins can remain in the vicinity of the redd for several months following hatching. The residence is limited to the redd itself and the spawning and incubation time period that eggs and alevins are present in the redd structure.

5. Threats

5.1 Threat assessment

An assessment and prioritization of threats to survival and recovery of the species is undertaken at the RPA. A two-step process is used, that first characterizes threats at the population level and then at the DU level. For more details on the threat assessment process, refer to the Guidance on Assessing Threats, Ecological Risk and Ecological Impacts for Species at Risk. This document defines a threat as "any human activity or process that has caused, is causing, or may cause harm, death, or behavioural changes to a wildlife species at risk, or the destruction, degradation, and/or impairment of its habitat, to the extent that population-level effects occur" (DFO 2014).

For Bull Trout, threats were first assessed at the HUC 8 level. The likelihood of occurrence, level of impact, causal certainty, HUC threat risk (product of likelihood of occurrence and level of impact), HUC-level threat occurrence, HUC-level threat frequency, and HUC-level threat extent were evaluated for each identified threat (appendix 1 and 2 in Sawatzky 2016). This assessment relied heavily on information compiled by AEP as part of their FSI and cumulative effects modelling approach to threats assessment. The HUC level threat assessment was then rolled up to the population level (watershed scale): Oldman, Bow, Red Deer and North Saskatchewan. The wildlife species level (DU scale) threats assessment was derived from the population level threats assessment. The population level (watershed scale) threat assessment provides a finer scale of resolution to demonstrate where threats are concentrated within DU 4 and is included in appendix C (tables 10a to c). Current information for the Oldman River watershed was not available at the time of publication, information from the 2013 version of the FSI was used instead (Sawatzky 2016). The DU level threat risk, threat occurrence, threat frequency, and DU threat extent were then calculated (table 4). When rolling up from the watershed-level threat risk, the highest level of risk for any watershed was retained for the entire DU. See appendix D for an explanation of the threat assessment categories and terminology.

Table 4. Overall threat risk, threat occurrence, threat frequency, and threat extent for DU 4 (Sawatzky 2016).

Threat	DU level threat risk	DU threat occurrence	DU threat frequency	DU threat extent
Interactions: Competition and hybridization with Brook Trout	High	Current	Continuous	Broad
Competition with Lake Trout	High	Current	Continuous	Broad
Human-induced mortality: Mortality (for example, angling, scientific sampling)	High	Historical, current	Recurrent	Broad
Habitat fragmentation: Culverts	High	Current	Continuous	Broad
Dams and weirs	High	Historical, current	Continuous	Extensive
Irrigation canals	High	Current	Continuous	Narrow
Habitat alteration and removal: Alteration of natural flow regimes (disruption of peak flow intensity, roads, dams)	High	Current	Recurrent	Broad
Suspended and deposited sediments	High	Current	Recurrent	Broad
Alteration of stream temperature (change from natural)	High	Current	Continuous	Broad
Alteration of groundwater quantity or quality	High	Current, anticipatory	Single, recurrent	Extensive
Nutrient loading	High	Current, anticipatory	Recurrent	Broad
Contaminants and toxic substances	High	Current, anticipatory	Single, recurrent	Broad
Other threats: Climate change	High	Current, anticipatory	Continuous	Broad
Interactive and cumulative effects	High	Current, anticipatory	Continuous	Broad

5.2 Description of threats

Anthropogenic threats facing Bull Trout fall under four main categories: habitat fragmentation (that is, migratory barriers), habitat alteration and removal, human-induced mortality, and interaction (competition/ hybridization) with other species (especially Brook Trout; ASRD and ACA 2009, COSEWIC 2012). Sawatzky (2016) provides a detailed description of the principal threats to Bull Trout in DU 4. The effects of climate change and cumulative effects were also considered. Only threats that are currently acting on the species or affecting the species are considered here.

5.2.1 Habitat fragmentation

Connectivity (that is, unobstructed passage through watersheds) is a key habitat requirement for migratory Bull Trout. It is important in linking spawning, rearing, and overwintering habitats and in linking populations to facilitate gene flow and aid in the re-establishment of declining populations.

Habitat fragmentation is caused by the creation of migratory barriers that include: elevated, over or under-sized culverts; watercourse crossings constructed using multiple culverts; dams without fish passage facilities; water diversion canals or water withdrawal practices that entrain fish or decrease stream flow; and land-use practices that negatively impact habitat. Large dams built between 1911 and 1991 were designed without fish passage facilities. Low head dams (weirs) generally have fish ladders, although regular required maintenance and/or upgrades may be lacking. The use of fish ladders by Bull Trout appears to be low (Sawatzky 2016). The Bow and Oldman basins are fragmented mostly by dams and weirs. Irrigation canals cause habitat fragmentation by decreasing instream flow, resulting in potential increases in water temperature above Bull Trout tolerance limits, as well as entraining migrating Bull Trout below water control structures.

The impacts of fragmentation on Bull Trout vary, but typically result in range contractions and population declines, and may delay or prevent recovery following a disturbance. Fragmentation may also result in rates of extinction or extirpation exceeding rates caused by habitat loss by decreasing the chance of recolonization through regional connectivity. Decreased habitat fragmentation would allow recolonization in the event of local extirpations. However, this may also allow other competing species access to habitats resulting in increased competition.

The extent of spatial configuration constraints in areas occupied by Bull Trout in DU 4 has not been quantified. It is likely that potential pathways of genetic interchange have been lost through the reduction in connectivity, localized loss or reduction of certain life history strategies and reduced access to habitats for all stages of the life cycle (access to spawning rearing, overwintering, adult habitat requirements). The locations of instream barriers with details on location and specifications for dams is summarized in Sawatzky (2016).

5.2.2 Habitat alteration and removal

Various activities such as residential and industrial development, mining, unmanaged grazing, agriculture, forestry, irrigation, wastewater / septic leachate, water management, linear development (roads, rails, trails, pipelines), and recreational development can damage or destroy habitat properties by altering natural flow regimes, increasing sediment input and/or altering stream thermal regimes. These activities may also lead to contaminant and toxic substance inputs and nutrient loading. Sawatzky (2016) describes the impacts on Bull Trout.

The activities that may have directly or indirectly affected Bull Trout habitat include watercourse crossings (bridges, culverts, open cut crossings, etc.), shoreline/streambank work (bank stabilization, riparian vegetation management, etc.), mineral and aggregate extraction, oil and gas exploration, extraction and/or production, instream works (channel maintenance, restoration, realignments, dredging, aquatic vegetation removal, etc.), water management (stormwater management, water withdrawal, etc.), installation and operation of structures in water (boat launches, docks, effluent outfalls, water intakes, etc.) and other projects (for example, conduit installation on bridge, bridge washing). Additional information on these types of work can be found in the RPA (DFO 2017).

5.2.3 Human-induced mortality

Overexploitation:

Mortality, injury or reduced survival, resulting principally from fishing activities (for example, angling, recreational by-catch, poaching, scientific sampling), and entrainment at hydroelectric facilities and irrigation canals, impact Bull Trout populations.

Bull Trout are slow growing, late to mature, and their opportunistic and aggressive feeding behaviour increase their vulnerability to angling. They form spawning aggregations in clear shallow water, making them easy targets for anglers. Angler access has increased substantially over the past 50 years with industrial development and its associated road network. A province-wide zero harvest regulation was implemented in Alberta in 1995, but prior to this, Bull Trout were overexploited throughout the province in accessible areas. Even with the zero-harvest regulation, poaching and misidentification are still a problem (Sawatzky 2016).

Incidental harvest:

Campaigns to educate anglers about the significance of Bull Trout, impacts to Bull Trout, its role in the ecosystem and how to identify the fish began in the 1990s and have had some success. Catch-and-release fisheries may be a source of mortality from injuries caused by hooking. In the Belly and Waterton rivers, hooking mortality was estimated to be 5% (DFO 2017). In systems where recreational fishing occurs, by-catch of Bull Trout by anglers targeting other trout species is also a concern. Simulations using reasonable estimates of fishing effort and associated mortality showed that restrictive angling regulations will continue to be required for many Bull Trout populations if they are to be sustained.

Scientific sampling is a low risk threat, but is a potential source of mortality. Since Bull Trout was listed under SARA, this activity is controlled by permitting, and sampling protocols must be followed.

5.2.4 Interactions with other species

Displacement and competition:

Interactions with other fish species are an important determinant of Bull Trout distribution and abundance. Interference competition from other species, such as Rainbow Trout, Brook Trout, or Westslope Cutthroat Trout, appears to be mediated by water temperature and the abundance of prey species can impact Bull Trout growth and survival (COSEWIC 2012). Temperature requirements, relatively slow growth, late maturity and variable spawning frequency make Bull Trout particularly susceptible to competition with introduced species. In many cases they have been out-competed, resulting in reduced abundance and population viability. Introduced species may also predate directly on juvenile Bull Trout.

Lake Trout (*Salvelinus namaycush*) and Brook Trout are the most frequently implicated species in the competitive displacement or replacement of Bull Trout in lakes and streams, respectively. Introduced Brown Trout are likely replacing, rather than displacing, Bull Trout, as Bull Trout declines have been observed to precede increases in Brown Trout. However, this requires further research.

The impacts of Brook Trout invasion into Bull Trout streams range from no impact to complete replacement of Bull Trout. Bull Trout may be displaced into smaller and more isolated populations in headwater streams as Brook Trout become more common in the preferred lower elevation areas (Thomas et al. 2007; ASRD and ACA 2009). These Bull Trout populations are at increased risk of local extinction due to non-native fish invasion and other identified threats.

Displacement of Bull Trout by Brook Trout, a species introduced to the area from eastern Canada, may be a greater threat to resident Bull Trout than to the migratory form. Residents have a greater direct niche overlap with Brook Trout (for example, similar diet, occur in small headwater streams) for their entire life cycle, whereas migratory Bull Trout move downstream to higher stream orders and shift to piscivory at the end of their juvenile phase.

Hybridization and introgression[8]:

In addition to competitive replacement or displacement, hybridization with Brook Trout may also be a threat to Bull Trout. Hybridization between Bull Trout and Brook Trout has been confirmed in Alberta, but the extent of population impacts is unknown. The offspring of Brook Trout and Bull Trout may reproduce, but genetic work is required to understand the significance of the threat of genetic introgression. While most hybrids can compete with Bull Trout for food and habitat, they rarely go on to produce viable offspring themselves, resulting in a wasted reproductive effort, that may reduce the fitness of the Bull Trout populations.

5.2.5 Other threats

Climate change:

The global warming observed over the past 50 years is due primarily to human-induced emissions of heat-trapping gases and warming over this century is projected to be considerably greater than over the last century (Thomas et al. 2009). In the Rocky Mountains, climate warming is occurring at two to three times the rate of the global average. In parts of Alberta, the mean temperatures of the warmest month have increased by at least 1°C, the frost-free period has increased by close to 20 days, and growing-degree-days (GDD) have increased by up to 200 GDD > 5°C. Increasing temperatures could result in significant loss of thermally suitable spawning and rearing habitat, as well as feeding, migrating, and overwintering habitat areas (Sawatzky 2016).

Precipitation-as-rain has been increasing in the northern mountains, parkland, and northern foothills, and has been stable or declining in other areas of Alberta. Precipitation-as-snow is stable, or possibly declining, in most regions. Snowpack and glacial meltwater maintain river and groundwater supplies, but the Bow, Saskatchewan and Athabasca glaciers are shrinking rapidly. Winter snowpack is expected to contribute much less meltwater and the spring melt is predicted to occur earlier in the year compounding the effects of drought. Higher latitudes and elevations will be most impacted by these conditions caused by a warming climate.

[8] Introgression is the transfer of genes between two species that can breed with one another, and the subsequent retention of those genes in future generations of the species.

Extreme weather events (floods, droughts, etc.) are predicted to increase as climate warms, although the extent that this will occur is uncertain. Large floods during fall, winter, or early spring may cause bed scour strong enough to destroy Bull Trout redds, embryos and alevins prior to emergence, and may displace newly emerged fry. Drought conditions may lead to an increase in wildfires that, in turn, may cause loss of riparian vegetation thereby reducing shade and causing an increase in water temperature and sedimentation. Large disturbances following a severe wildfire, such as extreme flooding and debris flow, may cause local extirpations. Longer term effects, such as changes in channel form and increased water temperatures, may cause changes in riverine food webs, have temperature-related physiological impacts on fish, and increase mortality or local extirpations if water temperatures increase beyond lethal limits.

Increasing water temperatures from climate warming may cause further habitat fragmentation and loss of Bull Trout. However, streams with greater riparian vegetation and/or groundwater inputs are less likely to be impacted by warmer air temperatures (MacDonald et al. 2014). Wenger et al. (2011) found that to effectively manage Bull Trout in a changing climate, areas with the coldest water temperatures have the best long-term potential to support the species, thus they suggested resources and protection should be allocated to these areas. Genetic diversity in populations may also offer resilience to climate warming.

Interactive and cumulative effects:

While not a threat by itself, cumulative environmental effects result from the incremental effect of a threat or stressor when added to past, present, and reasonably foreseeable future actions.

The impacts of multiple stressors acting at the same time may also interact in various ways. They may be additive (effect is equal to the sum of the impacts when each acts alone), synergistic (effect is greater than the sum of the individual stressor impacts), or antagonistic (effect is less than additive). Several studies examining the impacts of two stressors acting at once found that antagonistic effects are generally more common, however, net effects may still be detrimental (Sawatzky 2016).

Climate change can interact with other stressors by affecting the timing, spatial extent and/or intensity of effects of those stressors and may also limit the ability of an ecosystem to recover following a disturbance. Some stressors may also make ecosystems more vulnerable to climate change. For example, damage caused by deforestation (such as reduction of shade in riparian areas) can decrease the resiliency of an ecosystem to climate change by resulting in increased stream temperatures. Deforestation may also cause local warming and reduced rainfall and snow retention, exacerbating climate change impacts and water availability. Water withdrawals for agricultural purposes may increase with reduced precipitation or drought, further exacerbating impacts of climate change on freshwater ecosystems.

Disease and aquatic invasive species

Whirling Disease has recently been detected in many watershed within the range of Bull Trout in Alberta. Whirling Disease is caused by the parasite *Myxobolus cerebralis* that infects juvenile trout. In many cases, the parasite causes the infected fishes tail to turn black and produces a “whirling” swimming behaviour. Some literature suggests that Whirling Disease has a lesser impact on Bull Trout than Rainbow Trout and Westslope Cutthroat Trout (Hedrick 1999). This threat was not assessed in during the recovery potential assessment for Bull Trout, as it had not been detected in the province at the time of the assessment. This threat should continue to be monitored, and assessment of the potential impact of whirling disease on Bull Trout should be continued. It should be noted that the Province of Alberta and PCA are undertaking significant efforts to identify where whirling disease is encountered. A program and protocols to minimize and stop the transfer of this parasite and have been established to address this threat. Threats from other aquatic invasive species such as: Zebra Mussel (*Dreissena polymorpha*), Quagga Mussel (*Dreissena rostriformis bugensis*), and other aquatic invasive species were similarly not assessed but represent concerns. It should be noted that aquatic invasive species programs have been established in the province, and by DFO and PCA to address this threat.

Summary of threats in national parks:

The aforementioned threats apply in the national parks, albeit at different severities and scales compared to the approach taken by AEP. Some specific areas of the national parks have been impacted by habitat fragmentation, most notably in the Bow watershed in Banff (Schindler 2000). However, much of the mountain national park waterbodies are interconnected. Angling pressure is low with the exception of small local areas. While some habitat alteration has occurred in relation to linear disturbances like roads and railways, the largest mitigatable threat to Bull Trout in the national parks is the legacy of historic stocking of non-native trout such as Brook Trout and Rainbow Trout (Schindler 2000). With the exception of stocked non-native trout, climate change and two large hydropower dams in Banff National Park, all remaining threats can be grouped as cumulative effects.

The cumulative effects of waste water effluent, storm water, and linear disturbances such as roads and railways are generally mitigated through environmental management as guided by existing legislation such as the *Canada National Parks Act*, *Fisheries Act*, *Canadian Environmental Protection Act* and *Impact Assessment Act* (see Bowman 2003; Sullivan et al. 2019). In contrast to Bull Trout populations found outside of national parks, PCA's native trout recovery actions are mainly focused on eradicating the threat of non-native trout and their hybrids (see Pacas and Taylor 2015).

5.3 Description of limiting factors

The most significant natural limiting factor for Bull Trout is its habitat specificity, particularly water temperature (maximum daily August water temperature less than 12°C) (DFO 2017), and spawning and rearing habitat requirements that strongly influence its distribution. This sensitivity makes Bull Trout an excellent indicator of environmental disturbance and climate change (COSEWIC 2012).

Density-dependent survival, being a top aquatic predator and having high site fidelity can contribute to relatively low densities of Bull Trout. These factors, along with its restricted gene flow, naturally fragmented distribution, and the long period of time it takes to reach sexual maturity (average five years) relative to other freshwater salmonids, make Bull Trout vulnerable to local extinctions through stochastic processes.

Bull Trout have, however, evolved strategies to persist in variable environments such as, reaching adulthood and sexual maturity faster for some life history strategies, decreased size at maturity, and increased frequency of reproduction at lower densities. While these naturally occurring limiting factors may make Bull Trout vulnerable to anthropogenic disturbances, they may also provide some degree of insulation against some threats, such as habitat fragmentation.

6. Recovery

6.1 Population and distribution objectives

6.1.1 Recovery area

Approximately 22% of the historical extent of occurrence of Bull Trout in DU 4 is now functionally extirpated due to reductions in habitat quality (that is, higher water temperature, reduced water quality and/or quantity, changes to flow regime), loss of connectivity, historical fishing harvest, ongoing incidental mortality and illegal harvest. At this time, in a five- to ten-year time span, it is unfeasible to expect to recover Bull Trout in streams that:

- far exceed the species temperature tolerance
- are fragmented by dams that lack fish passage structures
- have undergone widespread changes in land use that are very difficult to reverse (for example, dam construction, conversion to agricultural areas, urban development)

Due to uncertainty around the possibility of reversing impacts required to recover Bull Trout in some areas, it is better to characterize what and where recovery is possible. The area where the population and distribution objectives are being applied is called the Recovery Area and it encompasses the HUC 8s and HUC 12s in DU 4 where there is historic evidence of Bull Trout occupancy (figures 3a and 3b), and continued occupancy. It excludes HUC 8s in the eastern part of the distribution where Bull Trout are considered functionally extirpated, and dams or significant land use change has made it unfeasible to consider restoration at this time. Included in the Recovery Area are historically fishless headwaters, as they are an essential component of the aquatic ecosystem that supports Bull Trout. Additionally, further assessment may identify these historically fishless sites as candidate sites for new populations. New information generated as part of recovery strategy implementation will be used to periodically revise the boundaries of the Recovery Area.

6.1.2 Recovery goal (population and distribution objective)

The long-term recovery goal within all historically occupied areas within the Recovery Area is:

> To protect, maintain and recover Bull Trout to self-sustaining populations where recovery is likely, within the Recovery Area.

To assist with the long-term goal within the Recovery Area, AEP, PCA, DFO, and several environmental non-governmental organizations (ENGOs) and community groups (for example, Trout Unlimited Canada, Alberta Conservation Association) have collected data on: current Bull Trout population abundances in the province (FSI), distribution indices in the national parks (DI), and used local expert knowledge to assist the resource managers assign HUC 8s (AEP) or HUC 12s (PCA) into one of the four categories described below. See figures 4a and 4b for visualizations of the predicted long-term recovery of Bull Trout populations within the Recovery Area.

> **Core Population:** FSI score ≥ 3 or DI in Reference Condition. High certainty that the population in the HUC 8 (or HUC 12 in the national parks) watershed can be maintained or increased.

Potential Core Population: FSI score = 2; DI in Potential Reference Condition. Given some improvements, these populations can be maintained as a Potential Core Population, or be recovered to a Core Population.

Support Population: FSI score = 1; DI in Potential Reference Condition. Given some improvements, these populations can be maintained as Support Populations or be recovered to a Potential Core or Core Population. It may not be possible to fully mitigate all threats, but the HUC may have tributaries within it that provide important spawning, rearing, overwintering, or migratory habitat.

Likely Unrecoverable: Populations that are at serious risk of extirpation in most of the HUC even if conservation actions are applied.

Given the uncertainty in the potential timing for achieving the long-term recovery goal, several objectives were developed for the next 10 years. As more information is collected during recovery implementation, the recovery goal can be refined and made more quantitative.

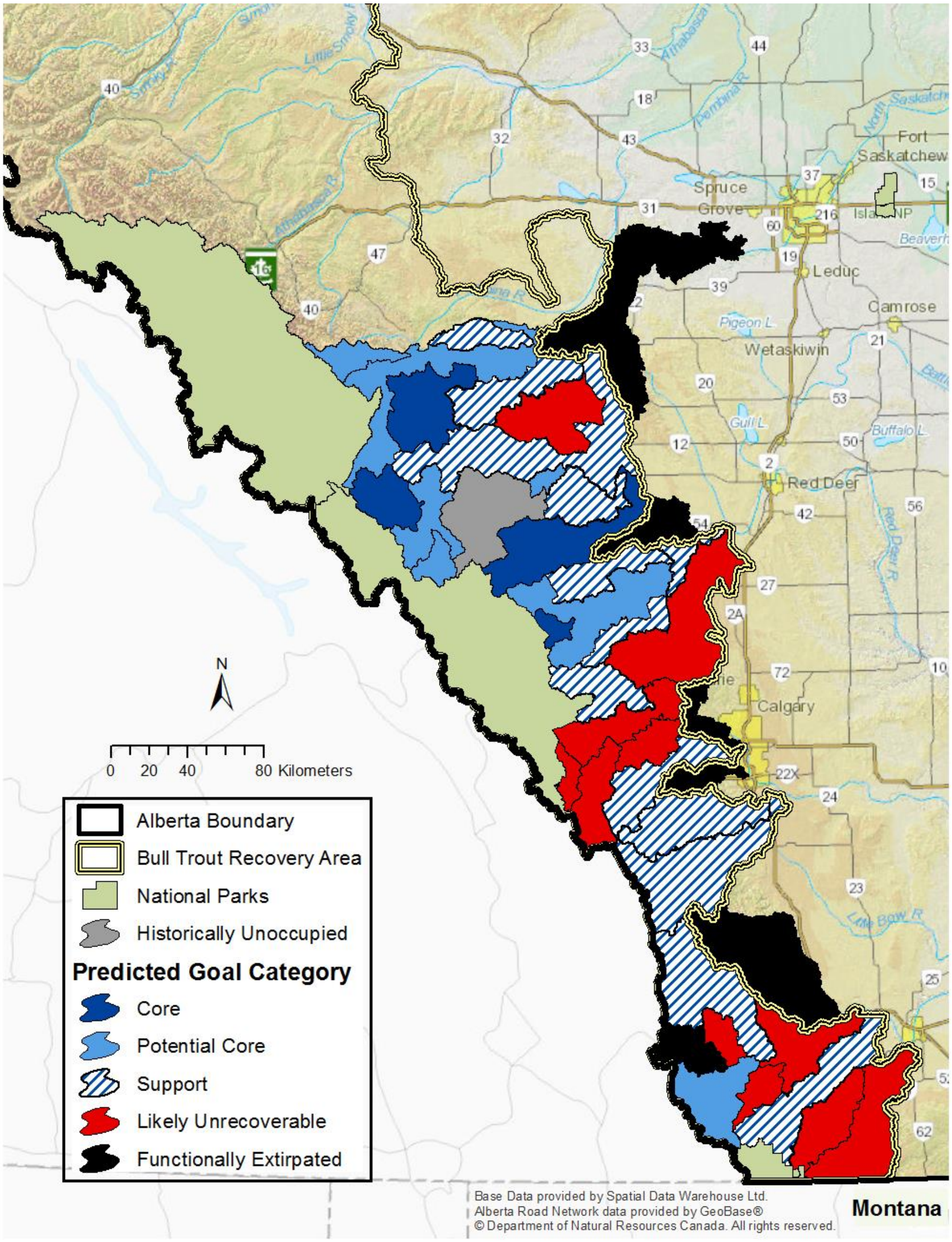

Figure 4a. Representation of the best-case long-term recovery scenario based on current understanding of the potential to mitigate the factors affecting Bull Trout populations in local watersheds at Hydrological Unit Code (HUC) 8 level, within the Recovery Area. The future state of each HUC 8 is based on model predictions of how system capacity can be improved based on a hypothetical threat mitigation scenario.

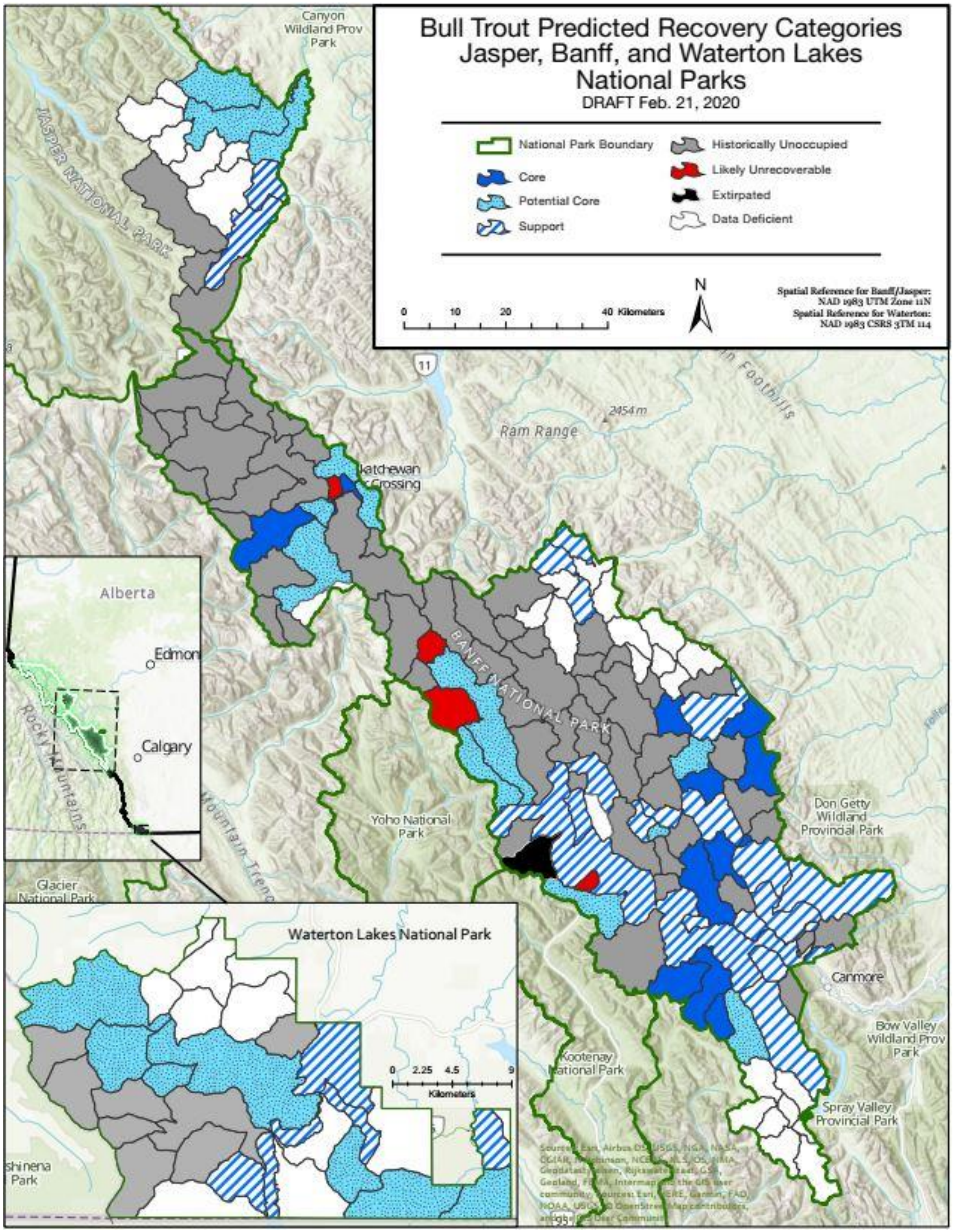

Figure 4b. Representation of the best-case long-term recovery scenario based on current understanding of the potential to mitigate the factors affecting Bull Trout populations in national parks Hydrological Unit Code (HUC) 12 watersheds within the Recovery Area.

6.1.3 Objectives to meet the recovery goal

It may take decades to see significant progress towards the recovery goal because:

- the generation time of Bull Trout is approximately 7 years (COSEWIC 2012)
- the area that Bull Trout occur in have a large range and occupy a variety of habitats
- additional information needs to be gathered during implementation of this recovery strategy to better understand the threats and to develop/refine the tools to mitigate the threats
- habitat restoration, modifying land use, and gaining support from directly affected stakeholders is a long-term endeavor

With the above in mind, specific objectives for the next 10 years were developed. Note that, while the HUC 8 and HUC 12 scale is used to describe populations in this recovery strategy, finer scale delineations (for example HUC 10, HUC 12 or individual site) may be used in future efforts to assess populations, and to plan and monitor recovery actions.

Objective 1 (5- to 10-year objective):

Maintain or improve the condition of Core, Potential Core, and Support populations through better understanding and mitigation of threats.

Indicator: It may not be logistically possible to quantitatively sample HUC 8s (or HUC 12s in the national parks) within Core, Potential Core, and Support populations frequently enough to determine trends in population abundance. However, there should be intensive monitoring on a subset of these HUCs as part of the recovery implementation in addition to other sources of population information, such as sampling for whirling disease and aquatic invasive species, creel surveys, and information on age structure and distribution. This information will be collated every five years (more frequently if possible) to evaluate the extent that this objective is being achieved.

Objective 2 (5-year objective):

Improve the condition of at least one HUC 8 (or HUC 12 in the national parks) within Core, Potential Core, or Support populations by increasing the adult abundance or distribution (for example, increasing minimum of one FSI score) within each of the Oldman, Bow, Red Deer and North Saskatchewan River basins. At least four HUC 8 (or HUC 12 in the national parks) recovery projects are initiated throughout the Recovery Area.

Indicator: The number of projects initiated in each basin, and changes to Bull Trout population distribution and abundance.

Objective 3 (10-year objective):

In addition to the four HUC 8 (or HUC 12 in the national parks) recovery projects associated with Objective 2, initiate at least two more projects for Core or Potential Core populations within each of the Oldman, Bow, Red Deer and North Saskatchewan River basins (eight new recovery projects in addition to the four recovery projects initiated for Objective 2, by the end of year 10 throughout the Recovery Area).

Indicator: The number of new projects initiated in each basin, and changes to Bull Trout population distribution and abundance.

7. Broad strategies and general approaches to meet objectives

7.1 Actions already completed or currently underway

Various approaches and regulatory tools now support Bull Trout conservation in Alberta, such as:

- provincial listing as Threatened under *The Wildlife Act*
- the protection of the population of DU 4 Bull Trout under the *Canada National Parks Act*, *Fisheries Act*, *Canadian Environmental Protection Act, Canadian Energy Regulator Act* and *Impact Assessment Act*;
- the protection of Westslope Cutthroat Trout and their critical habitat and residences under the *Species at Risk Act* within Bull Trout DU 4 due to overlapping range and similar habitat requirements.

As per the actions recommended in this recovery strategy, some of the following management approaches and regulations may require modifications to more fully recognize and support Bull Trout recovery and conservation.

1. Fisheries management and inventory:

    - Minimum harvestable length of 40 cm introduced in 1987
    - Alberta Fish and Wildlife released “Alberta’s Bull Trout management and recovery plan” in 1994
    - Alberta has maintained a zero-bag limit for Bull Trout since 1995
    - Fishing in Banff, Jasper and Waterton Lakes national parks is governed by the *National Parks Fishing Regulations*. Those regulations currently include a zero possession limit for Bull Trout.
    - As of 2016, Alberta completely banned the use of bait within the range of Bull Trout to reduce hooking mortality
    - Stocking programs have been changed: triploid (3N) fish only that have been certified disease-free and no stocking in waters with outflow (only 97% of fish are actually 3N, which can still pose a risk when millions of fish are stocked)
    - Increased public education to reduce misidentification of salmonids and increase awareness of regulations including website, pamphlets and signage
    - On-going population assessments in reference watersheds
    - AEP continues to work on a cumulative effects modelling approach to aid in the determination of the primary threats to watersheds (DFO 2019a)

2. Provincial Acts and Regulations that help to protect water courses (for example, water quality, streamflow) include:

    - *Environmental and Enhancement Act* (EPEA; for example, pesticide application guidelines, ambient water quality objectives and loading)

- *Water Act* (for example, codes of practice for crossings, stream setbacks)
- *Forest Act* (for example, reforestation, riparian buffers on most streams, maximum forest cover removal targets)
- *Public Lands Act* (for example, stream crossings)
- Provincial Policy Tools (for example, Water For Life, Land use Framework)
- a draft “Trouts and Droughts” policy (Alberta) that identifies the threshold for water level and temperature closures

3. Federal Acts that help to protect water courses:

- *Fisheries Act*
- *Canada National Parks Act*
- *Canadian Energy Regulator Act*
- *Canadian Environmental Protection Act*
- *Impact Assessment Act*

7.2 Strategic direction for recovery

The objectives to meet the Recovery Goal require research and management approaches to address the identified threats. Broad strategies are proposed to guide these research and management approaches and are discussed under the headings of:

1. research
2. monitoring and habitat assessment
3. management and regulatory actions
4. outreach and education

Some strategies have been discussed in supporting documents to this recovery strategy (see Sawatzky 2016) and they are designed to assess, mitigate, or eliminate specific threats to the species; to address information deficiencies that might otherwise inhibit species recovery; or to contribute to the species’ recovery in general. These strategies will also later help inform the development of specific recovery measures in one or more action plans and may benefit additional species (appendix C).

These four strategies will:

- conduct research on the Bull Trout population by further studying its biology, ecology, and environment
- continue to monitor, assess, and protect Bull Trout populations and their habitat, and monitor human activities to assess, minimize, and mitigate ongoing and newly-emerging threats on the fish and their habitats
- manage the mortality of Bull Trout from all non-natural causes, with emphasis on reducing mortality due to angling, managing angler access, understanding/managing cumulative effects
- communicate the need for and the content of this recovery strategy to promote understanding and support within the Province of Alberta, in large part, by promoting the conservation of all native salmonids

Table 5 summarizes the identified knowledge gaps and concerns, the broad strategies employed to address them, and the research and management approaches proposed in order to eventually achieve the recovery goal. Some of the measures proposed address multiple broad strategies.

Table 5. Recovery planning table.

Measure	Broad strategy	Concern addressed	Priority[9]	General description of research and management approaches
1	Research	Unknown or incomplete population status	High	• Complete inventory data for all populations in Recovery Area and classify as Core, Potential Core and Support at the Hydrologic Unit Code (HUC) 8 scale (HUC 12 in the national parks) • Classify all streams into Fish Sustainability Index (FSI)/Distribution Index (DI) risk categories and compare with potential carrying capacity; this will help to identify the most vulnerable populations and identify locations where there is room for population expansion
2	Research	Incomplete biological knowledge	High	• Test ways to increase the number of Core Bull Trout populations within the Recovery Area and reduce non-native trout populations where feasible (this includes understanding habitat stressors and mechanisms that influence Brook Trout colonization) • Undertake genetic analyses of Bull Trout populations in each HUC within the Recovery Area to understand gene flow between populations, and hybridization with Brook Trout, to inform restoration stocking initiatives • Improve understanding, and delineation, of critical habitat • Apply adaptive management to initial pilot projects within each watershed HUC 8 (or HUC 12 in the national parks) to address threats hypothesized to drive population decline to generate information about the relationship between threats identified through modelling and population response
3	Research	Interactions	High	• Maintain or increase the number of Core Bull Trout populations • Remove non-native species from areas they are known to be established within the Bull Trout range. Prioritize removal of non-natives based on biological risk and feasibility • Monitor the range of Bull Trout for the presence or establishment of competitive invasive fish species • Monitor range of Bull Trout for the presence of whirling disease and aquatic invasive species
4	Monitoring and habitat assessment Management and regulatory actions	Habitat fragmentation	High	• Develop Regional Access Plans to identify and address problematic stream crossings and linear disturbances, and immediately begin implementation of priority actions with emphasis on stream crossings • Identify migratory routes for fluvial Bull Trout, identify and assess barriers to fish passage and work with owners of obstructions (dams, watercourse crossings) to address fish passage concerns

[9] Priority" reflects the degree to which the approach contributes directly to the recovery of the species or is an essential precursor to an approach that contributes to the recovery of the species:

- "High" priority approaches are considered likely to have an immediate and/or direct influence on the recovery of the species
- "Medium" priority approaches are important but considered to have an indirect or less immediate influence on the recovery of the species
- "Low" priority approaches are considered important contributions to the knowledge base about the species and mitigation of threats

Measure	Broad strategy	Concern addressed	Priority[9]	General description of research and management approaches
				• Inspect all temporary and permanent stream crossings in Recovery Area and remove or repair any that restrict fish passage
5	Monitoring and habitat assessment Management and regulatory actions	Habitat loss and degradation	High	• Maintain natural stream flow and temperature regimes, primarily by managing riparian activities • Develop and implement a compliance promotion plan for the species to promote compliance with all relevant federal and provincial Acts aimed at protection of aquatic and riparian habitats • Undertake compliance promotion and compliance monitoring • Identify and decrease the number of point sources contributing to increased sedimentation and phosphorus concentrations • Identify and decrease the number of point sources contributing to water quality degradation and reverse the trends of degradation from non-point sources (for example, roadways, stream crossings) • Decrease the need for, and the number of, habitat compensation and restoration projects (because habitat is being adequately maintained) • Prioritize and restore areas of degraded aquatic and riparian habitat
6	Management and regulatory actions Outreach and education	Mortality	Moderate	• Increase angler knowledge about Bull Trout and fishing regulations • Increase compliance with regulations through education, awareness and enforcement
7	Monitoring and habitat assessment Management and regulatory actions Outreach and education	Habitat loss and degradation	Moderate	• Ensure native trout conservation and protection issues are identified and prioritized in plans for all regions that intersect with the Recovery Area • The Alberta Fish Conservation and Management Strategy, and the conservation status, recovery plans, and implications of federal Species at Risk listings should be used to communicate the need to better accommodate the needs of native trout in Alberta's land management system • When feasible, ensure new roads are not developed close to Bull Trout streams • Close industrial roads to public access, add signage and develop a compliance plan • Develop new regulatory approaches such as limited entry fisheries, alternate year closures in some areas, or having some reaches of river designated as sanctuaries and population sources
8	Outreach and education	Educate public about Bull Trout and native trout conservation	High	• Convey the importance of reducing damage to Bull Trout habitat from all sources (for example, industry, off-highway vehicles) • Outreach and awareness campaigns to increase the awareness and use of reporting systems for invasive species • Develop a stakeholder engagement plan for each river basin
9	Outreach and education	Improve education	High	• Produce training materials to improve angler identification of Bull Trout

Measure	Broad strategy	Concern addressed	Priority[9]	General description of research and management approaches
		and training of anglers		• Increase awareness of proper handling and release methods applicable to all species • Produce materials pertaining to threats and recovery of Bull Trout, including regulation changes that are coordinated and co-delivered with partners
10	Outreach and education	Increase the prominence of native trout conservation	High	• Ensure native trout conservation and protection issues are identified and prioritized in land use plans and resource management plans for all regions that intersect with the Recovery Area • Develop and implement regulatory guidance such as how Bull Trout recovery should influence regulatory decisions associated with water allocation and land use • Develop and deliver a native trout conservation outreach and education program for Government of Alberta staff and partner agencies that regulate land use in Bull Trout areas • The Alberta Fish Conservation and Management Strategy, and the conservation status, recovery plans, and implications of federal Species at Risk listings should be used to communicate the need to better accommodate the needs of native trout in Alberta's land management system

7.3 Narrative to support the recovery planning table

7.3.1 Research

Research will assist in informing actions related to the number of Core Bull Trout Populations. Currently, some information on Bull Trout relies on limited or inferred information from other populations. Information gaps exist regarding population structure, abundance, seasonal distribution and habitat requirements and need to be addressed to refine the recovery strategy and ensure that populations are adequately protected. Developing criteria to identify populations at high risk of extirpation will help to inform some actions.

Unknown or incomplete population status and incomplete biological knowledge:

Measures 1 and 2 identify the need to learn more about the distribution of the Bull Trout, its habitats, and the need to monitor the effect of recovery strategies. These Measures call for completing the genetic analysis of all populations, as well as:

- a complete inventory of streams, including genetic analyses, in Bull Trout range (that is, community composition, population status)
- continuing to categorize populations as Core, Potential Core, Support Population, and Likely Unrecoverable
- Refining the resolution of assessment within all HUCs to provide finer scale analysis (Undertaking future assessments finer scale HUCs within HUC8s to identify FSI status of populations at finer scales to ensure, for example, situations where robust populations within "Likely Unrecoverable" HUCs are not overlooked
- following statistically valid procedures to monitor population trends in watershed subunits at appropriate intervals (to be determined); the Core and Potential Core populations are the priority for regular population monitoring and genetic analyses, to enable restoration stocking
- updating fish species distribution maps
- updating critical habitat mapping
- classifying streams into FSI / DI categories

Knowledge gaps need to be addressed to inform priority recovery actions, especially those pertaining to habitat and invasive species, by:

- improving definitions of ecological thresholds linked to Bull Trout populations and their habitat across all life stages and life history strategies
- improving ways to identify and delineate critical habitat

Interactions:

Addressing this concern is contingent on research, and supported by fisheries management. It is important to reduce the number (and proportion in fish communities) of Brook Trout or other introduced salmonids in Bull Trout habitat to help populations recover by reducing competition. While anthropogenic barriers to migration are typically considered detrimental to a native population, in some cases they prevent the introduction of species that create competition. Critical examination of known barriers needs to be undertaken to determine if they are best left in place or if removal would be beneficial to Bull Trout. Overall habitat needs to be monitored for impacts in streams that potentially contribute to production of the diatom, *Didymosphenia* *geminate* (didymo, or "rock snot"), and regularly evaluate risk to Bull Trout streams. Monitoring and delineation of areas and populations impacted by the spread of Whirling Disease and aquatic invasive species, and the development and implementation of measure to avoid, curtail, and contain these threats must also continue.

7.3.2 Monitoring and habitat assessment

Once baseline information has been collected, regular monitoring with appropriate frequency, intensity, and methodology is necessary to establish trends to determine changes in Bull Trout distribution and abundance, as well as, to describe the availability of critical habitats once completely identified. An effective monitoring program will help to inform research and identify mechanisms that are affecting the population in either positive or negative ways.

7.3.3 Management and regulatory actions

New and revised management and regulatory actions are advised to protect Bull Trout and their habitat. This includes reviewing current non-compliance rates, working with regulators to build more systematic approaches and improving ground level outcomes with respect to existing rules.

Habitat fragmentation:

Barriers to the movement of Bull Trout is one of the three highest ranked threats with population level effects being predicted in all river basins. Barriers can prevent upstream migration to spawning areas and isolate populations and can extirpate populations below the barriers if no spawning habitat exists there. While the magnitude of the threat is based on modelled predictions that require further validation, road crossing culverts frequently fail with age and become a barrier to fish passage (ASRF and ACA 2009).

Within DU 4, the Bow River basin is the most fragmented with thirteen dams and four weirs. The Oldman River basin has three major dams and two weirs, the Red Deer River has one major dam and the North Saskatchewan River has two major dams. The majority of dams and weirs in Alberta do not provide fish passage although the ability of Bull Trout to use fish ladders may be limited.

Habitat loss and degradation:

Spring runoff and storm events are fundamental components affecting channel morphology, sediment transport and instream habitat characteristics. Peak flow intensity increases with increasing water input and the extent of increase depends upon nearby land use and the ecological region. Increased peak flow intensity may destabilize channels, scour gravel beds, speed the erosion of banks and riparian areas, cause stream widening, dislodge stable woody debris and displace fish, particularly early life stages. Activities such as residential and industrial development, mining, unmanaged grazing, agriculture, forestry, oil and gas exploration, irrigation, dams, dredging, watercourse crossings (for example, bridges, culverts, open cut crossings), shoreline/streambank work (for example, stabilization, riparian vegetation management), road construction and recreational development can damage or destroy habitat properties by altering natural flow regimes, increasing sediment input and/or altering stream thermal regimes (Sawatzky 2016).

Alteration of natural flow regimes - roads and dams:

Roads capture and concentrate surface and subsurface water flow into ditches, increasing delivery of water and sediment to stream channels. This increases the magnitude and frequency of high flows and siltation events. Road density, location (hillside vs valley bottom), watershed characteristics (topography, soils, geology) and watershed size influence the magnitude of impact. Smaller tributary watersheds are more easily impacted.

In addition to fragmenting habitat, dams can alter natural flow regimes of large rivers and the littoral zone in reservoirs through seasonal drawdown and reservoir filling. By decreasing summer flows, water diversions decrease physical and thermally suitable habitat for Bull Trout. The operation of hydroelectric plants often creates daily changes in river depth and velocity that can displace fish and disrupt spawning. Rapid reductions in flow negatively impact aquatic insect production, may strand fish, and may cause desiccation and loss of incubating Bull Trout eggs. Higher flows in late August and early September caused by summer flow augmentation significantly decrease the quantity and availability of Bull Trout habitat and can impact the food web dynamics of the ecosystem.

Alteration of stream temperature - land use:

Bull Trout require cold water for survival and are susceptible to watershed disturbances that contribute to increased water temperatures. While groundwater moderates the effects, temperature increases are directly proportional to the area of the stream exposed to sunlight and inversely proportional to stream discharge. Disturbances such as forest harvesting, road development and unmanaged grazing on riparian vegetation may increase water temperatures and decrease thermally suitable habitat for Bull Trout. Higher temperatures may also increase the risk of invasion of introduced species with higher temperature tolerances than Bull Trout, such as Brook Trout and Brown Trout, alter egg and juvenile development, slow growth, decrease survival, impact timing of life history events and increase disease (Hallock et al. 1970, Monan et al. 1975, Bjornn and Reiser 1991, Porter et al. 2000).

Reduction of sediment and phosphorus:

Suspended and deposited sediments are stressors to fish, disrupting their feeding, growth and movements. Sediment loading increases mortality, particularly for young-of-the-year and incubating eggs (through entombment). Bull Trout fry rely on loose substrate for cover; sedimentation embeds or buries the substrate, decreasing carrying capacity of the stream.

Mortality:

Angling mortality and illegal harvest can be a major contributing factor to the decline of Bull Trout. A combination of hooking mortality and illegal harvest may lead to unsustainable mortality rates for Bull Trout if angling effort is high. A combination of life history and angling traits such as slow growth, late age of maturity, low fecundity, longevity and high catchability render Bull Trout particularly susceptible to overfishing, even within relatively narrow bounds of angler effort. To address this concern, approaches to reduce angler impacts on Bull Trout should be undertaken as a precautionary measure.

Plan for angler access:

Development of new roads and linear features can increase access to Bull Trout streams. Increasing road density has been linked to declines in Bull Trout by increasing angler access as well as increasing erosion and barriers to fish passage. Given the improved understanding of the potential vulnerability of Bull Trout populations to catch-and-release fishing and illegal harvest, road placement effects on recreational fishing access needs to be given greater consideration in access management.

Within the range of Bull Trout in Alberta, some streams have regulated closures during seasons that Bull Trout spawn, to protect key spawning areas and spawning activity. Therefore, there is an opportunity to evaluate the effectiveness of these management measures, and investigate and consider new regulatory approaches, such as developing limited entry fisheries, alternate year closures in some areas (fallow), or having some reaches of river closed to angling so they act as sanctuaries and population sources.

Implement a compliance plan:

There is a need to develop and implement a plan that will include strategies (outreach and education/shared stewardship, intelligence led enforcement, compliance partnerships, strategic prosecutions, etc.) to support/advance recovery objectives and protection goals in the recovery strategy. These compliance strategies/activities will advance mitigations to reduce threats, as well as, activities likely to cause destruction to critical habitat.

7.3.4 Outreach and education

Education of the public, anglers, industry and governments addresses all threats to some extent, and is essential through stewardship and outreach, to gain acceptance of, and compliance with, this recovery strategy.

Educate public on recovery strategy:

The success of recovery and management actions depends on the involvement and support of the public and anglers, which, in turn, depends on their understanding of the threats and actions required for the recovery of Bull Trout. It is important to produce materials for the public pertaining to threats and recovery of Bull Trout, including regulation changes. Threats to Bull Trout habitat caused by the public, need to be explained in order to be reduced (for example, off-highway vehicle use). Public education campaigns should be undertaken to increase the awareness and use of reporting systems for invasive species.

Improve education and training of anglers:

Research on how to minimize incidental mortality and harm from catch-and-release angling is ongoing. Education and outreach messaging and programming needs to be updated to promote a high standard of practice for catch-and-release fishing, particularly when fishing for species of conservation concern, such as Bull Trout. Education on proper fish identification for anglers would increase awareness of Bull Trout conservation and recovery.

Increase the prominence of native trout conservation:

Public awareness of conservation issues facing native trout is low and, historically, trout have been managed primarily for their recreational value. The intention in this strategy is to increase the profile of the issues facing native trout in order to build support for change and help secure the long-term societal commitment that will be necessary to recover Bull Trout and other native trout.

8. Critical habitat

8.1 Identification of the species' critical habitat

8.1.1 General description of the species' critical habitat

Critical habitat is defined in SARA as "…the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species." [subsection 2(1)]

Also, SARA defines habitat for aquatic species as "… spawning grounds and nursery, rearing, food supply, migration and any other areas on which aquatic species depend directly or indirectly in order to carry out their life processes, or areas where aquatic species formerly occurred and have the potential to be reintroduced." [subsection 2(1)]

The critical habitat of the Saskatchewan-Nelson Rivers populations of Bull Trout, is identified to the extent possible, and provides the functions and features necessary to support the species' life-cycle processes, and to achieve the species' population and distribution objectives. The spatial extent of spawning, rearing, foraging and overwintering habitat has not yet been fully quantified for Bull Trout in DU 4.

This recovery strategy defines critical habitat of Bull Trout as clean, cold, waters that tend to be structurally diverse (complex habitat), well connected, contain areas of groundwater upwelling, and offer protection against: high or low stream flows, disruption of the stream bed, fine sediments, high water temperatures, freezing to the streambed, and the loss of pools and cover. Critical habitat for Bull Trout (Saskatchewan – Nelson Rivers populations) only occurs in areas that support current or historic Bull Trout populations within the Recovery Area identified in this recovery strategy.

The Schedule of studies (section 8.2) outlines the research required to evaluate whether the critical habitat identified in this recovery strategy is sufficient to achieve the population and distribution objectives within the Recovery Area and, if not, to identify additional critical habitat.

The habitat that contributes directly or indirectly to maintaining the biophysical attributes needed to support Bull Trout populations occur within the Recovery Area. Some areas have been positively identified as spawning habitat through the observation of redds, while in other areas redds have not been observed, even where habitat appears suitable for spawning. The critical habitat identified in this recovery strategy does not represent all the possible critical habitat within the Recovery Area, only the critical habitat that is currently known based on best available information as described below. Further studies to refine the definition of critical habitat (the functions, features and attributes) and identify locations on the landscape, is required (refer to section 8.2 of this recovery strategy for a summary of the studies required).

8.1.2 Information and methods used to identify critical habitat

Critical habitat was identified based on the presence of the species at various times of the year (for example, overwintering, spawning or resident fish), where this information was available [Sawatzky 2016]). The migratory life history types of fluvial Bull Trout require unimpeded access to extended areas of many streams and rivers to carry out their life processes. A process of peer review for the purpose of provision of best available information concerning the locations of critical habitat based on the defined features, functions and attributes was undertaken by DFO, PCA and AEP in early 2020 to identify the areas of critical habitat presented in appendix E (DFO 2020).

8.1.3 Identification of critical habitat

Geographic information:

Sawatzky (2016) described spawning and overwintering habitat identified within each river basin, but not the exact location. Redds are often concentrated in specific areas even though larger areas of suitable habitat appear to be available. This specificity can be so pronounced in some systems that a high degree of redd superimposition[10] occurs. Critical habitat exists in some portion of most flowing waters in the HUCs listed in tables 3a and 3b. Further studies to identify and delineate critical habitat should continue. See section 8.2 and table 7 for description of the studies required to identify additional critical habitat. For locations likely to contain the functions, features and attributes of critical habitat and a table, refer to the maps in Appendix E, and table 11 for corresponding location data for each HUC.

Critical habitat is identified for Bull Trout (Saskatchewan-Nelson Rivers populations), as locations that possess the known features, functions and attributes described in table 6. Due to the dynamic nature of aquatic habitats, their locations may shift upstream or downstream on an annual basis. Riparian habitat, extending 30 metres from the high water mark, is also considered critical habitat due to a strong reliance for providing food, instream structure, shade, moderating water temperature and regulating the amount of sediment entering the water. This is consistent with the critical habitat identified for Westslope Cutthroat Trout (DFO 2019b).

Defining riparian critical habitat areas:

Critical habitat for Bull Trout in Alberta, includes riparian cover and instream structure, which contributes to aquatic complexity, creation of refugia, stabilizes the banks of waterbodies, reduces predation, maintains colder water temperatures by reducing insolation and provides a significant food source of terrestrial insects (COSEWIC 2012). The definition of riparian critical habitat was informed by DFO (2019b) and scientific information related to riparian buffers. Critical habitat includes all riparian areas on both stream banks for the entire length of the stream segments and all banks of waterbodies identified as critical habitat. The width of the riparian area required to protect the attributes of critical habitat for Bull Trout has not been quantified, however the riparian area must be sufficient to maintain clean, cold water, sediment and silt free substrates, and provide food (invertebrates) and woody debris into the aquatic environment. In order to determine the width of the riparian area, DFO, PCA, AEP, and Alberta

[10] Redd superimposition refers to the construction of a redd over an existing redd.

Agriculture and Forestry (AAF) used benchmarks of the terrestrial components that effectively protect key biophysical features that influence water temperature, water flow, sediment, cover and food supply in the waterbody. In the absence of quantitative data specifically identified for Bull Trout, this seems to be a reasonable approach, until definitive standards are known. Where the attributes for riparian habitat, defined in table 6, are encountered within areas designated as aquatic critical habitat, the width of the riparian area within the areas designated as critical habitat are continuous and extend horizontally from the high water mark to a width of 30 meters on both banks of the waterbody for the entire geospatial area (figure 5).

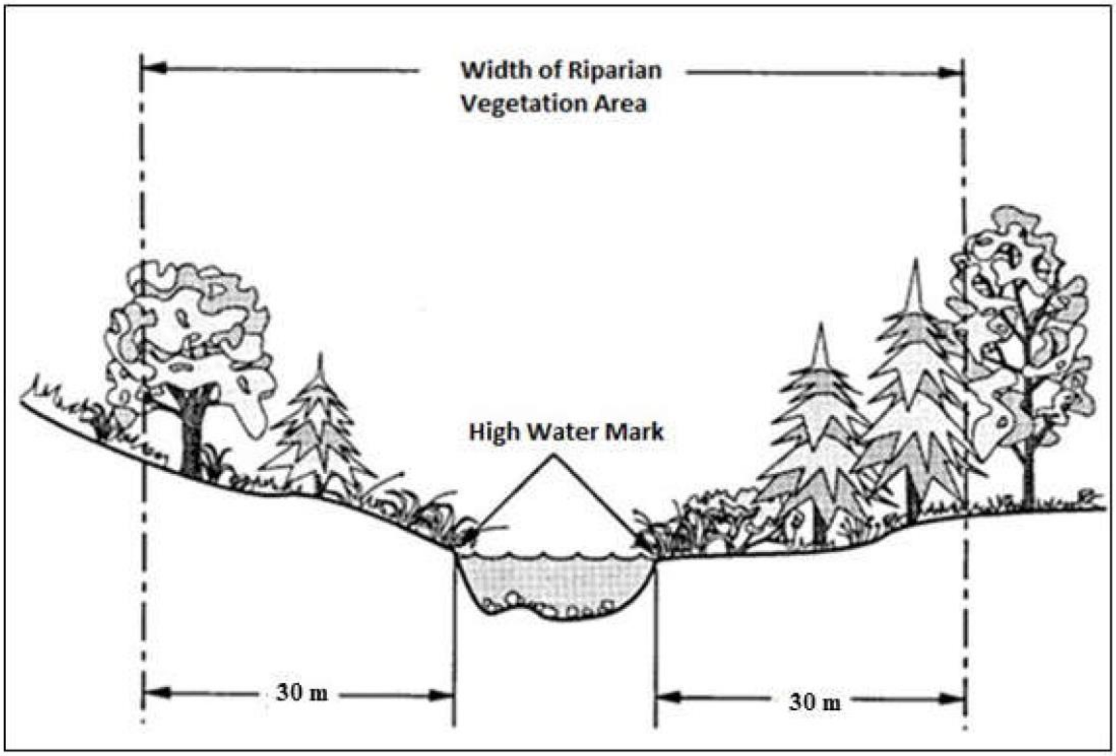

Figure 5. Width of riparian area

Defining excluded areas:

Existing anthropogenic structures such as bridges, culverts (regardless of size), roads, pipelines, water intakes, etc., that are within the areas delineated as critical habitat, are excluded and not considered to be critical habitat for Bull Trout. Because activities occurring outside of an area identified as critical habitat can destroy critical habitat, activities including installation, maintenance, repair or replacement of any anthropogenic structures, located within, or adjacent to, critical habitat, must be reviewed by DFO or PCA to determine whether a SARA permit, *Fisheries Act* and/or other authorizations or permits are required and can be issued. Some existing structures contribute to an anthropogenic barrier and consequences for Bull Trout recovery need to be an important consideration when upgrading and maintaining existing infrastructure.

Biophysical functions, features, and attributes:

The current critical habitat's functions features and attributes have been defined. Critical habitat is not comprised of the entire area within the identified boundaries but only those areas within the identified watersheds where the described biophysical feature and function it supports occur. The watersheds have been defined by adopting the HUC approach for consistency with AEP and PCA recovery and assessment approaches. The functions, features, and attributes for each life stage and life history strategy of the Bull Trout in DU 4 is summarized in table 6. A feature is considered to be a structural component of the habitat and attributes describe how the feature supports the function (for example, reproduction, overwintering) for each life stage. Not all attributes must be present in order for a location to be identified as critical habitat. If the features, as described in table 6, are present and capable of supporting the associated function, the feature is considered critical habitat for the species. This recovery strategy recognizes that the habitat attributes presented here may differ from optimal habitat, as Bull Trout may be occupying sub-optimal habitat where optimal habitat is not available.

Table 6. Summary of the biophysical functions, features, and attributes of critical habitat necessary for each life stage of the Bull Trout (from Sawatzky 2016).

Life Stage	Function[11]	Feature(s)[12]	Attribute(s)[13]	For identification of critical habitat[14]
Adult	Reproduction	• Interstices of bottom substrate in small tributary streams; redds are often constructed in areas with perennial groundwater upwellings	• High gradient streams (1.0 to 15.6%) • Spawning depth range: 0.07 to 0.93 m • Incubation depth range: 0.1 to 0.2 m • Substrate: gravel/cobble dominated substrate • Substrate size: 2.0 to 200 mm • Cover: overhanging vegetation, undercut banks, large woody debris, root wads, but overhead cover is not a prerequisite for spawning; redds are often constructed along river margins. • Run-type reaches; low gradient and flood plain sections • Velocity: 2 to 99 cm/s • Turbidity: 0.1 to 1.0 NTU • Oxygen: Intergravel 8 to 12 mg/L, mean 9 mg/L; Instream 10 to 11.5 mg/L, mean 10 mg/L • Water temperature: Spawning 5 to 9°C; Incubation 1.2 to 5.4°C; perennial groundwater upwellings are important in maintaining temperature • Fluvial and adfluvial Bull Trout migrate to spawning habitat, thus unobstructed access is required	• Unimpeded access to spawning areas (may be hundreds of km) • Gravel/cobble dominated substrate associated with perennial groundwater upwellings • Areas with minimal disturbances and low levels of fine sediment

[11] Function: A life-cycle process of the listed species taking place in critical habitat (for example, spawning, nursery, rearing, feeding and migration).

[12] Feature(s): A feature describes the essential structural component that provides the requisite function(s) to meet the species' needs. Features may change over time and are usually comprised of more than one part, or attribute. A change or disruption to the feature or any of its attributes may affect the function and its ability to meet the biological needs of the species. Not all features will have the proper attributes to function as habitat.

[13] Attribute: Attributes are measurable properties or characteristics of a feature. Attributes describe how the identified features support the identified functions necessary for the species' life processes.

[14] This column is intended to be a plain language summary of the definitions to assist the public in identifying when they may encounter an area of critical habitat.

Life Stage	Function[11]	Feature(s)[12]	Attribute(s)[13]	For identification of critical habitat[14]
Fry to Parr (to age one)	Nursery Cover Feeding Overwintering	• Shallow shoreline pools and riffles of side channels; deeper pools; interstices[15] of bottom substrate; often overwinter in areas associated with perennial groundwater	• Depth range: 0.07 to 0.93 m • Substrate: cobble and boulder, silt • Cover: overhanging vegetation, undercut banks, large woody debris, gravel substrate, boulders, small wood, cobble, velocity breaks • Velocity: low velocity backwaters and side channels • Nose Velocity[16]: 0 to 0.1 m/s; upper limit: 0.33 m/s • Bottom velocity: 0.05 to 0.15 m/s; upper limit: 0.23 m/s • Water temperature: 2 to 20°C; ultimate upper incipient lethal temperature (UUILT) 20.9°C (60 days), 23.5°C (7 days) • Pool and run habitats are preferred • Connectivity between spawning sites and rearing locations	• Low velocity backwaters and side channels; pool and run habitats • Adequate cover (intact riparian zone) • Seasonal and perennial groundwater upwellings • Connectivity between spawning sites and rearing locations
Juvenile (age one to sexual maturity at approximately age five) and Adult	Feeding Cover Overwintering	• Higher gradient habitats, often in shallow pools and riffles; interstices of bottom substrates; often overwinter in isolated pools maintained by perennial groundwater upwellings • Pools, riffles, runs, lakes (adfluvial populations)	• Gradient: 1.0 to 15.6% • Depth: deeper water during the day and shallower water (littoral zone, runs, channel margins, backwaters) at night; pools associated with groundwater input for overwintering • Substrate: cobble, boulder, silt (juveniles), rubble, sand (night use) • Cover: overhanging vegetation, undercut banks, large woody debris, substrate, boulders, root wads (juveniles), velocity breaks (juveniles), may also use deep-water habitat; diel shifts to habitats without cover at night are common • Oxygen: acute limit ≥2 mg/L; likely the same for juveniles and adults • Water temperature: below 12°C; UUILT slightly lower than for young-of- year; maximum daily-maximum temperature 12°C, maximum weekly-maximum temperature 11°C; average maximum summer temperature 17°C • Fluvial Bull Trout migrate to overwintering areas and therefore require well-connected habitat • Velocity (Juvenile): Nose velocity: 0.05 to 0.25 m/s, upper limit: 0.48	• Unimpeded access to overwintering areas • Adequate cover (intact riparian zone) • Pools and riffles • Seasonal and perennial groundwater upwellings

[15] Interstices are very small spaces and crevasses within and between bottom substrate materials.
[16] Nose velocity is the velocity of water measured at the vertical position in the water column occupied by the fish.

Life Stage	Function[11]	Feature(s)[12]	Attribute(s)[13]	For identification of critical habitat[14]
			m/s; Bottom velocity: 0.20 to 0.28 m/s, upper limit: 0.31 m/s, Mean column velocity: 0.0 to 0.20 m/s, upper limit: 0.8 m/s	

Summary of critical habitat relative to population and distribution objectives:

Critical habitat are areas that, based on current best available information, the Minister of Fisheries and Oceans and the Minister responsible for PCA, consider necessary to partially achieve the species' population and distribution objectives required for the survival/recovery of the species. Additional critical habitat is likely to be identified in future updates to the recovery strategy.

The critical habitat's functions, features and attributes have been defined in table 6 and areas within watersheds (HUC) that are most likely to contain critical habitat are identified in appendix D. The critical habitat does not comprise the entire area within the identified watershed (HUC), only where the functions, features and attributes are encountered.

8.2 Schedule of studies to identify critical habitat

Further research (table 7) is required to evaluate whether the currently identified critical habitat is sufficient to achieve the population and distribution objectives for the species and, if not, to identify additional critical habitat. This additional work includes the following studies:

Table 7. Schedule of studies to refine critical habitat.

Description of Study	Rationale	Timeline
Studies to identify lake and reservoir critical habitat	The presence of critical habitat in lake and reservoir environments is not well understood at this time	Ongoing to 2030
Studies to determine the width of riparian zone necessary to be protected as critical habitat	Studies to obtain quantitative data specific to Bull Trout in Alberta and/or the development of guidance materials will refine riparian critical habitat standards.	Ongoing to 2030
Studies to better understand the thresholds of tolerance to disturbance and destruction from human activities.	Knowledge of critical habitat's thresholds of tolerance to disturbance from human activities is lacking and should be improved to inform management and regulatory decision making in regard to critical habitat protection.	Ongoing to 2030
Studies to develop an improved water temperature model using the most current knowledge and techniques	Water temperature is a key habitat attribute for most life stages of Bull Trout.	Ongoing to 2030

Description of Study	Rationale	Timeline
Studies to develop Bull Trout water temperature thresholds that are appropriate to use with the best available water temperature models	The delineation of critical habitat can be better informed using an improved water temperature model and updated thresholds for the species based on data from representative populations and ecotypes.	Ongoing to 2030
Studies to understand the distribution and habitat use of Bull Trout within a watershed, particularly in watersheds that are data deficient	Many watersheds in Alberta are data deficient in terms of fisheries information, and so critical habitat delineation is largely reliant on modelled water temperatures, and in some cases, anecdotal information of Bull Trout presence.	Ongoing to 2030
Studies to identify life history use (migration corridors, overwintering and rearing) of Bull Trout, including, but not limited to, zones outside of the modelled thermally suitable zone.	These studies would enable the delineation of Bull Trout critical habitat along the eastern edge of the species range.	Ongoing

8.3 Examples of activities likely to result in the destruction of critical habitat

Under SARA, critical habitat for aquatic species must be legally protected from destruction[17] within 180 days of being identified in a recovery strategy or action plan. For the critical habitat of Bull Trout, Saskatchewan-Nelson Rivers populations, occurring outside of Banff, Jasper, and Waterton Lakes National Parks, it is anticipated that this will be accomplished through a SARA Critical Habitat Order made under subsections 58(4) and (5), which will invoke the prohibition in subsection 58(1) against the destruction of any part of the identified critical habitat.

For those areas of critical habitat located within national parks, a description of the critical habitat will be published in the *Canada Gazette* pursuant to subsection 58(2). Ninety days following publication in the *Canada Gazette*, the subsection 58(1) prohibition against destroying any part of the critical habitat will apply.

The following examples of activities likely to result in the destruction of critical habitat (table 8) are based on known human activities that are likely to occur in and around critical habitat and are likely to result in the destruction of critical habitat if unmitigated. The list of activities is neither exhaustive nor exclusive and has been guided by the threats described in section 5. The absence of a specific human activity from this table does not preclude or restrict the competent ministers' ability to regulate that activity under SARA. Furthermore, the inclusion of an activity does not result in its automatic prohibition since it is the destruction of critical habitat that is prohibited, not the activity. Every activity must be assessed on a case-by-case basis and the assessment must consider adverse effects after the implementation of feasible mitigations. Where information is available, quantitative estimates have been developed for critical habitat attributes to better inform management and regulatory decision making. However, in many cases knowledge of a species and its critical habitat's thresholds of tolerance to disturbance from anthropogenic activities is unknown.

[17] Destruction occurs when there is a temporary or permanent loss of a function of critical habitat.

Table 8. Activities likely to result in the destruction of critical habitat.

Threat	Activity	Effect-pathway	Function affected	Feature affected	Attribute affected[18]
Habitat alteration and removal	• Linear Disturbance (Construction, operation, and maintenance of roads and trails, pipelines, right-of-ways) • Drilling • Fracturing of bedrock • Underground pipelines • Water withdrawal	Loss of habitat for spawning and overwintering	Feeding Cover Overwintering Reproduction	Groundwater	Water temperature and flow rates
Habitat alteration and removal	• Temporary diversions and permanent removal	Loss of habitat	Reproduction	Surface water	Water temperatures and flow rate
Habitat alteration and removal	• Linear Disturbance • Forestry Operations • Prescribed fire • Crop cultivation • Unmanaged Livestock grazing • Human habitation	Loss of terrestrial food source Loss of cover Sedimentation	Nursery Cover Feeding Overwintering Reproduction	Riparian vegetation	Water temperature, cover for fry, sediment input
Habitat alteration and removal	• Linear Disturbance • Forestry Operations • Prescribed fire • Spills from oil and gas exploration • Development and pipelines • Municipal sewage • Rail and tanker accidents	Reduction in quality of habitat	Reproduction	Water quality	Sediment loads, pollutants / toxins

[18] See table 6 for specific attribute definitions.

Threat	Activity	Effect-pathway	Function affected	Feature affected	Attribute affected[18]
Habitat fragmentation	• Construction or operation of dams • Weirs • Diversions • Linear Disturbance	Loss of habitat	Reproduction Overwintering	Connectivity of streams / rivers	Ability to access different habitat types

9. Measuring progress

The performance indicators presented below provide a way to define and measure progress toward achieving the population and distribution objectives. A successful recovery program will achieve the overall aim of maintaining or improving the population status of the Core, Potential Core and Support populations in all watersheds that they are currently found (figures 3a and 3b). Progress towards meeting these objectives will be reported in the Report on the Progress of Recovery Strategy Implementation.

Every five years, the success of recovery strategy implementation will be measured against the following performance indicators:

- an increase in the number of Bull Trout in DU 4, especially in Core and Potential Core populations
- no decrease in the range or number of populations
- continued identification, refinement, and description of critical habitat (until it is believed that all has been identified), making protection of the habitat more effective for the species
- assessment of biological characteristics indicating good overall health of Bull Trout (for example, body growth, reproductive health, lack of disease)
- identification and monitoring of all existing, new or emerging human threats, and natural limiting factors, their overall effects on the population determined and, where possible, mitigated due to best practices or legislation to lessen their effect on Bull Trout in DU 4

10. Activities permitted by the recovery strategy

SARA states that "subsections 32(1) and (2), section 33 and subsections 36(1), 58(1), 60(1) and 61(1) do not apply to a person who is engaging in activities that are permitted by a recovery strategy, an action plan or a management plan and who is also authorized under an Act of Parliament to engage in that activity, including a regulation made under section 53, 59 or 71." (subsection 83(4))

The following activities are permitted by this recovery strategy:

Incidental catch-and-release angling, and Indigenous subsistence harvest.

The Province of Alberta administers fishery regulations and manages catch-and-release angling for Bull Trout throughout Alberta, except in national parks, where PCA has jurisdiction.

In accordance with subsection 83(4) of SARA, this recovery strategy authorizes Indigenous subsistence harvest of Bull Trout in all areas of Alberta. In addition, incidental catch-and-release angling of Bull Trout is authorized in all areas of Alberta provided they are released back to the waters where they were caught, as quickly as possible, with the least amount of harm. This includes areas managed by the Province of Alberta and those managed by PCA. These exemptions are subject to the following conditions:

a. in areas outside of national parks, angling is carried out pursuant to the *Alberta Fishery Regulations, 1998,* SOR/98-246; which state that fishing shall be carried out:

i. in accordance with a licence for sport fishing issued under the authority of the *Alberta Fishery Regulations, 1998*, SOR/98-246
ii. in accordance with a licence issued to an Indigenous person[19] under the authority of s.13(3) of the *Alberta Fishery Regulations, 1998*, SOR/98-246 to engage in fishing solely for the purpose of catching fish for food for their personal use or for the use of their immediate family
iii. by an Indigenous person[19] engaged in sport fishing under the authority of s.13(2) of the *Alberta Fishery Regulations, 1998*, SOR/98-246

b. for areas within national parks, angling is carried out in accordance with a licence issued under the provisions of the *National Parks of Canada Fishing Regulations*, C.R.C., c.1120; and

c. individual Bull Trout captured in the catch-and-release recreational fishery shall be released without delay to the waters from which they were caught in a manner that causes the least harm to the fish.

In considering whether to permit catch-and-release angling throughout the range of Bull Trout, allowable harm to Bull Trout was considered. Allowable harm is defined as harm to the population that will not jeopardize population recovery or survival (DFO 2017). The RPA (DFO 2017) identified that there is some scope for harm to the species. Specifically, it identified that impacts to juvenile Bull Trout are most likely to jeopardize recovery. Juvenile Bull Trout are least likely to be caught in the recreational fishery. For this reason, and to allow for the management of the fishery by the Province of Alberta and PCA, recreational fishing in Alberta is an activity that is permitted by this recovery strategy. A zero bag limit for Bull Trout has been in place in Alberta since 1995, although catch-and-release captures occur in many areas of the province. Some options, considered by the Province of Alberta, for the management of fisheries include: areas of closures to angling, as well as partial closures or specific stream closures depending on what impacts are identified as a result of angling pressure. Any angling restrictions that are already in place will continue, and will be evaluated to ensure recovery is possible for Bull Trout. The catch-and-release fishery will continue to be monitored to ensure the survival and recovery of Bull Trout.

For activities not listed above that are likely to interact with Bull Trout, Saskatchewan-Nelson Rivers populations, in a manner prohibited by SARA, permits under section 73 or 74 may be sought by contacting the appropriate authority (for example, regional DFO office or PCA).

11. Statement on action plans

The federal government's approach to recovery planning is a two-part approach, the first part being the recovery strategy and the second part being the action plan. An action plan contains specific recovery measures or activities required to meet the objectives outlined in the recovery strategy.

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[19] The Regulations use the term "Indian" because it is a reference to that term as it is used in the *Alberta Natural Resources Transfer Agreement*, dated December 14, 1929, between Canada and Alberta (confirmed by the *Constitution Act, 1930*); however, it is considered an outdated term and has been replaced for the purposes of this recovery strategy. This recovery strategy does not change the application of the Regulations as they apply to this exemption.

An action plan for the Bull Trout, Saskatchewan-Nelson Rivers populations, will be completed within five years of posting the final recovery strategy.

Additionally, PCA multi-species action plans identify recovery measures for species at risk in PCA places. For a list of current multi-species action plans that include Bull Trout, refer to the documents published for the species on the Species at Risk Public Registry.

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Appendix A: Effects on the environment and other species

In accordance with the Cabinet Directive on the Environmental Assessment of Policy, Plan and Program Proposals (2010), *Species at Risk Act* (SARA) recovery planning documents incorporate strategic environmental assessment (SEA) considerations throughout the document. The purpose of a SEA is to incorporate environmental considerations into the development of public policies, plans, and program proposals to support environmentally sound decision-making and to evaluate whether the outcomes of a recovery planning document could affect any component of the environment or achievement of any of the Federal Sustainable Development Strategy's goals and targets.

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

This recovery strategy will clearly benefit the environment by promoting the recovery of the Bull Trout, Saskatchewan-Nelson Rivers populations. Other native fish species such as Westslope Cutthroat Trout and Rocky Mountain Whitefish (*Prosopium williamsoni*) will also likely benefit from recovery activities associated with this strategy. The potential for the strategy to inadvertently lead to adverse effects on other species was considered and this strategy will not result in any significant adverse effects to the physical environment. However, recovery efforts have and will continue to result in impacts (primarily mortality) to other introduced fish species such as non-native Rainbow Trout and Brook Trout. Careful consideration will be given to potential effects to other species before implementing any actions should they be proposed (for example, barrier placement to prevent hybridization).

Appendix B: Record of cooperation and consultation

Recovery strategies are to be prepared in cooperation and consultation with other jurisdictions, organizations, affected parties and others as outlined in the *Species at Risk Act* (SARA) section 39.

DFO and PCA participated in AEP recovery planning processes, such as participation in the Provincial Bull Trout Advisory Committee (Bull Trout PAC), struck to develop the provincial draft recovery plan. The approach taken was intended to enable federal adoption of the provincial plan and recovery approaches, to ensure coordination between jurisdictions and stakeholders responsible for Bull Trout recovery. Bull Trout PAC meetings were held semi-annually to review and seek input on drafts of the provincial recovery plan. Membership in the Bull Trout PAC included representatives of the forestry industry (West Fraser, Spray Lakes Sawmills, fRI Research (Foothills Research Initiative), Canadian Association of Pipeline Producers (CAPP), Canadian Parks and Wilderness Society, Trout Unlimited Canada (TUC), Alberta Wilderness Association (AWA), and Alberta Fish and Game Association (AFGA).

The development of this federal recovery strategy has been undertaken in large part by incorporating the concepts and information developed in support of the provincial draft recovery plan for Bull Trout. In addition to incorporating components of the draft provincial recovery plan, a process of review and input was undertaken on the draft federal recovery strategy that included DFO, AEP, and PCA that occurred between late 2019 and early 2020. Proposed critical habitat was identified through a science-based process, coordinated through the DFO Canadian Science Advisory Secretariat (CSAS) (DFO 2020). The CSAS process included participation and provision of information from DFO, AEP, and PCA. Further support for the Recovery Strategy provided by CSAS includes: the development of the Recovery Potential Assessment (DFO 2017), and the review of the Province of Alberta’s Cumulative Effects Model (the ‘Joe’ Model) (DFO 2019a).

In addition, consultation and coordination on the listing of Bull Trout (Saskatchewan-Nelson Rivers populations) involved provision of information about Bull Trout, the species’ status, and the threats to it’s survival and recovery. This information was provided by DFO to the Province of Alberta, municipalities, stakeholders, industry groups, environmental non-governmental organizations and Indigenous communities within the range of Bull Trout (Saskatchewan – Nelson rivers populations). The Canadian public at large was invited to comment on the proposed listing of the Bull Trout (Saskatchewan – Nelson rivers populations) under SARA through the Species at Risk Registry Online Consultation Tool.

Appendix C: Watershed level threats assessment

Table 9a. Watershed-level threat risk, threat occurrence, threat frequency and threat extent in the Oldman watershed. When rolling up from the HUC-level, the highest risk level for any given HUC was retained for the watershed (Sawatzky 2016).

Threat	Threat risk	Threat occurrence	Threat frequency	Threat extent
Interactions and mortality: Hybridization and competition with Brook Trout	Low	Current	Continuous	Broad
Competition with Lake Trout	Medium	Current	Continuous	Broad
Mortality (for example, angling, poaching, scientific sampling)	High	Historical, current	Recurrent	Broad
Habitat fragmentation: Culverts	High	Current	Continuous	Broad
Dams and weirs	High	Historical, current	Continuous	Extensive
Irrigation canals	Medium	Current	Continuous	Narrow
Habitat alteration and removal: Alteration of natural flow regimes (disruption of peak flow intensity, roads, dams)	High	Current	Recurrent	Broad
Suspended and deposited sediments	High	Current	Recurrent	Broad
Alteration of stream temperature (change from natural)	High	Current	Continuous	Broad
Alteration of groundwater quantity or quality	High	Current, anticipatory	Single, recurrent	Extensive
Nutrient loading	High	Current, anticipatory	Recurrent	Broad
Contaminants and toxic substances (assessed at watershed and DU levels)	High	Current, anticipatory	Single, recurrent	Broad
Climate change (assessed at DU level only)				
Interactive and cumulative effects (assessed at DU level only)				

Table 9b. Watershed-level threat risk, threat occurrence, threat frequency and threat extent in the Bow watershed. When rolling up from the HUC-level, the highest risk level for any given HUC was retained for the watershed (Sawatzky 2016).

Threat	Threat risk	Threat occurrence	Threat frequency	Threat extent
Interactions and mortality: Hybridization and competition with Brook Trout	Medium	Current	Continuous	Broad
Competition with Lake Trout	High	Current	Continuous	Broad
Mortality (for example, angling, poaching, scientific sampling)	High	Historical, current	Recurrent	Broad
Habitat fragmentation: Culverts	High	Current	Continuous	Broad
Dams and weirs	High	Historical, current	Continuous	Extensive
Irrigation canals	Medium	Current	Continuous	Narrow
Habitat alteration and removal: Alteration of natural flow regimes (disruption of peak flow intensity, roads, dams)	High	Current	Recurrent	Broad
Suspended and deposited sediments	High	Current	Recurrent	Broad
Alteration of stream temperature (change from natural)	Medium	Current	Continuous	Broad
Alteration of groundwater quantity or quality	High	Current	Single, recurrent	Extensive
Nutrient loading	High	Current, anticipatory	Recurrent	Broad
Contaminants and toxic substances (assessed at watershed and DU levels)	High	Current, anticipatory	Single, recurrent	Broad
Climate change (assessed at DU level only)				
Interactive and cumulative effects (assessed at DU level only)				

Table 9c. Watershed-level threat risk, threat occurrence, threat frequency and threat extent in the Red Deer watershed. When rolling up from the HUC-level, the highest risk level for any given HUC was retained for the watershed (Sawatzky 2016).

Threat	Threat risk	Threat occurrence	Threat frequency	Threat extent
Interactions and mortality: Hybridization with Brook Trout	High	Current	Continuous	Broad
Competition with Lake Trout	Low	Current	Continuous	Broad
Mortality (for example, angling, scientific sampling)	High	Historical, current	Recurrent	Broad
Habitat fragmentation: Culverts	High	Current	Continuous	Broad
Dams and weirs	Low	Historical, current	Continuous	Extensive
Irrigation canals	Medium	Current	Continuous	Narrow
Habitat alteration and removal: Alteration of natural flow regimes (disruption of peak flow intensity, roads, dams)	High	Current	Recurrent	Broad
Suspended and deposited sediments	Medium	Current	Recurrent	Broad
Alteration of stream temperature (change from natural)	Medium	Current	Continuous	Broad
Alteration of groundwater quantity or quality	High	Current, anticipatory	Single, recurrent	Extensive
Nutrient loading	High	Current, anticipatory	Recurrent	Broad
Contaminants and toxic substances (assessed at watershed and DU levels only)	Medium	Current, anticipatory	Single, recurrent	Broad
Climate change (assessed at DU level only)				
Interactive and cumulative effects (assessed at DU level only)				

Table 9d. Watershed-level threat risk, threat occurrence, threat frequency and threat extent in the North Saskatchewan. When rolling up from the HUC-level, the highest risk level for any given HUC was retained for the watershed (Sawatzky 2016).

Threat	Threat risk	Threat occurrence	Threat frequency	Threat extent
Interactions and mortality: Hybridization with Brook Trout	Low	Current	Continuous	Broad
Competition with Lake Trout	Low	Current	Continuous	Broad
Mortality (for example, angling, scientific sampling)	High	Historical, current	Recurrent	Broad
Habitat fragmentation: Culverts	High	Current	Continuous	Broad
Dams and weirs	High	Historical, current	Continuous	Extensive
Irrigation canals	High	Current	Continuous	Narrow
Habitat alteration and removal: Alteration of natural flow regimes (disruption of peak flow intensity, roads, dams)	High	Current	Recurrent	Broad
Suspended and deposited sediments	Medium	Current	Recurrent	Broad
Alteration of stream temperature (change from natural)	High	Current	Continuous	Broad
Alteration of groundwater quantity or quality	High	Current	Single, recurrent	Extensive
Nutrient loading	High	Current, anticipatory	Recurrent	Broad
Contaminants and toxic substances (assessed at watershed and DU levels only)	High	Current, anticipatory	Single, recurrent	Broad
Climate change (assessed at DU level only)				
Interactive and cumulative effects (assessed at DU level only)				

Appendix D: Threat assessment categories

Likelihood of occurrence	Definition	Symbol
Known or very likely to occur	This threat has been recorded to occur in 91 to 100% of cases	**K**
Likely to occur	There is 51 to 90% chance that this threat is or will be occurring.	**L**
Unlikely	There is 11 to 50% chance that this threat is or will be occurring	**UL**
Remote	There is 1 to 10% or less chance that this threat is or will be occurring.	**R**
Unknown	There are no data or prior knowledge of this threat occurring now or in the future.	**U**

Level of impact	Definition	Symbol
Extreme	Severe population decline (for example, 71 to 100%) with the potential for extirpation.	**E**
High	Substantial loss of population (31 to 70%) or Threat would jeopardize the survival or recovery of the population.	**H**
Medium	Moderate loss of population (11 to 30%) or Threat is likely to jeopardize the survival or recovery of the population.	**M**
Low	Little change in population (1 to 10%) or Threat is unlikely to jeopardize the survival or recovery of the population.	**L**
Unknown	No prior knowledge, literature or data to guide the assessment of threat severity on population.	**U**

Causal certainty	Definition	Rank
Very high	Very strong evidence that threat is occurring and the magnitude of the impact to the population can be quantified.	**1**
High	Substantial evidence of a causal link between threat and population decline or jeopardy to survival or recovery	**2**
Medium	There is some evidence linking the threat to population decline or jeopardy to survival or recovery	**3**
Low	There is a theoretical link with limited evidence that threat is leading to a population decline or jeopardy to survival or recovery	**4**
Very low	There is a plausible link with no evidence that the threat is leading to a population decline or jeopardy to survival or recovery	**5**

Categories of Hydrological Unit Code (HUC) level threat frequency.

Threat occurrence	Definition	Symbol
Historical	A threat that is known to have occurred in the past and negatively impacted the population.	**H**
Current	A threat that is ongoing, and is currently negatively impacting the population.	**C**
Anticipatory	A threat that is anticipated to occur in the future, and will negatively impact the population.	**A**

Threat frequency	Definition	Symbol
Single	The threat occurs once.	**S**
Recurrent	The threat occurs periodically, or repeatedly.	**R**
Continuous	The threat occurs without interruption.	**C**

Threat extent	Definition	Symbol
Extensive	71 to 100% of the population is affected by the threat.	**E**
Broad	31 to 70% of the population is affected by the threat.	**B**
Narrow	11 to 30% of the population is affected by the threat.	**NA**
Restricted	1 to 10% of the population is affected by the threat.	**R**

Appendix E: Locations of critical habitat

The following critical habitat maps depict the areas of critical habitat for Bull Trout (Saskatchewan-Nelson Rivers populations) (red watercourse segments). For the most up-to-date maps, please visit DFO's Aquatic species at risk map webpage.

To assist with identifying where critical habitat occurs in headwater areas, geo-referenced location points (P1, P2; Decimal Degrees [WGS 1984]) have been added in some locations in each HUC in addition to the red line segments. These points are meant to help users identify the watercourses that may contain critical habitat upstream or downstream of these points. Coordinates for these points can be found in table 10. These points represent the locations of the areas within which critical habitat (indicated by the red lines) is found within a watercourse. For more information, refer to the legend of each map or DFO's Aquatic species at risk map webpage.

Figure 6. Overview of locations of critical habitat

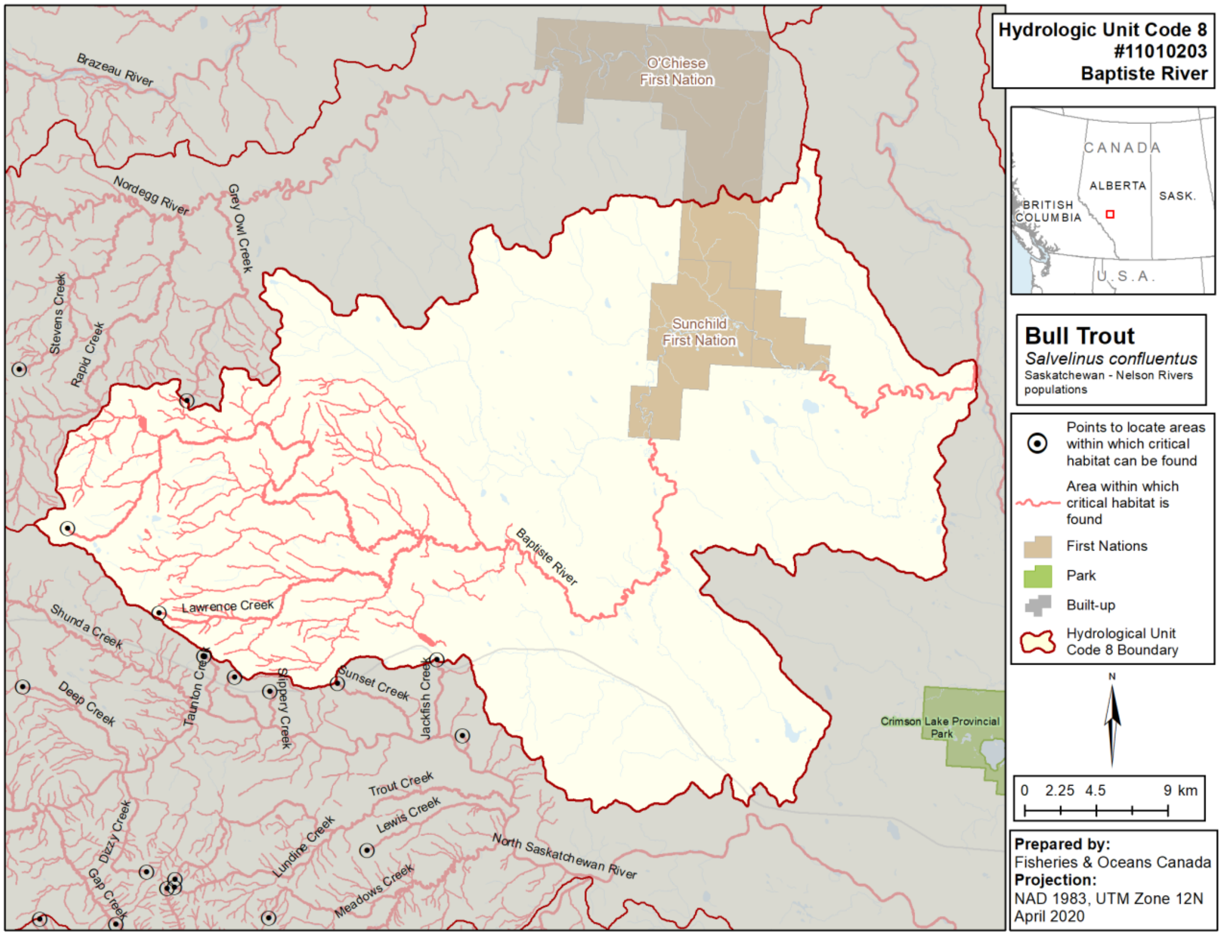

Figure 7. Critical habitat in Baptiste River

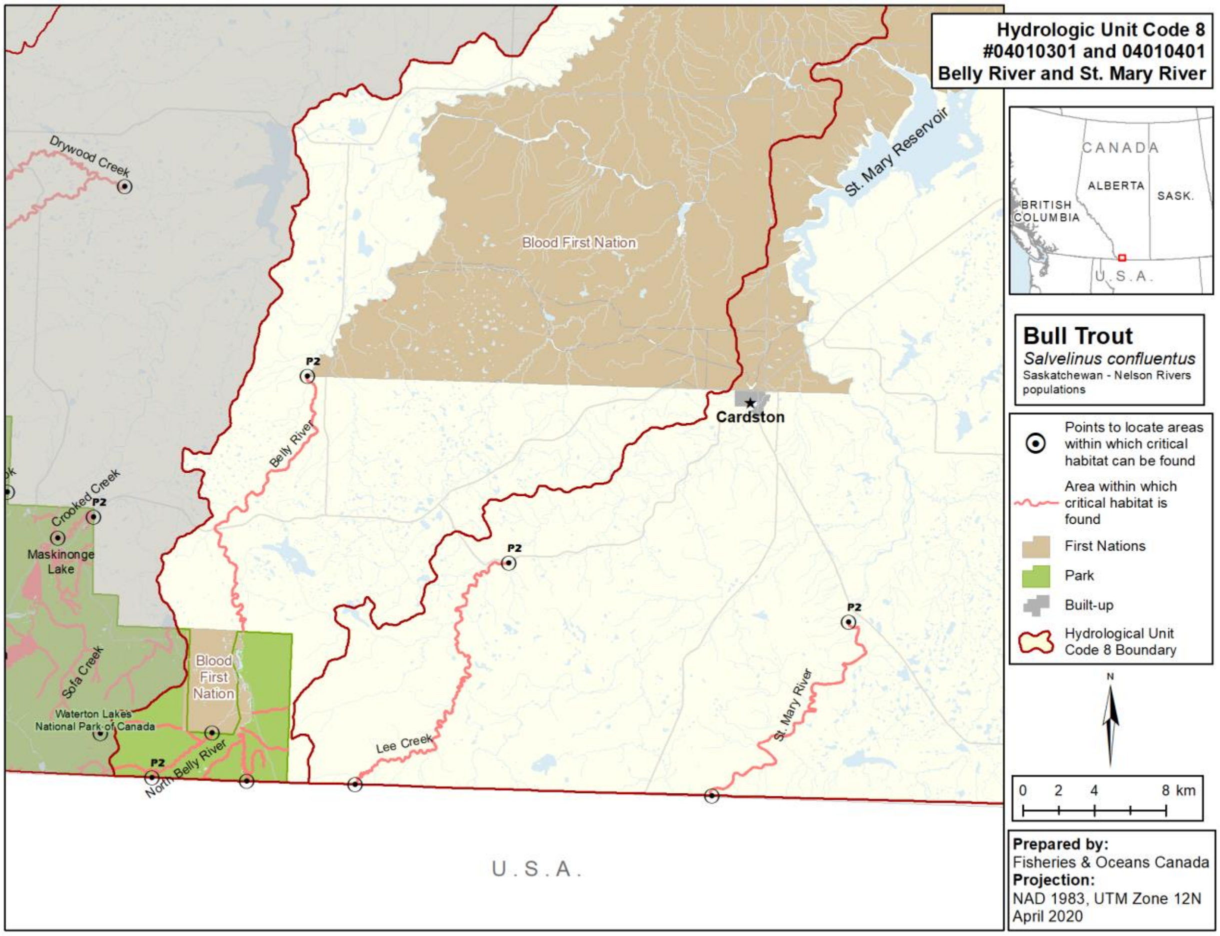

Figure 8. Critical habitat in the Belly River and St. Mary River

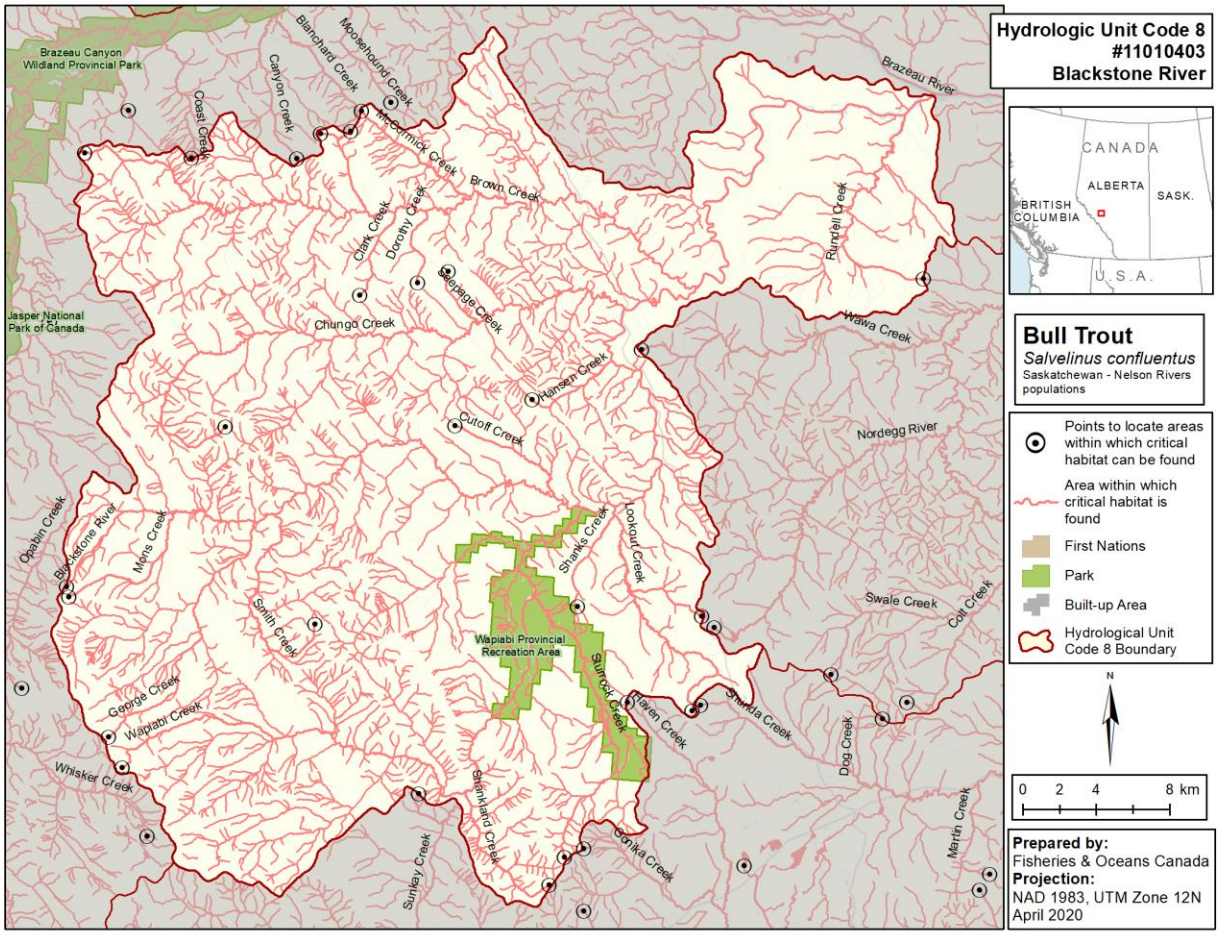

Figure 9. Critical habitat in the Blackstone River

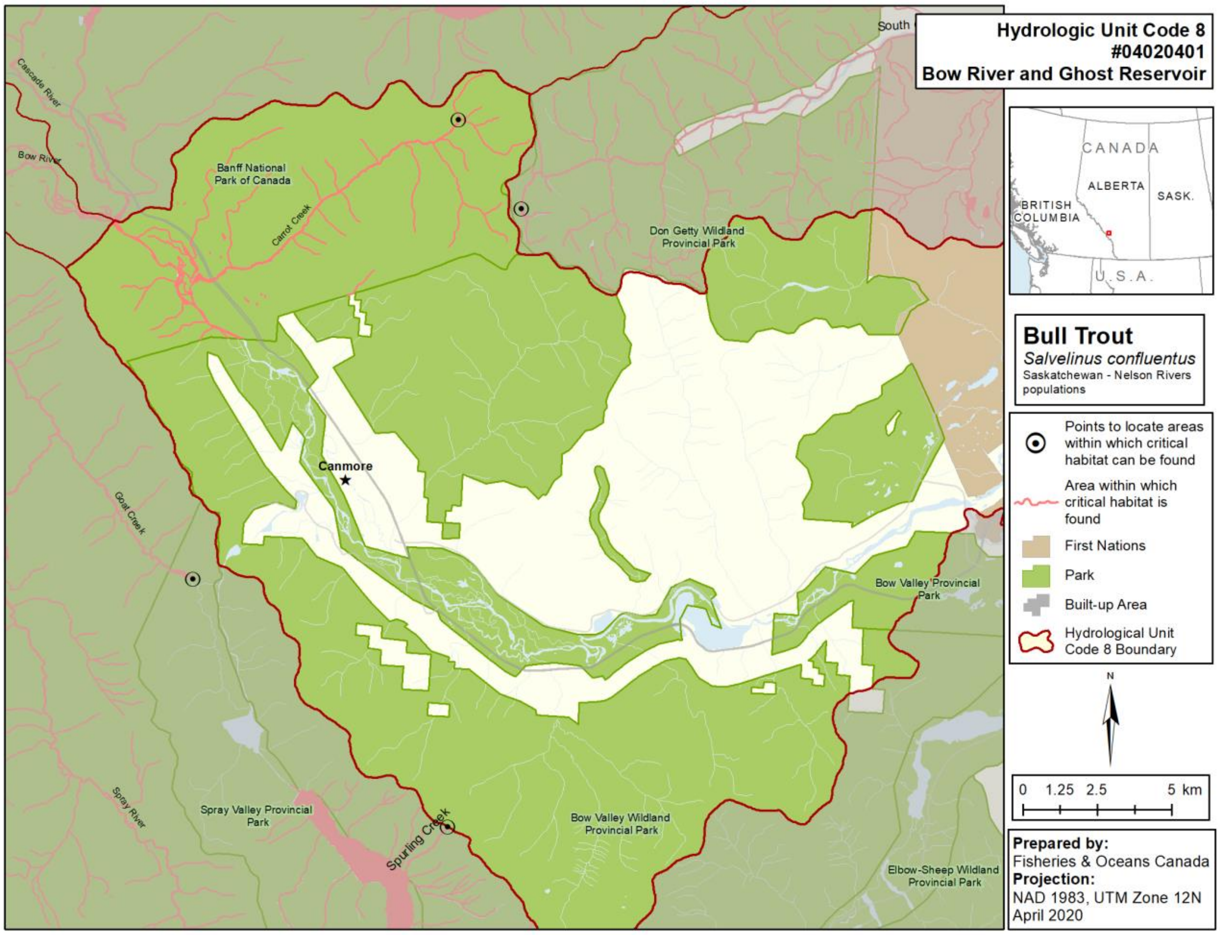

Figure 10. Critical habitat in the Bow River and Ghost Reservoir

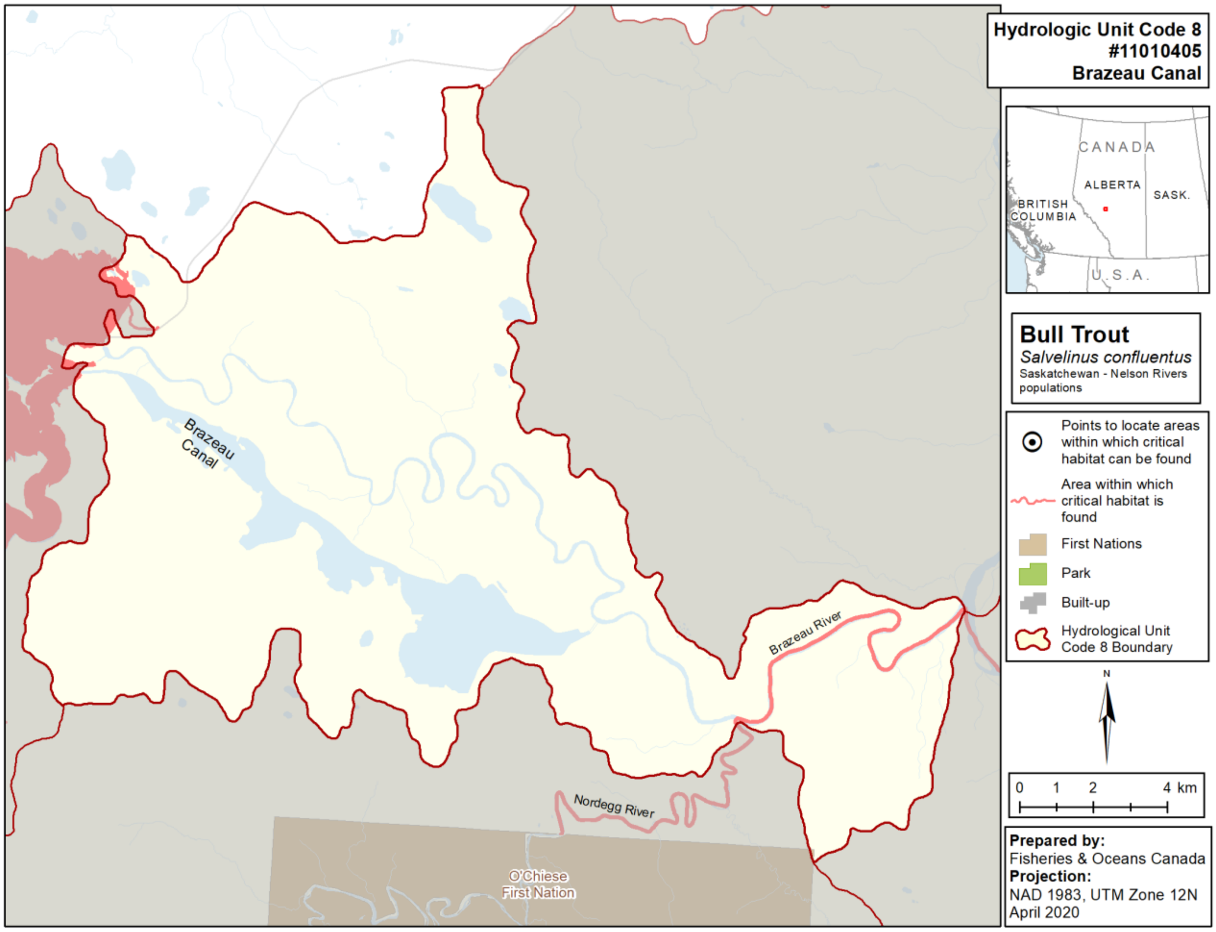

Figure 11. Critical habitat in the Brazeau Canal

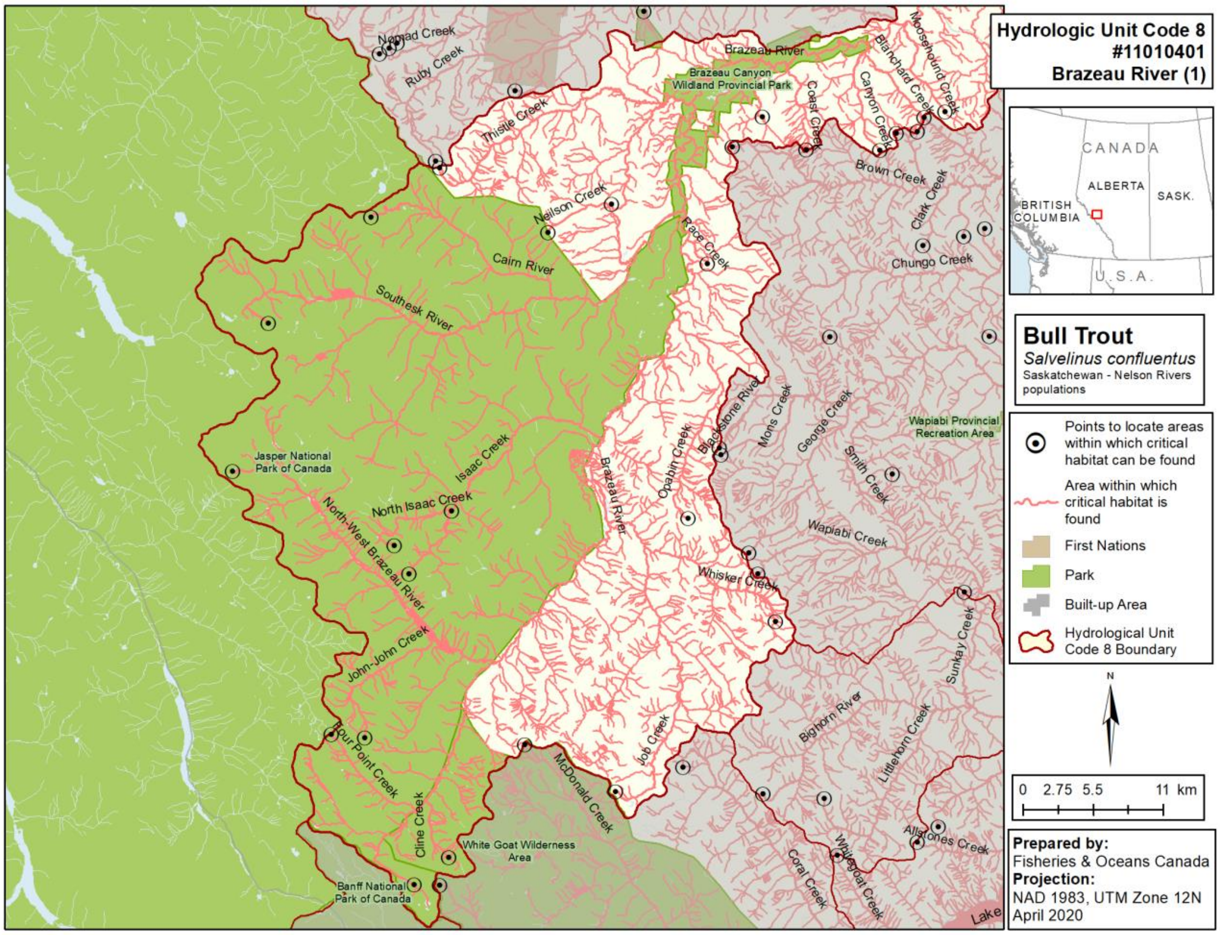

Figure 12. Critical habitat in the Brazeau River (1)

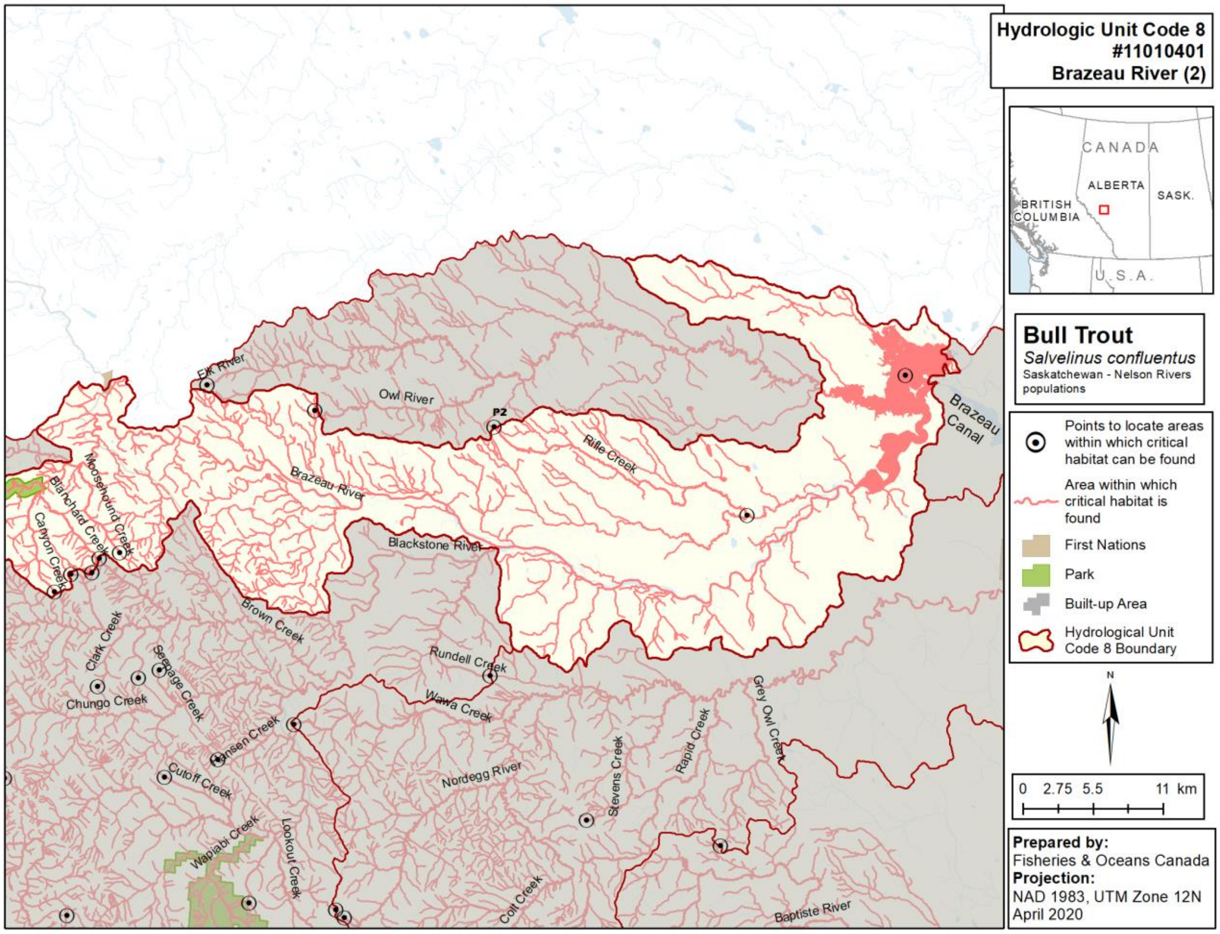

Figure 13. Critical habitat in the Brazeau River (2)

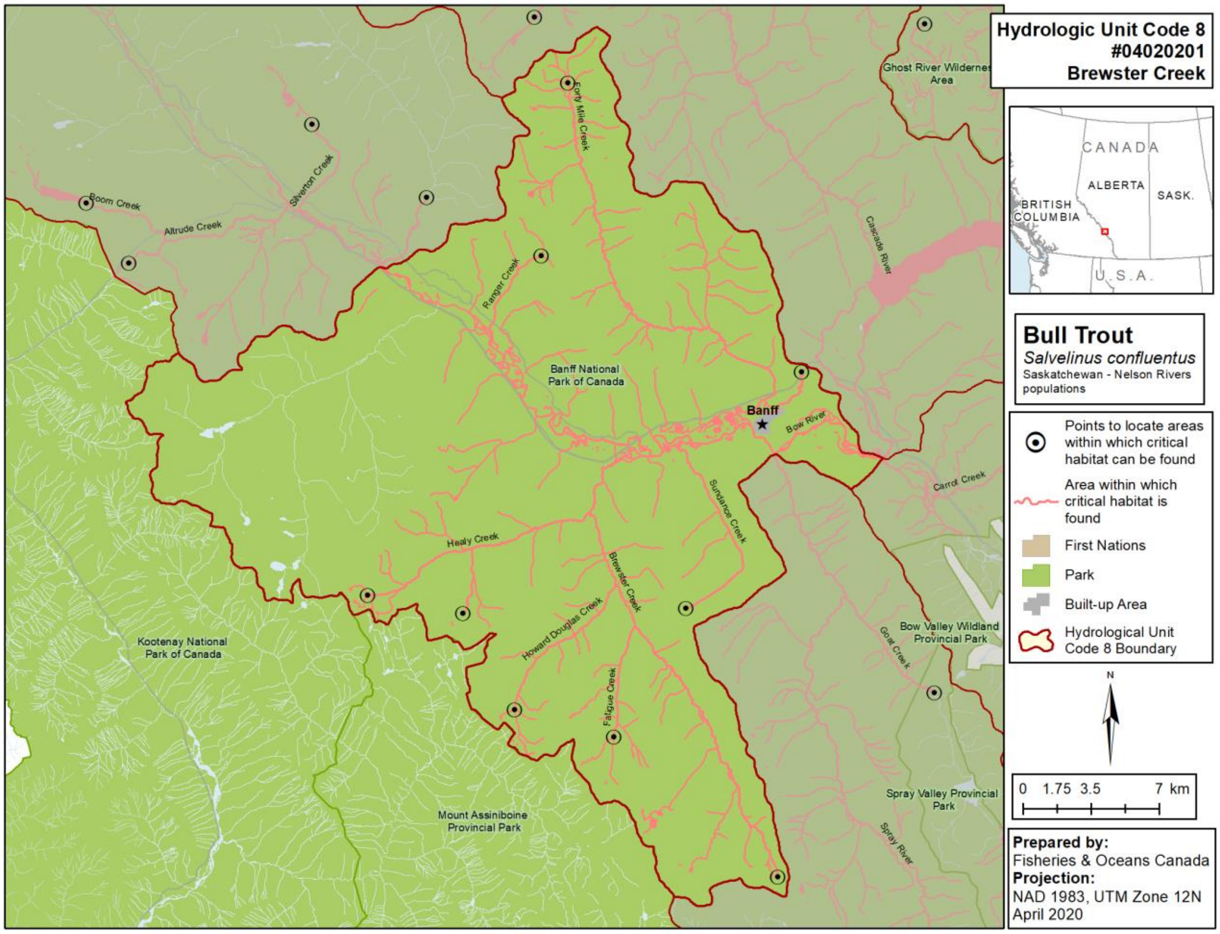

Figure 14. Critical habitat in Brewster Creek

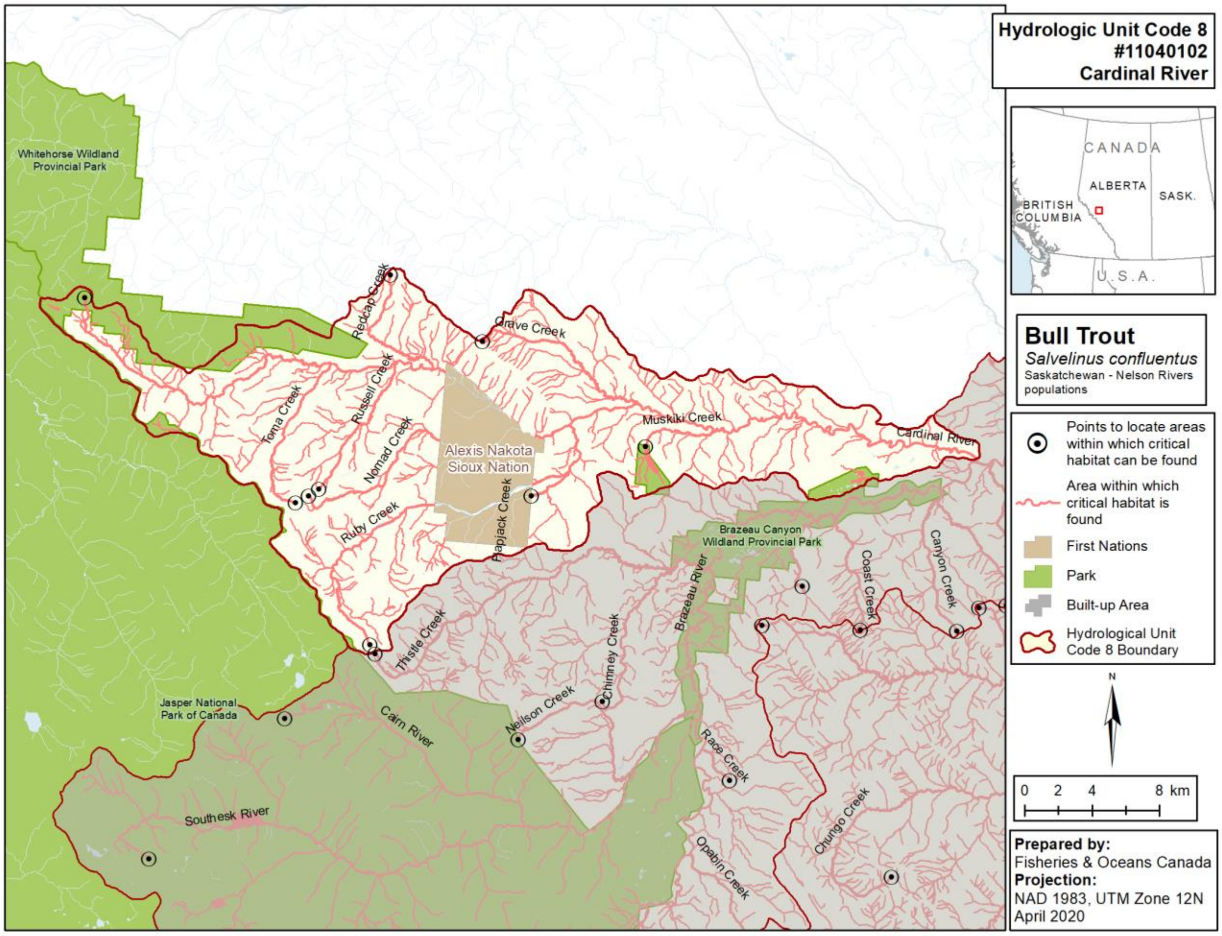

Figure 15. Critical habitat in the Cardinal River

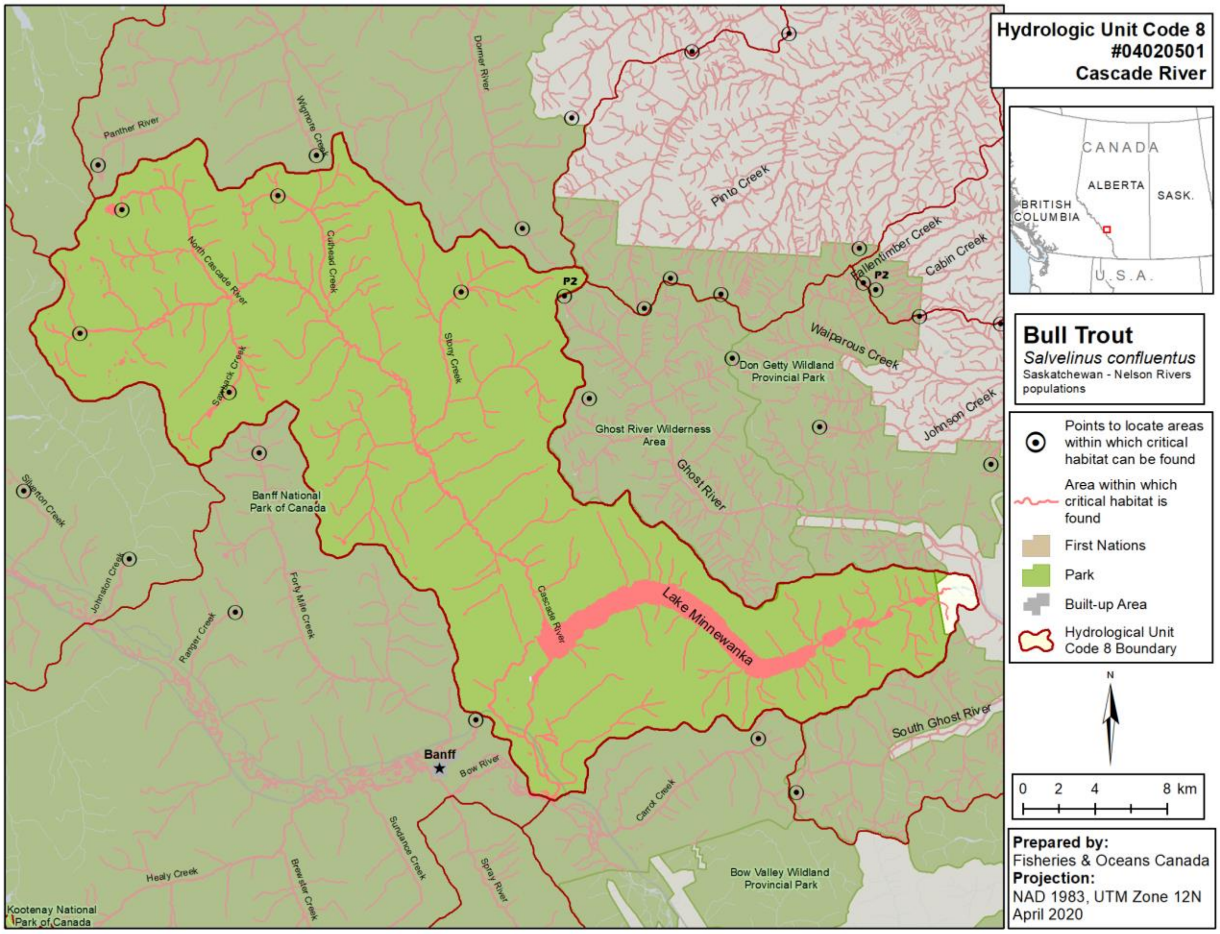

Figure 16. Critical habitat in the Cascade River

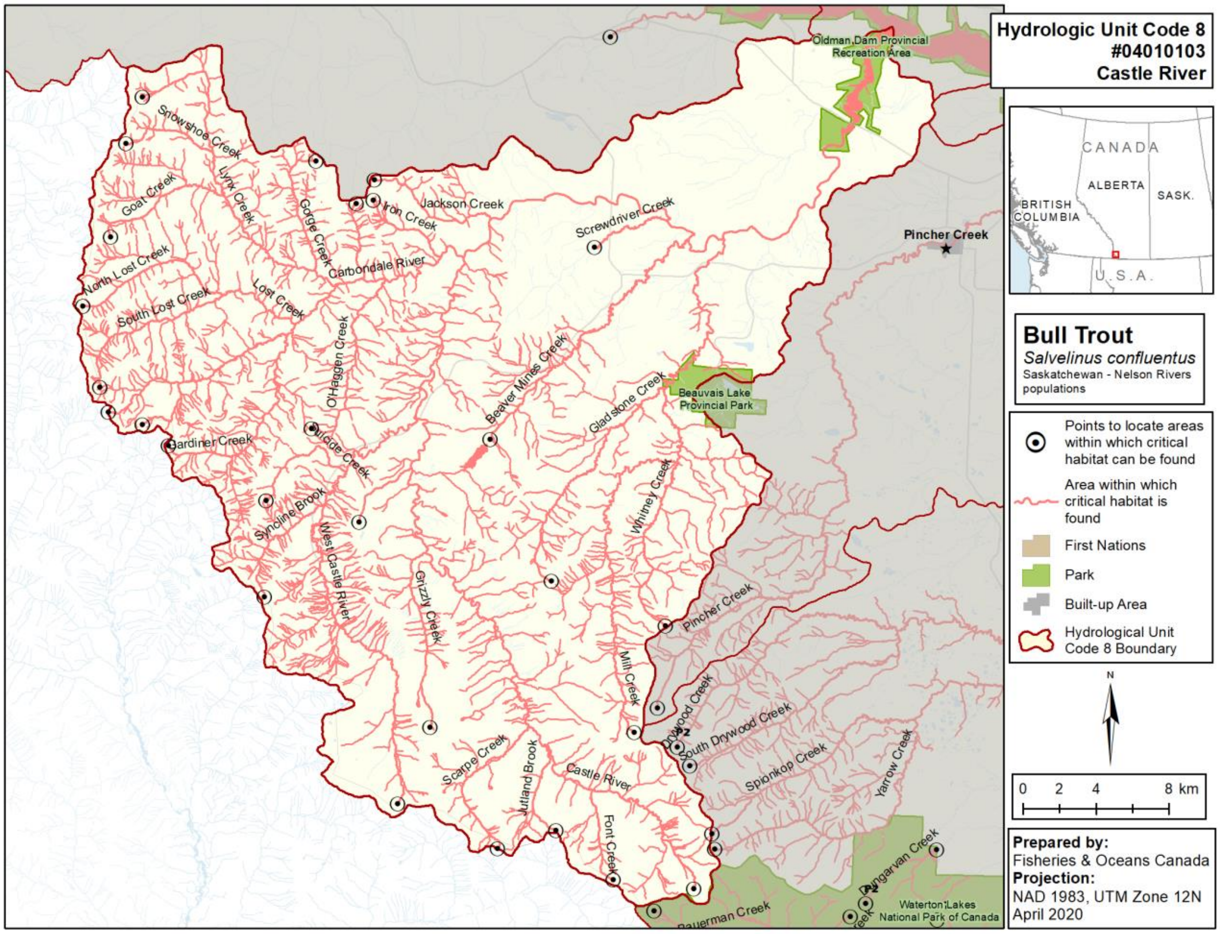

Figure 17. Critical habitat in the Castle River

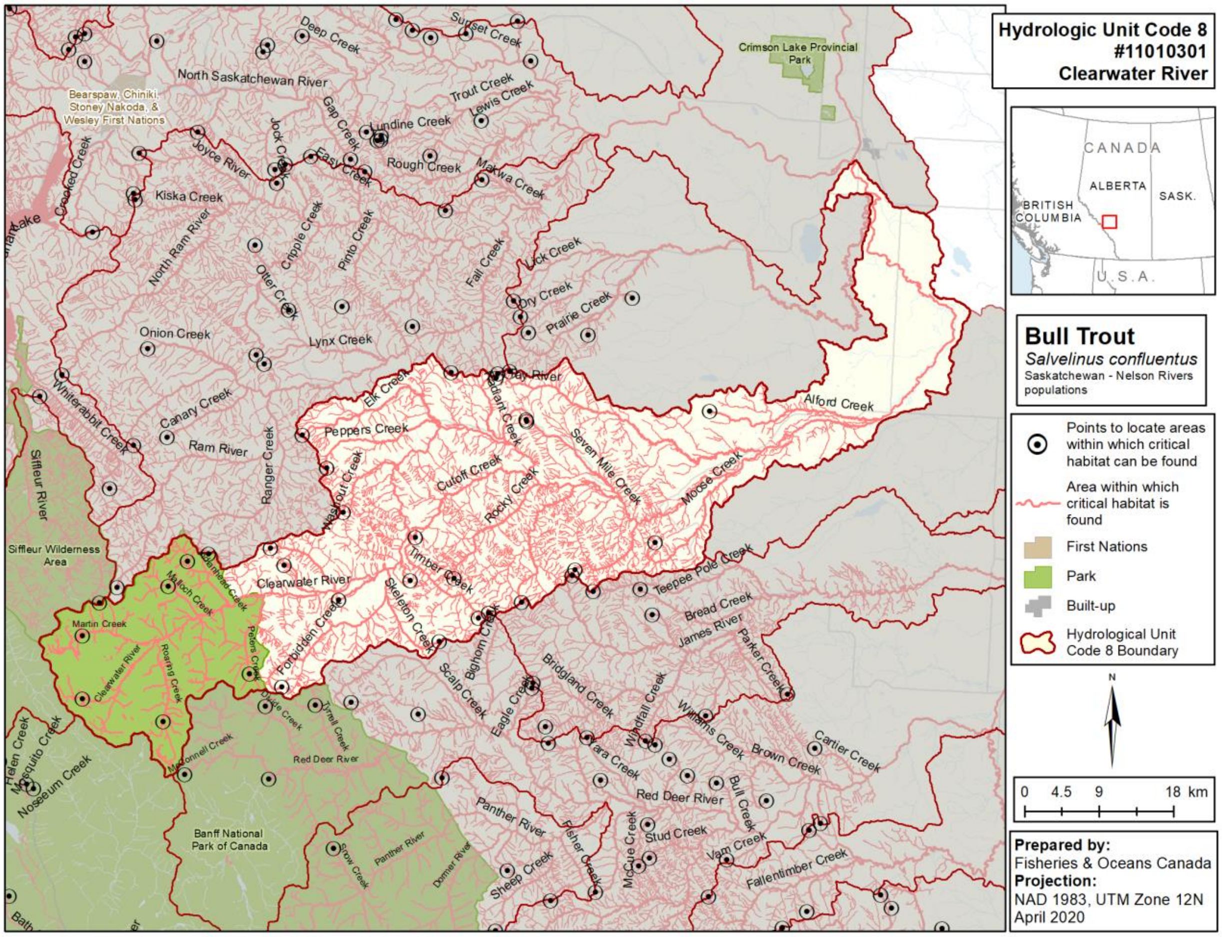

Figure 18. Critical habitat in the Clearwater River

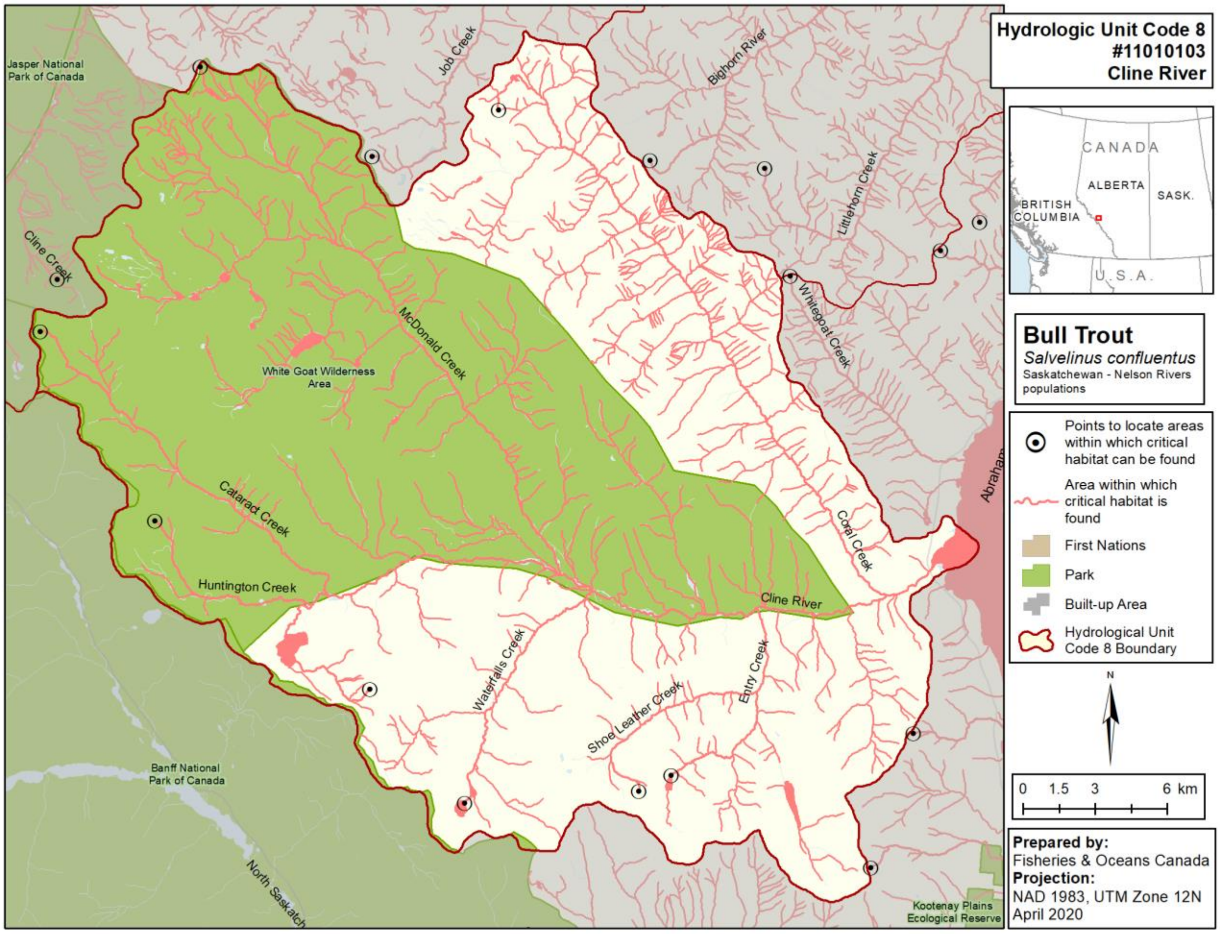

Figure 19. Critical habitat in the Cline River

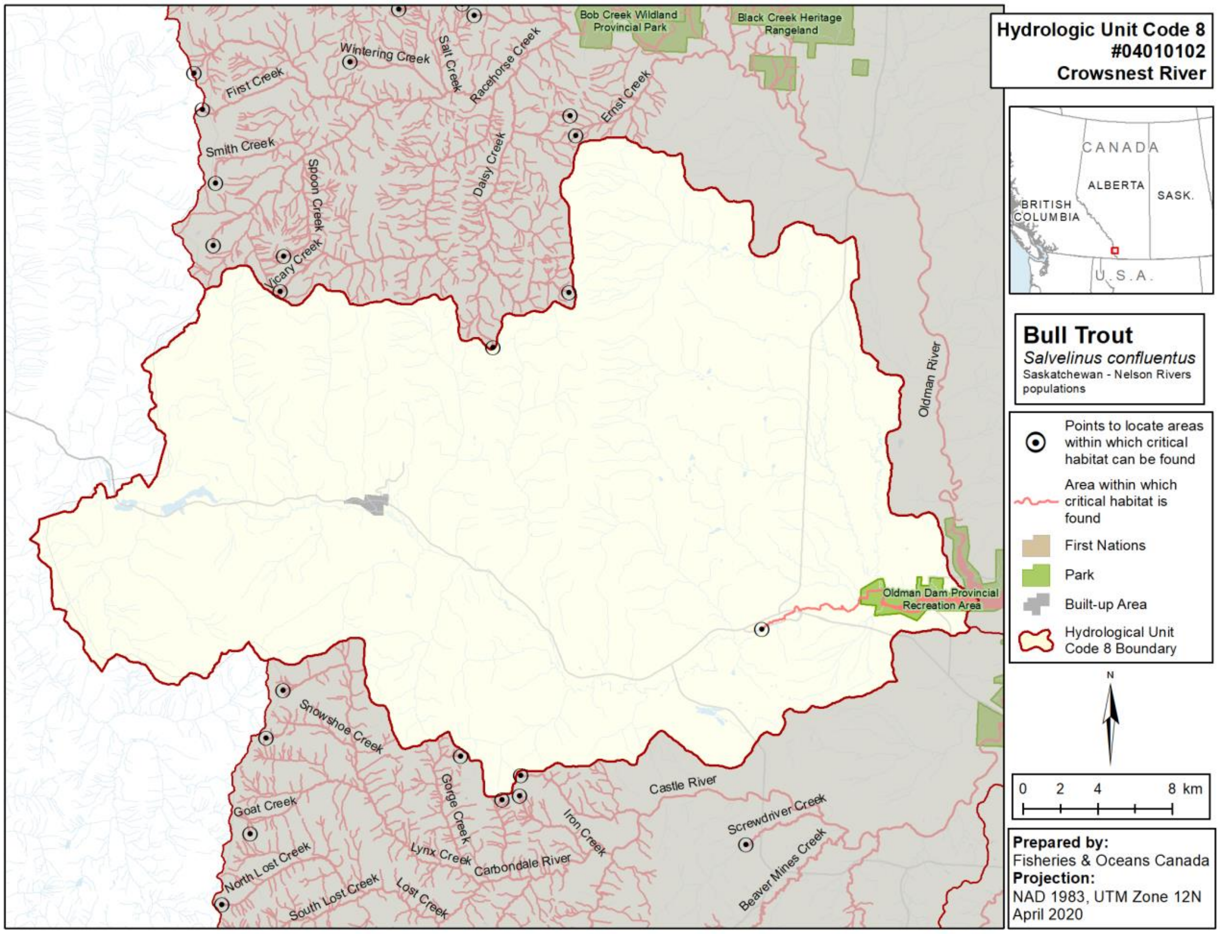

Figure 20. Critical habitat in the Crowsnest River

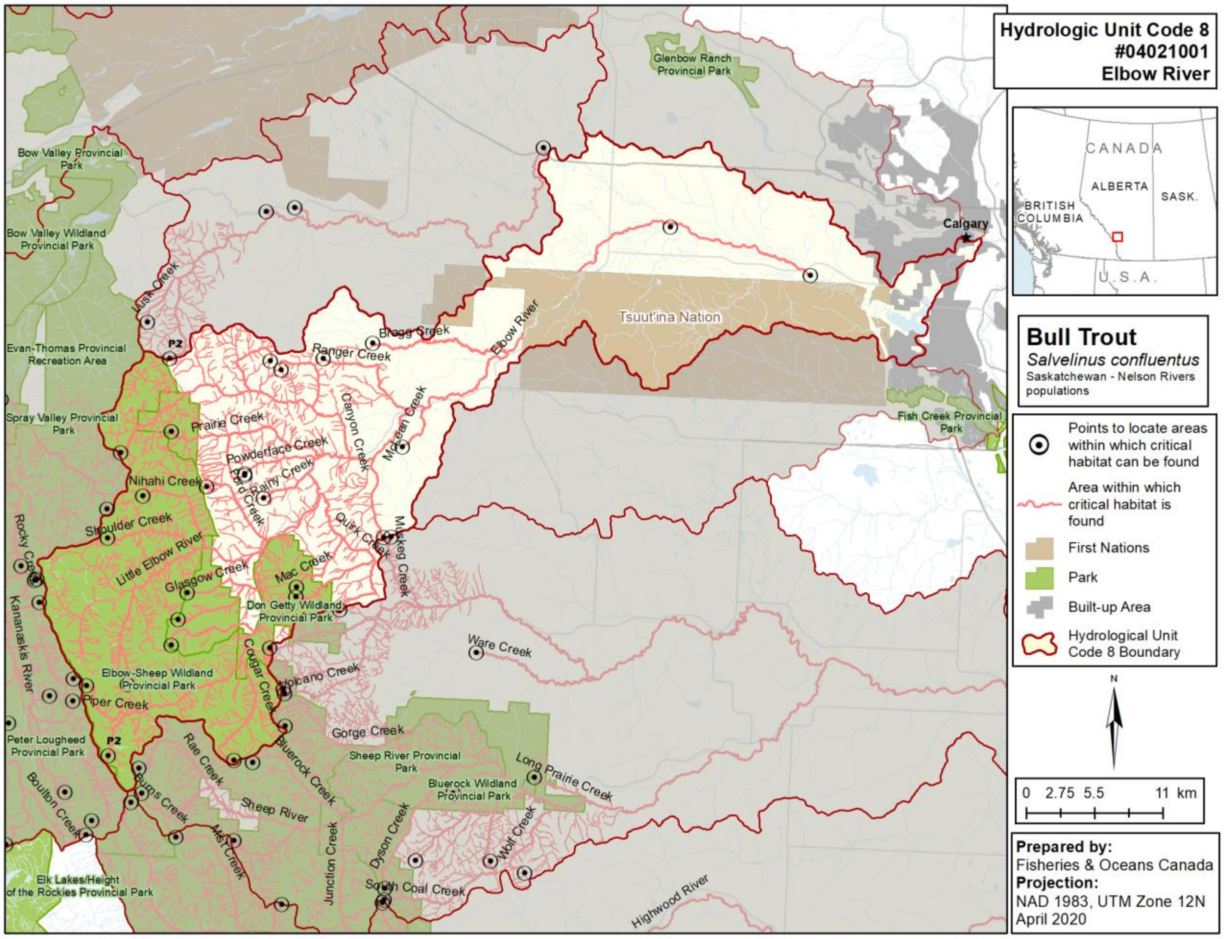

Figure 21. Critical habitat in the Elbow River

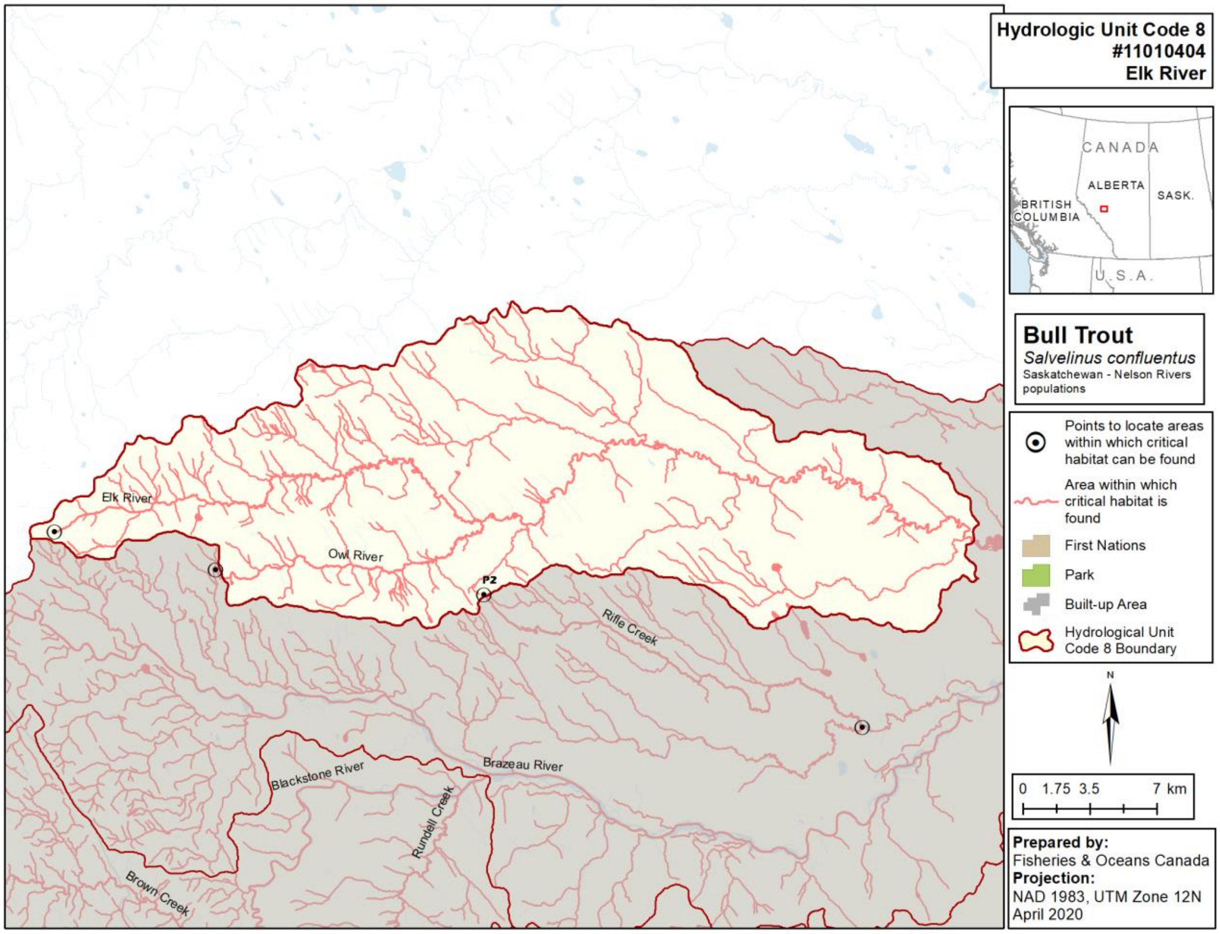

Figure 22. Critical habitat in the Elk River

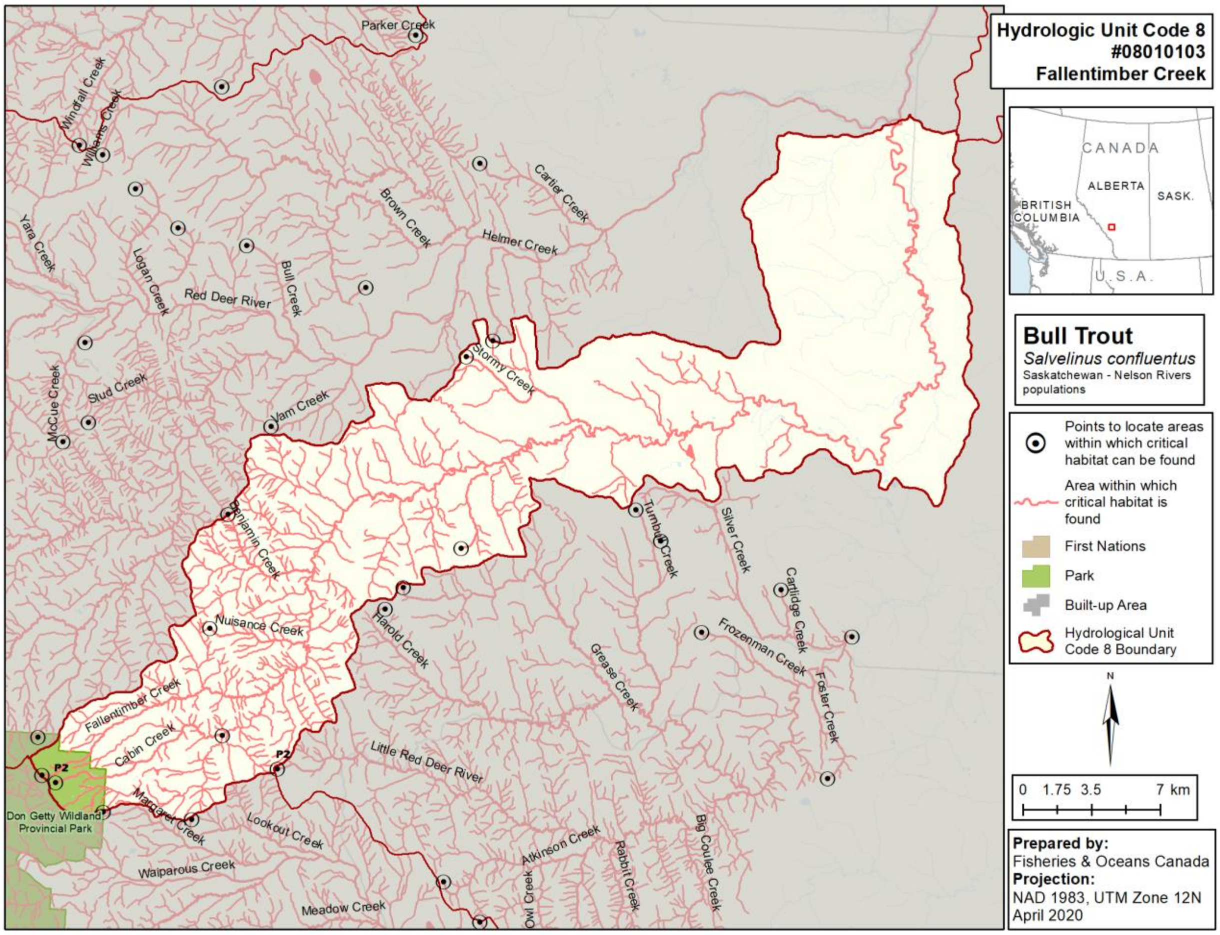

Figure 23. Critical habitat in Fallentimber Creek

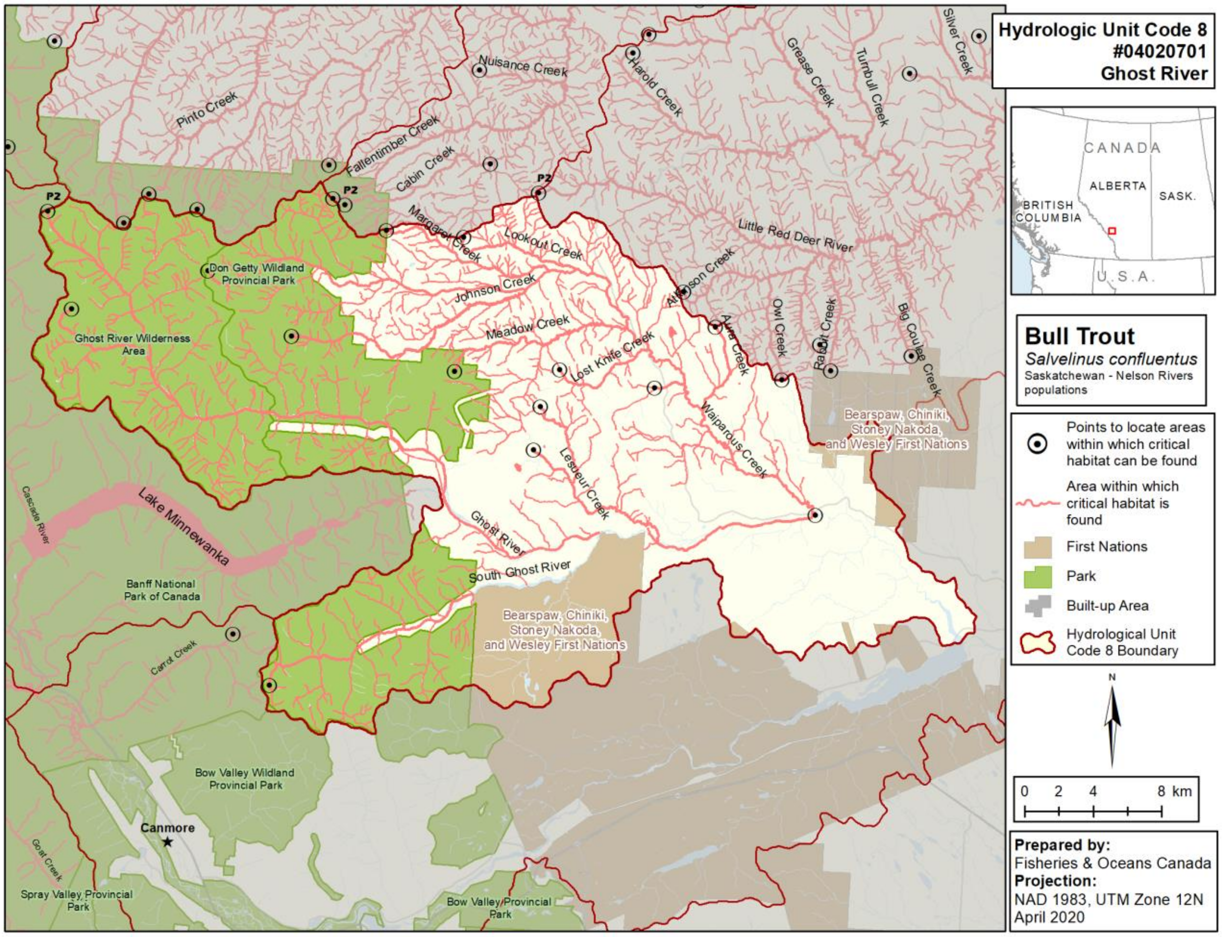

Figure 24. Critical habitat in the Ghost River

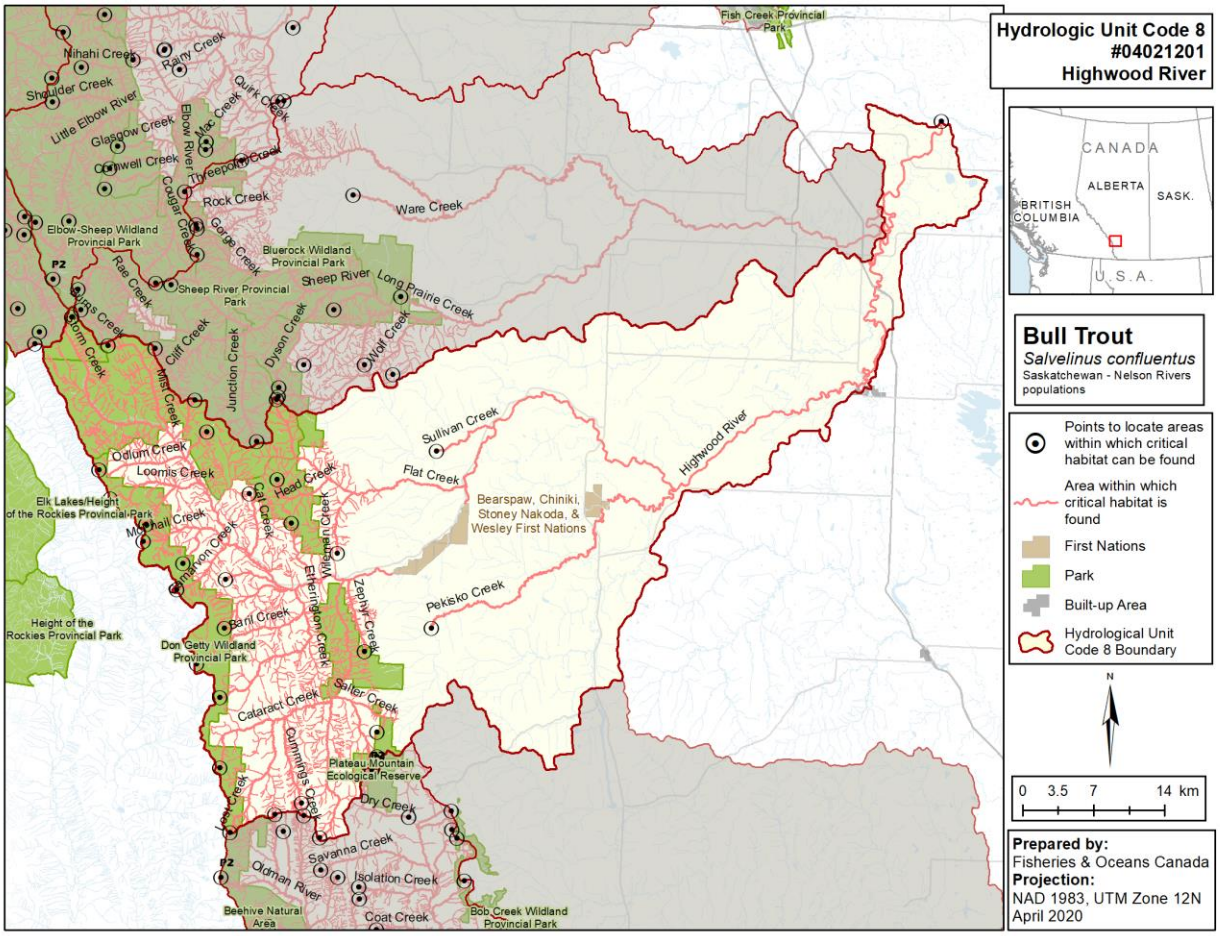

Figure 25. Critical Habitat in the Highwood River

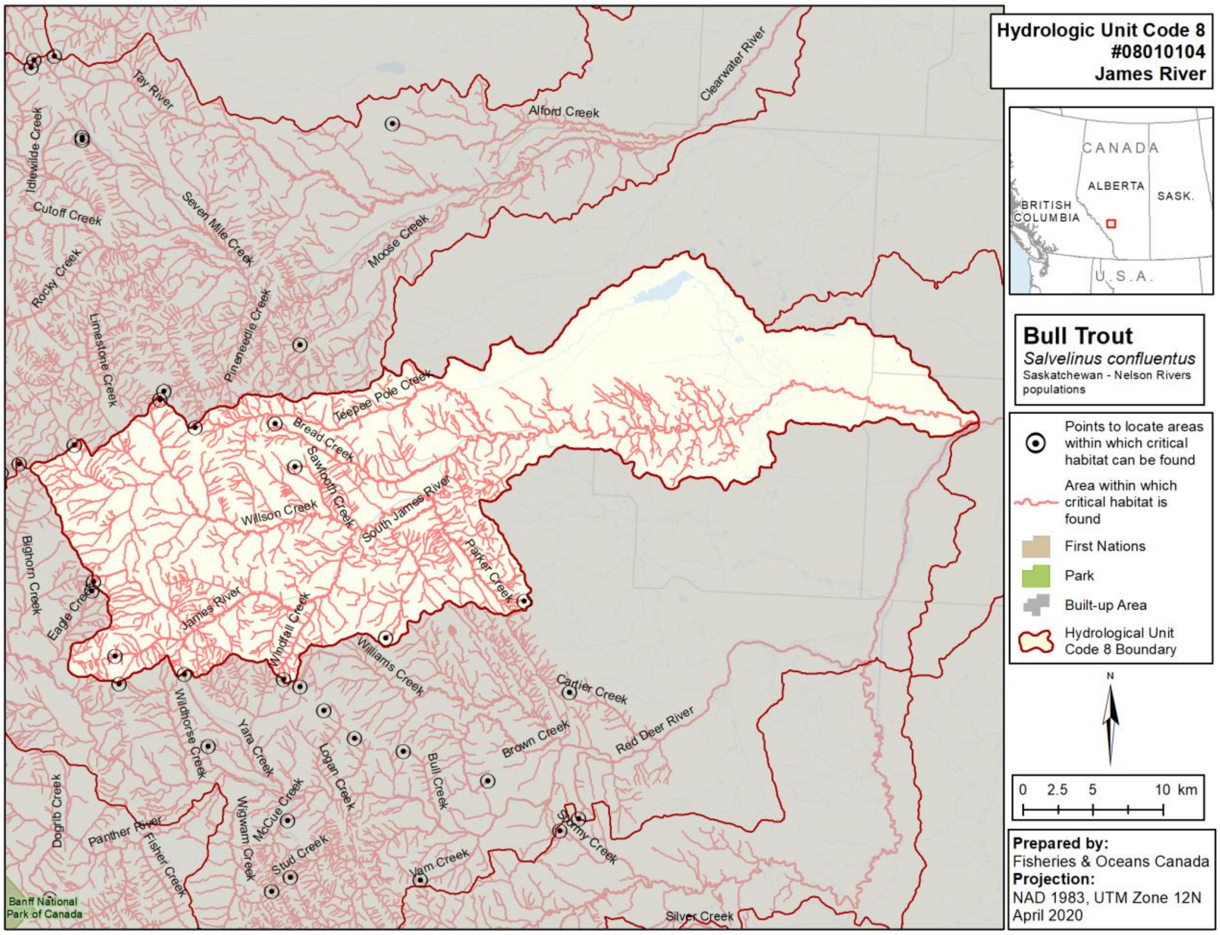

Figure 26. Critical habitat in the James River

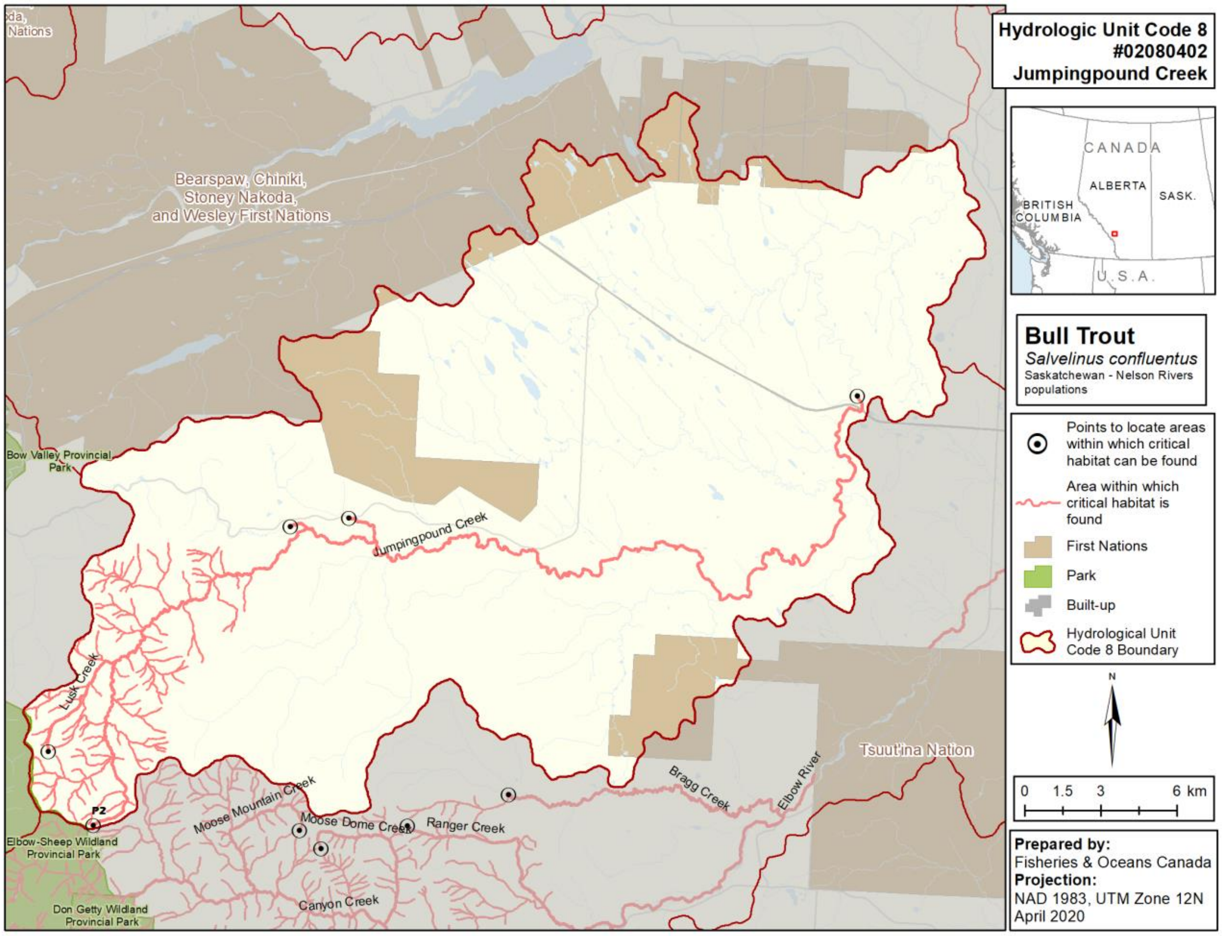

Figure 27. Critical habitat in Jumpingpound Creek

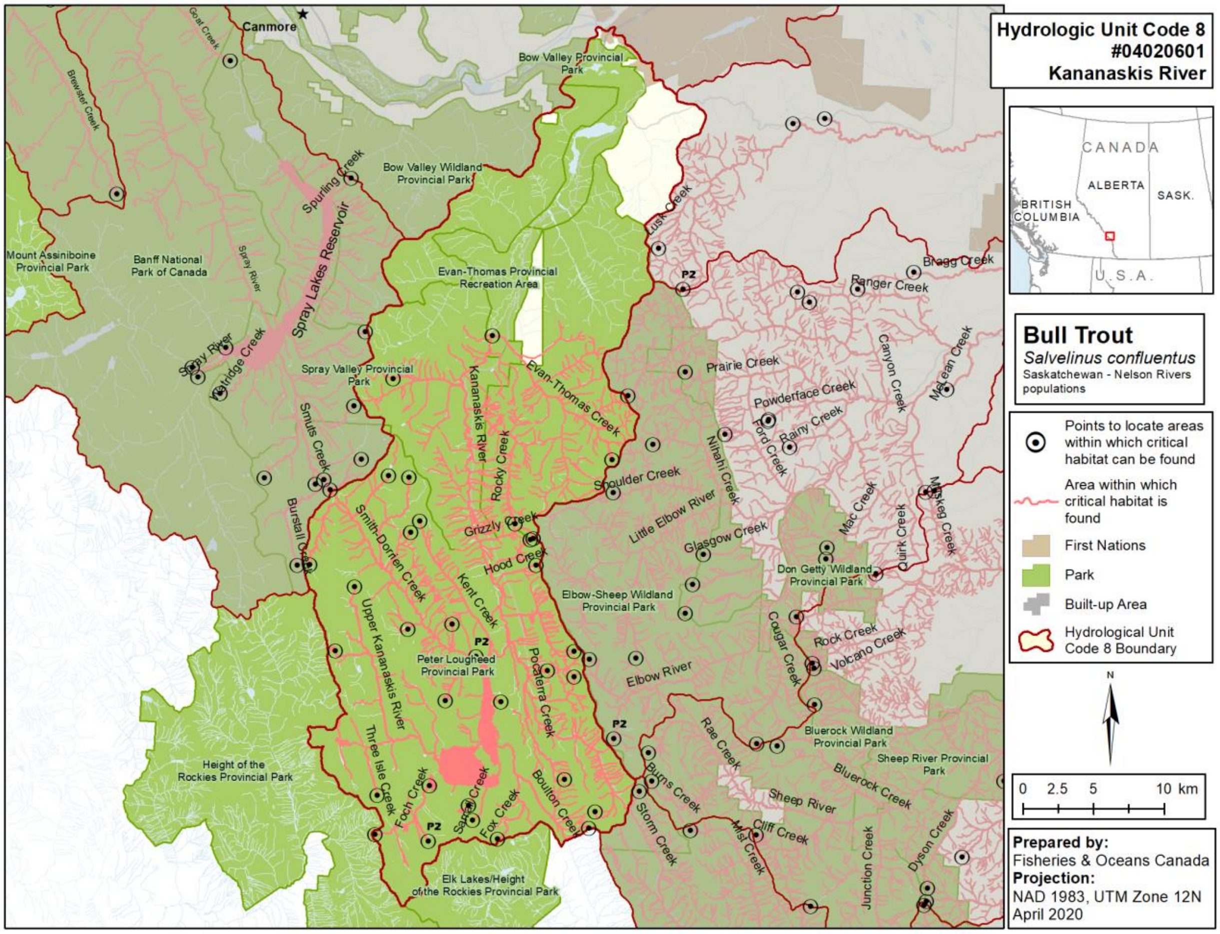

Figure 28. Critical habitat in the Kananaskis River

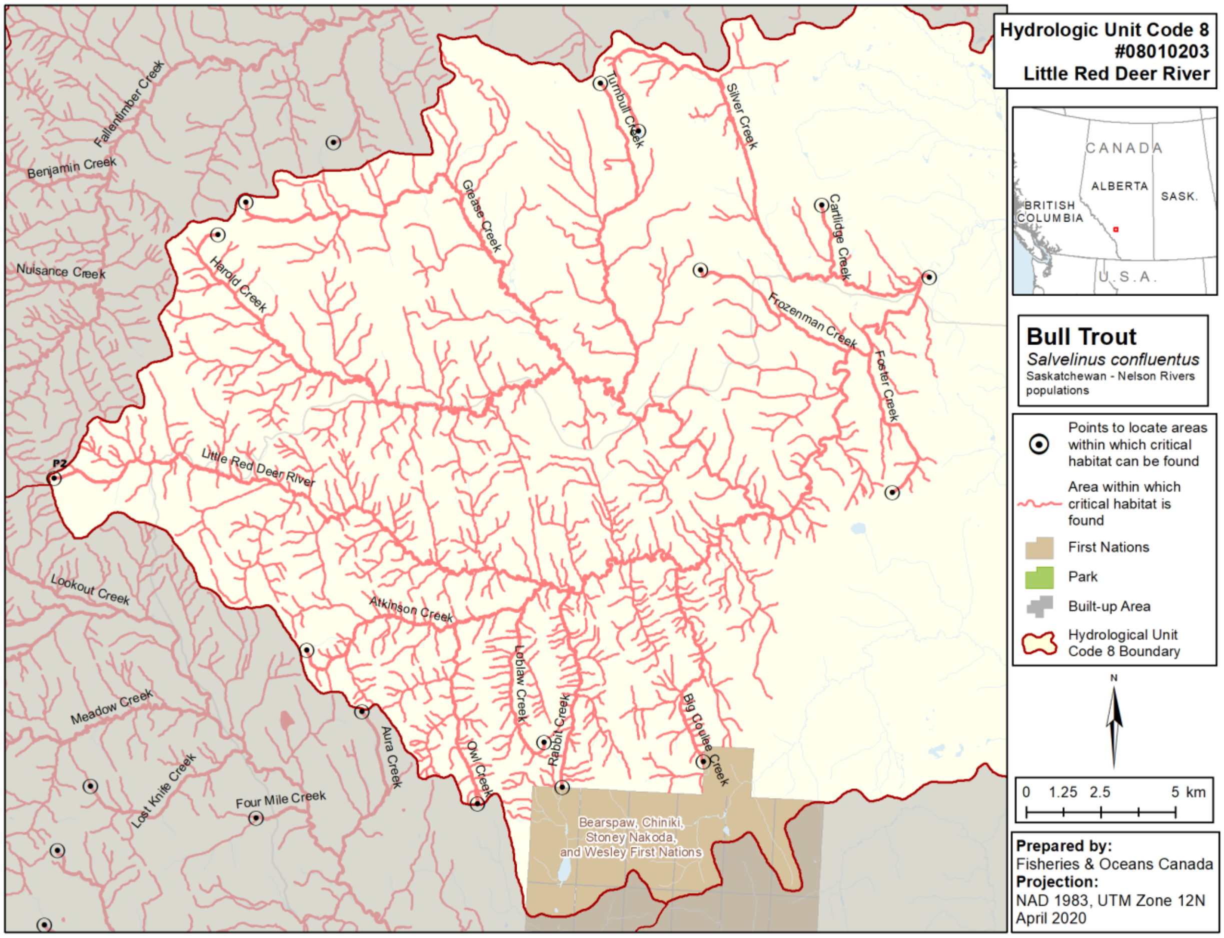

Figure 29. Critical habitat in Little Red Deer River

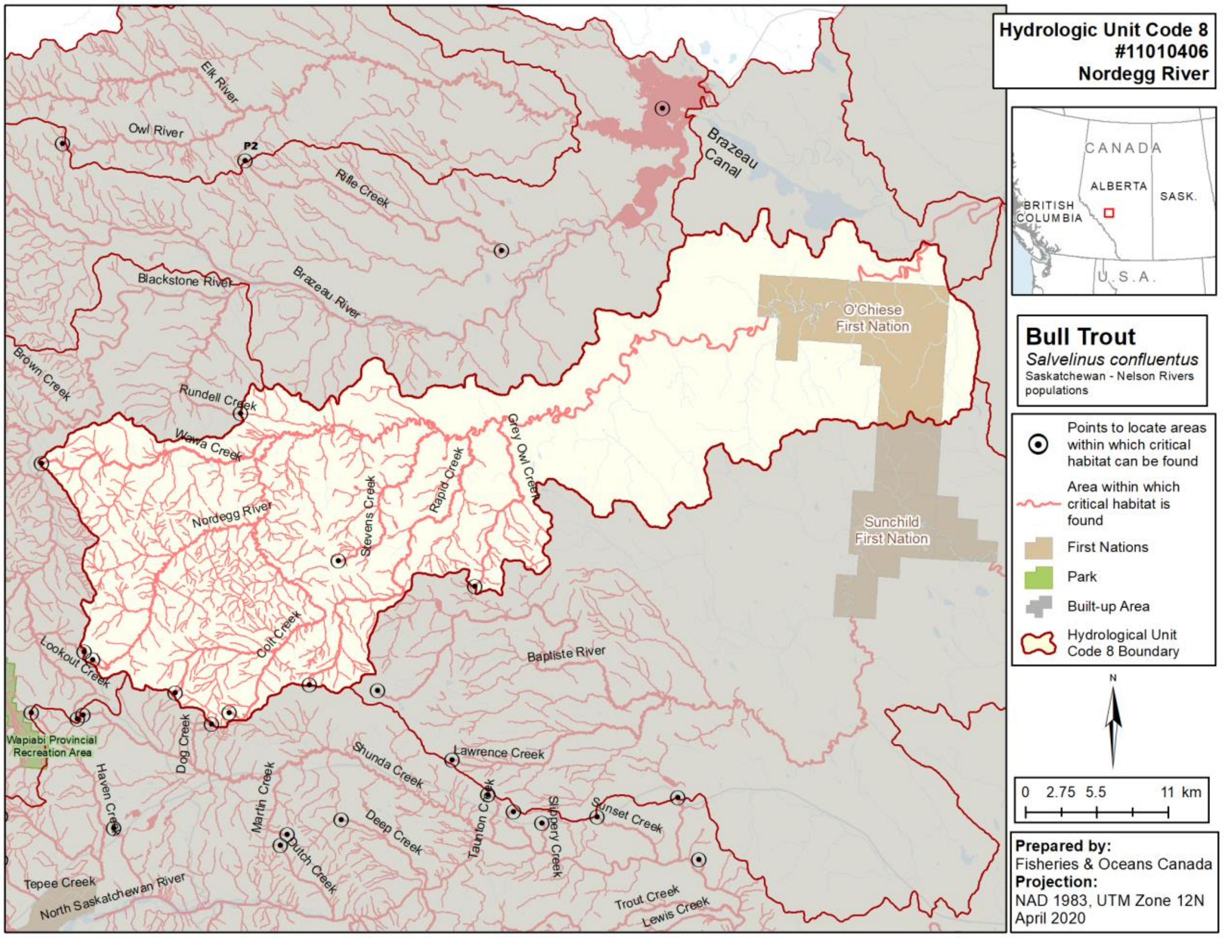

Figure 30. Critical habitat in the Nordegg River

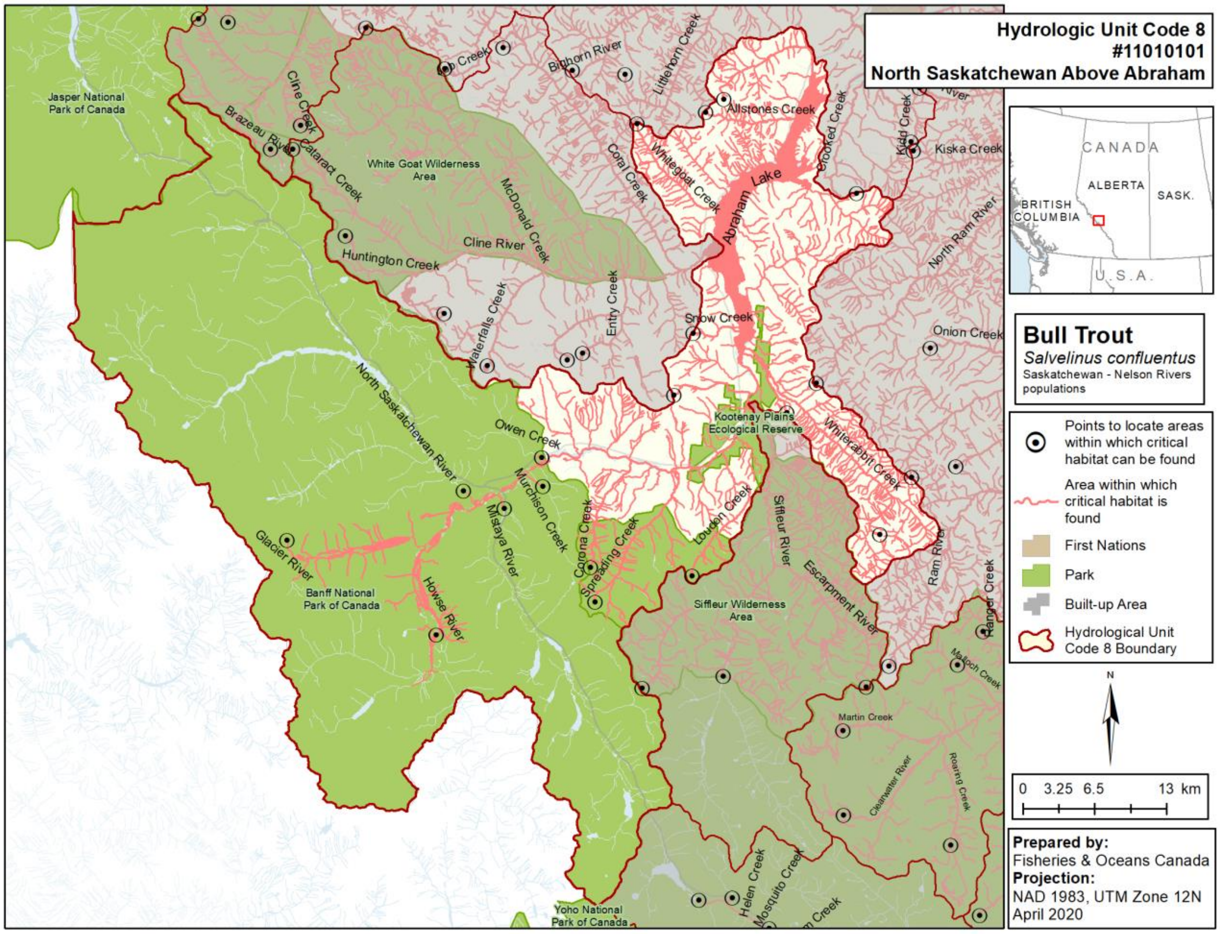

Figure 31. Critical habitat in the North Saskatchewan River above Abraham Dam

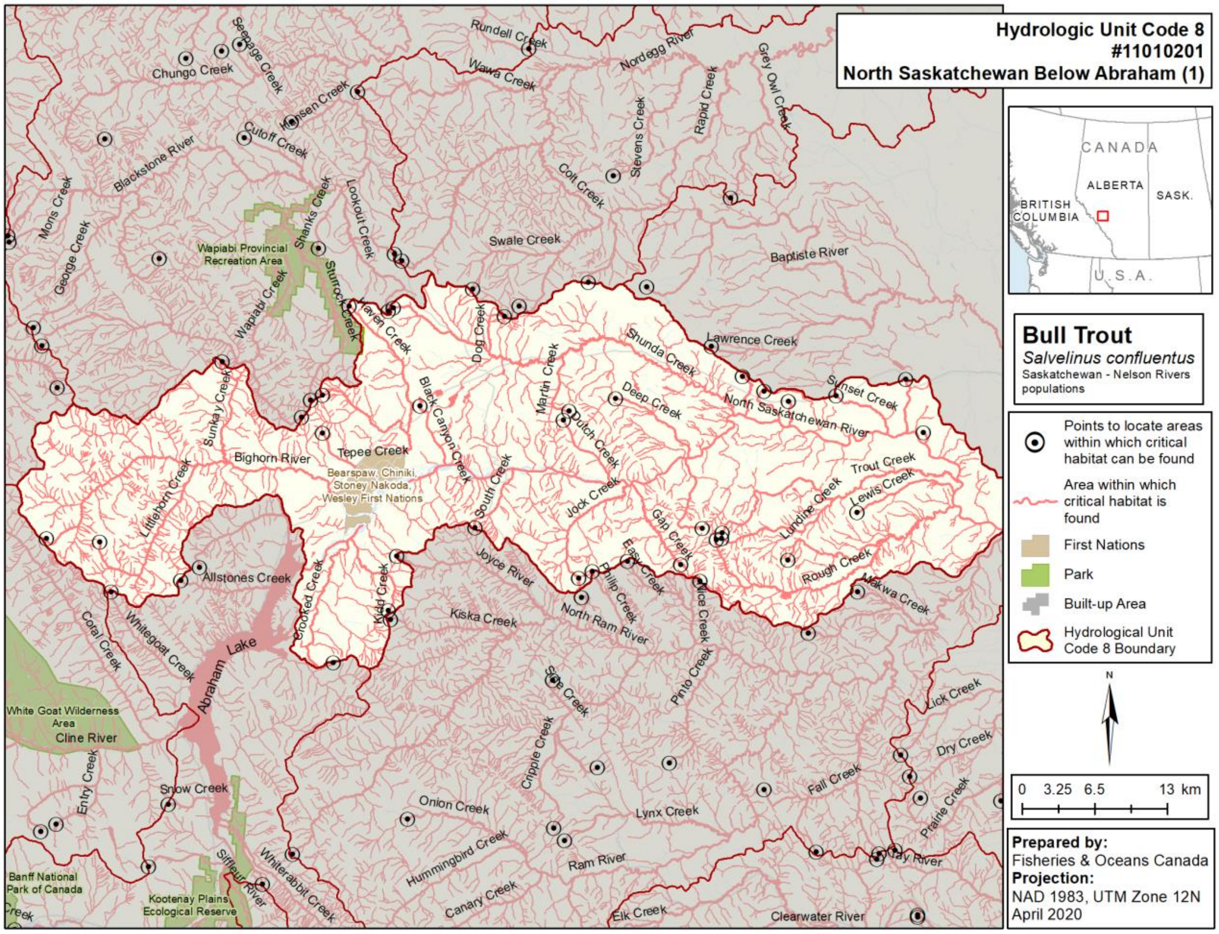

Figure 32. Critical habitat in the North Saskatchewan River below Abraham Dam (1)

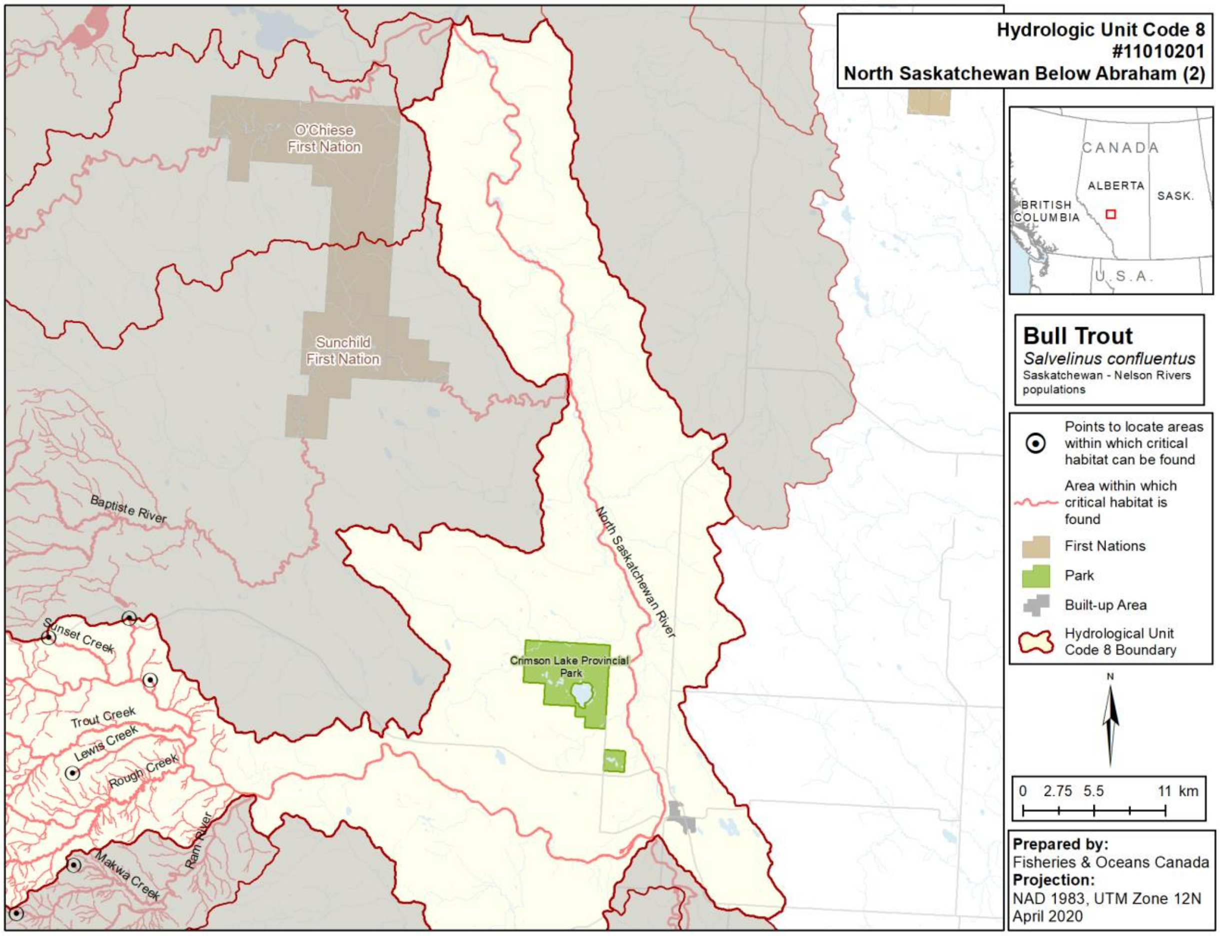

Figure 33. Critical habitat in the North Saskatchewan River below Abraham Dam (2)

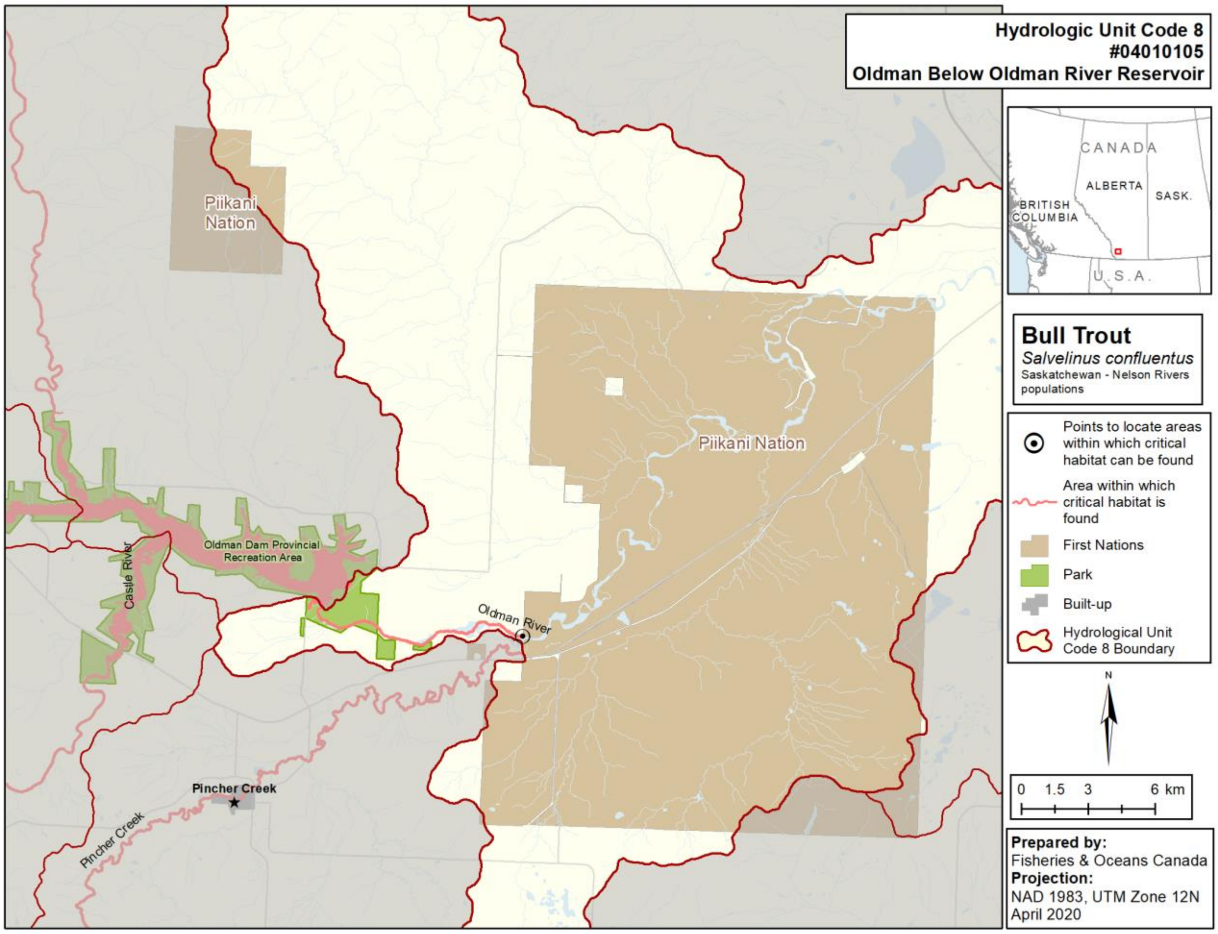

Figure 34. Critical habitat in the Oldman River below Oldman River Reservoir

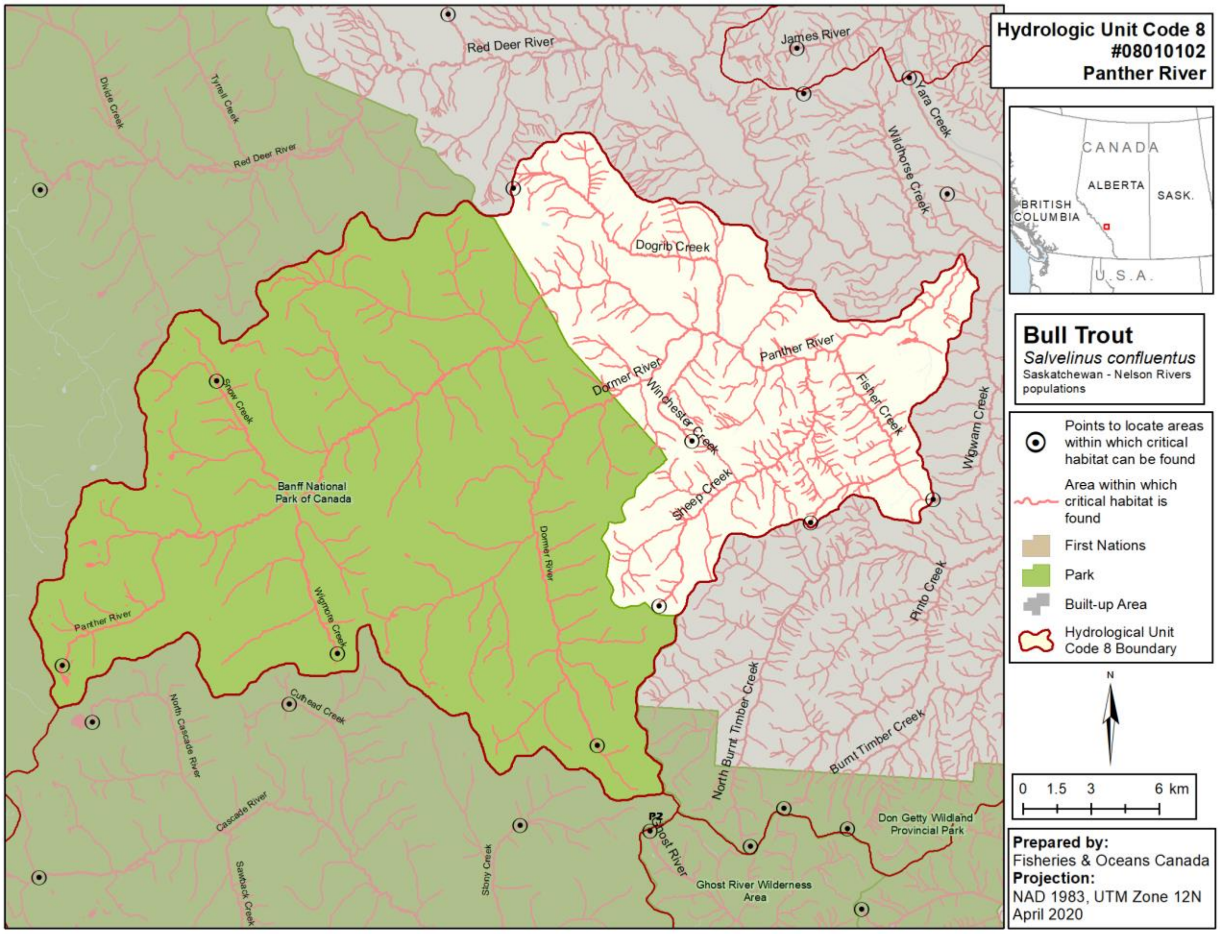

Figure 35. Critical habitat in the Panther River

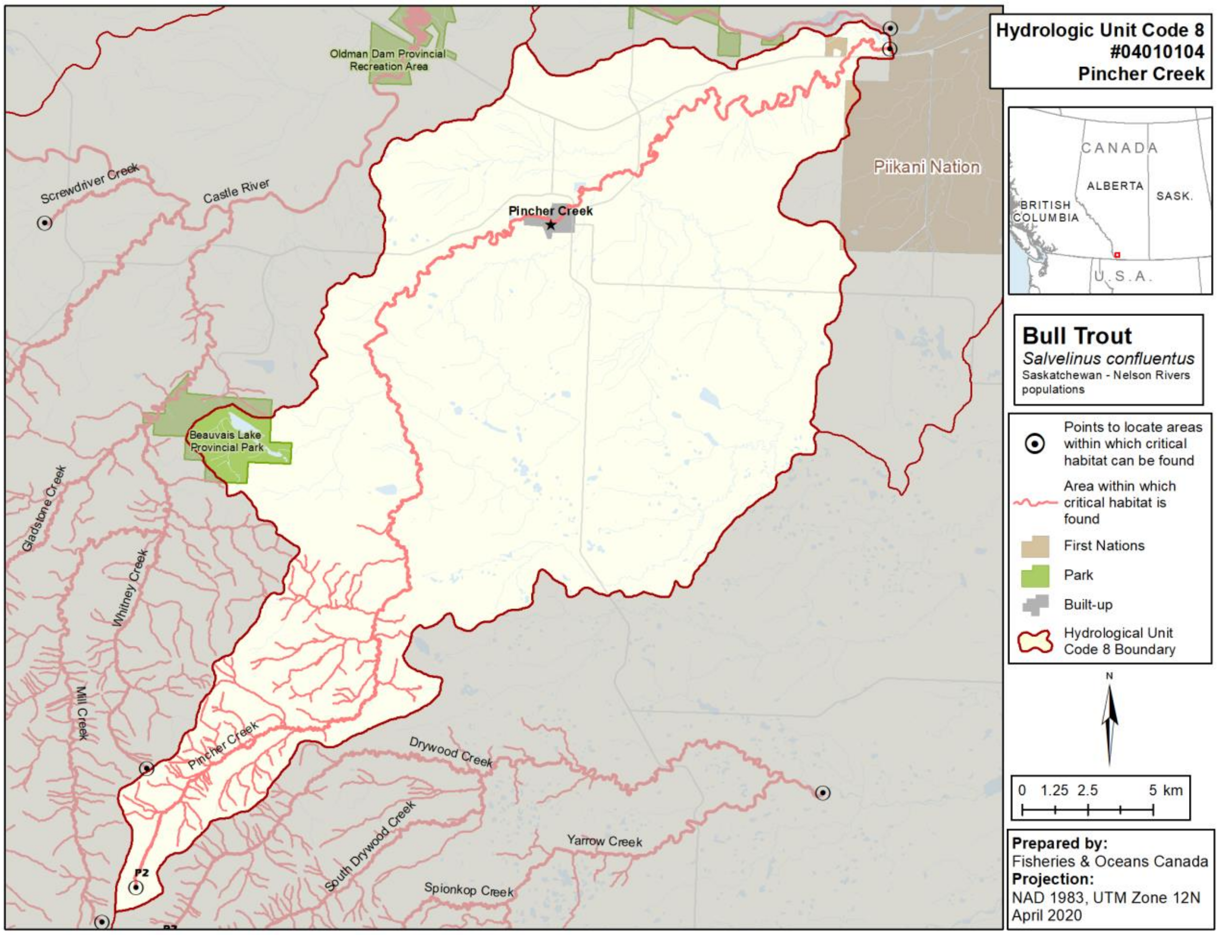

Figure 36. Critical habitat in Pincher Creek

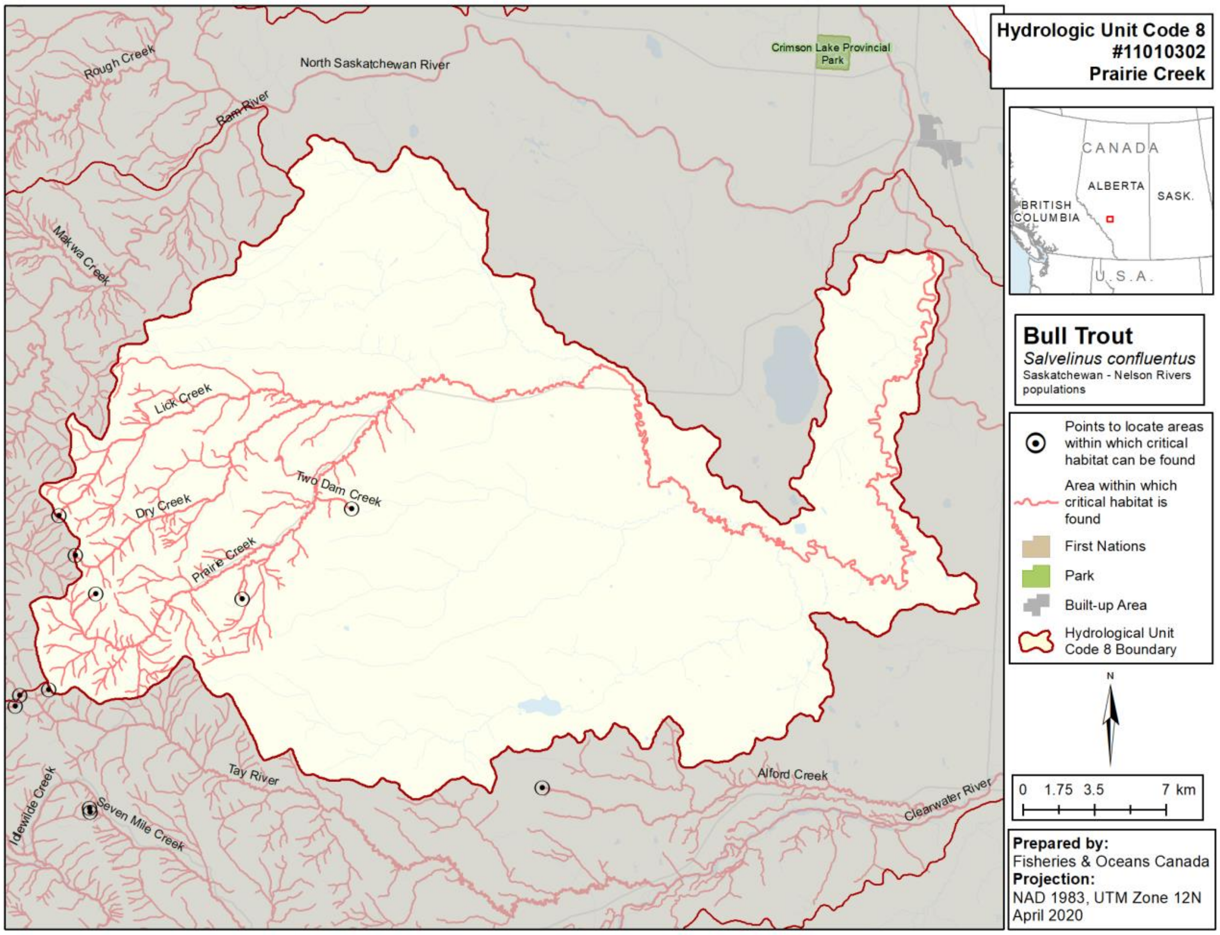

Figure 37. Critical habitat in Prairie Creek

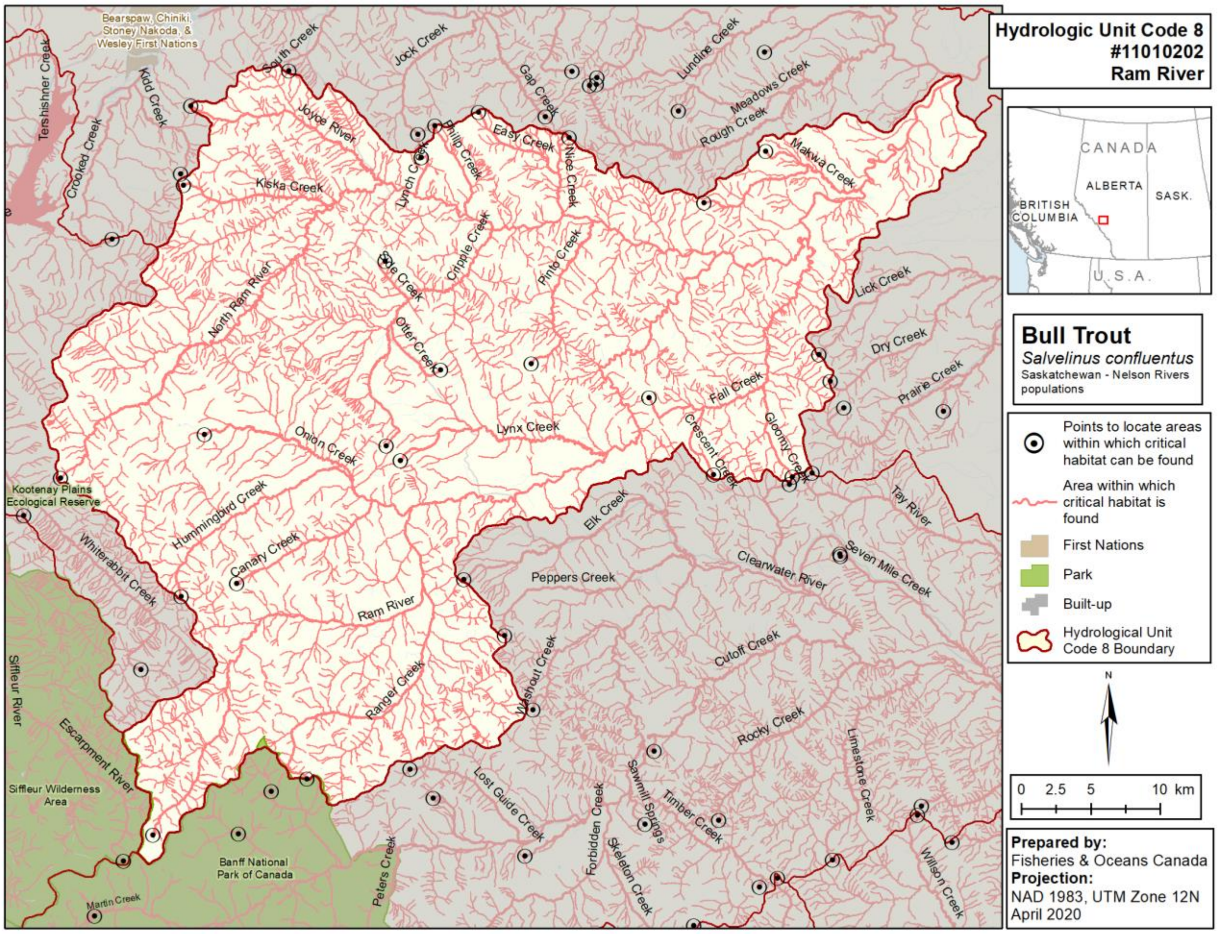

Figure 38. Critical habitat in the Ram River

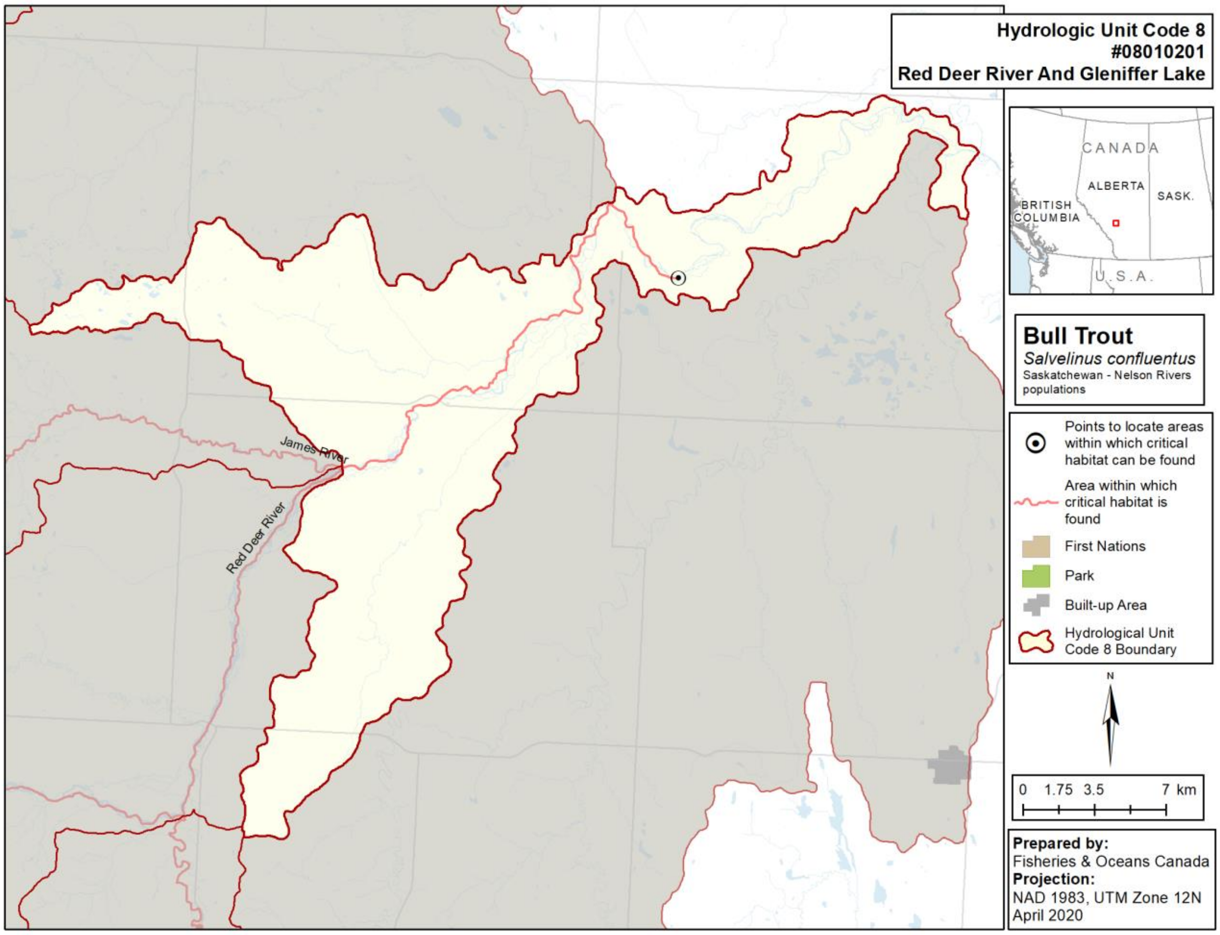

Figure 39. Critical habitat in the Red Deer River and Gleniffer Lake

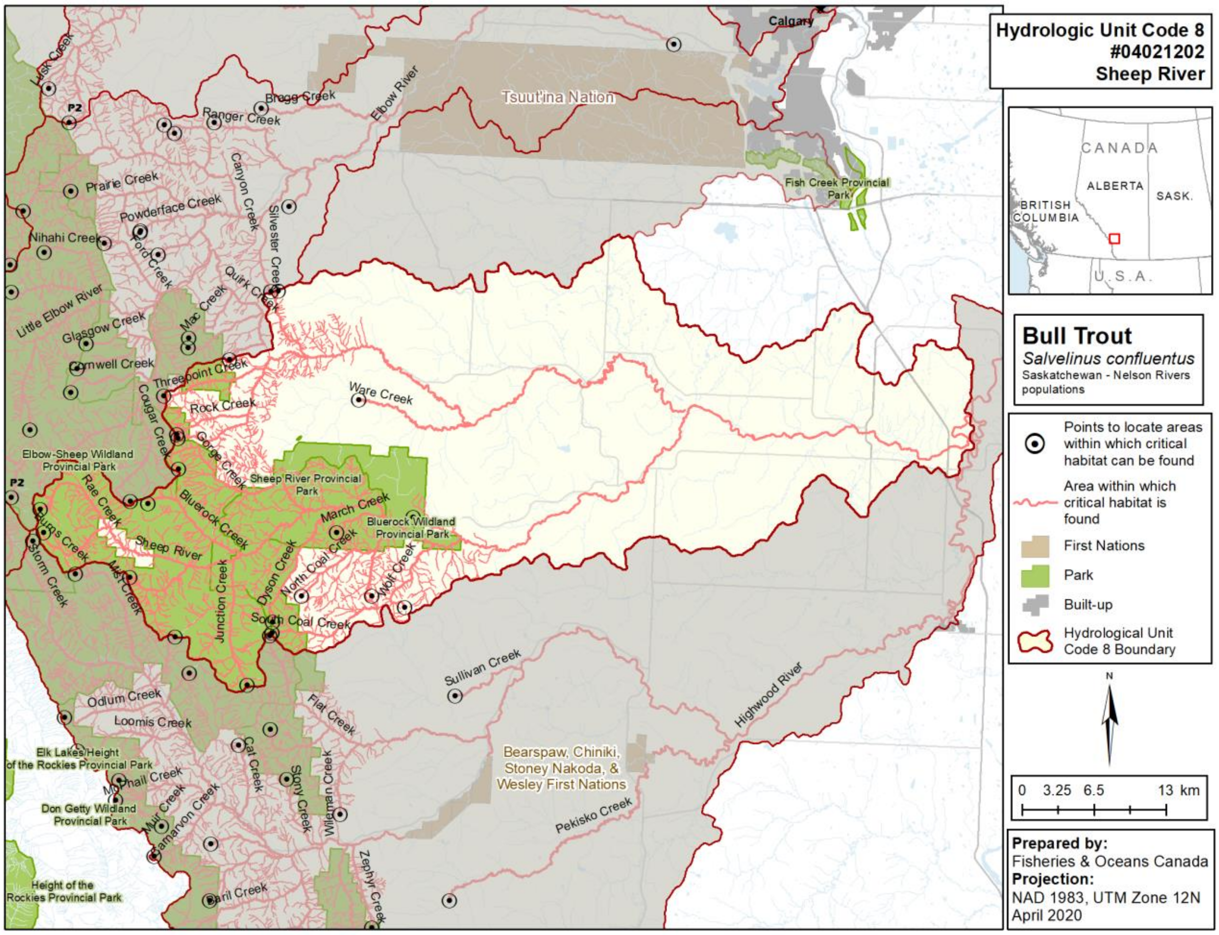

Figure 40. Critical habitat in Sheep River

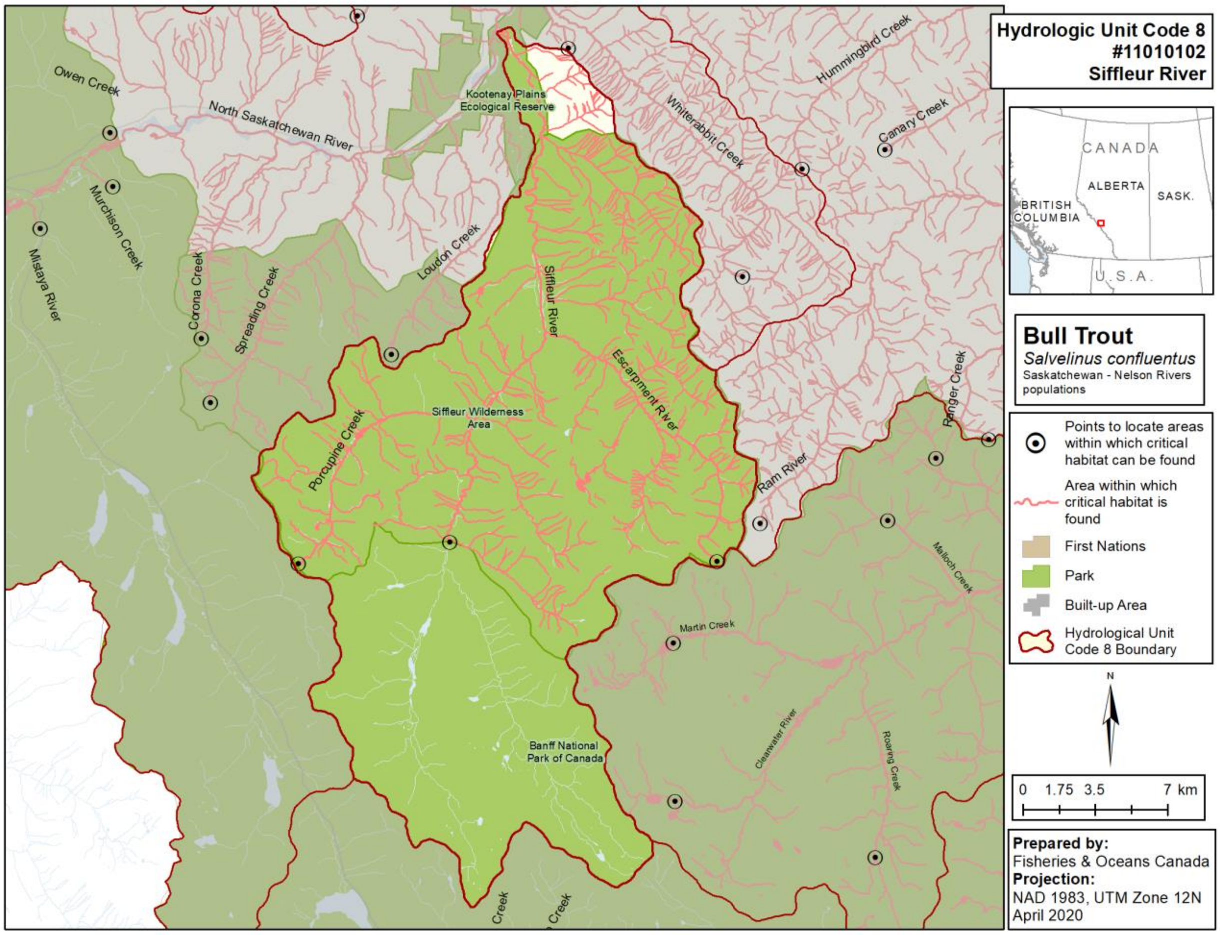

Figure 41. Critical habitat in Siffleur River

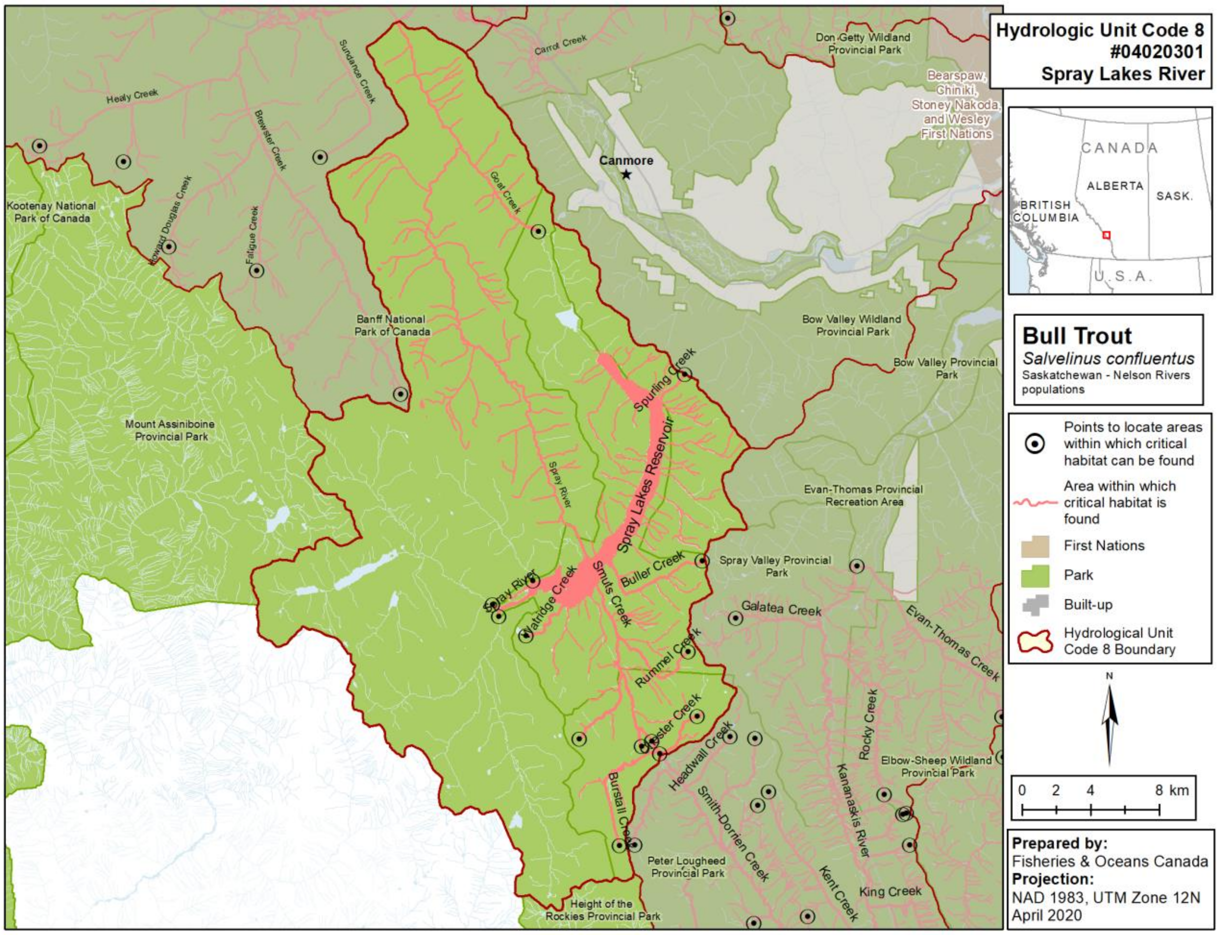

Figure 42. Critical habitat in Spray River

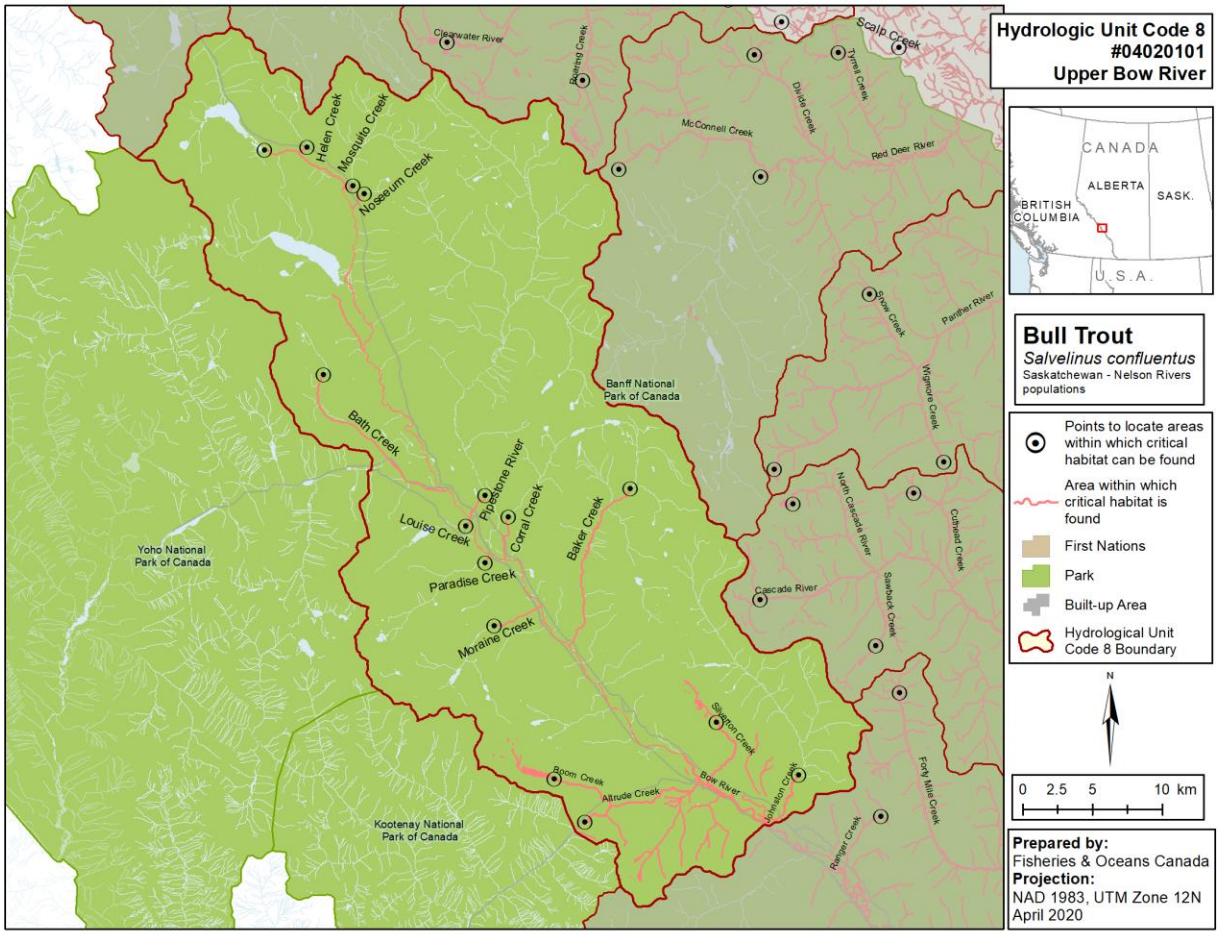

Figure 43. Critical habitat in the Upper Bow River

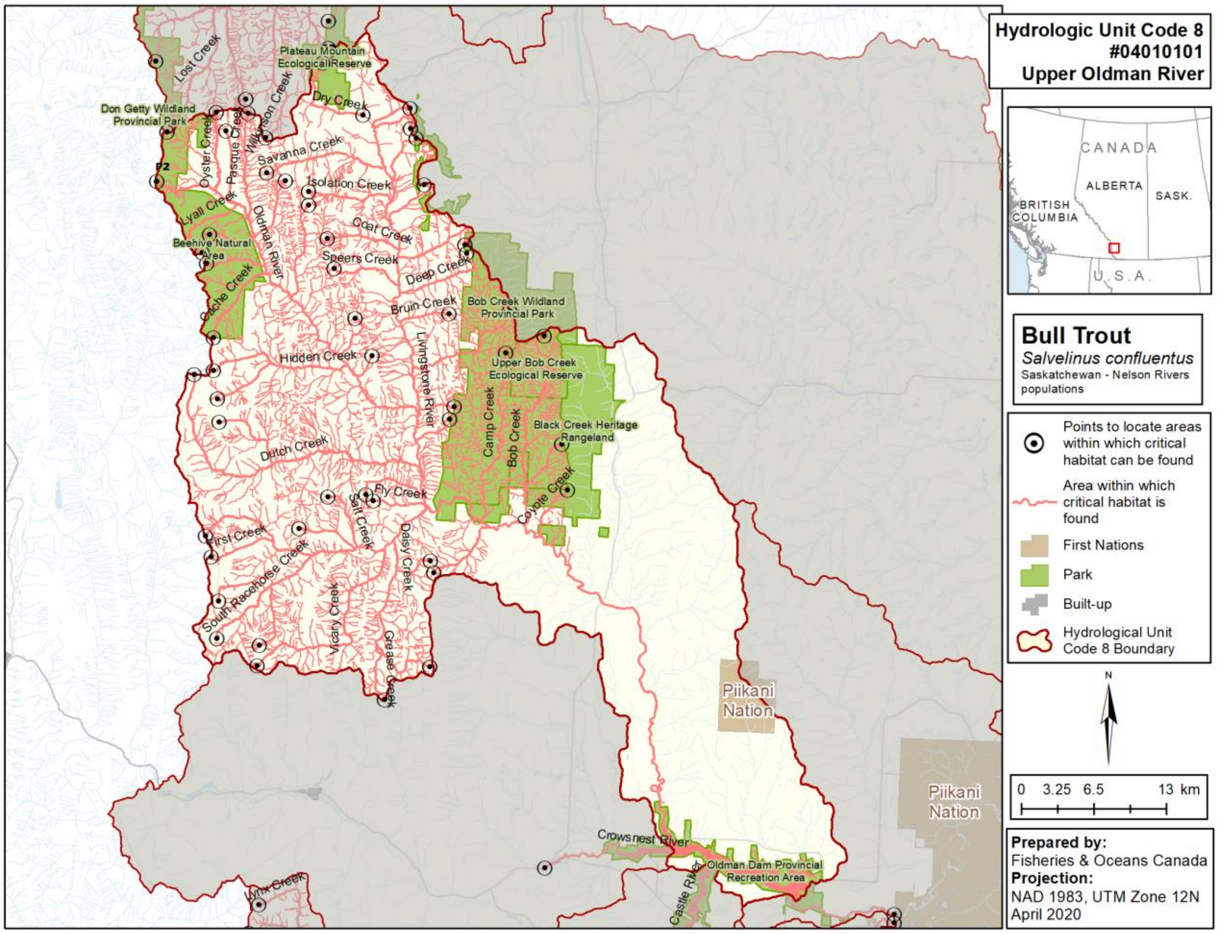

Figure 44. Critical habitat in the Upper Oldman River

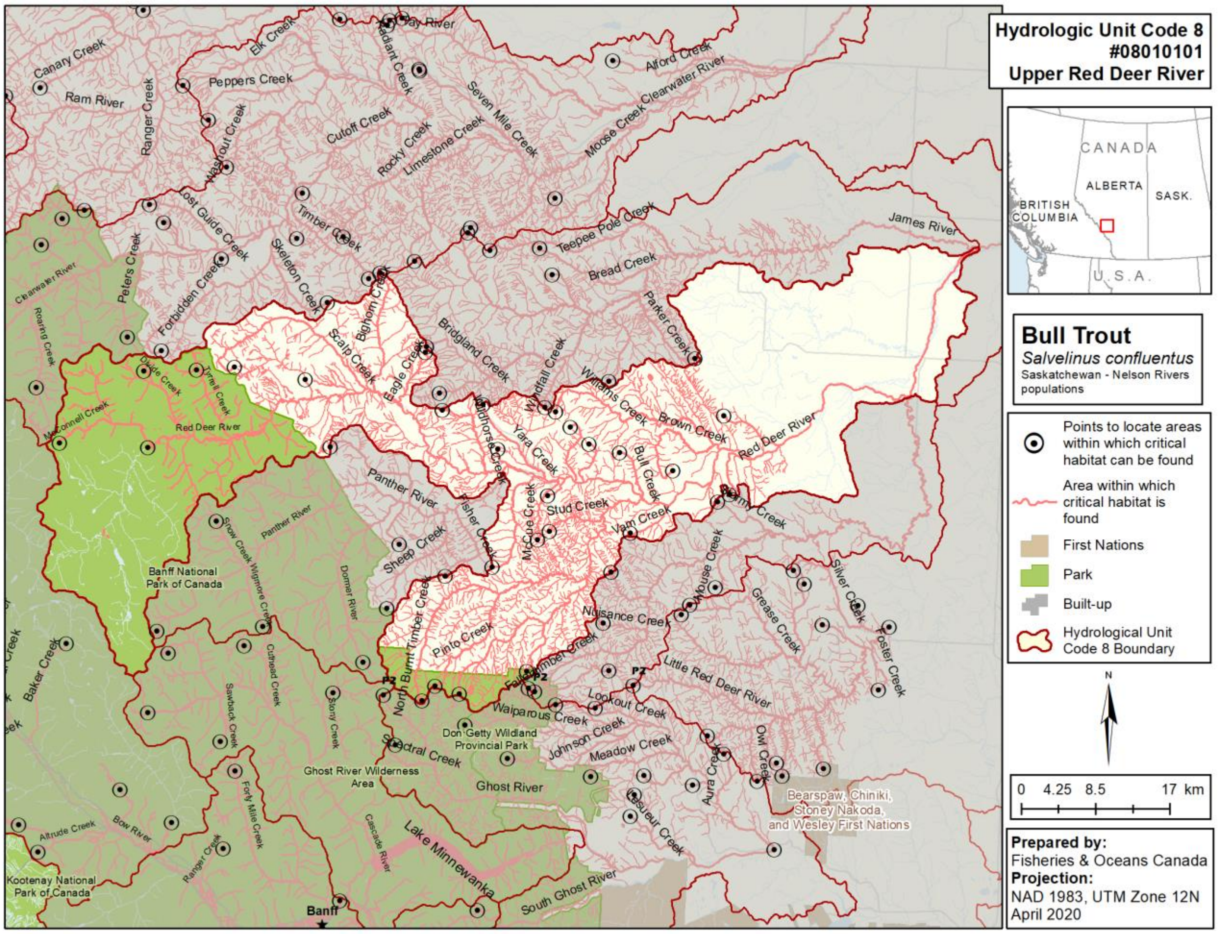

Figure 45. Critical habitat in the Upper Red Deer River

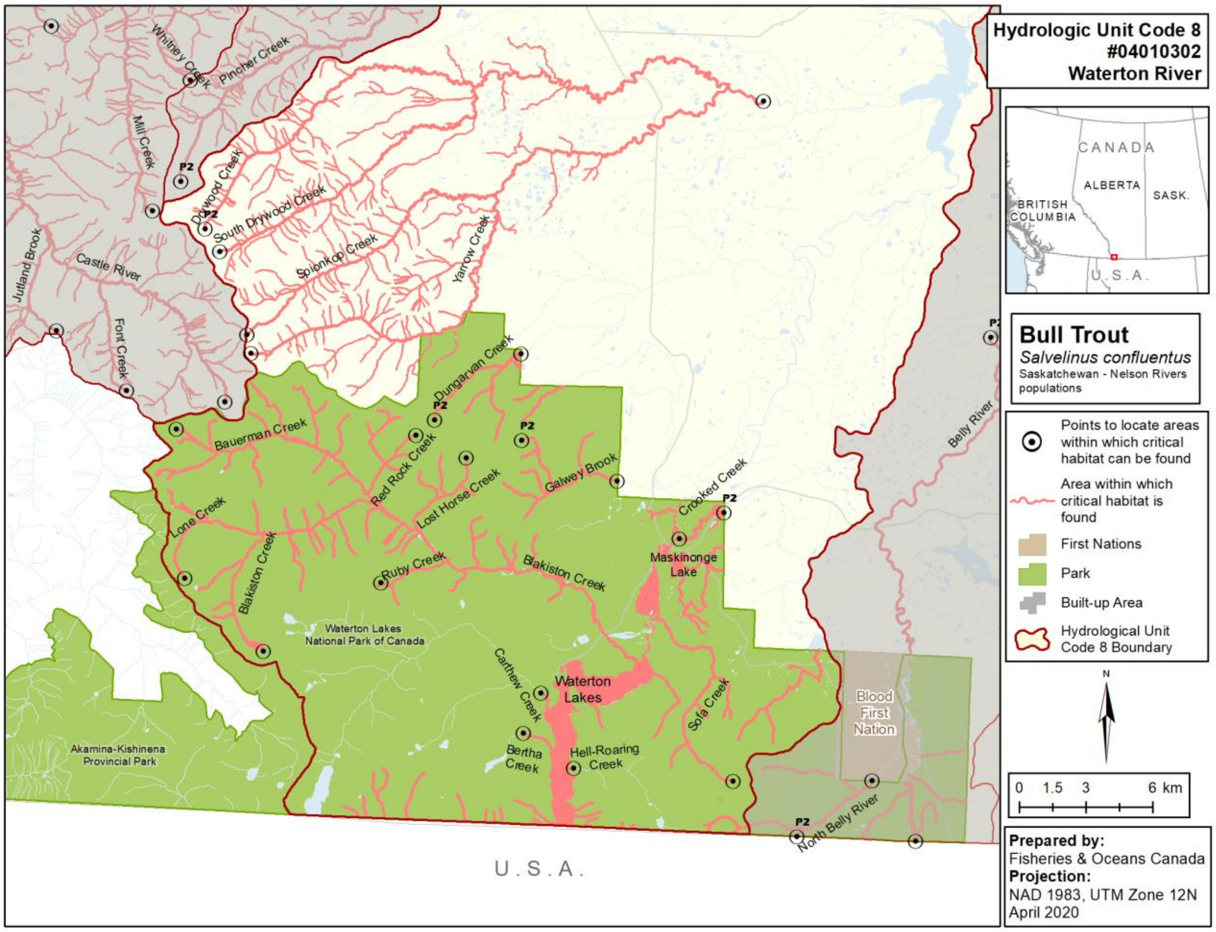

Figure 46. Critical habitat in the Waterton River

Table 10. Locations in Alberta identified to be areas containing the features, functions, and attributes of critical habitat. Decimal Degrees (DD) calculated using WGS 1984 datum.

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Baptiste River (Rivière)	Baptiste River	11010203	1	52.55335358720	-115.90476142500
Jackfish Creek (Crique)	Baptiste River	11010203	1	52.49298872160	-115.55608021200
Lawrence Creek (Crique)	Baptiste River	11010203	1	52.50894321300	-115.81499374900
Belly River (Rivière)	Belly River	04010301	2	49.21424474780	-113.63626073500
Belly River (Rivière)	Belly River	04010301	1	48.99772090730	-113.68350212100
North Belly River (Rivière)	Belly River	04010301	1	49.02142798230	-113.71141541200
North Belly River (Rivière)	Belly River	04010301	2	48.99785835400	-113.75623250000
Ashburner Creek (Crique)	Blackstone River	11010403	1	52.78712992880	-116.57578561900

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Blackstone River (Rivière)	Blackstone River	11010403	1	52.55655552860	-116.75092616800
Brown Creek (Crique)	Blackstone River	11010403	1	52.76854523250	-116.76416754100
Chungo Creek (Crique)	Blackstone River	11010403	1	52.64051005160	-116.63389198000
Clark Creek (Crique)	Blackstone River	11010403	1	52.70982221290	-116.53455335000
Cutoff Creek (Crique)	Blackstone River	11010403	1	52.64977886460	-116.44978484500
Dorothy Creek (Crique)	Blackstone River	11010403	1	52.71810097420	-116.48851080000
George Creek (Crique)	Blackstone River	11010403	1	52.48463874900	-116.70783343200
Hansen Creek (Crique)	Blackstone River	11010403	1	52.66522239950	-116.38941736200
Lookout Creek (Crique)	Blackstone River	11010403	1	52.51908532850	-116.24296068400
McCormick Creek (Crique)	Blackstone River	11010403	1	52.79978896180	-116.54456796800
Mons Creek (Crique)	Blackstone River	11010403	1	52.55161187130	-116.74865273000
Rundell Creek (Crique)	Blackstone River	11010403	1	52.73802085250	-116.08236474300
Seepage Creek (Crique)	Blackstone River	11010403	1	52.72482150280	-116.46503756700
Shankland Creek (Crique)	Blackstone River	11010403	1	52.42909257460	-116.34692003800
Shanks Creek (Crique)	Blackstone River	11010403	1	52.56581685130	-116.34099348400
Smith Creek (Crique)	Blackstone River	11010403	1	52.54774618050	-116.54997957500
Stovepipe Creek (Crique)	Blackstone River	11010403	1	52.56574869720	-116.24070071600
Sturrock Creek (Crique)	Blackstone River	11010403	1	52.44312378150	-116.33645206400
Sunkay Creek (Crique)	Blackstone River	11010403	1	52.46885523890	-116.45670099400
Wapiabi Creek (Crique)	Blackstone River	11010403	1	52.47033774220	-116.69514573000
Carrot Creek (Crique)	Bow River and Ghost Reservoir	04020401	1	51.20326189990	-115.31695690100
Blanchard Creek (Crique)	Brazeau River	11010401	1	52.78950108410	-116.55176673500
Brazeau Reservoir (Bassin)	Brazeau River	11010401	1	52.96867251850	-115.62378389800
Canyon Creek (Crique)	Brazeau River	11010401	1	52.77400352280	-116.59326649700
Chimney Creek (Crique)	Brazeau River	11010401	1	52.72145951010	-116.89834790300

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Coast Creek (Crique)	Brazeau River	11010401	1	52.77041404520	-116.67824233000
Job Creek (Crique)	Brazeau River	11010401	1	52.30947466510	-116.83822591500
Marshybank Creek (Crique)	Brazeau River	11010401	1	52.79115780030	-116.73195312900
Moosehound Creek (Crique)	Brazeau River	11010401	1	52.80498485120	-116.52133949100
Neilson Creek (Crique)	Brazeau River	11010401	1	52.69760488430	-116.96887597400
Opabin Creek (Crique)	Brazeau River	11010401	1	52.50524048370	-116.78019010300
Owl River (Rivière)	Brazeau River	11010401	1	52.91541882020	-116.30755605200
Race Creek (Crique)	Brazeau River	11010401	1	52.68514071590	-116.78156749100
Rifle Creek (Crique)	Brazeau River	11010401	1	52.86292428380	-115.79721232400
Thistle Creek (Crique)	Brazeau River	11010401	1	52.73660976110	-117.10017111000
Whisker Creek (Crique)	Brazeau River	11010401	1	52.43789971540	-116.67072482000
Brazeau River (Rivière)	Brazeau River	11010401	1	52.23256532320	-117.06000507300
Cairn River (Rivière)	Brazeau River	11010401	1	52.69816521100	-117.17425939600
Cline Creek (Crique)	Brazeau River	11010401	1	52.25398522620	-117.02296813600
Four Point Creek (Crique)	Brazeau River	11010401	1	52.33318056610	-117.16900574900
Isaac Creek (Crique)	Brazeau River	11010401	1	52.49703038330	-117.05283729600
John John Creek (Crique)	Brazeau River	11010401	1	52.33267214480	-117.13031901000
North Isaac Creek (Crique)	Brazeau River	11010401	1	52.46914347510	-117.11508810600
North West Brazeau River(Rivière)	Brazeau River	11010401	1	52.51155621180	-117.30796350000
South Isaac Creek (Crique)	Brazeau River	11010401	1	52.45021825880	-117.09573318900
Southesk River (Rivière)	Brazeau River	11010401	1	52.61765002190	-117.28216446700
Brewster Creek (Crique)	Brewster Creek	04020201	1	50.97069180010	-115.53731709900
Fatigue Creek (Crique)	Brewster Creek	04020201	1	51.03042209970	-115.66318550000
Forty Mile Creek (Crique)	Brewster Creek	04020201	1	51.33064060030	-115.72770930000
Healy Creek (Crique)	Brewster Creek	04020201	1	51.08851959990	-115.84992670000

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Howard Douglas Creek (Crique)	Brewster Creek	04020201	1	51.04003540010	-115.73708730000
Ranger Creek (Crique)	Brewster Creek	04020201	1	51.25026709990	-115.73882050000
Sundance Creek (Crique)	Brewster Creek	04020201	1	51.09195729950	-115.61639700000
Sunshine Creek (Crique)	Brewster Creek	04020201	1	51.08300390020	-115.77931360000
Whiskey Creek (Crique)	Brewster Creek	04020201	1	51.20430100000	-115.54242699900
Cardinal River (Rivière)	Cardinal River	11010402	1	52.91192093500	-117.38133949800
Flapjack Creek (Crique)	Cardinal River	11010402	1	52.79519259370	-117.02036611100
Grave Creek (Crique)	Cardinal River	11010402	1	52.90701014180	-117.02953718800
Muskiki Creek (Crique)	Cardinal River	11010402	1	52.85845510260	-116.87875744600
Nomad Creek (Crique)	Cardinal River	11010402	1	52.81737360070	-117.16998757000
Redcap Creek (Crique)	Cardinal River	11010402	1	52.93814713480	-117.11535756900
Ruby Creek (Crique)	Cardinal River	11010402	1	52.74125286440	-117.10545043200
Russell Creek (Crique)	Cardinal River	11010402	1	52.82155269040	-117.16159612400
Toma Creek (Crique)	Cardinal River	11010402	1	52.81299256730	-117.18100136900
Cascade River (Rivière)	Cascade River	04020501	1	51.38450660040	-115.87692970000
Cuthead Creek (Crique)	Cascade River	04020501	1	51.45964550050	-115.72619729900
North Cascade River (Rivière)	Cascade River	04020501	1	51.44736129970	-115.84997780000
Sawback Creek (Crique)	Cascade River	04020501	1	51.35988819970	-115.75511430000
Stony Creek (Crique)	Cascade River	04020501	1	51.41734300040	-115.57495220000
Barnaby Creek (Crique)	Castle River	04010103	1	49.33815669060	-114.38234655500
Beaver Mines Creek (Crique)	Castle River	04010103	1	49.38166520660	-114.28610464600
Carbondale River (Rivière)	Castle River	04010103	1	49.38654309020	-114.57512465300
Castle River (Rivière)	Castle River	04010103	1	49.16438975390	-114.11842045200
Font Creek (Crique)	Castle River	04010103	1	49.16733976040	-114.17937399400
Gardiner Creek (Crique)	Castle River	04010103	1	49.37144943270	-114.52875620700
Gladstone Creek (Crique)	Castle River	04010103	1	49.31309754160	-114.23520015500

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Goat Creek (Crique)	Castle River	04010103	1	49.47307593600	-114.57982540100
Gorge Creek (Crique)	Castle River	04010103	1	49.51510220180	-114.42716772600
Grizzly Creek (Crique)	Castle River	04010103	1	49.23856002560	-114.32171803100
Iron Creek (Crique)	Castle River	04010103	1	49.49729671020	-114.38237030800
Jackson Creek (Crique)	Castle River	04010103	1	49.50721699380	-114.38204217300
Jutland Brook (Ruisseau)	Castle River	04010103	1	49.19031632890	-114.22390023200
Lynx Creek (Crique)	Castle River	04010103	1	49.54281241940	-114.56058949600
Macdonald Creek (Crique)	Castle River	04010103	1	49.38124738060	-114.54902474200
Mill Creek (Crique)	Castle River	04010103	1	49.24034401990	-114.16792365800
North Lost Creek (Crique)	Castle River	04010103	1	49.43830652170	-114.59815941300
O'Haggen Creek (Crique)	Castle River	04010103	1	49.38326312220	-114.42123445800
Scarpe Creek (Crique)	Castle River	04010103	1	49.18019970380	-114.26706490400
Screwdriver Creek (Crique)	Castle River	04010103	1	49.47869195500	-114.21344964400
Snowshoe Creek (Crique)	Castle River	04010103	1	49.51950588960	-114.57139605100
South Lost Creek (Crique)	Castle River	04010103	1	49.39888385160	-114.58250840600
Suicide Creek (Crique)	Castle River	04010103	1	49.34668977390	-114.45308023200
Syncline Brook (Ruisseau)	Castle River	04010103	1	49.29901703250	-114.45081103900
Webb Creek (Crique)	Castle River	04010103	1	49.49512920510	-114.39503676400
West Castle River (Rivière)	Castle River	04010103	1	49.20009722000	-114.34369711500
Whitney Creek (Crique)	Castle River	04010103	1	49.29361959350	-114.14803408300
Alford Creek (Crique)	Clearwater River	11010301	1	52.08368577450	-115.17498382000
Cutoff Creek (Crique)	Clearwater River	11010301	1	51.92809116090	-115.67767529200
Elk Creek (Crique)	Clearwater River	11010301	1	52.03051161940	-115.88816502500
Forbidden Creek (Crique)	Clearwater River	11010301	1	51.75679107770	-115.89456606400
Forty Mile Springs (Source)	Clearwater River	11010301	1	51.85512087730	-115.80538957500
Idlewilde Creek (Crique)	Clearwater River	11010301	1	52.06294274880	-115.49661971700

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Limestone Creek (Crique)	Clearwater River	11010301	1	51.86543224550	-115.48487975500
Lost Guide Creek (Crique)	Clearwater River	11010301	1	51.90594414910	-115.93078632200
Moose Creek (Crique)	Clearwater River	11010301	1	51.93849074810	-115.25771572300
Peppers Creek (Crique)	Clearwater River	11010301	1	51.99640460020	-115.84168411700
Pineneedle Creek (Crique)	Clearwater River	11010301	1	51.90348490990	-115.39548027200
Radiant Creek (Crique)	Clearwater River	11010301	1	52.10569716110	-115.55436669700
Rocky Creek (Crique)	Clearwater River	11010301	1	51.88610142610	-115.60588363300
Rum Punch Creek (Crique)	Clearwater River	11010301	1	51.88847371630	-115.90448413500
Sawmill Springs (Source)	Clearwater River	11010301	1	51.88081840680	-115.68250590900
Seven Mile Creek (Crique)	Clearwater River	11010301	1	52.06124492840	-115.49616219400
Skeleton Creek (Crique)	Clearwater River	11010301	1	51.81729492230	-115.62492167800
Tay River (Rivière)	Clearwater River	11010301	1	52.11392139400	-115.53102140700
Timber Creek (Crique)	Clearwater River	11010301	1	51.84470037470	-115.55923266400
Washout Creek (Crique)	Clearwater River	11010301	1	51.94976234160	-115.80692739400
Clearwater River (Rivière)	Clearwater River	11010301	1	51.72872400010	-116.23962120000
Indianhead Creek (Crique)	Clearwater River	11010301	1	51.88550370030	-116.07377100000
Malloch Creek (Crique)	Clearwater River	11010301	1	51.85696690020	-116.10471730100
Martin Creek (Crique)	Clearwater River	11010301	1	51.79724690020	-116.24849050000
Peters Creek (Crique)	Clearwater River	11010301	1	51.76869850010	-115.95175600000
Roaring Creek (Crique)	Clearwater River	11010301	1	51.71046430010	-116.09666030000
Cataract Creek (Crique)	Cline River	11010103	1	52.23402436730	-117.03039442000
Cline River (Rivière)	Cline River	11010103	1	52.11095784580	-116.81351359300
Coral Creek (Crique)	Cline River	11010103	1	52.33046732920	-116.76375208900
Entry Creek (Crique)	Cline River	11010103	1	52.08775861860	-116.62733976100
Huntington Creek (Crique)	Cline River	11010103	1	52.16717511020	-116.95155218800
McDonald Creek (Crique)	Cline River	11010103	1	52.33739249660	-116.94698374900

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Shoe Leather Creek (Crique)	Cline River	11010103	1	52.08093360580	-116.64625892300
Waterfalls Creek (Crique)	Cline River	11010103	1	52.07139183830	-116.75091476200
Crowsnest River (Rivière)	Crowsnest River	04010102	1	49.58276662960	-114.20835659600
Bragg Creek (Crique)	Elbow River	04021001	1	50.94956272880	-114.73013389000
Canyon Creek (Crique)	Elbow River	04021001	1	50.86135471600	-115.01144920100
Cornwell Creek (Crique)	Elbow River	04021001	1	50.72462852910	-114.94203142600
Cougar Creek (Crique)	Elbow River	04021001	1	50.64401138090	-114.86364514900
Elbow River (Rivière)	Elbow River	04021001	1	51.00608223890	-114.21296486000
Elbow River (Rivière)	Elbow River	04021001	2	50.64225259940	-115.00668143300
Ford Creek (Crique)	Elbow River	04021001	1	50.84009321930	-114.91136478700
Glasgow Creek (Crique)	Elbow River	04021001	1	50.76278746450	-114.92700388400
Howard Creek (Crique)	Elbow River	04021001	1	50.76394389040	-114.80340155600
Little Elbow River (Rivière)	Elbow River	04021001	1	50.69436211660	-114.98918896700
Mac Creek (Crique)	Elbow River	04021001	1	50.77116727700	-114.80329972800
McLean Creek (Crique)	Elbow River	04021001	1	50.87570729040	-114.69076544500
Moose Dome Creek (Crique)	Elbow River	04021001	1	50.92703101240	-114.83351197400
Moose Mountain Creek (Crique)	Elbow River	04021001	1	50.93310137390	-114.84610147800
Nihahi Creek (Crique)	Elbow River	04021001	1	50.83087614210	-114.98344807100
Piper Creek (Crique)	Elbow River	04021001	1	50.69201343180	-115.03573471600
Pirmez Creek (Crique)	Elbow River	04021001	1	51.04362644410	-114.39629684800
Powderface Creek (Crique)	Elbow River	04021001	1	50.85092841960	-114.86840654300
Prairie Creek (Crique)	Elbow River	04021001	1	50.87854843940	-114.95483620000
Quirk Creek (Crique)	Elbow River	04021001	1	50.75608146530	-114.75281443200
Rainy Creek (Crique)	Elbow River	04021001	1	50.83373510990	-114.84584502000
Ranger Creek (Crique)	Elbow River	04021001	1	50.93668105140	-114.78593005700
Shoulder Creek (Crique)	Elbow River	04021001	1	50.79904396770	-115.02069858100

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Silvester Creek (Crique)	Elbow River	04021001	1	50.80986398030	-114.70699779400
South Glasgow Creek (Crique)	Elbow River	04021001	1	50.74313294260	-114.93589183800
Trail Creek (Crique)	Elbow River	04021001	1	50.84972886420	-114.86870184000
Elk River (Rivière)	Elk River	11010404	1	52.92742231610	-116.43478076200
Rifle Creek (Crique)	Elk River	11010404	2	52.91276689690	-116.09784447600
Cabin Creek (Crique)	Fallentimber Creek	08010103	1	51.45694668380	-115.12436417400
Cabin Creek (Crique)	Fallentimber Creek	08010103	2	51.43099900660	-115.24440811000
Fallentimber Creek (Crique)	Fallentimber Creek	08010103	1	51.43390116160	-115.25478911700
Mouse Creek (Crique)	Fallentimber Creek	08010103	1	51.54849101360	-114.95691866500
Nuisance Creek (Crique)	Fallentimber Creek	08010103	1	51.50566704510	-115.13786342600
Stormy Creek (Crique)	Fallentimber Creek	08010103	1	51.63639885760	-114.96058067100
Aura Creek (Crique)	Ghost River	04020701	1	51.37788279320	-114.92843977500
Four Mile Creek (Crique)	Ghost River	04020701	1	51.34430750310	-114.97659838700
Ghost River (Rivière)	Ghost River	04020701	1	51.28224170990	-114.83683371700
Ghost River (Rivière)	Ghost River	04020701	2	51.41842586470	-115.49258554200
Johnson Creek (Crique)	Ghost River	04020701	1	51.36083255480	-115.28277166400
Lesueur Creek (Crique)	Ghost River	04020701	1	51.30863739960	-115.07520062700
Lookout Creek (Crique)	Ghost River	04020701	1	51.41764627050	-115.14325816800
Lost Knife Creek (Crique)	Ghost River	04020701	1	51.35106578800	-115.05696514900
Margaret Creek (Crique)	Ghost River	04020701	1	51.41879580100	-115.20824753500
Meadow Creek (Crique)	Ghost River	04020701	1	51.34714704570	-115.14467901400
North Branch Lesueur Creek (Crique)	Ghost River	04020701	1	51.33124837350	-115.07112405900
South Ghost River (Rivière)	Ghost River	04020701	1	51.17762834250	-115.28428329800
Spectral Creek (Crique)	Ghost River	04020701	1	51.36811129690	-115.46772163100
Waiparous Creek (Crique)	Ghost River	04020701	1	51.39246866450	-115.35578142500

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Baril Creek (Crique)	Highwood River	04021201	1	50.30879354840	-114.78017197500
Bishop Creek (Crique)	Highwood River	04021201	1	50.43019664540	-114.85978290900
Carnarvon Creek (Crique)	Highwood River	04021201	1	50.37371850250	-114.81291249600
Cat Creek (Crique)	Highwood River	04021201	1	50.46205746390	-114.71896398000
Cataract Creek (Crique)	Highwood River	04021201	1	50.21799923810	-114.74028936200
Cummings Creek (Crique)	Highwood River	04021201	1	50.19075043260	-114.62528534300
Etherington Creek (Crique)	Highwood River	04021201	1	50.28053908420	-114.74551531000
Fitzsimmons Creek (Crique)	Highwood River	04021201	1	50.34206166540	-114.74402735600
Flat Creek (Crique)	Highwood River	04021201	1	50.54659694890	-114.68765874200
Head Creek (Crique)	Highwood River	04021201	1	50.47542474930	-114.68132799300
Highwood River (Rivière)	Highwood River	04021201	1	50.81816727760	-113.77853956100
Lantern Creek (Crique)	Highwood River	04021201	1	50.51490896080	-114.78217796100
Loomis Creek (Crique)	Highwood River	04021201	1	50.45120009670	-114.91119204000
Lost Creek (Crique)	Highwood River	04021201	1	50.16128197370	-114.72212200000
McPhail Creek (Crique)	Highwood River	04021201	1	50.41500010930	-114.86263908400
Mist Creek (Crique)	Highwood River	04021201	1	50.58643654200	-114.92521175400
Muir Creek (Crique)	Highwood River	04021201	1	50.39696406430	-114.80616125200
Odlum Creek (Crique)	Highwood River	04021201	1	50.47616894140	-114.92920281200
Pekisko Creek (Crique)	Highwood River	04021201	1	50.35076689670	-114.45746666600
Picklejar Creek (Crique)	Highwood River	04021201	1	50.54208585840	-114.80121436200
Plateau Creek (Crique)	Highwood River	04021201	1	50.23526536080	-114.52456468400
Salter Creek (Crique)	Highwood River	04021201	1	50.25684151560	-114.52598609700
Stony Creek (Crique)	Highwood River	04021201	1	50.43763467660	-114.65862859500
Storm Creek (Crique)	Highwood River	04021201	1	50.60971594810	-114.97813869700
Strawberry Creek (Crique)	Highwood River	04021201	1	50.38522196080	-114.74605309600
Sullivan Creek (Crique)	Highwood River	04021201	1	50.50769254200	-114.46180362600

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Wileman Creek (Crique)	Highwood River	04021201	1	50.41294645100	-114.59303427100
Wilkinson Creek (Crique)	Highwood River	04021201	1	50.16060258050	-114.59787206400
Zephyr Creek (Crique)	Highwood River	04021201	1	50.32735291590	-114.54869301900
Bread Creek (Crique)	James River	08010104	1	51.88681392920	-115.27873785800
Bridgland Creek (Crique)	James River	08010104	1	51.77842081910	-115.45634225200
James River (Rivière)	James River	08010104	1	51.73184169670	-115.42979490300
Parker Creek (Crique)	James River	08010104	1	51.78234490250	-115.01081094300
Sawtooth Creek (Crique)	James River	08010104	1	51.86005746520	-115.25567085100
South James River (Rivière)	James River	08010104	1	51.75378965860	-115.15165436800
Teepee Pole Creek (Crique)	James River	08010104	1	51.88128790940	-115.36131430300
Willson Creek (Crique)	James River	08010104	1	51.89763971590	-115.39918942500
Windfall Creek (Crique)	James River	08010104	1	51.72337374220	-115.25427713000
Bateman Creek (Crique)	Jumpingpound Creek	04020802	1	51.04430806590	-114.82751067000
Jumpingpound Creek (Crique)	Jumpingpound Creek	04020802	2	50.93092218680	-114.96137538000
Jumpingpound Creek (Crique)	Jumpingpound Creek	04020802	1	51.09627864520	-114.54601050900
Lusk Creek (Crique)	Jumpingpound Creek	04020802	1	50.95623620600	-114.98854431700
Sibbald Creek (Crique)	Jumpingpound Creek	04020802	1	51.04017505490	-114.85983584200
Aster Creek (Crique)	Kananaskis River	04020601	1	50.57298912950	-115.24022518100
Blackshale Creek (Crique)	Kananaskis River	04020601	1	50.70965591710	-115.17482531000
Boulton Creek (Crique)	Kananaskis River	04020601	1	50.58436765090	-115.02680256100
Elpoca Creek (Crique)	Kananaskis River	04020601	1	50.68027146360	-115.05004640100
Evan-Thomas Creek (Crique)	Kananaskis River	04020601	1	50.81987447100	-115.02357266500
Foch Creek (Crique)	Kananaskis River	04020601	1	50.60593116060	-115.18880278600
Foch Creek (Crique)	Kananaskis River	04020601	2	50.57039202600	-115.18634819900
Fox Creek (Crique)	Kananaskis River	04020601	1	50.57423983870	-115.11765107100
Galatea Creek (Crique)	Kananaskis River	04020601	1	50.86384676150	-115.24842192900

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Grizzly Creek (Crique)	Kananaskis River	04020601	1	50.76684291610	-115.09840436200
Gypsum Creek (Crique)	Kananaskis River	04020601	1	50.66047925790	-115.17752694900
Headwall Creek (Crique)	Kananaskis River	04020601	1	50.80171121910	-115.24747736100
Hood Creek (Crique)	Kananaskis River	04020601	1	50.75023314860	-115.09435861300
James Walker Creek (Crique)	Kananaskis River	04020601	1	50.80140682560	-115.22691842500
Kananaskis River (Rivière)	Kananaskis River	04020601	1	50.89473436150	-115.15086585900
Kent Creek (Crique)	Kananaskis River	04020601	1	50.77405709710	-115.21320214900
King Creek (Crique)	Kananaskis River	04020601	1	50.69639767020	-115.05104094100
Maude Brook (Ruisseau)	Kananaskis River	04020601	1	50.68835070900	-115.29074180000
Murray Creek (Crique)	Kananaskis River	04020601	1	50.76641963230	-115.22157867100
Muskeg Creek (Crique)	Kananaskis River	04020601	1	50.66170007060	-115.12196758100
Opal Creek (Crique)	Kananaskis River	04020601	1	50.68323020650	-115.07717857400
Pocaterra Creek (Crique)	Kananaskis River	04020601	1	50.59507510980	-115.02145952200
Rawson Creek (Crique)	Kananaskis River	04020601	1	50.59476013530	-115.14825942600
Ripple Rock Creek (Crique)	Kananaskis River	04020601	1	50.76602430970	-115.10103143200
Rocky Creek (Crique)	Kananaskis River	04020601	1	50.77577621960	-115.11732669000
Sarrail Creek (Crique)	Kananaskis River	04020601	1	50.58545107050	-115.14364516900
Smith-Dorrien Creek (Crique)	Kananaskis River	04020601	2	50.68974267750	-115.14915376700
Spotted Wolf Creek (Crique)	Kananaskis River	04020601	1	50.61464103870	-115.05379465700
Three Isle Creek (Crique)	Kananaskis River	04020601	1	50.59801316800	-115.24032769100
Upper Kananaskis River (Rivière)	Kananaskis River	04020601	1	50.72966009020	-115.27522987200
Warspite Creek (Crique)	Kananaskis River	04020601	1	50.70467515480	-115.21914554200
Atkinson Creek (Crique)	Little Red Deer River	08010203	1	51.39549641260	-114.95666072300
Big Coulee Creek (Crique)	Little Red Deer River	08010203	1	51.35451969640	-114.75420462700
Cartlidge Creek (Crique)	Little Red Deer River	08010203	1	51.53742216160	-114.72030687000

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Foster Creek (Crique)	Little Red Deer River	08010203	1	51.45200816150	-114.67918361900
Frozenman Creek (Crique)	Little Red Deer River	08010203	1	51.51600258100	-114.77690223300
Grease Creek (Crique)	Little Red Deer River	08010203	1	51.52913226390	-114.99757300100
Harold Creek (Crique)	Little Red Deer River	08010203	1	51.51888078060	-115.01015656100
Little Red Deer River (Rivière)	Little Red Deer River	08010203	2	51.44300652910	-115.08272606400
Little Red Deer River (Rivière)	Little Red Deer River	08010203	1	51.51727622320	-114.66654732100
Loblaw Creek (Crique)	Little Red Deer River	08010203	1	51.37156376770	-114.84049388500
Owl Creek (Crique)	Little Red Deer River	08010203	1	51.35207471020	-114.87069894300
Rabbit Creek (Crique)	Little Red Deer River	08010203	1	51.33904147130	-114.82747334200
Silver Creek (Crique)	Little Red Deer River	08010203	1	51.55677328390	-114.81041758100
Turnbull Creek (Crique)	Little Red Deer River	08010203	1	51.57045053010	-114.82987472900
Colt Creek (Crique)	Nordegg River	11010406	1	52.53091705160	-116.07148863900
Grey Owl Creek (Crique)	Nordegg River	11010406	1	52.62965103240	-115.80242467000
Nordegg River (Rivière)	Nordegg River	11010406	1	52.56063795550	-116.23033392300
Rapid Creek (Crique)	Nordegg River	11010406	1	52.55406874180	-115.98275452900
Stevens Creek (Crique)	Nordegg River	11010406	1	52.64093178070	-115.95925074200
Swale Creek (Crique)	Nordegg River	11010406	1	52.54184996760	-116.13381638000
Wawa Creek (Crique)	Nordegg River	11010406	1	52.69353976110	-116.30472505900
Allstones Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	52.29089296070	-116.48884612300
Corona Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	51.91413934820	-116.59503002000
Crooked Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	52.23393329720	-116.28154650400
Loudon Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	51.91349765080	-116.46107492300

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
North Saskatchewan River (Rivière)	North Saskatchewan Above Abraham	11010101	1	51.96825320760	-116.76922504600
Owen Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	52.00037260480	-116.67013763200
Snow Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	52.11039950930	-116.48301280700
Spreading Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	51.88669467060	-116.58531052200
Tershishner Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	52.30254632220	-116.46618146500
Two O'Clock Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	52.05913321320	-116.50266441300
Whitegoat Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	52.27724105810	-116.57891758800
Whiterabbit Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	51.95832863960	-116.21860827000
Wilson Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	52.05200876100	-116.35264196900
Glacier River (Rivière)	North Saskatchewan Above Abraham	11010101	1	51.91659066290	-116.99505061200
Howse River (Rivière)	North Saskatchewan Above Abraham	11010101	1	51.84976046310	-116.78970721200
Mistaya River (Rivière)	North Saskatchewan Above Abraham	11010101	1	51.95644496280	-116.71413431100
Murchison Creek (Crique)	North Saskatchewan Above Abraham	11010101	1	51.97689446420	-116.66537891100

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Bighorn River (Rivière)	North Saskatchewan Below Abraham	11010201	1	52.31624876170	-116.66938014200
Black Canyon Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.44533374820	-116.19256288400
Camp Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.45105218090	-115.52816842600
Deep Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.46221503870	-115.93601938700
Dizzy Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.36271135440	-115.81071867100
Dog Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.52202544520	-116.09010201900
Dutch Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.44166838760	-116.00289359400
Gap Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.33234211610	-115.83552756800
Gonika Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.44792032350	-116.32143096700
Haven Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.52099627730	-116.29540806500
Jock Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.31566258060	-115.96799680000
Kidd Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.27903763870	-116.21469431600
Lewis Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.38317067060	-115.60922427100

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Littlehorn Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.31654274850	-116.59928941400
Lundine Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.35528331590	-115.78415907100
Martin Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.44972602450	-115.99573156400
Meadows Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.34153161910	-115.69579470900
Philip Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.32183001320	-115.95063494200
Rough Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.35426527740	-115.79106031600
Saunders Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.47587966410	-115.74152129100
Shunda Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.52218040030	-116.23660196700
Slippery Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.46916489040	-115.70819432300
South Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.35041332240	-116.10864796200
Sunset Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.47598384480	-115.64647655500
Taunton Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.48645962550	-115.77136194800
Tepee Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.41771309680	-116.31795620600

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Trout Creek (Crique)	North Saskatchewan Below Abraham	11010201	1	52.35984656810	-115.78402363100
Oldman River (Rivière)	Oldman Below Oldman River Resevoir	04010105	1	49.66441888810	-113.60179537300
Dogrib Creek (Crique)	Panther River	08010102	1	51.66950895450	-115.60482871600
Fisher Creek (Crique)	Panther River	08010102	1	51.54433288330	-115.40265104500
Sheep Creek (Crique)	Panther River	08010102	1	51.50760262550	-115.49563007100
Winchester Creek (Crique)	Panther River	08010102	1	51.57368295530	-115.48119439400
Dormer River (Rivière)	Panther River	08010102	1	51.45084369970	-115.52942670000
Panther River (Rivière)	Panther River	08010102	1	51.46892950030	-115.87116980000
Snow Creek (Crique)	Panther River	08010102	1	51.58563580000	-115.78538140000
Wigmore Creek (Crique)	Panther River	08010102	1	51.48078060020	-115.69764020000
Pincher Creek (Crique)	Pincher Creek	04010104	1	49.25272636120	-114.15117139300
Dry Creek (Crique)	Prairie Creek	11010302	1	52.17367160650	-115.51806229800
Forty-Five Mile Creek (Crique)	Prairie Creek	11010302	1	52.15878403940	-115.39710345200
Lick Creek (Crique)	Prairie Creek	11010302	1	52.19062474170	-115.53155071000
Prairie Creek (Crique)	Prairie Creek	11010302	1	52.15707713560	-115.50196381900
Two Dam Creek (Crique)	Prairie Creek	11010302	1	52.20147677440	-115.32300171700
Canary Creek (Crique)	Ram River	11010202	1	52.01792369070	-116.12506498800
Crescent Creek (Crique)	Ram River	11010202	1	52.10866129680	-115.63388211600
Cripple Creek (Crique)	Ram River	11010202	1	52.11349387070	-115.97867607100
Easy Creek (Crique)	Ram River	11010202	1	52.33229112920	-115.90570721400
Fall Creek (Crique)	Ram River	11010202	1	52.15581587040	-115.70716689100
Gloomy Creek (Crique)	Ram River	11010202	1	52.11056396820	-115.55159508400
Hummingbird Creek (Crique)	Ram River	11010202	1	52.00697825850	-116.18211060000
Joyce River (Rivière)	Ram River	11010202	1	52.32326895480	-116.20893976800

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Kiska Creek (Crique)	Ram River	11010202	1	52.27201992280	-116.21057199300
Lynch Creek (Crique)	Ram River	11010202	1	52.30066552960	-115.96264832200
Lynx Creek (Crique)	Ram River	11010202	1	52.10445117400	-115.96285647900
Makwa Creek (Crique)	Ram River	11010202	1	52.31950883190	-115.60133909700
Nice Creek (Crique)	Ram River	11010202	1	52.31992157460	-115.80885327000
North Ram River (Rivière)	Ram River	11010202	1	52.07767073490	-116.31680936800
Onion Creek (Crique)	Ram River	11010202	1	52.11252386450	-116.16979694800
Otter Creek (Crique)	Ram River	11010202	1	52.16461635430	-115.92711618700
Pinto Creek (Crique)	Ram River	11010202	1	52.17249381280	-115.83295900000
Ram River (Rivière)	Ram River	11010202	1	51.85205158090	-116.19380114100
Ranger Creek (Crique)	Ram River	11010202	1	51.89540816070	-116.03792295600
Side Creek (Crique)	Ram River	11010202	1	52.23230042600	-115.99311388400
Tawadina Creek (Crique)	Ram River	11010202	1	52.28377954830	-115.66253387800
Red Deer River (Rivière)	Red Deer River and Gleniffer Lake	08010201	1	52.00160563550	-114.31728487300
Bluerock Creek (Crique)	Sheep River	04021202	1	50.64312612910	-114.84262243200
Burns Creek (Crique)	Sheep River	04021202	1	50.61673916140	-114.96622316800
Cliff Creek (Crique)	Sheep River	04021202	1	50.58591649010	-114.85948341800
Deer Creek (Crique)	Sheep River	04021202	1	50.58073807760	-114.56738837500
Dyson Creek (Crique)	Sheep River	04021202	1	50.55721335460	-114.68545438600
Gorge Creek (Crique)	Sheep River	04021202	1	50.67062129010	-114.80771347200
Junction Creek (Crique)	Sheep River	04021202	1	50.50834221950	-114.71187333700
Long Prairie Creek (Crique)	Sheep River	04021202	1	50.64264360630	-114.52217945300
March Creek (Crique)	Sheep River	04021202	1	50.62805281910	-114.61375301300
Muskeg Creek (Crique)	Sheep River	04021202	1	50.81073889700	-114.69822720500
North Coal Creek (Crique)	Sheep River	04021202	1	50.57836536740	-114.65214251500

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Rae Creek (Crique)	Sheep River	04021202	1	50.63449600660	-114.97126100000
Rock Creek (Crique)	Sheep River	04021202	1	50.69718286430	-114.81200494700
South Coal Creek (Crique)	Sheep River	04021202	1	50.54899045870	-114.68561087100
Threepoint Creek (Crique)	Sheep River	04021202	1	50.72605925890	-114.82997885700
Volcano Creek (Crique)	Sheep River	04021202	1	50.69385546490	-114.81013038700
Ware Creek (Crique)	Sheep River	04021202	1	50.73027154840	-114.59465886000
Wolf Creek (Crique)	Sheep River	04021202	1	50.57334736150	-114.52768342600
Escarpment River (Rivière)	Siffleur River	11010102	1	51.83405499400	-116.22223227700
Porcupine Creek (Crique)	Siffleur River	11010102	1	51.81968514870	-116.51481859400
Siffleur River (Rivière)	Siffleur River	11010102	1	51.83403382450	-116.40996701900
Bryant Creek (Crique)	SprayRiver	04020301	1	50.86346833570	-115.45057705700
Buller Creek (Crique)	Spray River	04020301	1	50.89273916110	-115.27892770900
Burstall Creek (Crique)	Spray River	04020301	1	50.74126129040	-115.33378700600
Chester Creek (Crique)	Spray River	04020301	1	50.81123259330	-115.27559267100
Commonwealth Creek (Crique)	Spray River	04020301	1	50.79585964520	-115.37195220000
French Creek (Crique)	Spray River	04020301	1	50.74207007780	-115.32123262000
Hogarth Lakes Outlet (Lacs)	Spray River	04020301	1	50.79380185760	-115.32018430300
Rummel Creek (Crique)	Spray River	04020301	1	50.84487094870	-115.28630937400
Smuts Creek (Crique)	Spray River	04020301	1	50.79696519420	-115.31190313500
Spray River (Rivière)	Spray River	04020301	1	50.85737591940	-115.44449087700
Spurling Creek (Crique)	Spray River	04020301	1	50.98998142550	-115.30244144400
Turbulent Creek (Crique)	Spray River	04020301	1	50.87713225130	-115.41815861900
Watridge Creek (Crique)	Spray River	04020301	1	50.84798234810	-115.42136329100
Goat Creek (Crique)	Spray River	04020301	1	51.06012557250	-115.43115871800
Lee Creek (Crique)	St. Mary River	04010401	2	49.11189336660	-113.48889044600
Lee Creek (Crique)	St. Mary River	04010401	1	48.99801831200	-113.60079958800

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
St. Mary River (Rivière)	St. Mary River	04010401	1	48.99817359750	-113.32767818300
St. Mary River (Rivière)	St. Mary River	04010401	2	49.08744824500	-113.22673678100
Altrude Creek (Crique)	Upper Bow River	04020101	1	51.23399310020	-116.04106700000
Boom Creek (Crique)	Upper Bow River	04020101	1	51.26053169970	-116.07555650100
Johnston Creek (Crique)	Upper Bow River	04020101	1	51.27354089940	-115.82570860000
Silverton Creek (Crique)	Upper Bow River	04020101	1	51.30394729990	-115.91339620000
Baker Creek (Crique)	Upper Bow River	04020101	1	51.45020346180	-116.01805430900
Bath Creek (Crique)	Upper Bow River	04020101	1	51.50974256210	-116.34206301000
Bow River (Rivière)	Upper Bow River	04020101	1	51.65091996320	-116.41984931100
Corral Creek (Crique)	Upper Bow River	04020101	1	51.42674726170	-116.14152481000
Helen Creek (Crique)	Upper Bow River	04020101	1	51.65476677680	-116.37649270200
Louise Creek (Crique)	Upper Bow River	04020101	1	51.41877432480	-116.18467608400
Moraine Creek (Crique)	Upper Bow River	04020101	1	51.35613255710	-116.14807241500
Mosquito Creek (Crique)	Upper Bow River	04020101	1	51.63211866190	-116.32583781000
Noseeum Creek (Crique)	Upper Bow River	04020101	1	51.62773645280	-116.31385264300
Paradise Creek (Crique)	Upper Bow River	04020101	1	51.39610246090	-116.16221081100
Pipestone River (Rivière)	Upper Bow River	04020101	1	51.43961574310	-116.16693955200
Beaver Creek (Crique)	Upper Oldman River	04010101	1	50.12859227790	-114.39650798700
Beaverdam Creek (Crique)	Upper Oldman River	04010101	1	49.92463904530	-114.20973898000
Beehive Creek (Crique)	Upper Oldman River	04010101	1	50.05728110940	-114.66393421900
Bob Creek (Crique)	Upper Oldman River	04010101	1	50.01138530960	-114.23760104000
Bruin Creek (Crique)	Upper Oldman River	04010101	1	50.02570307790	-114.35763529100
Cache Creek (Crique)	Upper Oldman River	04010101	1	49.99775314150	-114.65081976100
Camp Creek (Crique)	Upper Oldman River	04010101	1	49.99642889090	-114.28486393600
Coat Creek (Crique)	Upper Oldman River	04010101	1	50.08177405750	-114.51443076100
Cow Juicer Creek (Crique)	Upper Oldman River	04010101	1	49.94091820640	-114.35105345200

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Coyote Creek (Crique)	Upper Oldman River	04010101	1	49.88797725770	-114.20008745800
Daisy Creek (Crique)	Upper Oldman River	04010101	1	49.74080076080	-114.36237324500
Deep Creek (Crique)	Upper Oldman River	04010101	1	50.07509847100	-114.33968698600
Dome Creek (Crique)	Upper Oldman River	04010101	1	49.92988637440	-114.63855012200
Dry Creek (Crique)	Upper Oldman River	04010101	1	50.18253159960	-114.47691127100
Dry Creek (Crique)	Upper Oldman River	04010101	2	50.22293178050	-114.53054260700
Dutch Creek (Crique)	Upper Oldman River	04010101	1	49.96709838730	-114.67267947700
Ernst Creek (Crique)	Upper Oldman River	04010101	1	49.81651210250	-114.36251954200
First Creek (Crique)	Upper Oldman River	04010101	1	49.82077535400	-114.64081979400
Fly Creek (Crique)	Upper Oldman River	04010101	1	49.87219258030	-114.44213027100
Grease Creek (Crique)	Upper Oldman River	04010101	1	49.71279178730	-114.41679208300
Hidden Creek (Crique)	Upper Oldman River	04010101	1	49.97132085210	-114.64932796100
Honeymoon Creek (Crique)	Upper Oldman River	04010101	1	50.10823320640	-114.53969646400
Isolation Creek (Crique)	Upper Oldman River	04010101	1	50.11885332870	-114.54099153500
Lyall Creek (Crique)	Upper Oldman River	04010101	1	50.06574940690	-114.67058786400
Manystick Creek (Crique)	Upper Oldman River	04010101	1	49.98927148460	-114.45203793000
Mean Creek (Crique)	Upper Oldman River	04010101	1	50.16602020610	-114.40904511000
North Racehorse Creek (Crique)	Upper Oldman River	04010101	1	49.83781484500	-114.64854979400
North Twin Creek (Crique)	Upper Oldman River	04010101	1	50.18964508960	-114.41887791600
Oldman River (Rivière)	Upper Oldman River	04010101	2	50.12134234200	-114.73174053600
Oyster Creek (Crique)	Upper Oldman River	04010101	1	50.17922522580	-114.66112625100
Pasque Creek (Crique)	Upper Oldman River	04010101	1	50.17981247730	-114.62147756200
Pocket Creek (Crique)	Upper Oldman River	04010101	1	49.82598539970	-114.36743476200
Ridge Creek (Crique)	Upper Oldman River	04010101	1	50.08207106490	-114.34167687200
Salt Creek (Crique)	Upper Oldman River	04010101	1	49.87360651020	-114.49855797500
Savanna Creek (Crique)	Upper Oldman River	04010101	1	50.13224292840	-114.59423509800

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Shale Creek (Crique)	Upper Oldman River	04010101	1	50.01840383800	-114.47528120700
Slacker Creek (Crique)	Upper Oldman River	04010101	1	50.12663506470	-114.57073720000
Smith Creek (Crique)	Upper Oldman River	04010101	1	49.78547620580	-114.62879076900
Snake Creek (Crique)	Upper Oldman River	04010101	1	49.95095273540	-114.34613725700
Soda Creek (Crique)	Upper Oldman River	04010101	1	50.08055245850	-114.66234629800
South Hidden Creek (Crique)	Upper Oldman River	04010101	1	49.94828674230	-114.64244100600
South Racehorse Creek (Crique)	Upper Oldman River	04010101	1	49.75547785090	-114.62825033600
South Twin Creek (Crique)	Upper Oldman River	04010101	1	50.17353233500	-114.41683491600
Speers Creek (Crique)	Upper Oldman River	04010101	1	50.05800102490	-114.50432321800
Spoon Creek (Crique)	Upper Oldman River	04010101	1	49.75184781980	-114.57526373500
Station Creek (Crique)	Upper Oldman River	04010101	1	49.87730059340	-114.45127729000
Straight Creek (Crique)	Upper Oldman River	04010101	1	50.16455373490	-114.64827534200
Vicary Creek (Crique)	Upper Oldman River	04010101	1	49.73495712830	-114.57690599300
White Creek (Crique)	Upper Oldman River	04010101	1	50.03029101990	-114.28234090300
Wintering Creek (Crique)	Upper Oldman River	04010101	1	49.84702103910	-114.53307536800
Bankfoot Creek (Crique)	Upper Red Deer River	08010101	1	51.67774987720	-115.32821951000
Bear Creek (Crique)	Upper Red Deer River	08010101	1	51.68809403860	-115.17786198100
Benjamin Creek (Crique)	Upper Red Deer River	08010101	1	51.55820544550	-115.12932691000
Bighorn Creek (Crique)	Upper Red Deer River	08010101	1	51.85128037410	-115.54100385800
Brown Creek (Crique)	Upper Red Deer River	08010101	1	51.66572981300	-115.03752643200
Bull Creek (Crique)	Upper Red Deer River	08010101	1	51.68167732930	-115.12655538600
Burnt Timber Creek (Crique)	Upper Red Deer River	08010101	1	51.42398869700	-115.36774441200
Cartier Creek (Crique)	Upper Red Deer River	08010101	1	51.72526820680	-114.95829365800
Eagle Creek (Crique)	Upper Red Deer River	08010101	1	51.77275859970	-115.45785492300
Helmer Creek (Crique)	Upper Red Deer River	08010101	1	51.64439845800	-114.94179385800
Logan Creek (Crique)	Upper Red Deer River	08010101	1	51.70485310300	-115.21102193400

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
McCue Creek (Crique)	Upper Red Deer River	08010101	1	51.58705268370	-115.25371089600
North Burnt Timber Creek (Crique)	Upper Red Deer River	08010101	1	51.41473930340	-115.42836350300
Pinto Creek (Crique)	Upper Red Deer River	08010101	1	51.43055621320	-115.40876894200
Pretty Place Creek (Crique)	Upper Red Deer River	08010101	1	51.45124842630	-115.25937092200
Scalp Creek (Crique)	Upper Red Deer River	08010101	1	51.74529512920	-115.77137538000
Seismograph Creek (Crique)	Upper Red Deer River	08010101	1	51.63304056820	-115.24168669800
Stud Creek (Crique)	Upper Red Deer River	08010101	1	51.59668962620	-115.23560172900
Vam Creek (Crique)	Upper Red Deer River	08010101	1	51.59958039300	-115.10135442500
Wigwam Creek (Crique)	Upper Red Deer River	08010101	1	51.55637977360	-115.32594002600
Wildhorse Creek (Crique)	Upper Red Deer River	08010101	1	51.71414709020	-115.42354192300
Williams Creek (Crique)	Upper Red Deer River	08010101	1	51.71939897360	-115.23673606600
Yara Creek (Crique)	Upper Red Deer River	08010101	1	51.72284999970	-115.35697855000
Divide Creek (Crique)	Upper Red Deer River	08010101	1	51.73458809960	-115.92060600000
McConnell Creek (Crique)	Upper Red Deer River	08010101	1	51.65494390010	-116.05239630000
Red Deer River (Rivière)	Upper Red Deer River	08010101	1	51.65656509990	-115.90560520000
Tyrrell Creek (Crique)	Upper Red Deer River	08010101	1	51.73945109980	-115.83398590100
Eagle Creek (Crique)	Upper Red Deer River	08010101	1	51.73669955680	-115.65324817200
Drywood Creek (Crique)	Waterton River	04010302	2	49.23385043900	-114.13512044500
Drywood Creek (Crique)	Waterton River	04010302	1	49.29427579340	-113.79364064100
South Drywood Creek (Crique)	Waterton River	04010302	1	49.22500994880	-114.12536518100
Spionkop Creek (Crique)	Waterton River	04010302	1	49.19183302540	-114.10642541400
Yarrow Creek (Crique)	Waterton River	04010302	1	49.18445693540	-114.10368121100
Bauerman Creek (Crique)	Waterton River	04010302	1	49.15261110300	-114.14750740600
Blakiston Creek (Crique)	Waterton River	04010302	1	49.06438755880	-114.08852671900
Bertha Creek (Crique)	Waterton River	04010302	1	49.035275	-113.926672

Waterbody	Watershed	HUC	Critical Habitat Point	Latitude (DD)	Longitude (DD)
Carthew Creek (Crique)	Waterton River	04010302	1	49.05197868080	-113.91688022800
Crooked Creek (Crique)	Waterton River	04010302	1	49.11631871580	-113.83527771700
Crooked Creek (Crique)	Waterton River	04010302	2	49.12757539020	-113.80832291900
Dungarvan Creek (Crique)	Waterton River	04010302	1	49.18848981010	-113.93723280700
Dungarvan Creek (Crique)	Waterton River	04010302	2	49.16046911620	-113.98882719700
Galwey Brook (Ruisseau)	Waterton River	04010302	1	49.13871832720	-113.87491524500
Galwey Brook (Ruisseau)	Waterton River	04010302	2	49.15367964920	-113.93471717600
Hell-Roaring Creek (Crique)	Waterton River	04010302	1	49.021493	-113.894906
Lone Creek (Crique)	Waterton River	04010302	1	49.09247203880	-114.13866843300
Lost Horse Creek (Crique)	Waterton River	04010302	1	49.14559121820	-113.96848439900
Red Rock Creek (Crique)	Waterton River	04010302	1	49.15395318590	-114.00000179000
Ruby Creek (Crique)	Waterton River	04010302	1	49.09390215690	-114.01790117200
Sofa Creek (Crique)	Waterton River	04010302	1	49.01918837580	-113.79688012800