Comments on the Castle Management Plan Revised Draft

Effects on Trout & Their Critical Habitats

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Front cover: Upper West Castle River, Castle Wildland Provincial Park, 28 June 2010. This reach is critical habitat for westslope cutthroat trout and bull trout. Both species are threatened. They and their critical habitats are (will be, in the case of bull trout) protected under Canada's Species At Risk Act.

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on behalf of
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Summary

In March 2017, Alberta Environment and Parks issued a revised draft management plan for two new provincial parks, Castle Provincial Park and Castle Wildland Provincial Park (the Castle parks). The primary purposes of the Castle parks are "to ensure the conservation of nature, the respect of Indigenous rights, and the provision of recreational and tourism experiences. All management decisions will be consistent with the protection of biodiversity, water resources, ecological integrity and connectivity."

Here I review this plan to assess its potential effect on the aquatic ecology of the Castle parks, especially on two Threatened native trout species, westslope cutthroat trout, bull trout, and their critical habitats. I include bull trout in this review and treat it as listed under Canada's Species At Risk Act (SARA), even though it has not yet been listed, because if and when it is listed, it will be subject to the protections under that Act. The Castle parks final management plan will then have to be compliant with SARA-listed bull trout.

Despite the focus on aquatic species and habitats, I have commented occasionally on other aspects of the revised draft plan as opportunities arose. The results are summarized below.

- In establishing the parks, the Government of Alberta has returned special protection status to a large area removed from Waterton Lakes National Park in the 1920s, and has added some additional land important to achieving its stated goal. It has gone a long way toward properly managing some of the most valuable land for conservation in Alberta by doing so.
- The draft plan does not give sufficient weight to the need to adhere to the federal Species at Risk Act. In several places it contemplates balancing a variety of land-uses, including grazing, facilities development, and recreation, against protection of critical habitat of at-risk trout. The test of whether Castle parks land-uses are appropriate is section 58(1) of SARA, which forbids destruction of any part of designated critical habitat of a listed aquatic species. As the Act reads, there are no situations in which critical habitat may be legally destroyed, even under permit.
- Reliance on best management practices, thresholds (such as linear disturbance thresholds), and adaptive management to manage at-risk species habitat, as proposed in several places in the plan, are unlikely to work. Best management practices are typically based on average or typical conditions. In many cases, situations concerning critical habitats will not be average or typical. Natural thresholds often don't exist. Imposed thresholds amount to deciding how much damage to critical habitat will be tolerated. Adaptive management all too often relies on management failures to dictate a change in management practice. Adaptive management and best management practices contemplate that some acceptable amount of damage to critical habitat will be done. As I read SARA, no further damage is tolerable. According to SARA section 58(1), damage to critical habitats is illegal, because damage amounts to destruction of some part of critical habitat.

- Managing developments in watersheds holding critical habitat of at-risk aquatic species is inherently difficult because, generally speaking, all of the watershed is connected to the critical habitat. It is illegal to destroy any part of that habitat, making any human activities in the watershed risky. For example, the existence of roads is not scientifically defensible within the watersheds holding the designated critical habitat of bull trout and westslope cutthroat trout, because there is no threshold of road development below which critical habitats, and the fish populations reliant on them, are not affected. Attempts to retain roads and trails within the watersheds holding westslope cutthroat trout and bull trout critical habitat may well be actionable under SARA.
- As a specific example, the Sartoris Road in the Lynx Creek valley is currently destroying westslope cutthroat trout critical habitat. Protections for the roadbed against flood damage channelize Lynx Creek, destroying a part of critical habitat for westslope cutthroat trout. This is illegal under section 58(1) of SARA. The road, at least in those locations, must be removed and the streambed restored without delay. Other road impacts on the Lynx Creek floodplain provide evidence that damage to designated critical habitat could be more extensive via the road's effects on groundwater movement. Sediment delivery from the road to critical habitat is likely throughout, suggesting that the entire Sartoris Road from its crest on Willoughby Ridge south to the falls marking the lower boundary of designated critical habitat should be removed, and the land be reclaimed and restored.
- Actual critical habitat in South and West Castle rivers, Carbondale River, and North Lost Creek likely extends well downstream from the lower boundaries of designated critical habitat for westslope cutthroat trout. Trout populations in these reaches need re-evaluation given new research suggesting that apparently introgressed cutthroat stocks likely hold numbers of unhybridized individuals. In the meantime, the additional critical habitat needs to be managed accordingly.
- More generally, special care must be taken to conserve existing cold habitats suitable for supporting the parks' native trout. Many of these are now occupied by non-native rainbow trout that threaten the continued existence of westlope cutthroat trout. Removing the non-natives from these cold habitats to allow the native cutthroats to expand is one possible solution.
- Whirling disease is a critical threat to Threatened native trout, and requires a much more thorough management plan than is given here.
- There is considerable opportunity for improvement to tourism, sportfishing, and non-angling benefits of trout species recovery. At present there is little public understanding of, or appreciation for, the need to protect and recover at-risk trout and other species, and restore their critical habitats. Both westslope cutthroat trout and bull trout are ideal fish for flyfishers. Marketing the many benefits of restored at-risk stocks will be essential to the success of recovery activities for these fish, and should be a prominent part of the marketing plan. The proximity of the Castle parks to a potential Late Wisconsinan refugium in an ice-free area in southern Alberta - northern Montana may explain the high

number of rare and unusual species in and near the parks. That story could be part of an effective public education and marketing plan for the parks.

- The intent to phase out recreational OHV trails — over five years — in parks of unusually high conservation value, is unsupportable according to the following words from the same section of this draft plan. "Analysis of environmental data, reports and published science (including research related to biodiversity, critical habitats, linear thresholds, species at risk, riparian areas, erodibility and noise disturbance potential) confirms that summer recreational off-highway vehicle use at current or substantially reduced levels is incompatible with conservation goals of the parks. Summer OHV use is also incompatible with quiet recreation experience and other non-motorized recreation."
- Favoured treatment of trappers and hunters by maintaining an OHV trail network for their exclusive use cannot be justified. OHV use is neither needed, nor allowed in other large hunted regions on Alberta's Eastern Slopes, such as Kananaskis Country, for game retrieval or any other purpose. Motorized access is what protected areas most need to be protected *from*. The special network of single-use OHV trails will leave in place a trail network that can be re-opened as the already-operable basis for a new, much more extensive recreational OHV network at the whim of the Minister of Environment and Parks. A simple thoughtless action with virtually no financial cost would undo the value of the parks as conservation areas, which is their stated primary purpose.
- The Livingstone and Porcupine Hills public lands, as a sacrifice area to compensate recreational OHV users for exclusion from the Castle parks, are not suitable for OHV use of the magnitude envisioned in this revised draft plan. Experience with an Eastern Slopes sacrifice area (McLean Creek Public Land Use Zone) shows the irredeemable destructiveness of these machines and their trails in a similar landscape. The Government of Alberta must come to grips with the simple fact that OHVs, and several other abusive land-uses, cannot be supported on Alberta's Rocky Mountain Eastern Slopes. Southern Alberta depends on this forested mountain landscape as the primary source for our water: we can't live here without it. OHVs, especially the low-standard trails they need and that proliferate throughout the landscape wherever OHVs are active, have several decidedly negative effects on the hydrology of a region that is only going to become drier with the ongoing, unmitigated effects of climate change. If there is a place for tearing up our watersheds with powerful machines designed specifically for that purpose, ***simply for fun***, it is not here.

Contents

Introduction to This Review **1**

Introduction **5**
1.1 Purpose and Intent 5
1.2 Management Priorities 6
1.3 Management Vision 6
1.4 Guiding Principles 7
1.5 The Planning Process 7
1.6 Alberta's Provincial Parks System 7
1.8 Integration with Legislation, Policy and Regional Plan Initiatives 8
1.10 Location and Access 8

Conservation & Protection **11**
2.1 Geology, Landforms and Soils 12
2.2 Biodiversity 12
2.3 Water Resources 18
2.4 Vegetation Management 18
2.5 Climate Change 20
2.6 Cultural Heritage 21
2.7 Adjacent Land Use and Development 21

First Nations **22**

Tourism and Community **23**
4.1 Park Facilities and Infrastructure 23

Visitor Services **24**
5.2 Marketing 24
5.3 Information and Wayfinding 24
5.4 Programming 24
5.6 Volunteer, Community and Partnerships 24

Outdoor Recreation and Healthy Living **25**
6.2 Camping 25
6.3 Non-Motorized Trails Use 25
6.5 Commercial Recreation 27
6.6 Water-Based Recreation 27
6.7 Hunting 27
6.8 Trapping 28
6.9 Sportfishing 29
6.10 Recreational Off Highway Vehicles NEW 30
6.10.2 Winter Recreational Off Highway Vehicles NEW 31

Research, Monitoring and Adaptive Management **32**

Provincial Park Zoning Framework **33**

Implementation and Review **34**

Recommendations **35**

Acknowledgements **37**

Literature Cited **38**

Introduction to This Review

Two of the most important trout native to southern Alberta, westslope cutthroat trout (*Oncorhynchus clarkii lewisi)* and bull trout (*Salvelinus confluentus)*, are at significant risk of extinction (Costello and Rubidge 2006, Gow 2012). The Alberta populations of westslope cutthroat trout are listed as Threatened and protected under Canada's Species At Risk Act (SARA). The Saskatchewan-Nelson drainage populations of bull trout, which occupy Alberta's Rocky Mountain Eastern Slopes, are under consideration for listing as Threatened under SARA.

Westslope cutthroat trout Alberta native populations have been decimated by the combined, interacting effects of historical overexploitation, extensive habitat damage and loss, introgressive hybridization with non-native *Oncorhynchus* species, and competition from introduced non-native species (Costello and Rubidge 2006, Cleator *et al*. 2010). The native Alberta population as a whole is trending toward extinction, and its SARA listing requires that the species be recovered. To that end, a recovery strategy for Alberta populations has been published (DFO 2014), and an order has been issued under SARA to protect their critical habitat (http://www.registrelep-SARAregistry.gc.ca/document/default_e.cfm?documentID=2788).

Under SARA, critical habitat is

"…*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" [emphasis added].

It follows that any destruction of critical habitat poses a serious risk to the survival of protected fish, and to the success of recovery efforts. For this reason, section 58 of SARA forbids anyone to destroy *any part of* critical habitat. Section 97 of SARA provides heavy penalties for conviction, including fines up to $1,000,000 (in the case of corporations) or fines of up to $250,000, or imprisonment for up to five years, or both (in the case of an individual).

Some specific threats to westslope cutthroat trout critical habitat have been identified in the recovery strategy (DFO 2014:Table 3) that may be relevant to at-risk trout conservation in the Castle parks. There are many others (e.g., climate change).

1. Changes in flow reduce available habitats, affecting all aspects of life history, including spawning, nursery, overwintering, feeding, movements and cover.

   Causes

   - stream and runoff diversions by roads
   - logging
   - wildfire
   - water extraction

2. Sedimentation affects most aspects of life history, including spawning, nursery, overwintering, feeding and cover.

   Causes

   - logging
   - linear disturbance, such as roads and trails
   - urbanization
   - mining
   - grazing
   - intense or frequent off-highway (OHV) use
   - recreational access
   - instream construction

3. Habitat loss, fragmentation and or alteration affects all aspects of life history (see 1, above).

   Causes

   - weirs
   - culverts
   - roads and trails
   - pipelines
   - railways
   - OHV trails

Bull trout populations in southern Alberta have been severely reduced by habitat loss, degradation and fragmentation from human disturbance, including logging, dams, oil, gas and mining development, agriculture, urbanization, road development associated with those activities, and possibly by climate change (Rodtka 2009, Gow 2012). Historical overexploitation and outright persecution by anglers and fishery managers likely have also played a role (Colpitts 1997). As a result, the bull trout is rated as Threatened in the Saskatchewan-Nelson basin (Gow 2012), is under review for listing as Threatened under SARA, and is listed as Threatened under Alberta's Wildlife Act. A recovery plan is currently in preparation by Alberta Environment and Parks.

Listing bull trout under SARA will trigger a critical habitat order like that already in place for westslope cutthroat trout, with the same implications and restrictions described above. Whether bull trout is listed under SARA or not, the biological and ecological consequences of critical habitat destruction, in whole or in part, poses a serious risk to the survival of bull trout in the Saskatchewan-Nelson basin, and to the success of Alberta's recovery efforts.

Both Threatened bull trout and SARA-listed westslope cutthroat trout occur in southwestern Alberta, in the headwaters of the Castle River drainage, among others.

The Government of Alberta announced two new provincial parks to protect the headwaters of most of the Castle River drainage, Castle Provincial Park and Castle Wildland Provincial Park (together, the Castle parks), in September 2015. By doing so, it renewed conservation protection for an area that was removed from Waterton Lakes National Park in the 1920s (Gerrand *et al*. 1993).

These parks hold much of the remaining critical habitat for westslope cutthroat trout, where their distribution is highly fragmented into isolated headwater reaches (Table 1). Bull trout are distributed widely in the Castle drainage (DFO 2014, Gow 2012), occupying an estimated 200-1000 km of stream habitat (Rodtka 2009); likely very near the low end of that range (Fitch 1997), much of it within the Castle parks. Disturbance to these habitats, in the form of logging, road development and natural gas exploration, were associated with declines in bull trout in the 1960s and 1970s (Fitch 1997, Rodtka 2009).

In January 2017, Alberta Environment and Parks issued a draft management plan for the parks (AEP 2017a), to which an addendum was added in March 2017 (AEP 2017b), together with a summary report (AEP 2017c) presenting a brief explanation for the addendum. The original draft plan with addendum were quickly replaced with a revised draft management plan (AEP 2017d), which includes additional explanation and more detail on changes from these previously released documents, extending the comment period an additional 30 days to 19 April 2017. In addition to these changes, there since have been AEP news releases making more changes (AEP 2017e, 2017f).

In this Technical Note, I review this plan and the associated documents to assess their potential effect on westslope cutthroat trout, bull trout and their critical habitats. I take the revised draft (AEP 2017d) to be the definitive plan on which comment is sought by AEP. The revised draft plan is reviewed section by section according to the headings in that document.

I include bull trout in this review even though it has not yet been listed under SARA. When or if the species is listed, the final management plan will have to meet the stringent protection requirements that SARA places on the fishes it protects. Whether or not bull trout are SARA-listed, the protections, management and habitat they need to recover will not differ, and will need to be accommodated in the final management plan.

This review assesses and comments upon the effects of the management plan, if implemented as written, on the aquatic ecology of the Castle parks, more specifically Threatened westslope cutthroat trout and bull trout. The distributions of those species in the Castle parks are mapped elsewhere (DFO 2014:Figure 4, Smith *et al*. 2016:Figures 6 & 7). The coordinates for westslope cutthroat trout designated critical habitat in the Castle parks are provided in Table 1. Despite the aquatic focus, I have commented occasionally on other aspects of the revised draft plan as opportunities arose.

Extended direct quotations from the revised draft management plan are given in italics.

Table 1. Locations of westslope cutthroat trout critical habitat in the Castle Parks (from DFO 2014).

Downstream end stream name	N Latitude	W Longitude	Upstream end stream name(s)	N Latitude	W Longitude
West Castle River	49°16'45.402"	-114°22'46.600"	West Castle River	49°14'07.238"	-114°20'59.831"
			Unnamed tributary to West Castle R	49°14'45.571"	-114°21'09.058"
South Castle River	49°13'20.414"	-114°13'41.560"	South Castle River	49°11'50.009"	-114°08'44.492"
			Font Creek	49°12'31.466"	-114°11'55.543"
Syncline Brook	49°20'24.381"	-114°25'16.156"	Syncline Brook	49°19'34.087"	-114°26'58.134"
O'Haggen Creek	49°26'22.272"	-114°23'24.566"	O'Haggen Creek	49°25'09.847"	-114°23'27.069"
Gardiner Creek	49°22'55.026"	-114°27'42.597"	Gardiner Creek	49°22'16.046"	-114°28'15.653"
Unnamed tributary to Gardiner Creek	49°23'06.059"	-114°27'45.055"	Unnamed tributary to Gardiner Creek	49°23'07.271"	-114°27'55.956"
Carbondale River	49°24'24.268"	-114°29'55.227"	Carbondale River	49°24'10.413"	-114°31'55.732"
			Macdonald Creek	49°23'58.988"	-114°31'21.320"
			Unnamed tributary to Carbondale River	49°24'07.582"	-114°30'33.791"
			Unnamed tributary to Carbondale River	49°24'24.317"	-114°31'13.940"
North Lost Creek	49°26'52.795"	-114°29'49.357"	North Lost Creek	49°27'39.622"	-114°32'28.749"
			Unnamed tributary to North Lost Creek	49°26'59.268"	-114°29'47.636"
Lynx Creek	49°27'46.706"	-114°26'33.966"	Lynx Creek	49°33'09.083"	-114°30'41.366"
			Goat Creek	49°28'58.116"	-114°33'32.321"
			Unnamed tributary to Goat Creek	49°29'39.731"	-114°30'36.479"
			Unnamed tributary to Goat Creek	49°30'28.338"	-114°31'44.036"
			Snowshoe Creek	49°31'29.874"	-114°31'32.077"
			Unnamed tributary to Lynx Creek	49°32'16.900"	-114°30'46.954"
			Unnamed tributary to Lynx Creek	49°32'48.064"	-114°30'56.371"

Introduction

1.1 Purpose and Intent

The primary purposes of Castle Provincial Park and Castle Wildland Provincial Park are to ensure the conservation of nature, the respect of Indigenous rights, and the provision of recreational and tourism experiences. All management decisions will be consistent with the protection of biodiversity, water resources, ecological integrity and connectivity.

The second sentence is consistent with protection of listed fish species and designated critical habitat under SARA. Provided it is understood that it is impossible to maximize management for different goals simultaneously, the first sentence may also be consistent with SARA. Given the second sentence, the first actually places conservation of nature as the primary purpose. Indigenous rights, recreation and tourism experiences actually are secondary, as important as they are. It is not difficult to imagine conflicts arising among nature conservation, indigenous rights, recreation and tourism activities. The second sentence, if taken at face value, settles any conflict in favour of nature conservation, so is consistent with SARA.

Conservation of Natural Values. This section is consistent with protection of fishes and their critical habitats listed under SARA, with one proviso: that connectivity is maintained or restored in such a way that the genetic integrity of populations is not compromised. Often in freshwater fish conservation, maintaining *dis*connections is essential for maintaining local adaptation and genetic integrity.

Freshwater fishes exist in, and evolved in, island-like habitats, in that they are unable to travel overland, but are confined to watercourses and waterbodies. Typically these disconnections are critically important for conserving fish populations, dividing regional populations into sub-populations, often genetically distinct and locally adapted, that are an essential feature of the species, with great survival value (Schindler et al. 2010; Haak and Williams 2012). Park management programs that increase connectivity in such cases would be contrary to SARA.

Sometimes remnant fish populations only exist because they are isolated, either naturally by waterfalls, velocity barriers, or other natural blockages to movement; or by human interventions, such as impassable culverts. For example, the SARA-listed genetically pure remnant population of westslope cutthroat trout in Syncline Brook in the Castle parks remains pure only because the genome of invasive rainbow trout is blocked by a natural seasonally dry reach, and possibly by an impassable culvert, at the Highway 774 crossing. This barrier is an essential feature of the critical habitat for that population, and must be maintained to be compliant with SARA. This is true even though it lies *outside* the critical habitat designated under SARA.

On the other hand, stream fish habitat is frequently fragmented by human artifacts, such as dams, weirs, or improperly placed culverts at road and trail crossings. In many cases populations in fragmented critical habitats need to be re-connected to properly conserve and

restore the original stock. In such cases, the artifact fragmenting the critical habitat is contrary to *SARA*, and needs to be removed.

In maintaining or restoring connectivity, as contemplated in this section, it is crucial to consider whether the restorative action would be detrimental or beneficial to the prospects of restoring the protected population and its critical habitat.

Enhancement and Development of Recreation and Tourism. There is opportunity for conflicts with the critical habitat provisions of SARA under this heading, but the wording in this section, including the reference to the precautionary principle, makes it clear that recreation and tourism will be consistent with conservation objectives.

It is worth noting that recreation and tourism will both benefit significantly from recovered populations of native trout. Both species would support the existing excellent angling fisheries, including professional guiding. Historical records show that trout were abundant historically throughout the Bow and Oldman River drainages (Mayhood 1989, Mayhood *et al*. 1997; Masterman and Stelfox 2010). Recovered populations would be so again, albeit over a reduced range. Many anglers favour native trout fisheries of the kind that would be supported by recovered westslope cutthroat and bull trout populations within the Castle parks (Smith 1984, Butler and Maw 1985, Trotter 1987, Van Tighem 1997). The restoration programs for the two native trout could include opportunities for public participation (citizen science). Fish watching, a huge attraction in some American parks (Jennings 1980, Spencer *et al*. 1991), could also be developed.

1.2 Management Priorities

There are no inherent conflicts with SARA in this section; however it should be noted that the priority for Castle Provincial Park is that it would be the primary location for park facilities, and that most new development will be concentrated in the facility zone within this park. Some of these are, or will be located in watersheds holding critical habitat for one or both trout species. This issue will be covered in greater detail elsewhere in the review.

1.3 Management Vision

Castle Provincial Park and Castle Wildland Provincial Park are managed as world-class protected places, employing high standards in conservation, respecting Indigenous rights, and providing sites and facilities for exceptional recreational experiences.

The vision for managing the parks as outlined in this section is laudable. The only notable concern is

"This management vision will be achieved through the development and use of…[t]hresholds to inform type and volume of human activities."

Westslope cutthroat trout and bull trout often do not show threshold responses to human activity, so this statement implies that thresholds will be imposed by managers based on non-biological criteria. For example, westslope cutthroat trout relative abundances decline with various measures of road development (Valdal and Quinn 2010). There is no apparent

threshold in the data at which a response does not occur. Similarly, the probability of occurrence of bull trout in a drainage declines sharply with *any* amount of road or clearcut in a watershed (Ripley *et al*. 2005:Figure 2).

Both trout species are threatened and declining toward extinction. Their SARA listing requires that the species be recovered, meaning that no further decline is tolerable. Road occurrence is not scientifically defensible within the watersheds holding the critical habitat of these two species. Attempts to retain roads and trails within the watersheds holding westslope cutthroat trout and bull trout critical habitat may well be actionable under SARA.

Although the management vision outlined in this section appears to be supportable overall, the reliance on thresholds to manage the amount of human activity will not be workable, at least for some criteria.

1.4 Guiding Principles

Two principles in this list are worth comment.

Environmental leadership. Here it is proposed to use best management practices "in energy and water efficiency, environmental design, construction practices and products." As a general rule this is a good approach, as long as it is not used to take the place of practices tailored specifically to each situation. In many cases, best management practices may not be sufficient to protect critical habitat of salmonids (Bisson *et al*. 1992). This is particularly true for critical habitats designated under SARA, where *no part* of critical habitat may be destroyed. Best management practices may improve the situation over no action at all (Megahan *et al*. 1992, Wear *et al*. 2013), and adequately meet certain water quality criteria under other legislation (Cristan *et al*. 2016), but that is not necessarily adequate protection for critical habitat designated under Canada's SARA.

The Precautionary Principle. As stated here, this principle should avert damage to SARA-designated critical habitat if properly applied in watersheds holding it, provided that the potential for damage is recognized in the first place. This plan does not yet appear to recognize that potential.

1.5 The Planning Process

The planning process as described here does not mention any consultation with legal experts familiar with the consequences of land-use planning affecting the large areas of the parks holding SARA-listed critical habitat of westslope cutthroat trout and critical habitat of bull trout. This oversight has affected the validity of the plan in several places. Because of their highly restrictive nature, the requirements of SARA need to be central to this plan, and addressed throughout it.

1.6 Alberta's Provincial Parks System

1.6.3 Natural Regions Framework. The entry under this heading does not fully identify the uniqueness and biogeographical importance of the Castle parks, so fails to give adequate

recognition to the very high priority that should be placed on protecting the parks' biota, including its remnant populations of westslope cutthroat trout and bull trout.

The parks are immediately adjacent to a small low-elevation area, well known in the scientific literature, that was ice-free during the last glacial maximum (Rutter 1984, Prest 1984, Dyke 2004, Munyikwa *et al*. 2017:Figure 1). The Castle parks likely were invaded very early in deglaciation by organisms from this potential Late Wisconsinan refugium. If so, these organisms conceivably had 64,000 years to possibly as long as 300,000 years to adapt and evolve in isolation (Mayhood 1992:42). Their present-day traits are likely to reflect this. The Castle parks' biota, including remnant westslope cutthroat and bull trout populations, have an especially high priority for protection and restoration for this reason.

This putative refugium likely explains the "remarkably high numbers of species on the edge of their range" mentioned in this section.[1]

1.6.4 Role in the System Statement. The comments above, under the heading Natural Regions Framework, apply here as well.

1.8 Integration with Legislation, Policy and Regional Plan Initiatives

This section deals only with provincial legislation, policies and regional planning governing the parks. Federal legislation such as the Fisheries Act and SARA, are not considered, although they can have substantial effects on use of provincial lands affecting watercourses. It would be advisable to include the application of at least those two federal laws in this section.

1.10 Location and Access

Two additional seasonally-available gravel roads provide access into the area from Highway 3 at Blairmore and immediately south of Hillcrest.

These two roads, Sartoris Road on the west and Adanac Road on the east, enter Castle Provincial Park within 8 km of each other. Only one is needed for basic access; the other should be decommissioned.

The best candidate for decommissioning is the Sartoris Road. It enters the valley of upper Lynx Creek, SARA-designated critical habitat for westslope cutthroat trout, via a steep, very rough, rocky, highly-eroded route over Willoughby Ridge. It descends steeply 244 m in 3.25 km, an average 7.5% grade. Some sections are much steeper: the initial descent follows a direct drop down an intermittent Lynx Creek tributary at a 15% grade, crossing two other marked intermittent Lynx Creek tributaries before reaching the valley floor. The roadbed intercepts runoff from the west slope of Willoughby Ridge, concentrating it, making it more erosive, and diverting it down a few selected gullies to Lynx Creek.

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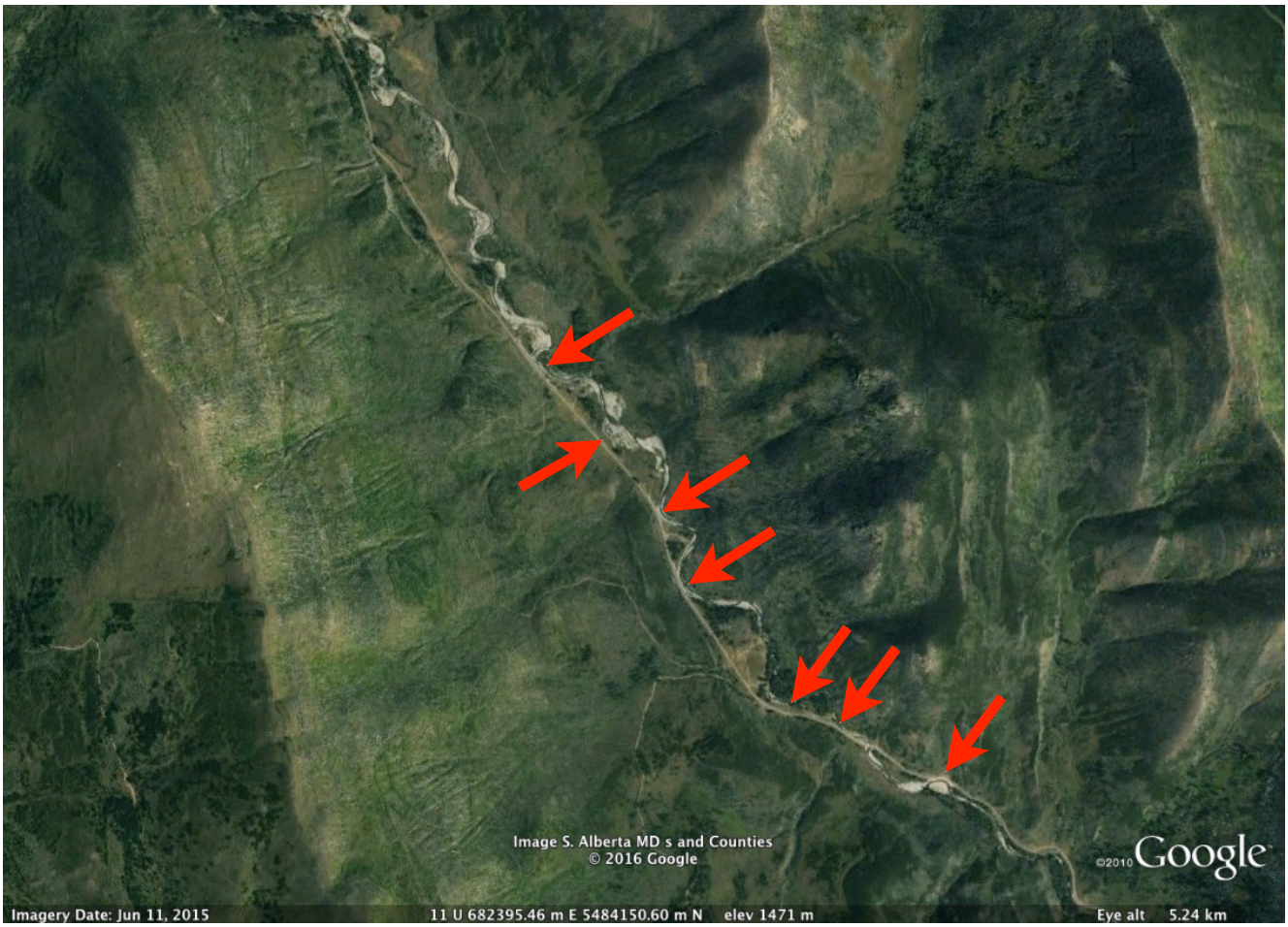
[1] The many unusual occurrences of certain aquatic organisms in this region, and the evidence of a postulated refugium in extreme southwestern Alberta and northern Montana, is reviewed at length elsewhere (Mayhood 1992:27-33). The larger postulated Late Wisconsinan Ice-Free Corridor between the Cordilleran and Laurentide Ice Sheets, discussed in that account, is no longer considered credible and is not relevant to this discussion.

Surface and ditch erosion is a serious problem on this section of road, and a direct threat to the critical habitat in Lynx Creek. New gravel spread thickly on this hill 27 July 2016 was already much eroded away by 15 November 2016. Much of these sediments were undoubtedly directed into Lynx Creek critical habitat via the road ditches, gullies and the intermittent tributaries crossed by the road.

At the bottom of this hill, the Sartoris Road crosses Lynx Creek via a bridge, then proceeds down the river-right floodplain for 5.9 km, crossing Lynx Creek by another bridge. It continues on the left bank floodplain for a further few hundred metres, after which it rises above Lynx Creek Canyon.

On the floodplain section, the road often closely parallels Lynx Creek critical habitat. At some points the creek is channelized for a total of hundreds of metres to accommodate the roadbed (e.g., Figure 1), which after the 1995 flood was rebuilt directly in the channel (Figure 2). Channelization simplifies the channel, usually reduces its length, and thereby reduces the amount of fish habitat (Fitch 1980a), after which recovery may take decades (Detenbeck e*t al*. 1992). Elsewhere within this section, the Sartoris Road intercepts groundwater emerging from the toe of the right (west) hillslope. It also diverts and redirects hyporheic groundwater emerging from the floodplain.

Figure 1. Local channelizations of westslope cutthroat trout critical habitat caused by roadbed protection, Sartoris Road, Castle Provincial Park.



These groundwaters should not be disturbed. They are important for keeping stream reaches open for overwintering fish (Brown 1999), and may be used for spawning and refuge in summer and winter (Hauer et al. 2016). They also tend to be hotspots of bioproduction (Gregory *et al*. 1991), and support vegetation growth that helps to set the morphology of the stream channel (Stoffel and Wilford 2011).

Figure 2. New, shorter channel (background) being constructed for Lynx Creek, now in a reach that is critical habitat for westslope cutthroat trout, to accommodate the Sartoris Road (foreground) in the natural channel. September 1998.

On these considerations, I believe the Sartoris Road is presently destroying critical habitat for westslope cutthroat trout, contrary to section 58(1) of SARA. This road should be removed and the stream and its floodplain restored.

Conservation & Protection

Conservation and protection represent the major over-arching intent for the management of Castle Provincial Park and Castle Wildland Provincial Park.

…Land uses such as grazing, recreation and access by Indigenous peoples will be managed to achieve a balance between these demands and the conservation intent.

There is no essential contradiction in these statements, provided it is recognized that SARA-listed trout and their critical habitats in the Castle parks always are unequivocally protected.

Section 58(1) of SARA unequivocally prohibits destruction of any part of critical habitat. A minor exception is made under ministerial permit in section 73(2), only if the competent minister is of the opinion that

(a) the activity is scientific research relating to the conservation of the species and conducted by qualified persons;

(b) the activity benefits the species or is required to enhance its chance of survival in the wild; or

(c) affecting the species is incidental to the carrying out of the activity.

The interpretation of "incidental" in (c) is open to interpretation, but whatever reasonable meaning is applied to it, it is clear that it cannot be interpreted in a way that allows activities to destroy any part of critical habitat, but only "affect" it in some (minor) way.

73. (1) The competent minister may enter into an agreement with a person, or issue a permit to a person, authorizing the person to engage in an activity ***affecting*** *a listed wildlife species, any part of its critical habitat or the residences of its individuals.* [emphasis added]

Notably, permission to "**destroy** any part" of critical habitat is not mentioned here, in this or any other section of the Act, so cannot reasonably be granted. Indeed, the Minister is further constrained in issuing permits to affect critical habitat in section 73(3)(a-c):

73(3) The agreement may be entered into, or the permit issued, only if the competent minister is of the opinion that

(a) all reasonable alternatives to the activity that would reduce the impact on the species have been considered and the best solution has been adopted;

(b) all feasible measures will be taken to minimize the impact of the activity on the species or its critical habitat or the residences of its individuals; and

(c) the activity will not jeopardize the survival or recovery of the species.

Not only is the Minister limited to permitting only activities the primary purpose of which is for the ultimate benefit of the species, or at worst will only affect, but not destroy critical habitat; but all reasonable alternatives must be considered, all feasible measures must be taken to minimize impacts, and the activity must not jeopardize the survival or recovery of

the species. While these limits are all subject to ministerial discretion and opinion, they give guidance as to how the law is to be interpreted.

It is difficult to see how recreation and grazing in or near critical habitat for SARA-listed trout, for example, could be considered to be so necessary that permission could ever be granted if these activities could conceivably destroy any part of trout critical habitat. In the case of westslope cutthroat trout and bull trout, "balance" in land-use versus conservation plays no role. Under SARA, protection for these fish and their critical habitats always takes precedence.

2.1 Geology, Landforms and Soils

2.1.2 Landforms. The specific reference under this heading to the Southfork Lakes, which would include Barnaby Lake, raises a conservation issue for protected native trout. These lakes have been previously stocked with non-native golden trout, *Oncorhynchus mykiss aguabonita,* that are capable of hybridizing with westslope cutthoat trout. The lakes drain via Barnaby Creek to the lower South Castle River near its confluence with the West Castle River. Both rivers hold accessible protected westslope cutthroat trout populations and critical habitat upstream from the confluence of those streams (DFO 2014). The lower South Castle River and lower West Castle River will likely be needed as critical habitat to permit recovery of the protected populations in those rivers (Mayhood 2014). It is important to prevent escape of non-native trout from these lakes to protect designated native stocks in the South and West Castle from introgression from that source.

2.2 Biodiversity

This section promises to "protect landscapes and their associated natural processes." This will be necessary for protecting westslope cutthroat trout, bull trout, and their critical habitats. It should be explicitly stated here that most landscapes in both parks are damaged, often severely. They are going to need an intensive program of restoration, some of them over a long period, to restore their critical natural functions.

2.2.1 Biodiversity Management.

…there has been no comprehensive biophysical inventory to date. Additional surveys, monitoring and research are required to better understand the ecological processes, biodiversity, focal species and ecological communities present.

A comprehensive biophysical inventory is fundamental as a baseline and foundation to support future biodiversity management. It should include assessments of the genetic diversity of westslope cutthroat trout and bull trout populations throughout both parks, comparing them as well to populations outside the parks. This will help to identify rare or unique stocks of both species. We should not be surprised to find rare or unique stocks in the Castle parks, because of the Late Wisconsinan ice-free area in extreme southern Alberta and northern Montana, and history of early deglaciation in the region. These populations may need special management to meet SARA requirements.

Current genetic surveys of westslope cutthroat trout in the Castle parks have used only a few microsatellite markers to distinguish hybrid individuals. Populations averaging less than 99% cutthroat markers are considered introgressed but worth conserving as potentially salvageable; those less than 95% cutthroat markers are effectively deemed to be introgressed to such a degree as not to represent adequately the original native species, and to not be recoverable. The method used so far is relatively insensitive because it uses only a few diagnostic markers to represent the entire genome, and relies only on population averages, not on assessing the frequency of individual hybrids, and the degree of hybridization within individuals. The significance of this difference in analysis is explained in detail elsewhere (Mayhood 2014, especially pp. 18-19).

Methods now available assess much more of a species' genome, so are able to get a much more accurate assessment of the degree of introgressive hybridization in populations (Hohenlohe *et al*. 2011, 2013). These are the methods that should be used for future genetic diversity surveys of biota, including westslope cutthroat trout and bull trout.

The genetic surveys for westslope cutthroat trout should not be restricted to known genetically pure or near-pure populations. Populations believed now to be introgressed, based on currently available microsatellite data, need to be re-surveyed using modern techniques that assess much more of the genome. Introgressed populations as currently identified are likely to contain many more genetically pure individuals than previously expected (McKelvey *et al*. 2016), meaning that some populations now believed lost actually still exist. They exist as pure individuals mixed in with numerous hybrid individuals. Those pure individuals collectively constitute pure populations, even though they are mixed in with, and occupy much of the same habitat as introgressed individuals.

They and their critical habitats are very important to aid the recovery of the species, and are eligible for protection under SARA. They are most likely to be found at lower elevations and in larger habitats than pure populations (Rasmussen *et al*. 2010, McKelvey *et al*. 2016, Young *et al*. 2016), such as mid-sized river mainstems in the Castle parks: the lower South Castle, lower West Castle and lower Carbondale rivers. In such cases, they may represent the last remnants of the fluvial (river-migratory) life history types, presently thought lost. Whether this is true or not, they have extremely high value for conservation and recovery of the species. If these "hidden" pure populations are found to exist, they and their critical habitats have the highest value for SARA protection. The final Castle Parks Management Plan document should account for this possibility.

Evidence- based decision making and clear management principles (see section 1.4) will guide the biodiversity or species-specific management within Castle Provincial Park and Castle Wildland Provincial Park.

With reference to section 1.4, please see my comments on best management practices in that section, above.

The collection and analysis of information in response to management actions will form the basis for ***adaptive management*** *of the parks.* [emphasis added]

It ought to go without saying that park managers should adapt their management if what they are doing is not achieving the objectives. "Adaptive management" too often amounts to "Let's try this, and if we screw it up, we'll try something else." The sentence above seems to suggest a more organized approach. If so, it is supportable, but a more careful elucidation of how precisely adaptive management will actually be implemented should be added here. It should, for example, rely on regular quantitative monitoring against quantified statements of goals and objectives.

A further problem with adaptive management in the context of managing biodiversity is that the monitoring required by adaptive management typically looks for evidence of failure to avoid failure. This is a serious problem when you are dealing with rare and at-risk species, and small populations, where *any* management failure could irredeemably wipe out a population before managers can adapt, as is the case with several small SARA-listed westslope cutthroat trout populations in the Castle parks.

A more supportable approach for managing at-risk populations might be to meticulously research the problem and use experiments on comparable, but not-at-risk, stocks to test effects of various possible management actions well away from the critical habitat of the at-risk population. Then manage the system with what the results say has the best chance of success, and monitor the system closely.

True adaptive management is a controlled experimental system. It is rarely appropriate for managing rare species, small populations, or species at risk. Whenever possible, it is far preferable to do preliminary research, mathematical modeling, and experimentation on controlled closely-comparable model populations that are not at risk. Save the adaptive management for emergencies, when the preferable procedure is not possible, and use it with great caution.

Areas demonstrating environmental degradation will be evaluated and prioritized for restoration or reclamation.

Also:

Identify and prioritize areas that require restoration and/or reclamation.

I think it is not enough to just state this out of context. It's almost an afterthought. Large areas of the Castle parks are badly damaged, and need to be restored. This is a major job. It will occupy park managers and command substantial funding for some time. People need to understand that restoration is a large part of the management plan, so it must be explained in some detail.

The immense OHV trail network is an obvious issue to describe, citing data from the excellent recent work of Global Forest Watch Canada (Smith and Cheng 2016a, 2016b; Smith *et al*. 2016). For example, "Although there are only 130 km of official roads, GFWC has identified at least 301 km of features in the Castle that may function as roads," and "The

density of linear disturbances for the entire Castle proposed protected areas is 1.76 km/km^2. The proposed Provincial Park is much more fragmented with a density over 3.5 km/km^2, while the Wildland Provincial Park is just over 1 km/km^2" (Smith and Cheng 2016b).

Why is this relevant to the management plan? Because "[t]he density of linear disturbances in the Castle Provincial Park far exceed thresholds to meet habitat requirements for grizzly bears or both trout species [westslope cutthroat trout and bull trout]" (Smith *et al*. 2016b) [2]. If it is true that "[c]onservation and protection represent the major over-arching intent for the management of Castle Provincial Park and Castle Wildland Provincial Park" (p. 23), then you must deal at some length with the linear disturbance (road and OHV trail) issue in the final management plan. If nothing else, ongoing destruction of westslope cutthroat trout critical habitat by roads and trails is a serious legal liability under SARA, and must be stopped immediately. This plan must acknowledge that, and state clearly how that will be done.

Restoring watersheds extensively damaged by past logging is another issue that the final management plan must cover. In the mid-1990s, the stream habitats of the Carbondale River watershed were all at high risk of damage from increased surface erosion and increased peak flows from the combined effects of logging roads, OHV trails, and extensive clearcuts (Sawyer and Mayhood 1998, Mayhood 2010). Actual stream habitat damage attributable to those causes was in fact observed in many Carbondale watershed streams in the late 1970s (Fitch 1980b).

The situation was made much worse in 2003, when the Lost Creek fire, ostensibly started by a hot OHV exhaust, burnt most of the basin, including many existing clearcuts (Silins *et al*. 2005:Figure 1). Studies on this fire in the immediate area of the Carbondale watershed, including Lynx Creek drainage, showed that the fire increased stream sediment concentrations and yields (Silins *et al*. 2009), soil nutrient loss from the basins into the creeks (Bladon *et al*. 2008), and stream temperatures (Wagner *et al*. 2014).

The increases in suspended sediment and stream temperatures potentially have strong negative effects on westslope cutthroat trout, bull trout, and their critical habitats. Both species are strongly cold stenothermic (Bear *et al* 2007, Jones *et al*. 2014), and salmonids in general are sensitive to prolonged exposure to suspended (Newcombe and Jensen 1996) and deposited (Shepard *et al*. 1984, Weaver and Fraley 1993) fine sediment, especially as eggs and larvae. On the other hand, burned basins also had higher biomass of algae and higher weight at ages 2 and 3 of trout relative to control sites (Silins *et al*. 2014). These findings may not have been the effects of fire.

Using the best available science, develop linear disturbance threshold targets and other targets as needed and available.

[2] But see my concerns and comments about thresholds, above, under the heading **1.3 Management Vision.**

Also:

Periodically review biodiversity targets based on current and relevant science. This may include using tools such as linear disturbances and total footprint levels.

The reference to best available science is the correct standard, and should be the standard for all decisions for managing biodiversity. It would be nice to see it stated in that way somewhere. It should replace the phrase "current and relevant science" in the second quoted paragraph.

Please see my earlier comments on thresholds, for which there are none known for effects of linear disturbance on trout critical habitat. The measures of linear disturbance should not be linear disturbance density, which is scale-sensitive and therefore misleading. This is the measure of linear disturbance most used in Alberta Environment and Parks conservation planning, including planning for critical habitat of SARA-listed trout. Other measures can reduce or eliminate this problem (Jaeger 2000), and should be preferred.

2.2.2 Connectivity. This section considers only connectivity for terrestrial wildlife species. Much needs to be done to restore connectivity for westslope cutthroat trout populations in the Carbondale, Lost Creek, West Castle and South Castle watersheds. It should be discussed in this section.

Taking the West Castle and South Castle drainages as an example, remnant populations of this trout now exist only in the extreme headwaters of both mainstem rivers. They are isolated there by intervening populations of rainbow trout and Rainbow-cutthroat trout hybrids. Either of these forms will create new hybrids if they mate with the pure-strain fish in the headwaters, so they pose a constant threat to the remnant populations. The hybrid threat needs to be eliminated by removing the hybrids and any pure-strain rainbow trout in the lower reaches.

The isolation has two other undesirable effects.

1. If either or both stocks have an effective population of less than about 500 adults, genetic diversity is likely to be lost through genetic drift. If these stocks have an effective population of less than about 50, inbreeding depression becomes a problem (Jamieson and Allendorf 2012). Larger effective populations, in the order of the low thousands at least, are needed to avoid extinction in the long term (Reed *et al*. 2003).
2. The headwater critical habitats holding the remnant populations are small and unproductive in relation to the mainstem habitat further downstream. The carrying capacity of the present critical habitat for trout may be limiting the size of the headwater refugial populations.

The most effective solution to both problems is to reconnect the West Castle and South Castle refugial westslope cutthroat trout stocks, and expand critical habitat downstream in both rivers. This can only be done by removing the hybrid populations now occupying the two rivers, downstream at least as far as their confluence, and allowing the native stocks to re-colonize their native mainstem habitats. This has the effect of restoring native habitat,

increasing the effective carrying capacity of the rivers for native cutthroats, and allowing genetic exchange among the presently isolated populations. A fish barrier would have to be installed below the confluence to keep prevent reinvasion by the rainbow trout genome.

Similar reconnections will need to be made in the Carbondale River and Lost Creek drainage networks for similar reasons.

2.2.3 Species at Risk.

Apply best practices to manage westslope cutthroat trout habitat and buffer zones. Additional buffers will be established in areas that will enhance the critical habitat.

Identify opportunities to enhance or restore critical habit for any species at risk.

These proposed management actions are insufficient. They need to be strengthened substantially. They need to emphasize recovery. The Castle parks need to lead the way on restoration and recovery, not just for westslope cutthroat trout, but for bull trout, grizzly bears, and other at-risk species in the parks.

As a SARA-listed Threatened species, westslope cutthroat trout are recognized as declining toward extinction, largely due to invasion by exotic rainbow trout, which hybridize them out of existence. Unless the few remaining pure stocks are isolated from the invasive rainbow trout genome, we can expect the decline to continue (Muhlfeld *et al*. 2017). In some cases, it may be possible to "purify" lightly-hybridized remnant stocks with the aid of modern genomic techniques (Hohenlohe *et al*. 2011, 2013).

It is not permissible to allow this decline to progress further. Protection is not enough: westslope cutthroat trout native stocks must be restored to a state where they are no longer at risk. That is the purpose of their listing under *SARA*.

A scientific assessment has determined that there are reasonable approaches to move toward recovery (Cleator et al. 2009). A conceptual framework and recovery guidelines are available that, if followed, would recover the species to the point where extinction in Alberta is highly unlikely (Mayhood 2014). Unless that level of recovery is achieved, management resources will be drained in maintaining at-risk populations at low levels in perpetuity, virtually guaranteeing that those populations will still go extinct anyway.

Sufficient recovery will not be possible if the Castle parks remnant populations are not managed to enlarge them and extend their critical habitat. A few remnant stocks in the Castle parks are among the strongest. They are key to recovering the species in Alberta; it can't be done without them.

With regard to best management practices, please see my previous comments these under the heading **1.4 Guiding Principles**. Relying on best management practices alone will not be enough to recover species at risk. They are based on average or typical conditions, leaving room for failure in many instances. With at-risk species, failure is too damaging to tolerate.

2.2.5 Fauna.

Alberta Parks will continue to participate in and promote the Government of Alberta Aquatic Invasive Species Prevention Programme…

This section should be enlarged to include a discussion of how Castle parks managers will control whirling disease, which can be deadly to trout, preferably preventing its introduction. Specifically, the final plan should include recognition that whirling disease could destroy SARA-listed critical habitat for westslope cutthroat trout (and ultimately, bull trout). It should provide at least a brief account of control measures, such as cleaning protocols for anglers' gear, and the need for such protocols for any instream work that could transfer the disease organism into the park.

2.3 Water Resources

This section is highly supportable. It strongly supports at-risk trout recovery.

Many waterbodies have the potential, by using sound restoration efforts and careful management actions, to become streams in which populations of listed fish species can flourish.

It might be added that these locations will be assessed early on, and those waters that are suitable will be reserved for restoring at-risk species will be submitted to the federal Minister of Fisheries and the Coast Guard for adding to the SARA critical habitat list for those species as being necessary for their recovery.

If those waters are naturally fishless, however, they need special consideration. Fishless waters are becoming increasingly rare as fish have been added to them to develop sport fisheries. Naturally fishless waters have distinctly different communities than those holding introduced populations (Anderson 1980, Townsend 2003, Dunham *et al*. 2004) function differently ecologically (González-Bergonzoni *et al*. 2014), may hold at-risk species that cannot tolerate predation by fish (Bosch *et al*. 2006), and should, as a general rule, be retained in a fishless state in parks intended primarily for conservation of natural conditions. At the very least, such waters should be carefully surveyed and assessed as to their conservation value in a fishless state before being used as habitat for trout recovery projects. In some cases it may be necessary to remove introduced trout populations from headwaters or mainstems to restore critical habitat for listed at-risk species.

2.4 Vegetation Management

Not mentioned here: Active vegetation management in the form of replanting, soil reclamation or restoration, and erosion control, may be needed to deal with enhanced sediment delivery (Silins *et al*. 2009) to trout critical habitats from the Lost Creek Fire of 2003. This damage was unlikely to have been a consequence of a natural fire. As a general rule, most of our wildfires are human-caused.

2.4.1 Invasive Species. References in this section to the need to control noxious weeds invading the Lost Creek Fire burn area raise the potential for herbicides to be washed into critical habitat in North Lost, Lynx, Goat, and Snowshoe creeks and their tributaries. Any

herbicide contamination could destroy a part of critical habitat, which would be a violation of section 58(1) of SARA. Contamination of any watercourse or waterbody holding fish may be a breach of the federal Fisheries Act section 36(3) prohibitions against depositing deleterious substances into fish-bearing waters. While presumably best management practices would be followed, these are unlikely to be stringent enough to protect designated critical habitat. The consequences of a spill or other release into SARA-listed critical habitat could be severe for at-risk species. Special precautions, including scientific and public review of the control plan, should be conducted as part of any such control operations using herbicides or pesticides in watersheds holding critical habitat for westslope cutthroat trout or bull trout. This should be specified under the heading in this section entitled "Manage and monitor invasive species, insect and pathogen infestations according to Government of Alberta policies, legislation and best practices," with the proviso that procedures must also be in accord with the relevant federal legislation noted above when watercourses and SARA-listed species and their critical habitats are involved.

Educate the public that key transmission vectors for invasive species include vehicles, trailers, OHVs, boats and other recreational equipment.

In the case of whirling disease, more restrictive measures may be needed. The causative organism has the potential to drive small populations extinct. Adequate protection may include use of a rigorous cleaning protocol for aquatic equipment, or closure of watersheds holding critical habitat for westslope cutthroat trout and bull trout to water-related recreation, including immediate closure to OHV use.

2.4.2 Fire. Active fire management by controlled burns needs peer review that includes aquatic scientists, and careful monitoring of affected aquatic habitats before and after the burn. This requirement should be included under the heading, "**Explore the use of fire as a vegetation management strategy**" in this section.

Controlled burns in watersheds holding critical habitat of at-risk trout can be especially risky (Dunham *et al*. 2003), but there is no inherent conflict in using controlled burns and conserving at-risk trout (Rieman *et al*. 2003). Westslope cutthroat trout populations may recover quickly after being reduced by moderate to severe fires in their basins (Sestrich *et al*. 2011), but populations that are already small cannot tolerate being reduced further without great risk to their viability. Although fire may appear to be beneficial to trout populations in some cases (e.g., better individual growth; Silins *et al*. 2014), that better growth can exacerbate individual competition, leading to smaller populations (Rosenberger *et al*. 2015). Many individual populations are at risk because they are too small; to recover, they need to be larger.

2.4.3 Grazing.

Existing grazing allotments and preference quotas that have been previously established for the Castle area will be honoured. NEW p. 48

Grazing cattle in watersheds holding SARA-listed critical habitat poses a serious risk to that habitat, and can cause severe damage (Platts 1991, Elmore 1992, Fitch *et al*. 2003, Sievers *et al*. 2017). The standard to be met is determined in SARA section 58(1), which forbids destruction of **any part** of designated critical habitat. Violators are subject to high fines and even jail time upon conviction. Given these serious issues, it would be prudent not to allow grazing within watersheds holding at-risk trout designated critical habitat.

Range management plans and strategies will be informed by range and riparian health assessments, conservation objectives for critical habitat, protection of critical fish habitat and the vegetation management strategy. p. 50

Given the likelihood of riparian and stream channel damage within SARA-listed critical habitat for at-risk trout, the conservation consequences, and the legal consequences, it would be advisable to reconsider a blanket commitment to honour **all** existing grazing leases within the parks.

Apply best management practices to minimize impacts of livestock grazing in sensitive sites (e.g. riparian areas and alpine sites). Initial priorities for implementation will be in critical habitat areas for westslope cutthroat trout, bull trout and harlequin ducks.

It is not sufficient to simply minimize impacts of livestock grazing in SARA-listed critical habitat. Under SARA, **no part of** critical habitat may be destroyed, for very good reason. Recall that SARA-listed species are already at risk, and trending toward extinction. Their numbers need to be increased; further decline is not tolerable, for scientific and for legal reasons. Best management practices are unlikely to be sufficient to protect their critical habitat, for reasons discussed above under the heading **1.4 Guiding Principles**.

2.5 Climate Change

Evaluate and strategically manage connectivity of habitat, linear disturbance and recreation use to provide climate refugia for species (minimize fragmentation to allow species movement as climate changes).

Climate warming poses an especially difficult problem for fish in mountainous regions. They are confined to linear streams or small, isolated island-like lakes. Unassisted migration and range shifts are not possible outside of the confines of these limited networks.

Conservation managers need to give considerable thought about precisely how they intend to retain cold stenotherms such as bull trout and westslope cutthrtoat trout native stocks, in the face of warming streams and lakes. Upstream relocation to higher elevations is not an option in most cases. The upstream habitats are already occupied if they are accessible, and are too small on their own to support viable populations in the long term.

In the Castle parks, special care must be taken to conserve existing cold habitats suitable for supporting the parks' native trout. Many of these are now occupied by non-native rainbow trout that threaten the continued existence of westlope cutthroat trout. Removing the non-natives from these cold habitats to allow the native cutthroats to expand is one possible

solution. Ultimately, assisted relocations (translocations) outside of the native range to unoccupied cold habitats further north may be needed to save the Castle parks' westslope cutthroat trout and bull trout genomes. This is an issue that needs careful planning now by managers, so that future needed habitat is not committed to other purposes.

2.6 Cultural Heritage

2.6.1 Cultural Heritage and Historic Resources. Archeological and historical research proposed under this heading could assist in determining the historical distributions of westslope cutthroat trout and bull trout in the Castle parks by documenting locations and ages of sites at which fishing gear and fish remains may be found. This information could be used in recovery planning for the two species.

2.6.2 Traditional Ecological Knowledge and Traditional Land Use. Traditional knowledge **r**esearch proposed under this heading could assist in determining the historical distributions of westslope cutthroat trout and bull trout in the Castle parks, which would be useful for recovering the two species.

2.7 Adjacent Land Use and Development

Recovered westslope cutthroat trout and bull trout populations within the Castle parks will support populations of the same species downstream, outside the parks. It will also support recreational fisheries and related tourism businesses within and outside the parks.

First Nations

Alberta Parks is committed to working with First Nations to identify and resolve issues as they arise. p. 60

The following practices have been identified as important and relevant to the specific interest of First Nations: …

- *Participation in future park planning.*
- *Exploration of economic opportunities for Indigenous people.* p. 61

Develop an effective and practical model for the cooperative management of Castle Provincial Park and Castle Wildland Provincial Park. p. 62

Explore opportunities for First Nations to participate in Castle park operational activities. p. 63

I strongly encourage the Province of Alberta and the Siksikaitsittapi First Nations to study the co-management of Gwaii Haanas National Park Reserve by the Haida Nation and the Government of Canada. That model appears to be highly successful, and may have features that could be adapted to a co-management agreement for the Castle parks.

Tourism and Community

Successful recovery of westslope cutthroat trout and bull trout populations, and the activities needed to restore them, would have strong benefits for tourism and the local community.

4.1 Park Facilities and Infrastructure

Ensure access to the Castle Parks from the north (Crowsnest Pass) and from the east (Beaver Mines and Pincher Creek) NEW

Maintain key road access into the Castle Parks along the Adanac and Sartoris roads. NEW p. 67

Please see my comments under the heading **1.10 Location and Access.** In brief, only a single access road into Castle Provincial Park is needed from the Municipality of Crowsnest Pass. The Sartoris Road presently destroys part of SARA-designated critical habitat of westslope cutthroat trout, contrary to section 58(1) of SARA. The responsible party is potentially subject to prosecution. The Sartoris Road needs to be reclaimed, and the critical habitat now destroyed needs to be restored as soon as possible. The Adanac Road, if properly upgraded, would not affect critical habitat. It also provides direct northern access from the Municipality of Crowsnest Pass, so is the preferred option.

Visitor Services

Opportunities for visitors to help with at-risk species recovery will be available. The necessary support should be part of the visitor services mandate.

5.2 Marketing

Prepare a marketing plan.

At present there is little understanding of, or appreciation for, the need to protect and recover at-risk trout and other species, and restore their critical habitats. Many anglers strongly favour introduced rainbow trout and brown trout. They need to be reassured that their presently favourite species and populations, which are primarily sought in the lower reaches of river mainstems, and outside the parks, are not going to be eliminated by native trout restoration focused on headwaters. Instead, they will have in addition more robust native populations when those native stocks have been successfully restored.

Both westslope cutthroat trout and bull trout are ideal fish for flyfishers: the former are ideal dry fly catch-and-release species; the latter grow to very large sizes. Historically, native cutthroats were abundant, much appreciated and sought after (Sisley 1911). More recently appreciation has grown for the once-persecuted, now decimated bull trout (Van Tighem 1997). Both species will be popular again, once their populations are restored, enhancing local sport fisheries and tourism. In addition, the parks' trout offer opportunities for fishwatching, a remarkably popular activity in many other parks, including Yellowstone and Glacier national parks in the USA (Jennings 1980, Spencer *et al*. 1991).

Marketing the many benefits of restored at-risk stocks will be essential to the success of recovery activities for these fish, and should be a prominent part of the marketing plan.

5.3 Information and Wayfinding

Examples of important regulatory messages include ***how to identify fish*** *for catch and release,* ***dangers of introducing invasive species*** *and hazard warnings.* p. 78

The items in bold will be important to the recovery of at-risk trout, so should also be included in the above marketing plan.

5.4 Programming

The entire recovery program for at-risk trout should be developed as a natural history program on the topic.

5.6 Volunteer, Community and Partnerships

Angling groups, natural history clubs, watershed councils, and environmental groups would be ideal citizen scientists to assisting in at-risk species recovery projects under the leadership of recovery team leaders.

Outdoor Recreation and Healthy Living

6.2 Camping

Commencing in Spring 2017, begin development of rustic group campsites to help manage the transition from random camping. NEW

This is a new initiative, so it is possible to easily avoid legacy mistakes in siting the campsites. Many of the most-used random campsites presently are crowded dangerously close to westslope cutthroat trout critical habitat (Figure 3). For example, Google Earth imagery of the Sartoris Road near Lynx Creek and Goat Creek critical habitat for summer 2011 shows at least 16 random campsites within the reaches holding westslope cutthroat trout critical habitat, most with multiple vehicles and dwelling units. Only one of those campsites is more than 100 metres from critical habitat, and one more is 95 metres from the creek. Of the rest, one is within 2 metres of the creek at the closest point; five more are about 10 metres or less from the creek; and the rest are an average of 20 metres from critical habitat. At those distances, that critical habitat is at considerable risk of damage from riparian soil compaction, bank trampling and breakdown, spillage of toxic fluids such as fuel, and contamination from human and pet waste. The floodplain of Lynx Creek is composed of highly permeable gravel with a high water table and considerable linkage to the open channel.

It will be important to favour siting rustic camping locations below or outside of the watersheds draining to cutthroat and bull trout critical habitat to avoid the risk of destroying any part of that habitat.

6.3 Non-Motorized Trails Use

The approach to providing and managing a trails network in the Castle area will: …

- *Consider trail density and linear disturbance to minimize cumulative impacts on the watershed and biodiversity.*
- *Acknowledge the limitations of the Park's operational capacity to ensure reasonable expectations for managing the trail network.*

Trail density as a measure of linear disturbance and its potential ecological effects has shortcomings associated with the scale at which the densities are calculated, and the precise boundaries and locations of those areas. Its continued use can no longer be justified for many purposes. Other approaches avoid those shortcomings and are preferred (Jaeger 2000, Bischof *et al*. 2016).

If there are major limitations to the parks' capacity "…to ensure reasonable expectations for managing the trail network," it would be best to adopt the precautionary principle and design the non-motorized trail network to avoid trout critical habitat completely. Alternatively, resources should be allocated preferentially to the parts of the trail design most likely to affect critical habitat.

Figure 3. A typical random campsite on Lynx Creek floodplain, much too close to westslope cutthroat trout critical habitat. Summer 2010.

Capital development planning will formally establish the trail network by enhancing or rerouting existing trails, and actively decommissioning and enforcing closure of trails in inappropriate areas.

There are few exclusively non-motorized trails existing now in the Castle parks. If the intention here is to adapt the heavily-eroded OHV trail system for non-motorized use, state that explicitly. Closing and decommissioning most former OHV trails is appropriate, but nearly all of these will also need significant remediation of soils and restoration of the original slope, with revegetation to follow. Capital investment now will reduce the need for expensive enforcement and repairs in the future, so plan for it.

Manage the impact of trail development and types of use to be consistent with biodiversity thresholds. p. 93

In the case of protecting critical habitat for at-risk trout, there are no meaningful thresholds for motorized trails (Ripley *et al*. 2005, Valdal and Quinn 2010). The same is likely true for non-motorized trails as well. Please see comments under the heading "**1.3 Management Vision**."

6.5 Commercial Recreation

Commercial recreation in the form of guided sportfishing already exists in the parks. Recovery of westslope cutthroat trout and bull trout populations within the Castle parks will add opportunities for that activity. In addition, one can imagine guided natural history activities that include fish watching from banks or watercraft, snorkling, and citizen science assistance with recovery projects.

6.6 Water-Based Recreation

Where ecologically and environmentally appropriate, identify infrastructure needs to support water-based recreation.

Take actions to minimize risks and impacts, or restrict access to areas that are environmentally sensitive, contain rare or at-risk species, or pose a high risk for the introduction of aquatic invasive species.

Infrastructure needs could include permanent submersed camera stations and webcams to observe aquatic animals (including at-risk trout) and other aquatic organisms at selected high-interest locations. While closures of critical habitat are often appropriate, as I have argued elsewhere above, there are also opportunities for controlled or supervised access to critical habitat for citizen science, educational, or even recreational purposes. All access to water within the Castle parks and connected waters needs to provide for rigorous controls against introducing invasive species such as whirling disease and other dangerous invasive aquatic organisms, which could devastate critical habitat and the at-risk populations that rely on them.

6.7 Hunting

Off-highway vehicle use, such as quads, may be permitted for the retrieval of game on a network of access trails specifically designated for those purposes. p. 98

Collaborate with fish and wildlife associated groups to determine best practices and develop guidelines to allow for limited use of Off Highway Vehicles for the purposes of game retrieval. NEW p. 99

Review best practices and develop guidelines for the responsible use of OHVs for the purposes of retrieving game. Guidelines for Park staff and users will address various management issues including the potential of permitting mechanisms, hours and seasonal limitations, code of conduct for users, etc. NEW p. 99

OHV use is neither needed, nor allowed in other large hunted regions on Alberta's Eastern Slopes, such as Kananaskis Country, for game retrieval or any other purpose. The reason for giving hunters privileged access to the Castle parks is not apparent.

Permitting OHV use could well favour heavier exploitation of the parks' wildlife relative to other hunting regions. A special network of trails for the exclusive use of hunters, at the cost of what will be significant disturbance of wildlife while the trails are in use, counters other provisions in the plan intended to *reduce* wildlife disturbance.

The proposed "network of access trails" that will be retained also retains a network of permanent erosion sites and sediment sources, much of which is connected to the stream network of the parks. The hunter-only trail system thereby extends watershed drainage networks, and will tend to accelerate runoff and increase peak flows, with the effect that watershed water storage and summer streamflows will tend to be reduced.

The special network of single-use OHV trails will leave in place a trail network that can be re-opened as the already-operable basis for a new, much more extensive recreational OHV network at the whim of the Minister of Environment and Parks. A simple thoughtless action with virtually no financial cost would undo the value of the parks as conservation areas, which is their stated primary purpose. Years of work and millions in public money spent on reclamation and restoration to develop a world-quality pair of conservation gems would be for nothing.

Motorized access is what protected areas most need to be protected *from*. The parks are intended for conservation as a priority. Activities such as hunting are secondary. This special trail provision provided just for hunters, severely compromises conservation values. There simply is no rational justification for it. If this plan is going to permit hunting and the use of motorized vehicles in support of it, please provide evidence for public review in the final plan that hunting cannot be conducted without it.

6.8 Trapping

Motorized access and trapping cabins are an important part of managing a trapline and, within the Provincial Park, renovations and/or relocation of existing trapping cabins and necessary changes to access will be subject to review of associated environmental impacts, aesthetics and other factors in influencing visitor experiences.

Motorized access is incompatible with the value and purpose of parks intended for conservation. The comments under the heading **6.7 Hunting,** above, are valid here, with negligible modification.[3] If this plan is going to permit trapping and the use of motorized vehicles in support of it, please provide evidence for public review in the final plan that trapping cannot be conducted without it.

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[3] It is worth remembering that the Hudson's Bay Company, established in 1670, managed, over hundreds of years and with industrial efficiency, to trap virtually all of western and northern Canada without the use of a single snow machine, ATV, or four-wheel drive truck.

Alberta Parks, in collaboration with Fish and Wildlife, will annually review trapping quotas. Annual trapping reports will be submitted to both Alberta Parks and Fish and Wildlife.

If trapping is to be permitted in the final plan, please publish evidence for public review of population sizes of species captured, and analysis showing that trapping is not a threat to those populations.

6.9 Sportfishing

The conservation and recovery of native species and their habitats is a management priority for Castle Provincial Park and Castle Wildland Provincial Park and aligns with the management objectives of watershed protection, lotic connectivity and the federal Westslope Cutthroat Trout Critical Habitat Order.

This section should be reworded to indicate that the management of listed native trout will comply (as it must) with the letter and intent of the federal *Species At Risk Act*, and the documents mandated under its auspices. For westslope cutthroat trout, these include the recovery strategy (DFO 2014), critical habitat order, and the long-overdue action plan. For bull trout, the species' populations within the parks' jurisdiction shall be managed as if the species is listed and its critical habitat is protected under SARA, even if it is not yet designated under that Act.

Alberta Parks also encourages anglers to minimise the transfer of pathogens and invasive species by ensuring that angling equipment is clean and dry before use.

This simple procedure is not adequate to protect critical habitat from invasion by whirling disease, and probably is not adequate to prevent invasions by other disease organisms either. It would be better here to specify that parks management will advise anglers to comply with procedures supported by the best available science, as made available to them periodically by Alberta Fish and Wildlife; the federal Department of Fisheries, Oceans and the Coast Guard; and the Canada Food Inspection Agency, which is responsible for controlling the disease in Canada. Control of whirling disease is under intensive research, so this approach makes it clear that Castle parks managers will stay on top of this crucial problem, which could easily drive small populations to extinction.

In collaboration with Alberta Environment and Parks' fish and wildlife biologists, develop strategies to improve sportfishing opportunities that are consistent with fisheries management and park objectives, referencing existing species management and recovery plans where available (e.g. westslope cutthroat trout and bull trout). NEW

Consider the conservation of native species as the primary management goal.

Evaluate the potential and capacity to expand sportfishing opportunities and incorporate findings into the Sport Fishery Plan.

In collaboration with Alberta Environment and Parks' fisheries biologists, implement[ed] recovery initiatives within the Castle Park to support recovery of the Westslope Cutthroat Trout and Bull Trout as per existing species management and recovery plans. NEW

All of these intentions are highly supportable.

6.10 Recreational Off Highway Vehicles NEW

6.10.1 Summer Recreational Off Highway Vehicles NEW.

To meet the conservation goal of the park and protect these ecosystems, landscapes and water resources, summer recreational off-highway vehicle use will be phased out of Castle Provincial Park and Castle Wildland Provincial Park.

This is wholly supportable by the best available science; however that science is not summarized with citation support in this section. In the final plan, it should be, very briefly. It could save a lot of grief.

This period will allow time to make decisions around the types of engineered trails and funding sources required to allow summer recreational OHV use on suitable public lands, with a specific focus in the neighboring Livingstone and Porcupine Hills public lands.

The Livingstone and Porcupine Hills public lands are not suitable for OHV use of the magnitude envisioned here. The existing trail system in the upper Oldman-Livingstone region, especially when coupled with other land disturbances such as logging, has long since destroyed most critical habitat for wolves, elk, and grizzly bears; has severely fragmented forest landscapes; and has placed virtually all watercourses in small regional watersheds at moderate to extreme risk of damage (Sawyer *et al*. 1997). Much of that damage is readily evident to the casual observer. Experience with an Eastern Slopes sacrifice area (McLean Creek Public Land Use Zone) shows the irredeemable destructiveness of these machines and their trails in a closely similar landscape (Mayhood 2013a, 2013b, 2015; Erdle and Mayhood 2014). Irrefutable graphic evidence of similar damage is routinely offered for other Eastern Slopes public lands by watershed groups, and in local news media. The Eastern Slopes is the last remaining refuge for threatened, SARA-listed westslope cutthroat trout, much of the critical habitat of which lies within the upper Oldman-Livingstone region. That critical habitat is protected by some rather inflexible language in the legislation.

The Government of Alberta must come to grips with the simple fact that OHVs, and several other abusive land-uses, cannot be supported on Alberta's Rocky Mountain Eastern Slopes. Southern Alberta is absolutely dependent on this landscape as the primary source for our water. OHVs, and especially the low-standard trails they need and that proliferate throughout the landscape where OHVs are active, have several decidedly negative effects on the hydrology of a region. This critical source area for southern Alberta water is only going to become drier with the ongoing, unmitigated effects of climate change (Schindler and Donahue 2006, Sauchyn & Kulshreshtha 2008). If there is any place for tearing up our watersheds with powerful machines designed with just that purpose in mind, simply ***for fun***, it is not here.

The Government of Alberta is committed to working with Off Highway Vehicle users on the design of trail systems on public lands, and the prioritization of trails for phase out over the next five years…

Those trails that are appropriate for recreational uses compatible with the conservation objectives of the parks will be designated as such, and restored.

The second paragraph could be interpreted as contemplating some OHV use after all. If so, please see the comments immediately above. They need to be repeated here even more emphatically, since here we are dealing with proposed recreational OHV use in parks that have their priority use for conservation. More generally, it is just not supportable to plan a major use of public lands in consultation with a single user group, without public input. It is even more egregious when the use contemplated is well known to be highly destructive, and is intended to accommodate a small minority of the Alberta population.

The intent to phase out only selected OHV trails — over five years — in parks of unusually high conservation value, is completely unsupportable by your own words in this section.

Analysis of environmental data, reports and published science (including research related to biodiversity, critical habitats, linear thresholds, species at risk, riparian areas, erodibility and noise disturbance potential) confirms that summer recreational off-highway vehicle use at current or substantially reduced levels is incompatible with conservation goals of the parks. Summer OHV use is also incompatible with quiet recreation experience and other non-motorized recreation.

6.10.2 Winter Recreational Off Highway Vehicles NEW

A thorough review of existing research, as well as an identification of the gaps in research, is required to better inform a clear management direction.

Given that this plan was prepared without the benefit of such a scientific review, this is a reasonable approach. That review needs to include an assessment of the literature on trails that exist year-round, if it is contemplated that some existing trails will be kept open and unreclaimed to accommodate snow machines.

The Government of Alberta will work with snowmobile associations and other user groups to undertake a review of winter OHV use in the Castle Parks prior to making any decisions on the future of this activity in the Castle Parks.

This is a potentially contentious issue affecting the use of high-value public lands. It is essential to consult widely with Albertans on it, and not restrict it to a few user groups.

Research, Monitoring and Adaptive Management

Alberta Parks recognizes that an adaptive management approach is required to best achieve ecosystem objectives.

Please see my comments on adaptive management under the heading **2.2.1 Biodiversity Management.** Adaptive management needs to be designed as a controlled experiment, in which a clearly-stated hypothesis is tested. Where consequences are high risk, involve high value resources and are irreversible, it is preferable to work with models to the extent possible. Monitoring of the management action should be designed to identify impending failure, not actual failure itself.

Monitor health and abundance of species, especially species at risk, and the quality of their habitats (e.g. westslope cutthroat trout, bull trout, grizzly bears). NEW

This strategy is highly supportable. It is a requirement of conservation management.

Provincial Park Zoning Framework

The proposed **Willoughby Ridge Facility Zone** lies on alluvial floodplain within a reach of Lynx Creek holding critical habitat for westslope cutthroat trout. This reach of the creek is unconfined. It is natural for it to move during flood flows, cutting new channels that move laterally across these coarse gravel deposits. In fact, lateral channel migration is an essential feature of the critical habitat. The floodplain deposits are highly permeable, and will be intimately connected to water in the channel itself. The entire floodplain can be thought of as a large subgravel filter, somewhat like those used in tropical fish aquaria, and can be crucial to productivity in the channel (Stanford and Ward 1988, Boulton *et al.* 2010). Spring water from the toe of a hillslope combined with emergent water from the floodplain itself moves across the floodplain, eventually joining the mainstem creek. This entire floodplain is highly sensitive, closely connected to the channel, and ecologically important. The floodplain is in fact a part of the creek. Building on it, even though the surface is mostly dry most of the time, is literally building *in* the creek. A facility here would be a major risk to designated critical habitat in the Lynx Creek open channel.

The proposed **Lost Creek Facility Zone** is proposed for a location just downstream (perhaps 100 - 200 metres) from the lower end of designated critical habitat for westslope cutthroat trout, at the confluence of North Lost Creek and South Lost Creek to form Lost Creek. Lost Creek and possibly South Lost Creek are very likely to be used, seasonally at least, by the protected cutthroat population in North Lost Creek, likely for overwintering, and possibly as refuge during summer low flows. Both creeks are in fact likely to be undesignated critical habitat that has heretofore been overlooked due inadequate seasonal sampling. Whether they are designated critical habitat or not, they are still potentially crucial to the survival and recovery prospects for the protected population. The proposed facility will require careful evaluation relative to the protected cutthroat population. It would best be moved from this site.

Implementation and Review

The general procedure very briefly outlined here does not directly affect aquatic habitats and fish populations.

Using the strategies outlined in this plan, the Government of Alberta is committed to managing Castle Provincial Park and Castle Wildland Provincial Park as world- class protected places, employing high standards in conservation, respecting Indigenous rights and providing the opportunity for exceptional recreational experiences.

I endorse this aspiration.

Recommendations

The revised draft management plan aspires to manage Castle Provincial Park and Castle Wildland Provincial Park as world-class protected places, giving highest priority to conservation. The plan goes a long way toward achieving that goal, but certain serious weaknesses in this draft doom it to failure. The draft fails by attempting to accommodate certain fundamentally opposed objectives in the same place at the same time.

When the plan gives priority to conservation, all other objectives are automatically subservient. This does not mean that no use of the land is possible. It just means that uses must serve the priority goal in some way, without significantly interfering with achieving that goal.

Here I suggest several changes that I believe will help managers achieve their aspiration.

- The federal Species At Risk Act is the standard against which management of at-risk aquatic species and their critical habitats will be judged by the courts. The final management plan for the Castle parks needs to use it as the standard as well.
- Motor vehicles and roads are fundamentally incompatible with protecting landscapes. Protecting landscapes means protecting them from motor vehicles and the destructive trails and roads they need. Motor vehicles and their routes are what the Castle parks need to be protected *from.* Remove OHVs and their trails, including those slated for the exclusive use of hunters and trappers, and restore the land and vegetation they have severely disrupted. Restrict roads to what is needed for basic access.
- Remove the Sartoris Road in the Lynx Creek valley, from the falls that mark the lower boundary of westslope cutthroat trout critical habitat, to the road's summit at the top of Willoughby Ridge. The road destroys critical habitat for westslope cutthroat trout, contrary to section 58(1) of the Species At Risk Act. In my view, it is illegal.
- Move the Lost Creek Facility Zone to a point remote from designated and *de facto* critical habitat for westslope cutthroat trout.
- Develop and actively promote as a central feature of the Castle parks the protection and recovery of westslope cutthroat trout, bull trout, and their critical habitats. There is considerable opportunity for improvement to tourism, sportfishing, and non-angling benefits of trout species recovery.
- Apply best management practices, thresholds and adaptive management only to management where mistakes are tolerable, or at least will not cause irrevocable harm when they occur. Abandon best management practices for managing at-risk species and their critical habitats; they are far too risky. Apply the precautionary principle instead. Adopt thresholds for managing at-risk species and critical habitats only where the science demonstrates that thresholds actually exist. Replace adaptive management of at-risk species and critical habitats with experimental manipulations of model populations to

study proposed management actions before applying those actions to actual at-risk populations and their critical habitats.

- Develop a complete, effective plan for preventing whirling disease and other invasive species from destroying critical habitat of at-risk trout in the Castle parks.
- Abandon the idea of sacrificing the Livingstone and Porcupine Hills public lands to compensate recreational OHV users for exclusion from the Castle parks. These lands are not capable of supporting the amount of OHV use they are presently subjected to. The Eastern Slopes in general are far too important as a principal water source to permit any further abuse from OHV abuse.

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