Organizational affiliation and credentials:
I work as an independent scientist in southwestern Alberta, and have been studying grizzly bears for the past seven years. My research is focused on grizzly bear population ecology and large carnivore-human conflicts. My past positions have included a job with the Alberta government where I coordinated a grizzly bear monitoring program.

1. *Are the assumptions and conclusions logical and do they reflect the best available science?*

For the most part, yes. The key assumption of this document is that the 2011 habitat conditions are consistent with a 3% per year population increase. However, the Mace et al. 2012 paper cited as documenting the 3% per year increase used data from 2004 through 2009, not 2004-2011 as this document states. The NDCE Grizzly Bear Conservation Strategy notes that the estimate of average annual population growth was re-calculated in 2012 using data through 2011, resulting in a rate of 3.03% per year from 2004-2011. That statement is not included in the current document and should be because the Mace et al. 2012 paper does not cover 2004-2011.

I am struggling with the assumption that the 2011 conditions contributed to the population growth observed from 2004 to 2011 because 2011 was the last year of the time period over which the grizzly bear population increase was documented. Surely, it would take time for any improvement in habitat to result in a demographic response by a bear population. Thus, it seems unlikely that the habitat in 2011 contributed to the population growth. Rather, it might make more sense to state that from 2004 to 2011 the grizzly bear population was highest in 2011, while motorized route density was lowest in 2011 (i.e. low motorized road density was associated with a high grizzly bear density). Thus, 2011 habitat conditions are associated with an increased grizzly bear population.

I would also suggest a slight wording change to indicate that the goal for habitat management is to maintain or improve on baseline 2011 conditions.

2. *Are the habitat protections provided in these criteria adequate to assure the long-term viability of the Northern Continental Divide Ecosystem grizzly bear population?*

Generally, yes. The habitat protections provided in these criteria will help ensure the long-term viability of the NCDE grizzly bear population, and these ideas are supported by the literature. My main concern is that highway, county, and private roads are not included in the calculation of OMRD or TMRD. By not including these, OMRD and TMRD are underestimated, and thus the percentage of each BMU that exceeds the threshold (1mi/m^2 or 2 mi/mi^2) is also underestimated. It would be important to include highways, county, and private roads to ensure that the thresholds are not exceeded – or at a minimum justify their exclusion.

Boulanger and Stenhouse (2014) show that a threshold density of 0.75 km/km^2 or lower is desirable to maintain viable grizzly bear populations. Thus, in addition to the percent increases allowed under habitat criteria 1 (page 5), it might be prudent to allow for these temporary increases provided they do not result in open road density exceeding the 0.75 km/km^2 threshold.

Criteria 1 sates that any changes to core habitat and road density values must be restored once the project is completed. This is an important inclusion. Are there any regulations around what restoration must look like? For example, prohibiting the use of clover as a reclamation material (Roever et al. 2008)?

In criteria #2, page 6, it would be important to also consider the extent of increase (e.g. is there a maximum size allowed for the addition of a new campground or other development?). I assume any roads associated with a new development are subject to Criteria 1, but this should be clarified.

Criteria #3 states that boneyards will not be established on National Forest lands. These lands constitute 61% of the federal lands in the recovery zone and all grazing allotments appear to be on National Forest lands (Table 4). Where will boneyards be established if not on National Forest lands? Because livestock are only grazed on NF lands, and boneyards cannot be established on NF lands, this would imply to me that any dead livestock will be removed. I question then, the establishment of boneyards at all. Past research has shown boneyards to be a major attractant not just for grizzly bears, but for all large carnivores (Morehouse and Boyce 2011, Northrup and Boyce 2012). Consequently, there has been a large emphasis in some regions of Montana as well as Alberta on removing boneyards (e.g. Blackfoot Challenge, Waterton Biosphere Reserve). If boneyards are going to be established, there should be more details provided (e.g. where are they allowed, minimum distances from other livestock pastures, minimum distances from roads or trails, etc.).

The objective of reducing sheep grazing is an important step towards reducing grizzly bear-livestock depredation.

3. *Are the habitat management mechanisms scientifically sound and sufficiently detailed?*

Yes, they are sufficiently sound, but I would have liked a few more details to be provided. It would be helpful to have a better understanding of how habitat conditions, specifically OMRD and TMRD have changed between 2004-2011. The report simply says motorized road density decreased but does not provide any details about where, by how much, or why this reduction occurred (e.g. were only certain BMUs affected?, was there an increase in access management or road reclamation?). Because there is so much emphasis on the assumption that habitat conditions in 2011 are associated with bear population growth, it would be helpful to have more details on why that year was chosen. Did 2011 have the lowest motorized road density of all years from 2004-2011? And if not, why choose 2011 over 2010 or 2009 or any other year? As mentioned in a previous comment, I struggle with the assumption that habitat conditions in 2011 contributed to population growth. The use of 2011 as baseline conditions might be better justified by providing more details.

4. *Did we include all the necessary and pertinent literature to support our assumptions and conclusions?*

Yes, pertinent literature is cited. However, the Literature Cited section should be renamed to References because there are essentially no papers cited in-text. Alternatively (and preferably),

keep the section as Literature Cited and add the appropriate references in-text. Without the in-text citations, it is hard to evaluate how the literature has been used to support the assumptions and conclusions in this document.

Other papers that might be considered:

Graham, K., J. Boulanger, J. Duval, and G. Stenhouse. 2010. Spatial and temporal use of roads by grizzly bears in west-central Alberta. Ursus 21:43–56.

McLellan, B. N. 2015. Some mechanisms underlying variation in vital rates of grizzly bears on a multiple use landscape. Journal of Wildlife Management 79:749–765.

Nielsen, S. E., S. Herrero, M. S. Boyce, R. D. Mace, B. Benn, M. L. Gibeau, S. Jevons. 2004. Modelling the spatial distribution of human-caused grizzly bear mortalities in the Central Rockies ecosystem of Canada. Biological Conservation 120:101–113.

Northrup, J. M., J. Pitt, T. B. Muhly, G. B. Stenhouse, M. Musiani, and M. S. Boyce. 2012. Vehicle traffic shapes grizzly bear behaviour on a multiple-use landscape. Journal of Applied Ecology 49:1159–1167.

Proctor, M. F., D. Paetkau, B. N. McLellan, G. B. Stenhouse, K. C. Kendall, R. D. Mace, W. F. Kasworm, C. Servheen, C. L. Lausen, M. L. Gibeau et al. 2012. Population fragmentation and inter-ecosystem movements of grizzly bears in Western Canada and the Northern United States. Wildlife Monographs 180:1–46.

Roever, C. L., M. S., and G. B. Stenhouse. 2008. Grizzly bears and foresty I: Road vegetation and placement as an attractant to grizzly bears. Forest Ecology and Management 256:1253–1261.

Roever, C. L., M. S. Boyce, and G. B. Stenhouse. 2010. Grizzly bear movements relative to roads: application of step selection functions. Ecography 33:1113–1122.

Schwartz, C. C., M. A. Haroldson, and G. C. White. 2010. Hazards affecting grizzly bear survivl in the greater Yellowstone ecosystem. Journal of Wildlife Management 74:654–667.

Other Comments:

On page 5, the document states that the habitat-based recovery criteria apply to Federal lands. By the numbers listed, this would be 78.4% of the recovery area (61% National Forests, 17% Glacier National Park, all other federal lands 0.4%). However, on page 16 it states that federal lands constitute 91% of the recovery zone. This discrepancy should be clarified.

In Appendix A, I question the statement that "habitat fragmentation is not an issue in the NCDE." Certainly, roads have the potential to fragment habitat. Highways can fragment habitat and have demographic and genetic connectivity consequences (Proctor et al. 2012)

Other papers cited (and not mentioned above or in supplement Lit Cited):

Morehouse, A. T., and M. S. Boyce. 2011. From venison to beef: seasonal changes in wolf diet composition in a livestock grazing landscape. Frontiers in Ecology and the Environment 9:440–445.

Northrup, J. M., and M. S. Boyce. 2012. Mad cow policy and management of grizzly bear incidents. Wildlife Society Bulletin 36:499–505.