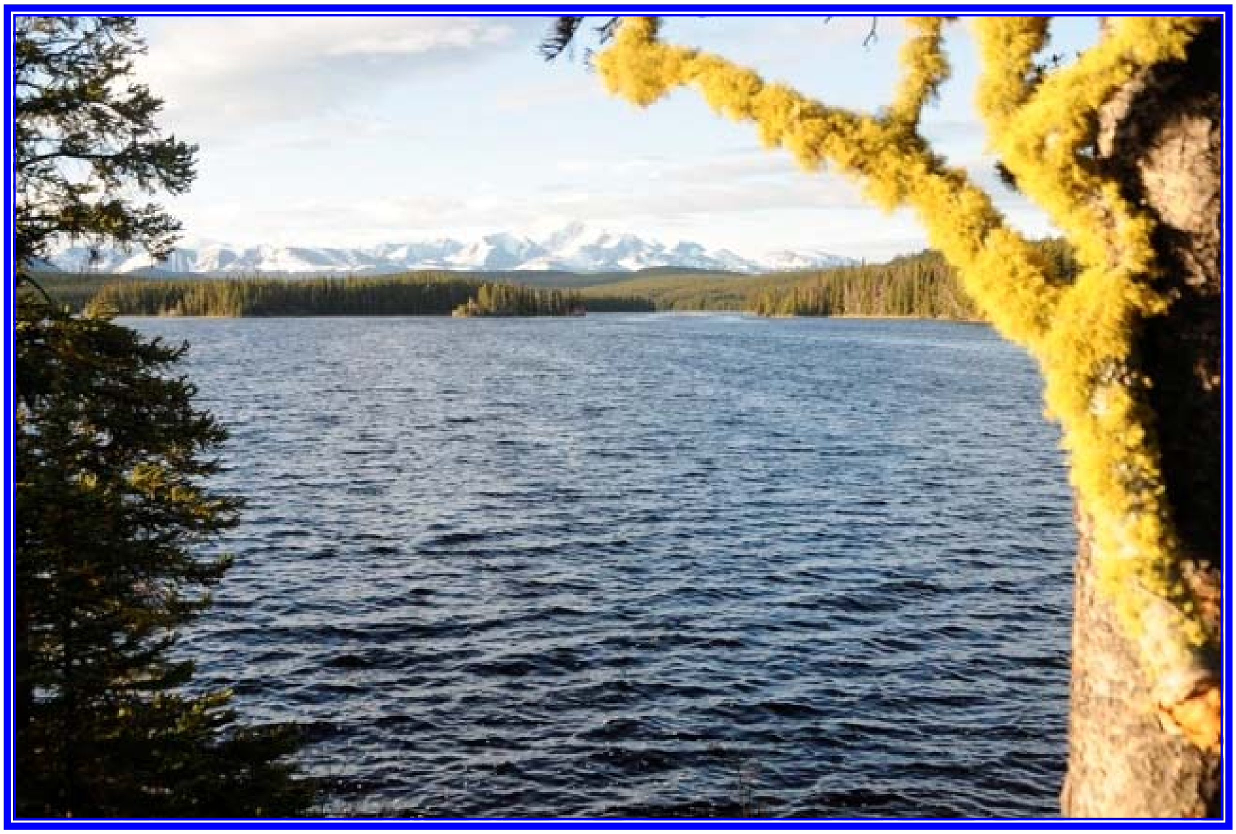
McCRORY WILDLIFE SERVICES LTD. RESPONSE TO 2011 TERRESTRIAL-WILDLIFE COMPONENT OF THE ENVIRONMENTAL IMPACT STATEMENT (EIS) & ASSOCIATED DOCUMENTS REGARDING THE PROPOSED NEW PROSPERITY GOLD-COPPER MINE PROJECT AT TEZTAN BINY (FISH LAKE) WITH SPECIFIC REFERENCE TO THE GRIZZLY BEAR

[With added comments on Northwestern Toad & Wild Horses]



Report for Friends of Nemaiah Valley (FONV)
for submission to the CEAA Panel

CEAR reference number 782

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PROFESSIONAL BACKGROUND AND QUALIFICATIONS & DISCLAIMER INFORMATION

Professional background & relevant qualifications

This report was prepared by me, bear biologist Wayne McCrory, for Friends of Nemaiah Valley (FONV) for submission to the federal CEAA Panel reviewing the New Prosperity mine proposal in the BC Chilcotin. I am a registered professional bear biologist in the province of British Columbia. I have an Honours Zoology degree from the University of British Columbia (1966) and have more than 40 years professional experience. My wildlife and extensive bear work has been published in ten proceedings, peer-reviewed journals, and government publications. I have produced 80 professional reports, some peer-reviewed, many involving environmental impacts, and bear habitat and bear hazard assessments.

I served for four years on the BC government's Grizzly Bear Scientific Advisory Committee (GBSAC).

Qualifications relevant to my review of the New Prosperity 2011 EIS include the following. I have had extensive experience in environmental impact assessment involving a diverse array of developments, including impacts of logging on grizzly bears, caribou surveys in the Yukon related to the Gas Arctic Pipeline, impacts of the Mackenzie Valley Pipeline road, impacts of the Syncrude Tar Sands development on waterfowl and other wildlife, and others. I have also done extensive grizzly bear habitat surveys in at least 15 provincial and national parks, including extensive habitat mapping and ground-truthing of several types of habitat map modeling.

I also have had extensive research experience in the BC Cariboo-Chilcotin, including an environmental impact study on wildlife for the proposed Moran Dam, an environmental impact study for the Toosey Indian Band of the effects of military exercises on the Chilcotin DND military block, bufflehead duck surveys for the Canadian Wildlife Service, two Aboriginal Species-at-Risk studies (ASFAR), including grizzly bears in the New Prosperity Regional Study Area (RSA and beyond, a biological assessment of the Brittany Triangle, a DNA study of wild horses of the Brittany with Texas A & M University, and for the Xeni Gwet'in First Nation, I have been involved in studies including wildlife tourism, grizzly bear viewing, climate change, and access management.

Disclaimer

The findings contained in this report were compiled from on-site field investigations of grizzly bear habitat values in the Teztan Biny (Fish Lake) study area; reviews of all available studies and information on grizzly bear habitats, population numbers, mortality, grizzly bear salmon and trout feeding areas, and conservation status in the Fish Lake study area and BC Chilcotin. The scientific literature was reviewed for all relevant materials. The author has also relied on anecdotal information, traditional knowledge of grizzly bears from Xeni Gwet'in wildlife researchers, and my own independent professional interpretation of the literature. I feel I have provided an accurate and authoritative analysis with regard to the subject matter covered herein. The conclusions and summation expressed herein are entirely my own and have not been subjected to outside peer review. I take full responsibility for any errors or omissions on my part but not on the part of errors or omissions extant in the data provided by outside sources. While best efforts have been made to ensure the validity of this review, no liability is assumed with respect to the use or application of the information contained herein.

LEGAL COVENANT FROM THE XENI GWET'IN GOVERNMENT

The Tsilhqot'in have met the test for aboriginal title in the lands described in *Tsilhqot'in Nation v. British Columbia*, 2007 BCSC 1700 ("*Tsilhqot'in Nation*"). *Tsilhqot'in Nation* also recognized the Tsilhqot'in aboriginal right to hunt and trap birds and animals for the purposes of securing animals for work and transportation, food, clothing, shelter, mats, blankets, and crafts, as well as for spiritual, ceremonial, and cultural uses throughout the Brittany Triangle (Tachelach'ed) and the Xeni Gwet'in Trapline. This right is inclusive of a right to capture and use horses for transportation and work. The Court found that the Tsilhqot'in people also have an aboriginal right to trade in skins and pelts as a means of securing a moderate livelihood. These lands are within the Tsilhqot'in traditional territory, the Xeni Gwet'in First Nation's caretaking area, and partially in the Yunesit'in Government's caretaking area. Nothing in this report shall abrogate or derogate from any aboriginal title or aboriginal rights of the Tsilhqot'in, the Xeni Gwet'in First Nation, or any Tsilhqot'in or Xeni Gwet'in members.

Midnight: A Chilcotin grizzly bear on mark trail along salmon stream

SPECIAL NOTE ON ASSUMPTIONS OF STANDARDS FOR MINE-UPGRADE OF THE TASEKO/WHITEWATER/4500 MINE ROAD

The proposed standards for the upgrade and re-routing of some of the Taseko/Whitewater/4500 road were important to my assessment of mortality risk to grizzly bears from traffic collisions. For example, I cite evidence from Apps et al. (2009) that the Duffy Lake Road (which is in the next GBPU south of the New Prosperity location) started as a logging road in about 1970, and was upgraded/paved in 1991 to become an extension of Highway 99. This transportation improvement is believed to have caused the extirpation of resident female grizzly bears north of the road.

Since the new mine road standards, such as paved/unpaved, were not made available in the Prosperity EIS documents, I made a written request to Taseko in 2010 that went through the review panel but I never received a response. Nor were the road standards available in the 2011 EIS. On July 24, 2013, I again asked Taseko representatives at the New Prosperity hearings to provide the standards (paved or unpaved) of a new road upgrade. They were vague and said they could not say. In light of the fact that if the mine is approved, the road will be significantly upgraded to handle large-scale industrial traffic, I am making the assumption that the road will, in effect, become a paved highway some time during the 35-year life span of the mine and am calling it that for purposes of discussion in this document.

The practice, now common, of identifying 'critical habitat' and classifying it into management situation categories is an approach that may help a few individual bears over the short-term, but, over the long-term, will surely violate the totality of resources and space necessary for population viabilit*y* (Dr. J. Craighead 1995).

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ABSTRACT

This is my second review of Taseko's Environmental Impact Statement (EIS) concerning the Prosperity, now called New Prosperity, proposed gold-copper mine at Teztan Biny (Fish Lake). In my first review (McCrory 2010), I presented evidence that the proposed mine would push the threatened Chilcotin grizzly bear of the South Chilcotin Ranges Grizzly Bear Population Unit (GBPU) over the threshold of extinction as defined by Bascompte and Sole (1996). I identify this GBPU as the last stronghold of the Coast Mountains dryland grizzly bear ecotype that used to exist from BC's Tweedsmuir Park to northern California, but is now extinct in the US, and seriously endangered south of the Taseko Watershed. Recovery of four other threatened GBPUs in the south coastal mountains depends on the South Chilcotin GBPU, which is itself seriously threatened.

In this current review, I present an expanded body of evidence that demonstrates that the New Prosperity mine, despite some physical alterations to the mine plan (such as not draining Fish Lake) and additional proposed mitigation, will cause significant residual adverse impacts on the threatened South Chilcotin grizzly bear. Displacement from moderate-high quality habitats leading to nutritional stress and reduced survivability, combined with excess human-caused mortality from the proposed mine and other factors, will exceed the extinction threshold and put this already threatened population into serious decline. The extinction/extant "front," where bears are already gone from the landscape, abuts the GBPU to the north and east, putting the mine study area on the extremely high risk "edge" of advancing decline/extermination.

In my professional opinion, I found that the New Prosperity 2011 EIS had significant deficiencies in baseline data, wrong assumptions, and a general lack of scientific rigour. These baseline deficiencies included, but were not limited to, an emphasis on the physical footprint without adequate ground-truthing of grizzly bear habitat RSA suitability ratings and detailed habitat values, including the importance of trout spawning to grizzly bears at the MDA level, lack of quantification of pre- and post-mine mortality estimates to accompany RSA mortality risk maps (core secure areas and road density), and an over reliance on proposed mitigation measures that have not been proven to be effective with respect to identified significant adverse cumulative environmental effects I have identified for grizzly bears**.**

There was also a general absence of integration from the scientific literature of some relevant information and case history studies on mine impacts on grizzly bears. The New Prosperity emphasis on the physical footprint is not sufficient evidence to determine significance of impacts. The continuum of scientific deficiencies evident in the EIS with respect to their analysis of cumulative effects on grizzly bears creates a high level of uncertainty and a low degree of confidence in their conclusion of ***no** significant adverse residual effects on grizzly bears from the proposed mine project.* I present qualitative and quantitative evidence using a more rigorous investigative approach that concludes the opposite.

I present quantitative evidence from my 2012 field surveys and DNA hair analysis from 17 grizzly bear mark trees in the Fish Lake MDA, which indicates that not only will the proposed mine effectively destroy a significant area of spring wetland and riparian habitat and an important grizzly bear movement corridor, but will eliminate from the overall population an important, ancestral grizzly bear feeding habitat for a very high biomass of spawning trout that, as in Yellowstone National Park, would be considered significant to the well-being of the population. The high digestibility and protein and lipid content of spawning trout at Fish Lake would be one of the highest sources of net digestible energy available in the spring-early summer to help bears regain body mass after emerging from their winter dens and also helps female grizzlies with young meet the energetic needs of lactation. I calculated the overall available spawning trout biomass at Fish Lake to be 78,143 kilograms, or 171,915 pounds, although only a portion of this biomass would spawn in shallow riffles where they

could be caught by bears. I estimated some 15-20 or more grizzly bears would feed at spawning trout "hot spots" at Fish Lake in May and June. An estimated 35-40 grizzly bears would come in contact with the MDA annually, exposing them to mortality risk and displacement from the key spring-fall habitats and a regional movement corridor. Although Fish Lake and some of the spawning habitat for rainbow trout will be left intact, most grizzlies will be displaced, while those that become habituated in order to access spawning trout, will come into conflict. The proposed trout compensation measures to offset reductions in the trout population and loss of some spawning habitat offers no viable replacement of spawning habitat suited to specialized grizzly bear feeding behaviour. This qualitative and quantitative evidence could not be more clear. The loss of wetland, riparian, movement, and trout-spawning habitat in the Little Fish – Fish Lake MDA translates to a significant residual adverse impact to the grizzly bears that use the RSA, and to the GBPU population, affecting population survivability, since the impacts cannot be effectively mitigated.

Baseline human-caused mortality to grizzly bears between 2001-2013 for the South Chilcotin Ranges GBPU from known and unreported causes was estimated to be 3.3-3.7 bears per year. Approximately one half of the kill was estimated to be females. Grizzly bears at reduced population levels cannot sustain human-induced mortality of greater than 4% of the total adult population if recovery is the management objective. If one accepts the 2010 MOE South Chilcotin Ranges GBPU population estimate of 100 bears, then the population is already teetering on the brink. If one accepts the revised but questionable estimate of 203 bears, there may be a bit more resiliency. However, I consider my estimate of human-caused mortality conservative. For example it may be double what I estimate during years of low berry production, poor whitebark pinenut crops, and/or poor salmon returns.

Total mine-caused mortality was estimated to be 4-7 grizzly bears annually from all causes over the 35-year life of the mine (1-2 at mine site, 2-3 reported/unreported collision kills of grizzly bears on the highway to the mine, and 1-2 along the 50 km long, 80-m-wide transmission line from hunters and others). It is to be noted that there recently was an unconfirmed report of a mother grizzly and young being killed on the Taseko Road by a logging truck.

These mortality results are consistent with a review of 13-radio-collaring studies in a 22-year period, including southern British Columbia (McLellan et al. 1999). People killed 77-85% of collared bears known or suspected to have died. A much smaller proportion died of apparent natural causes.

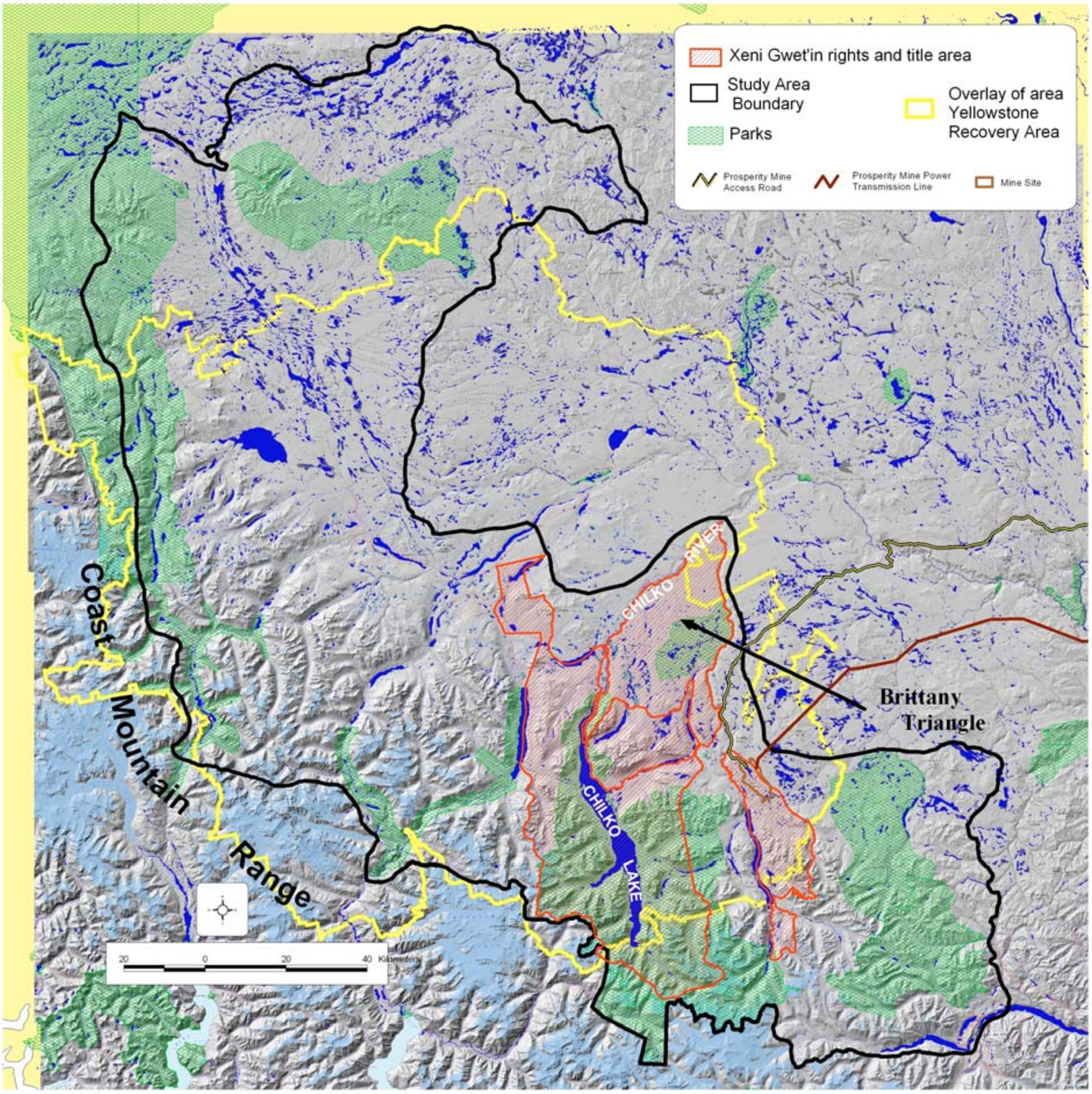
It is also to be noted in the context of the New Prosperity proposed access highway, that the Duffy Lake Road in an adjacent GBPU also started as a logging road. After it became a paved highway, it is believed to have caused the extirpation of female grizzly bears to the north of the road. Obviously, since much of the traffic on the mine highway will be mining-related, collisions with project-related mine traffic will far exceed the high magnitude effect of significance where more than one grizzly bear is killed during the life of the Project as a result of mine-related traffic (March 2009 EIS / Application, Volume 5, Section 6.3.4.5). As noted, mitigation measures, including zero tolerance, will be largely ineffective.

Additionally, the three-fold traffic volumes proposed for the 50 km mine highway to Fish Lake are such that they will block access of some grizzly bears, especially females, that would migrate from the northeast side of the GBPU to salmon feeding hotspots along the Taseko and Chilko rivers. This would also affect survivability of the population.

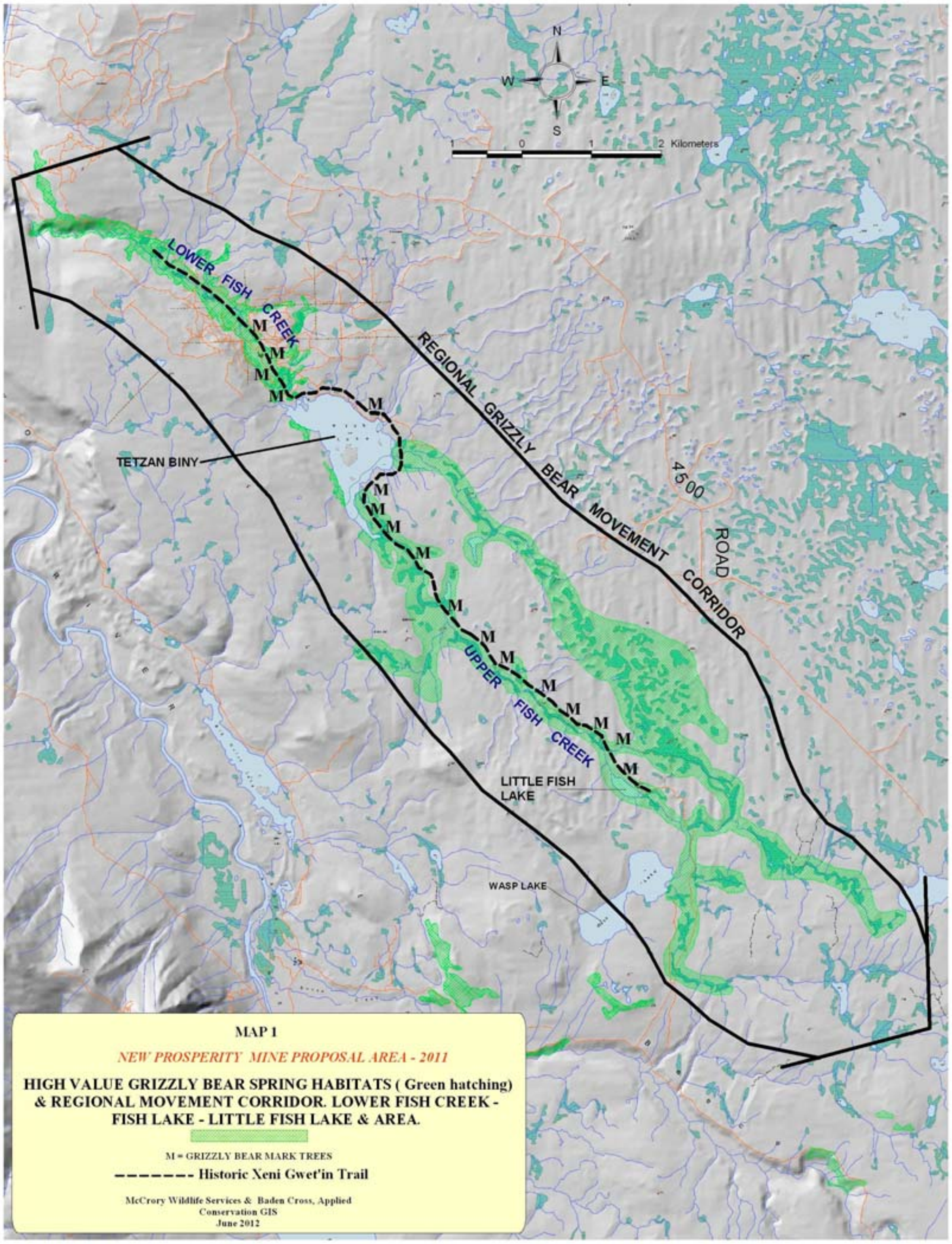
Most proposed mitigation measures other than garbage control will be largely ineffective in curtailing mortality from such a large mine and associated 50 km upgraded access road and transmission line. This includes the Grizzly Bear Mortality Risk Reduction Plan, which has not even been written. The province has made it clear to the Panel that it is not committed to a recovery plan; as well, the Conservation Officer Service (COS) has had severe cutbacks. Funding for the province's Bear Smart program has been curtailed such that there is barely any MOE conflict reduction involvement in the

Chilcotin except to deal with extreme situations. In addition, proposed monitoring by radio-collaring some grizzly bears in itself poses a threat from capture myopathy that negatively affects health and natural movement patterns of grizzly bears. In other words, the mine will create a mortality sink for the Chilcotin grizzly bear, a rare ecotype that is already on the brink of disappearance, and push it over the extinction threshold. The over-reliance of the Prosperity 2011 EIS on many proposed mitigation measures, which have not been proven to be effective in most circumstances, without over-riding strong endangered species legislation and long-term enforcement with respect to significant adverse cumulative residual environmental effects to grizzly bears, should not be accepted by the Panel. Where successful mitigation measures have been cited by Taseko, such as access management helping grizzly bears recover in the several endangered ecosystems in the continental US, it has also been because the US has strong federal endangered species legislation, large federal protected areas and national forests with core grizzly habitat, and adequate funding and staff to carry out and enforce mitigation measures over the long term. Such circumstances do not and will not exist in the near future on provincially managed lands in the BC Chilcotin.

A mother grizzly bear and two subadult cubs searching in autumn for whitebark pine nuts in subalpine habitat in the Xeni Gwet'in Caretaker Area. The area of the proposed New Prosperity Mine lies within a large core area of this threatened grizzly population, which is the last viable but threatened population of this unique ecotype that used to range from Tweedsmuir Park in BC to northern California. It is now extinct in the US, and very endangered south of the Taseko watershed. My analysis shows that New Prosperity will create significant adverse impacts to habitat and the remnant population, pushing the grizzly bears in the region over the extinction threshold as defined by Bascompte and Sole (1996). [Photo. S. Zirnhelt].

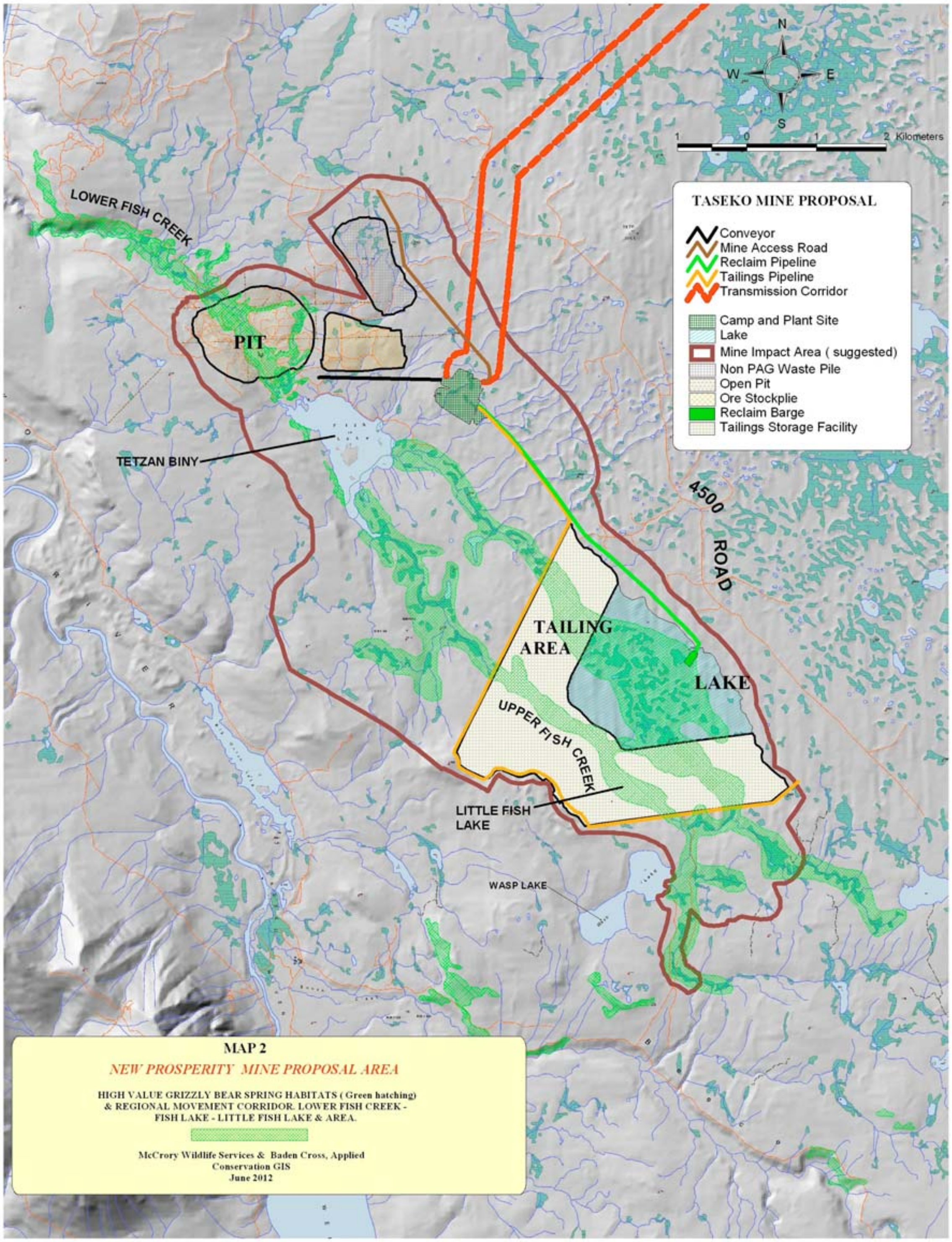


Map 1. Proposed New Prosperity mine area is situated within the Xeni Gwet'in aboriginal and Eagle Lake Henry wild horse preserve and on a cross-valley carnivore corridor between Tsy'los Provincial Park on the west, Nunsti Park on the north west, and Big Creek and Spruce Lake provincial protected areas on the east (light green). The cumulative impacts of this development will be such as to not only have an unmitigable significant adverse effect on survival of the threatened dryland grizzly bear population, but will affect the ecological integrity of approximately 2 million acres of protected areas that support such wide-ranging but vulnerable carnivore species, including the grizzly, grey wolf, Canada lynx, wolverine, and others. The associated major industrial road and transmission line, along with the mine itself, will function as a carnivore mortality sink.

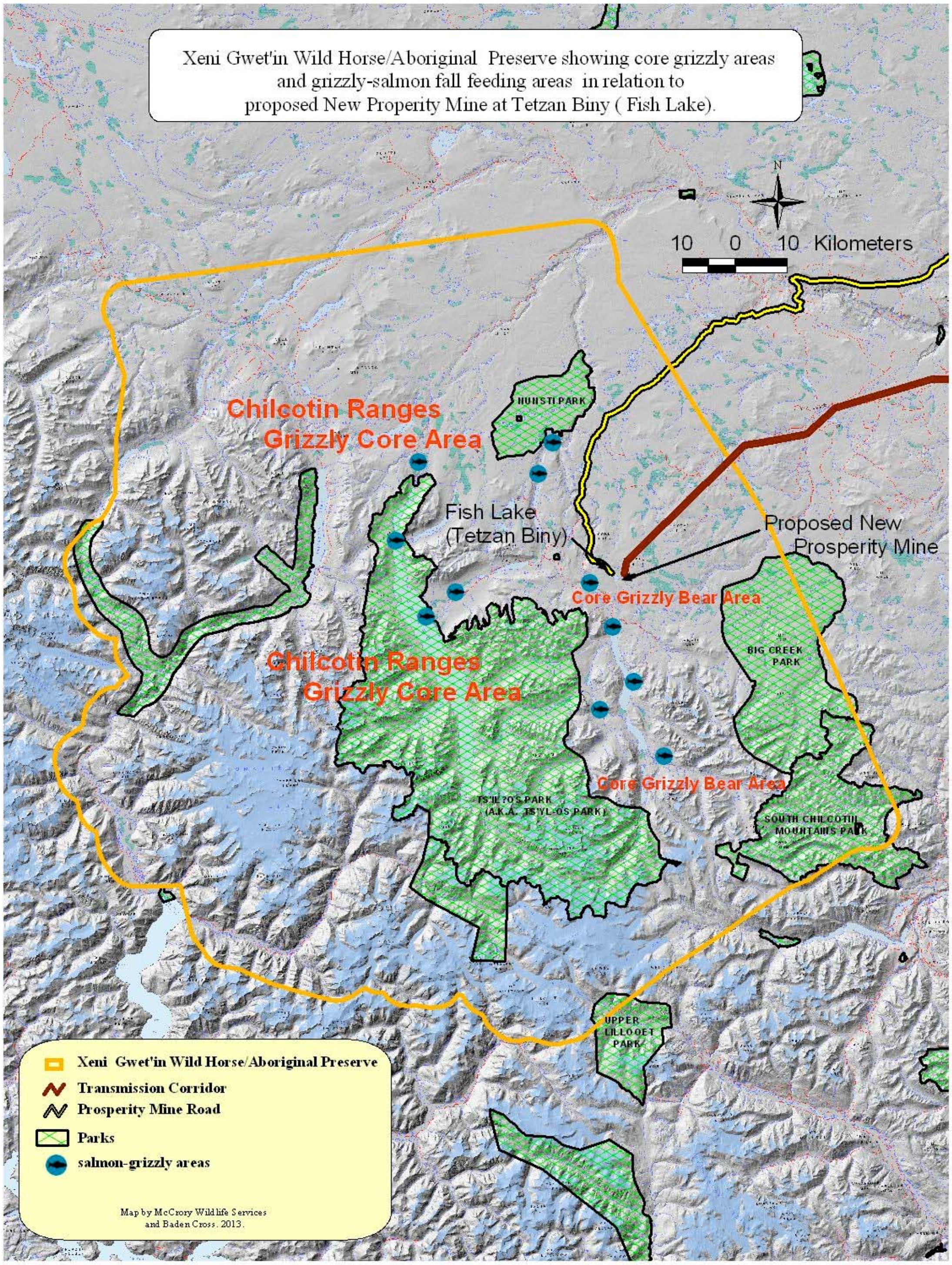


Map 2. The 17 grizzly bear mark trees (M) represent a high value movement corridor. High value grizzly bear spring habitat and the regional grizzly bear movement corridor in Fish Lake MDA, when combined with general loss of access to major spring rainbow trout feeding areas for an estimated 1/6-1/3 of the South Chilcotin Ranges GBPU, represents a significant adverse environmental effect. In addition, grizzlies attempting to move around the mine site by going north will experience some mortality from the traffic collisions on the mine road access highway.

Tributary and shallow trout spawning habitat (top) at s.e. corner of Fish Lake. Extensive grizzly bear feeding on trout was evident in late May as noted by tracks and fish remains along the edge (bottom). Fish Lake was identified as a very significant hot spot for grizzlies to feed on trout in spring-early summer.

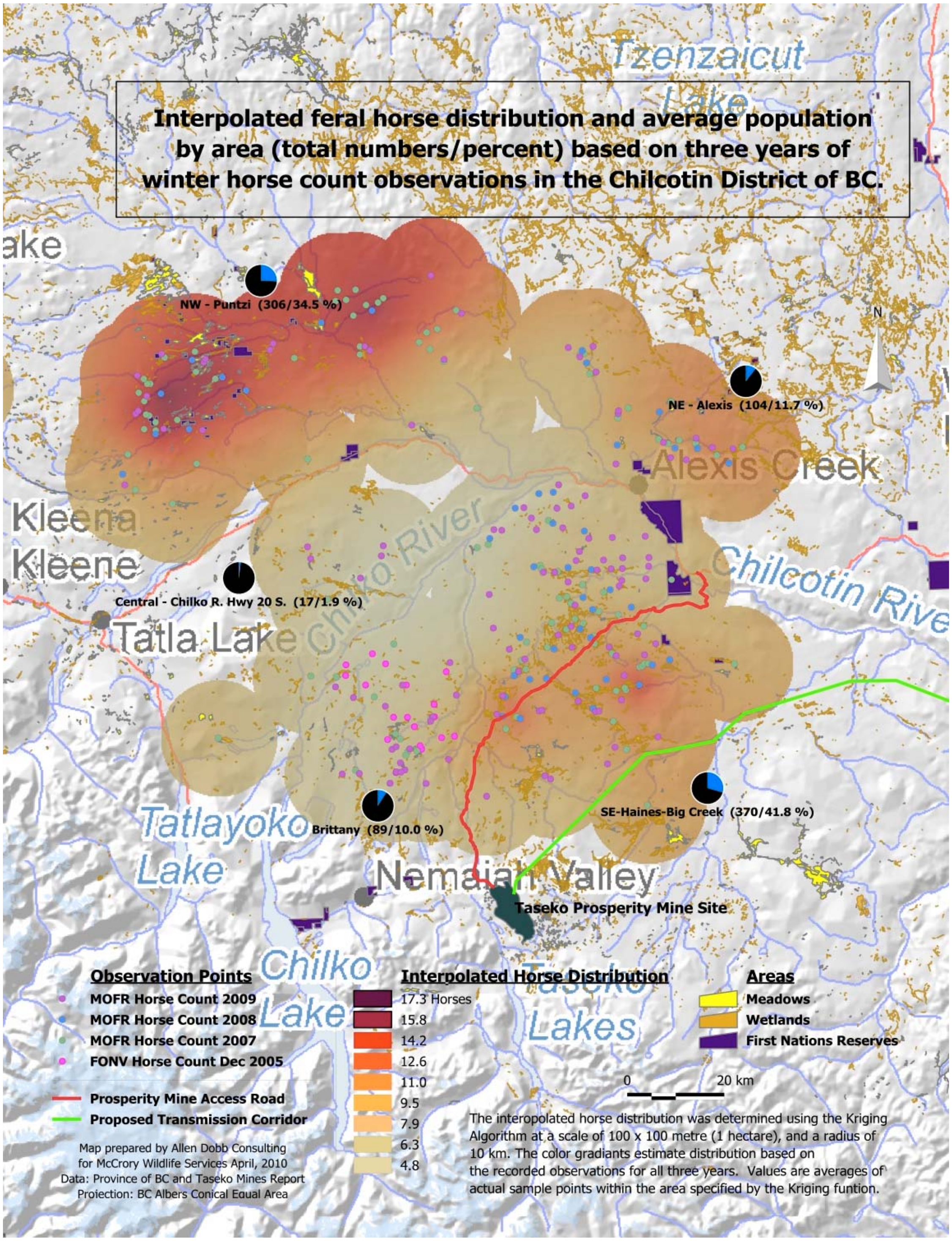


<u>Map 3.</u> Overlap of high value grizzly bear habitat with mine development. While Fish Lake will have some replica of its old self, with 40+ percent of trout-spawning areas lost to the mine development, it is expected that grizzly bears will still attempt to access this major spring food source with a high prognosis for conflict and traffic mortality.



Map 4 shows some of the main areas in the Taseko-Chilko watersheds where grizzly bears congregate to feed on salmon in the fall. For grizzly bears that migrate back and forth to these critical feeding sites from the northeast sector of the GBPU, mortality will be a reality from the New Prosperity mine highway. Some females will stop crossing the highway and be subject to nutritional stress.

Example of unreported grizzly bear mortality along a logging road on the BC coast, 2008. This bear was killed in a collision with a logging vehicle or was shot (W. McCrory Photo).



Map 5 shows wild horse distribution and numbers in relation to proposed upgraded New Prosperity Mine highway (red line). Once the road is improved and mine traffic volumes increase significantly, it is expected that road collisions with grizzly bears, wild horses, and other animals will increase significantly.

1.0 INTRODUCTION

In 2010, McCrory Wildlife Services Ltd. conducted an independent cumulative effects review (McCrory 2010) of the Environmental Impact Statement (EIS) prepared by Taseko Mine Limited (TML) for their proposed Prosperity Mine at Fish Lake. My report was submitted to the Canadian Environmental Assessment Agency (CEAA) panel as part of an intervener submission by RAVEN (Respecting Aboriginal Values and Environmental Needs) and labeled as Terrestrial Wildlife Component, CEAR reference number 09-05-44811.

In the CEAA Panel 2010 final report on the mine proposal, the panel accepted my findings that direct and indirect impacts of the proposed Prosperity Mine would push the already threatened Chilcotin grizzly bear population into extirpation. The panel also found other significant adverse impacts such that the federal government initially responded to the CEAA 2010 panel final report by turning down approval of the proposed mine at Fish Lake. Subsequently, TML re-named a previous mine option proposal, which did not entail draining Fish Lake, and submitted this old proposal as the “New Prosperity” mine proposal.

As a result, the federal government reversed its decision and announced that a second set of CEAA hearings would be convened, even though TML had admitted to the Prosperity panel that the option not to drain Fish Lake would have more severe environmental impacts than the previously reviewed option to drain it.

The about-face by the federal government, which announced a new round of CEAA hearings, produced a whole new set of challenges for First Nations, the public, and independent scientists who had been intensively involved in reviews to the Panel for the first Prosperity hearings. In particular, for grizzly bears, TML has provided much new information on grizzly bears in order to arrive at the same conclusions they did previously; i.e., that there would be no significant impacts on grizzly bears if proposed mitigation measures were implemented. I have been careful to objectively review and assess this new information and herein provide my own independent assessment and final conclusions.

Although I have focused on grizzly bears, I am also including information from looking more closely at several other focal species—including the Chilcotin wild horse and the northwestern toad—to determine if they would suffer adverse impacts if the mine were approved.

2.0 STUDY APPROACH

The general study approach is described in my previous TML review (McCrory 2010). Following is the approach I used to generate more detailed information on grizzly bears:

2.1 Background review: Expanded review of the scientific literature on grizzly bears, including conservation status

Dr. Brian Horejsi, an international expert on grizzly bears, assisted me with an expanded review of the scientific literature on the impacts of human developments on grizzly bears. Dr. Horesji also provided me with expanded background information on my review of TML’s road density analysis and proposed mitigation measures for grizzly bears. Biologist Maggie Paquet did additional background research for me on grizzly bears in the South Coast Ranges, including the Chilcotin Ranges, that helped me further expand the conservation perspective in this report.

2.2 Increased inventory of habitats, numbers, and movements of grizzly bears

2.2.1 Assessment of minimal numbers of grizzly bears that seasonally frequent the Fish Lake study area

During habitat surveys in May and September 2012, what appeared to be grizzly bear hair was collected from mark trees between Little Fish Lake and Lower Fish Creek in the meadows below Fish Lake. Small individual hairs or small clusters are often left behind caught in the bark when a grizzly bear stops to do its rubbing behaviour. Grizzly bear hair samples were numbered and placed in either plastic or paper bags. Samples were sent to the Wildlife Genetics International lab at Nelson BC for determination of bear species, gender, and individual DNA determination. DNA extraction methods are outlined by Wildlife Genetics International in Appendix 2 of this report.

The DNA results were combined with other field sign, such as track and scat data, to assess the approximate minimal number of grizzly bears using the Fish Lake area in spring, summer, and fall.

2.2.2 Assessment of minimal grizzly bear numbers that annually frequent the mid-upper Taseko and Fish Lake mine area and the Chilcotin Grizzly Bear Population Unit (GBPU)

I scrutinised previous and recent population estimates by the BC Wildlife Branch for the Chilcotin Grizzly Bear Population Unit (GBPU).

I used the Apps et al. (2009) DNA study for the South Coast Ranges to determine the approximate minimum number of grizzly bears that would range in the middle-upper Taseko Watershed and thus in proximity to Fish Lake. These numbers were determined by adding up the number of individual known identities of grizzly bears detected (Table A-9) in the Upper Taseko area of the grid map (Figure A-12) in the Apps *et al*. (2009) report. The results were then used to estimate the minimum numbers of male and female grizzly bears that would in all likelihood come in contact with the mine development and access road areas over the course of an average spring-fall grizzly bear active season.

2.2.3 Field surveys of grizzly bear habitats and their use in the Fish Lake study area

In May and September 2012, McCrory Wildlife Services, with the assistance of Xeni Gwet'in wildlife researchers, conducted detailed field surveys of grizzly bear habitats and their use in and around Fish Lake and between Little Fish and Fish lakes. This was supplemental to previous surveys described in my previous report (McCrory 2012).

Survey methods followed grizzly bear habitat evaluation methods originally developed by Hamer and Herrero (1983) for Banff National Park and later refined in various other studies I have done, including Kakwa Provincial Park (McCrory 1998; McCrory *et al.* 2004) and the Brittany Triangle biological surveys in the Chilcotin, not too far from Fish Lake (McCrory 2002).

During the 2012 spring field surveys in the Fish Lake area, we made a point of examining rainbow trout spawning areas, especially in small tributaries, to determine fish abundance and see if any grizzly bears were feeding on fish. This was supplemented by a literature review of grizzly bear feeding behaviour on cutthroat trout in Yellowstone National Park.

A GIS map (approx. 1:45,000 scale) was prepared of the important grizzly bear habitats between Little Fish Lake, Fish Lake, and the riparian meadows in middle Fish Creek for 1 km below Fish Lake.

2.2.4 Determination of grizzly bear/wildlife corridor movement values in the Fish Lake study area

The habitat map was used as the base map (approx.1:45,000 scale) to delineate the approximate riparian movement corridor between Little Fish Lake and the Middle Fish Creek riparian meadows just below Fish Lake. Since grizzly bear mark (rub) trees are a good index of bear travel/corridor values (McCrory *et al.* 2004), I documented 17 mark trees in the study area. These were added to the habitat map. Other evidence of bear travel, such as well-used wildlife trails and tracks, was used to identify movement values. This information, plus the evaluation of grizzly bear movements from the DNA studies locally and in the region, were combined to subjectively evaluate the extent and importance of the movement corridor and whether it was a localized or regional grizzly bear travel route, or both.

At the regional scale, three approaches were used to determine some grizzly bear movements and assess how they relate to grizzly bear use of the Fish Lake mine study area as a local and regional movement corridor:

1. Wildlife Genetics International used their DNA computer program to compare the individual grizzlies identified in our 2012 study in the Fish Lake area with 224 grizzly bears from Chilko River (Mueller 2008, 2012), and 399 grizzly bears from the South Coast dataset of Apps *et al.* (2009). I then used this information to ascertain some movement of Fish Lake grizzly bears to other areas.
2. Movements of individual grizzly bears across the landscape determined by Mueller (2008 and 2012) by comparing her DNA results with Apps *et al.* (2009).
3. Examination of individual movements in and out of the Mid-Upper Taseko Watershed using grizzly bear multiple locations detected by Apps *et al.* (2009). The Apps map (Figure 5-5) on coarse movements was used in conjunction with the description of multiple locations of individual grizzly bears to determine movements in and out of the Mid-Upper Taseko Watershed for male, female, and unknown gender grizzly bears.

These connectivity results were then used to evaluate the movement corridor values described in the New Prosperity 2011 EIS.

2.3 Assessment of Taseko Mine's New Prosperity EIS (2011)

To assist my evaluation, I prepared a map overlay by superimposing TML's New Prosperity "General Arrangement, Mine site" (Figure 2-3) map with my Fish Lake grizzly bear habitat/movement corridor map (1:45,000 scale). This gave a physical footprint evaluation of impact in the Mine Development Area (MDA).

Overall, my improved inventory information on conservation status, grizzly bear habitats and use, numbers, mortality, and movement corridors was used to independently assess the New Prosperity environmental impact statement.

3.0 RESULTS & DISCUSSION

According to the province's 2012 status report on grizzly bears (http://www.env.gov.bc.ca/soe/indicators/plants-and-animals/grizzly-bears.html?WT.ac=LU_Grizzly-status), "cumulative effects of human development is the greatest threat to Grizzly bears in BC; these effects impact bears in three main (often overlapping) ways":

1. Conflicts between bears and humans increase in frequency, often resulting in bears being killed or relocated;
2. Bear populations become isolated because of human settlements, agriculture, and utility corridors in major valley bottoms;
3. Habitat may be lost or degraded by development, alienated through bears' avoidance of humans and human activities, or fragmented (for example, by high density road networks with high traffic volumes).

I attempt to address these and other issues in my report within the framework of CEAA guidelines provided.

3.1 Part 1. Additional Grizzly Bear Baseline Inventory Information For The Teztan Biny (Fish Lake) Mine Study Area And The South Chilcotin Grizzly Bear Population Unit (GBPU)

3.1.1 Grizzly bear vulnerability and its value as an indicator species

The grizzly bear is a good indicator species. Caroll *et al.* (1996b) analyzed niche overlap for 410 terrestrial vertebrates in the central Canadian Rockies and found that by protecting the habitat needs of the grizzly bear, Canada lynx, and grey wolf, additional terrestrial species (98%) would also be protected. This means that if effective protective measures and good management are undertaken for grizzly bears, almost all other wildlife populations in the same area are automatically taken care of. Conversely, whatever happens to grizzly bear habitat will almost assuredly negatively affect habitats for the majority of all the other wildlife populations in the mine and transportation corridor footprint areas. This makes the grizzly tremendously useful for the Panel's understanding of wildlife habitat impacts caused by the proposed New Prosperity project.

A most important context in this regard is that the grizzly bear is one of North America's slowest reproducing mammals. Knight and Ebert (1985) note that when dealing with a small population of long-lived animals with a low reproductive rate, the population dynamics can be influenced by perturbations affecting age and sex structure. The ability of female grizzly bears to contribute to a bear population is limited by late sexual maturity (usually 5+ years), low survivability of the young (up to 50% mortality in the first year for cubs), and a 3-5 year non-breeding interval while the female raises her young. Female grizzly bears also peak in behavioural and reproductive maturity at 9 to 12 years (Craighead *et al.* 1995). Should a mother grizzly bear live long enough (at least 15-20 years), she will be lucky to contribute 4-5 offspring to the population. There is also some evidence that reproductive participation by male grizzlies is restricted to large and mature males (Craighead *et al.* 1995a). In the Arctic, reproduction by males may be confined to individuals nine or more years of age (Craighead *et al.* 1995b), although this may or may not apply to the BC Chilcotin.

The fraction of grizzly bears that do breed constitute what is known as the genetically effective population size (Horejsi 1999). The effective population size is estimated to be between 24-32% of the total number of bears in a population, although it may be lower where numbers are significantly reduced (Harris and Allendorf 1989), such as in the South Chilcotin Ranges. For example, for the subpopulation of 36 grizzly bears (based on the Apps *et al.* 2009 study) known to inhabit the mid-upper Taseko and that come under the strongest influence from the proposed New Prosperity development, the effective population size would only be 9-12 individuals.

This very slow reproductive cycle has made the species highly vulnerable to population declines and extirpation. Where remnant subpopulations still exist in relatively small numbers, such as in the peripheries of the South Chilcotin Ranges GBPU, recovery may take many decades and require drastic changes to existing land use practices and control of human-induced mortality if recovery, and not extirpation, is to happen at all. Population augmentation may be necessary in some cases to overcome genetic in-breeding from isolation caused by fragmentation and isolation from other healthy subpopulations. This was proposed in the North Cascades grizzly bear recovery plan for the areas south of Taseko near the US border (North Cascades Grizzly Bear Recovery Team, 2004) until the provincial government cancelled the entire recovery plan.

3.1.2 International, federal, & provincial conservation status of the South Chilcotin Ranges grizzly bear

3.1.2.1 International: International recognition of the vulnerability of British Columbia's grizzly bears includes banning the importation of any trophy grizzly bear parts into European Union (EU) countries

The South Chilcotin grizzly bear is also internationally important for the following reasons. The dryland grizzly ecotype is unique in the western Coast Mountains as it not only feeds on salmon, but, unlike its cousins in the adjacent coastal rainforests, also feeds on whitebark pinenuts and digs for wild potatoes and bear-claw. The grassland grizzly ecotype is now totally extirpated from a vast area of the Cariboo region on the east, is extinct along the lee of the coastal mountains in the continental US, with perhaps a few animals near the Canadian border, and is down to an estimated 23 animals in the BC North Cascades GBPU. Just to the north of this GBPU, using more precise methods, Apps et al. (2009) estimated the Stein-Nahatlatch GBPU was down to an isolated 23 individuals, rather than the 61 grizzly bears estimated by Austin et al. (2004). We would guess that perhaps half of the roughly 52 grizzlies estimated by Apps et al. (2009) to be remaining in the Squamish-Lillooet GBPU would occur in the dryland eastern portion.

From a continental perspective, a recent conservation review (Craighead and McCrory 2010) concluded that the Chilcotin Ranges grizzly bear is the last potentially viable population of grizzlies left in the dryland-grassland ecotype along the eastern fringes of North America's Coast Mountain Ranges and Cascade Mountains. The larger West Chilcotin grizzly bear conservation study area identified by Craighead and McCrory (2010) includes a small portion of the Klinaklini-Homathko GBPU, the Blackwater-West Chilcotin GBPU, and about half of the South Chilcotin Ranges GBPU. The 250 grizzly bears estimated in this region would be internationally significant. Despite the historic decline in the South Chilcotin grizzly populations, the conservation study by Craighead and McCrory (2008) showed that an area of viable grizzly habitat larger than the Greater Yellowstone Grizzly Bear Population Conservation Area (GYPCA) still exists along the west side of the Coast Ranges, their foothills, and partially onto the Chilcotin Plateau, ranging from the head of the Taseko River north-west to Tweedsmuir Provincial Park.

The GYPCA is 2,387,115 ha and is one of two grizzly bear populations in the continental US that have the potential to be viable in the short term (100 years). The GYPCA ecosystem is not only very large, but contains a high proportion (92%) of protected and roadless habitat that allows bears to stay alive in core security habitats. Unlike the GYPCA, some 46% of the greater Chilcotin grizzly bear conservation area was found to be already protected through a network of provincial parks and the Xeni Gwet'in aboriginal/wild horse preserve declarations (Craighead and McCrory 2010). Much of the Chilcotin grizzly area was also found to have moderate value grizzly bear habitat. The current protection is higher than most other grizzly bear regions of the province, but the study recommends that more core areas need to be protected. This is based on a comprehensive review of the number of grizzly bears required in a population for long-term viability by a panel of independent bear scientists (Gilbert et al. 2004). They concluded that some 68% of the habitat base must be protected, a higher percentage than previously expected. The Craighead-McCrory study also recommended that the province implement their planned grizzly bear recovery plan for the area.

3.1.2.2 Federal: Committee on the Status of Endangered Wildlife in Canada (COSEWIC)

COSEWIC lists the grizzly bear as a "Species of Concern." In 2002, COSEWIC warned that

> *The genetic and geographic continuity that currently prevents their identification as distinct population units is at risk... Preventing the slow northward migration of this line depends on active steps to conserve these insular and peninsular populations.*

When COSEWIC reassessed their status in 2012, these concerns were again emphasized:

> *A number of populations in the southern extent of its range in Alberta and southern BC are known to be declining, and their poor condition in some parts of the range, combined with their naturally low reproductive rates and increasing pressures of resource extraction and cumulative impacts in currently intact parts of the range, heighten concern for this species if such pressures are not successfully reversed.*

However, the federal government has so far failed to legally list the grizzly's "Special Concern" status under the Species-at-Risk Act, as recommended by COSEWIC. Gailus (2012) recommends that in the absence of provincial actions to protect BC's threatened grizzly bear subpopulations, the federal government should list the small and increasingly isolated grizzly subpopulations in southern BC under the safety net provision of the federal Species-at-Risk Act. By doing so, he felt this would provide the impetus for both federal and provincial governments to work together to ensure that all of Canada's grizzly bears remain a fundamental part of our natural and cultural heritage.

This failure of both the Canadian federal government and BC provincial government to implement adequate legislation and recovery plans for BC's dwindling grizzly bear populations means the South Chilcotin GBPU remains in a precarious and tenuous position and is extremely vulnerable to any further human-induced impacts, including increased mortality.

3.1.2.3 Provincial: Threatened status but no recovery plans

All 250 grizzly bears estimated in this Chilcotin dryland grizzly conservation area identified by the Craighead-McCrory report (2010) are under threatened status provincially.

The BC government still considers the grizzly bear as blue-listed (i.e., designated as "vulnerable"), while populations in nine of the 56 Grizzly Bear Population Units (GBPUs) are considered "threatened." Despite the recently revised BC Wildlife Branch population estimate that doubled the number of hypothetical grizzlies in the south Chilcotin Ranges GBPU, the South Chilcotin grizzly bear is still listed provincially as "threatened" (Tony Hamilton pers. comm.). Loosely, this means that the estimated population is still 50% or less below the habitat capability, which is the number of animals that the habitat could support under optimal conditions (Austin *et al*. 2004).

A goal of the 1995 British Columbia Grizzly Bear Conservation Strategy (GBCS) is to recover the threatened subpopulations to viable status. None of this has happened over the past 18 years. The province has yet to implement a recommended grizzly bear recovery plan for all of the threatened GBPUs in the South Coast Mountains except for one for the North Cascades GBPU in 2003 that, unfortunately, was cancelled by the Ministry due to controversy over a plan for population augmentation. Nor has British Columbia enacted stand-alone provincial Endangered Species legislation so that threatened grizzly bear subpopulations can be legally protected and recovered.

The southern portion of the South Chilcotin Ranges GBPU, south of the Taseko, lies within the Upper Lillooet area and was included in the province's 2008 Sea-to-Sky Land and Resource Management Plan (LRMP). The final plan directed that the province complete a recovery plan/strategy for all four threatened GBPUs (Squamish-Lillooet, Garibaldi-Pitt, South Chilcotin Ranges, Stein-Nahatlatch) (BCFLNRO 2008, p 77). Despite this having provincial Cabinet level and First Nations endorsement, five years later, recovery planning for grizzly bears has yet to be implemented (C. Ruddy *et al*. 2012 letter to BC government).

As for the South Chilcotin Ranges GBPU, the province recently indicated in a letter to the CEAA Panel that it had no commitment to implement a grizzly bear recovery plan for the South Chilcotin Ranges GBPU. It is, therefore, misleading of the TML 2011 EIA to claim that the province will be developing a recovery plan for the South Chilcotin Ranges GBPU when so much time has gone by without them even committing to one. A recent letter from the province to the CEAA Panel (June 14, 2013, Reference 103165) states that the Ministry of Forests, Lands and Natural Resources Operations (FLNRO) had the following comment on "Responses." This would be in reference to TML's EIA claims that: *It should be noted that the South Chilcotin GBPU has no grizzly bear recovery plan, although a recovery plan will be developed for the GBPU.* FLNRO notes that: ***its understanding is that there has been no commitment by the provincial government to undertake a grizzly bear recovery plan in the South Chilcotin GBPU.***

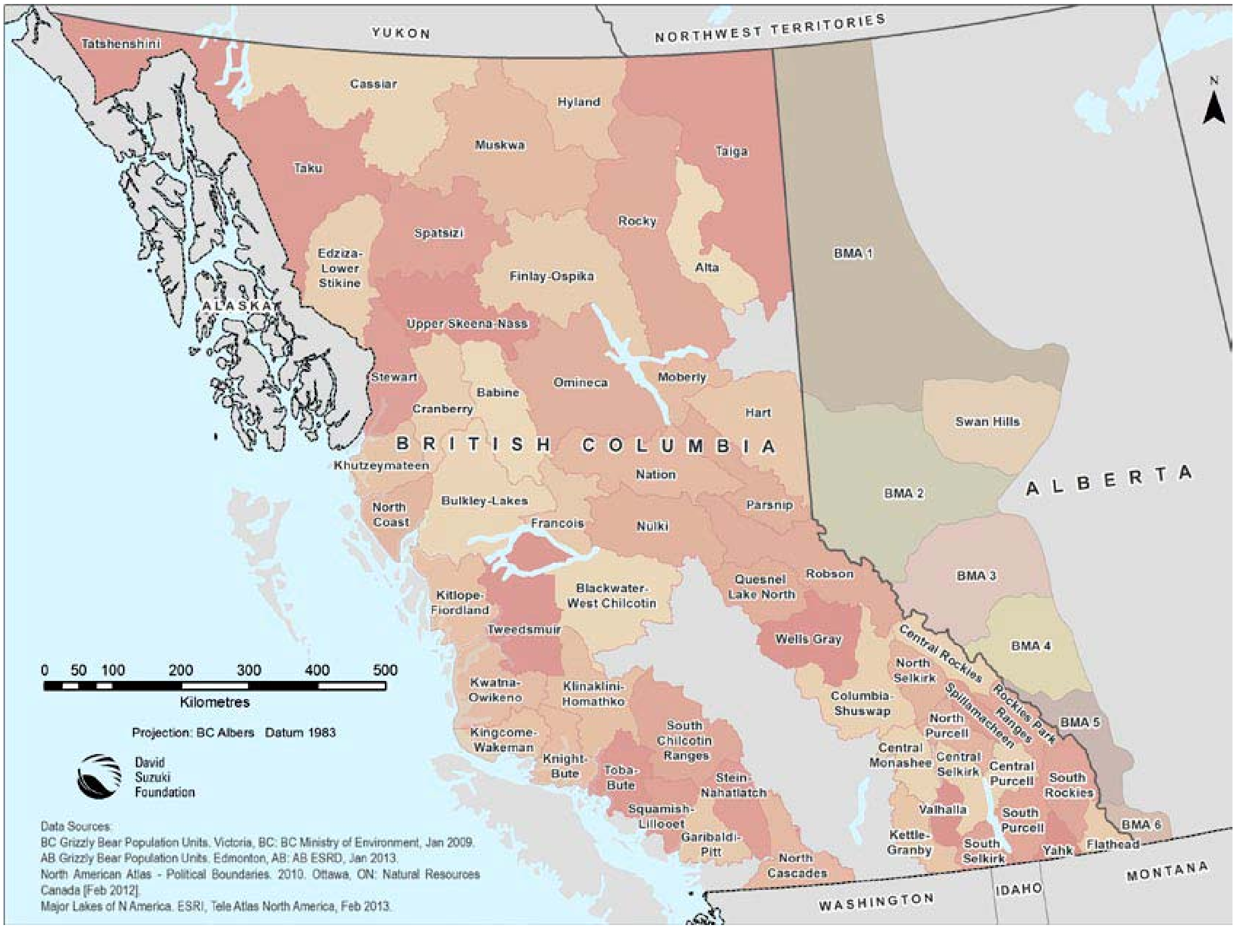
The provincial conservation status of "threatened" means the population estimate is <50% of carrying capacity. The total size of the population unit is 1,620,065 ha (16,201 km^2) with an estimated 15,220 km^2 of usable habitat (or 95% of the total area). In 2003, some 23% of the GBPU has a road density >0.6 km of roads/km^2. http://www.env.gov.bc.ca/soe/indicators/plants-and-animals/grizzly-bears.html?WT.ac=LU_Grizzly-status.

3.1.2.4 Ancestral grizzly bear landscapes revealed by genetic analysis of South Coast Mountains grizzly bears (Apps et al. 2009)

A recent hair-snagging and DNA study (Apps *et al*. 2009) of grizzly bear abundance, distribution, connectivity, and conservation across the Southern Coast Mountains of British Columbia, which included some information on the Taseko-Chilko and South Chilcotin Ranges areas, found 272 individual grizzly bears in nine genetically discrete population clusters. One such discrete cluster is in the South Chilcotin Ranges. The cluster arrangement indicated ancestral landscapes, with little human access, now separated by human activity and physiographic features that are likely to inhibit grizzly bear movement and survival. (The South Coast Ranges study area has four of the eight threatened GBPUs identified in the province.)

Additionally, the study concluded that the Taseko-Chilko group might originate from a relatively small and isolated ancestral population between Taseko and Chilko lakes (p.57).

For regional population recovery and conservation, their results and spatial outputs are focusing efforts to re-establish and maintain population core, peripheral, and linkage landscapes. In particular, their study demonstrated the importance of secure source areas in population recovery, and expansion to peripheral but connected landscapes. **In my opinion, grizzly bears in the mid-upper Taseko would help serve as a major source population for recovery of these smaller grizzly groupings in the south that are on the verge of winking out, provided the core habitat Upper Taseko core population is maintained at its current roadless status, without further mining and logging incursions. The New Prosperity proposal is a serious threat to this recovery possibility.**



Map 6. Grizzly Bear Population Units (GBPUs) and conservation status. The proposed New Prosperity Mine lies in the northeast sector of the South Chilcotin Ranges GBPU, which is provincially threatened. [David Suzuki Foundation].

3.1.3 Grizzly bear population estimates for the South Chilcotin Ranges GBPU and estimated numbers of grizzly bears that would come under the influence of the New Prosperity development seasonally and annually

The GBPU has 100-200 grizzly bears, based on questionable estimates. Based on field information, I estimated 15-20 grizzly bears would use the Fish Lake "hotspot" habitat activity centre for feeding on spawning trout and vegetation in the spring and, based on available hair-snagging DNA inventory, some 36 grizzly bears would come in contact with the mine development and/or main access highway on an annual basis. In other words some 7-20% of the total population would be displaced from critical spring habitat and some 18-36% would come under the influence of the mine development in the course of a year. Since this would have a strong mortality and nutritional displacement influence on the Effective Population Cohort (breeding component), the cumulative impacts represent the CEAA definition of immitigable significant adverse effects.

3.1.3.1 Ministry grizzly bear population estimates

The Fish Lake mine study area includes the northern portion of the South Chilcotin Ranges GBPU. According to the province's 2012 grizzly bear status report, the South Chilcotin Ranges GBPU has an estimated population of 203 grizzly bears, based on inventory data. The estimated population density is 13 grizzly bears/1000 km^2. Since my previous 2010 report to the CEAA Panel, the Wildlife Branch has doubled their population estimate for the GBPU from 104 bears estimated by Hamilton (2008). This increase does not reflect an increase in actual numbers but uses new and more detailed inventory information to estimate population size. According to provincial biologist Tony Hamilton (email June 26/13), the rationale for increasing the population estimate for this GBPU was the application of densities from the most recent DNA projects in the Wildlife Management Unit.

Based on my extensive knowledge of the northern part of the GBPU, the increased population estimate is questionable. Whether the actual resident population of grizzly bears in the South Chilcotin Ranges GBPU is now 203 animals is still a matter of conjecture, in my opinion. Although Apps *et al.* (2009) found higher densities than they expected in the southern part of the South Chilcotin Ranges GBPU, **they expressed caution about extrapolating to other areas of the GBPU**. For example, much of the logged northern portion would have a very low density. The south portion of the South Chilcotin Ranges GBPU in the Bridge-Seton area has an estimated population of 53 grizzly bears based on the Apps et al. (2009) DNA study (Fish and Wildlife Compensation Program. 2011).

Certainly the Apps *et al*. 2009 DNA inventory did detect a total of 36 different grizzly bears in the mid-upper Taseko in 2007, and Mueller did detect a total 168 different individual grizzly bears at her hair-snagging plots below the outlet of Chilko Lake between 2006-2011. In both of these instances the numbers would reflect seasonal concentrations and include a cohort of grizzly bears whose home ranges include areas outside the GBPU and, therefore, are not a true representation of population numbers. For example, 16 of the bears she detected came from the headwaters of the Southgate Watershed on the coastal side of the mountains within another GBPU. Certainly the field surveys we did at Fish Lake in the spring and the DNA hair sampling showed the presence of grizzly bears that would reflect the higher MOE population estimate. However, a decade of field monitoring surveys of grizzly bear observations in the Brittany Triangle-Nunsti Provincial Park and Nemiah Valley reveal a pattern of consistently low numbers suggesting the density in these core areas is likely even below the lower GBPU population density by the Ministry. This further suggests the revised population estimate is questionable and the actual population might be 100-150 grizzly bears at the outside.

For example, in 2001 and 2002, nine remote camera stations in Nunsti Park-Brittany Triangle did not detect one grizzly bear in 365 trap-nights, while tracks and several sightings yielded a total estimate of 4-5 grizzlies present (McCrory (2002). Similarly, during the six weeks of Xeni Gwet'in trail inventory (McCrory 2009) in the Nemiah Valley, northern portion of the Brittany Triangle, and Yohetta Creek, we observed no grizzly bears in the field and detected only one grizzly bear at a remote camera station set up for over a month. In 2013, wolf researcher Sadie Parr (pers. comm.) spent six weeks accounting for 350 km of transects (some repeat areas) doing transects in the Nemiah Valley and Nunsti Park-Brittany Triangle and saw only four grizzly bears.

Three of only 4 grizzly bears observed in 6 weeks of field transects in Brittany Triangle-Nunsti Park-Nemiah Valley in May-June, 2013, representing a consistent observation of very low population numbers over the past decade in this core area. The nearly grown subadults will likely be separated from the mother come mating season, representing the kind of slow grizzly bear population increment that appears not be increasing the population [Photo: Sadie Parr].

3.1.3.2 DNA studies show that high numbers of grizzly bears from an area larger than the GBPU gather at Chilko River salmon areas

The Chilko River near the outlet from the lake bearing the same name has large runs of salmon, including an average of 1.7 million sockeye salmon annually (McCrory 2002). This attracts a large number of grizzly bears from over a large area. The DNA study by Mueller (2008) detected 119 different grizzlies using the combined Tatlayoko and upper Chilko River sections of the Xeni Gwet'in Caretaker Area (XGCA) in fall 2007. The results were from hair-snagging stations in the fall. These numbers represent seasonal aggregations of grizzly bears feeding on the high numbers of Pacific salmon that migrate and spawn in these areas. During the 2011 sampling period, the same researcher (Mueller 2012) detected 80 individual grizzly bears (46 females, 34 males) using approximately 20 km of the upper Chilko River; 38 of these were recaptures (detected in previous years of study). She also compared individual grizzlies for each year with neighboring DNA studies. To date, 12 individual bears were also detected in the South Chilcotin between 2006 and 2007, and 16 bears were also detected in the headwaters of the Southgate Watershed on the coastal side of the mountains. This data indicates that grizzly bears occasionally travel between the coast (upper Southgate and Bute Inlet) and the upper Chilko for salmon.

Over a longer period (2006-2011 excluding 2009), the same researcher detected a total of 168 different individual grizzly bears in the same area of the upper Chilko River during the salmon season, for an average of 55 grizzly bears per year. However, as this number represents a seasonal aggregation that draws grizzly bears from the South Chilcotin and from Southgate-Bute Inlet on the coastal side, it does not actually tell us the population status of the South Chilcotin Ranges grizzly bear subpopulation today; i.e. those grizzlies whose home ranges lie entirely in the South Chilcotin Ranges GBPU and are therefore resident, and those that move in when salmon are spawning as part of a temporary seasonal aggregation.

3.1.3.3 Estimated minimum number of grizzly bears within the mid-upper Taseko Watershed that would come under a direct Zone of Influence of the Fish Lake Mine

I used the Apps *et al.* (2009) DNA study to determine the approximate **minimum** number of grizzly bears whose hypothetical home ranges would include the Fish Lake mine study area and therefore be within a reasonable realm of the direct Zone of Influence (ZOI) of the mine operation and associated access roads. Using the total number of individual known identities of grizzly bears detected (Table A-9) in the mid-upper Taseko area of grid Map (Figure A-12), a total of 36 grizzly bears were detected between June 7 and July 20, 2007.

This means that in the six-week period of late spring and early summer of 2007, there were 19 females, 14 males, and 3 with unidentified gender using the mid-upper watershed (Table 1). I consider the presence of this many grizzly bears significant but also reflective of the high quality nearly roadless core habitat in the mid-upper Taseko, including numerous wetlands, productive subalpine meadows, extensive whitebark pine stands, and significant salmon runs.

The 36 individual grizzlies using the mid-upper Taseko within the zone of influence of New Prosperity is also significant when considered in the regional context. Although a small sample area of the total South Chilcotin Ranges GBPU, this number represents over 1/3 of the previous population estimate for 100 bears for the GBPU, and 1/6 of the revised estimate of 203 grizzlies. This number also represents 7.5% of the entire South Coast Mountains DNA study area of 40,000 km^2.

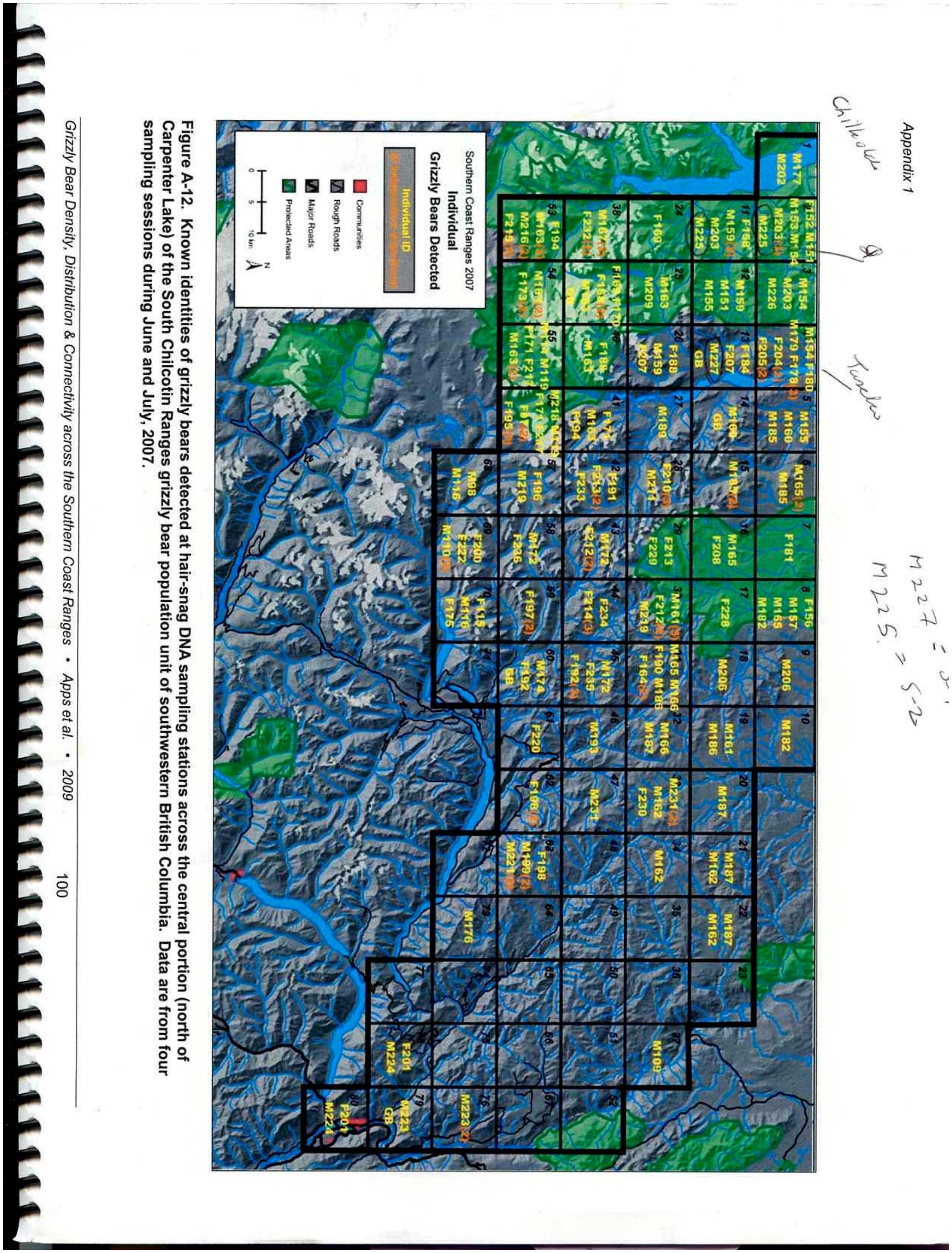
It is very likely that all or most of the 36 grizzly bears detected in 2007 by the Apps et al. (2009) study would have home ranges that would put them in annual contact with the proposed New Prosperity mine development and portions of the improved access road and transmission line, particularly as this is strong evidence that the Teztan Biny (Fish Lake) area attracts a portion of the regional grizzly bear population to feed on spawning rainbow trout.

This information is relevant because, should the mine development proceed, this would put a significant number of the South Chilcotin GBPU bears at high risk of coming into conflict with the mine operation as well as being exposed to increased mortality from traffic strikes on the improved (paved) industrial highway to the mine road; as well as increased human-conflict control kills from hunters and others using the improved access and visibility provided by the transmission line corridor.

Table 1. Number of individual grizzly bears in Upper Taseko Watershed based DNA hair detections from June 7 and July 20, 2007, derived from Apps et al. (2009)

Grid Plot #	# Males	# Females	Unknown gender	Total # Individuals
4	2	4	0	6
5	3	0	0	3
6	1	0	0	1
7	0	1	0	1
12	2	0	0	2
13	1	2	1	4
14	0	0	1	1
15	0	0	0	0
16	0	1	0	1
25	2	0	0	2
26	0	1	0	1
27	1	0	0	1
28	1	1	0	2
29	0	2	0	2
39	1	3	1	5
40	0	0	0	0
41	0	2	0	2
42	0	2	0	2
TOTAL	14	19	3	36

[Note: Table A-9 on p. 95 says 2 females (F188 and F97) vs. Figure A-12 on p. 100 says 1 female (F188)]



Map 7. From Apps et al. (2009) DNA study showing grids for hair snagging for DNA analysis. We used the grids for the mid-upper Taseko to determine that 36 grizzly bears used the area in June-July 2007.

3.1.3.4 Assessment of minimal numbers of grizzly bears that seasonally frequent the Fish Lake study area

During the late May 2012 field surveys, grizzly bear sign was common between Little Fish Lake-Fish Lake and for 1 km below Fish Lake (see habitat section). A grizzly bear was also sighted on the road between Fish Lake and the Taseko Lake access road. We collected 13 hair samples from different mark trees between Middle Fish Creek and Little Fish Lake. Unfortunately, only two of the samples produced results as DNA had deteriorated in the others due to either storing them wrongly in plastic bags or because the hair had been on the trees for a long time. The samples showed two different male grizzlies. We suspect these were from bears that recently used the mark trees as fresh tracks and scuffing were observed at each.

Overall, considering that we sampled only a lineal transect for the 8.5 km length of riparian habitat (generally following the old Xeni Gwet'in and wildlife trail) and therefore missed large areas of adjacent wetland and other habitat (including much of the tributary trout spawning habitat), I estimate from a combination of field sign and DNA results that there were 5-10 grizzly bears using the main core area we sampled in late May, and most likely 15-20 using the Fish Lake area over the spring season.

Due to the poor DNA results in May, I decided to resample grizzly bear hair from the study area. In mid-September 2012, a second bout of hair collection was done from most of the same mark trees between Fish and Little Fish lakes. No samples were taken from mark trees just below Fish Lake. Since all of the older hair was picked off in the spring, all 12 hair samples were assumed to have been deposited since the late May 2012 sampling period. The samples showed that at least two male grizzly bears used the mark trees in the area. These were different bears than detected in Middle Fish Creek in May, for a total of four different DNA-supported grizzly bear detections in 2012. One male grizzly bear (S-4) was found to have used four mark trees along the trail between Fish Lake and Little Fish Lake between late May and mid-September 2012, including the mark tree just north of the homestead cabins at Little Fish Lake. However, in mid-September, there was very little evidence of grizzly bear use in the area. Most likely most of the bears had moved to salmon areas to the west. The low fall grizzly use of the Fish Lake area also matched the low-moderate habitat capability observed for that season. However, late fall use would most likely increase post-salmon.

These small seasonal sample efforts over a small portion of the Fish Lake study area support my opinion that the Fish Lake study area is part of a significant core area for grizzly bears in the mid-upper Taseko Watershed. It is very likely from the evidence gathered that, based on the 36 grizzlies estimated in the mid-upper Taseko from the Apps *et al.* (2009) study, some 30-40 grizzlies would use the Fish Lake study area during the course of the year for feeding and travel. This would amount to about 1/3 of the total numbers in the GBPU if we accept the former population estimate, and 1/6 if we accept the recently revised one. Either way, a significant portion of the grizzly bears in the GBPU would annually come under the negative influence of the New Prosperity Mine development.

3.1.4 Baseline levels of grizzly bear mortality in the Chilcotin Ranges GBPU

3.1.4.1 Mortality from legal hunting

There has not been a legal grizzly bear hunt in the Chilcotin Ranges GBPU area since 2004 (Tony Hamilton pers. comm.). The BC Wildlife Branch's grizzly bear mortality history database from 1976 to 2011 lists only two grizzly bear mortalities, a female killed legally in 1977 and a male killed illegally in 1983 (http://www.env.gov.bc.ca/soe/indicators/plants-and-animals/grizzly-bears.html?WT.ac=LU_Grizzly-status). I do not believe this is an accurate record of reported mortality during this period, nor has the document been updated to reflect recent reported non-hunting mortality in the South Chilcotin Ranges GBPU.

3.1.4.2 Human-caused grizzly bear mortality based on reported and unreported causes (control situations including livestock, conflicts with hunters, and roads): 2001-2012

Grizzly bear mortality information was derived from a number of sources. Using the best information available, I estimated the total human-caused mortality for the GBPU to be 36-40 grizzly bears for the 12-year period 2001-2012, or an average of about 3.0-3.3 per year. Since approximately half of the reported kills were adult females, the kill rate would average about 1.5 females per year.

In this discussion, I loosely interpret "reported" grizzly bear mortality to be kills reported by the Ministry of Environment and Conservation Officer Service, or from other reliable sources. "Unreported" refers to mortality that is not reported to anyone. The following <u>reported</u> grizzly bear kills for the northern portion of the South Chilcotin Ranges GBPU were obtained from several other sources. Some were first documented in my 2010 Prosperity review report. New reported mortality information for 2010-2012 has been added for only the northern portion of the GBPU. This was obtained from the COS (Len Butler, pers. comm.), as well as from reliable but confidential sources, including a guide-outfitter. Because I was unable to obtain mortality information from the Bridge-Seton-Lillooet area of the GBPU south of the Taseko, the mortality information represents only a portion of the reported and unreported mortality data.

While the data is still incomplete in terms of overall mortality, during the 2001-2012 period, 13 grizzly bears were reported killed in the northern area of the GBPU, mostly in conflict situations. Although not confirmed, a mother grizzly bear and cub were reported to the COS as killed by a logging truck on the Taseko Road. I am accepting this as a reported mortality for purposes of my analysis. [In 2012, a mother grizzly and 2 cubs, which had become habituated to a ranch situation in the Nemiah Valley, were treated non-lethally by the COs and have not been a problem since].

Following is the mortality information obtained for the northern sector of the GBPU:

<u>2001</u>: 3 grizzly bears (female and subadults?) destroyed at Alexis Creek for killing calves (Chris Schmidt, BC Wildlife Branch, Alexis Creek, BC. Pers. comm. to David Williams. See McCrory 2002).

<u>2004-2009</u>: Tony Hamilton, pers. comm. 4 grizzlies destroyed as follows:

- 2004. Conflict kill, female, BC MOE Management Unit (MU) 5-4, Mud Creek fields
- 2007. Conflict kill, male, Big Creek (livestock likely issue)
- 2007. Conflict kill, male, MU 5-4, on Chilko River
- 2009. Conflict kill, female, MU 5-05, Chilko Lake

<u>2004-2009</u>: Confidential sources, 2-3 grizzlies killed by locals (mother grizzly with one or two young)

- A mother grizzly bear and at least one young were shot by a local First Nation resident in the Nemiah Valley due to conflict with attractants at a ranch residence. About 2005. (Confidential but reliable communication to Wayne McCrory).

<u>2010-2012</u>: 4 grizzlies killed, although 2 were unconfirmed. (Conservation Officer Len Butler, pers. comm, email, July 11, 2013) as follows:

- 2010. Road mortality. Unconfirmed female grizzly bear and cub killed by logging truck on the Taseko Road.
- 2012-05-09. Conflict kill. 1 adult male grizzly killed due to predation on cattle in Big Creek area.

- 2012. Non-lethal treatment. An adult female and 2 cubs habituated to a ranch situation in the Nemiah Valley were successfully treated with hard release.
- [2012-07-20. Conflict kill. 1 adult female grizzly killed at Anahim Lake dump due to aggressive behaviour. As this was not in the South Chilcotin Ranges GBPU, I did not include it].

<u>2010-2012</u>: Reliable confidential source. 1 grizzly bear.

- A grizzly bear was shot by a local First Nation as it swam across the Chilko River near Henry's Crossing as it was a perceived threat to people with fishing camps in the vicinity (Confidential but reliable communication to Wayne McCrory).

During the same period, information on the following additional grizzly kills were provided to me by a guide-outfitter who lives in the area but wished to remain anonymous:

- 1 grizzly bear shot and left on the Chilko River between Linfield and Canoe Crossing (may be a repeat of the above kill information?)
- 2 grizzlies shot by a lodge owner along the Chilko River due to harassing a pig.
- 1 grizzly shot by a lodge owner along the Chilko River.
- (3) Grizzly bear female and cubs shot in rancher's field in Tatlayoko Valley.

This data represents a total of 19-20 grizzlies known to have been killed between 2001-2012 by human causes in the north sector only of the South Chilcotin Ranges GBPU. At least seven of these were adult females.

At the time of writing my report, I was unable to obtain mortality data for the southern portion of the GBPU. However, mortality in this area is reported to be high due to human-bear conflicts (Fish and Wildlife Compensation Program 2011). Given that Apps et al. (2009) estimated 53 grizzlies for the south portion, or about 25% of the total revised population estimate for the GBPU, I am conservatively estimating another five grizzly bears would have been reported killed over the same 2001-2012 period for a total for the GBPU of 24-25 grizzly bears.

I then used two approaches to estimate the unreported kills that include conflicts with hunters (3S = "shoot-shovel & shut-up", kills by ranchers, road strikes, and others. Austin *et al.* (2004) estimated that unreported human-caused grizzly mortalities are believed to be positively correlated to hunter density. However, this is likely only partly applicable to the South Chilcotin Ranges since so many of the reported conflicts are with cattle-ranching operations.

I loosely applied the telemetry findings of McLellan *et al.* (1999) of one grizzly reported killed to one grizzly killed but not reported and estimated that there would have been at least an additional 20 grizzlies killed in the GBPU in the same 12-year period. Alternatively, using the Austin *et al.* (2004) estimate of a 0.8% unreported mortality rate for the South Chilcotin Ranges GBPU, this would mean another 16 unreported kills out of the revised population estimate of 203 grizzlies.

Total human-caused mortality for GBPU for the 2001-2012 period was estimated to be 36-40 grizzly bears, or an average of about 3.0-3.3 bears per year. Since approximately half of the reported kills were adult females, the kill rate would average about 1.5 females per year.

I consider my annual human-caused mortality estimate conservative and suspect from anecdotal reports that total mortality could be at least twice the average annual amount. The problem is, we really don't know. For example, I did not include the extrapolated road kill information derived in the next section since it was assumed to be included in both the McLellan et al. (1999) and Austin et al. (2004) estimated formula for unreported kills. As noted further, provincially, vehicle and train collisions have accounted for 0.9% of the total provincial grizzly bear mortality. Loosely applied to the GBPU, grizzly bear road kills as part of the unreported mortality could be as high as 5-10 annually.

Although the estimate of acceptable human-caused mortality in grizzly bear populations varies between experts, for a threatened grizzly bear population such as the South Chilcotin Ranges, grizzly bears likely cannot sustain induced mortality of greater than 4% if recovery is the management objective (Horejsi 1999).

If one accepts the previous MOE South Chilcotin Ranges GBPU population estimate of 100 bears, then the population is already teetering on the brink. If one accepts the revised estimate of 203 bears, there may be a bit more resiliency. However, since I consider my estimate conservative and perhaps half of the real man-caused mortality, such as in years of poor salmon returns combined with poor berry crops, then by applying the precautionary principle, the population could still be at or over the extinction threshold as described by Bascompte and Sole (1996).

3.1.4.3 Comments on grizzly bear road kills

My observations after eight years of travel to do wildlife research in the Xeni Gwet'in Caretaker area is that the Whitewater/Taseko Road currently is a "bush road" often with little traffic, even in the summer, and travel is slow. In my last 10 years of doing research in the Xeni Gwet'in Caretaker Area, I have never seen a bear road kill, although recently a horse was reported hit, and I have seen a wolf and a wild horse that were indiscriminately shot within 1/2 kilometre of the road. The current rough state of the road provides a natural type of speed control that limits collisions with wildlife and wild horses. In my Xeni Gwet'in Access Management Plan (McCrory 2005), I concluded that: *current levels of access roads, such as in the Nemiah Valley, north end of Chilko Lake, Tsuniah Road, and Taseko Lake are likely not having any significant impacts on grizzly bears, although some habitats near these roads might not be used by grizzly bears at certain times of the year.*

The BC Highways Engineering Branch instituted a wildlife accident reporting system in 1998 along with the Insurance Corporation of BC assembled a wildlife accident database (Kognaow 1955). I also reviewed the maps in my possession of reported "bear kills" from 1990-1999 (BC Wildlife Branch-Research and Conservation Section) that were derived from the Highways database. Unfortunately, the maps do not separate black bear and grizzly bear kills. The map had no kill locations from 1990-1999 for the Taseko/Whitewater Road because kills are not recorded by the Ministry on secondary roads.

Provincially, the reported grizzly bear mortality rate due to vehicle and train collisions was 0.9% for the period from 1978 to 2003 (Austin and Wrenshall, 2004). If the provincial average were applied to the South Chilcotin Ranges GBPU, vehicle collisions would account for about 1 grizzly per year at the old population estimate of 100 grizzlies, and about 2 per year for the revised population estimate. It is estimated that reported kills by traffic represent about 20% of those killed on roads because of lost data, bear remains being removed by predators, remains being covered by snow, ice, or vegetative debris; and data collection errors and omissions (BC Wildlife Branch-Research and Conservation Section Map for bear kills, 1990-1999). This being the case, reported and unreported grizzly bear road kills for the overall GBPU could be as high 5 and 10 annually, depending on what population estimate one accepts.

3.1.5 Grizzly bear mortality predicted from New Prosperity

For purposes of the EIS analysis, it should be noted that a high magnitude effect is considered significant where more than one grizzly bear is killed during the life of the project as a result of collisions with project-related traffic (March 2009 EIS/Application, Volume 5, Section 6.3.4.5).

Although the 2011 EIS acknowledges direct mortality risk from the mine development (p. 1092), no attempt was made to estimate mortality during the life of the mine.

I used the best information available, including an assessment of mine site habitat values and grizzly bear numbers, local knowledge, and the scientific literature, to project that, even with mitigation and the as-yet undefined "Grizzly Bear Mortality Reduction Plan," a minimum of 4-7 grizzly bears will still die annually as a direct result of the mine, at least half of these projected as a result of mine-related traffic collisions. Mortality could be higher in some years, such as with low berry crops and poor salmon returns. Grizzly bear mortality that would result from the mine includes direct mortality from conflicts and control handling during the construction and operation phase, vehicle collisions at the mine and along main access road, and indirect effects including poaching and defense of life kills from increased access, such as along the transmission line. Capture myopathy from bears radio-collared for the proposed mine monitoring program would also have a negative effect.

This minimum mine-caused mortality represents 4-7 % of the GBPU population if one accepts there are 100 grizzly bears, and 2-3.5 % if one accepts there are 200 grizzly bears.

3.1.5.1 Projected direct mortality at the mine site

The mine would be the largest open pit mine in Canada. The footprint would extend a distance of about 10 lineal kilometres from Little Fish Lake to Middle Fish Creek. Grizzly conflicts are expected to be high during the construction phase and to lessen during the operational phase due to the MDA being on a high value grizzly bear "hotspot" of regional significance. Given the high degree of overlap of grizzly bears with the mine site, no amount of mitigation will be able to stop some grizzly bears being killed.

It is expected that 1-2 accidental and control kills of grizzly bears will occur annually at the mine site, but that number could be higher in some years. Even during necessary wildlife officer control actions there is risk or injury to bears such as during the trapping and relocation process, use of rubber bullets as deterrents, younger bears being killed by other bears when released into new territory, and so on. In terms of the radio-telemetry monitoring program being promoted by government biologist A.N. Hamilton, there are mortality risks involved as well such as from capture myopathy. In a study of black and grizzly bears that had been live-captured, drugged and collared, Cattet *et al.* (2008) documented high muscle damage enzymes, long-term weight loss, physiological stress, and constrained movement patterns up to 100 days after release.

As an example of mine development bear mortality, in about 1975, I conducted an environmental impact assessment on waterfowl and furbearers for a consulting firm for the early stages of the Syncrude tar sands mine development. The property turned out to be on an important waterfowl migratory flyway and had important wildlife values. The assessment identified important concerns and made recommendations for monitoring and mitigation. The results, emerging decades later, have not been promising, including high mortality rates for black bears.

The following is from the website of Greenpages Canada (http://thegreenpages.ca). In eight years (2000-2008), three (out of the many) companies working in the oil sands in northern Alberta (Syncrude, Albion Sands, and Suncor) reported a total of 164 NON-AVIAN animals killed as a result of their operations. Among the animals listed as killed were black bears (27), red foxes (31), coyotes (21), white-tailed/mule deer (67), and slightly lesser numbers of muskrat, beaver, red-backed vole, marten, weasel, moose, grey wolf, and little brown bat. All these are in addition to the "infamous dead ducks" incident that made the national news when over 1,600 migratory birds landed on a Syncrude oil sands tailings pond in April 2008, and all but a few died. **Of the three operations, Syncrude was responsible for the majority of mortalities, including 43 deer, 20 red fox and eight black bears.** Possible causes of mortality include euthanasia of problem wildlife, drowning or oiling from tailings, animals hitting infrastructure (e.g., buildings), or vehicles and electrocution. According to independent scientist Dr. Kevin Timoney, the numbers of dead animals reported to government underestimated true mortality because they were derived from ad hoc reporting by companies rather than from a scientifically valid and statistically robust sampling design.

3.1.5.2 Projected direct mortality from the Taseko/Whitewater mine highway

As noted previously, since Taseko has provided no definitive information on the standard to which the road will be upgraded, I am making what I think is a reliable assumption that the mine road will become, in effect, a paved highway with significantly increased speed and a threefold increase in traffic volumes, and will lead to significant and increased grizzly bear mortality. My assumption is based on the fact that the Duffy Lake Road (which is in the next GBPU south of the New Prosperity location) started as a logging road in about 1970 and was upgraded/paved in 1991 to become an extension of Highway 99. This transportation improvement is believed to have caused the extirpation of resident female grizzly bears north of the road (Apps *et al*. 2009).

I estimate a minimum of about 2-3 reported/unreported collision kills of grizzly bears annually on the mine road, most of this occurring from mine-related traffic (the majority of vehicle users). As noted, in 2010, there was one reported but unconfirmed mortality of a female grizzly with cub as a result of a collision with a logging truck on the Taseko Road.

Although traffic volumes on the main Chilcotin Highway are much higher than projected for the Taseko/Whitewater mine road, the BC bear kill map for the area (BC Wildlife Branch-Research and Conservation Section) shows 3 reported bear kills between 1990-1999 on the highway between Williams Lake and Hanceville. Using the ratio of 1 reported: 5 unreported, this would equate to 18 bears, or approximately 2 per year. Most are assumed to be black bears since the highway passes through an area where grizzly bears are nearly extirpated. In a BC study on the potential impacts of the Greenville to Kincolith road project, Demarchi (2001) estimated that the new road could negatively affect a high proportion (40-60) of the 175-270 grizzly bears estimated to be within the Stewart-Meziadin GBPU. Most effects would be in the form of disturbance and displacement, but based on regional data, **an annual mortality rate of 4-6 individuals was forecast as a result of the road.** Assuming that 4-6 bears of a population of 175-270 were killed annually, the author concluded that the "safe" mortality limit of 3% is exceeded at the extremes of these parameters. There was already an average mortality of 2 per year from 1994-99 for the purposes of animal control (G. Searing pers. comm). According to Demarchi (2001), **wildlife biologist A. Hamilton (pers. comm. 1999) felt** that **concerns about the potential impacts of the project on grizzly bear habitat were superseded by concerns about mortality risk posed by construction and operation of the road.**

3.1.5.3 Projected indirect mortality effects from New Prosperity

I agree with the New Prosperity EIS that the consequences of mortality risk are high for grizzly bears (P. 1135) along the transmission line corridor. Although the 2011 EIS indicates Taseko will attempt to use as many existing roads as possible where the transmission corridor parallels an existing road, the corridor nonetheless will expose, at a large scale of 50 km long x 80 m wide, a significant expanse of Interior forest stands and hundreds, if not thousands, of micro-habitats important to bears to invasion by motorized and non-motorized access.

In addition, the 50 km paved mine highway from Hanceville will increase secondary access by hunters and recreationists. The New Prosperity EIS also acknowledges this change. However, as noted later in my report, gating and other measures to block motorized access on secondary roads and reduce grizzly bear mortality has been found to be largely ineffective.

As one example of illegal mortality along roads, Ciarnello *et al.* (2009) compared two study areas in central BC: The Plateau study area (Parsnip) had resource development (12% logged) with an extensive road network, while the mountainous study area (Hart Mountains) was relatively pristine (2% logged). Six of nine bears shot by hunters were within 100 m of a secondary or decommissioned logging road. Five grizzly bears were killed illegally in the more roaded plateau area (four not reported to authorities), while there were no illegal kills detected in the less developed mountain study area.

It is estimated that indirect kills resulting from the mine development will be 1-2 annually.

3.1.6 Results of McCrory Wildlife Services assessment of grizzly bear values and their use in the Teztan Biny (Fish lake) mine study area

My study found that Fish Lake is a grizzly bear "hotspot" activity centre in the spring because of significant feeding on spawning trout and other concentrated bear foods combined with a major movement corridor. In addition, it is also significant that Fish Lake is proximal to fall grizzly bear "hotspot" activity centres for salmon feeding along the Taseko.

3.1.6.1 2012 habitat surveys confirm high grizzly bear vegetation habitat values in Fish Lake area

Between May 27 and May 30, 2012, McCrory Wildlife Services, with the assistance of Xeni Gwet'in wildlife researchers, conducted a detailed field survey of grizzly bear habitats and their use. We covered from Fish Lake to the "4500" road to near its south terminus, as well as Upper Fish Creek Valley between Fish Lake and Little Fish Lake and the large riparian meadows to the east of Little Fish Lake. The open riparian meadows in Middle Fish Creek just below Fish Lake were also ground-truthed. On September 15, 2013, an additional field survey was done, but only between Little Fish Lake and the south-east corner of Fish Lake. Some of the mine roads for water testing were also driven, including to the 4500 road.

Map 2 shows the high value grizzly bear spring habitats and the historic Xeni Trail along Fish Creek, with a high number (N=13) of grizzly bear mark trees (M) along this section of trail.

3.1.6.2 Vegetation feeding habitat values

The field surveys found high grizzly bear vegetation habitat values for spring and moderate values for summer and fall. In general, lodgepole pine forests in the area have low to moderate but patchy densities of pinegrass (*Calamagrostis rubescens*) and kinnikinnick (*Arctostaphylos uva-ursi*), both important spring foods for grizzly bears, depending on the age class of the forest and other site classification characteristics. Kinnikinnick, also known as bearberry, has small reddish fruits that bears use in the fall. However, the berries tend to remain on these ground shrubs over the winter, increasing their sugar content and making for a rich spring food for both bear species. Soopolallie, or buffaloberry (*Shepherdia canadensis*), was found sporadically in the pine forests and along riparian areas; this is an important fall bear food. Ant colonies (*Hymenoptera: Formicidae*) were also commonly available in downed logs, dried stumps, and areas with large stones. Overall, the pine forests were of moderate potential for spring and low-moderate potential for summer and fall.

Habitat sampling of the wetland meadows between Middle Fish Creek and Little Fish Lake and east of Little Fish Lake showed high spring values due to high densities of grasses and sedges, as well as some horsetail (*Equisetum sp.)*. Ungulates, such as moose (*Alces alces*), were also available as a bear food, including potential calving areas. Summer values were moderate and fall values were low for this habitat type.

The gentle valley topography between Little Fish Lake and Middle Fish Creek supports a mosaic of pockets of open grasslands on drier slopes and benches that border the riparian zone. A high density of grass species and kinnikinnick make for the grassland mosaics being of high value grizzly habitat in the spring and fall, with lower summer but moderate fall values after fruits ripen. Added to the high spring habitat values are the high numbers of rainbow trout spawning within Fish Creek for most of its length and in small feeder tributaries such as on the east side of Middle Fish Creek and the south-east corner of Fish Lake.

Norman and Alice William, who grew up at Taseko Lake working on grizzly bear habitat mapping between Little Fish and Fish Lakes. Spring habitat values were significant, including key bear foods such as grasses, sedges, over-wintered kinnikinnick berries, and spawning rainbow trout.

3.1.6.3 Trout-spawning habitat values for grizzly bears

Evidence comprised of grizzly bear tracks, fish remains, and fish odours, along with spawning fish in shallow riffles was found in three trout-spawning sites; one in a small feeder stream on the southeast side of Fish Lake, and several with less definitive sign along Fish Creek above the lake. Since we were focused on vegetation habitat, very little time was actually spent surveying trout spawning areas. However, based on the evidence of consumed trout remains we observed (fin and gut remains, etc.), fish odours, the abundant presence of grizzly activity (scats, tracks, and mark trees) in the riparian zone above and below Fish Lake, and the extent of the spawning habitat noted, I concluded that trout-spawning habitat in the areas was a highly significant habitat for grizzly bears. This is particularly relevant in small tributary streams with the presence of trout or in shallow riffles and side channels along the main creek.

The utilisation of grizzly bears feeding on spawning trout in BC inland waters has only been reported anecdotally. However, the phenomenon has been well studied for spawning cutthroat trout (*Oncorhynchus clarki bouvieri*) in Yellowstone National Park (L. Craighead pers. comm.). Here, grizzly bears commonly catch and eat spawning cutthroat trout after they migrate from Yellowstone Lake to its tributaries to reproduce. The high digestibility and protein and lipid content of spawning cutthroat trout are one of the highest sources of net digestible energy for grizzly bears in the Yellowstone ecosystem (Mealey 1975, Knight et al. 1984, Reinhart 1990). This late-spring and early-summer food source is believed to help bears regain body mass after emerging from their winter dens and also helps female grizzlies with young meet the energetic needs of lactation. Grizzly bears were found to most successfully fish where small shallow streams or shallow riffle areas in larger streams made fish capture viable (Hoskins 1975).

The presence of a high number of rainbow trout spawning every spring in the Teztan Biny (Fish Lake) study area, including in small tributaries, provides a significant and high energy food biomass for grizzly bears and a number of other species. The Fish Lake ecosystem system supports an estimated 164,945 trout, of which over 14,471 adults are spring spawners. The average weight is .054 kg/fish (Section 2.6, P. 302). While only a portion of these would spawn in waters suited for grizzly bear fish-catching, I calculated the overall available spawning biomass to be 78,143.4 kg, or 171,915 pounds! While only a small portion of this biomass would be available to grizzly bears in catchable habitat, this is still no small measure for hungry spring grizzly bears.

Although my field observations were limited, I concluded that the grizzly bears trout-feeding activity observed in May 2012 at several locations in the area most likely represented a significant annual feeding phenomenon for at least 15-20 or more grizzly bears. In other words, this makes Fish Lake a grizzly bear "hotspot" activity centre.

3.1.6.4 Grizzly bear use of habitats in the Fish Lake MDA

Spring sign in the study area showed moderate use, but if a larger area had been sampled, it most likely would have registered high. No black bear tracks were observed, so all use was attributed to grizzly bears. The 17 grizzly bear mark (rub) trees mapped also suggested a high use area (Map 2).

Bear sign observed included tracks of possibly 2-3 different adult grizzly bears, a small number of root diggings, three small trout-spawning sites where grizzlies appeared to be feeding on fish, and six scats. Four of the scats were comprised of green plant matter and two were comprised of seeds from bearberry, which matched the high quality foods observed in the spring habitats. Several partial scat remains looked and smelled of fish, but it was uncertain if these were deposited by bears or other carnivores, such as river otter.

Vegetation feeding results for Fish Lake were consistent with results of my spring diet assessment from scats (black and grizzly) in the Brittany Triangle (McCrory 2002). I found that bear scats from the spring were comprised of about 50% over-wintered bearberries and 50% grasses/sedges.

Due to time constraints, we were unable to spend the time needed to more thoroughly assess overall use of spawning trout by grizzly bears. However, from the sign we observed at three small sites, I am convinced that use of trout in the spring is highly significant – just as it is for grizzly bears in Yellowstone National Park.

Less grizzly sign was observed in the middle of September 2012, but this was likely because it was a poor berry year and most grizzlies were probably feeding on salmon along the Taseko or elsewhere. Once salmon runs are over, I suspect fall grizzly use of the Fish Lake area for kinnikinnick berries, moose, and other late fall foods would increase.

3.1.6.5 Importance of adjacency of Fish Lake to Taseko River & tributary salmon-spawning habitats with respect to grizzly bears

Grizzly bears with access to the salmon resource have heavier body weights, produce larger litters, and are found at higher population densities than grizzly bears that do not have access to salmon (Hilderbrand *et. al*. 1999).

Map 4 shows most of the salmon spawning areas in the Xeni Gwet'in Caretaker Area where Chilcotin grizzly bears are known to feed on salmon in the fall. The map does not include downstream carcass feeding areas. Many dead salmon float down the Taseko and Chilko rivers after upstream spawning is over and contribute an important biomass to bears that frequent the lower reaches of these river systems. In September, I have observed bear trails at the Taseko-Chilko confluence where bears descend to the river to search for carcasses that float down from the spawning grounds far above.

For grizzly bears whose home ranges include the Fish Lake area, access to Taseko River and other salmon spawning areas in the Xeni Gwet'in Caretaker Area is highly important. Fish Lake is only approximately 4-5 kilometres from a major salmon-bearing river, the Taseko, and 8-10 kilometres to Lower Taseko Lake. The salmon resources of the Taseko are significant although poorly inventoried due to the difficulty in counting salmon because of the milky turbidity of the glacier-fed waters. Sockeye, coho, and chinook are known to use the watershed for spawning. For sockeye salmon, DFO counts using dead pitch of sockeye along Taseko Lake from 1948-2009 show estimated numbers varied from year to year. There were over 30,000 in 1968, but numbers were down to 20-40 in 2008-2009. DFO has very little information on chinook and coho populations in the Taseko due to the turbidity factors. There can be significant numbers of chinook spawning at the outlet of Lower Taseko Lake. By using DNA analyses and the ratio of Chilko to Taseko in the Albion test fishery, DFO believes that there are 500-2000 chinook likely using the lake outlet to spawn, but they consider this estimate to be very subjective (Richard E. Bailey, Program Head, Chinook and Coho Assessment Fraser River Salmon Section, email dated July 15, 2013).

Grizzlies are known to feed on dead salmon below the outlet of Lower Taseko Lake, as well as on spawned-out sockeye salmon that wash up on the lakeshore. Other known grizzly-salmon activity areas are widespread in the mid-upper Taseko, including the "narrows" between the two lakes, Beece Creek, and Yohetta Creek (Alice William, pers. comm.).

3.1.7 Assessment of the Fish Lake mine study area as a local and regional wildlife/grizzly bear movement corridor

3.1.7.1 Chilcotin grizzlies have very large home ranges and travel widely

Grizzly bears in drier landscapes are known to have larger home ranges (Mueller 2008). According to a review of BC grizzly bears by Gyug *et al.* (2004): *grizzly bear home ranges in productive coastal habitats near salmon streams are smaller than ranges in Interior mountains, which are again smaller than ranges in Interior plateau habitats.* For coastal BC, the average minimum single-year home range size was 137 km^2 for males and 52 km^2 for females. For drier Interior mountains or plateau areas (such as you would find in the South Chilcotin Ranges), average home range size was 804 km^2 for male grizzlies and 222 km^2 for females; i.e., six times larger in size than coastal male grizzlies and four times larger than coastal female grizzlies. This means that dryland grizzly bears cover much larger areas during their annual cycle and, as we see elsewhere in my report, sometimes travel long distances. This has implications for survival, since bears with larger home ranges expend more energy travelling longer distances to access concentrated food sources. As a result, they are more likely to come in conflict with people and human developments, such as the proposed New Prosperity mine. This greater vulnerability of dryland grizzly bears also explains clearly why this grizzly ecotype has been the first to vanish in North America and has already been extirpated from much of the Interior grassland biome of south central BC.

Within the larger-scale landscape, grizzly bears either travel randomly or use established movement corridors.

3.1.7.2 Determining grizzly bear movement corridors and their importance

An important but not too well understood component of grizzly bear habitat is their use of movement corridors ranging from the local level to the larger regional landscape level. Some effort has been made by various researchers to use GIS modeling components to assist with map delineations of grizzly bear travel corridors, but little effort has been made to ground-truth such models. The Silva

Forest Foundation (1996) developed a system of riparian zones for GIS-modeled wildlife corridors for their ecosystem-based planning. They have used such a system for riparian corridors for the Xeni Gwet'in Caretaker Area (Hammond et al. 2004a, 2004b). Conservation biologists have also developed GIS models for cross-valley corridors for grizzly bears but, as with the Silva ecosystem-based riparian corridors, these have never been ground-truthed (Dr. Lance Craighead, pers. comm.). I headed a four-year study to determine grizzly bear use of major trans-mountain grizzly bear travel corridors through the central Canadian Rockies (McCrory *et al.* 2004). The study determined that although grizzly bears tend to use riparian valley bottom corridors for local and regional travel, they did not necessarily follow riparian streamside zones *per se* but rather established pathways, such as hiking trails and abandoned roads whether or not they were in the riparian zones; i.e., the path of least resistance for travel was often the old established trail. Using information from over 100 grizzly bear travel incidents and remote-camera photo documentation of mark tree use, we were able to establish that the best index of a travel route was the number of grizzly bear mark trees per kilometer of lineal travel along the route/trail. Despite about 100 km of off-trail transects to search for bear mark trees, over 99% (n = 136 out of 137) of the mark tree sites were along established pathways used by grizzly bears for travel. Of these, 72% (n = 99 of 136) of the mark trees were situated along the edges of park trails/abandoned roads, and the remaining 28% (n = 37 of 136) were along established wildlife/bear or "bear" trails. Using the mark tree index, the degree of grizzly bear travel on a specific trail can be crudely predicted. A relatively high number of grizzly mark trees (>2/km) indicated a favoured travel route and suggested both local and regional cross-mountain significance. The absence of mark trees or a very low number (less than 1/km) indicated that few grizzlies travelled a route; although caution must be used in interpreting this for little-used roadways with wide right-of-way clearing.

3.1.7.3 The Fish Lake area as a locally and regionally significant grizzly bear/wildlife movement corridor

I used two ecological yardsticks to ascertain that the Fish Lake study area is on an important grizzly riparian travel corridor of both local and regional significance, or what I would call high wildlife/grizzly bear connectivity values (See Map 2).

a). <u>Evidence of high grizzly bear travel values in Fish Lake study area using field sign, including mark trees</u>

In May 2012, tracks indicated at least 2-3 different grizzly bears were using the Fish Lake-Fish Creek travel corridor. In the 8.5 km of riparian zone survey distance between below Fish Lake to Little Fish Lake, there were 17 mark trees mapped for an average of 2 mark trees/km. Most of the trees were along established trails. This is quite typical.

In some areas of provincial parks that I have surveyed, grizzly mark trees are typically along park hiking or established wildlife trails. In an exhaustive study of the use of mark trees in studies in the Canadian Rocky Mountain National Parks, researchers found that many other species appear to use the same grizzly mark trees for communication purposes, including a wide variety of ungulates and other carnivore species such as black bears, wolves, mountain lions, and others (McTavish and Gibeau 2010). The authors caution about the potential loss of these critical communication trees, which may have immeasurable value to many animals.

I also looked at the fact that based on the 2008 field surveys, some grizzlies appear to be using the west side of Fish Lake to avoid the camping areas and other human activities on the opposite side. Since the west side was not adequately surveyed for mark trees, I also used the option where I did not include the shores of Fish Lake in my assessment, although one mark tree was found on the east side. In the 5.5 km between Fish Lake and Little Fish Lake, a total of 12 mark trees, or approximately 2.2 mark trees/km, were found along the old Xeni Gwet'in/wildlife trail. In the 1 km below Fish Lake, four mark trees were identified for an index of 4 mark trees/km. These indices of grizzly travel use clearly indicate high movement values.

The 17 mark trees documented in the Fish Lake mine study area were also the most concentrated cluster of grizzly bear mark trees documented in my extensive grizzly bear field research in the Xeni Gwet'in Caretaker Area (XGCA), including an inventory of most of the hiking trails (McCrory 2009) and numerous wildlife/wild horse trails inventoried in the Brittany Triangle (McCrory 2002). I suspect that this high level of mark tree activity is partly related to a relatively high number of grizzly bears concentrating to feed on spawning rainbow trout in the spring; similar to concentrated mark tree clusters found along some coastal salmon streams.

Additionally, reconnaissance-level surveys of the access via Beece Creek to Little Fish Lake, the entire 4500 road, and some of the mine roads in the Fish Lake area, combined with a map review, indicate that the Fish Lake-Creek Valley is the main wildlife corridor in the RSA.

b). <u>Some wide-scale movements of grizzly bears detected at Fish Lake study area by comparing 2012 DNA results to other DNA studies</u>

A review of wide-scale movements of three male grizzlies detected by DNA at Fish Lake supports the habitat study and mapping exercise that the area is on an important regional grizzly bear movement corridor.

My DNA results show that of the two male grizzlies detected from the May sampling period none had been previously detected in the Apps et al. (2009) study. However, the male grizzly detected from a hair sample at Mark Tree #3 (south end of Fish Lake) had been previously detected in May 2010 at Tatlayoko Valley (Mueller pers. comm.) on the far west side of the Xeni Gwet'in Caretaker Area. From the September 2012 sampling period, a male grizzly (S-4) was found to have used four mark trees along the trail between Fish Lake and Little Fish Lake between late May and mid-September, including the mark tree just north of the homestead cabins at Little Fish Lake. The same bear was also detected during June and July 2007 at two hair-snagging stations on the east side of Chilko Lake and to the south of Nemiah Creek (Apps et al. 2009). It also showed up at a hair-snagging station at Canoe Crossing on the Upper Chilko River in October 2011 (Mueller 2012). Another male grizzly (S-2) was found to have used a mark tree along the trail just north of Little Fish Lake between late May and mid-September 2012. The same bear was detected during June and July 2007 at two hair-snagging stations on the west side of Upper Taseko Lake at what appears to be Yohetta Creek (Apps et al. 2009).

This data establishes that Fish Lake has high values in terms of local and regional connectivity for grizzly bears. The implications are that a relatively high proportion of the grizzly bear population in the GBPU will come in contact with the mine development and the access highway during each year, which means a high potential for conflict, mortality, and displacement.

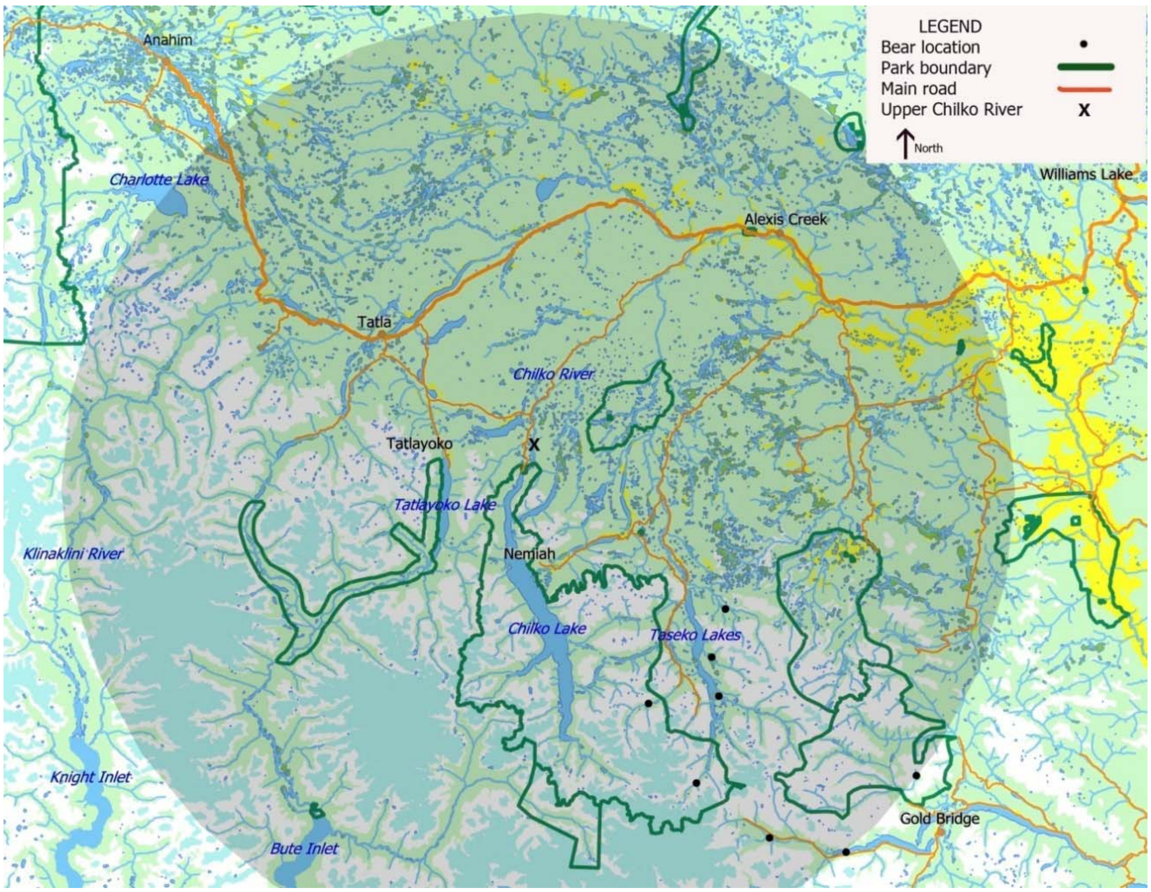
3.1.7.4 Other documented grizzly bear movements in the South Chilcotin Ranges GBPU

Other studies confirm the wide-ranging travel done by Chilcotin dryland grizzly bears. A recent grizzly bear telemetry study done in the Lillooet area indicated some travel of grizzly bears from that area into the Taseko (Sue Senger pers. comm.), but the specific information was not available.

As follows, DNA-based inventories from several hair-snagging studies also demonstrate some interesting long-range movements of these grizzly bears.

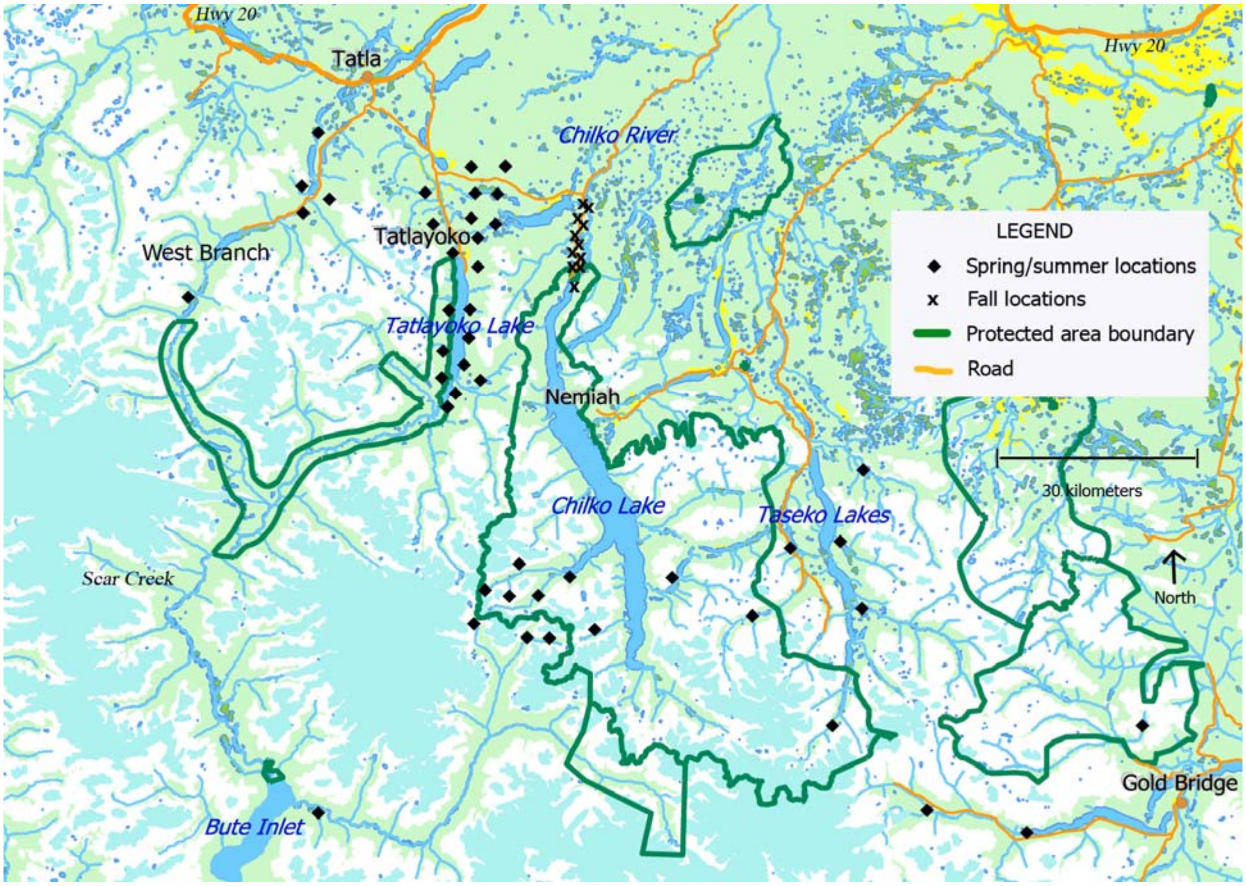
a). <u>Grizzly bear long-range movements as determined from Mueller's 2008-2012 research when compared to Apps et al. 2009 DNA results</u>

Using baited hair-snag stations, Mueller (2008) documented a total of 119 individual grizzly bears in the west side of the South Chilcotin Ranges from 2007-2008; 36 from the Tatlayoko and 83 from the upper Chilko River. Grizzlies in this area travelled up to 113 km from Gold Bridge in the southeast to access the spawning salmon food resource in the Chilko (Figure 3), reflecting that they have much larger home ranges than in most other reported grizzly bear studies.



<u>Map 8</u> from Mueller (2008). The dots show grizzly bears that were sampled in 2007-2008 both at the salmon-spawning areas on the Chilko River ("x") and around Taseko Lakes (dots), indicating some long distance movements. Some of these bears would undoubtedly use the Fish Lake area.

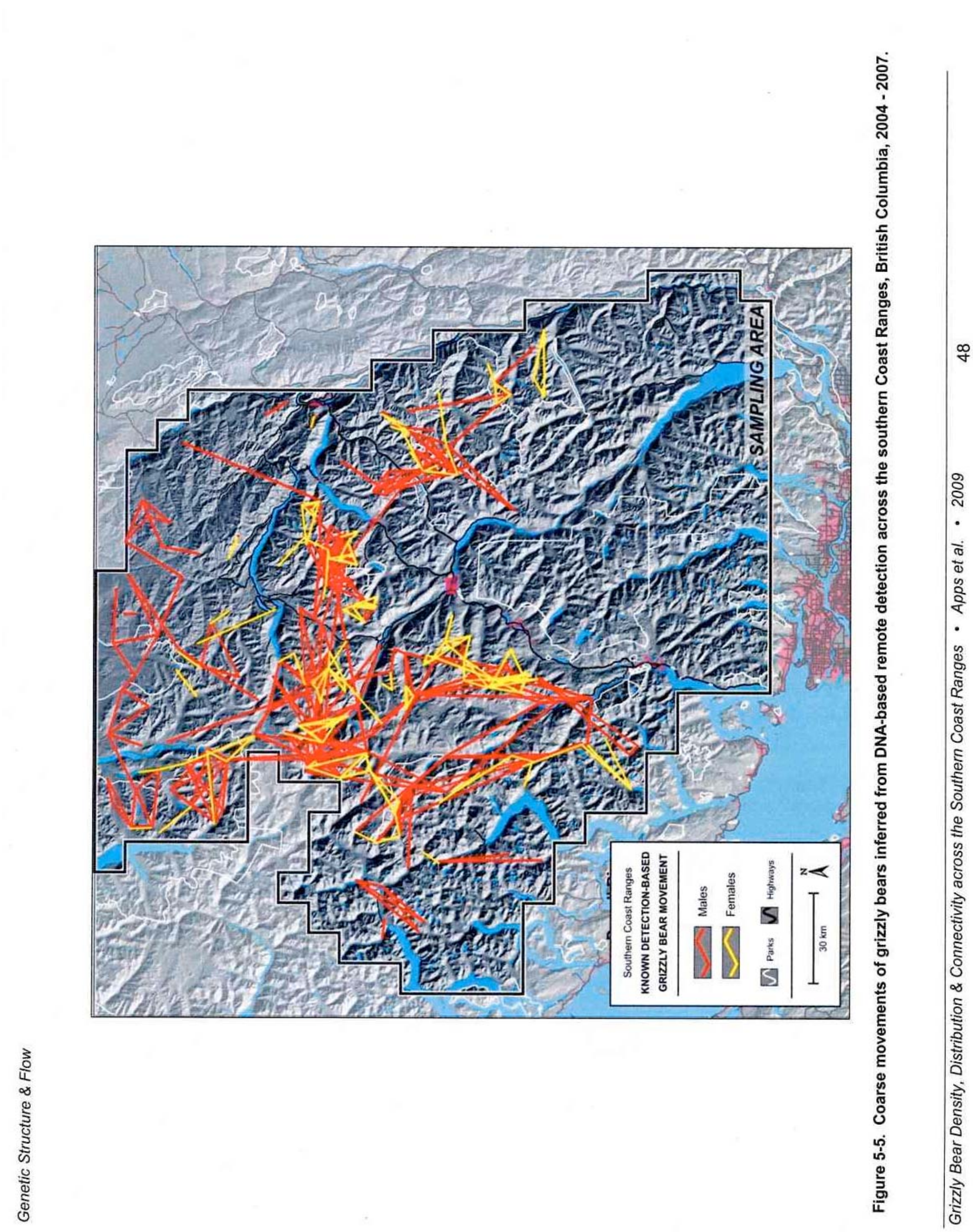
During the 2011 sampling period, the same researcher (Mueller 2012) detected 80 individual grizzly bears using approximately 20 km of the upper Chilko River. She again compared individual grizzlies for each year with DNA studies from neighbouring areas. To date, 12 individual bears were also detected in the South Chilcotin (Figure 3), and 16 bears were detected in the headwaters of the Southgate Watershed on the coastal side of the mountains. This data indicated that grizzly bears occasionally travel between the coast (upper Southgate and Bute Inlet) and the upper Chilko for salmon.



Map 9. Figure 3 from Mueller (2012). Locations of grizzly bears (triangular dots) detected in surrounding areas, including the Taseko Watershed and on the upper Chilko River ("x") between 2006 and 2011 (data courtesy of NCC and Clayton Apps). Some of these bears would undoubtedly use the Fish Lake area].

b). Grizzly bear movements in and out of the middle-upper Taseko Watershed during June-July 2007 from Apps et al. (2009)

Figure 5-5 map from the Apps *et al.* (2009) DNA-based inventory, shows coarse movement and includes the Fish Lake area. While it was beyond the scope of my study to interpolate individual movements of Taseko grizzlies across the regional landscape (from the Apps study), I was able to do a simple analysis of individual grizzly bears that either moved into the mid-upper Taseko Watershed, moved out of the mid-upper Taseko Watershed, or did not move in or out of the watershed at all during the six-week sample period from June 7-July 20 2007. As discussed, a total of 36 grizzly bears used the Taseko at this time (Table A-9), but I only used 34 of these for movement evaluation. Of the 12 males detected, seven stayed within the Taseko for the six-week period, four moved into the Taseko, and one moved out. Of the 19 females, 17 stayed within the Taseko during the six weeks of sampling, only one moved into the Taseko and one moved out. The three individuals of unknown gender were not analyzed. These results are not surprising since the timing of the study was during the spring mating season when male grizzlies travel far and wide and also because female grizzly bears have smaller home ranges than males. Theses results also reflect the fidelity of female grizzly bears to core security habitats within their home ranges. The most significant observation is that during the spring period, 90% (17 of 19) of the female grizzlies remained in the mid-upper Taseko and did not move in or out during the 6-week period of sampling; although a small number may have moved in or out without being detected at outside hair-snagging stations.



Map 10. Grizzly bear movements from DNA hair-snagging study by Apps *et al.* 2010.

3.1.8 Comments and concerns on some other terrestrial species

3.1.8.1 New Prosperity improved Taseko road mortality to Chilcotin wild horses, mule deer, moose, wolverines, and others

The mine transportation corridor will cross some 50 km of the plateau partly in the large Xeni Gwet'in aboriginal preserve that extends to the east side of the Taseko River. Despite fragmentation from clearcut logging, this area still has a complex of Chilcotin wildlife, including grizzly bears, wolves, mule deer, and 300+ wild horses. The horses were in the Chilcotin region before Europeans, indicating possible Spanish origin McCrory 2002). Recent DNA tests of Brittany Triangle wild horses show a small amount of Spanish bloodlines but a common ancestry suggesting origins from the Canadian Heritage horse and the Yakut horse, an ancient horse breed from remote Russia (Cothran and McCrory 2013). The horses are considered an alternate prey species for grizzly bears, wolves, mountain lions, and other predators (McCrory 2002). The plateau east of the Taseko is also a major movement corridor for mule deer that spend the summer in the XGCA and then migrate to the Fraser River valley for winter. The road corridor is not only a communal First Nations harvest area for mule deer and moose, but an excellent wildlife and wild horse viewing area. It is periodically used for film documentaries of wild horses.

I predict that development of the mine highway will lead to relatively high mortality to mule deer, especially during spring and fall migration periods. Moose will also be affected. This has serious implications to the First Nations reliance on these important meat/protein sources.

Our map (5) of wild horse distribution using Ministry of Forest counts shows that the highest number of horses in the region occurs in the plateau area where the mine road will cross. My 10 years of observations are such that only a small number of horse bands habituate to the Taseko/Whitewater Road and that most bands avoid it. On one winter drive, I counted where four separate bands had crossed the road after a snowstorm but did not frequent the road area. Also, because wild horses travel in bands up of to 16 animals, and sometimes to cross the road they just dash out of the forest and across, oblivious to any vehicles that may be on the road, I predict the mine highway will lead to a general slaughter of wild horses. The other effect will be on range cattle. Should the new mine highway be fenced to protect the cattle from traffic collisions, as I suspect it will, this will have a serious impact on separating the habitat that horse bands use into east and west sides of the highway with some survival consequences.

I predict that other species will also be subject to significantly increased road mortality. Some of the more wide-ranging carnivores, such as the blue-listed wolverine, likely will not be able to sustain mortality levels threatened by this road.

Wild horse killed by a large vehicle on Taseko-Whitewater Road on July 24, 2013. Ungulate road kills will attract grizzly bears and other predators to the road, increasing their mortality risk.

3.1.8.2 Significant adverse effects on the Northwestern Toad in the Fish Lake MDA

During a Xeni Gwet'in community workshop at Nemiah on their Aboriginal Fund for Species-at-Risk (ASFAR) project, it was brought to my attention that both Fish and Little Fish Lake have good populations of the northwestern toad, which is federally listed. One comment was that at Fish Lake it "rains frog," which appeared to be in reference to the migration in late summer of baby toads from the lake to surrounding terrestrial habitats.

The northwestern toad lives most of its life on land but migrates in the spring to suitable lake habitat to breed. The New Prosperity EIS indicates this may occur at Fish Lake. The Xeni Gwet'in report thousands of tadpoles, so this would appear to the case. Once the adults breed, some of them migrate back to the surrounding forests and other habitats.

The baby toads are often produced by the tens of thousands and in late summer undergo a mass migration to surrounding land habitats. Studies at Summit Lake BC show that tens of thousands of baby toads are killed annually while trying to cross Highway 3.

I note that the New Prosperity EIS states there will be no significant adverse impacts on toads and other amphibians, but I find this difficult to accept. How does Taseko propose to handle mine traffic mortality during the 3-stage annual migrations without causing significant adverse effects?

3.2 Part 2. Review of New Prosperity 2011 Environmental Impact Statement (EIS) & Associated Documents Concerning Non-Detriment Findings Re South Chilcotin Ranges Grizzly Bear Population Unit

3.2.1 Review of New Prosperity EIS findings of non-significance re loss of wetland (Nabas) and riparian habitats and grizzly bear habitat values in MDA

In general, the 2011 environmental assessment for the New Prosperity project used the same baseline information for wetlands/wildlife habitat conditions in the MDA and the regional study area (RSA) as in the 2009 Prosperity EIS, which reached the following conclusion:

> *The loss of grassland ecosystems is small in both the Regional and Eastern Trapline Study Areas (<1 and 2.5% respectively). The Project-related loss of wetlands is small (<2%) in the context of the Regional Study Area, but relatively large (14.6%) in the context of the Eastern Trapline Study Area.*

The following similar conclusions are provided in the 2011 New Prosperity EIS and associated documents, noting that less riparian habitat would be lost:

- *The New Prosperity maximum disturbance scenario will result in a loss of 564 ha (18%) of riparian ecosystems from baseline conditions in the RSA, compared to the 996 ha (32%) loss due to the Prosperity Project. The New Prosperity post-closure scenario will result in a loss of 317 ha (10%) of riparian ecosystems from baseline conditions in the RSA, compared to the 353 ha (11%) loss due to the Prosperity Project.*
- ***The mine development is not located in high value grizzly bear habitat.*** *For the proposal reviewed in 2009/2010, the federal review came to the conclusion that, due to the low numbers of grizzly in the South Chilcotin Grizzly Bear Management Unit where the mine will be built, any development of any kind would result in increased human activity and road traffic, and along with existing and future forestry and ranching activities that are expected to occur, may result in incidents of human-caused mortality.* ***The mine site layout in New Prosperity reduces the risk to grizzly bears as hectares of disturbance of bear habitat are reduced****; the habitat on the east and west flanks of the watershed are less fragmented; and, two new mitigation measures are proposed to assist with the province's efforts in documenting and protecting the region's grizzly bear population (Taseko EIS. 2011). (Emphasis added by McCrory Wildlife)*
- *For wetland ecosystems, following KI-specific definitions from Section 5.3.2.1 of the 2009 EIS/Application, the magnitude of potential effects is high, and the area is presently relatively undisturbed. Potential effects associated with loss of wetlands and change in wetland functions are long term in duration, and are reversible through implementation of the mitigation measures as detailed in the March 2009 EIS/Application including, as necessary, the Habitat Compensation Plan.* ***<u>The conclusion is therefore that the environmental effects are not significant</u>*** *(Section 2.7 Impact Assessment. New Prosperity Environmental Impact Statement September 2012. Page 1044) (Emphasis added by McCrory Wildlife)*

For riparian ecosystems, following KI-specific definitions from Section 5.3.3.1 of the 2009 EIS/Application, the magnitude is high and the area is presently relatively undisturbed. The potential environmental effect is long term in duration, and reversible with implementation of the mitigation measures as detailed in the March 2009 EIS/Application including the Fish and Fish Habitat Compensation Plan and as necessary, the Habitat Compensation Plan. ***<u>The conclusion is therefore that the environmental effect is not significant</u>*** (Section 2.7 Impact Assessment. New Prosperity Environmental Impact Statement September 2012. Page 1045) (Emphasis added by McCrory Wildlife).

Taseko (2013) also notes in its response to Information Request 38 with respect to Section 2.7.2.8 (p. 1091): *with the implementation of proposed mitigation measures (e.g. minimisation of clearing areas, reforestation of reclaimed areas, avoidance of non-pine forest types and wetlands),* ***the residual loss of grizzly bear feeding habitat is predicted to be not significant.***

McCrory Wildlife Services Comments on New Prosperity EIS comments on findings of non significant impacts on wetland /riparian and ecosystems and grizzly habitat significance in mine area

Taseko has repeatedly concluded in both their 2009 and 2011 EIS documents that their mine development will cause no significant impacts on wildlife species, including grizzly bears, due to no significant residual loss of habitats, including wetlands.

In my professional opinion, they arrived at this conclusion through the utilization of a misleading and seriously deficient ecological yardstick that determined the relative size of each habitat type to be eliminated by the mine and then compared the loss to a larger area, such as their regional study area (RSA). This is not a scientifically rigorous or ecologically defensible measure of environmental impact for cumulative effects purposes for the following reasons:

1. The Taseko analysis does not take into account the disproportionate utilization of different seasonal high quality feeding habitats, such as wetlands, by grizzly bears and other species. For example, a grizzly bear radio-telemetry study in southeast British Columbia (McLellan and Hovey 1993) demonstrated that grizzly bears made a much higher proportionate use of wetlands than their relative distribution over the landscape. Although wetland/riparian habitat comprised only 8.5% of the study area, 40% of the transmitter locations of 46 radio-collared grizzly bears between May 15 and July 22 (and located 10 or more times) were in wetland habitats. **Some bears were located 85% of the time in this type of habitat during this period.** It is expected that Chilcotin grizzly bears would show similar seasonal concentration of use of wetland habitats, including the Teztan Biny (Fish Lake) study area.
2. My decade of grizzly bear observations and field surveys in the South Chilcotin Ranges indicate a similar importance of wetlands to grizzly bears to the above-mentioned study. This includes my Brittany Triangle ecological report (McCrory 2002), which indicated that riparian/wetland areas are very important to grizzly bears in spring/summer for grasses, sedges, and horsetails.
3. The statement that the mine development is not in high quality grizzly bear habitat is also very inaccurate. In fact, using a more scientifically rigorous approach, I determined that the opposite is true. My 2012 field studies show that the riparian corridor through the Fish Lake area is high quality spring habitat and moderate summer and fall habitat for grizzly bears. Part of the problem in the Prosperity EIS assessment is that one of their grizzly habitat background reports (Madrone 1999) used misleading and outdated information to rank seasonal habitat values at Fish Lake and made no attempt to validate the habitat values through field testing. The Madrone study relied too much on grizzly bear food habitat data from the Rockies, including a previous study I was involved in (McCrory and Herrero 1983).
4. To be fair, the revised 2011 EIS does show some moderate to moderate-high spring, summer, and fall grizzly bear feeding habitat capability (Figures 2.7.2.8-7, 2.7.2.8-8, and 2.7.2.8-9) that is lower than most of my ratings. However, the large surrounding areas of Fish Lake, such as forested habitat, are ranked low and very low, when, in my opinion, many of these areas have moderate seasonal values.
5. Although both Taseko EIS reports make mention of observations that grizzly bears feed on spawning rainbow trout in the Teztan Biny (Fish Lake) study area in the spring, there is no attempt to quantify or examine its relevance to grizzly bear diet from the scientific literature and thus it is downplayed in their evaluation of significant, adverse impacts. My 2012 field surveys

determined that grizzly bears were feeding on spawning trout in at least three small stream areas related to Teztan Biny (Fish Lake). Fish Lake has a high biomass (85,000) of trout and high numbers spawn in shallow riffles and side tributaries where they are catchable to bears. Although further research would be desirable, based on the evidence of high overall grizzly bear use of the area, including an usually high cluster (N = 17) of grizzly bear mark trees between Little Fish Lake-Middle Fish Creek trout-spawning corridor, it is strongly apparent that trout-feeding by grizzly bears is likely of regional significance in the spring for grizzly bears, drawing in a high number of bears, as has been well-documented for grizzly bears in Yellowstone National Park. In other words, the mine site area is a significant feeding activity hotspot for grizzly bears.

6. Through field sign and DNA collection of hair samples from mark trees, I determined a minimum of 4-5 grizzlies were using the habitats in the riparian corridor in late May 2012. As this was a small sample area, I estimated, partly because of the high biomass of spawning rainbow trout, that upwards of some 15-20 grizzly bears would use the Teztan Biny (Fish Lake) mine development area in the two-month spring period. Additionally, over the full spring-fall season, all 36 grizzlies determined from the Apps et al. (2009) DNA study to use the mid-upper Taseko would likely travel through the mine area for reasons of feeding activities or travel, such as to salmon areas to the west.
7. The New Prosperity EIS measure of area of wetland habitat directly lost looks only at the direct physical loss from the footprint of the mine. This is also misleading from the point of view that it makes no attempt to include the loss of “habitat effectiveness” of wetlands and other important grizzly habitat through behavioural displacement of grizzly bears from within at least a 1 km Zone of Influence (ZOI) on either side of the mine site. (Similarly, there is no measure of loss of wetland habitat to grizzly bears within a 1 km ZOI along the main access road.) Thus, a far larger area of wetlands and other critical habitats in the mine area will be alienated from grizzly bears.
8. Also, as noted in my section on climate change, wetland and riparian habitats are expected to diminish significantly from droughts, particularly in this dryland ecosystem in the lee of the Coast Ranges.

3.2.2 Review of New Prosperity EIS findings of non-significance of effects of logging on wetland ecosystems in the mine RSA

The New Prosperity EIS states in section 2.7 (p. 1042) that:

> *There is limited potential for cumulative effects on wetlands as logging targets forested ecosystem types, and wetlands in the RSA are generally non-forested. For example, 84.2% of the mine site RSA wetlands are non-forested. Forest harvesting activities are not expected to have substantive cumulative interactions with riparian ecosystems, as provisions in the Forest Planning and Practices Regulation under the Forest and Range Practices Act are designed to avoid ecosystem loss and minimize indirect environmental effects to riparian areas.*

McCrory Wildlife Services Comments on New Prosperity EIS comments on effects of logging on wetlands ecosystems

1. Effects of logging on wetland ecosystems may be underestimated, such as impacts of clear-cutting on the hydrology of wetlands that depend on drainage from adjacent intact forests. In addition, clearing forested areas causes more rapid run off of snowmelt water into wetlands.
2. However, I agree with the EIS that the impact of logging on wetland ecosystems in the Teztan Biny (Fish Lake) study area would be far less in terms of cumulative effects than the direct and indirect losses engendered by the New Prosperity mine development of wetland ecosystems used by grizzly bears.

3.2.3 Review of New Prosperity EIS findings of significant loss of fish and fish habitats, but no significant loss of grizzly bear habitats

Fish Lake currently has an estimated rainbow trout population of 85,000 fish (p. 884. Section 2.7), but only a portion of these are spawners. The New Prosperity proposes to maintain Fish Lake intact with a population of 35,000 trout in Fish Lake of which approximately 6,200 will be spawners ([Taseko's Responses to The Panel's Technical Information Requests. July 2013].

The EIS concluded that the project would result in environmental effects on fish and fish habitat in the Fish Creek Watershed, including Fish Lake and Little Fish Lake. The proponent's cumulative effects assessment stated:

> *It is anticipated that habitat compensation and mitigation elements will compensate for losses and alteration of fish-bearing and non-fish-bearing habitat associated with the Project. Assuming that substantial aspects of the Compensation Plan are successful, the residual environmental effects of the Project on Lower, Middle and Upper Fish Creek in stream habitat is not expected to be significant. The residual environmental effects are predicted to be regional in geographic extent, permanent in duration, with no requirement to be reversible. The implementation of compensation elements associated with the loss of Rainbow Trout stream habitat can be initiated immediately, pending further baseline or design requirements, to achieve temporal gains in productive capacity (i.e., compensation plan implementation can begin pre-project construction) and to eliminate any potential temporal losses in productivity. (Section 2-7).*

The proponent also claims that because Fish Lake will be left intact that wildlife movements through that MDA will not be impeded and that loss of grizzly bear habitats will be insignificant.

McCrory Wildlife Services Comments on New Prosperity EIS comments on effects of loss of fish and fish habitats in relation to grizzly bears habitat values

1. Unfortunately, in its assessment, the New Prosperity EIS did not take into adequate consideration the importance to grizzly bears of the extensive rainbow trout biomass in the Fish Lake MDA. The presence of large numbers of trout spawning in the Teztan Biny (Fish Lake) study area, including small tributaries, provides a significant and high-energy food biomass for Chilcotin grizzly bears and a number of other species. As in Yellowstone National Park, grizzly bears have likely been utilising this food resource for a very long time. Although my field observations were limited, I concluded that the grizzly bear trout-feeding activity observed in May 2012 at several locations in the area most likely represented a significant annual feeding phenomenon for at least 15-20 or more grizzly bears. Favourable habitat circumstances appear to include a large population of trout that spawn in various areas of small riffles with shallow water depths similar to that reported to be the most favourable sites for grizzly bears to capture spawning trout in Yellowstone National Park. Since I have not observed similar spring trout feeding by bears during my extensive habitat surveys in the Xeni Gwet'in Caretaker Area, I consider the situation quite unique, although possibly not just isolated to the Fish Lake area.
2. It is my opinion that the proposed rainbow trout mitigation/compensation measures of no net loss will not benefit grizzly bears. In general, grizzly bears in the Teztan Biny (Fish Lake) study area will lose a significant regionally important source of high nutrition trout. There are likely few, if any, other areas within the RSA with similar and abundant rainbow trout spawning habitats to replace some of this loss; for example, moving some of the trout population to Slim Lake, which has no streams for spawning.

3. Additionally, it is highly speculative to claim that wildlife movements will not be impeded throughout the MDA. It is highly doubtful that any grizzly bears would attempt to access any remaining trout spawning areas at Fish Lake and if so, they run a high risk of conflict.

Therefore, I consider that the **combined** loss of spring wetland and rainbow trout spawning habitats in the Fish Lake area will have a significant adverse impact on grizzly bears that use the MDA and RSA. Loss of access to a large biomass of highly nutritious fish in the spring for lactating females and grizzlies that have emerged from their winter dens in poor condition could have a negative survival impact at the population level since this activity would represent an ancestral phenomenon dating back a long time, just as with fall grizzly bear feeding behaviour on spawning Fraser-run salmon.

3.2.4 Review of Taseko's 2011 EIS non-significance findings on grizzly bears determined from GIS modeling of grizzly secure habitats and road density estimates related to mortality risk

Roads are known to have a negative effect on grizzly bear habitat use when they reach a density of about 0.6 km length of road per sq. km; this effect increases when road density increases over ~1 km/sq. km. New or improved roads also bring people into contact with grizzly bears more frequently. Sometimes those encounters are lethal for bears. I have addressed this aspect more fully in my other section on mortality.

In the 2011 New Prosperity EIS, Taseko added a more detailed TEM-based analysis in the altered MDA and expanded RSA of core secure habitat and linear feature density and cumulative effects. This GIS map modeling exercise was most likely in response to the former Panel's ruling of significant adverse impacts on grizzly bears based on my 2010 submission. The new analysis was also expanded to include logging spatial data. The grizzly bear RSA for the core secure habitat evaluation was delineated based on a combination of the South Chilcotin Grizzly Bear Population Unit boundary and the boundaries of the Taseko River and Big Creek watersheds (Figure 2.7.2.8-2). The total area of the grizzly bear RSA is 6971 km^2 (Section 2.7.2.8). The EIS document considers that: *Two approaches are used to assess the effects of New Prosperity on grizzly bear mortality risk: core secures habitat analysis and linear feature density analysis (Section 2.7. Impact Assessment. p. 1092).*

The EIS reached the following conclusion:

> *The effect characterisation and determination of significance were not considered to have changed from the findings presented in the March 2009 EIS/Application. That is, with the implementation of the proposed mitigation measures (e.g., minimization of clearing area, reforestation of reclaimed areas, avoidance of non-pine forest types and wetlands), the residual loss of grizzly bear feeding habitat is predicted to be not significant with respect to the sustainability of the South Chilcotin Ranges GBPU23 (Section 2.7. Impact Assessment. p. 1091).*
>
> *In conclusion, given the relatively small effect of the New Prosperity Project in the context of the grizzly northwestern quadrant of the GBPU, the better state of this portion of the GBPU relative to other portions to the south and east, and the commitments in New Prosperity under the Grizzly Bear Mortality Risk Reduction Plan, the New Prosperity Project's incremental contribution to future cumulative effects is predicted to be not significant with respect to the sustainability of the GBPU. Confidence in this prediction is further enhanced with the addition of specific mitigation and compensation measures identified by Taseko in the Grizzly Bear Mortality Risk Reduction Plan (Section 2.7. Impact Assessment. p. 1124).*

McCrory Wildlife Services Comments on New Prosperity EIS comments on mortality risk determined from analysis of core secure areas and road density:

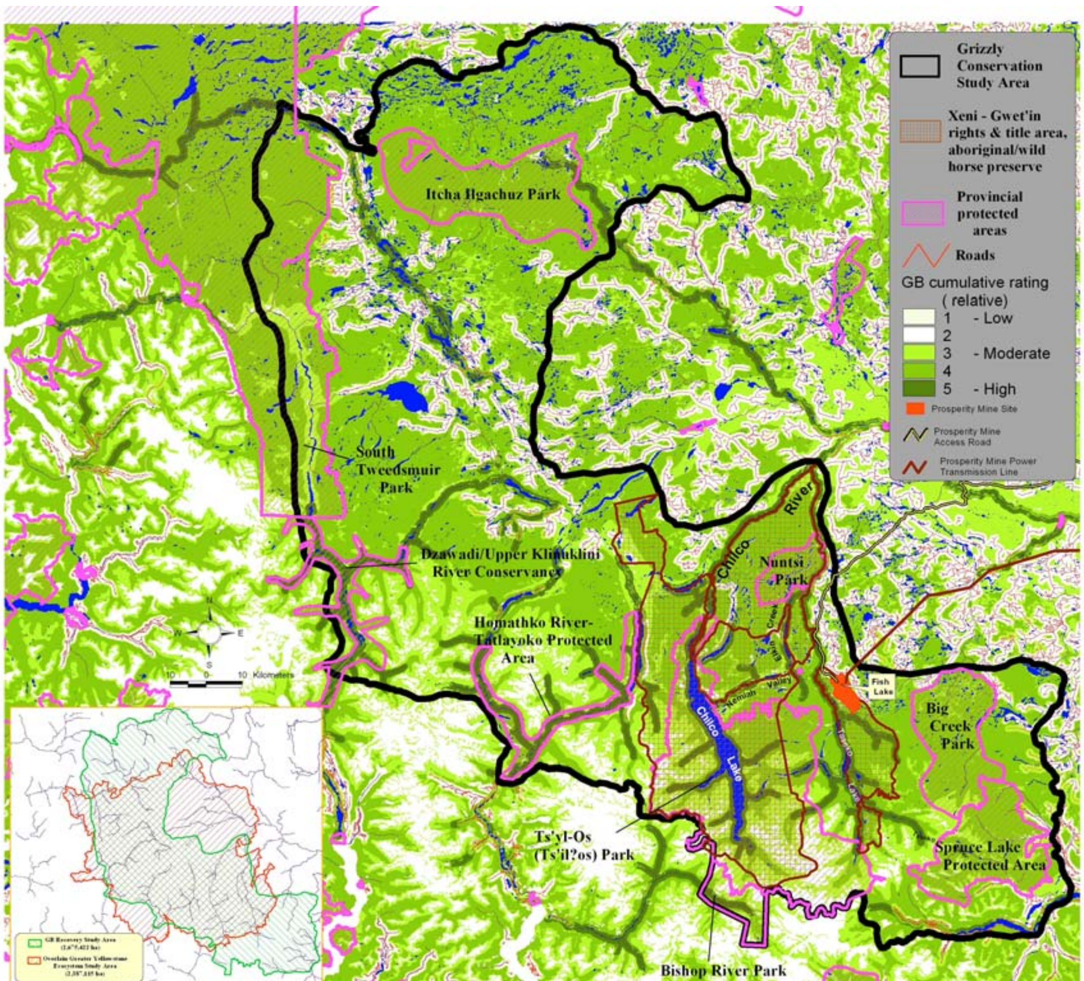
There are seven regions in BC where grizzly bears are now extirpated – extinct, for lay purposes – and nine where they are threatened, including the South Chilcotin Ranges Population Unit (GBPU), where there are perhaps 100-200 bears left, an estimate based on questionable scientific procedure, where substantial portions of habitat (4 watersheds) have been fragmented, and otherwise where there is continued evidence of high human-caused mortality, but the position of Taseko's 2009 and 2011 EIS reports appear to deny that this century-long trend of extermination could lead to elimination of the grizzly bear population in the RSA even though:

- The extinction/extirpation "front," where bears are already gone from the landscape, abuts the GBPU to the east, putting the Study Area on the extremely high risk "edge" of advancing decline / extermination,
- The kinds of impacts flowing from New Prosperity are precisely those that have forced grizzly bears out of a major portion of the province,
- There exists no evidence that the province (MOE) has the regulatory mandate, tools, or funding to meet the "collaborative" monitoring and mitigation agenda that New Prosperity is off-loading to the public agency, and
- The science and conflict history across North America clearly demonstrates that human activity, such as Taseko's New Prosperity project, will increase mortality and alienate habitat for grizzly bears.

1. Grizzly bears in the south portion of the GBPU are considered at the ecological tipping point. Some grizzlies travel into and use the Taseko watershed, likely including the Fish Lake MDA. While taking into account the adjacency to lower value core secure areas to the north and east of the MDA, no consideration is given for grizzly bears that have lost some of these secure core area values in the south and that are already under threat.
2. Mitigation measures for habitat loss, such as minimization of cleared area, will have only a small measured effect when compared to the direct loss of regionally significant wetland and trout-spawning habitats and a significant movement corridor for grizzly bears in the Fish Lake MDA combined with significant loss of grizzly bear habitat effectiveness and increased traffic mortality impacts on bears from the improved, paved road and three-fold increase in traffic volumes created by the mine.
3. As noted earlier in terms of direct habitat loss, the EIS statements on the small increase in road density and small impact on core security areas are misleading ecological yardsticks to draw any scientifically rigorous conclusions on the significance of impacts on mortality risk, particularly as it relates to increased loss of grizzly bear habitat effectiveness and the high mortality risk from increased traffic volumes in the MDA and along a good portion of the main access road. As with the 2010 EIS, the New Prosperity 2011 EIS continues to demonstrate a consistent under-reliance on scientific rigour and the precautionary principle and an over-reliance on qualitative data and mitigation measures, such as the *Grizzly Bear Mortality Risk Reduction Plan*. **The Taseko EIS represents a continuum of misclaims on proposed mitigation measures that have been proven to not be effective with respect to most of the significant adverse cumulative environmental effects I have identified on grizzly bears for the mine proposal.**
4. Nowhere in this analysis is there a consideration for the significant increase in traffic volumes for the 50 km paved access highway and the science on grizzly bear displacement and mortality that is available for a more rigorous and precautionary approach. As with their small habitat-lost versus large area ecological yardstick, the New Prosperity EIS does not represent a scientifically

rigorous and ecologically defensible measure of environmental impact for cumulative effects on grizzly bears.

5. A case in point is the fact that grizzly bear mortality associated with motorized access in recent decades along the Duffy Lake Road (which is in the next GBPU south of the New Prosperity location) is believed to have caused the extirpation of resident female grizzly bears north of the road. The Duffy Lake Road started as a logging road about 1970 and was upgraded/paved in 1991 to become an extension of Highway 99 (Apps *et al*. 2009).



Map 11. Craighead-McCrory (2010) map showing moderate-high grizzly bear suitability in Fish Lake area demonstrating inaccuracies in the New Prosperity 2011 EIS suitability maps that rated much of the area as low to very low capability. The EIS maps were not ground-truthed and did not include salmon values. We developed our habitat suitability model through expert opinion ranking six landscape layers (basic thematic mapping, biogeoclimatic zones, road density, slope, elevation, and salmon stream proximity). Several iterations were tested against known grizzly habitat areas on the ground.

6. The TEM-based habitat suitability maps were not based on ground-truthing and grossly under-represent the overall value of grizzly bear habitat values in the GBPU. In addition, the values of salmon spawning areas to grizzly bears in the Taseko and Chilko systems are not factored in. Ground-truthed rankings of vegetation types and riparian salmon values were used in my own suitability mapping system for the region. These showed moderate values where the EIS generally showed low values, including the mine RSA.

7. In addition, some studies (described below) show that the impacts of the proposed mine will extend over a much larger area than the 0.5-1.0 km habitat buffer zones around roads and the mine site:

a). **Mining exploration in central Arctic impacts on grizzly bear habitat use.** Johnson et al. (2005) modeled bear telemetry locations from May 1995 to June 1999 across the central Arctic in relation to resource development. In late summer, mineral exploration sites had a moderately negative influence on habitat use to a distance of 23 km (keeping in mind that the study area was essentially treeless, so open space/line-of-sight and sound were factors). In autumn, monitored bears avoided mineral exploration sites, but wide confidence intervals suggested the relationship was statistically uncertain. The disturbance effects suggested habitat loss for grizzly bears was most extreme during late summer and autumn, where they measured 12% and 11% reduction in the total availability of high and good quality habitats, respectively. The modeled response of bears to mineral exploration sites and outfitter camps suggested an even larger impact than did their assumptions about disturbance. The timing of disturbance in later summer and autumn was considered a critical issue, given that this is the season of hyperphagia (the physiological state of rapid gain of body fats in preparation for hibernation). This translates directly, through body size, to reproductive success (fitness), so these are impacts with significant consequences.

b). **Admiralty Island mine**. Schoen and Beier (1990) studied grizzly bear habitat preferences and brown bear logging and mining relationships in southeast Alaska. For a mine on Admiralty Island, they found six radio-collared female bears denned within 4 km of the mine site in Upper Greens - Zinc Creek. The mine site included a road and intensive helicopter traffic. The female bears denned a mean distance of 3.4 km from the mine site the first year of observation, but denned significantly further away (mean of 11.7 km) from the mine the next year. The researchers then compared the mean distance between den locations between the bears they thought might be impacted by the mine with that of 11 radio-collared females that denned outside the area of the mine influence. They found a significant difference; mine-influenced bears denned a mean of 10.4 km from their Year One den sites, while bears outside the mine influence denned a mean of only 1.9 km away from Year One dens. The scientists had limited evidence that bears altered their home range because of the mine and its road construction. Bears were attracted to a salmon stream alongside road construction. In 1986, the first year after road construction had commenced in the fall of 1985, two adult males (of 18 bears total) used other salmon streams within their home range that were not influenced by construction activity. The other bears continued to use the drainage, but shifted away from road activity, then moved in closer to the road when activity was reduced. The authors felt that this happened because the dense forest shielded some bears, and the abundant spawning salmon resource attracted them. One female bear was monitored from before the mine (1982) to the spring of 1989. Prior to 1986, she successfully weaned two litters of two cubs each. After that, she lost two consecutive litters. The researchers had no direct evidence that development activities were implicated in her reproductive failure, but suggested the possibility that **displacement from her familiar feeding area along lower Zinc Creek in 1987 may have reduced her reproductive effectiveness.** They also surveyed grizzly day bed locations in a strip 1.6 km long x 120 m wide; in 1985, *prior* to road construction, they identified 57 beds. In 1986, following major construction activities, they found only 17 beds in the same area. These beds were a few metres closer to Zinc Creek Mine in the activity year (1986: x = 41m) than in the previous year (x = 52 m).

The important point here, relative to impacts of the mine on grizzly bear distribution, is the decline in the overall number of beds. The equal distance of beds from the stream indicates some bears will hold to their traditional home ranges, and these are the bears that are subjected to increased stress and mortality. Characteristic of bears that are less likely to be displaced, one subadult female bear did habituate to workers and was later killed by a hunter. The authors concluded that these results reflected short-term effects of development activities on bears and that **it would be premature to conclude that development of the Greens Creek Mine will have minimal impacts on the local brown bear population**.

c). **Cumulative effects of human developments, including mines, on grizzlies in Chugach National Forest**. Suring et al. (1998) studied the cumulative effects on brown bears on some 500,000 ha of the Chugach National Forest on the Kenai Peninsula in south-central Alaska. They applied their analysis to and considered mining operations, recreation sites accessible by motorized means, recreation trails, open roads, and residential/town site areas. Their simultaneous analysis of all known human activities showed a total cumulative reduction in habitat effectiveness (HE) of 71% for spring and 72% for summer. This is an important study in that it showed that a reduction of habitat values, or HE, from various impacts within a given area are cumulative. In other words, you can't just pick the worst impact and conclude that that is it; all other impacts factor in to make the overall impact even greater.

d). **CEAA report on Cheviot coal mine mineral surface lease (MSL) in Alberta.** Despite access management, such as the public only being permitted along designated access trails that were either non-motorized or motorized, a recent review in the CEAA March 31, 2013 Practitioners' Guide (July 2013) reported on a case study of the Cheviot Mine that predicted an immediate and significant adverse effect on grizzly bears along with regional pressures on large carnivores reaching the tipping point where population losses would become serious and possibly irreversible. Even within a 100-year reclamation time frame, mitigation of these effects was considered difficult (*Cumulative Effects Assessment Practitioners' Guide Cheviot Coal Mine: Case Study Highlights* (March 31, 2013) [(https://www.ceaa-acee.gc.ca/default.asp?lang=En&n...1&offset].

3.2.6 Review of New Prosperity Mine EIS concerning human-caused mortality (hunter kills, livestock conflict, and human-bear conflict) to grizzly bears

New Prosperity's EIS states the following:

> *Hunter Kills, Livestock Conflict, and Human-bear Conflict at mine site*
>
> *As noted for hunter access, the annual unreported mortality rate for the South Chilcotin Ranges GBPU as a whole is 0.8% (Austin et al. 2004). From 1980 to present there have been 24 reported grizzly bear kills in the RSA. Sixteen were hunter kills (from 1980 to 1998). Since the hunt was closed in 1999 there have been seven kills—four illegal and three animal control. The last recorded grizzly bear kill in the RSA was in 2007. The Province is actively managing the mortality risks to individual bears in the southern Coast Ranges grizzly bear range, focused on areas south of the RSA. In the future case, logging and the New Prosperity Project are most likely to contribute to human-bear conflict rather than livestock conflict. Hunter kill is not considered to be a factor in the future case. The summary of the cumulative effects assessments for these three parameters (hunter kills, livestock conflict and human-bear conflict) is presented in Table 2.7.2.8-14 (Section 2.7. P. 1125).*
>
> *Each component will include a suite of mitigation measures, an implementation plan and a monitoring plan. Taseko has developed a draft framework for the plan (Table 2.7.2.8-15). This framework is intended as the foundation for engaging in discussion with regulatory agencies, other industrial operators, First Nations and local stakeholders. Taseko is cognizant of the Province's intention to develop a recovery plan for the South Chilcotin Ranges GBPU, and is committed to supporting that process and suggests this plan could be the basis for some elements of that strategy, particularly for areas with multiple land users. Taseko's target is to develop a detailed Grizzly Bear Mortality Risk Reduction Plan within 6 months of approval and a decision to proceed with project development (Section 2.7. p. 1129).*

In terms of mortality to grizzly bears from hunter access, the New Prosperity EIS, in section 2.7 (pp. 1124), states the following:

> *This parameter is directly related to linear feature density and hunting regulations. The annual unreported mortality rate for the South Chilcotin Ranges GBPU as a whole is 0.8% (Austin et al., 2004). The rate of unreported human-caused grizzly bear mortalities is believed to be positively correlated with hunter density (Austin et al. 2004). The grizzly bear RSA is primarily within Management Unit 5-4 with small area in Management Unit 5-3 as well. There is hunting season for a variety of species in these management units including mule deer, white-tailed deer, moose, black bear, wolf, grouse and waterfowl. No changes to these conditions in the RSA are anticipated in the future. The summary of the cumulative effects assessment for human access is presented in Table 2.7.2.8-14.*

McCrory Wildlife Services Comments:

1. Using only partial human-caused mortality data (when more was actually available), the New Prosperity 2011 EIS gives a totally wrong impression that current grizzly bear mortality is low and that the last known kill in the RSA was in 2007. My crude mortality review indicates a fairly high level of human-caused mortality to grizzly bears in the northern sector of the South Chilcotin Ranges GBPU. Mortality information from the southern sector was not available but was interpolated from the northern sector data.
2. The Taseko EIS appears to be in a constant state of denial about grizzly bear mortality from their operation and their proposed mitigation is out of touch with reality. For example, the Syncrude tar sands mine in northern Alberta has employed wildlife mitigation measures for decades. A recent analysis of non-avian animals killed over eight years (2000-2008) shows that Syncrude was responsible for the majority of mortalities, including 43 deer, 20 red fox, and eight black bears. Possible causes of mortality include euthanasia of problem wildlife, drowning or oiling from tailings, animals hitting infrastructure (e.g., buildings), or vehicles and electrocution. According to independent scientist Dr. Kevin Timoney, the numbers of dead animals reported to government underestimated true mortality because they were derived from ad hoc reporting by companies rather than from a scientifically valid and statistically robust sampling design (Greenpages Canada (http://thegreenpages.ca).
3. **As noted in my review, a baseline average of 3.0-3.3 grizzly bears is killed by human causes annually in the GBPU.** I estimated that the overall human-caused “known” mortality in the northern sector of the GBPU was 19-20 grizzly bears from 2001-2013. In my experience in working with the local communities for the past decade, there is a general mistrust of the government agencies and a reluctance to report grizzly bear-human conflict incidents to the authorities. Since considerable anecdotal evidence indicates a fairly high level of other unreported kills in the GBPU, including “shoot, shovel, and silence” involving conflicts with cattle, and unreported ungulate hunter defense of life kills, I crudely used the Ministry’s ratio of reported:unreported kills to estimate 16 additional “unreported “kills over this same period. I then extrapolated this information to include the area of the south part of the GBPU for an estimated total human-caused mortality for 2001-2013 for the entire GBPU to be 36-40 grizzly bears, or an average of about 3-3.3 bears per year. Given the large size of the GBPU, the many areas where grizzly bears and human uses overlap, the fact that the current “threatened” population is at least 50% below capacity **and mortality is what reduced it**, this is not an unrealistic estimate and is likely conservative.
4. I used the best information available including an assessment of mine site habitat values and grizzly bear numbers, local knowledge, and the scientific literature, to project that, even with mitigation and the as-yet-undefined “Grizzly Bear Mortality Reduction Plan,” a minimum of 4-7

grizzly bears will still die annually as a direct result of the mine, at least half of these projected as a result of mine-related traffic collisions (see following section). Mortality could be higher in some years, such as in low berry crop years and poor salmon returns. Grizzly bear mortality that would result from the mine includes direct mortality from conflicts and control handling during the construction and operation phase, vehicle collisions at the mine and along the main access road, and indirect effects including poaching and defense of life kills from increased access such as along the transmission line. Capture myopathy from bears radio-collared for the proposed mine monitoring program would also have a negative effect. This minimum mine-caused mortality represents 4-7 % of the GBPU population if one accepts there are 100 grizzly bears and 2-3.5 % if one accepts there are 200 grizzly bears.

5. Projected mine-caused mortality of 4-7 grizzlies per annum would exceed the current GBPU baseline of 3-3.3 killed by humans annually. The total all-inclusive minimum mortality would be 7-10 grizzly bears per year. This would equate to 7-10 % of the GBPU population if one accepts there are 100 grizzly bears and 3.5-5 % if one accepts there are 200 grizzly bears.
6. It is expected that human-induced mortality from the mine will be worse during years of poor berry crops, poor whitebark pine seed crops and low salmon returns. Mattson et al. (1992) found that human-caused grizzly bear mortality is much higher during years of low white-bark pine seed production (Fellicetti et al. 2003).
7. Although the estimate of acceptable human-caused mortality and extinction thresholds in grizzly bear populations varies between experts, for a threatened grizzly bear population such as the South Chilcotin Ranges, grizzly bears likely cannot sustain human-induced mortality of greater than 4%, if recovery is the management objective (Horesji 1999). If one accepts the previous MOE South Chilcotin Ranges GBPU population estimate of 100 bears, then the population is already teetering on the brink. If one accepts the revised estimate of 203 bears there may be a bit more resiliency. However, with either population estimate, the additive mine mortality would then, by applying the precautionary principle, push the population over the extinction threshold as described by Bascompte and Sole (1996).
8. Mention is also made elsewhere regarding mitigation involving development of a recovery plan (Section 2.7. P. 1133). The province recently made it clear to the CEAA Panel there will be no recovery plan.
9. There is some merit in Taseko implementing a rigid food/garbage control program in the mine development area; certainly this needs to be done properly and maintained over the lifespan of the mine. Given the development would be the largest open pit mine in Canada and because the mine site is in prime grizzly bear habitat and overlaps with a broad movement corridor, some grizzly bears will habituate to people and the development. This will lead to bear-people conflicts, such as access to careless garbage containment or encounters with mine staff, with a high risk of conflict-bear mortality as a result. Also, based on my Bear Smart studies in Whistler, the Waneta Expansion Project, and other areas, despite a provincial regulation against leaving attractants available for bears and project programs to control attractants, some construction workers become careless; such as throwing lunch bags into bins for construction material that end up attracting bears. I predict that despite an ideal “Zero Tolerance” policy and good garbage control at New Prosperity, it is inevitable that 1-2 grizzly bears will be killed in control measures during the construction and operation phases should New Prosperity be approved.
10. A classic case study of a man-caused grizzly bear mortality sink involved the Fishing Bridge recreation complex in Yellowstone National Park, which included a tourism village complex that was built historically in high quality grizzly bear habitat in Yellowstone (US National Park Service 1984). The habitat included a significant area where cutthroat trout spawned where shallow riffle conditions allowed a large number of grizzly bears to catch and feed on the fish. The attraction to the grizzly bears of the high, available fish biomass (and other concentrated

habitats) combined with poor garbage management and a high level of conflict between recreationists led to control kills that had a serious wide-ranging impact on the threatened grizzly population in the park. While some grizzlies were displaced by the development, others continued to frequent the area due to their reliance on the high value foods, including trout. An impact study by the Parks Service showed that from 1968-1983, Fishing Bridge accounted for 16 injuries to park visitors by grizzly bears. The development also accounted for half of the 61 grizzly control removals (kills and translocations) from 1966-1983. Today, we call this a "population mortality sink," a significant finding being that although Fishing Bridge was a tiny area in proportion to the overall large size of this large park, the negative influence affected the grizzly bear population over nearly the whole park. While not comparable to the New Prosperity development in many ways, one noteworthy similarity is the nutritional importance of the trout biomass at each site for grizzly bears. I expect a somewhat similar conflict pattern to emerge at New Prosperity, even with proposed mitigation, largely due to the ancestral relationship and reliance of a high number of grizzly bears on the abundant spawning trout in the Fish Lake ecosystem. As noted previously, even with garbage control, I estimate a minimum mortality loss of 1-2 grizzlies at the mine site annually that will contribute to the overall population sink I predict for the whole mine project.

11. While I agree that proper garbage control will help reduce potential grizzly bear-people conflicts around the mine site and that future grizzly bear hunting is not currently an issue, other measures proposed in the Grizzly Bear Mortality Risk Reduction Plan have limited proven effectiveness in reducing mortality risk for grizzly bears, such as gating of access roads. Where roads have been gated in the province to reduce risk to grizzly bears, there is virtually no enforcement by the Conservation Officer Service or others in a position of authority. As has been widely acknowledged across the province for a decade or so, the BC MOE is already highly understaffed with numbers insufficient to enforce current regulations and adequately address bear-people conflicts.
12. As identified in my Xeni Gwet'in Proposed Access Management Plan (McCrory 2005), prior to 2003, mining and mining exploration activities in the upper Taseko watershed increased the amount of roads in the XGCA by 45% of all primitive roads, and 24% of all roads, opening up a vast area of wilderness to motorised access, including hunting of black bears and ungulates. An indirect cumulative effect of improving the Taseko/Whitewater road to industrial standards will facilitate increased public access to the whole area for recreation purposes, including more armed hunters. It is expected that the increased population of construction and mineworkers for the 35-year span will also contribute significantly to increased motorised access to the backcountry, including the 50+ km transmission line. New Prosperity EIS also acknowledges that the consequences of mortality risk are high for grizzly bears (p. 1135).
13. Mitigation proposed to be developed in the Grizzly Bear Mortality Risk Reduction Plan will have limited value in reducing potential defense of life or illegal kills by an expanded recreation network and expanded motorised backcountry use.
14. According to Horesji (1999), administrative road restrictions, such as signs, gates, and regulations, have little effect on controlling bear mortality, nor do they reduce the rate of habitat displacement (such as where secondary roads are gated to prevent motorised access). Some examples include:
    - A study in the endangered Selkirk grizzly ecosystem in Idaho showed this low population of approximately 50 grizzly bears suffered 18 deaths between 1982 and 1996, 11 associated with open roads, and 4 on closed roads (Wakkinen 1993, Wakkinen and Johnson 1997).
    - In a National Forest in Idaho, of 10 roads administratively "closed" with gates by the US Forest Service (USFS) for wildlife protection purposes, a spot check by the Idaho State Wildlife Department revealed four were not locked and were open to public use (Pollard 1991).

- In Montana, 53 road closure structures (all gates) were inventoried in grizzly bear habitat with the following findings: 38% were ineffective in restricting passenger vehicle access to 44% of the road system; 25% of the failures were due to trails circumventing the closure; 50% were due to failure to lock gates; and 100% of the structures failed to control snow machines or ATV access (Hammer 1986).
- In the Kootenai National Forest in Montana, the USFS is responsible for limiting access to protect threatened grizzly bear populations and their habitat. They evaluated 281 closure structures, behind which were 1355 km of supposedly protected roads. Of these, 21.4% failed to control vehicle access and a further 25.3% failed to control ATV access; 64% of the roads claimed to be protected were not. Of the 281 structures, 146 were gates; their failure rate was 65.6%, higher than the overall failure rate of control structures (Platt 1993).

15. As noted in my report on deactivation of fireguards from the Brittany Triangle 2003 fire, hunters and mushroom-pickers built ATV access roads around all blockages (McCrory 2009). Illegal ATV access roads have also been built into Brittany Creek and portions of the upper Taseko for hunter access (McCrory 2009). Despite signage and remote cameras used by the Xeni Gwet'in BC Parks/Wild Horse Ranger in attempt to determine, with the RCMP, who was using this unauthorised access, no enforcement was done by the province.
16. At the Chilcotin-Fraser Junction protected area, BC Parks attempted to control access, but both a gate and the fence built to prevent motorised access were removed by unauthorised people in short order (Glen Davidsen pers. comm.).
17. In a survey I did for BC carnivore biologist Matt Austen of legally closed, signed, and blocked/gated access roads in the Pasayten and North Cascades in the BC North Cascade grizzly bear recovery area, motorised hunting groups violated all access points surveyed (W. McCrory pers. comm.).

To repeat, in conclusion, in terms of reliance on monitoring and mitigation measures, such as the *Grizzly Bear Mortality Risk Reduction Plan*, this **represents a continuum of misclaims by Taseko about proposed mitigation measures that have been proven to not be effective when applied to most of the significant adverse environmental effects I have identified for grizzly bears in the region.**

3.2.7 Review of Taseko's EIS comments of "no concern" on interruption of wildlife/grizzly bear movement patterns

> *No key indicators identified in Table 2.7.2.8-3 are carried forward to the assessment of Project effects on movement patterns. Disruption of daily and seasonal wildlife movement patterns can occur as the result of increased habitat fragmentation from habitat loss and linear feature creation or as the result of increased traffic volumes on existing roads. The potential for the Project to affect movement patterns of the KIs was assessed previously and considered not to be of concern* (see March 2009 EIS/Application, Volume 5, Section 6.3). (Section 2.7. Impact Assessment. p. 1092).

Elsewhere, the EIS makes note that since Fish Lake will be intact, bears and other wildlife movements across the area will generally not be impeded.

McCrory Wildlife Services Comments:

1. Although the EIS uses core habitat security areas from units in the adjacent parks, there is no mention of how the mine will drive a wedge into the ecological integrity of these adjacent protected areas and a major movement corridor (that we mapped this spring) that goes right through the heart of the proposed mine.

2. The identification of linear feature (road) vehicle use as High or Low "was generally subjective," according to the 2011 EIS analysis, even though a serious effort could have overcome this deficiency. In any event, this is not in keeping with the precautionary approach, which should have designated all roads as High impact (using spatial Zone of Impact x traffic level rationale).
3. Of the three landscape units (Road Density Figure 2.7.2.8-17) most impacted by the mine proposal, two presently have over 2x the acceptable road density that would permit long term grizzly bear occupation, and the third is 1.5 over the tolerance level. The New Prosperity mine will aggravate this condition and essentially eliminate the short and long-term prospects for grizzly bear population persistence, let alone recovery, in the northeast part of the RSA.
4. It is not a minor point to point out that the New Prosperity EIS was unaware of the grizzly bear recovery standards regarding road density and road buffer zones that have been in place in parts of North America for nearly three decades. It is an ominous sign that these standards, although minimal, are still greater than those used by the EIS in its initial analysis, indicating that Taseko has been resistant to using the best available science in its environmental assessment. This institutional resistance translates itself into a consistently inadequate interpretation of impacts—essentially denial—all of which they dismiss either as not significant or as manageable by some program at some time in the future. In short, the Taseko EIS has continued to misrepresent strong evidence and standards, and has promoted weak evidence or positions with little evidence.
5. As poor food years increase in frequency as a consequence of climate disruption/warming, the critical role that riparian areas play in grizzly bear survival will be accentuated and conflict with humans will accelerate. Dependence on some elusive future recovery and mitigation plan from Taseko's New Prosperity impacts is unwarranted. Coincidentally, but not inconsequentially, impact severity from a possible New Prosperity mine will be heightened and should be upgraded in the proponent's assessment and the Panel's assessment. This reality supports and amplifies the MOE observation that the bear population "could *not* sustain additional human induced mortality (Panel report, p. 107), and MOE's objection to the EIS claim of no significant residual effect on grizzly bears in this area.
6. As I noted previously, the MDA will effectively eliminate a significant regional wildlife/grizzly bear corridor I mapped between Little Fish Lake and Middle Fish Creek.
7. It is highly unlikely with the general mine disturbance regime that even some grizzly bears will continue their movement patterns through the intact Fish Lake area and also feed on spawning trout. A high degree of human-related conflict is expected for those bears that may habituate to the development area and attempt to travel, with a tendency for those cohorts to be females with young in order to avoid male bears that might prey on their young. This being the case, it is expected that some mortality will result over the construction and operational phase of the mine, such as defense of life kills.
8. While it is true that most grizzly bears will be able to disperse around the mine site development at Fish Lake (which will have a lineal blockage of approximately 8 km with a larger Zone of Influence), bears that try to disperse around and across the access highway to the north of the mine will be exposed to greater traffic mortality. The New Prosperity EIS plays this down.
9. My evidence indicates the development footprint (Improved Taseko/Whitewater Road) will negatively impact grizzly bear movement patterns. At the broader landscape level, some grizzly bears make annual movements across the Chilcotin Plateau to the north of the mine in order to access salmon areas to the west in the Taseko-Chilko systems, crossing the Taseko/Whitewater access road. Due to increased traffic volumes from the mine, some grizzly bears will not cross the highway and will thus have their movement patterns to salmon resources blocked. Others that do will experience increased mortality risk.

10. None of the proposed mitigation has been adequately tested nor will any proposed speed limits at identified animal crossings be enforced. The proposed mitigation will do very little, if anything, to reduce predictable road mortality.

3.2.8 Review of Taseko's EIS comments on grizzly bear mortality from collisions with mine traffic, and mitigation

For purposes of the EIS analysis, it should be noted that a high magnitude effect is considered significant where more than one grizzly bear is killed during the life of the project as a result of collisions with project-related traffic (March 2009 EIS/Application, Volume 5, Section 6.3.4.5).

The 2011 New Prosperity EIS repeats the conclusion of the 2010 Prosperity EIS with respect to grizzly bear mortality from mine roads. It says: *there is no significant effect on Grizzly Bear* and:

> *During the Project's construction phase, Project traffic consists of transporting material and persons to the construction site. There are no large units that will require special traffic management other than pilot car for wide loads. The composition of the traffic is about 60% trucks and 40% light vehicles. The largest increment to traffic is Year 1 of operations, which overlaps with construction, with an annual average daily traffic of about 250 vehicles. After that, the Project adds on average about 100 vehicle trips per day (i.e., 50 vehicles making round trip). Concentrate trucks would make about 15 trips per day on average over the mine life. When the mine closes, the traffic volume drops to a negligible value.*

<u>*Taseko Mines*</u> *Table 3-15, p. 3-38 of Vol 6 (social) Current Traffic and Project-Related Traffic Volumes (round trips per day)*. Prosperity 2010 EIS.*

	current traffic	construction	operations	closure	post-closure
	AADT	Yr-1AADT	typical year	Yr 20, AADT	Vehicles per wk
4500 Haul Road	5<	48	100	46	2
Taseko Lake/Whitewater roads	50	48	100	46	2
Hwy 20 Rural (Lee's Corner to Wms Lk)	1,600 to 1,800	48	100	46	2
Hwy 20 (Williams Lake to Hwy 97)	About 16,000	48	100	46	2
Hwy 97 (Wms Lk to McAlister load-out	2,900	-	32		
Note: * indicates will be upgraded					
Source: Taseko Mines, see Table 3-36 for annual values					

[*In my discussion, I have converted round trips per day to vehicles per day (vpd) by multiplying by 2]

The New Prosperity EIS section 2.7 (pp. 1094-1095) also concludes the following:

> *The potential effect of the New Prosperity Project on grizzly bear mortality risk is no different than what was predicted for the Prosperity Project (Volume 5, Section 6.3.4.5). That is, the finding that the Project effect is not significant hinges on the definition of significant. i.e. on a fine line between one versus more than one death and is contingent on: strict enforcement of mitigation measures related to traffic; and, a zero tolerance policy toward problem bear incidents and a non-lethal approach to resolving any incidents should they develop that clearly minimize the possibility of bear-human encounters. Road mortality along the access route and poaching due to increased public access along the transmission line were identified as concerns in the Report of the Federal Review Panel (see Panel Review, Section 6.7.1). In response to the Panel Review, Taseko has 1) updated and expanded the cumulative effects assessment for grizzly bear, with a focus on mortality risk; and 2) committed to new migration measures under an overarching Grizzly Bear Mortality Reduction Plan. The findings of the cumulative effects assessment and further detail on the plan are presented under 'Cumulative Effects Assessment'.*

In terms of mortality to grizzly bears from traffic volume, the New Prosperity EIS states the following in section 2.7 (pp. 1124):

> *Provincially, the reported grizzly bear mortality rate due to vehicle and train collisions was 0.9% for the period from 1978 to 2003 (Austin and Wrenshall, 2004)*. The only sections of the New Prosperity access route that grizzly bears might encounter are the 4500 Road and a portion of the Taseko Lake/Whitewater Road. There is no quantitative baseline data for these road sections or for any other roads in the RSA. Excluding project-related traffic, the primary users of the Taseko/Whitewater Road are residents, the logging industry, hunters, and anglers (March 2009 EIS/Application, Volume 6, Section 3). Daily traffic volume is likely highly variable, perhaps in the order of 50 vehicles per day under typical conditions (March 2009 EIS/Application, Volume 6, Section 3). The 4500 Road has a much lower traffic volume. At maximum disturbance and future case an increase in traffic volume is anticipated. The New Prosperity Project will likely result in a 3-fold increase in traffic volume along the 4500 Road and Taseko Lake/Whitewater Road. Although the bear habitat value is generally low in this area there is evidence of grizzly bear activity along the 4500 Road (T. Hamilton, pers. comm., July 2012) and road mortality along the access route was identified as a concern in the Report of the Federal Review Panel (see Panel Review, Section 6.7.1). Future logging and mining exploration will also increase traffic volume in the grizzly bear RSA through creation of new roads and trails and increasing volumes on existing roads (e.g. it is likely that some of the traffic associated with these projects will use the Taseko/Whitewater Road).*

The Taseko EIS 2011 acknowledges that the Ministry has no data on road kills along the Taseko-Whitewater road. It proposes as mitigation: *Road Mortality: Zero tolerance for grizzly bears road mortalities through road restrictions such as speeds and communication, and working with other parties to improve wildlife awareness and safe road use in the area* (Section 2.7. p. 1129).

McCrory Wildlife Services response to Taseko's EIS of non-significant effects on mortality of grizzly bears from mine-generated traffic mortality:

1. In my section 3.1.4.2, I conclude that the paved mine highway, with its significantly improved speed and threefold increase in traffic volumes, will lead to significant and unacceptable levels of grizzly bear mortality creating a "population sink" effect. I estimate a minimum of about 2-3 reported/unreported collision kills of grizzly bears annually on the mine road, most of this occurring from mine-related traffic (the majority of vehicle users). As noted, in 2010 there was one reported but unconfirmed mortality of a female grizzly with cub as a result of a collision with a logging truck on the Taseko Road. **Mine road mortality will far exceed the high magnitude effect of significance where more than one grizzly bear is killed during the life of the project as a result of collisions with project-related traffic (March 2009 EIS/Application, Volume 5, Section 6.3.4.5). Overall mine road mortality, combined with other mine-related mortality, will have a serious negative effect on the hopes for any recovery of the grizzly bear population in the southeast sector of the South Chilcotin GBPU, since most of the mortality cannot be mitigated.**

2. The EIS "Zero tolerance" of traffic related mortalities is somewhat of a mis-applied term since most of the collision mortalities are not preventable and most will only be reported after a bear is dead, while many will actually go undetected and unreported.

3. It is also misleading of Taseko's 2011 EIS to claim that the province will be developing a recovery plan that will take care of some of the mortality issue for the South Chilcotin Ranges GBPU when so much time has gone by without the government ever committing to one. A recent letter from the province to the CEAA Panel (June 14, 2013, Reference 103165, see Appendix 3) states that the Ministry of Forests, Lands and Natural Resources Operations (FLNRO) had the

following comment on "Responses". This would be in reference to Taseko's claims that: *It should be noted that the South Chilcotin GBPU has no grizzly bear recovery plan, although a recovery plan will be developed for the GBPU.* FLNRO notes that: ***its understanding is that there has been no commitment by the provincial government to undertake a grizzly bear recovery plan in the South Chilcotin GBPU.***

4. To repeat, in terms of reliance on mitigation and cooperative monitoring measures with the province, including a *Grizzly Bear Mortality Risk Reduction Plan* that will be devised within six months if the mine is approved, this also represents a continuum of misclaims by Taseko of insignificant adverse impacts on grizzly bears and proposed mitigation measures that have been proven to not be effective to most of the local conditions with respect to identified significant adverse cumulative environmental effects on grizzly bears from traffic mortality. Where mitigation, such as access management, has helped grizzly bears recover in the continental US, it has also been because of strong federal endangered species legislation, large federal protected areas and national forests with core grizzly habitat, and adequate funding and staff to carry out and enforce mitigation measures over the long term.
5. By denying that there would be any significant mine-related mortality, with no supporting evidence, Taseko is fully misrepresenting the situation. According to Horesji (1999): Understanding the impact of road access involves the recognition that the cumulative effects of incremental mortality and displacement events can quickly destabilise a bear population. In addition, Benn (1998) analysed grizzly bear mortality data for the central Canadian Rockies ecosystem from 1971-1996. Human-related causes were the primary sources of recorded mortality (N = 627 of 639). Some 85% of 462 mortalities with accurate locations occurred within 500 m wide zones of influence (ZOI) around roads and front country developments, and 200 m wide zones around trails and backcountry development. The author concluded that the spatial analysis showed that most grizzly bears died within a narrow zone along roads and trails, and around human settlements but despite this, roads and major developments continued to be constructed in the last unroaded areas. The author recommended: A commitment of no new roads into existing roadless, secure grizzly habitat is what is needed… combined with a program of decommissioning of some existing roads.
6. Cristescu (2013) study looked at 12 radio-collared adult grizzly bears monitored in 2008-2010 on and around coal mineral surface leases (MSLs) in west-central Alberta. This study detected no mortality on the 24 km Cheviot coal mine haul road during this period. The mean frequency of heavy haul truck traffic was one every 10 minutes, whereas light and support vehicles were intermittent. The inference is that 12 radio-collared grizzly bears were monitored at the Cheviot coal mine in Alberta and none were killed by traffic. As it turns, out a number of these bears lost their collars early in the study. Also, no male bears crossed the 24 km Cheviot haul road during the active hauling period. There was also a very small sample size (n = 5) of collared female grizzly bears that did cross the active haul road. There were also many other discrepancies that make any comparison to the proposed New Prosperity mine highway complex and difficult from which to draw any inferences. As noted, the Cheviot study found that no male bears crossed the haul road during the active haul road operation, so the conclusions about lack of road mortality can be somewhat misleading since collared male bears were not crossing the road; although a sample size of males (n = 3) crossed the location of the haul road before haul road construction. This would suggest a negative effect of the road by blocking crossings by male grizzly bears. Single females (n = 1) and females with cubs (n = 2) crossed the road in the phase before the haul road became active, and also during active coal hauling (single females: n = 3; females with cubs: n = 2). In other words, there were only five crossings recorded by female grizzly bears during the active mine operation period of the study, hardly a large enough sample size to draw conclusions about haul road mortality risks to grizzly bears over the long term. In addition The CEAA website: *Cumulative Effects Assessment Practitioners' Guide Cheviot Coal Mine: Case Study*

Highlights (March 31, 2013) [(https://www.ceaa-acee.gc.ca/default.asp?lang=En&n...1&offset] had the following to say about the case study on the impact of the Cheviot Mine on grizzly bears:

> *The analysis predicted an immediate and significant adverse effect on grizzly bears in the Bear Management Unit surrounding the mine. The CEA concluded that regional pressures on large carnivores were reaching the point where 'population losses will become serious and perhaps irreversible.' Mitigation of these effects, even within a 100-year reclamation time frame, was considered difficult.*

7. Although the current Taseko-Whitewater Road is likely causing a small amount of habitat displacement by warier grizzly bears and some apparent mortality, the greatly increased traffic and road upgrade for the Taseko mine will exacerbate this and effectively create a partial ecological blockage for grizzly bears and a mortality/sink area for the grizzly bears attempting to cross the road or that may habituate to the roadsides. In the same ecosystem further to the south, the recent genetic study by Apps et al. (2009) attributes isolation of the Stein-Nahatlatch grizzly bear population on the south from the McGillivray population to the north to grizzly bear mortality associated with human motorised access along the Duffy Lake Road in recent decades, such that resident female grizzly bears have become extirpated north of this road and south of Anderson Lake.

3.2.9 Comments on effects of climate change and wildfires on grizzly bear habitat and bears

Another major shortcoming of Taseko's 2011 EIS is that although it makes mention of climate change, it does not factor in climate change effects that will result in significant alterations to wildlife habitat composition and abundance over the next 30-50 years and beyond.

The Xeni Gwet'in recently completed a draft climate change adaptation study (Lerner et al. 2010). I contributed a review of effects on wildlife, including habitat changes, a previous draft of which has been submitted to the Panel. As a result of further input to myself from another biologist, some changes have recently been made to my final text. For grizzly bears, it is expected that some important habitats and food sources will decrease in abundance and productivity, including wild potatoes, whitebark pine, wetlands/riparian areas, and wild Pacific salmon. Warming waters in rivers and streams will also likely have an effect on trout populations, since these, too, are cold-water fish. Increased berry production from wildfires will offset some of the fall habitat and food source losses for grizzly bears, such as whitebark pine and salmon. Losses of other seasonal food sources, such as wild potato and green plants in wetlands, are a major concern as these represent specialized habitats that grizzly bears would use disproportionate to their low occurrence in the ecosystem, and **represent a net loss of food resources apart from the mine development.** This is particularly true of wetlands/riparian areas, as well wild potatoes and other root/corm foods, which are also only dug by grizzly bears where the soils are not compacted (McCrory and Herrero 1983).

Direct habitat losses from the mine, and losses from displacement from the mine, the road, and the transmission line zone of influence will, therefore, be cumulative to habitat reductions caused by climate change.

In addition, I note that the New Prosperity EIS fails to account for vegetation changes in the MDA and RSA from wildfires, particularly how this will create better habitat for grizzly bears as it has with the three major fires in the Brittany Triangle since 2003.

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APPENDIX 1. GRIZZLY BEAR MARK TREES IDENTIFIED AND SAMPLED FOR DNA – HAIR, BETWEEN LITTLE FISH LAKE AND MIDDLE FISH CREEK. 2012.

Table 2. Grizzly bear surveys Proposed Prosperity Mine. May 2012. Bear hair samples collected at mark trees from Middle Fish Creek and from Fish Lake to Little Fish Lake. In September 2012, hair samples were again collected from some of the same mark trees.

Sample i.d. #	Date collect	Mark Tree i.d.	Approx. location	Coordinates	Bear DNA id.	Sex
Upper Fish Creek (UFCr or U. Fish)						
1 (3 hairs)	May 29	Mark tree #2	Near s. end of Fish Lk, e. side			
2	"	#3	Trail near fish count camp	N 51 26.195 W 123 36.027		
3	"	#4	Trail to Little Fish Lake	N 51 25.634 W 123 36.027		
4	"	#5	"	N 51 25.041 W 123 34.606		
5	"	#6	"	N 51 25.041 W 123 34.606		
6	"	#7	"	N 51 24.748 W 123 33.962		
7	"	#8	"			
8	"	#10	"	N 51 24.560 W 123 33.577		
9	"	#11				
10	"	#12	Field-Trail, Little Fish Lake	N 51 24.229 W 123 33.186		
Lower Fish Cr., below Fish Lk						
1	May 30	L. Fish Cr. #2	Bridge-road to lava cave			
2	"	#3	Log cabin	N 51 28.091 W 123 37.981 (Elev. 4780 ft.)		
3	"	#4	400 m down road	N 51 28.332 W 123 38.502		

APPENDIX 2. RESULTS OF DNA ANALYSIS OF HAIR SAMPLES FROM GRIZZLY BEAR MARK TREES BETWEEN LITTLE FISH LAKE AND MIDDLE FISH CREEK (UPPER). MAY AND SEPTEMBER 2012 SAMPLING PERIODS.

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August 19, 2013

Wayne McCrory
McCrory Wildlife Services Ltd.
208 Laktin Road
New Denver, BC V0G 1S1

Re: WGI Project g1282 Fish Lake Griz

Dear Mr. McCrory:

I have enclosed genetic results for 15 hair samples that we received from you on November 7th, 2012. The results are presented in the attached MS Excel file. The following notes should provide the information needed to understand and defend this project, but feel free to contact us for further detail.
Sample Classes
The 15 samples were classified as follows:

Xblack (20%): 3 samples with odd-numbered alleles at *G10J.*

Xbomb (33%): 5 samples that failed during genotyping.

sample (47%): 7 samples that were assigned individual identity.

DNA Extraction and Success rates
DNA was extracted using QIAGEN DNeasy Tissue kits. All 15 samples met our quality threshold of ≥ 1 guard hair root or 5 underfur. We aimed to use 10 guard hair roots (see "#G" column) per extraction. With underfur we used clumps of entire hairs, rather than clipping individual roots, and recorded an estimate of the number of hairs used (see "#U" column). The amount of material leftover for potential re-extraction was classified as A (excellent) through C (none).

Routine Microsatellite Genotyping

The 15 DNA extracts were genotyped using the same approach as in project g1210, beginning with a first pass of the 8 markers (7 microsatellites and gender) that we have used in other projects from this region. After first pass we set aside 5 samples that had high-confidence[1] scores for ≤ 3 of 8 markers

[1] We use a combination of objective (peak height) and subjective (appearance) criteria to classify genotype scores. Low-confidence scores are identified by removing the leading digit from the allele score, and should be treated as equivalent to missing data.

(*Xbomb*), since it is our experience that no amount of effort will generate complete, reliable genotypes from such samples. We also set aside 3 samples that amplified odd-numbered alleles at marker *G10J*, which is indicative of black bear samples (*Xblack*).

The first pass was followed by a cleanup phase in which we re-analyzed several data points that were weak the first time. All 7 grizzly bear samples that remained in the analysis at this point had complete 8-locus genotypes.

The last phase of analysis was error-checking, following our published protocol of selective data re-analysis (Paetkau 2003). Intensive testing with blind control samples has shown that this protocol effectively prevents the recognition of false individuals through genotyping error (Kendall *et al.* 2009 *JWM*). During error-checking we found and corrected 1 error, of the sort that we expect to encounter when working with sparse DNA sources, like hair follicles.

The success rate for this project was better than in project g1210, with 67% (including black bears) of your samples producing complete 8-locus genotypes.

Individual Identification

The 7 successful grizzly bear samples were assigned to 4 individuals (3M:1F), all of which were new to your dataset (neither individual from g1210 was 'recaptured'). However, when we compared your genotypes to those of 224 grizzly bears from Cedar Mueller's Chilcotin study and 399 bears from the 'South Coastal' dataset of Apps *et al.*, your bear S-4 was found to have records in both the 'Coastal' dataset (where it is identified as 74013-a1) and the Chilcotin (C11-3723), and your bear S-2 matched to the 'Coastal' bear 74002-b1. Please contact Cedar Mueller and Clayton Apps for details on where and when they sampled these bears. Note that we can confirm any match that you find suspicious by analyzing samples from each study area at additional markers.

The 3 black bear samples produced identical 8-locus genotypes.

Various and Sundries

Please let us know if you need anything other than electronic versions of this letter and the associated results file and invoice. As in the past, we'll count on you to ensure timely payment of the invoice, which comes to $1,142.50 before tax.

We did not exhaust all of the sample material or all of the DNA that we extracted. We are willing to archive leftover materials here for up to 5 years, in case a need arises for it when error-checking against data from future sets of samples; if you see no prospect for additional work, we ask that you make arrangements for the return or disposal of leftover materials as soon as possible.

Thank you for your patronage, and please feel free to call with any questions or concerns.

Yours sincerely,

David Paetkau, Ph.D.
President

encl.: g1282 Results.xls; g1282 Invoice.pdf

Wildlife Genetics International

200-182 BAKER STREET (COURIER), P.O. BOX 274 (MAIL), NELSON, BC V1L 5P9

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July 20, 2012

Wayne McCrory
McCrory Wildlife Services Ltd.
208 Laktin Road
New Denver, BC V0G 1S1

Re: WGI Project g1210 Fish Lake Griz

Dear Mr. McCrory:
I have enclosed genetic results for 13 hair samples that we received from you on June 21, 2012. The results are presented in the attached MS Excel file. The following notes should provide the information needed to understand and defend this project, but feel free to contact us for further detail.

Sample Classes
The 13 samples were classified as follows:

Xbomb (85%): 11 samples that failed during genotyping.

sample (15%): 2 samples that were assigned individual identity.

DNA Extraction and Success rates

DNA was extracted using QIAGEN DNeasy Tissue kits (for details search http://www.qiagen.com/). All 13 samples met our minimum quality threshold of at least one guard hair root or 5 underfur. We aimed to use 10 guard hair roots (see "#G" column) per extraction. When underfurs were used, the number recorded (see "#U" column) was an estimate because entire clumps of whole underfur were used rather than clipping individual roots. An estimate of the amount of leftover hair (see "Left" column) was made using 3 classes: no guard hairs (C); 1 to 4 guard hairs (B); more than 4 guard hairs (A).

The success rate for your project was poor, with only 15% of extracted samples producing complete genotypes (70%–90% success is common for hair follicle projects). This may have been caused by storing the hair samples in plastic bags. Plastic bags trap moisture, which in turn degrades DNA, and we strongly recommend that samples are stored in breathable paper coin envelopes.

All 10 samples from Upper Fish Creek failed, but 2/3 samples from Lower Fish Creek produced useable genotypes. Perhaps you can think of a reason why the success rates would differ between the two areas. Obvious considerations are the age of the samples at the time of collection, or exposure to sun or moisture.

Routine Microsatellite Genotyping

Genotyping of your 13 extracted samples followed a three stage approach, beginning with a first pass at 7 microsatellite markers which are used in the Chilko River and Lillooet study areas. A gender marker was also analyzed, for a total of 8 markers.

Following the first pass, we set aside 11 samples that had high-confidence[2] scores for ≤ 3 of 8 markers. This cull eliminates the most problematic samples from the remainder of the analysis. We find that such samples require a disproportionate amount of effort, and seldom if ever yield accurate, complete data.

The first pass was followed by a cleanup phase in which we reanalyzed one data point that was weak the first time, using 5µl of DNA per reaction, rather than the 3µl used during first pass. Following cleanup both samples had complete 8-locus genotypes.

Individual Identification

The 2 successful samples had very distinct genotypes, differing at multiple markers, and in ways that were not consistent with the most common types of genotyping errors. We can therefore be confident that these 2 samples came from different individuals. Both individuals were male (heterozygous at the sex marker). We normally provide a second spreadsheet in the results file where results are summarized by individual, but with just 1 sample per individual this sheet would have been superfluous.

We compared the 2 individuals from this project with 224 bears from Chilko River (Cedar Mueller) and 399 bears from the ‘South Coastal’ dataset of Apps *et al.* Individual LFC1 had not been previously detected in either area but LFC2 matched to individual T10-2612 from the Chilko River study area. Please contact Cedar Mueller for details on her collections from this bear.

Various and Sundries

It is my intention to communicate these documents in electronic form only, but I’d be happy to send hardcopies through the post if you need them. I have attached an invoice for $927.50, plus tax. I’ll assume that I don’t need to send this invoice to another desk for processing, unless you tell me otherwise.

The biggest technical question to think about for any future project is whether the poor sample quality was due to degradation prior to collection, or due to the storage in plastic bags (which we generally associate with poor results). For larger groups of samples, there are lab strategies that can be used to lower costs for projects based on poor quality samples. However, a small group of low quality samples is always going to turn out poorly from a cost–benefit perspective.

Unless we receive other instructions from you, leftover DNA and hair will be archived under appropriate conditions for 5 years. If you have no plans to build on the dataset, we’d ask that you make arrangements for the leftovers sooner.

Thank you for your patronage, and please feel free to call with any questions or concerns.

Yours sincerely,

David Paetkau, Ph.D.
President

encl.: g1210 Results.xls; g1210 Invoice.pdf

[2] We use a combination of objective (peak height) and subjective (appearance) criteria to classify genotype scores. Low-confidence scores are identified by removing the leading digit from the allele score, and should be treated as equivalent to missing data.