Technical Paper
In Support of Listing Waterton-Glacier as a World Heritage Site in Danger Due to Proposed Coal Open-Pit Mining and Coalbed Methane Extraction in the Flathead River Headwaters

Prepared by:

Earthjustice
426 17th St.
Oakland CA 49612 USA

Ecojustice
131 Water St. Suite 214
Vancouver BC V6B4M3

On Behalf of the Signatories of the Petition to the World Heritage Committee on June 2, 2008:

Canadian Parks and Wilderness Society
Dogwood Initiative
Flathead Coalition
Forest Ethics
Headwaters Montana
National Parks Conservation Association
Pembina Institute
Sierra Club BC
Wilderness Society
Wildsight
Yellowstone to Yukon Conservation Initiative

Table of Contents

EXECUTIVE SUMMARY

This technical paper supports the petition to UNESCO's World Heritage Committee submitted by eleven environmental organizations on June 2, 2008 to add Waterton-Glacier International Peace Park to the List of World Heritage in Danger. This paper summarizes published information related to 1) the conservation values of Waterton-Glacier, the Flathead River basin and the Crown of the Continent ecosystem, 2) the potential threats to the World Heritage site from coalbed methane development in the coalfields of the headwaters of the Flathead River, and 3) potential threats to the site from open-pit coal mining in the same coalfields.

Petitioners are concerned that a proposed open-pit coal mine and a coalbed methane extraction project in the headwaters of the Flathead River threaten the features of the site that warranted its World Heritage listing in 1995. The petitioners request that the Secretariat and members of the Intergovernmental Committee for the Protection of the Cultural and Natural Heritage of Outstanding Universal Value (World Heritage Committee) place Waterton-Glacier International Peace Park on the List of World Heritage in Danger pursuant to its authority under Article 11, paragraph 4 of the Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention).[1]

Of utmost concern are threats to the water quality of this pristine and ecologically important transboundary river, which runs from southeastern British Columbia into Montana, along the western border of Glacier National Park and beyond to Flathead Lake and the Columbia River. Water pollution puts at risk the survival of riparian species, including endangered bull trout and genetically rare westslope cutthroat trout.

Habitat disturbance and fragmentation resulting from terrestrial disturbance will negatively impact the breeding grounds and migratory corridors of large, and in some cases endangered, mammals, including grizzly bear, wolf, lynx, wolverine, elk, moose and deer.

Recent statements by BP Canada and Cline Mining Corp. indicate that these companies are planning extensive mining, drilling, and infrastructure development in the Crowsnest coalfields, located in the headwaters of the Flathead and Elk rivers in southeastern British Columbia. Such development will adversely impact the water quality, habitat availability and wildlife populations of the Flathead River, Waterton-Glacier, and the Crown of the Continent ecosystem.

A listing on the List of World Heritage in Danger would highlight the threats posed by coal and coalbed methane extraction to terrestrial and downstream freshwater ecosystems. It would provide impetus for actions by the governments of British Columbia, Alberta, Montana, Canada and the United States to resolve energy and mineral development issues within the transboundary watershed.

Coal and coalbed methane (CBM) extraction activities in the headwaters of the Flathead River would have a significant impact on a landscape that provides internationally critical wildlife habitat that supports extraordinary densities of otherwise rare species including grizzly bears, wolves, Canada lynx, and wolverines. Important native fish populations, including populations of bull trout and westslope cutthroat trout are directly threatened by potential water quality changes in their spawning areas. The food webs of the Flathead River would be threatened by reduced fish populations, resulting in a ripple effect throughout the Waterton-Glacier ecosystem. An open-pit coal mine and CBM infrastructure of service roads, pipelines, powerlines, pump stations, compressors and flaring stations would reduce available habitat, fracture connectivity, and directly impact wildlife.

Terrestrial wildlife are threatened by industrialization of key valley bottom habitats. These areas are crucial for wintering and birthing for many species that cross international and park boundaries using the Flathead River basin each year, including grizzly, wolf, wolverine, marten, moose, deer and elk. Gene flow between wildlife populations to the north and south of Waterton-Glacier is also threatened by these proposed projects. The danger from upstream coal and CBM extraction exacerbates the many other ascertained threats to the park's internationally significant resources, which include highways, increasing human settlement, ranching, timber, recreation and mining in areas surrounding Waterton-Glacier.

Recent statements by the Province of British Columbia, BP Canada and Cline Mining indicate that the companies are investing over 100 million Canadian dollars in research, planning and exploration activities in anticipation of extensive mining, drilling, and infrastructure development in the Flathead headwaters. These activities are anticipated to start as early as 2009. If these projects proceed, the impacts to fish and wildlife in Waterton-Glacier and throughout the Crown of the Continent ecosystem are likely to be severe and irreversible.

A. CONSERVATION VALUES OF WATERTON-GLACIER INTERNATIONAL PEACE PARK AND ENCOMPASSING ECOSYSTEMS

Waterton-Glacier International Peace Park is a magnificent testament to the beauty of the wildlife and plant communities of the Rocky Mountains of North America. With diverse habitats including glaciated peaks, untouched riparian valleys, mountain lakes, prairie grasslands, aspen stands, montane coniferous forests, subalpine forests and alpine meadows, the park's location in the western Cordillera of North America has led to the evolution of unique plant communities and ecosystem complexes that do not occur anywhere else in the world.

A.1. The Crown of the Continent and the Flathead River Basin Ecosystem

Waterton-Glacier is located within the Crown of the Continent Ecosystem, which covers approximately 44,000 square kilometers (16,000 square miles). The northern-most boundaries are the headwaters of the Elk River in British Columbia and the Highwood River in Alberta, near Highwood Pass. The southernmost boundary is Montana's Blackfoot River Valley. The eastern periphery of the ecosystem in Alberta and Montana extends slightly into the Great Plains. Other mountain ranges of Montana and British Columbia, such as the Salish Mountains, make up the western fringe of the ecosystem.

It is one of the premier mountain ecoregions of the world and an integral part of the much larger mountainous landscape known as Yellowstone to Yukon. The ecosystem is split roughly in half lengthwise (north to south) by the Continental Divide, the high ridge that separates the Atlantic and Pacific ocean drainages of North America. Within the Crown of the Continent are mountain ranges including the Livingstone, Macdonald, Lewis, Clark, Whitefish, Galton, Lizard, Swan, Mission, and Flathead. Between these ranges are narrow river valleys including the Elk, the three forks of the Flathead, and the Swan. The Crown of the Continent is the headwaters of three of the North America's large river systems; the Columbia, Missouri and Saskatchewan all have their source in the region.

At the heart of the Crown of the Continent ecosystem is the transboundary Flathead River, one of the most pristine river drainages in the Rocky Mountain region. It is the last wide, low-elevation valley in southern Canada that has no permanent human settlement. It originates in and drains 4118 km^2 (1617mi^2) of land between the MacDonald-Whitefish and Clark-Livingstone ranges of British Columbia and Montana. The river begins in southeast British Columbia and flows across the international boundary into northwest Montana, where it is called the North Fork of the Flathead, forming the western border of Glacier National Park before emptying into Flathead Lake and continuing on to the Columbia River. Approximately 40% of the Flathead basin is in British Columbia and 60% is in Montana.

Geologically, the area is renowned for its ancient rocks and glacially carved mountains. It is valued for its bird migrations, unique communities of wildlife, and more than a thousand species of plants.

Wildlife biologists have long noted the critical importance of the Flathead River to the surrounding ecosystems, describing it as the ecological engine of the Crown of the Continent ecosystem, and a biodiversity hotspot on a continental scale.[2] It has one of the most outstanding large mammal assemblages in North America, including 16 carnivore and six ungulate species. This high diversity is attributed to low human population, isolation of the basin, exceptional biodiversity of the landscape and habitat, functional habitat connectivity, absence of industrial development and an intact floodplain ecosystem.[3]

The Flathead basin is the ancestral and spiritual home of Blackfoot, Salish, Kootenai, Pend d'Oreille and Ktunaxa native peoples, who have long sought and celebrated the land's spiritual power.[4] Cultural historian Thompson Smith summarizes the native cultural and archaeological importance of the region as follows:

> *Dr. Carling Malouf, a longtime professor of anthropology at the University of Montana, has written that "the density of occupation sites around Flathead Lake, and along the Flathead River...indicates that this was, perhaps, the most important center of ancient life in Montana west of the Continental Divide....The area around Flathead Lake, and along the Flathead River down as far as Dixon is so rich and dense in sites that one is tempted to regard the area as one vast archaeological site.".... Malouf was less informed about the various branches of the Flathead upstream from the lake, but these were just as important to the Pend d'Oreille, and also to the Kootenai.*[5]

Because the Flathead River headwaters has no permanent human settlement, species like grizzly bears are able to use lush riparian areas that they have been displaced from almost everywhere else. Because the river has never been dammed, nor had its banks tampered with to prevent flooding, a shifting mosaic of floodplains and forests provides outstanding habitat for birds. Because the soil and climate are not suitable for agriculture and the cross-Canada rail-line passed one valley north through the Elk Valley, the Flathead has remained unsettled.[6]

A.2. International Recognition of Conservation Values of the Region

In 1995, the World Heritage Committee designated Waterton-Glacier as a World Heritage site in recognition that it meets two of the criteria for natural heritage. First, it contains "superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance" (criterion vii, formerly criterion iii). Second, the two parks are "outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals" (criterion ix, formerly criterion ii).[7]

The Committee noted that "[t]he site is of biogeographical significance bringing mountain and prairie biomes into contact. The area serves as a genetic link between the northern and southern Rocky Mountains, and serves as a corridor for wildlife and gene flow in both directions across the international boundary."[8] The Committee also found that Waterton-Glacier contains the most important and significant natural habitats for threatened species:

> *The two parks are at the interface of five major ecoregions, with many plants and animals found at the extremities of their respective ranges. A number of nationally threatened plant and animal species are found in the parks, and Glacier National Park contains 98% of the world's remaining stock of genetically pure westslope cutthroat trout.*[9]

Upon inscription of Waterton-Glacier as a World Heritage site, the World Heritage Committee recommended that the site be eventually expanded to include part of the eastern side of the Flathead River drainage in British Columbia.[10]

The Government of Canada has expressed an interest in expanding Waterton Lakes National Park through the addition of lands in the Flathead Valley. In 2002, Canadian Prime Minister Jean Chrétien urged Parks Canada to double the size of Waterton Lakes National Park by lining up its western border with the western edge of Glacier National Park. According to Parks Canada:

> *The Flathead Valley in British Columbia, Canada remains an important area for conservation of shared wildlife resources with the Waterton-Glacier International Peace Park.... However, progress on this commitment will not proceed further without the support of the Province of British Columbia and First Nations…. Parks Canada will continue its attempts to expand Waterton Lakes National Park into the Flathead Valley; if successful, this would provide the opportunity to enlarge the World Heritage site….*[11]

In the United States, the North Fork of the Flathead River is protected under federal classification as a Wild and Scenic River.[12] In 2008, the Outdoor Rivers Council of British Columbia listed the Flathead River on the Endangered Rivers List for the second year in a row.[13]

British Columbia's 2004 Land Use Plan designates the upper headwaters of the Flathead River as "Core Grizzly Habitat," as well as key habitat for mountain goats and trout spawning.[14] Nevertheless, the current land use plan states that mining, development and oil and gas exploration take precedence over any of the wildlife and habitat management policies currently taking place.[15]

In 2000, Waterton-Glacier received 2.2 million visitors—420,000 at Waterton Lakes and 1.74 million at Glacier. Nearly 20% of non-resident summer visitors to Montana indicated that Glacier was their "primary" reason for visiting the state. Visitation to the Park has held steady for the past ten years.[16] Tourism brings in over USD$300 million annually to northwest Montana's economy, and the economic value of Flathead Lake is estimated to exceed US$10 billion.[17] Thus the conservation values of the Flathead and Waterton-Glacier translate directly into economic benefits for British Columbia, Alberta, and Montana.

In 2003, Montana and British Columbia signed an Environmental Cooperation Arrangement that required the development of a workplan to address transboundary environmental issues, including management of the Flathead River in British Columbia and Montana. The two governments committed to "identify, coordinate and promote mutual efforts to ensure the protection, conservation and enhancement of our shared environment for the benefit of current and future generations." [18]

As of June 2008, it remains to be seen if and when Montana and British Columbia will create a workplan as required by the Environmental Cooperation Arrangement, and whether National Park expansion will be a possibility for the Flathead.

A.3. Geology

The red and green argulite rocks found in the Flathead represent the oldest sedimentary formations in the Rocky Mountains. The rocks were laid down in shallow seas roughly 1.4 billion years ago, and they now crown mountains. Trails and creeks pass over and cascade down these ancient seabeds, creating the most colorful mountains in Canada. Made from mud and silt washed down from earlier mountains and colored by iron, the rocks preserve ripples and mud cracks made by gentle waves from eons ago. The Flathead basin also contains stromatolites – circular algal mats now preserved in stone – fossils of the oldest life forms on earth.[19]

A.4. Flora

The Flathead exists at a geographic crossroads, a mixing zone for plant and animal communities from the arctic, the boreal, the prairies, the Pacific and the American Rockies. This convergence creates a richness and diversity of life unmatched anywhere in the Rocky Mountains, and perhaps the highest diversity of vascular plants anywhere in Canada, with 24 rare and endemic plants.[20]

Over one thousand species of wildflowers live in shallow beds of topsoil, including glacier lily, fireweed, paintbrush, spring beauty, beard's tongue, western meadow rue, starry Solomon seal, and beargrass lily. The roots of the prolific yellow-blossomed glacier lily are a primary spring food of grizzlies. The unusual beargrass lily sprouts a meter-high stem from a tuft of waxy leaves and blooms profusely every seven years, covering entire hillsides in white blossoms.

Forests of the floodplains are populated by cottonwood and willow. Coniferous forests of lodgepole pine, Douglas-fir, western larch, spruce, and subalpine fir dominate the upland areas, and patches of fescue grasslands are scattered on the alluvial benches above the river.[21]

A.5. Riparian Habitats and Biodiversity

In addition to the river itself, the rich, riparian valley and floodplains of the Flathead River basin support a rich diversity of plant communities and wildlife. It supports a greater diversity and abundance of carnivores, such as mountain lion, grizzly bear, lynx and wolverine, than any other area in North America. The riparian floodplain is a natural travel corridor for wildlife, allowing seasonal movement in the rugged topography of the Rocky Mountains.

In addition to habitat connectivity, the floodplain and riparian areas contain important food sources for bears, with abundant early spring and late fall foods. According to biologist Dr. Jack Stanford of the University of Montana, the Flathead's shifting mosaic of habitat types facilitates very high biodiversity and bioproduction. The area contains what may be the highest level of species diversity in the Rocky Mountains, if not the entire continent.[22]

The Flathead valley provides important connectivity for wildlife moving back and forth between the U.S. and Canada. Connectivity between animal populations is critical to their long-term survival. Successful dispersal is the mechanism by which vanishing local populations are 'rescued' from extirpation through connectivity of metapopulations. Isolated "island" populations of mammals vanish over time.[23] As ecosystems worldwide face the stresses of climate change and the range of species shifts, the Flathead corridor will become increasingly important for species survival.

A.6. Rare and Endangered Fauna

The Flathead watershed offers premiere wildlife habitat supporting extraordinary densities of otherwise rare species including grizzly bears, wolves, Canada lynx, wolverines, fisher, Rocky Mountain bighorn sheep, and tailed frog. The watershed contains eight "blue-listed" aquatic and terrestrial species in British Columbia and six species listed as endangered or threatened under the U.S. Endangered Species Act.

British Columbia blue-listed species include the grizzly bear, Rocky Mountain bighorn sheep, northern goshawk, turkey vulture, Lewis' wood pecker, bull trout, and mottled sculpin.[24] Red-listed (endangered) species in British Columbia include the tailed frog and Rocky Mountain red tailed chipmunk.[25] Western populations of wolverine and grizzly bear are species of special concern in Canada. In the United States, grizzly bear, lynx, bald eagle, and bull trout are listed as threatened. The peregrine falcon is a species at risk in Canada.

a. Riparian species

The Flathead River itself supports over 300 species of aquatic insects, 10 species of native fish and 12 species of introduced fish. Important native fish populations include populations of bull trout (threatened in the U.S.) and rare genetically pure westslope cutthroat trout, both of which migrate from Montana to spawn in the Canadian headwaters. The tributary streams and main stem of the Flathead in B.C. are critical spawning and rearing habitat for bull trout, westslope cutthroat trout, mountain whitefish and sculpin.[26]

Bull trout are a sensitive species, native to cold, clear waters like those in the Flathead River. They spend their adult life in Flathead Lake in Montana, then migrate up river (up to 275 km) to spawn in select tributaries throughout the B.C. Flathead, as well as the Montana tributaries. Bull trout have highly specialized habitat requirements and are very sensitive to water temperature change and any form of habitat degradation.[27] Bull trout are listed as threatened under the U.S. Endangered Species Act and blue-listed in British Columbia. Research conducted within the last five years has uncovered new species in the British Columbia portion of the Flathead, including a species of sculpin thought to be endemic to the region.[28]

In 2003, the B.C. portion of the Flathead basin supported approximately 55% of the bull trout spawning population in the transboundary Flathead River.[29] In 2006, surveys found bull trout, westslope cutthroat trout and sculpin in Foisey Creek, and westslope cutthroat trout in Crabb Creek (see Figure 8).[30] The headwaters of both of these creeks, which are tributaries to the Flathead River, would be destroyed by the proposed Lodgepole open-pit coal mine's northwest waste dump (see Figure 16).[31]

b. Tailed Frogs

The Flathead supports a population of Rocky Mountain tailed frogs, the most primitive frog in the world. Like the native fish, the tailed frog is sensitive to habitat degradation and is the only stream-dwelling frog in Canada. The tailed frog is red-listed in British Columbia and is uncommon in the United States.[32]

c. Carnivores

The following carnivores live in the transboundary Flathead: grizzly bear, black bear, wolf, coyote, red fox, cougar, lynx, bobcat, marten, fisher, wolverine, badger, river otter, mink, and various weasels. According to a 2001 study by the Wildlife Conservation Society, the transboundary Flathead region "has a unique carnivore community unmatched in North America for its variety, completeness, use of bottomlands, and density of species that are rare elsewhere."[33]

i. Grizzly Bear

There are estimated to be between 100 to 200 grizzly bears in the Flathead area. They have a very low reproductive rate, with one to four cubs per litter. Cubs stay with their mother approximately two years. The home range size for males is 463 sq km, and 104 sq km for females, and their average daily movement is about 2.4km. In the Flathead area, key foods for grizzly bears include: (1) ungulates (elk and moose) and Hedysarum roots in the early spring, (2) grasses, horsetails, and cow parsnip later in spring and early summer, (3) huckleberries and buffaloberries in late summer, and (4) berries, ungulates, and Hedysarum roots in fall. The Flathead and adjacent Waterton Lakes National Park are the only bear study areas in North America that have all major bear foods found across the interior of the continent. The presence of both species of berries ameliorates fluctuation in availability of this key food and provides important stability in foraging opportunity.[34]

In spring, most grizzly bears in the Flathead move down to the broad valley where they find many key foods in riparian habitats; other bears remain in the mountains and find spring foods in avalanche chutes. Later in summer, bears feed on huckleberries in sites at 1700-2000 m elevation that were burned 50-70 years previously and/or for buffaloberries in open timber burns at various elevations. In the fall, many bears again use the broad riparian areas along the Flathead River for various foods.[35]

The Flathead valley serves both as a population center for grizzly bears and a vital north-south connector for grizzly populations. Research has demonstrated the highest density of inland grizzlies anywhere in the Rocky Mountains. However, encroaching development threatens grizzly bears' use of their habitat in the Flathead and adjacent territory. Highway 3 north of the Flathead acts as a barrier to females, and only a very few males have been shown to cross the highway. The long-term implication of this will be the isolation and weakening of the grizzly population in the Flathead. The key to grizzly conservation success requires restoring the bears' ability to cross Highway 3, and preventing further loss of habitat.[36] Fossil fuels development in the headwaters of the Flathead will increase development and road construction in the region, thus weakening the connectivity of the grizzly populations of Waterton-Glacier and the Flathead Basin with populations further north.

ii. Wolf

The wolf population of the Flathead has varied since their recolonization of the area in the early 1980's, increasing from one pack to four packs by 1992, and declining since then. Wolves are known to disperse up to 800km during their lifetimes, and wolves of British Columbia's Flathead have dispersed into both Waterton Lakes National Park in Alberta and

Glacier National Park in Montana. They use valley bottoms intensively, especially during winter months when ungulates are concentrated there.[37]

iii. Lynx

Lynx are specialized predators of snowshoe hare, so stable populations are dependent on the availability of their prey's habitat – mid-elevations with moderate slopes and early to mid-succession forest stands, or within low lateral branches of subalpine fir or shrub understories in late-succession coniferous stands. Lynx often use large logs for denning, further increasing their reliance on late-succession forests, such as are found in the British Columbia portion of the Flathead in both lowlands and uplands. Lynx are known to disperse up to 1000km in their lifetimes. Current number of lynx in the Flathead are unknown, but several lynx were trapped in the transboundary Flathead between 1985 and 2000, while over 150 were trapped in adjacent watersheds where trapping is more common.[38]

iv. Marten

Marten prey on voles and pine squirrels, which live in late-succession coniferous forests with a complex structure of leaning and downed logs at the forest floor, which provide access for marten to catch prey under snow, as well as a warmer microenvironment in winter. They require large live trees and snags for natal and maternal denning. Such old growth spruce stands are rare and scattered within the Flathead watershed. The headwaters of Foisey and McLatchie Creeks, where the Lodgepole coal mine is proposed, have significant remaining patches of old growth spruce. Major wildfires and salvage logging have greatly reduced available marten habitat, so conservation of remaining late-succession stands is important for marten conservation. An average of 216 marten are trapped each year on the B.C. and Montana portions of the Flathead, the highest of any major watershed in the region.[39]

v. Wolverine

Wolverine use a variety of habitats, feeding on ungulate carrion in winter and spring, and a range of foods, predominantly ground squirrels, in summer. Both the diversity of foods and availability of ungulate carrion appear important to the distribution, survival, and reproductive success of wolverines. Young females often establish home ranges within or adjacent to their mother's range. Wolverines are sensitive to human disturbance, particularly during the denning period. Because of their low reproductive rate, they are vulnerable to trapping. Over the past 15 years, 24 wolverine were trapped in the Montana and B.C. portions of the Flathead, making it the second-highest harvest of any watershed in the region.[40]

d. Ungulates

Moose, elk, mule deer, white-tail deer, mountain goat and bighorn sheep are all native to the area. Of these, mountain goat are regionally significant and Rocky Mountain bighorn sheep are provincially significant in British Columbia. The riparian meadows and old growth forests in the Flathead provide important wintering and calving habitats for these species, which migrate seasonally in and out of the watershed into Waterton-Glacier as well as more northern habitats.[41]

As part of the Southern Rocky Mountains Management Plan, the government of British Columbia calls for the following actions to conserve ungulates in the region: maintain healthy riparian ecosystems; maintain old-growth and mature seral forest habitat; manage ungulate winter range; and maintain habitat connectivity, including between seasonal ranges.[42]

e. Migratory Birds

Waterton-Glacier is located on the overlap of two major avian migratory routes: the Central and Pacific flyways. The marshes and lake areas of the region are also used extensively as staging areas. Both the bald eagle and peregrine falcon pass through the area.[43]

B. THREATS TO WATERTON-GLACIER FROM COALBED METHANE EXTRACTION

Coalbed methane (CBM) is 'natural' gas trapped in coal seams and adsorbed or held in coal seams by water pressure. It is also called 'coalbed gas,' 'natural gas from coal,' or 'unconventional gas.'[44] Historically, CBM posed a danger to coal miners due to the risk of explosion. Canaries were used by early coal miners to detect dangerous levels of this odorless gas.

CBM is usually comprised of about 90 to 100% methane (CH_4), and may contain carbon dioxide (CO_2), nitrogen (N_2), and small amounts of ethane (C_2H_6) or propane (C_3H_8). It is considered a 'sweet gas' in that it does not contain hydrogen sulfide. CBM can often be sent directly from the well to pipelines once trace amounts of water and carbon dioxide are removed. It is used to heat homes, generate electricity, and as a fuel for cars, trucks and public transit.[45]

Pressure from the overlying rock and water within the coal seam keeps the methane adsorbed in the coal. During production, water is pumped out of the coal seams, lowering the pressure and thus releasing the gas to be collected and sent to market.[46] Most CBM is extracted from 200 meters to two kilometers below the surface.[47]

Tapping CBM in the mountains requires up to 24 wells per square mile, between 0.5 to 2.0 miles of service road per well, and more than 4 acres of clearcut forest per well. Infrastructure for wells in the Flathead headwaters could cover roughly 58 square miles.[48]

B.1. <u>Habitat Fragmentation Due to Dense Surface Infrastructure</u>

Because CBM development results in the creation of a dense network of roads, well pads, generators, drilling rigs, pumps, compressors, gas pipelines, water pipelines, power lines, water storage ponds or other equipment across the landscape, one of the most severe environmental impacts of CBM extraction is on wildlife habitat and connectivity.[49] Large numbers of wells are required to penetrate the seams with enough fractures to remove water quickly and to release economically viable quantities of the gas. Because CBM is usually spread out over a large area, more wells are typically required than for conventional gas development in order to effectively 'de-water' the coal seams.[50]

While conventional gas production usually has one well per 640 acres, CBM wells may be set at one every 40 acres, as in some areas of the United States. Two to eight wells per section (640 acres or 258 hectares of land) are typically used to access CBM, as compared to one well per section for conventional natural gas.[51] British Columbia law does not limit the density of coalbed methane wells.[52]

Roads and pipelines have a severe impact on wildlife including: fragmentation of wilderness; cumulative loss of habitat: alteration of behavior patterns, migration, and predator-prey relationships; reproductive failure for sensitive species; and increases in hunting and poaching. Construction of roads can alter drainage patterns, trigger landslides, increase stream sedimentation and bank erosion, create barriers to fish passage, and destroy aquatic habitats.[53]

CBM development in the headwaters of the Flathead poses a serious threat to wildlife, especially large mammals and raptors that migrate seasonally, require large territories, or disperse widely over generations. Grizzly bear, grey wolf, mountain lion, lynx, wolverine, marten, moose, elk, mountain goats, deer and bald eagles move in and out of Waterton-Glacier Park, and require habitat connectivity along the Yukon to Yellowstone corridor. These species move across the international border, which is also the Park border, making the Flathead River basin truly a transboundary landscape that must be managed as one integral, ecological unit. If the headwaters of the Flathead are industrialized, ecological connectivity with pristine areas further north will be further disrupted, genetically isolating populations found at the furthest extremes of their ranges. This is particularly risky for grizzly bear and wolverine. In Canada, there is gene flow between animals in Waterton Park and the rest of the Canadian Rockies west and northward. In Montana, animals in Glacier National Park are connected to populations to the south. Thus populations are more resilient to changing environmental conditions because they have more habitat and genetic diversity to draw on in times of stress.[54] According to wildlife biologist Dr. John Weaver:

Due to these unique characteristics and its strategic position as a linkage between National Parks in both countries, the transboundary Flathead may be the single most important basin for carnivores in the Rocky Mountains.… It is in this context of biological vulnerability, vanishing spaces, and beckoning opportunity that the transboundary Flathead assumes critical importance for carnivores as a crucible for our commitment to conservation.[55]

B.2. Soil Disturbance

Installation of a CBM well begins with clearcutting the plot of land to be drilled. According to the British Columbia Ministry of Energy and Mines, once vegetation has been removed, a CBM operation must then remove all topsoil from the plot of land to be drilled, piling it along the sides of a one hectare plot (100m x 100m). The drilling rig is brought in, and the well drilled and hydraulically fractured. If the well does not produce economically viable CBM, the topsoil will be replaced and the well sealed with cement. If the site is viable, gas and waste water pipelines will be installed, and the topsoil returned.[56] However, even when topsoil is "returned", the creation of wells sites and connecting roads increases runoff, erosion, sediment depositions in streams, and stream turbidity (lack of transparency due to suspended solids), all of which can damage fish spawning grounds.[57] Slow regeneration of vegetation in regions with short growing seasons further increases the risk of continual erosion and run-off.

B.3. Aquifer Reductions from De-Watering of Coal

Many coal seams require removal of significant amounts of water to relieve pressure before gas can be extracted. The requirement of de-watering is the primary factor distinguishing CBM production from conventional oil and gas extraction. In a typical CBM well, the initial de-watering stage lasts six months to two years before significant methane production begins.[58] This water is typically stored on-site in lined impoundment pits.[59] De-watering of aquifers where coal seams are shallow could impact fresh groundwater supplies.[60] The U.S. Bureau of Land Management estimates that one CBM well can lower aquifer levels by 10 meters within three meters of a well. In Wyoming's Powder River and San Juan CBM developments, drinking water wells dropped 60 meters near CBM sites.[61] In streams with a high proportion of flow coming from groundwater, a reduction in groundwater inflow will significantly reduce total flow volume. This can lead to reductions in the depth of surface water, extent of wetted area, and changes in flow dynamics,[62] which can have serious implications for fish survival.

B.4. Water Pollution: Disposal of 'Produced' Water

The average CBM well pumps out 350 to 500 barrels of 'produced' water per day. While some produced water may be suitable for livestock, range animals, or domestic use, it is often too much or is unsuitable for local use. The quality of the water pumped from these seams ranges from relatively fresh, to salt-laden brines,[63] and may contain heavy metals. It is considered wastewater under US federal law.[64] Much of the water is not potable and can not be use for irrigation because of mineral salts as well as ammonium and fluoride.[65] Produced water is typically disposed of by dumping on the ground, into watercourses, or in unlined reservoirs where it can seep into the ground. Because CBM produced water is usually warmer than surface water due to the geothermal gradient, discharge of CBM water can raise the temperature of receiving waters.[66] Surface disposal of such water has proven damaging to vegetation, agricultural land, drinking water, fish and wildlife in the United States.[67]

Such damage could be avoided in British Columbia, as the B.C. Energy Policy of 2007 prohibits all surface disposal of produced waters (except for the "grandfathered" disposal of produced water in the Elk River watershed, adjacent to the Flathead River watershed). However, when produced water is not disposed of on-site at surface, other handling methods such as water pipelines or constant trucking of wastewater for deep re-injection off-site are necessary. These methods threaten other adverse environmental impacts (see sections B.9-10. below).[68] In British Columbia, contamination is increased due to the use of un-lined waste dumps and storage pits at the drilling site.

B.5. <u>Water Pollution: Methane Contamination of Groundwater</u>

Local aquifers provide water for natural springs as well as drinking water and irrigation for rural residents. This water also prevents methane from flowing, as the pressure in the aquifer keeps the methane adsorbed to coal. There are incidents of groundwater removal allowing methane to migrate underground to nearby wells, stock tanks and basements, creating health and safety hazards. Because it is odorless and colorless it can not be easily detected, which increases the likelihood of long-term exposure.[69]

B.6. <u>Water Pollution: Hydraulic Fracturing Fluids</u>

To stimulate the well, hydraulic fluids are pumped into the coal seams under pressure to increase water and gas flow. This widening of existing fractures, called "fraccing," allows gas to move freely into the well bore. Hydraulic fluids are generally water with hydrocarbons or gels, or a mixture of nitrogen and water to create a thick foam. Sand may be added to hold open the fractures.[70] Hydraulic fluids also include "drilling mud," which is clay mixed with a variety of chemical additives[71] including lubricants, surfactants, and defoamers.[72] Hydraulic fracturing in coalbed methane wells may require 50,000 to 350,000 gallons of fracturing fluids and 75,000 to 320,000 pounds of sand to prop or maintain the opening of fractures after the injection (fracturing) pressure is reduced.[73]

Fresh water supplies can be contaminated by these fluids, which can contain benzene, polycyclic aromatic hydrocarbons, ethylbenzene, toluene, xylenes, napthalene, methanol, sodium hydroxide, and MTBE.[74] Though companies try to remove fraccing agents, 20 to 30% of the materials may remain in the ground, and can remain even after flushing.[75] Studies with fluorescent paints at CBM sites indicate that in about half the experiments, fraccing fluids travel along existing and new cracks in a upwards "stair-step pattern" and migrate into roof rock overlying the coal seams.[76] This contamination is such a concern that U.S. courts have ruled that fraccing materials must be regulated under the U.S. Safe Water Drinking Act.[77]

B.7. Air Pollution: Venting and Flaring of CBM Gas

During de-watering, CBM may be vented or flared until gas volumes are sufficiently economical to be sent to pipeline. Such venting and flaring occurs for much longer durations than with conventional gas wells. Venting and flaring raise significant concerns over the impact of increases in local air pollution and greenhouse gas emissions on human health and the environment.[78] In British Columbia, the B.C. Energy Plan requires CBM producers to reduce venting and flaring during testing, but does not eliminate it. Similarly, venting and flaring during commercial production is not expected to be eliminated before 2016.[79] Under current practices, flaring occurs for the duration of exploration and testing until economically viable levels of gas production are achieved, which can take up to several years. Methane is approximately 23 times more powerful than CO_2 as a greenhouse gas.[80]

B.8. Air Pollution: Diesel-Powered Pumps and Compressors

Diesel generators are used at CBM sites to pump out water and to compress gas for pipelines. These generate air pollution, including ground-level ozone (O_3). In 2008, the U.S. EPA ordered the U.S. Bureau of Land Management to reduce the number of planned new CBM wells, citing the problem of worsening local ozone pollution and its risks to human health.[81] Ozone, the main component of smog, is a respiratory irritant to humans and animals.[82] Ground-level ozone is associated with aggravation of respiratory and cardiovascular disease, changes in lung function and increased respiratory symptoms, and chronic asthma and bronchitis. It also damages crops, trees, and other vegetation.[83]

B.9. Air Pollution: Dust from Roads

The frequency of truck traffic to and from well pads determines the levels of dust produced from rural roads. In the CBM sites of Powder River, Wyoming, dust from truck traffic has led to asthma problems in local communities, and ranchers must treat livestock for dust pneumonia.[84]

B.10. Noise Pollution

Where coal seams need de-watering, the lower gas pressure and higher density of CBM wells compared to conventional gas wells will result in increased intensity of pumps and compressors used to de-water the coal seams and pressurize the gas. Elevated noise levels created by compressors and pumps, continue 24 hours per day, seven days a week, and can disturb wildlife patterns.[85] Heavy traffic also contributes to noise pollution in and around well sites.

B.11. CBM's Track Record in North America

Although CBM extraction is a relatively new method of fossil fuels extraction, across North America, CBM has already demonstrated a poor environmental and public health track record. In Wyoming's Powder River Basin, with 14,000 CBM wells, CBM development has contaminated ranchers' water supplies, degraded agricultural land, and industrialized a previously rural landscape. As the industry moved into Alberta, local residents are now having many of the same problems. Affected communities and local governments across North America have begun organizing to reduce the environmental, agricultural and public health impacts of CBM.[86] In 2003, the Union of B.C. Municipalities passed a resolution calling for a moratorium on CBM development.[87] In April 2008, the City Council of Fernie, B.C. opposed granting of exploration rights (or 'tenure') to BP Canada, and urged the Province to deny tenure to BP for CBM exploration in the Crowsnest Coalfields.[88]

B.12. The Crowsnest Coalfield

The Crowsnest coalfield is part of the East Kootenay coalfields in southeast British Columbia. Located between the Elk River and the Alberta-B.C. border, it extends from southeast of the town of Fernie in the Flathead River watershed to north of the town of Sparwood (See Figures 1 &6). The coal seams occur within the Jura-Cretaceous Mist Mountain Formation. The southeast portion of the coalfield overlaps with the northwest headwaters of the Flathead River watershed. Nearly 27.7 billion tons of coal are contained in this coalfield. The Crowsnest coalfield is estimated to contain up to 12 Tcf (trillion cubic feet) of CBM,[89] but only about six Tcf of this are likely to be recoverable.[90]

CBM from the southeast British Columbia coalfields must be drilled over one kilometer deep.[91] CBM experts have predicted that economically viable CBM in the region will only be recovered from well sites located in riparian valleys that drill below existing water tables, concentrating disturbance in the most sensitive areas for wildlife and fisheries. [92]

In British Columbia, CBM is not yet produced commercially, though testing has begun in many places across the province.[93] Canada's largest independent oil and gas producer, EnCana, and their managing partner Storm Cat Energy, are drilling and pumping gas and water at their pilot CBM operation near the headwaters of the Elk River, adjacent to the Flathead watershed. EnCana's 30,000 hectare lease has had over 20 wells drilled in the last seven years.[94] Mobil/Chevron, Gulf Canada and Saskoil companies drilled a total of eight CBM exploration holes in the Crowsnest coalfield in the 1990's and demonstrated mixed results in terms of viability of commercial production.[95] Shell Canada and Chevron Texaco drilled seven exploratory wells in the Crowsnest coalfield between 2003 and 2005. There were many significant environmental impacts documented by local concerned citizens from this exploration activity, including the failure of a cut-and-fill well site, a large petrochemical spill from a tanker truck overturning after sliding off a steep mountain road, and massive erosion from unreclaimed well sites during significant rain events.

B.13. <u>The Mist Mountain CBM Project</u>

BP Canada Energy Company (BP) has proposed a vast CBM field that would cover more than 500 square kilometers, including significant portions of the Elk River watershed and part of the northwestern headwaters of the Flathead River watershed. In 2006, BP submitted a proposal for most of the exploration rights in the Crowsnest coalfield in response to the British Columbia Ministry of Energy and Mines' 2003 call for proposals. In 2007, Elk Valley Coal Partnership and BP entered into an agreement for a CBM development project known as the Mist Mountain Project. BP plans to conduct studies and drill test wells over the next three to five years. If the Mist Mountain Project proceeds, up to 150 well sites could be developed and in production for the next 50 years.[96] According to its website, BP Canada

> *anticipate[s] drilling up to 10 test wells per year over three to five years of appraisal activities. Commercial development could require approximately 100 to 150 multi-well pads, with up to 10 wells per pad. These pads would connect via a pipeline gathering system to nodal compression facilities. There, the gas would be compressed and transferred to one of two processing facilities which, following removal of excess CO_2, would send the gas to the North American natural gas market on the existing TransCanada pipeline.*[97]

BP America has stated that the Flathead Valley "is not in our development plans,"[98] and B.C.'s Premier Campbell has denied BP Canada exploration rights in the Flathead for the time being. Nevertheless, BP Canada is proceeding with environmental studies in the Flathead in anticipation of receiving drilling rights in the future. In public statements and on its website, BP Canada continues to state their interest in CBM development in the Flathead.

B.14. <u>Potential Impacts of Mist Mountain</u>

Because the Mist Mountain Project proposal is not yet permitted and its parameters not yet finalized, we can not predict its environmental impacts with certainty. The literature review conducted for this technical paper revealed a shortage of up-to-date scientific studies on the potential cumulative environmental impacts of coalbed methane development in southeastern

British Columbia. However, we can anticipate some impacts based on studies conducted in other regions.

In 2003, the B.C. Ministry of Energy, Mines and Petroleum Resources produced a report on CBM opportunities in the Crowsnest Coalfield for potential investors. It warned that potential social and environmental impacts of CBM in the Crowsnest include conflicts between CBM and forestry, recreation, hunting and coal extraction. Possible wildlife issues include dissection of migratory routes, habitat loss, increased access for hunting, introduction of invasive species, provision of unnatural vantage points for raptors or hazards to flight (*e.g.*, electrical power lines), disturbance during breeding seasons (*e.g.*, due to noise from drilling or compressor stations), impacts on endangered species, and damage to or modification of wetlands and riparian zones. The study further noted the risks of conflicts with First Nations, disturbance of archaeological sites and cultural resources, soil erosion, air quality issues, vegetation disturbance, visual impacts from roads and powerlines, and noise and lights from compressors and fracturing equipment.[99] The report concluded:

> *The cumulative impact of future CBG [coalbed gas] developments is difficult to predict. Although no single CBG project may cause unacceptable impacts, collectively CBG development and production over two or three decades will add to overall cumulative effects in the Crowsnest region.*[100]

B.15. <u>Waste Water from Mist Mountain: Regulatory and Enforcement Concerns</u>

British Columbia's 2007 Energy Plan advises that there should be no surface disposal of wastewater from CBM exploration, and according to BP Canada, wastewater associated with the Mist Mountain appraisal activities will be taken to a licensed injection site. However, it remains unclear where these sites will be located, or how local hydrology will be affected. There is no assurance that injected waste-water will not eventually reach aquifers that recharge riparian environments or aquifers used by agriculture, livestock or local communities. Moreover, there are no regulations or frameworks in place to enforce this guideline against surface disposal of wastewater. The application of injection technology to CBM in Elk and Flathead Valleys is theoretical at this time because no company has ever attempted this wastewater disposal strategy, nor demonstrated that it can be done successfully in this region.

Indeed, EnCana/Storm Cat's CBM wells in the Elk Valley, adjacent to the Flathead in British Columbia, have continued surface dumping of wastewater, despite toxicity tests of the wastewater proving fatal to 100% of exposed young rainbow trout. Wastewater from the Mist Mountain formation produced by EnCana is known to contain high concentrations of heavy metals, such as barium, copper and iron. The trout mortality was attributed to very high ammonium levels, which can threaten the entire food web of the receiving watershed. Nevertheless, surface discharge was permitted for a three and a half year period with no action taken on the part of the Province when water quality exceeded the standards and failed toxicity tests.[101]

C. THREATS TO WATERTON-GLACIER FROM THE LODGEPOLE OPEN-PIT COAL MINE

C.1. Open-Pit Coal Mining: Methods

Open-pit mining of coal is done where the overlying rock, called overburden, is relatively shallow. The overburden is blasted with explosives, then large earth-moving equipment, draglines, or shovels are used to remove the fractured overburden from the coal. The coal is then typically broken up by blasting it with explosives before being loaded into special haulage trucks.

Open-pit coal mines that remove mountain tops, as is proposed at the Lodgepole mine, are also called “mountaintop removal” mines. Mountaintop removal mining is a form of strip mining in which coal companies use explosives to blast as much as 800 to 1000 feet off the tops and sides of mountains in order to reach the coal seams that lie underneath. The resulting millions of tons of waste rock, dirt, and vegetation are then dumped into surrounding valleys, burying streams under piles of rubble hundreds of feet deep.

Mining companies first raze a mountainside, ripping trees from the ground with huge tractors. Brush is cleared and then the debris is set ablaze. Holes are dug for explosives, charges are set and mountaintops are literally blown apart. Excavators push rock and dirt into nearby streams and valleys, forever burying waterways.[102]

C.2. Mine Infrastructure and Habitat Destruction

Mountaintop removal mining harms not only aquatic ecosystems and water quality, but also destroys hundreds of acres of healthy forests and fish and wildlife habitat, including habitat of threatened and endangered species. Besides destruction of forest habitat on the mountain top and slopes that become the open-pit mine, habitat destruction and fragmentation occurs when haul roads, power lines, processing plants and waste dumps are constructed in what was once wilderness.

Many terrestrial species are sensitive to the lights, noise and blasting vibrations at the mine, as well as constant truck traffic on the haul roads. They may suffer decreased reproductive success or be displaced from the surrounding area entirely. Haul roads also fragment habitat and cause erosion and stream sedimentation on steep slopes. The presence of an open-pit coal mine and its supporting infrastructure would reduce habitat connectivity for migratory species of the Flathead and Crown of the Continent ecoregion, especially carnivores and ungulates.

C.3. Air pollution

Air pollution from open-pit coal mining is caused primarily by coal dust from blasting, emissions from machinery, and dust created by traffic on haul roads transporting the coal from extraction sites to processing plants. Mine fires in abandoned mines are also a risk, as they can burn for years, increasing risks of forest fires and generating significant air pollution from smoke.[103]

C.4. Water Pollution and Drainage Problems

Open-pit coal mining causes serious and long-term water-related problems including drainage problems, diversion and impoundment of water bodies, and the contamination of waterways. Drainage problems can result in catastrophic flooding, rock slides and land slides. Impounded water trapped in sediment basins can cause dam failures, which can cause long-term damage to aquatic habitat downstream. Water pollution, in the form of acid mine drainage, stream sedimentation, temperature changes and decreased dissolved oxygen content, is caused by runoff from overburden disposal sites, operation of machinery and explosives, and erosion from overburden removal activities.

Sedimentation occurs when erosion from unprotected banks of overburden rock ('spoil'), processing waste, haul roads or other unvegetated areas washes into nearby streams. As the water velocity of the stream slows, the particles settle into the streambed as sediment. Accumulation of sediment reduces the stream's capacity to carry water and can result in flooding, clogged culverts, and aquatic habitat destruction.[104] Subsidence problems can occur after pit closure, when overlying rock material sags or collapses and creates ground surface depressions that can change surface hydrology and increase risk of landslides on steep slopes.[105104]

Acid mine drainage occurs when pyrite in coal (and associated rocks exposed by mining) is oxidized and the soluble oxidation products are transported by water that flows through the mine to nearby streams. It can often be recognized by the orange color of iron precipitates in the streams and rivers. Acid mine drainage lowers pH and increases the chemical content of substances such as iron, manganese and other metals. Concentrations can reach toxic levels and can reduce or eliminate life in nearby streams, creeks and lakes. Repeated fish kills may occur whenever heavy rains flush toxic water from the mine areas into rivers or lakes. Entire stream systems can be devastated by continuous toxic runoff that kills plant and animal life.[106]

C.5. Open-Pit Coal Mining in British Columbia

Large open-pit coal mining has occurred at five sites in the Elk Valley since the 1970's. B.C.'s Ministry of Mines estimates that about four billion tons of the total coal resource (27.7 billion tons) of southeast British Columbia may be mineable, of which only 100 million tons may be surface mineable (in addition to the existing two mines).[107]

In 2005, the five open-pit coal mines in the Elk Valley (Fording River, Line Creek, Greenhills, Elkview, and Coal Mountain) contributed 95% of all coal produced in British Columbia. The average strip ratio for the mines is nine million tons of waste rock to one million tons of coal. To date, the mines have disturbed 13,479 hectares of land, of which only 20% has been reclaimed.[108]

A 1998 study by the British Columbia Ministry of Environment, Lands and Parks, Kootenay Region found elevated levels of selenium in water, sediments and aquatic life including westslope cutthroat trout downstream from coal mining in the Elk River. Selenium levels below the coal mines were 100 to 200 times the levels in water above the mines.[109] Selenium compounds occurring within coal's minerals are five times as toxic as arsenic, and can become concentrated in the soil and selenium-accumulating plants, sometimes to toxic levels. In the United States, selenium is listed as a Clean Air Act, Title III Hazardous Air Pollutant element of considerable environmental concern.[110] Selenium can accumulate in zooplankton and aquatic plants, causing embryonic mortality or deformities in fish, and congenital defects and reduced immunity in aquatic birds.[111]

Based on data from an Elk Valley coal mine, the downstream receiving waters showed pollution levels significantly above baseline conditions. Selenium was 25 times higher than baseline, nitrates/nitrites were 300 to 500 times higher than baseline, and biodiversity showed significant impacts, with only seven species of surviving, compared to 75 species in baseline creeks. Compared to the Flathead River, sulfates from the Elk Valley coal mine were 18 times higher, nitrates were 650 times higher, and selenium was 57 times higher. There were 72 species of diatoms and periphyton found in the Flathead, as compared with only 12 in the Elk River.[112] Selenium levels downstream from Elk Valley coal mines have shown an increasing trend since 1984, consistently exceeding provincial thresholds for the heavy metal. Despite the existence of a Selenium Task Force in the region for over ten years, there has been no regulatory response on the part of the province.[113]

C.6. The Lodgepole Coal Mine Project

Cline Mining Corporation of Sudbury, Ontario plans to construct and operate the Lodgepole open-pit coal mine in the Foisey Creek and McLatchie Creek tributaries to the Flathead, approximately 25 miles north of the US-Canadian border, which also forms the northwest border of Waterton-Glacier International Peace Park. Associated infrastructure will include access roads, waste rock dumps, a coal washing plant and dryer furnace, a dry tailings storage area, haul roads, a load-out facility, a power line corridor, a mine camp and a fuel storage area.[114] Three tons of clean coal will be burned on site every hour to fuel the coal dryer furnace.[115]

Mining or mining support activity will occur over 12,000 hectares of land. Of this, 1050 hectares will be within the active mining footprint.[116] The haul road, which will extend from the mine site to Elko, will cross or come in close proximity to numerous water bodies and tributaries.[117]

Cline Mining Corp. intends to remove at least two million tons of "saleable" coal and over 16 million tons of overburden rock and waste from the mine each year over a 20-year period. This will generate roughly 40 million tons of saleable coal and 326 million tones of waste.[118] While the coal processing plant itself is located outside of the Flathead watershed, overburden rock will be deposited along the banks of Foisey and Crabb Creeks, in the headwaters of the Flathead River.[119]

The project is proposed within the Mist Mountain Formation of the Kootenay Group of Jurassic-Cretaceous age. McLatchie Ridge has a maximum elevation of 2255m, while the base of the valley of Crabb Creek within the pit area has an elevation of 1645m where it joins Foisey Creek. The upper slopes of McLatchie Ridge are sub-alpine with widely spaced, stunted fir trees, while the lower slopes to the west are thickly forested with spruce, pine and fir.[120]

Explosives used in the mine will include Ammonium Nitrate and Fuel Oil (ANFO), which is six percent fuel oil, and Emulsion (Heavy Ammonium and Nitrate Fuel Oil) for wet holes.[121] With over 643kg of explosives used per blasting hole,[122] large volumes will be used over the life of the mine, potentially contaminating streams and aquifers.

Water management from dump sites includes collection ditches, diversion ditches, settling ponds, and catchment ponds.[123] Water from the mining and dumping areas will be directed into settling ponds in the Foisey Valley prior to entering natural streams.[124]

In 2005, Cline Mining Corp. began road building and exploration under a provincial permit without prior environmental review or consultation with downstream or local interests.[125] By 2006, Cline Mining Corp. had drilled 49 holes on the Lodgepole Property.[126]

Cline Mining is poised to begin operations at the Lodgepole mine as soon as British Columbia approves its proposal. According to Cline Mining Corp.'s website as of June 2008, "the permitting process for the Coal Project is proceeding subject to regulatory approval." In February 2008, CEO of Cline Mining Corp. Ken Bates stated

> *We are actively working to get [the permitting process] done as quickly as we can. We are hell-bent to get it done and are pushing the government to get it*

done. I'm sorry they are taking so long…. We are active in the process for permitting. We're trying very hard to progress this as quickly as we can because it's a really valuable piece of coal. This is the time to be developing mines, not sitting watching prices go up.[127]

The Terms of Reference for the mine are currently being reviewed by the B.C. Environmental Assessment Office (EAO) which will ultimately gauge whether or not the risks associated with the mine can be mitigated.[128]

C.7. <u>Overview of Potential Impacts</u>

The Lodgepole open-pit coal mine proposal is not yet permitted and its parameters not yet finalized, so we can not predict its environmental impacts with certainty. The literature review conducted for this technical paper revealed a shortage of up-to-date scientific studies on the potential cumulative environmental impacts of open-pit coal mining in southeastern British Columbia. However, we can anticipate some impacts based on older studies, and studies conducted in other regions.

According to the U.S. Department of Interior's comments on the proposed Terms of Reference for the Mine in December 2006,

> *Water from rain and snow will leach through these overburden materials and will enter the Flathead River system carrying heavy metals such as selenium and high levels of nitrates from blasting compounds. It has been estimated that water leaching through these overburden materials will reach the border of the United States in 24 hours and will enter Flathead Lake in approximately 48 hours. Mine development, including associated construction activities, providing transportation corridors, the operation of heavy equipment and increased settlement, and human activity in and around the project area is expected to have significant adverse impacts upon fish and wildlife of high importance….*[129]

a. <u>Noise Pollution</u>

During the anticipated 20-year span of operations at Lodgepole Mine, drilling, blasting, trucking, drying and dumping would occur almost constantly: 21 hours per day, 7 days per week, 52 weeks per year. When fully operational, the mine will use up to three diesel hydraulic shovels, three drills, 22 haul trucks, and 30 other vehicles at a time.[130] Constant blasting and operation of heavy machinery could have a severe impact on resident as well as migratory wildlife populations near the mine site and waste dumps, and would fragment the migratory corridors in the northern headwaters of the Flathead River watershed.

b. Air Quality

Open-pit coal mining negatively impacts air quality from dust generated from blasting, processing and transport of coal, waste rock, as well as from haul trucks and other heavy equipment on rural roads. Mine machinery, including diesel engines and coal-burning furnaces are also significant sources of emissions and particulate matter (PM). Dust landing on vegetation may affect photosynthesis, respiration, transpiration and allow the penetration of phytotoxic gaseous pollutants. Dust decreases productivity of plants and alters plant communities.[131] Dust entering the lungs of humans and wildlife can cause serious health problems, as coal dust can not be dispelled from the lungs.

The Lodgepole mine will be visible from vantage points within Glacier National Park. In commenting on the mine's Terms of Reference, the U.S. Environmental Protection Agency requested an assessment of impacts to the viewshed from Glacier National Park. The EPA also requested that Cline Mining be asked to mitigate any identified air impacts, including nutrient loading, regional haze/visibility impacts, contributions of PM_{10} (particulate matter smaller than 10 micrometers) and $PM_{2.5}$ (particulate matter smaller than 2.5 micrometers).[132]

In 2007, the U.S. Department of the Interior warned that air quality impacts from the proposed Lodgepole mine were insufficiently addressed in the Terms of Reference. It noted concerns regarding greenhouse gas emissions/atmospheric loading from methane liberated through coal combustion, emissions from backup diesel generators, and non-point air emissions from mobile mining equipment, haul trucks and trains.[133]

PM_{10} can settle in the bronchi and lungs and cause respiratory problems, while $PM_{2.5}$ can penetrate into the gas-exchange regions of the lung. Particles less than 100 nanometers may pass through the lungs, resulting in high plaque deposits in arteries, causing vascular inflammation and atherosclerosis.

c. Water Quality

In 1985, the International Joint Commission of the Unites States and Canada (IJC) was requested to examine and report on the transboundary water quality and quantity implications of a very similar proposed open-pit coal mine on Sage Creek, also a Flathead tributary closer to the U.S.-Canadian border than the Lodgepole mine. After three years of intensive study, in 1988 the Commission found "overwhelming evidence … that a significant loss of fish population will occur as the result of a combination of [] adverse effects," including an "increased level of toxic substances" as well as "sedimentation, temperature change, flow modification, degradation of habitat, dissolved oxygen reductions, increased dissolved solids and others."[134] The Commission concluded that "damage will inevitably occur to this habitat which would be located in the midst of a major mining development, and consequently to the fishery dependent on that habitat."[135]

Noting the pristine nature of the northern Flathead River and the high level of protection afforded the river under U.S. law, the Commission expressed concern over the potential impact of mine development on groundwater flows between the proposed mine site and the creeks in the headwaters of the Flathead River; toxic levels of nitrogen compounds, temperature changes and dissolved oxygen levels; and the potential risk of extreme or unusual events such as the failure of waste dumps and settling ponds.[136]

The Lodgepole mine and supporting infrastructure will develop 12,000 hectares of what is now wilderness. This will require extensive road construction, land clearing and earth-moving activities that generate large amounts of sediment. The tributaries of the Flathead and adjacent watersheds will be negatively effected by increased sediment loads in mountain streams as well as in valley bottoms. Sedimentation of streams reduces critical spawning and rearing habitat for native fish species such as bull and westslope cutthroat trout by filling in the spaces between rocks where these species deposit their eggs.[137] Sedimentation also disturbs macroinvertebrate habitat, the primary food source of native fish species. As the coals of the Mist Mountain formation contain high levels of heavy metals, the Lodgepole mine is anticipated to contaminate the Flathead River with nitrates, selenium, barium and copper, all of which can be toxic to riparian species.[138]

Mine waste rock dumps will be located both outside and inside the main pit area; dumps located outside of the main pit area will be placed on natural slopes.[139] Failure of waste dumps is a particular concern at the Lodgepole mine, as all of the waste dumps in the Elk Valley coal mines have failed at least once, and Cline Mining Corp. has been unable to guarantee that the external waste dumps and settling ponds will not fail.[140] The steep topography and complex geology of the area increase the risk of failure of the waste dumps or settling ponds, sending potentially catastrophic levels of sediment and toxics into downstream waterways. Cline Mining's Technical Report notes,

> *For waste dumps located outside of the main pit area, there is a risk that instability may develop during operations. This would be a concern if there was a potential for downslope risk, such as safety of personnel, damage to equipment or infrastructure facilities or delays to ongoing mining operations to clean up slide debris.*[141]

Cline Mining's report fails to note any risk of damage to downstream waterways and aquatic ecosystems due to failure of waste dumps placed on natural slopes.

d. Fisheries

Of critical concern to the International Joint Commission (IJC) in evaluating the impact of a proposed coal mine in the headwaters of the Flathead was the mine's proximity to a significant portion of the remaining available spawning and rearing habitat for prime game fish in the Flathead basin including bull trout, western (or westslope) cutthroat trout and mountain whitefish. The Commission found that the mine would have a deleterious effect on eggs and fry in the spawning ground, and would "undoubtedly act as an impediment to the adult fish in reaching and/or using those altered grounds." Thus, the Commission concluded that a significant loss of fish population would occur with "serious consequence to the integrity of the fishery itself."[142] The Commission noted that coal mining at Sage Creek would cause

> *significant increases in nitrite and ammonia concentrations in Cabin and Howell creeks due to blasting residues that contain large amounts of nitrates…. To the extent that there is a groundwater connection between sources of nitrite and ammonia and the streams, concentrations of these compounds would exceed the BC objectives…. resulting in toxic levels in the spawning areas in Howell and Cabin creeks under both the optimal and adverse cases.*[143]

All available evidence indicates that the developments proposed today in the Flathead basin threaten equally dire consequences. Indeed, the location of the proposed Lodgepole mine appears to be at least as sensitive for fishery impacts as the site of the proposed Sage Creek project of 1988. A critical fact underlying the Commission's 1988 conclusions was its finding that the proposed mine would abut two streams that form a significant portion of the remaining available spawning and rearing habitat for prime game fish in the Flathead basin, including the Howell Creek tributary to the Flathead River, which supported 55 percent of all bull trout spawning in the Canadian portion of the Flathead River system from 1980 to 1982.[144]

In 2003, a basin-wide bull trout spawning site inventory by Montana Fish, Wildlife, and Parks determined that approximately 67 percent of all known bull trout redds, or spawning nests, in the Canadian portion of the Flathead River system were found near the mouths and immediately downstream of Foisey, Crabb and McLatchie Creeks, representing 37% of the total redds detected in the entire North Fork drainage. Thus the current developments threaten an even greater impact on this critical transboundary resource than the project considered by the IJC in 1988.

According to the Technical Report on the Lodgepole Mine, "[t]he environmental impact investigations have identified a concern that the NW [northwest] dump encroaches on fish habitat in the middle reaches of Crabb Creek. The environmental planning will pursue mitigation measures for the lost fish habitat."[145] There is no clarification in the Technical Report as to what these mitigation measures would be, and how they would reduce damage to the spawning grounds of endangered and threatened fish species.

C.8. <u>Adequate Baseline Data Still Lacking</u>

The 1988 Report of the International Joint Commission recommended withholding regulatory approval of the proposed mine until "potential transboundary impacts have been adequately determined with reasonable certainty" and the potential impacts on the fish populations and habitats in the Flathead River system "would not occur or could be fully mitigated."[146] The Commission further stated that "the baseline data to assess the impacts of the proposed mine are generally not adequate."[147]

Reliable determinations of potential impacts rely on the compilation of adequate baseline environmental and biological information. The baseline data that was unavailable to the Commission in 1988 has yet to be collected. According to a report commissioned by the British Columbia government in 2004 to assess the existence of baseline environmental data in the Elk and Flathead valleys, there is very little water quality data available for the low-order streams that could be affected by proposed development. According to the report, "[t]his is a potentially critical information gap and baseline water quality monitoring will very likely be needed for at least three years" before development.[148] Other inventories of existing baseline data in the transboundary Flathead show a lack of botanical surveys, a lack of information on species at risk, and a failure to consider the cumulative impacts of coal development.[149]

These substantial gaps in baseline data are of utmost concern, If ground-disturbing activities commence prior to the compilation of baseline information, the opportunity will be lost to monitor resource changes, identify impacts and mitigation strategies, and assess impacts to the watershed and surrounding ecosystems.

D. OTHER ASCERTAINED THREATS TO WATERTON-GLACIER

The threats that coal mining and CBM extraction present to Waterton-Glacier International Peace Park are of particular concern in light of other external stresses on the park's ecosystems. In 2000, the Panel on the Ecological Integrity of Canada's National Parks found that Waterton Lakes National Park faced major impacts from external sources, confirming a 1980 study by the U.S. National Park Service that found that Glacier National Park had the fourth highest number of threats facing any U.S. park.[150] External threats identified by these studies include cumulative impacts from proposed highway expansion, conversion of working ranch and forest lands to recreation, commercial and residential developments, clearcut logging, a growing number of low-level sightseeing air tours, invasions of non-native species into parklands and waters, and potential extraction of coal, oil and gas resources.

The results of these threats include fragmented, degraded, and destroyed habitat for many wildlife species, severe limitations on the movement of wide-ranging species like bears, wolves, deer, and elk, diminished populations of native fish unable to compete with invasive non-native species, and the potential for degraded water quality. Because of these existing threats, coal and coalbed methane development in this unique and vulnerable region could be devastating to the conservation values of the transboundary Flathead Basin, Waterton-Glacier International Peace Park, and the Crown of the Continent ecosystem.

RECOMMENDED RESOURCES

References

Boyer, Matthew and Clint Muhlfeld, September 2006. Results of a fish distribution and habitat survey in the Foisey Creek drainage, British Columbia. Montana Fish, Wildlife, and Parks. Available upon request from mboyer@mt.gov, Tel. (406) 751-4556.

British Columbia Ministry of Energy and Mines, November 12, 2003. Coalbed Gas (CBG) opportunities in Crowsnest coalfield - Information package for potential investors - The Government of BC Oil and Gas Division, Oil and Gas Emerging Opportunities & Geosciences Branch . 25 pp. Available at: http://www.em.gov.bc.ca/DL/Oilgas/CBM/Main_text.pdf

Canadian Environmental Assessment Registry, December 21, 2007. Notice of Commencement of an environmental assessment: Lodgepole Coal Mine, British Columbia. Available at: http://www.ceaa.gc.ca/050/Viewer_e.cfm?CEAR_ID=36059

Chadwick, Douglas, Sept. 2007. Crown of the Continent--Two national parks—Glacier and Waterton Lakes—join in a soaring wonderland. National Geographic Magazine. Available at: http://ngm.nationalgeographic.com/2007/09/glacier-waterton/glacier-waterton-text.html

Crown of the Continent Ecosystem Education Consortium, 2002. Crown of the Continent: Profile of a Treasured Landscape. Available at: http://www.crownofthecontinent.org/table_contents.htm

Griffiths, Mary and Chris Severson-Baker, June 2003. Unconventional Gas: The environmental challenges of coalbed methane development in Alberta. The Pembina Institute. 73 pp. Available at: http://pubs.pembina.org/reports/CBM_Final_April2006D.pdf

International Joint Commission, December 1988. Impacts of a Proposed Coal Mine in the Flathead River Basin. 26 pages. Available at: http://www.ijc.org/php/publications/pdf/ID590.pdf

National Parks Conservation Association, Nov. 2002. State of the Parks: A Resource Assessment: Waterton-Glacier International Peace Park. 40 pp. Available at: http://www.npca.org/stateoftheparks/glacier/glacier.pdf

Natural Resources Defense Council, 2002. Hydraulic Fracturing of Coalbed Methane Wells: A Threat to Drinking Water. 7 pp. Available at: http://www.earthworksaction.org//pubs/200201_NRDC_HydrFrac_CBM.pdf

Sexton, Erin, August 2005, Coalbed Methane in British Columbia: A Case Study of the EnCana Corp. Elk Valley Coalbed Methane Pilot Project, National Parks Conservation Association, Glacier Field Office.

Transboundary Flathead Research Needs Workshop, Executive Summary, West Glacier, Glacier National Park, MT, November 3rd, 2005. Available at: http://www.flatheadcoalition.org/documents/Executive%20Summary%20Transboundary%20Flathead%20Research%20Needs%20Workshop%2011.05.pdf.

Vadgama, Jaisel, May 2008. Coalbed Methane and Salmon: Assessing the Risks, Pembina Institute, Available at: http://pubs.pembina.org/reports/cbmandsalmon-rpt.pdf .

Weaver, John L., July 2001. The Transboundary Flathead: A Critical Landscape for Carnivores in the Rocky Mountains. WCS Working Papers No. 18. Available at: http://wcs.org/media/file/WeaverBookComplete1.pdf.

West Coast Environmental Law, May 2003. Coalbed Methane Extraction: A Citizen's Guide. 59 pp. Available at: http://www.concernedaboutcbm.org/files/reports/cbm_citizensguide.pdf

West Coast Environmental Law, April 2004. Oil and Gas in British Columbia: 10 Steps to Responsible Development. Available at: http://www.wcel.org/wcelpub/2004/14100.pdf

Websites

BP Mist Mountain Project Backgrounders. Available at: http://www.bp.com/sectiongenericarticle.do?categoryId=9020972&contentId=7038676

British Columbia Environmental Assessment Office Project Information Centre, Lodgepole Project, including governmental and public comments to the Lodgepole Mine Terms of Reference. http://a100.gov.bc.ca/appsdata/epic/html/deploy/epic_project_home_272.html

British Columbia Environmental Assessment Office Project Information Centre, Lodgepole Project, Revised Draft Terms of Reference, December 2006. http://a100.gov.bc.ca/appsdata/epic/documents/p272/1166055822391_5a39885fbc9145099b75df097d67c59d.pdf

British Columbia Ministry of Environment -- Kootenay Division—Environmental Protection Division. Flathead River Water Monitoring and Assessment Reports. http://www.env.gov.bc.ca/epd/regions/kootenay/monitoring/flathead_riv/index.html

Citizens Concerned About Coalbed Methane: http://cccbm.org/

Cline Mining Corp. Lodgepole Project
http://www.clinemining.com/projects/coal/lodgepole.html

Flathead Basin Commission. http://flatheadbasincommission.org/, including US governmental and public comments on Cline Mine Terms of Reference.
http://flatheadbasincommission.org/mining/cline/reference/terms_of_reference.html

Flathead Coalition: http://www.flatheadcoalition.org/

Flathead Wild: http://www.flathead.ca

International Joint Commission: Links to all Reports for the Flathead River International Study Board Reports, 1987.
http://www.ijc.org/php/publications/libraryReturn.php?syear=1985&eyear=1989&keyword=flathead&language=english&search=Search

Maps

BP Mist Mountain Maps.
http://www.bp.com/sectiongenericarticle.do?categoryId=9020105&contentId=7037525
Relevant BP Mist Mountain maps can also be found at:
http://flatheadbasincommission.org/transboundary/cbm/bp_internal_documents/bp_internal_maps.html

British Columbia Ministry of Energy and Mines, 2003. Geological Map of the Crowsnest Coalfields. http://www.em.gov.bc.ca/DL/Oilgas/CBM/maps/crowsnest_geology.pdf

Canadian Parks and Wilderness Society, Flathead Map/Southeast BC Proposed Park and Wildlife Management Corridor.
http://www.cpawsbc.org/campaigns/newparks/flathead/index.php

Crown of the Continent Geotourism Council with Map Guide
http://www.crownofthecontinent.net/crown_continent_detail.php?cuid=cotB7977E4951A61B6EE&title=Transboundary+Flathead&content_type=Park+or+Wilderness

Videos

Appeal to BP Investors to Stop Mist Mountain Project. Available at:
http://www.youtube.com/watch?v=GlzySS4yFDw&feature=user

BP Coalbed Methane (CBM) in British Columbia's Rocky Mountains.
http://www.youtube.com/watch?v=Gz19W7e1eGs&feature=user

ENDNOTES

1 Convention Concerning the Protection of the World Cultural and Natural Heritage, art 4, signed Nov. 16, 1972, entered into force Dec. 17, 1975, 15 U.N.T.S. 511.

2 Flathead Transboundary Network, The State of the Crown of the Continent Ecosystem: Transboundary Bioregion (2001).

3 Transboundary Flathead Research Needs Workshop, West Glacier, Glacier National Park, MT, (Nov. 2005). Available at: http://www.flatheadcoalition.org/documents/Executive%20Summary%20Transboundary%20Flathead%20Research%20Needs%20Workshop%2011.05.pdf.

4 The Crown of the Continent Ecosystem Education Consortium, Crown of the Continent: Profile of a Treasured Landscape, Chapter 1 (2002). Available at: http://www.crownofthecontinent.org/profile/chap1_profile.pdf

5 Smith, Thompson, Comment on Proposed Terms of Reference for Analysis of Proposed Coal Mines in B.C. Flathead/North Fork drainage, British Columbia (February 1, 2007). Available at: http://flatheadbasincommission.org/mining/cline/reference/Smith_Cline2007-02-01.pdf.

6 Flathead Wild website, http://www.flathead.ca.

7 UNESCO, Operational Guidelines for the Implementation of the World Heritage Convention (February 2005).

8 World Heritage Committee, Justification for Inclusion on the World Heritage List [for Glacier and Waterton Lakes National Parks], at 2 (1995).

9 *Id.*

10 World Heritage Committee, Report on the Nineteenth Session in Berlin, Germany (Jan. 31, 2006). Available at: http://whc.unesco.org/archive/repcom95.htm#354.

11 Parks Canada, Agency Corporate Plan 2003/4-2007/8, (2003) at 55, *and* Parks Canada, Periodic Report on the Application of the World Heritage Convention, Section II: Report on the State of Conservation of Waterton Glacier International Peace Park (December 31, 2004).

12 National Wild and Scenic Rivers System, last accessed June 18 2008. Available at: http://www.rivers.gov/wsr-flathead.html.

13 Outdoor Recreation Council, Endangered Rivers List Backgrounder (2008). Available at: http://www.orcbc.ca/pro_endangered.htm.

14 British Columbia Ministry of Energy and Mines, Crowsnest Coalfield Community Information Summary. Government of British Columbia – CBG Team (July 2004) at 6. Available at: http://www.em.gov.bc.ca/dl/Oilgas/CBM/Crowsnest_community_information_summary.pdf.

15 British Columbia Integrated Land Management Bureau, Southern Rocky Mountain Management Plan, Appendix 22.1 Management of Coal-bearing Lands. Available at: http://ilmbwww.gov.bc.ca/slrp/srmp/south/srmmp/plan/cabinet/appendix22.1_coal_lands_v04.pdf.

16 National Parks Conservation Association, Waterton-Glacier International Peace Park: A Resource Assessment (2002). Available at: http://www.npca.org/stateoftheparks/glacier.

17 National Parks Conservation Association, The Flathead River and Waterton-Glacier: A Shared Treasure (2007).

18 Province of British Columbia and State of Montana, Environmental Cooperation Arrangement Between the Province of British Columbia and the State of Montana (2003). Available at: http://www.llbc.leg.bc.ca/public/PubDocs/bcdocs/364270/arrangement.pdf

19 The Crown of the Continent Ecosystem Education Consortium, Crown of the Continent: Profile of a Treasured Landscape, Chapter Three: The Geologic Foundation
The Story Behind the Landscape (2002). Available at: http://www.crownofthecontinent.org/profile/chap3_geology.pdf

20 Parks Canada, Periodic Report on the Application of the World Heritage Convention, Section II: Report on the State of Conservation of Waterton Glacier International Peace Park (December 31, 2004).

21 Weaver, John, The Transboundary Flathead: A Critical Landscape for Carnivores in the Rocky Mountains, WCS Working Papers No. 18, at 10 (2001). Available at: http://wcs.org/media/file/WeaverBookComplete1.pdf.

22 Dr. Jack Stanford, University of Montana, as quoted by Flathead Wild. Available at: http://www.flathead.ca (last visited June 16, 2008).

23 WEAVER, *supra* note 21, at 14.

24 British Columbia's "Blue List" lists species not immediately threatened with extinction but of special concern due to sensitivity to human activities or natural disturbances.

25 GR Technical Services Ltd, Technical Report: Resources and Reserves of the Lodgepole Coal Property for Cline Mining Corporation (February 22 2006) at p 204. Available at: http://www.clinemining.com/projects/pdf/lodgepole-43-101-technical-report.pdf.

26 U.S. Geological Survey, Glacier National Park, Montana Fish, & Wildlife & Parks, Native Fisheries Research and Monitoring in the Upper Flathead River System (2006).

27 Montana Fish, Wildlife and Parks, Animal Field Guide: Bull Trout (last accessed June 27, 2008). Available at: http://fwp.mt.gov/fieldguide/detail_afcha05020.aspx.

28 Neeley and George, Sequencing Sculpins from Foisey Creek, N. Fork Flathead River (2008).

29 Montana Chapter of the American Fisheries Society, Letter from Clint Muhlfeld to Premier Campbell and Gov. Schweitzer (January 2006). Available at: http://www.fisheries.org/units/AFSmontana/RecentCoor/BC%20mines%20letter-%20AFS.pdf

30 Montana Fish, Wildlife, and Parks, Results of a fish distribution and habitat survey in the Foisey Creek drainage, British Columbia, prepared by Matthew C. Boyer and Clint C. Muhlfeld (September 2006).

31 MONTANA FISH, WILDLIFE AND PARKS, *supra* note 30.

32 British Columbia Ministry of the Environment, Environmental Stewardship Division website, Tailed Frog Fact Sheet (last accessed June, 2008). Available at: http://www.env.gov.bc.ca/wld/frogwatch/whoswho/factshts/tailed.htm

33 WEAVER, *supra* note 25 at 14.

34 *Id.* at 31.

35 *Id.* at 30.

36 Dr. Mike Proctor, Wildlife Ecologist, Grizzly Bear Specialist, as quoted by Flathead Wild. Available at: http://www.flathead.ca (last visited June 16, 2008).

37 WEAVER, *supra* note 21 at 16.

38 *Id*. at 20.

39 *Id.* at 21.

40 *Id.* at 25.

41 *Id.* at 29.

42 British Columbia Integrated Land Management Bureau, Southern Rocky Mountain Management Plan, B.9.5. Ungulates, (2003). Available at: http://ilmbwww.gov.bc.ca/slrp/srmp/south/srmmp/plan/cabinet/b95.pdf.

43 United Nations Environment Programme/World Conservation Monitoring Centre, Protected Areas and World Heritage: Waterton Lakes National Park. Available at: http://www.unep-wcmc.org/sites/wh/waterton.html (last visited June 16, 2008).

44 Griffiths, Mary & Chris Severson-Baker, Unconventional Gas: The environmental challenges of coalbed methane development in Alberta, The Pembina Institute, at 10, (June 2003). Available at: http://pubs.pembina.org/reports/CBM_Final_April2006D.pdf .

45 Province of British Columbia, Questions and Answers: Coalbed Gas. Ministry of Energy and Mines (2008). Available at: http://www.em.gov.bc.ca/Subwebs/CoalbedGas/FAQs/Web_QA.pdf. [hereinafter PROVINCE OF BC]

46 British Columbia Ministry of Water, Land and Air Protection, Code of Practice for the Discharge of Produced Water from Coalbed Gas Operations (Dec. 2004).

47 PROVINCE OF BC, *supra* note 45 at 6.

48 Flathead Coalition, Coalfield Development Threatens North Fork Flathead River. Available at: http://www.flatheadcoalition.org/how-to-help/coalbed_methane_alert.pdf.

49 West Coast Environmental Law, Coalbed Methane Extraction: A Citizen’s Guide (May 2003). Available at: http://www.concernedaboutcbm.org/files/reports/cbm_citizensguide.pdf.

50 Citizens Concerned about Coalbed Methane, About Coalbed Methane. Available at: http://cccbm.org/about-cbm (last visited June 16, 2008).

51 GRIFFITHS, *supra* note 44 at 8.

52 West Coast Environmental Law, Oil and Gas in British Columbia: 10 Steps to Responsible Development, (April 2004). Available at: http://www.wcel.org/wcelpub/2004/14100.pdf.

53 Vadgama, Jaisel, Coalbed Methane and Salmon: Assessing the Risks, Pembina Institute (May 2008). Available at: http://pubs.pembina.org/reports/cbmandsalmon-rpt.pdf .

54 Dr Stephen Herrero, Prof. Emeritus of Env. Science, University of Calgary (Letter of January 17, 2001). As cited by Flathead Wild. Available at: www.flathead.ca.

55 WEAVER, *supra* note 25 at 55.

56 PROVINCE OF BRITISH COLUMBIA, *supra* note 45 at 6.

57 VADGAMA, *supra* note 53.

58 Montgomery, Scott L., Powder River Basin, Wyoming: an Expanding Coalbed Methane Play, 83 AAPG Bulletin 1207, 1207-1222, (1999).

59 Horn, C.R., Environmental management of coalbed methane, Chapter 10: Produced waters from coalbed methane wells-state and federal regulations, (Alabama Dept. of Environmental Management, 1990).

60 GRIFFITHS, *supra* note 44 at 2.

61 VADGAMA *supra* n.53.

62 *Id.* at 27.

63 British Columbia Ministry of Water, Land and Air Protection, Code of Practice for the Discharge of Produced Water from Coalbed Gas Operations (Dec. 2004).

64 WEST COAST ENVIRONMENTAL LAW: 10 STEPS, *supra* note 52.

65 VADGAMA *supra* note 53.

66 *Id.*

67 WEST COAST ENVIRONMENTAL LAW: 10 STEPS, *supra* note 52.

68 VADGAMA *supra* note 53.

69 WEST COAST ENVIRONMENTAL LAW: 10 STEPS, *supra* note 52.

70 PROVINCE OF BRITISH COLUMBIA, *supra* note 45 at 6.

71 *Id.*

72 Global Drilling Fluids and Chemicals, Ltd.. Available at: http://www.oil-drilling-fluids.com/ (last visited June 16, 2008).

73 US Environmental Protection Agency, Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs, Chapter 3: Characteristics of Coalbed Methane Production and Associated Hydraulic Fracturing Practices, (2004) EPA 816-R-04-003. Available at: http://www.epa.gov/safewater/uic/pdfs/cbmstudy_attach_uic_ch03_cbm_practices.pdf.

74 Natural Resources Defense Council, Hydraulic Fracturing of Coalbed Methane Wells: A Threat to Drinking Water (January 2002).

75 *Id.*

76 US Environmental Protection Agency, Chapter 3: Characteristics of Coalbed Methane Production and Associated Hydraulic Fracturing Practices, Evaluation of Impacts to Underground Sources of Drinking Water by Hydraulic Fracturing of Coalbed Methane Reservoirs (2004) EPA 816-R-04-003.

77 WEST COAST ENVIRONMENTAL LAW: 10 STEPS, *supra* note 52.

78 GRIFFITHS, *supra* note 44.

79 Province of British Columbia, BC Energy Plan: Oil and Gas Policies (Feb. 2007) at p. 1. Available at: http://www.energyplan.gov.bc.ca/PDF/BC_Energy_Plan_Oil_and_Gas.pdf.

80 GRIFFITHS, *supra* note 44.

81 Sirota, David, Backlash against energy exploration could hurt the Republicans out West, International Herald Tribune (May 18, 2008). Available at: http://www.iht.com/articles/2008/05/18/news/18repdem.php>.

82 US Environmental Protection Agency, Link Between Ozone Air Pollution and Premature Death Confirmed (webpage accessed June 2008). Available at: http://www.epa.gov/aging/press/othernews/2008/2008_0422_ons_1.htm.

83 U.S. Environmental Protection Agency, Office of Air and Radiation, Ground-level Ozone, (May 2008). Available at: http://www.epa.gov/air/ozonepollution/ (last visited Jun 17, 2008).

84 Jones, Trevor, Coalbed Methane in British Columbia: Potential Problems (2003). Available at: http://www.cbmwatch.ca/docs/JonesCBM_files/frame.htm.

85 GRIFFITHS, *supra* note 44.

86 WEST COAST ENVIRONMENTAL LAW: A CITIZEN'S GUIDE, *supra* note 49.

87 CITIZENS CONCERNED ABOUT COALBED METHANE, *supra* note 50.

88 City Council of Fernie, British Columbia, Resolution of Council Coal Bed Methane (April 14, 2008). Available at: http://www.fernie.ca/siteengine/activepage.asp?PageID=309

89 British Columbia Ministry of Energy and Mines, Coalbed Gas (CBG) opportunities in Crowsnest coalfield - Information package for potential investors - The Government of BC Oil and Gas Division, Oil and Gas Emerging Opportunities & Geosciences Branch (November 12, 2003) at p. 7. Available at: http://www.em.gov.bc.ca/DL/Oilgas/CBM/Main_text.pdf.

90 British Columbia Ministry of Energy and Mines, Coalbed Gas in the Crowsnest Coalfield (2008). Available at: http://www.em.gov.bc.ca/subwebs/coalbedgas/FAQs/Web_QA_Crowsnest.pdf.

91 BP Canada Energy Company, Mist Mountain Coalbed Gas Project: Sub Surface (April 2008). Available at: http://www.bp.com/liveassets/bp_internet/bp_canada_mist/bp_canada_mist_english/STAGING/local_assets/downloads_pdfs/m/mist_mtn_sub-surface_april_8_2008_.pdf.

92 Dawson, F.M., Coalbed Methane: A Comparison Between Canada and the United States, Bulletin No. 489, Geological Survey of Canada, Ottawa (1995) at p. 55.

93 WEST COAST ENVIRONMENTAL LAW: 10 STEPS, *supra* note 52.

94 CITIZENS CONCERNED ABOUT COALBED METHANE, *supra* note 50.

95 BRITISH COLUMBIA MINISTRY OF ENERGY AND MINES, *supra* note 89.

96. BRITISH COLUMBIA MINISTRY OF ENERGY AND MINES, supra note 90.

97 BP, Physical Footprint, Mist Mountain Coalbed Gas Project (April 8 2008). Available at: http://www.bp.com/liveassets/bp_internet/bp_canada_mist/bp_canada_mist_english/STAGING/local_assets/downloads_pdfs/m/mist_mtn_physical_footprint_april_8_2008_.pdf.

98 Letter from Robert Malone, Chairman & President, BP America, to U.S. Senator Max Baucus (April 2 2008).

99 BRITISH COLUMBIA MINISTRY OF ENERGY AND MINES, *supra* note 89 at 25.

100 *Id.* at 19.

101 Sexton, Erin, Coalbed Methane in British Columbia: A Case Study of the EnCana Corp. Elk Valley Coalbed Methane Pilot Project, National Parks Conservation Association, Glacier Field Office (August 2005).

102 StopMountaintopRemoval.org, What is Mountaintop Removal? (June 2008). Available at: http://www.stopmountaintopremoval.org.

103 United States Department of the Interior Office of Surface Mining Reclamation and Enforcement, Surface Coal Mining Reclamation: 15 Years of Progress, 1977-1992 (August 3, 1992) at p. 36.

104 *Id.* at 42.

105 *Id*. at 38.

106 *Id*. at 42.

107 Ministry of Energy and Mines, Coalbed Gas Opportunities in Southeastern British Columbia – Promotional Brochure (2008).

108 Presentation by the Elk Valley Coal Corporation in Sparwood at the Elk Valley Integrated Task Force meeting, June 2008.

109 British Columbia Ministry of Environment, Land and Parks, Kootenay Region, Selenium mobilization from surface coal mining in the Elk River basin, British Columbia: A survey of water, sediment and biota. By Leslie E. McDonald and Mark M. Strosher (September 1998). Available at: http://www.env.gov.bc.ca/wat/wq/studies/seleniumelk.pdf

110 West Virginia Geological & Economic Survey, Trace Elements in West Virginia Coals (March 2, 2002, last accessed June 18, 2008). Available at: http://www.wvgs.wvnet.edu/www/datastat/te/SeHome.htm

111 National Wildlife Health Center/USGS, Field Manual of Wildlife Diseases, Birds, Chapter 44: Selenium (1998). Available at: http://www.nwhc.usgs.gov/publications/field_manual/chapter_44.pdf.

112 British Columbia Ministry of Energy, Mines, and Petroleum Resources, Crowsnest Coalfield – Baseline Surface Water Quality Survey (2005). Available at: http://www.em.gov.bc.ca/subwebs/coalbedgas/ERIP/baseline.htm. *See also* Flathead Basin Commission website, Cline Mine in a nutshell, last accessed June 2008. Available at: http://flatheadbasincommission.org/mining/cline/nutshell/nutshell.html.

113 Heard, Sarah, Coal Mining and Water Quality: A Comparative Analysis of regulatory approaches in Montana and British Columbia. Masters Thesis for Goldman School of Public Policy, University of California Berkeley (Spring 2007), *and* Beers, Chris, Canadian Columbia River Inter-Tribal Fisheries Commission, Elk River Watershed Water Quality and Fisheries Summary Draft Report Prepared for Wildsight (2008).

114 Canadian Environmental Assessment Registry, Notice of Commencement of an environmental assessment: Lodgepole Coal Mine, British Columbia (December 2007). Available at: http://www.acee-ceaa.gc.ca/050/viewer_e.cfm?cear_id=36059.

115 Cline Mining Corporation, Technical Report: Resources and Reserves of the Lodgepole Coal Property for Cline Mining Corporation, prepared by GR Technical Services Ltd. (February

22 2006) at p 181. Available at: http://www.clinemining.com/projects/pdf/lodgepole-43-101-technical-report.pdf.

116 *Id.* at 147.

117 United States Environmental Protection Agency Region 8, Letter from Carol Rushin to Edward Lee, US Dept. of State (February 22, 2007).

118 CLINE MINING CORP., *supra* note 115 at 13.

119 Cline Mining Corporation website, Lodgepole Coal Mine Project, Canada (accessed June 2008). Available at: http://www.clinemining.com/projects/coal/lodgepole.html.

120 CLINE MINING CORP., *supra* note 115 at 35.

121 *Id.* at 173.

122 *Id.*

123 *Id.* at 182.

124 *Id.* at p.184

125 Jamison, Michael, Schweitzer goes to feds over mine impact on water, The Missoulian (May 27, 2005). Available at: http://www.missoulian.com/articles/2005/05/27/news/mtregional/news07.txt.

126 CLINE MINING CORP., *supra* note 115 at 85.

127 Whitely, Don, B.C. coal play hits troubled waters: But Cline vows to push ahead despite BP Canada's decision to shelve Flathead River portion of its own project, The Globe and Mail (February 28, 2008).

128 Outdoor Recreation Council, Endangered Rivers List Backgrounder (2008).

129 United States Department of the Interior, Letter from Willy R. Taylor, Director, Office of Environmental Policy and Compliance, to Edward Alexander Lee, Director, Office of Canadian Affairs (Feb. 21, 2007) at 2.

130 *Supra* n. 115at 176.

131 Farmer, A.M. The effects of dust on vegetation--a review. English Nature, Northminster House, Peterborough, PE1 1UA, UK. Environmental Pollution 79(1):63-75 (1993).

132 US Environmental Protection Agency, Letter to Edward Lee, Office of Canadian Affairs from Carol Rushin (February 22, 2007).

133 U.S. DEPT. OF INTERIOR, *supra* note 129 at 20.

134 International Joint Commission, Impacts of Proposed Coal In the Flathead River Basin, at p. 8 (December 1988).

135 *Id.*

136 *Id.*

137 Baxter, C.V., C.A. Frissell, and F.R. Hauer, Geomorphology, Logging Roads and the Distribution of Bull Trout Spawning in a Forested River Basin; Implications for Management and Conservation. Transactions of the American Fisheries Society 128:854-867 (1999).

138 Meridian Environmental Inc., Water Quality Review, Greenhills Coalbed Gas Pilot Project, submitted to EnCana Corporation Inc. (February 25, 2005).

139 CLINE MINING CORP., *supra* note 115 at 189.

140 U.S. DEPT. OF INTERIOR, *supra* note 129 at 47.

141 CLINE MINING CORP., *supra* note 115 at 145.

142 INTERNATIONAL JOINT COMMISSION, *supra* note 134 at 8.

143 *Id*. at p. 23.

144 International Joint Commission, Flathead River International Study, Biological Resources Committee Technical Report (October 1987) at p. 264.

145 CLINE MINING CORP., *supra* note 115 at 189.

146 INTERNATIONAL JOINT COMMISSION, *supra* note 134 at 11.

147 INTERNATIONAL JOINT COMMISSION, *supra* note 134 at 20.

148 Documentation Supporting Montana's Request for an IJC Referral for the Flathead Watershed (May 17, 2005). Available at: http://www.flatheadcoalition.org/documents/MT-IJC%20Supporting%20Document.pdf

149 *Id.*

150 NATIONAL PARKS CONSERVATION ASSOCIATION *supra* note 16.