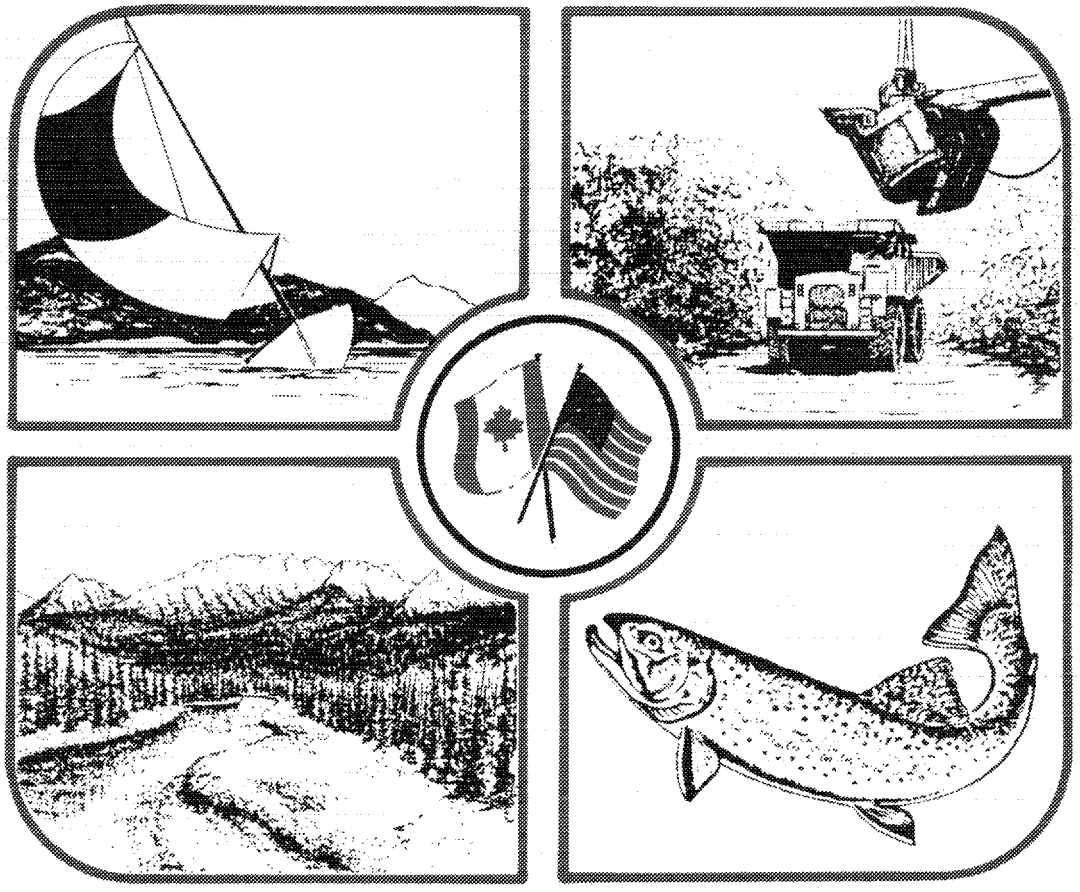
Flathead River
International Study



Biological Resources Committee
Technical Report Summary
October, 1987

On 18 April 1985 the International Joint Commission established the Flathead River International Study Board (FRISB) to investigate the water quality, biological, and water use implications of a proposed open-pit coal mine just north of the International Boundary in southeastern British Columbia. The Board in turn prepared a study plan, defined the study area, and established four technical committees and two subcommittees to assist in the investigation. The study area was defined as "the Flathead River Basin upstream from the outlet of Flathead Lake, including the uppermost potential influence of the Sage Creek Coal Company's Cabin Creek coal mine and its ancillary facilities."

The Board assigned the following tasks to the Biological Resources Committee (BRC):

1. Prepare a detailed work plan.
2. Characterize the aquatic biological resources (algae, macroinvertebrates, and fish), riparian vegetation, and stream-dependent and riparian-dependent wildlife of the study area.
3. Describe the life histories of significant sport fish, especially those which utilize Cabin and Howell creeks and the Flathead/North Fork Flathead River.[1]
4. Characterize the instream flow and water quality requirements of significant fish populations at key locations in the study area.
5. Predict how changes in the water quality and quantity associated with the development of a coal mine at Cabin Creek might affect the biological resources, especially fish, of the study area.
6. Present the results to the Board in a series of interim reports and a final report.

The BRC first met on 26 July 1985 and eight times thereafter. The BRC prepared a study plan and distributed the workload among four subcommittees: algae, macro-invertebrates, fish, and riparian vegetation and wildlife. The tasks assigned to the BRC were accomplished through the gathering and analysis of existing information, both published and unpublished. No additional studies or field work were undertaken, although some committee members had the opportunity to visit the site of the proposed mine as well as existing open-pit coal mines in southeastern British Columbia.

Biological Resources

The Flathead River and its feeder streams above Flathead Lake are headwaters for one of the principal tributaries of the Columbia River: the Clark Fork or Pend Oreille River. The upper Flathead drains a remote and picturesque mountain-rimmed valley in southeastern British Columbia and northwestern Montana. The clean, cold waters, native and self-sustaining trout fishery, and spectacular scenery combine to make the upper Flathead a prime recreational attraction. However, the proposed mine would, to some degree, impair the quality of the river's water, the integrity of the river's biological resources, and some of the recreational opportunities that the river offers.

Algae

Algae that live on stream bottoms (periphyton) are the principal plants (producers) in aquatic communities of the Flathead River and its tributaries upstream of Flathead Lake. The algal flora is composed predominantly of pollution-sensitive, freshwater species distributed among five major groups: greens (Chlorophyta), golden browns (Chrysophyta), diatoms (Bacillariophyta), reds (Rhodophyta), and bluegreens (Cyanophyta). Eighty-eight percent of the algal taxa reported from flowing-water habitats upstream of Flathead Lake are diatoms. For most streams of the study area, including those that may be affected by the proposed coal mine, there is only limited and incomplete seasonal and site-specific information on benthic metabolism trophic status, chemical composition of algae, species diversity, the functionally most important algal species or groups, and factors limiting algal growth.

[1] The Flathead/North Fork Flathead River refers to the body of water named the Flathead River in Canada and the North Fork Flathead River in the United States.

Macro invertebrates

Streams of the study area have a moderately productive, clean-water macroinvertebrate fauna composed mostly of immature insects that belong to the orders Ephemeroptera (mayflies), Plecoptera (stone lies), Trichoptera (caddisflies), and Diptera (true flies). Macroinvertebrates constitute the bulk of the diet of many fish species in the Flathead River Basin. Most taxa are sensitive to sediment deposition and organic pollution. The density and diversity of macroinvertebrates in Flathead Basin streams are typical of values recorded for other Rocky Mountain streams.

Sampling methods, notably the mesh size of collecting nets, have been inconsistent among studies, making it difficult to compare or interpret results quantitatively. The macroinvertebrates of the Flathead River system have received substantially more attention on the United States side of the International Boundary.

Fish

The Flathead Lake/River system supports 24 species of fish, 10 of which are native. The bull trout, westslope cutthroat trout, mountain whitefish, slimy sculpin, and large-scale sucker are the most common native fish in the Flathead River system above Flathead Lake. Kokanee, an introduced species, are seasonally abundant in the Flathead River below the Middle Fork and in the Middle Fork. Bull trout, westslope cutthroat trout, mountain whitefish, and kokanee exhibit varied and sometimes complex life histories and seasonal migration patterns that may extend the effects of the mine on populations of these species well beyond the downstream limit of chemical and physical influence.

The bull trout is the largest fish native to the Flathead drainage and is a species of special concern in Montana because of the limited numbers and distribution of the large, adfluvial form, and its sensitivity to environmental conditions for spawning in tributary streams. Bull trout grow to maturity in Flathead Lake, ascend the river and its tributaries in summer and fall to spawn, then return to the lake. Eggs and leavens typically remain in the grovels of spawning streams from September or October until April of the following year. Juveniles rear mostly in tributaries (some rear in the river) for one to three years before migrating to the lake.

Based on spawning site surveys conducted from 1980 to .1982, 3000 to 5000 bull trout migrants from Flathead Lake enter a small number of tributaries to spawn each year. In addition, 2000 to 3000 spanners are harvested by anglers in the river system before they reach the tributaries (based on 1981 census data). Howell and Cabin creeks supported roughly 10 percent of the bull trout spawning in the Flathead River drainage above Flathead Lake during the survey period, and about 55 percent of all spawning in the Canadian portion of the drainage. The long upriver and down river migration route (up to 250 km [155 miles] each way) coupled with the high visibility of adults in spawning streams, make the bull trout that use Canadian waters extremely vulnerable to fishing pressure. Bull trout are very sensitive to environmental perturbations because of the long over winter incubation and development period for embryos and leavens, and the sensitivity of juveniles to streamed changes.

The westslope cutthroat trout is a species of especial concern in Montana because of reductions in the abundance and distribution of genetically pure populations. Westslope cutthroat trout in the Flathead drainage exhibit one of three life history patterns: resident, fluvial, and adfluvial. Resident fish remain in their natal streams throughout their lives. Fluvial trout reside in the mainstem as adults and spawn in the tributaries. Adfluvial fish mature in Flathead Lake, ascend the river and its tributaries to spawn, then return to the lake. All cutthroat are sensitive to environmental disturbances that affect spawning, rearing and overwintering capability, and adult habitat.

Rainbow trout, which are neither common in nor indigenous to the Flathead drainage, are of interest because they have the potential to compete and hybridize with native cutthroat trout. Changes in physical or chemical factors may fa-

vor rainbow trout over cutthroat trout or help to break d own reproductive barriers, leading to an increase in hybridization.

The mountain whitefish is the most abundant fish species in the Flathead River and its tributaries. A significant overwintering site for whitefish in the Canadian portion of the drainage is located in the reach of river downstream from Howell Creek.

Three species of a sculpin are found in the Flathead/North Fork Flathead River drainage. Sculpins are important forage fish in many streams, where they inhabit riffle are as with clean, rocky bottoms. Shorthead sculpin are a threatened species in Canada and are a species of special concern in Montana because of their limited distribution

Kokanee comprised over 90 percent of the Montana fish harvest in the Flathead Lake/River system during the 1981 to 1982 fishing season, but only a small migrant population of several hundred fish has been observed in the Flat head/North Fork Flathead River above the mouth of the Middle Fork. Kokanee have been observed in Canada upstream from Howell Creek.

Riparian Vegetation and Wildlife

Streamside plant and animal communities contribute significantly to the biotic diversity and productivity of both terrestrial and aquatic environments along the length of the Flathead River and it tributaries. The close proximity of the riparian zone to the aquatic communities fosters many direct trophic links. At least 16 species of mammals and birds, including river otter, mink, spotted sandpiper, and dipper, depend entirely on aquatic life for sustenance. Saturated soils, flooding, redeposition of soil materials, and a generally high water table are among the important factors that shape riparian communities. Nearly all of the field studies conducted have been along the North Fork Flathead River in Montana, but the re results cans be extrapolated to active floodplains in British Columbia.

Impact Assessment

The proposed a mine would affect biological resources through alteration of physical habitat at the mine site and introduction of substances into the aquatic ecosystem. The Mine Development Committee (1986) predicts that mining and associated logging activity would increase concentrations of phosphorus, nitrogen, total suspended solids, and toxic chemicals in a Cabin and Howell creeks. Stream temperature would increase or decrease (depending on season and the stage of mine development) as a result of changes in ground water and surface water discharges. Peak spring flows would increase because of land disturbance at the mine site; late summer baseflow could decrease because of ground-water reversal when pit floors drop below creek levels.

Quantification of these changes is difficult because of uncertainties in mine development plans and a effects on various physical parameters. Consequently, predictions of the impact of mining activity on the biological resources of the Flathead drainage is uncertain. The Biological Resources Committee considered three scenarios to allow for an evaluation of a range of potential effects from the proposed mine. The optimal case is based ton the Stage II mine design and the assumption that all best management practices would be effectively implemented. The adverse case is based on past instances where existing mines have not met standards and conditions specified in British Columbia Government regulations and guidelines for coal mining. The committee also predicted the potential effects of an extreme event or accident, including such situations as the failure of a settling pond or dump. Such a failure would involve the rapid release of large amounts of inert sediments into Cabin Creek, Howell Creek, or both.

The proposed Sage Creek Coal Mine would convert a landscape dominated by natural processes to one dominated by industry. This conversion would have major effects on the aquatic

and riparian biota in portions of the study area and moderate to negligible effects elsewhere. These effects are summarized at three locations:

1. the mine-site area;
2. the International Boundary; and
3. downstream from the International Boundary.

Mine-Site Area

Periphyton standing crop in streams of the mine-site area (Howell Creek and Cabin Creek) would increase under optimal and adverse operating conditions. Visible patches of algae would accumulate ton stable substrates at times other than freshet. Algal biomass would more frequently exceed the criteria established by the Water Quality Criteria Task Force (1987). Algal diversity would decrease and taxonomic composition would shift from small, single-celled algae to larger, conspicuous, filamentous species not eaten by macroinvertebrates.

The mine would have additional detrimental effects on macroinvertebrates of local streams. The natural, diversified fauna would be replaced by the few invertebrate groups capable of tolerating the cumulative effects of the mine. Changes in stream flow characteristics and in suspended sediments would, by themselves, be sufficient to alter the invertebrate fauna, thereby making reaches of Howell and Cabin creeks incapable of supporting populations of salmonids and sculpins. These consequences would arise under both optimal and adverse operating conditions.

Bull trout would be virtually eliminated from Howell and Cabin creeks under both optimal and adverse mining scenarios. Bull trout are particularly sensitive because of their very specific spawning and rearing requirements. After mining, bull trout would not recover to pre-mining levels because of increases in deposited sediments, nitrogen, and temperature in the streams. Changes in the ground water regime in the mine-site area would also negatively affect bull trout recovery. Numbers of cutthroat trout and other fish species would be reduced in Cabin and Howell creeks in proportion to habitat loss. Reductions in fish populations would result largely from destruction of spawning and rearing habitat and reductions in water quality.

Impacts to the aquatic environment caused by mine development would affect the terrestrial environment as well. At the mine site, streamside encroachment, channelization, high spring flows, and general dewatering resulting from both optimal and adverse operating conditions would eliminate some habitat for at least 16 terrestrial vertebrate species. Reductions in fish and macroinvertebrates would have negative impacts ton a number of terrestrial species that depend on the stream as a source of food. Mammals and birds with small home ranges – muskrats and dippers, for example – would be especially sensitive to these anticipated changes.

International Boundary

The increase in periphyton standing crop at the International Boundary and for some distance downstream would be less pronounced than the increase in the mine-site area but still significant under both optimal and adverse operating conditions. It is not possible to predict whether the increase would be visible to the naked eye or whether there would be a significant decrease in algal diversity or a shift in relative abundance of species.

The influence a of the mine at the International Boundary would probably result in a slight to moderate decline in numbers of macroinvertebrates in the Flathead/ North Fork Flathead River under adverse operating conditions. Major changes in the kinds of macro-invertebrates in the river would be unlikely.

Under either the optimal or adverse condition there would be a 10 percent reduction in numbers of adult and juvenile bull trout in the Flathead Lake/River system as a consequence of lost recruitment of these fish from Howell Creek and Cabin Creek. The population in the Flathead/ North Fork Flathead River would be reduced by 55 percent upstream from the International Boundary. Migratory cutthroat trout in the river would be reduced to an unknown degree. Num-

bers of resident whitefish and sculpin in the river would be slightly reduced through degradation of physical habitat.

Bull trout and cutthroat trout from Howell and Cabin creeks would not spawn elsewhere because they are genetically programmed to return to home streams. Non-migratory cutthroat trout also would be affected by the lower quality habitat, but to a lesser degree than migratory fish.

Impacts ton riparian communities at the International Boundary would be negligible under optimal operating conditions. Under the adverse scenario a number of terrestrial species, including river otter, great blue heron, and belted kingfisher, would be negatively impacted by reductions in fish and macroinvertebrates as food sources.

Downstream

Downstream from the International Boundary, nutrient contributions from the mine could magnify existing algal productivity in the mainstem Flathead River downstream of outfalls from municipal wastewater treatment plants in Montana. The influence of the mine on macro-invertebrates would be insufficient to detect changes in numbers or species.

The number of adfluvial bull trout that leave Flathead Lake and successfully spawn in tributary streams would be reduced by about 10 percent, or approximately 300 to 500 fish. Fish spawning in Canada provide a disproportionately large percentage of the recreational angling for adult bull trout in the Flathead system because they are exposed to fishing pressure throughout their relatively long migratory route.

A smaller reduction would occur in Flathead Lake populations of migratory cutthroat trout because of the loss of tributary spawning habitat.

Extreme Event

An extreme event involving a sudden release of large amounts of inert sediment, such as the failure of a waste dump or sedimentation pond, could have profoundly damaging effects on the biological resources of the area. Such an event would locally curtail algal production by blanketing and scouring periphyton growths and by replacing stable substrates with deposited sediments. Should an extreme event occur at the mine site, the macroinvertebrate and fish faunas of the affected creeks would be destroyed. Populations might take 10 to 40 years to return to normal levels as deposited sediments are gradually flushed from the substrate; some species might never recover. Damage to spawning and rearing habitat could result in the loss of unique populations of migratory fish. In turn, terrestrial mammals and birds that depend ton the aquatic food chain would find the mine-site habitat severely degraded.

The effects of an extreme event would be lessened but still significant at the International Boundary. The only detectable effect at Flathead Lake would be reduced numbers of migratory bull trout, cutthroat trout, and possibly kokanee resulting from degradation of habitat upstream. Extreme events might affect terrestrial species that feed on these species downstream from the International Boundary.

Conclusion

The direct effects of the proposed mine on biological resources in the Flathead drainage would be highly detrimental at the mine site, slightly detrimental at the International Boundary, and negligible near Flathead Lake. Migratory fish populations, important to the entire Flathead Lake/River system, would experience significant long-term population declines because of severe damage to spawning and rearing habitat in the vicinity of the mine.

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