A REVIEW OF THE STAGE II ENVIRONMENTAL ASSESSMENT REGARDING A PROPOSED COAL MINE IN THE CANADIAN PORTION OF THE NORTH FORK FLATHEAD RIVER DRAINAGE:

FISHERIES CONCERNS

Submitted by

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EXECUTIVE SUMMARY

The Montana Department of Fish, Wildlife and Parks believes that the proposed coal mine on Cabin and Howell creeks in the North Fork of the Flathead River drainage in British Columbia poses a significant threat to the fishery of the upper Flathead River Basin. Any localized impacts on fish populations in Cabin Creek, Howell Creek, and/or the North Fork of the Flathead River will be reflected throughout the Flathead Lake-River system because of the migratory nature of the two principal gamefish, the westslope cutthroat trout and bull trout.

The North Fork drainage of the Flathead River supports a Class I (highest value) fishery resource and is inhabited by two species of statewide special concern, the westslope cutthroat trout and the shorthead sculpin. The trophy bull trout fishery of the Flathead system is a unique state resouce and is undoubtedly one of the most extensive high-quality bull trout fisheries in the contiguous United States.

The most concentrated bull trout spawning area in the entire Flathead River system above Flathead Lake is located in the portion of Howell Creek that runs directly through the proposed mine site, between the North Hill Pit and Waste Dump E. This spawning area contained 15 percent of all bull trout spawning sites found in the entire North Fork drainage during the 1981 spawning season. Based on our own analysis and a more detailed review by professional Montana hydrology specialists, we believe that significant sedimentation and dewatering of the critical Howell Creek bull trout spawning area will occur if mining activities are conducted as planned.

Increased sediment loading to the Howell Creek and North Fork drainages will likely stem from inadequate design of settlement ponds and drainage ditches. We are concerned that the mine drainage system is not designed to properly handle a "cold-low" type flood event. Critical design information pertaining to the design of clean and contaminated water ditches was omitted from the Stage II Assessment. Fine sediments would fill in intergravel spaces in the stream bottom which would decrease available habitat for juvenile fish and their invertebrate food supply. The survival of incubating fish eggs and fry would be reduced because decreased intergravel water flow would result in reduced oxygenation and increased accumulation of toxic metabolic wastes.

Dewatering of Howell Creek during base flow periods would result from interception of ground water by mine cuts and also from lateral subsurface flow from the stream channel to the mine pit as excavation proceeds below the elevation of the streambed. Future re-entry into the mine pits to extract deeper coal seams (located well below the valley floor) would probably result in the complete dewatering of Howell Creek during base flow periods. Dewatering during base flow periods would reduce or eliminate bull trout passage to the critical Howell Creek spawning area and would also reduce rearing and overwintering habitat for juvenile fish. It is estimated that the elimination of the Howell Creek bull trout spawning area would result in an annual loss of about 3,000 adult (18 inch) fish to the Flathead Lake-River fishery.

Potential water quality alterations resulting from mining activities pose more of a threat than has been acknowledged in the Stage II Assessment. We expect that anaerobic conditions will exist in the settling ponds during periods of winter stagnation due to the input of ammonium nitrate into mine drainage waters as a result of overburden blasting. Anoxic settling pond effluents would be extremely toxic to eggs, fry, and juvenile fish in the Howell Creek drainage and throughout the Flathead system. The potential for significant acidification of Howell Creek waters was inadequately addressed. If acidic Seam 4 leachates were to enter Howell Creek waters, the downstream fishery impacts would be significant. We suggest that the settlement pond effluent suspended solid standard be lowered from 50 mg/L to 15 mg/L to insure adequate protection of the fishery resource of Howell Creek and to insure compatibility with Montana water quality standards.

The Howell Creek floodplain was inadequately defined in the Stage II Assessment. Development within the 200-year floodplain should be precluded in order to preserve riparian vegetation, allow for natural channel movement, and reduce the potential for flood-induced settlement and drainage ditch failures. Encroachment on the floodplain would result in increased sediment loading and stream channelization. Increased stream channelization would result in larger substrate, gradient,and current velocities which would reduce habitat quality for spawning bull trout.

It is emphasized that increased sedimentation and water quality alterations would not only affect the Howell Creek drainage but would also impact the North Fork of the Flathead River and perhaps Flathead Lake. Increased sedimentation of the North Fork would fill intergravel spaces and cause the river channel to become wider and more shallow. Decreased river bottom substrate porousity would reduce invertebrate populations, fish carrying capacity, and fish overwintering habitat. The North Fork of the Flathead River is important to all migratory gamefish species in at least two phases of their complex life cycles. Over half (56 percent) of the nearly 38,000 cutthroat trout caught during 1975 in the entire Flathead River system above Flathead Lake were taken in the North Fork. Reductions in populations of migratory cutthroat or bull trout in the North Fork system would result in reduced recruitment to the Flathead Lake fishery.

The fisheries data presented in the Stage II Assessment is flawed by numerous omissions and inadequacies. The importance of the North Fork River in the vicinity of the Howell Creek confluence is virtually unknown. The fisheries potential of Cabin Creek was largely ignored in the Stage II Assessment. The fishery potential of Howell Creek above the mine site was also poorly documented. Fish population survey sections appeared to have been selected for the sake of convenience rather than for their representation of a particular stream reach, and the fish population estimation technique employed was inadequate and statistically inaccurate. We feel that the existing fishery resource must be adequately quantified before meaninful assessment of potential environmental effects can begin. Environmental conditions cannot be monitored until adequate baseline information is established.

If the mining plan is approved, we suggest that an intensive environmental monitoring plan be implemented. Measured parameters would include surface and groundwater quality and quantity, aquatic invertebrates, stream bottom substrate composition, fish population levels, and spawning surveys. The monitoring program should include sites above and below the mine site on Cabin and Howell creeks as well as locations on the North Fork of the Flathead River above and below its confluence with Howell Creek. Periodic monitoring reports should be issued to appropriate U.S. and Canadian agencies. Corrective measures should be taken immediately if environmental problems are detected.

INTRODUCTION

The Montana Department of Fish, Wildlife and Parks is extremely concerned about the potential adverse fishery and water quality impacts of Sage Creek Coal Limited's mining proposal for the Cabin-Howell Creek area of the North Fork Flathead River drainage in British Columbia.

By virtue of its free flowing status, high quality water, and other outstanding features, the North Fork of the Flathead River was added to the National Wild and Scenic Rivers System in 1976. This was accomplished by amending the National Wild and Scenic Rivers Act of 1968 (Public Law 90-542). The North and Middle Forks and mainstem Flathead River above Flathead Lake have all been designated Class I fishery waters in Montana. Class I streams represent streams with the highest fishery resource value (Montana Department of Fish, Wildlife and Parks and U.S. Fish and Wildlife Service 1980; see Attachment A for classification criteria). The North Fork of the Flathead River also comprises the western boundary of Glacier National Park which was designated as an International Biosphere Reserve by the Man and Biosphere Program, UNESCO in 1976. The North Fork of the Flathead River is classified as A-1 (see Attachment B for criteria used) by the Montana Department of Health and Environmental Sciences to protect the water quality of the river.

Flathead Lake is the second largest natural lake in the western half of the United States and is noted for its pristine quality and diverse cold water fishery. It is the favorable growing environment which exists in Flathead Lake that enables the migratory westslope cutthroat trout (*Salmo clarki lewisi*) and bull trout (*Salvelinus confluentus*) to attain the large size for which they are noted in this system. These fish are dependent upon spawning and rearing areas in the many tributaries to the North and Middle Forks of the Flathead River to perpetuate their stocks. Since fish fail to recognize political boundaries, some of the most important spawning and rearing areas for large adfluvial (migratory between lakes and river) Flathead Lake cutthroat and bull trout are located in the Canadian portion of the North Fork drainage.

The bull trout fishery in Flathead Lake and in the interconnected river system is a quality trophy fishery. This fishery is considered to be a unique Montana resource and is undoubtedly one of the most extensive high quality trophy bull trout fisheries in the contiguous United States. Montana Department of Fish, Wildlife and Parks recognizes this fact and has imposed a minimum size limit of 457 mm (18 inches) and more recently has reduced the creel limit to one fish for angler-caught bull trout in the Flathead system. In addition, most of the important bull trout spawning streams in the North and Middle Forks of the Flathead River have been closed to fishing since the 1950's to insure adequate recruitment to the lake population. Due to their migratory nature, bull trout provide a popular seasonal fishery throughout the lake-river system.

As was pointed out in the Stage II Environmental Assessment, Howell Creek is one of the most important bull trout spawning and rearing tributaries in the Flathead system. Bull trout spawning surveys conducted during 1980 by Montana Department of Fish, Wildlife and Parks personnel and by British Columbia Research indicated that Howell Creek was one of the four most important spawning streams out of a total of 38 tributaries and one river reach surveyed in the North and Middle Fork drainages (Stage II Environmental Assessment; Appendix 3.3.6-3). Howell Creek had the highest density of spawning sites in the Flathead drainage in 1980 (Fraley et al. 1981). The 1981 Montana Department of Fish, Wildlife and Parks spawning site census data further support the importance of Howell Creek (Table 1). It is obvious that detrimental impacts on bull trout spawning and rearing success in Howell Creek would be realized across the border in the United States portion of the Flathead system. Using redd count information, fecundity estimates, and egg and fry survival estimates, we project that the destruction of the Howell Creek bull trout spawning area would result in an annual loss of 3,000 adult bull trout (18 inch fish) to the Flathead Lake-River fishery.

The North Fork of the Flathead River serves as a corridor for migratory fish and also provides a significant summer fishery for cutthroat trout, bull trout and mountain whitefish . Over half (56 percent) of the nearly 38,000 cutthroat trout caught during 1975 in the entire Flathead River system above Flathead Lake were taken in the North Fork (Hanzel 1977). Late summer river snorkel counts in the North and Middle Forks have shown that bull trout tend to gather and hold below the mouths of spawning tributaries (Fraley et al. 1981). Stream trapping results (Graham et al. 1980) and biologist observations during fall bull trout redd counts suggest that limited mountain whitefish spawning occurs in tributary streams. With the exception of early summer migrations up certain tributaries, it is believed that mountain whitefish depend entirely on the river system (including the North Fork) to meet their life history requirements. Adverse changes in the water quality of the North Fork of the Flathead River could therefore affect at least two life cycle phases of the three principal migratory gamefish species.

Table 1. Bull trout redd counts in principal spawning areas of the Flathead River drainage during 1981 (Montana Department Fish, Wildlife & Parks; 1982 Flathead River Fisheries Study Report, in press).

Middle Fork Flathead River Drainage		North Fork Flathead River Drainage	
Tributary	No. redds	Tributary	No. redds
Strawberry Creek	21	Starvation Creek	1
Trail Creek	26	Trail Creek	82
Bowl Creek	10	Whale Creek	101
Clack Creek	7	Shorty Creek	17
Schafer Creek	12	Red Meadow Creek	19
Dolly Varden Creek	31	Coal Creek	30
Lodgepole Creek	18	South Fork Coal Creek	24
Morrison Creek	32	Mathias Creek	10
Granite Creek	14	Big Creek	24
Bear Creek	12	Hallawat Creek	14
Ole Creek	23	Kishinen(a) Creek (U.S. & Canada)	13
Nyack Creek	14	Couldrey Creek	24
Coal Creek	4	North Fork Flathead River (U.S. - Polebridge to Border)	0
Park Creek	13	North Fork Flathead River (Canada - Border to Squaw Cr.)	34
		Howell Creek	72
		Cabin Creek	2

The westslope cutthroat trout and the shorthead sculpin (*Cottus confusus*) are currently classified as Class B species of "special concern" in Montana (see Attachment C for criteria). The upper Flathead drainage is considered a stronghold for the westslope cutthroat trout and is also one of the few locations in the state where shorthead sculpins are found (Holton 1980). It has been estimated that the original population of cutthroat trout in the interior United States has declined by 99 percent during the past 100 years (Behnke 1979). The westslope cutthroat trout, in particular, has vanished over most of its range (Behnke 1979).

MAJOR AREAS OF CONCERN

Water Management Plan

The potential for a "cold-low" precipitation event to occur every 10 years was pointed out in Appendix 2.11.1-1 (p. 11 and 12). This Appendix (p. 12) states that the analytical procedure to predict the frequency of rainfall did not review the "synoptic conditions responsible for the recorded maximum annual 24-hour rainfall" due to the limitations of the statistical analysis. The Appendix (2.11.1-1, p. 24) ensures us that "This simplification has not produced significant underestimates for observed extreme discharges". We are not convinced and feel a more exhaustive analysis should be made on these "cold-low" precipitation events. Design standards should be based on these "cold-low" type events as the probability of at least one and most likely two of these events occurring during the life of the mine is too great to ignore. Appendix 2.11.1-1 (p. 24) recommends "A conservation safety factor has been recommended for engineering structures designed for these areas". Another factor which must be considered when evaluating potential runoff from 24-hour rainfall is the fact that, "Raininduced peak flows on Howell and Cabin creeks and their tributaries, downstream from disturbed areas, will be discharged progressively more rapidly as development proceeds at the mine site". (p.4-16, paragraph 3, main text). It appears this has not been considered in the water management plan design.

We have no way to evaluate the design criteria used in water management structures as the essential reports of Klohn Leonoff Consultants Ltd. (1978; 1979; 1981; 1981a) were not included for review. We cannot evaluate this project without adequate information explaining how the drainage systems were designed. The potential impacts on the Flathead fishery of an improperly designed water management system could be devastating. The potential impacts of a tailing pond failure or another disastrous event at the mine site would impact downstream areas, not only in Canada, but throughout the U.S. portion of the Flathead drainage. Excessive quantities of sediment delivered to area streams and the Flathead River could potentially reduce the number of bull and cutthroat trout produced in the upper Flathead drainage.

In summary, the application reports "The Water Management Plan outlined in Section 2.11 and on Maps 2.11.1-1 and 2.11.1-2 will mitigate any minor impacts which occur (p. 4-16, paragraph 1, Main Text). First, the potential impacts we described are not minor. Second, the application does not adequately represent these potential impacts, nor does it provide adequate information for complete analysis.

Ditches

The concept of routing natural runoff around the disturbed mine site is well conceived; however, we question the use of ditches for this purpose.

We would suggest that properly designed and maintained conduits consisting of half culverts or cement lined storm sewers with sediment traps placed along their length be used to route this natural runoff.

Contaminated water ditches pose a potential threat to the aquatic system. A detailed description is required before we can present informed testimony regarding the potential effects of these ditches on the fishery.

The design of these ditches is critical because till material in the area consists typically of "15 to 30% by weight of fines (silt and clay sizes), 30 to 40% sand, with the remainder being gravel, cobbles, and boulders up to about 0.5 m maximum dimension" (p. 3-6 of the Main Text). The reason for concern is that this till material is highly erodable. Ditches through this material should be lined to prevent downcutting and the subsequent transport of large quantities of fine sediment. Fine sediment has been shown to negatively impact salmonids when excessive amounts enter the streams (Reiser and Bjornn 1979, Bjornn et al. 1977). We would also recommend stabilizing all ditches with vegetation immediately after construction.

Constant maintenance of these ditches to remove ice and other debris will be imperative to insure they can handle storm run-off. A suitable ditch monitoring and maintenance program should be set up by Sage Creek Coal and the appropriate Canadian government agency before any permits are granted for operation. This plan should provide for spot inspections by the government agency to check on compliance, and substantial penalties should be levied for noncompliance.

Settlement Ponds

The highest concentration of suspended solids recorded in Howell Creek reached 14 mg/1 on 5 May, 1978 (Appendix 3.3.3-1, Table 7). We do not feel it is appropriate to allow a discharge of water containing levels as high as 50 mg/1 of suspended solids (p. 2-40, paragraph 1, Main Text) into Howell Creek from the settlement ponds. For this reason, we recommend lowering the discharge standards for suspended solids to 15 mg/1 for water discharged into Howell Creek.

The high standard, 50 mg/1 is incompatible with the A-1 water quality designation of the Flathead River by the State of Montana (Attachment B). The discharge standard should be significantly lowered because of the relative importance of Howell Creek and the Flathead River for the maintenance of the Flathead drainage bull trout population and the recognized harmful impacts of increased fine sediment levels on salmonid spawning success (Reiser and Bjornn 1979).

The Main Text states (p. 2-43) that "During periods of low runoff, no decant will occur..." from the settlement ponds. Compliance must be assured by the Canadian government or some regulatory agency. We cannot comment on sedimentation pond characteristics or design standards as the information is in Klohn Leonoff Ltd. (1981) which was not provided.

It is mentioned in the text (p. 2-43, paragraph 5) that a temporary settling pond will be cleaned and eliminated yet no procedure for doing this is described. This pond should not be constructed in the 200-year floodplain and should be reclaimed in a manner that will prevent the entrance of fine sediments to Howell Creek.

Tailings Pond

"The tailings pond will normally operate as a closed system with no overflow releases of water or tailings to natural watercourses" (p. 2-40, paragraph 2, Main Text). The tailings pond must operate as a closed system at all times. If there are "non-normal" events anticipated, the tailings pond should be designed to handle those "non-normal" conditions. A discharge of tailings or tailings water into Howell Creek or Cabin Creek is unacceptable.

"Seepage will be minimal" (p. 2-45, first paragraph, Main Text). The application does not define minimal seepage. We need percolation data to evaluate potential pond seepage. We also need design criteria for the tailings pond. A tailings pond failure would be devastating to the fishery.

We are concerned that the floodplain mapping done to design the entire Water Management Plan was not detailed enough to adequately protect the ditches and ponds from potential flooding. Norecol (1981) (Appendix 3.3.2-2, p. 3, paragraph 2) states, "Floodplain delineation using this technique is expensive and is not thought to be justified at the present stage of development". The technique they refer to is using aerial photographs and ground surveys "to determine channel and valley bottom geometry" (Norecol 1981).

The importance of the Howell Creek drainage for the bull trout fishery of the entire Flathead drainage makes it imperative to adequately assess potential flood hazards to the ditches, and settlement and tailings ponds. It is inappropriate to cut corners on such an important phase of mine development. We believe groundproofing of the initial interpretation of the aerial photographs should have been included in this assessment. Even the superficial floodplain analysis suggests that very real flood hazard exists for the contaminated water ditch near the North Hill to Howell Creek Waste Dump bridge. This contaminated water ditch passes through a wetland area (Map 2.11.1-1) described by Norecol (1981) (Appendix 3.3.2-2, p. 6, Table 2) as flooding annually. It is unacceptable to put a contaminated water ditch in an area that floods annually.

Pond 2 and 4 lie partially or entirely in areas that may be subject to flooding. In the interest of protecting the critical spawning and rearing area in Howell Creek, we urge that no such development occur in the 200-year floodplain of this stream.

Water Quality and Quantity

The Montana Department of Fish, Wildlife and Parks feels that the preservation of the pristine water quality of Flathead Lake and the North Fork of the Flathead River and its Howell Creek drainage are essential to the perpetuation of the existing international fishery resource. Sage Creek Coal Limited's proposed mine in the Howell Creek drainage poses significant threats to water quality and quantity which could affect the fishery of the entire river basin. These potential impacts must be reconciled before project approval-in-principle is granted.

We are particularly concerned that anoxic conditions may occur in the proposed settling ponds during certain times of the year and especially during periods of winter ice cover. The settling pond from a large coal mine in southeastern Montana was found to become stagnant during the winter months (Turbak and Olson 1977). If winter stagnation were to occur in in Pond 4, incubating bull trout eggs and alevins as well as juvenile fish rearing in Howell Creek would be exposed to highly unfavorable environmental conditions resulting from effluent discharge directly into Howell Creek. This effluent would consist of deoxygenated water carrying increased concentrations of highly toxic compounds such as ammonia (derived from nitrate enrichment from overburden blasting) and hydrogen sulfide. Such conditions could significantly decrease bull trout recruitment from Howell Creek and thus impact the entire international fishery for this species.

Storage facilities for the ammonium nitrate used in the blasting mixture should be located in an area where a minimal amount of surface and/or groundwater contamination via leaching or spillage would occur. Improper placement of such facilities at the above-mentioned mine in southeastern Montana was thought to be partially responsible for elevated nitrate concentrations in settling pond waters (Turbak and Olson 1977).

Frequent monitoring (i.e. biweekly) of all settling and tailings pond influents and effluents should be conducted as was mentioned on Text page 2-42. It is essential that monitoring sites be established on sections of Cabin and Howell creeks both upstream and downstream from areas of potential mining activity. In this way, mining impacts on water quality can be distinguished from impacts resulting from other activities further upstream in the drainage. A water quality monitoring station should be established in the North Fork River upstream from its confluence with Howell Creek for the same reason. We also suggest that pond aeration be considered as a mitigative measure if stagnation becomes a problem. If flocculents are used to modify effluent water quality (Text page 2-42), we request formal documentation that this treatment will not prove harmful to fish or invertebrates in the drainage. We also request that appropriate state and federal agencies concerned with protecting environmental quality in the U.S. portion of the Flathead drainage receive monthly mining company summaries of water quality monitoring results if the mining plan is approved and development proceeds.

Dustfall at the proposed mine site should be carefully monitored and controlled as is mentioned in the Stage II Assessment. Dustfall could contribute nutrients to Howell and Cabin creeks and also could contribute fine sediments to the creeks during base flow periods when flushing would be minimal. This could become a major problem in the vicinity of heavily used creek crossings and waste dumps. Areas adjacent to and above the critical bull trout spawning area on Howell Creek are particularly important and every means should be taken to preserve the quality of this reach. Revegetation of waste dumps should proceed as soon as is possible in order to minimize the potential dust problem.

The acid production potential of Seam 4 (mentioned on Text page 4-38) should be more thoroughly investigated under simulated "real" conditions and appropriate mitigation plans be made prior to any approval-in-principle of the proposed project. The initial pH (5.5) of this seam appears to be alarmingly low. Fish populations in lakes and rivers are especially sensitive to acidification, which typically causes decreased reproductive success (Beamish 1974; Harvey 1979). It has been concluded that fish reproduction is impaired at pH levels below 6.5 (Kennedy 1980). Increased acidity of waters in the critical bull trout spawning area within Howell Creek could have a devasting impact on its bull trout run and potentially affect the fishery downstream. Downstream effects on the water quality of the North Fork must also be considered since the A-1 water quality classification restricts induced variation of pH to less than 0.5 pH unit (Attachment B). Downstream impacts of acidity on Flathead Lake would be determined by the dilution factor. Acidity could directly impact the lake fishery via decreased fish reproduction success and could have an indirect effect by altering the species and size composition of the crustacean zooplankton (Yan and Strus 1980) which are an important food resource for most gamefish species in the lake (Montana Department of Fish, Wildlife and Parks, in press).

We are concerned that disruption of aquifers by mining activities will lower the level of Howell Creek "during base flow conditions (August-March) when ground water flows predominate" (Text page 3-43). Lowered base flows in Howell Creek would reduce bull trout access to critical spawning areas in Howell Creek and decrease the amount of spawning and rearing habitat available during the growing and overwintering periods. Lowered base flows could also influence the water temperature regime of Howell Creek. Water temperature is thought to be an important factor which cues bull trout spawning (Fraley et al. 1981).

Our investigations have shown that high use bull trout spawning areas in tributaries to the North and Middle Forks of the Flathead River occur in reaches having underlying bedrock such as limestone that typically have high permeability ratings. A good example of the preference of spawning bull trout for areas having high rates of ground water recharge was observed during the fall of 1981 on Trail Creek which is the most northerly tributary draining from the west side into the U.S. portion of the North Fork River. Montana Department of Fish, Wildlife and Parks biologists discovered 18 bull trout redds clustered in a channel that was approximately 200 m long and 8-10 m wide. The water supply for this channel originated from a large spring hole at the upstream end.

The depth (relative to the Howell Creek floodplain) to which mining will occur is not clearly defined in the Stage II Assessment. However, it is mentioned that little backfilling of mine pits will occur in order to facilitate possible re-entry if economic conditions for such action are favorable (Text page 5-13). The maximum depth (relative to the Howell Creek floodplain) to which mining will occur and the probable impacts on base flows and bull trout spawning success in Howell Creek should be specifically addressed before an agreement-in-principle for the mining proposal is granted. Provisions should also be made to re-evaluate impacts on Howell Creek base flows if mine extension into deeper strata is proposed in the future.

We recommend that ground water quantity and quality be monitored in Howell Creek both in the critical bull trout spawning area and upstream of the area of direct mine influence. Instream standpipe techniques such as those described by Wickett (1954), Pollard (1955) or Terhune (1958) should be employed to monitor this important aspect of bull trout reproductive biology.

Fisheries Data Deficiencies

The Montana Department of Fish, Wildlife and Parks feels that a number of significant deficiencies exist in the fishery data base presented by Sage Creek Coal Limited in the Stage II Environmental Assessment. With the exception of the bull trout redd count conducted in 1980, the importance of the North Fork of the Flathead River in the vicinity of Howell Creek to cutthroat trout, bull trout and mountain whitefish has not been assessed. Our bull trout redd survey of 1981 indicated that most of the bull trout spawning activity in the mainstem North Fork occurred above its confluence with Howell Creek. The section of river below Howell Creek would serve as an important rearing area for these river-spawned juvenile bull trout.

The importance of this section of river for the spawning and rearing of mountain whitefish is unknown. This section of river serves as a corridor for migratory fishes and also may be an important holding area for bull trout during their ascent up the river system to spawning areas in the upper North Fork River and its tributaries. Snorkel surveys of the North Fork of the Flathead River by Montana Department of Fish, Wildlife and Parks personnel during 1981 indicated that adult bull trout hold in large pools in the mainstem prior to migrating up into spawning tributaries.

The status of the fluvial (migratory between rivers and tributary streams) westlsope cutthroat trout population in the British Columbia portion of the mainstem North Fork has not been assessed. These fish would probably use tributaries such as Howell Creek for spawning and rearing purposes. Potential adverse changes in Howell Creek water quality resulting from coal mining activities could have detrimental effects on the, as yet, unquantified fish population in the mainstem North Fork below Howell Creek.

Information must be obtained on fish population size and seasonal utilization of this river section before meaningful impact assessment can begin. Fisheries information should also be collected in the North Fork, both above and below Howell Creek, for monitoring purposes.

The fish population estimation procedure for the Cabin-Howell Creek tributary system was poorly designed, statistically inaccurate, and does not adequately describe the interconnected North Fork River-Howell Creek system in British Columbia. Although it is stated in Appendix 1.4-1 (page 3) that fish habitat sampling locations were representative of the entire reach, it seems more than coincidental that three of these sites were clustered very closely around the Howell Creek bridge (see map 3.3.6-1). These locations appear to have been chosen more for convenience than for their representative qualities. Sampling locations should be more randomly distributed.

It is stated in Appendix 1.4-1 (page 4) that a barrier falls occurs on Cabin Creek approximately 7 km upstream from the confluence with Howell Creek; however, Caw (1976) estimated this distance to be 11 km. The fact that Caw (1976) reported good overall production, good fisheries potential, and low to moderate fish populations in Cabin Creek relative to other Flathead tributaries suggests that the fishery potential of this creek has been largely ignored in the Stage II Environmental Assessment.

The 26.5 minutes of electrofishing effort on an 86 m section at the mouth of the creek on a single date (Appendix 3.3.6-2) does not warrant the conclusion that both habitat and fish utilization of this creek are "marginal" (Appendix 1.4-1, page 5). Our investigations of other tributaries in the Flathead system have shown that cutthroat trout populations in the lower ends of drainages and particularly near creek mouths are variable and frequently lower than in upstream areas.

The accessible portion of Cabin Creek may be important to mountain whitefish, especially during the spring when these fish tend to move from the mainstem river into tributary streams. This has been observed in Trail and Red Meadow creeks in the U.S. portion of the North Fork drainage (Graham et al. 1980). Davies and Thompson (1976) noted that mountain whitefish moved into tributaries of the Sheep River in Alberta during the spring. These movements were apparently for the purpose of feeding and avoidance of turbidity. Although bull trout useage of Cabin Creek is low, as indicated by redd counts, it is possible that fluvial cutthroat from the North Fork River utilize this reach on a seasonal basis.

The Montana Department of Fish, Wildlife and Parks feels that the fishery potential of the upper section of Howell Creek (above Site 2 and up to the falls at the 17 km mark) has been similarly ignored in the Stage II Environmental Assessment. It is likely that this section of stream is utilized for spawning and rearing by the three stocks of cutthroat trout (resident, fluvial and adfluvial) as described in the Text on page 3-60.

Our studies have shown that cutthroat densities are frequently higher in upstream areas (Fraley et al. 1981). Fish trapping in upper Granite Creek (a tributary to the Middle Fork of the Flathead River) during the spring of 1981 revealed that during spring high water, fluvial and resident cutthroat successfully pass through a portion of the creek that is dry during most typical summers. These fish spawn during high water in headwater areas and return to the river and lower portions of the creek before flood-waters subside (Montana Department of Fish, Wildlife and Parks, in press).

It is unlikely that debris-jam obstructions near Site 2 (Map 3.3.6-1) pose a migration barrier to cutthroat since these fish migrate to and from spawning areas during high water periods. The lower portion of Howell

Creek would serve as a migration corridor and probable rearing area for cutthroat using the upper portion of the drainage. Consequently, these fish would be subject to potential mine impacts during migration and perhaps the rearing portions of their life cycle. In addition, fisheries information for sites above the actual mine area is needed to monitor the impacts of mining activities on Howell Creek.

The one-catch fish population estimation technique employed in the Stage II fisheries study was inadequate for the creeks in question. According to Appendix 3.3.6-2 (especially page 4 and 5), the value of "p" was assumed to be constant for all age groups of all species on all dates at a particular site. Seber and LeCren (1967) concluded that "it cannot be assumed that all species present, or all size or sexes of any one species will be equally liable to capture and have the same value for "p". Based on this finding, plus the fact that 95% confidence were not placed around population estimates, we conclude that the Stage II fish population estimates are unreliable.

Comparisons between two-catch and mark and recapture population estimation techniques were made on North and Middle Fork Flathead River tributaries during 1981 (Montana Department of Fish, Wildlife and Parks, in press). Results of these comparisons indicate that the two-catch method (with appropriate confidence intervals) adequately estimated fish population size in small streams (less than 15 cfs or 0.42 m^3/sec) where "p" is typically large. The relative effectiveness of the two-catch method was found to decline rapidly on larger creeks (more than 15 cfs) and mark-recapture techniques are strongly recommended for such creeks. This would apply to Sites 1 and 2 on the mainstem of Howell Creek (September flows 124 and 114 cfs) and probably Site 4 on Cabin Creek (August flow 17 cfs; Appendix 3.3.6-2).

Selection of fish population sampling dates (late September and late October 1980, mid-August 1981) does not lend itself to meaningful interpretation. In order to document existing conditions and predict and monitor potential future impacts of mining activities, it is imperative that fish population data be collected at regular time intervals. Acceptable sampling times would be prior to spring runoff (i.e. during late March) and during base flow periods prior to bull trout spawning to minimize disturbance of these fish.

Fisheries Impact Assessment

We are concerned about mine site impacts on the fisheries in Howell and Cabin creeks, as well as potential impacts downstream in the Flathead River and Lake. The Stage II Environmental Assessment (p. 4-33) identifies five potential impacts:

1) sedimentation
2) input of nutrients from sewage and blasting
3) road crossings
4) proximity of waste dumps to Howell Creek
5) increased angling pressures

We will organize our comments based on these five points.

Sedimentation

We pointed out in our evaluation of the Water Management Plan that we do not have sufficient information on the design criteria of all aspects of the plan to present specific comments. Consequently, we will restrict our present comments to potential impacts that would be expected on the aquatic resource considering the massive size of the proposed disturbance. We will also present recommended procedures for monitoring the extent of these impacts.

Increased sedimentation of Howell and Cabin Creeks and the Flathead River will undoubtedly occur. The extent of the increase and potential impact on the aquatic environment could be slight if no problems are encountered and the Water Management Plan is adequate (which is doubtful), or devastating if a sediment or tailings pond failure occurs.

The drainage is presently being impacted by sediment as is evident in the shift in the macroinvertebrate community in lower Howell Creek (p. 3-58, paragraph 1, main text). The relative abundance of Diptera increased at this site which was related to the fact that "exploration activity was high, possibly indicating stream degradation, a results of siltation due to exploration or upstream logging activities." If relatively minor land disturbances, such as upstream logging activities and preliminary exploration noticeably impact the macroinvertebrate community, what impacts can we expect from a massive disturbance such as that proposed? We are afraid the impacts will be significant and long-term.

Increased sedimentation can affect the fisheries in several ways. All life stages and seasonal habitat-use could potentially be impacted. Spawning survival may be drastically reduced by the accumulation of fine material in the substrate affecting incubation and emergence. Several studies have shown that direct fry mortality can occur due to decreased transport of dissolved oxygen and metabolic wastes (Bjornn 1969, Burns 1970, Koski 1966, Cooper 1965, Phillips et al. 1975, Reiser and Bjornn 1979) or that sedimentation may actually entrap fry and block emergence

(Hausle and Coble 1976, Phillips et al. 1975). Reduced fry survival would reduce juvenile recruitment to the Flathead River and Lake fishery.

Juvenile salmonids have been reported to overwinter in pools and the interstitial spaces found in large substrate (Everest 1969). The Main Text (p. 3-69, paragraph 2) reports "younger fish remained to overwinter in the substrate of Howell Creek". The deposition of fine sediment into these areas has been shown to reduce juvenile salmon abundance. (Stuehrenberg 1975, Klamt 1976, Bjornn et al. 1977). Sediment may also fill in pools which provide important summer rearing space for juvenile salmonids (Giger 1973, Burns 1971, Chapman 1966) and holding areas for adult bull trout prior to spawning.

Increased sedimentation resulting from mining activities would also alter fish populations in the North Fork River in the United States. Our data suggests that juvenile bull trout emigrate from tributaries during the fall and reside in interstitial spaces in river bottom gravels during the winter months (Graham et al. 1980). Increased sediment will fill interstitial spaces and reduce aquatic insect populations as well as the amount of overwintering habitat available for juvenile bull trout. Decreased aquatic insect standing crops (important trout food) will also lower the carrying capacity of the river for cutthroat trout. Cutthroat trout smolts spend up to several months in the river system prior to entering Flathead Lake (Fraley et al. 1981).

The Montana Department of Fish, Wildlife and Parks is presently conducting field and laboratory studies on the effects of fine sediment on bull trout spawning and recruitment. This is a cooperative study with the U.S. Forest Service. Study results will assist the Flathead National Forest in designing land management practices which will prevent degradation of important bull trout spawning areas in the United States.

A streambed monitoring program should be set up prior to the approval of the proposed mine development. The monitoring program should include collection of streambed samples in areas of known bull trout spawning above, within, and below the mine site in Howell and Cabin creeks. Substrate samples could be collected using hollow core methods described by McNeil and Ahnell (1964) or by cryogenic methods described by Everest et al. (1980). The samples could then be sieved and analyzed by methods suggested by Shirazi and Seim (1979). A spawning substrate monitoring program would allow changes in spawning gravel composition, due to the proposed project, to be identified and mitigating measures could then be taken.

Monitoring of aquatic macroinvertebrates should occur throughout the life of the project to determine if species diversity or relative abundance changes due to mining impacts. If this sampling indicates that macroinvertebrate community is being impacted, corrective measures could be implemented or mitigation measures could be negotiated.

Nutrients

Our comments regarding nutrient input from blasting are detailed in the Water Quality segment of this document. Our concerns regarding nutrient loading focus primarily on the possibility that toxic deoxygenated settlement pond effluents will be discharged during periods of winter stagnation. Caution is also urged before chemical flocculents are used.

Road Crossings

We disagree with the statement that "The severity of these potential impacts varies significantly ranging from low or nil (i.e. road crossings)..." (p. 4-33, paragraph 2, Main Text). We do not feel the impacts related to road crossings are "nil". Road crossings present increased opportunity for direct impacts from road related activities. Impacts such as increased wind borne or truck disturbed dust reaching the stream, potential drainage off roads, oil and gas spills, potential loss of juvenile bull trout rearing caused by the bridge approaches filling in side channels, and increased opportunity for legal and illegal angling.

One indirect impact which is difficult to quantify relates to adult bull trout behavior. Adult bull trout are extremely vulnerable when they reach the small tributary streams due to their large size. In response to this vulnerability, adult bull trout seek cover in these small tributary streams. The majority of adult bull trout observed in tributary stremas in the United States portion of the Flathead drainage by Montana Department of Fish, Wildlife and Parks personnel during snorkel censuses were seen associated with cover (i.e. under undercut banks or debris jams) or in deep pools. This behavior suggests that bull trout might avoid areas of increased human activity and the activity associated with the proposed mine may be unacceptable to adult bull trout.

Existing data suggest adult bull trout migrate upstream primarily at dusk and during darkness (Aquatico 1976, McPhail and Murray 1979). Driving trucks across Howell Creek every 14 minutes day and night might have an impact on upstream migrating adult bull trout. We would suggest that from the evidence presented on bull trout behavior, the constant traffic on these bridges may inhibit or prevent adults from reaching upstream spawning areas in Howell Creek. A possible mitigating measure may be to completely enclose the bridges and both approaches. Not only would this visually isolate the stream from the constant activity on the bridges, it would also prevent dust and possible spills on the bridges from reaching the stream channel.

Proper bridge approach placement would minimize the "pressure" exerted on the structure during high flows (Text, page 4-22). We suggest that bridge approaches be located at a point where no measurable current velocity would occur during typical high water. Back channel culverts should be placed ± one foot below the existing streambed to facilitate passage of shallow ground water as compacted road fill will no doubt limit such previous water movement.

Waste Dump Proximity

The proximity of waste dumps to Howell Creek may cause significant impacts to the entire aquatic community, if acid drainage from seam number 4 becomes a reality. Potential for failures of the waste dumps, especially in conjunction with possible channel migrations in Howell Creek cannot be overlooked. The steep slopes (37°) of the waste dumps, combined with the large amount of preciptation that the area receives, would be conducive to mass failures. If the slope of the waste dump closest to Howell Creek failed, a substantial sediment problem and probable fish barrier would result. The location of the waste dump in the Howell Creek bottom is unacceptable, we do not believe a 90 meter distance from the waste dump to Howell and Cabin creeks is enough.

Increased Angling Pressure

The increased angling pressure caused by the presence of a 400 man construction force and the permanent work force "is a potentially serious problem" (p. 4-35, paragraph 4, Main Text). We agree, and do not feel this problem was adequately addressed in the Stage II Environmental Assessment. We do feel a permanent closure of bull trout fishing in Howell and Cabin creeks would be the only recourse should development occur. A probable associated problem is the increased angling pressure in the United States portion of the Flathead drainage. If development of the site occurs, we believe that Montana should be allocated a portion of the Environmental Enhancement Fund to allow us to mitigate for lost recreational opportunity for the Montana angler and increased enforcement costs caused by the influx of Canadian mine workers. We are concerned that increased poaching for bull trout would occur in Trail and Whale creeks, the two most important spawning tributaries in the North Fork drainage of the Flathead River in the United States. We would have to increase enforcement in the area, at a substantial cost for transportation from Kalispell.

SPECIFIC COMMENTS ON FISHERIES

Page Paragraph Line	Comments
p. 3-54, P. 4, L. 2	Migratory populations of slimy sculpins were not documented in text.
p. 3-55, P. 1, L. 2 p. 3-57, P. 3, L. 2	We would like to receive a copy of Aquatico (1976 and 1977) reports.
P. 3-55, P. 2, L. 1	The dates and methods used for fish trapping were not included.
p. 3-55, P. 3, L. 5	We would be interested in information regarding fish abundance estimates obtained using snorkel surveys.
p. 3-57, P. 4, L. 8-10	Our snorkeling observations in the North and Middle Forks of the Flathead River located adult bull trout in deep pools. Many of these pools did not have debris accumulations associated with them. The adult bull trout held near the bottom of the river.
p. 3-57, P. 4, L. 11-12	Our snorkel surveys in tributaries to the North and Middle Forks of the Flathead River found that adult bull trout were generally associated with cover (undercut banks or debris accumulations) or pools.
p. 3-58, P. 1, L. 2-4	Our trapping information (Montana Dept. Fish and Game 1979) showed peak upstream migration of adult bull trout occurred in U.S. tributaries to the North Fork during mid-July to mid-August. Upstream movement may be triggered by stream flow and/or water temperature; therefore, it may vary from year to year.
p. 3-58, P. 2, L. 5	We disagree with the implication that bull trout prefer areas having large amounts of silt. This statement should not be extra-polated to conclude that increased amounts of fine sediments will improve the quality of bull trout spawning areas. McPhail and Murray (1979) reported bull trout spawning

Page Paragraph Line	Comments
	sites in the Upper Arrow Lake drainage of British Columbia contained low amounts of fine sediment (less than 10 percent under 1.0 mm).
p. 3-59, P. 2, L. 1-7	We have shown that the majority of juvenile bull trout leave tributary streams in the U.S. portion of the drainage at age 2+ and 3+ (Graham et al. 1980)
p. 3-59, P. 2, L. 12-14	Most Howell Creek juvenile bull trout emigrate to Flathead Lake for rearing to mature adults.
p. 3-60, P. 5, L. 1-3	Our data has shown adfluvial adult west-slope cutthroat move out of spawning tributaries two to four weeks after spawning (Graham et al. 1980).
p. 3-61, P. 2, L. 1-2	The minimum age at first spawning for an adfluvial adult (>300 mm) westslope cut-throat in the Flathead system is five years (Leathe and Graham 1981).
p. 3-61, P. 3, L. 1-2	This may be true for fluvial adults, but our data (Graham et al. 1980) suggests this is not true for adfluvial adults.
p. 3-61, P. 3, L. 7	typographic error (< 30 cm) should be (> 30 cm)
p. 3-61, P. 4, L. 2-4	See above comments regarding tributary useage by adult adfluvial westslope cutthroat.
p. 3-64, P. 2, L. 1-2	Our data suggests that mountain whitefish move out of the tributary streams in mid-summer. Snorkel counts in tributaries and the main stem North Fork of the Flathead River, and downstream trapping in tributaries supported the hypothesis of a mid-summer outmigration of mountain whitefish.

Page Paragraph Line	Comments
p. 3-66, P. 3, L. 1-6	We suggest that fish habitat measurements be made above the area of potential mine impacts as well in order to effecitvely monitor potential changes.
p. 3-67, P. 2, L. 1-4	It appears that your 1:5000 stream inventories were conducted at three sites in two (rather than three as stated in the report) reaches of Howell Creek. This description of stream inventory locations is confusing.
p. 3-68, Section 3.3.6.5	Due to deficiencies in fish population estimation techniques (as pointed out previously) we view all fish population data interpretation with skepticism.
p. 3-68, P. 3, L. 6 & 7	Low catch could also be attributed to inefficiency of electrofishing.
p. 3-69, P. 1, L. 1 & 2	Comparable seasonal use data should be collected.
p. 3-69, P. 4, L. 1	Define "significant".
p. 3-70, P. 1, L. 1-3	Vague - no data.
p. 3-75, P. 2, L. 6-8	While siltation of spawning areas may not affect spawning activity it could affect egg to fry survival thus reducing recruitment.

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ATTACHMENT A

Criteria employed in evaluating the quality
of stream fishery resources in Montana
(Montana Department of Fish, Wildlife and Parks
and U.S. Fish and Wildlife Service 1980)

Fish habitats were assigned to one of six value classes:

Value Class	Class definition
I	Highest-value fishery resource
II	High priority fishery resource
III	Substantial fishery resource
IV	Moderate fishery resource
V	Limited fishery resource
VI	Not yet classified

CRITERIA

1. Occurrence of State or Federal endangered species.
2. Occurrence of State or Federal threatened species.
3. Species of high interest to the State.
4. Habitat restoration, reclamation, or mitigation potential.

A value class was determined for criteria 3 and 4 (above) as follows:

3. Species of High Interest:

Value Class I — Habitat maintaining outstanding populations of species of high interest. To include self-sustaining "wild" populations that maintain a high yield or represent an exceptional aesthetic, scientific, economic, educational, or recreational value.

Value Class II — Priority habitat for highly valued species and/or outstanding habitat for less highly valued species.

Value Class III — Substantial habitat for highly valued species and/or priority habitat for less highly valued species.

Value Class IV — Moderate habitat for highly valued species and/or substantial habitat for less highly valued species.

Value Class V — Limited fish habitat.

4. Habitat Restoration, Reclamation, or Mitigation Potential.

Value Class I — Very low or essentially no potential for restoration or reclamation of the habitat to its present species composition and population levels, no alternate resource could be introduced that would be as highly valued; no acceptable options are available to compensate for the loss of this habitat, at the present time (includes stream reaches that have been designated as habitat for reintroduction of an endangered species by a National Recovery Team or State Rehabilitation Plan).

Value Class II — Low potential for restoration to present species composition and population levels; however, partial compensation options can be defined.

Value Class III — Moderate potential exists for either restoration of the habitat or reclamation to an equal or higher valued fishery, or total compensation options can be defined.

Value Class IV — Current technology makes it probable that the area can be restored or reclaimed to at least an equally valued fishery as that existing prior to development. Acceptable compensation options are likely.

STATE OF MONTANA

DEPARTMENT OF

FISH AND GAME

1420 East 6th Avenue
Helena, Montana 59620
April 27, 1981

Through a cooperative effort, the U.S. Fish and Wildlife Service and the Montana Department of Fish, Wildlife, and Parks have recently completed the attached stream evaluation map for the State of Montana. This map is designed to assist federal and state agencies and water users in assessing the impact of proposed water development projects on existing Montana fishery resources. The information on the map is intended to optimize state, local, and federal decisions about how and where development programs will be carried out and to place fishery resource agencies in a positive planning mode whereby the most important resources are identified in advance of specific developments. It is stressed that the map is not a guide to Montana sport fishing streams. It should also be understood that stream ratings shown on the map are not static and will change since the rating process is an ongoing and continuous activity.

Sincerely,

James W. Flynn
Director

Encl.

ATTACHMENT B

Montana State Department of Health
and Environmental Sciences

Water Quality Criteria

<u>16.20.617 A-1 CLASSIFICATION</u> (1) Waters classified A-1 are suitable for drinking, culinary and food processing purposes after conventional treatment for removal of naturally present impurities.

(2) Water quality must be suitable for bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

(3) For waters classified A-1 the following specific water quality standards shall not be violated by any person:

(a) The geometric mean number of organisms in the coliform group must not exceed 50 per 100 milliliters if resulting from domestic sewage.

(b) Dissolved oxygen concentration must not be reduced below 7.0 milligrams per liter.

(c) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 must be less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0.

(d) No increase above naturally occurring turbidity is allowed except as permitted in ARM 16.20.631 through 16.20.635 and ARM 16.20.641 and 16.20.642.

(e) A 1° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 66° F; within the naturally occurring range of 66° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F.

(f) No increases are allowed above naturally occurring concentrations of sediment, settleable solids, oils, or floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish, or other wildlife.

(g) True color must not be increased more than two units above naturally occurring color.

(h) Concentrations of toxic or other deleterious substances which would remain in the water after conventional water treatment must not exceed the maximum contaminant levels set forth in the 1975 National Interim Primary Drinking Water Standards (40 CFR Part 141) or subsequent revisions or the 1979 National Secondary Drinking Water Standards (40 CFR Part 143) or subsequent revisions. The maximum allowable concentrations of toxic or deleterious substances also must not exceed acute or chronic problem levels as revealed by bioassay or other methods. The values listed in Quality Criteria for Water published by the Office of Water and Hazardous Materials, EPA, Washington, D.C. (The Red Book) shall be used as a guide to determine problem levels unless local conditions make these values inappropriate. In accordance with section 75-5-306(1), MCA, it is not necessary that wastes be treated to a purer condition than the natural condition of the receiving water. (History: Sec. 75-5-301 MCA; IMP, Sec. 75-5-301 MCA; Eff. 12/31/72; AMD, Eff. 11/4/73; AMD, Eff. 9/5/74; AMD, 1980 MAR p. 2252, Eff. 8/1/80.)

16.20.618 B-1 CLASSIFICATION (1) Waters classified B-1 are suitable for drinking, culinary and food processing purposes, after conventional treatment; bathing, swimming and recreation; growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply.

(2) For waters classified B-1 the following specific water quality standards shall not be violated by any person:

(a) The geometric mean number of organisms in the fecal coliform group must not exceed 200 per 100 milliliters, nor are 10 percent of the total samples during any 30-day period to exceed 400 fecal coliforms per 100 milliliters.

(b) Dissolved oxygen concentration must not be reduced below 7.0 milligrams per liter.

(c) Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 8.5 must be less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0.

(d) The maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units except as permitted in ARM 16.20.631 through 16.20.635 and ARM 16.20.641 and 16.20.642.

(e) A 1° F maximum increase above naturally occurring water temperature is allowed within the range of 32° F to 66° F; within the naturally occurring range of 66° F to 66.5° F, no discharge is allowed which will cause the water temperature to exceed 67° F; and where the naturally occurring water temperature is 66.5° F or greater, the maximum allowable increase in water temperature is 0.5° F. A 2° F per hour maximum decrease below naturally occurring water temperature is allowed when the water temperature is above 55° F, and a 2° F maximum decrease below naturally occurring water temperature is allowed within the range of 55° F to 32° F. This applies to all waters in the state classified B-1 except for Prickly Pear Creek from McClellan Creek to the Montana Highway No. 433 crossing where a 2° F maximum increase above naturally occurring water temperature is allowed within the

ATTACHMENT C

Criteria employed for classification of
fish species of special concern
(from Holton 1980).

Class A Limited numbers and/or limited habitats both in Montana and elsewhere in North America; elimination from Montana would be a significant loss to the gene pool of the species and subspecies. These species are:

- White sturgeon (*Acipenser transmontanus*)
- Pallid sturgeon (*Scaphirhynchus albus*)
- Paddlefish (*Polydon spathula*)
- Yellowstone cutthroat trout (*Salmo clarki bouvieri*)
- Arctic grayling (*Thymallus arcticus*)

Class B Intermediate between classes A and C. Limited numbers and/or limited habitats in Montana; fairly widespread and fair numbers in North America as a whole; elimination from Montana would be at least a moderate loss to the gene pool of the species or subspecies. These species are:

- Westslope cutthroat trout (*Salmo clarki lewisi*) - includes upper Missouri cutthroat trout.
- Native rainbow trout (*Salmo gairdneri*)
- Sturgeon chub (*Hybopsis gelida*)
- Sicklefin chub (*Hybopsis meeki*)
- Shorthead sculpin (*Cottus confusus*)

Class C Limited numbers and/or limited habitat in Montana; widespread and numerous in North America as a whole; elimination from Montana would be only a minor loss to the gene pool of the species or subspecies. These species are:

- Shortnose gar (*Lepisosteus platostomus*)
- Finescale dace (*Phoxinus neogaeus*)
- Trout-perch (*Percopsis omiscomaycus*)
- Spoonhead sculpin (*Cottus ricei*)