F-11-8

KOOTENAI FALLS AQUATIC ENVIRONMENT STUDY

IMPACT ASSESSMENT

PREPARED FOR

NORTHERN LIGHTS, INC.

AND

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

BY

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JUNE 1979

I. Description of Possible Impacts

A. Introduction

Impacts on the aquatic resource and its associated recreational values are generally the result of habitat alterations. In some cases, impacts can extend far from the actual site of a project. Habitat alterations would include changes in the physical and/or chemical nature of the riverine habitat, including disruption of the riparian or streamside vegetation. Physical parameters that could be affected by instream diversions and impoundments include: water temperatures, conveyance area, water velocity, wetted perimeter, water level fluctuations, bedload deposition and other hydraulic factors associated with a river. Changes in the chemical nature of a river include: changes in the quantity of various nutrients, dissolved gasses and other minerals and chemicals that determine water hardness, conductivity, turbidity, pH and productivity. Both physical and chemical changes can be constant, periodic, or random. Often seasonal or diel shifts in the timing of a natural event can significantly affect aquatic organisms.

Immediate impacts of habitat alterations on aquatic organisms are most obvious when mortality is observed. Mortality of an organism may occur as a direct result of habitat alteration or secondarily if a food source is eliminated or following some form of impact induced long-term stress. Sublethal effects can result in stressing aquatic organisms by reducing desirability of their physical habitat or altering the quality of the water.

Increased stress on fish or aquatic insects may result in decreased reproduction or growth of those individuals remaining in the area while others may migrate to a more desirable habitat. Often a migration of individuals out of an altered area will result in an overcrowded situation elsewhere and delayed mortality in areas removed from the actual site of alteration. Organisms that are stressed are more susceptible to such causes of natural mortality as disease and predation.

B. Preconstruction impacts such as drilling and surveying are not expected to have impacts on the aquatic system.

C. General construction impacts

1. Clearing

Riparian vegetation provides 1) bank stabilization, 2) a buffer zone between aquatic ecosystems and potential impacts of upland activities on water quality, 3) green belts, 4) aid in maintenance of instream flows by contributing riparian zone ground water, 5) part of the habitat for the majority of wildlife species in North America, and 6) a food source for aquatic organisms. Despite the importance of this zone it has only been in recent years that attempts have been made to quantify the impacts of streamside vegetation removal on wildlife (Johnson and Jones 1977). The Northern Lights, Inc. project would eliminate the riparian zone along the south bank of the pool by raising the water elevation. The resulting bank along the majority of the southern shore would be a riprap covered railroad grade. Building a work platform and staging area would require the clearing of most of the riparian vegetation in the vicinity of Kootenai Falls.

2. Cofferdams

To provide an area for construction of the intake structure and tunnel, blasting a deep stream channel off the south shore, and construction of the majority of the dam, the applicants propose to build a cofferdam from the south bank approximately 600 feet (70%) across the channel. The fill material could contribute significant amounts of sediment to the river depending on the type of material used and the method and timing of construction. The cofferdam would constrict the river flow and could cause erosion along the north bank, particularly when peaking flows are discharged from Libby Dam. Leakage would probably occur through the cofferdam and would likely result in sedimentation downstream if not controlled.

A second stage cofferdam would be constructed along the north bank to complete the remaining section of the dam. Water would then pass over the southern half of the dam and could result in material from the cofferdam being washed downstream. Type of material, timing and method of construction will determine the extent of this impact. Placing and removing the cofferdams could result in large quantities of boulders being deposited along the upper face of the falls and downstream in the pools and channels below the falls. High velocities, peaking flows, and lack of access to the north bank will contribute to the problems involved in adequately removing this material.

3. Riverbed excavation

The thalweg (deepest part of the channel) is presently along the north bank in the area upstream from Kootenai Falls but would be shifted by this project. Besides causing an irreversible change in channel morphology, changes would also occur in channel geometry due to the shift in the thalweg.

The planned intake structure would be located along the south bank. This would require blasting and excavation of the river bottom which, at this point, is composed primarily of bedrock. This work would occur within the confines of the cofferdam and the blasting should not have a noticeable effect on the aquatic life in the main channel. Depending upon the type of explosives used and the disposal method of excavated material, large amounts of nitrates (nutrients) and sediments could be released into the aquatic system. Some of the nitrates will accumulate in the settling pond, but unlike phosphate compounds, a large amount will remain in solution and return to the river. Nitrates will stimulate algal growth and encourage eutrophication, principally in downstream areas. Ammonia will also be a by-product of the blasting process and produce a short-term impact on the immediate area.

4. Water quantity and quality

A pooling effect will result upstream from the cofferdam due to the narrow constriction of the river at that point. Pooling will be most pronounced at large discharges. At the point of construction, water velocities will be significantly increased and may cause erosion along the north bank which should be controlled. Water quality in and downstream from the construction area will depend upon extent and effectiveness of collection and settling structures, sanitary facilities, and runoff associated with access roads, clearing, and railroad relocation.

Water flows over the falls and dam during the construction phase should be adequate to insure protection of the aquatic environment. An emergency minimum flow, if needed, should only be used under extreme conditions and for only short periods of time. Size and duration of these flows should be determined before any construction is started.

5. Disposal of excavated material

Approximately 800,000 cubic yards of material would be excavated for construction of the underground powerhouse, associated tunnels and intake structure. Some of this material would be used to build the temporary cofferdams if the potential for introduction of sediments and nitrates into the river is minimized. Some of the material would also be used to make concrete, relocate the railroad, and modify the shoreline contours. Material not used in construction of relatively permanent structures would have to be hauled away from the project site to avoid further impacts. Method and location of disposal of excavated material must be adequately addressed before final approval is given.

To minimize sediment impacts, sediments collected in the settling pond would have to be removed before the river is allowed to return to that area behind the cofferdams. This would also have to be done without contributing sediment to the aquatic system. A more complete description of size and location of the settling pond system is necessary before further comment can be made on its impact.

D. Associated Impacts

1. Work camps

Impacts on the aquatic system from work camp areas would primarily be sanitary (sewage) waste materials associated with heavy equipment, and spills of petroleum products such as diesel fuel, hydraulic fluid, gasoline, and oil. Unless properly located and controlled, waste and spilled materials could easily cause pollution due to the close proximity of the proposed work camp to the river.

2. Material sites and storage yards

Impacts associated with these areas could result from burying discarded materials, uncontained storage of inorganic or organic wastes such as oil and disposal of excess concrete. It is unknown what amounts of dust and particulate will be produced from the various work plants associated with making concrete and the needed haul roads. This material will likely settle or be washed into the river because the river valley is narrow. Waste materials produced in solution from these plants would have to be contained by the settling pond.

3. Roads (access, haul, and delivery)

All roads built or used in construction of maintenance of the project could affect the aquatic environment by producing sediment runoff following rains or during spring breakup. Sediment has only a short distance to travel before it could enter the river unless it was collected through a drainage system and piped into a settling pond.

4. Railroad grade

Because of the increased water elevation due to pooling upstream from the dam, it would be necessary to raise the railroad bed for approximately 12,000 feet (2.27 miles) upstream from the dam site and 3,000 feet downstream. As with other sites mentioned, the excavation material would be used to raise the bed from 13 to 18 feet above present elevation. At normal pool elevation with the dam (2,000 feet above sea level), the river bank on the south shore would consist of a railroad grade for most of the lower 2.5 miles of the pool. This would eliminate most of the riparian vegetation and reduce the recreation desirability of the area (Lund 1976). It would also reduce habitat suitability for fish (Alvord and Peters 1973, Elser 1968), particularly when considered with the reduced water velocities that will occur. The steep riprap banks will make wildlife use of the river difficult and dangerous not only because of the type and size of substrate but also the proximity of the railroad.

E. Operation and Maintenance Impacts

1. Impacts of impoundment

a. *Physical impacts to the river*

In general, an unnatural habitat would be produced following impoundment of the river. The project could be defined as "run-of-the-river" because of the relatively small storage capacity (1,220 acre feet) and a fast turnover rate. A habitat intermediate to a lake and a river would be created. This new habitat would create a new niche but without the species to fill it. Rivers with the volume, depth, and velocity that would be created by this dam are also characterized by turbid, warm water and are usually rich in nutrients. Fauna associated with these large rivers are atypical of the fauna existing in the Kootenai River (Cummins 1975). Fauna which can exist in lake environments usually are dependent on a food base that originates with phytoplankton. These creatures could not be sustained in the impounded area because currents would carry them downstream.

Water velocity and stream depth and width would be significantly affected upstream from the proposed dam (Graham 1979). Only the velocity would vary with discharge because of the relatively constant pool level. The river at mid-pool would appear similar to a natural discharge of approximately 90,000 cfs in terms of width and mean depths as determined from extrapolation from river profiles provided by Jim Sewall and Assoc. (Newport, Was. 1978). That flow is exceeded less than 0.1 percent of the time as determined from a flow duration curve for the Kootenai River at Libby. Average water velocities in the downstream half of the pool would be reduced to 0.85 ft/sec which is only 22 percent of natural conditions at a median flow of 10,000 cfs (Graham 1979).

Sediment transport and deposition is a natural part of a river system. Accumulation of sediment on the stream bottom, however, can significantly alter the natural aquatic fauna (Cordone and Kelley 1961, Bjornn et al. 1977). Reduced water velocities and turbulence in the pool area would reduce the ability of the river to transport sediments which are then deposited on the stream bottom. Sediment deposition is not expected to be significant from an engineering standpoint, but will produce significant impacts biologically.

Amount of sediment deposition and distribution in the pool area was calculated by Harza Engineering for Northern Lights, Inc. (1979) (application to the F.E.R.C. Tables 1 and 2). Sand and smaller size particles provide poor substrate for aquatic insects because of their unstable nature, reduction in habitat surface area, and small particles can clog the external gills of some insects (Hynes 1970). Estimated deposition in the pool would be 8,900 tons/year or 4.2 AF/Yr (Table 1). The majority of deposition (86%) would occur in the upper 10 feet of the pool (Table 1).

Although sediment deposition would not be significant in terms of life of the project, it could seriously limit insect production and thereby fish production as sediments accumulated annually in the pool area. The quality of the fishery could be expected to decline progressively throughout the life of the project until insect production stabilized at some low level. This slow decline would follow a rapid decline caused by the initial reduction in water velocity.

Water temperature would not be significantly affected by this project due to the relatively fast turnover rate and small surface area.

Severe problems for aquatic life have occurred because of abnormally large dissolved gas levels (in excess of 140%) from Libby Dam when they discharge by spilling or sluicing (Graham 1979, May and Huston 1974 and 1975). Turbulence in the free-flowing river gradually reduced the levels of dissolved gas by allowing some excess gases to escape. Kootenai Falls had a significant effect on reducing gas supersaturation levels over approximately 112 percent (Graham 1979). The falls acted as an equalizer because it also raised gas saturation levels when they were less than 109 percent.

Diverting most of the water (97% at high flows) around the falls should keep gas levels which are less than 108 percent total partial pressure from increasing. During the summer of 1978 the average gas saturation just upstream from Kootenai Falls was 103 percent. Libby Dam discharged only from turbines during this period. However, the pooling of the river upstream from the falls and the possible construction of a reregulating dam by the Corps of Engineers could increase this level by reducing the amount of turbulent, free-flowing water between the dam and the falls.

Table 1. Sediment deposition and distribution in the reservoir area (from Northern Lights, Inc. application to the F.E.R.C. Exhibit H).

	Sediment Deposition			
Load	Tons/yr	AF/yr	Yrs	AF/50 yr
Suspended sand	8,900	4.2	50	210
Bed	7,600	3.6	50	180
Scour	--	--	1st 10	70
Total				460

Elevation,	50-Year Sediment Deposition					
Elevation (ft msl)	1975	1980	1985	1990	1995	2000
Cumulative sediment Volume (AF)	0	7	53	151	306	460
Percent of total deposited each 5 foot interval	2%	10%	21%	51%	33%	

Libby Dam is not likely to discharge water by spilling or sluicing unless water in excess of turbine capacity must be released or if the turbines are off-line. Under these special conditions, gas supersaturation levels would also increase with discharge (Graham 1979). Diversion of water around Kootenai Falls under these conditions would allow excessive levels of dissolved gases to continue downstream by eliminating the stabilizing effect of the falls.

Long-term nutrient levels should not change significantly as a result of the pool. In the short-term, some leaching may increase nutrient levels. Reduced shoreline water velocities could trap nutrients, stimulate plant growth, and result in increased local water temperatures.

b. Impacts on Biotic Communities

Modification of the physical stream habitat upstream from the dam would affect the abundance and composition of the aquatic community. Changes in the invertebrate community appear to be extensive since Libby Dam was constructed, resulting in reduced benthic invertebrate diversity and standing crop (Graham 1979). Further detrimental effects would be expected as velocity decreased and silt dominated the surface substrate. Aquatic macrophytes will become more abundant along the shore in some areas. This will provide new substrate for some insect colonization and some cover for fish. Macrophytes would also provide habitat for juvenile suckers and chubs as determined from underwater observations in the summer of 1978.

Phytoplankton, which can be a significant element in the food chain in lakes or reservoirs, is unimportant in all but the largest rivers. Currents prevent the accumulation of plankton and backwater areas are usually necessary to provide sources of plankton. On the Kootenai, the pool area above the dam is not likely to produce significant amounts of phytoplankton and the nearest source would be approximately 29 miles upstream at Libby Reservoir.

Chironomids will probably dominate the stream bottom as silt fills the interstices and covers the surface areas. It would be difficult to predict the abundance and composition of the insect community that would develop in association with the macrophyte community.

The physical habitat that would be produced upstream from the dam would provide habitat more suitable for less desirable fish species such as largescale suckers, northern squawfish, and Columbia River chubs. Presently these species are uncommon to rate in the river between Kootenai Falls and China Rapids, although they are now present in Libby Reservoir and in the deep waters of Kootenai River canyon.

Similar run-of-the-river dams are present near Great Falls on the Missouri River in Montana. Recent fish collections of the reservoir areas using gill nets resulted in catches comprised of white sucker (88.5%) and longnose suckers (8.2%) (Liek 1978). The habitat produced in the pool areas appears to favor less desirable fish species such as suckers and acts as a collection basin for silt and debris (personal communication Al Whipperman, Montana Dept. of Fish and Game, Great Falls, 1979).

The mountain whitefish population would probably exhibit both positive and negative responses to the impoundment. Rearing area for juvenile whitefish would probably be increased in the upper pool area, although reduced in the lower area. Suitable spawning areas would be nonexistent due to increased water depth and poor quality substrate. Overall, the whitefish population would be negatively affected due largely to a reduction in the amount of available food.

Rainbow trout, the principal game fish, might increase in numbers initially following impoundment in response to the large amount of unexploited habitat created. Because no spawning is thought to occur in the main river, recruitment of juvenile rainbow trout into the pool area would be determined by the success of the upstream population.

The decrease in insect production and relatively poor quality of the habitat for trout will result in the eventual decline of the population, although trout will continue to utilize the area as they are displaced from upstream areas. To maintain the same density of trout per unit volume of water in the pool as presently exists in the river. a three to four fold increase in numbers would be necessary.

c. Intake Structure

A large percentage of fish and insects which enter the intake structure would probably suffer immediate or delayed mortality from physical abrasion in the tunnel and turbine network and ruptured gas bladders due to large pressure changes resulting from a 148 foot verticle drop at the intake tunnel. Trash racks would be placed in front of the intake structure to prevent the larger fish from entering the intake. However, serious problems may result from entrainment[1], entrapment[2], and impingement[3] of fish and other aquatic organisms in the intake (Hanson, et al. 1977). These problems would be compounded by the large percentage of flow entering the intake and the proposed small flow over the dam and falls.

Fish population and movement data (Graham 1979) indicates that rainbow trout move downstream into the 2.5 mile river study section between Kootenai Falls and China Rapids. Some rainbow trout continue downstream and over the falls. The falls, however, apparently acts as a partial behavioral or motivational barrier to some fish resulting in larger fish densities than found in any other section of the Kootenai River to date. This downstream movement is larger than tag return information indicates as evidenced by the large density of fish in the 2.5 mile study section upstream from the falls. There are no known spawning tributaries in this section and no upstream movement over the falls has been documented. Growth rates of rainbow trout in the Kootenai Falls section were slower than in the Flower-Pipe section only seven miles upstream from the falls (Graham 1979). This occurred despite relatively good quality of habitat and could indicate increased competition for food and space (Chapman 1966).

The downstream movement of rainbow trout probably contributes significantly to recruitment in the fishery downstream from the falls. There was only one major spawning tributary that was not blocked by a dam or falls from Kootenai Falls to the Idaho border. Lake Creek has a dam near its mouth, the Yaak River has a falls 6 miles upstream from its mouth and O'Brien Creek had a dam near its mouth until it was removed in 1978. Callahan Creek was the only major tributary accessible to spawning rainbow trout.

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[1]An organism which is drawn into a water intake as part of the volume which it occupies is said to be entrained.

[2]Entrapment refers to the physical blocking of larger entrained organisms by a barrier, generally some type of screen located within the intake structure.

[3]Impingement occurs when the entrapped organism is held in contact with the barrier.

Reduced movement of fish or decreased survival of downstream migrants would impact the entire Kootenai River downstream to the Montana border. Reduced movement could occur because the apparent motivational or behavioral barrier imposed by the falls would be compounded by an additional barrier of a 30 foot high dam with a relatively small quantity of water flowing over it. Fish concentrated in the pool area by the dam would be limited by the quantity of available food. If out-migration did not occur, their condition and growth would decline. Large, trophy-sized fish might continue to inhabit this area if forage fish were sufficiently abundant. The probability of catching them, however, would decline due to the increased volume of the river.

Even if the dam did not reduce movement, it would increase downstream migrant mortality. Trout and other fish would have to swim over the dam through approximately 2 inches of water, fall about 30 feet onto bedrock covered by 2 inches of water or less and then negotiate the falls and another 20-30 foot drop. If the impact did not kill the fish, they would probably be stunned and subject to delayed mortality such as from predation.

Additional mortality of adult and juvenile fish can be expected from losses at the intake structure, despite design considerations to reduce intake velocities. Average intake water velocities would be over 1.00 ft/sec 43% of the time (Table 2). Although cruising speed for rainbow trout and whitefish is about 2.0 ft/sec and 1.5 ft/sec, respectively (Bell 1973), Hanson et al. (1977) and Boreman (1977) state that vulnerability of fish to entrapment or impingement by the intake are dependent on many more factors than just swimming speed for a period of time. Current policy on intake velocities is to reduce them to 0.50 ft/sec or less (U.S. Environmental Protection Agency, 1973, U.S. Nuclear Regulatory Commission 1975).

Table 2. Estimated water velocities at the intake structure of the proposed Kootenai Falls hydroelectric project (from Northern Lights, Inc. application to the Federal Energy Regulatory Commission).

Discharge (cfs)	Approximate Anticipated Frequency (%)	Intake Flow (cfs)	Approximate Intake Velocity at Trashracks (ft/sec)
2,750-3,750	8%	2,000- 3,000	0.25 - 0.375
3,750-6,750	34%	3,000- 6,000	0.375- 0.75
6,750-8,750	15%	6,000- 8,000	0.75 - 1.00
8,750-24,750	35%	8,000-24,000	1.00 - 3.00
24,750+	8%	24,000	3.00

Other factors which influence vulnerability of fish to the intake are behavioral characteristics of the fish such as rheotaxis (response of an organism to current) and phototaxis (response of an organism to light), water quality, volume of water into the intake, location of intake and others (Hanson et al. 1977, Boreman 1977). The intake was designated to remove water from the lower 20 feet of the 30 foot water column (FERC application). Although this may reduce the impact of the intake velocity on fish traveling in the upper 10 feet of the water column, other factors must be considered. Rainbow trout and mountain whitefish seek deeper parts of the river during the daytime. This is probably done to seek cover. These fish could not be taken electrofishing during the day when the river was clear. Turbid water resulted in increased daytime catches. At night, rainbow trout and whitefish moved into the shallower water along shore and were readily captured by electrofishing. Presently, downstream migrants probably travel along the north bank near the thalweg and over the falls.

The percentage of river flow taken by the intake will also effect vulnerability of the fish to entrapment and impingement (Hanson et al. 1977). River discharges of 6750 cfs and larger will occur 58% of the time and will result in 89% to 97% of river flow being diverted into the intake. Fish are very likely to become entrained in the trashracks by simply following the currents.

A recommended minimum flow over the dam would be 4,000 cfs to minimize entrainment and impingement, increase survival of fish migrating over the dam, increase aesthetic beauty of the falls and increase aquatic habitat downstream from the falls. This minimum operational flow has tentatively been accepted by the Corps of Engineers for Libby Dam upstream from Kootenai Falls.

2. Impacts Below the Dam

The loss of fish migrating downstream into the river below Kootenai Falls is probably the most significant biological effect of the proposed low flows over the falls. Equally important is the loss of recreational values of the falls area due to the reduced aesthetic value of the low water. The portion of the river between the dam and the outlet would be severely dewatered, particularly the falls itself.

It was difficult to quantify the amount of fish habitat that would be lost from low flows. The unique and varying character of the canyon area made standard techniques ineffective. Three types of habitat would be impacted. These include cove areas, rapids and a gravel bar. Cove areas provide shallow water habitat in the canyong area. They are generally located in areas where bedrock blocks fractured and were eroded. Coves gradually sloped into the river, dropping off at the edge of a fault block. Cove habitat would largely be eliminated at some low flow level which could not be determined under conditions experienced during this study.

Between the deep pool areas, bedrock protrusions create rapids which could cause fish passage problems at some low level of flow. The flow level at which passage problems would occur could not be determined under the conditions experienced in this study.

Only one gravel bar is present in the mile of river between the falls and the outlet. Although insect production was lower on this bar than those bars upstream from the falls or below the canyon, it is the major insect producing area in the canyon. Again, low flow conditions which were not experienced during this study may significantly reduce the potential production of this area.

At the outlet a pooling effect would occur because of the large volume of returning water. The nature of the canyon in that area is likely to produce several eddies, similar to those occurring naturally. Insects and fish carried into the power production system are likely to be killed. The eddies below the outlet would initially concentrate this potential food source. This would likely attract white sturgeon, ling, and possibly Dolly Varden. Therefore, the water quality, and in particular, the amount of dissolved gases at the outlet, would be critical. Gas saturation levels at the outlet are likely to change only slightly for many miles downstream because there are relatively few rapids. Although not specifically determined for white sturgeon, ling, or Dolly Varden, the detrimental effects of high levels of gas saturation has been demonstrated on many fish species as reviewed in Brungs et al. (1977).

The status of the white sturgeon population in Montana is questionable. Recent studies resulted in little data and few fish being collected. Recent reports from Idaho and British Columbia indicate that the white sturgeon population in the lower Kootenai River is in better condition than in Montana. An estimated 50 white sturgeon were captured last year in the Idaho section and 25 in the British Columbia section of the Kootenai River from the Idaho Border to Kootenai Lake (personal communication from Bill Goodnight, Idaho Fish and Game; and Harvey Andrusak, British Columbia Fish and Wildlife, 1979).

The causes for the apparent decline of the Montana segment of the population is only speculative at this point. The Fish and Game will stop all fishing for white sturgeon after 1979 until more information has been collected on this unique species. The white sturgeon has been placed on the list of species of special concern and were the reason the Kootenai River downstream from the falls has received the highest possible stream classification.

3. Fishing Pressure

The impact on fishing pressure will be determined largely by changes in fisherman success and fishing quality. Fisheries managers generally are concerned with catch quality, harvest quality, fish quality, and trip quality as defined by Weithman and Anderson (1978). Aesthetics, fish habitat, privacy, companionship, and facilities also influence quality of the fishery (Hampton and Lackey 1976). The latter group of factors are not always given equal weight in management strategies because the manager has little or no control over these variables. However, this project will significantly impact aesthetics, fish habitat, and accessibility to the river in addition to catch, harvest, fish, and trip quality.

Analysis of recreation values associated with the quality of the Kootenai River fishery were not contracted for in this study or any other study to date. Consequently, conclusions about the recreational loss can only be speculative, but are nonetheless a reality. In 1978, the fishing in the three-mile section upstream from the falls rated along the top trout streams in Montana in terms of fisherman use and success (Graham 1979). This section of river is particularly important to both local and nonlocal anglers due to its proximity to Libby and ease of access from Highway 2. Most of the river downstream from Kootenai Falls is inaccessible to the average shore angler because it is bordered by private property or lakes, roads, or trails. At the town of Libby, the river swings away from Highway 2 which is the major highway in the area. Access is relatively good in some areas upstream from Libby to Libby Dam, although the majority of these areas would be inundated by the proposed reregulating dam.

A decrease in aesthetics and fishing success would unquestionably reduce fishing pressure. This fishery resource will become more important to the local area because of the increased growth that will occur due to mining in the Lake Creek-Bull River drainage near Troy and the continued growth of recreational development in Northwestern Montana. In addition, to this project Libby Reservoir and the reregulating dam would result in the loss of 64% of the remaining free-flowing river in Montana. Meyer (1978) concluded that declines in hunting in urban areas were due primarily to lack of opportunity which could also affect the fishery in a similar manner if erosive pressures continue. A significant reduction in recreational opportunities in this reach of river would result in a major negative impact on recreational satisfaction to those currently enjoying the natural resource activities and will likely result in increased levels of tension and frustration.

If fish recruitment into the river downstream from Kootenai Falls declines due to the barrier posed by the dam, a decline in fishing pressure and recreational value would occur extending impacts a substantial distance downstream from the falls.

II. Mitigating Measures and Their Effectiveness

A. Dam location

A change in the location of the dam does not appear to offer positive mitigating measures.

B. Dam design

1. Intake structure

Impact of the intake structure design cannot readily be separated from the physical presence of the dam and the percentage of flow into the intake compared to the flow over the dam. Combined, they pose a significant threat to the aquatic biota in the falls area and downstream to near the Idaho border.

Quantifying the impacts of water intake systems on aquatic life is a formidable task (Boreman 1977, Goodyear 1977, Hanson et al. 1977) and could not be done with available data. However, significant impacts can be expected as discussed in Section D. Hanson et al. (1977), in a summary of available studies listed three strategies to reduce impacts of water intake systems including 1) minimize the probability of organism encounter to the intake through site evaluation and intake location, 2) minimize the volume withdrawn and reduce approach velocity, and 3) maximize fish survival by use of fish protection devices incorporated in behavioral or physical barriers.

The intake would be located about 600 feet upstream from the dam along the south shore. The bedrock bottom along the south side of the channel would be excavated to allow diversion of the river into the intake. A good understanding of how currents will direct organisms into the structure will require additional information. With the available information, it appears that organisms moving down the south bank (which would become the deepest channel) would be drawn into the trashracks. Those swimming in the upper 10 feet would be subject to slower water velocities than in the lower 20 feet of the water column according to the FERC application by Northern Lights, Inc. However, these velocities were not quantified and may still be too high, particularly when considering that most of the time over 90% of the river flow will be entering the intake.

Before mitigation measures can be suggested, a complete analysis of current patterns and velocities will be necessary. The significance of the potential impact (I.-E.-1.-c.) may require moving the structure into a bay, enlarging the intake and reducing its radius from shore or some other combination of design and location modifications.

A second major consideration would be to minimize the volume withdrawn and reduce approach velocity. As mentioned above, a complete analysis of velocity and current patterns of several alternatives are needed. One obvious mitigation measure would be to insure a sufficient flow over the dam to facilitate directing organisms away from the intake and protect them after they drop over the dam and falls. Goodyear (1977) used an equation to determine the proportion of a population of aquatic organisms that would be killed by entrainment as the organisms drfit downstream past a power plant intake. This loss can be estimated by the formula:

$$\text{Percent loss} + 100\ \frac{M\ Cp\ Qp}{Cr\ Qr}$$

Where:

Cr = mean concentration (i.e. number per ft^3) of organisms in a cross section of the river.

Cp = mean concentration of organisms in the intake water.

Qr = river flow in ft^3 per second (cfs).

Qp = water flow through the plant intake (cfs)

M = mortality rate of entrained organisms.

A conservative estimate of percentage lost to entrainment can be determined by assuming equal concentration of organisms in the river, that they are passive and randomly distributed, and all entrained organisms are killed.

This reduces to:

$$\text{Percent loss} = \frac{100\ Qp}{Qr}$$

This would mean that over 90% of the organisms drifting in the river would be killed during 57% of the period of dam operation.

Fish are generally not passively drifting in the river; however, movements of rainbow trout are subject to changes in discharge (Huston and Vaughan 1965). Although the volume in the reservoir would be constant, velocities will increase as discharge increases. Rainbow trout moving downstream are probably not randomly distributed in the river. Electrofishing collections indicate that during daylight hours the fish seek cover in the deeper part of the channel and not along the shoreline. At night trout and whitefish move into the shallower water along the shore.

Downstream movement will probably occur along the shoreline or in the deeper part of the channel. This pattern would funnel a large percentage of the fish into the intake structure. Although they should be able to escape the intake initially, all indicators (velocity, volume of flow, shoreline location, deep channel approach) would tend to lead them into the structure. Sustained swimming to avoid entrainment could eventually end in exhaustion, entrapment and death.

A third consideration would be to construct a physical or behavioral barrier to direct the fish away from the intake. This would also require increased flows over the dam, so fish migrating downstream could be directed to an alternative route where a larger percentage of survival would be expected. Numerous types of barrier designs are in use as summarized by Hanson et al. (1977). Behavioral barriers include light, sound, bubble screens, and electrical barriers. Physical barriers include traveling screens, drums, and perforated plates. Some form of barrier would be necessary near the intake structure in combination with site and design modifications and increased minimum flows over the dam.

2. Pool elevation

At mid-pool the proposed elevation of 2,000 feet msl would occur naturally at a flood discharge of approximately 90,000 cfs as determined from extrapolation from river profile elevation in information provided by Jim Sewall and Assoc. (Newport, Wa 1978). In the downstream end of the pool, mean depth would be 2.5 times that of the normal channel at a medium flow of 10,000 cfs and cross-sectional area would be nearly four times larger (Table 3) and (Graham 1979).

One measure to reduce impacts would be to lower the pool elevation by 10 feet to the level originally proposed (1,990 feet msl). A ten foot reduction in the downstream half of the pool would decrease mean depth by 34 percent or about 15 feet (Table 2), while width would decreased by only 12 percent. Mean velocity would not increase significantly in the downstream pool area as determined from the transect information, although certain areas in the lower pool may become more suitable as trout habitat.

Table 3. Some hydraulic parameters of transects across the Kootenai River upstream from Kootenai Falls at different discharges under present conditions and at the proposed full pool level of elevation 2,000 ft msl and 1,990 ft msl. Transects 2, 3, 4, and 5, 6, 7 would be in the downstream and upstream ends of the pool, respectively.

Discharges(cfs)	Mean velocity(ft/sec)	Width(ft)	Mean depth(ft)	Cross-sectional Area(ft)
	Transects 2, 3, 4			
5,000	2.49	337	8.0	2,520
10,000	3.93	380	8.9	3,077
20,000	5.58	419	10.2	3,690
Full Pool (2,000 ft msl)		595	22.6	11,867
5,000	0.42			
10,000	0.85			
20,000	1.70			
Full Pool (1,990 ft msl)		524	15.0	7,860
5,000	0.64			
10,000	1.27			
20,000	2.54			
	Transects 5, 6, 7			
5,000	2.06	360	7.6	2,743
10,000	3.12	406	8.6	3,490
20,000	4.56	462	10.0	4,583
Full Pool (2,000 ft msl)		551	16.7	9,230
5,000	0.56			
10,000	1.43			
20,000	2.25			
Full Pool (1,990 ft msl)				
5,000	1.66	447	9.88	3,010
10,000	2.16	460	10.44	4,690
20,000	4.03	471	10.84	4,968

The upstream pool area would be impacted far less at the lower pool elevation, particularly at higher discharges. Mean depth would only be 0.8 to 2.3 feet greater at pool elevation 1,990, than under normal flow conditions of 5,000 to 20,000 cfs, respectively. Mean velocities at the lower pool level would be similar at high discharges (20,000 cfs) to the normal conditions and approximately 20 percent slower at lower discharges (5,000 cfs) as shown in Table 3. Differences in water velocities would be more extreme in riffle-run areas than for the transects surveyed.

Reducing the pool elevation by 10 feet would reduce the impacts of the project in terms of providing more suitable physical trout habitat. Insect production would also be improved somewhat because increased water velocities should reduce sedimentation in some areas where higher quality substrate presently exists.

C. Timing and Planning

The basic outline of construction plans contained in the F.E.R.C. application are discussed in Part VII (Construction Guidelines and Stipulations). Stipulations and Guidelines on timing and construction of the dam and associated structures are designed to minimize impact and should not be construed as mitigation for other losses associated with this development.

D. Minimum Flows Over the Dam

Without a doubt, minimum flows over the dam are the most central issue next only to determining if a dam should be constructed at all. Three major impacts could be mitigated or their effect lessened by increasing the suggested minimum flow of 750 cfs over the proposed Kootenai Falls Dam. These include 1) recreational value of the Falls area by maintaining the aesthetic value of this unique area, 2) recreational value as measured by the fish migration downstream and over Kootenai Falls into the lower river, and 3) minimizing loss of fish habitat in the immediate canyon area downstream from the Falls.

The Montana Department of Fish and Game requested a minimum operational flow in the Kootenai River at the Libby gauge of 4,000 cfs. This will be the minimum flow requested for the Kootenai Falls section as well. This flow has been tentatively accepted by the Army Corps of Engineers who operate Libby Dam. It was requested to maintain fish and insect populations and to maintain recreational potential for fishermen. Presently, the Corps generally maintains flows at Libby near or over 4,000 cfs. Flows of 2,000 to 2,500 cfs are considered the absolute minimum and are exercised only under emergency conditions.

The operational flow requested by Northern Lights Inc. is less than the minimum historical mean daily flow of 1,000 cfs recorded at the Libby gauge by the U.S.G.S. The proposed operational flow will result in a very shallow flow over the Dam and Falls. At low flows, the river follows along the north (far) side of the channel. Concrete structures or rocks would be required to spread the flow over the falls.

Fish migrating downstream and over the Falls will probably be severely impacted by the intake structure as previously mentioned and any survival which is likely to occur would be from those fish going over the dam. Although mortality cannot be quantified presently, high mortality rates can be expected. Fish would probably not readily jump over the dam because the majority of the flow during all periods, except major floods, would be into the intake structure. Those that did drop over the Falls would fall up to 30 feet into shallow water on bedrock. They then would have to continue downstream and drop over the Falls; another 20-to 30-foot drop, into shallow water as discussed in the impact section. Increased operational flow over the dam would also aid in diverting fish from the intake structure as discussed in Section II.-B.-1.

1. Shoreline Modification

Large quantities of material would be excavated from the associated tunnels and river bottom. Although some of this material would be used to build temporary cofferdams, it eventually must be disposed of. A mitigation measure which could solve the problem of relocating part of the excavated material would be to modify the railroad grade which would border the southern river bank. Steep, rip-rapped railroad grades are usually poor places to fish. This could be improved by constructing two parallel berms contouring the south bank of the river. The upper berm would be approximately two feet above the expected pool level and a second berm would be approximately ten feet below the expected pool level. The upper berm could have nodes approximately every one-quarter mile to provide more fishing areas and landscape relief. The upper berm should be covered with fine rock fill to make it more usable for fishermen and wildlife. This upper berm could provide a short-term refuge from the railroad for wildlife watering at the river. A second berm, placed in at low flow, would be approximately 30 feet wide, follow the contour of the upper berm and gradually merge into the natural river bottom when the opportunity existed. In the upper end of the pool the lower berm should be discontinued where the natural river bottom reaches a depth of 10 feet and less. The lower berm should be made of only relatively large rubble. Although this is not ideal habitat for insects, it would provide insect habitat over a longer period of time because it would take longer for the sediments settling in the pool area to fill the interstices. The upper berm, but not grade, should be covered by a top soil fill and replanted with native grasses, shrubs and trees during early summer. The fill should be compacted soon after it is laid to reduce siltation and planted soon after.

2. Fish Ladder

Although some large rainbow trout or Dolly Varden may migrate upstream and over Kootenai Falls, there has been no documentation to date. A fish ladder would appear to be an ineffective form of mitigation at this time. If it could be established that white sturgeon could utilize the river upstream from the Falls or that rainbow trout would utilize a ladder for upstream migration, this may be a feasible mitigation measure.

III. Restoration of Fisheries

The Kootenai River continues to support one of the finest naturally reproducing rainbow trout populations of any large river in Northwestern Montana, although over half of the Montana portion of the river has already been impounded by Libby Dam. In addition, a proposed reregulating dam is threatening to impound 20 percent of the remaining river. The reregulating reservoir has a proposed 15-foot daily water fluctuation which would severely reduce its capacity to support aquatic life. The Kootenai Falls project would directly effect 10 percent of the remaining portion of the river in Montana if the reregulation dam were built.

Two primary methods could be used in an attempt to restore the number of rainbow trout to pre-Kootenai Falls Dam levels. Only one of these methods would be acceptable however. The two methods are fish stocking or a spawning-rearing channel. However, fish stocking would not be suitable for several reasons. It has recently been determined through genetic analysis that the Kootenai River drainage contains the only native rainbow trout in Montana. These fish are in Callahan Creek and the Yaak River (Espeland and Scow 1978). Montana Department of Fish and Game has not stocked rainbow trout into the Kootenai River although some imprint plants have been made in a few tributaries to start additional spawning runs. The importance of maintaining genetic integrity in the wild fish population has been documented and is receiving increasing attention in many areas (Calaprice 1969, Helle 1976, Reisenbichler and McIntyre 1977). Maintenance of genetric integrity and the detrimental effects of inbreeding or cross-breeding inferior stocks has also been documented in other populations (Dobzhansky 1951, Mayr 1971). To prevent the dilution of the wild gene pool by less fit hatchery stock (Reisenbichler and McIntyre 1977) and the possible demise of the overall fishery resource (Vincent 1972), the Montana Department of Fish and Game would not recommend fish stocking as a form of mitigation in the Kootenai River.

Another restoration method would be construction of a spawning channel downstream from the Kootenai Falls canyon. This area is likely to be impacted most by a loss of downstream recruitment from areas upstream from the falls. Imprint plants of wild rainbow trout fry could be made in the channel to establish a natural spawning run into the channel. Determining site location, size and maintenance will require further consideration.

IV. Short-term vs. Long-term Impacts

A. Short-term

Cofferdam construction, activities associated with making concrete, material storage, channel-restrictions, sedimentation, and excavation activities would all have short-term impacts on the aquatic community. These impacts could become long-term if sedimentation exceeds established limits and collects in canyon pools which would subsequently be subject to constant low flow conditions. Excavation and cofferdam construction and removal could result in long-term impacts because large quantities of rocks and boulders would probably be left in the channel, along the upper edge of the falls, and in the pools and breaks below the falls. Accumulation of both fine sediments and rock debris could reduce pool depths and create unnatural senic conditions. Sediment accumulation would reduce substrate suitability for aquatic insects.

B. Long-term

Long-term impacts include creation of a pool over 3 miles long upstream from the dam, diverting nearly all of the river flow around the falls and one mile of the canyon, disrupting approximately 2-2.5 miles of river bank upstream from the falls by raising the pool level alongside an elevated railroad grade, change in channel geometry, and all the related impacts on the aquatic biota and recreational value of the falls and river area.

Impacts of the project on the aquatic environment would be realized in a decreased suitability of the pool area for aquatic insects, the primary food source for fish in this area. Decreased water velocities and increased depths would reduce the relative abundance of suitable habitat for sport fish but provide more suitable habitat for less desirable species such as chubs, suckers and squawfish. A decline in relative abundance of trout and probably whitefish would be expected over the long-term. Other run-of-the-river reservoirs in northwestern Montana have demonstrated a similar decline (Huston and Vaughan 1965 and Huston, personal communication, 1979).

Design of intake structure, quantity of water diverted, and flow over the dam would all contribute to impacts on downstream migrating rainbow trout and subsequently the quality of the fishery downstream from Kootenai Falls. This factor extends the potential impact of the project far beyond the study area.

Creating a steep, rip-rap covered bank along the south shore (the only one accessible to the general public) would further impact the fishery, not only by reducing fish habitat suitability, but also by reducing the suitability of the area for fishermen use and access.

A constant small discharge over Kootenai Falls would not only effect mortality of downstream migrating fish over Kootenai Falls and reduce habitat in the canyon below, but would also reduce the recreational quality of the falls. A suggested flow of 750 cfs is less than the historic average daily minimum flow at Libby, Montana. Even with the hydraulic gates and proposed dispersal of material to keep the flow closer to the south bank, 750 cfs would not appear to be 8,000 cfs as suggested in the F.E.R.C. application.

Gas supersation could be an impact at any time during the period of operation, particularly if discharge from Libby Dam was by sluices or spillways and involved high discharges. Potential impacts were discussed and long-term monitoring is recommended.

V. Irreversible and Irretrievable Impacts

Changes in the channel geometry would result from filling the natural thalweg along the north bank and excavation along the south bank. The resulting impact is difficult to predict. It would depend in part on how the dam was removed. After dam removal, the river would scour some of the sediments which accumulated within the confines of the natural channel. Sediments deposited above the high water line would erode into the river for many years. The river would not be able to rework the channel to compensate for changes in the thalweg caused by excavation because the parent material is largely bedrock near the Falls. In addition, flood flows which are necessary to rework the substrate no longer occur because of Libby Dam. Removal of the dam and associated debris would be costly but should be done when amounts of energy produced were less than the recreational benefits lost. If no plans are made to remove the dam, then all long-term impacts created by the project would have to be considered irreversible and irretrievable.

Restoring the nature of the present system after the project life would require sealing and removing the intake structure after dam removal. Otherwise, significant quantities of water could still be divereted. Attempts would also have to be made to reclaim the upper falls area by removing rock debris.

Any attempts at restoration of rainbow trout populations downstream from the falls would require strict guidelines for natural propagation. The only remaining pure Montana rainbow trout stock is found in Callahan Creek and the Yaak River. Dilution of this gene pool by fish stocking would result in an irreversible and irretrievable impact.

VI. Overall Significance of Impacts to Montana's Fishery Resource

Two significant fishery resources exist in the area that would be impacted by the project. These are the white sturgeon and rainbow trout. White sturgeon are listed as one of two fish species of special concern in the State of Montana. It is only found from Kootenai Falls downstream to the border in Montana. The numbers of white sturgeon appear to be declining. An average of 10 sturgeon per year were caught by anglers in the Kootenai Falls area from 1968 to 1970. This has subsequently declined and in 1978 no fishermen were even observed fishing for sturgeon during the study period. Fish and Game personnel managed to catch only 6 in 1975, 2 in 1976 and 3 in 1978 after extensive effort with nets and trotlines. Although no direct connection can be drawn due to a lack of data on the requirements of this species, this decline coincided with impoundment of the river by Libby Dam. It is probable that habitat preference or environmental events that signaled the time for upstream migration were altered by Libby Dam operations. White sturgeon populations appear to be stable downstream in Idaho and British Columbia. Moderating effects by the Yaak and Moyie Rivers on the Kootenai River and the longer distance from the dam might explain this.

Although no immediate or potential impact of the project on white sturgeon has been established, several precautions should be made. These include monitoring gas supersaturation levels at the outlet. White sturgeon, being scavengers, would likely concentrate near the outlet and feed on stunned and dead fish and other organisms that passed through the intake. If it can be shown that white sturgeon spawn or rear in the canyon between the falls and the outlet, immediate attention should be made to insure that the flow regime over the dam did not adversely affect the sturgeon. Effects of mortality during egg or juvenile life stages may not be detected until a number of years later in a population of fish where individuals live 20 to 30 years or longer.

Rainbow trout support a good fishery in the section of river from Kootenai Falls upstream 3.5 miles. This area was censused in 1978. Results showed that this river section was comparable to Montana's finest blue ribbon trout streams in both catch rates and fishing pressure (Graham 1979). This fish population is naturally reproducing and characterized by good growth rates, relatively large numbers and a few trophy fish.

The expected adverse impacts of the project on the rainbow trout population would decrease relative abundance and probably the growth rates of the fish. Not only would the project affect the pool area upstream from the dam, but a loss of downstream migrants would effect the fishery downstream from the falls to near the Idaho border.

Potential impact of this project is more significant than might otherwise be expected. Libby Dam has inundated half of the Kootenai River flowing through Montana (50 miles) and a proposed reregulating dam is threatening to disrupt another 10 miles of river with 15 foot vertical fluctuations daily. The recreational base of the area is being continually reduced at the same time that recreational pressures are increasing. Fishing pressure has continually increased from 116 man-days per mile in 1968-69 to 406 man-days per mile in 1975-76. The estimate for the 3.5 mile section upstream from Kootenai Falls was 1,630 man-days per mile for year 1978. Statewide trends also indicate a 30 percent increase in fishing pressure by 1985 (Montana Department of Fish and

Game 1978). Meyer (1978) examined recreational values near urban areas and noticed a decline in the outdoor recreation base which he stated could lead to increased tension and frustration in people who seek recreation for pleasure and relaxation.

The Kootenai Falls section also attracted a larger than average number of out-of-state (20%) and out-of-county (17%) anglers than did other sections of the Kootenai River, which attracted 10 percent out-of-state and 3 percent out-of-county (Graham 1979). The proximity to Highway Two and numerous access points provided opportunities for the potential anglers to stop.

Lincoln County will probably experience more growth than most areas of the State in the next few years with proposed copper mines, highway construction, dam building and the associated increase in services. This will undoubtedly put more pressure on the outdoor recreation activities. Therefore, the significance of the impact on the fishery resource will continue to grow.

VII. Construction Guidelines and Stipulations

A. Clearing

Any clearing of a work platform or other construction areas should be done so that no debris is placed below the high water line of the river, in this case, the expected pool elevation. Cleared material should be removed from the site. No vegetation in the riparian zone should be removed unless absolutely necessary for construction purposes above the expected pool elevation.

B. Cofferdam Construction

Cofferdam construction would result in a constriction of the river channel to less than 25 percent of normal. This will not be particularly significant at low flows (4,000 cfs) because most of the water flows along the north bank naturally at low flows. Low flows would generally occur from March through May because Libby Reservoir would be filling. This is the scheduled time for construction. The outside wall should be of large rock placed above the low water line. It may be necessary to use interlocking steel pilons along the outside edge to prevent the rock from washing down the channel during peaking flows.

It may be necessary to rip-rap or otherwise stabilize segments of the north bank to prevent erosion of the steep banks. Sediment could also wash from fill material if it is not washed. Material placed on the outside wall should be washed into the settling pond.

C. Settling Pond

Settling ponds should be constructed to allow control of sediments to meet State Water Quality Standards and be situated so it cannot be washed out under peaking operations from Libby Dam. It is possible that two or more walls of filter blanket material could be used in the pond to allow water to pass through relatively quickly while trapping sediment (i.e. Mirafi 500 x fabric). Settling ponds should be large enough to hold water collected in erosion control from ditches or pipes along access roads, from the working platform and from plant operations. Settling ponds should be cleaned when necessary, and material hauled from the site unless an acceptable use can be determined.

D. River Bed Excavation

It would be necessary to excavate bedrock from the river bottom along the south bank to get water into the intake. This would require the use of explosives. Explosives should only be used after the cofferdam diverted the channel from the south bank. It should be determined what amount of nitrates (nutrients) would be produced in solution per 100 lbs. of explosives used. It should also be determined how these substances can be handled in a settling pond.

E. Disposal of Excavated Material

Material used in construction of both the stage 1 and 2 cofferdams must be removed after it has served its function. It would be necessary to remove as much construction material as possible upstream and downstream from the dam. In the case of the stage 2 cofferdam, it would be necessary to remove material while maintaining adequate flows over the dam.

Material could be used to construct the new railroad grade and to slope the river bank and form berms along the south bank as described in a succeeding section. Excavated materials used in construction on site or railroad grade facing the river should be washed to reduce sediment loading. The remainder of the material should be hauled off site. A more complete quantification of the means of distribution and location for disposal of the large quantity of excavated material is necessary.

F. Railroad Grade and Berms

As mentioned, material used in the south face of the railroad grade should be cleaned to prevent sediment washing into the river. Additional material could be placed in the river under low flow conditions to construct two berms along the south bank as a mitigating measure. It would also be more economical than hauling the material to an off-site disposal area.

A description of a possible berm design is contained in the mitigation section. Briefly, an upper berm (10-15 feet wide) would contour the shoreline along the railroad grade. No berm should be constructed if a natural bank remains along any part of that section. The upper berm would be about 2 feet above the pool level. The upper berm would slope into the river and be covered by large rock and boulders to provide fish habitat. The surface of the upper berm should be covered with crushed material and then topsoiled. This should then be compacted and seeded. Nodes should be placed along the upper berm to provide shoreline relief and increased area for fishing. A second berm, approximately 10 feet below the pool elevation should parallel the upper berm. It could be 30-40 feet wide and covered by large substrate. These berms should be discontinued when a natural bottom and shoreline is reached.

G. Work Camp

Sewage and waste treatment should be contained and be above the high water line. All construction, hauling, storage and other activities should be done to minimize pollution of the river or any unnecessary long-term impact on the surrounding area. Fuel dumps, vehicle and hydraulic service and repair areas, and storage dumps should not be on the staging area because of the close proximity of the river and high risk for pollution. Sediment run-off from the camp area should be controlled.

H. Material Sites and Storage Yards

Any waste material produced in solution should be channeled into the settling pond or contained in some other manner. Excess cement should not be dumped near the river or on the staging area. All waste materials such as metal drums and scrap wood and metal should be hauled from the site and not buried in the project area.

I. Access Roads

Any roads in the project area should be constructed to minimize sediment run-off. Drainage ditches should funnel into the settling ponds when feasible. Where springs are encountered, culverts would be needed to prevent surface run-off of sediments such as the access road to the power line south of Highway Two near the falls. Existing roads should be used whenever possible.

J. Minimum Flow

At no time should flow be completely diverted around Kootenai Falls without consulting the Montana Fish and Game Department. A minimum flow should be established during the construction phase of the project. Initially, we recommend an instantaneous minimum flow of no less than 4,000 cfs over the falls. A minimum flow for the operational period is discussed under impacts and mitigation sections.

VIII. Plan for Long-Term Monitoring

A. Pre-completion

Annual fish collections should be made in the Kootenai Falls area to monitor changes in the fish population and to continue tagging rainbow trout to determine the extent of movement. A collection should be made upstream from the falls during late summer as done in 1978. Insect collections should be made biennially to maintain a continuous set of baseline data due to the probable instability of the aquatic biota below Libby Dam. Collections should be made both upstream and downstream from the dam at sites used in 1978. Collections should be made in spring for comparison to the 1978 collections.

A fish population estimate should be made downstream near the town of Troy to provide baseline information on suspected declines in the fish population caused by the project's dam, intake structure, and low minimum flows.

Additional work which should be continued to understand potential impacts on white sturgeon should include further attempts to delineate their distribution and abundance. Attempts to document their presence in the Kootenai Falls area might be attempted using SCUBA gear. If they are found in the canyon area, further attempts to document spawning and rearing should be made.

B. Post-Completion

Continued monitoring of the fish population in the pool area upstream from the falls should continue on a biennial basis for several years to monitor population changes. Attempts should be made to determine the effectiveness of barriers or various minimum flows in preventing mortality of fish and other organisms that could enter the intake system. Fish collections should be made downstream from the outlet to monitor fish abundance and condition in that area. In addition, insect collections should be made on a biennial basis to document the suspected decline in insect production.

Gas supersaturation levels should be monitored upstream from the pool area, at the intake, at the outlet and downstream from the canyon. Only through continued monitoring will the effect of the project on gas supersaturation be determined. This is particularly important when Libby Dam is sluicing or spilling, under high flow conditions, and under very low flow conditions.

Analysis of the habitat condition in the river between the falls and the outlet should be conducted to determine the extent of the impact of proposed operating flows for the project.

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