Review of the Aquatic Environmental Impact Assessment for the Kemess North Project

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Executive Summary

The application by Northgate Minerals Corporation to develop the Kemess North property includes a proposal for tailings disposal that would severely affect aquatic life. Duncan Lake would be impounded by a 90 m dam and converted into a Tailings Disposal Facility that would cut off discharge into Duncan Creek. Loss of critical fisheries habitat within the project footprint, together with degraded water quality from the disposal of acidic waste rock, would effectively eliminate the Duncan Lake ecosystem. Upon closure, downstream water quality at the Attycelley Creek confluence would exceed sulphate and cadmium water quality guidelines by factors of 14 and 3, respectively. A Fish Habitat Compensation Plan proposes to transfer fish into adjacent fishless lakes, construct a fish ladder on Black Lake, and construct rearing channels and bull trout spawning platforms in Attycelley Creek. This proposal is inadequate for habitat compensation and incorrectly applies the existing productive capacity of three fishless lakes against the lost productive capacity of Duncan Lake to achieve No Net Loss. While fish salvage is a responsible approach to environmental management, it does not replace habitat mitigation designed to meet the “No Net Loss” principle of DFO’s Policy for the Management of Fish Habitat. Post-closure restoration commitments for Duncan Lake contained in the EIA are ambiguous and contingent on the results of future studies. In order to protect aquatic biota and to maintain productive capacity, it will be necessary to redesign the project with an alternate tailings disposal system.

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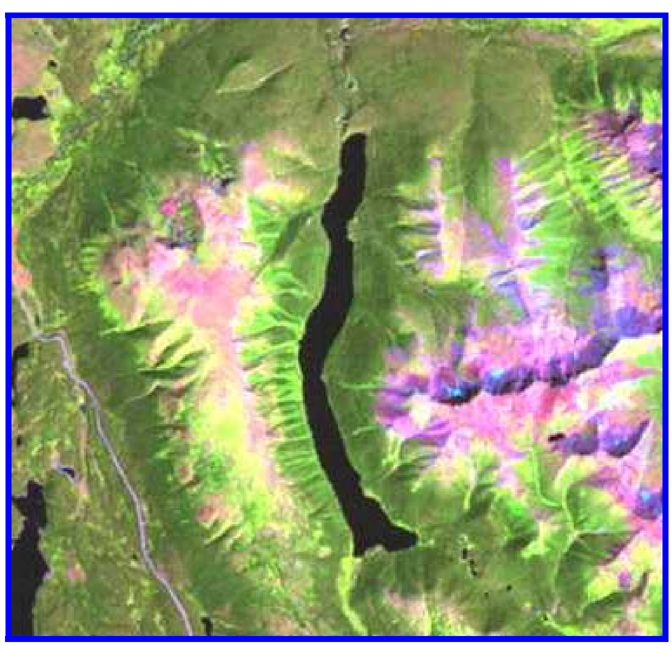
Introduction

MiningWatch Canada has a mandate to ensure that mining ventures in Canada and elsewhere are carried out responsibly and in the best public interest. The organization scrutinizes new projects to ensure that relevant environmental regulations are enforced and that projects are designed with minimal environmental impacts. MiningWatch is presently evaluating the proposed Kemess North project in Northern BC that will be subject to public review in 2006 under a harmonized Federal/Provincial environmental review process.

The Kemess North Project, if pursued, would profoundly alter aquatic ecosystems in the vicinity of the project. The elevation of Duncan Lake would be raised by 90 m to create a Tailings Disposal Reservoir that would receive 740 million tonnes of acidic waste rock over the operating period of the mine. There would be no discharge from the reservoir thereby eliminating Duncan Creek and reducing water flows in Attycelley Creek. The mitigation plans that address these impacts reflect the proponents' commitment to sustainable development; they must satisfy the DFO No Net Loss criteria and provide assurance that Duncan Lake will be successfully restored upon completion of the project.

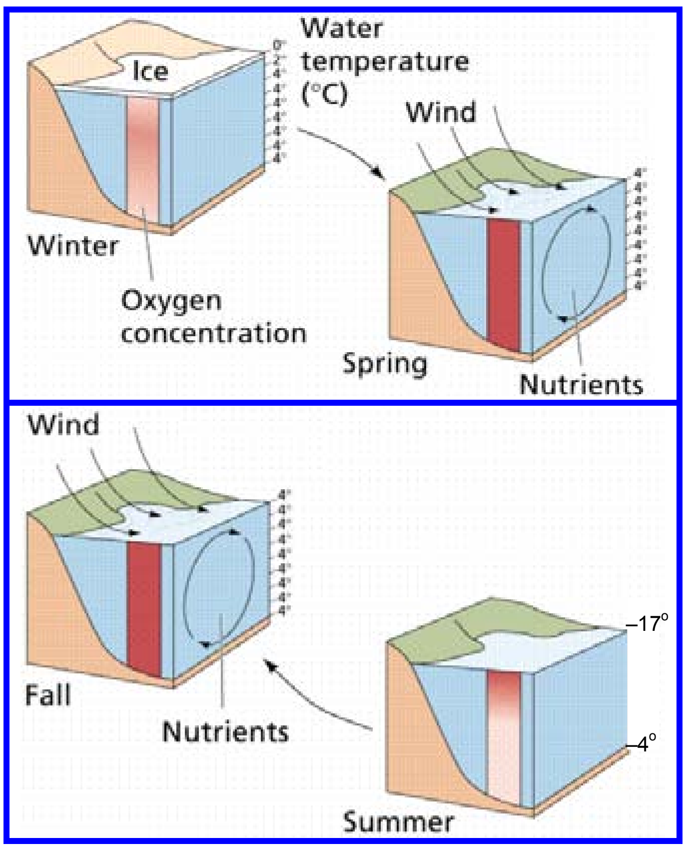
This report was prepared on behalf of MiningWatch to review the aquatic components of the Kemess North Environmental Impact Assessment. Sections of the EIA that were analyzed include chapters and appendices related to baseline information, impact predictions, the habitat compensation plan and the reclamation plan. The report begins with a description of the Duncan Lake ecosystem and then considers human components of the ecosystem – the First Nations which have occupied the Finlay River watershed for millennia. Next, the water quality impacts of the proposed mine development are summarized. Two key mitigation plans are reviewed: the fish habitat compensation plan, and the restoration plan for Duncan Lake. Lastly, the report concludes with a brief review of Appendix 4 of the EIA: Tailings Disposal in Natural Water Bodies.



The Duncan Lake Ecosystem

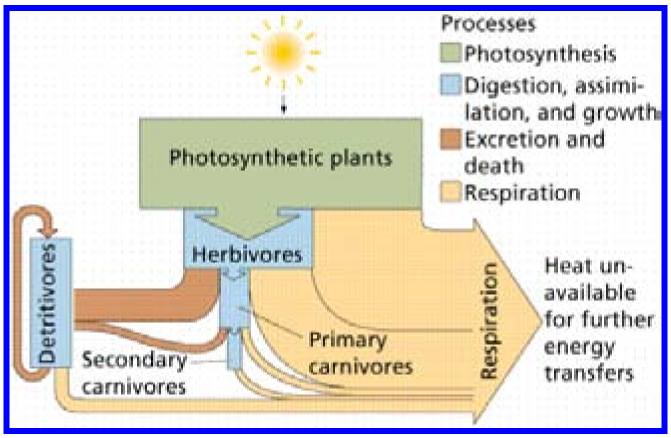
The Kemess North Project, if approved, would eliminate the biological populations and communities within Duncan Lake and convert the lake into a Tailings Disposal Reservoir with degraded water quality. The EIA only partially evaluates the aquatic ecosystem consequences of the proposed project. This section of the report provides a brief summary of ecological processes in Duncan Lake so that the consequences of mining development can be more fully appreciated.

Duncan Lake is an ultra-oligotrophic lake with low nutrient concentrations, high water clarity (maximum Secchi depth of 18 m) and low biological productivity. The lake is ice-covered between mid-November to late-May. The lake overturns twice per annum during June and November as illustrated below. Maximum summer surface water temperatures are around 17^{o}C and the lake is sharply stratified in September with a thermocline at around 20 m. The lake is 4^{o}C or colder during winter months. The lake is slightly alkaline with pH values between 7.4 - 7.8.

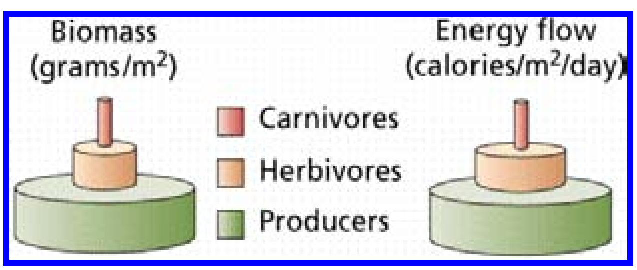


Dissolved oxygen concentrations are as low as 50% saturation, indicating a moderate oxygen demand from the sediments, most likely from decomposing organic matter. Associated with low nutrient concentrations, both phytoplankton biomass and species richness is extremely low and chlorophyll ‘a’ concentrations are among the lowest for any lake that has been surveyed in BC. Typical of ultra-oligotrophic northern lakes, zooplankton densities and diversity are low and there are only three species of macro-zooplankton present. Reasonably high densities of benthic invertebrates are present in shallow sublittoral habitats, especially chironomid (midge) larvae, small freshwater clams and gammarid amphipods.

Sunlight provides the basic energy source for the Duncan Lake ecosystem. Phytoplankton are the main photosynthetic plant producers in the lake. Herbivores include zooplankton and some benthic invertebrates. Most benthic invertebrates are detritivores which feed on decaying organic matter and detritus, some of which originates on land. Primary and secondary carnivores include one species of copepod, a number of benthic invertebrates, and rainbow trout, Dolly Varden and mountain whitefish. A diagram of the energy flow in Duncan Lake (also called a food chain) is shown below:



Population size in an undisturbed ecosystem like Duncan Lake can be limited by food supply, competition, predation, or parasitism. In most ecosystems including Duncan Lake, the trophic structure forms an ecological pyramid. The base of the pyramid is formed by primary producers and at the apex are the top predators). A pyramid of biomass for an ecosystem results from the fact that only about 10% of the energy available at a particular trophic level is incorporated into the biomass of the higher level. The rest of the energy goes into respiration.

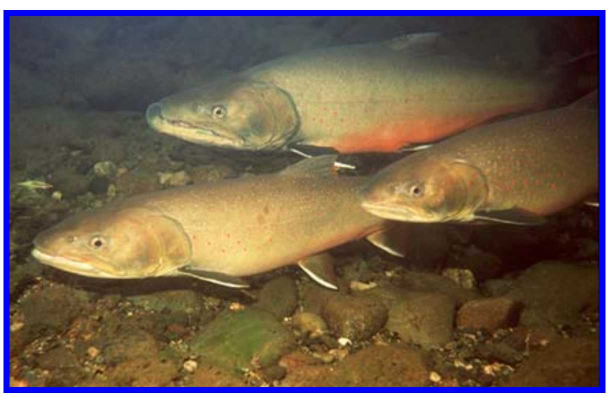


Food chains are simplifications of complex relationships. A food web is a network of feeding interactions between species and provides a more realistic and accurate depiction of energy flow. The food web in Duncan Lake is not well understood at the present time.

Net primary productivity is the rate at which producer biomass is formed, and usually sets the upper boundary for production at higher trophic levels. Productivity is measured as grams of carbon on an areal basis over time and is usually expressed as $g/m^2/year$. Duncan Lake productivity rates are extremely low due the physical conditions and the low nutrient concentrations. However, it would be misleading to conclude that just because productivity is low that Duncan Lake has inherently lower "value" to humans. If anything the converse is true, since all things being equal, a simple ecosystem like Duncan Lake is more vulnerable to disturbance than a more complex one[1].

Recent research by Dr. Eric Taylor of the Univ. of BC suggests that the Upper Finlay Watershed is unique from a fisheries perspective and forms a "suture" (contact) zone between coastal and interior fish lineages. When Dolly Varden and bull trout[2] come into contact (e.g. Thutade Lake), bull trout always adopt a lake-run piscivorous life history, reaching over 1 m in length. In the presence of bull trout, Dolly Varden always adopt a stream-resident insectivorous life history and rarely exceed 20 cm. In the Duncan Lake watershed, all of the char appear to be Dolly Varden, although hydrid Dolly Varden/bull trout are also present. Hybrids are the progeny of male Dolly Varden which mate successfully with female bull trout by adopting a satellite, or "sneak" spawning behavior. Owing to the absence of bull trout in Duncan Lake, Dolly Varden adopt the lake life history growing up to 40 cm in length. Elsewhere in BC where Dolly Varden are absent, bull trout adopt both stream-resident and lake-run life histories. Such interactions between species are termed "character displacement" by evolutionary biologists. The Finlay River system appears to be a microcosm of the interactions that have shaped the evolution of these two species char over their geographical range.

Duncan Lake is scientifically significant because it represents one of the few, and perhaps the only occurrence of lake-run Dolly Varden in the interior drainage of BC. As such, it provides an opportunity to better understand character displacement in Dolly Varden and bull trout. It is essential that this scientific importance be recognized and factored into the environmental assessment.



Bull Trout, Upper Finlay River: Thutade Lake watershed.

Photo courtesy of Dr. E. Taylor, Univ. of BC

[1] Duncan Lake is a "simple" ecosystem because species diversity is low and food webs are relatively direct.

[2] Both bull trout and Dolly Varden are a type of char, genus *Salvelinus*.

First Nation Values

The Kemess North Project falls within the Traditional Territories of the Takla Lake, Tsay Keh Dene and Kwadacha First Nations, and the Gitxsan House of Nii Kyap. These Territories have been occupied for millennia, pre-dating the construction of the Great Pyramids of Egypt by many thousands of years. First Nations maintain a long-term and holistic view of nature, consider themselves as an integral part of the ecosystem, and are strongly committed to ensuring that the land and water remains healthy.

Key features of First Nations resource use have been studied in the Fraser River by Kew and Griggs (1991)[3] and similar principles apply to terrestrial and aquatic areas in the Finlay River watershed. These include:

- commitment to place and an enduring association with a homeland encompassed by the Traditional Territory;
- local control and shared responsibility for resource stewardship, with decentralization of decision-making to the local level;
- regulated access and an identified community of users with a shared ethic of resource use;
- resilience to cope with fluctuating levels of supply;
- long term perspective on resource use which builds an understanding of feedback mechanisms within the ecosystem;
- mutual dependency between resources and humans which is reinforced within a complex ethical framework by strong linkages between humans, animals and the spirit world.

These are some of the attributes that need to be reflected in present-day environmental co-management and decision-making policies for the Finlay River watershed.

The First Nation consultation requirement in EIA is an attempt to integrate First Nation perspectives into the assessment. However, First Nations values are usually incompatible with development activities that harm the ecosystems upon which they depend for physical and spiritual sustenance. The proposed destruction of Amazay (Duncan) Lake and conversion into a Tailings Disposal Facility will have environmental impacts on First Nations[4] with long standing interests and aboriginal rights in the vicinity of Kemess North. These impacts are neither addressed nor adequately mitigated by the EIA.

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[3] Kew, M. and J. Griggs. 1991. Native Indians of the Fraser Basin: Towards a Model of Sustainable Resource Use. In *Perspectives on Sustainable Development in Water Management: Towards Agreement in the Fraser River Basin*, A. Dorcey [ed.]. UBC Westwater Research Centre, Vancouver

[4] see: "BC First Nations Oppose Mining Company's Plans to Destroy Lake', First Nations Summit, Oct. 24, 2005 http://www.fns.bc.ca/pdf/PR_FNOpposeMine10_05.pdf

Water Quality Impacts

The Duncan Tailings Impoundment is a zero discharge facility, so downstream water quality concerns only arise at closure. Results from computer simulation models were used to predict post-closure water quality conditions in Attycelley Creek, downstream of Duncan Creek confluence. Results are shown in the Table below. There are two contaminants that trigger concerns: sulphate and cadmium which will reach concentrations of 1370 and 0.0003 mg/L, respectively. These concentrations are 14 times greater (sulphate) and 3 times greater (cadmium) than the BC Water Quality Guidelines.

	PREDICTED WATER QUALITY ATTYCELLEY CREEK DOWNSTREAM OF DUNCAN CREEK	
PARAMETER	BC WATER QUALITY GUIDELINE AT HARDNESS 400 mg/L $CaCO_3$	PREDICTED** CONCENTRATIONS (mg/L)[1]
Hardness		
SO_4 *	100	**1370**
T-As *	0.005	0.002
T-Cd	0.0001	**0.0003**
T-Cr *	0.009	0.005
T-Co *	0.004	0.0003
T-Cu	0.016	0.007
D-Fe *	0.3	0.06
T-Mn	2	0.4
T-Mo *	1	0.06
T-Ni	0.15	0.03
T-Pb	0.02	0.009
T-Ag	0.0015	0.0007
T-Sb *	0.02	0.009
T-Se *	0.002	0.002
T-Zn	0.24	0.004
D-Al *	0.05	0.02

There will be an absolute increase in cadmium concentrations from 0.07µg/L (baseline) to 0.3 µg/L (predicted) in Attycelley Creek immediately downstream of the Duncan Creek, an increase of 0.23 µg/L, or 328%.

In view of these results, the proponent has suggested that the water quality guidelines be modified and replaced by site-specific water quality objectives:

> "The current BC Water Quality Guidelines for the protection of freshwater aquatic life for sulphate (100 mg/L) should be reviewed in light of active mines in British Columbia..…..It is recommended that site specific receiving environment objectives for sulphate be developed to facilitate appropriate mine closure options to achieve the desired acceptable water quality objectives."
>
> "However, due to the estimated receiving water quality concentrations of cadmium, it is recommended that a site-specific guideline be established that accounts for the increased hardness expected in the water downstream of the Duncan Impoundment and the currently elevated background cadmium load."

Effective water management involves project design to meet BC Water Quality Guidelines. For Kemess North, the proponent is advocating a more liberal approach, namely the derivation of site-specific water quality objectives to justify the discharge of contaminants at higher concentrations than elsewhere in the province. This is equivalent to changing the rules as you go. The proponents' last statement (above) about currently elevated background cadmium load fails to recognize that cadmium toxicity is independent of whether the cadmium is of natural or industrial origin; it is the absolute concentration that controls toxicity of cadmium to organisms.

Elsewhere, the proponent is mistaken about toxic effect thresholds and how these relate to water quality guidelines and objectives:

> "Predicted cadmium levels in the Attycelley Creek are lower than toxic effects levels for most of organisms."

All water quality guidelines have a built-in safety factor, so protecting most organisms is insufficient: guidelines are set well below the toxic effect threshold of all of the aquatic organisms that are used to define the guideline.

In the event that water quality is poor the proponent has committed to undertake additional design work to route water through a wetlands complex that could remove sulphates and metals from the mine waste water. An alternative suggestion in the EIA is to pump impoundment water into the north pit until enough dilution occurs to allow for a discharge with lower levels of sulphate.

The establishment of wetlands to provide wastewater treatment is a widely accepted practice in temperate and tropical climates with long growing seasons. However, in northern BC where plant growing seasons are short, the effectiveness of this technology is untested. For about half of the year between November – June, marsh and other wetland plants would be dormant in the vicinity of Kemess North and biogenic wastewater treatment processes would stop. The practicality of this proposal should be evaluated before it is proposed as a relevant approach for treatment of Kemess North wastewater

Design study proposals in the EIA to manage water quality conditions (e.g., wetlands, pumping of wastewater into the north pit) do not commit the proponent to construct an effective wastewater treatment system. In order to be proactive and to provide a measure of insurance, wastewater treatment needs to be built into the project design. The proponent suggests that the Duncan Tailings Impoundment would have sufficient neutralizing potential for the increased input of acidity from tailings. However the proponent acknowledges that there is uncertainty and that treatment may be required ("if the increased volume of acidity proves worst case, then a treatment plant would be needed"). During project planning, it is best to assume worst-case conditions and to design accordingly.

Another area where water quality problems are anticipated is the Kemess South open pit which will be filled with Kemess North tailings. The tailings supernatant in the open pit will be potentially toxic and may need to be routed through a constructed wetland (see above) proposed for the outlet of the open pit. The wastewater treatment contingency is identified in the EIA, but no hard commitments have been built into the design of the project.

Existing Tailings Disposal Facility for the Kemess South Mine

Fish Habitat Compensation Plan

Development projects in Canada are required to comply with DFO's Policy for the Management of Fish Habitat. The "No Net Loss" principle guides the policy and seeks to balance unavoidable habitat losses with habitat replacement in order to prevent reductions to Canada's fisheries resources. One of the metrics under this principle is "productive capacity" which has been defined by DFO as:

> "The maximum natural capability of habitats to produce healthy fish, safe for human consumption, or to support or produce aquatic organisms upon which fish depend."

Evaluations of net gain or net loss in productive capacity are central to the evaluation of the acceptability of a project to Government Agencies, First Nations, NGOs and other stakeholders. Where projects have adverse impacts on productive capacity, proponents are required to undertake mitigation to alleviate such impacts. Mitigation has been defined by DFO as actions taken during the planning, design, construction and operation of works to compensate for potential adverse effects on the productive capacity of fish habitats.

Aquatic impacts from the proposed Kemess North project include:

1. Destruction of Duncan Lake, Inlet Creeks 1, 1A and 2, Upper Duncan Creek; and the fish populations contained within;
2. Dewatering of Duncan Creek[5] during operations; and,
3. Reduced flow in Attycelley Creek below the Duncan Creek confluence.

The aquatic environmental assessment was done to a high standard and the irreversible impacts on rainbow trout, Dolly Varden, and whitefish are acknowledged. Regarding rainbow trout and whitefish:

> "The population of rainbow trout in Duncan Lake will be eliminated as a result of conversion of the lake to the storage of tailings and waste rock…After instream construction is completed in upper Duncan Creek, the creek mainstem would no longer flow, thus directly eliminating habitat for rainbow trout in Duncan Creek."
>
> "Construction and operation of the Duncan Lake tailings facility would eliminate whitefish and their habitats in Duncan Lake".

The proposed habitat compensation strategy includes:

- Transplant rainbow trout and Dolly Varden char to the Mulvaney Lake system;
- Transplant Dolly Varden char to the Whudzi Lake system;
- Construct a fish ladder at the outlet of Black Lake;
- Transplant Dolly Varden char to Jock Creek and enhance the creek;
- Construction of rearing channels in lower Attycelley Creek; and,
- Construction of bull trout spawning platforms in Reach 2 of Attycelley Creek.

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[5] During reservoir construction flows will increase by 2 m^3/sec. After reservoir filling, dewatering will dry up Duncan Creek and reduce downstream flows in Attycelley Creek by 10% - 30%.

The Kemess North habitat compensation strategy is described in the EIA:

> "Although some people would classify the loss of the lake as a catastrophic failure, it is an impact that can be compensated for within the Fisheries and Oceans Canada risk management framework."
>
> "This habitat compensation strategy meets or exceeds the Federal No Net Loss requirements as well as the BC requirement to maintain the genetic integrity of the Dolly Varden char stock present in Duncan Lake. The options are of relatively low risk, require low maintenance, and have a high likelihood of success."

To state that these proposed fish transfers are "low risk" is incorrect. When fish are introduced and become established in fishless lakes, they can cause irreversible impacts on existing animal species (e.g., amphibians, benthic invertebrates) in the recipient lakes. These species have evolved in the absence of fish and may be adversely affected via competition or predation and some aquatic species will likely disappear. No information or field data is provided in the EIA to evaluate these ecological interactions and it is highly unlikely that the fish transfer proposal will be acceptable to the Biodiversity Branch of the BC Ministry of Environment.

Even if fish transfers were acceptable, this compensation strategy does not even come close to meeting the No Net Loss requirement and should be rejected outright. The major flaw in the approach is an attempt to balance the elimination of productive capacity in Duncan Lake with existing productive capacity in adjacent fishless lakes. Transplanting fish from Duncan Lake into these lakes is not habitat compensation, it is merely a transfer of the productive capacity of the fishless lakes onto the Kemess North balance sheet for habitat loss.

In the EIA, Table 9.22 compares the productive capacity of adjacent fishless lakes with Duncan Lake as measured by the number of fish that could potentially be produced in the different lakes. This table is re-printed below.

	Productive Capacity			
	Duncan L.	Mulvaney L.	Whudzi L.	Black L.
Stocking Model (#juveniles)	3,282 (from survey)	4,351	597	2,317
Phosphorous Model (kg/fish)	430.4 (from survey)	656.6	63.18	700
Habitat Evaluation Potential Model (Habitat Units)	691,395	888,193	269,398	n/a
Area per Individual Model (# individuals)	3,282 (from survey)	19,612 to 30,697	840 to 3600	n/a

The data in this table represent the number of fish that can be produced in the four lakes (Duncan Lake vs. three fishless lakes) as estimated by four different fish production models.

The proponent uses these data to conclude that:

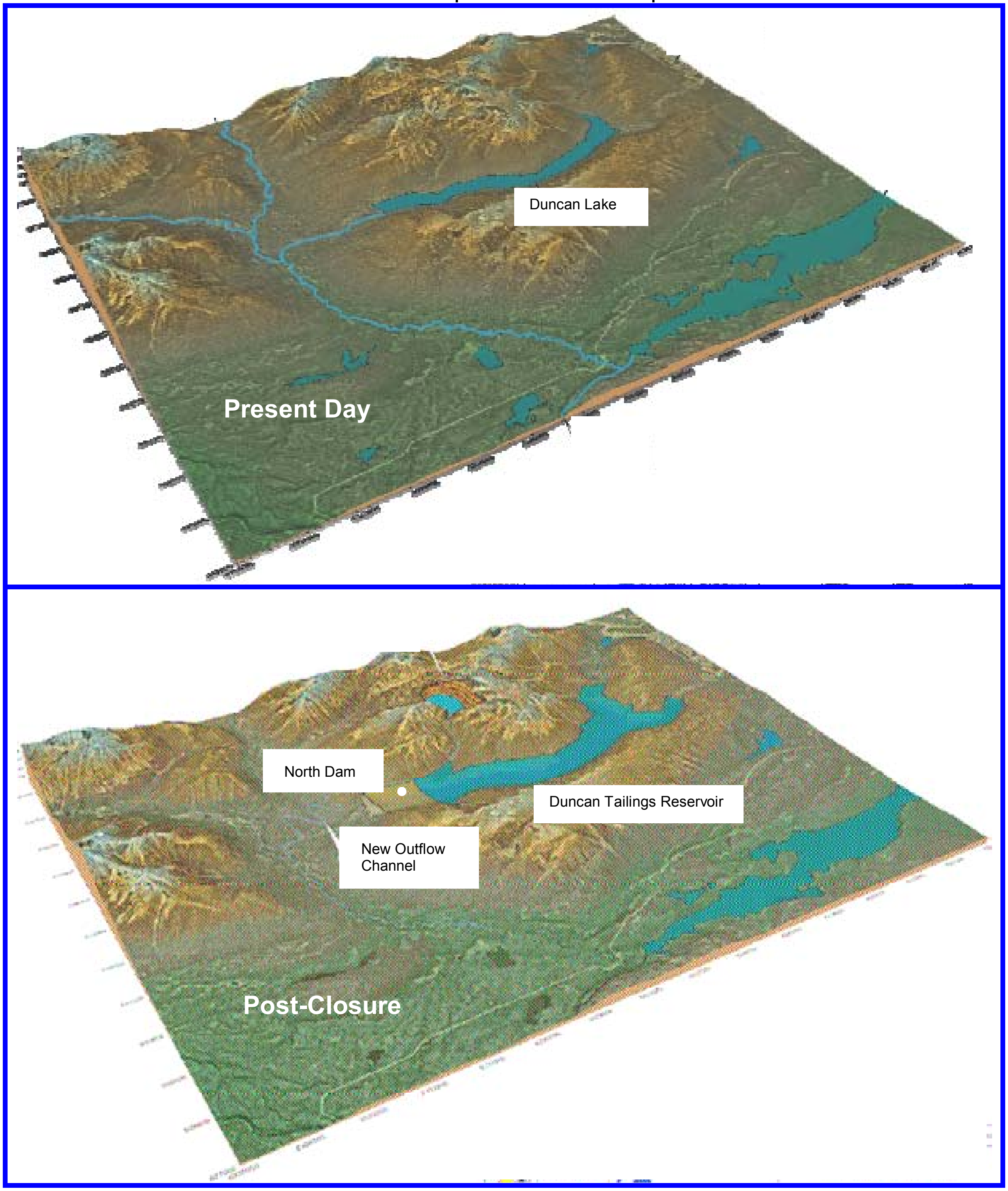
> "All models show that lost productive capacity will be replaced with an overall balance of at least 2:1"

This type of habitat accounting practice does not suffice for compensation. The Mulvaney, Whudzi and Black Lake productive capacity presently exists independently of Kemess North so it is false accounting to apply it against the Duncan Lake productive capacity that will be destroyed by the project. In other types of development projects, e.g. stream crossings for highway and linear developments, proponents usually undertake fish salvage and habitat compensation to meet No Net Loss requirements. Fish transfers in themselves cannot be considered habitat compensation. In order to mitigate impacts, it is necessary to compensate for the productive capacity of the habitat that will be lost, as laid out in the DFO policy. Where this cannot be done there will be a net habitat loss and for the Kemess North project, the net loss is a self-sustaining fish population and a subalpine lake with a surface area of 269 ha, a volume of 64.6 million m^3 and a mean depth of 24 m.

The proposed habitat compensation strategy fails to meet the spirit and intent of the No Net Loss policy. It is presumptuous to suggest that human technological intervention or an existing environmental management procedure coupled with a few minor mitigation works can compensate for the destruction of Duncan Lake. The proposed Kemess North project will result in the elimination of an ecosystem and needs to be presented and understood by the public as such.

Post-Closure Restoration Plan for Duncan Lake

The change in morphology of Duncan Lake and Duncan Creek following project development is shown in the renderings below. The proposed dam at the north end of the lake would be 90 m, while those at the south ends would be 35 m and 10 m. A channel would be established post-closure to replace Duncan Creek.



“No Net Loss” of productive capacity could be achievable over a longer time frame if Duncan Lake can be successfully restored. The proponent predicts that this can be done:

> “It is anticipated that in the long-term, (similar to other projects in Appendix 4) the Duncan Impoundment will be rehabilitated to the point where it can support a fish population”.

The Reclamation Plan has the primary objective to achieve water quality similar to the pre-mining condition. Future development of aquatic habitat is conditional on water quality conditions and further studies:

> “If the first objective is met and studies support it, aquatic habitat would be created in this facility.” (note: facility = Duncan Tailings Impoundment)

Studies during operations would determine whether lake restoration is technically feasible:

> ‘‘Appropriate testwork and modeling will be completed to confirm the biogeochemical cycling of the water and biota in a post-closure lake will not be harmful to fish and fish habitat.”

Assuming that restoration is feasible, the proponent proposes to improve lake conditions by means of fertilization and plankton population introductions.

> "Concepts to make the lake habitable include re-development of a plankton population by introducing plankton and fertilizing the lake for several years. This is expected to help develop a sediment and organic layer that would provide habitat for benthic communities.”

While fertilization is a recognized and accepted aquatic management technique, plankton population introductions are untested. The size of the Tailings Reservoir will be around 269 ha, making any such scheme extremely ambitious. There would need to be a bulk source of plankton identified and transported to Duncan Lake. Range extensions of aquatic organisms including plankton are generally not permitted in BC and are subject to approval by a Federal-Provincial Fish Transfer Committee. There are no lakes in BC where plankton introductions on the scale proposed for the Tailings Reservoir have been successfully undertaken, and the practicality of this proposal is questionable.

Following the restoration of water quality, a new outlet stream would be constructed to re-connect the Tailings Reservoir to Attycelly Creek at a favorable grade that allows upstream and downstream fish migration. The Reclamation Plan doesn’t make any reference to fish stocking, or whether fish to be introduced or otherwise re-established in Duncan Lake following restoration would be safe for consumption. Target species and separate restoration strategies are required for rainbow trout, Dolly Varden and whitefish; none are provided in the Reclamation Plan.

The Reclamation Plan includes the re-creation of a lake over the tailings and waste rock in the Duncan Lake basin. The lake basin at mine closure would be formed by strategic placement of mine waste rock and tailings prior to closure. The stated goal is:

> "restore the productive capacity of Duncan Lake to pre-development levels."

Elsewhere in the EIA, the goal is stated somewhat differently:

> "Reclamation plans also aim to restore some or all of the productive capacity of Duncan Lake following mine closure."

Since the EIA reflects the Proponent's intentions, it is important to clarify whether the restoration goal is: a) some, or b) all of the productive capacity. If it is some of the productive capacity, the amount of productive capacity to be restored should be specified *a priori*.

The biggest weakness in the Reclamation Plan for the Tailings Reservoir is the lack of assurance that any restoration will be carried out. The evasive commitments are contingent on the outcomes of future studies and are presented in a manner that does not instill confidence that meaningful restoration of Duncan Lake will take place:

> "However, the potential for the proposed tailings facility to provide fish habitat will depend on further studies to be conducted during the operational phase and remains uncertain at this point."

Without a practical conceptual plan for restoration of the Duncan Lake ecosystem and a commitment for implementation, the long-term aquatic impacts from the proposed Kemess North project cannot be properly evaluated.

Tailings Disposal in Natural Water Bodies

Appendix 4 of the EIA presents a compendium of descriptive information regarding tailings disposal in Canada to inform the evaluation of the Kemess North proposal. There are six major conclusions in the report which are presented in the absence of supporting data and studies which actually evaluate tailings disposal effects and mitigation effectiveness. Responses to these conclusions are provided below:

Appendix 4 Conclusion	MiningWatch Reviewer Comments
1. Of all of the examples where tailings and waste rock have been deposited sub-aqueously in natural lakes, none are causing acid rock drainage, an impact that is recognized as the most serious environmental liability facing the mining industry in Canada.	Provided that waste rock remains saturated and run-off is controlled, this conclusion is correct.
2. The majority of natural lakes used for tailings disposal have been reclaimed to a usable fish habitat similar to that which existed prior to mining without the use of lake restoration techniques.	Highly misleading inference with minimal data and analyses provided to justify conclusion.
3. Most of the mining operations presented in this report would not have been economically viable operations if tailings disposal in natural water bodies or other mining related impacts of natural water bodies were not permitted.	Classic example of treating the environment as an “externality” in the cost:benefit analysis for a project. The true costs of environmental management must be factored into economic evaluations during pre-planning and feasibility analysis. If the project is not economically viable when the environmental costs are included, then it cannot be justified and should not proceed.
4. Projects similar to that proposed by Northgate Minerals Corporation to develop the Kemess North deposit utilizing Duncan Lake for tailings and waste rock disposal have been undertaken in Canada previously.	Without supporting data on the impacts at the other locations, this statement is meaningless and seeks to provide rationale for perpetuating mining environmental impacts.
5. Within the last decade, six mines within Canada have been approved to discharge mine waste to natural water bodies, or have been allowed to impact natural water bodies from mining operations.	Since 2001 an amendment to the Metal Mining Effluent Regulations is required before this can happen. These have been political decisions, not technical ones.
6. Fisheries compensation measures implemented at mine sites within Canada are reported to have been successful in replacing fish habitat lost by development of the mines.	Anecdotal information. Reported by who? No studies available to back-up this conclusion. A recent MiningWatch Report (“Protecting Fish/Protecting Mines”) concluded that fish habitat compensation activities have a mixed track record across Canada.

Conclusions

The main aquatic impact of the proposed Kemess North development results from the conversion of Duncan Lake into a Tailings Disposal Impoundment, and the elimination of outflow discharges. There are numerous tailings disposal options for the project, but the use of Duncan Lake is the preferred one for economic reasons. The proponent's justification for tailings disposal in Duncan Lake blurs the distinction between engineered tailings impoundments and lake ecosystems:

> "Industry-wide best available technology to manage potentially acid generating waste rock and tailings is to deposit it in a closed, saturated impoundment. Management plans for the proposed Kemess Mine Expansion therefore include the use of Duncan Lake for deposition of waste rock and tailings."

It is proposed that the elimination of the Duncan Lake ecosystem be mitigated by means of the fish habitat compensation plan, and the mine reclamation plan:

> "The loss of Duncan Lake would be a "major" aquatic habitat loss, and a rigorous program of compensation and mitigation is required. The fish habitat compensation and reclamation plans seek as much as possible to compensate for and restore fish and wildlife habitat, and to restore habitat that will be lost due to the development."

As discussed previously, the Fish Habitat Compensation Plan does not meet the No Net Loss criteria and the Post-Closure Restoration Plan for Duncan Lake is inadequate. If this proposal is approved, construction of the impoundment and disposal of acidic waste rock will destroy the Duncan Lake ecosystem.

The EIA acknowledges the need to design a project that is consistent with sustainable development, and to practice mining in a manner that protects the environment and maintains opportunities for future generations. The main conclusion of this review is that the project, as presently proposed, reduces the opportunities for future generations by eliminating the Duncan Lake ecosystem. To moderate the environmental impacts, it will be necessary to design an environmentally-friendly tailings disposal system that protects Duncan Lake and other aquatic habitats from adverse impacts.