REVIEW OF THE MIDWEST PROJECT ENVIRONMENTAL IMPACT STATEMENT AND COMPENSATION PLAN

Context

Areva Resources Canada Inc. has proposed to expand its current uranium mining and milling operations in northern Saskatchewan to include the proposed Midwest Mine, and has submitted an environmental impact statement to Fisheries and Oceans (DFO) for review. The project is subject to a Comprehensive Study under the Canadian Environmental Assessment Act (CEAA). DFO is a Responsible Authority (RA) for the project due to the requirement for authorization of the destruction of fish habitat under s. 35(2) of the Fisheries Act and the destruction of fish by means other than fishing under s. 32 of the Fisheries Act.

Habitat Management requested DFO Science review of the compensation plan for the Midwest Mine. In particular, they asked the following questions:

1. Have impacts of the project on fish and fish habitat been adequately assessed?
2. If impacts have not been adequately assessed, what procedures are required to enable an adequate assessment of impacts?
3. Is the fish habitat compensation plan and follow-up monitoring plan that has been provided adequate, and does it show that there will be no net loss in the productive capacity of fish habitat as a result of the project?
4. If the fish habitat compensation and follow-up monitoring plan that has been provided is inadequate, what changes are required to ensure that the plan is adequate, and that there will be no net loss of productive capacity after plan implementation?

Habitat Management (HM) provided Science with the Midwest Project Environmental Impact Statement (EIS) February 13, 2008 without the compensation plan. The proposed Compensation Plan (Areva 2007 Appendix III) for the Midwest Project was provided to reviewers on April 1, 2008 and the review was requested by May 2, 2008. Given the short timeline to prepare a response, and since DFO is not the final advisory body for this request (CEAA process), DFO Central and Arctic Science determined that a Special Science Response Process would be used.

Background

The Midwest project involves the development of a new open-pit uranium mine, which will require the permanent dewatering of a significant portion of the Mink Arm of South McMahon Lake. Major concerns as identified by DFO and the public include:

1. The permanent destruction of fish habitat resulting from the dewatering of the Mink Arm of South McMahon Lake.
2. Challenges in developing and implementing a fish habitat compensation plan that will result in no net loss of productive capacity.
3. The short-term and long-term impacts of radionuclides, metals, and other non-radionuclides on water and sediment quality, and aquatic biota.

Analysis and responses

1. Have impacts of the project on fish and fish habitat been adequately assessed?
2. If impacts have not been adequately assessed, what procedures are required to enable an adequate assessment of impacts?

There was uncertainty about whether or not the impact on fish and fish habitat had been adequately assessed. There was a suggestion that the major impacts have been assessed adequately aside from the possible issue of contamination of biota but that there were other issues where information was incomplete. Questions, comments or concerns with the impact assessment presented are as follows:

- During dewatering of Mink Arm, the proponents indicate that they will discharge water to South McMahon Lake at rates that increase the flow of Smith Creek to mean annual flood thresholds for 28-48 weeks or ten year flood thresholds for 14-24 weeks. This represents a large increase in the flows of Smith Creek for a longer duration than would be expected under "normal" flood conditions. No indication of the potential impact of these increased flows on fish or fish habitat is provided. There are similar concerns about the alteration of flows in Collins creek, but this system will be impacted less and has already been affected for several years.

- During dewatering of Mink Arm, the proponents indicate that they will remove fish and transfer them to South McMahon Lake. Although not directly stated, the implication is that this will limit direct fish mortalities resulting from dewatering. It is uncertain whether this will be the case. If fish productivity in South McMahon Lake is limited by habitat or food availability, the system may already be at carrying capacity and unable to assimilate additional fish. It is unclear from the EIS, how many fish currently live in Mink Arm, as compared with the rest of South McMahon Lake.

- In Appendix IV, the proponents indicate that pit dewatering could result in substantial drawdown of several local lakes, with potential impacts on fish habitat. Although impacts of this type were not observed at lakes near the JEB and Sue Pit sites, they indicate that, under the worst case scenario, pit dewatering could result in complete draining of Too Small Lake and substantial drawdown in other lakes. In this event, they propose to pump RO treated water into the lakes to replace water lost from pit dewatering. It is unclear what the impact of this proposed mitigation approach would be on the biology and fish populations of the affected lakes. Natural runoff and groundwater typically provide nutrients, etc. that sustain aquatic productivity. Replacement of groundwater by increased flushing of RO treated water may have unintended impacts. It is unclear what the impact of this proposed mitigation approach would be on the biology and fish populations of the affected lakes. Natural runoff and groundwater typically provide nutrients, etc. that sustain aquatic productivity. Replacement of groundwater by increased flushing of RO treated water may have unintended impacts.

- How might pit dewatering activities and proposed mitigation measures affect stream habitat in the region?

- More information on current chemical conditions in the Sink Reservoir and Vulture Lake is needed:

- Only a few selected parameters for surface water are plotted in Figures 3.4.6. What are the values at depth? This is especially important for parameters such as ammonia, which typically increase in deep waters. Note that water outflows from Sink Reservoir and Vulture Lake are via deep-water pipes (Figure 3.5-4) and conditions in these waters may have effects on downstream water bodies.

- Several important water chemistry parameters are not provided for Sink Reservoir and Vulture Lake. For example, are low oxygen conditions ever observed in either lake? What are pH values in the lakes? In Appendix V, a pH of 7.5 is assumed in estimations of ammonia toxicity. What are the observed pHs and what is their impact on ammonia toxicity? How have changes in SO_4 affected pHs in Sink Reservoir and Vulture Lake?

- While it is recognized there is a need to limit details of water quality modelling to increase readability of the EIS, it was unclear which parameters were manipulated in the model employed. For example, were changes in flushing times with associated impacts on particle settling rates incorporated? The flushing times of Sink Reservoir and Vulture Lake were not presented (unless inadvertently missed), making it difficult to assess whether changes in this factor may even be important. Confidence in the model was not enhanced by the need to artificially manipulate parameters (suspended solid concentrations) to generate realistic results. One can often generate realistic looking results with post-hoc manipulations of model inputs, but this does not ensure meaningful predictions into the future. On the positive side, the models appear to have generated overly negative predictions in previous runs, so hopefully the predicted impacts are conservative.

- Several reviewers indicated that they did not consider the suitability of the EIS assessment of impacts to stream habitat from road crossings but this should be reviewed by someone with this expertise. The approach to assessing productive capacity of the stream reaches in the document was questioned. It is obvious that there is the possibility of fish movement between water bodies using many of the streams (particularly at high flow periods). The current assessment is based on presence/absence of fish species during times other than maximum flow of theses streams. Because individuals of a variety of species have been caught in many streams, any individual with experience evaluating exchange/movement of species in these steams would insist on ensuring that any species exchange/nursery habitat/refuge areas are maintained by structures used for stream crossings. Although there have been great advances in classifying fish habitat types, this is a static approach to a dynamic situation.

- Information is available on what species occur in the stream segments that will be impacted by culvert placement. However, information on fish species communities in adjacent lakes is needed to evaluate whether there could be potential impacts on the stream species. This information may already be available. Procedures that the company uses to place the culverts will be very important to minimize impacts on any fish species in the streams or any movement of fishes during high water periods in the streams.

- Complete water chemistry for water bodies of concern should be included, with data on metals (and metalloids) including selenium and molybdenum concentrations.

- There was some concern expressed about potential impacts of the waste stockpile on Shallow Lake and Pig Lake.

- The similarity in phytoplankton taxa among the lakes is good news given it suggests that nutrient & other growth conditions are similar. However, such similarity is also surprising given that South McMahon Lake and Mink Arm are much deeper than John Pond.

- Is the greater algal biomass seen in Too Small Lake simply a volumetric dilution issue compared to the other deeper systems, i.e., is biomass per unit of lake surface similar between South McMahon Lake and Too Small Lake? The greater algal biomass in Too Small Lake is likely unrelated to increased water temperatures in the shallower system because of the similarity in surface temperatures seen in the lakes during the April and September 2003 surveys (Table 2.6). Differences in average light intensity are also unlikely to be a factor because Secchi depths in Too Small Lake (1.2 m) are the lowest of the four surveyed lakes (1.2 - 3 m).

- Note that the greater zoobenthic density and biomass in Too Small Lake versus South McMahon Lake is likely due to differences in both growth conditions (habitat) or predation pressure (lower in Too Small Lake due to few fish present). In terms of habitat, the % of littoral area is greater in Too Small Lake (Fig. 2.1).

- Information is missing on current contaminant loads in the aquatic biota. These biota are sometimes relied upon for subsistence fishing, and the mining activities will generate both waste water and waste rock piles. Hence, where is the assurance that biota will be safe for consumption by both humans and wildlife?

- The proponent describes fish species composition in the lakes and streams based on relatively comprehensive fish surveys.

- Information on fish in the effected area is absent with respect to fish growth rates and condition.

- The population of nine-spine stickleback in Too Small Lake should be evaluated in detail. A non-lethal fish survey approach, such as that employed in the Environmental Effects Monitoring Program for Metal Mining, could provide this information.

- Information on fish habitat use according to fish species, life stage and time of year have not been provided.

- It is unclear that the winter oxygen data that have been provided in the document are entirely robust as descriptors of overwintering oxygen conditions for biota in the various lakes as a whole. A first example involves the low values of oxygen reported for South McMahon Lake (Appendix III section 2.5.1, page 9) were a surprise, and they probably do not characterize the majority of South McMahon Lake. Based on a GoogleEarth image, South McMahon Lake is much larger than Mink Arm, and likely as least as deep and should therefore probably have as much or more oxygen remaining at the end of winter. This means that some of the comments about overwintering habitat are of uncertain value.

  A second example is the absence of data to support the contention that Lake C1 supports northern pike and white sucker despite Lake C1 having winter oxygen values of

0.5 mg/L (Appendix III section 5.2, page 18). It is difficult to believe that these fish were able to live in conditions of such low oxygen.

It is surprising that there are fishes with relatively high dissolved oxygen requirements present in South McMahon Lake. The maximum depth in the main basin of the lake, as indicated in this document (4 m, table 2.6) is likely too shallow to support the species that occur in this lake, especially given the low oxygen values for South McMahon at the end of winter. There are too many fish species in the fish species list for this lake that require relatively high oxygen values to believe that there are not problems with the sampling in the main basin of South McMahon Lake. The conclusion has to be that the survey methods employed to characterize the water chemistry of the study lakes are flawed.

- Another explanation is that all the individuals of fish species requiring relatively oxygen concentration migrate to the deeper Mink Arm area but then the implication of lessening this area would mean the loss of productive capacity of the entire lake, not just the area being separated by the dam. If addition morphometric data are available for South McMahon Lake, it would be possible to make a realistic assessment of potential for loss of productive capacity by loss of the additional area of Mink Arm.

- More morphometric information about the lake (bathymetric map) is needed. This may show deeper areas in the lake than indicated in this document. However, if this is not the case, then the loss of productive capacity for this lake by limiting "over-wintering habitat" will be catastrophic. If there are substantial areas of the lake that are deeper than indicated in the table in the document, then the loss of productive capacity by damning a further small section of the lake will likely be minimal.

- Although it is unclear whether fish populations (and other biota) resident in the remainder of South McMahon Lake rely upon the Mink Arm bay of the lake, it has been effectively isolated for some time (Appendix III page 1). As a result this point may be moot.

- Aquatic and wetland vegetation are largely excluded from the discussion of aquatic resources (Appendix III section 2) though stakeholders consulted identify pondweeds (macrophytes) as a valued ecosystem component (EIS, page 4-46). There are subjective measures of vegetation abundance provided in Table 3.1 (sparse and moderate), but there are no quantitative benchmarks for these assessments of abundance, which means that they have little value. Additionally, it is entirely unclear what is meant by algal growth in the aquatic / wetland vegetation category of Table 3.1.

- An important metric for understanding watershed-level impacts is the rate of water renewal. This information is unavailable for the lake systems in Appendix III, and causes one to guess about what is likely to occur (see also later comments about lake closure). Though this hydrological characterization may be outside the scope of the study, this deficiency should be acknowledged.

3. Is the fish habitat compensation plan and follow-up monitoring plan that has been provided adequate, and does it show that there will be no net loss in the productive capacity of fish habitat as a result of the project?

4. If the fish habitat compensation and follow-up monitoring plan that has been provided is inadequate, what changes are required to ensure that the plan is adequate, and that there will be no net loss of productive capacity after plan implementation?

Several reviewers suggested that in general, the compensation plan lays out the framework for an approach that appears to be feasible however it fails to provide sufficient data to fully quantify losses in productive capacity that may result from the project. In general, reviewers felt that insufficient information is provided to fully evaluate the proposed monitoring plan. Further details are as follows:

Compensation

- It is impossible to fully assess whether the proposed compensation plan is adequate and whether it shows no net loss of productive capacity. This is because: 1) the loss of productive capacity from the dewatering of Mink Arm and possible filling of John Pond cannot be adequately quantified, and 2) the gain in productive capacity resulting from the proposed compensation plan is also unknown. The proposed plan only makes sense as a research project to explore possible mitigation options.

- The proponents use the approach of Minns *et al*. (1995) to estimate losses of productive capacity. It must be recognized that this is a far from exact method, although better alternatives may not exist. The application of the HSI to newly-created habitats seems especially uncertain. In addition, it is unclear how much of the productive capacity of Mink Arm may be derived from its connection to the rest of South McMahon Lake. For example, while it may offer limited spawning or over wintering habitat, Mink Arm may provide important support for the successful completion of another part of the life cycle of resident fish.

- New lakes have been created in many temperate locations (e.g. the quarry lakes at the Ft. Whyte Center in Winnipeg). A review of existing literature on the success of these new lakes as fish habitat might provide an indication of the likely success of the Too Small Lake proposal and provide an indication of the potential value of any research undertaken in support of the project. The research aspects of this project should only be undertaken if important new information can be derived.

- The primary compensation measure in the current plan is to deepen Too Small Lake and introduce large fish species. Although there may be additional habitat created in Too Small Lake by changing its bathymetry, there will likely no be much net increase in productive capacity of the lake. This certainly will not compensate for loss of productive capacity from Mink Arm and John Pond. It appears there is little fish productive capacity in John Pond. Any loss of productive capacity in this small water body might be compensated by improved spawning habitat in another nearby water body where obvious spawning habitat for either northern pike or white sucker may be lacking (indicated by poor catches of either species). Disturbing the basin of Too Small Lake may decrease rather than increasing its productive capacity.

- Enhancement of fish habitat in a lake that already supports a diverse fish community, or enhance spawning/nursery areas in a wet land adjacent to a lake or that separates a lake is preferable. There is concern with the present compensation plan in that modifying Too Small Lake might only result in temporary increased productive capacity, or it might decrease if the forage base is decimated by introduction of northern pike. At

DFO's Experimental Lakes Area, northern pike have been introduced to a small lake with a large forage base, and they did extirpate the forage base completely. In the process, individual northern pike grew extensively to a mass that could not be sustained after the forage base was extirpated. They starved and survival decreased. Productive capacity actually decreased by the introduction of the novel species.

- The proposed monitoring plan for Too Small Lake is insufficient, if it is to be regarded as a research project "… to gain better understanding of the relationships between fish habitat and productive capacity in northern aquatic systems…". If this is one of the stated goals, longer term, more frequent sampling of fish populations and of factors affecting fish production would be required. Should the project fail to work as hoped, it is important to understand why, so that future proposals can gain from this knowledge. This can only be achieved with more detailed monitoring.

- Possibly of most concern in the expanded Too Small Lake is the absence of suitable stream or riverine spawning habitat for suckers (and northern pike?). Moreover, it is unclear from the lake section of the compensation plan how it can be concluded that the plan will improve the connectivity to Collins Creek (Section 7, page 25). Related to this is the earlier assertion that the lake systems are essentially closed (p. 5).

- Has the winter oxygen demand been estimated for the expanded section of Too Small Lake? Although deeper than Too Small Lake, it will also be affected by the 'excess' oxygen demand of Too Small Lake, which in part is driven by the higher algal and zoobenthic biomass seen there.

- Why not also introduce the long nose sucker (also available in South McMahon Lake), which may be displaying greater tolerance of low oxygen?

- Does the breeding biology of the white sucker (or longnose sucker) require access to streams in the spring? If so, how will this access be achieved in the expansion of Too Small Lake? The indistinctness and shallowness suggest that the stream (N1 and S1 are the 'outlet' of Too Small Lake) would not be suitable as spawning habitat for suckers? There is the following description of the surveyed reach (Fig 18 and from Table 2 of the stream section of Appendix III): "A large open bog with subsurface flow dispersed through terrestrial vegetation. Terrestrial vegetation consists mainly of mosses and lichen with scattered coniferous trees. Drainage course is a low-lying linear bog representing the natural drainage pattern for the immediate landscape." From the centreline: "The proposed crossing is situated within a long, linear bog connecting two lakes. No defined channel was observed at the centreline. Flow between the two lakes occurs overland (mosses/lichens). Fluvial bed material was not present at the centreline. Fish passage between the two lakes is unlikely because of the absence of a defined channel."

- Large woody debris is a habitat characteristic to consider including in the expansion of Too Small Lake for improving the habitat suitability for northern pike.

- Note that sometimes the proponent compares the expansion of Too Small Lake with South McMahon Lake (e.g. the comparison of zoobenthic densities on page 8 & 9). The comparison should probably be with Mink Arm rather than South McMahon Lake given that it is Mink Arm that is to be destroyed as habitat. The revised comparison does not yield as dramatic an improvement in zoobenthic densities and biomass, though the directions are similar.

- This proposal raises many questions, to which there are probably no answers: Can the creation of new habitat for pike and suckers compensate for potential losses of burbot, whitefish, etc.? Are some fish species more valuable than others to local communities? Could the new fish populations in Too Small Lake ever be considered a resource for local communities (it is doubtful)? What is the expected carrying capacity of the new Too Small Lake? Does the expected capacity of the new lake justify the expense of its creation?

- Note also that there is a trade off of terrestrial for aquatic habitat in the compensation plan. Though there is no discussion of this in the plan, it is probably a discussion for EC and DFO to have.

Monitoring

- Insufficient information is provided to fully evaluate the proposed monitoring plan. In the development of any monitoring program, it is essential to evaluate existing spatial and temporal variation relative to expected effects and to provide a rationale for the proposed sampling frequency, timing, site locations, and site replication. Estimates of expected precision should be provided. None of this information is available in the EIS for either the McLean Lake or Midwest operations and, without it, the potential effectiveness of the program cannot be assessed.

- The sampling strategies (biota, methods & frequencies) during the monitoring period to assess the effectiveness of the compensation plan are generally insufficient to analyse the adequacy of the follow-up monitoring. For example, what is meant by assessment of fish populations during the monitoring phase? Will non-lethal sampling be done as with a trapnet, or will lethal sampling be done with a gill net where the observer imposes an additional source of mortality on the population? If the latter, can it be assured that the unnatural mortality will not impair the compensation plan? Similarly, will the pike added to expanded Too Small Lake also be tagged in order to better understand their population dynamics with repeated sampling?

- Why is only surface water proposed to be sampled? Some of the potential effects of the mine operations may manifest themselves in deeper water, with potential impacts on fish.

- Information is needed to understand how the rate of water renewal will be changed in Too Small Lake? Is sedimentation likely to overwhelm the oxygen supply? Is there information to understand how long will it take for resuspension of bottom and shoreline materials to subside following the construction phase?

- It appears that no sampling of lakes potentially affected by drawdown (except South McMahon Lake) is proposed. As note above, there are concerns that drawdown and possible mitigation measures may affect water quality. These effects can only be determined with a pre-development characterization of the lakes followed by more intensive follow-up should drawdown be detected.

- Effects on Smith Creek fish habitat should be monitored.

- Shouldn't stream crossings be monitored for potential impacts along the haulage road? Culvert installations and road maintenance should be watched carefully to limit impacts.

- Water chemistry must be interpreted in the context of hydrology, especially in streams. It is unclear that this will be done.

- How will sampling locations in Henday Lake and South McMahon Lake be chosen? How frequently will samples be collected? Far more information is required.

- Assessing regional variation in the biota of interest should be considered in the follow-up monitoring plan to better understand the effectiveness of the compensation. There is no sampling of reference systems proposed to provide insight into regional fluctuations that might influence the sustainability of the productivity enhancements made in the expansion of Too Small Lake. Might sampling of Lake C1 be used as a reference lake for evaluating the success of the introductions to Too Small Lake?

- Details on the follow-up monitoring need to be expanded. Would it be appropriate to validate the predictions about habitat suitability in Tables 5.4? Should other parameters be measured during monitoring of the effectiveness of the compensation plan? For example, nutrients, algae, stability of created habitat, such as the lake bottom. Currently only overwintering habitat appears to be monitored. What about spawning, juvenile rearing ... (see text p. 11)?

- Younger age classes (also marked but batch marked) could be added in order to accelerate knowledge of successful use of habitat by other age classes.

- Delaying the introduction of northern pike given that it should allow for the separation of effects of habitat and predation on the success of the sucker introduction.

Conclusions

The proponents effectively acknowledge the destruction of fish habitat and populations as a result of the dewatering of Mink Arm and the possible infilling of John Lake. Major impacts may have been adequately assessed, however, there are areas where the assessment lacked detail including the possible issue of contamination of biota. Although the compensation plan lays out the framework for an approach that appears to be feasible, it fails to provide sufficient data to fully quantify losses in productive capacity that may result from the project. Insufficient information is provided to fully evaluate the proposed monitoring plan.

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Sources of information

AREVA Resources Canada Inc. 2007. August 2007 – Version 1 MIDWEST PROJECT Environmental Impact Statement

Minns, C.K., J.D. Meisner, J.E. Moore, L.A. Greig, and R.G. Randall. 1995. Defensible Method for Pre- and Post-Development Assessment of Fish Habitat in the Great Lakes I. A Prototype for Headlands and Offshore Structures. Department of Fisheries and Oceans, Great Lakes Laboratory for Fisheries and Aquatic Sciences, Burlington, ON. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2328.

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