SCIENCE REVIEW OF THE TAZI TWÉ HYDROELECTRIC PROJECT ENVIRONMENTAL IMPACT STATEMENT

Context

The proposed Tazi Twé Hydroelectric Project, located in northern Saskatchewan, is subject to a federal environmental assessment under the *Canadian Environmental Assessment Act* (2012). On March 1, 2013, the Canadian Environmental Assessment Agency (CEAA) commenced the Project's environmental assessment. The Proponents, Black Lake First Nation and Saskatchewan Power Corporation, submitted the Tazi Twé Hydroelectric Project's Environmental Impact Statement (EIS) to CEAA on February 21, 2014. Fisheries and Oceans Canada (DFO) is a federal authority for the review of this project and must comment on the potential for the Project, as proposed, to result in significant adverse environmental effects.

DFO's Fisheries Protection Program (FPP) requested advice from DFO Science on whether the baseline information in the EIS is adequate to support the Proponents' conclusions about the Project. They requested that Science focus on the section of the Fond du Lac River to be impacted by the Project. They asked if the Proponents' conclusions regarding potential impacts to resident Arctic Grayling population(s) due to flow reductions in the Fond du Lac River are supported. Science was also asked to identify deficiencies and approaches to address areas of deficiency in the EIS. The request was submitted to Science on September 12, 2014 with a response required by October 2, 2014.

This Science Response results from the Science Response Process of September 2014 to provide a Science review of the Tazi Twé Hydroelectric Project's Environmental Impact Statement (EIS).

Background

The proposed Tazi Twé Hydroelectric Project (Appendix 1) is located 7 km from the community of Black Lake, within the Chicken Indian Reserve No. 224 in Saskatchewan. The Black Lake First Nation has exclusive use and benefit from the Chicken Indian Reserve No. 224 although the area surrounding the reserve is provincial crown land and accessible to all aboriginal people. The energy produced by the Project will be integrated into the Saskatchewan Power Corporation (SaskPower) northern electrical grid.

The proposed Project will be a 50 megawatt water diversion-type electrical generating station. The Project is located adjacent to the Fond du Lac River between Black Lake and Middle Lake. Water from Black Lake will be diverted through a water intake structure and power tunnel to the powerhouse before being released through a tailrace channel into the Fond du Lac River, which ultimately discharges into Middle Lake (Appendix 1). Water flow in the Fond du Lac River between Black Lake and the tail race channel will be reduced year-round as a result of the diversion.

Analysis and Response

The EIS summarizes projected changes from baseline conditions for various components of the environment. There was insufficient time to review the EIS fully. No attempt was made to evaluate entrainment predictions. DFO Science comments on the EIS report are as follows:

Fish in the Fond du Lac River

Fish species captured in Black Lake, the Fond du Lac River and Middle Lake (EIS Tables 3.6-1 to 3.6-3 p. 63-64[1]) are listed along with the total number of each species captured. However, there is no mention of the fishing effort associated with these numbers. Without this, it is unclear how they provide a substantive measure of relative species abundance. Details of the life-stages of the fishes captured are also lacking. Detailed fish community information and habitat usage within the Fond du Lac River over the full year is lacking in the report.

The EIS focuses on Arctic Grayling in the Fond du Lac River, however, a more complete evaluation of other species within the bypassed section of the Fond du Lac River would provide a more complete baseline for future comparisons.

The document states that there are three Arctic Grayling populations in the 6.1 km stretch of the Fond du Lac River (p. 163 EIS Table 7.2-1) but there is no documentation provided to support this statement beyond speculation on possible barriers to movement. It is important to understand how the populations are distinguished from each other. Genetic analysis of Arctic Grayling in the river should be provided to support this hypothesis.

Fish Production

It has been widely demonstrated in the literature that the morphoedaphic index (MEI) that links total dissolved solids (TDS)/depth to annual fish production may be biased and more appropriate analytical approaches should be used (Jackson et al. 1990).

Fish Habitat

The Proponents indicate (p. 388 section 12.4.2) that “it is anticipated that changes to hydrology within the bypassed section of the Fond du Lac River will have implications for the foraging habitats available to fish, as well as the sources and types of foods consumed.” They go on to indicate that “reduced flow velocities within many areas of the Fond du Lac River will result in a net increase in suitable (i.e., easily used) foraging habitat”. The validity of this hypothesis is uncertain. Detailed monitoring of foraging behaviour and invertebrate availability prior to and during operations of the Project is needed to evaluate it. Data presented in the EIS is insufficient as a baseline to test this hypothesis.

Throughout the EIS (e.g., see p. 62) it states that the Elizabeth Falls and two additional waterfall-type habitats may represent a barrier to upstream fish passage barrier within the Fond du Lac River. Information on the distance over which the 13.7 m elevation change occurs for Elizabeth Falls (from Annex III Table 3.3-1) should be provided as well as the location of the other two areas identified as potential barriers. Two (out of the 29) radio-tagged Arctic Grayling moved downstream over Elizabeth Falls (Annex III Appendix III.12) and although none of the tagged fish were detected to have passed in an upstream direction over Elizabeth Falls, it is speculative to state that the falls are impassable without more evidence. Have flood events occurred that would allow upstream passage? How will passage be affected under the various flow options proposed during the Project operations?

The EIS (p. 103 Annex III section 6.2.3.2.1) indicates that “the Fond du Lac River is known to contain important spawning habitat for Arctic Grayling and other fish species, including White Sucker and Longnose Sucker”. The Proponents indicate that spawning areas are generally located in shallow sections of the river, often near the shorelines, and therefore may be affected by reduced water levels in the Fond du Lac River. The Proponents also suggest that the “quantity of suitable overwintering habitat available to Arctic Grayling in the bypassed section of the Fond du Lac River during Project operation is expected to be greater than that available

[1] Page numbers refer to Adobe page numbers in the report. Unless specified the pages are from the EIS.

under historically normal flow conditions (i.e., without the Project in place)" (p. 705 section 17.5.1.1). Maps showing the distribution of the Arctic Grayling (and other species) spawning habitats and the connectivity of the Fond du Lac River at the low flows of 40-70 m^3/s are needed to evaluate the Proponents' statement about habitat availability.

There are a number of assumptions incorporated into the Proponents' analysis, particularly in relation to Project effects on benthos and primary productivity (which Proponents discount as negligible and not requiring offsetting). The weir could reduce the input of primary and secondary productivity into the system, and the reduced flow could affect the forage base available for Arctic Grayling and other fishes. This assumption adds uncertainty to their conclusions.

Engineering Structures

At the water intake site (p. 82 section 4.2.1), the Proponents plan to fit the water intake opening with an "exclusion bar rack" to reduce the potential for fish entrainment by presenting a visual barrier, however, no further description and/or evaluation of the effectiveness of these bar racks are provided. The bar rack spacing (clear openings 70-150 mm) will allow most fish in the lake and river system to pass. 3D hydrodynamic analysis is still needed to support the Proponents' suggested bar spacing and trash rack model dimensions and also the optimal bar shape.

A 3D modelling exercise at the intake itself is still needed to assess the potential for fish entrainment or mortality.

The Proponents do not indicate that screens are to be used at the bar racks although they acknowledge the need for screens at water pumps that will be used during the construction phase (p. 376). "Pump intakes will be screened to prevent entrainment of fish in accordance with the "Freshwater Intake End-of-Pipe Fish Screen Guideline" (DFO 1995)." The Proponents argue (Attachment D - p.154) that "In northern climates, operation in winter of fine screens also becomes a concern, as any frazil ice will adhere to the screen surface and quickly plug the screen and intake." However, the probability of frazil ice formation at the water intake that is situated at depth is less likely than in the open water of the Fond du Lac River. Furthermore, screens are regularly installed in other jurisdiction in northern climates (e.g., Norway, see Gebre et al. 2013). Installation of screens at the water intake would reduce risk of entrainment and turbine mortalities.

The Proponents also indicate (p. 82 section 4.2.1) "the shallow water intake is expected to reduce the entrainment of deep-water species such as Lake Trout (*Salvelinus namaycush*) and cisco (*Coregonus sp.*)." The shallow intake option (surface to 5 m depth) may still entrain a variety of species including deep-water species, which may be found at these depths seasonally. How the shallow depth option would impact the probability of entrainment of fishes using the surface to 5 m water depths is not presented.

Important hydraulic studies or modelling exercises to support the conclusions, pertaining in particular to fish and fish habitat in Fond du Lac River, were completely missing from the study. Hydraulic and modelling studies should be performed for the engineering structures suggested in this study. The proposed flow reduction (nearly 50% of the natural flow) will substantially change the natural flow regime at the proposed engineering structures and consequently in the Fond du Lac River. Therefore, highly accurate hydraulic analyses are still needed to resolve the changes in flow regime adequately to support the conclusions drawn in this study. 3D modelling exercises to resolve the flow regime in the intake, in the vicinity of the submerged weir (upstream and downstream), and near the proposed trashrack are still needed. The element of ice dynamics should be also included in the analysis. Impacts of these studies on fish and fish habitat in Fond du Lac River should be also provided. Failure to do so, or missing such information, will result in unjustified/inadequate/incomplete conclusions drawn for the fish and fish habitat analysis or impacts particularly in the Fond du Lac River.

Appendix 10.1, Figure 4 doesn't clearly show the proposed type of weir. A better description or more detailed drawings is needed.

Discussion of turbine mortality (p. 84) is highly speculative, and modelling of turbine mortality and its impact on fisheries productivity was not attempted.

Hydrology

The EIS provides an overview of the hydrology and hydraulics of the study area. Evaluation of impacts within the Local Study Area would have been easier if it had been delineated by watershed boundaries.

Water level measurements (p. 23 Annex III) were collected from early June to late October 2010. Adequate baseline data should have been collected over a full year and included winter and open water measurements.

More detailed information should be provided in the EIS to allow evaluation of some of the Proponents' conclusions. The following are examples where more details should have been included.

- Details on the correlation analysis with Waterfound River flows are lacking for years where data from the Fond du Lac River were missing (p. 25 Annex III section 3.2.2.2).
- The maximum observed discharge flow for Black Lake is 775 m^3/s (p. 27 Annex III section 3.2.2.3.1) with higher flows determined from regression analysis. The logarithmic equation and extrapolated data should be plotted to support the Proponents' results.
- More details including producing graphs, particularly for the developed rating curve, should be included to support the Proponents' results.
- More cross sections (Figure 3.3-1) should have been included between km0 and km1 and between km3 and km4 (in the vicinity of 14R4) to capture the meandering nature of the river in these areas. This affects the accuracy or the results of the impacts analysis.
- It is not clear how the estimated stage-discharge relationship was developed (Annex III section 3.3.3.2). More details are needed and should be supported with graphs.
- Additional information about the assessment of riparian flows is needed.
- It is unclear how climate change has been considered in the Project design.
- More information is needed to understand the data tables in the section on changes to hydrology during routine operations (p. 277 Tables 10.5-1 to 10.5-3).
- The mesh grid (Appendix 10.2 section 2.2.2) should be displayed on a map. The refined bed file should be displayed on a map showing the measured nodes, specified exterior boundary condition, and identified breaklines (if any). The bed topography or mesh generated for each segment do not appear to be displayed in the report. To be able to review the analysis, these should be provided or displayed on maps for each segment.
- Computational time was a criteria considered in defining the domain boundary (Appendix 10.2 section 2.2.1) suggesting that the boundary domain was reduced to reduce computational effort. Computational time should not dictate the boundary of the

domain. For the sake of accurate output, the degree of details or accuracy required should be the dictating factors even at the expense of longer computational effort.

- The quality index (QI) values (Appendix 10.2 section 2.2.2) calculated for the mesh systems are needed to evaluate the accuracy of the modelling exercise and should be reported.
- The percentage comparison of the Middle Lake Outflow (p. 280 section 10.5.1.3) where a reduction of flow in the Middle Lake Outflow of more than 10% is predicted to occur less than 3% of the time should also have been provided for the bypass channel.
- The open water stage-discharge curve for Middle Lake (Appendix 9.2, section 2.6 Figure 5) would benefit from including the estimated winter curve. The data used to derive the curve and the resulting equation should be reported.
- A column in the table reporting predicted discharge rates in the Fond du Lac River (Appendix 9.2 section 4.2 Table 2) with flow changes expressed as a percentage should be included.
- The EIS indicates "Flow velocities at the submerged weir will not exceed swimming thresholds of fish species identified as VCs" (p. 364 section 12.4). However, information on the velocities and how they were calculated are missing from the report. This information is needed to support the conclusions.

Given the relatively small scale of the proposed project, the 1:100 year return period presented in the EIS is reasonable.

Temperature impacts will be particularly important to the bypass section of the Fond du Lac River. Changes to water temperatures, especially during the spawning season, could impact Arctic Grayling spawning success. Monitoring should be in place along the length of the River and a mitigation plan should be developed to address negative impacts related to temperature.

An evaluation of the ramping rate (Appendix 10.3) during riparian flows (40 and 70 m^3/s) should be conducted. It would be helpful to illustrate the risk of stranding on maps that show the decrease in habitat area with ramping rather than expressing the changes in water depth (e.g., 5 cm/h).

The EIS indicates (p. 413 section 12.5.3) "Reaches 3 through 21 are located downstream of the proposed submerged weir at Grayling Island and upstream of the proposed tailrace channel outlet location in Reach 22. The submerged weir is expected to maintain historically normal water levels in Black Lake and Reach 2 of the Fond du Lac River; riparian flows and water levels are expected to return to relatively normal levels below the tailrace channel outlet in Reach 22. Therefore, Reaches 2 and 22 were classified as secondary interactions (p. 386 section 12.4.2) and Reaches 3 through 21 are discussed as primary interactions for effects on fish and fish habitat." Although water levels may be normal below the tailrace channel, there may be significant changes to the flow pattern and resulting fish habitat in this area during Project operations. This area should be monitored to evaluate changes.

The suggested winter flow of 40 m3/s is far below what an Instream Flow Methodology would recommend as a sustainable instream flow requirement or ecosystem base flow. No maps are provided that illustrate the availability, distribution and connectivity of spawning habitat for Arctic Grayling at flows between of 40-70 m3/s. Furthermore, there is no evidence that the suggested 70 m3/s is enough flow to trigger a spawning migration for Arctic Grayling.

The report mentions, in several places, the use of a 70 m^3/s spawning initiation flow on May 1 that would help trigger spawning by spring-spawning fishes (primarily Arctic Grayling).

Apparently the natural rise in flows during a typical spring may be muted during a dryer than normal spring or after a winter with reduced accumulations of snow, and this artificial rise in flow from 40 m^3/s to 70 m^3/s will provide an environmental cue to trigger spawning. However, this flow which is an important component of the offsetting plan was not modelled or discussed in conjunction to the other flows that were modelled for their impact upon spawning habitat (i.e., 112, 210, 302, 320, 400, and 510 m^3/s).

While the modelling of different flows for overwintering and spawning habitat in the Fond du Lac River was provided in Appendix 12.1, the report would have benefited from some additional high-level flow statistics. In particular, a clearer description of the relationship between Figure 10.5-2 on p. 10-19 and the results of spawning flow modelling in Appendix 12.1 would have been helpful. Perhaps additional charts or a table could link these sections of the report for a clearer understanding of the differences in spawning and overwintering flows between existing conditions and operational conditions.

A DFO science peer review on ecological flows was held and recommended the following (DFO 2013):

- The probability of degradation to ecosystems sustaining fisheries increases with increasing alteration to the natural flow conditions. Thus, the assessment of alterations to the flow regime should be considered in a cumulative sense, and not only on a project-by-project basis.
- Cumulative flow alterations <10% in amplitude of the actual (instantaneous) flow in the river relative to a “natural flow regime” have a low probability of detectable impacts to ecosystems that support commercial, recreational or Aboriginal fisheries. Such projects can be assessed with “desktop” methodologies.
- Cumulative flow alterations that result in instantaneous flows < 30% of the mean annual discharge (MAD) have a heightened risk of impacts to fisheries.

The changes proposed in the diversion reach of the Fond du Lac River greatly exceed <30% mean annual flow.

River2D modelling

River2D modelling should have included the spring spawning riparian flow (70 m^3/s). This flow should be included in the analyses and modelling exercise as the Proponents have drawn important conclusions based on it. As the bypass section of the Fond du Lac River, between Black Lake and Middle Lake is 6.1 km and the total elevation change is approximately 36 m, the slope is steep. Was the 2D modelling done for a super or sub-critical case?

Hydraulic analysis supported by 2D modelling was not done for the tailrace channel. Such information is needed to adequately study the impacts on fish and fish habitat. A table with velocities simulated in the tailrace for different flows should be presented with the expected frequency to evaluate if the tailrace can be accessible for fishes and are not below the prolonged swimming speeds of fishes (Appendix 12.2 section 2.1.7).

There was no hydrodynamic or habitat analysis provided for the diverted power tunnel.

For model calibration (Appendix 10.2 section 2.3) the percentage of error is important and should be added as a column to Table 2. Merging Segments 1 and 2 into a single model is likely to improve calibration results and modelling of the two merged segments should be provided for completeness and accuracy. It is unclear why numerical roughness for the modelling was not classified on actual bed roughness or composition measurements. Calibrated velocities are not, but should be, displayed with the percentage of error or alternatively accuracy attained. This information is needed to complete the assessment and support the conclusions drawn in this study.

The EIS indicates that “the calibrated River2D model was further validated using water edges and velocities measured during field surveys” (Appendix 10.2 section 2.4) although the water edges validation is not presented. High water marks should also have been used for model validation.

The comparison of simulated velocities and measured velocities is not provided and is needed to assess the quality of the velocity modelling.

It would be helpful to display coloured contour maps of model results and, to facilitate comparisons, results could have been displayed per flow rather than segment (i.e., display 30 m^3/s flows for segments 1, 2, and 3, then display for 40 m^3/s flows for segments 1, 2, 3, etc.).

A 2D model should be used to design several structures and address specific concerns, such as the water intake, a submerged weir, the tailrace channel, riverbank erosion protection, dry-out areas on the bypassed reach and the impact of the project on fish habitats. However, 3D analysis is required for resolving flow accurately for the intake and the submerged weir structures.

The 2D hydrodynamic and habitat modelling analysis and output were not sufficient to support the Proponents’ conclusions particularly with regard to fish and fish habitat in the Fond du Lac River. A large part of the necessary habitat analysis is missing. The complete analysis of the Weighted Usable Area (WUA) for different fish species for different life stages should be included. The total wetted areas along with distribution of depth suitabilities analysis provided are not adequate to support the conclusions. The substrate and bathymetric baseline information are also missing in the Fond du Lac River. Such baseline information is needed for accurate 2D habitat modelling and habitat assessment.

Habitat Suitability

Maps for depth, velocity, substrate, and their combined suitabilities for each species for different life stages must be provided to support the conclusions. Optimal flow requirements for each species based on WUA calculations per different life stages (flow (Q)-WUA graphs) should be provided to support the conclusions. Maps for WUA for different species are also required. The habitat suitability index assessment (Appendix 12.1) is not sufficient to support the conclusions.

Many of the HSI predictions result in a gain in fish habitat due to reduced velocities being preferred by fishes. The habitat preferences were modelled using average depths and average velocities by reach. This method ignores microhabitat available to fishes in existing conditions. Many larger, high gradient systems are not really suitable for using an HSI, as many would predict few, if any, fish able to inhabit such a river under flow preference curves. HSI curves also don’t always accurately predict fish presence/abundance/productivity. For example, an HSI was not used in the assessment of the Lower Churchill River, because the model would have predicted that under original conditions the flows would have been too high to support any fish. Clearly, this was not the case, as the Lower Churchill River does support a healthy fish community. Similarly, Bradford et al. (2011) used an HSI in their flow augmentation experiment and predicted that with greater flows there would be fewer fish because habitat would be less suitable as velocity increased. However, this prediction was not supported as the fish abundance in the affected reaches did not change with increased flows.

Ice

Baseline information (e.g., ice thickness or snow depth) and modelling of the effect of ice dynamics on fish and fish habitat is missing from the EIS. This is particularly important for the

Fond du Lac River. A 2D ice modelling exercise should be carried out to evaluate ice impacts on fish and fish habitat. Without this type of analysis, conclusions about Project impacts on fish and fish habitat, particularly in the bypass section of the Fond du Lac River, will be made with incomplete information.

The Proponents did not measure ice conditions. Assumptions are also made about winter ice not affecting overwintering habitat suitability and availability.

The EIS lacked a study of the ice conditions in the bypassed section of the Fond du Lac River, and how this may change under project operation. It is important to understand these potential changes, as they may have impacts upon flow through the river, water levels in Black Lake and Middle Lake, and fish habitat (e.g., overwintering).

The Proponents argue that frazil ice is not currently a problem because temperature was never measured to be 0°C (loggers used over one winter – in pool and run habitat, all below 0.5 m) (p. 93-98 attachments A to Q and S, T consolidated). They didn't monitor the river for ice at all. The Proponents also claim that temperature is only predicted to be low enough to form frazil ice just upstream of the tailrace outlet (p. 89 attachments A to Q and S, T consolidated) and only if discharge falls below 50 m^3/s. They indicate that this may only occur in Jan-Feb, after which spring temperatures and increased flows start to increase. They indicate that they will monitor for temperature and ice impacts and if there is a problem then adjust flows.

DFO Science considers their conclusions are incorrect for the following reasons:

- Frazil ice can form in surface waters in turbulent zones even if water temperature at depths of >0.5 m is just above 0°C (all the temperature sensors were installed at depths >0.5 m).
- Few sensors are capable of picking up the supercooling - it's very minute.
- Also, water cooling models don't predict supercooling if they are not set up explicitly to do so. The only real mitigating factor usually is ice cover formation as supercooling ceases once a continuous ice cover forms.
- It is unlikely much continuous ice forms on this river given its high energy, high gradient profile.
- Frazil ice is likely an issue currently for fish in the river, and refuge areas would likely become less with the significant drop in flows over winter.
- It is a serious deficiency that the Proponents did not monitor ice and habitat conditions in the winter under current flow conditions (it appears they only monitored winter temperatures using loggers installed overwinter).
- The Proponents have not provided information as to how they will monitor ice and habitat and fish health in winter under reduced flows (only that temperatures will continue to be monitored using loggers) and what threshold will constitute a reason to implement their 'contingency plan' of increasing minimum flows to >50 m^3/s.
- It is likely that frazil ice will continue to be a problem and possibly even more than in current conditions as water is cooled further (lower volume) and refuge habitat will be smaller. Thus, the prediction that overwintering habitat will be greater under reduced flows is likely false.

With respect to Ice on the Fond du Lac River (p. 6 Addendum II_IR Resp_22Sept2014), the Proponents conclude that the changes in water temperature resulting from the project are expected to be biologically insignificant. However, modelling of the riparian flow temperatures

(Appendix 5.1) with the Project operating could fall as low as 0.0°C when the Fond du Lac River riparian flows are reduced below about 50 m^3/s. One of the concerns with the water withdrawal from the Fond du Lac River is changes in the development of frazil and anchor ice and their effects on fishes. However, the accuracy of the temperature sensors (Onset Tidbit V2; ± 0.21°C) used by the Proponents (Attachment B and C) is insufficient to detect frazil ice formation that occurs when water is supercooled (below 0°C). In addition, the measuring frequency of 6 h is inadequate to detect supercooling. Consequently, there is insufficient support for the conclusion that the predicted water temperature changes to the Fond du Lac River will have no biological significance. On the contrary, the predicted drop in water temperature to 0°C seems to suggest that ice formation will occur, which is a drastic change to the current situation in which the river stays open during the winter.

To measure frazil ice and onset of winter conditions, water temperature sensors that are within ± 0.01°C (1/100°C), or at least ± 0.1°C are required. The sensors should also be tested in an ice/water bath to ensure they measure a true value of 0°C.

Detailed information on groundwater input into the river systems does not appear to be included in the EIS but could impact hydrology and frazil ice formation.

Modelling should be undertaken to address the ice condition effects on over-wintering habitat availability.

Offsetting

A concise summary of area lost and proposed area to be gained from offset is not presented in the EIS. What is the compensation ratio being used for the initial option of adding spawning habitat just below the tailrace outflow? Realizing that the proposed offsetting is still uncertain, but with a loss of 3,000-8,000 m^2 of spawning habitat, the Proponents don't indicate what would be gained by their preferred (easier) option of adding spawning habitat below the tailrace and how much potential habitat would be accessed if they improved the culverts on the other tributary (relative to the fish that are able to cross the culverts currently – it is the improvement that needs to be assessed). Even the proposed contingency offsetting of improving/adding spawning habitat to the diversion reach indicates a maximum of 10,000 m^2 of spawning habitat added. This contingency does not even represent a 2:1 ratio to the maximum lost habitat estimate. A 2:1 ratio is generally considered a minimum offset ratio, when the value of the offset habitat is uncertain.

FPP does indicate that the greater the uncertainty in estimates, the greater the offsetting ratio should be to account for that uncertainty. This project includes much uncertainty that the Proponents propose to address through monitoring after the project proceeds. We would suggest that extreme caution should be exercised in both the offsetting amount/type and follow-up monitoring required, as well as contingencies in the event that serious harm to the fisheries is detected.

However, care should be taken with improving existing habitat. Creating new habitat may be a better approach as there is always the possibility of making the existing habitat worse.

Environmental Management, Monitoring and Follow-up

Particularly given the high uncertainties, the environmental monitoring program (p. 285 section 10.6) is extremely vague and should be further developed to study the impacts of the hydro development on the fisheries productivity.

Local impacts of flow reductions to small tributaries with connection to the Fond du Lac River should be documented.

Additional monitoring of fish habitats and river ice dynamics should take place.

Conclusions

The EIS concludes (p. 412 section 12.5.4) that “Although appropriate and applicable mitigation practices will be used and sensitive habitats will be avoided to the best extent possible, construction and operation of the Project is expected to result in some permanent alteration or destruction of fish habitat” particularly in the bypassed section of the Fond du Lac River and DFO Science agrees.

In general, DFO Science also agrees with the EIS conclusion that “While the Project structures were designed to avoid or mitigate potential serious harm to fish, including the loss or alteration of fish habitat, it is expected that some effects to the productivity and sustainability of area fisheries will occur.”

However, the baseline information presented is, in some cases, inadequate to assess potential Project effects. Modelling as currently presented is not adequate to address effects to fish and fish habitat. Therefore, the Proponents’ conclusions regarding potential impacts to resident Arctic Grayling population(s) due to flow reductions in the Fond du Lac River are uncertain and could be too optimistic.

The Project will be reducing the flow in the bypassed section of the Fond du Lac River by over 50%. This will decrease fish habitat in this section of the river and potentially impact fish productivity.

Further work could be undertaken to address existing data gaps and further analyses could be completed to address some of the deficiencies. Current baseline sampling is not sufficient to characterize the current fish community (e.g., species, abundance) and habitat use, particularly in the Fond du Lac River. Further baseline sampling would be needed to address uncertainties and to provide a more solid basis for the effects predictions.

Particularly given the high uncertainties, a detailed environmental monitoring program should be developed to evaluate the impacts of the hydro development on the fisheries productivity. The monitoring plan will need to be designed to collect data with sufficient precision and accuracy to identify potential project effects at biologically-appropriate thresholds.

Contributors

Eva Enders, DFO Science, Central and Arctic Region

Haitham Ghamry, DFO Science, Central and Arctic Region

Kathleen Martin, DFO Science, Central and Arctic Region

Karen Smokorowski, DFO Science, Central and Arctic Region

Approved by

Michelle Wheatley, Director of Science, Central and Arctic Region

Patricia Ramlal, Manager, Environmental Science Division

Gavin Christie, Manager, Great Lakes Laboratory for Fisheries and Aquatic Sciences Division

(Approved October 9, 2014)

Sources of information

Black Lake First Nations and Saskatchewan Power Corporation. 2014. Tazi Twé Hydroelectric Project Environmental Impact Statement. Report submitted to Saskatchewan Ministry of Environment and the Canadian Environmental Assessment Agency.

Bradford, M.J., Higgins, P.S., Korman, J., and Sneep, J. 2011. Test of an environmental flow release in a British Columbia river: does more water mean more fish? Freshwater Biology 56: 2119–2134.

DFO. 1995. Freshwater Intake End-of-Pipe Fish Screen Guidelines. Communications Directorate, Department of Fisheries and Oceans. ISBN 0-662-36334-5.

DFO. 2013. Framework for Assessing the Ecological Flow Requirements to Support Fisheries in Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/017.

Gebre, S., Alfredsen, K., Lia, L., Stickler, M., and Tesaker, E. (2013). "Review of Ice Effects on Hydropower Systems." Journal of Cold Regions Engineering, 27(4): 196–222.

Jackson, D.A., Harvey, H.H., and Somers, K.M. 1990. Ratios in Aquatic Sciences: Statistical Shortcomings with Mean Depth and the Morphoedaphic Index. Can. J. Fish. Aquat. Sci. 47(9):1788–1795. doi: 10.1139/f90-203

Appendix 1

Figure 1. Map of the Fond du Lac River between Middle Lake and Black Lake (from Google earth). Approximate locations of the proposed Taxi Twé Hydroelectric Project's submerged weir, water intake, power tunnel and tailrace channel are identified.

This Report is Available from the

Centre for Science Advice (CSA)
Central and Arctic Region
Fisheries and Oceans Canada
501 University Crescent
Winnipeg, Manitoba
R3T 2M6

Telephone: 204-983-5131
E-Mail: xcna-csa-cas@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas-sccs/

ISSN 1919-3769

Correct Citation for this Publication:

DFO. 2015. Science review of the Tazi Twé Hydroelectric Project environmental impact statement. DFO Can. Sci. Advis. Sec. Sci. Resp. 2014/048.

Aussi disponible en français :

MPO. 2015. Examen scientifique que de l'énoncé des incidences environnementales du projet hydroélectrique Tazi Twé. Secr. can. de consult. sci. du MPO, Rép. des Sci. 2014/048.