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Your file *Votre référence*
EA0809-004

Our file *Notre référence*
09-HCAA-CA6-00014

June 15, 2012

Mackenzie Valley Environmental Impact Review Board
#200 Scotia Centre
5102-50th Avenue
Yellowknife, NT
X1A 2N7

Via e-mail to:
chubert@reviewboard.ca

RE: Fisheries and Oceans Canada – Technical Submission for Fortune Mineral Ltd.'s proposed NICO Mine Project

Fisheries and Oceans Canada (DFO) is pleased to provide the Mackenzie Valley Environmental Impact Review Board (MVEIRB) with our technical submission for Fortune Mineral Ltd.'s Nico Mine environmental assessment.

DFO looks forward to participating in the community and public hearings in Whati and Behchoko as well as the technical hearing in Yellowknife. If you have any questions, please do not hesitate to contact Sarah Olivier at (867) 669-4919, or email at Sarah.Olivier@dfo-mpo.gc.ca.

Sincerely,

Larry Dow
A/ Area Director – Western Arctic Area
Fisheries and Oceans Canada

cc Beverley Ross, Fisheries and Oceans Canada
Julie Dahl, Fisheries and Oceans Canada
Rick Walbourne, Fisheries and Oceans Canada



Fisheries and Oceans Pêches et Océans
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TECHNICAL REPORT

Fortune Minerals Ltd. NICO Cobalt-Gold-Bismuth Mine Project

Submitted to:
Mackenzie Valley Environmental Impact Review Board
June 15th, 2012

MVEIRB Code: EA0809-004
DFO File No.: 09-HCAA-CA6-00014

Canada

PLAIN LANGUAGE SUMMARY

The Department of Fisheries and Oceans (DFO) is responsible for developing and implementing policies and programs in support of Canada's scientific, ecological, social and economic interests in oceans and fresh waters. The following technical comments and recommendations are based upon our departmental mandate under the *Fisheries Act*, specifically related to the management of fish and fish habitat. DFO's primary focus in reviewing proposed developments in and around Canadian fisheries waters is to ensure that the works and undertakings are conducted in such a way that the proponent is in compliance with the applicable provisions of the *Fisheries Act*. DFO's technical review of Fortune Minerals Ltd. (Fortune) NICO Mine Project proposal is divided into four (4) main categories: Grid Ponds, Watercourse Crossings, Water Withdrawals and Fish Habitat Assessment.

Based on Fortune's fisheries assessments, lake connectivity investigations and winter under ice dissolved oxygen data, DFO agrees that the Grid Ponds do not support fish or fish habitat and therefore would not require an authorization under Section 35 or be subject to Section 36 of the *Fisheries Act*.

The Marian River is the only permanent flowing stream that supports fish and fish habitat within the project boundaries. Fortune has committed to using DFO's Clear Span Bridge operational statement and has stated that there will be no in-water works associated with the bridge construction. DFO recommends that Fortune implement all mitigation measures outlined in the operational statement as well as develop a comprehensive Sediment and Erosion control plan for the construction, operation and decommissioning of all components of the project located near water, including the bridge, to ensure that potential impacts on the aquatic environment are avoided.

Large amounts of water withdrawn from ice covered waterbodies or watercourses can lead to oxygen depletion, loss of over-wintering habitat and/or reduction in littoral habitat. Lou Lake has been identified as the sole water source for the NICO project. Given the relatively small quantities of water required by the project, DFO concluded that the likelihood of impacts to fish and fish habitat as a result of water withdrawals in Lou Lake are negligible.

Fortune provided a thorough fish habitat assessment for the water intake and diffuser structures that assisted DFO in determining that an authorization under ss. 35(2) of the *Fisheries Act* for the harmful alteration, disruption or destruction (HADD) of fish habitat was not required. DFO recommends that a mitigation and monitoring plan for the construction, operation and decommissioning of these two in-water structures be developed. The plan should include fish salvage procedures (within the silt fences), monitoring of total suspended solids as well as a discussion of contingency plans in the event of failure of these two structures.

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1.0 INTRODUCTION

1.1 Background

Fortune Minerals Ltd (Fortune) is proposing to develop an underground and open pit cobalt-gold-bismuth mine located approximately 160 kilometres northwest of Yellowknife and approximately 50 km north-east of the community of Whati. The proposed development includes:

- Camp Facilities
- Co-disposal Facility
- Effluent and sewage treatment facilities
- Ore processing facilities
- Roads within the mine site
- Freshwater intake on Lou Lake
- Diffuser in Peanut Lake
- Watercourse crossings including Marian River

The Department of Fisheries and Oceans (DFO) has completed its technical review of the proposed development, taking into consideration the information supplied by Fortune through their correspondence with DFO, their Developer's Assessment Report (DAR), responses to Information Requests and other pertinent documents submitted to the Mackenzie Valley Environmental Impact Review Board (MVEIRB).

1.2 Mandate

DFO's guiding legislation includes the *Fisheries Act*, which confers responsibility to the Minister for the management of fisheries, habitat and aquaculture. The *Fisheries Act* provides DFO with its regulatory powers to conserve and protect fish and fish habitat. This is accomplished through the administration of the Habitat Protection provisions and other sections of the *Fisheries Act* which are binding on all levels of government and the public. These include the following sections:

- the provision of sufficient water flows – **section 22**
- passage of fish around migration barriers – **sections 20 and 21**
- screening of water intakes – **section 30**
- prohibition against the destruction of fish by means other than fishing unless authorized by DFO – **section 32**
- the prohibition against the harmful alteration, disruption or destruction (HADD) of fish habitat unless authorized by DFO – **section 35**
- prohibition to deposit deleterious substances unless by regulation – **section 36**

Of note, Environment Canada (EC) is responsible for the administration and enforcement of the pollution prevention provisions of the *Fisheries Act* on behalf of DFO (section 34 and sections 36-42).

2.0 TECHNICAL COMMENTS – GRID PONDS

Fortune is proposing to construct a Co-Disposal Facility within the footprint of Grid Pond and Little Grid Pond (Grid Ponds). DFO reviewed the application to determine if the Grid Ponds are fish frequented and therefore subject to the *Metal Mining Effluent Regulations* (MMER), pursuant to Section 36 of the *Fisheries Act*, and administered by Environment Canada. The information used by DFO in this determination included, but is not limited to, fisheries assessment efforts and methods, seasonal variability in fish presence, connectivity with surrounding lakes, and winter water chemistry data.

2.1 Fisheries Status – Grid Ponds

2.1.1 Document Reviewed

- Developer's Assessment Report (DAR), May 2011 :
 - o Section 7.3
 - o Section 12.2.1, 12.2.3 and 12.2.5
- DAR Annex C
 - o Section 1.2
 - o Section 2.2.1, 2.2.2 and 2.3.2
 - o Section 3.5.1
 - o Appendix III – Table III-1
 - o Appendix XI.7
- Fortune response to additional information request from DFO dated January 10, 2012

2.1.2 Proponent's Assessment and Conclusions

Fortune submitted their Developer's Assessment Report (DAR) to the Review Board in June 2011, a component of which was Annex C – Aquatic Baseline Report, dated December 2010. This report included the fish and aquatic habitat assessments of the Grid Ponds conducted from 2003-2005, water quality work conducted from 2003-2010, as well as bathymetric surveys in August 2004.

Fortune concluded that while adequate habitat is available for small-bodied fish, Grid and Little Grid Ponds likely do not support fish communities due to poor water quality and shallow depths, the latter of which suggest that they may freeze to the substrate in winter. As well, these ponds have high concentrations of dissolved arsenic and copper, which likely preclude survival of fish populations in these water bodies. Finally, fish were not captured during the 2003 and 2005 surveys (DAR Annex C, p 25).

2.1.3 DFO's Conclusions and Recommendations

DFO has reviewed a variety of information provided by Fortune over the last several years to assist in determining the likelihood that the Grid Ponds are potentially fish frequented.

Fisheries Assessments

Two (2) gillnets (60 m x 1.8 m) with mesh ranging from 25-100mm were set in Grid Pond in September 2003, each with 22hr durations, with an additional two nets (20 m x 1.8 m) with 38mm mesh set in August 2005 for 20-21 hr durations. Little Grid Pond was sampled during the same sampling period

with two 2 hr sets (60 m x 1.8 m) in September 2003 and two 20 hr sets (20m x 1.8m) in August 2005. Additionally, minnow traps were set for 20-30 hr durations in each pond. No fish were captured during these field investigations.

Connectivity

While there may be no fish residing in a water body during a specific sampling period, it is also important to determine if connectivity exists to other waterbodies with known fisheries populations during periods of high flow, such as spring freshet. This may indicate the potential usage of the area during specific times of year by migrant fish species including spring spawners. DFO requested additional information in January 2012 and was provided the following information from Golder Associates on behalf of Fortune:

“Over most of its length, the watercourse from Little Grid Pond to Nico Lake meanders through sedge meadows and complexes of willows...and shows the lack of distinct channel that would allow for fish passage. A wetland exists approximately 200m downstream of Little Grid Pond, which has a large beaver dam on its downstream side.....The overall conclusion from the survey was that there is no connection for fish passage between Little Grid Pond and Nico Lake due to the lack of a distinct channel in most locations and the presence of a large beaver dam on the downstream side of the wetland.” (Golder 2012)

Winter/Under Ice Dissolved Oxygen

While there may be no connection between Little Grid Pond and Nico Lake, there may still be a potential for the Grid Ponds to have over-wintering habitat for a resident fish population, despite the lack of fish captured during sampling. For a waterbody to sustain over-wintering fish habitat there must be a source of dissolved oxygen. The CCME Guidelines for Dissolved Oxygen in Freshwater for the Protection of Aquatic Life in coldwater is 9.5 mg/L for early life stages and 6.5 mg/L for other life stages (CCME, 1999). During the winter months, DO concentrations in winter systems are reduced by ice cover, which decreases re-aeration, influxes of oxygen-depleted groundwater and oxidation of organic material (Chambers, 1996). Under-ice dissolved oxygen was taken from the Grid Ponds and found to annually range from 1.19-5.02 mg/L at Grid Pond and 0.33-3.06 mg/L at Little Grid Ponds, respectively. It is unlikely that these levels would sustain over-wintering fisheries populations.

Based on the information outlined above, DFO concurs with Fortune's assessment that the Grid Ponds are unlikely to support fish populations. We have no further information requirements or recommendations in this area.

3.0 TECHNICAL COMMENTS – WATERCOURSE CROSSINGS

3.1 Marian River Crossing

3.1.1 Documents Reviewed

- DAR, May 2011:
 - o Section 3.3.1
 - o Section 12.3 (p. 12-67)
- Fortune Response to Information Request TG_6
- Fortune Response to Information Request DFO_1
- Fortune Response to Information Request TC_1 and TC_2 – Supporting Document

3.1.2 Proponent's Assessment and Conclusions

The Marian River is the only permanently flowing stream found within the proposed road corridor (Golder 2007). Fortune has proposed a clear-span bridge which will be built on competent rock with moderate fracturing space (EBA 2007). The road top will have a width of 6m with a 25m span. 100 year flood flow conditions and the river's use by summer canoeists have been considered when configuring the bridge opening and height (Golder 2007). As there will be no in-water works associated with bridge construction and that sediment and erosion control measures will be implemented, Fortune anticipates no impacts to fish and fish habitat (DAR, Section 12.3).

3.1.3 DFO's Conclusions and Recommendations

DFO has a *Clear Span Bridge Operational Statement*¹ which applies to the construction of a small-scale bridge structure that completely spans a watercourse without altering the stream bed or bank and with the bridge structure built entirely above the high water mark. The Operational Statement outlines conditions under which it is applicable to a particular project as well as measures to avoid negative impacts to fish habitat. Provided the conditions and measures outlined are met, DFO anticipates the installation of any clear-span bridge to be of low-risk to fish and fish habitat.

Recommendation#1: DFO recommends that Fortune follow DFO's Northwest Territories Clear-Span Bridges Operational Statement at the Marian River crossing. All mitigation measures contained therein should be incorporated into the construction of the Marian River crossing to avoid any negative impacts to fish habitat and to maintain fish passage.

¹ DFO operational statement for Clear Span Bridges - <http://www.dfo-mpo.gc.ca/regions/central/habitat/os-ee/provinces-territories-territoires/nt/os-ee05-eng.htm>

3.2 Other Watercourse Crossings

3.2.1 Documents Reviewed

- DAR, May 2011:
 - o Section 3.3
- Fortune Response to Information Request DFO_3
- Fortune Response to Information Request TC_1 – Supporting Document
- Fortune response to additional information request from DFO dated January 10, 2012

3.2.2 Proponent's Assessment and Conclusions

The DAR states that there are “5 minor crossing (*sic*) proposed along the route that will make use of larger 800mm culverts, one major crossing at the Marian River that will use a girder-type bridge structure, and an additional 60 ephemeral topographic lows that the route will cross” (DAR, pg 3-10). In response to Information Request DFO_3, regarding sediment and erosion control Fortune stated that “where large-bodied fish occur, cross-drainage structures will be designed so that flow velocities do not become a barrier to fish passage”

To further clarify, in additional information provided on January 10th, 2012, Fortune re-iterated their original statement that “(w)ith the exception of the Marian River crossing, all other crossings along the 27 kilometer (km) NICO Project Access Road (NPAR) are over ephemeral streams not considered to support fish habitat” and that “the baseline assessment was originally completed on a 51-km road prior to the NPAR being reduced to 27km. Therefore, the stream crossings (C1 to C5) that were identified in Golder (2007) are no longer relevant to the assessment as they are located along the Whati to Gameti portion of the road (not part of the current NICO project) and not part of the Fortune proposed NPAR road for the NICO project.” (Golder 2012).

3.2.3 DFO's Conclusions and Recommendations

As part of the Water Licence submission, DFO was provided with a “*Fish and Fish Assessment of Watercourses Along the Proposed Nico All-Weather Road*” report (Golder 2007) which was also submitted as part of a supporting document to an Information Response from Fortune to Transport Canada. This document assessed the entire 50-km all-weather road from the NICO Property to the existing Gameti Winter Road including fisheries surveys along nine watercourses. Fish presence was confirmed at watercourse C1 and C8 (Marian River) and likely at C2. In correspondence dated December 19th, 2011, DFO requested clarification on several IR responses, including on watercourse crossings. During a meeting on January 4th, 2012 between Fortune, Golder Associates and DFO it was explained that the fisheries assessment provided to Transport Canada was in relation to the Marian River and that watercourses C1 and C2 were no longer within the scope of the project. Based on the information outlined above, DFO concurs with Fortune's assessment that watercourses within the current scope of this assessment, other than the Marian River, are unlikely to support fish populations.

Recommendation#2: DFO recommends that Fortune develop a comprehensive Sediment and Erosion control plan for the construction, operation and decommissions of all components of the project located near water, including the bridge, to ensure that potential impacts on the aquatic environment are avoided.

4.0 TECHNICAL COMMENTS - WATER WITHDRAWAL

4.1 Water Quantity Effects – Lou Lake

4.1.1 Documents Reviewed

- DAR, May 2011:
 - o Section 3.9
 - o Section 11.3
 - o Section 12.2
 - o Section 12.3
 - o Appendix 3.III
 - o Appendix 11.II
- Fortune response to DFO on bathymetry data dated September 30th, 2011

4.1.2 Proponent's Assessment and Conclusions

Lou Lake has been identified as the sole water source to support the NICO project. Fortune anticipates that water usage will range from 112,000 m³/year under average climatic conditions to up to 146,000 m³/year during a 1:25 year dry period with the maximum potential fresh water withdrawal of 179,000 m³ during a 12-month period (DAR, Section 11.3.2). As the mean annual discharge from Lou Lake is approximately 0.0971 m³/sec, Fortune anticipates that average fresh water withdrawal would not exceed 3.7% of the mean annual discharge relative to baseline conditions, which is expected to have negligible residual effect on water level in Lou Lake and downstream flow into the Marian River (DAR Table 11.3-1).

In addition, bathymetric surveys conducted on Lou Lake indicate a maximum depth of 32m and an available under ice volume of 9.42 Mm³ (DAR Section 12.3.2) and as water is withdrawn all year round only a portion of the total would be required during the winter.

4.1.3 DFO's Conclusions and Recommendations

Excessive amounts of water withdrawn from ice covered waterbodies or watercourses can lead to oxygen depletion, loss of over-wintering habitat and/or reduction in littoral habitat. To address the issue of water withdrawal, and to provide standardized guidance to water users, including volume limits for certain water source types, the *DFO Protocol for Winter Water Withdrawal from Ice-Covered Waterbodies in the NWT and Nunavut (June 2010)* (Appendix I) was developed in conjunction with industry and other regulators. The intent of the protocol is to provide a standardized tool to assist industry in avoiding possible impacts to fish from winter water withdrawals while obtaining the water they require, as well as ensuring consistency among water users. The protocol recommends that in one ice-covered season, total water withdrawal from a single waterbody is not to exceed 10% of the available water volume calculated. Based on the total volume of available under ice volume provided of 9.42 Mm³, the anticipated maximum annual amount of 179,000 m³ represents approximately 2% of the available volume.

DFO concludes that given the relatively minor amount of water required by Fortune from Lou Lake that the likelihood of impacts to fish and fish habitat as a result of water withdrawal is negligible.

4.2 Water Intake Screen – Lou Lake

4.2.1 Documents Reviewed

- DAR, May 2011:
 - o Section 3.9
 - o Section 12.3
- Fortune Response to Information Request DFO_3

4.2.2 Proponent's Assessment and Conclusions

A water intake will be required at Lou Lake in order to support the NICO operation. Fortune has stated that the intake structure will be designed to meet DFO guidelines for water intakes (DAR Section 3.9.9.2). Additionally, Fortune states that appropriately sized fish screens will be fitted to the pumps to limit fish access and to protect fish from entrainment and impingement (DAR Table 12.3-1).

Also, in their response to Information Request DFO_5, Fortune stated that the intake design will consider recommendations and input from DFO and that the design will include the installation of a fish screen for the protection of resident species in Lou Lake and will follow the specifications in *Freshwater Intake End-of-Pipe Fish Screen Guidelines* (DFO, 1995)².

4.2.3 DFO's Conclusions and Recommendations

A requirement for the use of fish screens is identified under Section 30 of the *Fisheries Act*, which states “Every water intake, ditch, channel or canal in Canada constructed or adapted for conducting water from any Canadian fisheries waters for irrigating, manufacturing, power generation, domestic or other purposes shall, if the Minister deems it necessary in the public interest, be provided at its entrance or intake with a fish guard or a screen, covering or netting so fixed as to prevent the passage of fish from any Canadian fisheries waters into the water intake, ditch, channel or canal.”

With Fortune committing to using the *Freshwater Intake End-of-Pipe Fish Screen Guidelines*, DFO has no concerns related to the potential impacts of the water intake structure on fish in Lou Lake.

² *Freshwater Intake End-of-Pipe Fish Screen Guidelines* - <http://www.dfo-mpo.gc.ca/library/223669.pdf>

5.0 TECHNICAL COMMENTS - FISH HABITAT ASSESSMENT

A fish habitat assessment was done to determine potential fish habitat gains, or losses, from the installation of the water intake and diffuser in Lou Lake and Peanut Lake, respectively.

5.1 In-Water Structures

5.1.1 Documents Reviewed

- DAR, May 2011:
 - o Section 12.3
- DAR Annex C
 - o Section 7.3
- Appendix 7.IV – Peanut Lake Conceptual Diffuser Design
- Fortune Response to Information Request DFO_3 and DFO_6

5.1.2 Proponent's Assessment and Conclusions

Lou Lake Intake Pipe

Lou Lake is the sole water source for the NICO project and holds several fish species including longnose sucker (*Catostomus catostomus*), white sucker (*Catostomus commersoni*), walleye (*Sander vitreum*), northern pike (*Esox lucius*), lake whitefish (*Coregonus clupeaformis*) and cisco (*Coregonus artedi*). The submerged water intake will be 53m in length and resulting in a total footprint of approximately 160m², which amounts to 90% being in shallow water habitat (less than 4m). The substrate in this area consists of a mix of boulder with some cobble, silt, and organics. Upon installation of the intake pipe, the area will be covered with fine aggregate (2-5 cm diameter) over the pipe and lake bottom, then with an outer layer of coarse rock and protective rip-rap. It is anticipated that aggregate fill such as gravel and cobble will create spawning and rearing habitat for coldwater fish species (Machniak 1975; Richardson et al. 2001; Golder 2009).

Peanut Lake Diffuser

Fortune is proposing to discharge water from the NICO project via a pipe and diffuser into Peanut Lake. Peanut Lake has only two resident fish species, northern pike and lake whitefish. The in-water works in Peanut Lake will result in a total area of 110 m², which 87% is shallow water habitat. The substrate in this area is generally homogenous and dominated by silt and detritus with some intermittent boulders. Similar to the Lou Lake intake, the diffuser pipe will be approximately 86m in length installed over the lake bottom to a water depth of about 9 m and will be covered with aggregate fill up until a depth of 4 m. The nozzle depth of the diffuser structure at the end of the pipe will be at 8.75 m (25 cm off the bottom), anchored, and at a 30 degree angle from the bottom. The expected output rate from the Effluent Treatment Facility for average conditions during operations is an exit velocity of about 4 m/s. Again, it is anticipated that aggregate fill such as gravel and cobble will create spawning and rearing habitat for coldwater fish species (Machniak 1975; Richardson et al. 2001; Golder 2009).

5.1.3 DFO's Conclusions and Recommendations

Lou Lake

DFO concurs with the methodology and conclusions outlined in Table 7 of Fortune's Response to Information Request DFO_06. While there may be changes to habitat for northern pike, and in forage habitat of other species, DFO has determined that the habitat alterations to Lou Lake are not harmful, and therefore, a ss. 35(2) *Fisheries Act* Authorization is not be required.

Peanut Lake

DFO concurs with the methodology and conclusions outlined in Table 8 of Fortune's Response to Information Request DFO_06. While there may be change in habitat for northern pike habitat, DFO has determined that the habitat alterations to Peanut Lake are not harmful, and therefore, a ss. 35(2) *Fisheries Act* Authorization will not be required.

5.2 Installation Methods

5.2.1 Documents Reviewed

- Fortune Response to Information Request DFO_3

5.2.2 Proponent's Assessment and Conclusions

In response to Information Request DFO_3, Fortune provided detailed methods for the installation of the Peanut Lake diffuser and the Lou Lake Freshwater Intake. For the in-water works related to Peanut and Lou Lakes, Fortune will stabilize the worksite entrances, install silt fences on shore, install a silt curtain around the area of concern, do a fish salvage, and avoid sensitive timing windows when spawning fish, eggs and fry are vulnerable to disturbance or sediment.

5.2.3 DFO's Assessment and Conclusions

DFO agrees that the proposed mitigation measures outline by Fortune will be sufficient to avoid any impacts to fish and fish habitat within Lou and Peanut Lake during construction.

Recommendation #3: DFO recommends the development of a mitigation and monitoring plan for the construction, operation and decommissioning of the proposed water intake and diffuser to ensure adverse physical impacts to fish and fish habitat are avoided. This should include fish salvage procedures, monitoring details for total suspended solids and contingency planning in the event of failure of these structures.

6.0 SUMMARY OF RECOMMENDATIONS

Recommendation#1: *DFO recommends that Fortune follow DFO's Northwest Territories Clear-Span Bridges Operational Statement at the Marian River crossing. All mitigation measures contained therein should be incorporated into the construction of the Marian River crossing to avoid any negative impacts to fish habitat and to maintain fish passage.*

Recommendation#2: *DFO recommends that Fortune develop a comprehensive Sediment and Erosion control plan for the construction, operation and decommissions of all components of the project located near water, including the bridge, to ensure that potential impacts on the aquatic environment are avoided.*

Recommendation #3: *DFO recommends the development of a mitigation and monitoring plan for the construction, operation and decommissioning of the proposed water intake and diffuser to ensure adverse physical impacts to fish and fish habitat are avoided. This should include fish salvage procedures, monitoring details for total suspended solids and contingency planning in the event of failure of these structures.*

7.0 REFERENCES

CCME (Canadian Council of the Ministers of the Environment). 1999. Canadian Water Quality Guidelines for the Protection of Aquatic Life – Dissolved Oxygen (Freshwater). 6 p.

Chambers, P.A. 1996. Dissolved oxygen conditions and fish requirements in the Athabasca, Peace, and Slave rivers: Assessment of present conditions and future trends. Northern River Basins Study Synthesis Report No. 5. Edmonton.

EBA. 2007. NICO Mine Access - Proposed Bridge Marian River Crossing. 23 p.

Golder Associates. 2007. Fish and Fish Habitat Assessment of Watercourses along the proposed NICO All-Weather Road. 68 p.

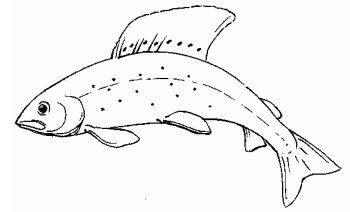
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Machniak, K. 1975. The effects of hydroelectric development on the biology of northern fishes (reproduction and population dynamics). I. Lake Whitefish *Coregonus clupeaformis* (Mitchell). Technical Report No. 527, Fisheries and Marine Service, Environment Canada. 67 p.

Richardson, E.S., J.D. Reist. and C.K. Minns. 2001. Life history characteristics of freshwater fishes occurring in the Northwest Territories and Nunavut, with major emphasis on lake habitat requirements. Canadian Manuscript Report of Fisheries and Aquatic Sciences. 2569: vii+146 p.

Appendix I – DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut



DFO Protocol for Winter Water Withdrawal from Ice-covered Waterbodies in the Northwest Territories and Nunavut

Rationale

In the Northwest Territories and Nunavut, winter activities such as access road construction, exploratory drilling and camp operations often require large amounts of water. Excessive amounts of water withdrawn from ice-covered waterbodies can impact fish through oxygen depletion, loss of over-wintering habitat and/or reductions in littoral habitat. The potential for such negative impacts to over-wintering fish and fish habitat has made winter water withdrawal a critical issue for Fisheries and Oceans Canada (DFO) in the Northwest Territories and Nunavut. To mitigate impacts to fish from water withdrawal from ice-covered waterbodies, and to provide standardized guidance to water users, including volume limits for certain water source types, DFO has developed this protocol in conjunction with industry and other regulators.

For the purposes of this protocol, a **waterbody** is defined as any water-filled basin that is potential fish habitat. A waterbody is defined by the ordinary high water mark of the basin, and excludes connecting watercourses.

This protocol will **not** apply to the following:

- Any waterbody that is exempted by DFO (e.g. Great Bear Lake, Great Slave Lake, Gordon Lake, and others as and when determined by DFO), and;
- Any waterbody from which less than 100m³ is to be withdrawn over the course of one ice-covered period.

In order to establish a winter water withdrawal limit for a given waterbody, the following criteria must be adhered to:

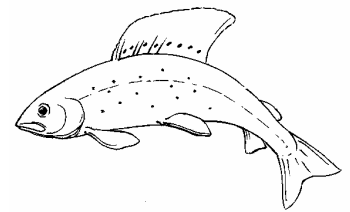
1. In one ice-covered season, total water withdrawal from a single waterbody is not to exceed 10% of the available water volume calculated using the appropriate maximum expected ice thickness provided in Table 1.
2. In cases where there are multiple users withdrawing water from a single waterbody, the total combined withdrawal volume is not to exceed 10% of the available water volume calculated using the appropriate maximum expected ice thickness provided in Table 1. Therefore, consistent and coordinated water source identification is essential.
3. Only waterbodies with maximum depths that are $\geq 1.5\text{m}$ than their corresponding maximum expected ice thickness should be considered for water withdrawal (Table 1). Waterbodies with less than 1.5m of free water beneath the maximum ice are considered to be particularly vulnerable to the effects of water withdrawal.
4. Any waterbody with a maximum expected ice thickness that is greater than, or equal to, its maximum depth (as determined from a bathymetric survey) is exempt from the 10% maximum withdrawal limit (Table 1).

To further mitigate the impacts of water withdrawal, water is to be removed from deep areas of waterbodies (>2m below the ice surface) wherever feasible, to avoid the removal of oxygenated surface waters that are critical to over-wintering fish. The littoral zone should be avoided as a water withdrawal location. Water intakes should also be properly screened with fine mesh of 2.54 mm (1/10") and have moderate intake velocities to prevent the entrainment of fish. Please refer to the *Freshwater Intake End-of-Pipe Fish Screen Guideline* (DFO, 1995) which is available upon request, or at the following internet address: www.dfo-mpo.gc.ca/Library/223669.pdf.

In order to determine the maximum water withdrawal volume from an ice-covered waterbody, and thereby conform to this protocol, the following information must be provided to DFO for review and concurrence prior to program commencement.

Water Source Identification

1. Proposed water sources, access routes, and crossing locations clearly identified on a map, with geographical coordinates (latitude/longitude and/or UTM) included.
2. Any watercourse connectivity (permanently flowing and/or seasonal) between the proposed water source and any other waterbody or watercourse.



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3. Aerial photos or satellite imagery of the water sources.
4. Estimated total water withdrawal requirement for work or activity and estimated total water withdrawal per water source (in m³).

Bathymetric Survey Results

1. For all waterbodies: One longitudinal transect, connecting the two farthest shorelines, is to be conducted regardless of waterbody size. Note: a longitudinal transect may be straight or curved in order to accommodate the shape of a lake (see Figure 1).
2. For waterbodies equal to or less than 1 km in length: a minimum of one longitudinal transect and two perpendicular transects are to be conducted. Perpendicular transects should be evenly spaced on the longest longitudinal transect, dividing the lake into thirds (Figure 1).
3. For lakes greater than 1 km in length: a minimum of one longitudinal transect is to be conducted. Perpendicular transects (minimum of 2) should be evenly spaced on the longest longitudinal transect at maximum intervals of 500 m.
4. Additional transects should be run as required to include irregularities in waterbody shape such as fingers or bays (Figure 1).
5. All longitudinal and perpendicular transects are to be conducted using an accurate, continuous depth sounding methodology, such as open water echo sounding or ground penetrating radar (GPR), that provides a continuous depth recording from one shore to the farthest opposing shore (Figure 1). Any alternative technology should be reviewed by DFO prior to implementing for bathymetric surveys.

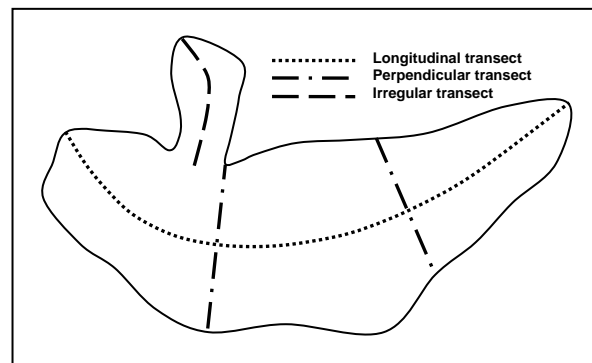
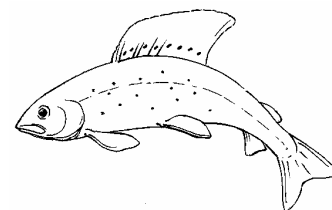


Figure 1. Minimum transect layout for a lake that is less than 1 km in length, with an irregularity.

Volume Calculations

1. Document the methods used to calculate surface area. If aerial photos or satellite imagery were used, provide the date (day/month/year) taken, as surface area may change depending on the time of year. If maps were used, provide the year that they were surveyed.
2. Detail the methods used to determine the total volume of free water, incorporating the relevant bathymetric information.
3. Calculate the available water volume under the ice using the appropriate maximum expected ice thickness, i.e. $Total\ Volume_{lake} - Ice\ Volume_{max\ thickness} = Available\ Water\ Volume$ (see Table 1 for maximum ice thickness).
4. For programs where ice-chipping is used, the total ice volume to be removed from the waterbody should be converted to total liquid volume and incorporated into the estimate of total water withdrawal requirement per water source.



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Table 1. Maximum expected ice thickness, and corresponding water depth requirements, for different regions in the Northwest Territories.

Area	Maximum Expected Ice Thickness (m)	Minimum Waterbody depth Required for 10% Water Withdrawal (m)
Above the Tree Line	2.0	≥3.5
Below the Tree Line - North of Fort Simpson	1.5	≥3.0
Deh Cho –South of Fort Simpson	1.0	≥2.5

A brief project summary report documenting and confirming total water volume used per water source and corresponding dates should be submitted to DFO within 60 days of project completion. Information should be provided in the following format (this information would also be useful as part of the project description):

Lake ID	number and/or name
Coordinates	latitude and longitude and/or UTM coordinates
Surface area	in ha
Total Lake Volume	in m ³
Under Ice Volume	in m ³ (based on max ice thickness for region)
Max expected ice thickness value used	in m
Calculated 10% Withdrawal volume	in m ³
Total required water volume extracted	in m ³
Aerial photographs of waterbody	PDF format
Bathymetric Map(s) of waterbody	PDF format

Any requests deviating from the above must be submitted to DFO and will be addressed on a site-specific basis.

Beaver and Muskrat

Many species of animals are highly sensitive to water fluctuations. In areas where beaver and muskrat may occur, the appropriate agencies or organizations should be consulted to determine if harmful effects will result from your activities, and whether these effects can be successfully mitigated through modifications to your plans including best management practices.

Please note that adherence to this protocol does not release the proponent of the responsibility for obtaining any permits, licenses or authorizations that may be required.

For more information contact DFO at (867) 669-4915.