ATTACHMENT A

Fish and Fish Habitat Assessment of Watercourses Along the Proposed Nico All-Weather Road

Fish and Fish Habitat Assessment of Watercourses Along the Proposed Nico All-Weather Road

December 2007
07-1373-0068

Prepared for:

FORTUNE
MINERALS LIMITED

140 Fullarton Street, Suite 1902
London, Ontario
N6A 5P2

Prepared by:

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300, 10525 - 170 Street,
Edmonton, Alberta
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Golder Associates

FISH AND FISH HABITAT ASSESSMENT OF WATERCOURSES ALONG THE PROPOSED NICO ALL-WEATHER ROAD

FORTUNE MINERALS LTD.
NICO PROJECT

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December 2007 **07-1373-0068**

Cover Photo: Downstream view of the proposed winter road crossing location at the C8 crossing location over the Marian River, August 16, 2005.

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EXECUTIVE SUMMARY

Fortune Minerals Ltd. proposes to develop a gold-cobalt-bismuth deposit located approximately 150 km northwest of Yellowknife, NT. The proposed mine would be accessed by a 50 km all-weather road, starting at the NICO property and ending at an existing winter trail along the proposed Behchoko to Gameti all-weather road. The proposed all-weather road, linking the communities of Gameti and Wha Ti to Highway 3, would be built by the Government of the Northwest Territories and the Tli Cho government. Approximately half of the section of the all-weather road route, to be constructed by Fortune Minerals is aligned with an old winter road constructed to access the Echo Bay Mine, on Great Bear Lake, in 1972.

This report contains information on fish and fish habitat for nine watercourse crossings (C1 – C9) identified along the proposed road alignment. Assessments are based on field data collected from 2004 through 2006. The intent of this document is to provide adequate baseline information to support applications for regulatory approvals associated with the Class A Water Licence, Land Use Permit, *Federal Fisheries Act, Mackenzie Valley Resource Management Act*, and the *Navigable Waters Protection Act*.

Surveyed watercourses ranged from small ephemeral streams to one large river. As such, they varied in their ability to support fish and their sensitivity to disturbance. The baseline information collected was used to classify the watercourses into one of three groups:

Group 1. Small watercourses with no potential to support fish populations;

Group 2. Small watercourses that do not provide fish habitat at the crossing location but may contribute to downstream fish habitat; and

Group 3. Watercourses that may have the potential to support sportfish populations on at least a seasonal basis, and/or provide suitable habitat for forage species.

Based on the above groupings, three of the nine watercourses surveyed had the potential to provide or contribute to fish habitat (Groups 2 and 3). Detailed field assessments of aquatic habitat were carried out only for watercourses in Group 2 and Group 3, because they were considered to be more likely affected by road construction activities.

The remaining six watercourse crossings (C3 – C7 and C9), were assessed as not supporting fish or fish habitat, and all were given Group 1 status. Assessments of these Group 1 sites were limited to photographic documentation from the air

and/or the ground, and a brief qualitative description of the main aquatic habitat features.

The size of the watercourse and the potential to impact fish habitat were the main factors in the selection of crossing methods, and resulted in the selection of the most conservative method. Based on this, the recommended crossing structures will include the following: a clear-span bridge structure over Stream C8 (Marian River), an arch culvert for the Stream C1 crossing, and appropriately sized culverts for the remaining watercourse crossings along the NICO all-weather road. It is anticipated that by following the crossing structure recommendations, there will be no long-term negative impacts to fish or fish habitat as a result of the all-weather NICO road construction project.

In summary, of the nine proposed watercourse crossings surveyed, six are not expected to require a case-specific DFO review, because they are not considered fish habitat. The remaining three crossings will likely require a DFO review, and one (Marian River) also will require review under the *Navigable Waters Protection Act*.

Provided that crossing structure recommendations outlined in this report are adhered to, it is our belief that the construction of the NICO all-weather will not result in a harmful alteration, disruption or destruction (HADD) of fish habitat. Under the *Federal Fisheries Act*, no one may carry out any work or undertaking that results in a HADD, unless authorized by the Minister of Fisheries and Oceans. Although there is the potential for an increase in suspended sediments during the road construction, the increased sediment levels are expected to be temporary and of low magnitude, provided that appropriate mitigation strategies outlined in this document are applied. Close monitoring of the environmental effects will be implemented during construction; however, it is not expected that additional provisions will be necessary to compensate for the temporary reduction in habitat quality, unless they are requested by DFO after the case-specific reviews.

ACKNOWLEDGEMENTS

This report was prepared for Fortune Minerals Ltd. by Golder Associates Ltd. (Golder) under the direction of Scott MacNeill (Project Manager) and Gary Ash (Project Director). Technical field studies were carried out by John Embury-Hyatt, Dustin Ford, JR Hall, and Mark Dunnigan. Scott MacNeill and Alison Ondrack were responsible for data analysis and report preparation. Jacek Patalas and Gary Ash provided senior review for the report.

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1 INTRODUCTION

Fortune Minerals Ltd. proposes to develop a gold-cobalt-bismuth deposit that is located approximately 150 km northwest of Yellowknife, NT. The proposed mine would be accessed by a 50 km all-weather road, starting at the NICO property and ending at an existing winter trail along the proposed Edzo to Gameti all-weather road (Figure 1). The proposed all-weather road, linking the communities of Gameti and Wha Ti to Highway 3, would be built by the Government of the Northwest Territories and the Tli Cho government. Approximately half of the section of the all-weather road route that will be constructed by Fortune Minerals is aligned with an old winter road route, originally constructed by Robinson's Trucking in 1972, to access to the Echo Bay Mine, on Great Bear Lake.

As part of the regulatory approval process, territorial and federal government agency approvals are required to construct the watercourse crossings associated with the project. Relevant government legislation includes the following:

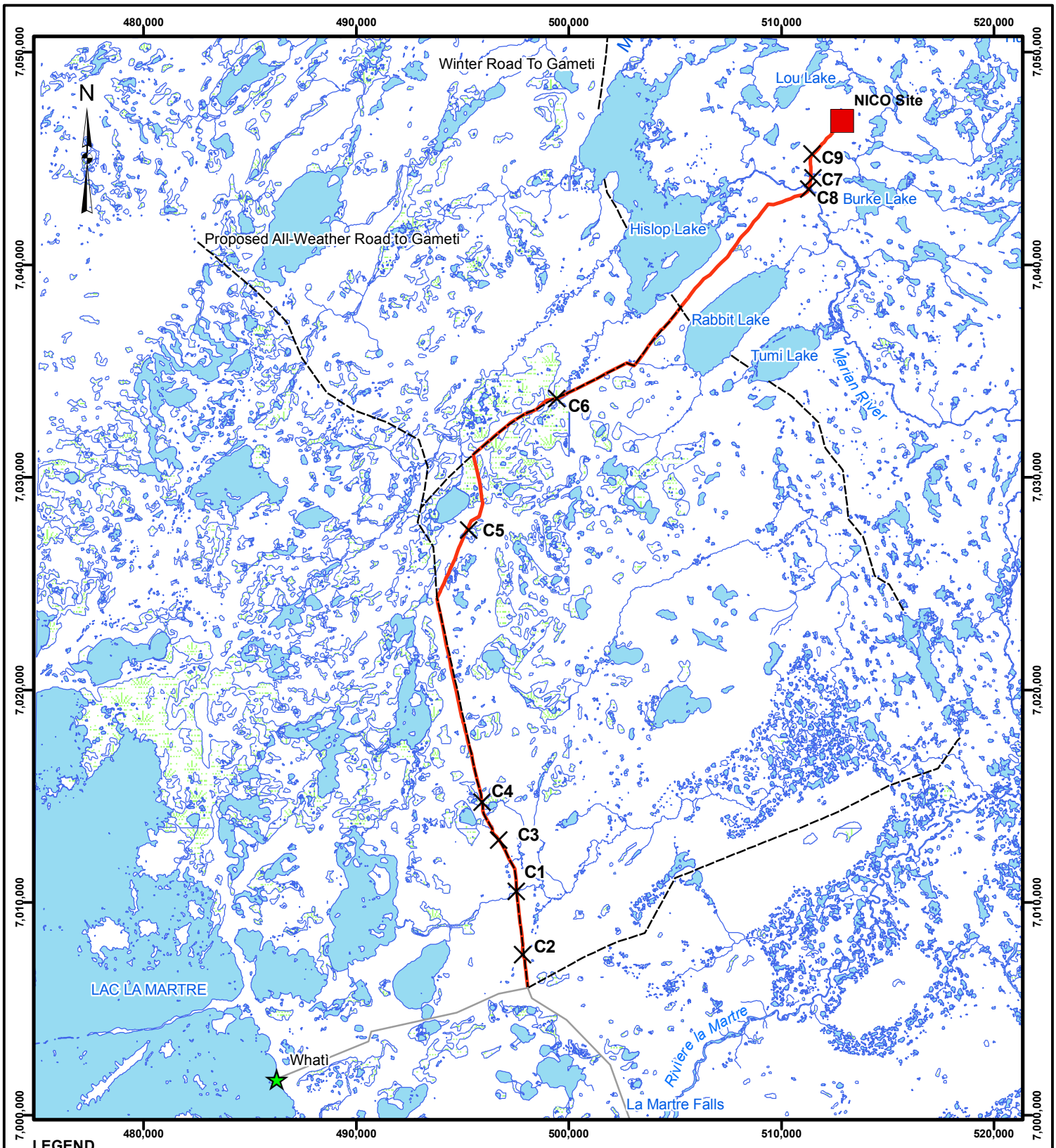
- *Northwest Territories Water Act;*
- *Mackenzie Valley Resource Management Act*;
- *Federal Fisheries Act; and*
- *Navigable Waters Protection Act.*

Golder Associates Ltd. (Golder) was retained by Fortune Minerals Ltd. to provide environmental services to support regulatory applications for the construction of the all-weather road. This report contains information on fish and fish habitat for all watercourse crossings along the proposed alignment that was collected by Golder from 2004 to 2006. The intent of this document is to provide adequate baseline information to support applications for regulatory approvals for the road construction.

1.1 OBJECTIVES

The objectives of the study were to collect site-specific information at each of the proposed watercourse crossing locations, including the following:

- description of fish habitat and channel characteristics (e.g., instream habitat types, channel width and depth, bed material, instream cover, bank condition, water quality); and
- assessment of fish presence and habitat use in the vicinity of the proposed crossing locations (e.g., species composition, distribution, life history stages, relative abundance).



LEGEND

- NICO Site
- Community
- Stream Crossing
- Proposed Road Route
- Approximate Existing Winter Road or Trail
- Existing Road
- Rivers and Streams
- Lakes
- Wetlands

FINAL

5,000 0 5,000

SCALE 1:250,000 METRES

REFERENCE

Sources: Data obtained from the Government of Canada, Natural Resources Canada, Centre for Topographic Information.
Projection: UTM Zone 11N Datum: NAD 83
This map is for information purposes only. The creators do not accept any liability arising from its misuse or misrepresentation, and cannot be held liable for the compatibility, completeness or correctness of the data.

PROJECT

FORTUNE MINERALS LTD.

TITLE

Overview Map of the Proposed All-Weather Road Route

Golder Associates
Edmonton, Alberta

PROJECT No. 07-1373-0068			SCALE AS SHOWN	REV. 0
DESIGN	AO	29 Oct. 2007		
GIS	BR	05 Dec. 2007		
CHECK	SM	11 Dec 2007		
REVIEW	GA	11 Dec. 2007		

FIGURE 1

1.2 STUDY AREA

The proposed alignment of the NICO project all-weather road is shown in Figure 1. The proposed route follows the existing winter trail from Highway 3 to Gameti to the point between Hislop Lake and Rabbit Lakes, where it crosses the existing Gameti Winter Road. Farther northeast, the route follows the ground contour of the southeast-facing slope of the ridge between Hislop Lake and Rabbit Lake. The total length of the route proposed by Fortune Minerals to access the NICO Mine is approximately 50 km. Detailed field assessments identified a total of nine watercourse crossings, which included one major river crossing (Marian River), two minor stream crossings, and six small, ephemeral watercourses (Figure 1 and Appendix A).

2 METHODS

2.1 BACKGROUND INFORMATION

Watercourse identification along the road alignment, completed in 2004, was based on 1:50 000 scale National Topographic Series (NTS) maps, aerial photos and reconnaissance flights. Follow-up field investigations, conducted in 2005, were additionally based on a review of the "NICO Mine Access Route Evaluation Report" (EBA 2005). All watercourse crossings were assigned a unique crossing number (C1 – C9) and were assessed from a minimum of 100 m upstream to 300 m downstream of the proposed crossing.

It should be noted that the EBA (2005) route evaluation report only identified eight watercourse crossings along the proposed road route; one additional watercourse crossing was identified by Golder staff during the reconnaissance flight in 2004 (watercourse C9). Owing to its omission from the EBA (2005) report, it will be necessary to conduct an additional engineering technical evaluation for this crossing, prior to the initiation of road construction activities.

2.2 STREAM HABITAT ASSESSMENT

2.2.1 Aerial Reconnaissance Flights

Watercourses to be crossed by the proposed road alignment ranged from small ephemeral streams to one large river. As such, they varied in their ability to support fish and their sensitivity to disturbance. To efficiently assess these different types of watercourses, a two-tiered approach was applied to the fisheries field studies. At the most basic level, all watercourses were assessed from the air during aerial reconnaissance flights on July 17, 2004. Extensive and geo-referenced photographic documentation of habitat conditions was collected at all stream crossings during the reconnaissance flight. This information, supplemented by the field notes and air photo interpretation, was used to classify all watercourses into one of three groups:

Group 1. Small watercourses with no potential to support fish populations;

Group 2. Small watercourses that do not provide fish habitat at the crossing location but may contribute to downstream fish habitat; and

Group 3. Watercourses that may have the potential to support sportfish populations on at least a seasonal basis, and/or provide suitable habitat for forage species.

The presence of nine watercourse crossings along the road route was confirmed during the 2004 aerial reconnaissance flights; however, only two small streams, C1 (locally referred to as "1 m Stream") and C2 (locally referred to as "3 m Stream"), as well as one major river, C8 (Marian River), were identified as having the potential to support fish habitat. The remainder of the streams were small, ephemeral drainages that did not appear to support fish populations. Because stream C2 did not appear to provide fish habitat at the crossing location, it was assigned Group 2 status. Stream C2 and the Marian River both provided fish habitat and were assigned Group 3 status. The streams at the remaining six watercourse crossings (C3 – C7 and C9) did not have the potential to provide fish habitat and all were given Group 1 status.

Detailed field assessments of aquatic habitat were carried out only for watercourses in Group 2 and 3, because they were considered to be more likely affected by road construction activities. The information collected for watercourses in Group 1 was limited to photographic documentation (from the air and/or the ground if access was readily available) and a brief qualitative description of the main aquatic habitat types. Site photographs of all stream crossings are provided in Appendix B.

2.2.2 Detailed Habitat Assessments

Stream crossings C1 and C2 were accessed by helicopter and surveyed by foot, and crossing C8 (Marian River) was accessed by boat and surveyed on foot where depths permitted. This report includes the detailed fish and fish habitat assessment results for stream crossings C1, C2 and C8 ("1 m Stream," "3 m Stream," and the Marian River, respectively). Additional environmental and geotechnical details concerning the Marian River crossing are outlined in a previous Golder report entitled "Supporting Environmental Report for the Marian River Bridge Crossing at the NICO Mine Site" (Golder 2006).

Habitat assessments at Group 2 and Group 3 crossings were carried out using the methods outlined in the Golder's Technical Procedure 8.14-1 (Golder Associates Ltd. 2002). The following information was collected at streams C1, C2 and C8:

- general watercourse characteristics;
- channel widths and depths;
- field water quality (dissolved oxygen, conductivity, pH, turbidity, temperature);
- substrate characterization;
- bank and erosion characterization;

- % instream and overhead cover;
- % cover by algae and aquatic plants;
- fish habitat potential; and
- general description of the crossing site.

Velocity at each detailed assessment crossing site was recorded using a direct read-out Swoffer™ Model 2100 meter; readings were taken along a single transect aligned perpendicular to the channel. Water depth and mean column velocities were measured at representative vertical stations on the cross-sectional transect. Discharge was calculated according to methods outlined by Buchanan and Somers (1969).

Water quality samples were collected in July 2004 and July 2005 at each detailed crossing assessment site, and sent to ALS Environmental Laboratory in Edmonton, AB. Results are presented in Appendix C. An additional water quality sample was also collected at the Marian River crossing in July 2006 (Appendix C).

Basic water quality parameters (conductivity, turbidity, pH, temperature) were measured at all detailed survey sites during field investigations. Conductivity was measured with an Oakton ECTestr3™ conductivity meter (±10 µS/cm). Turbidity was recorded with a LaMotte Model 2020 meter (±0.01 NTU). The pH was determined using an Oakton pHTestr2™ meter (±0.1 pH unit), and water temperature and dissolved oxygen were recorded with Oxyguard Mark2™ meter.

In addition to instream habitat characterization, detailed habitat maps of the reach were created according to Golder's Technical Procedure 8.5-1 (Golder 1997a). Mapping was done by visual estimation from the stream channel, where depths permitted. The following characteristics were recorded at crossing locations of streams C1, C2 and C8:

- bottom substrates (silt, sand, gravel, cobble, boulder);
- presence of wood debris in and above streams;
- presence of beaver dams;
- extent of aquatic plant growth;
- shoreline vegetation (coniferous forest, muskeg, mixed wood forest, bedrock, grass/forbes);
- channel connectivity (the potential for fish migration); and
- photographic record of relevant features.

2.3 FISH CAPTURE AND ASSESSMENT

Fisheries surveys at stream crossings C1, C2 and C8 were conducted over a three year period from 2004 to 2006. Due to the variation in waterbody sizes, a variety of fish sampling methods were employed. Fish species presence and relative abundance were documented at crossings C1 and C2 using backpack electrofishing during the 2004 and 2005 surveys. The Marian River (C8) was sampled for large bodied fish using a combination of gill nets and minnow traps during the 2004 and 2006 surveys. In 2005, localized areas immediately upstream and downstream of the proposed Marian River crossing were surveyed for small bodied fish using a backpack electrofishing unit, and fish spawning potential was assessed along the proposed right-of-way (RoW) during the spring spawning period, through kick sampling for eggs into a D-frame net.

Fish were sampled according to Golder's Technical Procedure 8.1-3 (Golder 1997b). Nets and traps were set in a variety of habitat types. Standard 15 m (3.8 cm mesh size) index gillnets were used and checked frequently to minimize fish capture mortality. Gee minnow traps baited with cat food were set overnight to maximize sampling effort and to account for the diurnal activity of some species.

In 2005, fish species presence and relative abundance in the vicinity of each of the three assessed crossings (C1, C2 and C8) were documented with a Smith-Root Type XII high output backpack electrofisher. The electrofisher settings were as follows: voltage (100 to 300 VDC), pulse rate (60 to 700 Hz), and pulse width of 6 ms. The electrofisher operator waded upstream along the banks and sampled in the immediate vicinity of suspected fish holding sites (e.g., overhanging branches, undercut banks, submerged logs, boulders). The netter, who was positioned immediately downstream, collected the temporarily immobilized fish and placed them in a hand-held container filled with water.

The following parameters were recorded during each fish survey:

- gear type used;
- set time or duration;
- fish species captured;
- fish maturity and sex (if possible);
- weight of each fish (grams);
- fish fork length (millimetres); and
- external health assessment (evidence of parasites, lesions, body condition) of each fish.

3 WATERCOURSE CROSSING ASSESSMENTS

The following subsections provide the results of the fish habitat assessments along the proposed all-weather road corridor. As discussed, only three of the nine watercourses surveyed had the potential to provide or contribute to fish habitat (Group 2 and 3 streams)(Table 3.1). Assessments of these Group 1 sites were limited to photographic documentation from the air and/or the ground and a brief qualitative description of the main aquatic habitat types, which can be found in Table 3.1 and Appendix E. Habitat maps and summaries of the collected habitat data from each detailed survey site (Group 2 and 3 streams), as well as the fish capture data summary, are also appended to this report (Appendix D and Appendix E, respectively).

Table 3.1 Recorded Fish Species and Habitat Quality at Watercourses Along the Proposed All-Weather Road

Crossing ID	Watercourse Name	Recorded Fish Species	Fish Habitat Quality	Channel Characteristics
C1	Unnamed[1]	Northern pike; Arctic grayling	Low sport fish habitat quality: 1.0 m debris pile may impede fish movement. Marginal forage fish habitat	Bankfull width at crossing 3.2 m; wetted width 2.8 m.
C2	Unnamed[2]	Nil	Not considered fish habitat at the crossing location (under-ground flows). May contribute to fish habitat downstream.	Poorly defined channel; beaver impounded and underground flows; bankfull width at crossing 2.0 m; wetted width 2.0 m.
C3	Unnamed	Nil	Not considered fish habitat	Stagnant peat bog; poorly defined channel and flows mostly underground; depth in visible section ~5 cm.
C4	Unnamed	Nil	Not considered fish habitat	Stagnant peat bog; poorly defined channel; depth in visible section ~5 cm.
C5	Unnamed	Nil	Not considered fish habitat	Stagnant peat bog; no visible channel.
C6	Unnamed	Nil	Not considered fish habitat	Poorly defined stream flows through large peat bog with little to no visible flow; depth < 5 cm.
C7	Unnamed	Nil	Not considered fish habitat	Very narrow, braided stream within horsetail bog; little to no visible flow; large ponds flank either side of the stream; depth < 5 cm; channel width 15 cm.
C8	Marian River	Northern pike, lake whitefish, burbot, white sucker	Moderate habitat quality: variety of habitat uses for species presen. Suitable rearing habitat for northern pike and lake whitefish noted near the crossing	Mean wetted channel width 25.6 m; bankfull width 33.1 m.
C9	Unnamed	Nil	Not considered fish habitat	Channel runs along road and flows mostly underground; channel depth 2 cm; channel width 10 cm.

1. Locally called "3 m Stream"

2. Locally called "1 m Stream"

3.1 CROSSING C1 (KP 4.6)

General Description

The unnamed stream at crossing C1 ("3 m Stream") flows into the La Marte River approximately 3.4 km downstream of the proposed crossing location. The stream has total stream length of 10.5 km and originates from a small lake located approximately 7.1 km upstream of the crossing. The mean gradient near the crossing is 2.5 m/km, with a total drainage area upstream of the crossing of 21.2 km^2. The C1 stream in the general area of the crossing flows through mixed forest, confined within a small meandering floodplain. The mean depth throughout the reach of the crossing is 0.40 m, with a maximum recorded depth of 0.65 m.

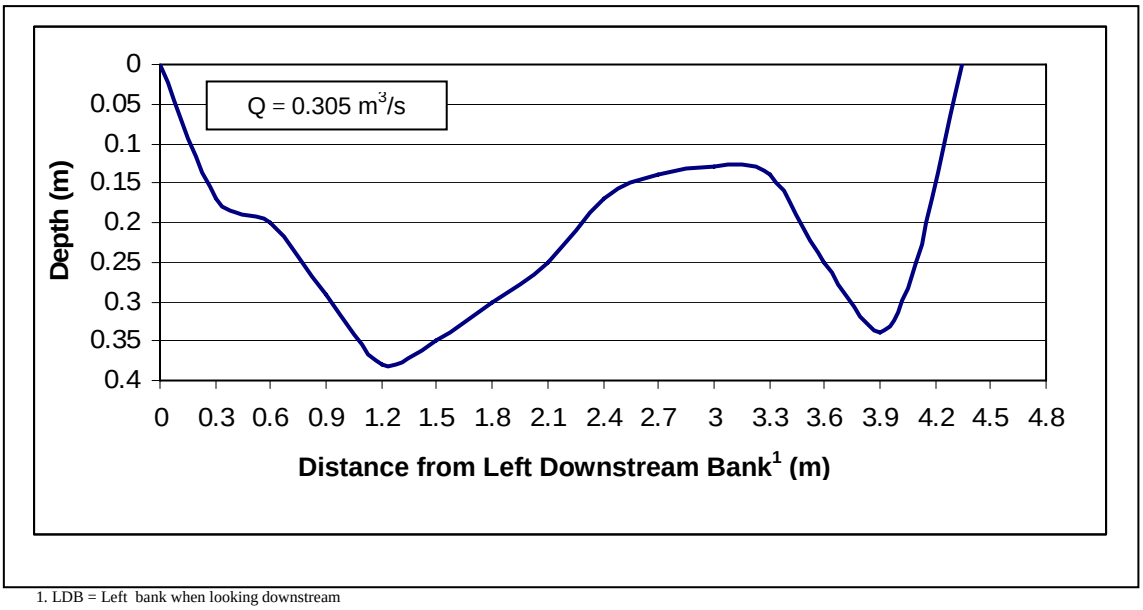
Hydrological data are summarized in Table 3.2 and a channel cross section is provided in Figure 2. Site photos of the crossing are provided in Appendix B.

Table 3.2 Hydrology Summary for Watercourse Crossing C1

Location and Size			
Highway km	KP 4.6	Northing - 7010408.0	NAD 83
Drainage Area	211.9 km^2	Easting - 497523.8	ZONE 11W
2004 Observations			
Crossing ID	C1		
Channel Type	R3	Discharge (17-July-04)	0.252 m^3/s
Channel Width	3.2 m		
Channel Slope	Steep		
Substrate	Boulder-Gravel		
Storage	Low		
Comments	Winter conditions unconfirmed		
2005 Observations			
Bankfull Width	4.35 m	Discharge (16-Aug-05)	0.305 m^3/s
Comments	Discharge conducted < 100 m downstream of proposed crossing.		

Detailed Habitat Assessment

A detailed fish habitat assessment was conducted on July 17, 2004. Instream habitat was surveyed and mapped along a 400 m section of the stream in the vicinity of the proposed road crossing. At the time of the survey, the mean wetted width was 3.4 m. The maximum recorded water depth within the survey area was 0.65 m. Bank stability was high, with moderately-steep to steep slopes, thickly vegetated banks and the average bank height was 0.57 m. Stream discharge was 0.25 m^3/s on July 17, 2004 and 0.31 m^3/s on August 16, 2005.



1. LDB = Left bank when looking downstream

Figure 2 Flow Cross Section for Watercourse Crossing C1, August 16, 2005.

Instream habitat within the surveyed reach consisted mainly of shallow Riffle (RF) habitat, with occasional shallow Run (R3) and Backwater (BW) habitat types, and one small set of Rapids (RA). The contribution of individual habitat types to the overall surface area was as follows: RF - 94%, R3 - 3%, BW - 2%, and RA - 1%. The backwater and rapids were formed by a large instream organic debris pile (over 1.0 m in height) downstream of the crossing. The streambed was composed entirely of coarse textured material, including gravel (5%), cobble (70%), and boulders (25%). At the crossing, instream cover (70% of stream area) was provided by woody debris, boulders, aquatic vegetation, and depth/surface turbulence. Overhead cover was provided primarily by overhanging grasses and shrubs, and large woody debris (overhead cover = 90% of stream area). Bank stability was considered high. The riparian vegetation at the crossing location was composed of mainly grasses (90%) with some forbs (10%), and a transition to mixed-wood forest farther away from the stream.

Fish Populations

Fish presence was assessed with a backpack electrofisher along a 130 m section of the stream in 2004 (effort of 323 seconds), and along the same area in 2005 (effort of 1377 seconds). In total, five juvenile northern pike (ranging from 117 to 220 mm in length) and two juvenile Arctic grayling (98 and 99 mm in length) were captured.

Habitat Use

The presence of sportfish within the proposed road crossing area is evidence that this stream provides adequate quality fish habitat. Due to shallow depths, it is likely this stream section will freeze to the bottom over winter; therefore, overwintering potential is low. However, adequate instream and overhead cover, as well as abundant cobble/boulder streambed substrate, provide suitable rearing and/or spawning habitat for most species known to inhabit the Lac la Marte watershed. Although no forage fish were observed in the area, abundant cobble and boulder substrates, large woody debris and overhanging and instream vegetation provide excellent cover for forage fish.

3.2 CROSSING C2 (KP 1.6)

General Location

The unnamed stream at watercourse crossing C2 ("1 m Stream") flows into a larger unnamed stream, 2.5 km downstream of the proposed crossing location, which eventually empties into the La Marte River. The watercourse has a total stream length of 6.75 km and originates from a small unnamed pond 4.25 km upstream of the proposed crossing. The mean gradient near the crossing is 3.47 m/km. The watershed area upstream of the crossing is approximately 13.5 km^2. Hydrological data are summarized in Table 3.3 and a channel cross section is provided in Figure 3. Site photos of the crossing are provided in Appendix B.

General Description

The unnamed stream at crossing C2 flows through a vegetated floodplain dominated by sedges, small shrubs and forbs with coniferous forest dominating the landscape farther away from the stream. The stream is not navigable, as it is extremely braided with numerous underground flows and has an average width of approximately 1.0 m. Upstream of the crossing, the stream flows through a large marsh-like meadow, within numerous irregular channels. Immediately downstream of the crossing, the stream goes underground for approximately 3 m after which the stream channel becomes more defined and flows among thick overhanging riparian vegetation.

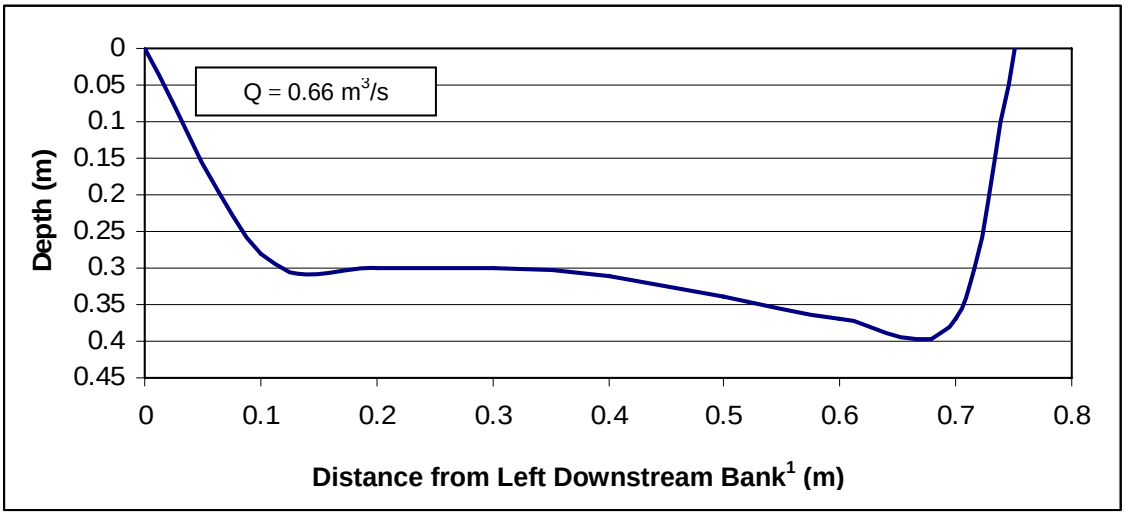
Detailed Habitat Assessment

A detailed fish habitat assessment was conducted on July 17, 2004. Instream habitat was surveyed and mapped along a 400 m section of the channel at the proposed all-weather road crossing C2. At the time of the survey, the wetted width of the stream varied between 0.3 and 2.0 m (average wetted width of

0.9 m), and the bankfull width at the crossing was approximately 2.0 m. The maximum recorded water depth was 0.64 m. Bank slope was generally steep, with an average height of 0.6 m. Due to the presence of numerous underground flows and impoundments at the crossing location, velocity measurement on July 14th, 2007 stream discharge was below detectable limits. Discharge measured again during the August 2005 survey at a more suitable downstream location was 0.066 m^3/s.

Table 3.3 Hydrology Summary for Watercourse Crossing C2

Location and Size			
Highway km	KP 1.6	Northing -7007563	NAD 83
Drainage Area	13.5 km^2	Easting - 497821.9	ZONE 11W
2004 Observations			
Crossing ID	C2		
Channel Type	R3	Discharge (14-July-04)	See comment below
Channel Width	2.0 m		
Channel Slope	Steep		
Substrate	Fines/Gravel/Cobble		
Storage	Low		
Comments	Unable to collect accurate discharge measurement due to extensive braiding of the channel.		
2005 Observations			
Bankfull Width	0.8 m	Discharge (16-Aug-05)	0.0656 m^3/s
Comments	Discharge collected downstream of proposed all-weather road crossing.		



[1]LDB = Left bank looking downstream

Figure 3 Flow Cross Section for Watercourse Crossing C2, August 16, 2005.

Instream habitat within the surveyed reach consisted mainly of a repetitive series of shallow depth Run and Riffle habitats. Fines were the dominant streambed material in all habitat units (86% by area). The remaining portion of the stream bed was composed of gravel (5%), cobble (7%), and boulder (2%). Upstream of the crossing location, fines were the only substrate present; farther downstream, where the channel was more defined, cobble, gravel and boulder substrates were present in the stream bed. At the crossing, instream cover was provided by instream vegetation (80% instream cover). Overhead cover was provided by large woody debris, undercut banks, and overhanging grasses and shrubs (available overhead cover = 90%).

The stream banks within the surveyed area were considered stable; however, some undercut banks were noted. The riparian vegetation at the immediate stream crossing was composed of grass, forbs and shrubs with a transition to a mixed wood then coniferous forest farther away from the stream.

Fish Populations

No fish were captured during either fish sampling attempt in 2004 and 2005. Fish sampling was carried out with a backpack electrofisher along a 130 m section of the stream in 2004 (effort of 140 seconds) and along the same area in 2005 (effort of 448 seconds).

Habitat Use

The surveyed reach of the stream provides poor habitat for forage fish species and sportfish. A variety of instream habitat features (i.e., boulders, woody debris, overhanging vegetation, and undercut banks) offer abundant fish cover and moderate spawning and rearing conditions for northern pike; however, extensive braiding, shallow depths and underground flows restrict fish movement and provide poor overwintering conditions for both forage fish and sport fish.

3.3 CROSSING C8 (KP 47.4): MARIAN RIVER

General Description

The proposed all-weather road crosses the Marian River at watercourse crossing C8 (Figure 1). The Marian River is a tributary to Marian Lake, which ultimately flows into Great Slave Lake. The river drains a sub-watershed of Great Slave Lake, and is formed by a series of lakes and streams. The Marian River has an estimated total length of approximately 81.4 km, and is characterized by an overall stream gradient of 0.44 m/km. The estimated drainage area upstream of the crossing is 1798 km^2. The river in the general area of the proposed crossing

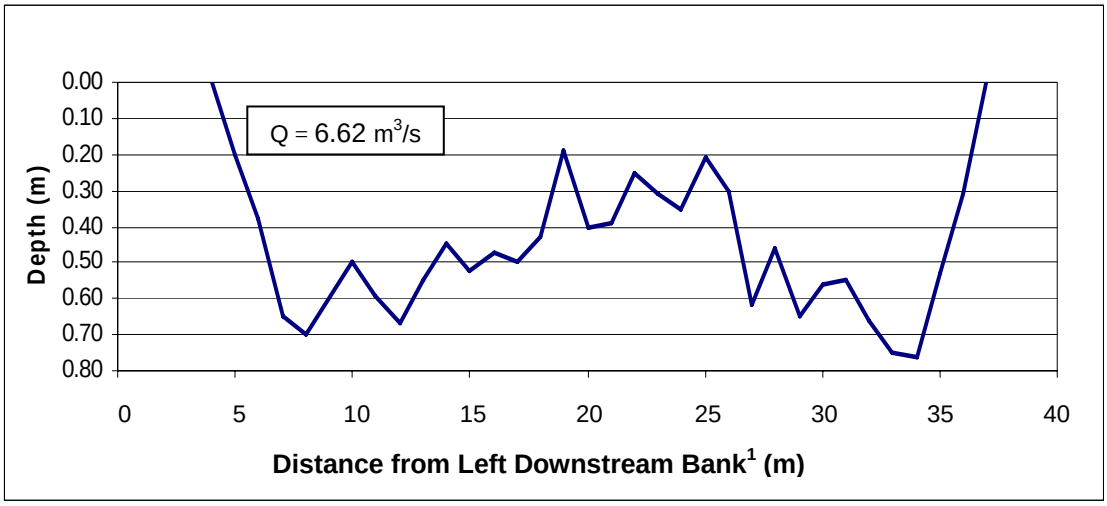
flows through boreal spruce forest habitat. The proposed all-weather road crossing is located approximately 4.2 km downstream of Hislop Lake. The calculated stream gradient at the proposed crossing is 0.46 m/km, and the elevation of the crossing is approximately 190 m above sea level. Hydrological data are summarized in Table 3.4 and a channel cross section is provided in Figure 4. Site photos of the crossing location are provided in Appendix B.

Table 3.4 Hydrology Summary for Watercourse Crossing C8 – (Marian River)

Location and Size			
Highway km	KP 47.4	Northing - 7043367	NAD 83
Drainage Area	1798 km^2	Easting - 511367	Zone 11W
2005 Observations			
Crossing ID	C8		
Channel Type	R1	Discharge (01-Jun-05)	11.5 m^3/s
Channel Width	33 m	Discharge (25-Jul-05)	6.62 m^3/s
Channel Slope	Low to Moderate	Discharge (22-Sep-05)	5.31 m^3/s
Substrate	Fines/Bedrock/Boulders		
Storage	High		
Comments	-		
2006 Observations			
Bankfull Width	33 m	Discharge (06-Jun-06)	42.95 m^3/s
		Discharge (27-Jul-06)	13.93 m^3/s
		Discharge (24-Sep-06)	12.16 m^3/s
Comments	-		
2006 Observations			
Bankfull Width	33 m	Discharge (14-Jun-07)	10.38 m^3/s
		Discharge (03-Aug-07)	6.95 m^3/s
Comments	Discharge measurements not available for Fall 2007 program.		
Other Observations			
Discharge data collected during the 2004 survey is not available.			

Detailed Habitat Assessment

A detailed fish habitat assessment in the vicinity of the road crossing was completed on July 18, 2004. At the time of the survey, the wetted width of the river varied between 16 and 40 m (average wetted width of 25.6 m). The bankfull width at the proposed crossing was 33.1 m. The maximum recorded water depth within the surveyed section was 2.6 m. Stream discharge was not recorded in 2004; however, seasonal data are available from 2005 to 2007 and are summarized in Table 3.4.



[1]LDB = Left bank looking downstream

Figure 4 Flow Cross Section for Watercourse C8 – Marian River, July 25, 2005.

Differences in stream habitat characteristics upstream and downstream of the proposed crossing were noted. Habitat upstream of the proposed crossing was classified as high quality Run (R1) habitat (i.e. average depth greater than 1.0 m). Downstream of the proposed crossing, the stream featured long, moderately-deep to deep Flat habitat (FL), interspersed by occasional short sections of moderate to high quality Runs (R1 and R2) and Rapids. Overall habitat composition within the assessed area was as follows: 69% FL, 18% R1, 8% Rapids, 3% Snye, and 1% R2. Upstream of the crossing, the streambed was composed primarily of a mixture of fines (sand and silt) cobble, boulders and bedrock. Downstream of the proposed crossing, silt and bedrock were the dominant substrate types. Within the total assessed area, the streambed was composed of 50% silt, 30% bedrock, 12% boulders, 5% cobble and 3% sand. Water depth and turbulence was the dominant form of instream cover. Other cover features included instream vegetation, undercut banks, overhanging vegetation, boulders, and large woody debris. Submergent aquatic macrophytes and macrophytic algae contributed 65% of the total instream vegetation within the vicinity of the proposed crossing location.

The Marian River, in the vicinity of the proposed stream crossing C8, exhibited a winding meander pattern. The channel was frequently confined and displayed an incised channel form; a moderate depth to width ratio was noted. The stream banks within the surveyed area were considered highly stable, as the majority (70-80%) of the bank was composed of exposed bedrock. The riparian vegetation at the crossing location was composed of grass, forbs and shrubs, with a transition to a mixed forest farther away from the stream.

Fish Populations

Fish sampling for large and small bodied fish was conducted from 2004 through 2006. Over the three year period, a variety of sampling methods were used including gill netting, minnow trapping, kick sampling, and backpack electrofishing. In 2004, 12 minnow traps and two gill nets were employed upstream and downstream of the proposed crossing. In total, seven adult northern pike, three juvenile northern pike, four adult lake whitefish, and two juvenile white suckers were captured. In addition, three juvenile burbot were observed being predated upon by a mink near the crossing.

In June of 2005, backpack electrofishing (total effort of 186 seconds) and kick sampling for evidence of spawning fish was carried out in localized areas immediately upstream and downstream of the crossing. In total, four young-of-the-year lake whitefish were captured; two were captured upstream and two were captured downstream of the crossing.

Habitat Use

The Marian River at the proposed crossing location provides moderate fish habitat for most fish species found in the system. Good quality rearing habitat for fish species present within the river is provided by instream cover features such as depth and turbidity, undercut banks, and overhanging vegetation. Deep Runs are capable of providing good overwintering conditions for forage fish, and possibly large-bodied fish. Owing to the absence of any gravel and cobble substrates within this section of river, spawning potential for white sucker or lake whitefish was considered low. However, the presence of young-of-the-year lake whitefish and juvenile white sucker suggests that spawning for these species may occur elsewhere within the Marian River. The absence of slow moving areas with macrophyte growth would limit the spawning potential for northern pike within this section of the river.

3.4 POTENTIAL IMPACTS AND PROPOSED MITIGATION

The disturbances typically associated with watercourse crossings may result in localized changes in habitat at the crossing site. Direct effects on habitat result from changes to stream morphology, changes in composition and size of bed materials, changes in bank configuration, and/or removal of bank vegetation. These effects can result in alteration of the stream channel and increased sediment deposition.

The extent and nature of potential adverse effects on fish habitat is related to the type of habitat present within the area affected by crossing construction and the crossing method. Specifically, effects on fish habitat may result from:

- direct disturbance, alteration or loss of productive habitats at the watercourse crossing site; and
- increased deposition of fine sediments downstream of the crossing site as a result of instream construction activities or run-off from newly excavated banks or approach slopes, which may result in changes in food availability, reduction in suitability of spawning or overwintering habitats and alterations to channel morphology and cover habitat.

Proper construction practices and mitigation measures during construction are expected to minimize negative impacts on the fisheries resources. In addition to mitigation measures designed to protect fish and fish habitat outlined in this report, any conditions and/or mitigations outlined by regulatory agencies under the following *Acts* or licence requirements should additionally be adhered to:

- *Federal Fisheries Act*;
- *Mackenzie Valley Resource Management Act*;
- *Navigable Waters Protection Act*; and
- Class A Water Licence and Land Use Permit.

3.5 WATERCOURSE CROSSING METHODS

The selection of the proposed crossing method is based on the habitat sensitivity to disturbance, as determined by field assessments and the watercourse categories assigned during the field assessment (i.e., Groups 1 to 3). All watercourses to be crossed have been assessed by a qualified fisheries biologist. In addition, where deemed necessary, a hydrological assessment will be completed to determine the appropriate size of each crossing structure. The proposed crossing structure and construction schedule for each watercourse crossing are provided in Table 3.5.

Table 3.5 Proposed NICO All-Weather Road Watercourse Crossing Methods

Crossing ID (KP)	Crossing ID	Watercourse Name	Habitat Sensitivity to Disturbance	Recommended Crossing Method	Crossing Schedule
1.6	C2	1m Stream	Low (Group 2)	CSP Culvert	Fall/Winter
4.6	C1	3m Stream	High (Group 3)	Arch Culvert or Single Span Bridge	Fall/Winter
6.9	C3	Unnamed	Nil (Group 1)	CSP Culvert	Fall/Winter
12.0	C4	Unnamed	Nil (Group 1)	CSP Culvert	Fall/Winter
22.6	C5	Unnamed	Nil (Group 1)	CSP Culvert	Fall/Winter
31.3	C6	Unnamed	Nil (Group 1)	CSP Culvert	Fall/Winter
47.4	C8	Marian River	High (Group 3)	Single Span Bridge	Fall/Winter
47.9	C7	Unnamed	Nil (Group 1)	CSP Culvert	Fall/Winter
48.8	C9	Unnamed	Nil (Group 1)	Unknown	Fall/Winter

The size of the watercourse and the potential to impact fish habitat are deemed to be the main factors influencing selection of crossing methods, and leads to the selection of the most conservative method. The following factors were considered in sequence for determining the appropriate crossing structures:

- timing and geographical location of the construction;
- fish habitat effects (potential effects to sensitive fish habitat and impediment to fish passage);
- hydraulic capacity (consideration of flow volume expected in the watercourse during construction);
- icing risk (susceptibility of watercourse to blockage due to winter ice accumulation); and
- height of fill (considered when choosing between a bridge and a culvert in high-fill situations; bridge headslopes and fill sideslopes influence the required length of structure).

Based on the above, a clear-span bridge structure, an arch culvert and appropriately sized culverts have been selected as the appropriate structures for watercourse crossings along the NICO all-weather road (Table 3.5). It is anticipated that by following the crossing structure recommendations outlined in Table 3.5, there will no negative impacts to fish or fish habitat as a result of the all-weather NICO road construction project.

During tree clearing activities, vehicle and equipment crossing methods may additionally include snowfill, ice bridges or temporary clear span bridges. The selection of the appropriate crossing method for movement of equipment will be influenced by the presence/quantity of under-ice flow.

4 FISHERIES ACT IMPLICATIONS

As discussed, the proposed 50 km NICO all weather road will cross a total of nine watercourses. Fisheries values have been assessed at each stream crossed along the route. Table 3.5 provides a summary of fisheries information, including ratings for fish habitat quality and fish habitat sensitivity to disturbance for all of the proposed watercourse crossings.

The Federal *Fisheries Act* provides for the protection of fish habitat, which is defined as "*spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes."* Under the *Fisheries Act*, no one may carry out any work or undertaking that results in the harmful alteration, disruption or destruction (HADD) of fish habitat, unless this HADD has been authorized by the Minister of Fisheries and Oceans Canada. Where adverse effects to fish habitat cannot be avoided through project relocation, redesign or mitigation, habitat compensation options may be required and a subsection 35(2) *Fisheries Act* authorization issued. In keeping with DFO's "Policy for the Management of Fish Habitat," no such authorizations are issued unless acceptable measures for the habitat loss are developed and implemented by the proponent.

After a detailed habitat assessment of all proposed watercourse crossings, according to the conditions outlined in the *Fisheries Act*, it was concluded that the construction of only the C1, C2 and C9 watercourse crossings have the potential to result in a HADD. However, provided the designated works follow the recommended watercourse crossing methods outlined in Section 3.5, it should not be necessary for the proponent to receive a *Fisheries Act* authorization for the proposed route.

It should be noted that because the Marian River would be considered navigable waters, approvals must be obtained from the Canadian Coast Guard, under the *Navigable Waters Protection Act* prior to construction.

To facilitate the review of the proposed works by the regulatory agencies, each watercourse crossing was classified into one of the following three categories:

- DFO review is not required, because the watercourse does not provide fish habitat;
- DFO review is required, because of potential HADD concerns in the receiving waterbody (e.g., larger watercourse downstream), even though the crossed watercourse is narrow and lacks fish habitat; and

- DFO review is required, because of potential HADD concerns related to fish presence, habitat quality, or sensitivity to disturbance. Mitigation measures employed (i.e., clear span bridge, arch culverts and sediment control measures) would prevent a HADD from occurring and should result is the issuance of a "Letter of Advice" from DFO to complete the works.

Table 4.1 classifies the proposed watercourse crossings according to the above categories. It should be noted that although some watercourse crossings require case-specific DFO review because they are considered fish habitat, they are not expected to result in HADD of fish habitat, provided the recommendations for specific crossing structures outlined in Section 3.5 are followed.

Table 4.1 Requirement for Case-Specific DFO Review of Watercourses along the NICO All-Weather Road

Crossing ID (KP)	Crossing ID	Not Required	Required (HADD unlikely)	Required (Potential for HADD)
1.6	C2		X	
4.6	C1			X
6.9	C3	X		
12.0	C4	X		
22.6	C5	X		
31.3	C6	X		
47.4	C8			X
47.9	C7	X		
48.8	C9	X		

In addition to the measures set out in this report, the following mitigative measures should be incorporated into the project, and are intended to alleviate any potentially harmful impacts to fish and fish habitat:

- To protect local fish populations during their spawning and nursery periods, all works should be conducted between Nov 1 – April 1, when all streams, with the exception of the Marian River, are expected to be frozen to the bottom.

- If the watercourse is not frozen to the bottom, a silt fence/curtain should be erected around the entire work site when all in-stream works are being conducted. Other measures including, but not limited, to silt fences or sand bags may be used to trap mobilized materials.

- Sediment and erosion control measures should be implemented prior to, and maintained during the construction phase, to prevent entry of sediment into the water.

- A rehabilitation plan should be developed to restore the construction site back to its pre-construction state, or better.

- All activities, including maintenance procedures, should be controlled to prevent the entry of petroleum products, debris, rubble, concrete or other deleterious substances into the water.

- Vehicular refueling and maintenance should be conducted away from the water.

- An emergency response plan will be developed to allow rapid deployment of cleanup equipment in the unlikely event of a spill.

In summary, of the nine proposed watercourse crossings, six are not expected to require a case-specific DFO review because they are not considered fish habitat. The remaining three crossings will likely require a DFO review, and one (Marian River) will require review under the *Navigable Waters Protection Act*.

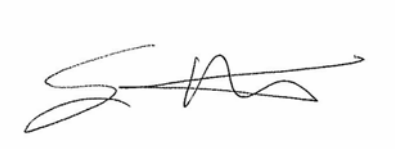
A HADD is not expected to occur as a result of the construction of the watercourse crossings along the NICO all-weather road, provided that appropriate mitigation strategies, outlined in this document, are followed. Close monitoring of the environmental effects will be implemented during construction. Based on the present assessment, compensation measures are not expected to be required for the NICO all-weather road crossings, unless specifically requested by DFO after the case specific reviews.

5 CLOSURE

We trust this fish and fish habitat report for the proposed NICO Project All-Weather Road meets your present requirements. If you have any questions, or require additional details or further clarification on the contents of this report, please contact the undersigned at (780) 930-8681.

GOLDER ASSOCIATES LTD.

Prepared by:



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APPENDIX A

WATERCOURSE CROSSING LOCATIONS

Appendix A: Location of Watercourse Crossings along the All-Weather Road

KP	Crossing ID	Watercourse Name	UTM (Zone 11W; NAD 83)	
			Easting	Northing
1.6	C2	Unnamed[1]	497599	7010313
4.6	C1	Unnamed[2]	497903	7007350
6.9	C3	Unnamed	496926	7012494
12.0	C4	Unnamed	495989	7014504
22.6	C5	Unnamed	495565	7027243
31.3	C6	Unnamed	499510	7033485
47.9	C7	Unnamed	511553	7043900
47.4	C8	Marian River	511367	7043367
48.8	C9	Unnamed	511513	7045013

[1]Locally called "3 m Stream"
[2]Locally called "1 m Stream"

APPENDIX B

SITE PHOTOGRAPHS

WATERCOURSE CROSSING C1 (“3 M STREAM”)

August 16th, 2005. Downstream aerial view of the proposed crossing location.

August 16th, 2005. Upstream aerial view of the proposed crossing location.

August 16th, 2005. Downstream view of the Riffle and Run habitat at the proposed crossing.

August 16th, 2005. Upstream view of the Run habitat at the proposed crossing.

August 16, 2005. Backpack electrofishing downstream of the crossing.

August 16, 2005. Artic grayling and northern pike captured at the proposed crossing location.

WATERCOURSE CROSSING C2 (“1 M STREAM”)

August 17th, 2005. Downstream aerial view of the proposed crossing area.

August 16th, 2005. Upstream aerial view of the proposed crossing area.

September 23, 2004. Aerial view of the proposed crossing location.

June 20, 2004. Upstream view at the proposed crossing.

August 16, 2005. Downstream of proposed crossing where the stream flow goes underground.

WATERCOURSE CROSSING C3 - (UNNAMED STREAM)

September 23, 2004. Aerial view of the proposed crossing area, looking south.

September 23, 2004. View at the proposed crossing area, looking north toward Lou Lake Camp.

June 20, 2004. Upstream habitat at the proposed crossing.

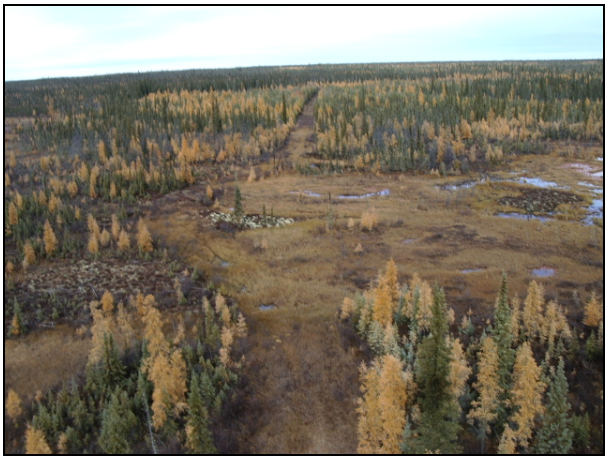
June 20, 2004. Downstream view of the habitat at the proposed crossing.

June 20, 2004. Aerial view of the habitat at the proposed crossing looking east.

June 20, 2004. Aerial view of the habitat at the proposed crossing looking west.

WATERCOURSE CROSSING C4 - (UNNAMED STREAM)

September 23, 2004. Aerial view of the proposed crossing area, looking south.

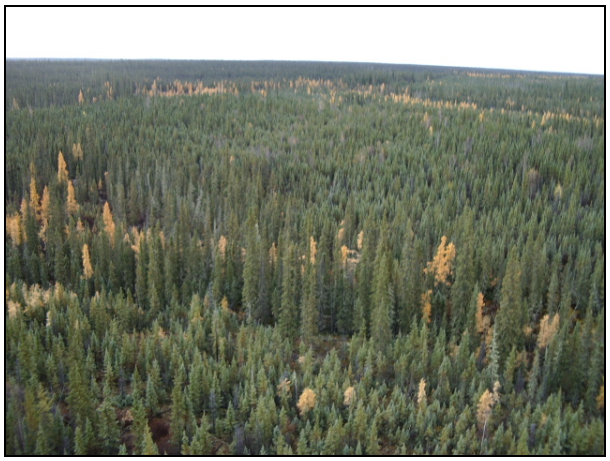


September 23, 2004. Aerial view of the proposed crossing area, looking north.

June 20, 2004. Upstream view at the proposed crossing.

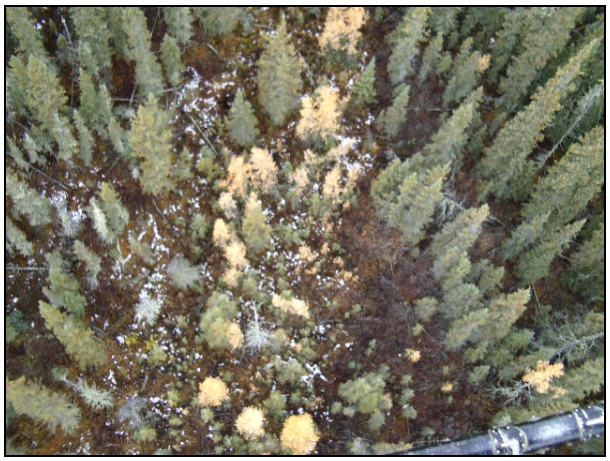
June 20, 2004. Downstream view at the proposed crossing.

WATERCOURSE CROSSING C5 - (UNNAMED STREAM)



September 23, 2004. Aerial view of the proposed crossing area looking south.

September 23, 2004. Aerial view of the proposed crossing area looking north.



September 23, 2004. Aerial view of the proposed crossing location

WATERCOURSE CROSSING C6 – (UNNAMED STREAM)

September 23, 2004. Aerial view of the proposed crossing area looking northeast towards Lou Lake Camp.

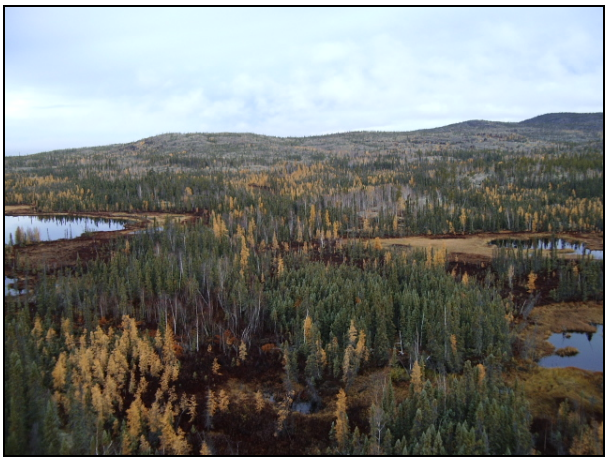
July 20, 2004. Aerial view of the proposed crossing area looking south.

July 20, 2004. Upstream view at the proposed crossing.

July 20, 2004. Downstream view at the proposed crossing

WATERCOURSE CROSSING C7 – (UNNAMED STREAM)

July18, 2004. Aerial view of the proposed stream crossing looking north.



September 23, 2004. Aerial view of the proposed crossing area facing north.

September 23, 2004. Aerial view of the proposed crossing.

June 20, 2004. Watercourse condition at the proposed crossing.

WATERCOURSE CROSSING C8 – (MARIAN RIVER)

September 23, 2004. Aerial view of the proposed crossing location.

June 20, 2004. Aerial view immediately upstream of the proposed crossing.

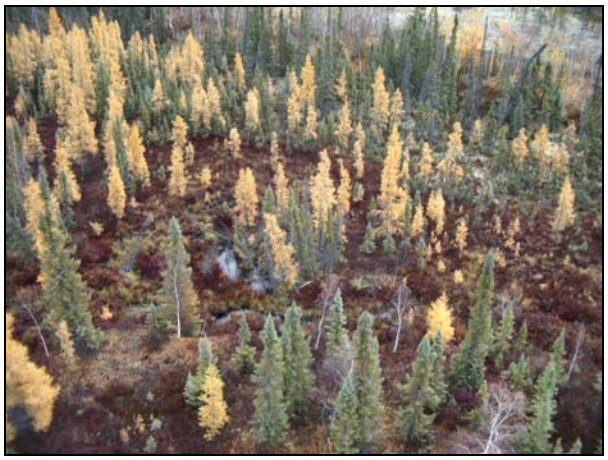
September 23, 2004. Aerial view of the proposed crossing location looking upstream.

September 23, 2004. Aerial view looking downstream at the proposed crossing.

June 11th, 2005. Looking immediately downstream of the proposed crossing where juvenile lake whitefish were captured.

June 11th, 2005. Juvenile lake whitefish captured below the proposed crossing location.

WATERCOURSE CROSSING C9 – (UNNAMED STREAM)



September 23, 2004. Aerial view of the proposed crossing.

September 23, 2004. Aerial view of the proposed crossing.

June 20, 2004. Upstream view at the proposed crossing.

June 20, 2004. Downstream view at the proposed crossing.

APPENDIX C

WATER QUALITY

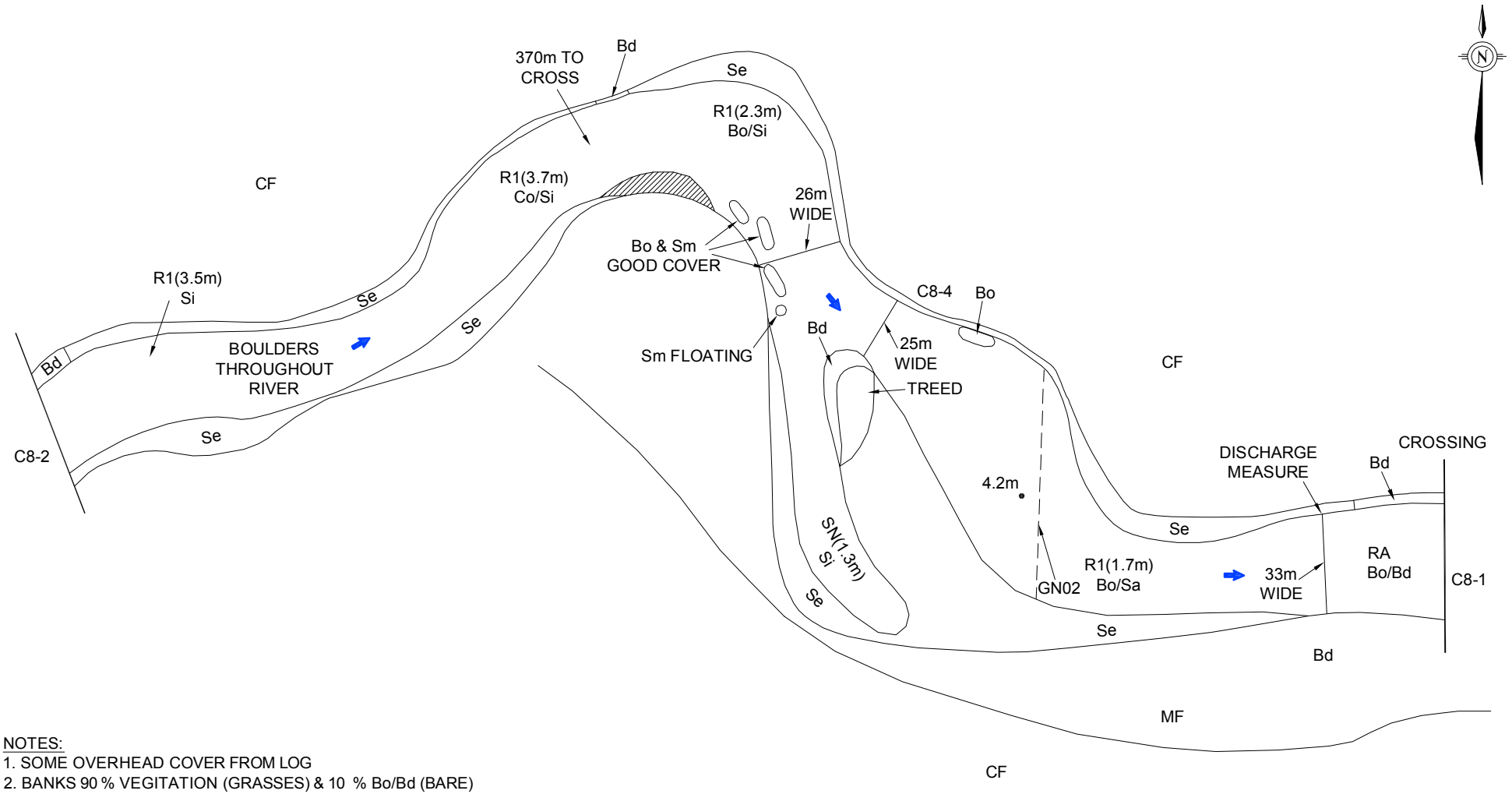
Appendix C. Water Quality Data, 2004-2006.

			C1 (3 m Stream)	C2 (1 m Stream)	C8 (Marian River)			Duplicates @ C8 (Marian River)			Field Blank
Parameter	***Unit***	***CWQG***	**17-Jul-04**	**17-Jul-04**	**18-Jul-04**	**11-Jun-05**	**27-Jul-06**	**18-Jul-04**	**11-Jun-05**	**11-Jun-05**	**18-Jul-04**
Total Metals											
Aluminum (Al)	*mg/L*	*0.1*	<0.02	0.03	0.06	0.01	0.01	0.05	0.01	0.01	<0.02
Antimony (Sb)	*mg/L*		<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	0.00012
Arsenic (As)	*mg/L*	*0.005*	0.0007	0.0007	0.0005	<0.0004	0.0005	0.0006	<0.0004	<0.0004	<0.0004
Barium (Ba)	*mg/L*		0.0680	0.0239	0.0157	0.01	0.011	0.0128	0.011	0.011	<0.0002
Beryllium (Be)	*mg/L*		<0.001	<0.001	<0.001	<0.002	<0.002	<0.001	<0.002	<0.002	<0.001
Bismuth (Bi)	*mg/L*		<0.0001	<0.0001	<0.0001	<1	<1	<0.0001	<1	<1	<0.0001
Boron (B)	*mg/L*		0.03	0.03	0.03	<0.05	<0.05	0.03	<0.05	<0.05	<0.02
Cadmium (Cd)	*mg/L*	*0.002*	<0.002	<0.002	<0.002	<0.001	<0.001	<0.002	<0.001	<0.001	<0.002
Calcium (Ca)	*mg/L*		51.9	31.3	21	17.5	16.6	19.7	17.5	17.1	<0.5
Cesium (Cs)	*mg/L*		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chromium (Cr)	*mg/L*	*0.01*	<0.0008	<0.0008	<0.0008	<0.005	<0.005	<0.0008	<0.005	<0.005	<0.0008
Cobalt (Co)	*mg/L*		<0.0002	<0.0002	<0.0002	<0.002	<0.002	0.001	<0.002	<0.002	<0.0002
Copper (Cu)	*mg/L*	*0.002*	<0.001	<0.001	0.001	0.001	<0.001	0.001	<0.001	0.001	<0.001
Iron (Fe)	*mg/L*	*0.3*	0.243	0.148	0.064	0.067	0.075	0.06	0.066	0.059	<0.005
Lead (Pb)	*mg/L*	*0.002*	<0.0001	<0.0001	<0.0001	<0.005	<0.005	<0.0001	<0.005	<0.005	<0.0001
Lithium (Li)-Total	*mg/L*		<0.006	<0.006	<0.006	<0.01	<0.01	<0.006	<0.01	<0.01	<0.006
Magnesium (Mg)	*mg/L*		27.8	23.9	8.9	7.3	7.5	8.7	7.3	7.3	<0.1
Manganese (Mn)	*mg/L*		0.026	0.023	0.022	0.01	0.016	0.021	0.01	0.01	0.0008
Mercury, (Hg)-Total	*mg/L*	*0.000026*	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Molybdenum (Mo)	*mg/L*	*0.073*	<0.0001	<0.0001	0.0002	<0.005	<0.005	0.0002	<0.005	<0.005	<0.0001
Nickel (Ni)	*mg/L*	*0.065*	<0.0002	<0.0002	<0.0002	<0.002	<0.002	<0.0002	<0.002	<0.002	<0.0002
Potassium (K)	*mg/L*		1.5	1.2	1.5	1.2	1.4	1.5	1.2	1.2	<0.1
Rubidium (Rb)	*mg/L*		<0.05	<0.05	<0.05	<0.01	<0.01	<0.05	<0.01	<0.01	<0.05
Selenium (Se)	*mg/L*	*0.001*	0.0005	0.0005	0.0009	<0.0004	0.0004	0.0008	<0.0004	<0.0004	<0.0004
Silver (Ag)	*mg/L*	*0.0001*	<0.0004	<0.0004	<0.0004	<0.005	<0.005	<0.0004	<0.005	<0.005	<0.0004
Sodium (Na)	*mg/L*		3	2	3	2	2	3	2	2	<1
Strontium (Sr)	*mg/L*		0.0607	0.0449	0.0947	0.064	0.067	0.0827	0.068	0.065	<0.0002
Thallium (Tl)	*mg/L*		<0.0001	<0.0001	<0.0001	<0.05	<0.05	<0.0001	<0.05	<0.05	<0.0001
Tin (Sn)	*mg/L*		<0.0004	<0.0004	<0.0004	<0.05	<0.05	<0.0004	<0.05	<0.05	<0.0004
Titanium (Ti)	*mg/L*		<0.005	<0.005	0.009	0.002	0.001	<0.005	0.002	0.002	<0.005
Uranium (U)	*mg/L*		0.0003	<0.0001	0.0007	<0.05	<0.05	0.0007	<0.05	<0.05	<0.0001
Vanadium (V)	*mg/L*		0.0006	0.0006	0.0008	<0.001	<0.001	0.001	<0.001	<0.001	<0.0002
Zinc (Zn)	*mg/L*	*0.03*	0.011	0.018	0.019	<0.001	0.008	0.007	0.002	0.006	<0.004
Dissolved Metals											
Aluminum (Al)	*mg/L*		-	-	-	0.01	0.01	-	0.01	0.01	-
Antimony (Sb)	*mg/L*		-	-	-	<0.0004	<0.0004	-	<0.0004	<0.0004	-
Arsenic (As)	*mg/L*		-	-	-	<0.0004	0.0005	-	<0.0004	<0.0004	-
Barium (Ba)	*mg/L*		-	-	-	0.01	0.011	-	0.01	0.01	-
Beryllium (Be)	*mg/L*		-	-	-	<0.001	<0.001	-	<0.001	<0.001	-
Bismuth (Bi)	*mg/L*		-	-	-	<1	<1	-	<1	<1	-
Boron (B)	*mg/L*		-	-	-	<0.05	<0.05	-	<0.05	<0.05	-
Cadmium (Cd)	*mg/L*		-	-	-	<0.001	<0.001	-	<0.001	<0.001	-
Calcium (Ca)	*mg/L*		-	-	-	16.3	18.1	-	15.5	16.9	-
Cesium (Cs)	*mg/L*		-	-	-	<0.05	<0.05	-	<0.05	<0.05	-
Chromium (Cr)	*mg/L*		-	-	-	<0.005	<0.005	-	<0.005	<0.005	-
Cobalt (Co)	*mg/L*		-	-	-	<0.002	<0.002	-	<0.002	<0.002	-
Copper (Cu)	*mg/L*		-	-	-	<0.001	<0.001	-	<0.001	<0.001	-
Iron (Fe)	*mg/L*		-	-	-	0.038	0.020	-	0.032	0.031	-
Lead (Pb)	*mg/L*		-	-	-	<0.005	<0.005	-	<0.005	<0.005	-
Lithium (Li)-Total	*mg/L*		-	-	-	<0.003	<0.003	-	<0.003	<0.003	-
Magnesium (Mg)	*mg/L*		-	-	-	7.27	8.4	-	6.95	7.25	-
Manganese (Mn)	*mg/L*		-	-	-	0.002	<0.001	-	0.003	0.003	-
Mercury, (Hg)-Total	*mg/L*		-	-	-	<0.0002	<0.0002	-	<0.0002	<0.0002	-
Molybdenum (Mo)	*mg/L*		-	-	-	<0.005	<0.005	-	<0.005	<0.005	-
Nickel (Ni)	*mg/L*		-	-	-	<0.002	<0.002	-	<0.002	<0.002	-
Potassium (K)	*mg/L*		-	-	-	1.2	1.4	-	1.1	1.2	-
Rubidium (Rb)	*mg/L*		-	-	-	<0.05	<0.05	-	<0.05	<0.05	-
Selenium (Se)	*mg/L*		-	-	-	<0.0004	<0.0004	-	<0.0004	<0.0004	-
Silver (Ag)	*mg/L*		-	-	-	<0.005	<0.005	-	<0.005	<0.005	-
Sodium (Na)	*mg/L*		-	-	-	1.8	3	-	1.7	1.9	-
Strontium (Sr)	*mg/L*		-	-	-	0.063	0.062	-	0.062	0.062	-
Thallium (Tl)	*mg/L*		-	-	-	<0.05	<0.05	-	<0.05	<0.05	-
Tin (Sn)	*mg/L*		-	-	-	<0.05	<0.05	-	<0.05	<0.05	-
Titanium (Ti)	*mg/L*		-	-	-	<0.001	<0.001	-	<0.001	<0.001	-
Uranium (U)	*mg/L*		-	-	-	<0.05	<0.05	-	<0.05	<0.05	-
Vanadium (V)	*mg/L*		-	-	-	<0.001	<0.001	-	<0.001	<0.001	-
Zinc (Zn)	*mg/L*		-	-	-	<0.001	0.008	-	0.002	0.006	-
Nutrients											
Phosphorus, Total	*mg/L*		0.007	0.012	0.015	<0.02	<0.02	0.017	<0.02	0.02	<0.001
Ammonia-N	*mg/L*		0.032	0.026	<0.005	<0.05	<0.05	<0.005	<0.05	<0.05	<0.005
Total Kjeldahl Nitrogen	*mg/L*		0.69	0.85	0.5	0.5	0.6	0.46	0.5	0.5	<0.05
Total Organic Carbon	*mg/L*		16	15	10	10	12	9	10	11	<1
Total Suspended Solids	*mg/L*		<3	5	5	<3	3	6	<3	<3	<3
Total Dissolved Solids	*mg/L*		290	240	130	100	101	150	120	110	20
Turbidity	*NTU*		0.55	0.70	1.1	0.8	1.2	1.1	0.9	0.8	0.10
Routine Water Analysis											
Chloride (Cl)	*mg/L*		3	3	3	3	3	4	3	3	<1
Nitrate+Nitrite-N	*mg/L*		0.031	0.037	<0.006	<0.1	<0.1	<0.006	<0.1	<0.1	<0.006
Nitrate-N	*mg/L*	*0.06*	0.031	0.037	<0.006	<0.1	<0.1	<0.006	<0.1	<0.1	<0.006
Nitrite-N	*mg/L*		<0.002	<0.002	<0.002	<0.05	<0.05	<0.002	<0.05	<0.05	<0.002
Sulphate (SO4)	*mg/L*		2.20	8.01	15	15.5	15.9	14.9	15.3	15.4	<0.05
pH, Conductivity and Alkalinity											
pH	*pH*	*6.5-9.0*	8.2	8.3	8.1	8	7.9	8.1	7.8	7.8	5.9
Conductivity (EC)	*uS/cm*		404	297	169	156	152	168	156	156	1.0
Bicarbonate (HCO3)	*mg/L*		295	195	85	72	75	86	72	72	<5
Carbonate (CO3)	*mg/L*		<5	<5	<5	<5	<5	<5	<5	<5	<5
Hydroxide (OH)	*mg/L*		<5	<5	<5	<5	<5	<5	<5	<5	<5
Alkalinity, Total (as CaCO3)	*mg/L*		242	162	70	59	61	70	59	59	<5
Ion Balance Calculation											
Ion Balance	*%*		99.5	102	101	105	107	99	103	103	Low TDS
TDS (Calculated)	*mg/L*		233	165	92	83	86	93	82	83	<1
Hardness (as CaCO3)	*mg/L*		239	170	82	75	80	82	74	73	<1
ICP Metals and SO4 for Routine Water											
Calcium (Ca)	*mg/L*		50.0	30.0	18.8	17.3	18.1	19	16.9	16.7	<0.5
Potassium (K)	*mg/L*		1.4	1.2	1.3	1.3	1.4	1.4	1.1	1.4	<0.1
Magnesium (Mg)	*mg/L*		27.7	23.0	8.5	7.7	8.4	8.5	7.7	7.6	<0.1
Sodium (Na)	*mg/L*		3	2	3	3	3	3	3	3	<1
ALS Sample ID			L190960-2	L190960-3	L190960-4	L277102-1	L417340-9	L190960-1	L277102-2	L277102-3	L190960-5

Note: DL = Detection Limit CWQG = Canadian Water Quality Guidelines for freshwater (CCME 2007)

APPENDIX D

HABITAT MAPS



NOTES:
1. SOME OVERHEAD COVER FROM LOG
2. BANKS 90 % VEGITATION (GRASSES) & 10 % Bo/Bd (BARE)
3. BANKS GENTLE WHEN VEGITATION & STEEP WHEN BARE

LEGEND

R1	Run - Semi Turbulent >1.0m
Bd	Bedrock
Bo	Boulder
Co	Cobble
Sa	Sand
Si	Silt
→	Direction of Flow
////	Emergent vegetation
Se	Sedges
Sm	Submergent Macrophytes
MF	Mixedwood Forest
CF	Coniferous Forest
SN	Snye
RA	Rapid - area with turbulent flow, high velocity and armoured substrate

40 0 40
SCALE 1:2000 METRES

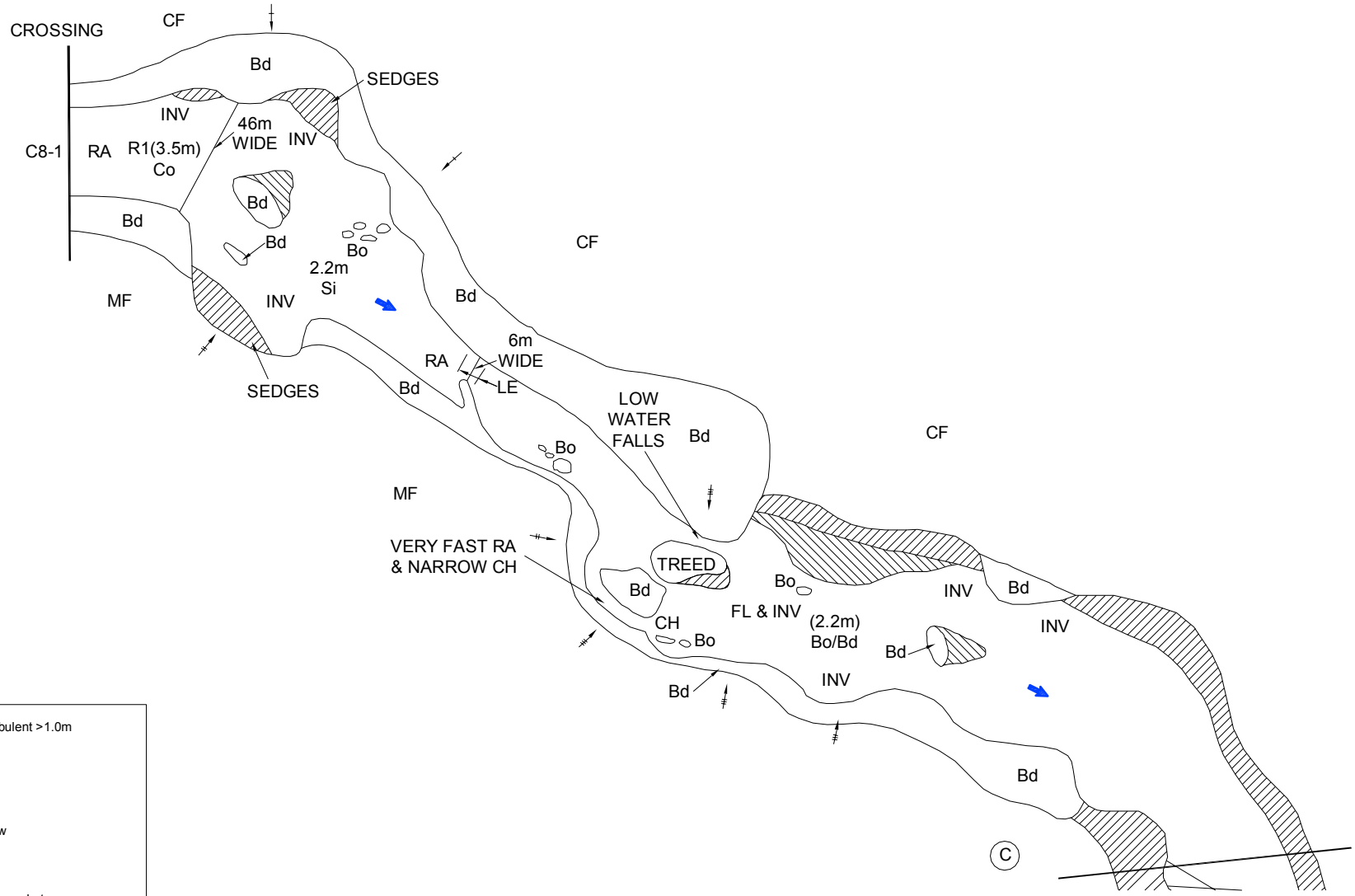
PROJECT
FORTUNE MINERALS
NICO MINE
YELLOWKNIFE, NWT

TITLE
CROSSING C8 (MARIAN RIVER)
HABITAT MAP, UPSTREAM, JULY 2004
(Taken from original figure 03-1117-029_habitat_maps_1-marian river upstream, Courtesy of Golder Associates Ltd, Saskatoon, SK)

Golder Associates
Edmonton, AB

PROJECT	07-1373-0068		FILE No.	
DESIGN	AO	12/07/07	SCALE AS SHOWN	REV. 0
CADD	JDS	25/08/04		
CHECK	SM	12/11/07		
REVIEW	GA	12/11/07		

FIGURE: D1



LEGEND

R1	Run - Semi Turbulent >1.0m
Bd	Bedrock
Bo	Boulder
Co	Cobble
Sa	Sand
Si	Silt
	Direction of Flow
	1m vegetation
	Flat vegetation
Se	Sedges
Sm	Submergent Macrophytes
MF	Mixedwood Forest
FL	Flat
CF	Coniferous Forest
SN	Snye
	Shallow Slope
	Moderate Slope
	Moderately Steep Slope
	Steep Slope
RA	Rapid - area with turbulent flow, high velocity and armoured substrate
LE	Ledge
CH	Chute
INV	Inundated vegetation

50 0 50
SCALE 1:2500 METRES

PROJECT
FORTUNE MINERALS
NICO MINE
YELLOWKNIFE, NWT

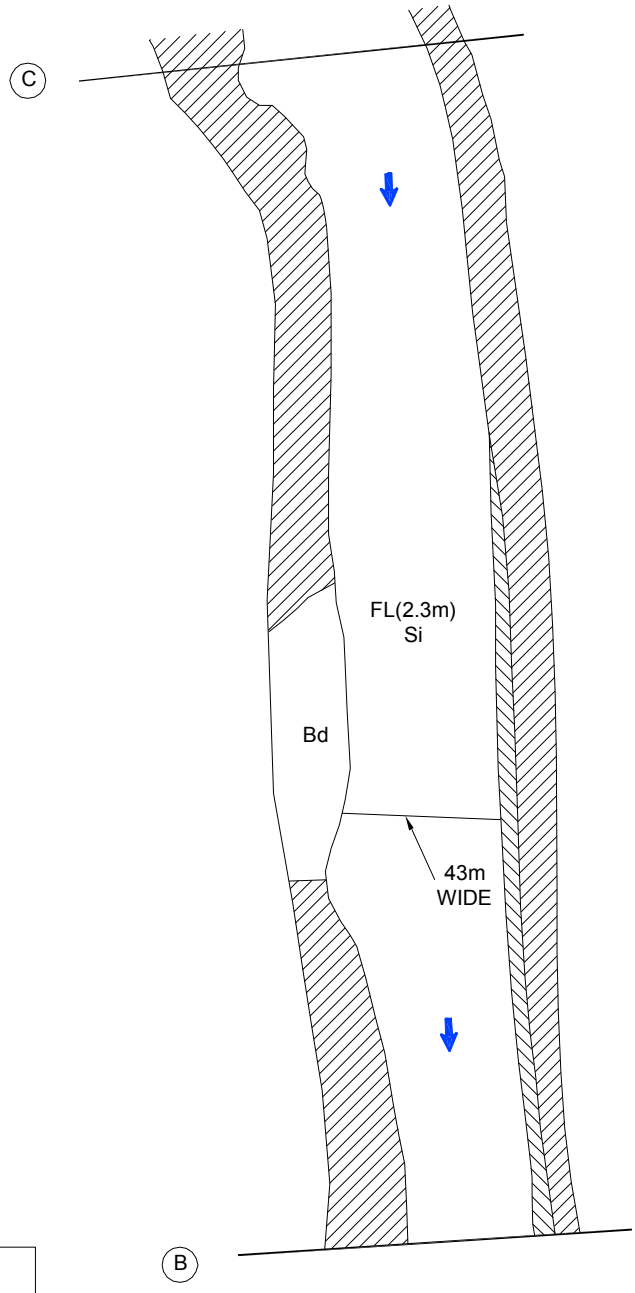
TITLE
CROSSING C8 (MARIAN RIVER) HABITAT MAP, DOWNSTREAM (1 OF 4), JULY 2004

(Taken from original figure 03-1117-029_habitat_maps_2-MR Downstream C-Crossing, Courtesy of Golder Associates Ltd, Saskatoon, SK)

Golder Associates
Edmonton, AB

PROJECT	07-1373-0068		FILE No.	
DESIGN	AO	12/07/07	SCALE AS SHOWN	REV. 0
CADD	JDS	25/08/04		
CHECK	SM	12/11/07		
REVIEW	GA	12/11/07		

FIGURE: D2



LEGEND

R1	Run - Semi Turbulent >1.0m
R2	Run - Semi Turbulent 0.5-1.0m
Ba	Bare Ground
Bd	Bedrock
Bo	Boulder
Co	Cobble
Sa	Sand
Si	Silt
→	Direction of Flow
////	1m vegetation
\\\\	Flat vegetation
Se	Sedges
Sm	Submergent Macrophytes
MF	Mixedwood Forest
FL	Flat
CF	Coniferous Forest
SN	Snye
—►	Shallow Slope
—+►	Moderate Slope
—++►	Moderately Steep Slope
—+++►	Steep Slope
RA	Rapid - area with turbulent flow, high velocity and armoured substrate
BL	Beaver Lodge

40 0 40
SCALE 1:2000 METRES

PROJECT
FORTUNE MINERALS
NICO
YELLOWKNIFE, NWT

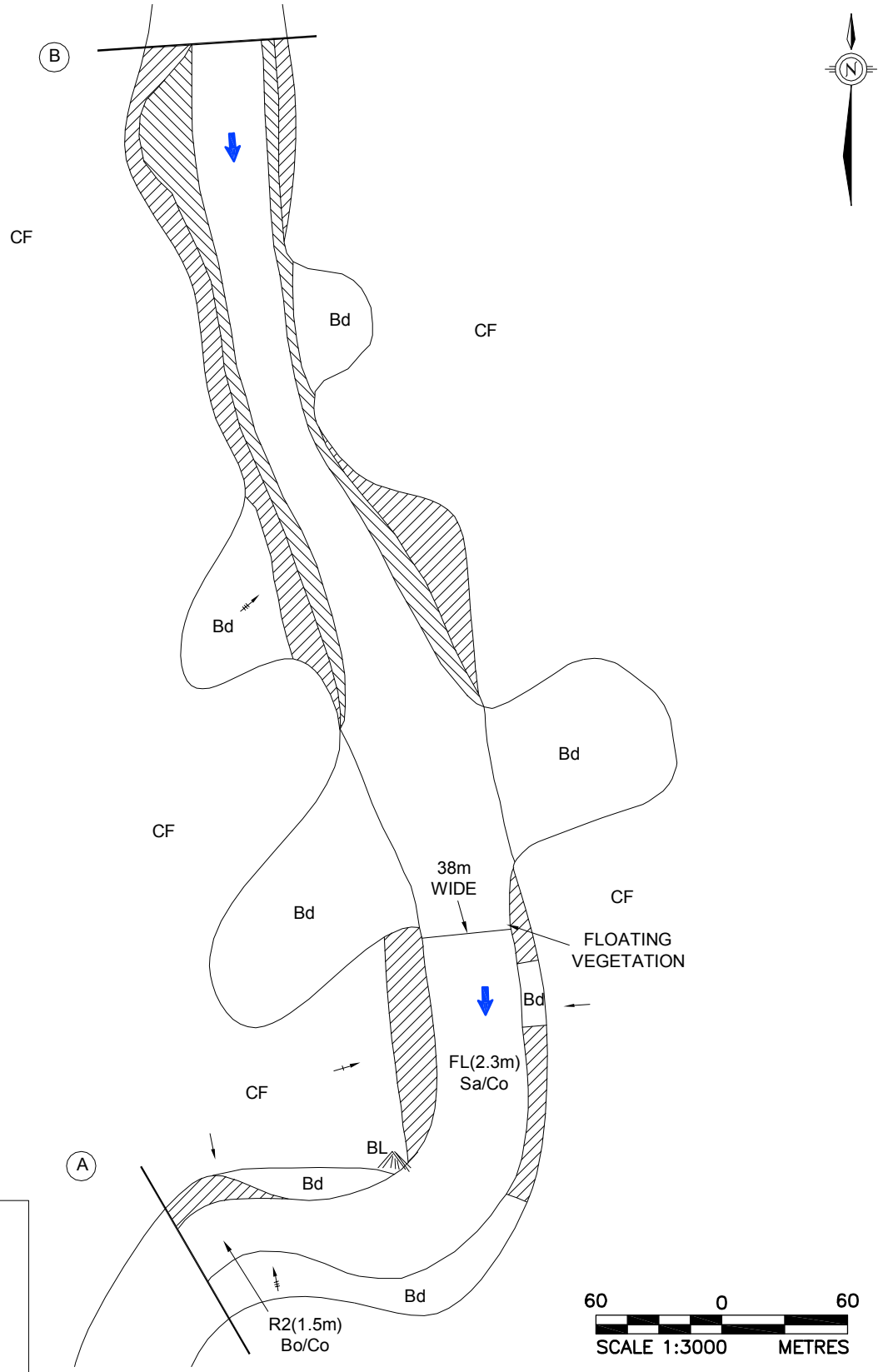
TITLE
CROSSING C8 (MARIAN RIVER) HABITAT MAP, DOWNSTREAM (2 OF 4), JULY 2004

(Taken from original figure 03-1117-029_habitat_maps_2-MR downstream B-C, Courtesy of Golder Associates Ltd, Saskatoon, SK)

Golder Associates
Edmonton, AB

PROJECT	07-1373-0068		FILE No.	
DESIGN	AO	12/07/07	SCALE AS SHOWN	REV. 0
CADD	JDS	25/08/04		
CHECK	SM	12/11/07		
REVIEW	GA	12/11/07		

FIGURE: D3



LEGEND

R1	Run - Semi Turbulent >1.0m
R2	Run - Semi Turbulent 0.5-1.0m
Bd	Bedrock
Bo	Boulder
Co	Cobble
Sa	Sand
Si	Silt
	Direction of Flow
	1m vegetation
	Flat vegetation
Se	Sedges
Sm	Submergent Macrophytes
MF	Mixedwood Forest
FL	Flat
CF	Coniferous Forest
SN	Snye
	Shallow Slope
	Moderate Slope
	Moderately Steep Slope
	Steep Slope
RA	Rapid - area with turbulent flow, high velocity and armoured substrate
BL	Beaver Lodge

PROJECT
FORTUNE MINERALS
NICO
YELLOWKNIFE, NWT

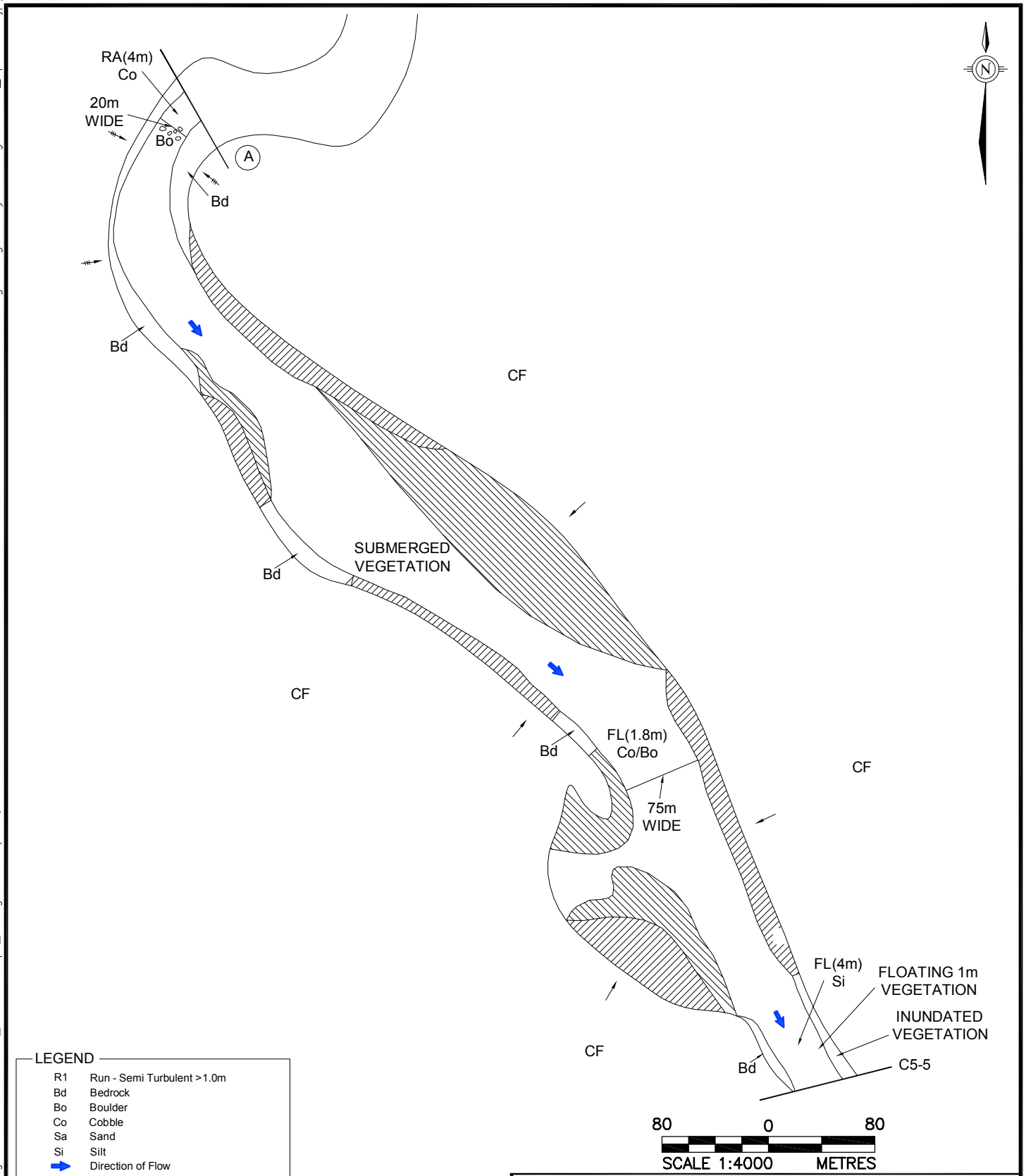
TITLE
CROSSING C8 (MARIAN RIVER) HABITAT MAP, DOWNSTREAM (3 OF 4), JULY 2004

(Taken from original figure 03-1117-029_habitat_maps_1-MR downstream A-B, Courtesy of Golder Associates Ltd, Saskatoon, SK)

Golder Associates
Edmonton, AB

PROJECT	07-1373-0068		FILE No.	
DESIGN	AO	12/07/07	SCALE AS SHOWN	REV. 0
CADD	JDS	25/08/04		
CHECK	SM	12/11/07		
REVIEW	GA	12/11/07		

FIGURE: D4



LEGEND

R1	Run - Semi Turbulent >1.0m
Bd	Bedrock
Bo	Boulder
Co	Cobble
Sa	Sand
Si	Silt
	Direction of Flow
	1m vegetation
	Flat vegetation
Se	Sedges
Sm	Submergent Macrophytes
MF	Mixedwood Forest
FL	Flat
CF	Coniferous Forest
SN	Snye
	Shallow Slope
	Moderate Slope
	Moderately Steep Slope
	Steep Slope
RA	Rapid - area with turbulent flow, high velocity and armoured substrate

PROJECT

FORTUNE MINERALS
NICO
YELLOWKNIFE, NWT

TITLE

CROSSING C8 (MARIAN RIVER) HABITAT MAP, DOWNSTREAM (4 OF 4), JULY 2004

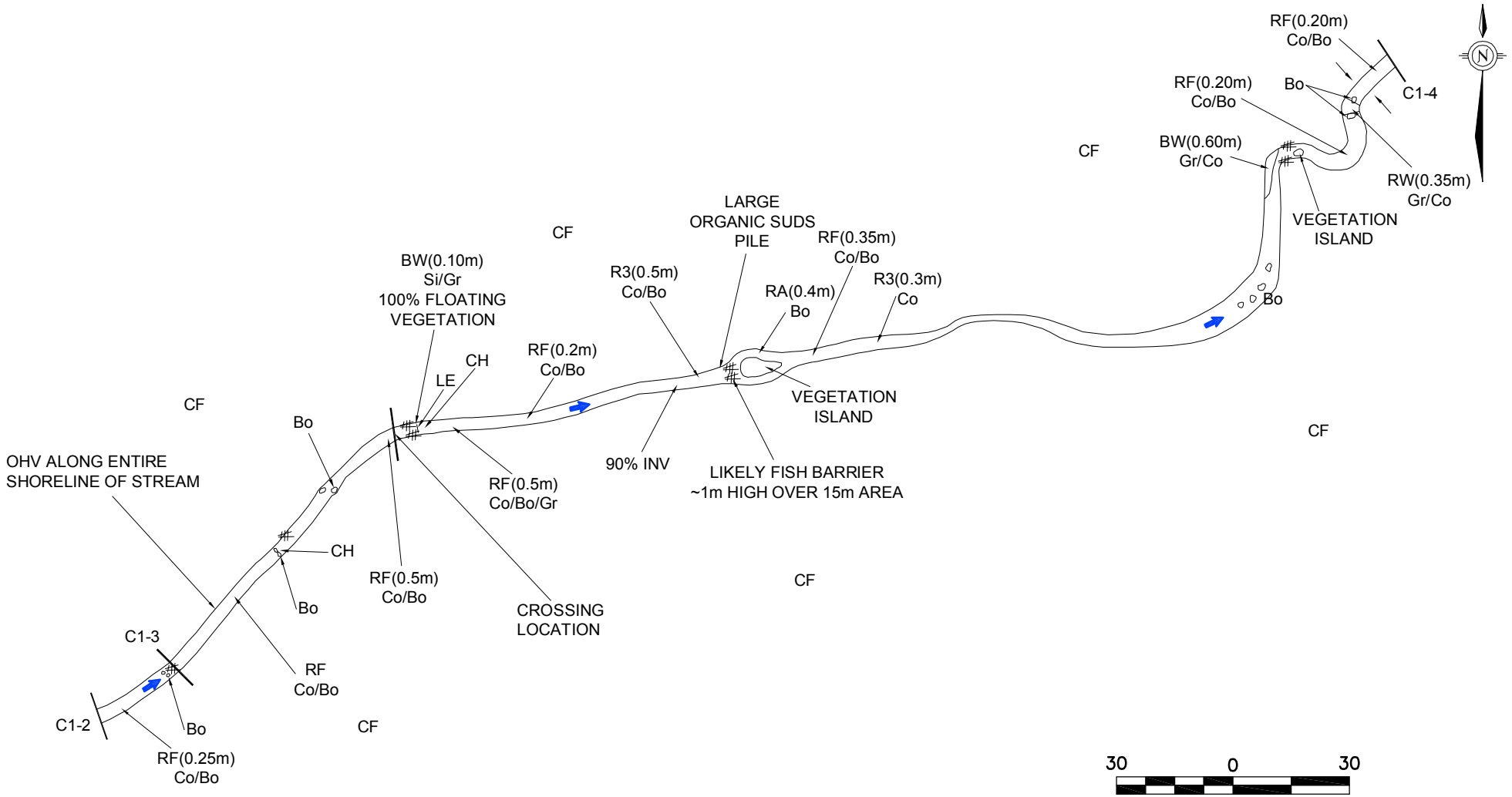
(Taken from original figure 03-1117-029_habitat_maps_1-MR downstream END-A, Courtesy of Golder Associates Ltd, Saskatoon, SK)

Golder Associates
Edmonton, AB

PROJECT	07-1373-0068		FILE No.	
DESIGN	AO	12/07/07	SCALE AS SHOWN	REV. 0
CADD	JDS	25/08/04		
CHECK	SM	12/11/07		
REVIEW	GA	12/11/07		

FIGURE: D5

G:\2003\1117\03-1117-029\ Drawing file: 03-1117-029_habitat maps_1.dwg Sep 21, 2004 - 11:35am Image:imagerectify.tif Image:marian_upstream.jpg



LEGEND

→	Direction of Flow	BL	Beaver Lodge
BW	Backwater	CF	Coniferous Forest
CH	Chute	FL	Flat
LE	Ledge	Fo	Forbs
OHV	Overhanging Vegetation	Ba	Bare Ground
RA	Rapid - area with turbulent flow, high velocity and armoured substrate	Bo	Boulder
RF	Riffle	Co	Cobble
R1	Run - Semi Turbulent >1.0m	Gr	Gravel
R2	Run - Semi Turbulent 0.5-1.0m	MF	Mixedwood Forest
R3	Run - Semi Turbulent <0.5m	Sa	Sand
RW	Root Wad	Se	Sedges
Sm	Submergent Macrophytes	Si	Silt
SN	Snye		Shallow Slope
	1m vegetation		Moderate Slope
	Flat vegetation		Moderately Steep Slope
			Steep Slope

PROJECT

FORTUNE MINERALS
NICO MINE
YELLOWKNIFE, NWT

TITLE

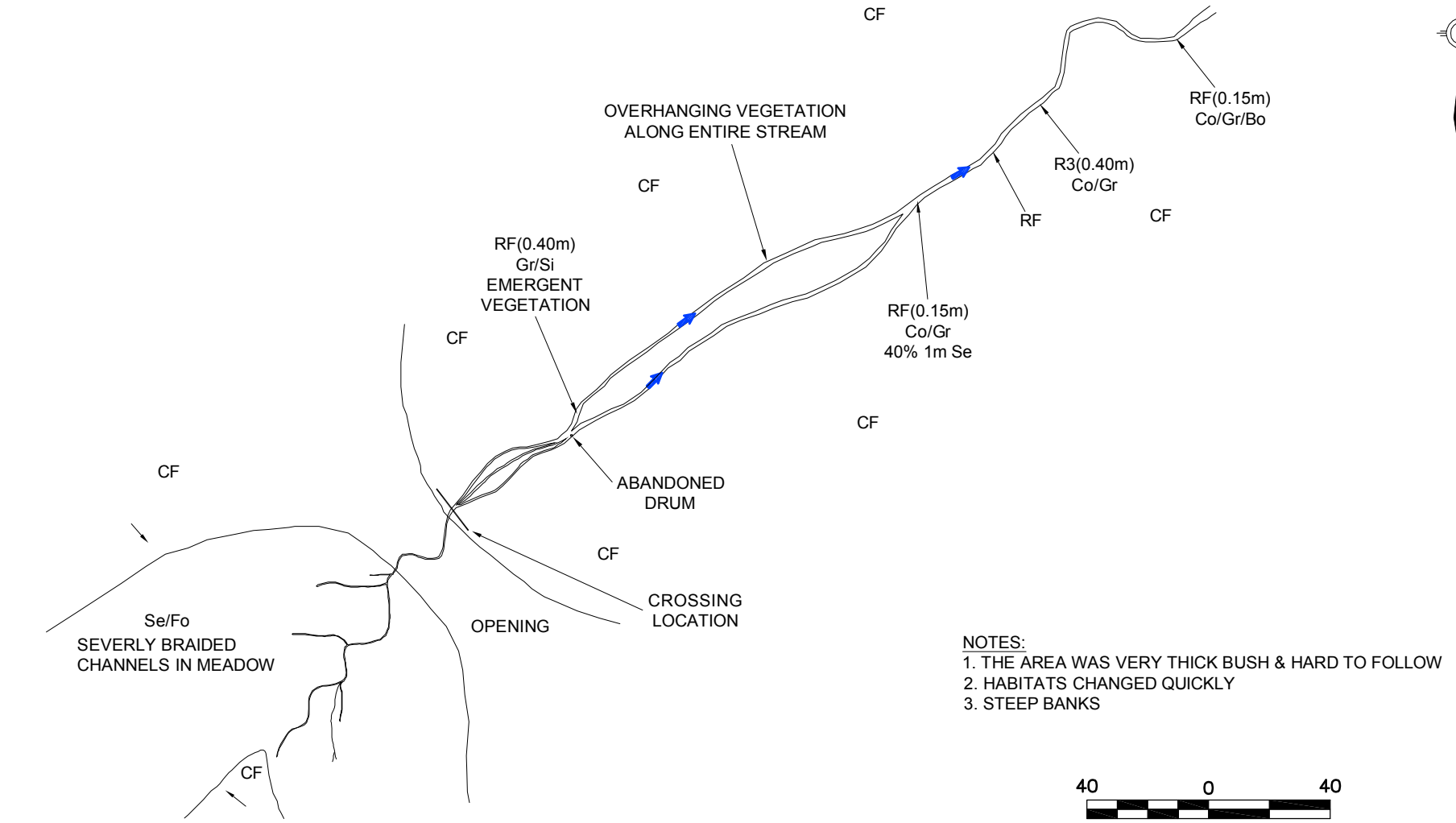
CROSSING C1 (3 m STREAM)
HABITAT MAP, JULY 2004

(Taken from original figure 03-1117-029_habitat_maps_2-3m Stream,
Courtesy of Golder Associates Ltd, Saskatoon, SK)

Golder Associates
Edmonton, AB

PROJECT	07-1373-0068		FILE No.	
DESIGN	AO	12/07/07	SCALE AS SHOWN	REV. 0
CADD	JDS	25/08/04		
CHECK	SM	12/11/07		
REVIEW	GA	12/11/07		

FIGURE: D6



NOTES:
1. THE AREA WAS VERY THICK BUSH & HARD TO FOLLOW
2. HABITATS CHANGED QUICKLY
3. STEEP BANKS

40 0 40
SCALE 1:2000 METRES

LEGEND

	Direction of Flow	BL	Beaver Lodge
BW	Backwater	CF	Coniferous Forest
CH	Chute	FL	Flat
LE	Ledge	Fo	Forbs
OHV	Overhanging Vegetation	Ba	Bare Ground
RA	Rapid - area with turbulent flow, high velocity and armoured substrate	Bo	Boulder
		Co	Cobble
RF	Riffle	Gr	Gravel
R1	Run - Semi Turbulent >1.0m	MF	Mixedwood Forest
R2	Run - Semi Turbulent 0.5-1.0m	Sa	Sand
R3	Run - Semi Turbulent <0.5m	Se	Sedges
RW	Root Wad	Si	Silt
Sm	Submergent Macrophytes		Shallow Slope
SN	Snye		Moderate Slope
	1m vegetation		Moderately Steep Slope
	Flat vegetation		Steep Slope

PROJECT
FORTUNE MINERALS
NICO MINE
YELLOWKNIFE, NWT

TITLE
CROSSING C2 (1 m STREAM) HABITAT MAP,JULY 2004

(Taken from original figure 03-1117-029_habitat_maps_2-1m Stream, Courtesy of Golder Associates Ltd, Saskatoon, SK)

Golder Associates
Edmonton, AB

PROJECT	07-1373-0068		FILE No.	
DESIGN	AO	12/07/07	SCALE AS SHOWN	REV. 0
CADD	JDS	25/08/04		
CHECK	SM	12/11/07		
REVIEW	GA	12/11/07		

FIGURE: D7

APPENDIX E

FISH CAPTURE DATA

Appendix E1: Number of Fish Captured or Observed During Backpack Electrofishing, Minnow Trapping, and Gillnetting at Watercourse Crossings Along the Proposed All-weather Road, 2004-2006.

Site ID	Watercourse Name	Northern pike	White sucker	Lake Whitefish	Arctic Grayling	Burbot	TOTAL
C1	Unnamed[1]	5	0	0	2	0	**7**
C2	Unnamed[2]	0	0	0	0	0	**0**
C3	Unnamed	0	0	0	0	0	**0**
C4	Unnamed	0	0	0	0	0	**0**
C5	Unnamed	0	0	0	0	0	**0**
C6	Unnamed	0	0	0	0	0	**0**
C7	Unnamed	0	0	0	0	0	**0**
C8	Marian River	10	3	8	0	3 (obs)	**24**
C9	Unnamed	0	0	0	0	0	**0**
	TOTAL	**15**	**3**	**8**	**2**	**3**	**31**

[1]Locally called "3 m Stream"
[2]Locally called "1 m Stream"

Appendix E2: Length and Weight of Fish Captured at Watercourse Crossings Along the Proposed All-weather Road, 2004-2006.

Date	Species	Length (mm)	Weight (g)	Site	Method*
18-Jul-04	Northern Pike	592	1190	C8 (Marian R.)	GN
18-Jul-04	Northern Pike	608	1525	C8 (Marian R.)	GN
18-Jul-04	Northern Pike	585	1250	C8 (Marian R.)	GN
18-Jul-04	Lake Whitefish	486	2200	C8 (Marian R.)	GN
18-Jul-04	Lake Whitefish	491	2175	C8 (Marian R.)	GN
18-Jul-04	Lake Whitefish	480	1875	C8 (Marian R.)	GN
18-Jul-04	Northern Pike	661	1950	C8 (Marian R.)	GN
18-Jul-04	Northern Pike	595	1600	C8 (Marian R.)	GN
18-Jul-04	Northern Pike	629	1550	C8 (Marian R.)	GN
18-Jul-04	Northern Pike	515	1290	C8 (Marian R.)	GN
18-Jul-04	White Sucker	166	65.2	C8 (Marian R.)	GN
18-Jul-04	Lake Whitefish	457	1625	C8 (Marian R.)	GN
18-Jul-04	Northern Pike	260	142.2	C8 (Marian R.)	GN
18-Jul-04	Northern Pike	66	20	C8 (Marian R.)	MT
18-Jul-04	Northern Pike	66	22	C8 (Marian R.)	MT
18-Jul-04	White Sucker	75	53	C8 (Marian R.)	MT
11-Jun-05	Lake Whitefish	YOY**		C8 (Marian R.)	KN
11-Jun-05	Lake Whitefish	YOY**		C8 (Marian R.)	KN
11-Jun-05	Lake Whitefish	YOY**		C8 (Marian R.)	KN
11-Jun-05	Lake Whitefish	YOY**		C8 (Marian R.)	KN
24-Sep-06	White Sucker	165	66	C8 (Marian R.)	GN
16-Aug-05	Northern Pike	158	26	C1 (3 m Stream)	BP
16-Aug-05	Northern Pike	157	24	C1 (3 m Stream)	BP
16-Aug-05	Northern Pike	139	16	C1 (3 m Stream)	BP
16-Aug-05	Northern Pike	117	10	C1 (3 m Stream)	BP
16-Aug-05	Arctic Grayling	98	8	C1 (3 m Stream)	BP
16-Aug-05	Arctic Grayling	95	8	C1 (3 m Stream)	BP
17-Jul-04	Northern Pike	85	220	C1 (3 m Stream)	BP

*GN = Gill Net; MT = Minnow Trap; KN = Kick Net; BP = Backpack Electrofisher

**YOY = Young-of-the-Year; not measured or weighed