FISH HABITAT ASSESSMENT AT A PROPOSED ROAD CROSSING NEAR MELIADINE WEST EXPLORATION CAMP

Engineering Earth's Development, Preserving Earth's Integrity

Golder Associates

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AT A PROPOSED ROAD CROSSING NEAR
MELIADINE WEST EXPLORATION CAMP

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Cover Photo: Proposed road crossing location on an unnamed stream, which flows from a small lake (lower right of photo) into a bay of Meliadine Lake (lower left). The Comaplex exploration camp and the east basin of Meliadine Lake are in the background. *7 July 2004*.

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Field data collections and reporting were completed by Rob Stack of Golder Associates (Edmonton office). Jacek Patalas and Gary Ash reviewed and edited the report.

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1.0 INTRODUCTION

Comaplex Minerals Corporation (Comaplex) plans to construct an all-weather road between the existing Meliadine West exploration camp and the exploration site, approximately 2 km west of the camp. The proposed road alignment crosses one small stream that drains into Meliadine Lake. Comaplex commissioned Golder Associates Ltd. (Golder) to assess fisheries potential and aquatic habitat of the unnamed stream in the vicinity of the proposed road crossing. This information will form part of the application to Department of Fisheries and Oceans (DFO) for authorization to construct the stream crossing under Section 35(2) of the *Federal Fisheries Act*.

The present document describes the fish community of the Meliadine Lake, based on previous studies conducted in the project area during 1997 to 2000 (RL&L 1998, 1999, 2000, 2001). It also provides the results of a field survey conducted at the proposed stream crossing on 7 July 2004 and a brief assessment of potential impacts associated with the road crossing construction and operation.

2.0 STUDY AREA

The Meliadine West exploration camp (63° 1.5' N, 92° 10.5' E) is located approximately 25 km north of Rankin Inlet, Nunavut (Figure 1). It is situated on a small peninsula at the east basin of Meliadine Lake. Meliadine Lake is a large waterbody, with a surface area of 107 km^2 and a maximum length of 31 km (Environment Canada 1973). Most of the outflow from Meliadine Lake drains to the Meliadine River, which originates in the south basin and flows through Little Meliadine Lake into Hudson Bay. A second, smaller outflow drains the west basin of Meliadine Lake into Peter Lake, which discharges into the Hudson Bay through the Diana River system.

Several small watersheds drain into Meliadine Lake from the surrounding terrain. These watersheds comprise an extensive network of lakes, ponds and interconnecting streams. The lakes are generally small and shallow, and can be isolated from each other by limited flow during the summer (RL&L 1999).

The proposed road alignment crosses one such small drainage. The unnamed stream drains a small lake (17 ha in area), immediately south of the exploration camp. The entire drainage basin of this small watershed is about 75 ha in area. The UTM coordinates (NAD 27) for the confluence of the stream with Meliadine Lake are Zone 15, 541727 E 6988673 N. The proposed road crossing is located about 300 m southwest of the exploration camp (Figure 2).

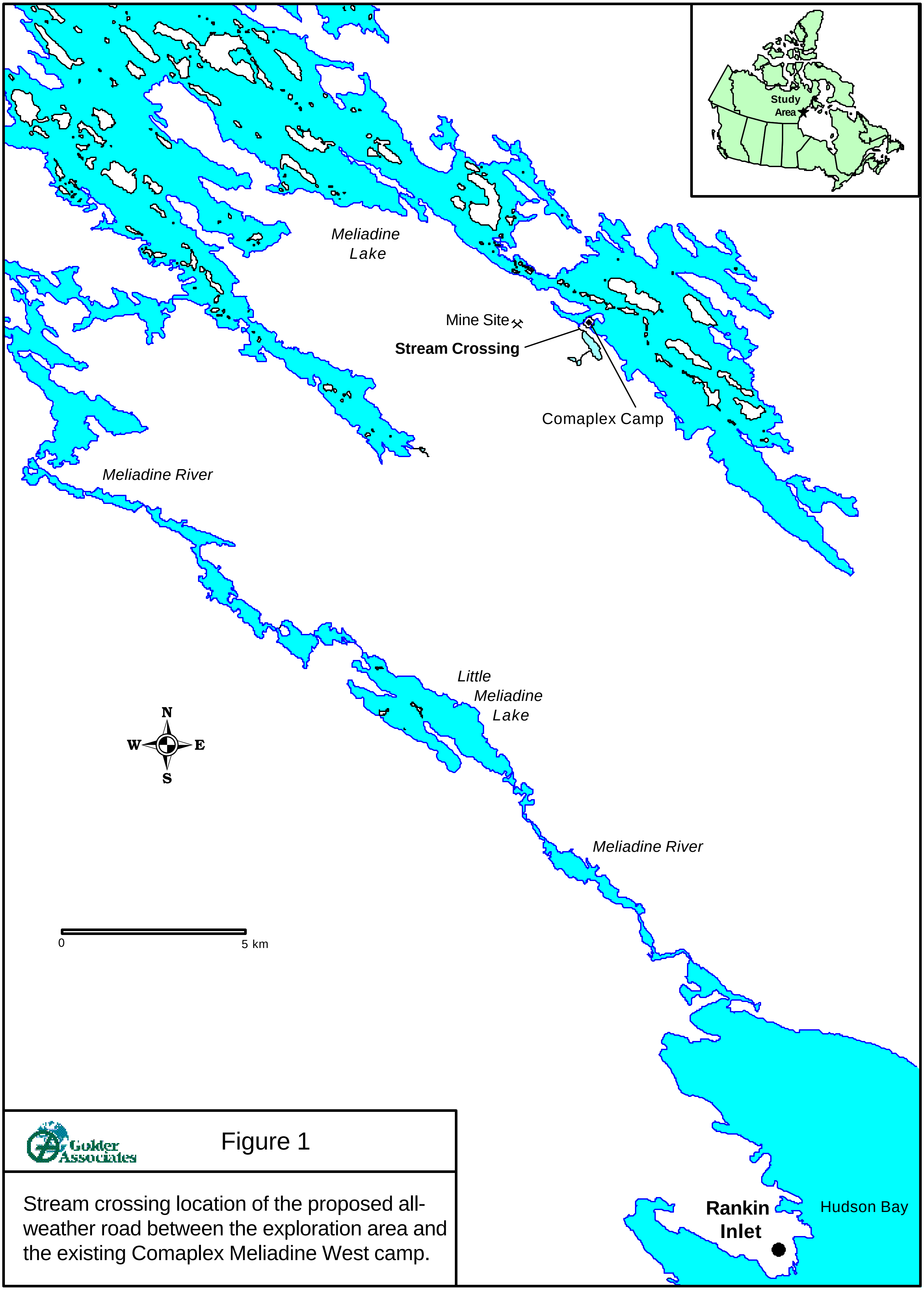

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Figure 1

Stream crossing location of the proposed all-weather road between the exploration area and the existing Comaplex Meliadine West camp.

Figure 2

Approximate drainage basin
of unnamed stream.

3.0 FISHERIES INFORMATION REVIEW

Extensive fish and fish habitat investigations were conducted in the Meliadine West Gold Project exploration area during the 1997 to 2001 period (RL&L 1998, 1999, 2000, 2001); however, they did not include the small watershed along the proposed road alignment. Based on previous fish capture data from Meliadine Lake and the surrounding streams and lakes, there are 10 fish species that inhabit the Meliadine Lake watershed (Table 1). Seven of these species are sportfish and include Arctic char, lake trout, Arctic grayling, round whitefish, cisco, and burbot. Non-sportfish species include slimy sculpin, ninespine stickleback, and threespine stickleback.

Table 1 Documented fish species in the Meliadine Lake watershed.

Family	Species	Scientific Name
Salmonidae	Arctic char	*Salvelinus alpinus* (Linnaeus)
	Lake trout	*Salvelinus namaycush* (Walbaum)
	Arctic grayling	*Thymallus arcticus* (Pallas)
	Round whitefish	*Prosopium cylindraceum* (Pallas)
	Cisco	*Coregonus artedi* Lesueur
Gadidae	Burbot	*Lota lota* (Linnaeus)
Gasterostidae	Ninespine stickleback	*Pungitus pungitus* (Linnaeus)
	Threespine stickleback	*Gasterosteus aculeatus* Linnaeus
Cottidae	Slimy sculpin	*Cottus cognatus* Richardson

Small streams in the watershed were used primarily by ninespine stickleback and slimy sculpin. Sportfish use was limited mainly to rearing juvenile lake trout and Arctic grayling. Some of the larger streams were also used seasonally for Arctic grayling spawning and occasionally for rearing juvenile Arctic char and burbot. Round whitefish, cisco and threespine stickleback were encountered primarily in Meliadine Lake proper, and their use of small lakes and streams was very limited.

4.0 FIELD SURVEY

A field survey of the unnamed stream was conducted on 6 and 7 July 2004. The survey included assessments of the aquatic habitat along the entire stream length, measurements of basic water quality parameters, and determination of fish use through backpack electrofishing and sampling for deposited eggs.

4.1 Field Methods

Aquatic habitat was delineated into individual reaches, according to marked changes in stream gradient, channel width, degree of channel braiding, habitat type (e.g., riffles, runs, pools, and flats), and substrate. Channel length and width measurements were carried out with a tape measure and/or a laser range finder. Overall stream gradient (from source lake to the outlet) was calculated from a 1:10 000 scale contour map supplied by Comaplex staff on site. The areas of the headwater lake and its drainage basin were calculated by digitizing these areas from the same map.

Stream discharge was measured with a direct-readout meter (Swoffer Model 2100). Readings were taken along a tag line positioned perpendicular to flow. Water depth and mean column velocity (at 0.6 depth) were measured at six stations along the cross-section. Stream discharge was calculated according to methods outlined by Bovee and Cochnauer (1977). Water quality parameters collected were temperature, conductivity, and pH. Water temperature was measured with a hand-held thermometer. Water conductivity was measured with a TDSTestr3 portable meter and pH was measured with a pHTestr2 meter.

Assessment of fish use was conducted by direct observations, backpack electrofishing, and kick-net sampling for the presence of deposited eggs. The small size of the stream and high water clarity provided favourable conditions for observing the presence of adult fish. The presence of small fish was determined by sampling with a Smith-Root Type XII high output backpack electrofisher. Stunned fish were collected and placed in a holding bucket. Recorded information for each sampling run included location/reach number, time-of-day, sampling effort (distance and time), range of water depth, substrate type, water temperature, conductivity, pH, and the number of each fish species captured or observed. The length of all captured fish was measured to the nearest millimeter.

Kick-net sampling for deposited eggs was conducted at all potential Arctic grayling spawning sites within the stream (i.e., areas with gravel/cobble substrate). The procedure involved positioning a fine mesh kick-net on the stream bottom immediately downstream of a potential spawning site and disturbing the substrate with a foot for approximately 10 seconds. The contents of each sampled area were examined in the field for the presence of eggs.

4.2 Habitat Assessment

Detailed measurements of aquatic habitat characteristics, including reach length, width, and area, habitat type, channel type, substrate, and instream cover are provided in Appendix A. These measurements were taken when the stream was in a flooded stage, near the peak of the 2004 freshet period.

The entire stream length, as measured along the main channel, was 198 m. Mean stream gradient was approximately 2.5% (based on a 5.0 m difference in elevation between the source lake and the confluence with Meliadine Lake). Five distinct stream reaches were identified on the bases of major changes in stream characteristics, such as gradient, channel width, channel braiding, habitat type and substrate composition (Figure 3). Overall, 92 % of the stream was heavily braided (i.e., comprised of two or more channels). Instream habitat consisted primarily of run sections (78% of stream area), interspersed with flat (18%) and riffle (4%) habitats. Small pool habitats contributed only 0.4% to the total stream area. Abundant instream cover for small fish was provided by the grass and detritus throughout reaches #1 to #4. Reach #5 also contained grass and detritus as cover; however, boulders provided cover in approximately 2% of the reach area.

Reach #1 extended from the source lake to 16 m downstream of the lake. This reach was the only section of stream where the entire flow passed through a single, narrow channel. The average channel width was estimated at 0.7 m, and ranged from 0.4 to 1.2 m. The average channel depth was estimated at 0.10 m, with a maximum of 0.20 m. Aquatic habitat in this section was comprised entirely of shallow run. The substrate was composed of fines and detritus. Stream gradient in this section was low relative to the reaches farther downstream.

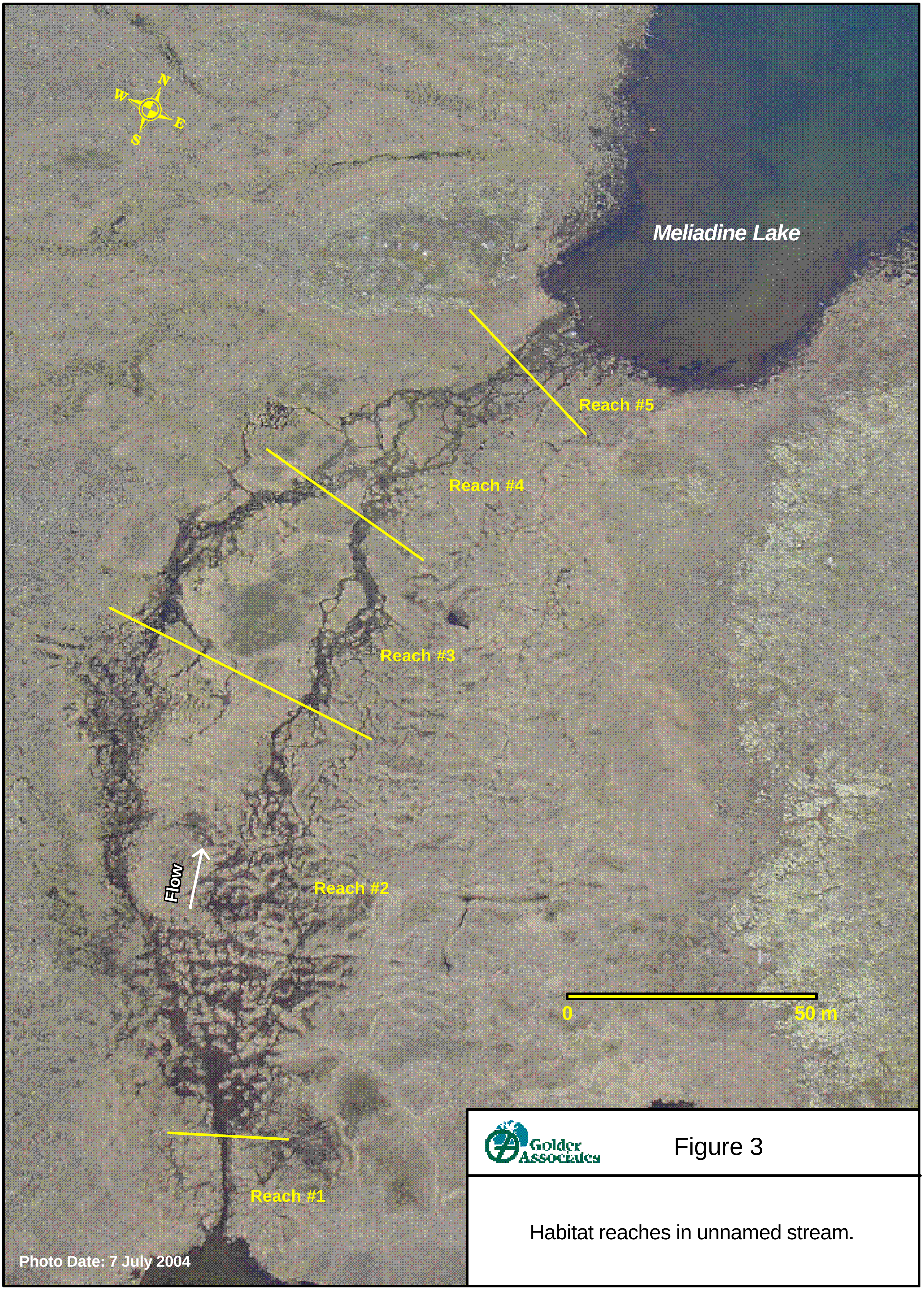

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Figure 3

Habitat reaches in unnamed stream.

Reach #2 was 88 m in length; the longest of the surveyed reaches. Water depth in this section was shallow, with an estimated mean of 0.10 m and a maximum recorded depth of 0.15 m. Approximately 40% of the channel in this section featured multiple braids; however, most (60%) of the stream length consisted of dispersed flow over terrestrial vegetation and the stream banks were not well defined. Shallow run habitats contributed approximately 60% to the total reach area, with shallow flat habitat comprising the remaining 40% of the area. Substrate was dominated by detritus and flooded grass (98%), with fines (silt and sand) encountered in only 2% of the reach area.

Reach #3 began 104 m downstream of the source lake and extended for 34 m in length. This section of stream was characterized by two main channels, separated by a gentle rise in terrain. Each main channel was composed of areas that featured either one or multiple channel braids. The channel width was about 2.5 m on average, with widths ranging from 0.5 to 4 m. Similar to the upstream reaches, the average depth in this section was low (about 0.10 m); however, the maximum recorded depth was slightly higher (0.26 m). The channels featured mainly shallow run habitats (90% of reach area). Shallow riffles and three small pools accounted for the remainder. Substrate was dominated by detritus, flooded grass and fines; however, small amounts of gravel and cobble were present in the riffle and pool habitats. Stream gradient in this section was higher than in the upstream reaches.

Reach #4 was 44 m long and composed entirely of multiple channel braids. The average width of individual channels was estimated to be 0.4 m, with channel widths ranging from 0.2 to 4.0 m. The average depth in this section was about 0.10 m; however, a single, small pool in this reach was 0.84 m deep. Channel type was 100% multiple braids. Habitat type composition in this section was similar to Reach #3 (mainly run habitats). The substrate contained greater amounts of gravel (3%), cobble (2%) and exposed fines (20%) than in the upstream reaches. Relative gradient in this section was high.

Reach #5 was 16 m in length and terminated at a shallow bay of Meliadine Lake. The average channel width in this section was about 10 m; width ranged from 6 to 15 m. The average depth was about 0.15 m, with a maximum of 0.25 m. The channel consisted entirely of multiple braids. Instream habitat was dominated by run (95%) and riffle (5%) sections. Substrate composition in Reach #5 was more diverse than in the other reaches. Although detritus and grass covered 50% of the area, boulders were present (10%), as were gravel and cobble (5% each), with the remainder being fines.

4.3 Water Quality

Water temperature, conductivity, and pH were measured throughout the survey and were recorded at each electrofishing and egg sampling site (Appendices B and C). On the afternoon of 6 July, during the initial site inspection, water temperature was measured at both the upper and lower reaches of the stream. Water temperature in Reach #5 was 16°C, whereas in Reach #1 it was only 6°C. A small amount of ice was still present on the source lake, indicating it was at the end of the spring thaw. However, atmospheric conditions were such (air temperature of 20°C and bright sun) that the stream was warming significantly over its 198 m course. Water conductivity (60 µS/cm) and pH (7.2 pH units) were consistent throughout the stream during electrofishing and egg sampling.

In the evening of 6 July 2004, water temperature in the source lake was 6°C, conductivity was 50 µS/cm, and pH was 7.2 pH units. Similar conductivity (60 µS/cm) and pH (7.4) values were recorded at the same time in Meliadine Lake near the mouth of the unnamed stream; however, water temperature was slightly higher (10°C). The elevated water temperature at the mouth of the stream was likely due to the input of sun-warmed water from Reach #5.

4.4 Stream Discharge

Instantaneous stream discharge was measured in Reach #1 on 7 July (Appendix D). This site featured a single channel carrying the entire flow. Discharge at this location was 0.012 m^3/s.

This low amount of flow during the period of spring freshet suggested that the stream is ephemeral and flow is restricted to periods of spring melt and precipitation events during summer and fall. It likely ceases to flow and may dry up completely during periods of dry weather in the summer or fall.

4.5 Fish Sampling

Direct Observations

During the initial site inspection on 6 July 2004, all stream channels were visually examined for the presence of fish. Shallow stream depth and high water clarity provided favourable conditions for identifying fish holding within the stream. No large fish (i.e., adult sportfish) were observed; however, many (i.e., several dozen) small fish were seen darting through the submerged grass. Swimming style of these fish indicated they were ninespine stickleback. No other species were observed.

Backpack Electrofishing

Capture of fish in, and near, the unnamed stream was conducted via backpack electrofishing on 6 July. Two sampling runs were carried out in the unnamed stream, two along the shore of Meliadine Lake, and one in the source lake (Appendix B). The combined sampling effort was 1728 s of electrofisher operating time over a total sampled distance of 450 m.

In an attempt to identify fish that may have been staging in the lake prior to moving into the stream, two electrofishing sampling runs (#1 and #2) were conducted along the shoreline of Meliadine Lake near the mouth of the stream. The combined sampling effort was 544 s of electrofishing time over a distance of 150 m. Off-shore lake habitat sampled during Run #1 varied in depth from 0.4 to 0.8 m, and contained boulder and cobble substrate. No fish were captured or observed. Near-shore lake habitat sampled during Run #2 was similar to much of the stream habitat, with shallow depths (0.05 to 0.25 m) and substrate consisting of fines and flooded grass. Fourteen ninespine stickleback were captured.

Two sampling runs (#3 and #4) were conducted within the five reaches of the stream. The total sampling effort was 994 s of electrofishing time over 200 m of channel length. The total catch included 86 ninespine stickleback.

One sampling run (Run #5) was carried out along the shore of the source lake near the outflow (sampling effort of 190 s over 100 m of shoreline). Two ninespine stickleback were captured. Water depth quickly dropped off from 0.3 to 1.2 m, over bedrock and fines. Very little cover was present, except immediately along the shore, where willow and grass were present.

The combined catch of ninespine stickleback (n=102) ranged from 26 to 67 mm in total length (mean of 38mm; Appendix B). The wide range of fish sizes indicated that both juvenile and adult size-classes were present in the catch.

Egg Sampling

Sampling for fish eggs was conducted on 7 July. Five small pools (total area of 1.3 m^2) were sampled in reaches #3 and #4 (Appendix C). These were the only likely locations for Arctic grayling spawning, based on the presence of gravel substrate at these sites. No eggs were encountered during sampling. As the sampling was conducted shortly after the stream temperature reached the optimal thermal conditions for Arctic grayling spawning (i.e., 3 to 6°C; RL&L 1999), the absence of deposited eggs suggested that Arctic grayling do not use this stream for spawning.

5.0 POTENTIAL IMPACTS AND MITIGATION

The potential impacts of the proposed road crossing on the aquatic habitat of the unnamed stream may include instream habitat alteration and deposition of sediment downstream of the crossing. There is also potential for inadvertent release of toxic substances (e.g., hydrocarbons) into the watercourse during construction, so appropriate mitigation measures should be implemented to minimize the effects of potential accidents and/or spills. The sources of these impacts, their significance and mitigation opportunities will be discussed briefly in the following sections.

Instream Habitat Alteration

Construction activities in the vicinity of the stream (e.g., preparation of the road bed, excavation of the channel to provide the required depth for culvert installation, diversion of dispersed flow to pass through the culvert) may alter the physical habitat in the immediate area of the crossing. The road alignment and stream crossing design have yet to be developed, so the extent of potential habitat alteration is not known. We recommend construction plans include the following mitigation measures to minimize disturbance and potential impact on aquatic habitat:

- The timing of the construction activities should be selected to coincide with the periods of minimal or no flow in the stream (i.e., late summer or winter).
- The alignment of the road crossing should be selected to cross the stream in Reach #4 or in Reach #1, where the width of the channels and the extent of channel braiding is lower relative to the other reaches. The selection of the crossing at these locations would minimize the need to install extensive diversion barriers to channel the flow through a central culvert under the road.
- The material removed by excavation should be replaced with clean native gravel and cobble. Final reshaping of the channel is expected to occur naturally during the first spring freshet post construction.
- Because of the temporary nature of the road crossing (i.e., the road is expected to be operational for only two years), considerations should be given to installing a wooden SwampMat™ over the stream, instead of a conventional culvert crossing. These wooden mats (see www.swampmats.ca) are placed over the stream to provide a hard surface for vehicular passage, resulting in less damage to the stream

than the placement of a culvert. Other factors that favor the use of mats instead of a culvert include the ephemeral nature of the stream and its suspected lack of use by fish species other than ninespine stickleback.

Provided that appropriate construction and reclamation techniques are applied, the impacts associated with habitat alteration will be localized, short-term and insignificant. Considering the low habitat quality of the stream (mainly due to shallow depth and scarcity of coarse substrates), the placement of gravel/cobble to stabilize the stream banks in the vicinity of the crossing may locally enhance fish habitat by providing cover and more diverse substrate.

Sediment Entrainment and Deposition

The primary concerns for fish and fish habitat resulting from any type of instream activity are the effects of downstream transport and deposition of sediment. The increased water turbidity and sediment load could potentially result in “harmful alteration, disruption or destruction” (i.e., HADD) of fish habitat, thus contravening the federal *Fisheries Act*, and exceeding the federal water quality guidelines (CCME 2001). To minimize the entrainment and deposition of sediment, the following mitigation measures are recommended:

- The timing of the construction activities should coincide with the periods of minimal or no flow in the stream (i.e., late summer or winter).
- If the construction takes place in late summer, silt fences should be used at the site to minimize sediment input (i.e., due to bank work and excavation of channel) to the stream and/or the nearshore areas of Meliadine Lake.
- Instream monitoring of suspended sediment (i.e., collection of turbidity/TSS samples) should be conducted concurrent with the construction activities, if they occur during periods of flow in the stream. The monitoring program should be designed to track compliance with the following CCME (2001) guidelines:

  clear flows: The total suspended solids (TSS) levels should not be increased by more than 25 mg/L above background levels for any short-term exposure (e.g., 24 h period) and not more than 5 mg/L for any long-term exposure (e.g., inputs lasting between 24 h and 30 d).

high flows: TSS levels should not be increased by more than 25 mg/L above background levels at any time when background levels are between 25 and 250 mg/L and should not increase more than 10% of background levels when background is >250 mg/L.

If the road crossing is constructed during winter, when the stream is frozen to the substrate, and appropriate coarse material is placed over the disturbed areas, sediment entrainment and deposition are not expected to occur. If the crossing is installed during late summer, sediment-related effects will be minimal, because instream activities are expected to be of short duration. Provided that appropriate mitigation techniques are applied during periods of low flow, the impacts associated with sedimentation will be localized, short-term, and insignificant.

Inadvertent Release of Toxic Substances

Construction machinery operating in and adjacent to watercourses introduces risk of inadvertent release of contaminants (e.g., petroleum products) to the stream. Depending on the type and volume of released substance, the effects may be deleterious to aquatic biota at the construction site and in downstream areas. Mitigation of these impacts generally involves prevention by ensuring that contractors on site are properly trained in the use, handling, spill response, and storage of hazardous materials. Strict adherence to established guidelines, systematic reporting, and established contingency response plan should be implemented to minimize the risk of toxic releases.

6.0 CONCLUSIONS

Based on the review of previous studies and the habitat survey conducted on 6 and 7 July 2004, fish use of the unnamed stream is likely limited to ninespine stickleback. The stream lacks adequate depth and suitable riffles with coarse substrate to provide Arctic grayling spawning habitat. Although juvenile size-classes of Arctic grayling, lake trout and Arctic char were documented in some of the larger tributaries to Meliadine Lake during previous studies, the much smaller drainage size and ephemeral nature of the unnamed stream likely prevents its use by these species. As such, the stream was rated as having a very low feeding, spawning or rearing potential for sportfish. There was no potential for fish overwintering, as the stream will freeze to the substrate during winter.

Provided that established construction and reclamation techniques are implemented and the construction takes place during low or no flow period, it is the professional opinion of Golder Associates Ltd. that fish habitat loss or damage associated with the project will be minimal. This conclusion is based on the low quality and low sensitivity of the existing habitat (i.e., ephemeral, homogeneous, shallow, and silt-laden) and the relatively small amount of instream work that would be required.

7.0 LITERATURE CITED

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8.0 CLOSURE

This report was prepared by Golder Associates Ltd. for the account of Comaplex Minerals Corporation. The material in it reflects Golder's best judgment in light of information available to it at the time of preparation. Any use which a third party makes of this report or any reliance on or decisions to be made based on it, are the responsibility of such third party. Golder accepts no responsibility for damages, if any, suffered by any third party as a result of decision made or action based on this report.

We trust the information contained in this report is sufficient for your present needs. Should you have any questions regarding the project, please do not hesitate to contact the undersigned.

GOLDER ASSOCIATES LTD.

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PHOTOGRAPHIC PLATES

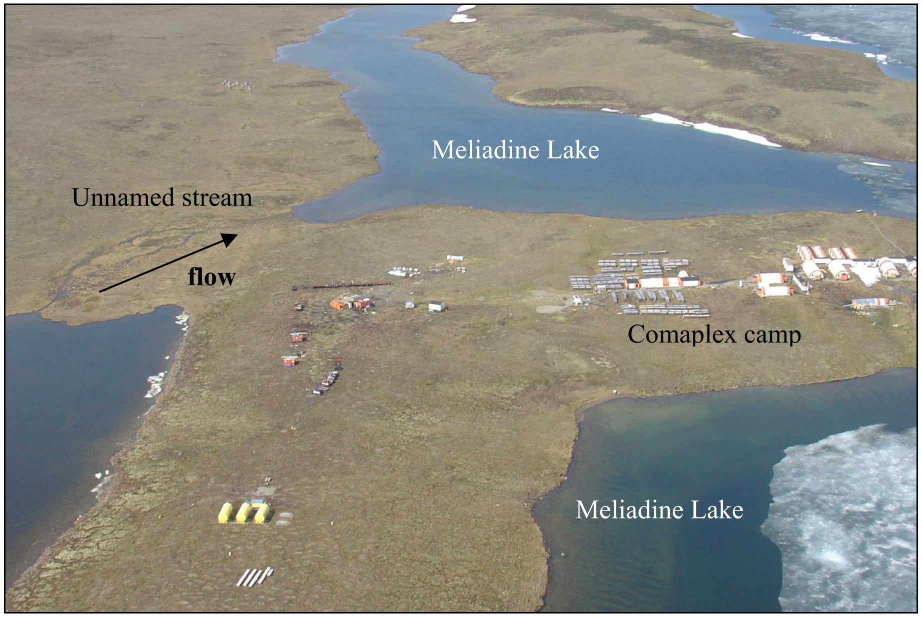

Plate 1 *7 July 2004*. Location of the unnamed stream relative to the Comaplex exploration camp and Meliadine Lake.

Plate 2 *7 July 2004*. Reach #1 was the only section of the stream where the entire flow passed through a single channel.

Plate 3 *7 July 2004*. Habitat in Reach #2 was predominantly flooded grass with indistinct channel edges.

Plate 4 7 *July 2004.* Shallow run habitat through grass was the dominant habitat type in Reach #3; however, a few pools with gravel substrate were present.

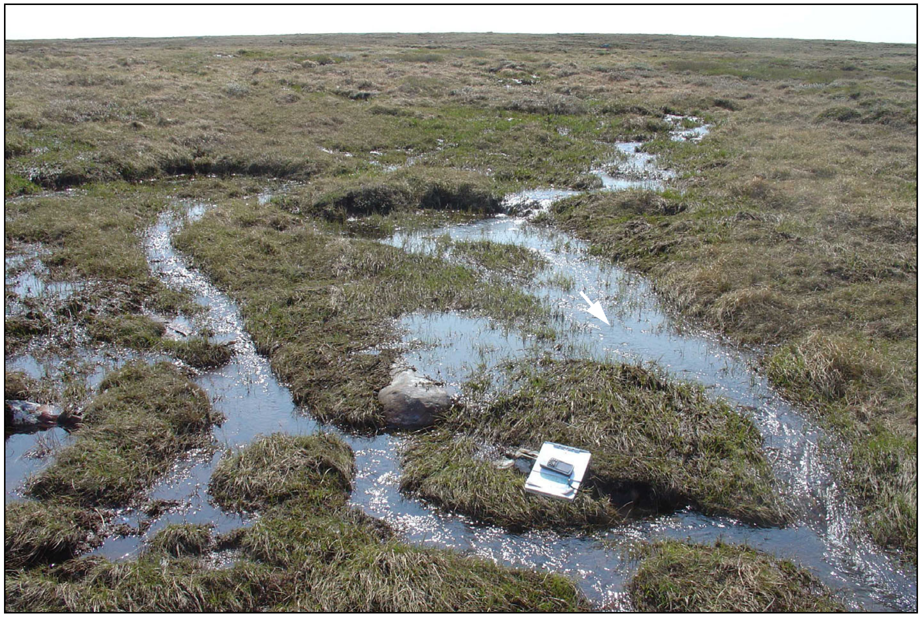

Plate 5 *7 July 2004.* Multiple narrow braids and a higher gradient than upstream sections characterized Reach #4.

Plate 6 *7 July 2004*. Reach #5 had the greatest diversity of substrate types, with 20% of the area covered by gravel, cobble, or boulders.

Plate7 *7 July 2004*. Substrate in Meliadine Lake, near the mouth of the stream, was fractured boulder and cobble.

Plate 8 7 *July 2004.* Tiny pool habitats were the only areas with gravel substrate suitable for sampling for the presence of Arctic grayling eggs.

APPENDIX A

HABITAT CHARACTERISTICS

Appendix A Habitat characteristics of the unnamed stream near the Meliadine West exploration camp, 7 July 2004.

PARAMETER			REACH # 1	2	3	4	5	Total
STREAM SIZE	Length (m)		16	88	34	44	16	198
	Channel Width[a] (m)	Mean	0.7	2.0	2.5	0.4	10.0	3.1
		Min.	0.4	1.0	0.5	0.2	6.0	0.2
		Max.	1.2	6.0	4.0	4.0	15.0	15.0
	Depth (m)	Mean	0.10	0.10	0.10	0.10	0.15	0.11
		Max.	0.20	0.15	0.26	0.84	0.25	0.84
CHANNEL TYPE (% Length)	Single		100					8.1
	Double				50			8.6
	Multiple Braids			40	50	100	100	56.6
	Dispersed			60				26.7
HABITAT TYPE (% Length)	Riffles				9	9	5	3.9
	Runs		100	60	90	90	95	78.0
	Pools				1	1		0.4
	Flats (pond)			40				17.7
SUBSTRATE (% Area)	Detritus and grass		25	98	88	75	50	92.8
	Fines (<2 mm)		75	2	10	20	30	5.5
	Gravel (2-64 mm)				1	3	5	0.5
	Cobble (65-256 mm)				1	2	5	0.5
	Boulder (>256 mm)						10	0.7
INSTREAM COVER (% Area)	Terrestrial Grass		10	80	90	90	80	97.1
	Boulder Garden						2	0.1
RELATIVE GRADIENT			low	low	mod	high	low	2.5 %
UTM (Zone 15V) NAD27	Upstream Easting		541794	541786	541729	541721	541722	
	Upstream Northing		6988489	6988500	6988575	6988618	6988659	
	Downstream Easting		541786	541729	541721	541722	541727	
	Downstream Northing		6988500	6988575	6988618	6988659	6988673	

[a] In sections of braided channel, the mean, minimum and maximum widths apply to the largest individual channel. Channel width measurements do not apply to areas of dispersed flow with undefined banks.

APPENDIX B

BACKPACK ELECTROFISHING DATA

Appendix B. Backpack electrofishing locations, effort, and catch in the unnamed stream, 6 July 2004.

Run #	Time	Location[a]/ Reach	Sampling Effort (m)	Sampling Effort (s)	Water Temp. (°C)	Conduc-tivity (µS/cm)	pH (units)	Habitat: Depth (m)	Habitat: Substrate[b]	Ninespine Stickleback Catch: Number	CPUE[c] (fish/100s)	Total Length (mm)
1	20:00	outlet	70	282	10	60	7.4	0.40 - 0.80	Bo/Co	0	0.0	-
2	20:30	outlet	80	262	10	60	7.4	0.05 - 0.25	Fi/Grass	14	5.3	26 - 41
3	21:30	4 & 5	75	451	8	60	7.2	0.05 - 0.50	Fi/Grass	46	10.2	27 - 59
4	22:00	1, 2, & 3	125	543	8	60	7.2	0.05 - 0.15	Fi/Grass	40	7.4	31 - 65
5	22:30	inlet	100	190	6	50	7.2	0.30 - 1.20	Bd/Fi	2	1.1	51 - 67
Total			**450**	**1728**				**0.05 - 1.20**		**102**	**5.9**	**26 - 67**

[a] Outlet refers to Meliadine Lake habitat near Reach #5, inlet refers to source lake habitat near Reach #1.

[b] Bo = boulder, Co = cobble, Fi = fines, Bd = bedrock

[c] CPUE = catch-per-unit-effort

Length statistics for ninespine stickleback captured on 6 July 2004.

Total Length (mm)	Electrofishing Run Number: 1	2	3	4	5	Combined
Mean	-	35	37	40	59	**38**
Minimum	-	26	27	31	51	**26**
Maximum	-	41	59	65	67	**67**
St. Dev.	-	4	5	9	11	**8**
No. Fish	*0*	*14*	*46*	*40*	*2*	***102***

APPENDIX C

ARCTIC GRAYLING EGG SAMPLING DATA

Appendix C. Arctic grayling egg sampling locations, habitat, effort, and catch data in the unnamed stream near the Meliadine West exploration camp, 7 July 2004.

Site #	Reach #	Time	Habitat Type	UTM (Zone 15V)[a]		Water Temp (°C)	Conduc-tivity (µS/cm)	pH	Water Depth (m)	Water Velocity (m/s)		Substrate[b]	Sampled Area (m^2)	Eggs Collected
				Easting	Northing					5 cm above bottom	5 cm below surface			
1	4	9:30	pool	541711	6988601	11	60	7.2	0.56	0.00	0.27	Gr/Si	0.3	0
2	4	10:00	pool	541716	6988609	11	60	7.2	0.29	0.06	0.09	Gr/Si	0.4	0
3	3	10:30	pool	541731	6988603	13.5	60	7.2	0.25	0.01	0.06	Gr/Co/Si	0.2	0
4	3	10:45	pool	541738	6988594	13.5	60	7.2	0.26	0.00	0.02	Gr/Co/Si	0.2	0
5	3	11:00	pool	541743	6988590	14.5	60	7.2	0.22	0.08	0.15	Gr/Sa/Si	0.2	0

[a] UTM datum is NAD 27

[b] Co = cobble, Gr = gravel, Sa = sand, Si = silt

APPENDIX D

STREAM DISCHARGE DATA

Appendix D Discharge data collected in Reach #1 of the unnamed stream, 7 July 2004.

Distance from Bank (m)	Water Depth (m)	Water Velocity at 0.6 Depth (m/s)	Discharge (m^3/s)
0.00	0.00	0.00	0.0000
0.10	0.08	0.23	0.0014
0.15	0.11	0.33	0.0018
0.20	0.12	0.41	0.0025
0.25	0.11	0.56	0.0031
0.30	0.10	0.37	0.0019
0.35	0.09	0.28	0.0013
0.40	0.00	0.00	0.0000
Total Discharge			**0.0118**