Appendix V5-3P

Boston and Madrid Project Areas
2006 – 2007 Aquatic Studies

TMAC RESOURCES

BOSTON AND MADRID PROJECT AREAS
2006 – 2007 AQUATIC STUDIES

- FINAL REPORT -

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EXECUTIVE SUMMARY

Hope Bay Mining Ltd. (HBML) proposes to construct and operate a gold mine in the West Kitikmeot Region of Nunavut (NU). In September of 2008, HBML announced a deferral of plans to build and operate the Doris North Project as previously proposed and permitted by Miramar Hope Bay Ltd. The mine, mill, and tailings facility have been placed on hold while HBML analyzes options for development of a multi-mine development in the Hope Bay Greenstone Belt. Infrastructure associated with a temporary port, a 900 m airstrip, a 118 person camp, and connecting roads were completed by HBML in 2008 to support advanced exploration and project feasibility studies in the belt.

The project is located 685 km northeast of Yellowknife and 125 km southwest of Cambridge Bay on the south shore of Melville Sound. The mine is on Inuit-owned land, approximately 5 km south of the Arctic Ocean. The nearest communities are Umingmaktok, located 75 km to the southwest, and Bathurst Inlet, located 160 km to the southwest. The Project area consists of three main Project areas: Doris North, Madrid, and Boston. The Doris North and Madrid Project areas are located in the northern-most area, and include several lake systems that drain into Roberts Bay. The Boston Project area is situated approximately 50 km south from the Doris North and Madrid Project areas and includes several lake and river systems that drain into Hope Bay.

Baseline information collected during aquatic studies in 2006 and 2007 for the Madrid and Boston project areas included seasonal monitoring of stream discharge; monitoring lake levels; conducting snowcourse surveys; collecting water quality and limnology data in selected lakes and streams; determining relative abundance of fish species in potentially affected systems; conducting habitat assessments in selected lakes; conducting a population estimate for lake trout in Patch Lake; and assessing spawning habitat for Arctic grayling in the Koignuk River. This information will be used to support the environmental assessment, permitting, and monitoring requirements for future mining development in the Hope Bay Belt.

Hydrology

Monitoring of lake water levels and stream discharge in 2006 and 2007 in the Madrid and Boston areas showed that the bulk of runoff resulted from snowmelt. Water surface elevations and discharge from Aimaokatalok Inflow, Aimaokatalok Lake and Outflow, Fickle Duck Lake and Outflow, Koignuk River, Stickleback Lake, Glenn Lake and Outflow, Ogama Lake and Outflow, Patch Lake and Outflow, Wolverine Lake, Windy Lake and Outflow, and Hope Bay were monitored from the end of June to mid-September in 2006 and 2007.

Water surface elevation from Aimaokatalok Lake was also monitored over the winter of 2006 – 2007. Resulting data suggest that spring melt in 2006 began in the upper watersheds in late May, with stream discharge peaking on approximately 11 June. Water yields ranged from approximately 28 mm to 78 mm for the Patch, Ogama, Glenn, and Stickleback watersheds in 2006. In 2007, spring melt began in mid-June, with peak stream discharge around 30 June 2007. Water yields ranged from approximately 55 mm for the Stickleback Lake watershed to approximately 97 mm for the Ogama Lake watershed in 2007.

Snow course surveys were undertaken in the Doris Lake watershed (which includes Patch, Ogama, and Wolverine lakes) on 30 April 2006 and 28 April to 4 May 2007 to measure snowpack contributing to spring runoff. Twenty-one survey plots on seven terrain types were measured, and the mean snow water equivalent depth was 80 mm in 2006 and 55.6 mm in 2007.

Rainfall measurements at the Boston Camp meteorological station indicated that 41.7 mm of precipitation fell between July and October, 2006. Rainfall measurements for 2007 are not presented due to equipment malfunction at the Boston meteorological station.

Physical Limnology and Water Quality

Water quality sampling was conducted in the Boston Project area, which included Aimaokatalok, Fickle Duck, Stickleback, and Reference lakes and their corresponding outflow streams, Koignuk and Aimaokatalok rivers, and Hope Bay. Sampling was also conducted in the Madrid Project area, which included Glenn, Ogama, Patch, P.O., Pelvic, Windy, and Wolverine lakes and their corresponding outflow streams.

All lakes and outflows within the two Project areas were characterized as possessing soft water, and being relatively clear and coloured. The majority of the Boston Project area lakes possessed a moderate to high sensitivity to acidification, whereas the Madrid Project area lakes had a low to negligible sensitivity to acidification. This difference between the two Project areas was due primarily to the higher TDS levels associated with the Madrid wterbodies. The pH values in the waterbodies of the Project areas were typically near neutral to slightly alkaline, although slightly acidic pH values were measured in several waterbodies during late winter ice-covered conditions

In 2006, most waterbodies in the Boston and Madrid Project areas were well-mixed and isothermic during the open water season, with the exception of Windy and Pelvic lakes, which showed weak thermal stratification in July 2006.

In July 2007, Glenn, Ogama, Patch, and Pelvic lakes had well-developed thermal and dissolved oxygen (DO) strata, with DO in deeper waters below the 6.5 mg/L Canadian Water Quality Guideline (CWQG; CCME 2007a) for protection of aquatic life. In August and September 2007, all lakes were well mixed, with DO concentrations above the 9.5 mg/L CWQG for protection of early life stages of fish.

Naturally occurring concentrations of aluminum, selenium, cadmium, chromium, copper, and iron were higher than the respective Canadian Council of Ministers of the Environment (CCME 2007a) water quality guidelines in one or more water quality samples collected in the Boston and Madrid Project area lakes in 2006 and 2007. In 2006, mercury was measured above CWQGs in Patch Lake in August and in Aimaokatalok Lake (Station 4) in September.

During the 2006 and 2007 sampling seasons, the concentrations of total aluminum, cadmium, chromium, and iron in several Boston Project area outflows were higher than the respective CWQGs. Additionally, the mercury concentration in the Fickle Duck Outflow was higher than the CWQG in September 2006. Total aluminum, iron, and selenium concentrations in several outflows in the Madrid Project area were higher than CWQGs in 2006. Similalry, total aluminum, chromium, cadmium, copper, iron, and selenium were occasionally higher than guidelines in 2007.

Sediment Quality

Generally, metals concentrations in lake sediment samples were low at all stations and the CCME Probable Effects Level (PEL) was not exceeded. However, there were several instances where baseline concentrations of total chromium, copper, and arsenic were higher than applicable CCME Interim Sediment Quality Guidelines (ISQG). Sediment metals concentrations were generally lower in the Boston Project area lakes than in the Madrid Project area lakes. One notable exception was total copper concentrations at Stickleback Lake, which were also slightly higher than the ISQG.

Sediment toxicity was observed in a number of samples from both Aimaokatalok (Boston Project area) and Patch (Madrid Project area) lakes; determination of the potential causes for these results was difficult as sediment chemistry data were not collected at the specific locations from which toxicity samples were obtained. In Aimaokatalok Lake, survival and growth of test organisms (*Hyalella azteca* and *Chironomus tentans*) was not reduced, with the exception of one sample for the *Chironomus* test. Toxicity tests conducted on Patch Lake sediments showed significant reductions in survival of *H. azteca* and *C. tentans* for various samples; however, significant reductions in growth were not observed.

In addition to the aquatic benthic invertebrate toxicity testing, an examination of the effect of sediments on bacterial luminescence was also conducted. Toxic effects and inhibition of light output by *Vibrio fischeri* were observed in bacterial luminescence tests for samples obtained from the southern section of Aimaokatalok Lake, and in samples from deep-water stations in Patch Lake.

Phytoplankton

Phytoplankton communities in sampled waterbodies were similar to those in other small lakes in the Arctic and sub-Arctic. Based on the phytoplankton community, two types of lakes existed in the Hope Bay Belt: Cyanobacteria-dominated and non-Cyanobacteria dominated.

The five lakes with high phytoplankton productivity were Doris, Little Roberts, Ogama, Pelvic, and Roberts lakes; however, their high phytoplankton abundances were mainly due to Cyanobacteria. Cyanobacteria (otherwise known as blue-green algae) are generally not used by aquatic consumers as a food source and can be responsible for toxic blooms. Environmental conditions in these lakes are conducive to high phytoplankton abundances and, in particular, Cyanobacteria growth. Concentrations of nutrients (nitrogen and phosphorus) were high in these waterbodies and were likely the primary cause of the large phytoplankton abundances. Pelvic Lake contained the highest phosphorus and nitrogen concentrations, along with the highest phytoplankton abundances. Cyanobacteria typically thrive under high-nutrient conditions because of their unique ability of fix atmospheric nitrogen into a usable form, especially when phosphorus is high and nitrogen is the limiting nutrient. However, Cyanobacteria abundance was not correlated with nutrient concentrations in these lakes, which suggests that other factors may be contributing to the high abundances (i.e., large cyanobacteria abundances may be linked to selective zooplankton grazing, water temperature or other unmeasured variables).

Zooplankton

Zooplankton communities in the study area were typical of small lakes in the Arctic and sub-Arctic; no rare species were found. Lake depth was often an important factor influencing community composition.

Zooplankton communities were dominated by Rotifera in waterbodies less than 5 m deep (Fickle Duck, Reference, Stickleback, and Wolverine lakes), except P.O. Lake. Rotifera was virtually absent from the remaining waterbodies. The dominance of Rotifera in shallow waterbodies may be explained by behavioral differences (i.e., vertical migration) between large and small-bodied taxonomic groups which favor the selection for small bodied organisms in shallow waterbodies.

Deeper waterbodies were dominated by large-bodied zooplankton; however, no patterns of dominance among taxa were observed. For example, Windy and Glenn lakes were dominated by calanoid copepods, whereas Pelvic, Ogama, and Aimaokatalok (Station 6) lakes were dominated by cyclopoid copepods. Lastly, Patch and Aimaokatalok (Station 4) lakes had large biomasses of calanoid and cyclopoid copepods, and cladocerans (water fleas) that alternated between these taxonomic groups between sampling periods.

Benthic Invertebrates

Benthic invertebrate communities in the Boston and Madrid Project areas were typical of Arctic lakes. The abundant invertebrate groups included Nematoda (roundworms), Oligochaeta (aquatic earthworms), Pelycopoda (clams), Ostracoda (seed shrimp), and Chironomidae (midges). Either Ostracoda or Chironomidae were the most abundant group at all stations. Benthic invertebrate abundance was greater at shallow stations than at deep stations.

Benthic invertebrate community diversity in the Boston and Madrid Project area lakes was variable, as indicated by the wide range of Simpson's Diversity Indices. Taxonomic richness ranged from 5 to 19 taxa. Evenness was generally low, indicating that a small number of taxa contributed the majority of invertebrate abundance at most stations. Boston Project area lakes were more similar to the reference median than the Madrid Project area lakes, as indicated by Bray-Curtis Index values.

Fish Communities

In total, 444 fish representing 10 species were collected in the Boston Project area and 7155 fish representing six species were collected in the Madrid Project area during surveys conducted in 2006 and 2007. Sampling methods included angling, backpack electrofishing, beach seining, fyke and gill netting, minnow trapping, and dip netting. The fish species captured in the Boston Project area included ninespine stickleback, lake whitefish, lake trout, Arctic grayling, Arctic flounder, slimy sculpin, burbot, cisco, fourhorn sculpin, and Arctic char. In the Madrid Project area, the fish species captured included least cisco, ninespine stickleback, cisco, lake whitefish, lake trout, and Arctic char.

In general, the fish captured in the Boston and Madrid Project area appeared to be in good condition and were within the reported ranges of condition factors for fish in the Hope Bay Belt (RL&L/Golder 2002; Golder 2007; Golder 2008a; and Golder 2008b).

Lake Communities

In 2006, fish sampling in the Boston Project area was conducted in Aimaokatalok, Fickle Duck, Reference, and Stickleback lakes. In total, 177 fish representing three species were captured. Ninespine stickleback was the dominant catch (86.4%); other species captured in the sampled lakes included lake trout (11.9%) and cisco (1.7%).

Fish sampling in the Madrid Project area in 2006 was conducted in Ogama, Patch, P.O., P.O. Connector, P.O. Inflow, and Wolverine lakes. In 2007, fish were sampled in Patch, Glenn, and Wolverine lakes. In total, 6866 fish representing six species were captured in the Madrid Project area lakes. Least cisco was the most frequently captured species (58.4%), followed by cisco (16.2%), ninespine stickleback (15.7%), lake trout (5.5%), lake whitefish (4.1%), and Arctic char (0.1%). Ninespine stickleback was the predominant species in three of the five lakes sampled: P.O. Lake, P.O. Connector Lake, and P.O. Inflow Lake. In Patch Lake, lake trout was the most commonly captured species, and in Ogama Lake, cisco was the most common species. Lake trout was captured in all of the lakes except for P.O. Inflow Lake and Wolverine Lake. Wolverine Lake was found to have a unique stunted population of mature adult least cisco with fork lengths ranging from only 35 to 85 mm.

Stream Communities

In 2006, Fickle Duck Inflow and Outflow, Stickleback Outflow, the lowest reach of the Aimaokatalok River (as it entered Aimaokatalok Lake), and the upper reaches of the Koignuk River (downstream of Aimaokatalok Lake) were sampled. In 2007, sampling was also conducted in the lower reaches of the Koignuk River, just upstream from the mouth at Hope Bay. In total, 267 fish representing 10 species were captured. Lake whitefish was the dominant fish species (46.8%); most of these were young-of-the-year captured during beach seining on the upper Koignuk River in 2006. Ninespine stickleback (31.1%), Arctic grayling (6.7%), lake trout (7.1%), slimy sculpin (1.5%), and burbot (1.1%) were also captured in these streams. The remaining 3.3% of the catch was composed of Arctic char, fourhorn sculpin, and Arctic flounder, which were only caught in the lower reaches of the Koignuk River. In 2006, burbot were captured in Fickle Duck Outflow and the Koignuk River, which were the first reported captures of this species in the Boston Project area.

Within the Madrid Project area, the fish community was sampled in streams flowing out of Ogama, Patch, and P.O. lakes, as well as the inflow to Ogama Lake. In total, 289 fish representing four species were captured in the sampled streams. Ninespine stickleback was the most frequently captured species (88.9%), followed by lake trout (7.6%), lake whitefish (3.1%), and cisco (0.3%). Only ninespine stickleback was captured in P.O. Outflow, and a single lake trout was observed in Patch Outflow.

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Appendix B Water Quality
Appendix C Sediment Chemistry
Appendix D Primary Producers
Appendix E Fish Populations

1 INTRODUCTION

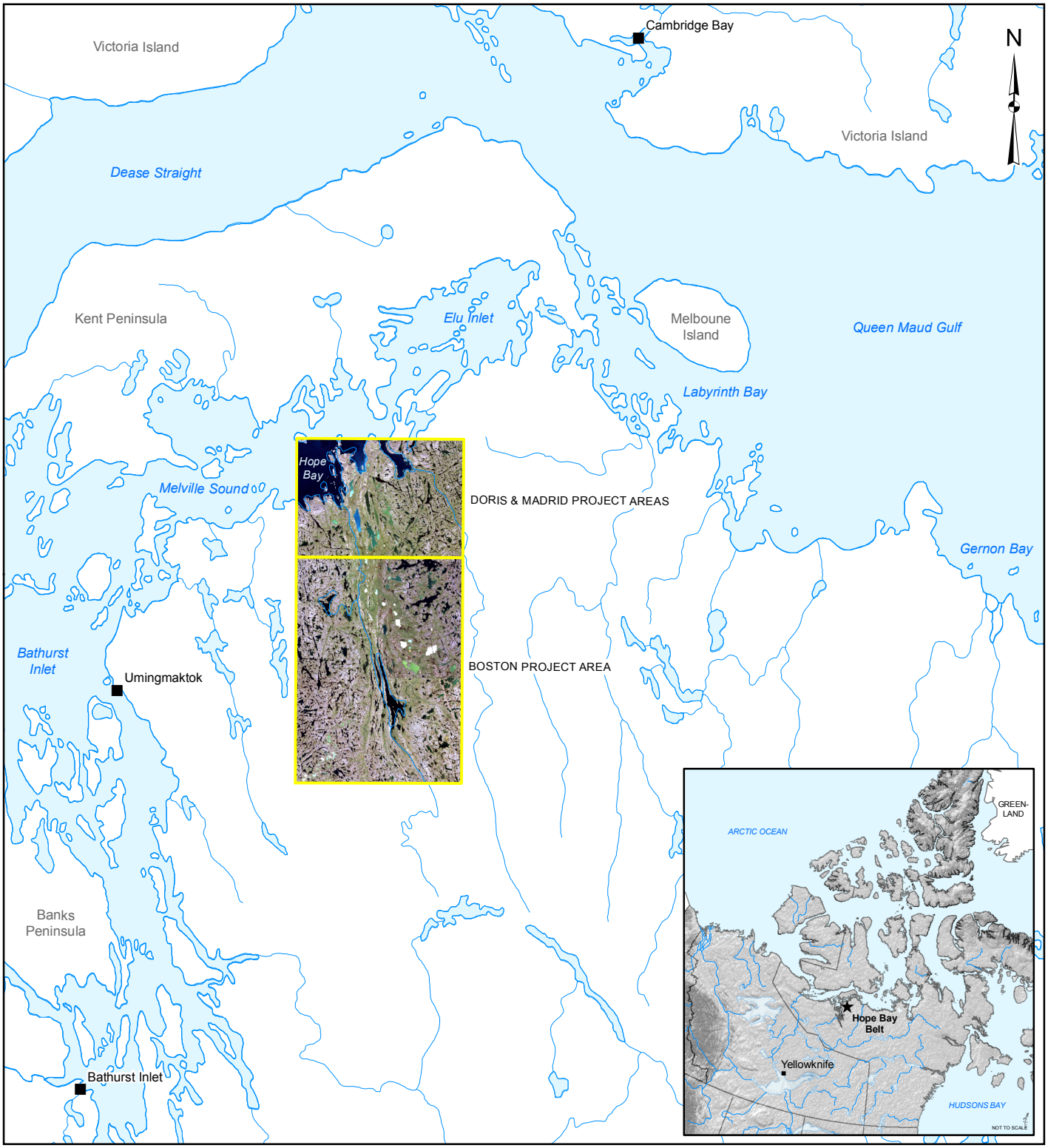
1.1 GENERAL

Hope Bay Mining Ltd. (HBML) proposes to construct and operate a gold mine in the West Kitikmeot Region of Nunavut (NU). In September of 2008, HBML announced a deferral of plans to build and operate the Doris North Project as previously proposed and permitted by Miramar Hope Bay Ltd. The mine, mill, and tailings facility have been placed on hold while HBML analyzes options for development of a multi-mine development in the Hope Bay Greenstone Belt. Infrastructure associated with a temporary port, a 900 m airstrip, a 118 person camp, and connecting roads were completed by HBML in 2008 to support advanced exploration and project feasibility studies in the belt.

The project is located 685 km northeast of Yellowknife and 125 km southwest of Cambridge Bay on the south shore of Melville Sound (Figure 1.1). The mine is on Inuit owned land, approximately 5 km south of the Arctic Ocean. The nearest communities are Umingmaktok, located 75 km to the southwest, and Bathurst Inlet, located 160 km to the southwest. The Project area consists of three main Project areas: Doris North, Madrid, and Boston. The Doris North and Madrid Project areas are located in the northern-most area and include several lake systems that drain into Roberts Bay. The Boston Project area is situated approximately 50 km south from the Doris North and Madrid Project areas and includes several lake and river systems that drain into Hope Bay.

Previous environmental baseline studies were carried out within the Boston Project area from 1992 to 2000 and within the Madrid Project area from 1995 to 2000. The aquatic environmental baseline information previously collected was synthesized and consolidated into two data compilation reports (Golder 2008a; RL&L/Golder 2002). The previous sampling programs conducted within the Boston and Madrid Project areas focused on different disciplines and waterbodies each year.

Field studies were conducted by Golder Associates Ltd. in 2006 and 2007 to gather additional baseline data regarding species composition and abundance in lakes and streams that potentially could be affected by the future development in the Boston and Madrid Project areas. The proposed studies build upon, rather than duplicate, surveys conducted in some of the waterbodies during the 1993 to 2000 period. The 2006 and 2007 field programs were designed to address several specific objectives, which are as follows:



LEGEND

- COMMUNITY
- WATERCOURSE
- WATERBODY
- STUDY AREA

40 0 40

SCALE 1:1325000 KILOMETRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery capture in 2007, obtained from CanImage.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

PROJECT LOCATION MAP

Golder Associates Edmonton, Alberta

PROJECT NO. 08-1373-0026			SCALE AS SHOWN	REV. 1
DESIGN	AH	24 Sep. 2008		
GIS	RC	29 Dec. 2008		
CHECK	AH	29 Dec. 2008		
REVIEW	GA	29 Dec. 2008		

FIGURE: 1.1

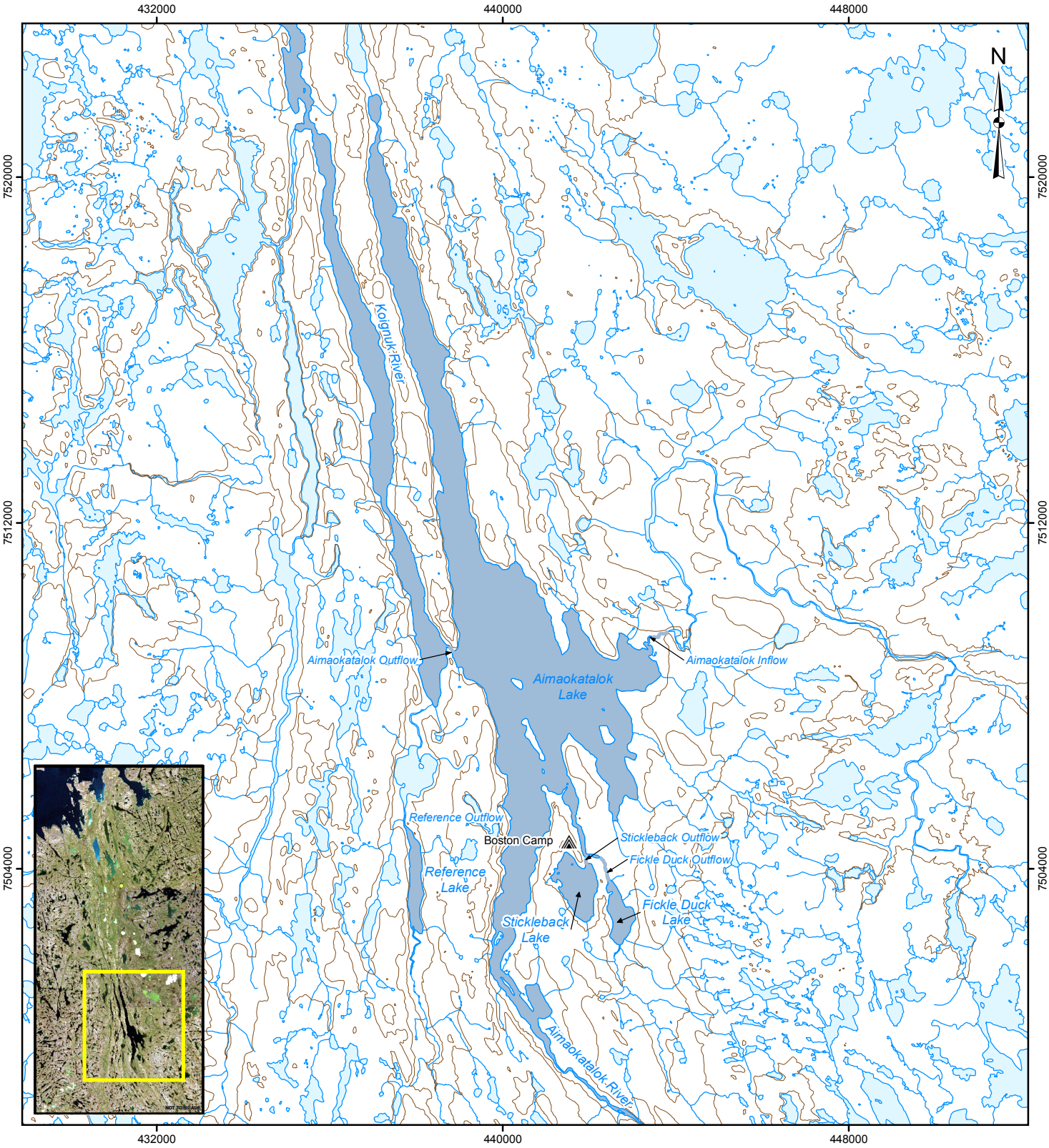
M:\Projects\2008\1373\0026_HBML_Doris_North_Environmental_Programs\MapDocs\mxd\Current\Fig1_1_AQ_RF_ProjectLocation_09Jan2009.mxd

- conducting snowcourse surveys in the Doris Lake and Aimaokatalok Lake watersheds;
- monitoring of meteorological data, including rainfall and other parameters, to support lake evaporation estimates in the Aimaokatalok Lake watershed;
- monitoring of seasonal water surface elevations on Aimaokatalok, Fickle Duck, Stickleback, Reference, Windy, Glenn, Patch, Pelvic, P.O., Ogama, and Wolverine lakes and discharge in associated outflows;
- sampling of water quality in selected lakes and streams in the Boston Project area (Aimaokatalok, Fickle Duck, Reference, and Stickleback lakes, corresponding outflow streams, Koignuk and Aimaokatalok rivers, Aimaokatalok Inflow, and Hope Bay);
- sampling of water quality in selected lakes and streams in the Madrid Project area (Windy, Pelvic, Ogama, Wolverine, Patch, P.O., and Glenn lakes, and corresponding outflow streams);
- collecting sediment, zooplankton, benthic invertebrates and phytoplankton samples in 2007;
- mapping fish habitat in selected lakes;
- sampling to determine fish species presence and relative abundance in the potentially affected systems;
- tagging fish from Patch and Ogama lakes, as well as three small connecting lakes, to facilitate future population estimates in this system;
- conducting a fish population estimate in Patch Lake; and
- conducting detailed habitat surveys along the Koignuk River to identify potential spawning habitat for Arctic grayling, and sampling fish to determine use of spawning habitat.

The field programs were conducted between 30 April and 13 September 2006, and between 28 April and 16 September 2007.

1.2 SAMPLING PROGRAMS IN 2006 AND 2007

Lakes sampled as part of baseline studies within the Boston and Madrid Project areas in 2006 and 2007 included Aimaokatalok, Fickle Duck, Reference, Stickleback, Ogama, Patch, P.O., P.O. Connector, P.O. Inflow, Windy, Pelvic, Glenn, and Wolverine (Figures 1.2 and 1.3). Streams sampled were Aimaokatalok, Fickle Duck, Stickleback, Reference, Patch, Ogama, P.O., Windy, Glenn, Pelvic, and Wolverine outflows, Aimaokatalok and Fickle Duck inflows, and the Koignuk and Aimaokatalok rivers. The marine station, Hope Bay, was also sampled.



LEGEND

- CAMP
- CONTOUR (20 m INTERVAL)
- WATERCOURSE
- STUDY AREA WATERCOURSE
- STUDY AREA WATERBODY
- WATERBODY

4000 0 4000

SCALE 1:125000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT. The Gold Company

HOPE BAY MINING LTD.

TITLE

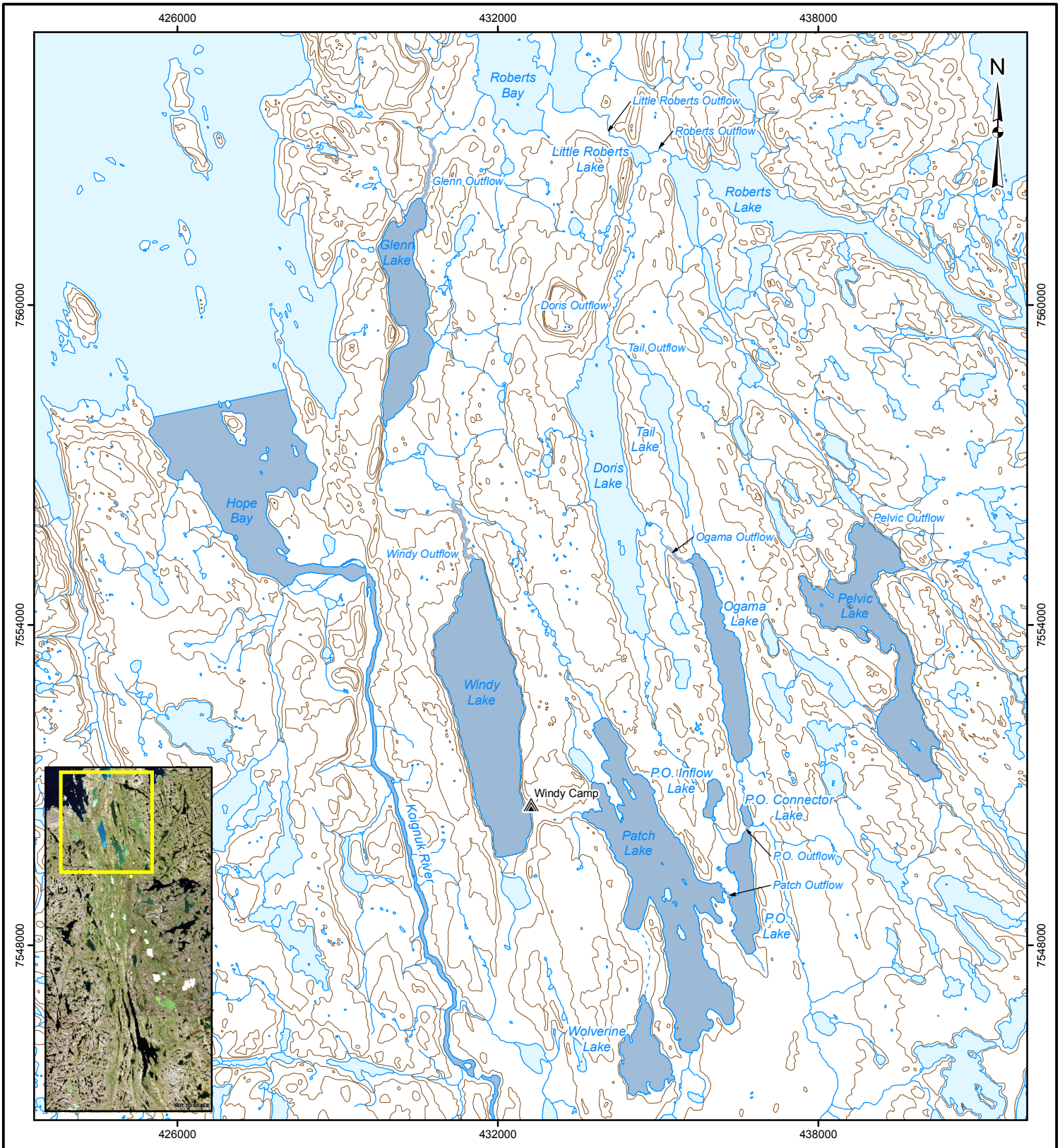
2006 AND 2007 WATERBODIES SAMPLED BOSTON PROJECT AREA

Golder Associates Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	BR	30 Mar. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 1.2

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LEGEND

- CAMP
- CONTOUR (20 m INTERVAL)
- INTERMITTENT STREAM
- WATERCOURSE
- STUDY AREA WATERCOURSE
- STUDY AREA WATERBODY
- WATERBODY

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT. The Gold Company

HOPE BAY MINING LTD.

TITLE

2006 AND 2007 WATERBODIES SAMPLED BOSTON AND MADRID PROJECT AREA

Golder Associates
Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	BR	30 Mar. 2009		
CHECK	AH	30 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 1.3

M:\Projects\2008\13730026_HBML_Doris_North_Environmental_Programs\MapDocs\2007_Revised\Current\Fig1_3_AQ_SL_WaterbodiesSampled_Boston_Madrid07_Mar3009.mxd

Stations and sampling methods used in 2006 and 2007 are summarized in Tables 1.1 and 1.2.

Table 1.1 Boston Project Area Hydrology, Water Quality and Fish Sampling Programs, 2006 – 2007

Waterbody	Discharge/ Water Level	Water Quality	Fish Population Sampling Methods					
			Angling	Beach Seining	Electro-fishing	Fyke Netting	Gill Netting	Minnow Trapping
Aimaokatalok Lake	2006/2007	2006/ 2007			2006	2006	2006	2006
Fickle Duck Lake	2006/2007	2006/ 2007		2006			2006	2006
Reference Lake		2006/ 2007			2006		2006	2006
Stickleback Lake	2006/2007	2006/ 2007					2006	2006
Aimaokatalok River		2006/ 2007			2006			
Aimaokatalok Inflow	2006/2007	2006/ 2007						
Aimaokatalok Outflow	2006/2007	2006/ 2007						
Fickle Duck Outflow	2006/2007	2006/ 2007			2006			
Fickle Duck Inflow					2006			
Koignuk River	2006/2007	2007	2006	2006/ 2007	2006/ 2007		2006/ 2007	2006
Reference Outflow		2006/ 2007						
Stickleback Outflow	2006/2007	2006/ 2007			2006			

1.3 OVERVIEW OF REPORT

To facilitate subsequent integration of the 2006 and 2007 data with historical data, the format and organization of this report closely follows the outline used in the historical data summary reports (RL&L/Golder 2002; Golder 2008a). This report is organized by major disciplines with a separate discussion for each waterbody sampled. Aquatic disciplines are presented as separate sections in the following order: hydrology, physical limnology and water quality, sediment quality, lower trophic levels (phytoplankton, zooplankton, and benthic invertebrates), fish habitat, and fish populations. Raw data and analytical results are provided as appendices at the end of the report.

Table 1.2 Madrid Project Area Hydrology, Water Quality and Fish Sampling Programs, 2006 – 2007

Waterbody	Discharge/ Water Level	Water Quality	Fish Population Sampling Methods					
			Angling	Beach Seining	Electro -fishing	Fyke Netting	Gill Netting	Minnow Trapping
Glenn Lake	2006/2007	2007			2007		2007	
Ogama Lake	2006/2007	2006/ 2007	2006	2006	2006		2006	2006
Patch Lake	2006/2007	2006/ 2007	2006/ 2007		2006/ 2007	2006/ 2007	2006/ 2007	2006/ 2007
Pelvic Lake		2006/ 2007						
P.O. Lake	2007	2006/ 2007		2006		2006	2006	2006
P.O. Connector Lake				2006		2006	2006	2006
P.O. Inflow Lake				2006	2006		2006	2006
Wolverine Lake	2006/2007	2006/ 2007	2006/ 2007	2006/ 2007	2006/ 2007		2006/ 2007	2006/ 2007
Windy Lake	2006/2007	2006/ 2007						
Glenn Outflow	2006/2007	2007						
Ogama Outflow	2006/2007	2006/ 2007			2006	2006		
Ogama Inflow					2006	2006		2006
Patch Outflow	2006/2007	2006/ 2007		2006				
Pelvic Outflow		2006/ 2007						
P.O. Outflow	2007	2006/ 2007		2006				
Windy Outflow	2006/2007	2006/ 2007						
Hope Bay	2006	2007						

2 HYDROLOGY

2.1 INTRODUCTION

The hydrology program conducted by Golder in the Boston and Madrid Project areas is in the second year of data collection for the Boston and Madrid Project areas. The objective of the data collection is to characterize the hydrology and hydrometeorology for key waterbodies in these areas, including annual and seasonal wet and dry conditions.

Runoff from small Arctic watersheds is dominated by lake storage and by the conditions at individual lake outlets. Regional hydrological analysis methods of predicting the flow regimes of ungauged watersheds are often inappropriate in this context. The data collected under this program are intended to be used to develop water balance models for these small watersheds, to allow mean and wet and dry extreme (e.g., 100-year flood and drought) conditions to be characterized on the basis of a relatively short (e.g., three to six year) data set.

2.2 METHODS

The monitoring approach was to select key watersheds that are likely to be affected by mine development and to monitor lake water levels and watercourse discharges concurrently with snowpack, rainfall, temperature, and other meteorological parameters. This provides data for model development, including stage-discharge rating curves at lake outlets, as well as data for model calibration and verification. The monitoring program after baseline model development may be used for further validation and for monitoring of project effects through construction, operations, and closure.

In some situations, logistics and ice conditions mean that early and late season flows could not be collected for some waterbodies. The data that are collected, even if they do not include flood peaks or are not continuous, are still of value for model development, calibration, and validation.

2.2.1 Hydrometry

In 2008, the hydrology program monitored lake water levels and stream discharge during the open water season at 12 hydrometric stations in the following locations:

- Boston Project Area: H83 Aimaokatalok River, H84 Aimaokatalok Lake and Outflow, H85 Koignuk River, H86 Fickle Duck Lake and Outflow, and H87 Stickleback Lake and Outflow, H88 Hope Bay Tide (six stations) (Figures 2.1 and 2.2); and
- Madrid Project Area: H81 Patch Lake and Outflow, H82 Ogama Lake and Outflow, H89 P.O. Lake and Outflow, H91 Wolverine Lake and Outflow, H92 Windy Lake and Outflow, and H93 Glenn Lake and Outflow (six stations) (Figure 2.2).

At H84 Aimaokatalok Lake and Outflow, the transducer and data logger were left in place to collect data for the 2006-2007 winter, and they remained in place to collect data for the 2007-2008 winter.

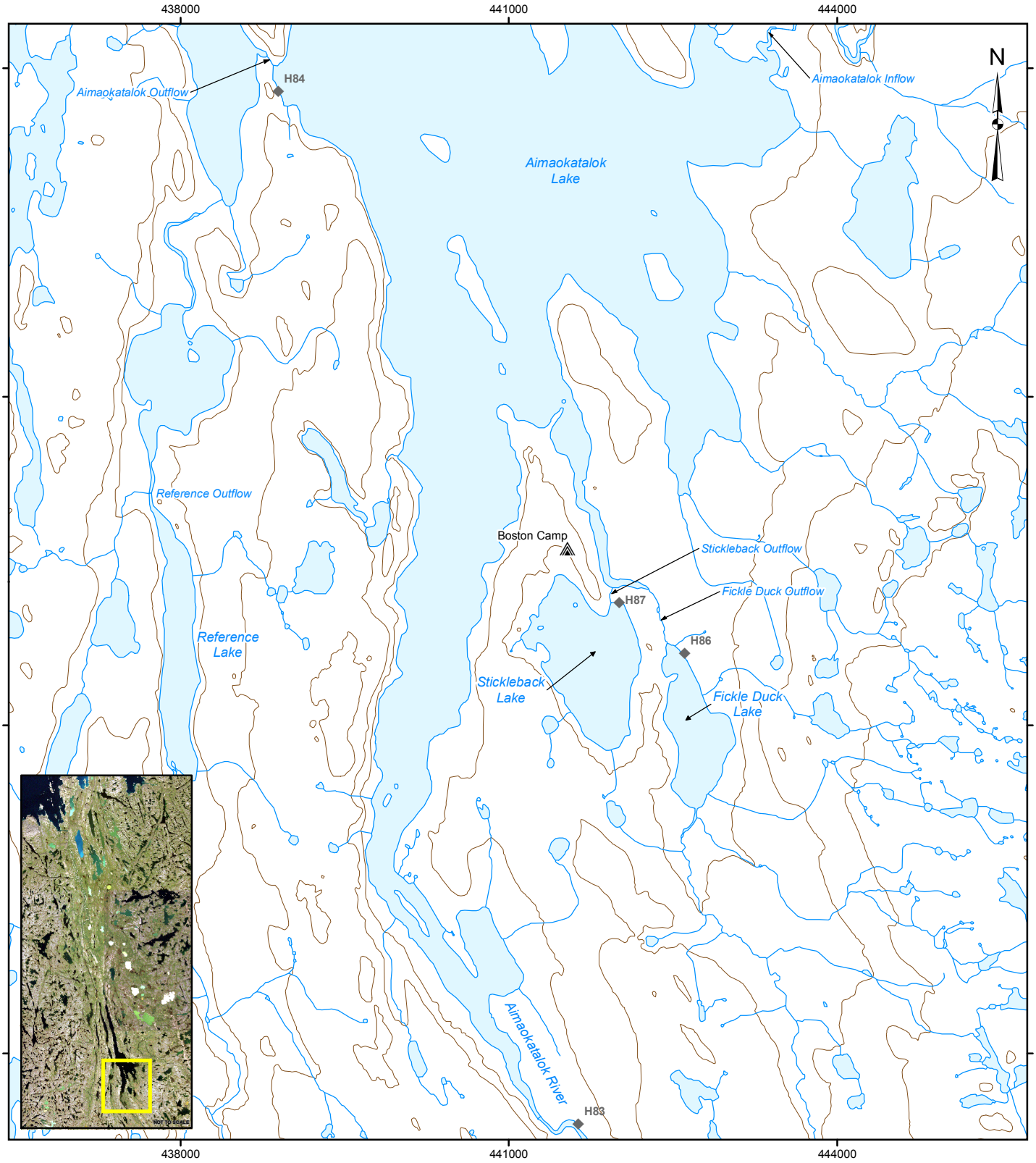
At each hydrometric station, a KPSI 730-series solid-state pressure transducer and Optimum Instruments DD-320 data logger were installed. Each data logger was programmed to record water pressure measurements at 15-minute intervals. Each station was referenced to an elevation benchmark.

Transducers at Patch Lake and Outflow (H81), Ogama Lake and Outflow (H82), Fickle Duck Lake and Outflow (H86), Stickleback Lake and Outflow (H87), Wolverine Lake (H91), Windy Lake and Outflow (H92), and Glenn Lake and Outflow (H93) were installed before the peak flow, under-ice upstream of the lake outlet.

Transducers at Aimaokatalok Inflow (H83), Koignuk River (H85), and P.O. Lake and Outflow were installed after peak flows in 2007 as permitted by ice conditions and station access.

In 2007, the transducer on Aimaokatalok Inflow was found damaged on the 4 July visit; it was replaced below the riffle on the 21 July visit.

The transducer at the Aimaokatalok Outflow (H84) station was installed under the ice upstream of the lake outlet before peak flows began. However, the rise in lake water level submerged the data logger and data in 2006 are only available for the period after the reinstallation in July. This station was later installed to over-winter for the winters of 2006 and 2007. Continuous data are available for the remainder of 2006 and 2007. The transducer was installed below the bottom of the lake ice to provide lake level readings over the course of the year. The pressure transducer cable was protected by steel pipe stem, bolted to a rock face, and the data logger placed well above the high-water elevation.



LEGEND

- CAMP
- HYDROMETRIC STATION
- CONTOUR (20 m INTERVAL)
- WATERCOURSE
- WATERBODY

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

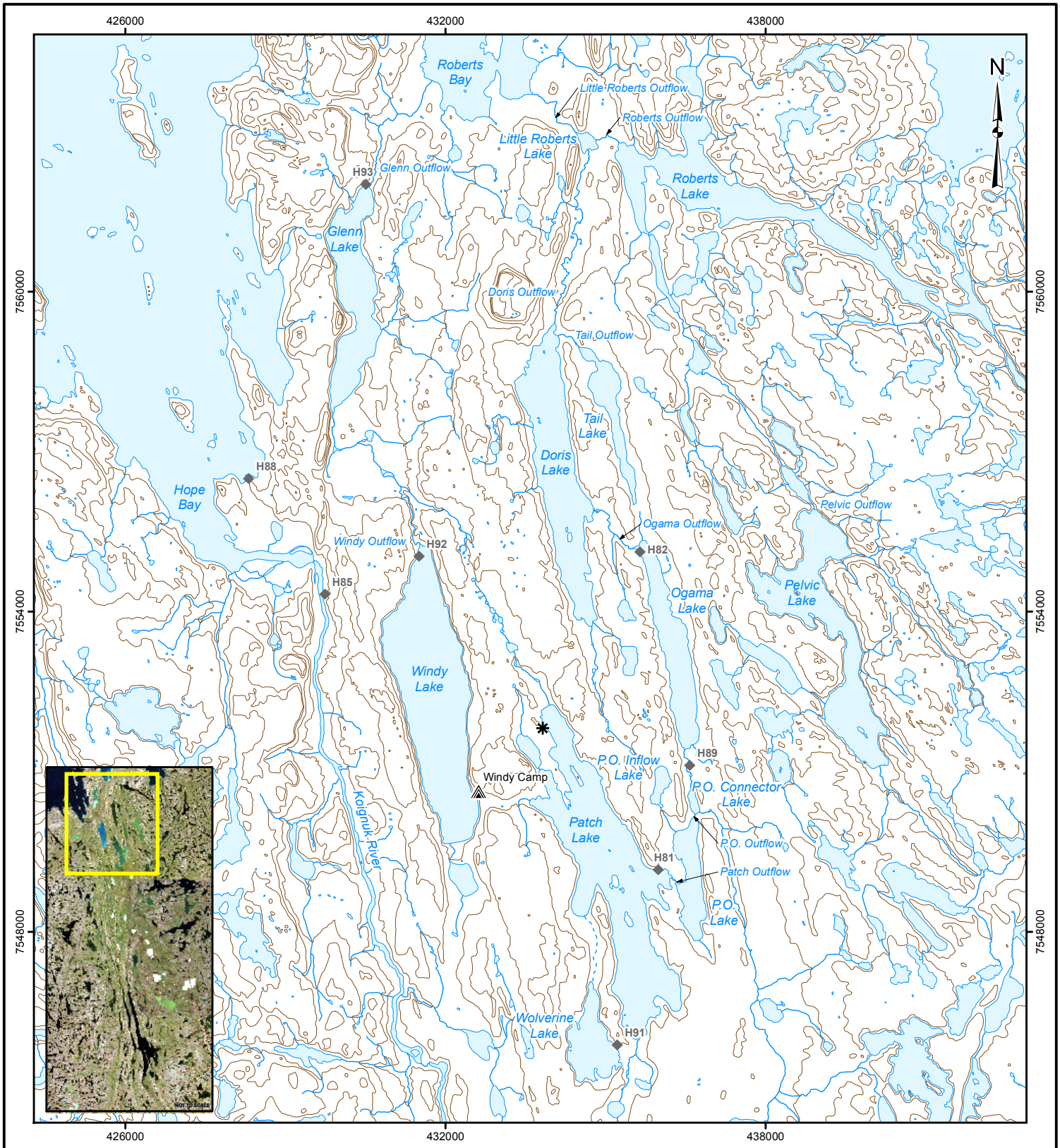
2006 AND 2007 HYDROMETRIC STATION LOCATIONS BOSTON PROJECT AREA

Golder Associates
Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	BR	30 Mar. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 2.1

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LEGEND

- MAJOR DRILLING SHOP
- CAMP
- HYDROMETRIC STATION
- CONTOUR (20 m INTERVAL)
- INTERMITTENT STREAM
- WATERCOURSE
- WATERBODY

3000 0 3000

SCALE 1:100000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

2006 AND 2007 HYDROMETRIC STATION LOCATIONS BOSTON AND MADRID PROJECT AREAS

Golder Associates Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	BF	07 Jul. 2009		
CHECK	AH	10 Jul. 2009		
REVIEW	GA	10 Jul. 2009		

FIGURE: 2.2

i:\2008\08-1373\00026_HBML_Doris_North_Environmental_Programs\MapDocs\2007_Revised\Current\Fig2_2_AQ_SL_Hydrometric_Madrid07_07July2009.mxd

The data logger at the Windy Lake (H92) station was malfunctioning at the end of the open-water program; continuous data are not available after 4 August 2007.

The transducer at the Glenn Lake (H93) station was found to have failed on 3 July 2007; readings are not available after this date.

In 2006, the transducer at Hope Bay (H88), measuring variations in water level with tidal fluctuations, was installed after ice had left the bay. In 2007, a transducer was not installed.

During visits to stations with flowing water, stream discharge measurements were performed according to the Water Survey of Canada standard described by Terzl et al. (1994). Data were downloaded periodically and pressure transducer readings associated with each discharge measurement were recorded.

During selected data logger downloads, water surface elevations were surveyed from the permanent benchmark, and pressure transducer readings were recorded.

During the last visits of 2006 and 2007, the pressure transducer and data logger were removed from the hydrometric stations to prevent ice damage over the winter. The exception was at Aimaokatalok Lake where measurement devices were left in place to record measurements over-winter.

When all data were available for flowing water stations, the record of water surface elevation versus discharge was used to establish a stage-discharge rating curve for each station. This rating curve was then applied to the continuous record of water surface elevations to derive a continuous record of discharges. For some stations, limited stage-discharge data were available so continuous discharges were not derived. Stage data not used to derive discharges may be used in the future when a more complete stage-discharge data set is available.

2.2.2 Snow Course Surveys

Late winter measurements of snow depths, snow densities, and snow water equivalents were performed to characterize the amount of snow available to contribute to spring runoff over a range of terrain types. Snow course surveys were undertaken on 1 May 2006 and from 28 April to 5 May 2007 using the following methods:

Plot Selection

Plot locations within the Aimaokatalok Lake watershed were selected based on terrain type. These included the following:

- open lake (flat areas on lakes);
- exposed lowland (flat areas at the top of slopes);
- sheltered lowland (flat areas at the toe of slopes); and
- north, east, south, and west aspects (slopes facing these directions).

This was done to identify differences in snow accumulation between terrain types. Where possible, locations sampled in 2006 were re-sampled in 2007.

Snow Depth Measurement

At each plot, 30 depth measurements were taken at locations randomly selected from within a large circle, with approximately 10 m between measurements. Depth was measured by inserting a metre stick into the snowpack and reading the snowline mark.

Snow Density Measurement

Three density measurements were recorded at each plot using a snow density sampler. The sampler was carefully inserted to avoid compacting the snowpack. Snow depth was recorded when the corer reached the soil surface. The corer was then pushed further into the ground to ensure that a plug of soil was extracted with the sampler, thereby preventing granular snow from falling out. After extracting the sampler and carefully removing the soil plug, the sampler weight was measured with and without the snow core, snow mass was measured, and the snow-water equivalent was calculated.

2.2.3 Rainfall

Rainfall monitoring was performed to characterize the amount of rain that contributed to runoff during the open water season. The meteorological station in the Boston Project area was located at the Boston Camp and has sensors to measure the following parameters:

- air temperature (hourly mean, maximum and minimum);
- relative humidity (hourly maximum and minimum);
- vapor pressure (hourly mean, maximum and minimum);
- global solar radiation (hourly mean and total);

- wind speed and direction (value and time of hourly maximum, mean horizontal wind speed, unit vector of mean wind direction, and standard deviation of wind direction for each hour; and
- rainfall (hourly accumulated depth).

Rainfall at this station was recorded in 2006 using a tipping bucket rain gauge, and the rainfall record was used to derive total daily and monthly rainfall during the summer months. Rainfall data are not included for 2007 because of equipment malfunction.

2.3 BOSTON PROJECT HYDROMETRY

2.3.1 H83 Aimaokatalok River

A factsheet describing the location of the hydrometric station and equipment installed at Aimaokatalok River (Station H83) is provided in Appendix A. The appendix also contains stage-discharge data; the derived stage-discharge rating curve based on 2006 data; the derived stage-discharge rating curve based on 2007 data; mean daily discharge and water level data; and manual discharge measurement data and calculation sheets for 2006 and 2007.

The Aimaokatalok River hydrometric station was visited six times (Table 2.1) during the 2006 field program and five times during the 2007 field program; continuous logger data resulted in a hydrograph for the period of 23 June to 10 September 2006 (Figure 2.3) and 4 July to 9 September 2007 (Figure 2.4).

Continuous water level data (2 June to 8 September 2006) for the station are available; however, a reliable stage-discharge rating curve has not yet been derived for discharges prior to 23 June. Water level data for the period prior to 23 June can be used to determine discharges for that period once the rating curve is able to be extended using discharges higher than those measured in 2006.

Between 4 and 21 July 2007, mean daily discharges were derived by interpolation, and discharges between 9 September and 16 October 2007 were estimated based on linear recession to freeze-up (Figure 2.4).

Table 2.1 Station Visits to Aimaokatalok River Hydrometric Station, 2006 – 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
02-Jun-06	Installed pressure transducer under ice. Observed onset of spring melt.	n/a			
23-Jun-06	Measured discharge and water surface elevation and downloaded data logger.			✓	11.01 m^3/s
17-Jul-06	Measured discharge and downloaded data logger.			✓	1.51 m^3/s
09-Aug-06	Measured discharge and water surface elevation and downloaded data logger.			✓	0.850 m^3/s
13-Aug-06	Measured discharge and downloaded data logger.			✓	0.994 m^3/s
10-Sep-06	Measured discharge and downloaded data logger. Removed data logger for winter.			✓	1.30 m^3/s
26-May-07	Installed pressure transducer, surveyed ice level.	n/a			
04-Jul-07	Measured discharge and water surface elevation.			✓	6.70 m^3/s
21-Jul-07	Measured discharge and water surface elevation.			✓	3.23 m^3/s
18-Aug-07	Measured discharge and downloaded data logger.			✓	4.61 m^3/s
09-Sep-07	Measured discharge, water surface elevation and downloaded data logger. Removed data logger for winter.			✓	2.50 m^3/s

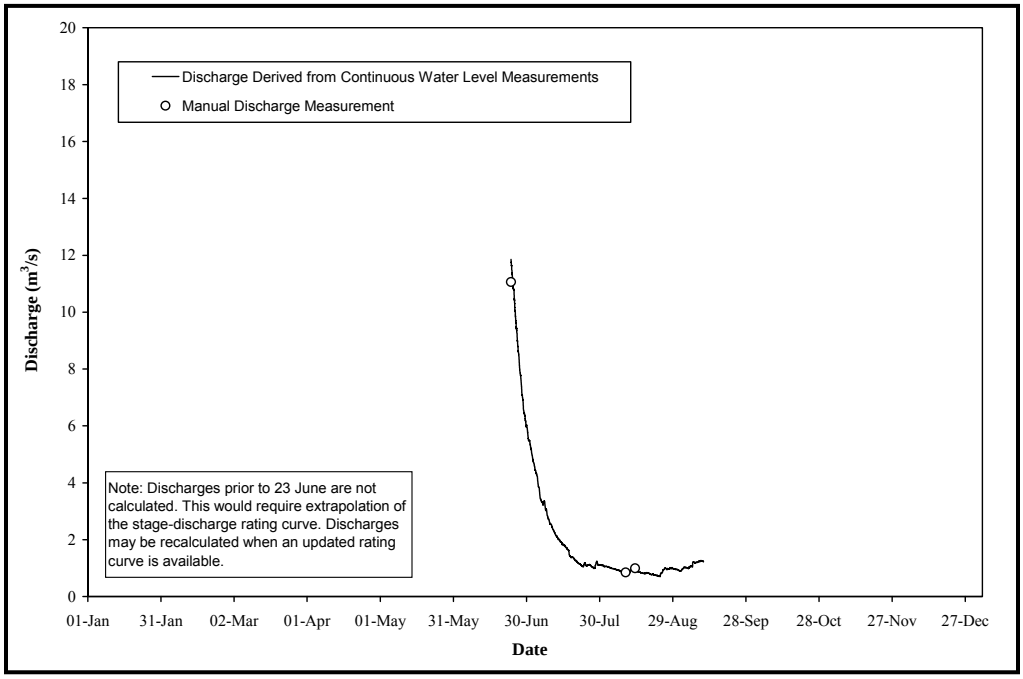


Figure 2.3 Hydrograph for Aimaokatalok River, 2006

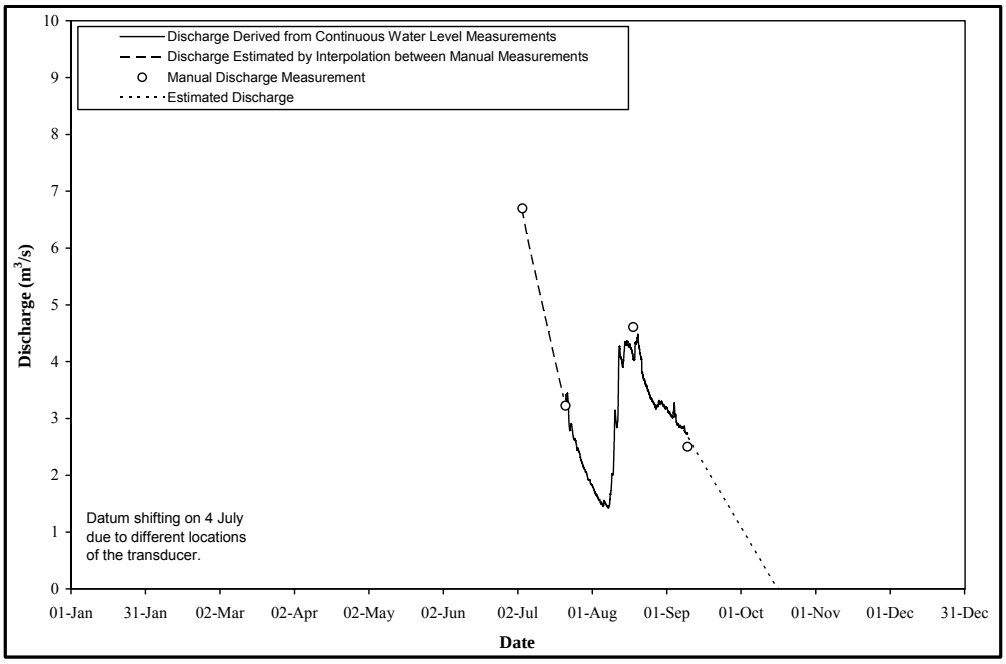


Figure 2.4 Hydrograph for Aimaokatalok River, 2007

2.3.2 H84 Aimaokatalok Lake and Outflow

A factsheet describing the location of the hydrometric station and equipment installed at Aimaokatalok Lake and Outflow (Station H84) is provided in Appendix A. The appendix also contains stage-discharge data; the derived stage-discharge rating curve based on 2006 data; the derived stage-discharge rating curve based on 2007 data; mean daily discharge and water level data; and manual discharge measurement data and calculation sheets.

The Aimaokatalok Lake and Outflow hydrometric station was visited six times during the 2006 field program and five times during the 2007 field program (Table 2.2); a continuous hydrograph was derived for the period of 8 July to 31 December 2006 (Figure 2.5) and 1 January to 10 September 2007 (Figure 2.6) based on continuous logger data.

The field data indicate that Aimaokatalok Lake water levels increase dramatically during spring runoff. The data logger at the station, installed under ice, was submerged when the station was visited on 23 June 2006. It was replaced during the next station visit on 8 July, and a permanent installation with ice protection was constructed on 9 August. At that time, the pressure transducer was installed in deep water for winter and a cold-tested data logger was installed.

Table 2.2 Station Visits to Aimaokatalok Lake and Outflow Hydrometric Station, 2006 – 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
02-Jun-06	Installed pressure transducer under ice. Observed onset of spring melt.	✓	97.296 m		
23-Jun-06	Data logger was found submerged and was retrieved. Discharge was not measured because of safety concerns associated with high water levels.				
08-Jul-06	Replaced data logger. No discharge was measured because of safety concerns associated with high water levels.				
09-Aug-06	Measured discharge and water surface elevation and downloaded data logger. Installed transducer in deep water for winter with pipe stem protection for transducer cable.	✓	95.855 m	✓	2.67 m^3/s
13-Aug-06	Measured discharge only.	✓	97.639 m	✓	2.48 m^3/s
10-Sep-06	Measured discharge and downloaded data logger. Removed data logger for winter.			✓	2.21 m^3/s
26-May-07	Installed pressure transducer under ice. Surveyed ice level				
04-Jul-07	Measured discharge and water surface elevation and downloaded data logger.	✓	97.520 m	✓	37.8 m^3/s
20-Jul-07	Measured water surface elevation and downloaded data logger.	✓	96.720 m		
18-Aug-07	Measured discharge and water surface elevation and downloaded data logger.	✓	96.401 m	✓	8.13 m^3/s
10-Sep-07	Measured discharge, water surface elevation and downloaded data logger.	✓	96.082 m	✓	6.88 m^3/s

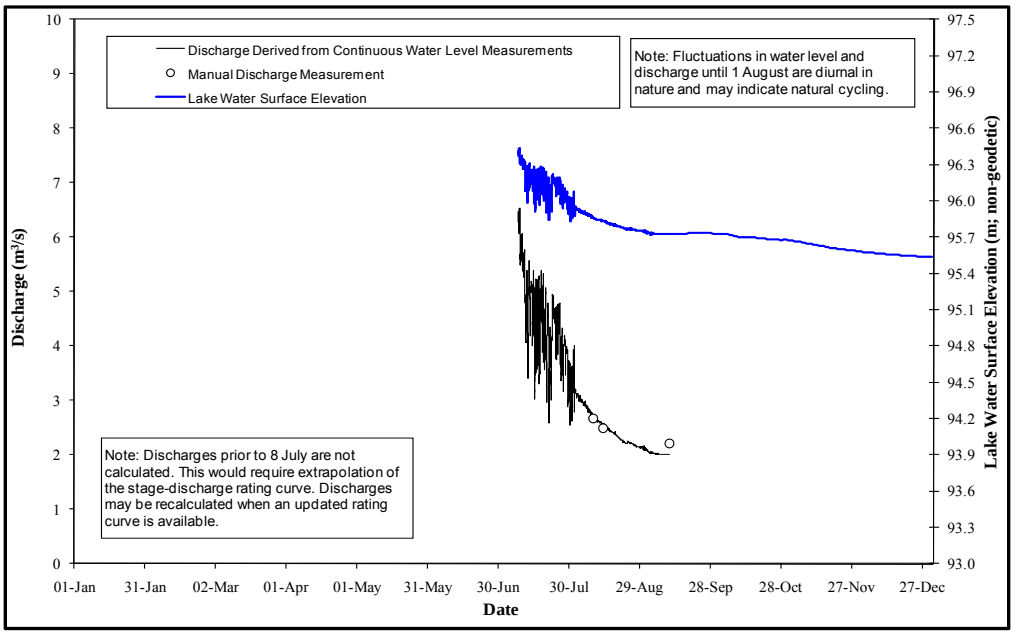


Figure 2.5 Hydrograph for Aimaokatalok Lake and Outflow, 2006

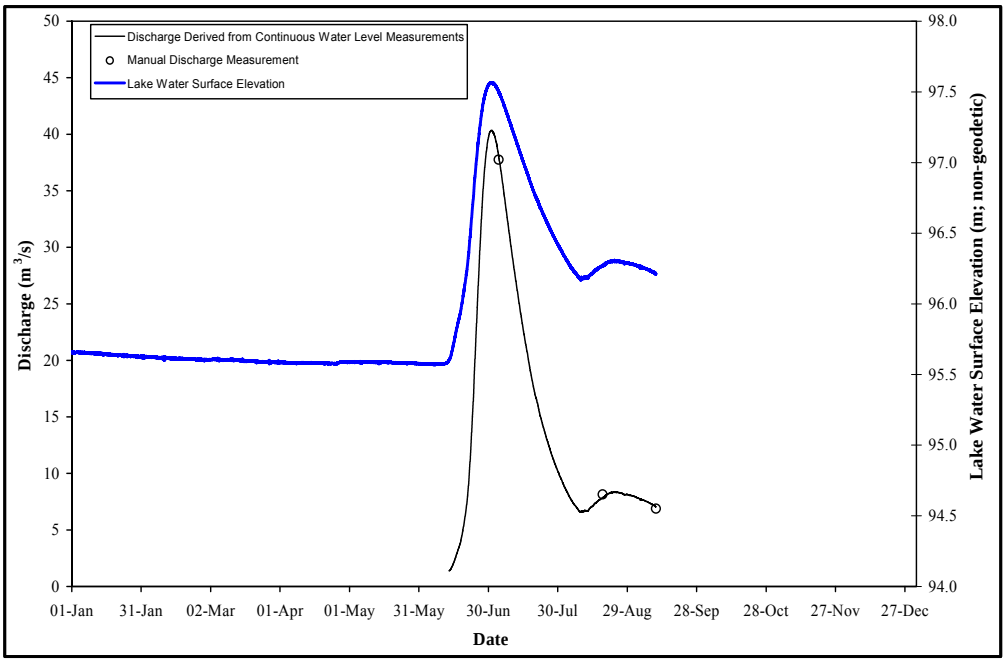


Figure 2.6 Hydrograph for Aimaokatalok Lake and Outflow, 2007

2.3.3 H86 Fickle Duck Lake and Outflow

A factsheet describing the location of the hydrometric station and equipment installed at Fickle Duck Lake and Outflow (Station H86) is provided in Appendix A. The appendix also contains stage-discharge data; the derived stage-discharge rating curve based on 2006 data; the derived stage-discharge rating curve based on 2007 data; mean daily discharge and water level data; and manual discharge measurement data and calculation sheets.

The Fickle Duck Lake and Outflow hydrometric station was visited six times during the 2006 field program and six times during the 2007 field program (Table 2.3). Continuous hydrographs were generated for the periods 3 to 17 June and 8 July to 10 September 2006 (Figure 2.7) and 23 July to 12 August 2007 (Figure 2.8). A gap exists between 17 June and 8 July 2006 because lake water levels dropped below the transducer elevation during this period. There was no observable flow recorded during discharge sampling in July 2006 and 2007.

Table 2.3 Station Visits to Fickle Duck Lake and Outflow Hydrometric Station, 2006 – 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
03-Jun-06	Installed pressure transducer under ice. Observed onset of spring melt.	✓	99.087 m		
24-Jun-06	Measured discharge and downloaded data logger.			✓	0.074 m^3/s
08-Jul-06	Measured discharge and water surface elevation and downloaded data logger.	✓	98.697 m	✓	0.002 m^3/s
17-Jul-06	Measured discharge and downloaded data logger.			✓	0.000 m^3/s
13-Aug-06	Measured discharge and water surface elevation and downloaded data logger.	✓	98.697 m	✓	0.006 m^3/s
10-Sep-06	Measured discharge and water surface elevation and downloaded data logger. Removed data logger for winter.	✓	98.702 m	✓	0.013 m^3/s
26-May-07	Installed pressure transducer.				
23-Jun-07	Measured discharge and water surface elevation and downloaded data logger.	✓	98.470 m	✓	1.33 m^3/s
20-Jul-07	Measured water surface elevation, reinstalled transducer.			✓	Very low flow, approximately zero
22-Jul-07	Downloaded data logger.				
19-Aug-07	Measured discharge and water surface elevation and downloaded data logger.	✓	98.972 m	✓	0.427 m^3/s
09-Sep-07	Measured discharge and downloaded data logger. Removed data logger for winter.	✓	98.800 m	✓	0.053 m^3/s

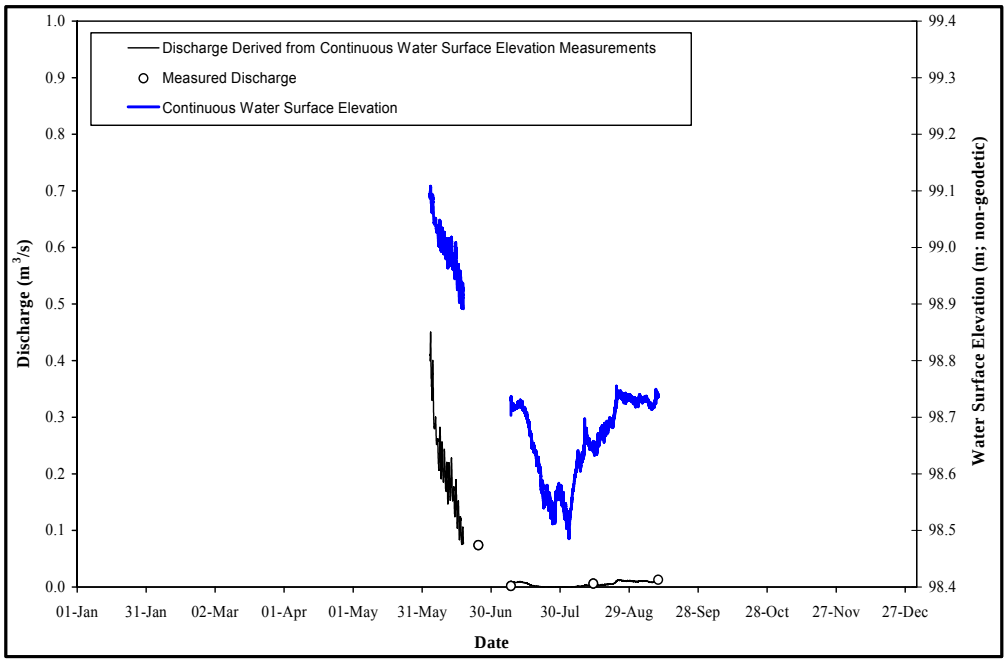


Figure 2.7 Hydrograph for Fickle Duck Lake and Outflow, 2006

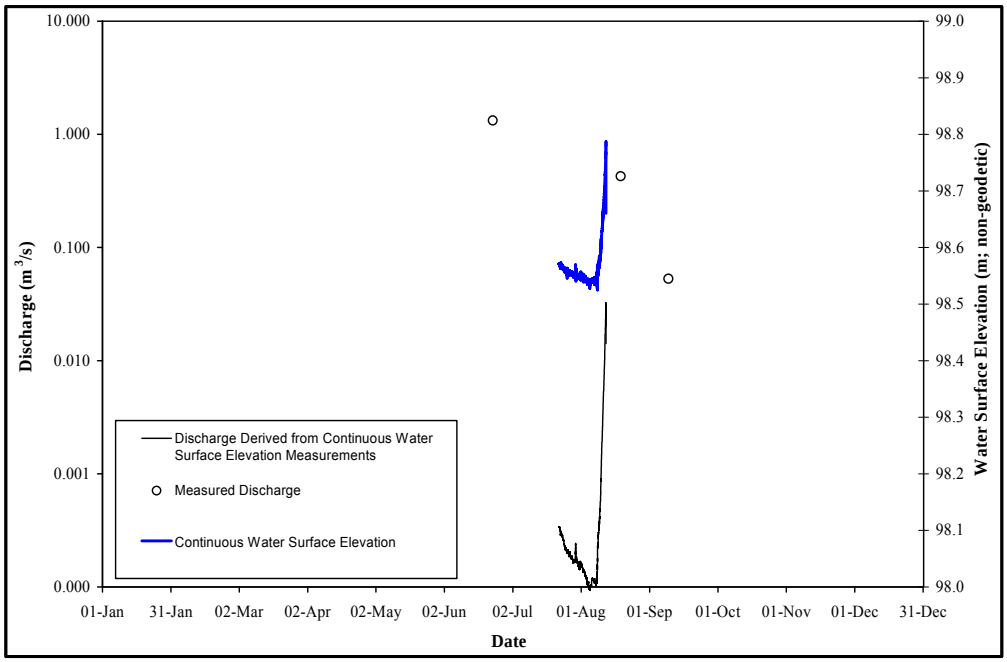


Figure 2.8 Hydrograph for Fickle Duck Lake and Outflow, 2007

2.3.4 H85 Koignuk River

A factsheet describing the location of the hydrometric station and equipment installed at Koignuk River (Station H85) is provided in Appendix A. The appendix also contains stage-discharge data; the derived stage-discharge rating curve based on 2006 data; the derived stage-discharge rating curve based on 2007 data; mean daily discharge and water level data; and manual discharge measurement data and calculation sheets.

The Koignuk River hydrometric station was visited five times during the 2006 field program and six times during the 2007 field program (Table 2.4). A continuous hydrograph was generated for the period from 21 July to 8 September 2006 (Figure 2.9) and 2 July to 13 September 2007 (Figure 2.10).

Continuous water level data (29 May to 8 September 2006 and 2 July to 13 September 2007) for the station are available; however, a reliable stage-discharge rating curve has not yet been derived for discharges prior to 21 July.

Table 2.4 Station Visits to Koignuk River Hydrometric Station, 2006 – 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
29-May-06	Installed pressure transducer under ice. Observed onset of spring melt.	n/a			
03-Jul-06	Measured water surface elevation and downloaded data logger. Discharge was not measured because of safety concerns associated with high water levels.				
21-Jul-06	Measured discharge and downloaded data logger.			✓	9.64 m^3/s
14-Aug-06	Measured discharge water surface elevation and downloaded data logger.			✓	4.51m^3/s
08-Sep-06	Measured discharge and water surface elevation and downloaded data logger. Removed data logger for winter.			✓	2.82 m^3/s
25-May-07	Installed pressure transducer under ice.	n/a			
01-Jul-07	Measured discharge and water surface elevation.			✓	72.9 m^3/s
19-Jul-07	Measured water surface elevation and downloaded data logger. Discharge not measured because of safety concerns associated with high water levels.				
16-Aug-07	Measured water surface elevation. Discharge not measured because of safety concerns associated with high water levels.				
31-Aug-07	Measured discharge and water surface elevation and downloaded data logger.			✓	20.2 m^3/s
13-Sep-07	Measured discharge and water surface elevation and downloaded data logger. Removed data logger for winter.			✓	14.8 m^3/s

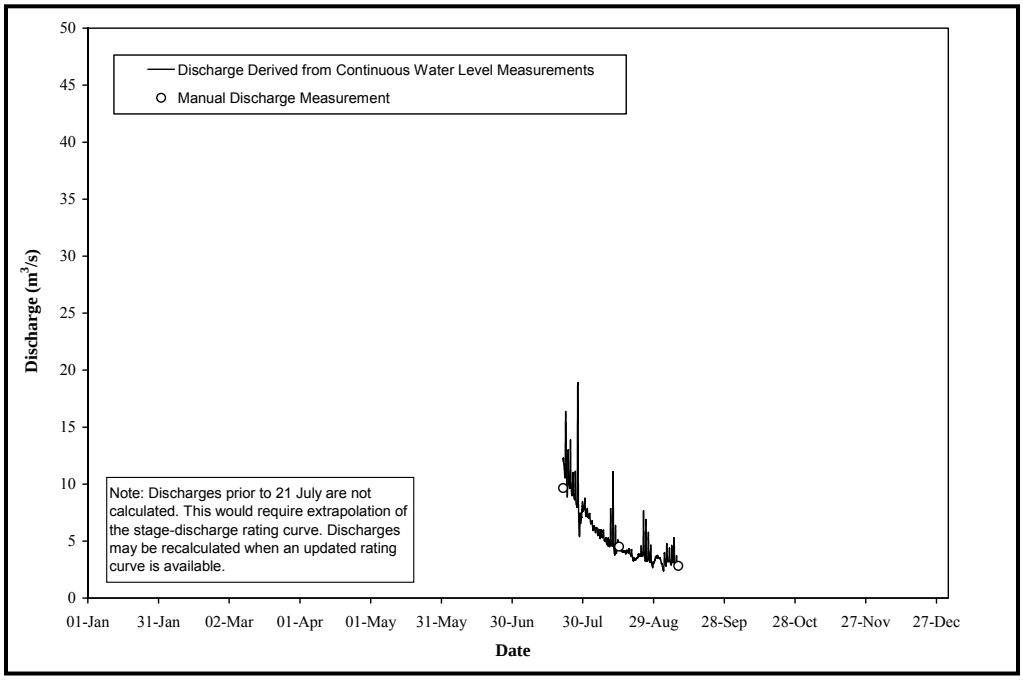


Figure 2.9 Hydrograph for Koignuk River, 2006

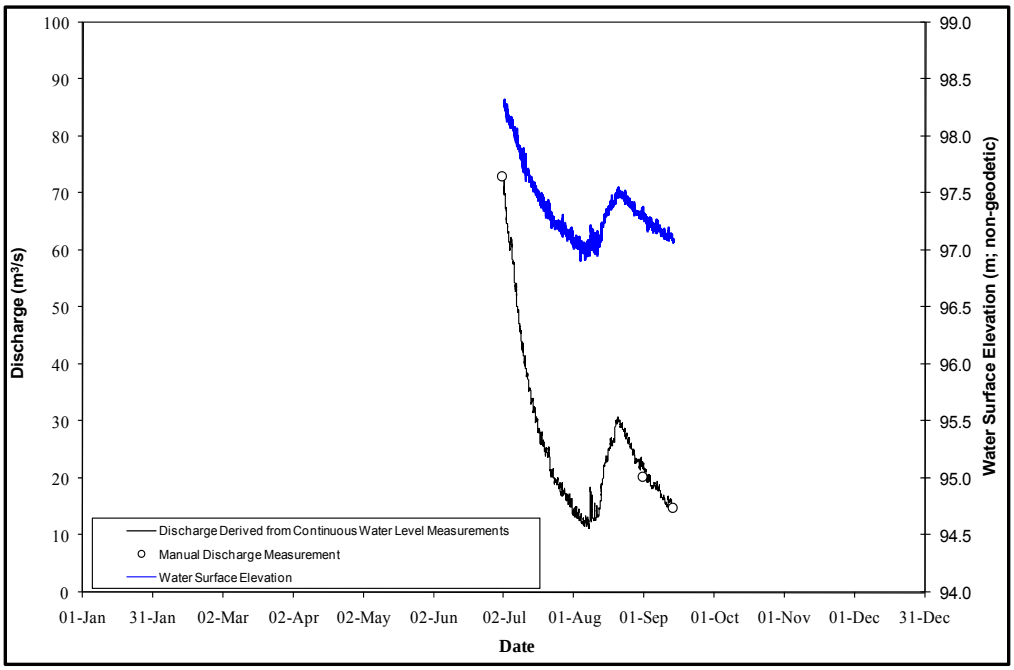


Figure 2.10 Hydrograph for Koignuk River, 2007

2.3.5 H87 Stickleback Lake and Outflow

A factsheet describing the location of the hydrometric station and equipment installed at Stickleback Lake and Outflow (Station H87) is provided in Appendix A. The appendix also contains stage-discharge data; the derived stage-discharge rating curve based on 2006 data; the derived stage-discharge rating curve based on 2006 data; mean daily discharge and water level data; and manual discharge measurement data and calculation sheets.

The Stickleback Lake and Outflow hydrometric station was visited six times during the 2006 field program and four times during the 2007 field program (Table 2.5). Data were used to generate a continuous hydrograph for the period between 2 June to 10 September 2006 (Figure 2.11) and 10 June to 9 September 2007 (Figure 2.12). Discharges between 8 and 10 June 2007 were estimated based on linear interpolation between the onset of runoff and the first transducer readings unaffected by ice. Discharges between 9 and 19 September 2007 were estimated based on linear interpolation between the last measurement and the estimated freeze-up date.

Table 2.5 Station Visits to Stickleback Lake and Outflow Hydrometric Station, 2006 – 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
03-Jun-06	Installed pressure transducer under ice. Observed onset of spring melt.	✓	99.498 m		
24-Jun-06	Measured discharge and water surface elevation and downloaded data logger.	✓	99.473 m	✓	0.021 m^3/s
08-Jul-06	Measured discharge and water surface elevation and downloaded data logger.	✓	99.417 m	✓	0.009 m^3/s
17-Jul-06	Measured discharge and downloaded data logger.			✓	0.001 m^3/s
13-Aug-06	Measured discharge and water surface elevation and downloaded data logger.	✓	99.361 m	✓	0.001 m^3/s
10-Sep-06	Measured discharge and water surface elevation and downloaded data logger. Removed data logger for winter.	✓	99.346 m	✓	0.0005 m^3/s
25-May-07	Installed pressure transducer under ice.				
23-Jun-07	Measured discharge and water surface elevation and downloaded data logger.	✓	98.876 m	✓	0.043 m^3/s
19-Aug-07	Measured discharge and water surface elevation and downloaded data logger.	✓	98.757 m	✓	0.013 m^3/s
06-Sep-07	Measured discharge and water surface elevation and downloaded data logger. Removed data logger for winter.	✓	98.785 m	✓	0.005 m^3/s

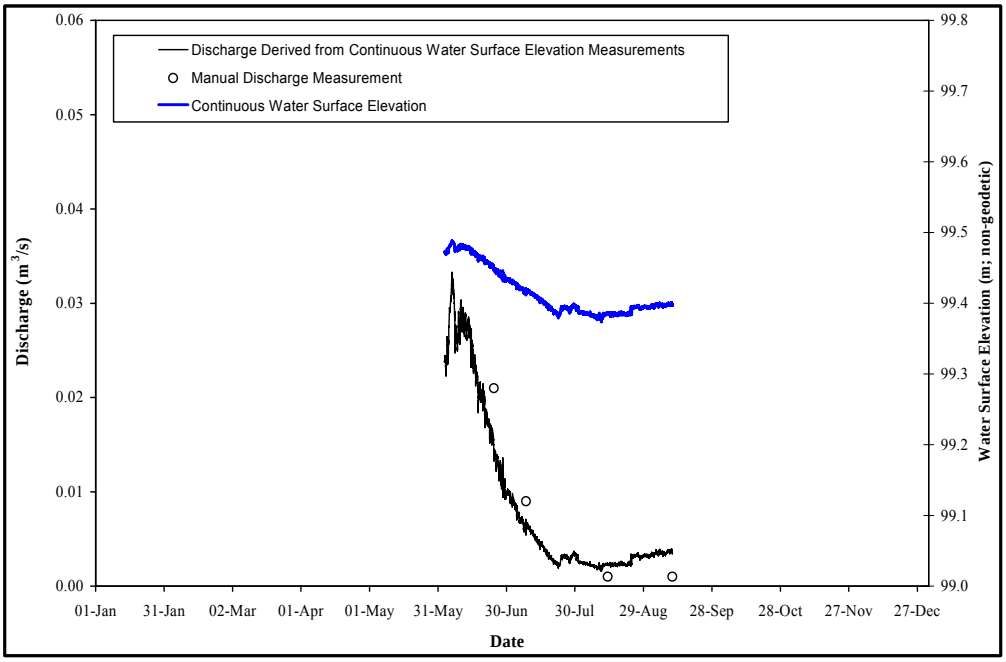


Figure 2.11 Hydrograph for Stickleback Lake and Outflow, 2006

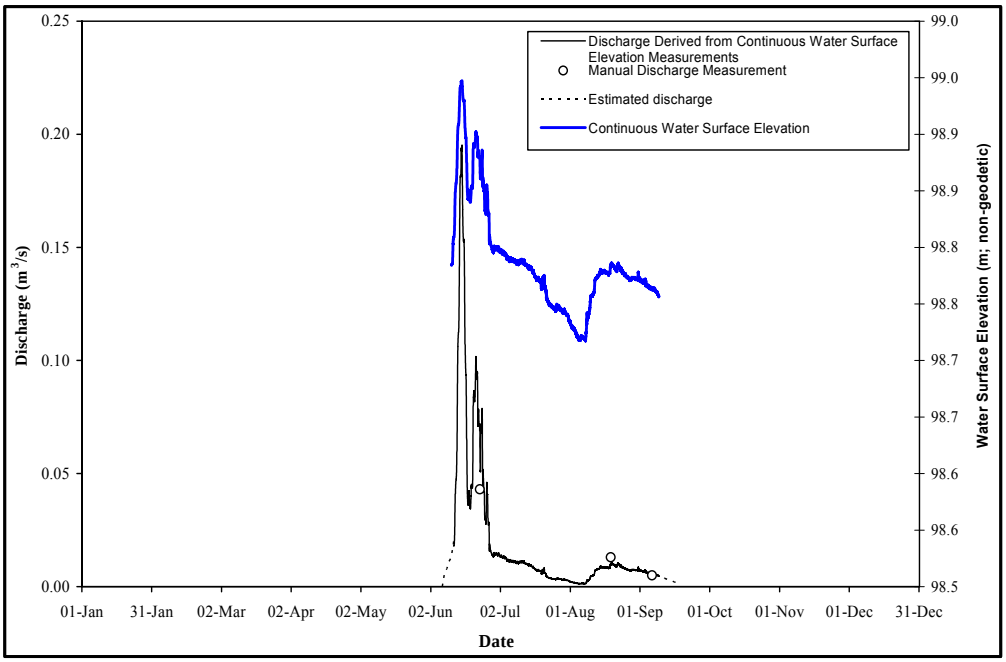


Figure 2.12 Hydrograph for Stickleback Lake and Outflow, 2007

2.3.6 H88 Hope Bay Tide

A factsheet describing the locations of the hydrometric station and equipment installed at Hope Bay Tide (Station H88) is provided in Appendix A. The appendix also contains stage data and daily maximum and minimum water level data.

The Hope Bay Tide hydrometric station was visited four times (Table 2.6) during the 2006 field program, and a continuous hydrograph was derived for the period from 3 July to 8 September (Figure 2.13).

The data collected at the Hope Bay tide gauge show that the daily tidal range is typically between 0.3 and 0.4 m. The minimum daily tidal range over the monitoring period was 0.20 m and the maximum daily tidal range was 0.61 m. The minimum measured water surface elevation was 0.38 m below the mean for the monitoring period, and the maximum monitored water surface elevation was 0.55 m above the mean for the monitoring period. The variability in water surface elevation shown in Figure 2.13 is due to a combination of diurnal variation, longer-term tidal variation, and the effects of wind.

Table 2.6 Station Visits to Hope Bay Tide Hydrometric Station, 2006

Date	Activities	Ocean	Water Level (non-geodetic)	Outflow	Discharge
3-Jul-06	Installed transducer and logger. Surveyed water level and downloaded data logger.	✓	0.090 m	n/a	
21-Jul-06	Downloaded data logger.				
14-Aug-06	Surveyed water level and downloaded data logger.	✓	-0.238 m		
8-Sep-06	Surveyed water level and downloaded data logger. Removed transducer and logger for winter.	✓	0.093 m		

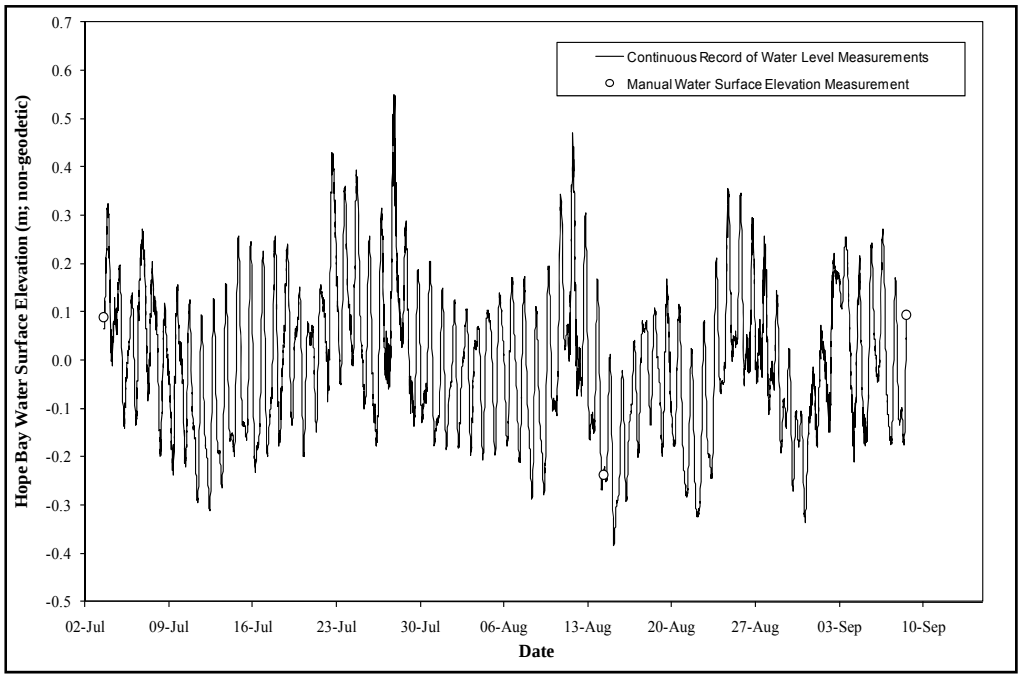


Figure 2.13 Hydrograph for Hope Bay Tide Gauge, 2006

2.4 MADRID PROJECT HYDROMETRY

2.4.1 H93 Glenn Lake and Outflow

A factsheet describing the locations of the hydrometric station and equipment installed at Glenn Lake and Outflow (Station H93) is provided in Appendix A. The appendix also contains stage-discharge data; the derived stage-discharge rating curve based on 2006 data; the derived stage-discharge rating curve based

on 2007 data; mean daily discharge and water level data; and manual discharge measurement data and calculation sheets.

The Glenn Lake and Outflow hydrometric station was visited five times during the 2006 field program and six times during the 2007 field program (Table 2.7). Continuous hydrographs were derived for 29 May to 8 September (Figure 2.14) and 29 May to 3 July 2007 (Figure 2.15). Data are not available after 3 July because the transducer failed. During field visits, the transducer readings appeared normal but at the end of the open water program, the transducer was found to be malfunctioning.

Table 2.7 Station Visits to Glenn Lake and Outflow Hydrometric Station, 2006 – 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
29-May-06	Installed transducer and data logger. Surveyed lake water level. Ice-covered conditions with no flow.	✓	97.200 m		
03-Jul-06	Measured discharge and water level. Downloaded data logger.	✓	97.044 m	✓	0.287 m^3/s
21-Jul-06	Measured discharge and downloaded data logger.			✓	0.140 m^3/s
12-Aug-06	Measured discharge and water level. Downloaded data logger.	✓	96.972 m	✓	0.077 m^3/s
08-Sep-06	Measured discharge and water level. Downloaded data logger. Removed transducer and logger for winter.	✓	96.916 m	✓	0.038 m^3/s
24-May-07	Installed transducer and data logger. Ice-covered conditions with no flow.				
22-Jun-07	Measured discharge. Downloaded data logger.			✓	0.695 m^3/s
07-Jul-07	Measured water surface elevation. Downloaded data logger.	✓	97.207 m		
19-Jul-07	Measured discharge and water level. Downloaded data logger.	✓	97.042 m	✓	0.201 m^3/s
16-Aug-07	Measured discharge and water level. Downloaded data logger.	✓	96.994 m	✓	0.088 m^3/s
15-Sep-07	Measured discharge and water level. Downloaded data logger. Removed transducer and logger for winter.	✓	97.108 m	✓	0.139 m^3/s

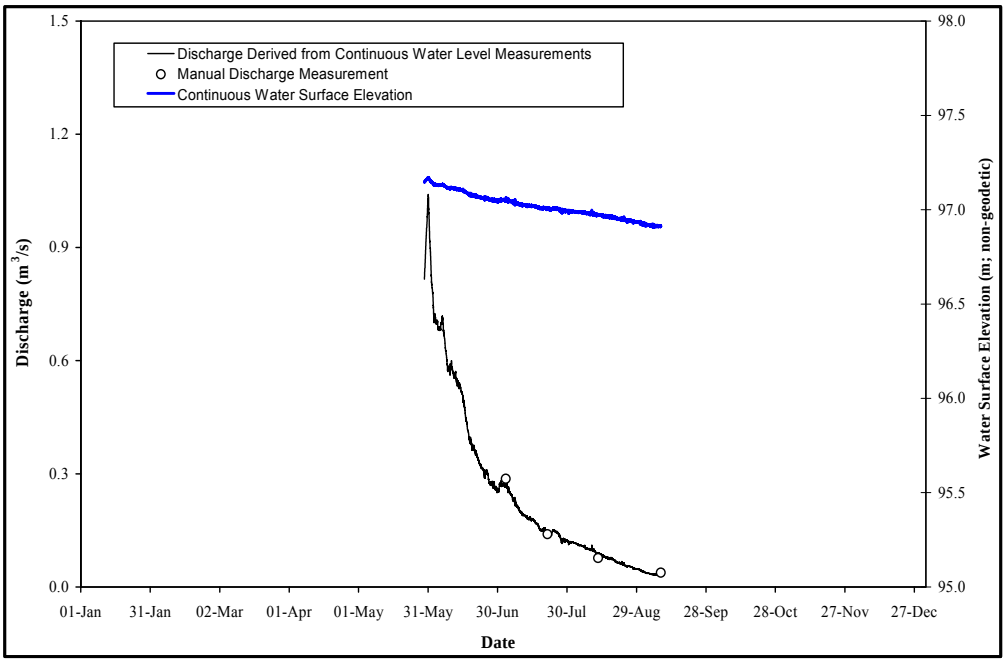


Figure 2.14 Hydrograph for Glenn Outflow, 2006

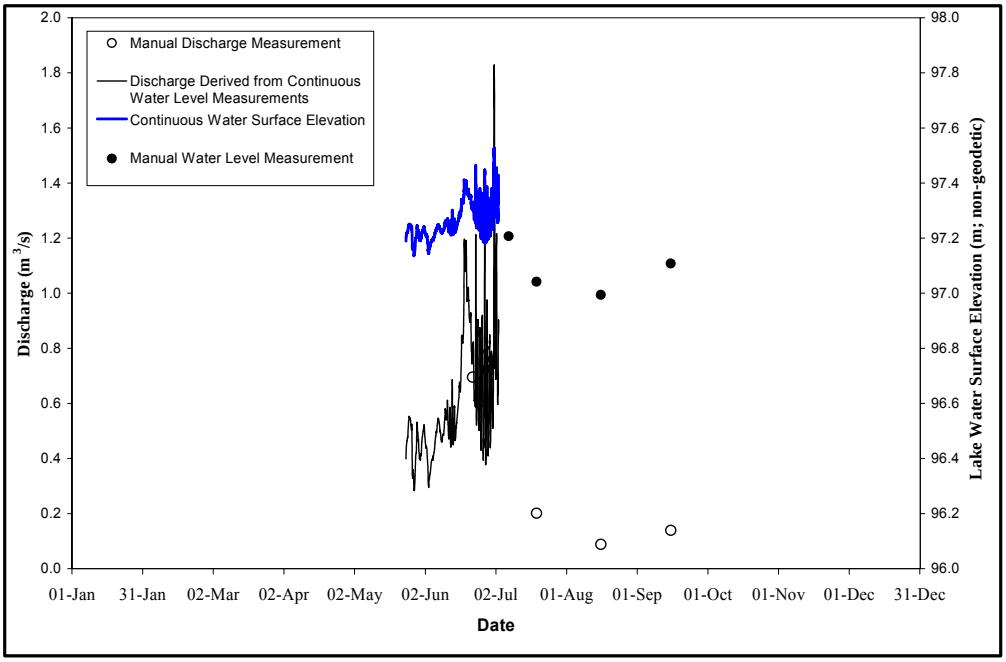


Figure 2.15 Hydrograph for Glenn Outflow, 2007

2.4.2 H82 Ogama Lake and Outflow

A factsheet describing the location of the hydrometric station and equipment installed at Ogama Lake and Outflow (Station H82) is provided in Appendix A. The appendix also contains stage-discharge data; the derived stage-discharge rating curve based on 2006 data; the derived stage-discharge rating curve based on 2007 data; mean daily discharge and water level data; and manual discharge measurement data and calculation sheets.

The Ogama Lake and Outflow hydrometric station was visited five times during the 2006 field program and seven times during the 2007 field program (Table 2.8). A continuous hydrograph was derived from data collected between 31 May to 8 September 2006 (Figure 2.16) and 19 June to 14 September 2007 (Figure 2.17). Discharges between 15 and 19 June 2007 were estimated based on linear interpolation between the onset of runoff and the first transducer readings unaffected by ice. Discharges between 14 September and 9 October 2007 were estimated based on linear interpolation between the last measurement and the estimated freeze-up date.

Table 2.8 Station Visits to Ogama Lake and Outflow Hydrometric Station, 2006 – 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
31-May-06	Installed pressure transducer under ice. Observed onset of spring melt.				
03-Jul-06	Measured discharge and water surface elevation and downloaded data logger.	✓	97.732 m	✓	0.539 m^3/s
22-Jul-06	Measured discharge and downloaded data logger.			✓	0.141 m^3/s
12-Aug-06	Measured discharge and water surface elevation and downloaded data logger.	✓	97.639 m	✓	0.122 m^3/s
08-Sep-06	Measured discharge and downloaded data logger. Removed data logger for winter.			✓	0.059 m^3/s
23-May-07	Installed pressure transducer.				
22-Jun-07	Measured discharge.			✓	1.236 m^3/s
03-Jul-07	Measured water surface elevation.	✓	98.507 m		
10-Jul-07	Measured discharge and water surface elevation.	✓	98.446 m	✓	0.789 m^3/s
19-Jul-07	Measured discharge and water surface elevation and downloaded data logger.	✓	98.360 m	✓	0.329 m^3/s
16-Aug-07	Measured discharge and water surface elevation and downloaded data logger.	✓	98.370 m	✓	0.425 m^3/s
14-Sep-07	Measured discharge, water surface elevation and downloaded data logger. Removed data logger for winter.	✓	98.381 m	✓	0.400 m^3/s

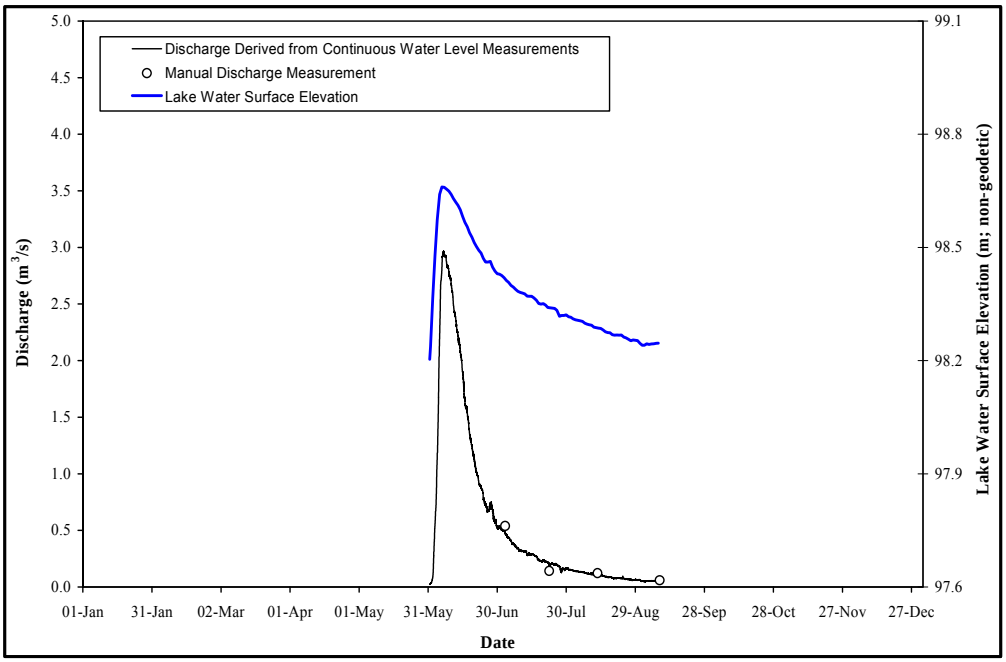


Figure 2.16 Hydrograph for Ogama Lake and Outflow, 2006

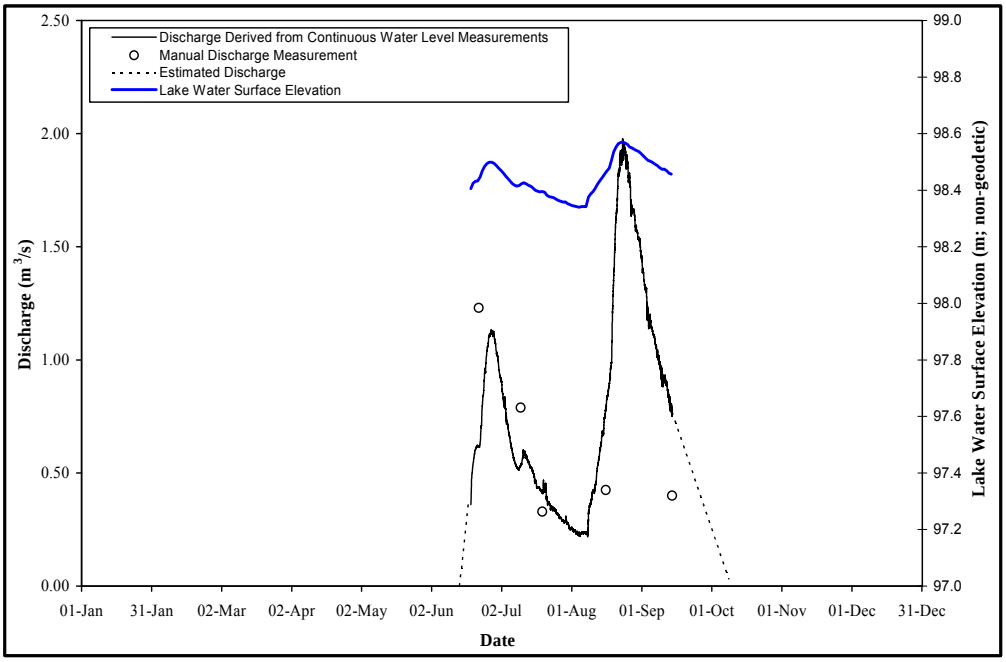


Figure 2.17 Hydrograph for Ogama Lake and Outflow, 2007

2.4.3 H81 Patch Lake and Outflow

A factsheet describing the location of the hydrometric station and equipment installed at Patch Lake and Outflow (Station H81) is provided in Appendix A1. The appendix also contains stage-discharge data; the derived stage-discharge rating curve based on 2006 data; mean daily discharge and water level data; manual discharge measurement data and calculation sheets; channel survey graphic between Patch Lake and P.O. Lake; and manual discharge measurement data and calculation sheets. Because of backwater effects from P.O. Lake, a single rating curve does not exist for Patch Outflow.

The Patch Lake and Outflow hydrometric station was visited five times during the 2006 field program and seven times during the 2007 field program (Table 2.9). Resulting data were used to generate a continuous hydrograph for the period of 1 June to 9 September 2006 (Figure 2.18) and 25 June to 12 September 2007 (Figure 2.19).

Table 2.9 Station Visits to Patch Lake and Outflow Hydrometric Station, 2006 – 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
1-Jun-06	Installed pressure transducer under ice. Observed onset of spring melt.				
3-Jul-06	Measured discharge and water surface elevation and downloaded data logger.	✓	98.984 m	✓	0.300 m^3/s
22-Jul-06	Measured discharge and downloaded data logger.			✓	0.109 m^3/s
12-Aug-06	Measured discharge and water surface elevation and downloaded data logger.	✓	98.831 m	✓	0.085 m^3/s
9-Sep-06	Measured discharge and downloaded data logger. Removed data logger for winter.			✓	0.029 m^3/s
23-May-07	Installed pressure transducer, surveyed ice level.				
22-Jun-07	Measured discharge - no discharge, ice on bottom of channel.			✓	
3-Jul-07	Measured water surface elevation.	✓	98.996 m		
10-Jul-07	Measured discharge and water surface elevation.	✓	98.984 m	✓	0.279 m^3/s
19-Jul-07	Measured discharge and water surface elevation and downloaded data logger.	✓	98.958 m	✓	0.149 m^3/s
14-Aug-07	Measured discharge and water surface elevation and downloaded data logger.	✓	97.945 m	✓	0.117 m^3/s
12-Sep-07	Measured discharge, water surface elevation and downloaded data logger. Removed data logger for winter.	✓	98.932 m	✓	0.051 m^3/s

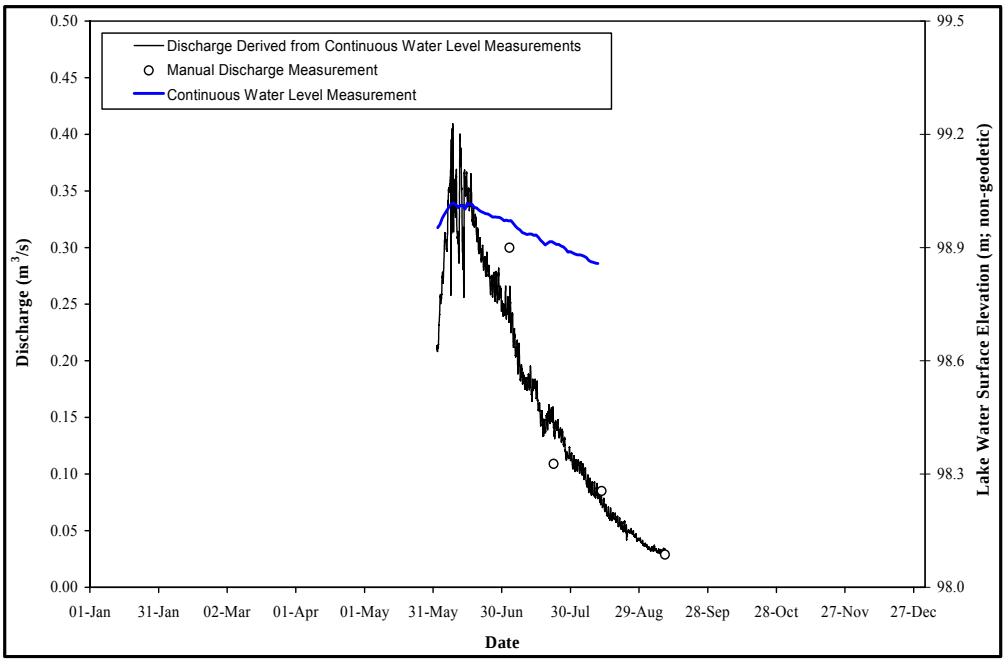


Figure 2.18 Hydrograph for Patch Lake and Outflow, 2006

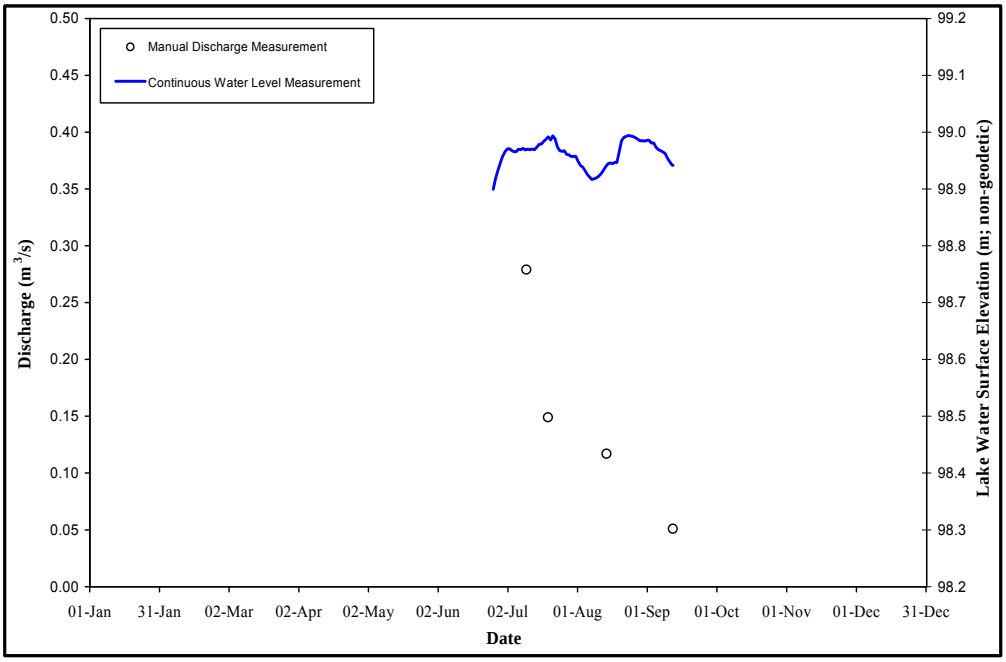


Figure 2.19 Hydrograph for Patch Lake and Outflow, 2007

2.4.4 H89 P.O. Lake and Outflow

A factsheet describing the locations of the hydrometric station and equipment installed at P.O. Lake and Outflow (Station H89) is provided in Appendix A.

The appendix also contains stage-discharge data; the derived stage-discharge rating curve (2007 data); mean daily discharge and water level data; and manual discharge measurement data and calculation sheets.

The P.O. Lake and Outflow hydrometric station was visited seven times (Table 2.10) during the 2007 field program, and a hydrograph was derived for the period from 18 June to 14 September (Figure 2.20).

Table 2.10 Station Visits to P.O. Lake and Outflow Hydrometric Station, 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
14-Jun-07	Installed transducer. Ice-covered conditions with no outflow.				
22-Jun-07	Measured discharge. Downloaded data logger.			✓	0.111 m^3/s
3-Jul-07	Downloaded data logger.				
10-Jul-07	Measured water level and discharge. Downloaded data logger.	✓	99.241 m	✓	0.441 m^3/s
14-Aug-07	Measured discharge and downloaded data logger.			✓	0.425 m^3/s
12-Sep-07	Downloaded data logger.				
14-Sep-07	Measured discharge and downloaded data logger. Removed transducer and logger for winter.			✓	0.261 m^3/s

Discharges between 14 September and 12 October 2007 were estimated based on linear interpolation between the last measurement and the estimated freeze-up date.

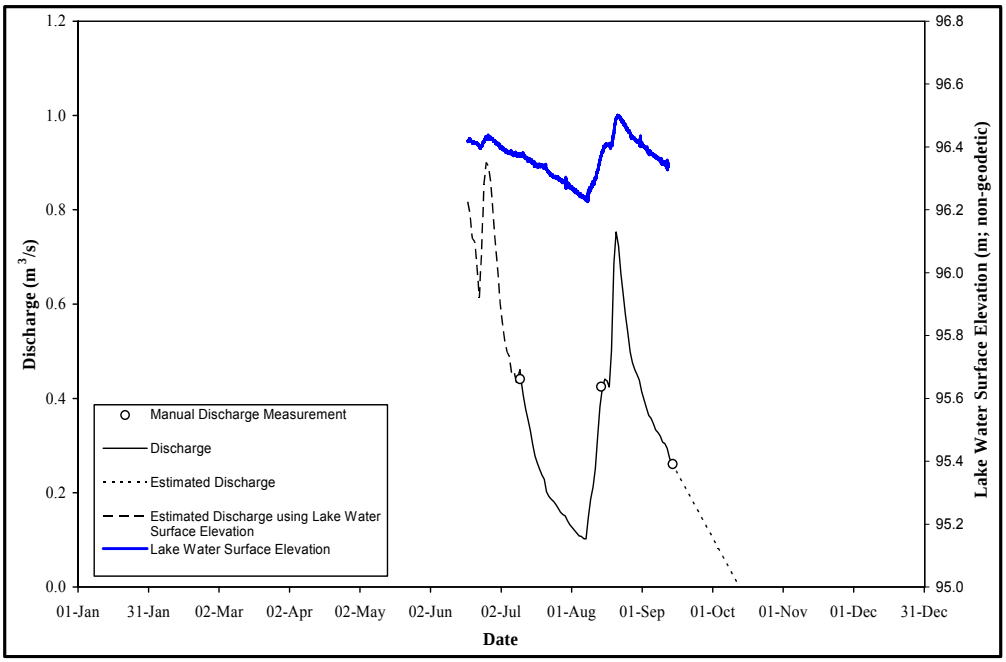


Figure 2.20 Hydrograph for P.O. Lake Outflow, 2007

2.4.5 H91 Windy Lake and Outflow

A factsheet describing the locations of the hydrometric station and equipment installed at Windy Lake and Outflow (Station H91) is provided in Appendix A. The appendix also contains stage-discharge data; the derived stage-discharge rating curve based on 2006 data; the derived stage-discharge rating curve based on 2007 data; mean daily discharge and water level data; and manual discharge measurement data and calculation sheets.

The station was visited five times during the 2006 field program and six times during the 2007 field program (Table 2.11). Continuous data are not available for 2006 because the data logger appeared to be providing realistic readings when downloaded but at the completion of the open water program, it was found to have been malfunctioning. Manual water surface elevation are available for 3 July and 12 August 2006, and discharge measurements are available for 3 July, 19 July, 12 August and 8 September 2006 (Figure 2.21). Continuous data collected between 22 June and 4 August 2007 were used to derive a hydrograph (Figure 2.22). The data logger was providing appropriate readings when downloaded but at the completion of the open-water program, it was found to be malfunctioning and so continuous data are not available after 4 August 2007. Manual water surface elevation and discharge measurements are available for 13 August and 14 September 2007.

Table 2.11 Station Visits to Windy Lake and Outflow Hydrometric Station, 2006 – 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
29-May-06	Installed transducer and logger. Ice-covered conditions with no outflow.				
3-Jul-06	Surveyed water level and measured discharge at outflow. Downloaded data logger.	✓	98.435 m	✓	0.135 m^3/s
19-Jul-06	Measured discharge at outflow.			✓	0.059 m^3/s
12-Aug-06	Surveyed water level and measured discharge. Downloaded data logger.	✓	98.405 m	✓	0.052 m^3/s
8-Sep-06	Measured discharge. Removed transducer and for winter.			✓	0.042 m^3/s
24-May-07	Installed pressure transducer.				
22-Jun-07	Measured discharge under ice.			✓	0.003 m^3/s
3-Jul-07	Measured water surface elevation.	✓	Very low levels.		
20-Jul-07	Measured discharge and water surface elevation and downloaded data logger.	✓	98.379 m	✓	0.051 m^3/s
13-Aug-07	Measured discharge and water surface elevation and downloaded data logger.	✓	98.432 m	✓	0.078 m^3/s
15-Sep-07	Measured discharge, water surface elevation and downloaded data logger. Removed data logger for winter.	✓	98.409 m	✓	0.061 m^3/s

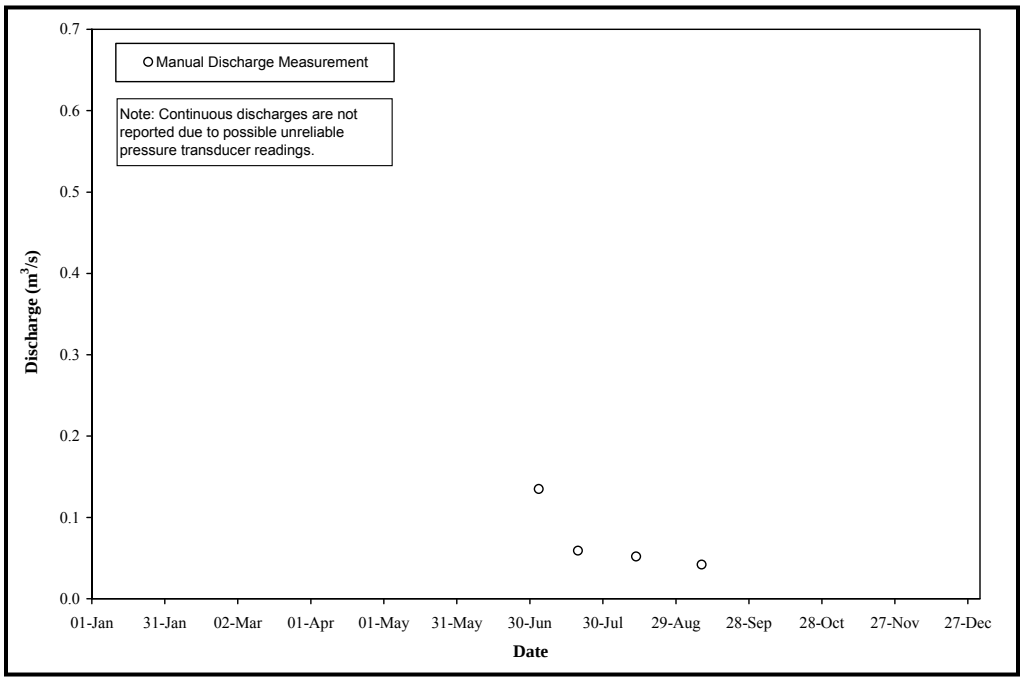


Figure 2.21 Hydrograph for Windy Lake and Outflow, 2006

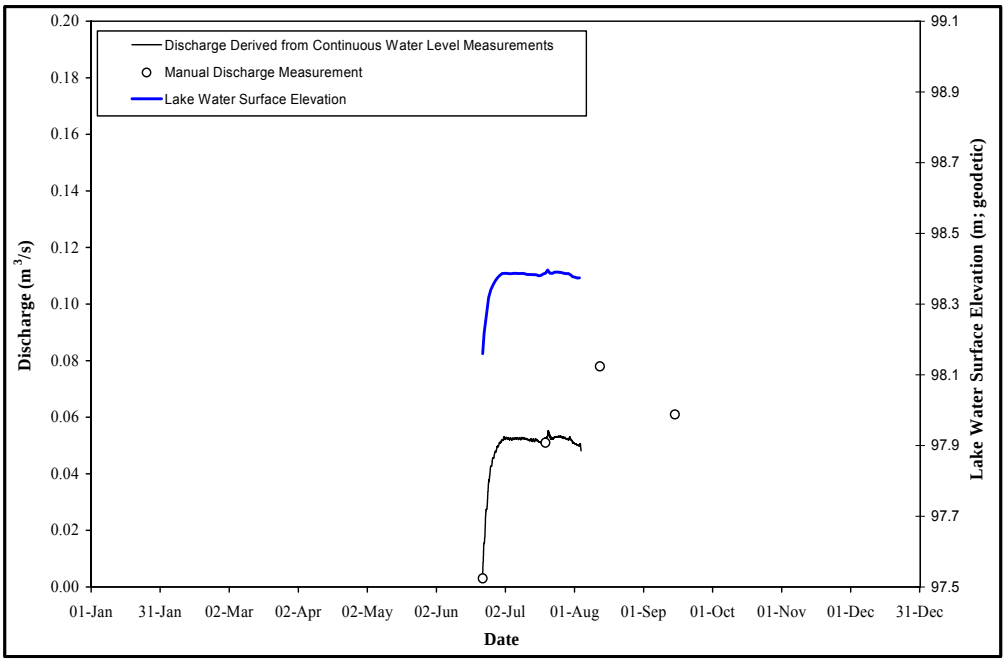


Figure 2.22 Hydrograph for Windy Lake and Outflow, 2007

2.4.6 Wolverine Lake

A factsheet describing the locations of the hydrometric station and equipment installed at Wolverine Lake (Station H91) is located in Appendix A. The appendix also contains stage data and mean daily water level data.

The Wolverine Lake hydrometric station was visited five times during the 2006 field program and four times during the 2007 field program (Table 2.12). Continuous hydrographs were derived for the period from 1 June to 8 September (Figure 2.23) and 13 June to 14 August 2007 (Figure 2.24). No discharge was observed at the outflow in 2006 or 2007 suggesting discharge only occurs during periods of high water.

Table 2.12 Station visits to Wolverine Lake Hydrometric Station, 2006 – 2007

Date	Activities	Lake	Water Level (non-geodetic)	Outflow	Discharge
1-Jun-06	Installed transducer and logger. Ice-covered conditions with no outflow.			n/a	
3-Jul-06	Measured water surface elevation and downloaded data logger.	✓	98.349 m		
23-Jul-06	Downloaded data logger at.				
12-Aug-06	Measured water surface elevation and downloaded data logger.	✓	98.273 m		
8-Sep-06	Measured water surface elevation and downloaded data logger. Removed transducer and logger for winter.	✓	98.204 m		
23-May-07	Installed pressure transducer, surveyed water level/ice surface.	✓	96.113 m	n/a	
7-Jul-07	Measured water surface elevation.	✓	96.143 m		
19-Jul-07	Downloaded data logger.				
14-Aug-07	Measured water surface elevation and downloaded data logger.	✓	96.042 m		

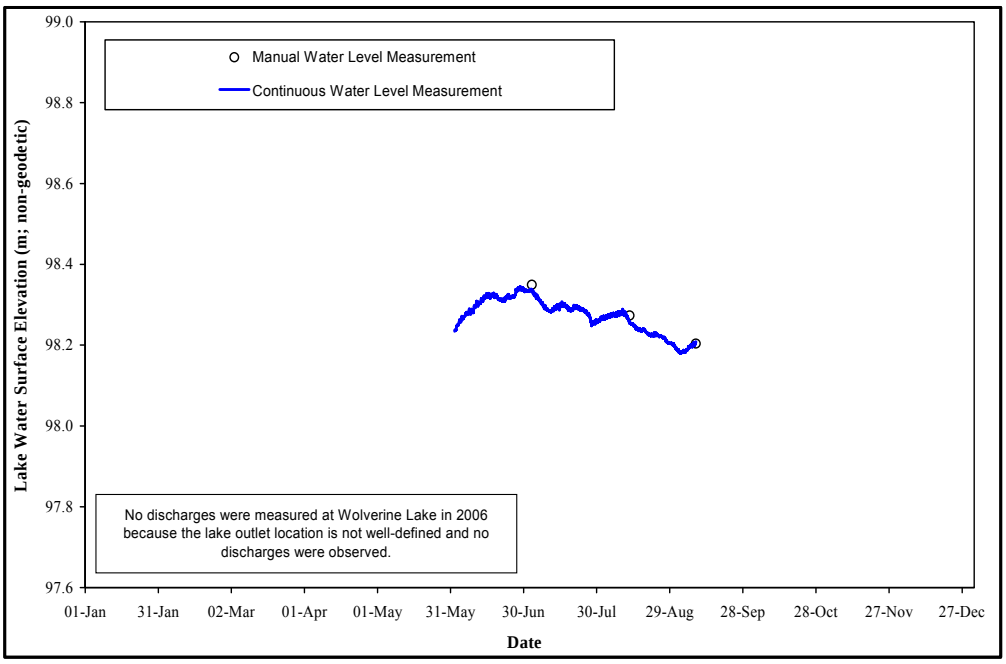


Figure 2.23 Hydrograph for Wolverine Lake, 2006

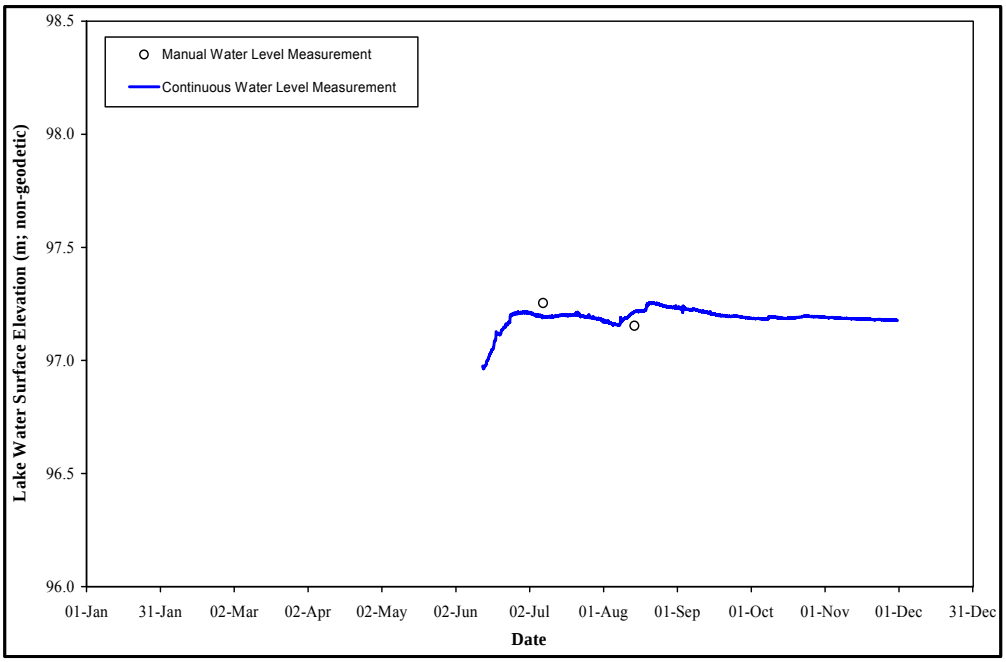


Figure 2.24 Hydrograph for Wolverine Lake, 2007

2.5 BOSTON AND MADRID PROJECT DISCUSSION

The 2006 and 2007 hydrometry programs marked the first and second year of hydrological data collection by Golder for the Boston and Madrid Project areas. Water surface elevation and discharge data were collected during the 2006 and 2007 open-water season for the Aimaokatalok River and Outflow, Koignuk River, Fickle Duck, Stickleback, Aimaokatalok, Glenn, Ogama, Patch, and Windy outflows. Water surface elevation and discharge data were also collected for P.O. Lake Outflow in 2007. Calculated annual water yields for Patch, Glenn, Ogama, and Stickleback lakes are presented in Table 2.13. The remaining stations do not have hydrographs estimated before or after the monitoring period.

Water surface elevation data were collected during the open-water season in 2006 for the Hope Bay tidal gauge, and in 2006 and 2007 for Wolverine Lake; Wolverine Lake appears to discharge only at extreme high water. Discharge data were collected for the north-east Aimaokatalok Inflow in 2006 and 2007.

Water yields for the lakes listed in Table 2.13 appear consistent with data from the monitoring program for the Doris North Project area. By comparison, Doris Lake Outflow had an annual water yield of 72.9 mm compared to 71.6 mm at Roberts Lake in 2006 (Golder 2007). Tail and Stickleback lakes have similar

watershed areas and the annual water yields are similar: 53.1 mm for Tail Lake and 55.4 mm for Stickleback Lake (Golder 2008a). Patch Lake watershed has a greater ratio of lake surface area to watershed area than Tail Lake, and so would be expected to have lower water yields. The measured water yields for Glenn and Ogama lakes are consistent with lower ratios of lake water surface area to watershed area.

Table 2.13 Calculated Water Yields for Glenn, Ogama, Patch, and Stickleback Lakes, 2006 – 2007

Watershed	Total Annual Discharge in 2006[a] (m^3)	Total Annual Discharge in 2007[a] (m^3)	Watershed Area (km^2)	2006 Annual Water Yield (mm)	2007 Annual Water Yield (mm)
Patch Lake	1,432 000		35.5	40.3	
Ogama Lake	5,615 000	6983 169	71.9	78.1	97.1
Stickleback Lake	79 200	155 331	2.8	28.3	55.4
Glenn Lake	1,977 000		31.6	62.6	

[a] Hydrograph estimated before and after monitoring period.

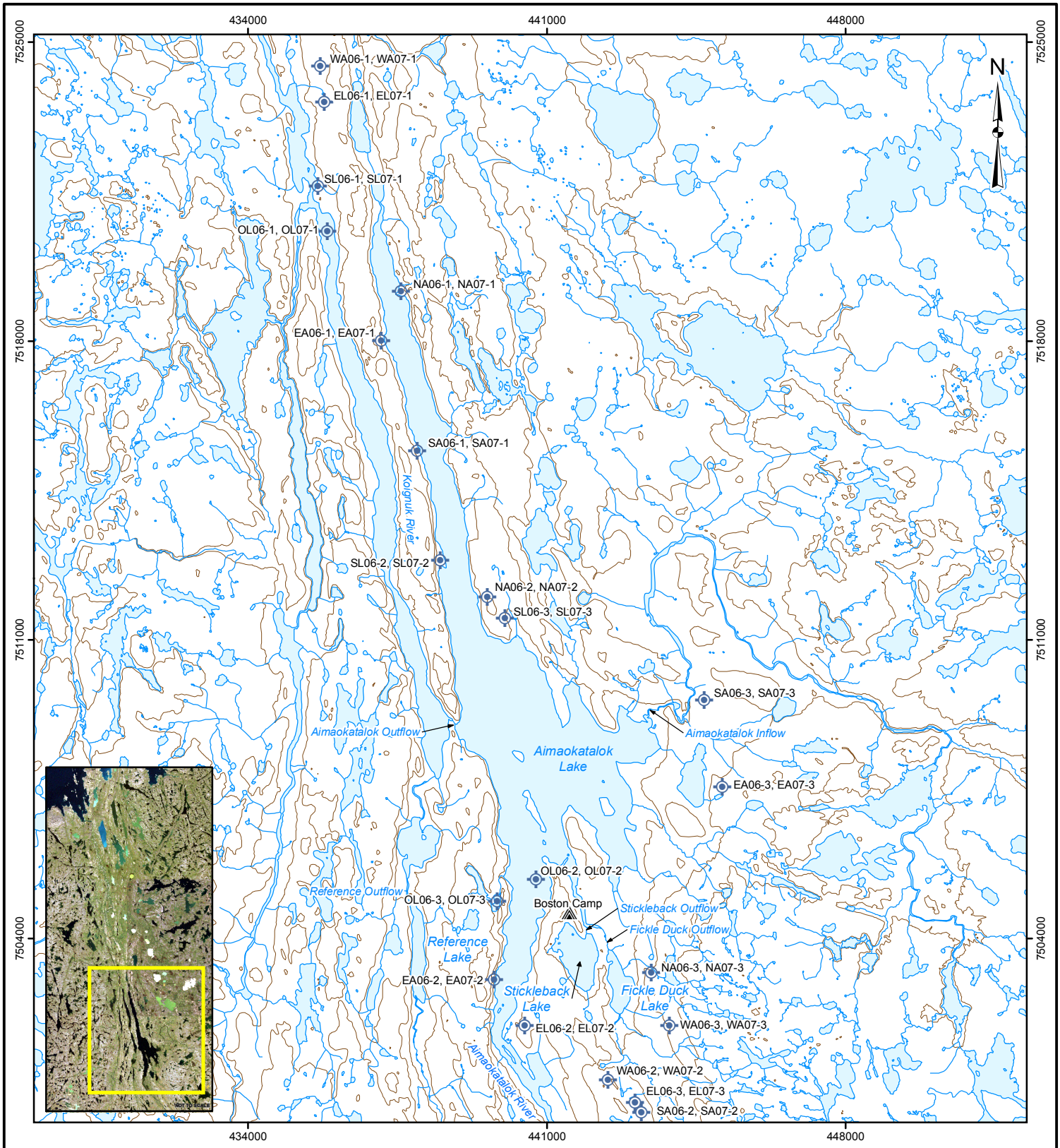
Though no baseline analysis currently exists to estimate mean annual water yields for lakes in this program, the consistency with Doris North Project area values indicate that these water yields represent conditions drier than the long-term mean.

Because sampling in 2006 at the Aimaokatalok Lake Inflow and Outflow and the Koignuk River served as reconnaissance, only partial annual data sets were collected. However, complete data sets were collected for the Koignuk River and Aimaokatalok Outflow in 2007. The Aimaokatalok Lake Outflow station was installed in deep water in September 2006 to allow continuous monitoring through the year.

2.6 SNOW COURSE SURVEYS

The water equivalent of a snowpack is a product of snow depth and density. Appendix A presents terrain type and snowpack measurement data collected in 2006 and 2007. Sampling locations for the 2006 and 2007 snow course survey program are shown in Figure 2.25.

Twenty-one stations over seven terrain types were examined during the snow course surveys in 2006 and 2007. Snow densities were similar across terrain types with the exception of the open lake and north aspect terrain types where values were higher. Snow depth for open lake terrain was 19.4 cm (mean) in 2006 and 22.2 cm (mean) in 2007. North aspect slope terrain had mean snow depths of 42.0 cm in 2006 and 51.8 cm in 2007.



LEGEND

- CAMP
- SNOW COURSE SURVEY LOCATION
- CONTOUR (20 m INTERVAL)
- WATERCOURSE
- WATERBODY

3500 0 3500

SCALE 1:125000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT. The Gold Company

HOPE BAY MINING LTD.

TITLE

2006 AND 2007 SNOW COURSE SURVEY SITES, BOSTON PROJECT AREA

Golder Associates Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	DC	20 Nov. 2008		
GIS	BR	30 Mar. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 2.25

M:\Projects\2008\1373\0026_HBML_Doris_North_Environmental_Programs\MapDocs\2007_Revised\Current\Fig2_25_AQ_SL_SWES_SnowSurvey_Boston07_30March09.mxd

In 2006, snow water equivalents ranged from 59.4 mm of water for open lake terrain to 130.6 mm for north aspect slope terrain. In 2007, snow water equivalents ranged from 38.1 mm of water for exposed lowland terrain to 91.3 mm for south aspect terrain (Table 2.14, Figures 2.26 and 2.27,).

Table 2.14 Snow Course Survey Data for Boston Project Area, 2006 – 2007

Terrain Type	Survey Plot Number		Snow Density (g/cm^3)[a]		Snow Depth (cm)[b]		Snow Water Equivalent (mm)	
	2006	2007	2006	2007	2006	2007	2006	2007
Open Lake	OL-06-1	OL-07-1	0.298	0.216	24.3	22.0	72.2	47.4
	OL-06-2	OL-07-2	0.328	0.370	22.7	26.7	74.6	98.9
	OL-06-3	OL-07-3	0.278	0.112	11.3	17.9	31.4	20.0
	Mean		0.301	0.233	19.4	22.2	59.4	55.4
Exposed Lowland	EL-06-1	EL-07-1	0.185	0.171	38.8	40.1	71.6	68.4
	EL-06-2	EL-07-2	0.247	0.090	35.8	36.8	88.4	33.3
	EL-06-3	EL-07-3	0.309	0.058	24.3	21.5	75.2	12.5
	Mean		0.247	0.106	33.0	32.8	78.4	38.1
Sheltered Lowland	SL-06-1	SL-07-1	0.191	0.153	29.9	44.1	57.0	67.5
	SL-06-2	SL-07-2	0.254	0.126	30.9	41.2	78.4	52.1
	SL-06-3	SL-07-3	0.227	0.079	22.1	30.5	50.3	24.0
	Mean		0.224	0.119	27.6	38.6	61.9	47.9
North Aspect	NA-06-1	NA-07-1	0.294	0.191	40.9	25.4	120.3	48.6
	NA-06-2	NA-07-2	0.292	0.152	41.9	29.3	122.1	44.6
	NA-06-3	NA-07-3	0.346	0.267	43.2	40.4	149.6	107.9
	Mean		0.311	0.203	42.0	31.7	130.6	67.0
East Aspect	EA-06-1	EA-07-1	0.279	0.095	22.9	26.3	63.8	24.9
	EA-06-2	EA-07-2	0.214	0.146	31.1	57.0	66.6	83.5
	EA-06-3	EA-07-3	0.327	0.132	22.7	31.7	74.3	41.9
	Mean		0.273	0.124	25.6	38.3	68.2	50.1
South Aspect	SA-06-1	SA-07-1	0.254	0.119	28.9	35.0	73.3	41.7
	SA-06-2	SA-07-2	0.248	0.129	9.8	24.1	24.3	31.0
	SA-06-3	SA-07-3	0.295	0.183	31.6	28.2	93.3	51.6
	Mean		0.266	0.179	23.4	49.4	63.6	91.3
West Aspect	WA-06-1	WA-07-1	0.206	0.136	16.8	29.7	34.6	40.4
	WA-06-2	WA-07-2	0.314	0.174	45.8	45.0	143.9	78.3
	WA-06-3	WA-07-3	0.267	0.186	39.1	80.7	104.6	150.1
	Mean		0.263	0.165	33.9	51.8	94.4	89.6

[a] Mean based on three samples per plot.

[b] Mean based on 30 measurements per plot.

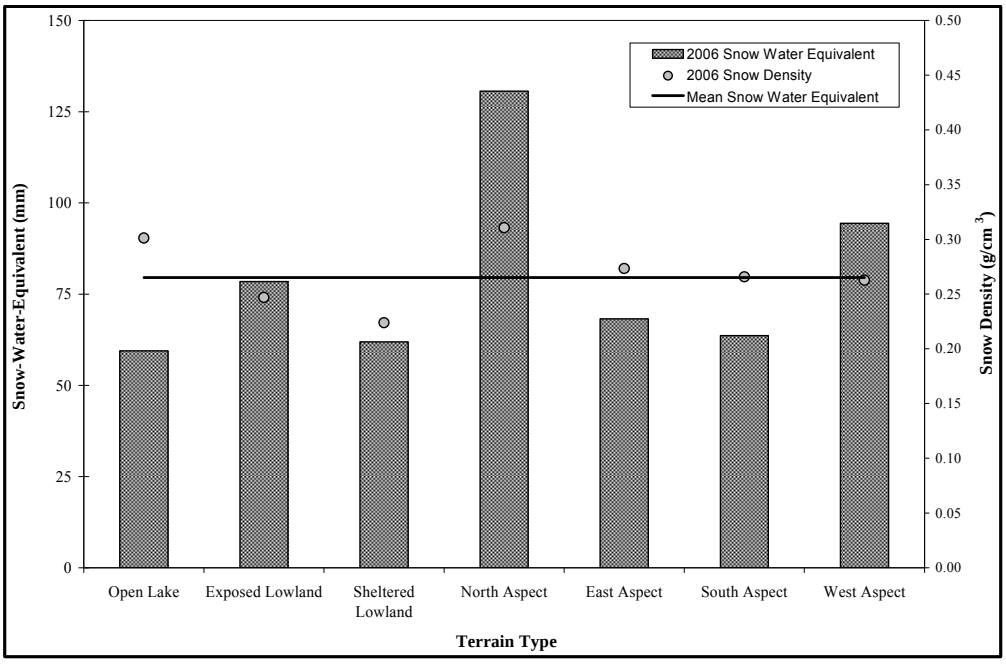


Figure 2.26 Snow Course Survey Data for Boston Project Area, 1 May 2006

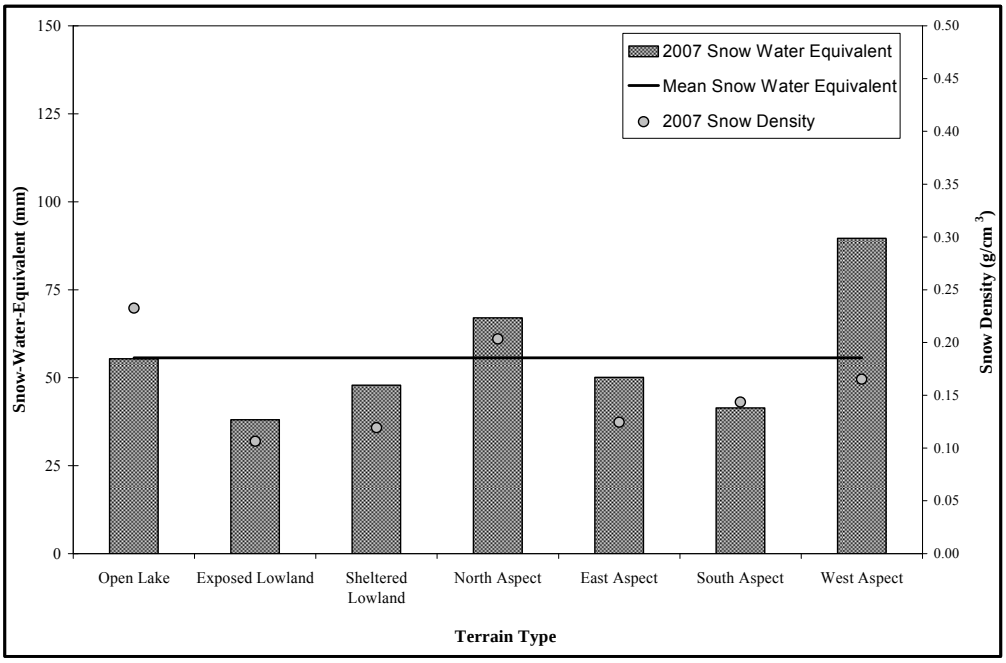


Figure 2.27 Snow Course Survey Data for Boston Project Area, 28 April - 5 May 2007

Wind redistributes snowfall over the course of a winter, and in general, less snow collects on exposed terrain, such as open lake areas, compared with sheltered lowlands. Similarly, prevailing winds redistribute snow unequally across slopes of differing aspect. These effects may result in substantial differences between

terrain types. Our study involved a limited number of sampling stations in an area with little vegetation, and broad ranges of measured values were observed among terrain types. As such, detailed calculation of mean snow water equivalent, based on the relative proportion of each terrain type, is not recommended. An un-weighted mean snow water equivalent of 80 mm should be used in any water balance calculations in 2006 and 55.6 mm in 2007 (Figure 2.26 and 2.27)

2.7 RAINFALL

The Boston Camp meteorological station was installed on 2 July 2006 and operated continuously through 31 December 2006. Rainfall data were recorded at the station in months when air temperatures were above 0°C, which generally included May to September. It is possible that trace, or localized, rainfall events occurred during open water months in parts of the watershed distant from the meteorological station, and hence, were not recorded. Rainfall data for 2007 are not available due to malfunction of the tipping bucket rain gauge at the Boston climate station.

The Boston Camp meteorological station recorded 41.7 mm of rainfall between July and October 2006. The undercatch-adjusted depth of 49.6 mm is comparable to an estimated baseline mean of 67.6 mm for that period (Table 2.15). Daily and annual cumulative rainfall are plotted in Figure 2.28.

Table 2.15 Monthly Rainfall Measured at Boston Camp Meteorological Station, July – December 2006

Month	Measured Rainfall	Estimated Rainfall[a]	Baseline Mean Rainfall[b]
May[c]	n/a	n/a	3.2 mm
June[c]	n/a	n/a	13.7 mm
July[c]	20.1 mm	23.9 mm	24.2 mm
August	19.1 mm	22.7 mm	29.0 mm
September	1.8 mm	2.1 mm	14.4 mm
October	2.0 mm	2.4 mm	1.2 mm
Total[c]	**41.7 mm**	**49.6 mm**	**84.5 mm**

[a] Values incorporate an undercatch factor of 1.19.

[b] Source: Amec (2003). Values incorporate an undercatch factor of 1.19.

[c] Monitoring began when the meteorological station was installed on 2 July 2006. Baseline mean rainfall for the period July through September is 67.6 mm.

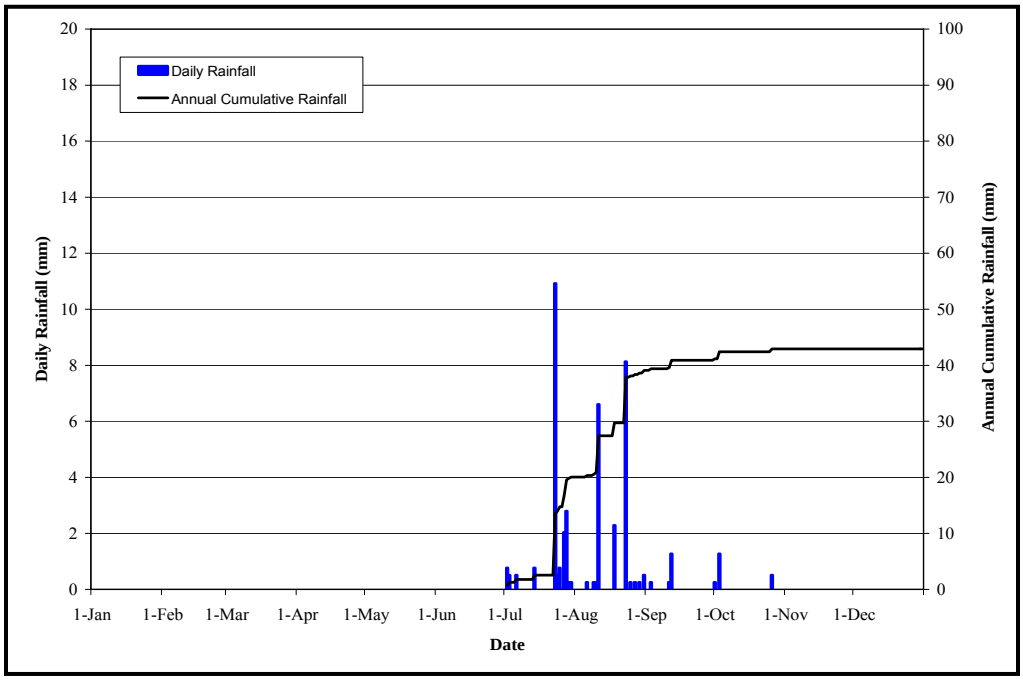


Figure 2.28 Rainfall Data from Boston Camp Meteorology Station, July - December 2006

3 PHYSICAL LIMNOLOGY AND WATER QUALITY

3.1 INTRODUCTION

The purpose of the 2006 and 2007 water quality programs was to collect sufficient information for an overall spatial and temporal characterization of the water quality within the Boston and Madrid Project areas.

3.2 METHODS

3.2.1 Field Sampling Stations and Timing

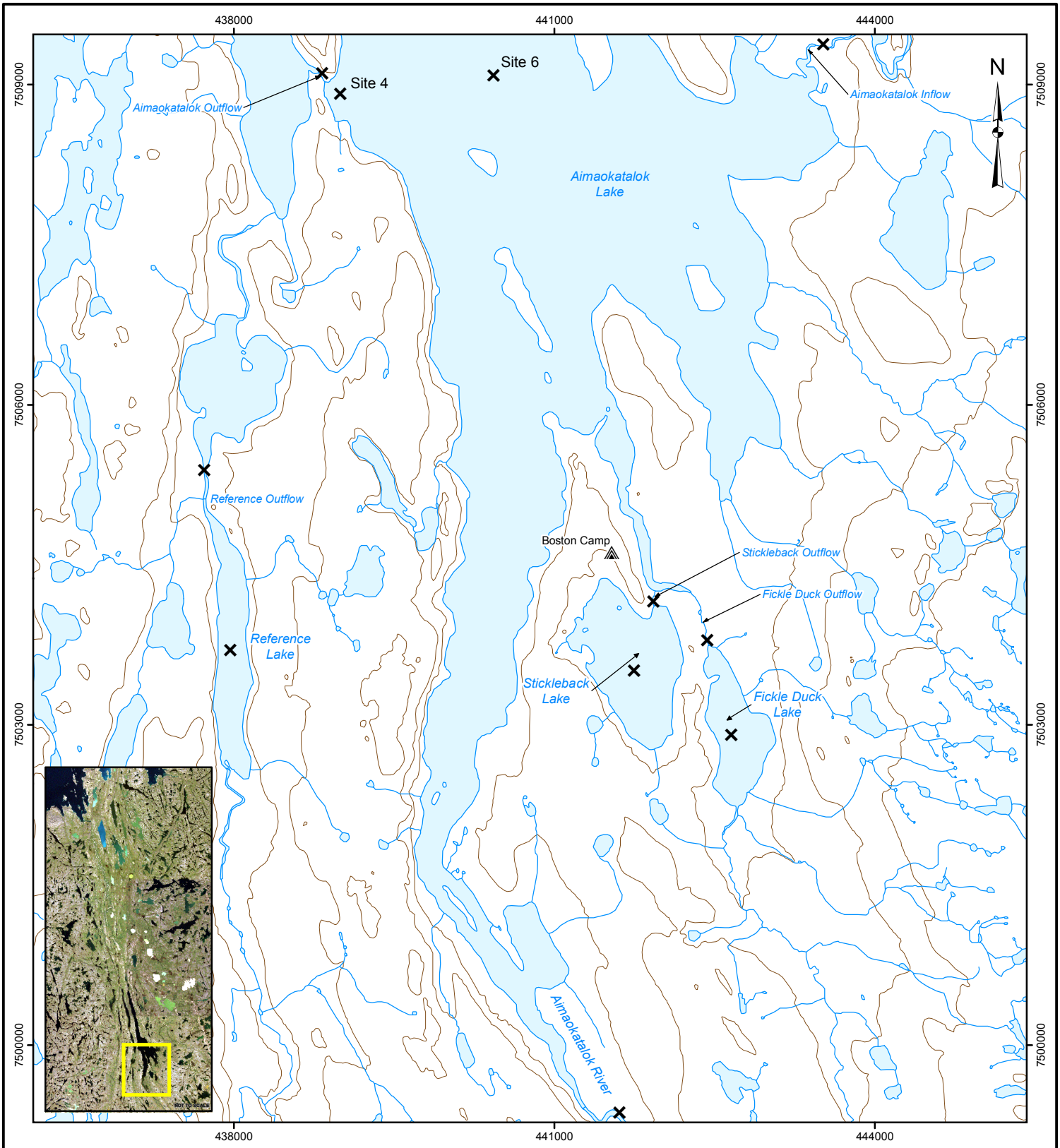
The majority of the water quality sampling stations in the Project Area were initially established in 2006, with the Hope Bay and Glenn Lake sampling locations established in 2007 (Figures 3.1 and 3.2).

Lakes and bays were sampled a minimum of three times between June and September 2006 and four times between May and September 2007. Generally stations were sampled in ice-covered conditions in May or June, with open water conditions occurring during the July to September sampling periods. Under-ice sampling was not conducted in all lakes due to logistic and accessibility constraints (i.e., limited availability of camp accommodations, and snow conditions to accommodate snowmachine access). Streams were sampled four times during open water conditions between June and September in both 2006 and 2007.

Sample stations were located using a Global Positioning System (GPS; hand-held Garmin GPS 76 with an accuracy of ± 5 m). Universal Transverse Mercator (UTM) coordinates were recorded for each sampling station; all UTM coordinates were recorded in North American Datum (NAD) 83, Zone 13.

3.2.1.1 Boston Project Area

The Boston Project Area includes Aimaokatalok, Fickle Duck, Stickleback, and Reference lakes, as well as the corresponding outflow streams and the Hope Bay marine station (Figures 3.1 and 3.2). In general, one sampling station was established in each lake, with the exception of Aimaokatalok Lake, where two stations (Stations 4 and 6) were located. There was one sampling station associated with the Aimaokatalok River, Aimaokatalok Inflow, and Koignuk River.



LEGEND

- CAMP
- WATER QUALITY SAMPLING STATION
- CONTOUR (20 m INTERVAL)
- WATERCOURSE
- WATERBODY

1500 0 1500

SCALE 1:50000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

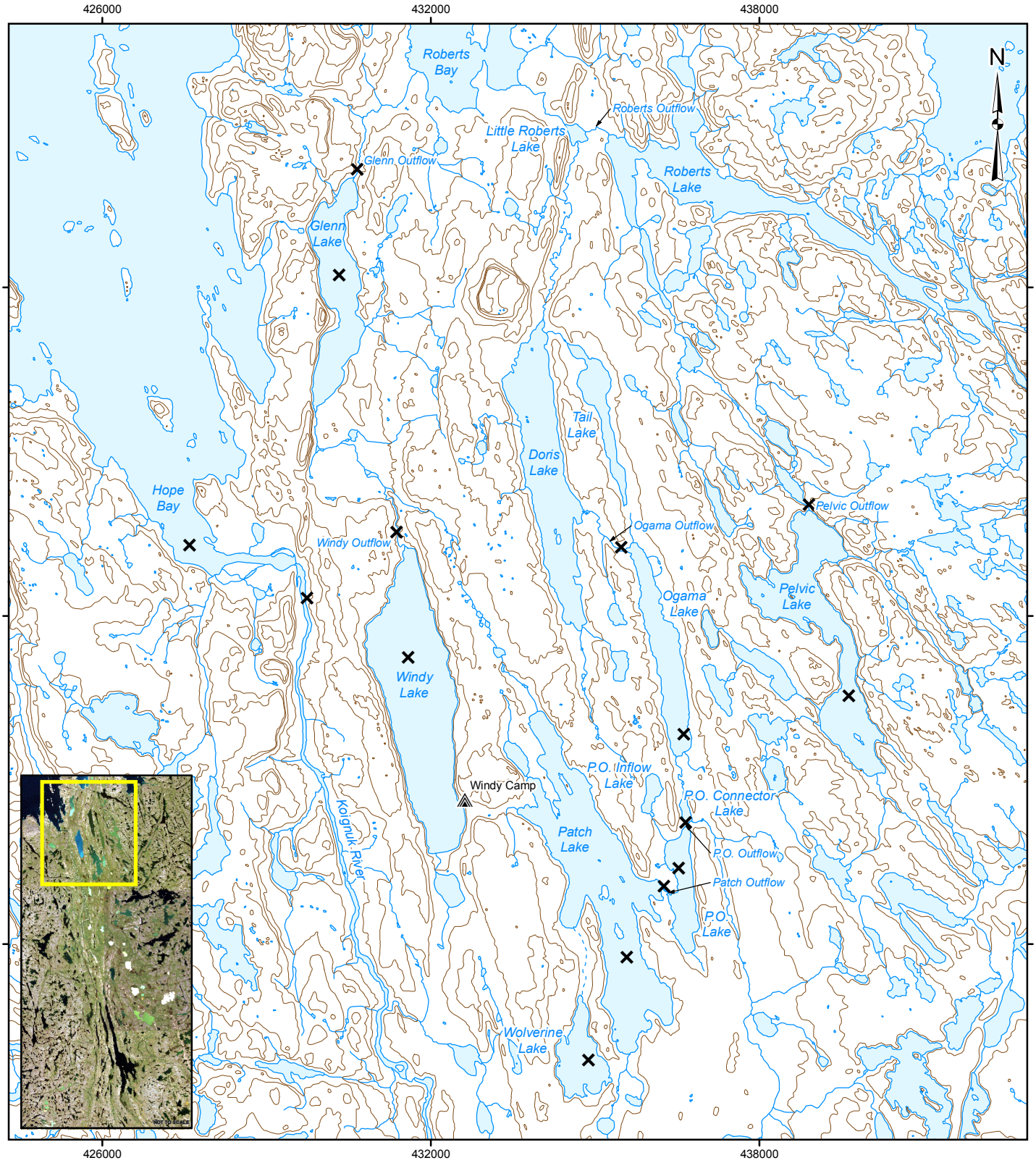
2006 AND 2007 WATER QUALITY SAMPLING STATIONS BOSTON PROJECT AREA

Golder Associates Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	RC	11 Mar. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 3.1

M:\Projects\2008\1373\0026_HBML_Doris_North_Environmental_Programs\MapDocs\2007_Revised\Current\Fig3_1_AQ_SL_WaterQuality_Boston07_30March09.mxd



LEGEND

- CAMP
- WATER QUALITY SAMPLING STATION
- CONTOUR (20 m INTERVAL)
- INTERMITTENT STREAM
- WATERCOURSE
- WATERBODY

3000 0 3000

SCALE 1:100000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

2006 AND 2007 WATER QUALITY SAMPLING STATIONS BOSTON AND MADRID PROJECT AREAS

Golder Associates Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	BR	30 Mar. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 3.2

M:\Projects\2008\1373\0026_HBML_Doris_North_Environmental_Programs\MapDocs\2007_Revised\Current\Fig3_2_AQ_SL_WaterQuality_Madrid07_30March09.mxd

All Boston Project area lakes were sampled monthly during July, August, and September in 2006 and 2007. Under-ice samples were collected in Aimaokatalok and Stickleback lakes in June 2006. Three under-ice samples (top, middle, bottom) were collected in Aimaokatalok Lake Station 6. Each lake was sampled under-ice in 2007. In total, 56 lake water quality samples were collected between 2 June 2006 and 9 September 2007 (Table 3.1).

Table 3.1 Sampling Date and Number of Water Samples[a] Collected in the Boston Project Area Lakes, 2006 – 2007

Date	Aimaokatalok Lake		Fickle Duck Lake	Reference Lake	Stickleback Lake	Total No.
	Station 4	Station 6				
02-Jun-06	2[b]				1	**3**
03-Jun-06		3[c]		1		**4**
16-Jul-06	2	2				**4**
17-Jul-06					1	**1**
18-Jul-06			1	1		**2**
17-Aug-06	2	2	1	1	1	**7**
10-Sep-06	2	2	1		1	**6**
11-Sep-06				1		**1**
2006 Total	***8***	***9***	***3***	***4***	***4***	***28***
24-May-07	2	2	1		1	**6**
26-May-07				1		**1**
20-Jul-07		2				**2**
21-Jul-07	2			1	1	**4**
22-Jul-07			1			**1**
19-Aug-07	2	2				**4**
20-Aug-07			1	1	1	**3**
08-Sep-07	1	2				**3**
09-Sep-07	1[d]		1	1	1	**4**
2007 Total	***8***	***8***	***4***	***4***	***4***	***28***

[a] Excluding QA/QC samples – these are listed in Table 3.7.

[b] 2 = one top and one bottom sample; 1 = top sample unless indicated otherwise.

[c] Three samples were collected (top, middle, and bottom of water column) from Station 6.

[d] Bottom sample only.

Prepared by: EJJ Checked by: LR

All Boston Project area streams were sampled monthly during the open water season between June and September 2008 (Table 3.2). In total, 52 stream water quality samples were collected between 23 June 2006 and 16 September 2007.

One marine station in Hope Bay was included in the water quality program in 2007 because the Boston Project area waterbodies flow into Hope Bay *via* the Koignuk River and have the potential to influence water quality in the bay (Figure 3.2). Two water samples (top and bottom of the water column) were collected from the Hope

Bay station on each of the following dates: 27 May, 23 July, 17 August, and 15 September 2007.

Table 3.2 Sampling Date and Number of Water Samples[a] Collected in the Boston Project Area Streams, 2006 – 2007

Date	Aimaokatalok			Fickle Duck Outflow	Koignuk River	Reference Outflow	Stickleback Outflow	Total No.
	River	Inflow	Outflow					
23-Jun-06	1	1	1			1		4
24-Jun-06				1			1	2
16-Jul-06		1	1					2
17-Jul-06	1			1			1	3
18-Jul-06						1		1
13-Aug-06	1	1	1	1		1	1	6
10-Sep-06	1	1	1	1		1	1	6
2006 Total	*4*	*4*	*4*	*4*	*0*	*4*	*4*	*24*
23-Jun-07	1	1	1	1		1	1	6
02-Jul-07					1			1
19-Jul-07					1			1
20-Jul-07		1	1	1		1		4
21-Jul-07	1							1
22-Jul-07							1	1
18-Aug-07					1			1
19-Aug-07			1					1
20-Aug-07	1	1		1		1	1	5
09-Sep-07	1			1		1	1	4
10-Sep-07		1	1					2
16-Sep-07					1			1
2007 Total	*4*	*4*	*4*	*4*	*4*	*4*	*4*	*28*

[a] Excluding QA/QC samples – these are listed in Table 3.7.

Prepared by: EJJ Checked by: LR

3.2.1.2 Madrid Project Area

The Madrid Project area includes Glenn, Windy, Pelvic, Ogama, Wolverine, Patch, and P.O. lakes, as well as corresponding outflows for all lakes, except Wolverine Lake (Figure 3.2). One water quality sampling station was established in each of the lakes and outflow streams. Glenn Lake was not sampled in 2006, as this location was added to the sampling program in 2007.

All Madrid Project lakes were sampled monthly during July, August, and September 2006 and 2007. Each lake was sampled under-ice in June 2006 and May 2007, with the exception of P.O. Lake. In total, 84 lake water quality samples were collected between 1 June 2006 and 15 September 2007 (Table 3.3). Outflow streams were sampled monthly during the two open water seasons

between June 2006 and September 2007. In total, 49 stream water quality samples were collected between 19 June 2006 and 17 September 2007 (Table 3.4).

Table 3.3 Sampling Date and Number of Water Samples[a] Collected in the Madrid Project Area Lakes, 2006 – 2007

Date	Glenn Lake[b]	Ogama Lake	Patch Lake	Pelvic Lake	P.O. Lake	Windy Lake	Wolverine Lake	Total No.
1-Jun-06		2[c]		2			1	**5**
2-Jun-06			1			2		**3**
21-Jul-06		2		2				**4**
22-Jul-06							2	**2**
23-Jul-06			2		1			**3**
24-Jul-06						2		**2**
12-Aug-06							1	**1**
15-Aug-06		2	1		1			**4**
16-Aug-06			1	2				**3**
18-Aug-06						2		**2**
8-Sep-06		2	2		1		1	**6**
9-Sep-06				2		2		**4**
2006 Total	***0***	***8***	***7***	***8***	***3***	***8***	***5***	***39***
22-May-07		1						**1**
23-May-07			2	2			1	**5**
24-May-07	2					2		**4**
16-Jul-07	2	1		2				**5**
17-Jul-07			2		1		1	**4**
18-Jul-07						2		**2**
15-Aug-07			2		1		1	**4**
16-Aug-07		2		2				**4**
17-Aug-07	2							**2**
20-Aug-07						2		**2**
11-Sep-07		1	2		1		1	**5**
12-Sep-07		1[d]						**1**
13-Sep-07				2				**2**
15-Sep-07	2					2		**4**
2007 Total	***8***	***6***	***8***	***8***	***3***	***8***	***4***	***45***

[a] Excluding QA/QC samples – these are listed in Table 3.8.

[b] Only sampled in 2007.

[c] 2 = one top and one bottom sample; 1= top sample unless indicated otherwise.

[d] Bottom sample only.

Prepared by: EJJ Checked by: LR

Table 3.4 Sampling Date and Number of Water Samples[a] Collected in the Madrid Project Area Streams, 2006 – 2007

Date	Glenn Outflow[b]	Ogama Outflow	Patch Outflow	Pelvic Outflow	P.O. Outflow	Windy Outflow	Total No.
19-Jun-06		1	1	1	1	1	**5**
21-Jul-06		1		1			**2**
22-Jul-06			1				**1**
23-Jul-06						1	**1**
24-Jul-06					1		**1**
12-Aug-06		1	1			1	**3**
15-Aug-06					1		**1**
16-Aug-06				1		1	**2**
9-Sep-06		1	1		1	1	**4**
2006 Total	***0***	***4***	***4***	***3***	***4***	***5***	***20***
22-Jun-07	1	1	1	1	1	1	**6**
2-Jul-07							**1**
17-Jul-07		1					**1**
19-Jul-07	1		1	1	1	1	**6**
12-Aug-07	1	1	1		1	1	**5**
18-Aug-07				1			**2**
15-Sep-07	1					1	**2**
16-Sep-07				1			**2**
17-Sep-07		1	1		1		**3**
2007 Total	***4***	***4***	***4***	***4***	***4***	***4***	***28***

[a] Excluding QA/QC samples – these are listed in Table 3.7.

[b] Only sampled in 2007.

Prepared by: EJJ Checked by: LR

3.2.2 Hope Bay

In 2007, one marine sampling station was established in Hope Bay as a component of the the water quality sampling program. This station was established because the Boston Project waterbodies flow into Hope Bay via the Koignuk River and have the potential to influence water quality. Eight water quality samples (four sets of surface and bottom samples) were collected between May and September 2007 (Table 3.5).

Table 3.5 Sampling Date and Number of Water Samples[a] Collected in Hope Bay, 2007

Date	Hope Bay	Total No.
27-May-07	2	**2**
23-Jul-07	2	**2**
17-Aug-07	2	**2**
15-Sep-07	2	**2**
2007 Total	**8**	**8**

Prepared by: EJJ
Checked by: LR

[a] Excluding QA/QC samples – these are listed in Table 3.7.

3.2.3 Field Sampling Procedures

All water quality sampling was completed according to the following Golder Technical Procedures (unpublished file information):

- 8.23-0: *Basic Limnology and Bathymetric Procedures*; and
- 8.3-1: *Surface Water Sampling Methods*.

3.2.3.1 Lakes and Bays

The water quality of the lakes and bays was characterized by measuring in situ physico-chemical water quality data and analyzing water quality samples for standard water quality parameters (e.g., total suspended solids [TSS]), major ionic composition, chlorophyll *a* (Chl *a*), nutrient, and trace metals concentrations.

Physico-Chemical Water Quality

Field measurements of physico-chemical water quality parameters (e.g., water temperature, dissolved oxygen [DO], conductivity, and pH) were recorded at each sampling station, except in Aimaokatalok Lake on 22 May 2008 because of equipment malfunction. When possible, DO and temperature profiles were measured monthly (at least three times during the 2006 sampling season and four times during 2007) using a field-calibrated Oxyguard™ Beta dissolved oxygen and temperature meter (accuracy: ± 0.1 mg/L DO and ± 0.1°C) in 2006, and a Horiba U-22 multi-parameter probe (precision ± 0.01 mg/L DO and ± 0.01°C) in 2007. DO and temperature were measured at 0.5 m intervals for lakes with water depth less than 10 m, and at 1.0 m intervals for lakes with water depth greater than 10 m. Measurements were taken along a vertical transect beginning at the water surface to 0.5 m above the bottom of the waterbody. The pH was measured approximately 0.2 m below the water surface using a field-calibrated Oakton WTW 340I in 2006 and a field-calibrated Horiba U-22 multi-parameter probe in 2007.

Water transparency, or clarity, was determined using a standard 20 cm diameter Secchi disk. Secchi depth is measured by calculating the average of the depth that the disk disappears when it is lowered into the water column and the depth that it re-appears when it is raised back through the water column. This depth was used to estimate the euphotic depth within the water column (i.e., approximate depth to which 1% of incident light penetrates), which coincides with approximately twice the Secchi depth (Mitchell and Prepas 1990).

Chemical Analysis

Water samples for chemical analysis were collected using a Trace Metals Acrylic Kemmerer water sampler, which was rinsed with ambient water prior to sample collection. Surface samples were collected 1.0 m below the water surface. Bottom samples were collected 1.0 m above the lake bed to prevent contamination from sediments through physical disturbance of the surface benthic sediment layer. Appropriate preservatives were added in the field according to laboratory specifications, when required. All water chemistry samples were stored and transported on ice to the applicable analytical laboratory.

One litre of water for Chl *a* samples was collected from the euphotic zone at the sampling location at each lake using a depth-integrated tube sampler. The euphotic zone was estimated as being approximately two times the Secchi depth or the extent of the water column to 0.5 m above the bottom, whichever depth was less. The 1 L water sample was split into three replicate samples consisting of 0.33 L. Each replicate sample was filtered through a Whatman GF/C glass-fibre filter (1.0 to 1.2 µm pore size) using a syringe and attached filter holder. Each filter was treated with 1.0 to 1.5 mL of a magnesium carbonate ($MgCO_3$) suspension (> 1 mg $MgCO_3$ per 100 mL deionized water) to reduce the potential for Chl *a* degradation prior to analysis. Each filter was then carefully rolled up, placed in an opaque vial, frozen, and transported in a dark, cold container to the analytical laboratory. Samples for Chl *a* analysis were kept frozen until analysis.

3.2.3.2 Streams

Field measurements of water temperature, DO, conductivity, and pH in streams were collected using the same procedures and instruments used at lake sampling stations. In addition, a water temperature data logger (HOBO Water Temp Pro v2) was installed at each stream sampling station to record continuous water temperature readings (i.e., measurement recorded every six minutes), generally between June and September in 2006 and 2007. Each data logger was secured to the bank of the watercourse and anchored to the substrate using a weight. If at any time the temperature data logger was exposed to air (e.g., disruption by an animal, fast moving current, drop in water level), readings were identified and excluded from further analysis.

Water samples for chemical analysis taken from streams were collected approximately 0.1 m below the water surface. Sample collection and handling followed the same protocols used for lake water samples.

3.2.4 Laboratory Analytical Procedures

All freshwater samples were analyzed by Alberta Research Council (ARC), Vegreville, Alberta. Marine samples were analyzed by Alberta Research Council (ARC), Vegreville, Alberta in 2006, by Maxxam Analytics Inc., Burnaby, British Columbia in May 2007, and by ALS Laboratory Group, Vancouver, BC from July to September 2007. Ultra-trace mercury in marine samples was analyzed by ARC in 2007.

All water samples for chemical analysis were analyzed for the following parameters:

- general water quality – included total alkalinity, laboratory pH and specific conductance, total dissolved solids (TDS), major cations and anions (i.e., bicarbonate, carbonate, calcium, chloride, magnesium, potassium, sodium, and sulphate), ionic balance, total hardness, true colour, and total suspended solids (TSS);
- nutrients – included total phosphorus, total Kjeldahl nitrogen, ammonia, nitrate, and nitrite;
- carbon species – particulate carbon, dissolved organic carbon, and total organic carbon;
- total and dissolved metals – included aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, uranium, vanadium, and zinc; and
- other parameters – cyanide, fluoride, and sulphide.

Minimum Reported Values (MRVs) or Reported Detection Limits (RDLs) for each analytical laboratory are provided in Tables 3.6 and 3.7.

3.2.5 Data Analysis

Water quality data were summarized in tabular format, and a qualitative assessment (i.e., no statistical analysis) was completed as part of the characterization of existing baseline conditions in the Project area. The discussion of results are provided for each lake and stream station in the Boston and Madrid Project areas, with specific focus on physico-chemical condition and general water quality, including nutrient, and trace metals concentrations. In

particular, the discussion of trace metals concentrations is limited to those that are higher than the applicable environmental guidelines.

Table 3.6 Water Quality Parameters and Corresponding Minimum Reported Values (MRV) from Laboratory Analyses of Freshwater Samples for the Boston and Madrid Project Areas, 2006 – 2007

Parameter	Unit	MRV	Parameter	Unit	MRV
Physical			***Metals - Total and Dissolved***		
Alkalinity, Total (as $CaCO_3$)	mg/L	1	Aluminum (Al)	µg/L	0.5 (0.2)[c]
Hardness, Total (as $CaCO_3$)	mg/L	0.01	Antimony (Sb)	µg/L	0.0005
Conductivity (EC)	µS/cm	0.1	Arsenic (As)	µg/L	0.002
Total Dissolved Solids	mg/L	0.1	Barium (Ba)	µg/L	0.004
Total Suspended Solids	mg/L	1	Beryllium (Be)	µg/L	0.003
Colour, True	TCU	1	Bismuth (Bi)	µg/L	0.001
			Boron (B)	µg/L	0.05 (0.03)[c]
Nutrients			Cadmium (Cd)	µg/L	0.002
Phosphorus, Total	mg/L	0.001	Chromium (Cr)	µg/L	0.03
Total Kjeldahl Nitrogen	mg/L	0.01	Cobalt (Co)	µg/L	0.001
Ammonia-N	mg/L	0.001	Copper (Cu)	µg/L	0.1 (0.05)[c]
Nitrate+Nitrite-N	mg/L	0.005	Cyanide	mg/L	0.001
Nitrite-N	mg/L	0.001	Iron (Fe)	µg/L	2
Nitrate-N[a]	mg/L	0.005	Lead (Pb)	µg/L	0.001
			Manganese (Mn)	µg/L	0.003
Organics			Mercury (Hg)	ng/L	0.6
Dissolved Organic Carbon	mg/L	0.2	Molybdenum (Mo)	µg/L	0.001
Total Organic Carbon[a]	mg/L	0.8	Nickel (Ni)	µg/L	0.005
Carbon, Particulate	mg/L	0.02	Selenium (Se)	µg/L	0.1
			Silver (Ag)	µg/L	0.0005
Major Ions			Strontium (Sr)	µg/L	0.004
Bicarbonate (HCO_3)	mg/L	1	Thallium (Tl)	µg/L	0.0003
Calcium (Ca)	mg/L	0.004	Tin (Sn)	µg/L	0.03
Chloride (Cl)	mg/L	0.3	Uranium (U)	µg/L	0.0001
Magnesium (Mg)	mg/L	0.0001	Vanadium (V)	µg/L	0.005
Potassium (K)	µg/L	0.002, 0.1[b]	Zinc (Zn)	µg/L	0.1 (0.05)
Sodium (Na)	µg/L	0.02, 0.5[b]	***Other***		
Sulphate (SO_4)	mg/L	3	Fluoride (F)	mg/L	0.01
			Sulphide (S^{2-})	mg/L	0.001
			Cyanide (CN^{2-})	mg/L	0.001

[a] Values are calculated.

[b] extractable Potassium and Sodium had higher MRVs.

[c] MRV values in brackets are for dissolved metals. Metals without values in brackets indicate that total and dissolved MRVs are the same

Prepared by: EJJ Checked by: SE

Table 3.7 Water Quality Parameters and Corresponding Minimum Reported Values (RDL and MRV) from Laboratory Analyses of Marine Samples for the Boston and Madrid Project Areas, 2007

Parameter	Unit	RDL	MRV			Parameter	Unit	RDL	MRV		
		Maxxam	ALS					Maxxam	ALS		
Metals – Total		**May**	**Jul**	**Aug**	**Sep**	***Nutrients***		**May**	**Jul**	**Aug**	**Sep**
Aluminum (Al)	µg/L		100	10, 250	100, 150	Ammonia-N	mg/L	0.005	0.020	0.020	0.020
Antimony (Sb)	µg/L		1, 10	5, 10	5, 10	Dissolved Organic Carbon	mg/L	0.5	0.50	0.50	0.50
Arsenic (As)[a]	µg/L	0.1	0.20	0.20	0.20	Fluoride (F)	mg/L	0.01	0.20	2.0	0.20, 2.0
Barium (Ba)	µg/L		0.050	0.050	0.050	Phosphorus, Total	mg/L	0.005	1.5, 3.0	3.0	3.0
Beryllium (Be)	µg/L		5, 50	25, 50	25, 50	Sulphide	mg/L	0.005	0.020	0.020	0.020
Bismuth (Bi)	mg/L		0.005, 0.050	0.025, 0.050	0.025, 0.050	Total Kjeldahl Nitrogen	mg/L	0.02	0.050	0.050	0.050
Boron (B)	µg/L	500	10	10	10	Total Organic Carbon	mg/L	0.5	0.50	0.50	0.50
Cadmium (Cd)[a]	µg/L	0.1	0.020	0.020	0.020	Total Suspended Solids[a]	mg/L	4.0	3.0	3.0	3.0
Calcium (Ca)	mg/L		0.050	0.050	0.050						
Chromium (Cr)[a]	µg/L	0.5	5, 50	25, 50	25, 50	***Routine Water Analysis***					
Cobalt (Co)	µg/L	0.1	0.050	0.050	0.050	Chloride (Cl)	mg/L	50	0.50	0.50	0.50
Copper (Cu)	µg/L	0.1	0.050	0.050	0.050	Color, True	T.C.U.	5.0	5.0	5.0	5.0
Cyanide, Total	mg/L	0.0005	0.0050	0.0050	0.0050	Nitrate+Nitrite-N	mg/L	0.02	0.050[c]	0.10, 0.50[c]	0.10[c]
Iron (Fe)	µg/L	1	10	10	10	Nitrate-N[a]	mg/L	0.02	0.050	0.10, 0.50	0.10
Lead (Pb)	µg/L	0.1	0.050	0.050	0.050	Nitrite-N	mg/L	0.005	0.010	0.010	0.020
Magnesium (Mg)	mg/L		0.10	0.10	0.10	Sulphate (SO_4)	mg/L	50	0.50	0.50	0.50
Manganese (Mn)	µg/L	1	0.050	0.050	0.050						
Mercury (Hg)[a]	ng/L	10	0.6[c]	0.6[c]	0.6[c]	***Conductivity and***					
Molybdenum (Mo)	µg/L		2.5	2.5	2.5	***Total Alkalinity***					
Nickel (Ni)	µg/L	0.5	0.050	0.050	0.050	Conductivity (EC)	µS/cm	1	2.0	2.0	2.0
Potassium (K)	µg/L		2.0	2.0	2.0	Bicarbonate (HCO_3)	mg/L	0.5	-	-	-
Selenium (Se)	µg/L		0.50	0.50	0.50	Alkalinity, Total (as $CaCO_3$	mg/L	0.5	2.0	2.0	2.0
Silver (Ag)	µg/L	0.1	0.010, 0.10	0.50, 1.0	0.50, 1.0	Total Dissolved Solids	mg/L	10	10	10	10
Sodium (Na)	µg/L		2.0	2.0	2.0						
Strontium (Sr)	µg/L	500	0.10	0.10	0.10						
Thallium (Tl)	mg/L		0.0010, 0.010	0.0050, 0.010	0.0050, 0.010						
Tin (Sn)	mg/L		0.0010, 0.010	0.0050, 0.010	0.0050, 0.010						
Uranium (U)	µg/L		0.050	0.050	0.050						
Vanadium (V)	µg/L		10, 100	50, 100	50, 100						
Zinc (Zn)	µg/L	1.0	0.50	0.50	0.50						

[a] Parameters included in CCME Guidelines (2007) for the protection of aquatic life in the marine system.

[b] Calculated.

Prepared by: LR Checked by: AH

3.2.5.1 Comparison to Water Quality Guidelines

All water chemistry results were compared to applicable federal Canadian Water Quality Guidelines (CWQG) for the Protection of Aquatic Life – Freshwater or Marine, as applicable (Canadian Council of Ministers for the Environment [CCME] 1987, 1999, 2007a, 2007b). The CWQG values are conservative as they err on the side of caution for the protection of aquatic life under daily exposure conditions. CWQGs are derived using data for the most sensitive test species, and are considered to protective of all receptors 100% of the time (CCME 1999). Therefore, any substances with concentrations below CWQG values are unlikely to pose a substantial risk to aquatic life. If there was either no applicable CWQG or the CWQG was considered dated, then other provincial/national guidelines were used (e.g., United States Environmental Protection Agency [U.S. EPA]).

The identification of a parameter whose concentration is higher than a particular guideline does not necessarily indicate impaired environmental conditions. The use of the guidelines for comparative purposes allows a better understanding of parameters that may be more important to evaluate during the environmental assessment. It also provides a better understanding of existing conditions to which resident biological community would be accustomed. There are often site-specific conditions related to geomorphology and geology that naturally result in locally elevated concentrations of various parameters within the aquatic environment (e.g., trace metals such as aluminium, copper, and selenium).

CWQGs for metals pertain to total metal concentrations, which consist of both the particulate and dissolved metal fractions (CCME 1999, 2007a). The bioavailability of most metals is affected by a number of environmental factors including pH, water hardness, oxidation-reduction conditions, and microbial degradation, as well as chemical speciation of specific metals (CCME 1987). Uncomplexed metal ions (e.g., Cd^{2+}, Cu^{2+}, Pb^{4+}, Ni^{2+}) are usually more bioavailable than complexed forms (i.e., particulate forms) (CCME 1987). The development of metal species-specific guidelines are problematic due to problems related to analytical methods, which may result in either overestimation or underestimation of the bioavailable fraction, as well as the relative toxicity of the different metal species. Therefore, comparisons using total concentrations of metals have been implemented as a protective measure (CCME 1987). In cases where the total metal concentration is higher than applicable CWQG, the dissolved concentration is also compared to determine if this concentration reports higher than the CWQG. This results in a conservative assessment of CWQG exceedences.

In some instances, guidelines are dependant on other environmental variables (e.g., water hardness, pH). A number of guidelines are based on a range of values rather than a single parameter concentration. Brief explanations of these parameters are provided in Appendix B1.

3.2.6 Quality Assurance/Quality Control

As part of the water quality QA/QC, field blanks, equipment blanks, and replicate samples were collected (Table 3.8). These samples were submitted to laboratories listed above for analysis. A detailed discussion of QA/QC methodology is presented in Appendix B2.

3.3 RESULTS AND DISCUSSION: LAKES

The following section provides a discussion of the water quality results in lakes within the Boston and Madrid Project areas. A detailed discussions of the water quality of each lake is provided under respective lake headings and focuses on general water quality characteristics and water quality parameters that have specific guidelines or assessment criteria (e.g., TSS, pH, DO, TP, dissolved inorganic nitrogen [ammonia, nitrate, and nitrite], and trace metals).

All field measurements, including water profiles of water temperature and DO, as well as pH, conductivity, and Secchi depth values are provided in Appendices B3 and B4. Water chemistry data, including Chl *a* concentrations, are provided in Appendix B5. Water quality QA/QC data are presented in Appendix B2.

3.3.1 Boston Project Area Lakes

3.3.1.1 Aimaokatalok Lake - Stations 4 & 6

The two sampling stations in Aimaokatalok Lake are situated in different water depths. Station 4 is located in a moderately shallow area, with a depth of approximately 6.5 m, and Station 6 is located in a deeper region of the lake, with a depth of approximately 27 m.

Aimaokatalok Lake is characterized as a clear freshwater lake, with soft water and a moderate to high acid sensitivity (Saffran and Trew 1996; Weiner 2000). The field pH ranged from slightly acidic to slightly alkaline (pH 6.0 to 7.8), with occasional pH values measured below the CWQG range of pH 6.5 to 9.0 (CCME 2007a) in August and September 2007 (Appendix B5).

Table 3.8 Summary of the QA/QC Samples Collected in the Boston and Madrid Project Areas, 2006 – 2007

Waterbody		QA/QC Sample Type	No. of Samples	Date
BOSTON PROJECT AREA	Fickle Duck Lake	Field blank	1	18-Jul-06
			1	17-Aug-06
			1	10-Sep-06
			1	21-Jul-07
			1	20-Aug-07
			1	9-Sep-07
	Reference Outflow	Equipment blank	1	18-Jul-06
			1	17-Aug-06
			1	11-Sep-06
			1	23-Jun-07
			1	21-Jul-07
			1	20-Aug-07
			1	9-Sep-07
	Stickleback Lake	Replicate	2	17-Jul-06
			2	17-Aug-06
			2	10-Sep-06
			1	24-May-07
			1	21-Jul-07
			1	20-Aug-07
			1	9-Sep-07
MADRID PROJECT AREA	Patch Outflow	Field blank	1	22-Jul-06
			1	22-Jun-07
	Patch Lake	Equipment blank	1	22-Jul-06
			1	15-Aug-06
			1	8-Sep-06
			1	24-May-07
			1	18-Jul-07
			1	18-Aug-07
			1	13-Sep-07
	Windy Outflow	Replicate	2	9-Sep-06
			1	19-Jul-07
	Pelvic Outflow		1	18-Aug-07
	Ogama Outflow		1	17-Sep-07

Prepared by: EJJ Checked by:SE

The range of laboratory conductivity values was similar at both stations, i.e., from 49 to 72 µS/cm, indicating low conductivity waters. Concentrations of major ions were typically low, and dominated by sodium and chloride (Appendix B5).

TSS concentrations ranged from <1 to 2 mg/L at Station 4, and < 1 to 3 mg/L at Station 6. The waters were slightly coloured at both stations (6 to 30 TCU), with higher colour evident during snow melt conditions. The Secchi depth ranged from 2.4 to 4.6 m (Figures 3.3 to 3.6; Appendix B3).

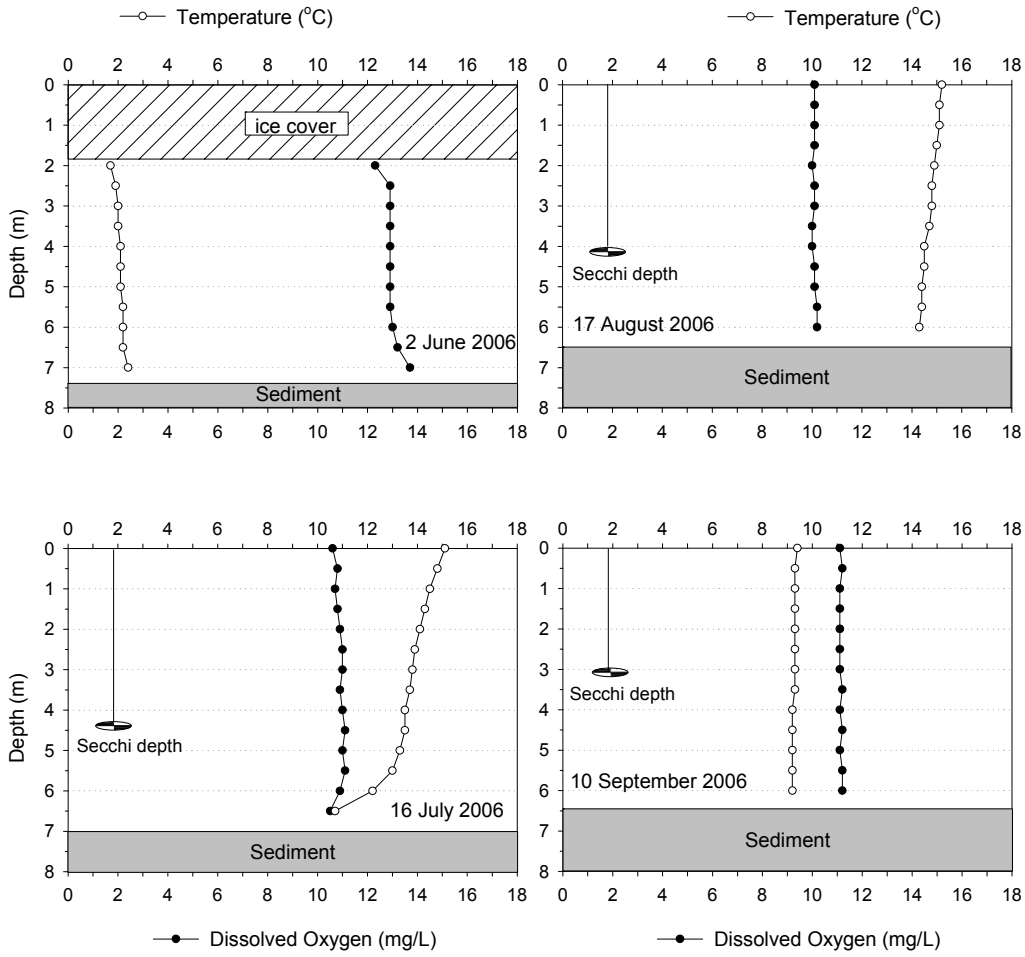


Figure 3.3 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Aimaokatalok Lake Station 4, 2006

Water column profiles of DO at Stations 4 and 6 indicated that the entire water column was generally well oxygenated throughout the monitoring periods in 2006 and 2007 (Figures 3.3 to 3.6). With the exception of Station 6 in May 2007, during ice-covered conditions, DO concentrations remained above the 9.5 mg/L CWQG for protection of early life stages of fish (CCME 2007a). In May 2007 at Station 6, the DO declined uniformly with depth, falling below 9.5 mg/L at 18 m, and below the 6.5 mg/L CWQG for the protection of aquatic life (CCME 2007a) at depths greater than 23 m (Figure 3.6). Decreases in DO at the bottom of the water column at Station 6 were evident in June and August

2006, with DO concentrations below the 6.5 mg/L CWQG for the protection of aquatic life in June, and below the 9.5 mg/L CWQG in August (Figure 3.5); as both of these low concentrations occurred at the bottom depth, they may have been the result of sediment disturbance by the probe during DO measurement.

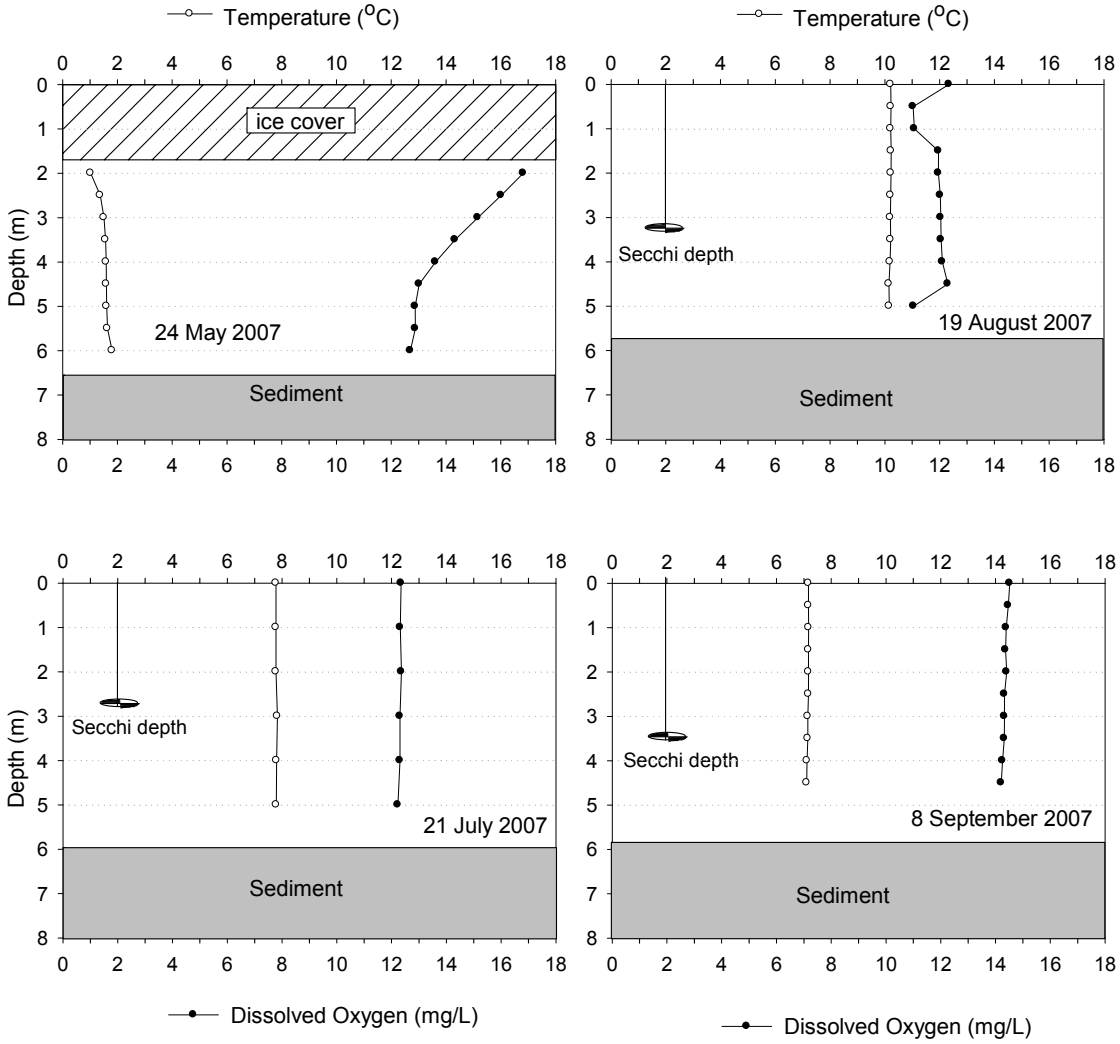


Figure 3.4 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Aimaokatalok Lake Station 4, 2007

Seasonal water column temperature trends were observed as expected, i.e., warmer water temperatures were measured in August, compared to July and September. Although the water column at Stations 4 and 6 was not obviously thermally stratified on any of the sampling dates in either 2006 or 2007 (Figures 3.3 to 3.6), a gradual decline in temperature with depth was evident in July at Station 6 in 2006 and 2007, and to a lesser extent in August 2006. Station 6 was

cooler by 1 to 3°C (even at the surface) than Station 4 on both July and August 2006 sampling dates (Figures 3.3 and 3.5).

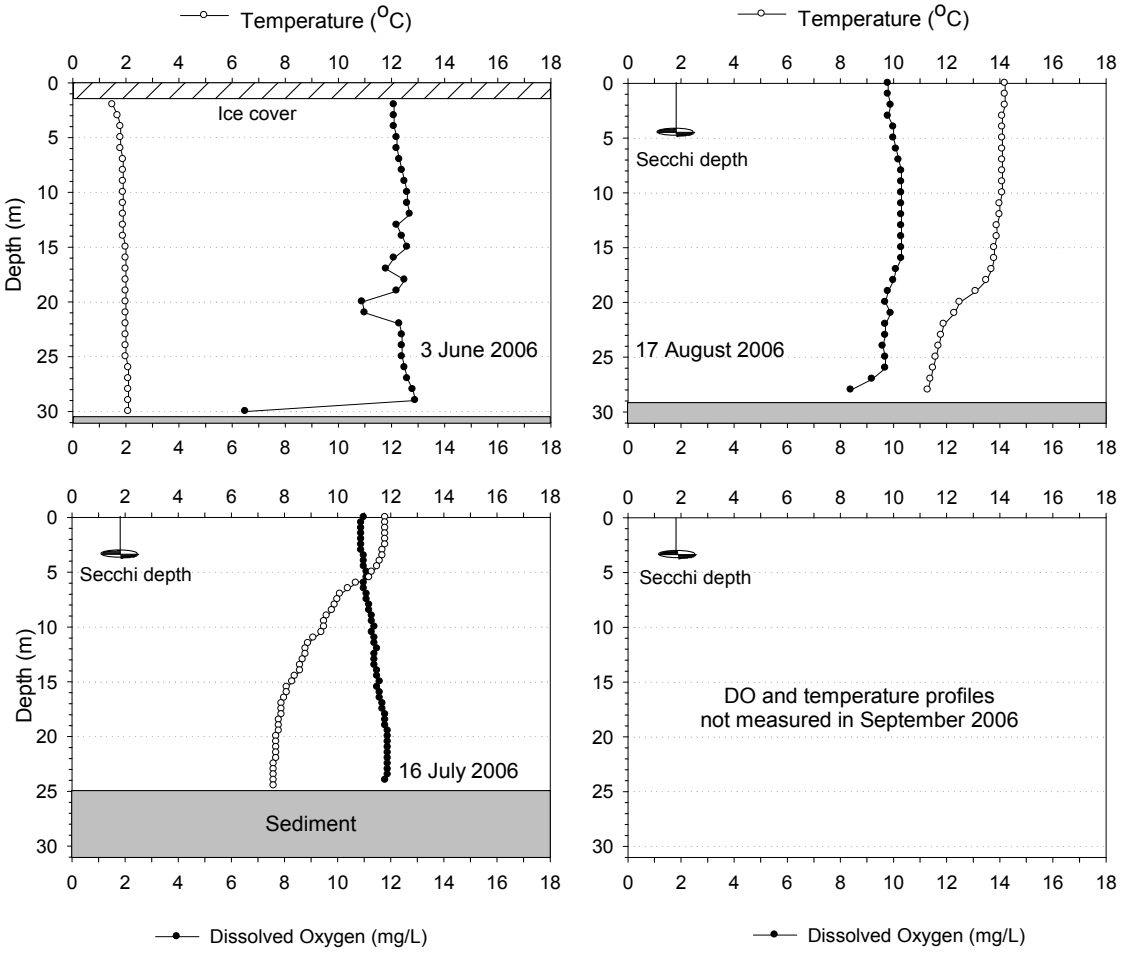


Figure 3.5 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Aimaokatalok Lake Station 6, 2006

Total phosphorus concentrations in Aimaokatalok Lake were similar at Stations 4 and 6, ranging from 6 to 28 µg/L over the course of the sampling periods (Appendix B5). Spot measurements of chlorophyll *a* collected in September 2006 and 2007 varied from 8.8 µg/L at Station 4 and 4.7 µg/L at Station 6 in 2006 and 1.1 to 2.3 µg/L in 2007. Based on the total phosphorus concentrations in 2006 and 2007, Aimaokatalok Lake could be conservatively classified as mesotrophic to meso-eutrophic (Appendix B1) (CCME 2004). Based on the concentrations of Chl *a*, Aimaokatalok Lake could be classified as oligo-mesotrophic (2006) and oligotrophic (2007) (Appendix B1) (Mitchell and Prepas 1990). In both years, concentrations of the dissolved inorganic forms of nitrogen (ammonia, nitrate, and nitrite) were well below CWQGs (CCME 2007a), representing <15% of the

total nitrogen concentration (the TKN ranged from 0.23 to 1.49 mg/L at Station 4 and 0.23 to 0.37 mg/L).

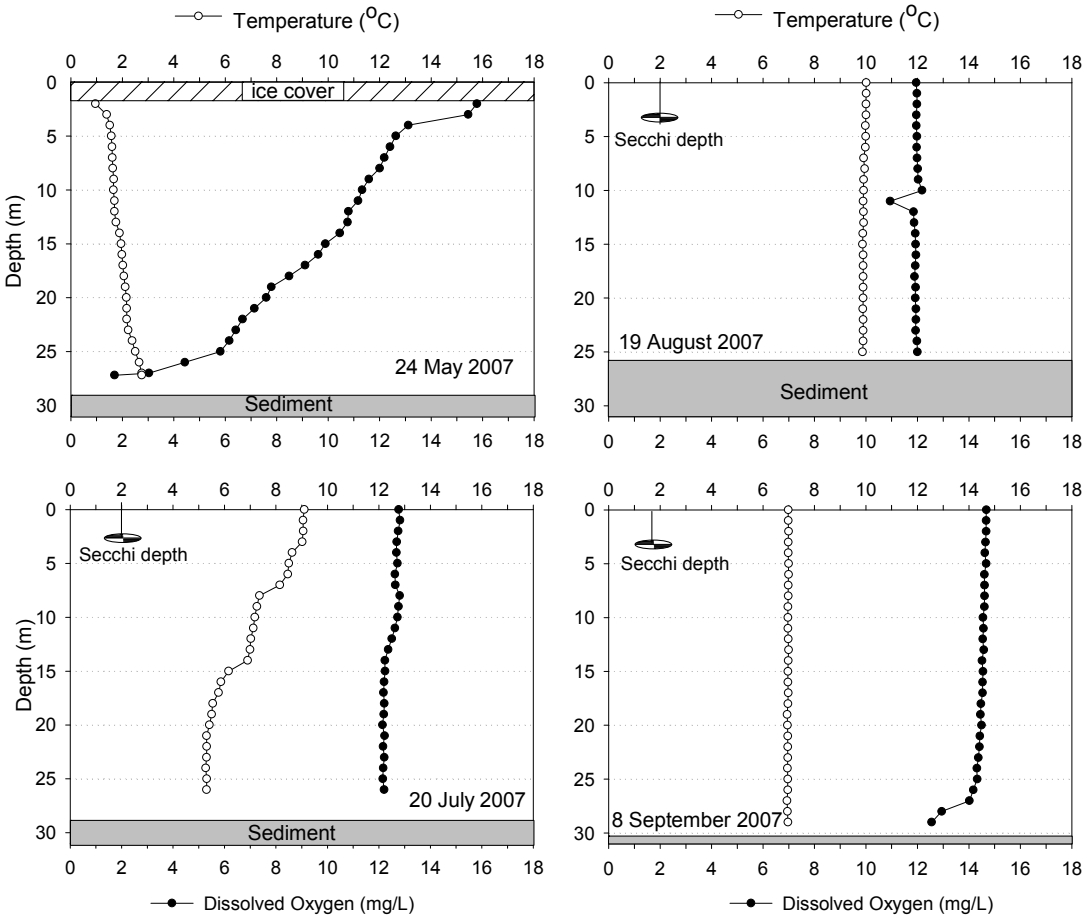


Figure 3.6 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Aimaokatalok Lake Station 6, 2007

Most baseline total metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of aluminum, cadmium, chromium, and copper. These exceptions are as follows:

- The total aluminum concentration was higher than the 100 µg/L CWQG (for pH ≥6.5) in the bottom sample collected at Station 6 in June 2006 (192 µg/L; Appendix B5). In 2007, total aluminum concentrations at Stations 4 and 6 were higher than the 5.0 µg/L CWQG (when pH <6.5) on every sampling date during the open-water season in slightly acidic surface waters, with concentrations ranging from 31.7 to 59.8 µg/L

(Appendix B5). The range of dissolved aluminium concentration in these cases was also higher than the CWQG (6.2 to 9.4 µg/L).

- Baseline total cadmium was above the site-adjusted CWQG in August 2006 (0.006 µg/L) and May 2007 (top: 0.024 µg/L; bottom: 0.009 µg/L).
- Total and dissolved chromium concentrations were naturally above the 1 µg/L CWQG sublethal toxicity of Cr (IV) in the bottom sample collected under-ice in May 2007 (1.2 µg/L). The surface sample had a total chromium concentration of 1 µg/L.
- Baseline total and dissolved copper concentrations were also above the 2 µg/L CWQG in the top sample collected under-ice in May 2007 with concentrations of 2.3 and 2.2 µg/L, respectively.

Elevated total mercury concentrations were measured in samples collected from Stations 4 and 6 in September 2006. These concentrations were at or just below the 26 ng/L CWQG concentration (Station 4 (top), 26 ng/L; and Station 6 (bottom), 22 ng/L) (Appendix B5). However, in the other two samples taken in September, and on all other occasions, the total mercury concentrations were well below the CWQG (CCME 2007a).

Total cyanide concentrations were consistently below the MRV (0.001 mg/L), with the exception of the August 2007 bottom sample (0.001 mg/L) and the May 2007 middle sample (0.001 mg/L).

3.3.1.2 Fickle Duck Lake

Fickle Duck Lake is a shallow (~4 m deep) freshwater lake. It is characterized by soft water, with a moderate to low sensitivity to acidification (Saffran and Trew 1996; Weiner 2000). Sampling was limited to open water conditions at this lake in 2006.

Field pH was slightly acidic to alkaline (6.6 to 8.0) and was within the CWQG range of pH 6.5 to 9.0 in 2006 and 2007 (CCME 2007a). The electrical conductivity of Fickle Duck Lake was typically low, ranging from 54 to 90 µS/cm. An atypically high conductivity of 332 µS/cm was recorded in the 2007 under-ice sample, which is consistent with salt exclusion processes often evident during ice-covered conditions. Typically, TDS concentrations in the water column increase during under-ice conditions (Pieters and Lawrence 2009; Hammer 1986), with the level of increases in TDS concentration directly related to the thickness of the ice and the water depth (e.g., TDS increases will likely be more pronounced in shallow lakes). Concentrations of major ions were typically

low during open water conditions, and were dominated by calcium, sodium, and chloride (Appendix B5).

The TSS concentrations ranged from < 1 to 4 mg/L in 2006 and 2007. The Secchi depths ranged from 1.0 to 1.9 m, which was considered shallow in association with the relatively low TSS concentrations (Figures 3.7 and 3.8; Appendix B3). The waters were coloured (24 to 119 TCU), with the highest colour evident during under-ice conditions in May 2007.

The open-water DO profiles in 2006 and 2007 showed that Fickle Duck Lake was well oxygenated throughout the water column, with DO concentrations above the 9.5 mg/L CWQG for protection of early life stages of fish (Figures 3.7 and 3.8) (CCME 2007a). However, in May 2007, the shallow depth of water between the ice and sediments (0.5 m) was anoxic (0.0 mg/L; Figure 3.8).

Thermal stratification was not observed in Fickle Duck Lake, with isothermic conditions evident in 2006 and 2007 (Figures 3.7 and 3.8). Typical seasonal water column temperature trends were observed as expected, i.e., warmer water temperatures were measured in August, compared to July and September.

The total phosphorus concentrations in Fickle Duck Lake ranged from 16 to 39 µg/L in 2006 and 2007. Spot measurements of Chl *a* varied from 24.9 µg/L in September 2006 to a range of 3.4 to 5.6 µg/L in 2007 (Appendix B5). An algal bloom was evident during the August 2006 sampling; however, this was not clearly represented in the TSS and nutrient concentrations or the Secchi depth measurements, and Chl *a* samples were not collected. Based on the high total phosphorus concentrations, Fickle Duck Lake typically could be classified as mesotrophic to eutrophic (Appendix B1) (CCME 2004). However, based on Chl *a* concentrations, this lake could be classified as meso-eutrophic in 2006, and oligotrophic in 2007 (Appendix B1) (Mitchell and Prepas 1990).

All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) in both years, and represented 20% of total nitrogen concentration during one sampling period and < 5% during the remaining periods (the TKN ranged from 0.38 to 0.66 mg/L in 2006, and 0.36 to 1.28 mg/L in 2007). Elevated TKN and dissolved inorganic nitrogen were measured in the under-ice sample collected in May 2007.

Most total metal concentrations were below applicable CWQGs (CCME 2007a), with the exception of baseline total aluminum, chromium, copper, and iron. These exceptions are as follows:

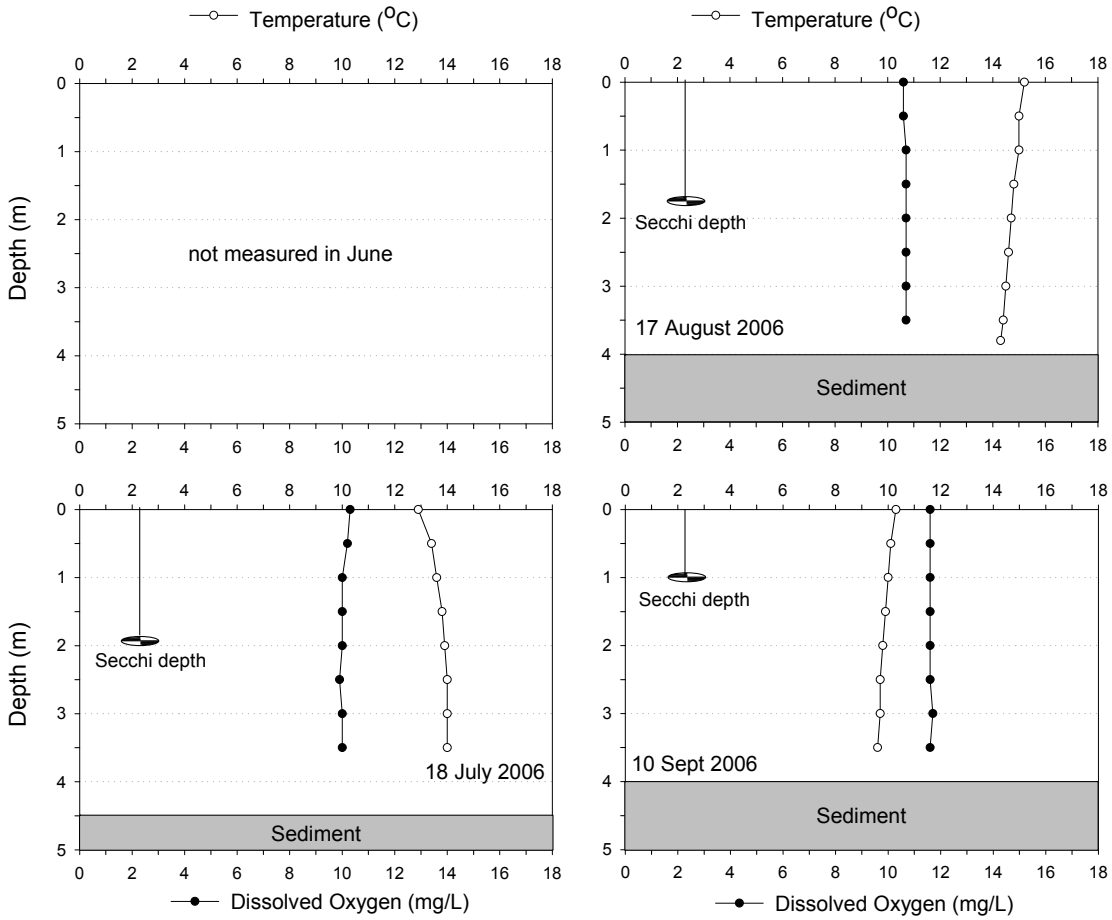


Figure 3.7 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Fickle Duck Lake, 2006

- Total aluminum baseline concentrations were above the 100 µg/L CWQG (for pH >6.5) in July 2006 (122 µg/L), September 2006 (172 µg/L), July 2007 (114 µg/L), August 2007 (155 µg/L), and September 2007 (112 µg/L) (Appendix B5).
- The total and dissolved chromium concentrations were above the 1 µg/L CWQG sublethal toxicity of Cr (IV) in anoxic, under-ice conditions in May 2007 (1.8 and 1.7 µg/L, respectively) (Appendix B5).
- The total and dissolved copper concentrations were above the 2 µg/L CWQG in anoxic, under-ice conditions in May 2007, and in September 2007 (2.6 and 2.4 µg/L, and 2.3 and 2.3 µg/L, respectively) (Appendix B5).
- Baseline total iron concentrations were at, or higher than, the 300 µg/L CWQG on each sampling occasion. The highest concentration was measured in the anoxic, under-ice conditions in May 2007 (2810 µg/L), in

which the dissolved iron concentration was also high (2130 µg/L) (Appendix B5).

Total cyanide concentrations were consistently below the MRV (0.001 mg/L).

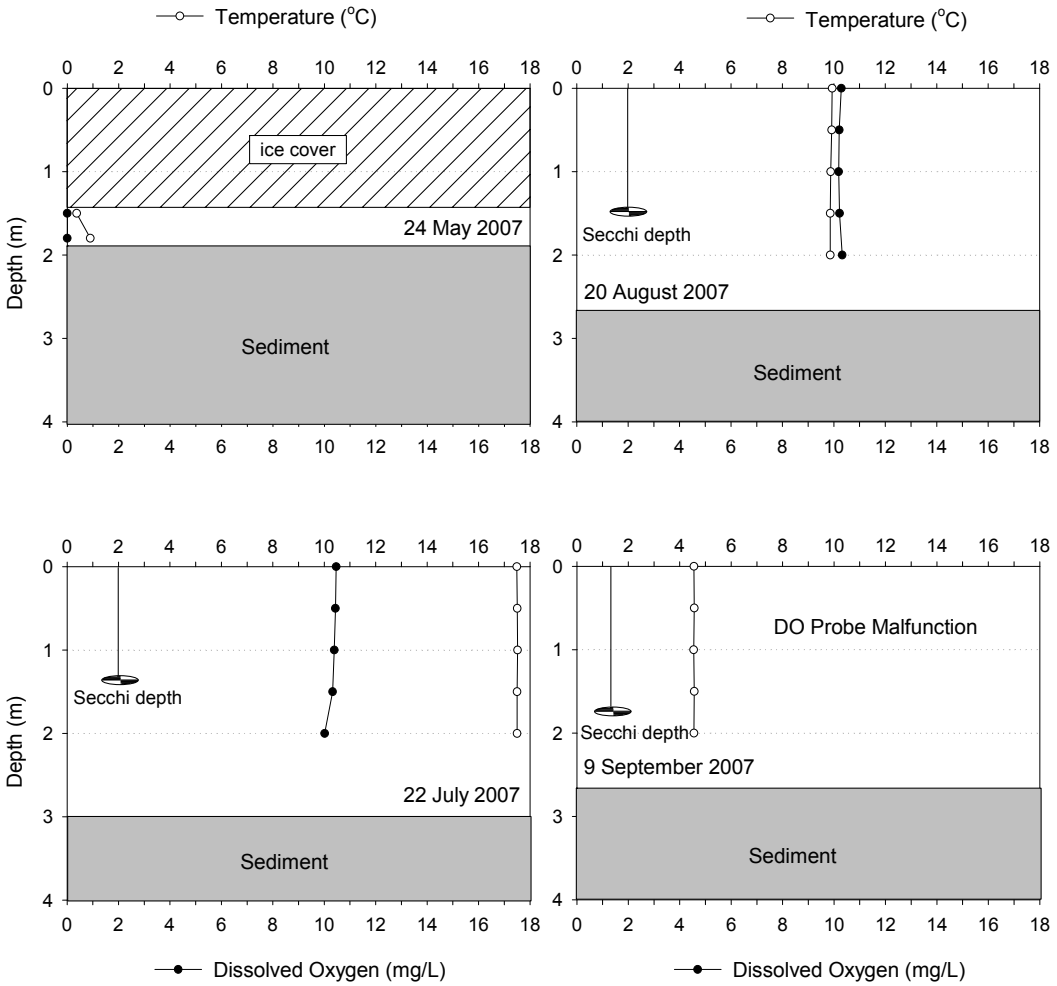


Figure 3.8 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Fickle Duck Lake, 2007

3.3.1.3 Reference Lake

Reference Lake is a clear, shallow (>4 m deep) freshwater lake. It is characterized by soft water, with a moderate sensitivity to acidification (Saffran and Trew 1996). Sampling was limited to open water conditions at this lake in 2006.

The field pH in Reference Lake in 2006 and 2007 was slightly acidic to slightly alkaline (6.4 to 7.7) and was generally within the CWQG range of pH 6.5 to 9.0 (CCME 2007a). A pH value of 6.4 in July 2006 was just below the minimum CWQG (Appendix B3).

The electrical conductivity of Reference Lake was typically low, with values ranging from 46 to 69 µS/cm during the open-water season in 2006 and 2007. An elevated conductivity of 270 µS/cm was measured in the 2007 under-ice sample (Appendix B5), consistent with higher TDS concentrations associated with salt exclusion processes during under ice conditions.

The TSS concentrations in Reference Lake were generally low, ranging from <1 to 4 mg/L in the 2006 and 2007 open-water seasons (Appendix B5). In the under-ice sample collected in May 2007, the higher TSS concentration (10 mg/L) may have been due to sediment disturbance while drilling the hole through the ice. The Secchi depths ranged from 1.0 to 2.5 m in 2006 and 2007 (Figures 3.9 and 3.10). The waters were coloured (14 to 58 TCU), with the highest colour measured in under-ice conditions in May 2007 (Appendix B5).

The water column remained well oxygenated during open-water conditions, with DO concentrations above the 9.5 mg/L CWQG for the protection of aquatic life (CCME 2007a) throughout the 2006 and 2007 open water period (Figures 3.9 and 3.10). During under-ice conditions in May 2007, the near-bottom DO was below the 6.5 mg/L CWQG for the protection of aquatic life (Appendix B4) (CCME 2007a).

Thermal stratification was not observed in Reference Lake, with a typically isothermic water column evident on all sampling occasions in 2006 and 2007. The water temperatures showed typical seasonal trends, with the warmest temperatures recorded in August 2006 and July 2007 (Figures 3.9 and 3.10).

The total phosphorus concentrations in Reference Lake ranged from 18 to 42 µg/L during the 2006 and 2007 open-water sampling periods, with a maximum concentration of 162 µg/L under-ice in May 2007. This high concentration was associated with high TSS (10 mg/L). The Chl *a* concentration was 7.1 µg/L in September 2006 and ranged from 1.9 to 4.2 µg/L in 2007 (Appendix B5). Based on the typical total phosphorus concentrations, Reference Lake could be classified as meso-eutrophic, although the high under-ice phosphorus concentration would indicate a hyper-eutrophic status (Appendix B1) (CCME 2004). Based on the the Chl *a* concentrations, Reference Lake could be classified as oligotrophic (Appendix B1) (Mitchell and Prepas 1990).

All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) in both years, and represented < 5% of the total nitrogen concentration (the TKN ranged from 0.38 to 0.49 mg/L in 2006, and 0.39 to 1.49 mg/L in 2007). Elevated TKN and dissolved inorganic nitrogen were measured in the under-ice sample collected in May 2007.

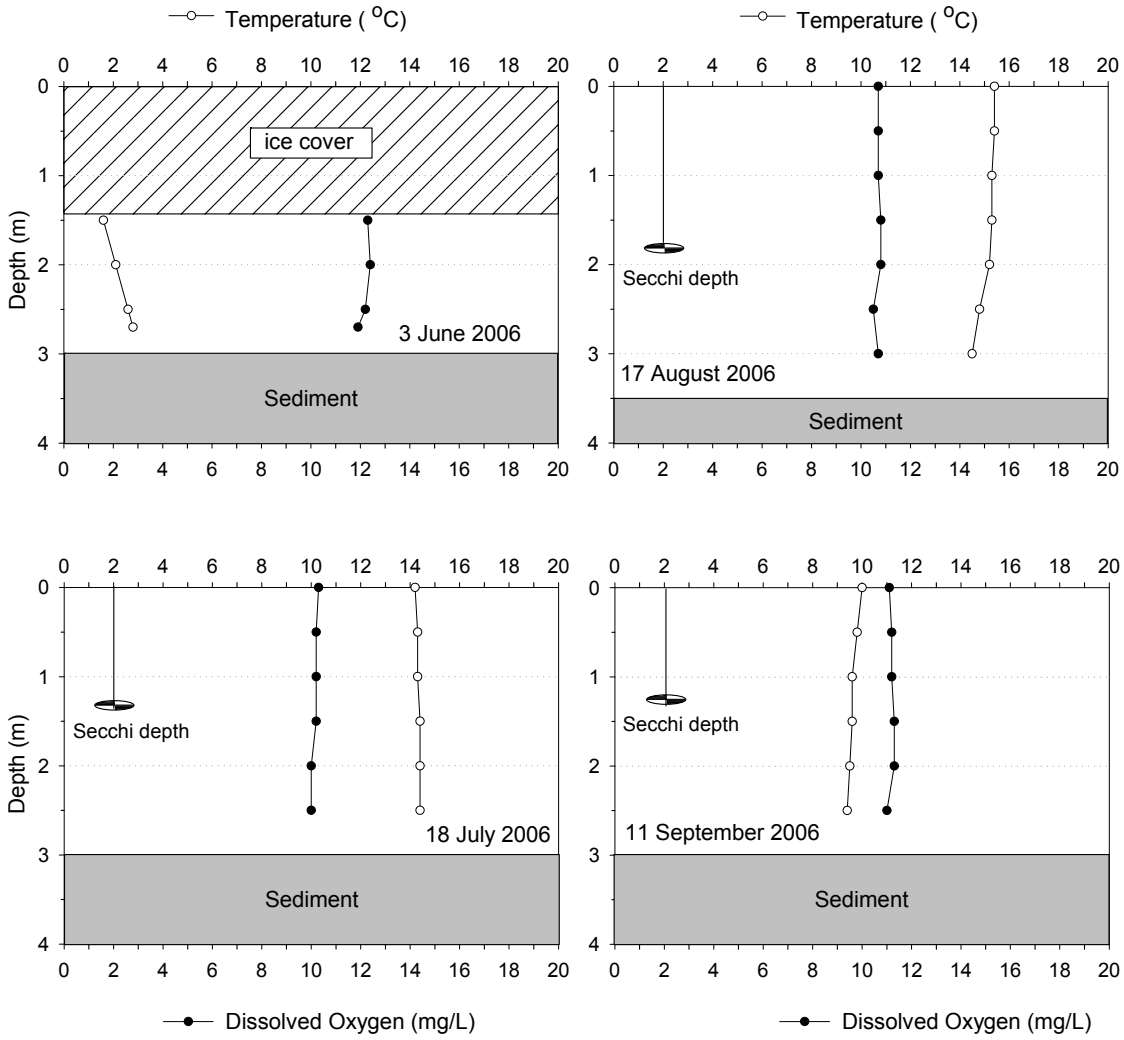


Figure 3.9 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Reference Lake, 2006

With the exception of baseline total aluminum, chromium, copper, and iron, most metals were below the applicable CWQGs (CCME 2007a). The exceptions are as follows:

- Total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) on all four sampling occasions in 2006 and in the July 2007

sample (211 µg/L; Appendix B5). The 5.0 µg/L CWQG for total aluminum (for pH < 6.5) was substantially exceeded in July 2006 (173 mg/L) when the lake was at pH 6.4.

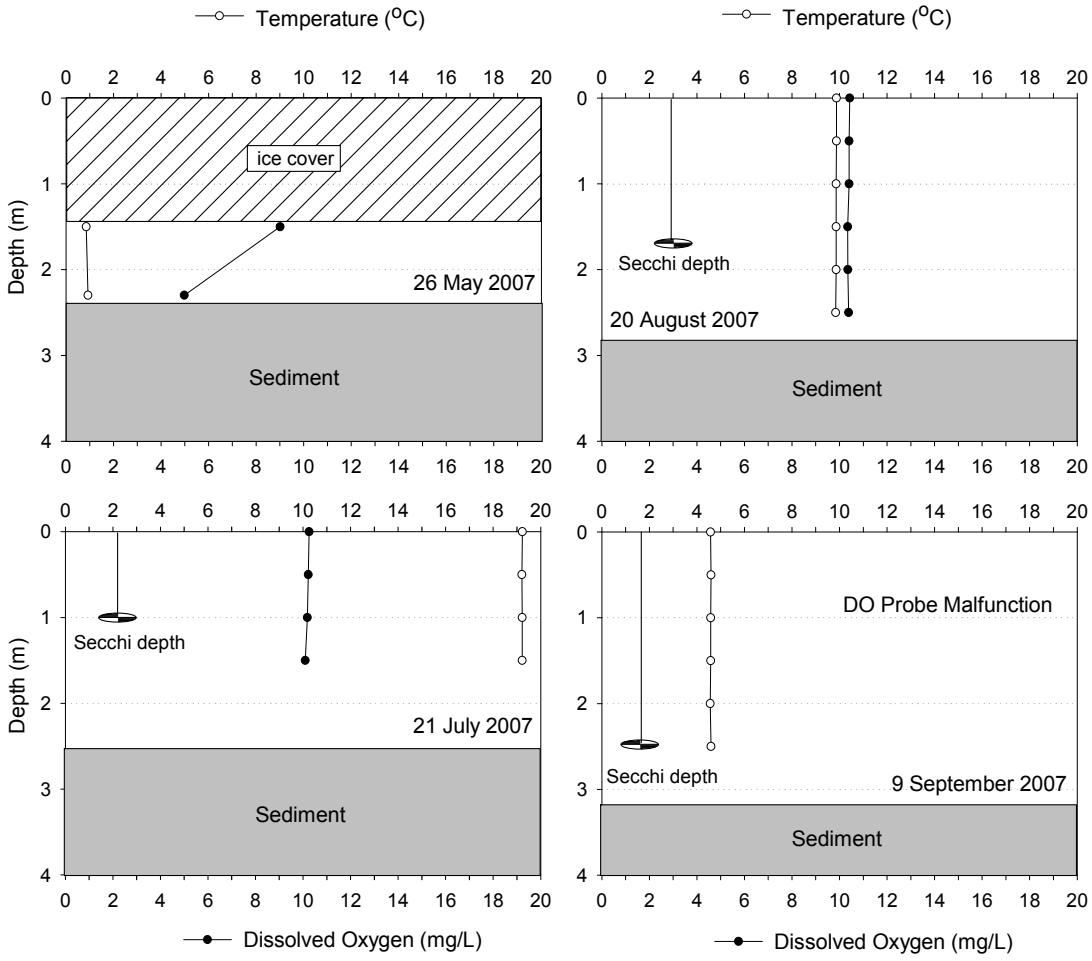


Figure 3.10 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Reference Lake, 2007

- The total and dissolved chromium concentrations were above the 1 µg/L CWQG sublethal toxicity of Cr (IV) in under-ice conditions in May 2007 (both at 1.2 µg/L) (Appendix B5).
- The total and dissolved copper concentrations were above the 2 µg/L CWQG in anoxic, under-ice conditions in May 2007 and in August 2007 (2.5 and 2.2 µg/L, and 3.1 and 2.6 µg/L, respectively) (Appendix B5).
- Baseline total iron concentrations were at, or higher than, the 300 µg/L CWQG in August 2006 (301 µg/L) and May (1790 µg/L) and July

2007 (340 µg/L). The highest concentration was measured in the low oxygen under-ice conditions in May 2007, in which the dissolved iron concentration was also high (1030 µg/L) (Appendix B5).

Total cyanide concentrations were consistently below the MRV (0.001 mg/L), with the exception of the August 2007 sample (0.001 mg/L).

3.3.1.4 Stickleback Lake

Stickleback Lake is a very clear, shallow (approximately 3.5 m deep) freshwater lake. It is characterized by soft water, with a low sensitivity to acidification (Saffran and Trew 1996; Weiner 2000).

In 2006 and 2007, the field pH measurements were slightly acidic to alkaline (pH 6.5 to 8.2) and within the CWQGs (pH 6.5 to 9.0) (CCME 2007a). During open water conditions, electrical conductivity values ranged from 167 to 252 µS/cm in 2006 and 246 to 248 µS/cm in 2007, which was approximately three times higher than other lakes within the Boston Project area (Appendix B5). The major ions were dominated by calcium and chloride. Consistent with the elevated conductivity measured during under-ice conditions in the shallow Fickle Duck and Reference lakes, elevated conductivity was also measured in Stickleback Lake during the under-ice conditions in May 2007 (643 µS/cm).

Total suspended solids concentrations were low, ranging between < 1 and 2 mg/L in 2006 and 2007. The Secchi depth ranged from 2.4 to 2.8 m in 2006 and to the bottom in 2007 (Figures 3.11 and 3.12). The waters were slightly coloured (< 1 to 8 TCU), with the highest colour typically observed during under-ice or snowmelt conditions.

The water column remained well oxygenated (10 to 12 mg/L) throughout the water column during open-water conditions (Figure 3.11 and 3.12). During under-ice conditions, the free water exhibited low DO concentrations. In June 2006, DO concentrations declined gradually with depth from below the minimum CWQG for protection of early life stages of fish (9.5 mg/L) at 1.5 m depth, to 4.7 mg/L at the bottom, which was below the 6.5 mg/L CWQG for the protection of aquatic life (Figure 3.11) (CCME 2007a). In May 2007, the 1 m of free water below the ice was near anoxic (between 0 and 0.5 mg/L; Figure 3.12).

No distinct thermal stratification was observed in Stickleback Lake in 2006 and 2007, although a slight positive temperature gradient with depth from 2 to 4°C was present in the ice-covered water column in May 2006. Typical seasonal trends were evident, with the warmest temperatures measured in July or August (Figures 3.11 and 3.12).

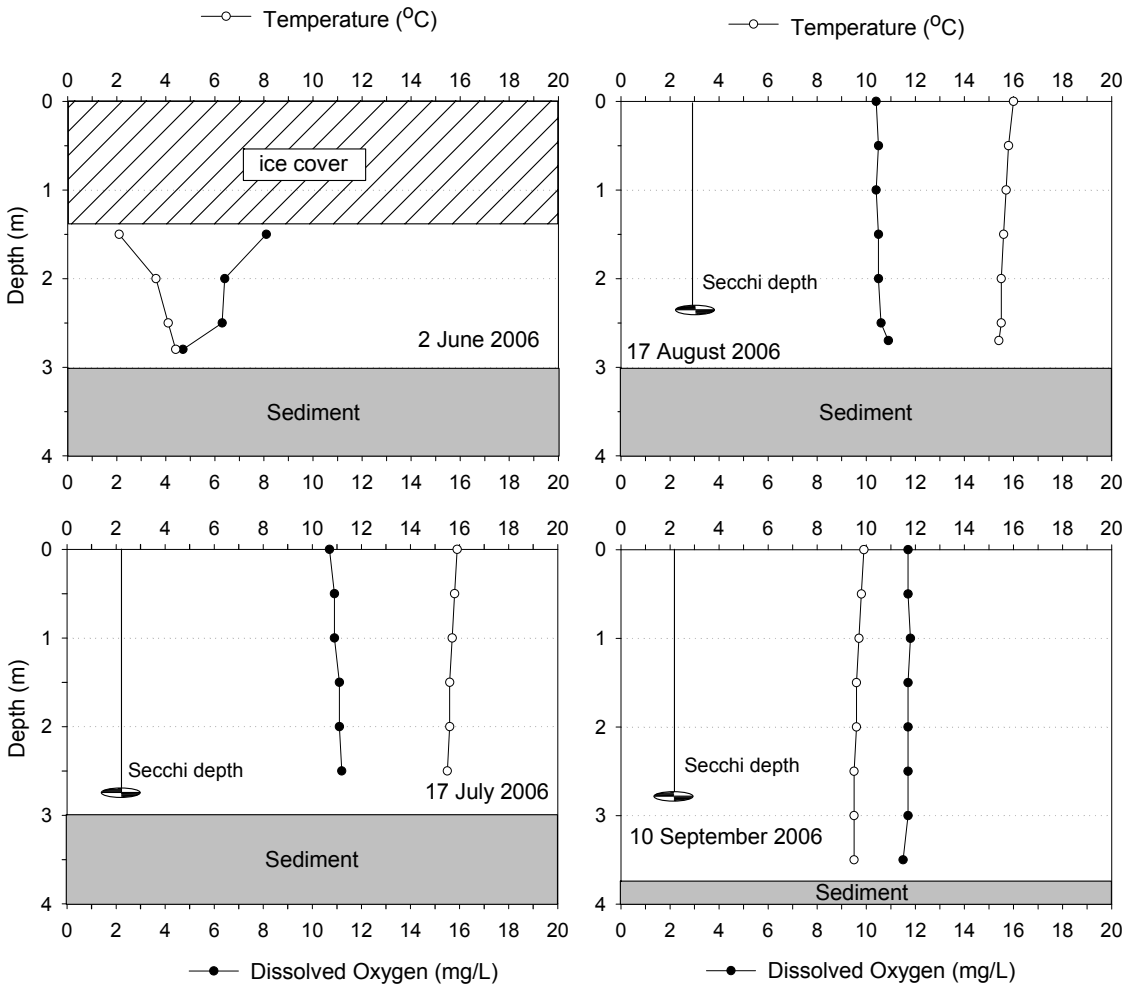


Figure 3.11 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Stickleback Lake, 2006

Total phosphorus concentrations in Stickleback Lake ranged from 11 to 28 µg/L. The September 2006 Chl *a* concentration was 4.2 µg/L, and ranged from 1.4 to 2.0 µg/L in 2007 (Appendix B5). Based on the total phosphorus concentrations, the lake would be classified as mesotrophic to meso-eutrophic (Appendix B1) (CCME 2004); however, the Chl *a* concentrations were indicative of oligotrophic lakes (Appendix B1) (Mitchell and Prepas 1990).

All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) in both years, and represented < 13% of the total nitrogen concentration (the TKN ranged from 0.36 to 0.40 mg/L in 2006, and 0.36 to 0.77 mg/L in 2007). As observed in the shallow Fickle Duck and Reference lakes, an elevated TKN concentration was measured in May 2007 under-ice conditions.

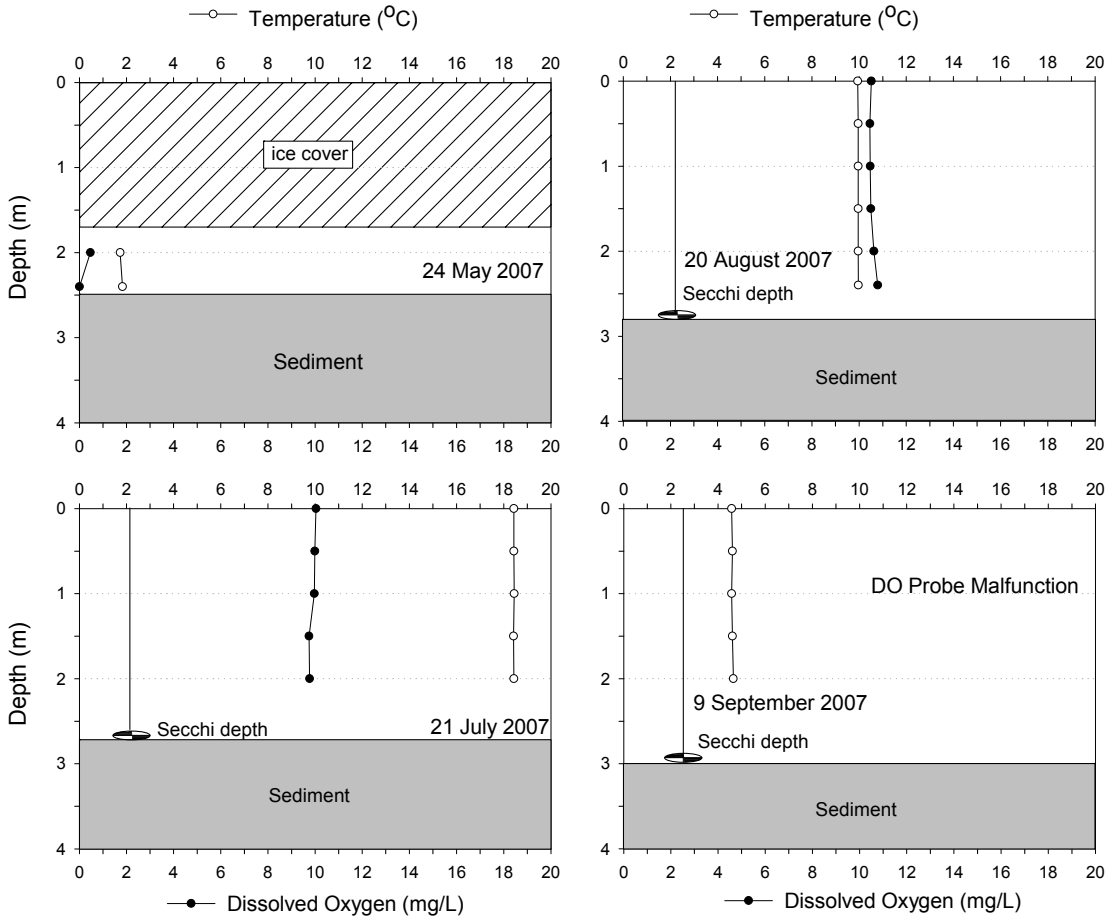


Figure 3.12 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Stickleback Lake, 2007

Baseline total metal concentrations remained below applicable CWQGs (CCME 2007a), with the exception of total iron and selenium that were associated with the May 2007 under-ice conditions. These exceptions are as follows:

- The total iron concentration (574 µg/L) was higher than the 300 µg/L CWQG (Appendix B5).
- The total selenium concentration (2.0 µg/L) was higher than the 1.0 µg/L CWQG (Appendix B5).

Total cyanide concentrations were generally below the MRV (0.001 mg/L), with exceptions during under-ice conditions in June 2006 (0.001 mg/L) and May 2007 (0.002 mg/L).

3.3.1.5 Boston Project Area Lakes Summary

The lakes within the Boston Project area were typically clear, with soft water, low TDS concentrations, and a moderate to high sensitivity to acidification. The exception to this generalization was Stickleback Lake, which had higher TDS concentrations and corresponding higher alkalinity and hardness values, and therefore a lower sensitivity to acidification. TDS concentrations in Stickleback Lake were approximately three times the concentrations measured in the other Boston Project area lakes, which suggests that the watershed may drain through slightly different geology or that there is a distinct groundwater input to this lake. Sodium, calcium, and chloride were the dominant major ions. The range of pH values was slightly acidic to alkaline for all lakes in the Boston Project area (Appendix B5).

Thermal stratification was not evident during the open water season. The water column of each lake remained well oxygenated throughout open water conditions. Under-ice DO concentrations fell below the CWQG for protection of all life stages of fish in the shallow lakes, namely Fickle Duck, Reference, and Stickleback lakes, with anoxic DO conditions measured in Fickle Duck Lake in May 2007.

Based on total phosphorus concentrations measured in 2006 and 2007, the Boston Project area lakes ranged from mesotrophic (Aimaokatalok, Fickle Duck, and Stickleback lakes) to hyper-eutrophic (Fickle Duck Lake). Based on Chl *a* concentrations, the Boston Project area lakes ranged from oligotrophic (Reference and Stickleback lakes) to meso-eutrophic (Fickle Duck Lake). All of the lakes in the Boston Project area were considered to be phosphorus-limited.

Baseline total metal concentrations were rarely higher than CWQGs (CCME 2007a) in the Boston Project area lakes, with the exception of occurrences of elevated total aluminum, cadmium, chromium, copper, iron, and selenium concentrations. Total aluminum and iron concentrations were higher than relevant CWQGs on one or more sampling occasions in all lakes except Aimaokatalok Lake. Total copper and cadmium concentrations were higher than applicable CWQGs on at least one sampling occasion in all lakes. Selenium was only above the CWQG on one sampling event in Stickleback Lake (Tables 3.9 and 3.10). For most metals, the proportion of the dissolved fraction was moderate to high, accounting for 50 to 100% of the total concentration.

Table 3.9 Summary of Aimaokatalok Lake (Stations 4 and 6) Water Samples that were Above Guidelines for the Protection of Aquatic Life in Freshwater, 2006 – 2007

Station	Strata	Date	TSS	Field pH	Al (Total)		Cd (Total)	Cr (Total)	Cu (Total)
				CWQG 6.5-9.0	CWQG 100 µg/L for pH≥6.5	CWQG 5.0 µg/L for pH<6.5	CWQG 0.010 µg/L[a]	CWQG 1.0 µg/L or USEPA 16 µg/L[b]	CWQG 2-4 µg/L[a]
Aimaokatalok Lake Station 4	Top*	2-Jun-06	<1	6.7					
	Top	10-Sep-06	1	7.3					
	Top*	24-May-07	<1	7.0			**0.024**		**2.3**
	Bottom*	24-May-07	<1	7.0				**1.2**	
	Top	21-Jul-07	<1	**6.0**		**31.7**			
	Top	19-Aug-07	<1	**6.2**		**43.7**			
	Top	8-Sep-07	<1	**6.0**		**42.9**			
Aimaokatalok Lake Station 6	Bottom*	3-Jun-06	2	6.9	**192**				
	Top	20-Jul-07	<1	**6.0**		**36.2**			
	Top	19-Aug-07	2	**6.1**		**48.1**			
	Top	8-Sep-07	<1	**6.1**		**59.8**			

Total suspended solids (TSS) and field pH values are provided to help in interpretation of the values exceeding guidelines.

[a] CWQG was adjusted for hardness (See Appendix B1).

[b] For Cr sublethal toxicity, the CWQG is 1.0 µg/L; for acute toxicity, the USEPA guideline is 16 µg/L (See Appendix B1).

* Samples were taken under ice.

Values exceeding CWQGs are **bold.**

Prepared by: EJJ Checked by: JM

Table 3.10 Summary of Fickle Duck, Reference, and Stickleback Lake Water Samples that were Above Guidelines for the Protection of Aquatic Life in Freshwater, 2006 – 2007

Station	Strata	Date	TSS	Field pH	Al (Total)		Cr (Total)	Cu (Total)	Iron (Total)	Se (Total)
				CWQG 6.5-9.0	CWQG 100 µg/L for pH≥6.5	CWQG 5.0 µg/L for pH<6.5	CWQG 1.0 µg/L or USEPA 16 µg/L[b]	CWQG 2-4 µg/L[a]	CWQG 300 µg/L	CWQG 1.0 µg/L
Fickle Duck Lake	Top	18-Jul-06	2	7.0	**122**				**364**	
	Top	17-Aug-06	3	8.0					**501**	
	Top	10-Sep-06	4	7.7	**172**				**532**	
	Top*	24-May-07	1	6.9			**1.8**	**2.6**	**2810**	
	Top	22-Jul-07	2	7.3	**114**				**357**	
	Top	20-Aug-07	<1	6.8	**155**				**317**	
	Top	9-Sep-07	1	6.6	**112**			**2.3**		
Reference Lake	Bottom*	3-Jun-06	1	6.9	**191**				**402**	
	Top	18-Jul-06	3	**6.4**		**173**				
	Top	17-Aug-06	2	7.4	**101**				**301**	
	Top	11-Sep-06	2	7.7	**156**					
	Top*	26-May-07	10	6.7			**1.2**	**2.5**	**1790**	
	Top	21-Jul-07	4	6.8	**211**				**340**	
	Top	20-Aug-07	<1	6.5				**3.1**		
Stickleback Lake	Top	17-Aug-06	<1	8.2				**2.0**		
	Top*	24-May-07	2	7.3					**574**	**2.0**

Total suspended solids (TSS) and field pH values are provided to help in interpretation of the values exceeding guidelines.

[a] CWQG was adjusted for hardness (See Appendix B1).

[b] For Cr sublethal toxicity, the CWQG is 1.0 µg/L; for acute toxicity, the USEPA guideline is 16 µg/L (See Appendix B1).

* Samples were taken under ice.

Values exceeding CWQGs are **bold.**

Prepared by: EJJ Checked by: JM

3.3.2 Madrid Project Area

3.3.2.1 Glenn Lake

Glenn Lake is a deep (approximately 20 m deep) freshwater lake. It is characterized by soft water, with a negligible sensitivity to acidification (Saffran and Trew 1996; Weiner 2000).

The lake pH values were very consistent and near-neutral (7.2 to 7.4) and were within the CWQG range of pH 6.5 to 9.0 (CCME 2007a).

Glenn Lake exhibited moderate electrical conductivity ranging from 331 µS/cm to 464 µS/cm, which was also the water column differential in July 2007; this profile gradient was attributed to the expression of low conductivity surface flows from melting ice at the time of sampling. Conductivity was typically between 373 and 457 µS/cm in all other samples, reflecting the marine origins of sediments in the basin. The major ions were dominated by sodium and chloride (Appendix B5).

Total suspended solids concentrations ranged from < 1 to 4 mg/L, and the Secchi depth ranged from 1.0 to 3.0 m (Figure 3.13). The waters were slightly coloured (6 to 22 TCU), with the highest colour values measured in September 2007 (Appendix B5).

The water column remained well oxygenated throughout the 2007 sampling season, which included under-ice conditions. Glenn Lake DO concentrations were above the 9.5 mg/L CWQG for protection of early life stages of fish (CCME 2007a) throughout the water column (Figure 3.13).

Slight thermal stratification was evident in July; the water temperature declined from 8.9°C near water surface to 2.9°C near bottom sediments, with slight stratification observed at 5 and 12 m (Figure 3.13). Typically isothermic conditions were evident in the remaining sampling periods in 2007. Typical seasonal trends were evident, with the warmest temperatures measured in August (Figure 3.13). The differences in Glenn Lake water depth between sampling dates was due to the sharp relief in the lake bottom around the sampling station, and the marginal error associated with locating sampling stations using GPS devices.

Total phosphorus concentrations in Glenn Lake ranged from 5 to 18 µg/L. The Chl *a* concentrations in Glenn Lake were very low in 2007, ranging from 0.8 to 1.0 µg/L (Appendix B5). Based on the TP and Chl *a* concentrations, Glenn Lake could be classified as oligo-mesotrophic (Appendix B1) (Mitchell and Prepas 1990; CCME 2004).

All of the dissolved inorganic forms of nitrogen (ammonia, nitrate, and nitrite) were well below the CWQGs, representing < 14% of the total nitrogen concentrations (the TKN ranged from 0.20 to 0.25 mg/L).

Most metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of baseline total aluminum, chromium, copper, iron, and selenium. These exceptions are as follows:

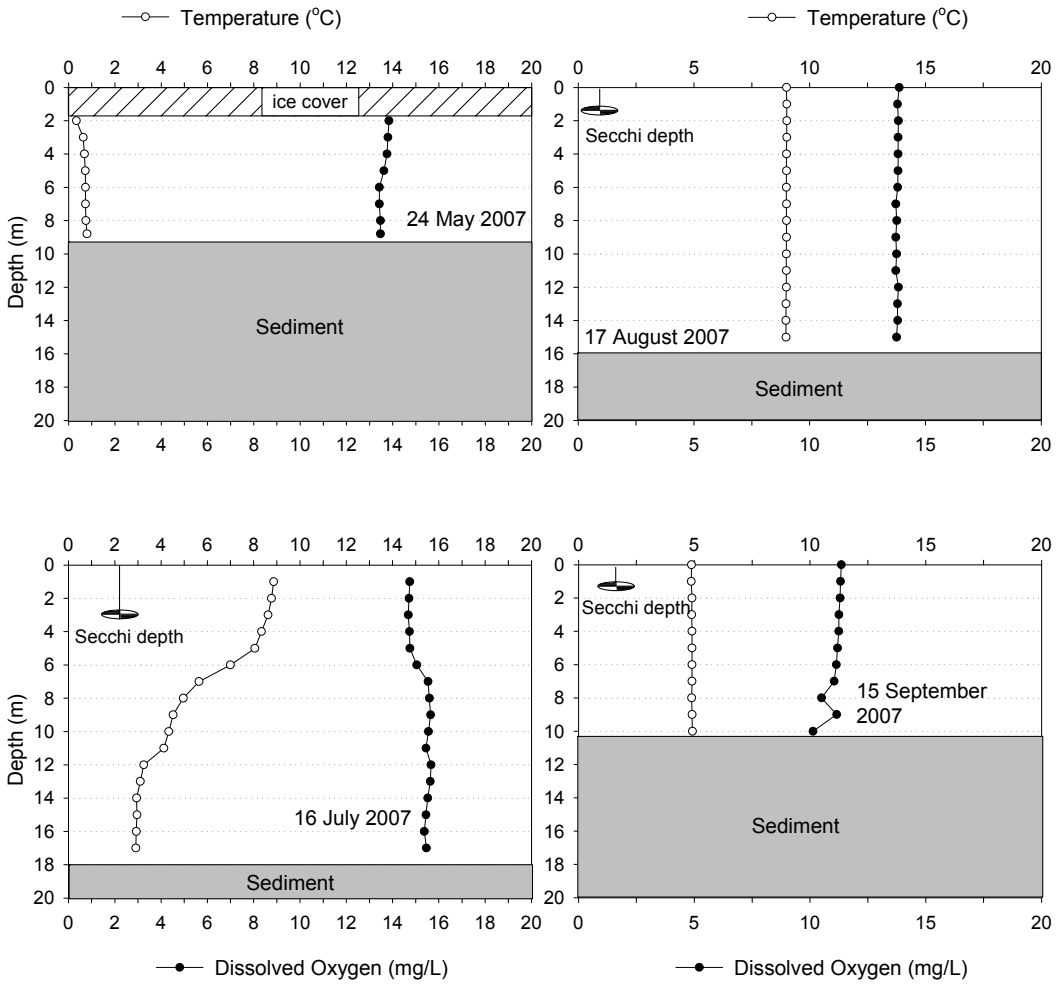


Figure 3.13 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Glenn Lake, 2007

- Baseline total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) for top and bottom samples collected on all three open-water sampling dates in 2007, with concentrations ranging from 112 to 650 µg/L (Appendix B5).
- Background total chromium was above the 1.0 µg/L CWQG for sublethal toxicity of Cr (IV), with a concentration of 1.1 µg/L in the top sample in September 2007.
- Total and dissolved copper concentrations in Glenn Lake were naturally at, or above, the 2 µg/L CWQG in all water quality samples collected in 2007 (Appendix B5). The total copper concentrations ranged from 2.2 to 3.8 µg/L, and the dissolved copper concentrations ranged from 1.9 to 2.8 µg/L.

- Baseline total iron concentrations were above the 300 µg/L CWQG in the surface and bottom samples collected in August and September, with concentrations ranging from 325 to 436 µg/L.
- Baseline total selenium exceeded the 1.0 µg/L CWQG in the surface and bottom samples collected in May (under-ice), July, and August, with concentrations ranging from 1.1 to 2.0 µg/L (Appendix B5). Dissolved selenium concentrations were higher than the CWQG in the surface and bottom sample in May (1.3 and 1.6 µg/L, respectively), and the bottom sample in July (1.5 µg/L).

Total cyanide concentrations were below the MRV (0.001mg/L) in all but the July 2007 top sample (0.002 mg/L) (Appendix B5).

3.3.2.2 Ogama Lake

Ogama Lake is a shallow (approximately 7 m deep) freshwater lake. It is characterized by soft water, typically with a low sensitivity to acidification (Saffran and Trew 1996; Weiner 2000).

Field measured pH was slightly acidic to alkaline (6.5 to 8.3) and within the CWQG range of pH 6.5 to 9.0 (CCME 2007a). The acidic pH was associated with the under-ice conditions in June 2006.

Ogama Lake had moderate electrical conductivity values during open-water conditions, which ranged from 252 to 298 µS/cm in 2006 and 2007. The under-ice conductivity was considerably greater in the deep sample in June 2006 (701 µS/cm) and May 2007 (602 µS/cm), reflecting the elevated TDS conditions that are often associated with ice-covered lakes. The dominant major ions were sodium and chloride.

Total suspended solids concentrations ranged from 1 to 7 mg/L in 2006 and 2007 (Appendix B5). The corresponding Secchi depth measurements ranged from 0.9 m to 1.7 m in 2006 and 2007 (Figures 3.14 and 3.15). The waters were coloured, ranging between < 1 to 58 TCU, with the highest colour values in 2006 associated with under-ice conditions, and the highest colour values in 2007 associated with late summer/early fall conditions.

During under ice conditions, water column DO concentrations exhibited a negative gradient with depth. DO concentrations during under-ice conditions in June 2006 declined from >12 mg/L in the upper water column to < 0.5 mg/L near the bottom (Figure 3.14). In 2007 the under-ice DO concentrations declined from 5.9 mg/L in the upper water column, which was below the 6.5 mg/L CWQG for

the protection of aquatic life (CCME 2007a), to anoxic conditions at the bottom (Figure 3.15). In July 2006 and 2007, the top 4.5 to 5.0 m of water column was well oxygenated (> 10 mg/L), but DO declined to concentrations just below the 9.5 mg/L CWQG for protection of early life stages of fish (CCME 2007a) below 5.0 m depth (July 2006), and below the 6.5 mg/L CWQG for protection of aquatic life below 6.0 m (July 2007) (Figure 3.15). The DO concentrations remained high and near-uniform throughout the water column in August and September of 2006 and 2007.

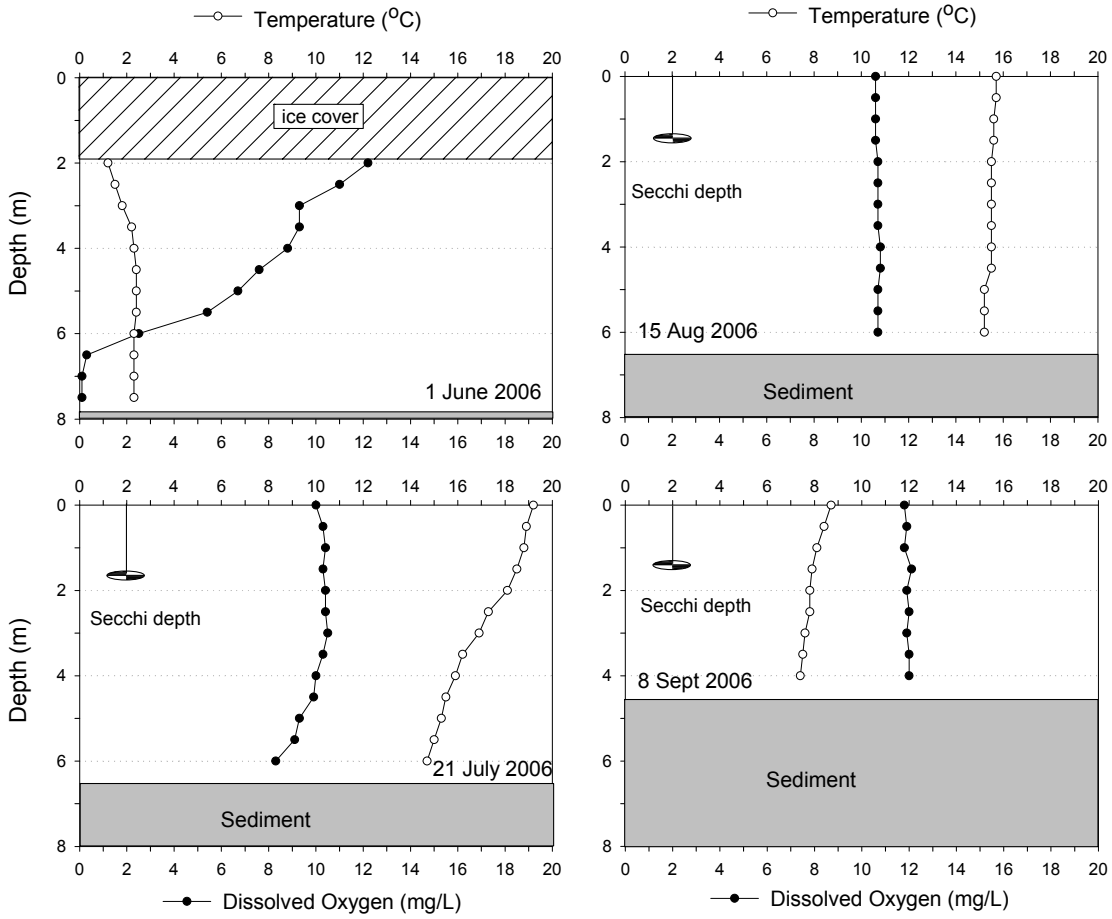


Figure 3.14 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Ogama Lake, 2006

The water column in Ogama Lake was not thermally stratified during any of the sampling events in 2006 (Figure 3.14) or during May, August, and September 2007. Ogama Lake was thermally stratified in July 2007; water temperature dropped from 17.7°C at 2 m to 11.2°C at 3 m depth (Figure 3.15). Typical seasonal temperature trends were observed in the water column, with

warmer water column temperatures in July and August compared to September in 2006 and 2007.

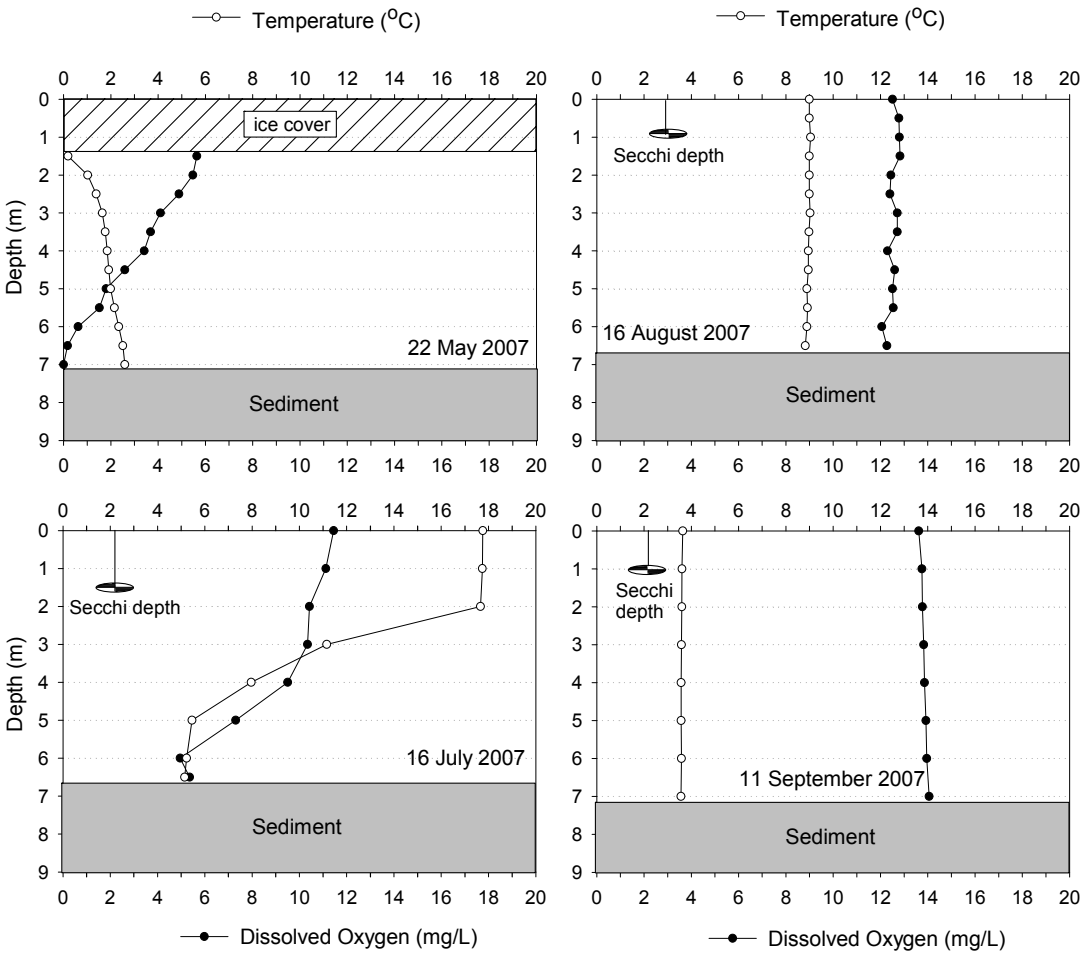


Figure 3.15 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Ogama Lake, 2007

During the 2006 and 2007 sampling periods, the total phosphorus concentrations ranged from 21 to 49 µg/L (Appendix B5). The Chl *a* concentration was 6.8 µg/L in September 2006 and ranged from 3.4 to 5.5 µg/L in 2007. Based on total phosphorus concentrations, Ogama Lake could be classified as meso-eutrophic to eutrophic (Appendix B1) (CCME 2004); however, the range of Chl *a* concentrations indicated an oligotrophic productivity status (Appendix B1) (Mitchell and Prepas 1990).

All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) in both years, and generally represented < 4% of the total

nitrogen concentrations (the TKN ranged from 0.40 to 0.63 mg/L in 2006, and 0.42 to 0.63 mg/L in 2007); however, in the June 2006 bottom sample, dissolved inorganic nitrogen represented 26% of the total nitrogen concetration due to elevated concentrations of ammonia (108 µg N/L) and nitrate (74 µg N/L).

With the exception of baseline total aluminium, copper, iron, and selenium, most total metal concentrations were below the applicable CWQGs (CCME 2007a). The exceptions are as follows:

- Total aluminum concentrations were naturally above the 100 µg/L CWQG for total aluminum (for pH ≥ 6.5) on all sampling occasions in top and bottom samples in 2006 and 2007 with one exception, with concentrations above the CWQG ranging from 117 to 495 µg/L (Appendix B5). The one exception was an aluminum concentration of 63.4 in the top sample collected under ice on 22 May 2007.
- Baseline total copper concentrations were above the 2 µg/L CWQG in June 2006 (top and bottom), and May (top), August (bottom), and September (bottom) 2007, with concentrations ranging from 2.2 to 3.0 µg/L (Appendix B5). In the majority of these cases, the dissolved copper concetrations were also above CWQGs, ranging from 2.0 to 2.6 µg/L.
- Background total iron concentrations were above the 300 µg/L CWQG in the June 2006 (top and bottom), and July (top) and August 2007 (bottom), with concentrations ranging from 319 to 823 µg/L (Appendix B5). The dissolved iron concentration in June 2006 was also above the CWQG (320 µg/L).
- Baseline total selenium concentrations were at, or above, the 1.0 µg/L CWQG in top and bottom samples on June, August, and September 2006, and May, August and September (bottom only) 2007, ranging from from 1.0 to 3.6 µg/L (Appendix B5). In the majority of these cases, the dissolved selenium concentrations were also above CWQGs, ranging from 1.0 to 3.3 µg/L.

Total cyanide concentrations were generally below the MRV (0.001 mg/L); however, values at or higher than the MRV were measured in June 2006 (0.001 and 0.002 mg/L for top and bottom samples, respectively), August 2006 (0.001 mg/L for top and bottom samples), September 2006 (0.001 mg/L for the top sample), and in May 2007 (0.001 mg/L) and August 2007 (0.002 mg/L for the bottom sample (Appendix B5).

3.3.2.3 Patch Lake

Patch Lake is a moderately deep (approximately 16 m) freshwater lake. It is characterized by soft water, with a low sensitivity to acidification (Saffran and Trew 1996; Weiner 2000).

Field pH measurements were slightly acidic to alkaline (6.8 to 8.1) and within the CWQG of pH 6.5 to 9.0 (CCME 2007a) on all sampling occasions in 2006 and 2007. Patch Lake exhibited moderate conductivity, ranging from 325 to 458 µS/cm in 2006, and 336 to 531 µS/cm in 2007. The major ions were dominated by sodium and chloride (Appendix B5).

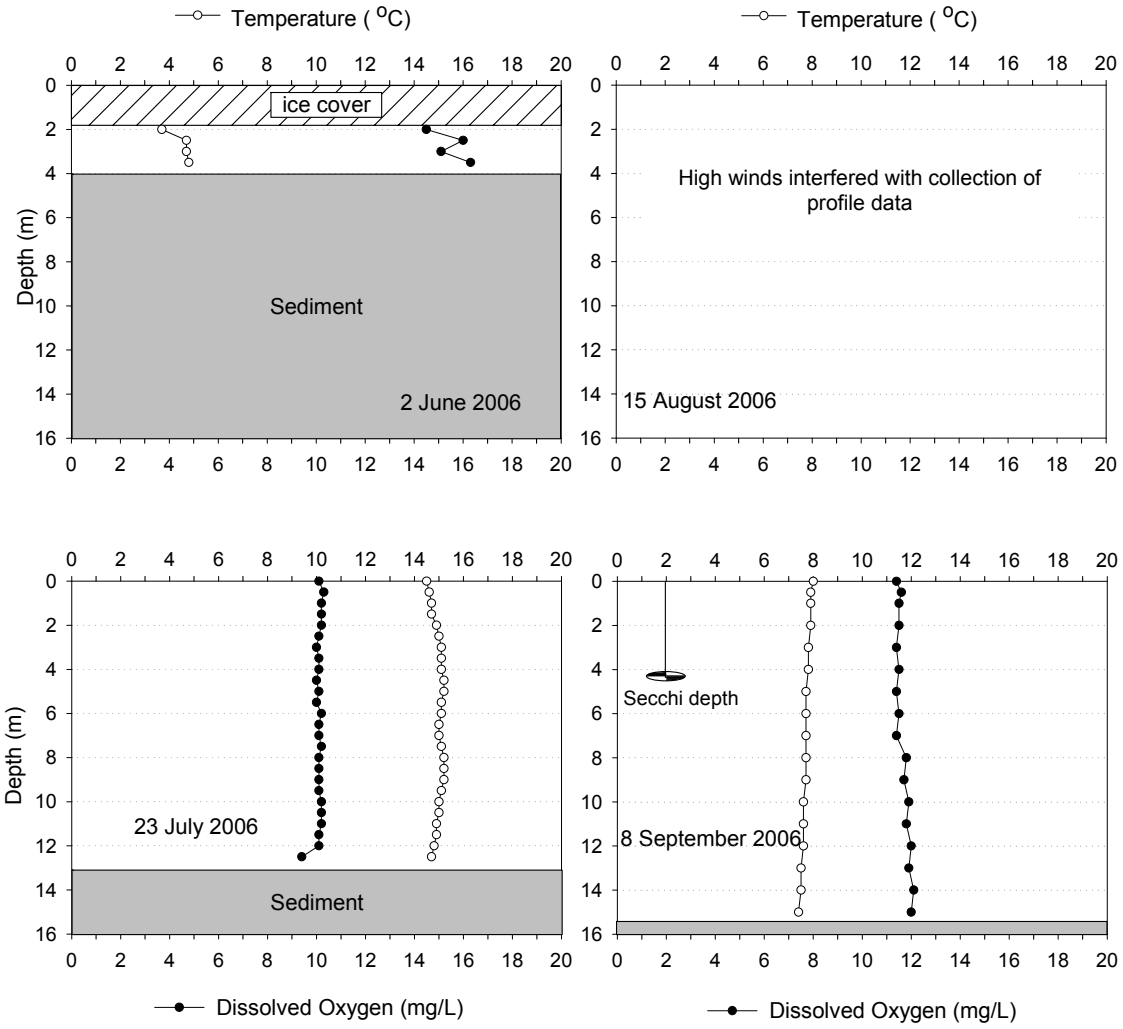


Figure 3.16 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Patch Lake, 2006

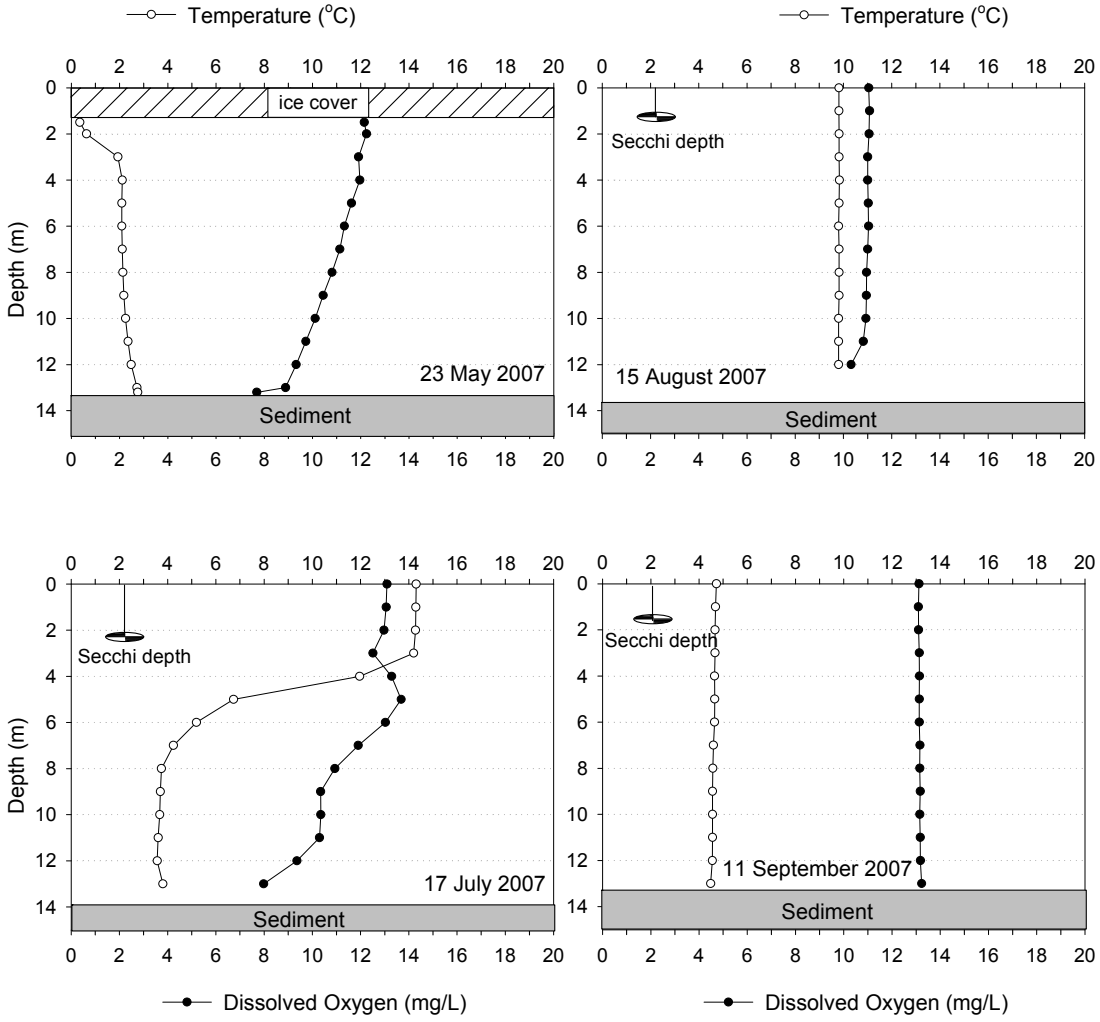


Figure 3.17 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Patch Lake, 2007

Patch Lake was relatively clear, with TSS concentrations typically around 1 µg/L in 2006, and ranging from < 1 to 4 mg/L in 2007. The Secchi depth in September 2006 was 4.25 m (it was recorded only once in 2006) (Figure 3.16), and ranged from 1.25 to 2.2 m in 2007 (Figure 3.17). The waters were slightly coloured ranging from < 1 to 8 TCU (Appendix B5).

Patch Lake was well oxygenated throughout 2006 and 2007, and remained above the CWQG of 9.5 mg/L (CCME 2007a) even during under-ice conditions (however, the June 2006 sampling station was not consistent with the location used for the other seven sampling dates in 2006 and 2007) (Figures 3.16 and 3.17). In July 2007, the DO was weakly stratified around 5 m depth, declining from 13.7 to 8 mg/L at 13 m. Occassionaly the bottom DO readings fell

below the 9.5 mg/L CWQG for protection of early life stages of fish (July 2006 and May 2007) (Figure 3.16).

Thermal stratification was not generally evident thoughout the sampling in 2006 and 2007, with the exception of July 2007. A pronounced thermocline was observed at 4 m depth, when the water temperature declined from 12.0°C (at 4.0 m) to 6.7°C (at 5.0 m; Figure 3.17). The lower water column maintained a temperature of 4°C from 8 to 13 m. As expected, during under-ice conditions, a colder upper water layer was obvious down to 3 m depth.

Baseline total phosphorus concentrations ranged from 9 to 23 µg/L in 2006, and from 4 to 12 µg/L in 2007, with one elevated TP concentration measured in August 2007 (60 µg/L, bottom sample). The Chl *a* concentrations were consistently low in 2006 and 2007, and ranged from 0.6 to 1.0 µg/L (Appendix B5). The typical total phosphorus concentrations indicated that Patch Lake could be classified as oligo-mesotrophic (Appendix B1) (CCME 2004). The low Chl *a* concentrations indicated that the phytoplankton productivity in this lake was very low, typical of an oligotrophic system (Appendix B1) (Mitchell and Prepas 1990).

All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) in 2006 and 2007, and generally represented < 11% of the total nitrogen concentration. The TKN ranged from 0.18 to 0.31 mg/L in 2006, and 0.18 to 0.29 mg/L in 2007.

Most baseline total metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of total aluminum, copper, mercury, and selenium. These exceptions are as follows:

- Baseline total aluminum concentrations were higher than the 100 µg/L CWQG (for pH ≥ 6.5) in the July 2006 (top sample), and August and September 2007 top and bottom samples, with concentrations ranging from 138 to 351 µg/L (Appendix B5).

- Baseline total copper concentrations were above the 2.0 µg/L CWQG in June 2006 bottom, and August 2007 top and bottom samples, ranging from 2.2 and 3.8 µg/L (Appendix B5). The dissolved copper concentration in the August 2007 bottom sample was also above the CWQG (2.2 µg/L).
- The background total mercury concentration was above the 26 ng/L CWQG in the August 2006 top water sample (44 ng/L) (Appendix B5).
- Total selenium concentrations were above the 1.0 µg/L CWQG in most 2006 and 2007 samples (ranging from 1.2 to 2.1 µg/L), with the

exception of July 2006 and September 2007. (Appendix B5). In many of these cases, the dissolved selenium concentrations were also higher than the CWQGs.

Total cyanide concentrations were generally below the MRV (0.001 mg/L); however, values at or higher than the MRV were measured in June 2006 (0.001 mg/L), August 2006 (0.002 and 0.001 mg/L for top and bottom samples, respectively), and September 2006 (0.001 mg/L for the top sample) (Appendix B5).

3.3.2.4 Pelvic Lake

Pelvic Lake is a deep (approximately 16 m deep) freshwater lake. Its background conditions are characterized by soft water, with a moderate to low sensitivity to acidification (Saffran and Trew 1996; Weiner 2000).

The pH was slightly acidic to alkaline (6.5 to 8.6) in 2006 and 2007 and within the CWQG range of pH 6.5 to 9.0 (CCME 2007a). In 2006, the lake was slightly acidic during under-ice conditions, and alkaline during open water conditions. In 2007, the field pH of ranged from 6.7 to 7.7. Electrical conductivity was consistent in 2006 and 2007, ranging from 226 to 360 µS/cm. The major ions were dominated by sodium and chloride (Appendix B5).

Total suspended solids ranged from 1 to 11 mg/L in 2006 and 2007. The corresponding Secchi depths were shallow, varying between 0.8 and 1.1 m in both years (Figures 3.18 and 3.19) The waters were coloured ranging from < 1 to 49 TCU, with the highest values measured during under-ice and snow melt conditions (Appendix B5).

Oxic stratification or oxic gradients through the water column were evident during under-ice or early summer conditions in 2006 and 2007. In June 2006 (under-ice), Pelvic Lake was well oxygenated down to 10.5 m, below which DO declined to < 1.0 mg/L at the bottom (Figure 3.18). In May 2007 (under-ice), the top 1.0 m of water was well oxygenated but gradually declined to anoxic conditions at the bottom of the water column (Figure 3.19). A similar gradient was evident in July 2007. Pelvic Lake remained well oxygenated throughout the water column during open-water conditions in 2006, and August and September 2007. In July 2006, only the bottom of the water column was slightly below the 9.5 mg/L CWQG for protection of early life stages of fish (9.2 mg/L; Figure 3.18) (CCME 2007a).

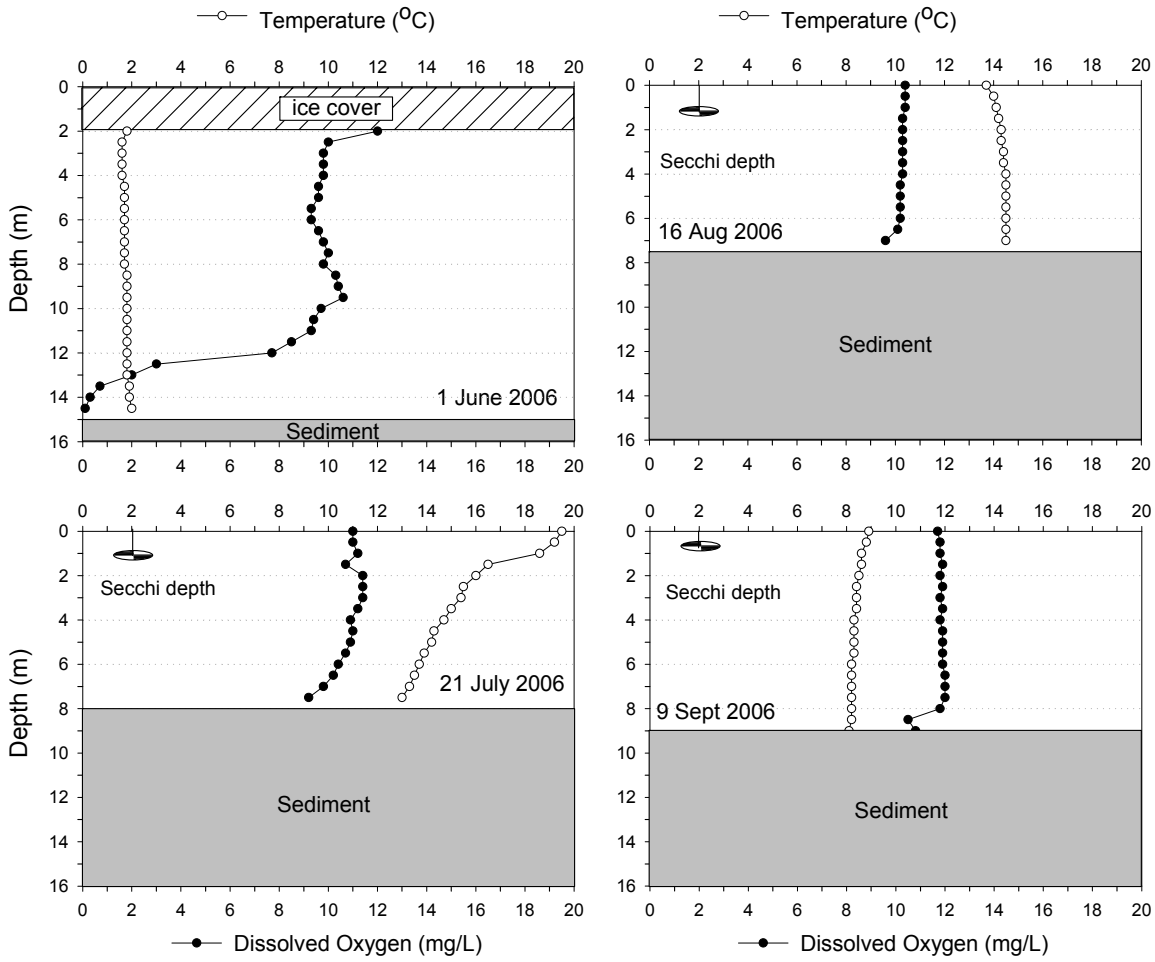


Figure 3.18 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Pelvic Lake, 2006

Thermal stratification was evident in July 2006 and July 2007. In July 2006, a 2°C decline was present from 1.0 to 1.5 m (Figure 3.18). Above the thermocline, the water temperature reached 19.5°C, which was the warmest temperature recorded for all Boston and Madrid Project area stations in 2006. In July 2007, the temperature declined from 16.8°C at the surface of the water column to 6.4°C at 4.0 m depth (Figure 3.19). Temperature profiles were isothermal in August and September of 2006 and 2007 (Figures 3.18 and 3.19). Typical seasonal trends were evident with the warmer surface temperatures prevalent in July (Figures 3.18 and 3.19).

Total phosphorus concentrations in Pelvic Lake ranged from 34 to 62 µg/L in 2006 and from 27 to 62 µg/L in 2007, with the exception of 128 µg/L in the July 2007 bottom sample. The Chl *a* concentration in September 2006 was 19.1 µg/L,

and the concentration range in 2007 was 6.5 to 14.4 µg/L. The total phosphorus concentrations indicated that Pelvic Lake could be classified with a meso-eutrophic to eutrophic status (Appendix B1) (CCME 2004). The range of Chl *a* concentrations indicated that phytoplankton productivity was high, consistent with a mesotrophic classification (Appendix B1) (Mitchell and Prepas 1990).

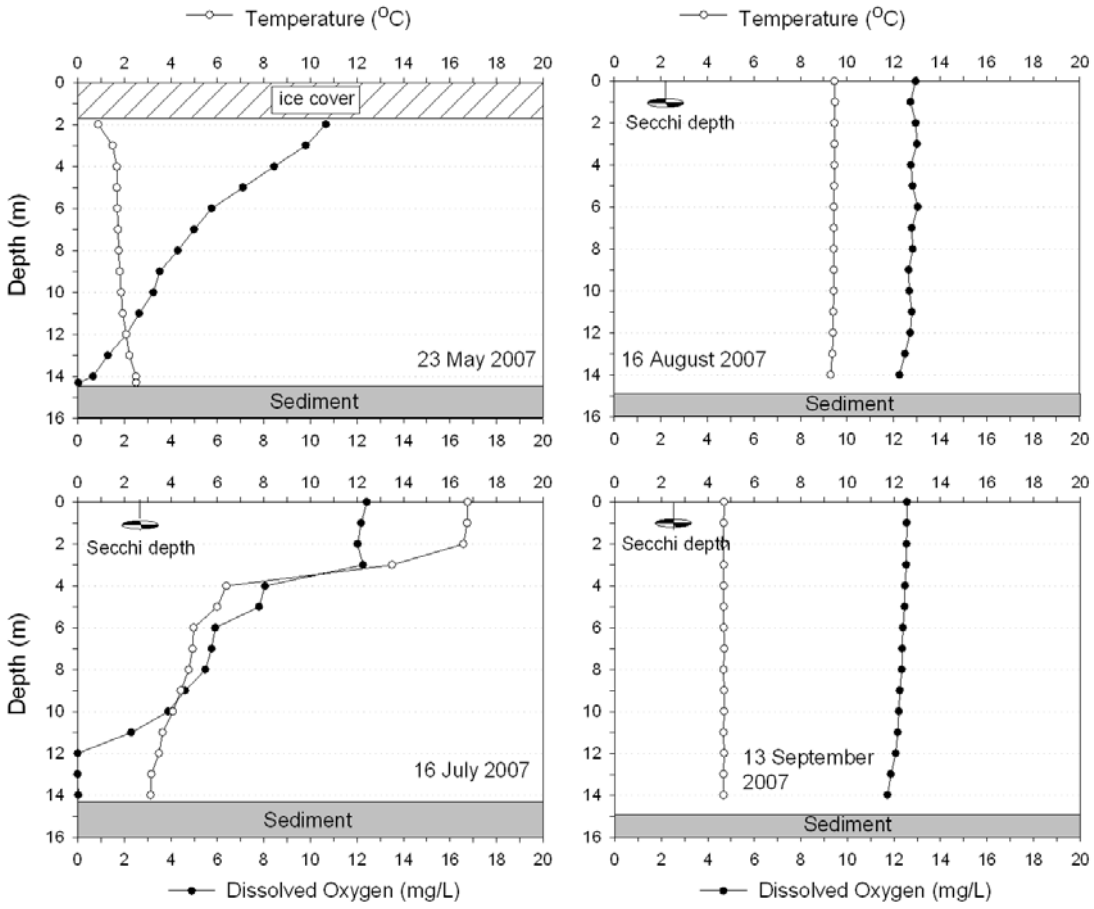


Figure 3.19 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Pelvic Lake, 2007

All of the dissolved inorganic forms of nitrogen (ammonia, nitrate, and nitrite) were well below the CWQGs (CCME 2007a) in 2006 and 2007, and generally represented < 5% of the total nitrogen concentration during open water conditions. A substantially higher proportion of dissolved inorganic nitrogen was evident during under-ice conditions, particularly in the deeper, anoxic regions of the water column, with the dissolved inorganic nitrogen representing 45 to 58% of the total nitrogen concentration (Appendix B5). The TKN ranged from 0.52 to 0.84 mg/L in 2006, and 0.49 to 1.05 mg/L in 2007.

Baseline total metal concentrations were below the applicable CWQGs (CCME 2007a) for most metals, with the exception of total aluminum, copper, iron, and selenium. The exceptions are as follows:

- Baseline total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) in September 2006 and in open water conditions in 2007. The elevated concentrations ranged from 103 to 262 µg/L.
- Total copper concentrations were higher than the 2 µg/L CWQG during under-ice conditions in June 2006, and in the bottom samples collected in July and September 2006, and August 2007. The range of elevated concentrations was 2.3 to 3.0 µg/L (Appendix B5). The dissolved copper concentration in the August 2007 bottom sample was also above the CWQG (2.9 µg/L).
- Background total iron concentrations were above the 300 µg/L CWQG during under-ice conditions in June 2006 and May 2007 (under-ice), and in July and August 2007, with elevated concentrations ranging fron 407 to 2 760 µg/L. The highest iron concentrations were associated with low DO or anoxic conditions in the lower region of the water column, with the dissolved iron concentrations in May and July 2007 samples also higher than guideline concentrations (May: 515 µg/L; July: 1670 µg/L) (Appendix B5).
- Total selenium concentrations exceeded the 1.0 µg/L CWQG throughout 2006, with the exception of the July sampling event, and in the May and July 2007 samples. The elevated concentrations ranged from 1.1 to 2.1 µg/L (Appendix B5).

Total cyanide concentrations were measured at, or below, the MRV (0.001 mg/L) in top and bottom samples collected throughout 2006, and 2007, with the exception of the May 2007 top sample that had a concentration of 0.0002 mg/L (Appendix B5).

3.3.2.5 P.O. Lake

P.O Lake is a shallow (approximately 3 m deep) freshwater lake situated between Patch and Ogama lakes. Its background condition is characterized by soft water, with a low acid sensitivity (Saffran and Trew 1996; Weiner 2000). Sampling was limited to open water conditions in 2006 and 2007.

The pH was slightly alkaline (7.4 to 8.3) in 2006 and neutral to slightly alkaline (7.0 to 7.4) in 2007 and within the CWQG range of pH 6.5 to 9.0 (CCME 2007a).

The range of electrical conductivity values was relatively consistent in 2006 and 2007 (306 to 350 µS/cm in 2006, and 322 to 356 µS/cm in 2007). The major ions were dominated by sodium and chloride (Appendix B5).

The TSS concentrations in P.O. Lake ranged from < 1 to 4 mg/L in 2006 and 2007. The corresponding Secchi depths ranged from 2.2 to 2.5 m in 2006 (Figure 3.20) and from 1.0 to 2.0 m in 2007 (Figure 3.21). The waters were slightly coloured, ranging from < 1 to 13 TCU, with the highest value measured in September 2007 (Appendix B5).

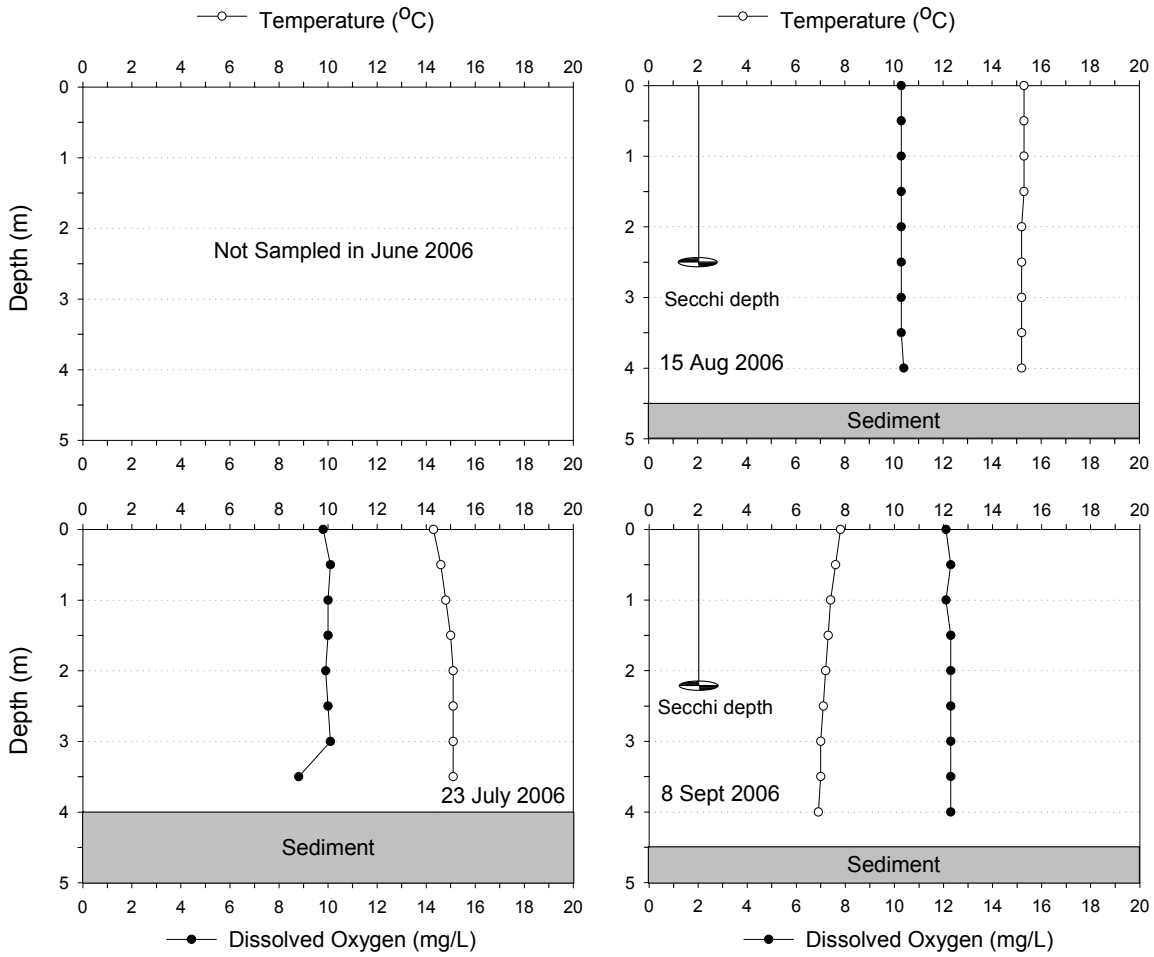


Figure 3.20 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for P.O. Lake, 2006

DO profiles in both 2006 and 2007 showed that during open water conditions P.O. Lake was well oxygenated and near uniform throughout the water column (Figures 3.20 and 3.21). DO was above the 9.5 mg/L CWQG for protection of early life stages of fish (CCME 2007a) in all but one measurement (8.8 mg/L), taken at lake bottom in July 2006 (Figure 3.20). Variation in maximum depth

between sampling dates is likely due to sampling at a different location due to the error associated with using GPS devices.

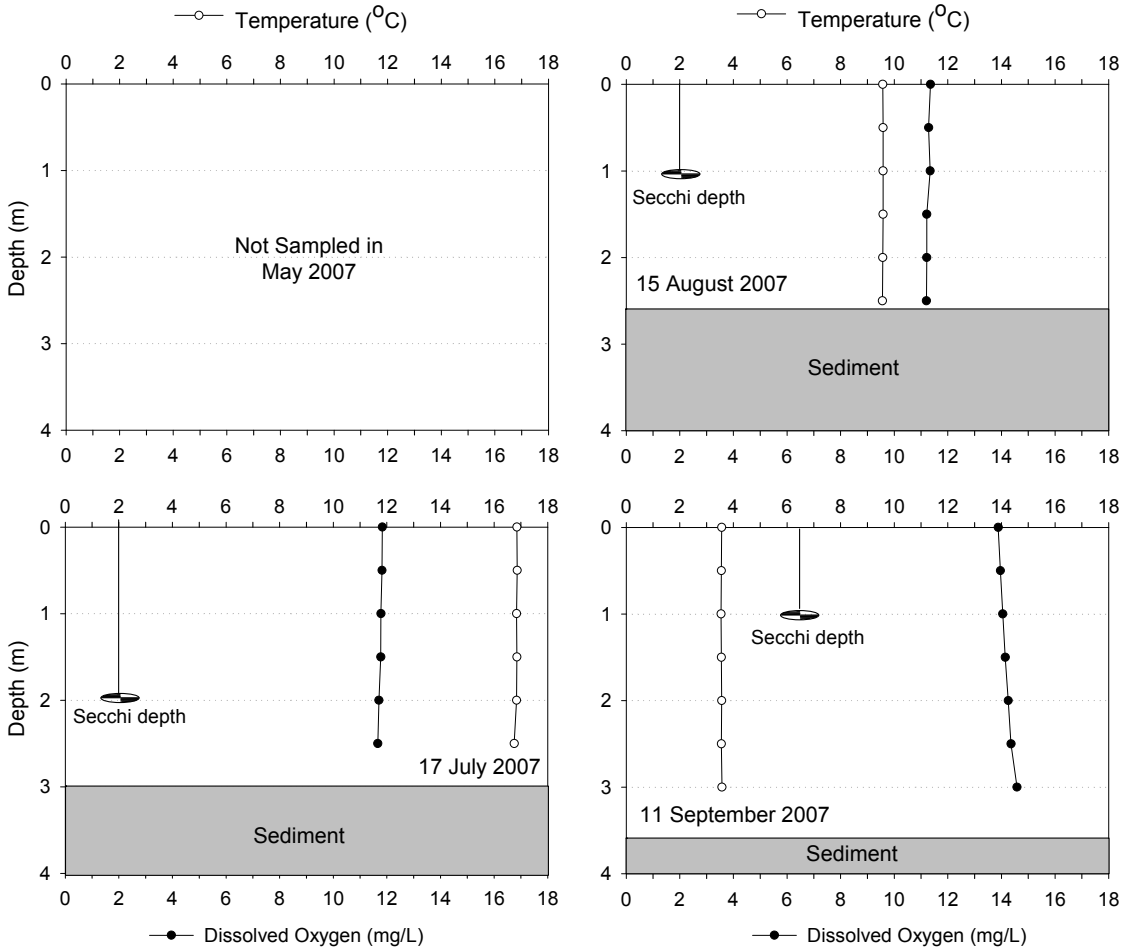


Figure 3.21 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for P.O. Lake, 2007

The water column was isothermic during all sampling events in 2006 and 2007 and showed typical seasonal trends with warmer temperatures prevalent in July and August (Figures 3.20 and 3.21).

TP concentrations in P.O. Lake ranged from 8 to 20 µg/L in 2006, and 10 to 14 µg/L in 2007. An anomalously high TP concentration was measured in September (188 µg/L), which is most likely attributed to analytical error or sample contamination. In September 2006, the Chl *a* concentration was 1.3 µg/L and in 2007, it ranged from 1.2 to 2.5 µg/L (Appendix B5). The TP concentrations indicated that P.O. Lake could be classified as mesotrophic (Appendix B1)

(CCME 2004); however, the range of Chl *a* concentrations indicated low phytoplankton productivity, which is typical of an oligotrophic status (Appendix B1) (Mitchell and Prepas 1990).

All of the dissolved inorganic forms of nitrogen (ammonia, nitrate, and nitrite) were well below the CWQGs for both years, and generally represented < 9% of the total nitrogen concentration during open water conditions. The TKN ranged from 0.19 to 0.35 mg/L in 2006, and 0.21 to 0.27 mg/L in 2007.

With the exception of baseline total aluminum, selenium, and iron, most metal concentrations were below the CWQGs (CCME 2007a). The exceptions are as follows:

- Baseline total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) in all 2006 and 2007 samples. The concentrations ranged from 106 to 527 µg/L (Appendix B5).
- Total selenium concentrations were above the 1.0 µg/L CWQG in August 2006, September 2006, and all 2007 samples, with elevated concentrations ranging from 1.2 to 2.2 g/L (Appendix B5). Dissolved selenium concentrations in August and September 2006, and July 2007 were also above guidelines (concentrations ranging from 1.0 to 1.2 µg/L).
- The total iron concentration measured in September 2007 (314 µg/L) was above the 300 µg/L CWQG.

Total cyanide concentrations ranged from below the MRV (0.001 mg/L) to 0.002 mg/L (August) in 2006. The total cyanide concentrations in 2007 samples were below an the 0.001 mg/L MRV (Appendix B5).

3.3.2.6 Windy Lake

Windy Lake is a clear, deep (approximately 18 m deep) freshwater lake. The background condition is characterized by soft water, with a negligible sensitivity to acidification (Saffran and Trew 1996; Weiner 2000).

The field pH ranged from slightly acidic to alkaline (6.4 to 8.2) in 2006 and 2007, with most of measured pH values within the CWQG range of pH 6.5 to 9.0 (Appendix B5) (CCME 2007a). A surface and bottom pH measurement (6.4) in Augsut 2007 was slightly below the lower limit of the CWQGs.

The range of electrical conductivity measurements were consistent in 2006 and 2007, ranging from 416 to 508 µS/cm. The close proximity of Windy Lake to

Hope Bay and the marine origin of the sediments in which the lake is situated account for the higher conductivity of Windy Lake. The major ions were dominated by sodium and chloride (Appendix B5).

Windy Lake was generally very clear, with TSS concentrations ranging from < 1 to 1 mg/L in all but one sample during 2006 and 2007. The surface sample collected in September 2007 had a TSS concentration of 5 mg/L; however, the bottom sample had only 1 mg/L TSS. The high degree of clarity in Windy Lake was evident in the deep Secchi depths; the maximum Secchi depth in 2006 was 6.3 m recorded in September (Figure 3.22), and in 2007, a maximum Secchi depth of 4.9 m was recorded in July (Figure 3.23). The waters were slightly coloured ranging from <1 to 11 TCU, with the highest value measured in July 2006 (Appendix B5).

The turquoise colour feature of Windy Lake, which is unique within the lakes of the Hope Bay region, is considered due to a combination of very low suspended sediment concentrations, low dissolved organic carbon, and the backscattering of light from calcium carbonate floc (consistently higher concentrations than other Boston and Madrid Project lakes) suspended in the water.

Windy Lake was well oxygenated throughout the water column in 2006 (Figure 3.22) and 2007 (Figure 3.23). The DO profile readings were above the 9.5 mg/L CWQG for protection of early life stages of fish (CCME 2007a), with the exception of below a distinct oxycline at 14.5 m depth in June 2006, where the near-bottom concentration dropped to 3.5 mg/L at 17.5 m depth. A more gradual reduction of DO with depth was evident in May 2007 (Figure 3.23), with the oxygen concentration in the bottom region of the water column reduced to 8 mg/L. Slight DO aberrations were evident in July 2006 and 2007, with DO discontinuities below the thermocline at 12 m depth in July 2006, and a positive oxycline with depth resulting in a DO increase from 14 to 16 mg/L at 7 m depth in July 2007.

Slight thermal stratification was present in July 2006; the thermocline was at 12 to 13 m where the temperature dropped from 11.0 to 9.5°C (Figure 3.22). Windy Lake was not thermally stratified on the remaining 2006 sampling dates, or on any of the 2007 sampling dates (Figures 3.22 and 3.23). Typical seasonal trends were evident with warmer temperatures prevalent in July and August.

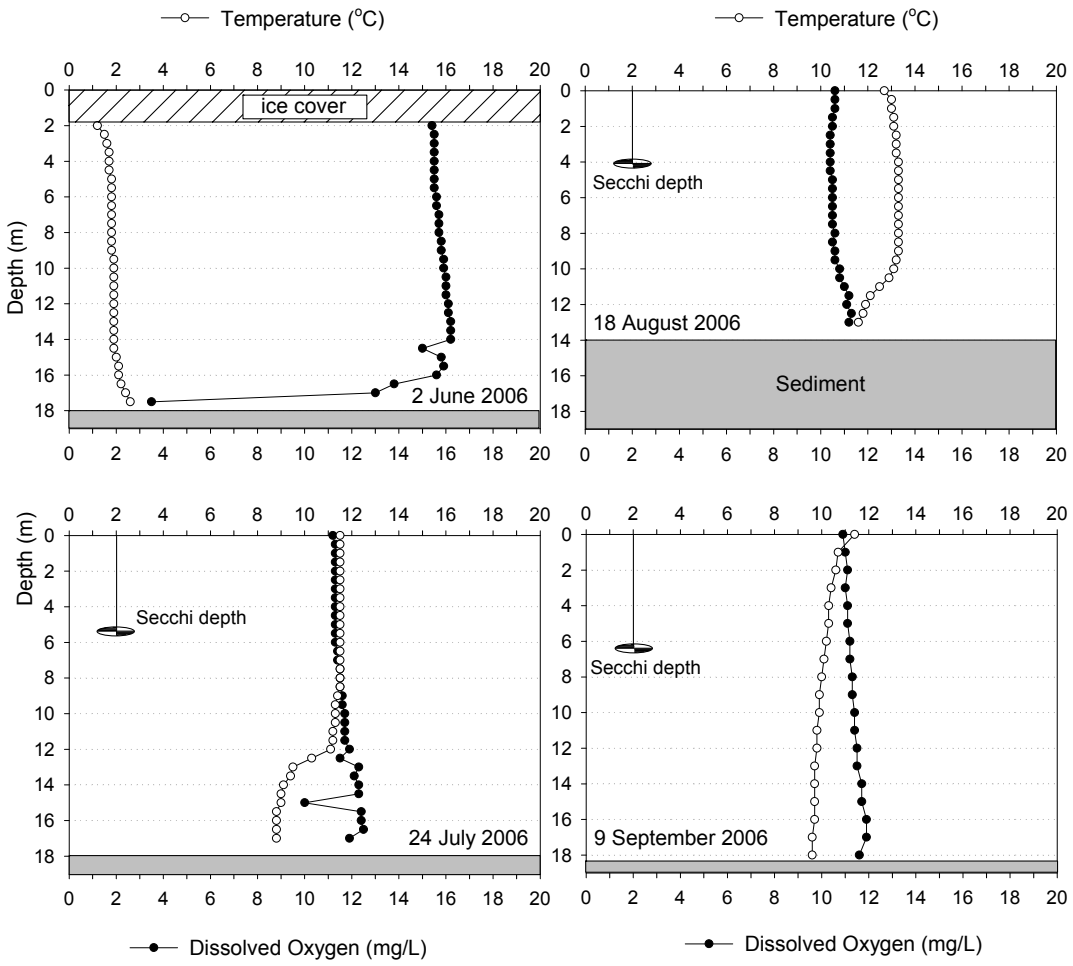


Figure 3.22 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Windy Lake, 2006

TP ranged from 6 to 22 µg/L in 2006 and from 3 to 7 µg/L in 2007, with the 2007 range of TP concentrations being the lowest compared to other lakes in the Boston and Madrid Project areas. Based on the TP concentrations, Windy Lake would be classified conservatively as a mesotrophic system in 2006, but oligotrophic in 2007 (Appendis B1) (CCME 2004). The Chl *a* concentration ranged from 0.3 to 1.1 µg/L in the 2006 to 2007 sampling program (Appendix B5). The low concentrations of Chl *a* indicated that the phytoplankton productivity was typical of an oligotrophic system (Appendix B1) (Mitchell and Prepas 1990).

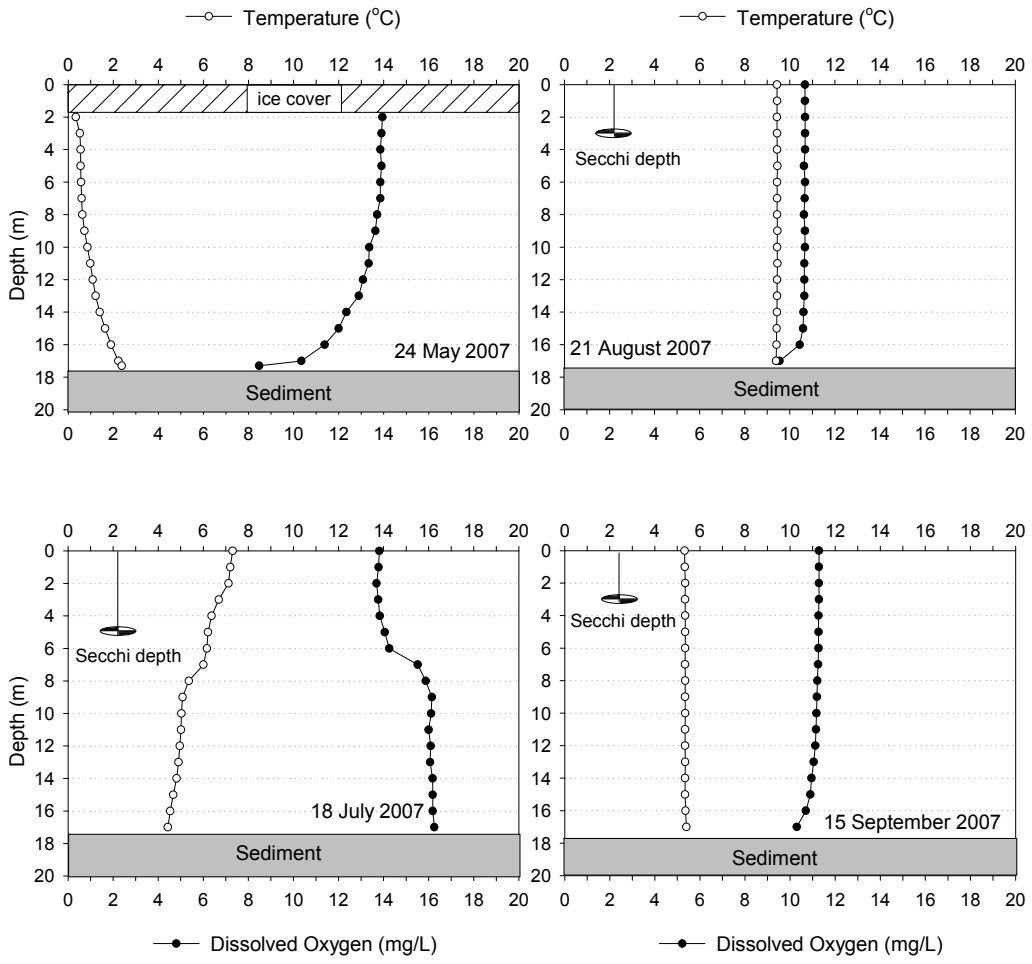


Figure 3.23 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Windy Lake, 2007

All of the dissolved inorganic forms of nitrogen (ammonia, nitrate, and nitrite) were also well below the CWQGs (CCME 2007a) in 2006 and 2007, and generally represented < 10% of the total nitrogen concentration during open water conditions, although elevated ammonia in June and July 2006 resulted in dissolved inorganic nitrogen (ammonia concentrations ranged from 0.018 to 0.025 mg/L) representing approximately 20% of the total nitrogen. The TKN ranged from 0.09 to 0.16 mg/L in 2006, and 0.07 to 0.12 mg/L in 2007, which were low compared to other lakes in the Boston and Madrid Project areas.

Most metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of baseline total aluminum and selenium. These exceptions are as follows:

- Baseline total aluminum was above the 5.0 µg/L CWQG (for pH < 6.5) in August 2007 (top: 89.7 µg/L; bottom: 93.3 µg/L) and the 100 µg/L CWQG (for pH ≥ 6.5) in September 2007 (top: 110 µg/L; bottom: 146 µg/L) (Appendix B5).
- Background total selenium concentrations were above the 1.0 µg/L CWQG in every sample collected from Windy Lake in 2006 and at least one water column sample collected in May, July, and August 2007. The elevated concentrations ranged from 1.1 to 2.3 µg/L (Appendix B5).

Total cyanide concentrations were generally measured at, or below, the MRV (0.001 mg/L) in 2006. The total cyanide concentrations in 2007 samples were reported below the MRV (0.001 mg/L), with the exception of the top sample collected in August 2007 which was measured at 0.001 mg/L (Appendix B5).

3.3.2.7 Wolverine Lake

Wolverine Lake is a shallow (approximately 4.7 m deep) freshwater lake. Its background conditon is characterized by soft water, with a low sensitivity to acidification during open water conditions, and negligible acid sensitivity under ice-covered conditions (Saffran and Trew 1996; Weiner 2000).

In 2006 and 2007, field pH in Wolverine Lake was slightly acidic to slightly alkaline, ranging from pH 6.6 to 8.3, which was within the CWQG range of pH 6.5 to 9.0 (CCME 2007a).

The electrical conductivity of Wolverine Lake ranged from 215 to 375 µS/cm in 2006, and from 340 to 378 µS/cm during the open-water season in 2007. The higher under-ice conductivity observed in 2007 (880 µS/cm) was consistent with elevated TDS concentrations resulting from salt exclusion processes, which occur during under-ice conditions. Sodium and chloride were the dominant ions in Wolverine Lake.

Wolverine Lake waters were clear, with TSS concentrations ranging from < 1 to 2 mg/L in 2006 and 2007. The greatest Secchi depth recorded for Wolverine Lake in 2006 was 3.7 m in July (Figure 3.24), and to the bottom (> 3.4 m) in September 2007 (Figure 3.25). The waters were slightly coloured (1 to 31 TCU), with the highest colour evident during under-ice conditions.

During open water conditions in 2006 and 2007, Wolverine Lake was generally well oxygenated and above the 9.5 mg/L CWQG for protection of early life stages of fish (CCME 2007a) in all but one profile measurement (Figures 3.24

and 3.25). In August 2007, the DO concentration (6.6 mg/L) near the bottom of the lake was below the 9.5 mg/L CWQG for protection of early life stages of fish. During under-ice conditions, DO conditions within the water column were varied, with well oxygenated conditions in May 2006 (11.3 to 14.4 mg/L), but hypoxic DO conditions evident in the 1 m of free water beneath the ice in May 2007 (1.4 to 1.5 mg/L) (Figure 3.25).

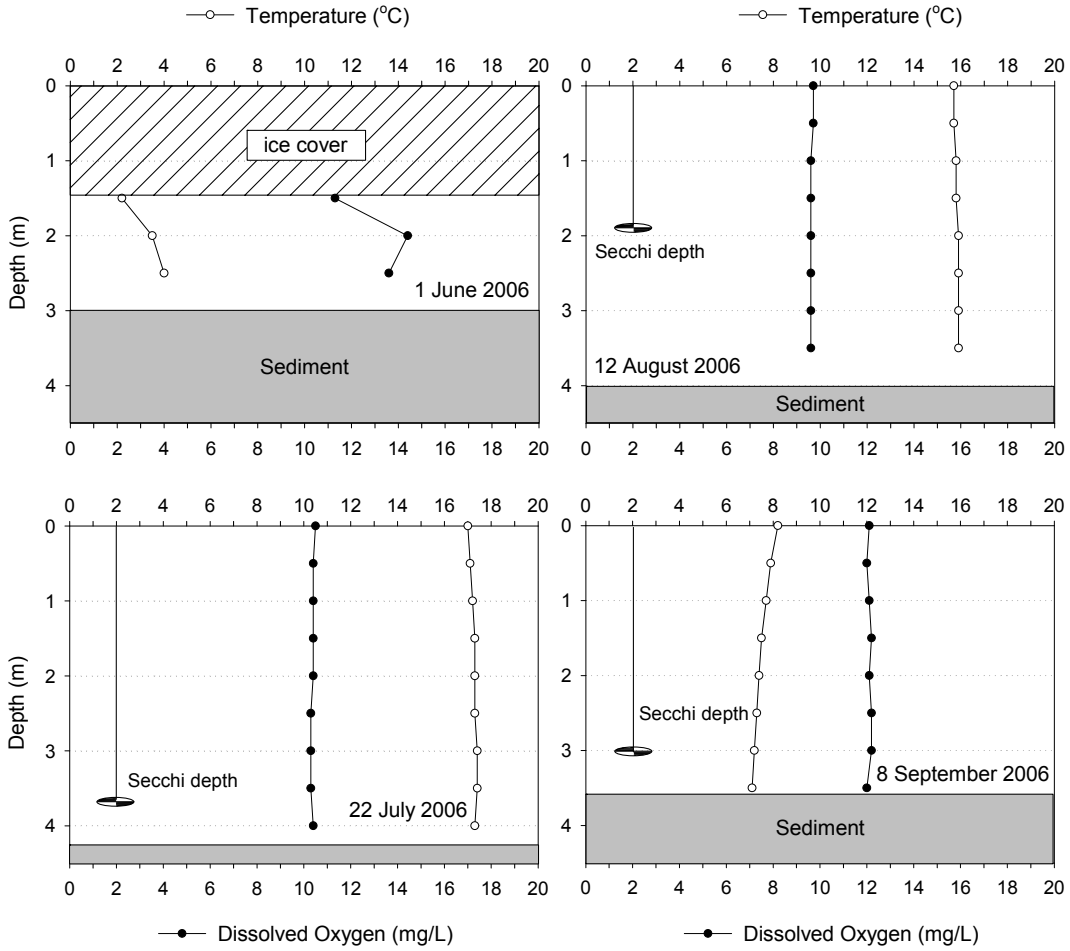


Figure 3.24 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Wolverine Lake, 2006

Wolverine Lake did not thermally stratify in 2006 or 2007, and showed typical seasonal temperature trends (Figures 3.24 and 3.25).

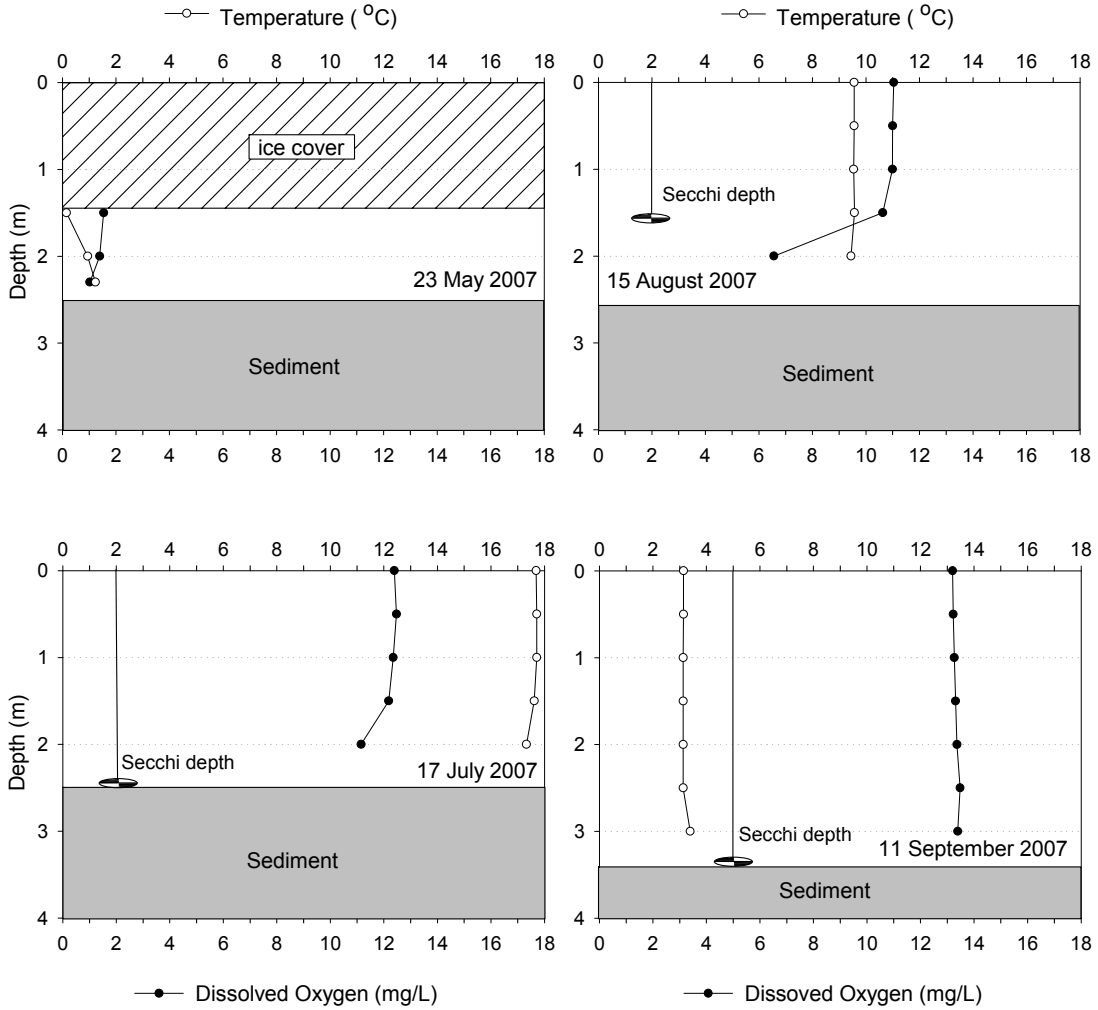


Figure 3.25 Secchi Depths, Temperature, and Dissolved Oxygen Profiles for Wolverine Lake, 2007

TP concentrations generally ranged from 11 to 27 µg/L in 2006 and 2007, with the exception of an elevated TP concentration measured in the May 2007 under-ice sample (48 µg/L). The Chl *a* concentration was 4.5 µg/L in September 2006, and ranged from 1.5 to 1.8 µg/L in 2007. The typical TP concentrations indicated that Wolverine Lake would be classified with a mesotrophic to meso-eutrophic status (Appendix B1) (CCME 2004); however, the Chl *a* concentrations indicated an oligotrophic status (Appendix B1) (Mitchell and Prepas 1990).

All of the dissolved inorganic forms of nitrogen (ammonia, nitrate, and nitrite) were also well below the CWQGs (CCME 2007a) in 2006 and 2007, and generally represented < 5% of the total nitrogen concentration, although elevated nitrate (0.19 mg/L) in May 2007, during hypoxic under-ice conditions resulted in dissolved inorganic nitrogen representing approximately 20% of the total

nitrogen. The TKN concentrations ranged from 0.35 to 0.40 mg/L in 2006, and 0.31 to 0.82 mg/L in 2007, which were low compared to most other lakes in the Boston and Madrid Project areas.

Most of the baseline metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of total aluminum, cadmium and selenium. These exceptions are as follows:

- The total aluminum concentration measured in August 2007 (168 µg/L) was above the 100 µg/L CWQG (for pH > 6.5).
- The total cadmium concentration measured in June 2006 (0.016 µg/L) was above the 0.014 µg/L CWQG (adjusted for hardness).
- Baseline total selenium concentrations were higher than or at the 1.0 µg/L CWQG in all samples, with the exception of the June 2006 under-ice sample. The elevated total selenium concentrations ranged from 1.0 to 4.4 µg/L (Appendix B5). The dissolved selenium concentrations in July 2006, and May and July 2007 were also at or above the guideline concentrations (ranging from 1.0 to 3.1 µg/L).

Total cyanide concentrations ranged from below the MRV (0.001 mg/L) to 0.002 mg/L (August) in 2006. The total cyanide concentrations in 2007 samples were reported below the MRV (0.001 mg/L), with the exception of the May 2007 under-ice sample (0.002 mg/L) (Appendix B5).

3.3.2.8 Madrid Project Area Lakes Summary

Background conditions within the Madrid Project area characterized lakes as having fresh, soft water, with low to negligible sensitivity to acidification. Shallow lakes, such as Ogama and Wolverine, showed elevated TDS concentrations, and associated hardness and alkalinity during under-ice conditions, which reduced the sensitivity of these lakes to acidification. Glenn and Windy lakes had a negligible sensitivity to acidification due to generally higher TDS concentrations throughout the monitoring period.

The pH values indicated near neutral to slightly alkaline waters during under-ice and open water conditions. The field pH was measured below the CWQG range on one occasion in the Madrid Project area (Windy Lake: pH 6.4 in August 2007) (CCME 2007a).

The range of conductivity values in the Madrid Project lakes was 153 to 701 µS/cm in 2006 and 2007 (Appendix B5). The proximity of the Madrid Project area to the marine environment and the marine origin of sediments compared to the Boston

Project area would account for the higher conductivity of the Madrid Project area lakes. The major ions were dominated by sodium and chloride.

All lakes were generally clear, with TSS between < 1 and 7 mg/L in 2006 and between < 1 and 11 mg/L in 2007 (Appendix B5). Glenn, Patch, P.O., Windy, and Wolverine lakes had maximum TSS concentrations below 5 mg/L and Secchi depths ranged up to a maximum of 6.3 m. Pelvic Lake was the least transparent lake with TSS concentrations up to 11 mg/L and correspondingly low Secchi depths (1 m or less). The waters were slightly to moderately coloured (< 1 to 58 TCU), with elevated colour associated with a variety of seasonal conditions: during under-ice (e.g., Ogama Lake), snow melt (e.g., Pelvic Lake) and late summer conditions (e.g., Glenn Lake). The least coloured lakes (< 1 to 13 TCU) were Patch, P.O., and Windy lakes.

The water column of all lakes were generally well oxygenated throughout open water conditions, with DO reductions in the deeper water column associated with thermocline development in several lakes in July 2007 (e.g., Glenn, Ogama, Patch, Pelvic, and Windy lakes). During these conditions, and during ice-covered conditions in the shallow lakes, DO concentrations were below the lower CWQG of 6.5 mg/L (CCME 2007a).

Thermal stratification was evident in several lakes during the open water season, particularly in July 2007 (i.e., the shallow Glenn[1], Patch, Ogama and Pelvic lakes, and the deeper Windy Lake). Normal seasonal temperature trends were observed in most lakes, with warmer water column temperatures in late July and August.

With reference to the range of annual TP concentrations in 2006 and 2007, the trophic classification of the Madrid Project area lakes ranged from oligo-mesotrophic (i.e., Glenn, Patch, and Windy lakes) to eutrophic (i.e., Ogama and Pelvic lakes). Based on the range of Chl *a* concentrations, the phytoplankton production based on the Organisation for Economic Co-operation and Development (OECD) productivity classification (Appendix B1) was typical of oligotrophic systems in all but Glenn and Pelvic lakes, which were typical of oligo-mesotrophic and mesotrophic systems, respectively.

Most of the baseline metal concentrations were below applicable CWQGs (CCME 2007a); however, total aluminum, cadmium, chromium, copper, iron, mercury, and selenium were measured above the CWQGs in one or more

[1] Note that although Glenn Lake is considered a deep lake, this sampling event was conducted in a water depth of approximately 18 m. The sharp relief in the lake bottom around this sampling station resulted in a large variance in water depth throughout the 2007 sampling period.

samples in 2006 and 2007 (Tables 3.11 to 3.13). For most metals, the proportion of the dissolved fraction was moderate to high, accounting for 50 to 100% of the total concentrations in the lakes. Cyanide was typically below the MRV, though all but P.O. Lake had at least one sample measured at or slightly above the MRV.

Table 3.11 Summary of Glenn and Ogama Lake Water Samples that Were Above Guidelines for the Protection of Aquatic Life in Freshwater, 2006 – 2007

Station	Strata	Date	TSS	Field pH	Al (Total)	Cr (Total)	Cu (Total)	Iron (Total)	Se (Total)
				CWQG 6.5-9.0	CWQG 100 µg/L for pH≥6.5	CWQG 1.0 µg/L	CWQG 2.0 µg/L	CWQG 300 µg/L	CWQG 1.0 µg/L
Glenn Lake	Top*	24-May-07	2	7.4			***3***		***1.7***
	Bottom*	24-May-07	<1	7.4			***2.9***		***2***
	Top	16-Jul-07	2	7.3	***112***		***2.2***		***1.1***
	Bottom	16-Jul-07	<1	7.3	***125***		***2.8***		***1.9***
	Top	17-Aug-07	3	7.2	***457***		***3.1***	***327***	***1.1***
	Bottom	17-Aug-07	3	7.2	***458***		***2.8***	***325***	***1.2***
	Top	15-Sep-07	4	-	***650***	***1.1***	***3.8***	***436***	
	Bottom	15-Sep-07	2	-	***593***		***3.7***	***391***	
Ogama Lake	Top*	1-Jun-06	3	6.5	***495***		***2.2***	***728***	***1.7***
	Bottom*	1-Jun-06	4	**6.5**	***120***		***3***	***823***	***3.6***
	Top	21-Jul-06	3	7.3	***186***				
	Bottom	21-Jul-06	5	**7.3**	***263***				
	Top	15-Aug-06	4	8.3	***117***				***1.9***
	Bottom	15-Aug-06	3	**8.3**	***139***				***1.7***
	Top	8-Sep-06	4	8	***172***				***1.4***
	Bottom	8-Sep-06	4	**8**	***184***				***1.4***
	Top*	22-May-07	1	7.1			***2.5***		***3.1***
	Top	16-Jul-07	3	7	***200***			***319***	
	Top	16-Aug-07	7	7.1	***336***				
	Bottom	16-Aug-07	7	7	***375***		***2.2***	***320***	
	Top	11-Sep-07	5	7.1	***306***				
	Bottom	11-Sep-07	5	7.1	***305***		***2.6***		

Total suspended solids (TSS) and field pH values are provided to help in interpretation of the values exceeding guidelines.
Values exceeding guidelines are ***italicized and bold***.

* Samples collected under ice.

Prepared by: EJJ Checked by: JM

Table 3.12 Summary of Patch and Pelvic Lake Water Samples that Were Above Guidelines for the Protection of Aquatic Life in Freshwater, 2006 – 2007

Station	Strata	Date	TSS	Field pH	Al (Total)	Cu (Total)	Iron (Total)	Hg (Total)	Se (Total)
				CWQG 6.5-9.0	CWQG 100 µg/L for pH≥6.5	CWQG 2.0 µg/L	CWQG 300 µg/L	CWQG 26 ng/L	CWQG 1.0 µg/L
Patch Lake	Bottom*	2-Jun-06	<1	6.8		***2.2***			***1.8***
	Top	23-Jul-06	2	7.0	***138***				
	Top	15-Aug-06	1	-				***44***	***1.6***
	Bottom	16-Aug-06	<1	-					***1.8***
	Top	8-Sep-06	<1	8.1					***1.3***
	Bottom	8-Sep-06	<1	8.1					***1.8***
	Top*	23-May-07	<1	7.4					***1.9***
	Bottom*	23-May-07	<1	7.4					***2.1***
	Top	17-Jul-07	<1	7.1					***1.4***
	Bottom	17-Jul-07	<1	7.1					***1.6***
	Top	15-Aug-07	3	7.0	***306***	***2.2***			***1.2***
	Bottom	15-Aug-07	4	7.0	***351***	***3.8***			***1.3***
	Top	11-Sep-07	3	-	***195***				
	Bottom	11-Sep-07	2	-	***179***				
Pelvic Lake	Top*	1-Jun-06	3	6.5		***2.7***			***1.5***
	Bottom*	1-Jun-06	1	6.5			***407***		***2.0***
	Top	21-Jul-06	5	8.6					
	Bottom	21-Jul-06	4	8.6		***2.4***			
	Top	16-Aug-06	7	8.2					***1.5***
	Bottom	16-Aug-06	7	8.2					***1.5***
	Top	9-Sep-06	7	8.2	***103***				***1.9***
	Bottom	9-Sep-06	7	6.8	***133***	***2.3***			***1.6***
	Top*	23-May-07	11	7.7					***2.1***
	Bottom*	23-May-07	5	7.7			***1100***		***1.9***
	Top	16-Jul-07	2	6.9	***186***				***1.1***
	Bottom	16-Jul-07	9	6.9	***111***		***2760***		***1.1***
	Top	16-Aug-07	6	6.7	***201***				
	Bottom	16-Aug-07	6	6.7	***178***	***3.0***	***429***		
	Top	13-Sep-07	8	-	***258***				
	Bottom	13-Sep-07	7	-	***262***				

Total suspended solids (TSS) and field pH values are provided to help in interpretation of the values exceeding guidelines.
Values exceeding guidelines are ***italicized and bold***.
* Samples collected under ice.

Prepared by: EJJ Checked by: JM

Table 3.13 Summary of P.O., Windy, and Wolverine Lake Water Samples that Were Above Guidelines for the Protection of Aquatic Life in Freshwater, 2006 – 2007

Station	Strata	Date	TSS	Field pH	Al (Total)		Cd (Total)	Iron (Total)	Se (Total)
				CWQG 6.5-9.0	CWQG 100 µg/L for pH≥6.5	CWQG 5.0 µg/L for pH<6.5	CWQG 0.014[d] µg/L	CWQG 300 µg/L	CWQG 1.0 µg/L
P.O. Lake	Top	23-Jul-06	<1	7.4	***106***				
	Top	15-Aug-06	1	8.3	***115***				***1.5***
	Top	8-Sep-06	<1	8.3	***176***				***2.2***
	Top	17-Jul-07	<1	7.4	***121***				***1.3***
	Top	15-Aug-07	3	7.0	***369***				***1.3***
	Top	11-Sep-07	4	7.1	***527***			***314***	***1.2***
Windy Lake	Top*	2-Jun-06	<1	6.7					***1.7***
	Bottom*	2-Jun-06	<1						***1.6***
	Top	24-Jul-06	1	6.9					***1.1***
	Bottom	24-Jul-06	<1						***1.3***
	Top	18-Aug-06	1	8.2					***1.5***
	Bottom	18-Aug-06	<1						***1.7***
	Top	9-Sep-06	<1	8.1					***2.1***
	Bottom	9-Sep-06	<1						***2.3***
	Top	20-Aug-07	1	***6.4***		***89.7***			***1.1***
	Bottom	20-Aug-07	1	***6.4***		***93.3***			***1.1***
	Bottom	15-Sep-07	1		***146***				
	Top	15-Sep-07	5		***110***				
Wolverine Lake	Bottom*	1-Jun-06	1	6.6			***0.015***		
	Top	22-Jul-06	2	8.1					***1.1***
	Bottom	22-Jul-06	2						***1.3***
	Top	12-Aug-06	<1	7.7					***1.5***
	Top	8-Sep-06	<1	8.3					***1.4***
	Top	23-May-07	2	7.3					***4.4***
	Top	17-Jul-07	<1	7.8					***1.3***
	Top	15-Aug-07	2	6.8	***168***				***1.1***
	Top	11-Sep-07	<1						

Total suspended solids (TSS) and field pH values are provided to help in interpretation of the values exceeding guidelines.

Values exceeding guidelines are ***italicized and bold.***

* Samples collected under ice.

Prepared by: EJJ Checked by: JM

3.4 RESULTS AND DISCUSSION: STREAMS AND RIVERS

The following section provides a discussion of the water quality results in streams within the Boston and Madrid Project areas. Detailed discussions for each stream are provided under respective stream headings and focus on general water quality characteristics, and water quality parameters that have specific guidelines or assessment criteria (e.g., TSS, pH, DO, TP, dissolved inorganic nitrogen [ammonia, nitrate, and nitrite], and trace metals).

All field spot measurements of pH, conductivity, DO, and water temperature are provided in Appendix B3. Laboratory results of water quality analyses for the sampling programs are presented in Appendices B5.

3.4.1 Boston Project Area

3.4.1.1 Aimaokatalok Inflow

Aimaokatalok Inflow is a coloured (15 to 52 TCU), freshwater stream, characterized by naturally soft water with low alkalinity and low conductivity. This stream enters Aimaokatalok Lake from the east.

Field pH was near neutral (7.1 to 7.4) in 2006, but was slightly acidic (6.1 to 6.5) in 2007, which fell below the CWQG range of pH 6.5 to 9.0 in early July (pH 6.3) and September (pH 6.1) (CCME 2007a).

The electrical conductivity was similar in both years, ranging from 64 to 109 µS/cm. Sodium and chloride were the dominant major ions in 2006 (Appendix B5); chloride data were not available for 2007, but similar concentrations of the other ions indicated that chloride concentrations in 2007 would have been consistent with those measured in 2006.

Baseline TSS concentrations in Aimaokatalok Inflow in 2006 and 2007 typically were low (2 to 4 mg/L); however, the exception of an elevated TSS concentration measured in June 2007 (23 mg/L) was likely associated with ice-melt conditions and elevated watershed runoff.

Aimaokatalok Inflow was well oxygenated throughout both sampling seasons during open water conditions, with all DO measurements above the 9.5 mg/L CWQG for protection of early life stages of fish (Appendix B3) (CCME 2007a). Logged temperature data showed typical seasonal trends, with warmest temperatures in mid-July and early August, and the coolest temperatures at the time of logger removal in early September (Figure 3.26).

TP concentrations in Aimaokatalok Inflow ranged from 19 to 60 µg/L in 2006 and from 27 to 40 µg/L in 2007. The TP concentrations in the inflow were high compared to Aimaokatalok Lake, where the maximum concentration was 29 µg/L (Appendix B5). Based on these baseline total phosphorus concentrations, the stream would be classified as mesotrophic to eutrophic (Appendix B1) (CCME 2004).

All of the dissolved inorganic forms of nitrogen (ammonia, nitrite and nitrate) were well below the CWQGs (CCME 2007a) in both 2006 and 2007, and represented

< 10% of total nitrogen concentration (the TKN ranged from 0.40 to 0.71 mg/L in 2006, and 0.48 to 1.34 mg/L in 2007).

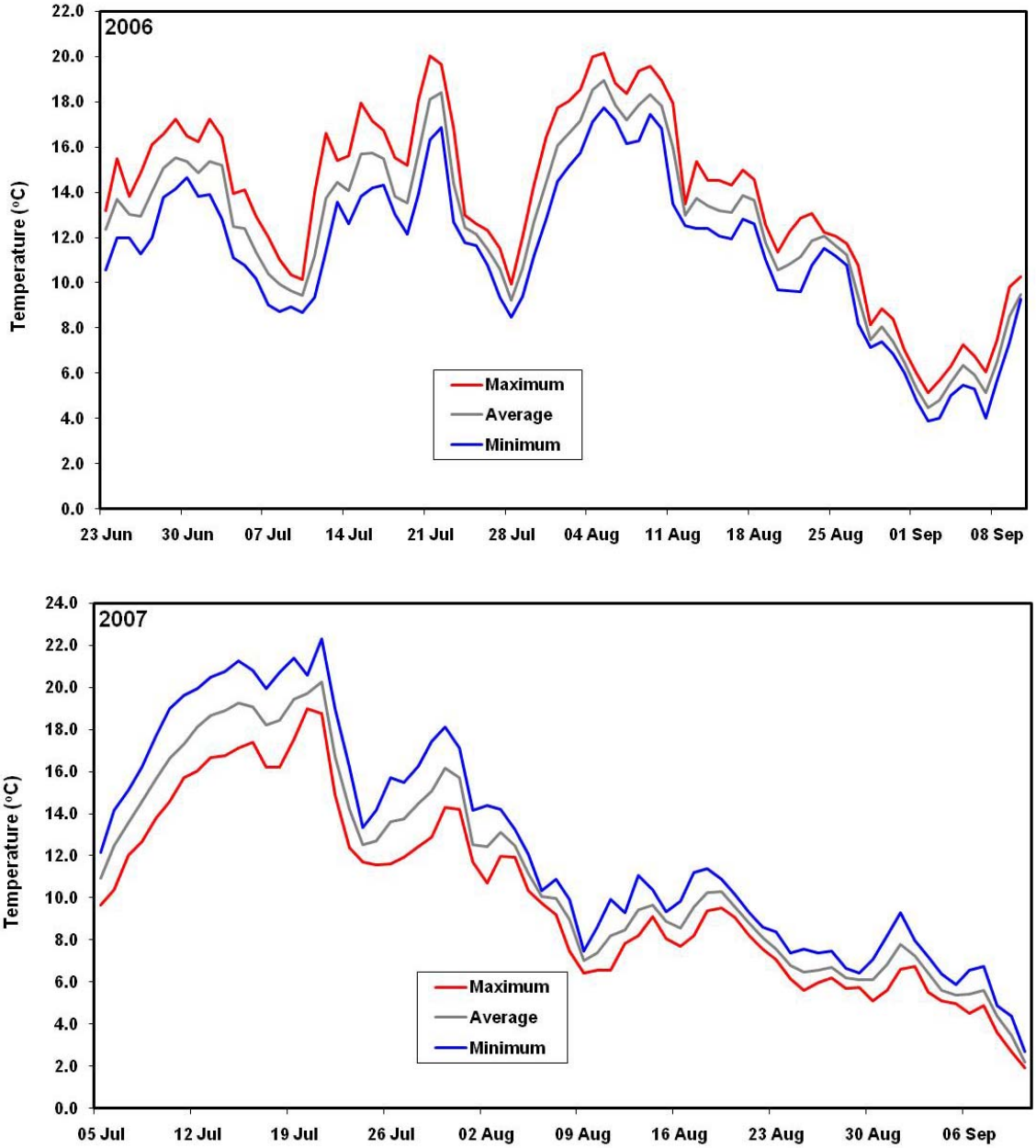


Figure 3.26 Aimaokatalok Inflow Daily Temperature: Maximum, Minimum, and Average, 2006 and 2007

With the exception of total aluminum, cadmium, chromium, and iron, baseline metal concentrations were below the applicable CWQGs (CCME 2007a). The exceptions are as follows:

- Baseline total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) on five of the eight sampling dates. The elevated values ranged from 120 to 728 µg/L (Appendix B5). The September 2007 sample (144 µg/L) was above the CWQG of 5.0 µg/L (for pH < 6.5).
- Background total cadmium concentrations were above the hardness adjusted CWQG in July 2006 (0.010 µg/L) and June 2007 (0.007 µg/L).
- Baseline total chromium was above the 1.0 µg/L CWQG for sublethal toxicity of Cr (VI) in June 2007 (1.4 µg/L).
- Total iron was higher than the 300 µg/L CWQG in all samples collected in 2006 and 2007, ranging from 329 to 1020 µg/L (Appendix B5). This was in contrast to the other Aimaokatalok sampling stations (i.e., the lake stations, outflow, and river) where total iron concentrations were well below the CWQG in 2006 and 2007.

The total cyanide concentrations in 2006 and 2007 were at, or below, the MRV (0.001 mg/L).

3.4.1.2 Aimaokatalok River

Aimaokatalok River, which enters Aimaokatalok Lake from the south, is characterized as a relatively clear, coloured (< 1 to 29 TCU) freshwater river, with naturally soft water, with low alkalinity, and low conductivity.

The river was slightly acidic to neutral in 2006 and 2007 (2006: pH 6.6 to 7.2; 2007: pH 6.0 to 6.5). In 2007, three of the four pH measurements were below the CWQG range (6.5 to 9.0) (Appendix B3) (CCME 2007a).

The electrical conductivity was measured between 28 and 53 µS/cm in 2006, and from 40 to 56 µS/cm in 2007. The major ions were dominated by sodium and chloride (Appendix B5). Aimaokatalok River possessed a high clarity, with the range of TSS concentrations between < 1 and 5 mg/L in 2006 and 2007.

The river was well oxygenated on most of the sampling events in both years (Appendix B3). Only the July 2006 DO concentration was slightly below the 9.5 mg/L CWQG for protection of early life stages of fish (CCME 2007a). Logged temperature data showed typical seasonal trends with warmest

temperatures in late July to early August and the coolest temperatures in June and September (Figure 3.27).

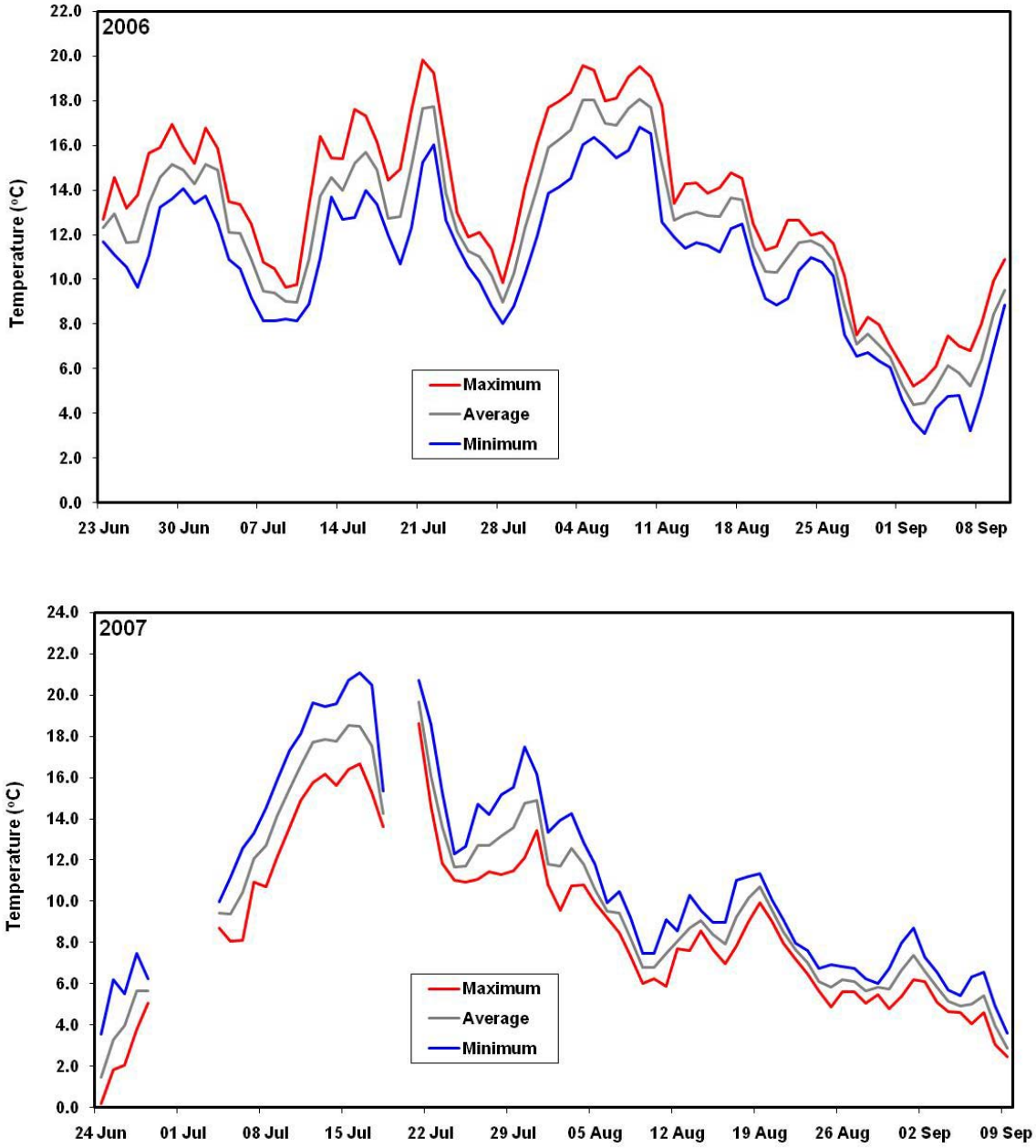


Figure 3.27 Aimaokatalok River Daily Temperature: Maximum, Minimum, and Average, 2006 and 2007

TP concentrations in Aimaokatalok River were consistent in 2006 and 2007, ranging from 9 to 20 µg/L in 2006 and 7 to 16 µg/L in 2007. Based on these

natural TP concentrations, the river would be classified as mesotrophic (Appendix B1) (CCME 2004).

All of the dissolved inorganic forms of nitrogen in 2006 and 2007 were well below the CWQG (CCME 2007a), and represented < 11% of total nitrogen concentration (the TKN ranged from 0.25 to 0.31 mg/L in 2007, and 0.28 to 0.35 mg/L in 2007).

Most of the baseline metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of baseline total aluminum, iron, and zinc. These exceptions are as follows:

- Baseline total aluminum concentrations were above the 5.0 µg/L CWQG (for pH < 6.5) on three of the four sampling dates in 2007. The elevated concentrations ranged from 16 to 153 µg/L (Appendix B5).
- The total iron concentration in June 2007 (375 µg/L) was above the 300 µg/L CWQG.
- The U.S. EPA acute zinc toxicity guideline, which is adjusted for water hardness, was exceeded in August 2006, with a concentration of 26 µg/L.

The total cyanide concentrations in 2006 and 2007 were below the MRV (0.001 mg/L).

3.4.1.3 Aimaokatalok Outflow

Aimaokatalok Outflow is a clear, yet coloured (6 to 21 TCU) freshwater stream, characterized by naturally soft water, low alkalinity and hardness. The water quality was consistent with that of Aimaokatalok Lake.

The field pH was slightly acidic to neutral in 2006 (6.5 to 7.1), but remained slightly acidic in 2007, and below the CWQG range of pH 6.5 to 9.0 (Appendix B3) (CCME 2007a).

The electrical conductivity was measured between 49 and 62 µS/cm in 2006 and 2007. The major ions were dominated by sodium and chloride.

Aimaokatalok Outflow typically had TSS concentrations between < 1 and 2 mg/L in 2006 and 2007, which was consistent with the range measured in Aimaokatalok Lake, with the exception of a TSS concentration of 7 mg/L measured in September 2006.

Aimaokatalok Outflow was well oxygenated on all sampling dates in 2006 and 2007, with DO measurements consistently above the 9.5 mg/L CWQG for the protection of early life stages of fish (Appendix B3) (CCME 2007a).

A temperature logger was not installed in the outflow in 2006; however, the logged data from 2007, and the monthly temperature measurements recorded during water chemistry sampling occasions in 2006, were consistent with seasonal temperature trends observed at the other stream stations in the Boston Project area. The warmest month was August and the coolest stream temperatures were recorded on the initial sampling date in June (Figure 3.28; Appendix B3).

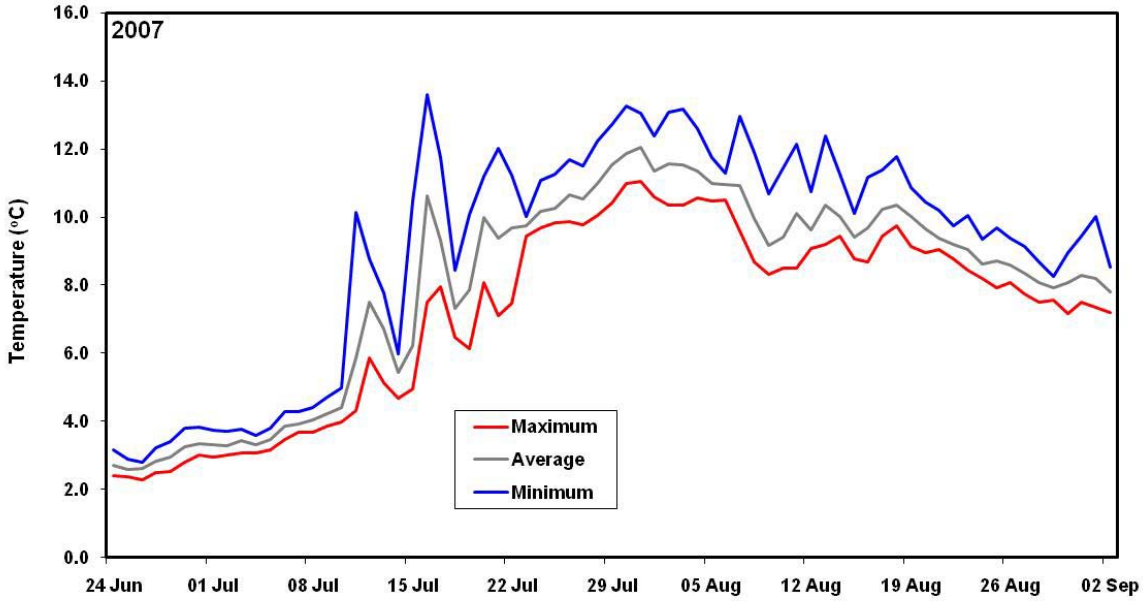


Figure 3.28 Aimaokatalok Outflow Daily Temperature: Maximum, Minimum, and Average, 2007

TP concentrations in Aimaokatalok Outflow ranged from 14 to 23 µg/L during the 2006 sampling period and from 9 to 11 µg/L during the 2007 sampling period. Based on the typical concentrations, the stream would be classified as mesotrophic (Appendix B1) (CCME 2004).

All of the dissolved inorganic forms of nitrogen in 2006 and 2007 were well below the CWQGs (CCME 2007a), and represented < 12% of total nitrogen concentration (the TKN ranged from 0.25 to 0.38 mg/L in 2007, and 0.25 to 0.28 mg/L in 2007).

Most of the baseline metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of total aluminum and cadmium. These exceptions are as follows:

- Total aluminum concentrations were above the 5.0 µg/L CWQG (for pH < 6.5) on all four sampling dates in 2007. The elevated values ranged from 27 to 60 µg/L. For these samples, the dissolved aluminum concentrations were also above the guidelines, ranging between 5.2 and 7.8 µg/L.
- Total cadmium concentrations were above the hardness adjusted CWQG in June 2006 (0.008 µg/L) and June 2007 (0.009 µg/L).

The total cyanide concentrations in 2006 and 2007 were below the MRV (0.001 mg/L).

3.4.1.4 Fickle Duck Outflow

Fickle Duck Outflow is a relatively clear, coloured (21 to 44 TCU) freshwater stream, characterized by naturally soft water, with low alkalinity and low conductivity. The water quality was generally consistent with that of Fickle Duck Lake.

The field pH ranged from slightly acidic to neutral conditions (6.0 to 7.1) in 2006 and 2007. On three occasions in 2006 (August) and 2007 (June and July), stream pH was below the CWQG range of pH 6.5 to 9.0 (Appendix B3) (CCME 2007a).

Conductivity values ranged from 48 to 98 µS/cm in 2006 and 2007. The major ions were dominated by sodium, calcium, and chloride (Appendix B5).

TSS levels in Fickle Duck Outflow were similar in 2006 and 2007, typically ranging from < 1 to 5 mg/L. The low TSS concentrations were consistent with TSS concentrations in Fickle Duck Lake. However, elevated TSS concentrations well above these levels were measured in July and August 2006, and July 2007, i.e., from 8 to 50 mg/L.

Fickle Duck Outflow was generally well oxygenated throughout the 2006 and 2007 open water season. In July (7.5 mg/L) and August (7.6 mg/L) 2006, the surface DO concentrations were below the 9.5 mg/L CWQG for protection of early life stages of fish. In July 2007, the DO concentration (1.6 mg/L) was well below the 6.5 mg/L CWQG for protection of other stages of cold water aquatic life (CCME 2007a). This low DO state was associated with a low flow/stagnant condition in the stream.

Logged temperature data in 2006 showed that maximum temperatures (around 20°C) were reached earlier in the season (late June) than recorded for 2007 (Figure 3.29). Water temperatures remained high through July and August in 2006. Although the temperature record is incomplete from 2007, it appears peek temperatures occurred in mid July, with a cooler August compared to 2006.

Total phosphorus concentrations in Fickle Duck Outflow ranged from 18 to 54 µg/L in 2006. In 2007, with one exception, the TP concentrations ranged from 15 to 20 µg/L. A high TP concentration was measured in July 2007 (99 µg/L), which was associated the low flow and low DO condition of the stream (Appendix B5). The trophic classification varied from mesotrophic to eutrophic based on the TP concentrations (Appendix B1) (CCME 2004). All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) in both years, and represented < 13% of total nitrogen concentration (the TKN ranged from 0.36 to 0.61 mg/L in 2006, and 0.40 to 0.96 mg/L in 2007).

Most of the baseline metal concentrations fell below the applicable CWQGs (CCME 2007a), with the exception of total aluminum, cadmium, chromium, iron, and mercury. These exceptions are as follows:

- Natural total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) or the 5.0 µg/L CWQG (for pH < 6.5) throughout 2006 and on all but one sampling date in2007. The concentrations ranged from 80 to 666 µg/L (Appendix B5). The dissolved aluminium concentrations in August 2006 and June and July 2007 were also above low pH guidelines (i.e., pH<6.5), with concentrations ranging from 16.8 to 26.9 µg/L.
- The total cadmium concentration in July 2006 (0.011 µg/L) was above the hardness adjusted CWQG (Appendix B5).
- Background total chromium concentration in July 2006 (1.2 µg/L) was above the 1.0 µg/L CWQG for sublethol toxicity of Cr (IV).
- Baseline total iron exceeded the 300 µg/L CWQG on all but two sampling occasion in 2006 and 2007. The exceedance concentrations ranged from 312 to 3460 µg/L (Appendix B5). The high concentrations were measured in July and August 2006 (2760 and 1630 µg/L, respectively) and July 2007 (3460 µg/L), with the dissolved iron concentration in July and August 2006 and July 2007 also higher than guidelines (532 to 1060 µg/L).
- The background total mercury concentration in September 2006 was (55 ng/L) higher than the 26 ng/L CWQG.

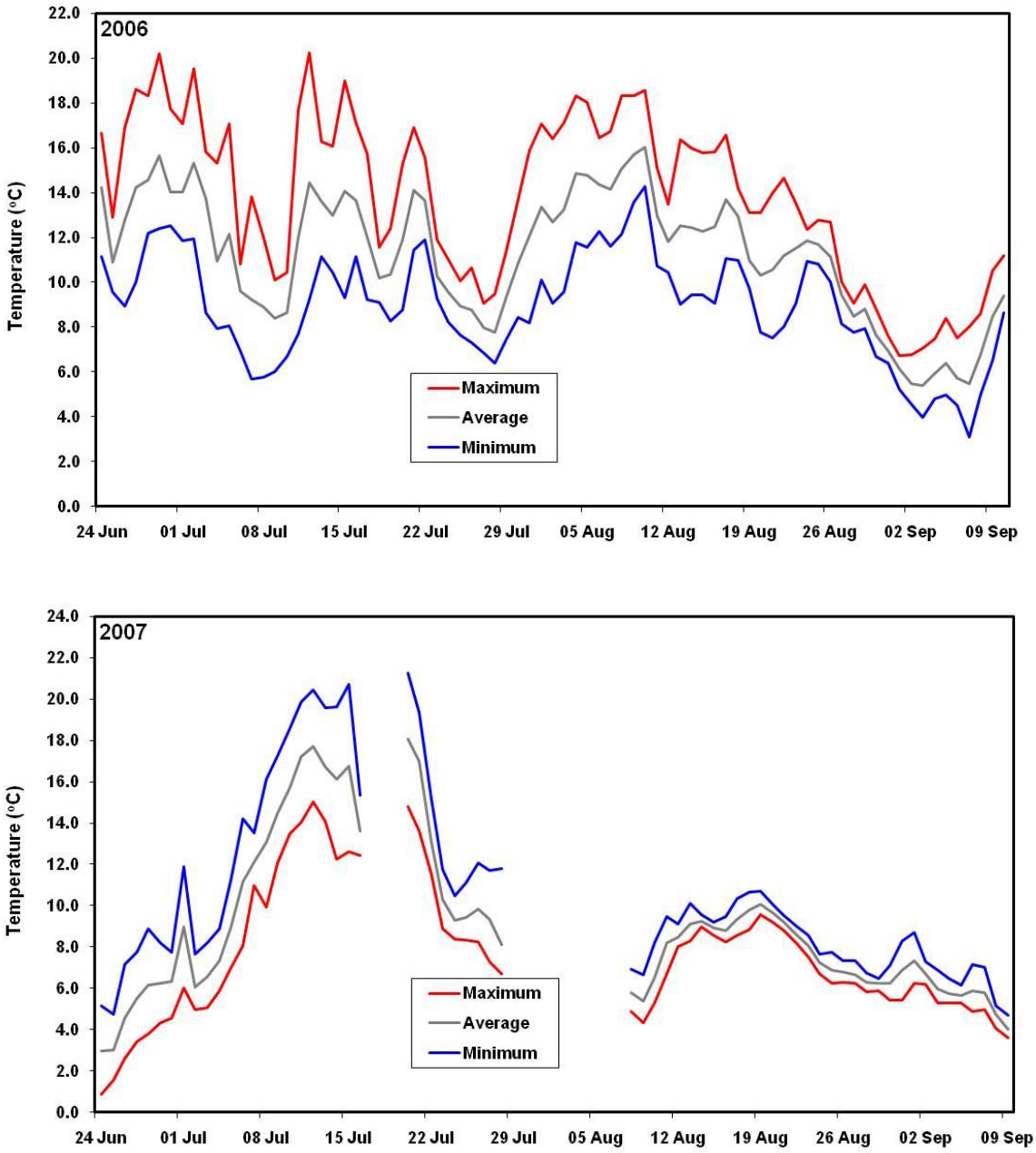


Figure 3.29 Fickle Duck Outflow Daily Temperature: Maximum, Minimum, and Average, 2006 and 2007

The total cyanide concentrations in 2006 and 2007 were at, or below, the MRV (0.001 mg/L).

3.4.1.5 Koignuk River

Field surveys of the Koignuk River were limited to 2007. The Koignuk River flows north from Aimaokatalok Outflow, and is characterized as a naturally soft, coloured (12 to 22 TCU) freshwater river, with low alkalinity and low conductivity.

Field pH was slightly acidic (6.5 to 6.9) and within the CWQG range (6.5 to 9.0) for the protection of freshwater aquatic life (CCME 2007a).

The conductivity values ranged from 58 µS/cm at the beginning of July to 87 µS/cm in mid-August. The major ions were dominated by sodium and chloride (Appendix B5).

TSS concentrations were lowest in mid-July (1 mg/L) and highest early in July and September (both 5 mg/L).

The Koignuk River was well oxygenated on all four sampling dates in 2007, with DO concentrations consistently above the 9.5 mg/L CWQG for protection of early life stages of fish (Appendix B3) (CCME 2007a).

The temperature logger was installed in the stream on 19 July, about 1 month later than the other stream stations. The recorded temperatures (Figure 3.30) indicated similar seasonal trends to the other streams in the Boston Project area in 2007, with the warmest water temperatures occurring in July.

TP concentrations in Koignuk River ranged from 12 to 19 µg/L during the 2007 sampling period. Based on this natural range of TP concetartions, Koignuk River would be classified as mesotrophic (Appendix B1) (CCME 2004).

All of the dissolved inorganic forms of nitrogen in 2007 were well below the CWQGs (CCME 2007a), and represented < 4% of total nitrogen concentration (the TKN ranged from 0.25 to 0.40 mg/L in 2007).

Most total metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of baseline total aluminum, cadmium, and iron. The details of these exceptions are below:

- Background total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) throughout 2007, with elevated concentrations between 112 and 650 µg/L (Appendix B5).

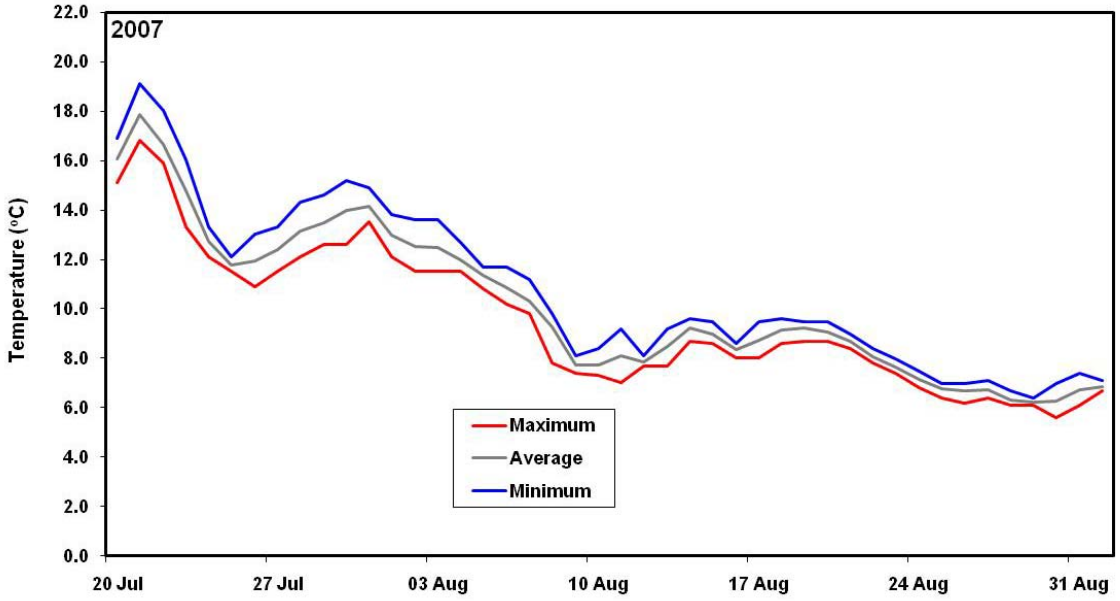


Figure 3.30 Koignuk River Daily Temperature: Maximum, Minimum, and Average, 2007

- The baseline total cadmium concentration in August 2007 (0.024 µg/L) was higher than the hardness adjusted CWQG (Appendix B5).
- Total iron concentrations were above the 300 µg/L CWQG on three sampling occasions, which ranged from 313 to 523 µg/L (Appendix B5).

The total cyanide concentrations in 2007 were below the MRV (0.001 mg/L).

3.4.1.6 Reference Outflow

Reference Outflow is a clear, coloured (14 to 38 TCU) freshwater stream, characterized by naturally soft water, with low alkalinity and low conductivity.

Field pH was slightly acidic to slightly alkaline (pH 6.6 to 7.8 in 2006, and 6.1 to 6.7 in 2007). The field pH values in June (pH 6.1) and September (pH 6.4) 2007 were below the CWQG range (6.5 to 9.0) for the protection of freshwater aquatic life (Appendix B3) (CCME 2007a).

The conductivity values were similar in 2006 and 2007, ranging from 38 to 71 µS/cm. The dominant major ions were sodium and chloride (Appendix B5).

Reference Outflow was clear during both sampling seasons, with TSS concentrations ranging between < 1 and 3 mg/L.

Reference Outflow was well oxygenated throughout 2006 and 2007, with all DO measurements above the 9.5 mg/L CWQG for protection of early life stages of fish with the exception of July 2007 (8.8 mg/L) (Appendix B3) (CCME 2007a).

Logged temperature data showed that Reference Outflow exhibited typical seasonal temperature trends consistent with other streams in the Boston Project area. Maximum temperatures were reached in July and August, with cooler temperatures later in the season (Figure 3.31).

TP concentrations in Reference Outflow ranged from 12 to 39 µg/L in 2006 and 2007. Based on the natural TP concentrations, this stream would be classified as meso-eutrophic (Appendix B1) (CCME 2004). In both years, all of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) and represented < 10% of total nitrogen concentration (the TKN ranged from 0.34 to 0.50 mg/L in 2006).

With the exception of total aluminum and iron, baseline metal concentrations were below the applicable CWQGs (CCME 2007a). The exceptions are detailed below:

- Baseline total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) in three of the four 2006 samples and the July 2007 sample. Elevated concentrations ranged from 118 to 178 µg/L (Appendix B5). Total aluminum concentrations in June (173 µg/L) and September 2007 (54 µg/L) were above the 5 µg/L CWQG (for pH < 6.5). Dissolved aluminum concentrations were also above the CWQG (for pH >6.5) in both June (19 µg/L) and September (14 µg/L) 2007.
- Baseline total iron concentrations were above the 300 µg/L CWQG in July and August 2006, and June and July 2007. Elevated concentrations ranged from 324 to 506 µg/L (Appendix B5).

The total cyanide concentrations in 2006 and 2007 were below the MRV (0.001 mg/L).

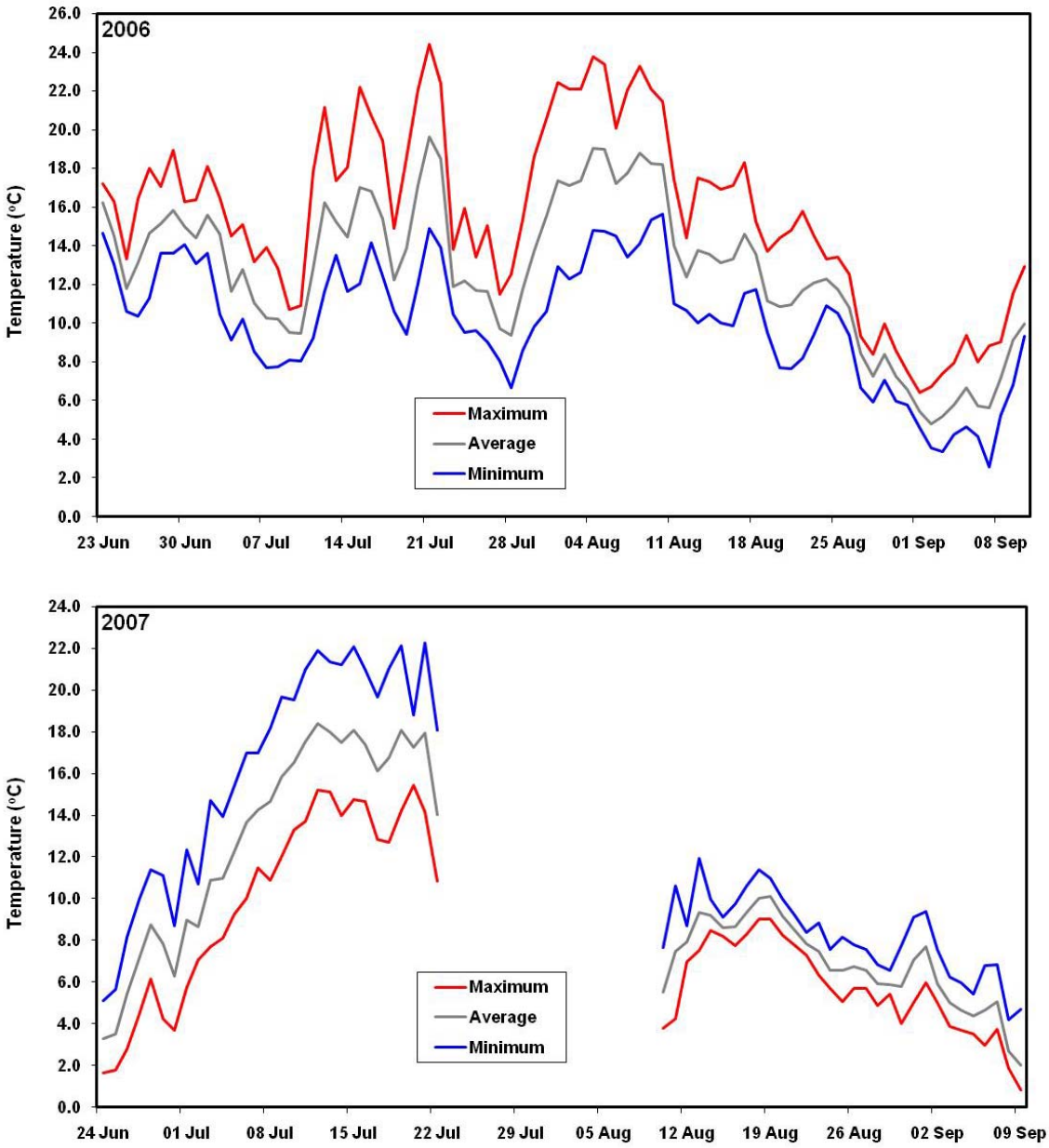


Figure 3.31 Reference Outflow Daily Temperature: Maximum, Minimum, and Average, 2006 and 2007

3.4.1.7 Stickleback Outflow

Stickleback Outflow is a clear, slightly coloured (< 1 to 13 TCU) freshwater stream, characterized by naturally soft water, with low alkalinity and low

conductivity. This outflow possessed a lower colour compared to other streams in the Boston Project area.

Field pH was slightly acidic to neutral (6.0 to 7.1) and fell below the CWQG pH 6.5 to 9.0 range (CCME 2007a) in September 2006 (pH 6.3) and June 2007 (pH 6.0).

The conductivity values in Stickleback Outflow were consistent with Stickleback Lake, typically ranging from 238 to 263 µS/cm in 2006 and 2007, with the exception of June 2007 (41 µS/cm). The lower June conductivity was likely due to dilution from snow melt. Calcium, sodium and chloride were the dominant major ions (Appendix B5).

TSS concentrations ranged from <1 to 3 mg/L in 2006, and < 1 to 1 mg/L in 2007.

DO concentrations were variable in Stickleback Outflow. In 2006, DO was high in June (12.4 mg/L), with DO below the 6.5 mg/L CWQG for the protection of aquatic life (CCME 2007a) on the other three sampling occasions (4.5 to 6.1 mg/L). In 2007, DO was above the 9.5 mg/L CWQG (CCME 2007a) for the majority of the sampling occasions, with the exception of July (7.0 mg/L) (Appendix B3).

Logged temperature data from the 2006 sampling season showed that Stickleback Outflow was approximately 2°C cooler than the other Boston Project area streams (Figure 3.32). Seasonal temperature trends were typical of the Boston Project area, with the warmest temperatures occurring between mid-July and early August (Figure 3.32).

Concentrations of TP in Stickleback Outflow ranged from 24 to 28 µg/L in 2006, and 13 to 20 µg/L in 2007. The outflow stream TP concentrations were similar to those measured in Stickleback Lake. Based on TP concentrations, Stickleback Outflow would be classified at mesotrophic in 2006, and meso-eutrophic in 2007 (Appendix B1) (CCME 2004).

All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) in 2006 and 2007, and represented < 13% of total nitrogen concentration (the TKN ranged from 0.30 to 0.46 mg/L in 2006 and 0.19 to 0.42 mg/L in 2007).

With the exception of total aluminum and iron, baseline metals concentrations were below the applicable CWQGs (CCME 2007a). The exceptions are as follows:

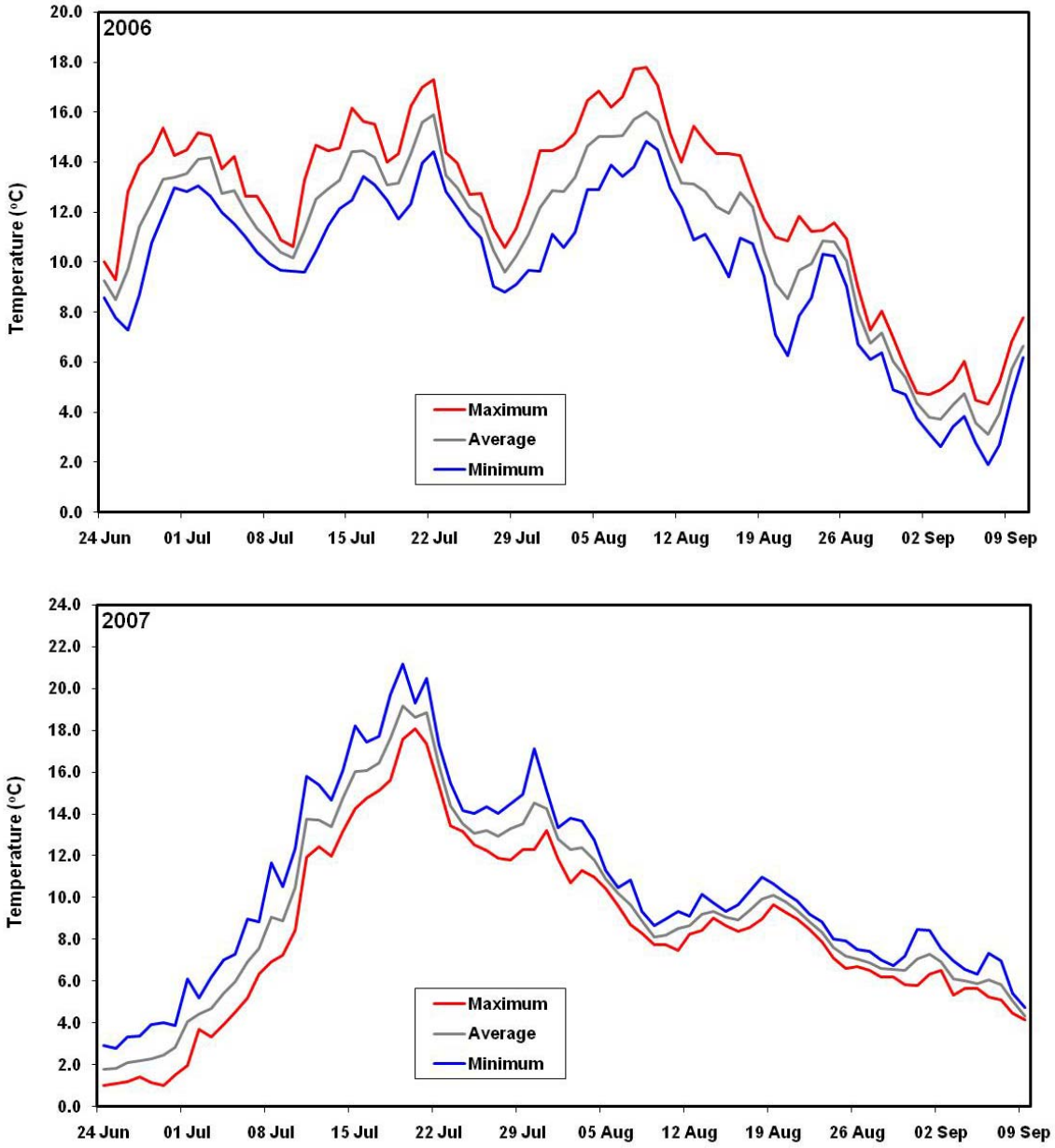


Figure 3.32 Stickleback Outflow Daily Temperature: Maximum, Minimum, and Average, 2006 and 2007

- Baseline total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) in July 2006 (116 µg/L), and the 5 µg/L CWQG (for pH < 6.5) in September 2006 (14 µg/L) and June 2007 (30 µg/L). The dissolved aluminum concentration in June 2007 (6.7 µg/L) was also above the guideline (Appendix B5).

- Total iron concentrations were above the 300 µg/L CWQG in July and September 2006 (602 µg/L and 1030 µg/L, respectively) (Appendix B5).

The total cyanide concentrations in 2006 and 2007 were at, or below, the MRV (0.001 mg/L).

3.4.1.8 Boston Project Area Streams Summary

The baseline water quality of streams within the Boston Project area generally was consistent with their associated lakes in the Project area. The streams were typically clear, coloured, and characterized by naturally soft waters with relatively low TDS concentrations.

The range of pH values was slightly acidic to slightly alkaline in 2006 and 2007, with slightly lower pH values evident in 2007 (Appendix B5). Major ions were generally dominated by sodium and chloride, although calcium was dominant in Stickleback Outflow. Stickleback Outflow was also characterized as having the highest TDS concentrations in the area.

Most of the streams were generally well oxygenated over the open water season, with most of the measured DO concentrations above the 9.5 mg/L CWQG (CCME 2007a). Occurences of DO concentrations below the 9.5 mg/L were reported in Fickle Duck and Stickleback outflows in 2006 and 2007. The DO also fell below the 6.5 mg/L CWQG in both of these streams on at lease one sampling date (Appendix B3).

Logged temperatures in the streams and rivers indicated typical seasonal patterns, with the warmest temperatures in July and August, and cooler temperatures in early June and September. The general temperature trend in 2006 was a series of three maxima peaks throughout July and August, with only one maxima peak evident in 2007.

Total phosphorus concentrations in the outflows and rivers were more variable compared to concentrations measured in their associated lakes. Based on the TP concentrations, the streams and rivers would be classified as typically mesotrophic; however, Reference and Stickleback outflows would be meso-eutrophic, and Aimaokatalok Inflow and Fickle Duck Outflow would be classified as eutrophic. The nitrogen to phosphorus stoichiometric ratio for streams and rivers in the Boston Project area indicated phosphorus limitation, i.e., the ratio was greater than 23 to 1, which is commonly considered to be the lower boundary of a phosphorus-limited system (Wetzel 2001).

During the 2006 and 2007 sampling seasons, baseline concentrations of total aluminum, cadmium, chromium, iron, mercury, and zinc were higher than the

CWQGs (CCME 2007a) on one or more occasions in the Boston Project area streams (Table 3.14).

The total cyanide concentrations in 2006 and 2007 were generally at, or below, the MRV (0.001 mg/L).

Table 3.14 Summary of Boston Project Area Stream Water Samples that Were Above Guidelines for the Protection of Aquatic Life in Freshwater, 2006 – 2007

Station	Date	Field pH	TSS	Al (Total)		Cd (Total)	Cr (Total)	Fe (Total)	Hg (Total)	Zn (Total)
		CWQG 6.5-9.0		CWQG 100 µg/L for pH≥6.5	CWQG 5.0 µg/L for pH<6.5	CWQG 0.003-0.055 µg/L	CWQG 1.0 µg/L	CWQG 300 µg/L	CWQG 26 ng/L	CWQG 13-198 µg/L
Aimaokatalok River	23-Jun-06	7.2	<1			***0.004***				
	13-Aug-06	6.6	<1							***26.1***
	23-Jun-07	***6.0***	5		***153***			***375***		
	21-Jul-07	***6.3***	<1		***16.3***					
	09-Sep-07	***6.3***	<1		***20.3***					
Aimaokatalok Inflow	23-Jun-06	7.4	2	***176***				***450***		
	16-Jul-06	7.2	4	***135***		***0.010***		***417***		
	13-Aug-06	7.2	4					***544***		
	10-Sep-06	7.1	4	***120***				***573***		
	23-Jun-07		23	***728***		***0.007***	***1.4***	***1020***		
	20-Jul-07	6.6	3					***521***		
	20-Aug-07	6.5	4	***206***				***393***		
	10-Sep-07	***6.1***	3		***144***			***329***		
Aimaokatalok Outflow	23-Jun-06	7.1	1			***0.008***				
	23-Jun-07	***6.1***	2		***27.3***					
	20-Jul-07	***6.2***	<1		***30.5***	***0.009***				
	19-Aug-07	***6.2***	<1		***42.7***					
	10-Sep-07	***6.0***	<1		***59.8***					
Fickle Duck Outflow	24-Jun-06	7.1	2	***275***				***605***		
	17-Jul-06	6.5	51	***666***		***0.011***	***1.2***	***2760***		
	13-Aug-06	***6.3***	10		***407***			***1630***		
	10-Sep-06	6.7	3	***158***				***671***	***55***	
	23-Jun-07	***6.2***	2		***80.4***					
	20-Jul-07	***6.0***	8		***274***			***3460***		
	20-Aug-07	6.5	2	***125***				***312***		
Koignuk River	02-Jul-07	6.5	5	***317***				***303***		
	19-Jul-07	6.6	1	***112***						
	18-Aug-07	6.8	3	***650***		***0.024***		***523***		
	16-Sep-07	6.9	5	***403***				***366***		
Reference Outflow	23-Jun-06	7.5	3	***178***						
	18-Jul-06	6.6	2					***324***		
	13-Aug-06	7.8	3	***154***				***369***		
	10-Sep-06	7.2	1	***118***						
	23-Jun-07	***6.1***	3		***173***			***356***		
	20-Jul-07	6.7	3	***160***				***506***		
	09-Sep-07	***6.4***	2		***54.2***					
Stickleback Outflow	17-Jul-06	6.9	3	***116***				***602***		
	10-Sep-06	***6.3***	<1		***13.6***			***1030***		
	23-Jun-07	***6.0***	1		***30.2***					

Total suspended solids (TSS).

Values exceeding guidelines are italicized and **bold.**

Prepared by: EJJ Checked by: JM

3.4.2 Madrid Project Area

3.4.2.1 Glenn Outflow

Glenn Outflow is a clear, coloured (3 to 30 TCU) freshwater stream, characterized by naturally soft water and low to moderate conductivity during open water conditions. Field surveys were limited to open water conditions in 2007.

Field pH ranged from near neutral to slightly alkaline conditions (pH 6.9 to 7.5), and within the CWQG range of pH 6.5 to 9.0 (CCME 2007a).

Conductivity values were relatively consistent in 2007 ranging from 315 to 371 µS/cm. The dominant major ions were sodium and chloride (Appendix B5).

TSS concentrations ranged from 1 to 9 mg/L, with the highest TSS measured in August 2007.

Glenn Outflow was very well oxygenated on the three sampling dates in 2007 for which DO was measured, with DO consistently above the 9.5 mg/L CWQG for protection of early life stages of fish (Appendix B3) (CCME 2007a).

Data from thermograph installed in the stream in 2007 showed seasonal trends that were typical of the streasm in the Madrid Project area, i.e., maximum temperatures occurring in mid-July and cooler temperatures associated with spring freshet conditions and towards the end of the open water season (Figure 3.33).

Total phosphorus concentrations in Glenn Outflow ranged from 12 to 16 µg/L. Based on these concentrations, the outflow would be classified as mesotrophic (Appendix B1) (CCME 2004).

All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a), and represented < 11% of total nitrogen concentration (the TKN ranged from 0.18 to 0.26 mg/L in 2007).

Glenn Outflow had the greatest number of baseline metals concentrations that were above CWQG (CCME 2007a) of all the streams within the Madrid Project area. Baseline concentrations of total aluminum, chromium, copper, iron, and selenium were higher than applicable CWQGs, which was consistent with the metals assessment for Glenn Lake:

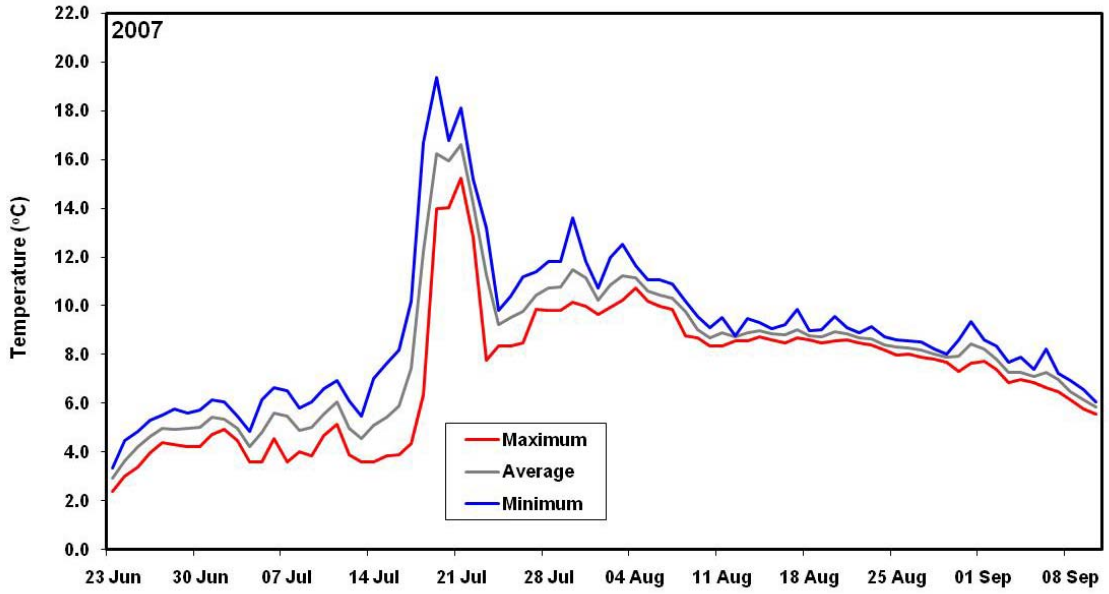


Figure 3.33 Glenn Outflow Daily Temperature: Maximum, Minimum, and Average, 2007

- Baseline total aluminum concentrations were consistently above the 100 µg/L CWQG (for pH ≥ 6.5) in 2007 with concentrations ranging from 195 to 694 µg/L (Appendix B5).
- Total chromium concentrations were above the 1.0 µg/L CWQG for sublethal toxicity of Cr(VI) in July (1.2 µg/L) and September (1.2 µg/L) (Appendix B5).
- Background total copper concentrations were consistently above the 2.0 µg/L CWQG in 2007, with concentrations ranging between 2.4 and 4.1 µg/L (Appendix B5). The dissolved copper concentrations in June, August and September were also above the guideline.
- Borderline total iron concentrations were above the 300 µg/L CWQG in July, Aguust, and September. Elevated concentrations ranged from 357 to 550 µg/L.
- Natural total selenium concentrations were higher than the 1 µg/L CWQG in June, July, and August; the elevated concentrations ranged from 1.3 to 1.5 µg/L (Appendix B5). The dissolved selenium concentrations in June and July were also above the guideline.

The total cyanide concentrations in 2007 were below the MRV (0.001 mg/L).

3.4.2.2 Ogama Outflow

Ogama Outflow is a clear, coloured (6 to 48 TCU) freshwater stream, characterized by naturally soft water and low to moderate conductivity during open water conditions.

Field pH measurements ranged from slightly acidic to slightly alkaline in 2006 and 2007 (6.6 to 7.7) and were consistently within the CWQG of pH 6.5 to 9.0 (CCME 2007a).

Conductivity values ranged from 240 to 297 µS/cm in 2006 and from 281 to 290 µS/cm in 2007. The major ions were dominated by sodium and chloride.

TSS concentrations ranged from 3 to 6 mg/L in 2006 and 2007 (Appendix B5).

Ogama Outflow was well oxygenated throughout both sampling seasons (Appendices B3) with all DO concetrations above the 9.5 mg/L CWQG for protection of early life stages of fish (CCME 2007a).

Logged temperature data showed typical seasonal trends. The warmest temperatures were recorded in August during the 2006 sampling period, which was somewhat later than 2007, when the maximum temperature was recorded in mid-July. Temperatures were lower in June and September (Figure 3.34).

TP concentrations in Ogama Outflow ranged from 19 to 41 µg/L in 2006 and from 28 to 65 µg/L in 2007. Based on these TP concentrations, Ogama Outflow would be classified as meso-eutrophic (Appendix B1) (CCME 2004).

All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) in both 2006 and 2007 sampling seasons, and represented < 11% of total nitrogen concentration (the TKN ranged from 0.38 to 0.56 mg/L in 2006 and 0.51 to 0.66 mg/L in 2007).

With the exception of total aluminum, iron, and selenium, baseline total metals concentrations were below the applicable CWQGs (CCME 2007a). The exceptions are as follows:

- Baseline total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) throughout 2006 and 2007, with the exception of August 2006. The elevated concentrations ranged from 119 to 290 µg/L (Appendix B5).

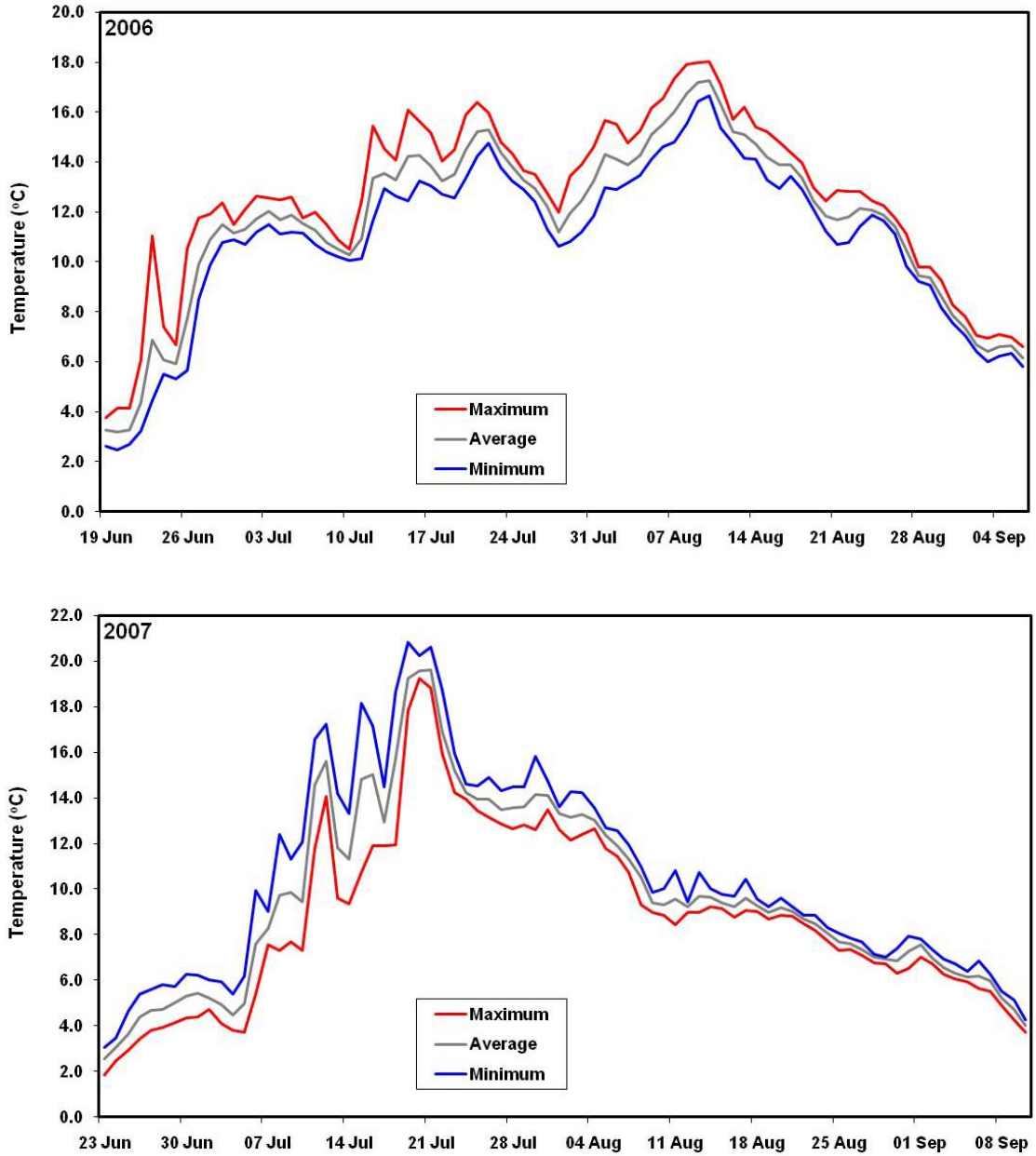


Figure 3.34 Ogama Outflow Daily Temperature: Maximum, Minimum, and Average, 2006 and 2007

- Total iron concentrations were above the 300 µg/L CWQG in June 2006 (323 µg/L) and July 2007 (368 µg/L).
- Baseline total selenium concentrations were above the 1 µg/L CWQG in August and September 2006, and June and July 2007. The elevated concentrations ranged from 1.1 to 2.0 µg/L (Appendix B5). The

dissolved selenium concentrations in September 2006 (1.0 µg/L), June 2007 (1.3 µg/L), and July 2007 (1.1 µg/L) were also at, or above, the guideline.

The total cyanide concentrations in 2006 and 2007 were generally at, or below, the MRV (0.001 mg/L).

3.4.2.3 Patch Outflow

Patch Outflow is a clear, coloured (1 to 95 TCU) freshwater stream, characterized by naturally soft water with low to moderate conductivity during open water conditions.

Field pH was acidic to slightly alkaline (pH 5.6 to 7.7) in 2006 and 2007, and with the exception of June 2007 (5.6), was within the CWQG range of pH 6.5 to 9.0 (Appendix B5) (CCME 2007a).

Conductivity values were highly variable in 2006 and 2007. In 2006, conductivity ranged from 173 to 345 µS/cm, and in 2007, the range was 55 to 333 µS/cm) (Appendix B5). The low conductivity measured in July 2007 was likely associated with the diluting influence of snow melt inflow to the outflow. The major ions were dominated by sodium and chloride.

TSS concentrations ranged from < 1 to 7 mg/L in 2006 and 2007 (Appendix B5).

Patch Outflow was typically well oxygenated in 2006 and 2007. In June 2007, DO was measured at 8.7 mg/L, just below the 9.5 mg/L CWQG for protection of early life stages of fish (Appendix B3) (CCME 2007a).

Temperature trends typical of those observed in the Hope Bay Belt were recorded in 2006 and 2007. The warmest temperatures were recorded in mid-July in 2007, which was slightly earlier than observed in 2006, when the maximum temperatures occurred in early August. Cooler temperatures were observed in June and September in both years (Figure 3.35).

TP concentrations in Patch Outflow ranged from 7 to 26 µg/L in 2006 and 6 to 48 µg/L in 2007. The highest TP concentration (48 µg/L) was measured in June 2007, which coincided with maximum colour (95 TCU), TKN (0.63 mg/L) and ammonia (0.033 mg N/L). Based on the typical TP concentrations, the outflow would be classified as oligotrophic to meso-eutrophic (Appendix B1) (CCME 2004).

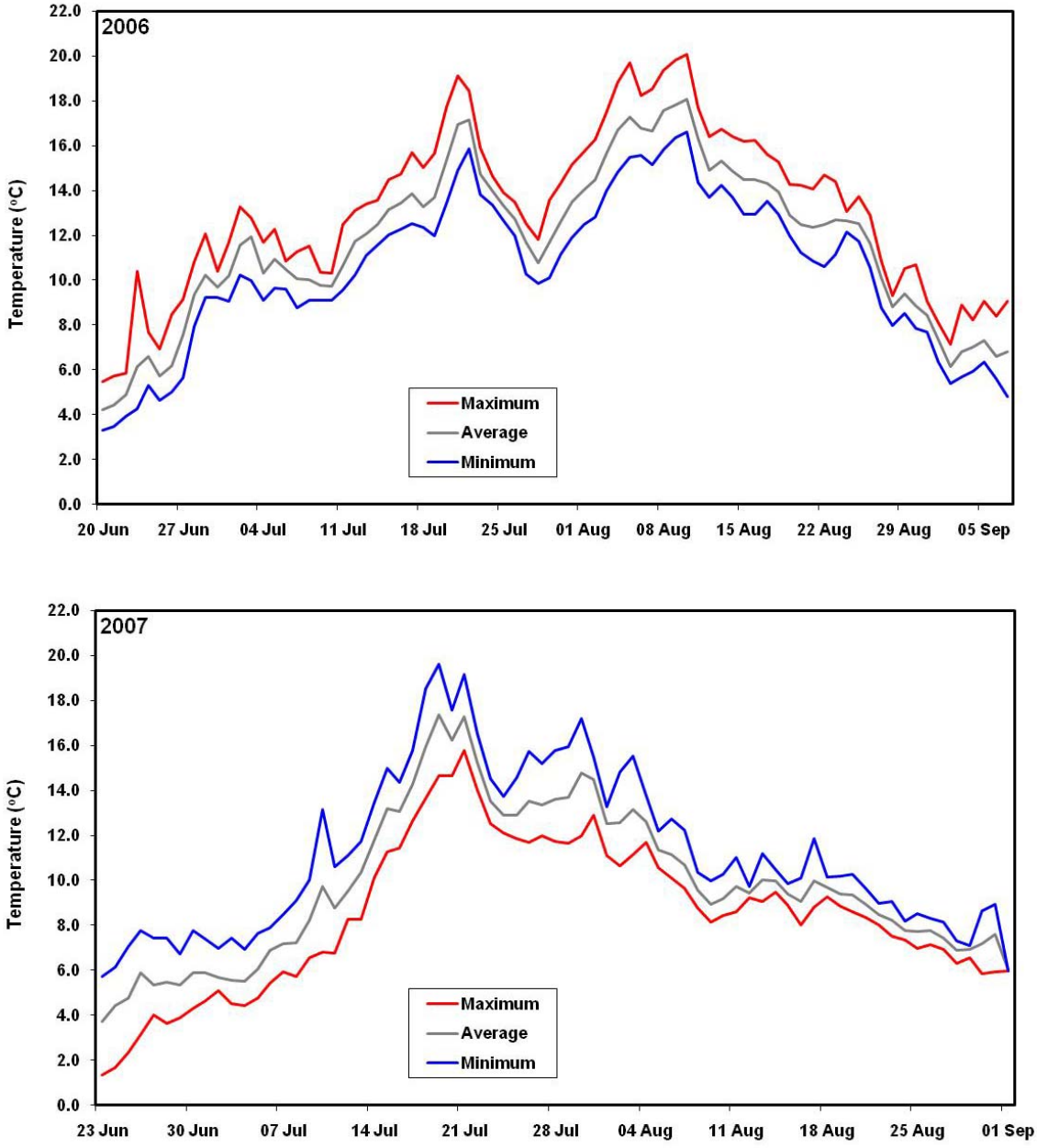


Figure 3.35 Patch Outflow Daily Temperature: Maximum, Minimum, and Average, 2006 and 2007

All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) in 2006 and 2007, and represented < 11% of total nitrogen concentration (the TKN ranged from 0.18 to 0.24 mg/L in 2006 and 0.19 to 0.63 mg/L in 2007).

Most baseline metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of total aluminum, copper, iron, and selenium. These exceptions are described as follows:

- Total aluminum concentrations were above the 100 µg/L CWQG (for pH ≥ 6.5) in June, July and August 2006, and August and September 2007, and above the 5.0 µg/L CWQG (for pH < 6.5) in June 2007. Elevated concentrations ranged from 135 to 763 µg/L (Appendix B5). The dissolved aluminum concentration was above the 5.0 µg/L CWQG (for pH <6.5) in June 2007 (92.5 µg/L).
- The total and dissolved copper was above the 2 µg/L CWQG (3.0 and 2.8 µg/L, respectively) in June 2007 (Appendix B5).
- Total iron concentrations were higher than the 300 µg/L CWQG in August 2006 (376 µg/L), June 2007 (497 µg/L), and August 2007 (491 µg/L) (Appendix B5).
- Total selenium concentrations were Above the 1.0 µg/L CWQG in July, August, and September 2006, and August 2007. The elevated concentrations ranged from 1.2 to 1.5 µg/L (Appendix B5). The dissolved selenium concentration was above the guideline in July 2006 (1.1 µg/L).

The total cyanide concentrations in 2006 and 2007 were generally at, or below, the MRV (0.001 mg/L).

3.4.2.4 Pelvic Outflow

Pelvic Outflow is a relatively clear, coloured (6 to 32 TCU) freshwater stream characterized by naturally soft water and low to moderate conductivity during open water conditions.

Field pH values were slightly acidic to alkaline (6.5 to 8.8) and within the CWQG of pH 6.5 to 9.0 in 2006 and 2007 (CCME 2007a).

The range of conductivity values was slightly lower in 2006 (207 to 249 µS/cm) than in 2007 (223 to 251 µS/cm). Consistent with other streams in the Hope Bay Belt, sodium and chloride were the dominant major ions.

In 2006, Pelvic Outflow was slightly more turbid than the other Madrid Project area streams, with TSS concentrations ranging from 5 to 9 mg/L. In 2007, the TSS ranged from 3 mg/L (June and July) to 9 mg/L (September).

Pelvic Outflow was generally well oxygenated in 2006 and 2007, with the exception of June 2007, when the DO concentration (9.1 mg/L) fell slightly below the CWQG (Appendix B3) (CCME 2007a).

Temperature trends consistent with those observed in the Madrid Project area were recorded in Pelvic Outflow. Maximum temperatures were reached in mid-July, with cooler temperatures in June and September. The temperature logger showed extreme daily temperature fluctuations between the end of July and early August, suggesting that the data logger had been dislodged from the stream; these data were excluded from the graph (Figure 3.36).

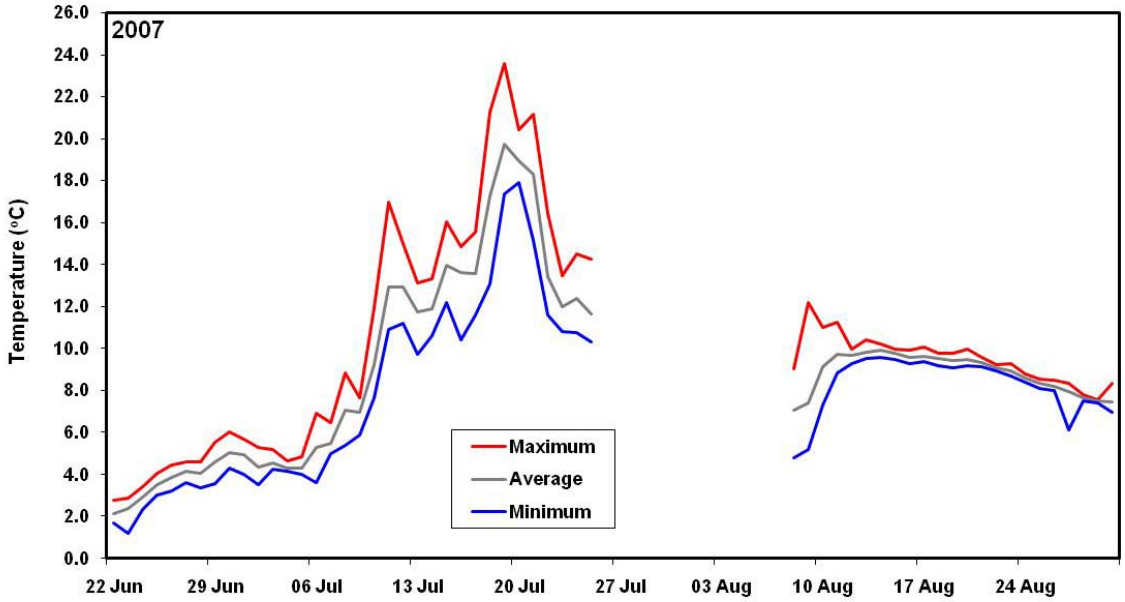


Figure 3.36 Pelvic Outflow Daily Temperature: Maximum, Minimum, and Average, 2007

Total phosphorus concentrations ranged from 32 to 69 µg/L in 2006 and 2007. The relatively higher TP concentrations measured in Pelvic Outflow were consistent with those measured in Pelvic Lake. Based on the TP concentrations, Pelvic Outflow would be classified as a eutrophic system (Appendix B1) (CCME 2004). The eutrophic status is further supported by the vast assemblage of filamentous mats of algae associated with the stream substrate.

In 2006 and 2007, all of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a), and represented < 8% of total nitrogen concentration (the TKN ranged from 0.60 to 0.88 mg/L in 2006 and 0.52 to 0.75 mg/L in 2007).

With the exception of total aluminum, iron and selenium, baseline metal concentrations were below the applicable CWQGs (CCME 2007a). These exceptions are as follows:

- Total aluminum concentrations were naturally above the 100 µg/L CWQG (for pH ≥ 6.5) throughout 2006 and 2007, with the exception of June 2007. Elevated concentrations ranged from 119 to 380 µg/L.
- Baseline total iron concentration was higher than the 300 µg/L CWQG in August 2007 (421 µg/L) (Appendix B5).
- Baseline total selenium concentrations were above the 1.0 µg/L CWQG in August 2006, and June and July 2007, with elevated concentrations ranging from 1.1 to 1.6 µg/L (Appendix B5). The dissolved selenium concentration was above the guideline in June 2007 (1.1 µg/L).

The total cyanide concentrations in 2006 and 2007 were below the MRV (0.001 mg/L), with the exception of August 2006 (0.002 mg/L).

3.4.2.5 P.O. Outflow

P.O. Outflow is a clear, coloured (5 to 73 TCU) freshwater stream characterized by naturally soft water and low to moderate conductivity during open water conditions.

Field pH generally ranged from slightly acidic to alkaline conditions (6.6 to 8.2) and within the CWQG range of pH 6.5 to 9.0 in 2006 and 2007, with the exception of June 2007 (5.6) (Appendix B3) (CCME 2007a).

Conductivity values ranged from 159 to 349 µS/cm in 2006, and 140 to 327 µS/cm in 2007. The lower conductivity values in 2006 and 2007 (159 and 140 µS/cm, repectively) were measured in June and attributed to the influence of snow melt on the outflow. The major ions were dominated by sodium and chloride.

TSS concentrations ranged from <1 to 7 mg/L in 2006, and 1 to 4 mg/L in 2007 (Appendix B5).

P.O. Outflow was well oxygenated throughout both sampling seasons (Appendix B3), with all DO measurements above the 9.5 mg/L CWQG for protection of early life stages of fish (CCME 2007a).

Logged temperature data showed typical seasonal trends in 2006 and 2007 with warmer temperature in July and August (Figure 3.37). The temperature logger was dislodged from the stream through most of July in 2006; however, it is likely that peak stream temperatures were not missed in July 2006 because maximum temperatures in most streams in the Madrid Project area were generally recorded in August 2006.

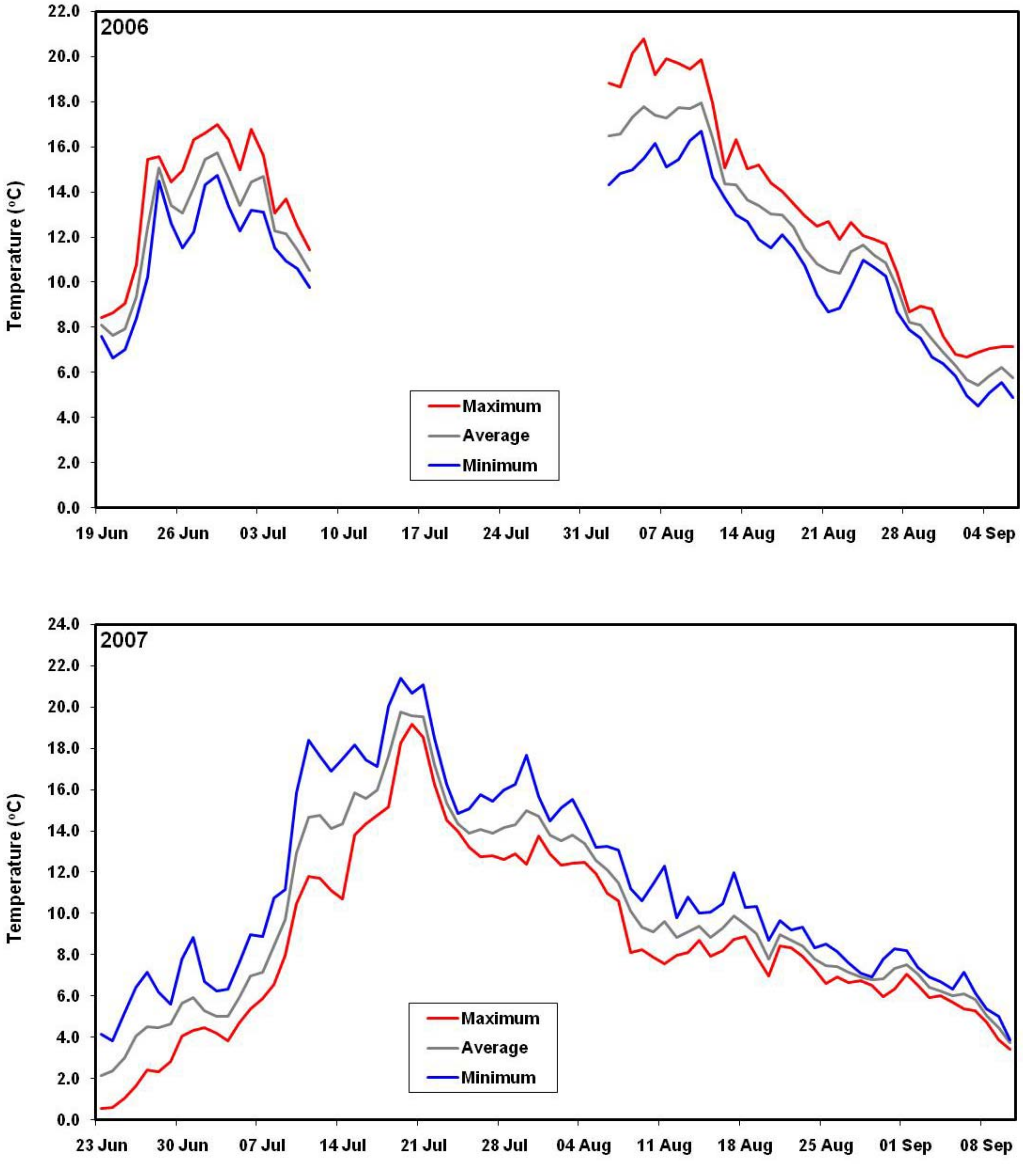


Figure 3.37 P.O. Outflow Daily Temperature: Maximum, Minimum, and Average, 2006 and 2007

Total phosphorus concentrations in P.O. Outflow ranged from 8 to 29 µg/L during the 2006 and 2007 sampling periods. Based on these TP concentrations, the outflow would be classified as oligotrophic to meso-eutrophic (Appendix B1) (CCME 2004).

All of the dissolved inorganic forms of nitrogen were also well below the CWQGs (CCME 2007a) in both years, and generally represented < 8% of total nitrogen concentration (the TKN ranged from 0.24 to 0.46 mg/L in 2006 and 0.23 to 0.50 mg/L in 2007). The proportion of dissolved inorganic nitrogen to total nitrogen was higher in June 2006 and 2007 (i.e., 20 and 9%) due to elevated ammonia (2006: 0.087 mg N/L and 2007: 0.022 mg N/L) and nitrate (2007: 0.026 mg N/L) concentrations.

Most baseline metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of total aluminum, iron, and selenium. These exceptions are described as follows:

- Baseline total aluminum concentrations were generally above the 100 µg/L CWQG (for pH ≥ 6.5), with the exception of August 2006. The total aluminum concentration in June 2007 (275 µg/L) was above the 5.0 µg/L CWQG (for pH < 6.5). The elevated concentrations ranged from 113 to 321 µg/L (Appendix B5). The dissolved aluminum concentration was above the guideline in June 2007 (46 µg/L).
- Baseline total iron was above the 300 µg/L CWQG in June (346 µg/L) and August 2007 (479 µg/L) (Appendix B5).
- Total selenium concentrations were naturally above the 1 µg/L CWQG in August and September 2006, and July and August 2007. The elevated concentrations ranged from 1.1 to 2.0 µg/L (Appendix B5). The dissolved selenium concentrations in August and September 2006 (1.2 and 1.3 µg/L, respectively) were also above the guideline.

The total cyanide concentrations in 2006 and 2007 were below the MRV (0.001 mg/L), with the exception of August 2006 (0.002 mg/L).

3.4.2.6 Windy Outflow

Windy Outflow is a clear, coloured (< 1 to 48 TCU) freshwater stream characterized by naturally soft water and low to moderate conductivity during open water conditions. The waters were generally slightly coloured (< 1 to 11 TCU) throughout most of the year, with the highest colour value recorded (48 TCU) associated with snow melt conditions in June 2007.

Field pH was near neutral to slightly alkaline (pH 6.9 to 7.8) and within the CWQG of pH 6.5 to 9.0 in 2006 and 2007) (Appendix B3) (CCME 2007a).

Conductivity values were variable in 2006 and 2007, ranging from 431 to 437 µS/cm in 2006 and 86 to 411 µS/cm in 2007. The lowest conductivity value (86 µS/cm) was measured in June 2007 and attributed to the influence of snow melt conditions on the outflow. The major ions were dominated by sodium and chloride. Windy Outflow was characterized as having the highest conductivity (437 µS/cm), which was measured in September 2006.

TSS concentrations were typically < 1 mg/L in 2006 and 2007, with elevated concentrations measured in August 2006 (10 mg/L) and June 2007 (4 mg/L) (Appendix B5).

Windy Outflow was generally well oxygenated in 2006 and 2007; however, the July 2007 DO concentration (7.9 mg/L) was below the 9.5 mg/L CWQG for protection of early life stages of fish (Appendix B3) (CCME 2007a).

Typical seasonal temperature trends were recorded in 2006 and 2007; the warmest temperatures were recorded in July and August, with cooler temperatures in June and September (Figure 3.38).

Concentrations of TP in Windy Outflow generally ranged from 3 to 21 µg/L in 2006 and 2007, with the exception of an elevated concentration in August 2006 (73 µg/L), which was also associated with the highest TSS and TKN concentrations (10 and 0.97 mg/L, respectively). Based on the TP concentrations, the outflow would be classified as being ultra-oligotrophic to meso-eutrophic (Appendix B1) (CCME 2004). All of the dissolved inorganic forms of nitrogen were well below the CWQGs (CCME 2007a) in both years, and generally represented < 12% of total nitrogen concentration (the TKN ranged from 0.11 to 0.97 mg/L in 2006 and 0.08 to 0.35 mg/L in 2007). The proportion of dissolved inorganic nitrogen to total nitrogen was higher in June 2006 (i.e., 17%) due to elevated ammonia (0.016 mg N/L), which was associated with a relatively low TKN concentration (0.12 mg/L).

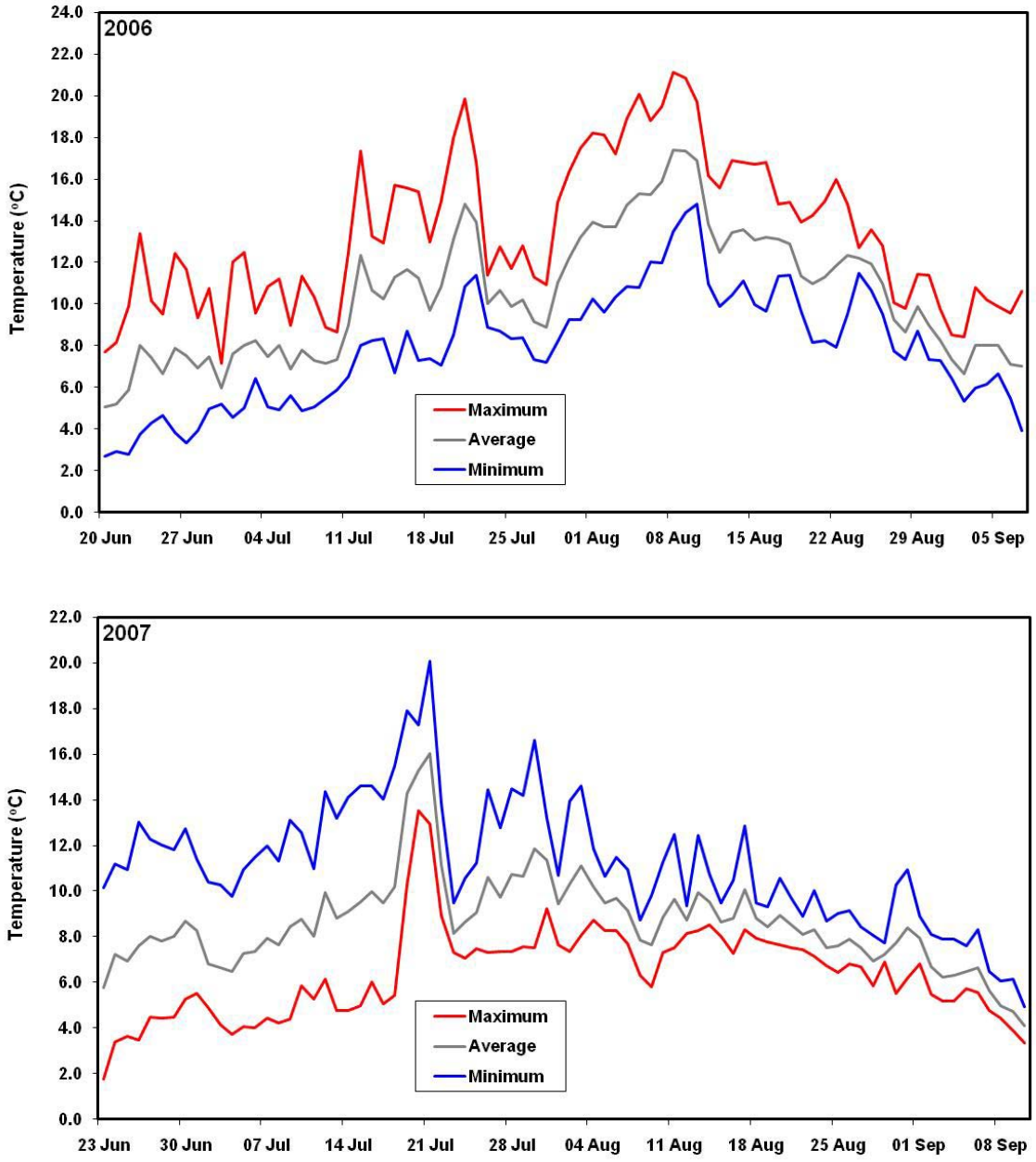


Figure 3.38 Windy Outflow Daily Temperature: Maximum, Minimum, and Average, 2006 and 2007

Baseline metal concentrations were below the applicable CWQGs (CCME 2007a), with the exception of total aluminum, copper and selenium. These exceptions are as follows:

- Baseline total aluminum concentrations were higher than the 100 µg/L CWQG (for pH ≥ 6.5) in August 2006, with the concentration of 204 µg/L (Appendix B5). This elevated concentration corresponded with the high TSS concetration (10 mg/L).
- Total and dissolved copper concentrations in June 2007 (2.2 and 2.0 µg/L respectively) were at, or above, the 2.0 µg/L CWQG (Appendix B5).
- Baseline total selenium concentrations were above the 1.0 µg/L CWQG in 2006, and in July 2007, with elevated concentrations ranging from 1.3 to 2.0 µg/L (Appendix B5).

The total cyanide concentrations ranged from < 0.001 to 0.002 mg/L in 2006. In 2007, the total cyanide concentrations were below the MRV (0.001 mg/L).

3.4.3 Madrid Project Area Streams Summary

The water quality of streams within the Madrid Project area generally was consistent with their associated lakes in the Project area. The streams were normally clear, coloured, and characterized as soft with naturally low to moderate conductivity.

The range of pH values exhibited by each stream in 2006 and 2007 was slightly acidic to slightly alkaline in both years, with slightly lower pH values measured in 2007 (Appendix B5). The pH was generally within the CWQG range of pH 6.5 to 9.0 (CCME 2007a); the notable exception was June 2007, when the pH in Patch and P.O. outflows was 5.6. Major ions were generally dominated by sodium, chloride, or calcium.

Most of the streams were well oxygenated over the open water season, with most of the measured DO concentrations above the 9.5 mg/L CWQG. During the 2006 and 2007 sampling season, Patch, Pelvic, and Windy outflows had DO concentrations slightly below the 9.5 mg/L CWQG for protection of early life stages of fish (CCME 2007a) on one sampling occasion.

Logged temperatures in the streams and rivers indicated typical seasonal patterns, with the warmest temperatures in July and August, and cooler temperatures in early June and September. As observed in the Boston Project area streams, the general temperature trend in 2006 was for a series of maxima peaks throughout July and August, but only one prominent maxima peak in 2007.

Phosphorus concentrations in the outflows were more variable compared to levels measured in their associated lakes in 2006 and 2007. Based on the TP

concentrations, the outflows would be classified from ultra-oligotrophic to meso-eutrophic. Windy Outflow had the lowest TP concentration reported for the Madrid Project area (ultra-oligotrophic) and Pelvic Outflow TP concentrations were more typical of eutrophic systems. The nitrogen to phosphorus ratio for streams and rivers in the Boston Project area streams indicated phosphorus limitation, i.e., the ratio was greater than 23 to 1, which is commonly considered to be the lower boundary of a phosphorus-limited system (Wetzel 2001).

During the 2006 and 2007 sampling seasons, baseline concentrations of total aluminum, chromium, copper, iron, and selenium were higher than the CWQGs (CCME 2007a) on one or more occasion in the Madrid Project area streams (Table 3.15). As significant intensive developments are not currently established within the Madrid or the Doris Project area watersheds, the range of measured total metals concentrations likely were sourced from natural catchment sources.

Total cyanide concentrations were consistently at, or below, both sets of MRVs (0.001 and 0.005 mg/L, respectively) in all outflows.

3.5 RESULTS AND DISCUSSION: MARINE BAYS

The following section provides a discussion of the water quality results in the marine bay study areas. Detailed discussion focusses on general water quality characteristics, and water quality parameters that have specific guidelines or assessment criteria (e.g., pH, DO, TSS, TP, dissolved inorganic nitrogen [ammonia, nitrate, and nitrite], and trace metals).

All field measurements of pH, conductivity, dissolved oxygen, and water temperature are provided in Appendix B3. Laboratory results of water quality analyses for the sampling programs are presented in Appendix B5.

3.5.1 Hope Bay

The sampling station in Hope Bay is moderately deep (approximately 16 m). The pH values (7.6 to 7.8) were consistent with the range expected for marine waters, and within the CWQG of pH 7.0 to 8.7 for the protection of marine life (CCME 2007a).

Table 3.15 Summary of Madrid Project Area Stream Water Samples that Were Above Guidelines for the Protection of Aquatic Life in Freshwater, 2006 – 2007

Station	Date	Field pH	TSS[a]	Al (Total)		Cr (Total)	Cu (Total)	Fe (Total)	Se (Total)
		CWQG 6.5-9.0		CWQG 100 µg/L for pH≥6.5	CWQG 5.0 µg/L for pH<6.5	CWQG 1.0 µg/L	CWQG 2.0 µg/L	CWQG 300 µg/L	CWQG 1.0 µg/L
Glenn Outflow	22-Jun-07	6.9	1	***195***			***2.6***		***1.5***
	19-Jul-07	7.5	8	***611***		***1.2***	***2.4***	***550***	***1.4***
	12-Aug-07	7.1	9	***570***			***2.9***	***357***	***1.3***
	15-Sep-07		3	***694***		***1.2***	***4.1***	***457***	
Ogama Outflow	19-Jun-06	6.6	3	***290***				***323***	
	21-Jul-06	7.7	3	***181***					
	12-Aug-06	7.5	4						***1.3***
	09-Sep-06	7.5	3	***119***					***2.0***
	22-Jun-07	6.9	3	***150***					***1.6***
	17-Jul-07	7.3	6	***198***				***368***	***1.1***
	12-Aug-07	6.9	5	***258***					
	17-Sep-07	6.8	4	***221***					
Patch Outflow	19-Jun-06	6.6	1	***135***					
	22-Jul-06	7.7	3	***253***					***1.4***
	12-Aug-06	6.8	5	***441***				***376***	***1.5***
	09-Sep-06	7.6	<1						***1.2***
	22-Jun-07	***5.6***	4		***320***		***3.0***	***497***	
	12-Aug-07	6.8	7	***763***		***1.2***		***491***	***1.3***
	17-Sep-07	6.9	2	***214***					
Pelvic Outflow	19-Jun-06	6.6	5	***119***					
	21-Jul-06	8.8	7	***135***					
	16-Aug-06	7.9	9	***143***					***1.6***
	22-Jun-07	6.5	3						***1.3***
	19-Jul-07	7.5	3	***128***					***1.1***
	18-Aug-07	7.0	8	***380***				***421***	
	16-Sep-07	6.7	9	***220***					
P.O. Outflow	19-Jun-06	6.6	<1	***192***					
	24-Jul-06	7.1	1	***115***					
	15-Aug-06	8.2	<1						***2.0***
	09-Sep-06	7.7	7	***113***					***1.8***
	22-Jun-07	***5.6***	3		***275***			***346***	
	19-Jul-07	7.3	1	***106***					***1.1***
	12-Aug-07	7.2	4	***318***				***479***	***1.2***
	17-Sep-07	6.8	2	***321***					
Windy Outflow	19-Jun-06	7.0	<1						***1.5***
	23-Jul-06	7.5	<1						***1.2***
	12-Aug-06	7.8	<1						***1.8***
	16-Aug-06		10	***204***					***1.7***
	09-Sep-06	6.9	<1						***2.0***
	22-Jun-07	7.2	4				***2.2***		
	19-Jul-07	6.9	<1						***1.3***

[a] Total suspended solids (TSS)

Values exceeding guidelines are italicized and bold.

Prepared by EJJ Checked by: JM

In July, August and September 2007, TDS concentrations were lower in the surface water column samples (3440 to 6900 mg/L) than in the bottom samples (23 300 to 30 600 mg/L) (Appendix B6). The low TDS concentration in the surface of the water column was indicative of the freshwater input to the bay during open water conditions, especially during spring melt. Higher TDS concentrations in bottom samples were associated with the density difference between the freshwater input and marine waters. Low density freshwater, particularly in high flow periods, will enter the bay and flow over the surface of the more dense marine waters. The extent of any TDS gradient through the water column will be dependent on the volume of freshwater inflow and the stability of the bay environment (calm conditions will maintain a distinct gradient between the surface and the bottom of the water column, whereas stormy conditions and high wave action will promote active mixing through a deeper proportion of the water column). As the bay is relatively deep, higher TDS concentrations will persist in the deeper portions of the water column.

Total suspended solids concentration Hope Bay ranged from < 3 to 17 mg/L (Appendix B6), with Secchi depths between 1.2 and 1.5 m (Appendix B3). TSS was highest during under ice conditions in May 2007 (Appendix B6).

During sampling in the open-water season of 2007, the DO concentrations were above the CWQG of 8.0 mg/L for the protection of aquatic life in marine waters (CCME 2007a), with the exception of measurements in September below 14 m (Figure 3.39). Dissolved oxygen stratification was observed in August and September. The stratification in September occurred at approximately 2 m depth, in association with thermal stratification. Strong temperature stratification of the water column was observed in July (Figure 3.39) when the temperature dropped from 11.7°C at 6.5 m depth to 1.3°C at 8.0 m depth. Weaker stratification was observed in September, with cooler water temperatures recorded in the top 2 m of the water column.

Baseline TP concentrations ranged from 12 to 32 µg/L. Total Kjeldahl Nitrogen concentrations ranged between 0.070 and 0.34 mg/L, with dissolved inorganic nitrogen (nitrate, nitrite, ammonia) contributing up to 61% of the total nitrogen in some samples. An evaluation of the dissolved inorganic nitrogen samples was made difficult due to inconsistent reporting levels, and the generally low analytical resolution of the ammonia, nitrite and nitrate analyses. Chl *a* concentrations ranged from 0.45 to 0.90 µg/L (Appendix B6). Based on the Trophic Index (TRIX) for marine systems, Hope Bay would be conservatively classified as naturally mesotrophic (CCME 2007b).

The CCME is still in the process of developing CWQGs for many of the marine parameters for which environmental toxicity is well established in freshwater. All

of the baseline total metal concentrations for which CWQGs (CCME 2007a) do exist for the marine environment were below the corresponding guidelines (Appendix B6).

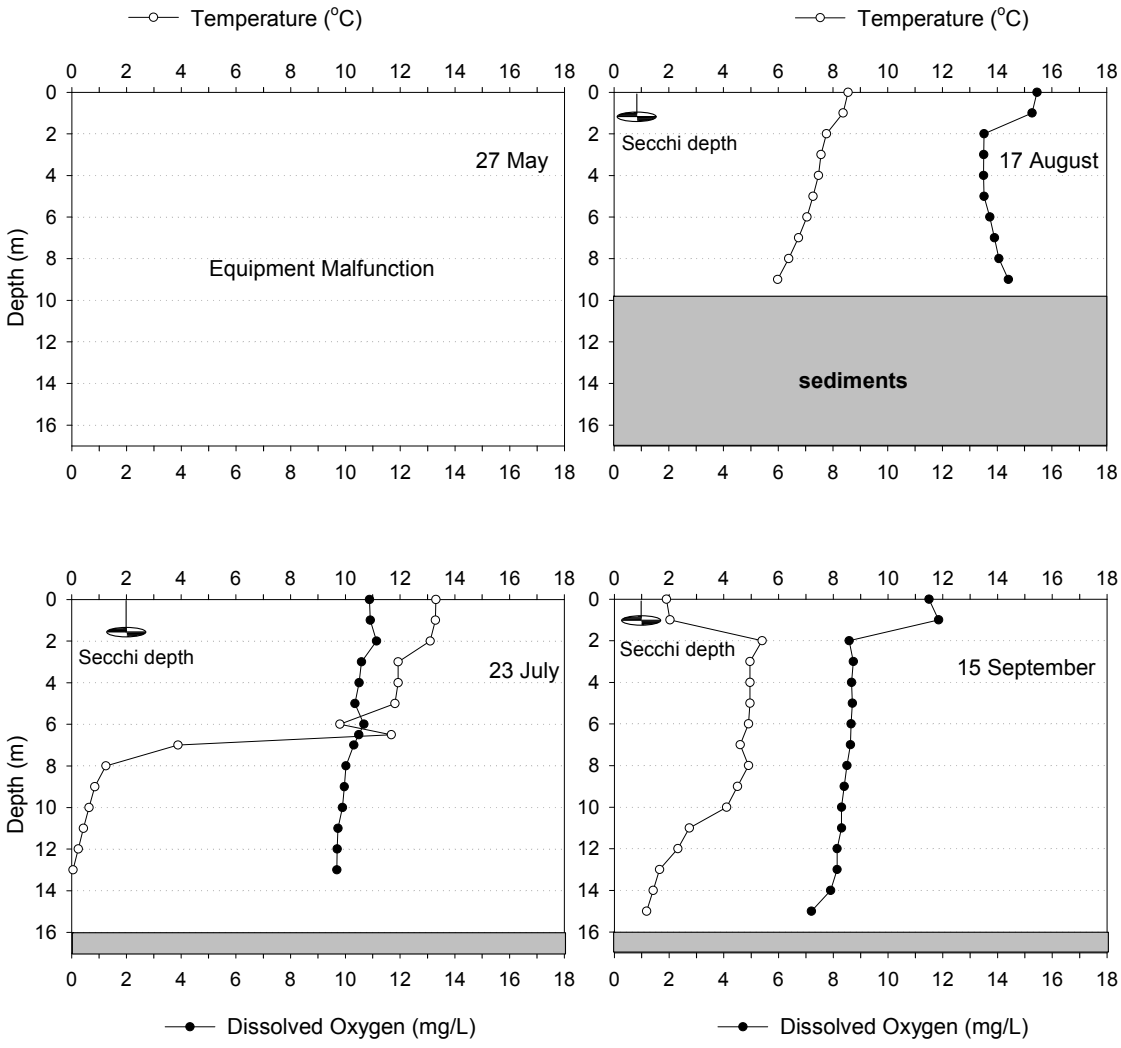


Figure 3.39 Temperature and Dissolved Oxygen (DO) Profiles and Secchi Depth for Hope Bay, 2007

4 SEDIMENT QUALITY

4.1 INTRODUCTION

Sediment chemistry and toxicity sampling was completed in the Boston and Madrid Project areas in 2007. The purpose of the sediment program was to collect baseline information for an overall spatial and temporal characterization of the sediment quality within the Project area.

4.2 METHODS

4.2.1 Field Sampling Stations

In August 2007, sediment sampling was conducted in Aimaokatalok, Fickle Duck, Reference and, Stickleback lakes located within the Boston Project area, and Glenn, Ogama, Patch, Pelvic, P.O., Windy, and Wolverine lakes located within the Madrid Project area (Figures 4.1 and 4.2; Tables 4.1 and 4.2). Sampling stations were marked using a Garmin 76 GPS.

Table 4.1 Summary of Sediment Sampling Locations in the Boston Project Area, 2007

Sampling Station	UTM Coordinates NAD 83 Zone 13W		Water Depth (m)	Location Description
	Easting	Northing		
Sediment Core Samples (Chemistry)				
Aimaokatalok Lake	440427	7509089	25.9	at WQ Station (Station 6)
Fickle Duck Lake	442641	7502851	3.5	at WQ Station
Reference Lake	437958	7503684	2.9	at WQ Station
Stickleback Lake	442034	7503839	3.5	E Section of Lake
Ekman Samples (Toxicity)				
Aimaokatalok Lake 1 (Deep - North)	440427	7509089	25.9	at WQ Station (Station 6)
Aimaokatalok Lake 2 (Shallow - North)	438954	7508845	4.0	W Section of Lake
Aimaokatalok Lake 3 (Shallow - South)	440366	7503654	4.0	S Section of Lake
Aimaokatalok Lake 4 (Deep - South)	440259	7504409	6.0	S Section of Lake
Aimaokatalok Lake 5 (Deep - South)	440607	7504748	6.0	S Section of Lake
Ekman Samples (Benthos & Concurrent Chemistry)				
Aimaokatalok Lake - Shallow	440360	7503267	2.2	S Section of Lake
Aimaokatalok Lake - Deep	440427	7509089	25.9	at WQ Station
Fickle Duck Lake - Shallow	442641	7502851	3.5	at WQ Station
Reference Lake - Shallow	437958	7503684	2.9	at WQ Station
Stickleback Lake - Shallow	442034	7503839	3.5	E Section of Lake

Prepared by: DM Checked by: AH



LEGEND

- CAMP
- SEDIMENT SITE
- TOXICITY SITE
- SEDIMENT AND TOXICITY SITE
- CONTOUR (20 m INTERVAL)
- WATERCOURSE
- WATERBODY

1500 0 1500

SCALE 1:50000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

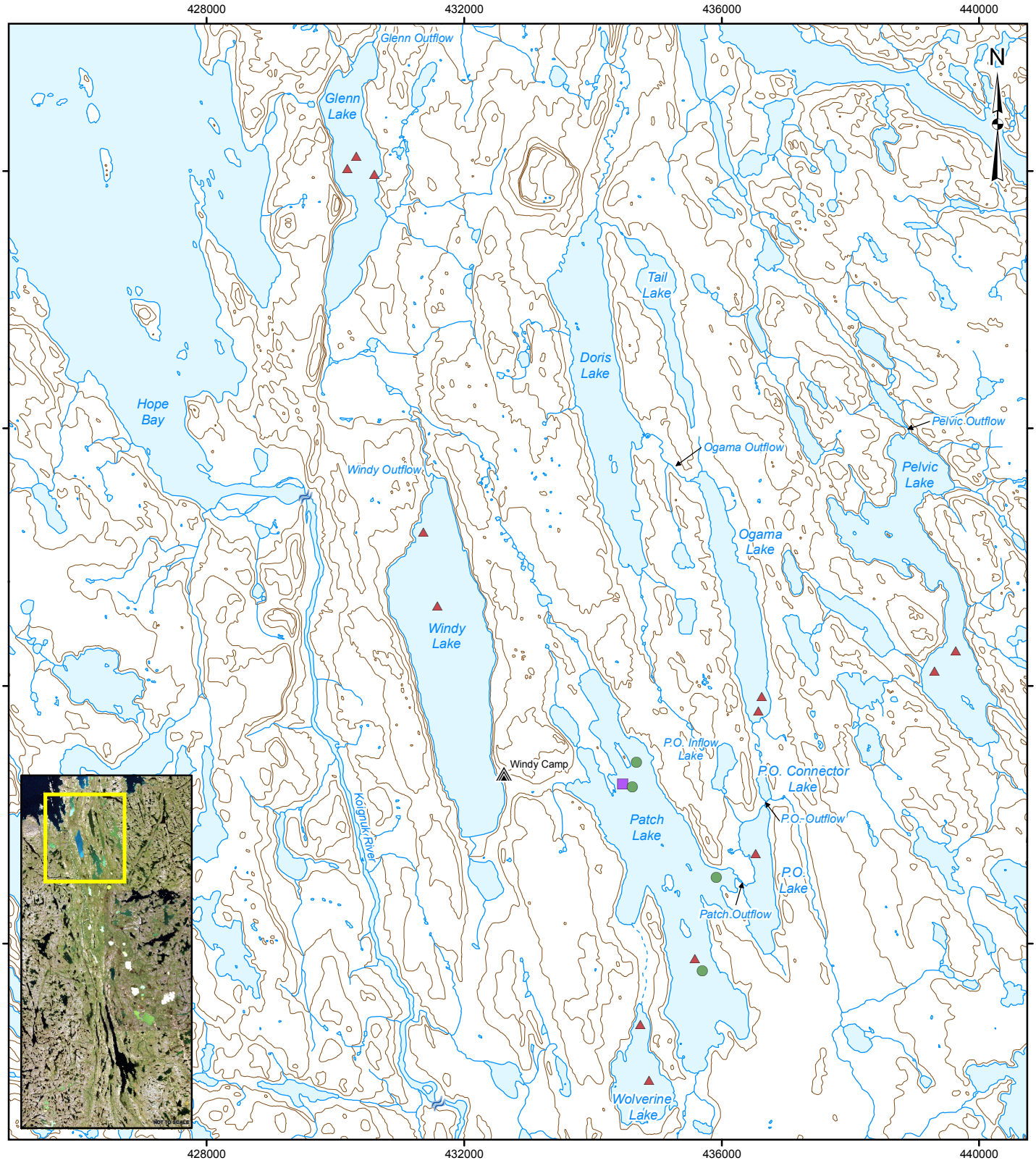
2007 SEDIMENT AND TOXICITY SAMPLING STATIONS, BOSTON PROJECT AREA

Golder Associates
Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	RC	16 Mar. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 4.1

M:\Projects\2008\1373\0026_HBML_Doris_North_Environmental_Programs\MapDocs\2007_Revised\Fig4_1_AQ_SL_SedimentSampling_Boston07_Feb1809.mxd



LEGEND

- CAMP
- SEDIMENT SITE
- TOXICITY SITE
- SEDIMENT AND TOXICITY SITE
- RAPID
- CONTOUR (20 m INTERVAL)
- INTERMITTENT STREAM
- WATERCOURSE
- WATERBODY

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

2007 SEDIMENT AND TOXICITY SAMPLING STATIONS, MADRID PROJECT AREA

Golder Associates
Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	RC	11 Mar. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 4.2

M:\Projects\2008\1373\0026_HBML_Doris_North_Environmental_Programs\MapDocs\2007_Revised\Current\Fig4_2_AQ_SL_SedimentSampling_Madrid07_10March09.mxd

Table 4.2 Summary of Sediment Sampling Stations in the Madrid Project Area, 2007

Sampling Station	UTM Coordinates NAD83 Zone 13W		Water Depth (m)	Location Description
	Easting	Northing		
Sediment Core Samples (Chemistry)				
Glenn Lake[a]	430185	7560026	9.0	at WQ Station
Ogama Lake	436610	7551839	6.0	at WQ Station
Patch Lake (South)	435583	7547770	13.7	at WQ Station
Patch Lake (North)	434461	7550485	3.9	N Section of Lake
Pelvic Lake	439631	7552509	15.0	at WQ Station
P.O. Lake	436504	7549439	4.0	at WQ Station
Windy Lake	431569	7553210	18.0	at WQ Station
Wolverine Lake	434826	7547029	3.0	at WQ Station
Ekman Samples (Toxicity)				
Patch Lake 1 (Shallow - North)	433763	7550475	2.5	NW Corner of Lake
Patch Lake 2 (Deep - North)	434612	7550429	5.2	N Section of Lake
Patch Lake 3 (Deep - North)	434677	7550824	6.0	N Section of Lake
Patch Lake 4 (Shallow - South)	435918	7549027	3.0	E Section of Lake
Patch Lake 5 (Deep - South)	435597	7547755	13.7	adjacent to WQ Station
Ekman Samples (Benthos & Concurrent Chemistry)				
Glenn Lake - Shallow	430665	7559962	2.5	SE Section of Lake
Glenn Lake - Deep	430332	7560218	9.0	at WQ Station
Ogama Lake - Shallow	436607	7551621	2.5	S Section of Lake
Ogama Lake - Deep	436610	7551839	6.0	at WQ Station
Patch Lake - Shallow	434312	7550572	3.1	N Section of Lake
Patch Lake - Deep	435583	7547770	13.7	at WQ Station
Pelvic Lake - Shallow	439231	7552339	4.2	SW Section of Lake
Pelvic Lake - Deep	439631	7552509	15.0	at WQ Station
P.O. Lake - Shallow	436504	7549439	4.0	at WQ Station
Windy Lake - Shallow	431298	7554449	3.5	N Section of Lake
Windy Lake - Deep	431569	7553210	18.0	at WQ Station
Wolverine Lake - Shallow	434717	7546873	3.5	S Section of Lake

[a] Replicate 1 collected approximately 3 m to the north (water depth 13.0 m).

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4.2.2 Field Sampling Procedures

All sediment sampling was completed according to the Golder Technical Procedure 8.2-3: *Sediment Sampling* (unpublished file information).

4.2.2.1 Core Samples

A 5.08 cm diameter Wildco gravity corer was used to collect surficial sediment samples for chemical analyses. Physical properties, such as texture, grain size, and moisture content, were also analyzed for these samples. Field observations of

colour, odour, and presence/absence of biota were recorded during the sampling program.

The gravity corer was deployed by releasing it from the boat at the water surface and allowing it to penetrate the surface sediment layers. The corer was then raised to the surface and the cored sediment retrieved, provided that the penetration depth was sufficient (i.e., >10 cm). Five replicate samples were collected at each sediment core station, which generally corresponded to the water quality sampling station (Tables 4.1 and 4.2). In select instances, the sediment core station was relocated from the station used for water quality sampling because excessive benthic vegetation or other conditions hindered the collection of adequate core samples.

Each replicate sample consisted of a composite of three core samples, where the top 5 cm of each core was retained in labeled clean plastic bags provided by the analytical laboratory. Initially, clean disposable plastic core tubes were fitted inside the gravity corer with an end cap to hold the apparatus together; however, the cap was lost approximately mid-way through the sampling program and the gravity corer was subsequently used without disposable plastic core tubes. Between stations, the gravity corer was thoroughly washed with station water to clean any adhered sediments and reduce the possibility for cross-contamination from the previous station.

Sediment samples were submitted to Maxxam Analytics Inc. (Burnaby, BC) for analysis of physical and chemical properties, including texture, particle size, moisture content, total organic carbon (TOC), and total metals.

4.2.2.2 Ekman Samples

Additional grab samples of surficial sediments were collected using an Ekman bottom grab sampler for chemical analyses, toxicological investigations, and benthos identification and abundance assessments. The Ekman sampler was deployed through the water column at deep (> 5 m) and shallow (approximately 2 to 4 m) stations at each lake. Where the maximum lake depth was less than 5 m, samples were collected only from the shallow station.

Five benthos replicate samples were collected at each station, and an additional Ekman grab sample was collected for concurrent chemical analysis. Samples were retained in clean plastic bags and stored in coolers with ice packs prior to shipment to Joanna Fedoruk & Associates Environmental Consultants (Redwater, AB) for benthic identification and Maxxam Analytics Inc. (Burnaby, BC) for chemical analysis.

Sediment samples for toxicological investigations were collected from Aimaokatalok and Patch lakes. Five depositional habitat locations in each lake were sampled. Toxicity samples were collected from three deep (> 5 m) and two shallow (2 to 4 m) stations in each lake at the following locations:

- Aimaokatalok Lake – northern section (1 deep, 1 shallow);
- Aimaokatalok Lake – southern section (2 deep, 1 shallow);
- Patch Lake – northern section (2 deep, 1 shallow); and
- Patch Lake – southern section (1 deep, 1 shallow).

Sediments were retained in clean 10 L plastic buckets supplied by the toxicological laboratory. Following collection, samples were kept cool in coolers with ice packs and shipped to HydroQual Laboratories Ltd. (Calgary, AB) for toxicological testing.

4.2.3 Laboratory Analytical Procedures

Sediment quality samples were analysed for moisture content, particle size, TOC, and total metals. Analytical detection limits are presented in Table 4.3. Maxxam Analytics Inc. (Burnaby, BC) performed the physical and chemical analyses.

Laboratory QA/QC procedures, including analysis of laboratory duplicates, blank, and spiked samples, were conducted to verify accuracy of laboratory results. Parameter values and recovery were within the acceptable quality control limits (Appendix C3).

4.2.4 Toxicological Laboratory Methods

Sediment samples obtained from Aimaokatalok and Patch lakes were analyzed for toxicity effects at HydroQual Laboratories Ltd. (Calgary, AB) using the following tests:

- 14-day static *Hyalella azteca* survival and growth test (Environment Canada EPS 1/RM/33);
- 10-day static *Chironomus tentans* survival and growth test (Environment Canada EPS 1/RM/32); and
- Luminescent Bacterium *Vibrio fischeri* 30-minute inhibition of light output test (Environment Canada EPS 1/RM/42).

Table 4.3 Reported Detection Limits (RDL) for Sediment Quality Analyses, 2007

Parameter	Units	Detection Limit	Parameter	Units	Detection Limit
Physical			**Organic**		
Moisture	**%**	**0.3**	**Total Organic Carbon (TOC)**	**%**	**0.02-0.1**
Total Metals					
Aluminum (Al)	mg/kg	100	Molybdenum (Mo)	mg/kg	0.1
Antimony (Sb)	mg/kg	0.1	Nickel (Ni)	mg/kg	0.8
Arsenic (As)	mg/kg	0.2	Phosphorus (P)	mg/kg	10
Barium (Ba)	mg/kg	0.1	Potassium (K)	mg/kg	100
Beryllium (Be)	mg/kg	0.1	Selenium (Se)	mg/kg	0.5
Bismuth (Bi)	mg/kg	0.1	Silver (Ag)	mg/kg	0.05
Cadmium (Cd)	mg/kg	0.05	Sodium (Na)	mg/kg	100
Chromium (Cr)	mg/kg	1	Strontium (Sr)	mg/kg	0.1
Cobalt (Co)	mg/kg	0.3	Thallium (Tl)	mg/kg	0.05
Copper (Cu)	mg/kg	0.5	Tin (Sn)	mg/kg	0.1
Iron (Fe)	mg/kg	100	Titanium (Ti)	mg/kg	1
Lead (Pb)	mg/kg	0.1	Vanadium (V)	mg/kg	2
Magnesium (Mg)	mg/kg	100	Zinc (Zn)	mg/kg	1
Manganese (Mn)	mg/kg	0.2	Zirconium (Zr)	mg/kg	0.5
Mercury (Hg)	mg/kg	0.05			

Note: % = percent; mg/kg = milligrams per kilogram

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Five samples from each lake were submitted for toxicity testing. The above tests were performed according to appropriate Environment Canada protocols (Environment Canada 1997a, 1997b, 2002a). One deviation to the Environment Canada protocol with reference to the luminescent bacterium tests was noted. These tests were initiated at eight weeks following sample collection, while stipulated holding times for this test are ≤ 2 to 6 weeks. This deviation from protocol is not anticipated to have affected test results as the sample containers were filled with little to no headspace (i.e., a limited amount of oxygen was available for oxidation reactions) and were held in the dark at a temperature of approximately 4^{o}C. Although the effects of increased holding times on sediment toxicity are variable, a maximum holding time of up to eight weeks in a cold (4^{o}C) and dark, nitrogen-rich environment is acceptable in some jurisdictions (Washington State Department of Ecology 2003). All other aspects of the Environment Canada protocols were met during toxicity testing.

4.3 RESULTS AND DISCUSSION: LAKE SEDIMENT PHYSICAL AND CHEMICAL CHARACTERISTICS

The following sections provide a description of physical and chemical characteristics of the sediments collected in the Boston and Madrid Project area lakes in August 2007. Parameters included field observations (colour and odour of the sediment), texture, particle size, and TOC and total metals concentrations.

Sediment metals concentrations were compared to the Canadian Sediment Quality Guidelines (CSQGs) for the Protection of Freshwater Aquatic Life to assess whether baseline sediment metals concentrations were below recommended maximum concentrations (CCME 2002). The CSQGs recommend screening metals concentrations using two values to assess sediment quality. The first, referred to as the Threshold Effect Level (TEL), is the concentration below which adverse effects are rare. The second, referred to as the Probable Effects Level (PEL), is the concentration at which adverse effects are likely to occur. The definition of the TEL is consistent with that of the CSQGs (and Interim Sediment Quality Guidelines [ISQG]), whereas the PEL is recommended as an additional sediment quality assessment tool that can be useful in identifying sediments in which adverse biological effects are more likely to occur (CCME 2002). Metals concentrations in lake sediments for this report were screened against both the ISQG (TEL) and PEL values.

Total arsenic, chromium, and copper concentrations were above the applicable CSQGs in one or more samples collected from the Boston and Madrid Project area lakes. However, sediment metals concentrations remained below PEL levels for all sediment samples (Appendix C1).

Raw chemistry data for all sediment samples are provided in Appendix C1, and summary statistics are provided in Appendix C2. Where applicable, values below detection limits were treated as one half of the detection limit during calculations.

4.3.1 Boston Project Area Lakes

4.3.1.1 Aimaokatalok Lake

Sediment samples collected from Aimaokatalok Lake were grey in colour and consisted primarily of clay to silt sized particles (Appendix C1). A thin rust-coloured layer was observed at the surface of the sediment samples. No detectable odour was noted in the samples at the time of collection.

Core Samples

Total organic carbon (TOC) concentrations ranged from 0.75 to 1.1%, with a median concentration of 0.8% (Appendix C2). Only the total chromium concentrations were above the ISQG in cored sediments obtained from Aimaokatalok Lake. Total chromium concentrations ranged from 52 to 60 mg/kg, with a mean concentration of 56 mg/kg and a median concentration of 55 mg/kg (Appendix C2), which is above the ISQG (37.3 mg/kg). Concentrations of all other metals for which ISQGs are available were below applicable guidelines (Appendix C2). PELs were not exceeded in any samples.

Ekman Samples

Sediments from the deep station were collected in close proximity to the core sampling location in support of the benthic invertebrate samples. Physical properties and chemistry results for sediment collected using the Ekman grab were similar to samples collected with the core sampler. Total chromium was the only metal with a concentration (55 mg/kg) above the ISQG (37.3 mg/kg) at the deep station (Appendix C1).

Sediment chemistry results for the Aimaokatalok Lake shallow Ekman station were considerably lower than all other lake stations for all metals analysed. There were no exceedances of ISQG or PEL guidelines for this sample. Lower metals concentrations in this sample were possibly due, in part, to a large sand component compared to higher proportions of fine particles (i.e., silt and clay) in the core samples and the deep Ekman sample (Appendix C1). Higher metal concentrations are often associated with increased proportions of fine-grained sediments, particularly clay particles (Kersten and Smedes 2002; Newman and Watling 2007).

4.3.1.2 Fickle Duck Lake

Fickle Duck Lake sediments were grey in colour and were composed primarily of silty loam. There was a faint hydrogen sulfide odour detected in the sediments during field collection.

Core Samples

TOC concentrations ranged from 2.4 to 4.0%, with a median concentration of 3.4% (Appendix C2). Only the total chromium concentrations were above the ISQG (37.3 mg/kg), with concentrations ranging from 40 to 55 mg/kg, with a mean concentration of 48 mg/kg and a median concentration of 47 mg/kg (Appendix C2). Concentrations of all other metals for which ISQGs are available were below applicable guidelines (Appendix C2). PELs were not exceeded in any samples.

Ekman Sample

Since the maximum lake depth at Fickle Duck Lake was less than 5 m, a deep Ekman sample was not collected. The shallow station was located in the same location as the core sampling station, and physical and chemical characteristics of sediments were generally consistent between the two sampling methods. The total chromium concentration was 39 mg/kg, which was above the ISQG (Appendix C1). All other metals were below ISQGs, and all metals were below the PELs.

4.3.1.3 Reference Lake

During sediment collection efforts at Reference Lake, an equipment malfunction resulted in an incomplete set of replicate gravity core samples being collected. Thus, two replicate samples were collected with the gravity corer and the remaining three replicates were collected using an Ekman grab. Sediments from both equipment types were collected from similar depth horizons and were considered to be consistent and representative of actual conditions, despite the differences in collection methods.

Sediments collected at Reference Lake consisted of silty loam sized particles. The sediment was grey in colour and had a patchy surface organic layer. No odour was detected in the sampled sediments.

Core and Ekman Samples

TOC concentrations ranged from 2.1 to 2.6%, with a median concentration of 2.6% (Appendix C2). Concentrations of total chromium ranged from 50 to 53 mg/kg,

with a mean concentration of 51 mg/kg and a median concentration of 52 mg/kg, which were above the ISQG value of 37.3 mg/kg (Appendix C2). All other parameters were below applicable ISQGs. PELs were not exceeded in any samples.

Ekman Sample

There was no deep station for Reference Lake, as the maximum lake depth was less than 5 m. Ekman sampling for the shallow station was conducted at the same location as the core sampling. Physical and chemical properties of sediment collected from the shallow station at Reference Lake by Ekman grab were similar to those collected with the core sampling method. The total chromium concentration in the shallow Ekman sample (53 mg/kg) was above the ISQG of 37.3 mg/kg (Appendix C1). Concentrations of all other metal metals were below applicable ISQGs.

4.3.1.4 Stickleback Lake

The particle size of sediments collected from Stickleback Lake consisted primarily of silt to silty loam. Sediments were brown in colour and emitted a strong H_2S odour during field collection.

Core Samples

TOC concentrations in Stickleback Lake sediments were high compared to other surrounding Boston Project area lakes; TOC concentrations ranged between 9.2 and 12%, with a median concentration of 9.9% (Appendix C2). Mean and median total chromium concentrations (36 mg/kg) were slightly below the ISQG (37.3 mg/kg); however, two of the five replicates had concentrations of total chromium that were elevated slightly above the guideline. The range of concentrations of total chromium was between 34 and 38 mg/kg (Appendix C1 and Appendix C2).

Total copper concentrations were higher than the ISQG in four of the five replicate samples. Concentrations ranged from 34.6 to 39.0 mg/kg, with a mean of 36.8 mg/kg and a median of 36.7 mg/kg, which were slightly higher than the ISQG concentration of 35.7 mg/kg (Appendix C2). All other metal concentrations were below applicable ISQGs, and all metals were below the PELs in all samples.

Ekman Sample

Ekman sampling was only conducted at the shallow station, since the maximum lake depth was less than 5 m. The shallow station was consistent with the core sampling station, and physical and chemical properties of the collected sediments were similar for both sampling methods. Concentrations of total chromium

(38 mg/kg) and total copper (39.1 mg/kg) were above the ISQGs (Appendix C1). Concentrations of all other metals were below the ISQGs for the Stickleback Lake shallow station.

4.3.2 Madrid Project Area Lakes

4.3.2.1 Glenn Lake

The grey-brown coloured sediments collected at Glenn Lake were predominantly fine-grained, with a high proportion of clay-sized particles; however, sediments collected at the shallow Ekman station had higher silt content than those of the core and deep Ekman samples (Appendix C1). There was no detectable odour in the samples at the time of collection.

Core Samples

TOC concentrations were low in comparison to other lakes, ranging from 0.59 to 0.65%, with a median concentration of 0.61% (Appendix C2). Total chromium concentrations were above the ISQG in all five replicate samples, ranging between 70 and 82 mg/kg, with a mean concentration of 75 mg/kg and a median concentration of 76 mg/kg (Appendix C2).

Total copper concentrations were slightly above the ISQG (35.7 mg/kg) in four of the five replicate samples, with a mean concentration of 37.2 mg/kg and a median concentration of 37.3 mg/kg (range from 34.6 to 39.8 mg/kg) (Appendix C2). Concentrations of all other metals were below ISQG values and PELs were not exceeded in any of the samples.

Ekman Sample

The deep Ekman sampling station was located at the same station as the core sampling, and sediment characteristics were consistent between the two sampling methods. Concentrations of total chromium (73 mg/kg) and copper (37.9 mg/kg) were above the ISQGs (Table 4.5). Concentrations of all other parameters were below ISQG values (Appendix C2).

Sediment quality results for the shallow Ekman station were consistently lower than those of both the deep Ekman and core samples. Total chromium was the only metal with a concentration (49 mg/kg) above the ISQG (Appendix C1). Metal concentrations did not exceed the PELs in any samples.

4.3.2.2 Ogama Lake

The texture of Ogama Lake sediments ranged from silt-clay-loam to loam. Sediments were dark grey in colour with a thin brown/rust-coloured surface layer. A faint H_2S odour was present, and observations of *Chironomus* sp. within the core samples were recorded at the time of sampling.

Core Samples

Concentrations of TOC in sediments collected at Ogama Lake ranged from 1.9 to 2.7%, with a median concentration of 2.3% (Appendix C2). Total chromium was the only metal with a concentration that was higher than the ISQG. The mean and median total chromium concentrations were 60 mg/kg, with a range of 59 to 61 mg/kg (Appendix C2). There were no exceedances of the PEL, and concentrations of all other metals were below applicable ISQGs.

Ekman Samples

Ekman sampling for the Ogama Lake deep station was conducted at the core sampling station, and total metals concentrations were within or slightly below the ranges measured for core samples. Total chromium was the only metal with a concentration (60 mg/kg) above the ISQGs (Appendix C1).

Sediment from the Ogama Lake shallow station contained metals concentrations consistently lower than those measured in the core samples and the deep Ekman sample, with the exception of total zirconium (Appendix C1). The TOC concentration was also considerably lower at the shallow station, measuring 0.45%. The total chromium concentration was 44 mg/kg, which was above the ISQG (Appendix C1). All other metals were below applicable ISQGs, and all samples had metal concentrations below the PELs.

4.3.2.3 Patch Lake South

Sediment collected from the Patch Lake South station consisted primarily of silt-clay textured particles, which were grey in colour and had a thin rust-coloured layer near the surface. There was no detectable odour within the sediment grabs at the time of sample collection.

Core Samples

TOC concentrations ranged from 1.5 to 1.6%, with a median concentration of 1.6% (Appendix C2). Total chromium concentrations were above the ISQG in all replicates, with concentrations ranging from 65 to 72 mg/kg (Appendix C1). The mean total chromium concentration was 69 mg/kg and the median concentration

was 70 mg/kg (Appendix C2). All other metals were below applicable ISQGs. PELs were not exceeded for any samples.

Ekman Sample

Sediment chemistry results for the deep Ekman station at Patch Lake South were similar to those for the core samples, as the same location was used for both core sampling and the Ekman grab. Consistent with the core samples, total chromium was the only metal with a concentration (68 mg/kg) above the ISQG (Appendix C1). PELs were not exceeded in any samples.

4.3.2.4 Patch Lake North

The sediment coring station for Patch Lake North was located approximately 175 m to the southeast from the benthic sampling station. The change in sampling station was due to an abundance of vegetation on the substrate surface, which would have limited the collection of a core sample of sufficient depth for analysis.

The particle size of sediments obtained from the Patch Lake North sampling station ranged from silt-clay-loam to loam (Appendix C1). Sediment colour was light brown, and a layer of vegetation approximately 5 cm thick was observed on the surface of each core sample. Sediments had no detectable odour.

Core Samples

TOC concentrations in Patch Lake North sediments were slightly higher than those of Patch Lake South, with a median concentration of 2.5%, and a concentration range of 2.1 to 3.0% (Appendix C2). Total chromium and total copper concentrations were above the ISQGs for all five replicate samples (Table 4.5). Total chromium concentrations ranged from 74 to 82 mg/kg, with a mean and median concentration of 78 mg/kg. Total copper concentrations ranged from 50.9 to 55.1 mg/kg, with a mean concentration of 53.4 mg/kg and a median concentration of 53.8 mg/kg (Appendix C2). All other metal parameters, for which ISQGs and PELs are available, were below guidelines.

Ekman Samples

Sediment chemistry results for the shallow Ekman station at Patch Lake North were similar to the core samples from the North area. Consistent with the core samples, the total copper concentration of 58.3 mg/kg and the total chromium concentration of 64 mg/kg were higher than their applicable ISQGs (35.7 and 37.3 mg/kg, respectively) (Appendix C1).

4.3.2.5 Pelvic Lake

The predominantly silt-clay sediment was dark grey in colour, with a thin brown-coloured organic layer near the surface of each sample. A pungent H_2S odour was noted at the time of sample collection.

Core Samples

Concentrations of TOC in sediment core samples ranged from 1.4 to 1.7%, with a median concentration of 1.6% (Appendix C2). Total chromium concentrations were above the ISQG (37.3 mg/kg) in all of the five replicate samples, with concentrations ranging from 59 to 68 mg/kg, a mean concentration of 63 mg/kg, and a median concentration of 64 mg/kg (Appendix C2). Concentrations of all other metals for which ISQGs and PELs are available were below guidelines.

Ekman Samples

The deep sampling station at Pelvic Lake coincided with the core sampling station, and physical and chemical properties were similar to samples collected using the core sampling method. Total chromium, with a concentration of 68 mg/kg, was above the ISQG (Appendix C1). All other metals were below applicable guidelines.

Metal concentrations in sediments in the Ekman sample collected at the Pelvic Lake shallow station were lower than those for sediments collected at the deep Ekman and core stations. The total chromium concentration (41 mg/kg) was above the ISQG (Appendix C1). All other metals were below applicable guidelines.

4.3.2.6 P.O. Lake

The particle size of sediments collected from P.O. Lake ranged from silt-clay to clay. Sediments were dark grey in colour, and there was an organic layer at the top of each sediment sample. A moderate H_2S odour was present at the time of sampling.

Core Samples

Concentrations of TOC ranged from 1.3 to 1.7%, with a median concentration of 1.3% (Appendix C2). Total chromium concentrations were above the ISQG in all five replicate samples (Appendix C1); concentrations ranged between 65 and 76 mg/kg, with a mean and median concentration of 71 mg/kg (Appendix C2). All other metals were below applicable sediment quality guidelines, and there were no exceedances of the PEL.

Ekman Sample

Due to a maximum lake depth of less than 5 m, a deep sample was not collected in P.O. Lake. The shallow station was located at the same location as the core sampling station. Physical characteristics were similar between sediment samples collected with the corer and Ekman grab; however, there were some differences in sediment chemistry results. Five parameters were measured in the Ekman grab sample at levels above those found in the core samples. These included TOC, total arsenic, iron, manganese, and phosphorus (Appendix C2). Most notable of these parameters was total arsenic, with a concentration of 8.2 mg/kg that was elevated above the ISQG (5.9 mg/kg) (Appendix C1). Concentrations of other parameters were either within or slightly below the ranges of concentrations observed for the core samples. The total chromium concentration (63 mg/kg) was above the ISQG of 37.3 mg/kg (Appendix C1). All other metals were below applicable guidelines.

4.3.2.7 Windy Lake

Sediments collected from Windy Lake were dominated by silt-clay-sized particles at the core sampling and deep Ekman sampling stations. Sediments collected at the shallow Ekman station had lower clay content, and were dominated by silts (Appendix C1). Sediments were grey in colour, with a thin brown/rust-coloured surface layer. There was no odour present within the collected samples.

Core Samples

Concentrations of TOC were low compared to most of the other lakes within the area. The median TOC concentration was 0.84 %, and the concentration range was 0.73 to 0.97% (Appendix C2). Total chromium and copper concentrations were above the ISQG for all replicate samples. Total chromium concentrations ranged from 73 to 76 mg/kg, with a mean concentration of 74 mg/kg and a median concentration of 73 mg/kg (Appendix C2). Concentrations of total copper ranged from 40.6 to 43.7 mg/kg, with a mean concentration of 41.6 mg/kg and a median concentration of 41.3 mg/kg (Appendix C2). Concentrations of all other metals for which ISQGs are available were below applicable guidelines. Of note, the maximum total arsenic concentration (5.8 mg/kg) approached the ISQG value (5.9 mg/kg). There were no exceedances of the PEL for Windy Lake sediments.

Ekman Samples

Sediment chemistry from the deep Ekman station was consistent with that of the core samples as these samples were collected at the same location. The total arsenic concentration at the deep station was elevated slightly above the ISQG

(5.9 mg/kg), with a concentration of 6.1 mg/kg. Concentrations of total chromium (74 mg/kg) and copper (42.3 mg/kg) (Appendix C1) were also above the ISQG.

The sediment sample collected from the shallow Ekman station had metal concentrations consistently lower than levels observed for the deep Ekman sample and the core samples. These lower concentrations may be due, in part, to a lower proportion of fine particles at the shallow station compared to those of the core and deep stations. There were no ISQG or PEL guideline exceedances at the Windy Lake shallow station (Appendix C1).

4.3.2.8 Wolverine Lake

Particle size distribution for sediments collected at Wolverine Lake ranged from silt-clay to silt-clay-loam. Sediments were grey in colour and had no detectable odour at the time of sampling.

Core Samples

Total organic carbon concentrations in the core sediments from Wolverine Lake were generally higher than for most other lakes, and ranged from 3.6 to 4.9%, with a median concentration of 4.4% (Appendix C2). Total chromium was the only metal with concentrations above the ISQG, with a concentration range from 63 to 71 mg/kg (mean concentration of 66 mg/kg and median concentration of 65 mg/kg) (Appendix C2). All other metals were below applicable ISQGs, and there were no exceedances of the PELs for any parameter in Wolverine Lake samples.

Ekman Sample

A deep Ekman sample was not collected at Wolverine Lake due to a maximum lake depth of less than 5 m. The shallow station was located in the same location as the core sampling station, and physical and chemical properties of sediments were consistent between the two sampling methods. Total chromium was the only metal with a concentration (59 mg/kg) above the ISQG in the shallow Ekman sample (Appendix C1). All other parameters were below applicable guidelines.

4.4 SUMMARY

Particle size distribution of sediments collected in the Boston and Madrid Project area lakes ranged from clay to sand-loam sized particles; however, the majority of lake sediments contained a higher proportion of fine-sized particles (silt and

clays). In general, samples collected at shallow Ekman stations contained less clay than samples collected at deeper sampling stations. Contaminant concentrations can often be higher in sediments rich in clay. Higher metal concentrations in clays may occur because minerals that form fine grained sediments often contain higher initial metal concentrations, clays provide increased surface area to mass ratios available for adsorption of metals, and negatively charged clay particles may attract positively charged free metallic ions, thus increasing their metal concentration (Kersten and Smedes 2002; Newman and Watling 2007). Due to the higher proportion of coarse grained sediment in the shallow lake regions, these factors may contribute to the lower metal concentrations generally observed in lake sediments collected at the shallow stations versus those collected at deeper stations.

Concentrations of TOC varied considerably among lakes, ranging from 0.42% (Aimaokatalok Lake shallow) to 12% (Stickleback Lake). Stickleback Lake had the highest TOC concentrations, both in the core and Ekman samples. There was no apparent correlation between TOC concentrations and any of the three total metal (arsenic, chromium, and copper) concentrations that were higher than the ISQG values.

Metal concentrations in lake sediment samples were generally low at all stations, and there were no exceedances of the CCME PEL. However, there were several instances where baseline concentrations of total chromium, copper, and arsenic were above the applicable ISQGs (Tables 4.4 and 4.5). These metals concentrations were also elevated in similar stations during previous studies (RL&L/Golder 2002; Golder 2008a). Concentrations of metals were generally lower in Boston Project area lake sediments compared to those of Madrid Project area lakes. One notable exception was total copper concentrations in Stickleback Lake, which were elevated slightly above the ISQG (Tables 4.4 and 4.5). Nevertheless, these sediment metal concentrations remained within the range of natural variability for the Slave Structural Province (Puznicki 1996). During previous studies in the Madrid Project area (RL&L/Golder 2002), concentrations of chromium, copper, and arsenic were reported as being higher than PEL.

Table 4.4 Summary of Boston Project Area Sediment Samples that were Above CSQGs for the Protection of Freshwater Aquatic Life, 2007

Waterbody	Sample Type	Station	Moisture (%)	TOC (%)	Elevated Concentrations	
					Total Cr (mg/kg dry)	Total Cu (mg/kg dry)
					ISQG 37.3 mg/kg	ISQG 35.7 mg/kg
Aimaokatalok Lake	Gravity Core	1	44.5	1.1	55	
		2	42.2	1.1	52	
		3	44.7	0.87	55	
		4	46.0	0.78	60	
		5	47.4	0.75	56	
	Ekman	Deep	48.3	0.82	55	
Fickle Duck Lake	Gravity Core	1	50.5	3.4	40	
		2	56.7	2.4	55	
		3	55.2	3.7	46	
		4	44.4	4.0	50	
		5	50.5	3.2	47	
	Ekman	Shallow	56.4	3.2	39	
Reference Lake	Gravity Core/ Ekman	1	41.5	2.1	50	
		2	44.9	2.6	52	
		3	53.9	2.6	53	
		4	47.0	2.3	50	
		5	44.1	2.6	52	
	Ekman	Shallow	49.8	2.5	53	
Stickleback Lake	Gravity Core	1	87.7	9.5	38	37.7
		2	84.2	9.9		36.0
		4	87.4	12		36.7
		5	88.0	9.2	38	39.0
	Ekman	Shallow	89.8	11	38	39.1

Note: % = percent; TOC = total organic carbon; Cr = chromium; Cu = copper; mg/kg dry = milligrams per kilogram as dry weight; ISQG = Interim Sediment Quality Guideline; mg/kg = milligrams per kilogram

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Total chromium concentrations in sediments ranged from 34 to 82 mg/kg for core samples, and 10 to 74 mg/kg for Ekman samples. Concentrations in core samples were higher than the ISQG (37.3 mg/kg) at all stations for all replicate samples, with one exception. In Stickleback Lake, three of the five replicate samples contained total chromium concentrations slightly below the ISQG (Appendix C1). Average total chromium concentrations in sediments at Stickleback Lake (36 mg/kg) were also slightly below the ISQG. In the Ekman samples, total chromium concentrations were above the ISQG for all stations except Aimaokatalok Lake shallow and Windy Lake shallow stations. For all other lake sampling stations, total chromium concentrations were elevated above the ISQG, but were below the PEL (Figure 4.4).

Table 4.5 Summary of Madrid Project Area Sediment Samples that were Above CSQGs for the Protection of Freshwater Aquatic Life, 2007

Waterbody	Sample Type	Station	Moisture (%)	TOC (%)	Elevated Concentrations		
					Total As mg/kg (dry)	Total Cr mg/kg (dry)	Total Cu mg/kg (dry)
					ISQG 5.9 mg/kg	ISQG 37.3 mg/kg	ISQG 35.7 mg/kg
Glenn Lake	Gravity Core	1	52.3	0.65		82	39.8
		2	52.0	0.59		76	37.3
		3	53.5	0.61		76	37.7
		4	51.9	0.59		73	36.7
		5	54.2	0.61		70	
	Ekman	Shallow	47.2	0.46		49	
		Deep	57.4	0.66		73	37.9
Ogama Lake	Gravity Core	1	55.9	2.7		60	
		2	52.8	2.2		60	
		3	54.5	2.3		60	
		4	49.6	1.9		59	
		5	51.1	2.3		61	
	Ekman	Shallow	36.7	0.45		44	
		Deep	57.1	2.7		60	
Patch Lake South	Gravity Core	1	60.3	1.6		65	
		2	56.1	1.6		70	
		3	59.7	1.5		72	
		4	62.9	1.6		70	
		5	60.1	1.6		69	
	Ekman	Shallow	83.7	8.9		64	58.3
		Deep	61.6	1.7		68	
Patch Lake North	Gravity Core	1	74.1	2.5		79	55.1
		2	72.1	2.5		75	53.8
		3	68.6	2.1		82	53.4
		4	75.4	3.0		74	50.9
		5	66.9	2.1		78	54.0
Pelvic Lake	Gravity Core	1	54.6	1.6		64	
		2	62.3	1.5		62	
		3	65.1	1.7		68	
		4	60.6	1.4		59	
		5	56.2	1.6		64	
	Ekman	Shallow	47.1	1.3		41	
		Deep	59.4	1.5		68	
P.O. Lake	Gravity Core	1	53.4	1.3		65	
		2	67.8	1.7		76	
		3	62.4	1.4		69	
		4	63.2	1.3		71	
		5	57.3	1.3		74	
	Ekman	Shallow	62.9	2.1	8.2	63	
Windy Lake	Gravity Core	1	58.6	0.84		76	43.7
		2	62.5	0.82		73	41.3
		3	62.7	0.89		73	41.5
		4	61.3	0.73		73	40.6
		5	59.1	0.97		75	40.7
	Ekman	Deep	61.8	1.0	6.1	74	42.3

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Table 4.5 Summary of Madrid Project Area Sediment Samples that were Above CSQGs for the Protection of Freshwater Aquatic Life, 2007 (continued)

Waterbody	Sample Type	Station	Moisture (%)	TOC (%)	Elevated Concentrations		
					Total As mg/kg (dry)	Total Cr mg/kg (dry)	Total Cu mg/kg (dry)
					ISQG 5.9 mg/kg	ISQG 37.3 mg/kg	ISQG 35.7 mg/kg
Wolverine Lake	Gravity Core	1	70.7	4.4		71	
		2	71.5	4.9		67	
		3	66.8	3.6		63	
		4	70.3	4.5		65	
		5	65.2	3.8		65	
	Ekman	Shallow	69.5	3.5		59	

Note: % = percent; TOC = total organic carbon; Cr = chromium; Cu = copper; mg/kg dry = milligrams per kilogram as dry weight; ISQG = Interim Sediment Quality Guideline; mg/kg = milligrams per kilogram

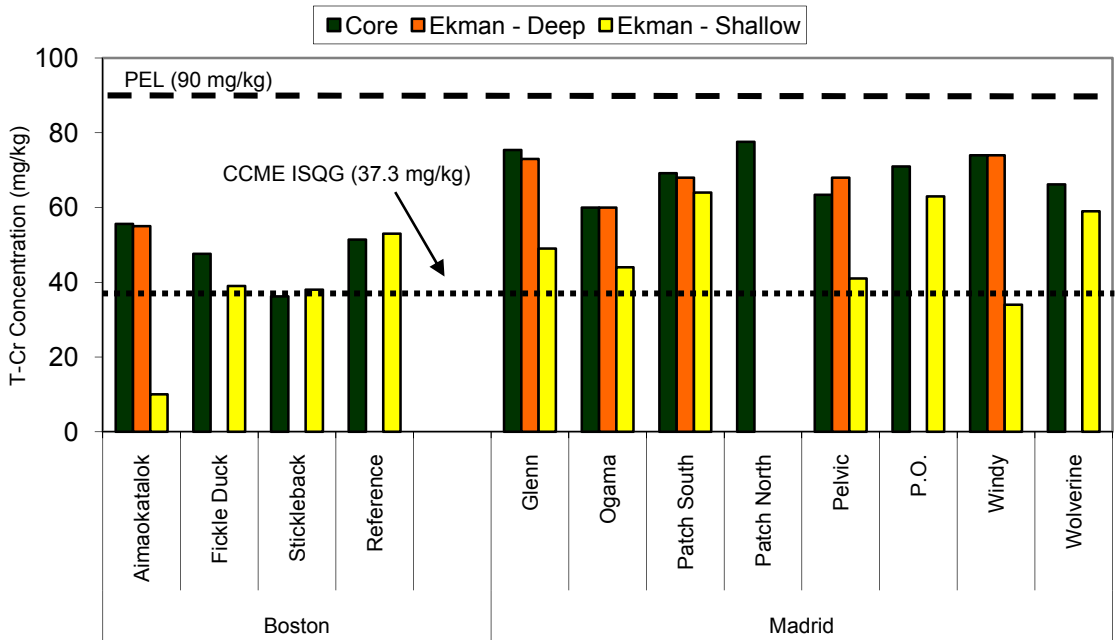


Figure 4.3 Mean Total Chromium Concentrations in Sediments Collected in Boston and Madrid Project Area Lakes, August 2007

Total copper concentrations slightly exceeded the ISQG (35.7 mg/kg) at four of the 12 lakes sampled, including Stickleback, Patch (North), Windy, and Glenn lakes (Tables 4.4 and 4.5). Concentrations of total copper at all lake stations

ranged from 19.2 to 55.1 mg/kg for core samples, and 5.2 to 58.3 mg/kg for Ekman samples (Figure 4.4).

Total arsenic exceeded the ISQG (5.9 mg/kg) at the P.O. Lake shallow (8.2 mg/kg) and Windy Lake deep (6.1 mg/kg) Ekman stations (Table 4.5). All other samples contained total arsenic in concentrations below the ISQG.

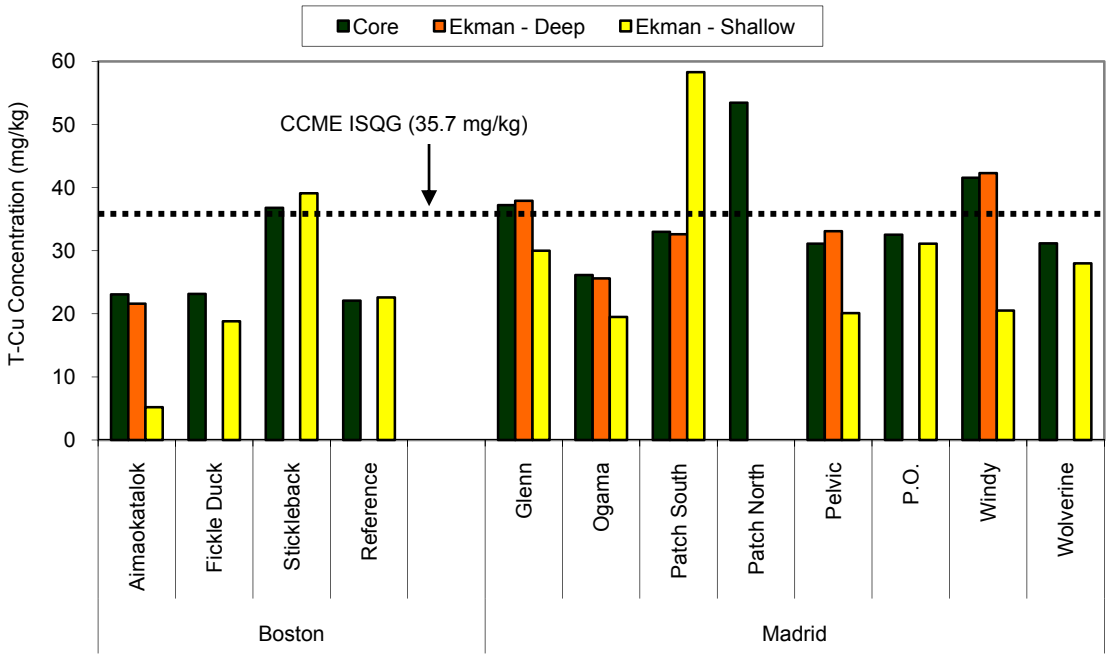


Figure 4.4 Mean Total Copper Concentrations in Sediments Collected in Boston and Madrid Project Area Lakes, August 2007

4.5 LAKE SEDIMENT TOXICITY

During sediment toxicity analyses for samples collected from Aimaokatalok and Patch lakes, toxicity was observed at a number of stations for one or more test organisms. The following sections provide an overview of toxicology test results. Sampling locations are provided in Tables 4.1 and 4.2.

4.5.1 Aimaokatalok Lake

Hyalella azteca

Survival of *H. azteca* test organisms exposed to Aimaokatalok Lake sediments in samples ranged from 66 to 100% and was not significantly lower ($p < 0.05$) than controls. In one sample, *H. azteca* survival in all replicates was 0% (Table 4.6). Though sediment chemistry data were not collected at the same location as this sample, total chromium was above the ISQG in all sediment samples except the shallow Ekman sample (Appendix C1). *H. azteca* mortality may have been a result of the elevated chromium concentrations.

Overall, growth of *H. azteca* in Aimaokatalok Lake test treatments ranged from 83 to 237%, compared to controls. Growth of test organisms in three samples during the *H. azteca* toxicity tests was significantly higher than that of control organisms (Table 4.6). There were no significant reductions in growth in any samples (note that since all test organisms in one sample died, no growth measurements could be taken).

Table 4.6 Summary of Toxicity Test Results for *H. azteca* and *C. tentans*, 2007

Sample Number & Location			*Hyalella azteca*		*Chironomus tentans*	
			Response (% Controls)		Response (% Controls)	
			Survival	Growth	Survival	Growth
Aimaokatalok Lake	1	North - Deep	100	237*	111	94
	2	North - Shallow	66	83	107	124*
	3	South - Shallow	93	184*	78	124*
	4	South - Deep	82	136*	93	110
	5	South - Deep	0*	n/a	82	127
Patch Lake	1	North - Shallow	105	82	73*	72
	2	North - Deep	98	136*	77	75
	3	North - Deep	33*	121	82*	66
	4	South - Shallow	109	139*	95	86
	5	South - Deep	79	80	57*	81

Note: * denotes a significant difference ($p < 0.05$) from controls using a standard T-test.

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Chironomus tentans

Survival of *C. tentans* test organisms exposed to Aimaokatalok Lake sediments ranged from 78 to 111%, compared to the control organisms. There were no significant differences in survival between control and test organisms (Table 4.6).

Growth of *C. tentans* ranged from 94 to 127%, compared to control treatments. Statistically significant ($p < 0.05$) increases in growth compared to controls were

noted in *C. tentans* test organisms for two samples. Growth in all other samples was not significantly different from the control treatments (Table 4.6).

Vibrio fischeri

Results of bacterial luminescence toxicity tests using *Vibrio fischeri* exposed to Aimaokatalok Lake sediment indicated toxic effects on light inhibition in test organisms for two samples (IC_{50} values of $< 0.1 \times 10^3$ and 0.11×10^3 mg/L dry weight sediment). The IC_{50} for one sample (1.8×10^3 mg/L dry weight sediment) also elicited an inhibition in light output of test organisms; however, the sample was not considered toxic (IC_{50} was greater than 1.0×10^3 mg/L dry weight sediment) (Table 4.7). Sediment samples from the northern section of Aimaokatalok Lake did not elicit toxic effects on test organisms during the bacterial luminescence tests (Table 4.7). One possible reason for increased toxic effects observed in tests conducted on sediments obtained from the southern section of the lake is that drilling activities might have resulted in deposition of contaminants in these areas. Concurrent chemistry data are not available, but total chromium was elevated in the sediment samples, which may have influenced the toxic effects of the samples.

Table 4.7 Summary of *V. fischeri* Bacterial Luminescence Toxicity Test Results, 2007

Sample Number & Location			*Vibrio fischeri*	
			IC_{20} (mg/L)	IC_{50} (mg/L)
Aimaokatalok Lake	1	North - Deep	11	56
	2	North - Shallow	1.1	414
	3	South - Shallow	<0.1	<0.1*
	4	South - Deep	<0.1	0.11*
	5	South - Deep	<0.1	1.8
Patch Lake	1	North - Shallow	7.5	37
	2	North - Deep	<0.1	0.3*
	3	North - Deep	<0.1	<0.1*
	4	South - Shallow	2.7	14
	5	South - Deep	<0.1	0.59*

Note: * denotes a toxic effect ($IC_{50} < 1 \times 10^3$ mg/L dry weight sediment) compared to controls.

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4.5.2 Patch Lake

Hyalella azteca

Survival of *H. azteca* test organisms exposed to Patch Lake sediments ranged from 33 to 109% when compared to control treatments (Table 4.6). A statistically significant ($p < 0.05$) reduction in survival was noted for one sample. Survival in all other samples was not significantly different from the controls.

The range of growth in *H. azteca* test organisms exposed to Patch Lake sediments was from 80 to 139%, compared to control organisms. Despite a significant reduction in test organism survival in one sample, increased growth of the surviving *H. azteca* was noted. However, this growth increase in test organisms was not statistically significant. Increases in growth were also noted for two other samples; these differences were significant ($p < 0.05$). Two samples showed slight decreases in test organism weight (i.e., growth) compared to controls; however, results were not statistically different (Table 4.6).

Chironomus tentans

C. tentans survival in Patch Lake sediment test treatments ranged from 57 to 95%, compared to control organisms. Significant ($p < 0.05$) reductions in survival were observed for three samples (Table 4.6).

Growth of test organisms exposed to Patch Lake sediments ranged from 66 to 86%, compared to control organisms (Table 4.6). Although reductions in growth of *C. tentans* test organisms were observed for all samples, significant differences ($p < 0.05$) were not detected (Table 4.6) most likely due to high variability in growth of the control organisms.

Vibrio fischeri

The range of IC_{50} values for inhibition of light output by *V. fischeri* exposed to Patch Lake sediments ranged from $< 0.1 \times 10^3$ to 37×10^3 mg/L dry weight sediment. IC_{20} values ranged from $< 0.1 \times 10^3$ to 7.5×10^3 mg/L dry weight sediment. Toxic effects were observed for three samples (Table 4.7), which were collected from the deep sampling stations from the northern and southern sections of Patch Lake. Toxic effects were not observed in tests conducted on samples collected at shallow stations (Table 4.7). These results could be indicative of higher metal concentrations generally observed in deep lake sediments compared to those in shallow lake sediments (Section 4.2.2.3); however, sediment chemistry results for Patch Lake at the shallow Ekman station were not consistently lower than those from the deep Ekman station (Section 4.2.2.3). Since sediment chemistry results are not available for the specific locations from which samples for toxicological analyses were collected, further investigation may be warranted.

4.5.3 Summary

Although toxicity was observed in a number of samples from both Patch and Aimaokatalok lakes, determination of the potential causes for these toxicity results is difficult as chemistry data were not collected at the specific locations

from which the samples for toxicological analyses were obtained. Total chromium was above the ISQG in all of the Aimaokatalok Lake sediment samples, except the shallow Ekman sample, and on all of the Patch Lake sediment samples. Total copper was also above the ISQG Patch Lake North samples (Appendix C1). These elevated metal concentrations may have influenced the toxic effects of the samples.

Some patterns were observed in the results. In Aimaokatalok Lake, survival of *H. azteca* and *C. tentans* test organisms was not reduced, with the exception of one sample for the *Chironomus* test. Likewise, growth of these test organisms was generally higher than that of the control organisms. Toxic effects were observed in the bacterial luminescence tests for samples obtained from the southern section of Aimaokatalok Lake, which may be due to a high concentration of drilling efforts in close proximity to the sampling locations.

Toxicity tests conducted on Patch Lake sediments showed significant reductions in survival of *H. azteca* and *C. tentans* for various samples; however, significant reductions in growth were not observed. There were no clear patterns between toxicity results and the section or depth from which samples were collected. Results of the bacterial luminescence tests conducted on Patch Lake sediments showed toxic effects for samples collected at the deep sampling stations. Although available sediment chemistry results for Patch Lake did not identify a clear difference between deep and shallow stations, other area lakes have shown a general trend for higher metal concentrations at deep sampling stations compared to shallow stations. Since chemistry results were not obtained from the specific locations where toxicity sampling was conducted, it is recommended that concurrent sediment samples be collected in future years from Patch and Aimaokatalok lakes for toxicity and chemical analyses.

5 LOWER TROPHIC LEVELS

Phytoplankton, zooplankton, and benthic invertebrate samples were collected in lakes in the Boston, Doris North, and Madrid Project areas. The purpose of this sampling program was to provide baseline data for characterizing the plankton and benthic invertebrate communities in lakes and selected marine areas.

5.1 PHYTOPLANKTON

Phytoplankton are tiny, free-floating organisms that use energy from sunlight to convert carbon dioxide and water into organic materials to be used in biological tissues. They live near the water surface where there is sufficient light to support photosynthesis. Phytoplankton form the base of the aquatic food web, providing an essential ecological function for all aquatic life.

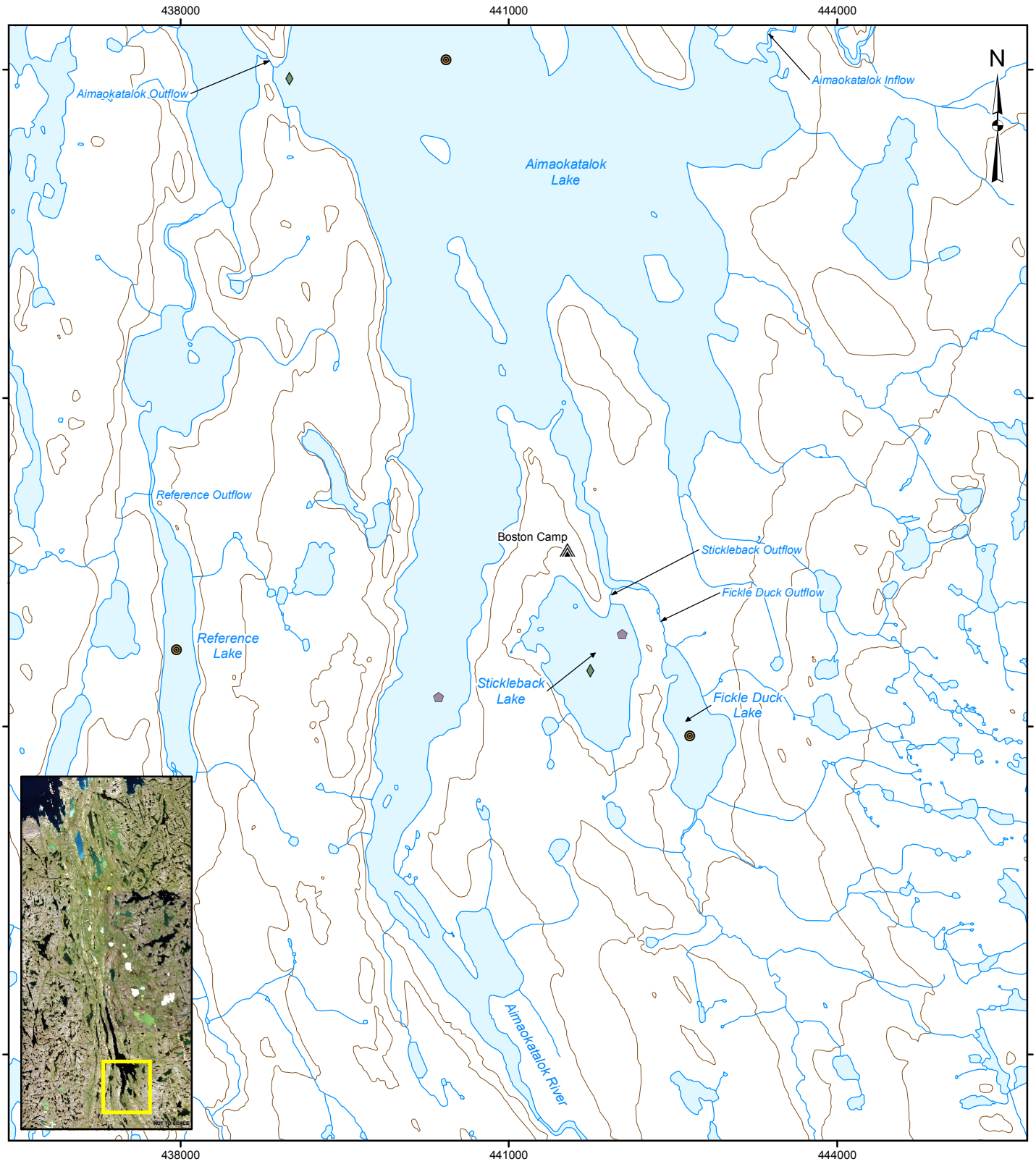
5.1.1 Methods

5.1.1.1 Sampling Stations and Timing

Phytoplankton and chlorophyll *a* (Chl *a*) samples were collected from 18 stations within the Boston, Doris North, and Madrid Project areas (Table 5.1; Figures 5.1 and 5.2). Each waterbody was sampled three times at the water quality sampling station during the open-water season (July to September 2007).

Table 5.1 Waterbodies Sampled for Phytoplankton and Chlorophyll *a*, July to September, 2007

Boston Project Lakes	Doris North Project Lakes	Madrid Project Lakes	Marine Areas
Aimaokatalok Lake (two sites)	Doris Lake	Glenn Lake	Hope Bay
Fickle Duck Lake	Little Roberts Lake	Ogama Lake	Roberts Bay
Reference Lake	Roberts Lake	Patch Lake	
Stickleback Lake	Tail Lake	Pelvic Lake	
		P.O. Lake	
		Windy Lake	
		Wolverine Lake	



LEGEND

- CAMP
- BENTHIC INVERTEBRATE SITE
- PHYTOPLANKTON AND ZOOPLANKTON SITE
- PHYTOPLANKTON, ZOOPLANKTON, AND BENTHIC INVERTEBRATE SITE
- CONTOUR (20 m INTERVAL)
- WATERCOURSE
- WATERBODY

1500 0 1500

SCALE 1:50000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

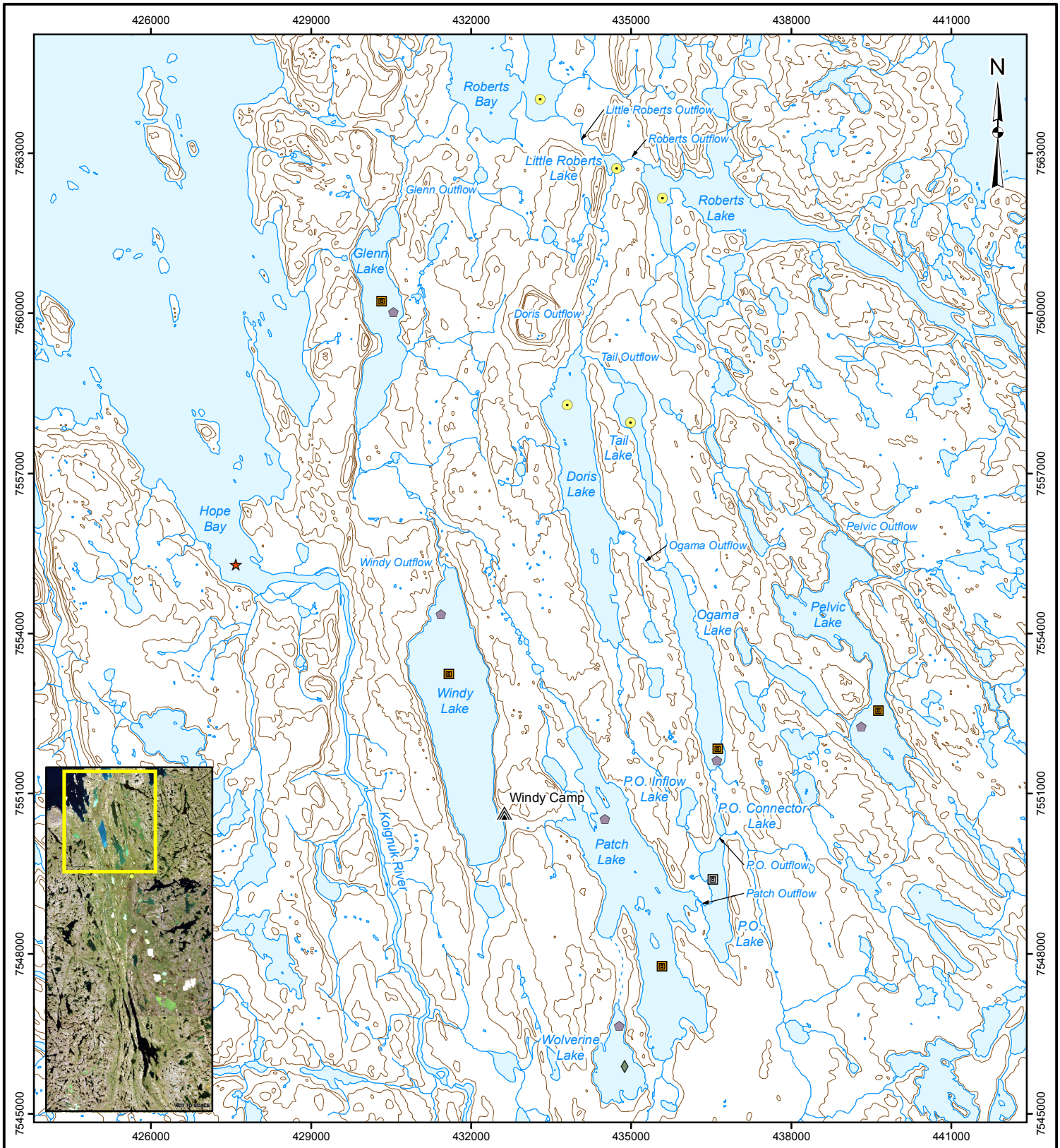
2007 LOWER TROPHIC LEVEL SAMPLING STATIONS, BOSTON PROJECT AREA

Golder Associates
Edmonton, Alberta

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DESIGN	AH	23 Oct. 2008		
GIS	BR	18 Feb. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 5.1

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LEGEND

- CAMP
- BENTHIC INVERTEBRATE SITE (SHALLOW)
- MARINE PHYTOPLANKTON AND ZOOPLANKTON SITE (DEEP)
- PHYTOPLANKTON AND ZOOPLANKTON SITE (SHALLOW)
- PHYTOPLANKTON, ZOOPLANKTON AND BENTHIC INVERTEBRATE (SHALLOW)
- PHYTOPLANKTON, ZOOPLANKTON AND BENTHIC INVERTEBRATE (DEEP)
- PYTHOPLANKTON
- CONTOUR (20 M INTERVAL)
- INTERMITTENT STREAM
- WATERCOURSE
- WATERBODY

3500 0 3500

SCALE 1:100000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

2007 LOWER TROPHIC LEVEL SAMPLING STATIONS, MADRID PROJECT AREA

Golder Associates Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
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GIS	BR	18 Feb. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 5.2

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5.1.1.2 Sampling Procedures

Phytoplankton sampling was conducted according to the Golder Technical Procedure 8.7-1: *Phytoplankton and Zooplankton Sampling* (unpublished file information). Chl *a* samples were collected and preserved following the instructions provided by the analytical laboratory (D. Beliveau, Bio-Aquatics Research & Consulting, personal communication). Phytoplankton and Chl *a* samples were collected from the entire euphotic zone of the lake (i.e., twice the Secchi depth, or 0.5 m above the lake sediments, whichever is less) using a depth-integrated water sampler. One litre of water was collected and immediately preserved with Lugol's iodine solution for phytoplankton identification and enumeration.

An additional 3 L of water were collected in Nalgene bottles and immediately placed in a cooler with ice-packs for Chl *a* analysis. Samples were filtered through 0.45 µm membrane filters. Magnesium carbonate ($MgCO_3$) was added to the filters to prevent degradation of Chl *a*. After filtering was complete, the filters were frozen until analyzed for Chl *a*.

5.1.1.3 Laboratory Analytical Procedures

Phytoplankton and Chl *a* samples were submitted to Bio-Aquatics Research & Consulting, Edmonton. Phytoplankton were enumerated according to the keys of Prescott (1970), Taft (1971), and Webber (1971).

Phytoplankton abundances were converted to biomasses by measuring cell dimensions and comparing cell morphologies to geometric shapes of known volumes and assuming a density of one. Chl *a* analyses were performed according to the methods described by Moss (1967a, 1967b).

5.1.1.4 Data Analysis

Correlation analysis was conducted for Chl *a* vs. total phytoplankton biomass for the lakes in each Project Area, and the marine sampling stations. Both Chl *a* and total phytoplankton biomass are used to estimate the primary productivity of lakes, and typically there is a strong positive correlation between the two variables. Weak correlations (r^2 values near 0) indicate that large numbers of picophytoplankton, such as cyanobacteria, or partially photosynthetic (i.e., mixotrophic) bacteria and protists are present in the phytoplankton community.

Non-linear and linear regression models were used to determine the significance of the relationship between nutrients (total Kjeldahl nitrogen and total phosphorus) and phytoplankton abundance.

Phytoplankton abundance and composition are typically influenced by seasonal differences and nutrient concentrations. Since only one sample was collected per lake each month, abundance and species richness were qualitatively compared among months to assess seasonal variability in each Project Area.

5.1.2 Results and Discussion

5.1.2.1 Chlorophyll *a* and Phytoplankton Biomass

Chl *a* and phytoplankton biomass data are presented in appendices at the end of this report (Appendices B5, B6, and D2); phytoplankton abundance is discussed in terms of biomass in the following sections, because abundance and biomass are strongly correlated.

The correlation between Chl *a* concentration and phytoplankton biomass was generally strong (Figures 5.3 to 5.6). In the Boston Project area, there was one outlier data point, corresponding to the July sample collected at Station 6 in Aimaokatalok Lake (Figure 5.3), which was composed of predominantly mixotrophic flagellates from the taxonomic groups Chrysophyta and Cryptophyta.

The low r^2 value (0.29) for the Doris North Project area stations was largely due to the August sample from Doris Lake, which was dominated by diatoms and blue-green algae (Figure 5.4). Without this data point, the r^2 value for the Doris North Project area lakes would be 0.62.

The correlations between Chl a and biomass for the Madrid Project area lakes (Figure 5.5), and particularly for the marine stations (Figure 5.6), were even stronger, suggesting that mixotrophic picophytoplankton did not substantially contribute to total phytoplankton.

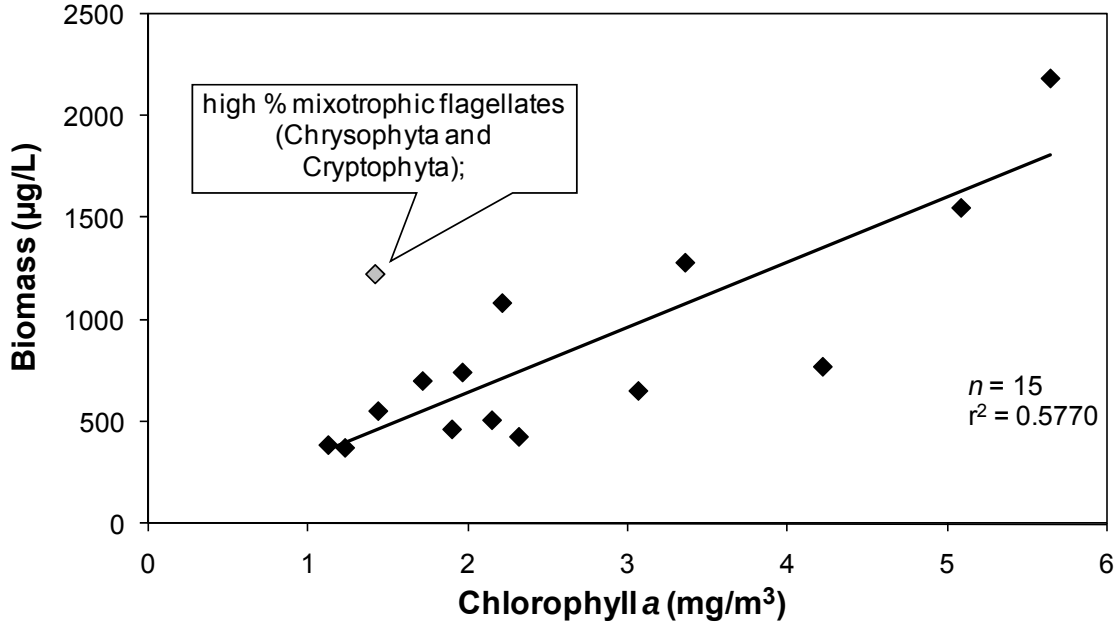


Figure 5.3 Phytoplankton Biomass Versus Chlorophyll *a* Concentration for Boston Project Area Lakes, 2007

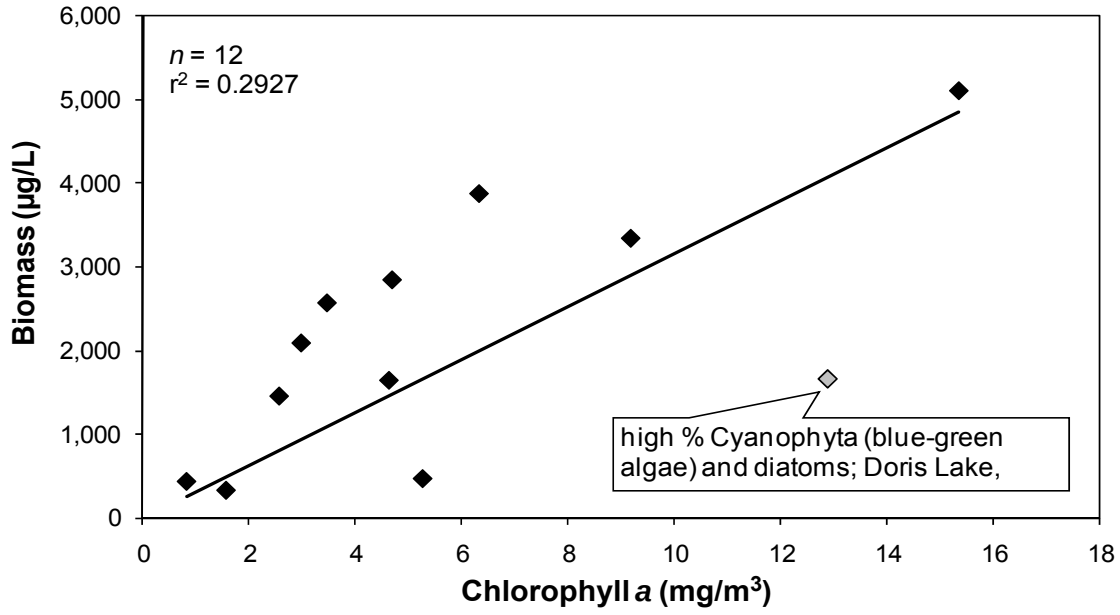


Figure 5.4 Phytoplankton Biomass Versus Chlorophyll *a* Concentration for Doris North Project Area Lakes, 2007

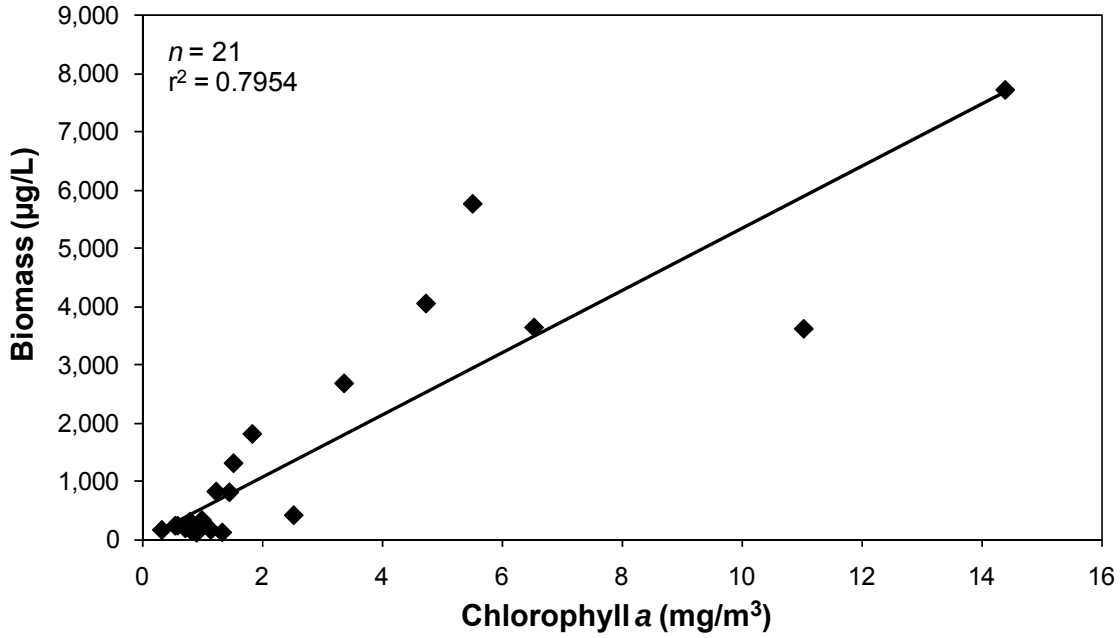


Figure 5.5 Phytoplankton Biomass Versus Chlorophyll *a* Concentration for Madrid Project Lakes, 2007

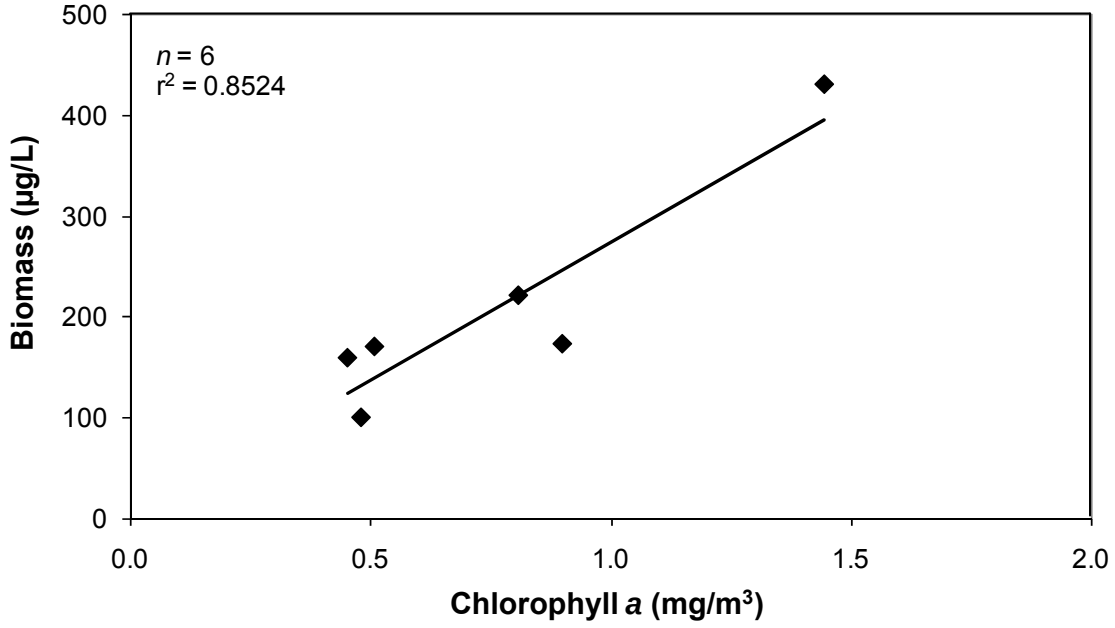


Figure 5.6 Phytoplankton Biomass Versus Chlorophyll *a* Concentration for Marine Project Stations, 2007

5.1.2.2 Nutrients and Phytoplankton Biomass

In most waterbodies, the abundance of phytoplankton is limited by the availability of nutrients, which are typically nitrogen and phosphorus (Graham and Wilcox 2000). In 2007, phytoplankton biomass was significantly related to total Kjeldahl nitrogen ($r^2 = 0.73$; $p < 0.001$) (Figure 5.7; Appendices B5 and D2) and, to a slightly lesser extent, to total phosphorus (Figure 5.8; Appendices B5 and D1; $r^2 = 0.60$; $p < 0.001$)

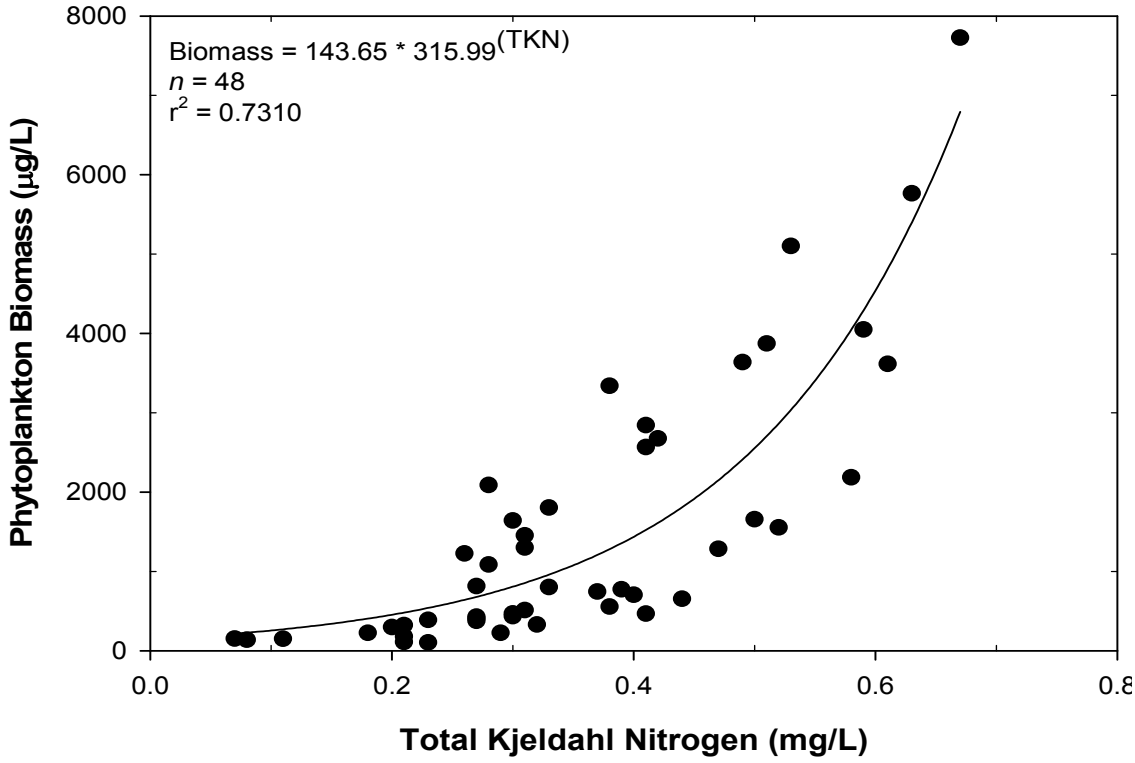


Figure 5.7 Phytoplankton Biomass versus Total Kjeldahl Nitrogen for Project Area Lakes, 2007

5.1.2.3 Abundance and Species Richness – Overview

Phytoplankton abundance in lakes typically follows a distinct seasonal pattern and periodicity due to changes in temperature, light, nutrients, and other factors. (Wetzel 2001). Phytoplankton abundance varied between the sampling periods but there was no overall seasonal pattern. Nevertheless, in the four most productive lakes, which were Doris Lake, Little Roberts Lake, Ogama Lake, and Pelvic Lake (Figure 5.9), the greatest phytoplankton abundances (both in terms of biomass and Chl *a*) were measured in September (Appendices B5 and D2).

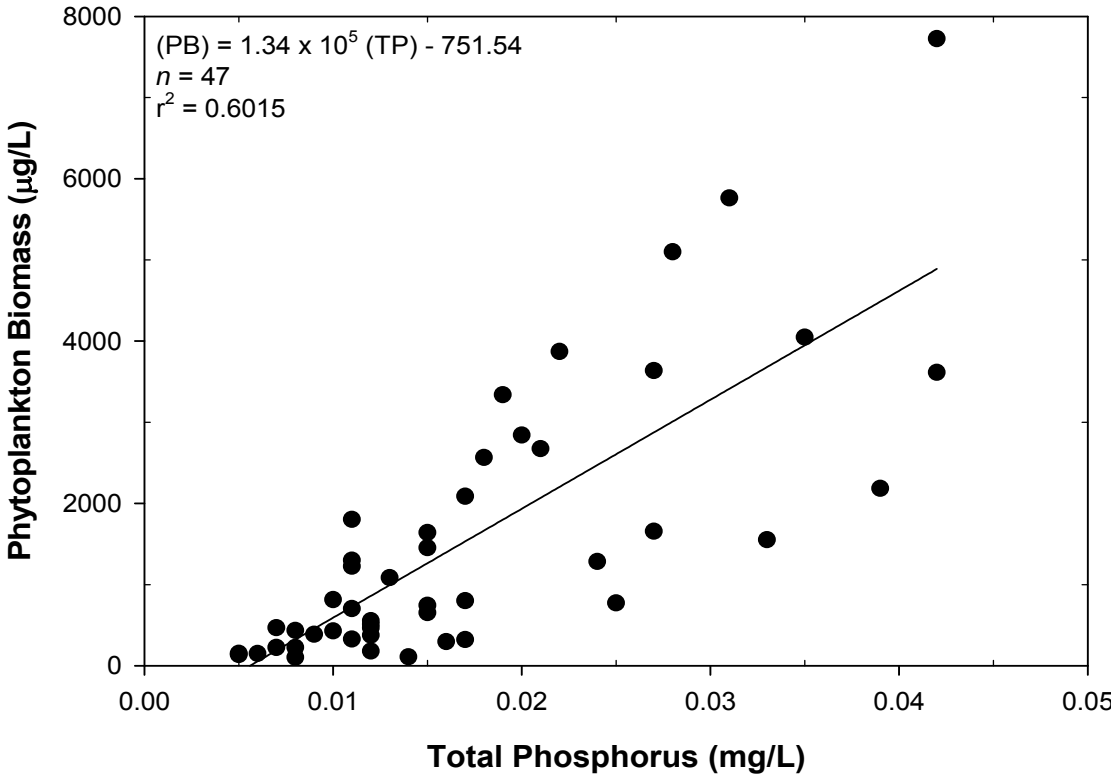
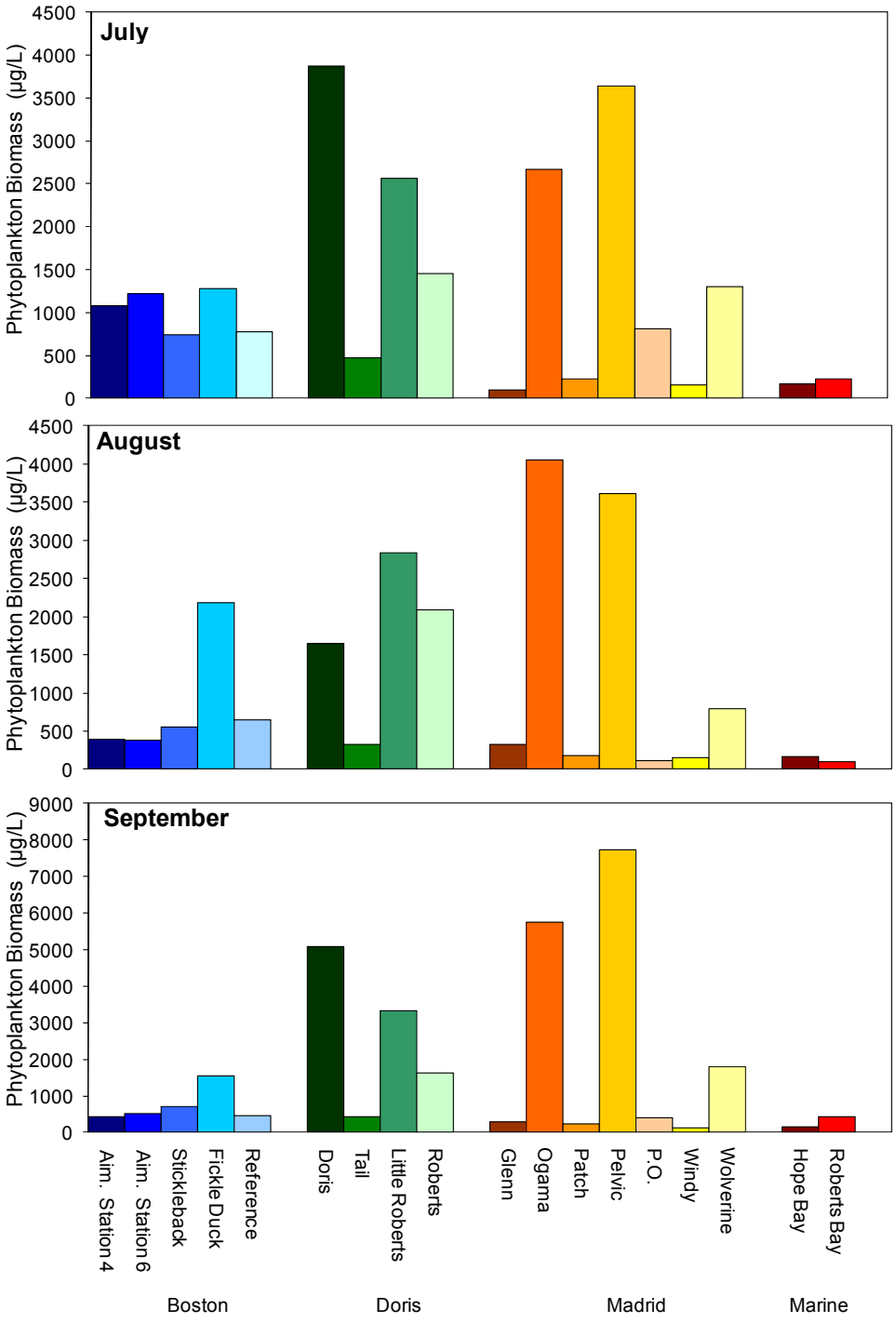


Figure 5.8 Phytoplankton Biomass versus Total Phosphorus for Project Area Lakes, 2007

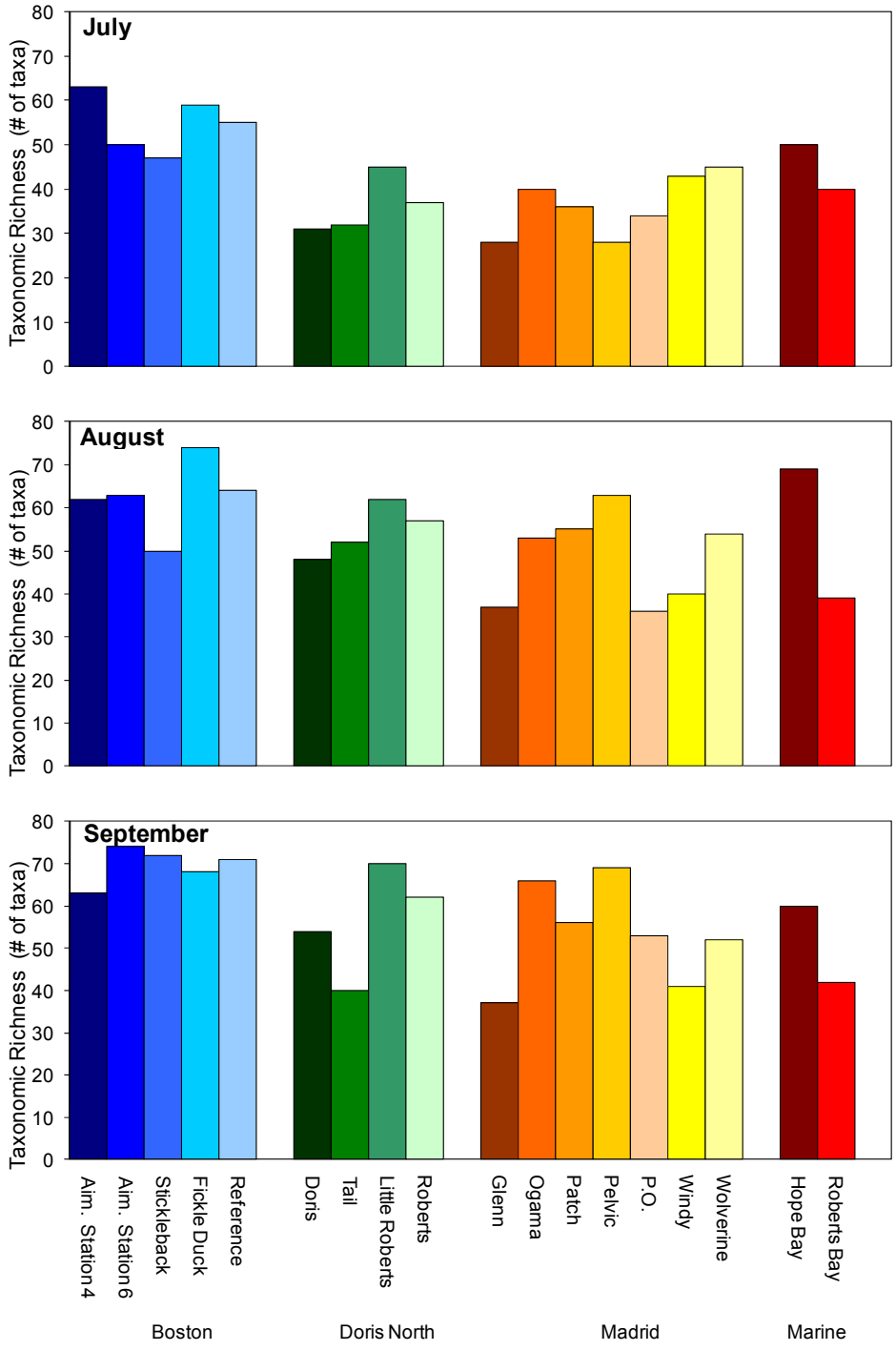
Phytoplankton abundance was more variable within the Doris North and Madrid Project area lakes than in the Boston Project Area lakes (Figure 5.9). Phytoplankton abundance in the Boston Project area lakes was less variable, with overall biomass concentrations being similar to median values for the other two Project areas. The phytoplankton abundance at the two marine stations was similar to those at the least productive lakes (Glenn, Patch, and Windy lakes; Figure 5.9).

Phytoplankton species richness was less variable among stations than phytoplankton abundance (Figure 5.10). Overall, Boston Project area lakes had slightly greater species richness than the Doris North and Madrid Project area lakes. Phytoplankton species richness generally increased throughout the sampling period of July to September 2007 (Figure 5.10).



Aim. = Aimaokatalok

Figure 5.9 Phytoplankton Biomass Concentrations in Project Area Lakes and Marine Stations, 2007



Aim. = Aimaokatalok

Figure 5.10 Phytoplankton Taxonomic Richness in Project Area Lakes and Marine Stations, 2007

5.1.2.4 Boston Project Area

Aimaokatalok Lake

Total phytoplankton biomass in Aimaokatalok Lake ranged from 375 µg/L in August to 1225 µg/L in July; the two sampled stations (Station 4 and Station 6) had similar phytoplankton abundances (Figures 5.11 and 5.12; Appendices D1 and D2). The mean (from July to September) phytoplankton biomass in Aimaokatalok Lake was 669 µg/L, which was below the overall mean for the Project area lakes (1577 µg/L).

On all three sampling dates, and at both Station 4 and Station 6, Chrysophyta was the most abundant taxonomic group in Aimaokatalok Lake (Figures 5.11 and 5.12; Appendix D2). In July, the abundance of Cryptophyta (cryptophytes) and Pyrrophyta (dinoflagellates) was also substantial. In August, Bacillariophyta (diatoms) and Cryptophyta contributed substantially to the community. In September, Cryptophyta, Chlorophyta (green algae), Bacillariophyta, and Cyanobacteria were all similarly subdominant to Chrysophyta. Depending on the month, the most abundant Chrysophyta species were *Dinobryon sertularia* (July), *Dinobryon sociale* (August), and *Stelexmonas dichotoma* (September) (Appendix D1).

Fickle Duck Lake

Mean phytoplankton biomass in Fickle Duck Lake ranged from 1283 µg/L in July to 2186 µg/L in August (Figure 5.13; Appendices D1 and D2). Phytoplankton biomass in Fickle Duck Lake was higher than in the other Boston Project area lakes, and slightly higher than in other lakes in the Project area (Figure 5.9).

In July, Chrysophyta and Cyanobacteria were the two co-dominant taxa, whereas Chrysophyta was dominant in August and September (Figure 5.13; Appendix D2). Additionally, on these sampling dates, Pyrrophyta, Cyanobacteria, Cryptophyta, and Chlorophyta contributed substantial abundances to the total phytoplankton biomass. The common phytoplankton species were *Dinobryon sociale* (Chrysophyta) and *Anabaena solitaria* (Cyanobacteria).

Reference Lake

Total phytoplankton biomass in Reference Lake ranged from 466 µg/L in September to 772 µg/L in July (Figure 5.14; Appendices D1 and D2). Mean phytoplankton biomass in Reference Lake (631 µg/L) was similar to those in Aimaokatalok and Stickleback lakes, and was below the overall mean biomass (1577 µg/L) for the Project area lakes.

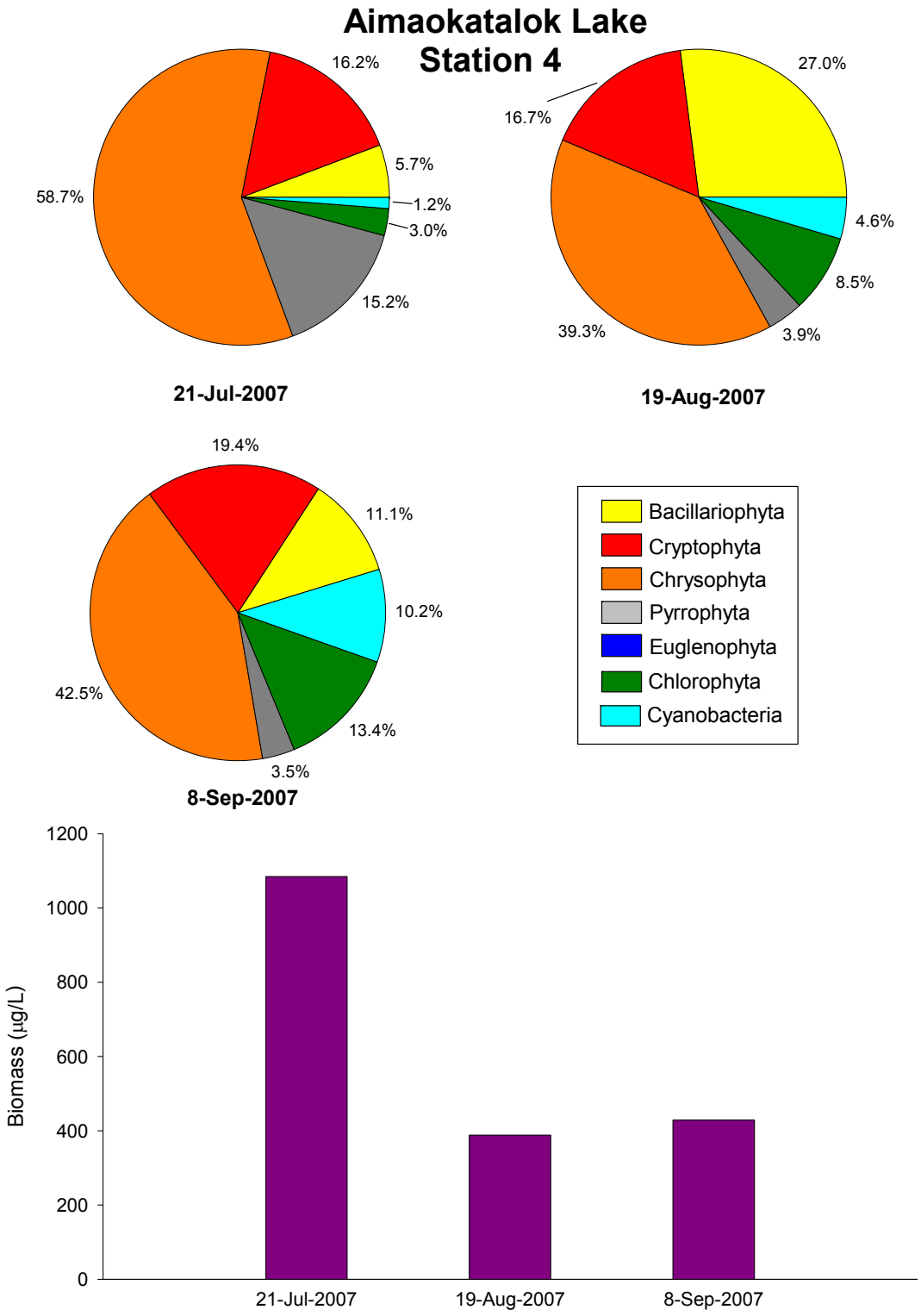


Figure 5.11 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Aimaokatalok Lake at Station 4, 2007

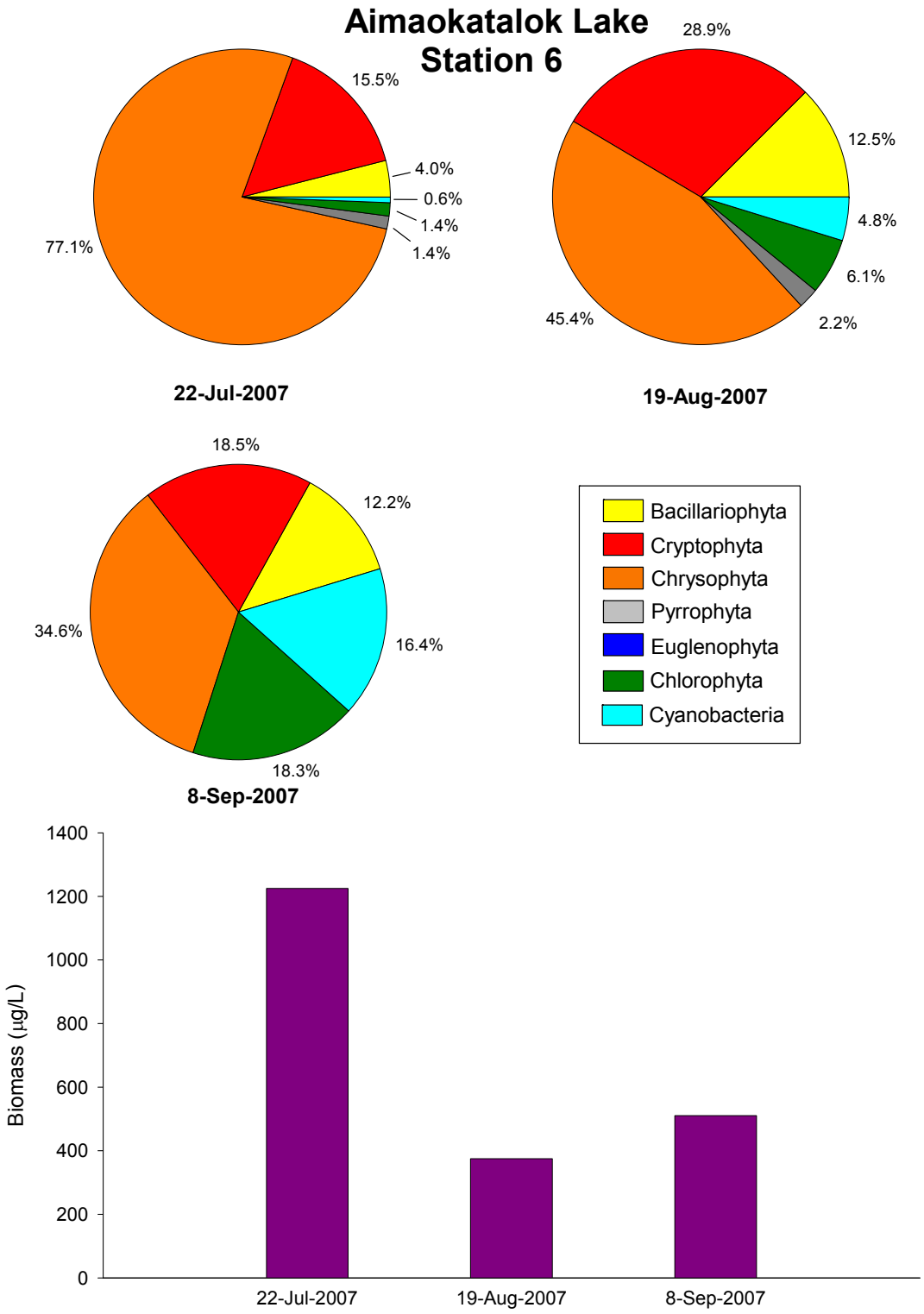


Figure 5.12 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Aimaokatalok Lake at Station 6, 2007

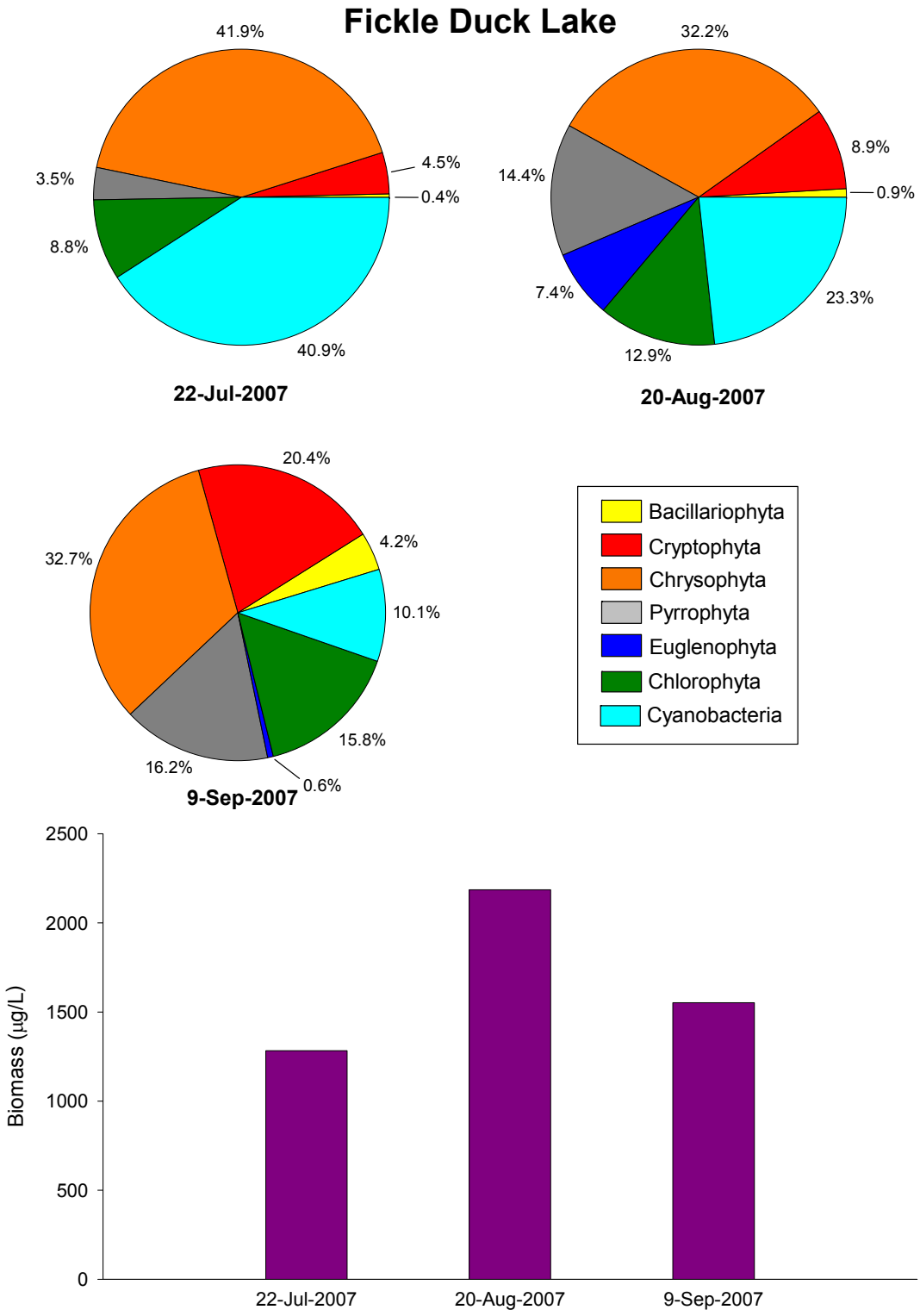


Figure 5.13 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Fickle Duck Lake, 2007

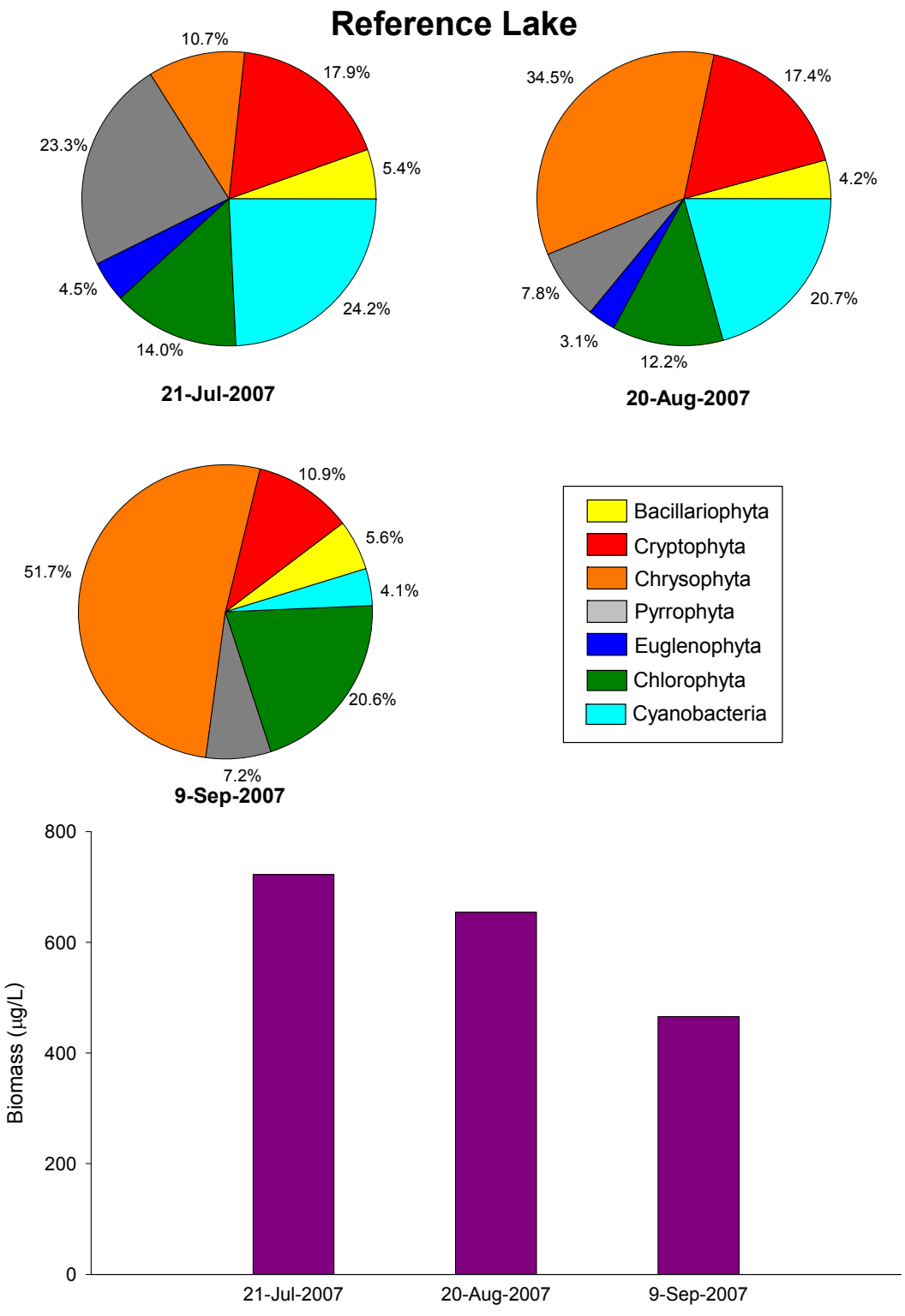


Figure 5.14 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Reference Lake, 2007

In July, the phytoplankton community in Reference Lake was co-dominated by Cyanobacteria and Pyrrophyta, with slightly lower abundances of Cryptophyta, Chlorophyta, and Chrysophyta (Figure 5.14; Appendix D2). In August, Chrysophyta was the most abundant group, with Cyanobacteria, Cryptophyta, and Chlorophyta still present in substantial numbers. In September, Chrysophyta remained the dominant taxon, with Chlorophyta and Cryptophyta also contributing large amounts to the total phytoplankton biomass. Chrysophyta was represented mainly by *Chrysococcus* sp. and *Kephyrion boreale.* Other abundant species included *Oscillatoria limnetica* (Cyanobacteria), *Gymnodinium* spp. (Pyrrophyta), *Cryptomonas erosa* (Cryptophyta), and *Chlamydomonas* spp. (Chlorophyta).

Stickleback Lake

Total phytoplankton biomass in Stickleback Lake ranged from 555 µg/L in August to 745 µg/L in September (Figure 5.15; Appendices D1 and D2). Mean phytoplankton biomass in Stickleback Lake (667 µg/L) was similar to that of Aimaokatalok and Reference lakes, and was below the overall average (1557 µg/L) for the Project area lakes.

On all sampling dates, Chrysophyta was the most abundant taxonomic group in Stickleback Lake (Figure 5.15; Appendix D2). In July, Cryptophyta and Pyrrophyta were also present in large numbers. In August and September, Cryptophyta, Chlorophyta, Bacillariophyta, Pyrrophyta, and Cyanobacteria were all abundant. The most abundant Chrysophyta species were *Dinobryon sertularia* (July), *Kephyrion obliquum* (August), and *Dinobryon sociale* (September).

5.1.2.5 Doris North Project Area

Doris Lake

Total phytoplankton biomass in Doris Lake ranged from 1655 µg/L in August to 5099 µg/L in September (Figure 5.16; Appendices D1 and D2). Phytoplankton biomass in Doris Lake was one the highest among sampled waterbodies (Figure 5.9).

In July, the phytoplankton community in Doris Lake was co-dominated by Cyanobacteria and Chrysophyta (Figure 5.16; Appendix D2). In August, Cyanobacteria became increasingly dominant, with large abundances of Bacillariophyta and Chrysophyta. By September, 94.7% of the phytoplankton community consisted of Cyanobacteria. This group was represented mainly by *Oscillatoria agardhii* and *Aphanizomenon gracile*. The Bacillariophyta and Chrysophyta were represented primarily by *Asterionalla formosa* and *Dinobryon sociale,* respectively.

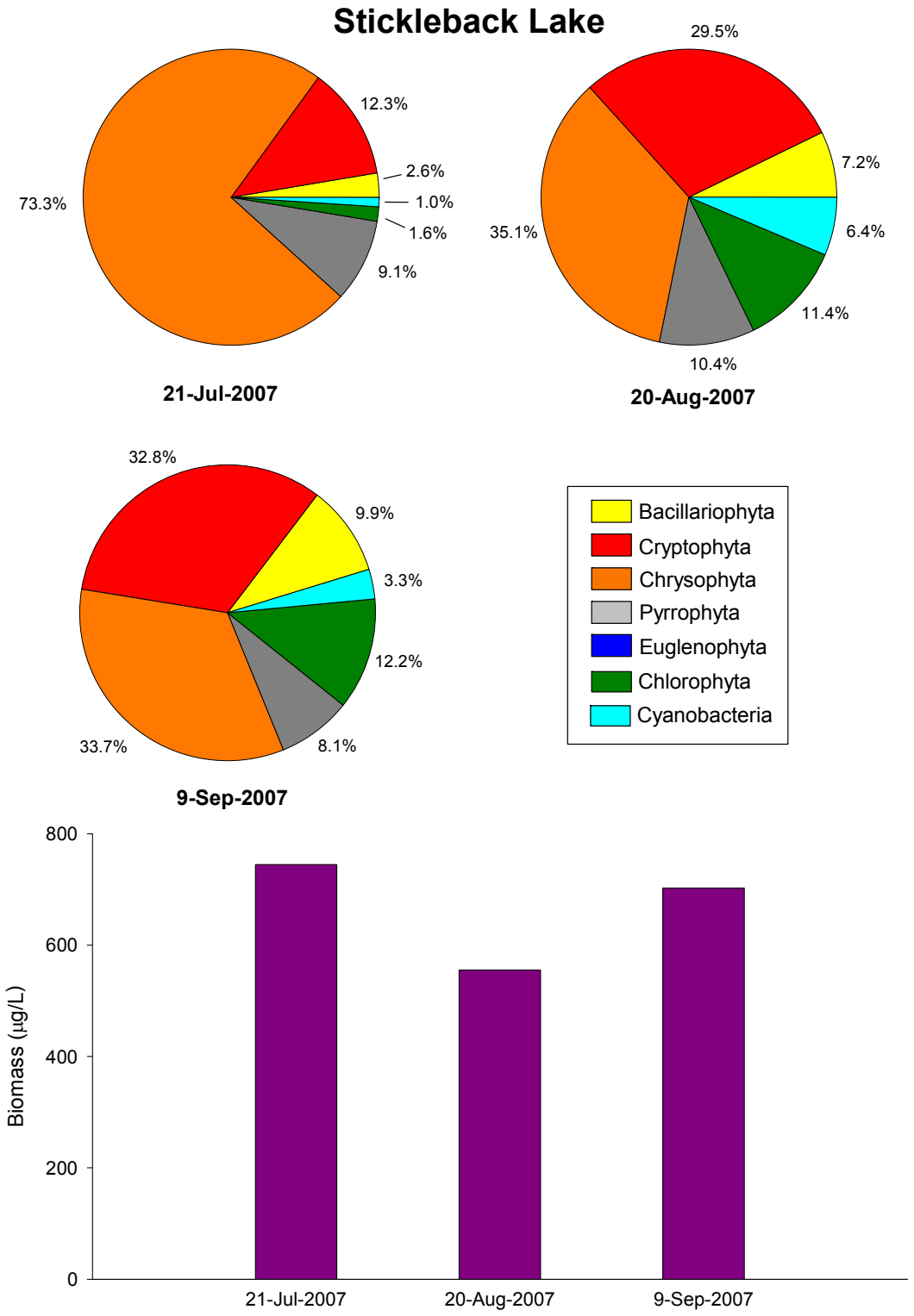


Figure 5.15 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Stickleback Lake, 2007

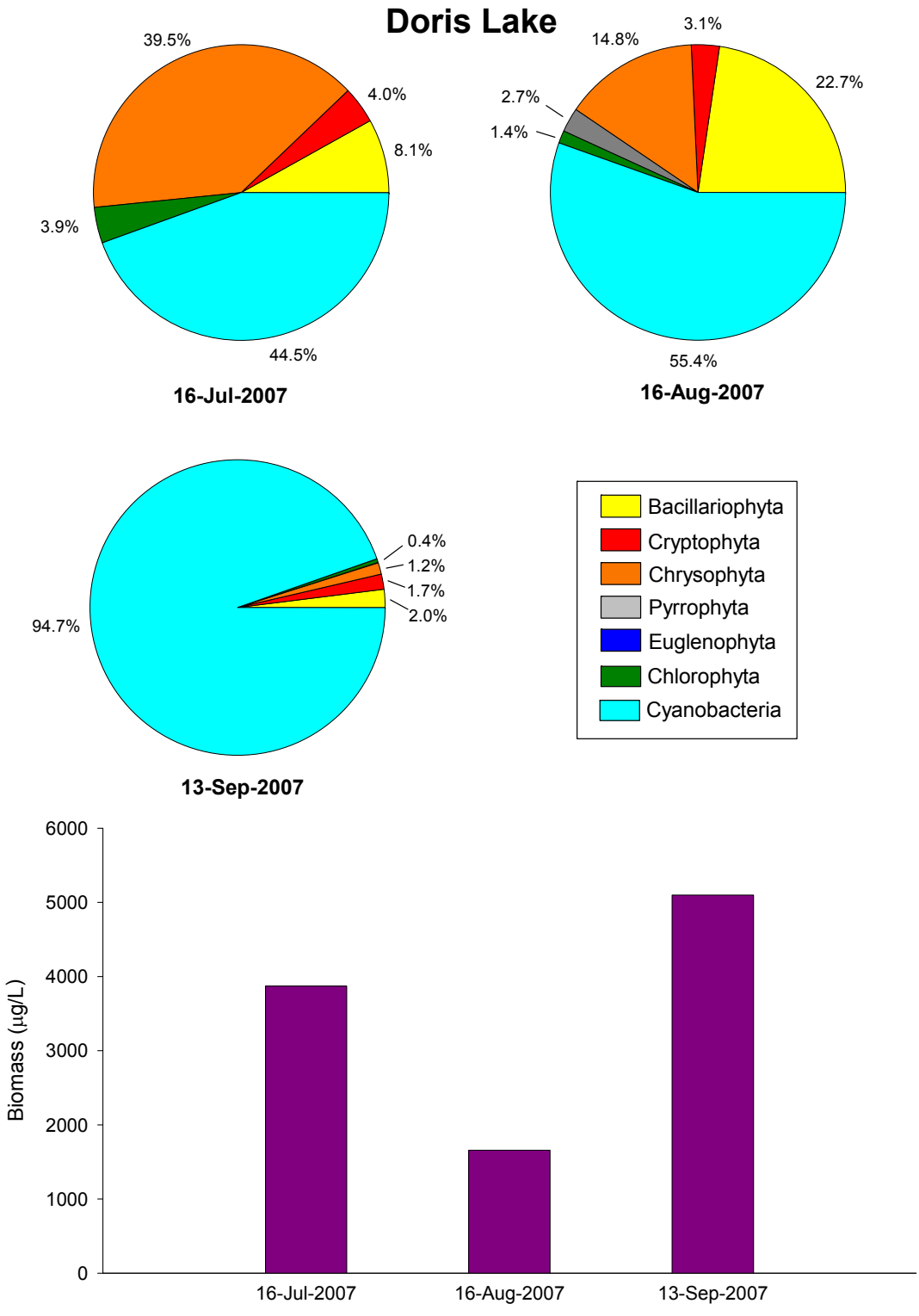


Figure 5.16 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Doris Lake, 2007

Little Roberts Lake

Total phytoplankton biomass in Little Roberts Lake ranged from 2566 µg/L in July to 3337 µg/L in September (Figure 5.17; Appendices D1 and D2). Phytoplankton biomass in Little Roberts Lake was among the highest in the sampled waterbodies (Figure 5.9).

In July, Cyanobacteria were the most abundant taxonomic group in Little Roberts Lake, followed by Chrysophyta and Cryptophyta (Figure 5.17; Appendix D2). In August, Cyanobacteria were the dominant taxonomic group, with large abundances of Bacillariophyta and Chrysophyta. By September, Cyanobacteria contributed more than 80% of the total phytoplankton biomass. Cyanobacteria was represented mainly by *Oscillatoria agardhii,* Chrysophyta by *Dinobryon* spp.*,* Cryptophyta by *Rhodomonas lens,* and Bacillariophyta by *Asterionalla formosa*.

Roberts Lake

Total phytoplankton biomass in Roberts Lake ranged from 1453 µg/L in July to 2088 µg/L in August (Figure 5.18; Appendices D1 and D2). Phytoplankton biomass in Roberts Lake was the fifth highest of the lakes sampled in 2007 (Figure 5.9).

In July, Chrysophyta, Cryptophyta, and Bacillariophyta were co-dominant in Roberts Lake (Figure 5.18; Appendix D2). In August, the most abundant group was Chrysophyta, followed by Cyanobacteria. In September, Cyanobacteria dominated the phytoplankton community, with Chrysophyta and Bacillariophyta still contributing substantially to the biomass. The most common species in major taxonomic groups were as follows: Chrysophyta, *Dinobryon spp.*; Cryptophyta, *Rhodomonas minuta*; Bacillariophyta, *Melosira* spp.; and Cyanobacteria, *Oscillatoria agardhii*.

Tail Lake

Total phytoplankton biomass in Tail Lake ranged from 329 µg/L in August to 468 µg/L in July (Figure 5.19; Appendices D1 and D2). Phytoplankton biomass in Tail Lake was considerably lower than in the other three Doris North Project area lakes, and most similar to P.O. Lake – one of the lakes with low primary productivity in the Madrid Project area (Figure 5.9).

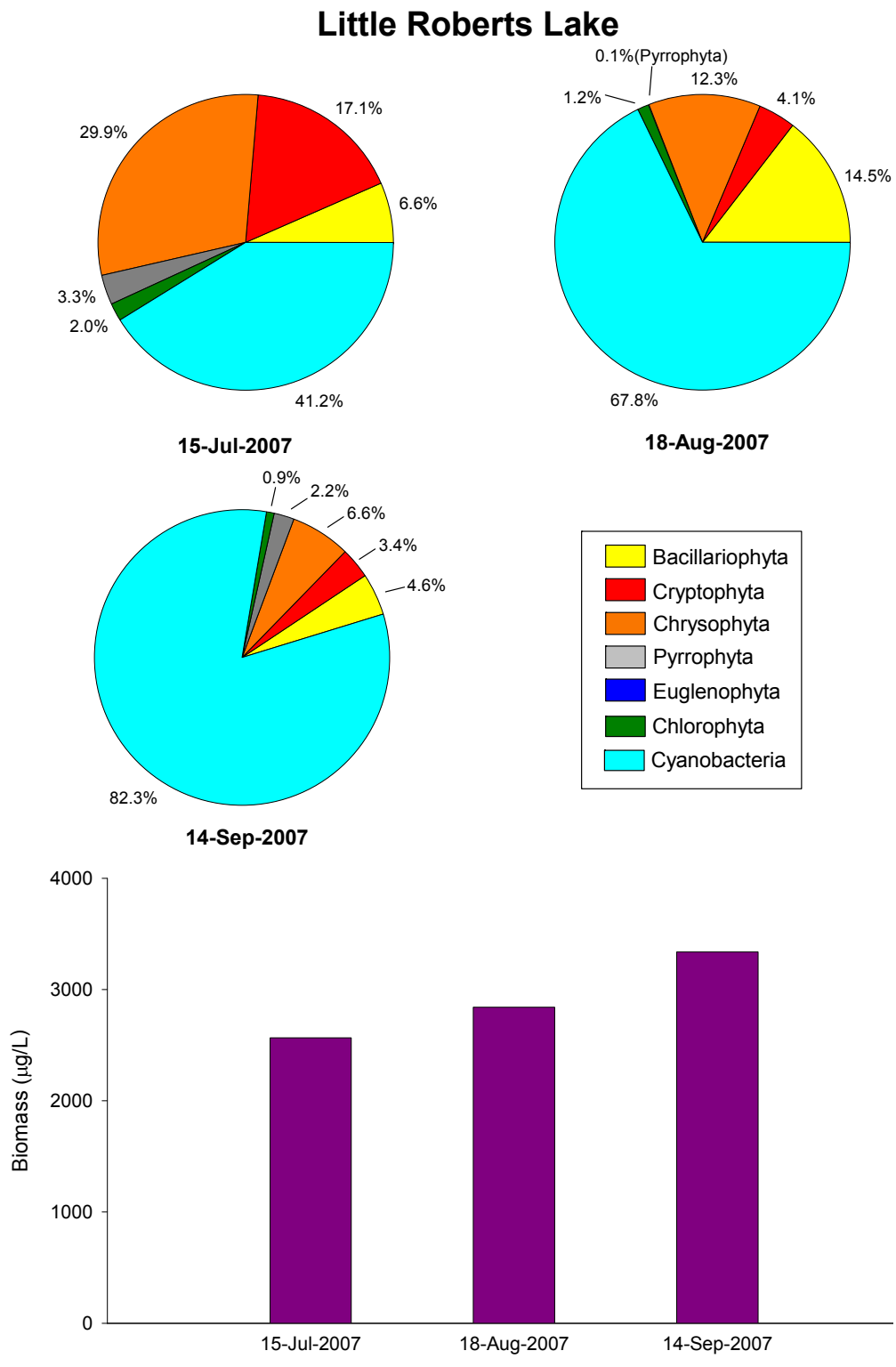


Figure 5.17 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Little Roberts Lake, 2007

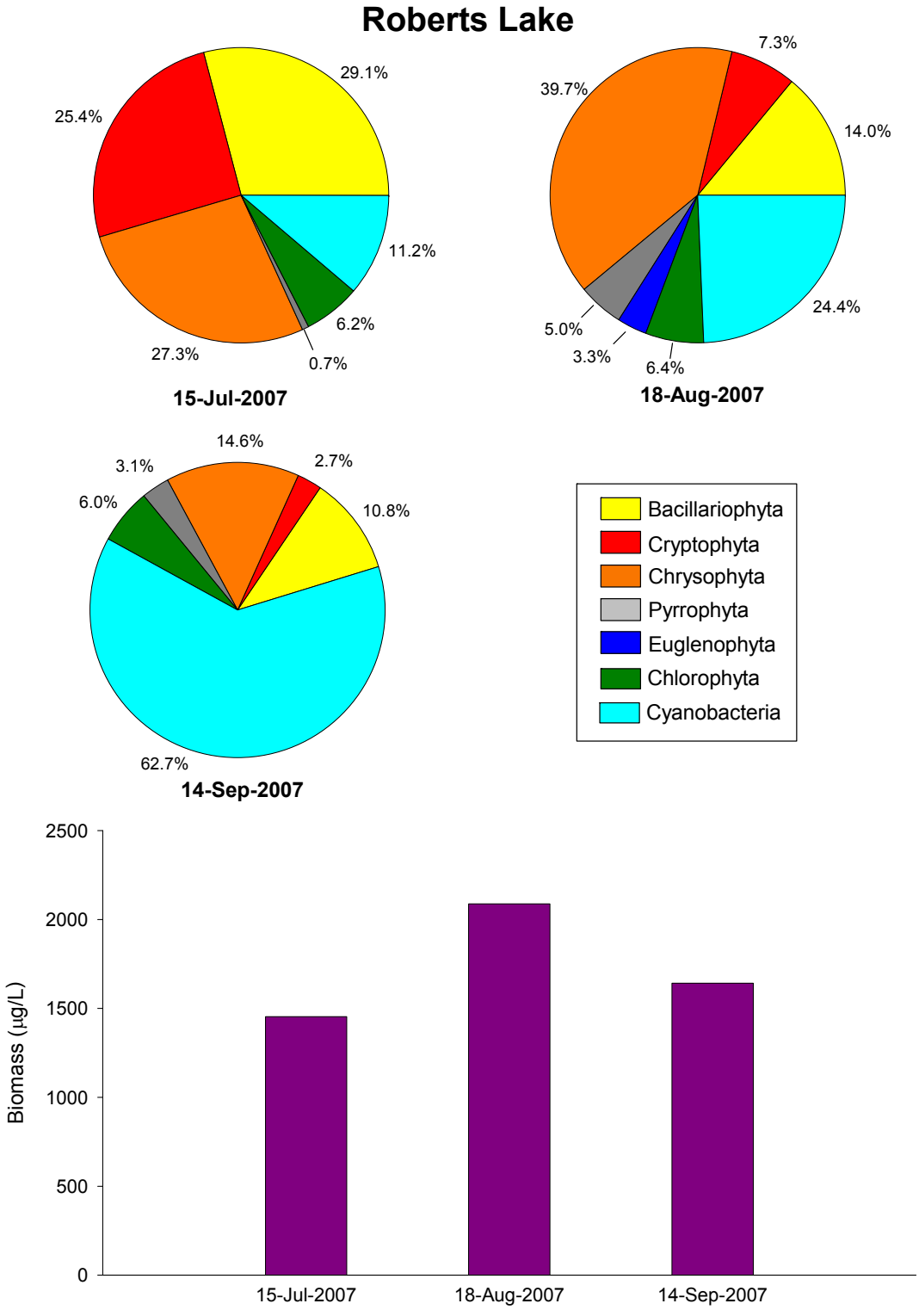


Figure 5.18 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Roberts Lake, 2007

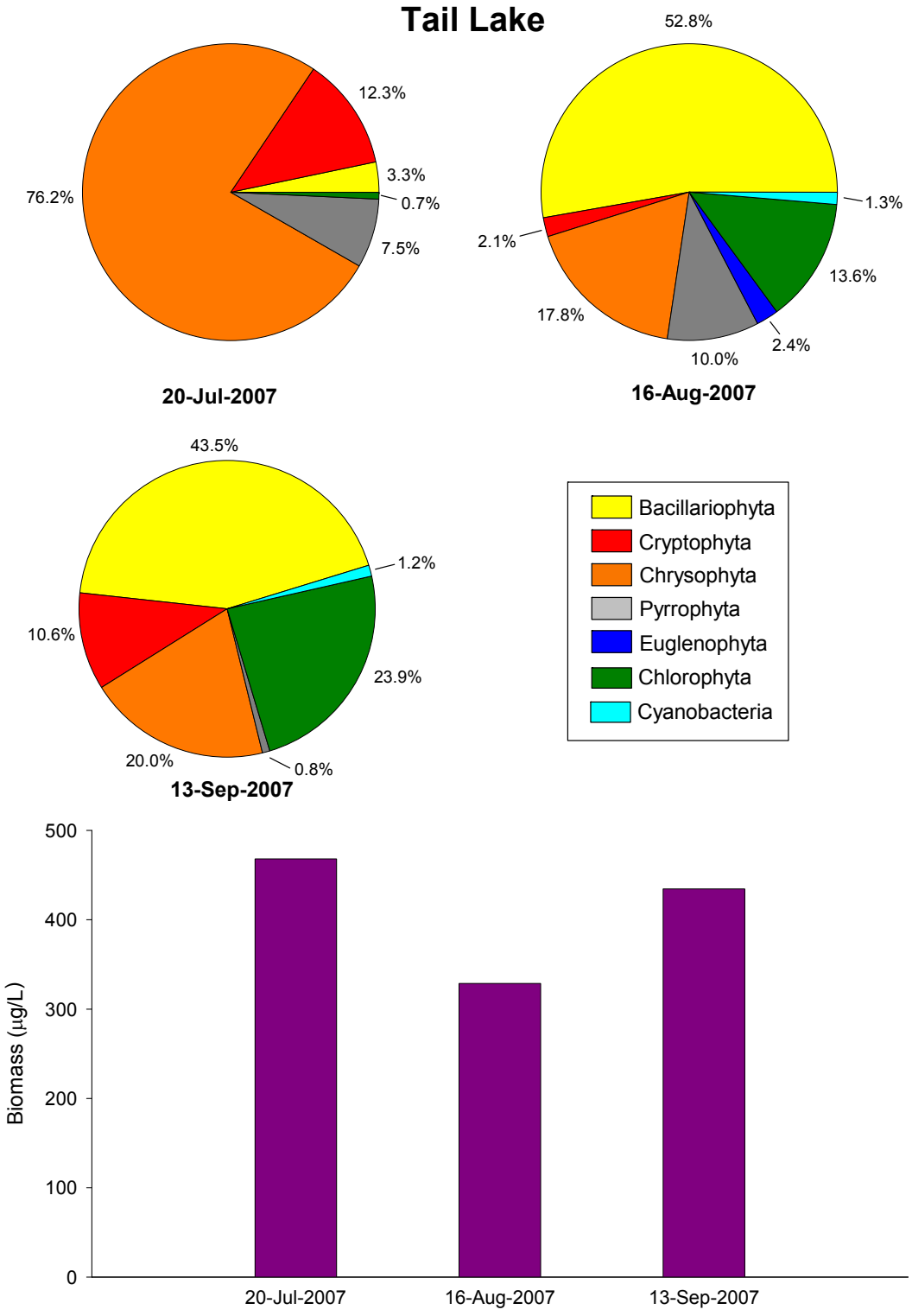


Figure 5.19 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Tail Lake, 2007

In July, the phytoplankton community of Tail Lake was dominated by Chrysophyta, with a large abundance of Cryptophyta (Figure 5.19; Appendix D2). In both August and September, Bacillariophyta was the most abundant taxonomic group, followed by Chrysophyta and Chlorophyta. Chrysophyta was represented by *Dinobryon sociale, Dinobryon divergens,* and *Chrysosphaerella rodhei*. Cryptophyta was composed largely of *Katablepharis ovalis.* Chlorophyta was represented by *Oocystis* sp. in August and *Botryococcus* sp. in September.

5.1.2.6 Madrid Project Area

Glenn Lake

Total phytoplankton biomass in Glenn Lake ranged from 102 µg/L in July to 322 µg/L in August (Figure 5.20; Appendices D1 and D2). Phytoplankton biomass in Glenn Lake was among the lowest of all sampled waterbodies (Figure 5.9).

In July and September, Bacillariophyta, Cryptophyta, and Chrysophyta co-dominated the phytoplankton community in Glenn Lake (Figure 5.20; Appendix D2). In August, the phytoplankton community was dominated by Bacillariophyta, Cryptophyta, and Chlorophyta. Bacillariophyta was represented by an unidentified centric diatom and *Melosira sp*. *Rhodomonas minuta* was the main Cryptophyta species, whereas Chrysophyta and Chlorophyta were represented by *Dinobryon tabellariae* and *Sphaerocystis schroeteri*, respectively.

Ogama Lake

Total phytoplankton biomass in Ogama Lake ranged from 2674 µg/L in July to 5764 µg/L in September (Figure 5.21; Appendices D1 and D2). Phytoplankton biomass in Ogama Lake was the second highest of the sampled waterbodies (Figure 5.9).

In July, Chrysophyta was the most abundant taxonomic group in Ogama Lake, followed by Cyanobacteria and Bacillariophyta (Figure 5.21; Appendix D2). In August and September, the phytoplankton community was dominated by Cyanobacteria, accounting for 80 and 91% of total biomass in August and September, respectively. *Oscillatoria agardhii* was the most abundant species of Cyanobacteria during all sampling dates. *Asterionalla formosa* was the principal Bacillariophyta species.

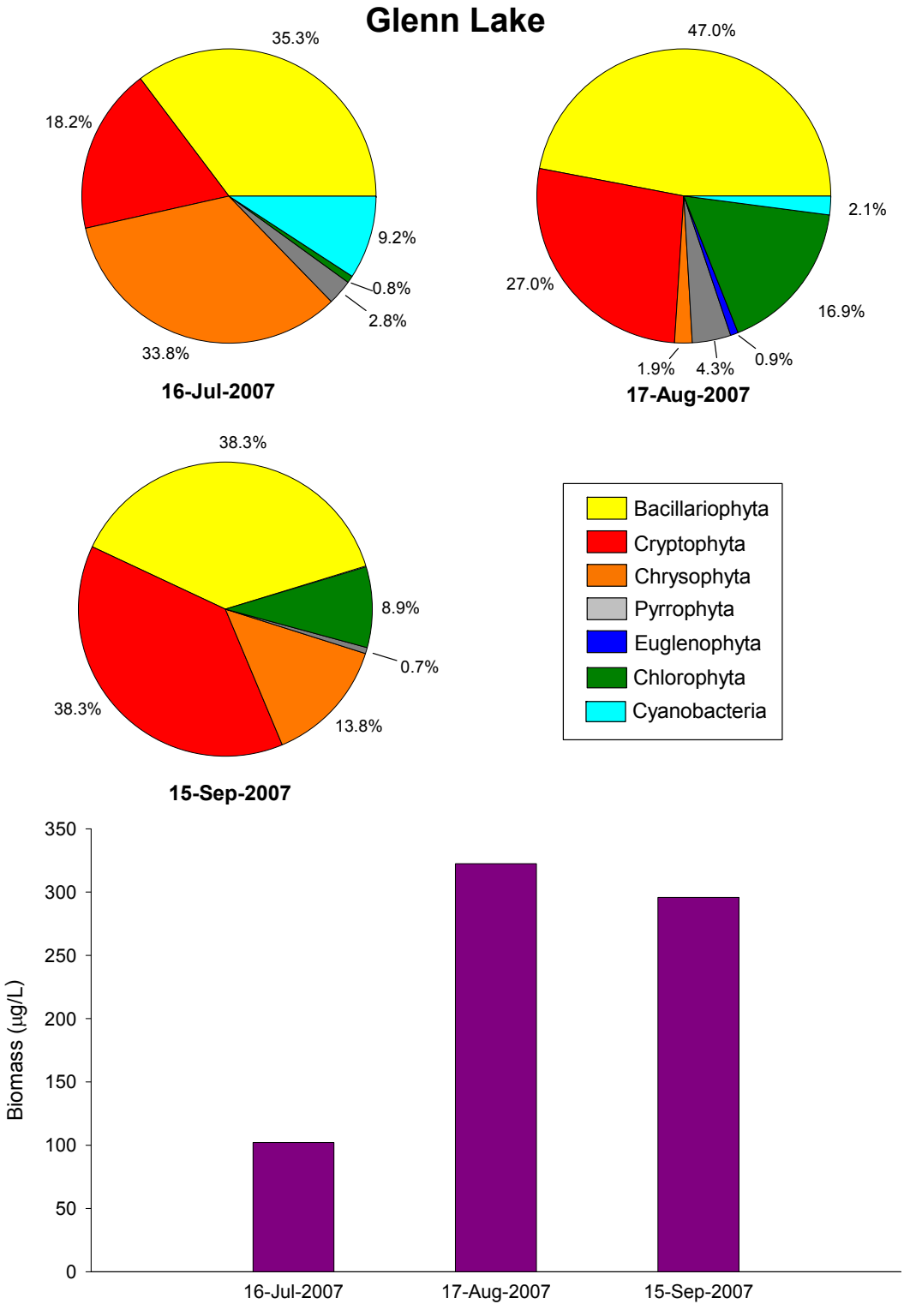


Figure 5.20 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Glenn Lake, 2007

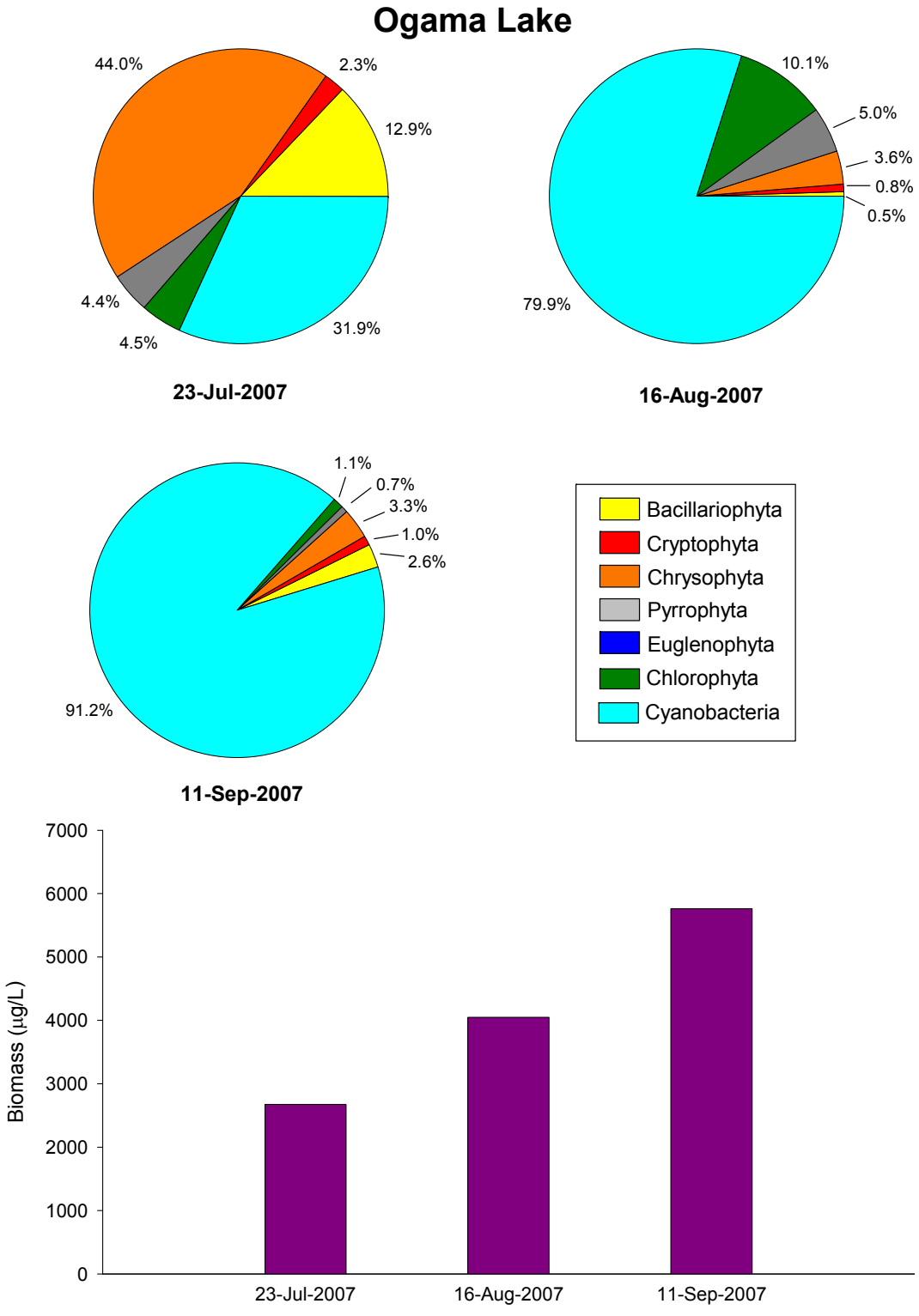


Figure 5.21 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Ogama Lake, 2007

Patch Lake

Total phytoplankton biomass in Patch Lake ranged from 179 µg/L in August to 225 µg/L in July (Figure 5.22; Appendices D1 and D2). Phytoplankton biomass in Patch Lake was among the lowest of all of the sampled waterbodies (Figure 5.9).

In July, the phytoplankton community of Patch Lake was co-dominated by Chrysophyta and Pyrrophyta (Figure 5.22; Appendix D2). Chrysophyta was the most abundant taxonomic group in August, with large contributions by Pyrrophyta and Cryptophyta. In September, Chrysophyta dominated the community, followed by Chlorophyta, Bacillariophyta, and Cryptophyta. The Chrysophyta taxa were dominated by *Dinobryon sociale* and *Chrysococcus* sp. The other groups were dominated as follows: Pyrrophyta, represented mainly by *Gymnodinium helveticum*; Cryptophyta, *Rhodomonas minuta;* Bacillariophyta, *Stephanodiscus astraea;* and Chlorophyta, *Sphaerocystis schroeteri*.

Pelvic Lake

Total phytoplankton biomass in Pelvic Lake ranged from 3613 µg/L in August to 7725 µg/L in September (Figure 5.23; Appendices D1 and D2). Phytoplankton biomass in Pelvic Lake was the highest of all sampled waterbodies (Figure 5.9).

In July, August, and September, Cyanobacteria dominated the phytoplankton community of Pelvic Lake, contributing between 69 and 92% of the total biomass (Figure 5.23; Appendix D2). The other abundant taxonomic groups were Chrysophyta (mainly *Dinobryon sociale*) in July and Bacillariophyta (mainly *Asterionalla formosa*) in August. *Oscillatoria agardhii* was the most abundant Cyanobacteria species on each sampling date.

P.O. Lake

Total phytoplankton biomass in P.O. Lake ranged from 109 µg/L in August to 813 µg/L in July (Figure 5.24; Appendices D1 and D2). Phytoplankton biomass in P.O. Lake was low and was most similar to that observed in Tail Lake (Figure 5.9).

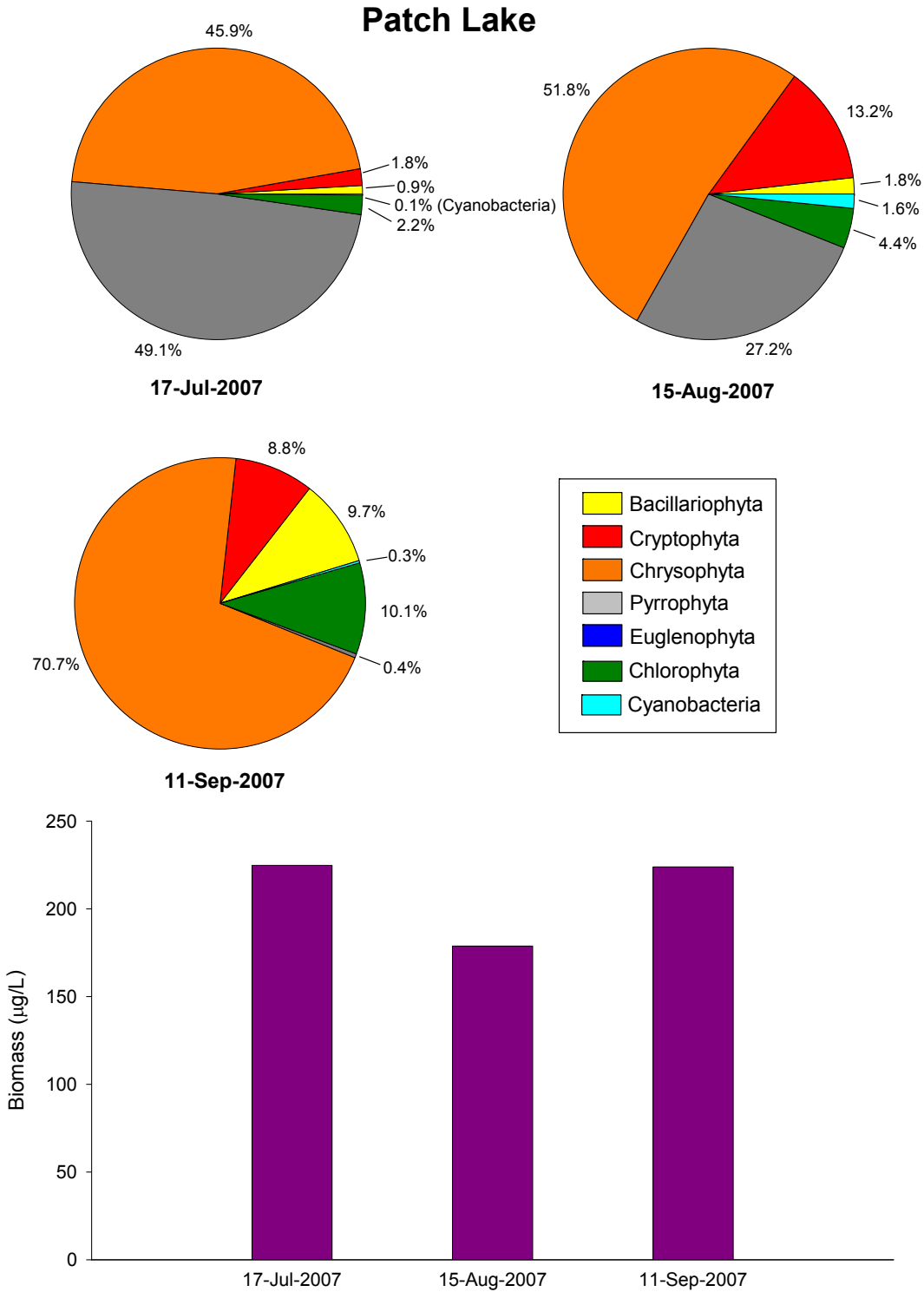


Figure 5.22 Relative abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Patch Lake, 2007

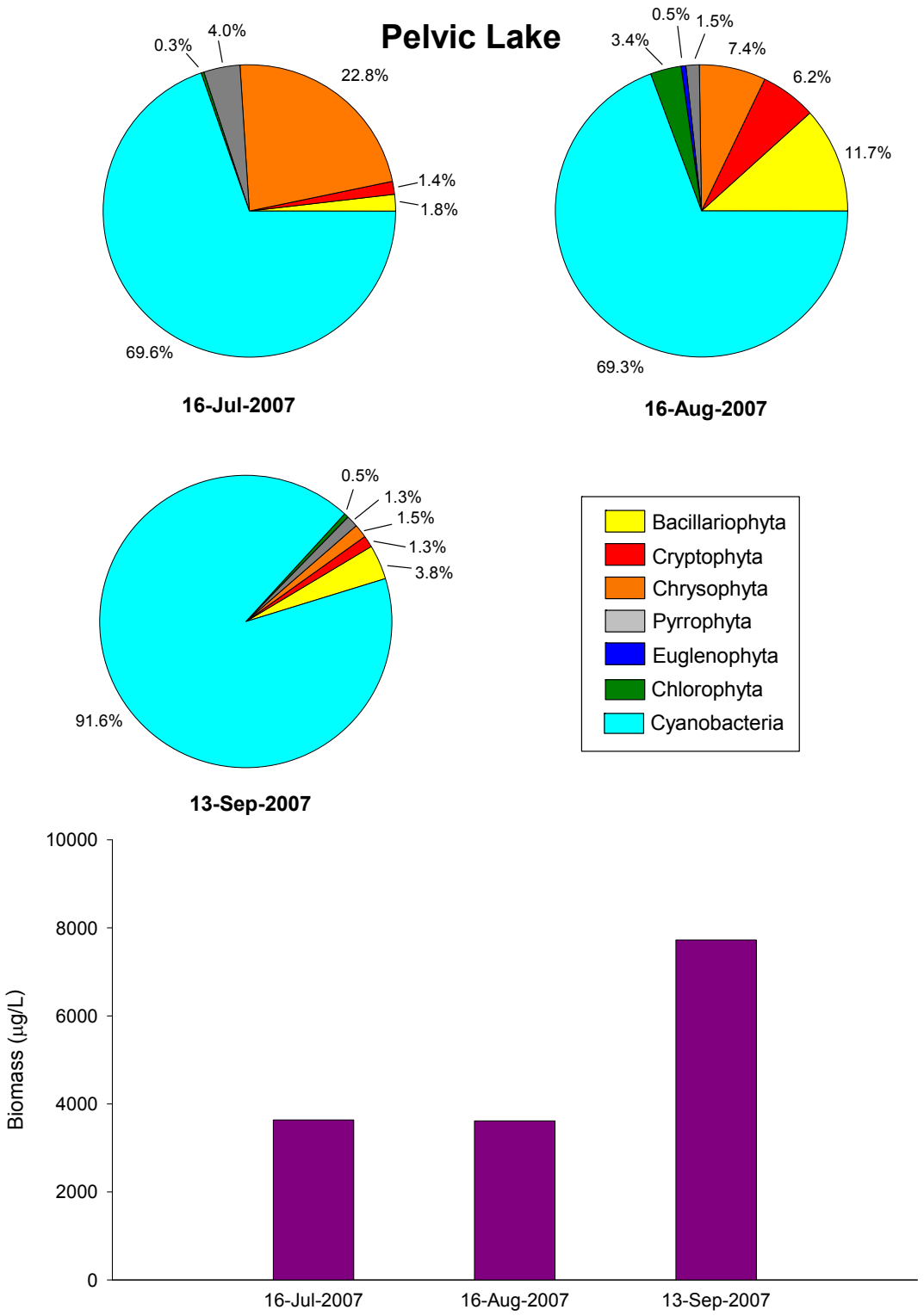


Figure 5.23 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Pelvic Lake, 2007

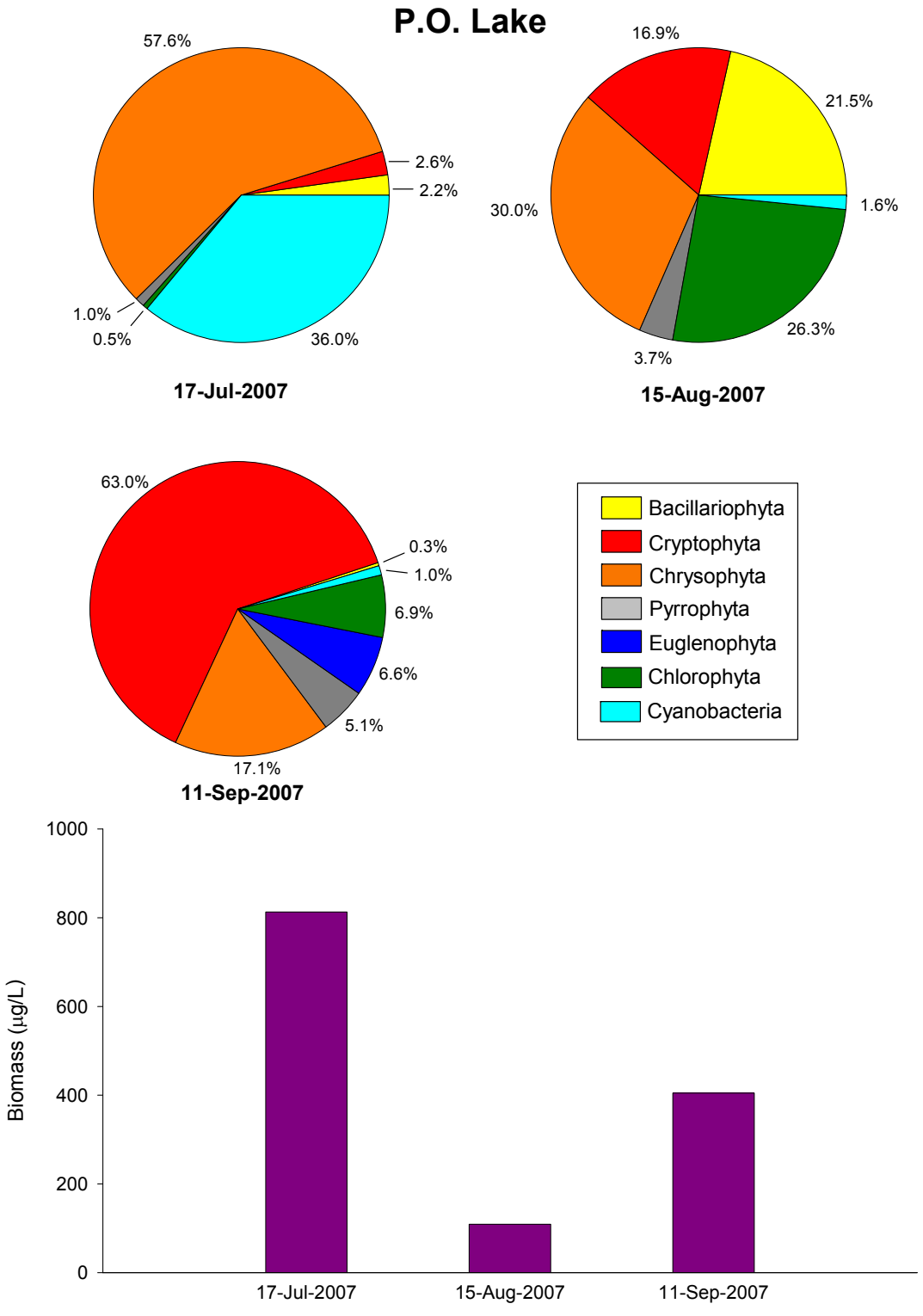


Figure 5.24 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in P.O. Lake, 2007

In July, the phytoplankton community of P.O. Lake was dominated by Chrysophyta, with a large abundance of Cyanobacteria (Figure 5.24; Appendix D2). In August, the phytoplankton community was composed of large numbers of Chrysophyta, Chlorophyta, Bacillariophyta, and Cryptophyta. In September, Cryptophyta was the dominant taxonomic group, and there also was a large abundance of Chrysophyta. *Dinobryon sociale* and *Chrysococcus* sp. were the more abundant taxa of Chrysophyta, and *Katablepharis ovalis* and *Rhodomonas minuta* were the more abundant species of Cryptophyta. *Pseudanabaena* sp. was the dominant taxa of Cyanobacteria, whereas *Chlamydomonas* sp. was the dominant taxa of Chlorophyta, and an unidentified centric diatom was the most abundant taxa of Bacillariophyta.

Windy Lake

Total phytoplankton biomass in Windy Lake ranged from 135 µg/L in September to 152 µg/L in August (Figure 5.25; Appendices D1 and D2). Phytoplankton biomass in Windy Lake was the lowest of all of the sampled waterbodies (Figure 5.9).

In July, the phytoplankton community was dominated by Chrysophyta, followed by Pyrrophyta and Bacillariophyta (Figure 5.25; Appendix D2). In August, Windy Lake had large abundances of Pyrrophyta, Bacillariophyta, Cyanobacteria, and Chrysophyta. In September, the community was composed primarily of Pyrrophyta, Bacillariophyta, and Chrysophyta. The Chrysophyta was represented by *Synura* sp. (July), *Dinobryon tabellariae* (August), and *Stelexmonas dichotoma* (September). Pyrrophyta was represented mainly by *Gymnodinium helveticum*, Bacillariophyta by *Stephanodiscus astraea*, and Cyanobacteria by *Anabaena* sp.

Wolverine Lake

Total phytoplankton biomass in Wolverine Lake ranged from 800 µg/L in August to 1804 µg/L in September (Figure 5.26; Appendices D1 and D2). The mean phytoplankton biomass (1307 µg/L) in Wolverine Lake was close to the overall average (1577 µg/L) for the Project area lakes.

In July and August, Chrysophyta and Pyrrophyta were the co-dominant taxonomic groups in Wolverine Lake (Figure 5.26; Appendix D2). In August, the abundances of Cryptophyta and Chlorophyta were also substantial. In September, the phytoplankton community was dominated by Chrysophyta, which contributed over 80% of the total phytoplankton biomass. Chrysophyta were primarily composed of *Dinobryon sociale* (July), *Chrysococcus* sp. (August), and *Kephyrion spirale* (September). Pyrrophyta were represented by *Peridinium* sp.

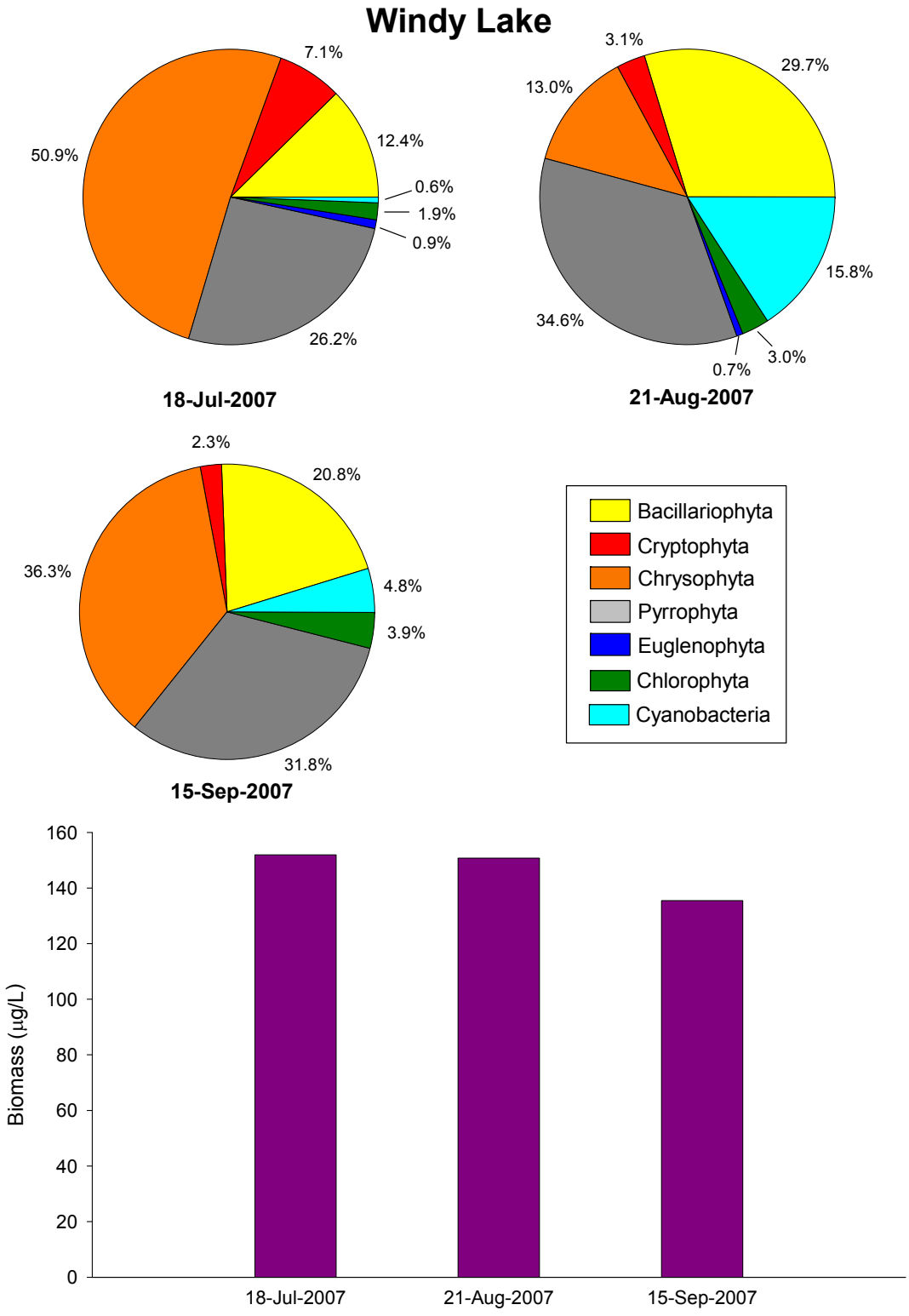


Figure 5.25 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Windy Lake, 2007

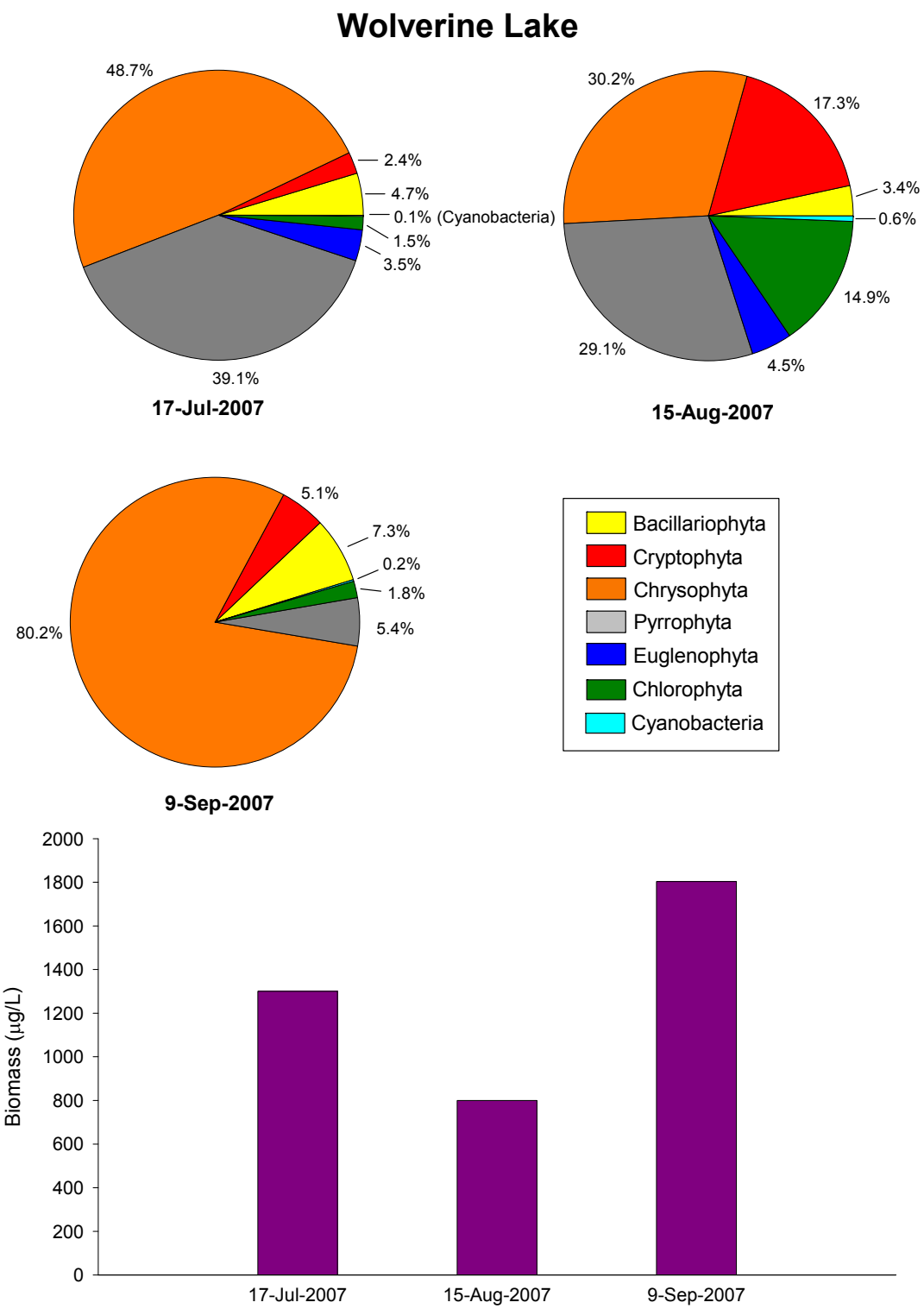


Figure 5.26 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Wolverine Lake, 2007

and *Gymnodinium helveticum*. The most abundant member of Cryptophyta was *Cryptomonas ovata* and the most abundant Chlorophyta was *Ankistrodesmus falcatus v. acicularis*.

5.1.2.7 Marine Areas

Hope Bay

Total phytoplankton biomass in Hope Bay ranged from 159 µg/L in September to 173 µg/L in July (Figure 5.27; Appendices D1 and D2). Phytoplankton biomass in Hope Bay was the second lowest of all of the sampled waterbodies (Figure 5.9).

In July, Bacillariophyta was the most abundant taxonomic group, with significant contributions from Pyrrophyta, Chrysophyta and Cryptophyta (Figure 5.27; Appendix D2). In August and September, the most abundant phytoplankton group was Chlorophyta, with slightly lower abundances of Cryptophyta, Chrysophyta, and Pyrrophyta. The most abundant species were *Melosira varians* (Bacillariophyta), *Crypyochrysis commutatai* (Cryptophyta), *Chrysococcus* sp. (Chrysophyta), and *Gymnodinium* sp. (Pyrrophyta). Chlorophyta was represented by two species of desmids: *Cosmarium* sp. and *Staurastrum* sp.

Roberts Bay

Total phytoplankton biomass in Roberts Bay ranged from 99 µg/L in August to 431 µg/L in September (Figure 5.28; Appendices D1 and D2). Phytoplankton productivity in Roberts Bay was among the lowest of the sampled waterbodies (Figure 5.9).

In July, Pyrrophyta, followed by Cyanobacteria, were the dominant taxonomic groups in Roberts Bay (Figure 5.28; Appendix D2). In August, Cyanobacteria was the dominant group, contributing 71% of the total phytoplankton biomass. In September, this group was also dominant, contributing over 91% of the total phytoplankton biomass. Pyrrophyta was represented by *Peridinium* sp. and Cyanobacteria by *Oscillatoria agardhii*.

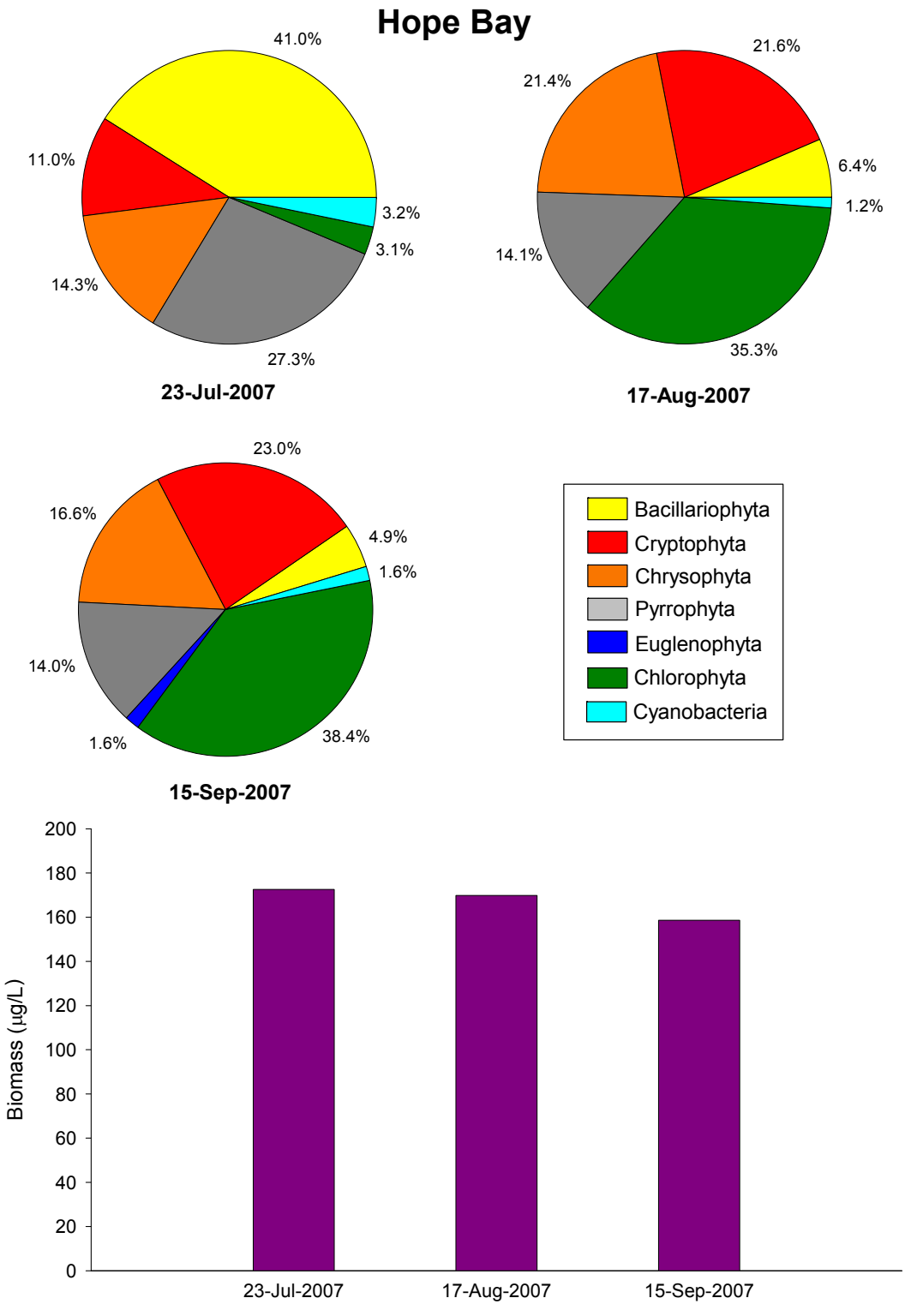


Figure 5.27 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Hope Bay, 2007

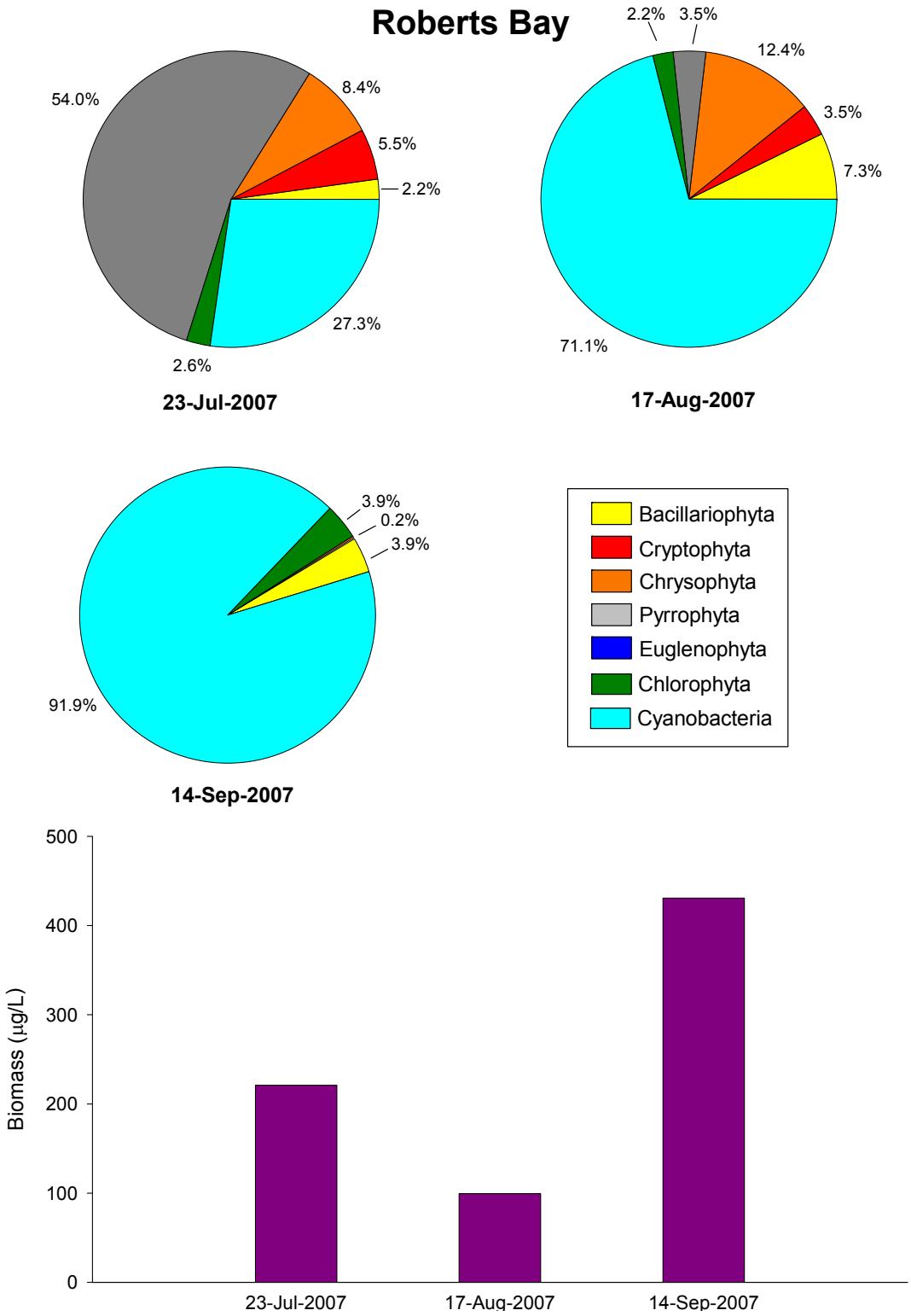


Figure 5.28 Relative Abundance of Major Taxonomic Groups and Total Biomass of Phytoplankton in Roberts Bay, 2007

5.1.3 Summary

The phytoplankton communities in the sampled waterbodies in the Project area were similar in many respects to the communities of many other small lakes in the Arctic and sub-Arctic (as described by Moore 1978a, 1978b; RL&L 1997, 1998, 1999; RL&L/Golder 2002; Golder 2008a). Based on the phytoplankton community, it appeared that two different categories of lakes existed in the Hope Bay Belt: Cyanobacteria-dominated and non-Cyanobacteria dominated (Table 5.2). Lakes that fall under the Cyanobacteria-dominated category are typified by high phytoplankton biomass and chlorophyll *a*, and the following phytoplankton community succession pattern:

- July – phytoplankton community consisting of >30% Cyanobacteria, with large abundances of Chrysophyta and Cryptophyta;
- August – phytoplankton community consisting of >50% Cyanobacteria, with contributions of Chrysophyta and Bacillariophyta; and
- September – phytoplankton community consisting of >80% Cyanobacteria.

In contrast, waterbodies that were not Cyanobacteria dominated had low to moderate total biomass and chlorophyll *a*, and the following phytoplankton community succession pattern:

- July – typically dominated by Chrysophyta;
- August – typically dominated by Bacillariophyta, Chrysophyta, or a mix of several taxonomic groups; and
- September – typically a mix of several taxonomic groups; Cyanobacteria not greater than 25%.

Cyanobacteria are generally not utilized by aquatic consumers as a food source and can be responsible for toxic blooms. Cyanobacteria tend to thrive under high-nutrient conditions, particularly when nitrogen becomes limiting, due to their unique ability of fix atmospheric nitrogen into a usable form, although nitrogen concentrations did not seem to be limiting in these lakes.

Seven lakes with high phytoplankton productivity were Doris, Little Roberts, Ogama, Pelvic, Roberts, Fickle Duck and Wolverine lakes. Each of these lakes, except Fickle Duck Lake and Wolverine Lake also had high abundances of Cyanobacteria. This is similar to the trend seen in previous studies in the Doris North and Madrid Project areas (RL&L/Golder 2002). Previous studies in the Boston Project area indicated that Cyanobacteria also dominated the

phytoplankton community in these lakes (Golder 2008a); however, the 2007 data indicate that the Boston Project area lakes generally were dominated by Chrysophyta, with the exception of the July phytoplankton community in Fickle Duck and Reference lakes, which were dominated by Cyanobacteria.

Table 5.2 Summary of Phytoplankton Abundance in the Hope Bay Belt Waterbodies, July to September, 2007

Waterbody	Mean Biomass[a] (µg/L)	Mean Number of Species[a]	Mean Chlorphyll *a*[a] (mg/m^3)	Cyanobacteria-Dominated
Boston Project Area				
Aimaokatalok Lake Station 4	634	61	1.9	
Aimaokatalok Lake Station 6	703	61	1.6	
Fickle Duck Lake	1673	65	4.7	
Reference Lake	631	62	3.1	
Stickleback Lake	667	56	1.7	
Doris North Project Area				
Doris Lake	3542	43	11.5	√
Little Roberts Lake	2915	58	5.8	√
Roberts Lake	1727	50	3.4	√
Tail Lake	410	40	2.6	
Madrid Project Area				
Glenn Lake	240	33	0.9	
Ogama Lake	4162	52	4.5	√
Patch Lake	209	48	0.6	
Pelvic Lake	4992	52	10.7	√
P.O. Lake	442	40	1.7	
Windy Lake	146	40	0.8	
Wolverine Lake	1301	49	1.6	
Marine Areas				
Hope Bay (marine)	167	59	0.6	
Roberts Bay (marine)	250	39	0.9	√

[a] Mean value based on the three sampling dates in 2007.

Prepared By: MC Checked by: EJJ

Environmental conditions in Doris, Little Roberts, Roberts, Ogama, and Pelvic lakes are conducive to high phytoplankton abundances and, in particular, Cyanobacteria growth. Concentrations of nutrients (nitrogen and phosphorus) were higher in all of these waterbodies compared to the others sampled in 2007 and likely were the primary cause of large phytoplankton biomass. Pelvic Lake contained the highest phosphorus and nitrogen concentrations, along with the highest phytoplankton biomass.

5.2 ZOOPLANKTON

Zooplankton are small invertebrates that inhabit the water column of lakes. Typically, zooplankton consume phytoplankton, bacteria, and other organic matter; however, some species also prey upon other zooplankton. Zooplankton in turn, are utilized by larger invertebrates and fish as a food source; therefore, they are an important link between primary producers and fish.

5.2.1 Methods

5.2.1.1 Sampling Stations and Timing

Zooplankton samples were collected from 13 stations within the Boston and Madrid Project areas (Figures 5.1 and 5.2; Table 5.3). Each waterbody was sampled monthly during the open-water season (July-September) in 2007.

Table 5.3 Zooplankton Sampling Periods, Locations, and Depths for the Boston and Madrid Project Areas, 2007

Waterbody	Sampling Location (UTM Coordinates[a])		Depth (m)		
	Easting	Northing	July	August	September
Boston Project Area					
Aimaokatalok Lake Station 4	438994	7508922	5.5	5.5	5.5
Aimaokatalok Lake Station 6	440427	7509089	20	15	20
Fickle Duck Lake	442653	7502914	horizontal tow		
Reference Lake	437961	7503702	horizontal tow		
Stickleback Lake	441744	7503511	horizontal tow		
Madrid Project Area					
Glenn Lake	430325	7560234	15	15.5	9
Ogama Lake	436619	7551845	4	5	5
Patch Lake	435583	7547770	6	10	10
Pelvic Lake	439639	7552550	7	10	10
P.O. Lake	436527	7549401	horizontal tow		
Windy Lake	431584	7553249	15	17	16.5
Wolverine Lake	434874	7545885	horizontal tow		
Marine Areas					
Hope Bay	427587	7555296	10	7	13

[a] Projection: NAD83, Zone13W.

Prepared by: MC Checked by: EJJ

5.2.1.2 Sampling Procedures

Zooplankton sampling procedures followed Golder Technical Procedure 8.7-1: *Phytoplankton and Zooplankton Sampling* (unpublished file information).

During each sampling session, a single zooplankton sample was collected using a Wisconsin net with a 0.25 m diameter mouth and a 153 µm mesh size. Zooplankton samples were collected using vertical hauls from 1 m above the sediments. Typically, a single vertical haul collected adequate numbers of zooplankton; however, multiple hauls were performed when necessary. In shallow lakes (i.e., <3 m), vertical hauls were not successful for collecting sufficient numbers of zooplankton. In these shallow waterbodies, horizontal tows were performed by dragging the Wisconsin net behind a boat at its lowest speed for exactly one minute. Using GPS data, it was determined that each horizontal tow was approximately 50 m in distance, and that the boat speed was close to the ideal speed for vertical tows (0.5 m/s). Each zooplankton sample was transferred to a clean 500 mL plastic jar and preserved with ethanol to a final concentration of 70%.

5.2.1.3 Laboratory Analytical Procedures

Zooplankton samples were submitted to Dr. Rolf Vinebrooke at the University of Alberta (Dept. of Biological Sciences) for taxonomic identification and enumeration. All crustacean zooplankton (i.e., non-Rotifera) were identified to the lowest possible taxonomic level using a stereomicroscope. A minimum of 300 individuals were identified and enumerated, which incorporated all life-stages (adults, juveniles, copepodites, and nauplii). Two hundred Rotifera individuals were enumerated to the lowest possible taxonomic level using a Sedgewick-Rafter counting cell and an inverted light microscope. Identifications were based on the taxonomic keys of Thorp and Covich (2001) and Pennak (1989).

Zooplankton biomass per sample was converted to biomass per cubic metre based upon the estimated volume filtered by the Wisconsin net. The biomass of crustacean zooplankton was estimated by using published length-weight regressions, and the biomass of rotifers was estimated using published species-specific geometric formulae (McCauley 1984). Zooplankton length and dimensions were measured using a digital imaging system and Openlab v. 4.0.1 (Improvision 2002). Zooplankton length and dimension data were collected from a minimum of 30 individuals of each species from each sample, whenever possible. Raw data and biomass estimates are presented in Appendix D3 and D4.

5.2.2 Results and Discussion

5.2.2.1 Abundance and Species Richness – Overview

Zooplankton abundance in lakes typically follows a distinct seasonal pattern and periodicity due to changes in temperature, light, phytoplankton, and other factors.

(Wetzel 2001). Zooplankton biomass was typically highest in August and low in both July and September, with the exception of the Ogama Lake September sampling session. Freshwater lakes with the highest zooplankton biomass were Ogama Lake and Aimaokatalok Lake (Figure 5.29; Appendix D3).

Zooplankton species richness was less variable among stations than biomass and ranged between 2 and 13 species (Figure 5.30). Overall, Boston Project area lakes had slightly greater species richness than the Madrid Project area lakes and marine areas. Zooplankton taxonomic richness remained generally consistent throughout the sampling period (Figure 5.30).

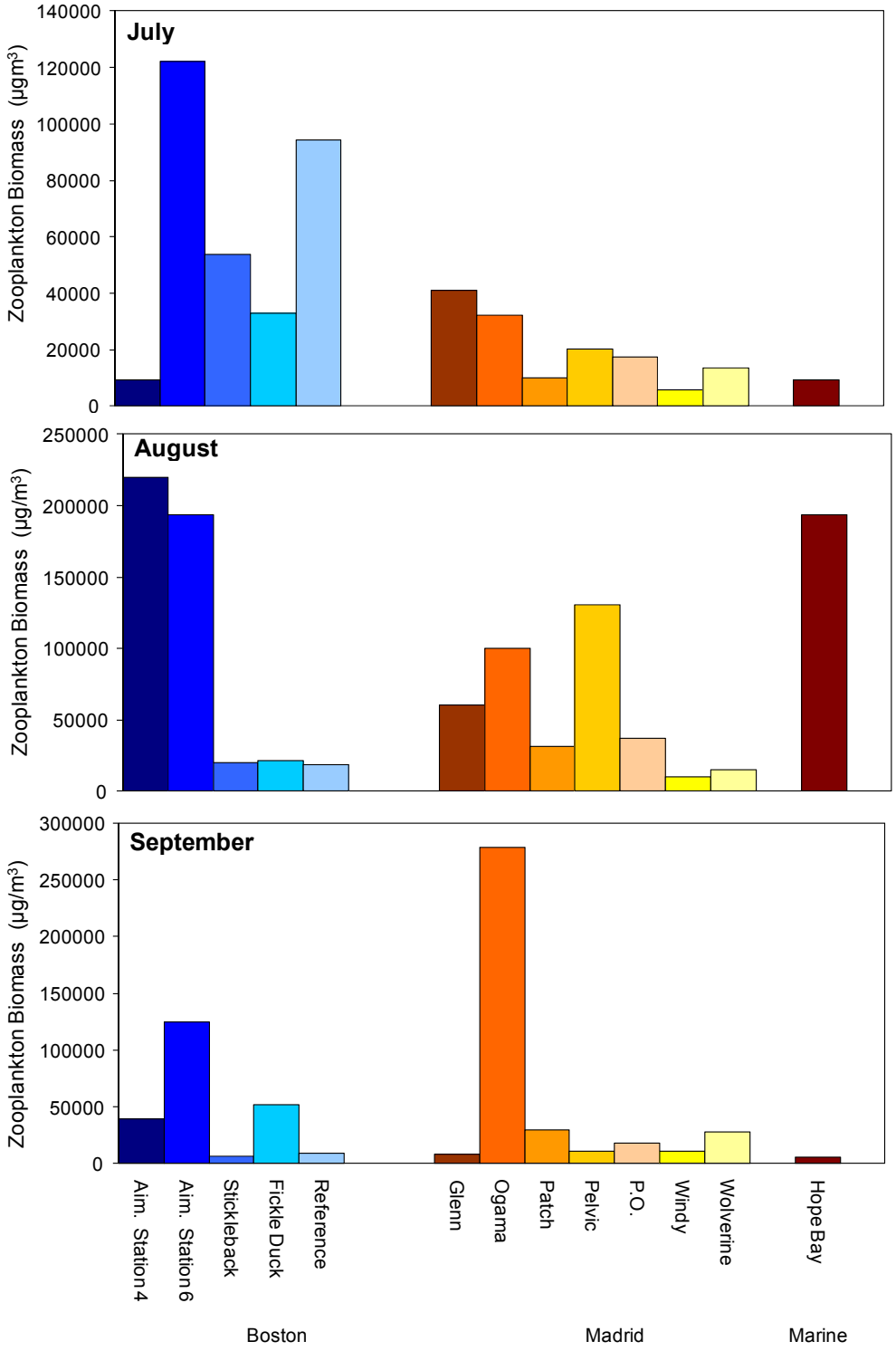
5.2.2.2 Boston Project Area

Aimaokatalok Lake

Zooplankton biomass at Aimaokatalok Lake Station 4 ranged from 9391 µg/m^3 in July to 219 789 µg/m^3 in August (Figure 5.31; Appendices D3 and D4). Zooplankton biomass at Aimaokatalok Lake Station 6 was higher, ranging from 122 331 µg/m^3 (July) to 193 917 µg/m^3 (August) (Figure 5.32; Appendices D3 and D4). Zooplankton biomass in Aimaokatalok Lake was the highest of all the sampled Boston Project Area waterbodies. Taxonomic richness was high at Station 6 (mean of 10.7 ± 1.3 (SE) species per sampling event) and moderate at Station 4 (mean of 7.3 ± 1.2 (SE) species).

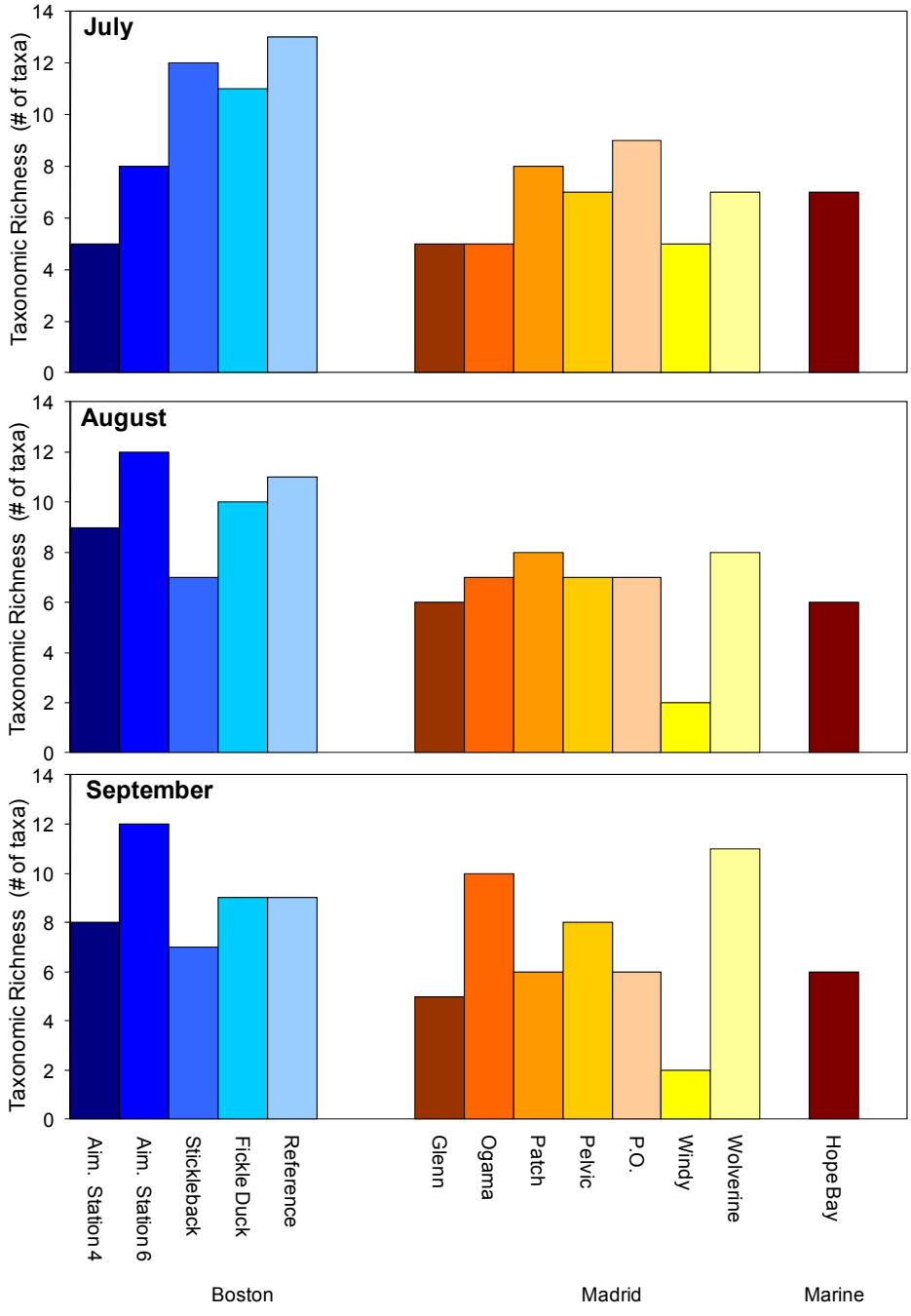
In July, the zooplankton community at Station 4 in Aimaokatalok Lake was co-dominated by calanoid and cyclopoid copepods (Figure 5.31). In August, Cladocera (water fleas) was the taxonomic group with the largest biomass, followed by Cyclopoida. In September, Calanoida contributed the highest amount of biomass, followed by Cladocera. The most abundant member of each zooplankton group was as follows: Calanoida, *Limnocalanus macrurus*; Cladocera, *Holopedium gibberum*; and Cyclopoida, *Cyclops bicuspidatus thomasi* (Appendix D3).

Throughout the open-water season, Cyclopoida was the most abundant taxonomic group at Station 6 in Aimaokatalok Lake (Figure 5.32). In July, Cyclopoida dominated the zooplankton community, with only a low abundance of Calanoida. In August, Calanoida and Cladocera each had low abundances, and by September, the two groups contributed almost half of the zooplankton community, with the rest composed of Cyclopoida. On the July and August sampling dates, the most abundant member of Cyclopoida was *Cyclops bicuspidatus thomas*i, whereas in September it was *Mesocyclops edax* (Appendix D3). Of the cladocerans, *Daphnia longiremis* and *Holopedium*



Aim. = Aimaokatalok.

Figure 5.29 Zooplankton Biomass Concentrations in Project Area Lakes and Marine Stations, 2007



Aim. = Aimaokatalok.

Figure 5.30 Zooplankton Taxonomic Richness in Project Area Lakes and Marine Stations, 2007

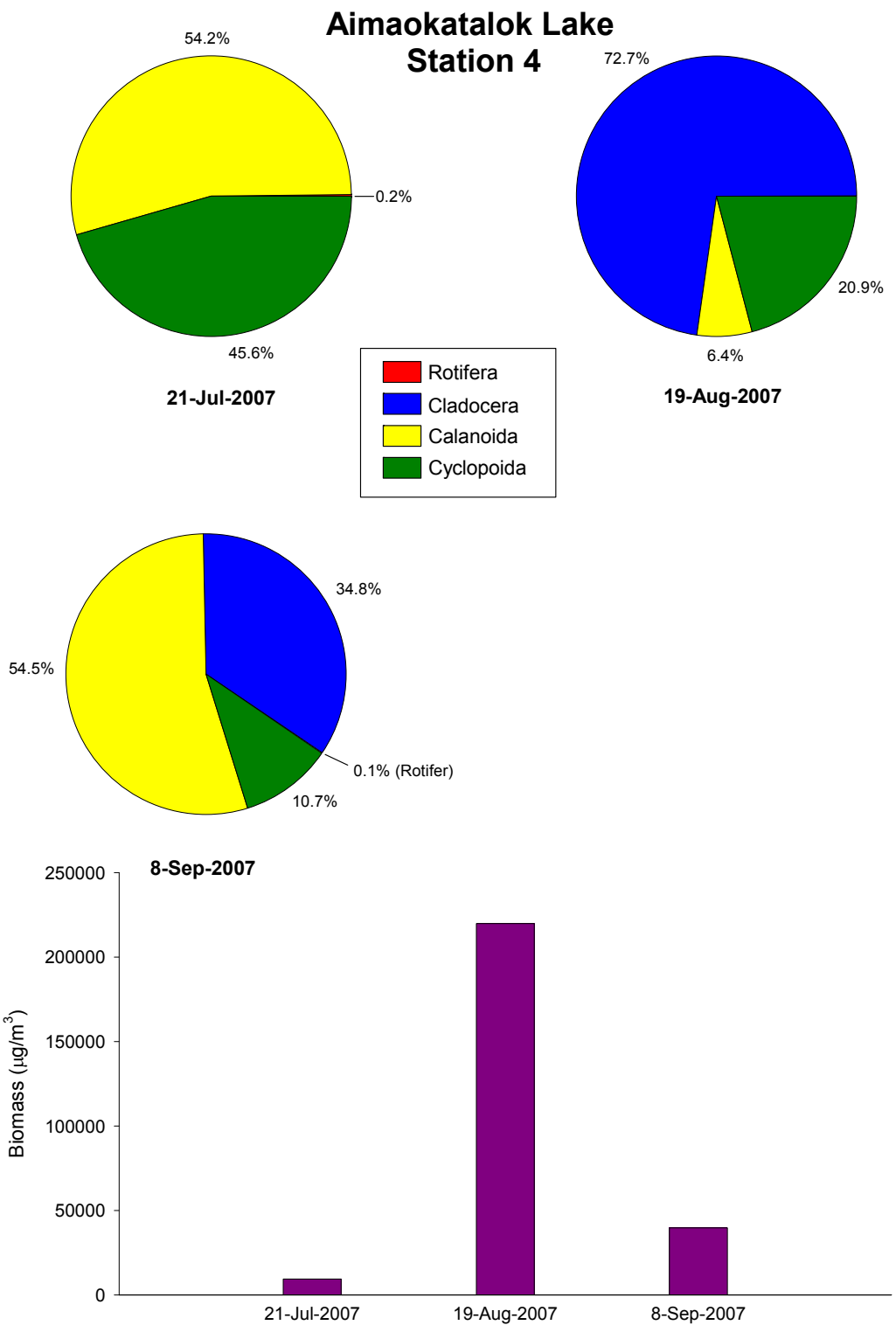


Figure 5.31 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Aimaokatalok Lake Station 4, 2007

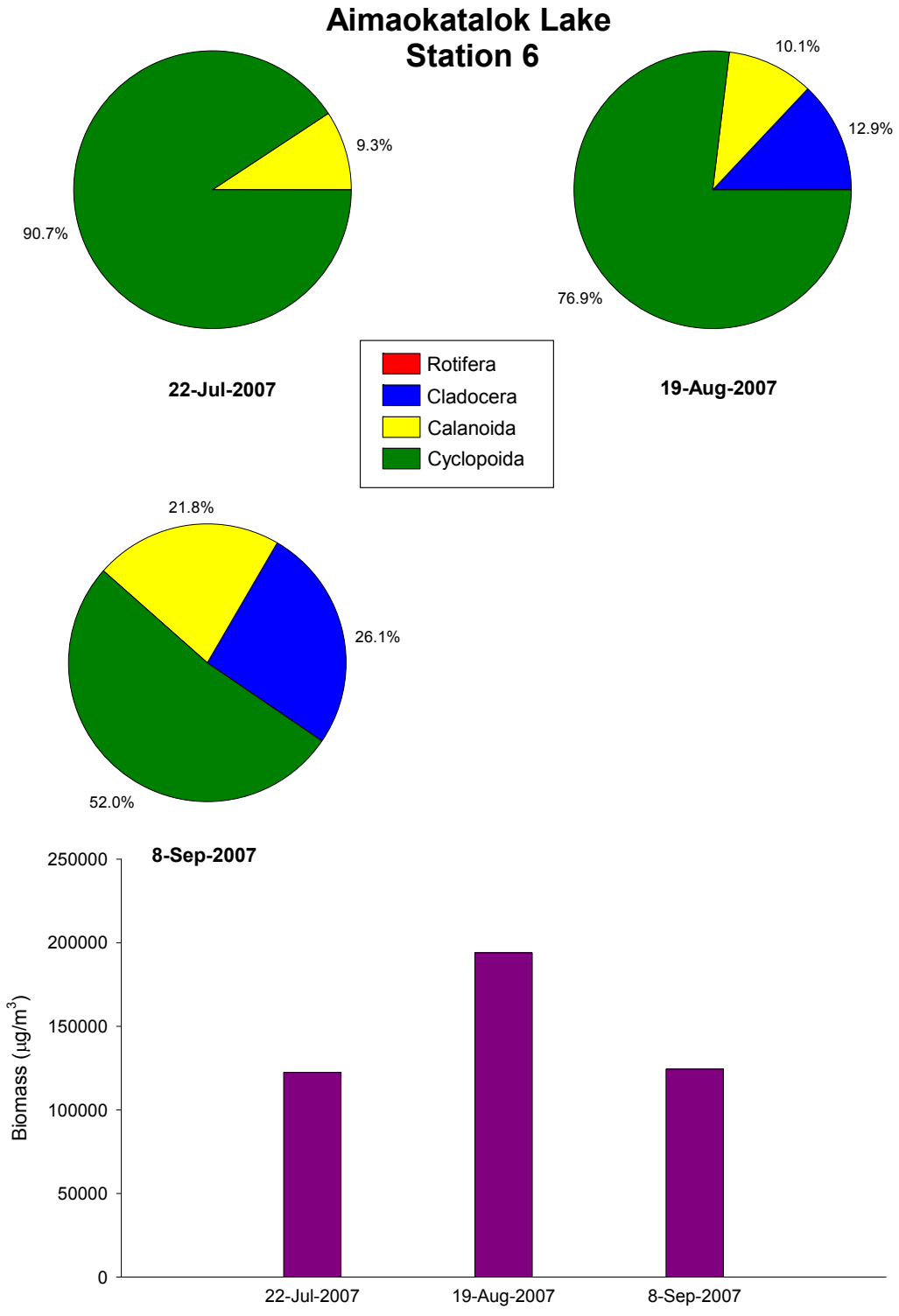


Figure 5.32 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Aimaokatalok Lake Station 6, 2007

gibberum were both common. Calanoida was represented by adult stages of *Limnocalanus macrurus* (Appendix D3).

Zooplankton biomass and species composition varied considerably between the two stations in Aimaokatalok Lake. While biomass was similar at the two stations in August, it was 10-fold higher in July and 3-fold higher in September at Station 6. Additionally, Cyclopoida consistently had the highest biomass at Station 6, whereas it was not dominant at Station 4. Similarly, in July, Calanoida contributed 54% of the zooplankton biomass at Station 4, but only 9% at Station 6. These differences were likely due to the difference in water depth between stations. Station 4 was approximately 6 m deep, whereas Station 6 was close to 30 m deep. Greater water depth can allow greater biomass due to the presence of a depth refuge for large zooplankton to avoid visual predators (planktivorous fish).

Fickle Duck Lake

Zooplankton biomass in Fickle Duck Lake ranged from 21 333 µg/m^3 in August to 51 554 µg/m^3 in September (Figure 5.33; Appendices D3 and D4). Zooplankton biomass in Fickle Duck Lake was moderate. The taxonomic richness in Fickle Duck Lake was high, with 10.0 ± 0.6 (SE) species per sampling event.

In July, Rotifera had the highest biomass, followed by Cladocera in Fickle Duck Lake. Cyclopoida and Calanoida also had high biomasses on the July sampling date. In August and September, the zooplankton community was dominated by Cladocera, with a high biomass of Rotifera as well (Figure 5.33). The most abundant taxon in each major zooplankton group was as follows: Cladocera, *Bosmina longirostris*; Rotifera, *Asplanchna* sp.; Cyclopoida, *Cyclops bicuspidatus thomasi*; Calanoida, *Limnocalanus macrurus* (Appendix D3).

Reference Lake

The total zooplankton biomass in Reference Lake ranged from 9248 µg/m^3 in September to 94 379 µg/m^3 in July (Figure 5.34; Appendix D3 and D4). Zooplankton biomass in Reference Lake was moderate. Taxonomic richness in Reference Lake was the highest of all lakes, with an average of 11.0 ± 1.2 (SE) species per sampling event.

Throughout the open-water season, Rotifera dominated the zooplankton community in Reference Lake. Cyclopoida contributed a small proportion of total zooplankton biomass in August and September (Figure 5.34). Nearly all of the rotifer biomass was contributed by the predatory rotifer *Asplanchna* sp. Adult

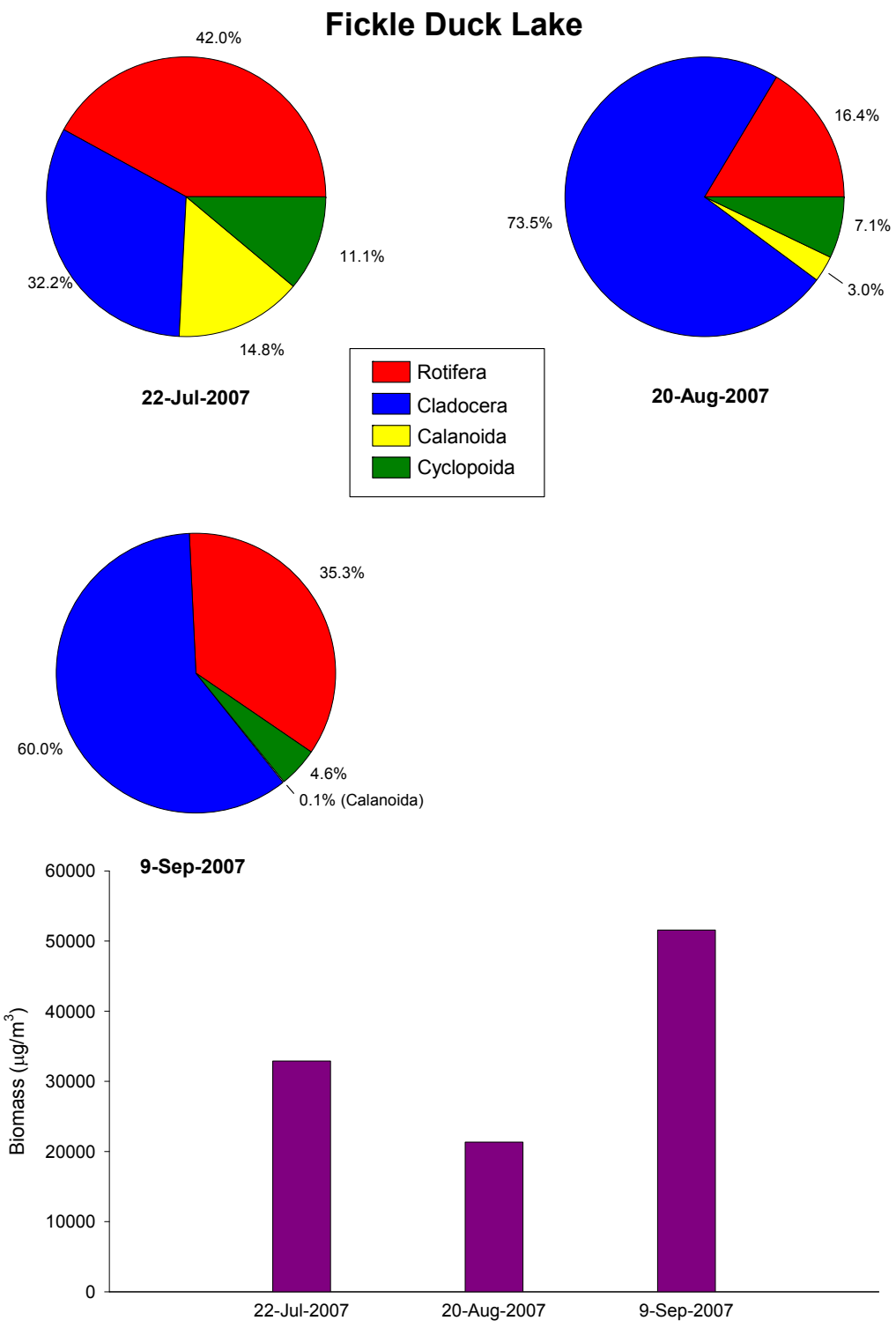


Figure 5.33 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Fickle Duck Lake, 2007

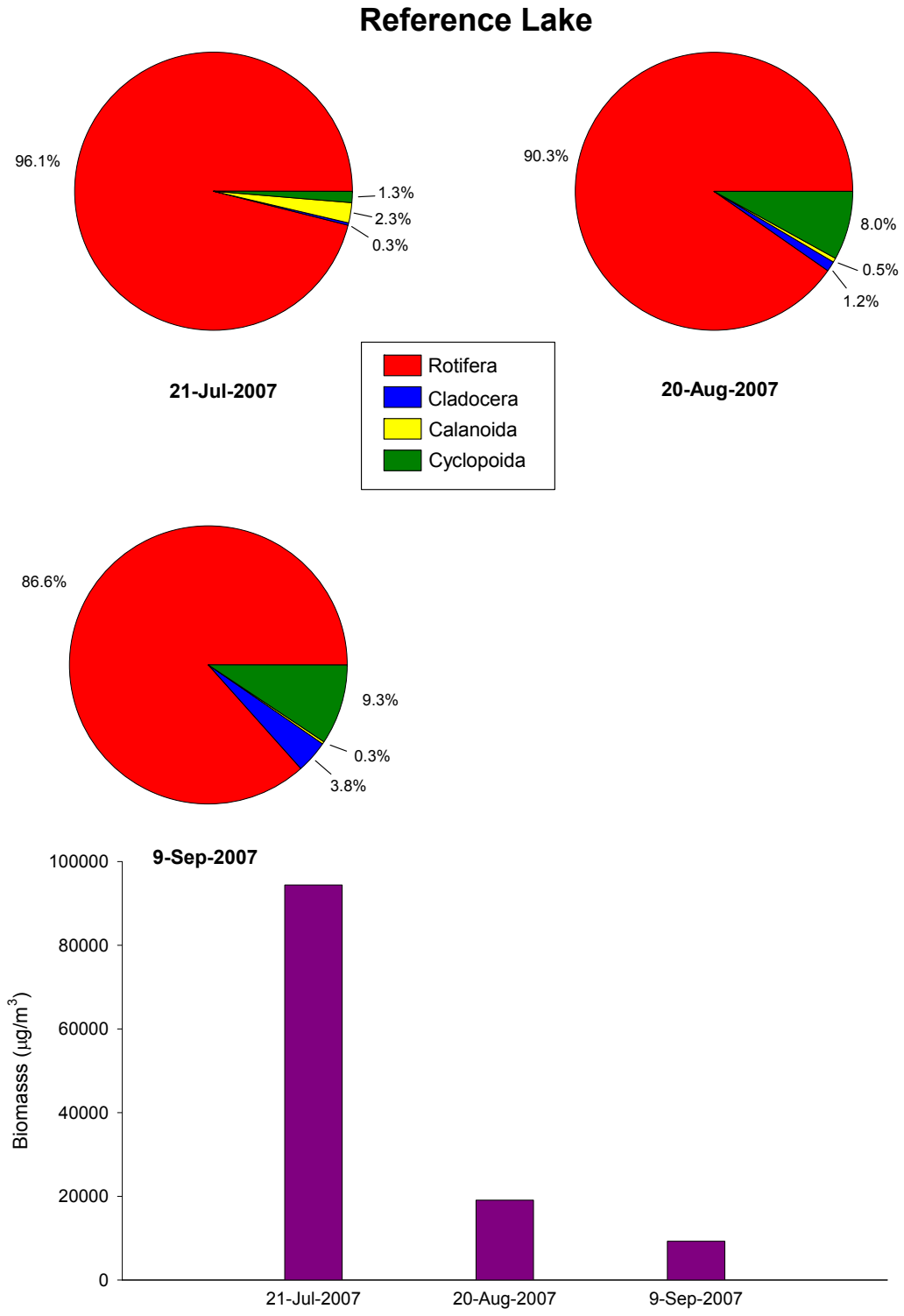


Figure 5.34 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Reference Lake, 2007

stages of the copepod *Cyclops bicuspidatus thomasi* was the most abundant member of Cyclopoida (Appendix D3).

Stickleback Lake

The total zooplankton biomass in Stickleback Lake ranged from 6378 µg/m^3 in September to 53 635 µg/m^3 in July (Figure 5.35; Appendices D3 and D4). Zooplankton biomass in Stickleback Lake was moderate in comparison to other sampled waterbodies. Stickleback Lake taxonomic richness was moderate, with an average of 8.7 ± 1.7 (SE) species per sampling event.

In July and August, the zooplankton community of Stickleback Lake was co-dominated by Rotifera and Cyclopoida. In September, Rotifera dominated the zooplankton community, while Cyclopoida and Calanoida had smaller biomasses (Figure 5.35). The predatory rotifer, *Asplanchna* spp. was the dominant member of Rotifera. Cyclopoida was represented by *Cyclops bicuspidatus thomasi*, while Calanoida was represented by *Epischura lacustris* (Appendix D3).

5.2.2.3 Madrid Project Area

Glenn Lake

The total zooplankton biomass in Glenn Lake ranged from 8724 µg/m^3 (September) to 60 697 µg/m^3 (August) (Figure 5.36; Appendices D3 and D4). The total zooplankton biomass in Glenn Lake was moderate compared to other sampled waterbodies. Glenn Lake was among the lakes with the lowest species richness, with an average of 5.3 ± 0.3 (SE) species per sampling event.

Throughout the entire open-water season, Calanoida dominated the zooplankton community of Glenn Lake (>75%). In August, rotifers contributed a moderate proportion of total of biomass (~25%); however, Calanoida biomass was three times greater (Figure 5.36). Calanoida was represented mainly by *Limnocalanus macrurus,* and Rotifera was represented mainly by *Conochilus nataus* (Appendix D3).

Ogama Lake

Zooplankton biomass in Ogama Lake ranged from 32 048 µg/m^3 in July to 278 389 µg/m^3 in September (Figure 5.37; Appendices D3 and D4). Zooplankton biomass in Ogama Lake was the second highest of all the sampled waterbodies. The taxonomic richness in Ogama Lake was moderate, with an average of 7.3 ± 1.5 (SE) species per sampling event.

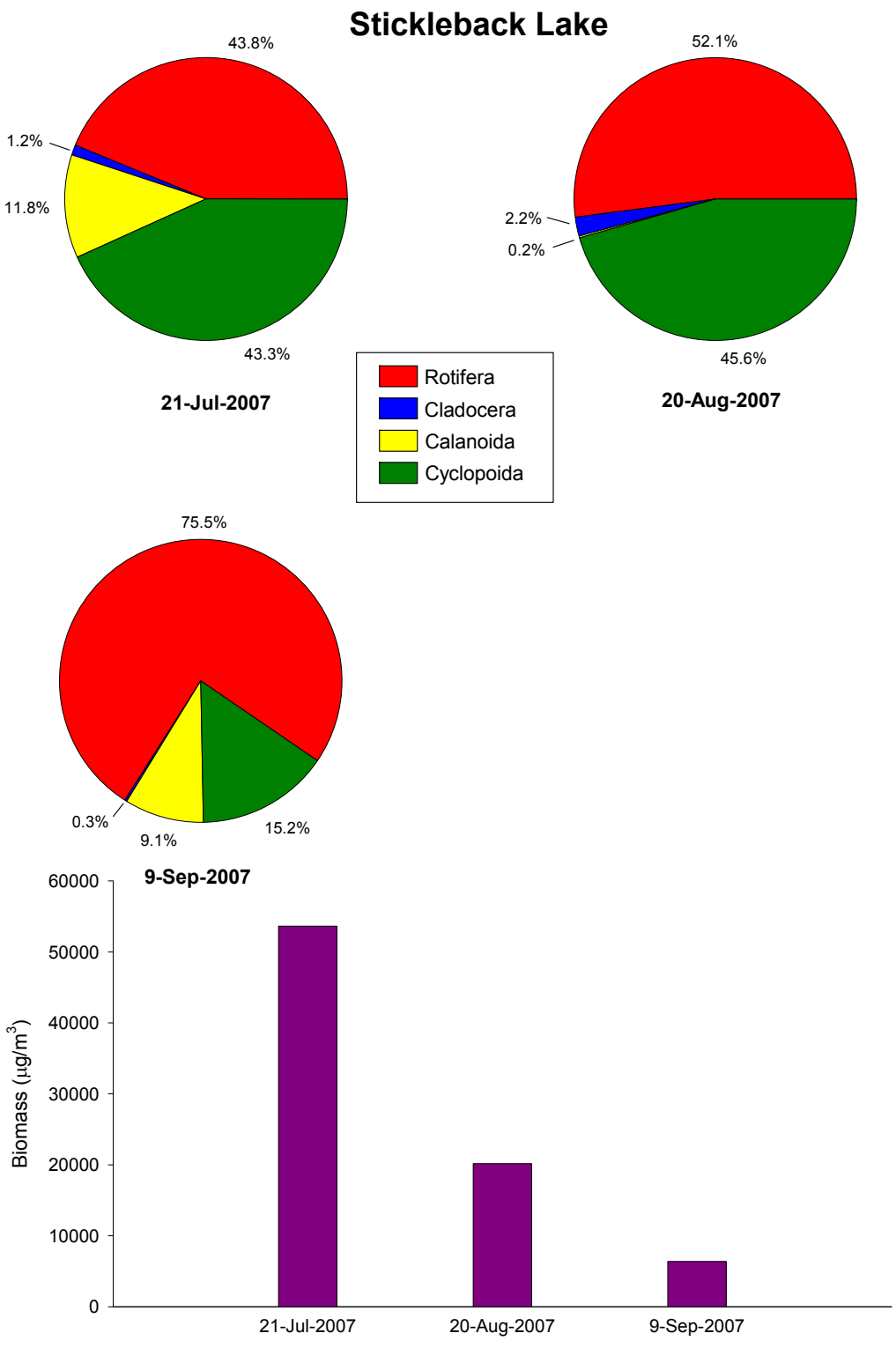


Figure 5.35 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Stickleback Lake, 2007

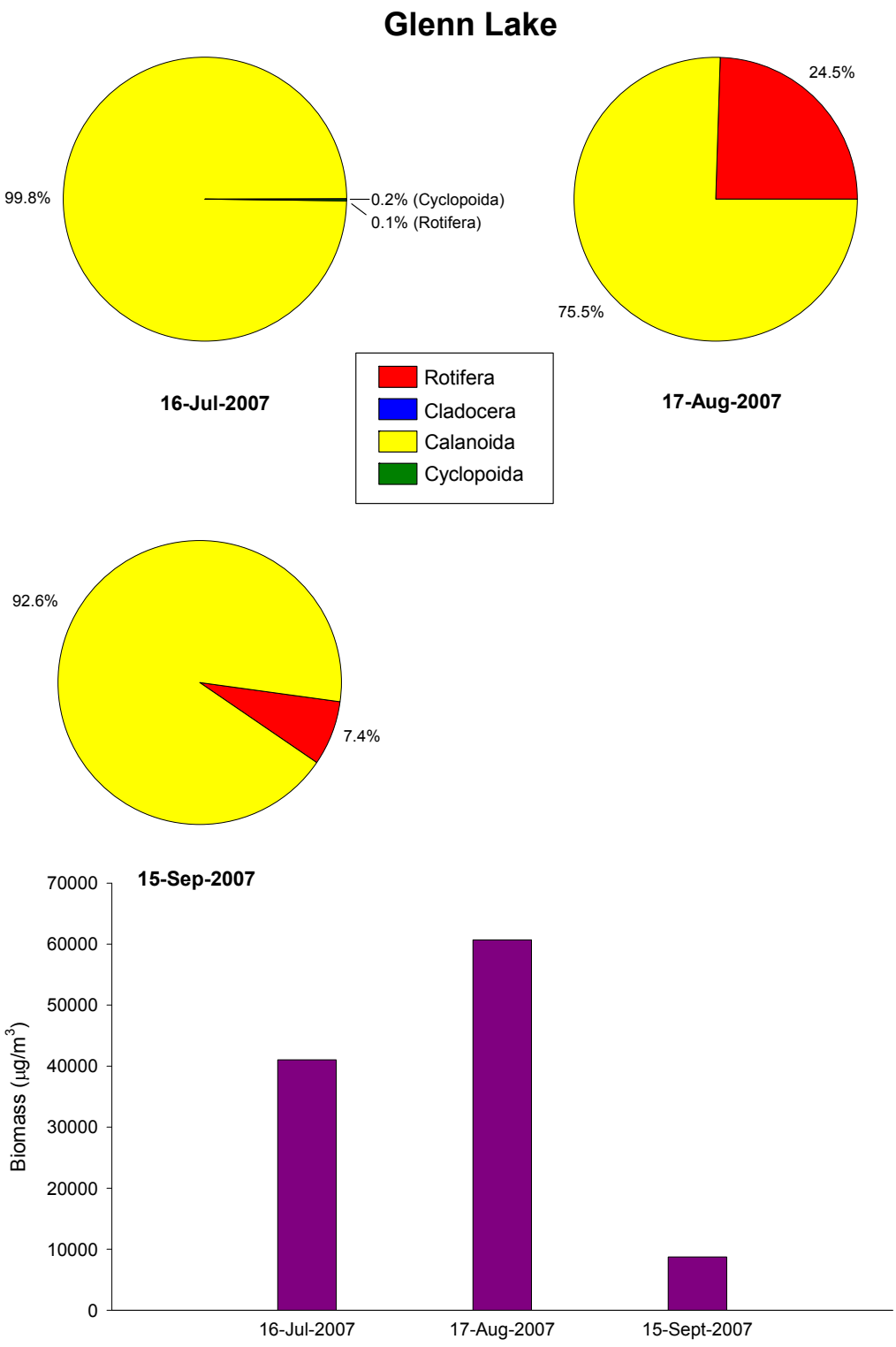


Figure 5.36 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Glenn Lake, 2007

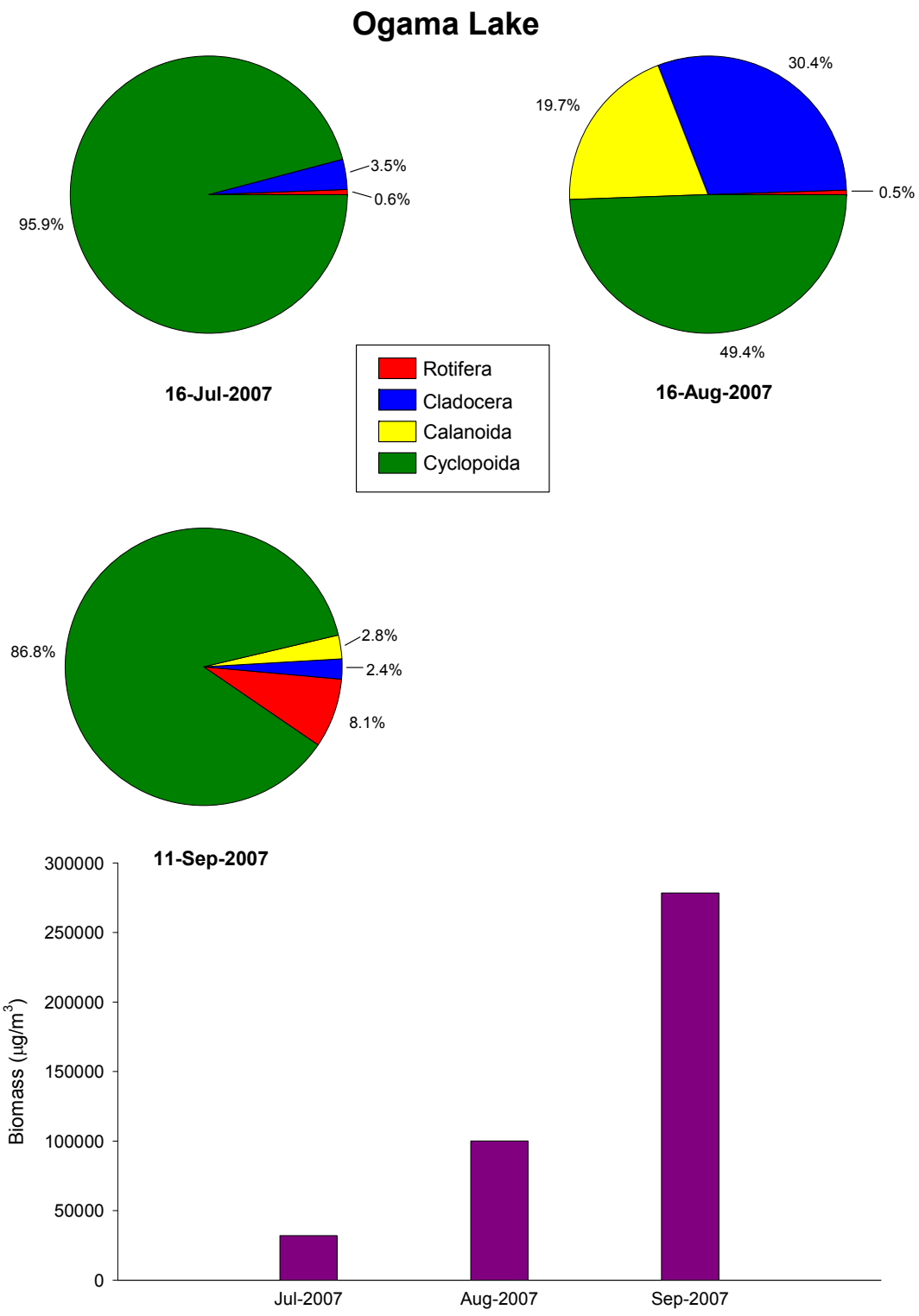


Figure 5.37 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Ogama Lake, 2007

In July and September, Cyclopoida dominated the zooplankton community of Ogama Lake. In August, Cyclopoida was still the most abundant taxonomic group, contributing half of the total biomass, but Cladocera and Calanoida also had large abundances, contributing most of the remaining biomass (Figure 5.37). Cyclopoida was dominated by *Cyclops bicuspidatus thomasi*, Cladocera was dominated by *Bosmina longirostris,* and Calanoida was dominated by *Epischura lacustris* (Appendix D3).

Patch Lake

The total zooplankton biomass in Patch Lake ranged from 10 126 µg/m^3 (July) to 31 229 µg/m^3 (August) (Figure 5.38; Appendices D3 and D4). Zooplankton biomass in Patch Lake was among the lowest of all the sampled waterbodies. The taxonomic richness in Patch Lake was moderate, with an average of 7.3 ± 0.7 (SE) species per sampling event.

The Calanoida was consistently the most abundant taxonomic group during the open-water season in Patch Lake. Cyclopoida and Cladocera also contributed a substantial amount to the total zooplankton biomass. Rotifera were only abundant in July (Figure 5.38). Calanoida was represented primarily by the adult stage of *Limnocalanus macrurus*. Cyclopoida was primarily represented by adult stages of *Cyclops bicuspidatus thomasi*, and Cladocera was primarily represented by adult stages of *Holopedium gibberum* (Appendix D3).

Pelvic Lake

The total zooplankton biomass in Pelvic Lake ranged from 11 232 µg/m^3 in September to 130 462 µg/m^3 in August (Figure 5.39; Appendices D3 and D4). Zooplankton biomass in Pelvic Lake was moderate compared to other sampled waterbodies. The mean taxonomic richness in Pelvic Lake was 7.3 ± 0.3 (SE) species.

Throughout the open-water season, Cyclopoida was the most abundant taxonomic group in Pelvic Lake, with Cladocera contributing about one-quarter of the biomass (Figure 5.39). *Cyclops bicuspidatus thomasi* was the most abundant member of Cyclopoida, and *Bosmina longirostris* was the most abundant member of Cladocera (Appendix D3).

P.O. Lake

The total zooplankton biomass in P.O. Lake ranged from 17 317 µg/m^3 in July to 37 206 µg/m^3 in August (Figure 5.40; Appendices D3 and D4). Zooplankton biomass in P.O. Lake was among the lowest of all the sampled waterbodies. P.O. Lake species richness was 7.3 ± 0.7 (SE) species.

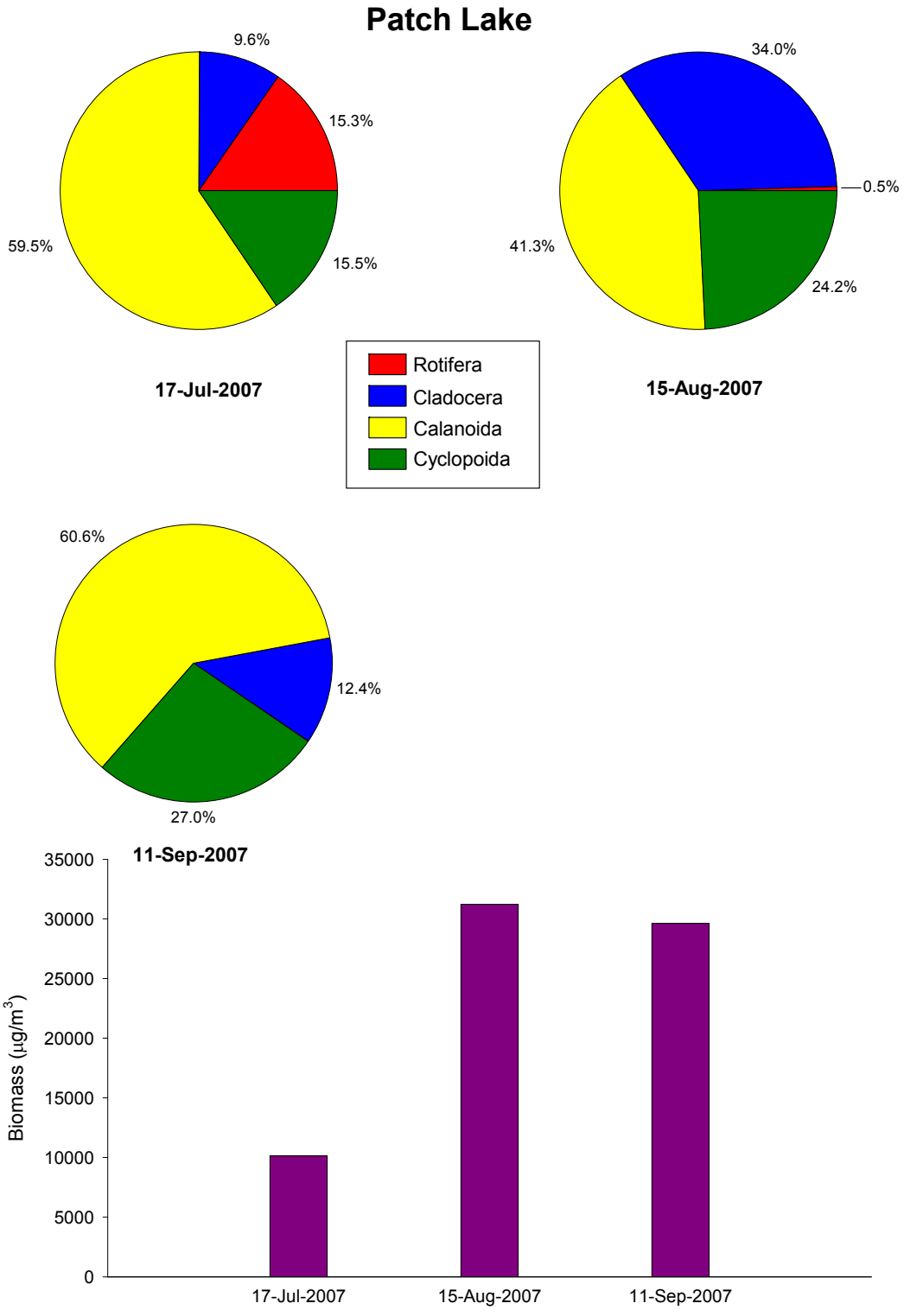


Figure 5.38 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Patch Lake, 2007

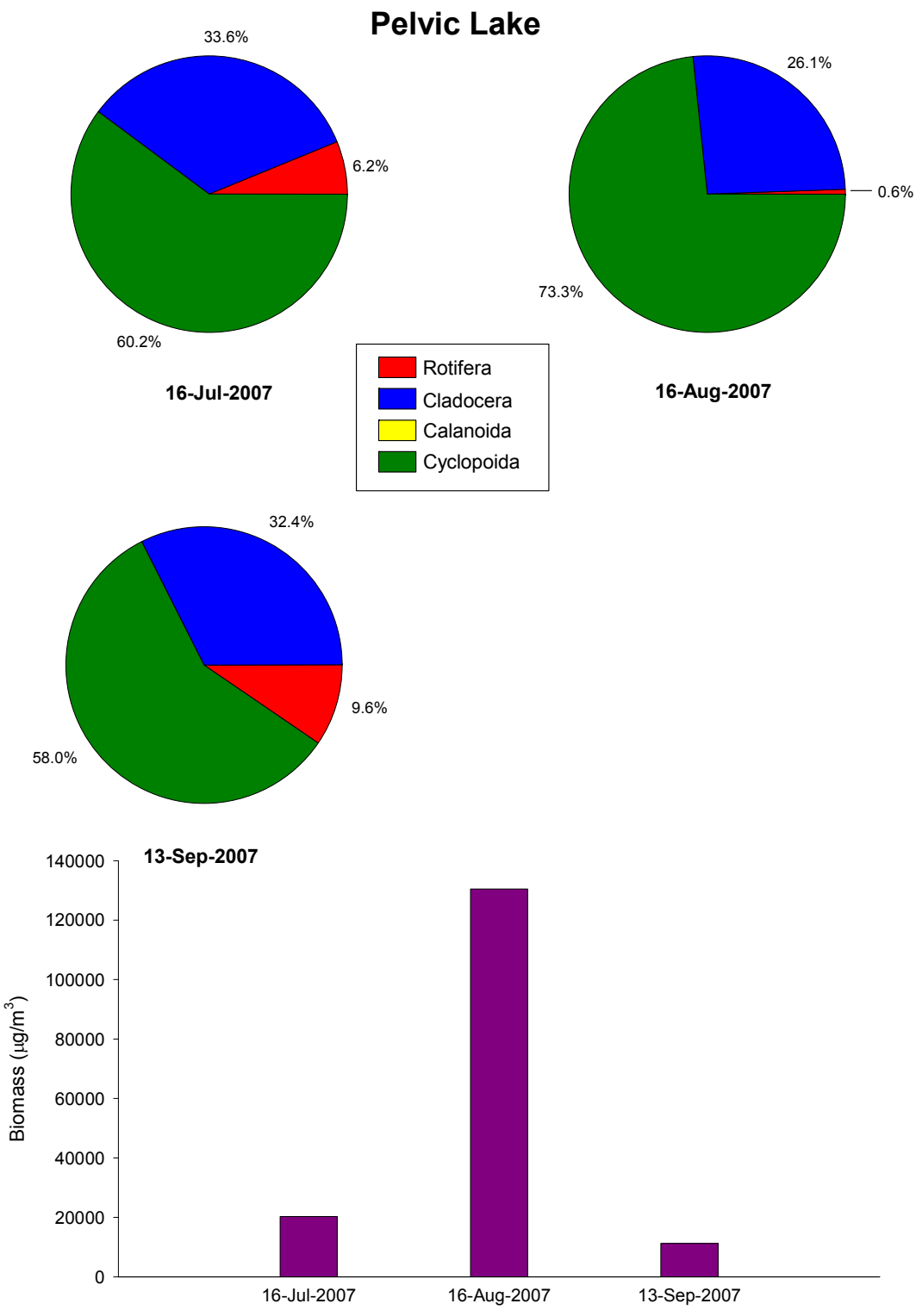


Figure 5.39 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Pelvic Lake, 2007

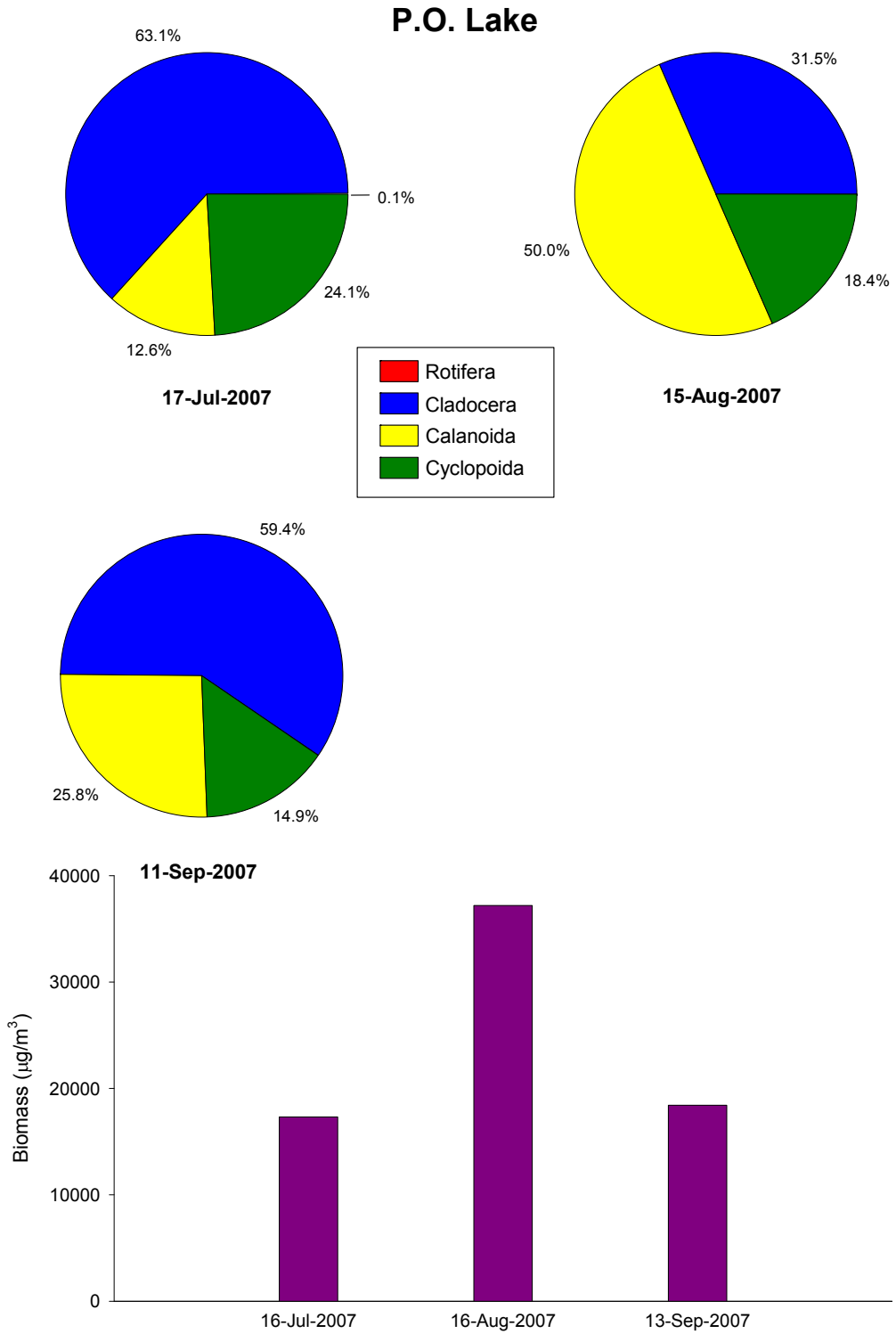


Figure 5.40 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in P.O. Lake, 2007

In July and September, the zooplankton community was composed predominantly of Cladocera, although large biomasses of Calanoida and Cyclopoida were also present (Figure 5.40). In August, Calanoida had the highest biomass, followed by Cladocera and Cyclopoida. The most abundant cladoceran was *Daphnia longiremis*; the most abundant calanoid copepod was *Epischura lacustris*; and the most abundant cyclopoid copepod was *Cyclops bicuspidatus thomasi* (Appendix D3).

Windy Lake

Total zooplankton biomass in Windy Lake ranged from 5599 µg/m^3 (July) to 10 717 µg/m^3 (September) (Figure 5.41; Appendices D3 and D4). Zooplankton biomass in Windy Lake was the lowest of all the sampled waterbodies. Additionally, the taxonomic richness in Windy Lake was the lowest, with an average of 3.0 ± 1.0 (SE) species per sampling event.

Throughout the open-water season, Calanoida contributed to over 99% of the biomass of the zooplankton community in Windy Lake (Figure 5.41). Calanoida was represented almost entirely by the adult stage of *Limnocalanus macrurus* (Appendix D3). Some juvenile stages (copepodid and nauplius) of *Limnocalanus macrurus* were observed on the July sampling date, but not in August or September.

Wolverine Lake

Zooplankton biomass in Wolverine Lake ranged from 13 426 µg/m^3 in July to 27 870 µg/m^3 in September (Figure 5.42; Appendices D3 and D4). Zooplankton biomass in Wolverine Lake was among the lowest of all the sampled waterbodies. The zooplankton taxonomic richness in Wolverine Lake was moderate, with an average of 8.7 ± 1.2 (SE) species per sampling event.

Throughout the entire open-water season, Rotifera dominated the zooplankton community of Wolverine Lake, with smaller biomasses of Cyclopoida (Figure 5.42). Rotifera was represented by the colony-forming *Conochilus hippocrepis* and the large predatory rotifer, *Asplanchna* sp. (Appendix D3). Cyclopoida was represented primarily by adult stages of *Cyclops bicuspidatus thomasi*.

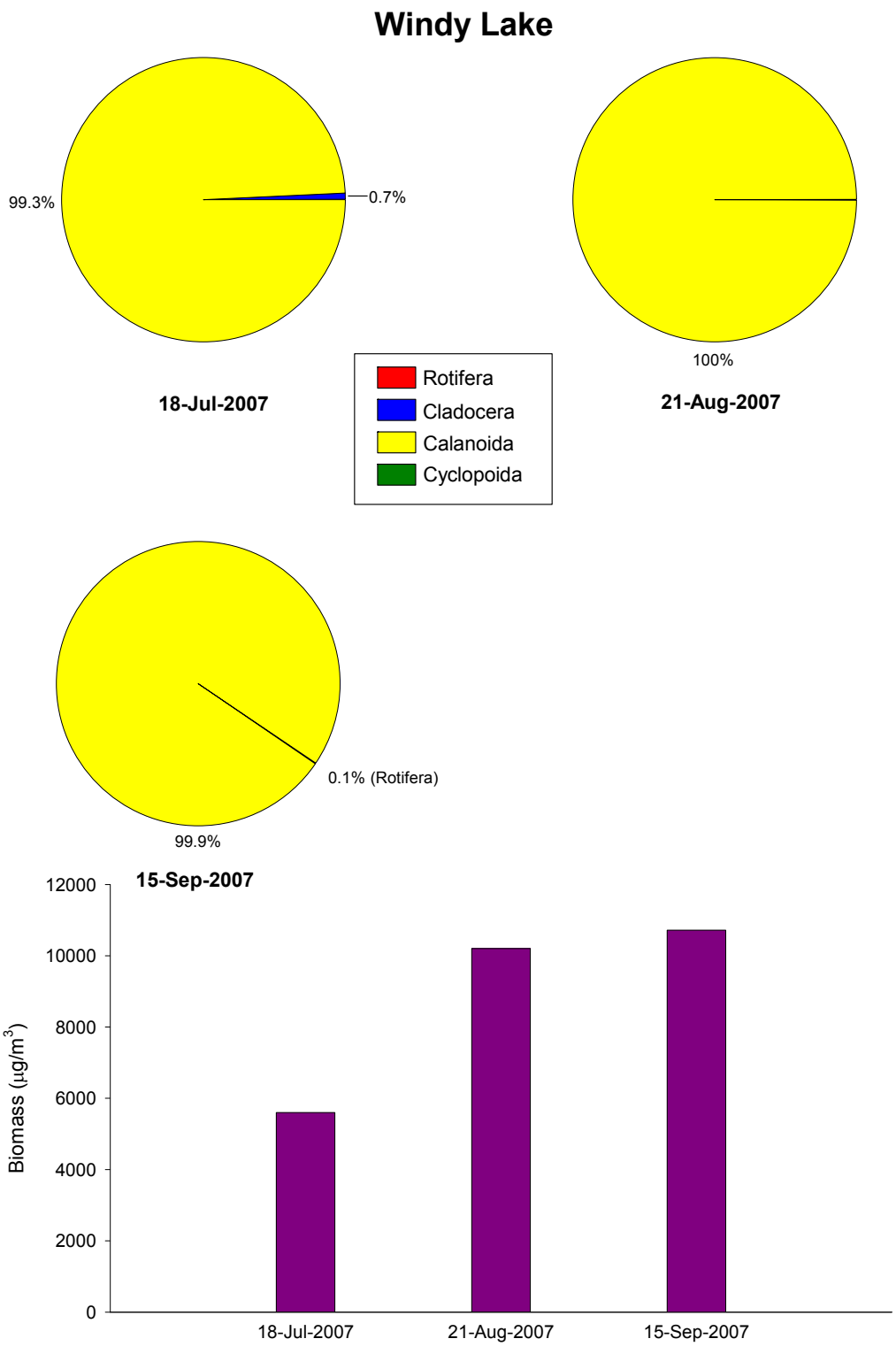


Figure 5.41 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Windy Lake, 2007

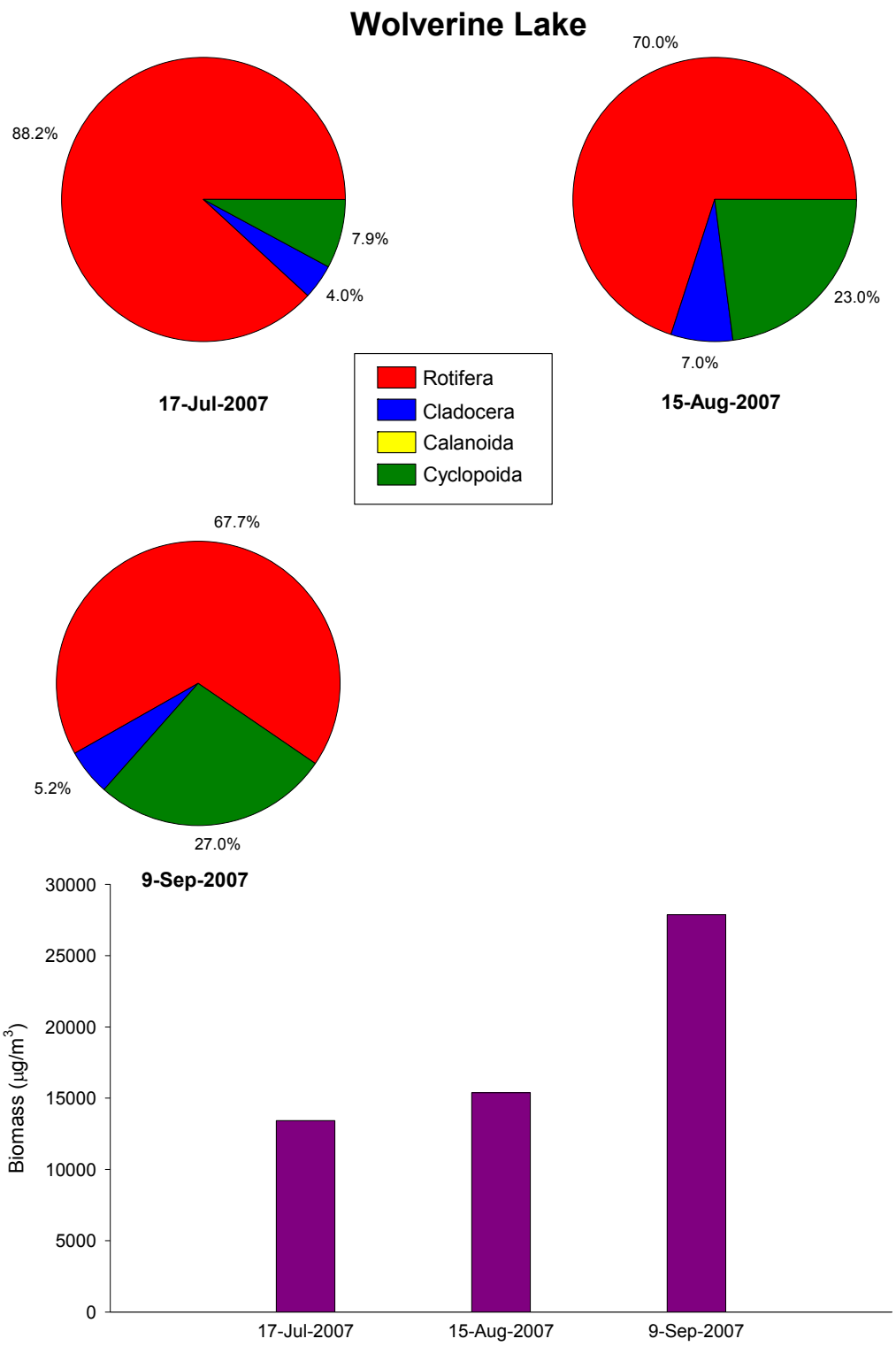


Figure 5.42 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Wolverine Lake, 2007

5.2.2.4 Marine Area

Hope Bay

The total zooplankton biomass in Hope Bay ranged from 5633 µg/m^3 (September) to 193 774 µg/m^3 (August) (Figure 5.43; Appendices D3 and D4). Zooplankton biomass in Hope Bay was among the highest of all sampled waterbodies. However, taxonomic richness in Hope Bay was one of the lowest of all waterbodies sampled, with an average of 6.3 ± 0.3 (SE) species per sampling event.

The zooplankton community of Hope Bay was dominated by juvenile and adult stages of the calanoid copepod *Limnocalanus macrurus* over the entire open-water season (Appendix D3). No unique zooplankton species were found in the marine environment of Hope Bay. Every species found in Hope Bay was also found in multiple inland freshwater waterbodies. Hope Bay is the receiving environment for the lakes in the Boston Project Area (*via* the Koignuk River). Likely due to these freshwater inputs, Hope Bay contains similar zooplankton species to the freshwater lakes sampled in the Hope Bay Belt.

5.2.3 Summary

Zooplankton biomass within the Boston and Madrid Project areas and the marine environment of Hope Bay ranged from 5599 µg/m^3 to 278 389 µg/m^3, and taxonomic richness ranged from 2 to 13 species, on the three sampling events during the open water season.

Lake depth was often an important factor in defining the zooplankton community composition. In waterbodies with maximum depths less than 5 m (Fickle Duck, Reference, Stickleback, and Wolverine lakes), except P.O. Lake, the zooplankton community was dominated by Rotifera, whereas this group was virtually absent from the remaining waterbodies.

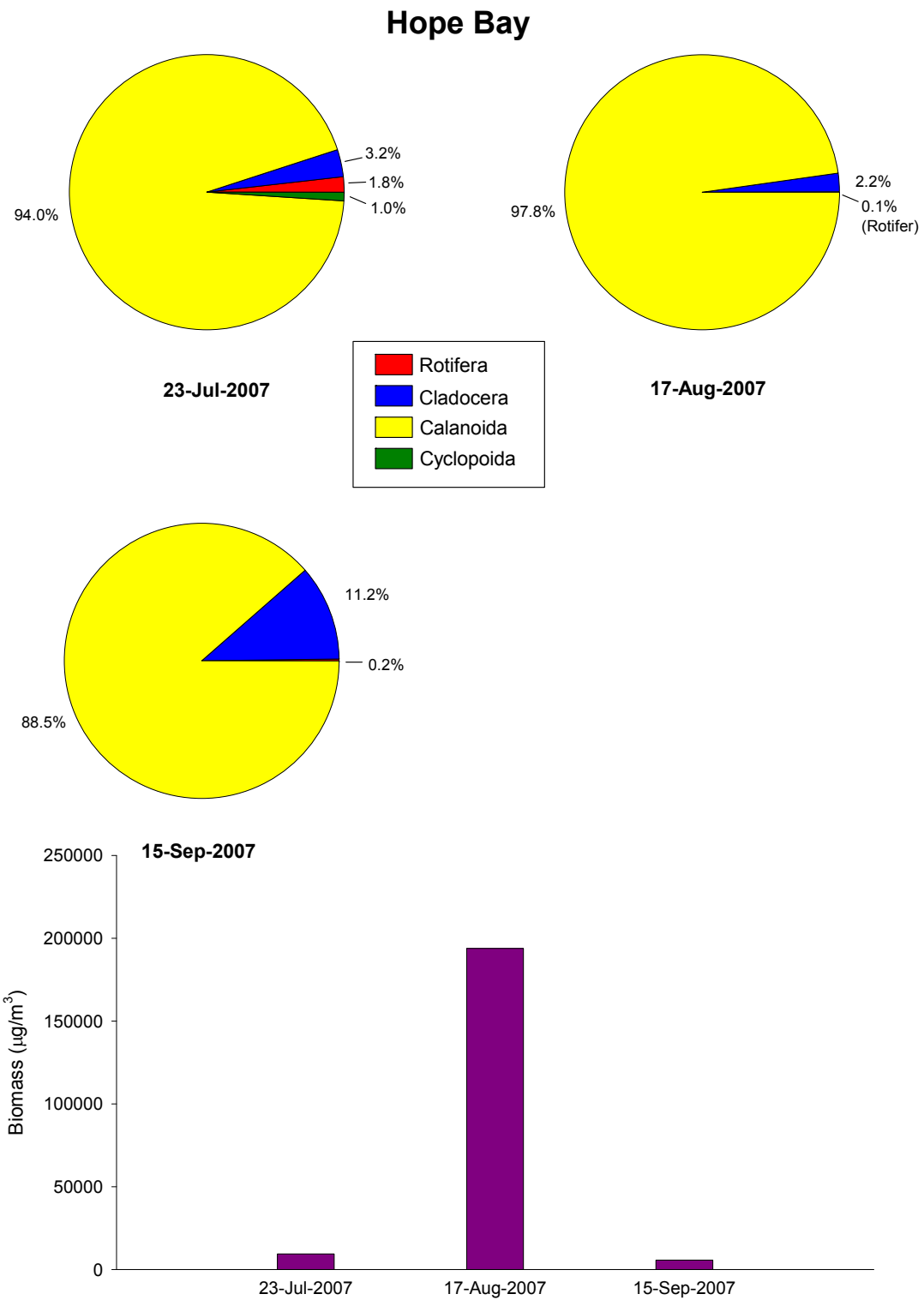


Figure 5.43 Relative Abundance of Major Taxonomic Groups and Biomass of Zooplankton in Hope Bay, 2007

The dominance of Rotifera in these shallow systems can potentially be explained by the physiological differences between the zooplankton taxonomic groups. Large-bodied zooplankton, such as Cladocera, Calanoida, and Cyclopoida, are widely known to perform daily vertical migration in the water column to take advantage of high food concentrations near the surface, and the cooler and darker conditions near the bottom of deep lakes (Orcutt and Porter 1983). Low light conditions near the bottom of deep lakes provide a refuge from visual predators such as fish. Conversely, small-bodied zooplankton, such as Rotifera, do not exhibit vertical migration and are potentially better adapted in these shallow systems. For example, the small size of most Rotifera species limits the extent of predation from planktivorous fish (Brooks and Dodson 1965).

An additional explanation for the dominance of Rotifera within shallow waterbodies is the composition of the resident fish population. Shallow waterbodies, such as Wolverine, Stickleback, Fickle Duck, and Reference lakes, either lack, or have low numbers of large piscivorous fish. As a result, these systems are dominated by planktivorous fish. Large numbers of planktivorous fish rely heavily on large-bodied zooplankton for food, allowing small-bodied zooplankton, such as Rotifera, to proliferate (Brooks and Dodson 1965). This explanation may also explain why Rotifera is nearly absent in P.O. Lake despite similarities in size and depth to other Rotifera-dominated waterbodies. Piscivorous lake trout reside in and migrate through P.O. Lake, potentially reducing the number of planktivorous fish, such as ninespine stickleback and cisco. Lower numbers of planktivorous fish would allow large-bodied zooplankton to thrive, as they do in P.O. Lake and the deeper waterbodies.

Deeper waterbodies (i.e., maximum depth >5 m) were dominated by large-bodied zooplankton; however, it is unclear why waterbodies were dominated by specific groups. For example, Windy Lake and Glenn Lake were dominated by Calanoida. In contrast Pelvic Lake, Ogama Lake, and Aimaokatalok Lake Station 6 were dominated by Cyclopoida. In contrast, Patch Lake and Aimaokatalok Lake Station 4 had large biomasses of Calanoida, Cyclopoida, and Cladocera that fluctuated between sampling periods. Windy Lake flows into Glenn Lake, both have very similar zooplankton communities, and they are both in a separate watershed from the other lakes. In contrast, the two stations in Aimaokatalok Lake had remarkably different zooplankton communities, despite having similar phytoplankton communities (Section 5.1).

Zooplankton biomass was also highly variable among waterbodies. For example, some waterbodies had increasing zooplankton biomass throughout the year, others had decreasing biomass, and some had a maximum biomass midway through the open-water season. Zooplankton community biomass is typically highest in early summer, conciding with warm temperatures and high

phytoplankton biomass (Sommer et al. 1986). However, this trend was described for temperate systems and may not apply to Arctic systems, as factors more complex than temperature may be operating in systems with short open-water seasons.

The zooplankton communities in Project area lakes included no uncommon or rare species, and were similar in many respects to the communities of many other small lakes in the Arctic and sub-Arctic (as reported by Moore 1978a, 1978b; RL&L 1997, 1998, 1999; RL&L/Golder 2002; Golder 2008a). Direct comparisons to previous zooplankton data collected in the sampled waterbodies are difficult due to previous studies reporting zooplankton density instead of the more representative measurement of biomass. However, the major zooplankton species collected by Rescan Environmental Services Ltd. between 1993 and 1998 were the same as those identified in 2007 (RL&L/Golder 2002; Golder 2008a).

5.3 BENTHIC INVERTEBRATES

Benthic invertebrates (benthos) live in or on the bottom substrate of a waterbody. Often present in very high abundances, they are an important aspect of aquatic food webs, serving as consumers of aquatic plants and other invertebrates, as well as prey for many fish, including early life stages of some piscivorous taxa.

5.3.1 Methods

5.3.1.1 Sampling Locations and Timing

Benthic invertebrate and sediment samples were collected from 11 lakes in the Boston and Madrid Project areas in August 2007 (Figures 5.1 and 5.2). Both shallow (< 5 m) and deep (> 5 m) stations were sampled in lakes with a depth greater than 5 m. Only one station was sampled in shallow lakes (i.e., less than 5 m deep) (Table 5.4).

5.3.1.2 Sampling Procedures

At each station, five replicate benthic invertebrate samples were taken using an Ekman grab (0.0225 m^2). Samples were sieved using a 243 µm mesh bag, transferred to a clean 500 mL plastic jar, and preserved with 95% ethanol. Sampling dates, locations, depths, and number of replicates processed were recorded (Table 5.4).

Table 5.4 Benthic Invertebrate Sampling Dates, Locations, Depths, and Number of Samples used in Analyses for Lakes in the Boston and Madrid Project Areas, 2007

Waterbody	Sampling Date	Sampling Depth	UTM Coordinates (13W NAD83)		Depth (m)	Number of Replicates Processed
			Easting	Northing		
Boston Project Area						
Aimaokatalok Lake	22-Aug-07	shallow	440360	7503267	2.2	5
		deep	440427	7509089	25.9	5
Fickle Duck Lake	23-Aug-07	shallow	442653	7502914	3.5	5
Reference Lake	23-Aug-07	shallow	437961	7503702	3.3	5
Stickleback Lake	23-Aug-07	shallow	442034	7503839	3.5	5
Madrid Project Area						
Glenn Lake	26-Aug-07	shallow	430665	7559962	2.5	3
		deep	430325	7560234	13.0	5
Ogama Lake	26-Aug-07	shallow	436607	7551621	2.5	3
		deep	436619	7551845	6.0	3
Patch Lake	20-Aug-07	shallow	434312	7550572	3.1	5
		deep	435583	7547770	13.7	5
Pelvic Lake	27-Aug-07	shallow	439231	7552339	4.2	5
		deep	439639	7552550	15.0	5
P.O. Lake	27-Aug-07	shallow	436527	7549401	4.0	5
Windy Lake	25-Aug-07	shallow	431298	7554449	3.5	5
		deep	431584	7553249	18.0	3
Wolverine Lake	21-Aug-07	shallow	434717	7546873	3.5	4

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Sediment samples were collected using an Ekman grab in conjunction with benthic sampling in each lake. Total organic carbon (TOC) and particle size distribution was determined. The sediment information is used in the corresponding analyses. Detailed sediment sampling methods and parameters analyzed are described in Section 4.2.

5.3.1.3 Laboratory Analytical Procedures

Benthic invertebrate samples were submitted to J. Fedoruk and Associates Environmental Consultants, in Redwater, Alberta, for taxonomic identification and enumeration. Each sample was passed through a 1 mm and a 250 µm sieve to separate it into coarse and fine-size fractions. Only the fine-size fractions of unusually large samples were subsampled, according to the methods outlined by Wrona et al. (1982). Benthic invertebrates were identified to the lowest practical taxonomic level (as recommended by Alberta Environment 1990), typically genus for most invertebrates, with the exception of the Nematoda, Oligochaeta, Hydrachnida, Ostracoda, and Chironomidae. Nematodes and ostracods were

identified to order, oligochaetes and hydrachnids were identified to family, and chironomids were identified to subfamily, tribe or genus. Small, early instar animals were identified to the lowest level possible. Typical taxonomic references, such as those listed in Environment Canada (2002b) were used and included both general and regional keys (Stewart and Oswood 2006; Thorp and Covich 2001; Merritt and Cummins 1996; Clifford 1991; Pennak 1989; Oliver and Roussel 1983).

A minimum of three replicates were processed per station, and the mean and standard error were calculated for total invertebrate abundance. If the standard error was less than 20% of the mean based on the three replicates, sample processing was terminated. If it was greater than 20% of the mean, a fourth replicate from that station was processed, and the mean and standard error were calculated again. If necessary, the fifth replicate was processed based on the same analysis done for the previous four replicates. To ensure that a sorting efficiency of 90% was met (i.e., no more than 10% of the total number of animals in a given sample were overlooked), 10% of the samples were chosen at random and resorted. Sorting efficiency ranged between 94.9% and 100%.

5.3.1.4 Data Analysis

Benthic Invertebrates

For each station, the following benthic invertebrate community descriptors and indices were calculated, as identified in Chapter 5 of the Metal Mining Guidance Document for Aquatic Environmental Effects Monitoring (Environment Canada 2002b):

- the percentage contribution of each major taxonomic group;
- total invertebrate density;
- Simpson's Diversity Index;
- taxonomic richness;
- evenness; and
- Bray-Curtis (B-C) Index.

Percentage contribution of each major taxonomic group: number of individuals of a taxon at the station divided by total number of individuals at the station, multiplied by 100. This analysis was done at the major taxon level and results were illustrated as pie graphs.

Total invertebrate density: number of invertebrates per square metre.

Simpson's Diversity Index: the proportional distribution of organisms in a community, taking into account the number of taxonomic groups at a station as well as the abundance of each group. Values range from 0 to 1. Values close to zero indicate that the community has either very few taxonomic groups, or a large number of taxonomic groups but the majority are rare. Values close to one have a large number of taxonomic groups, very few of which are rare. This analysis was done using data at the lowest taxonomic level.

Taxonomic richness: the total number of taxonomic groups at a station, with invertebrates identified to the lowest taxonomic level.

Evenness: a measure of relative abundance of all taxonomic groups at a sampling station. Values range from 0 to 1. A value close to 0 indicates that taxonomic groups are not present in equal abundance at a station, i.e., a small portion of taxa collected are present in higher abundance than the remaining taxa. A value close to 1 indicates that all taxonomic groups are present in equal (or close to equal) abundance at a station. This analysis was done using data at the lowest taxonomic level.

Bray-Curtis (B-C) Index: a measure of dissimilarity between two stations, based on abundances of taxa at both stations. Values range from 0 to 1. A value close to 0 indicates that stations are similar in terms of taxon presence and abundance, whereas a value close to 1 indicates that stations are dissimilar. The B-C index for each station was calculated from reference median communities, one for both shallow and deep stations. The overall reference median communities were determined using the median abundance across all stations for each taxon collected, as recommended by Environment Canada (2002b). An average B-C index was calculated for the shallow and deep stations in each of the Boston and Madrid Project areas to determine which area is more similar to the reference median in terms of benthic community structure.

Relative abundances and total densities of major taxa were also calculated for each station. Taxa that contributed a minimum of 10% to the total abundance at one or more stations are treated as major taxa. Ephemeroptera, Plecoptera, and Trichoptera were included in the 'remaining taxa' category because, while often used as bio-indicators (Rosenberg and Resh 1993), these taxa either contributed less than 2% to total mean abundances or were completely absent from the lakes.

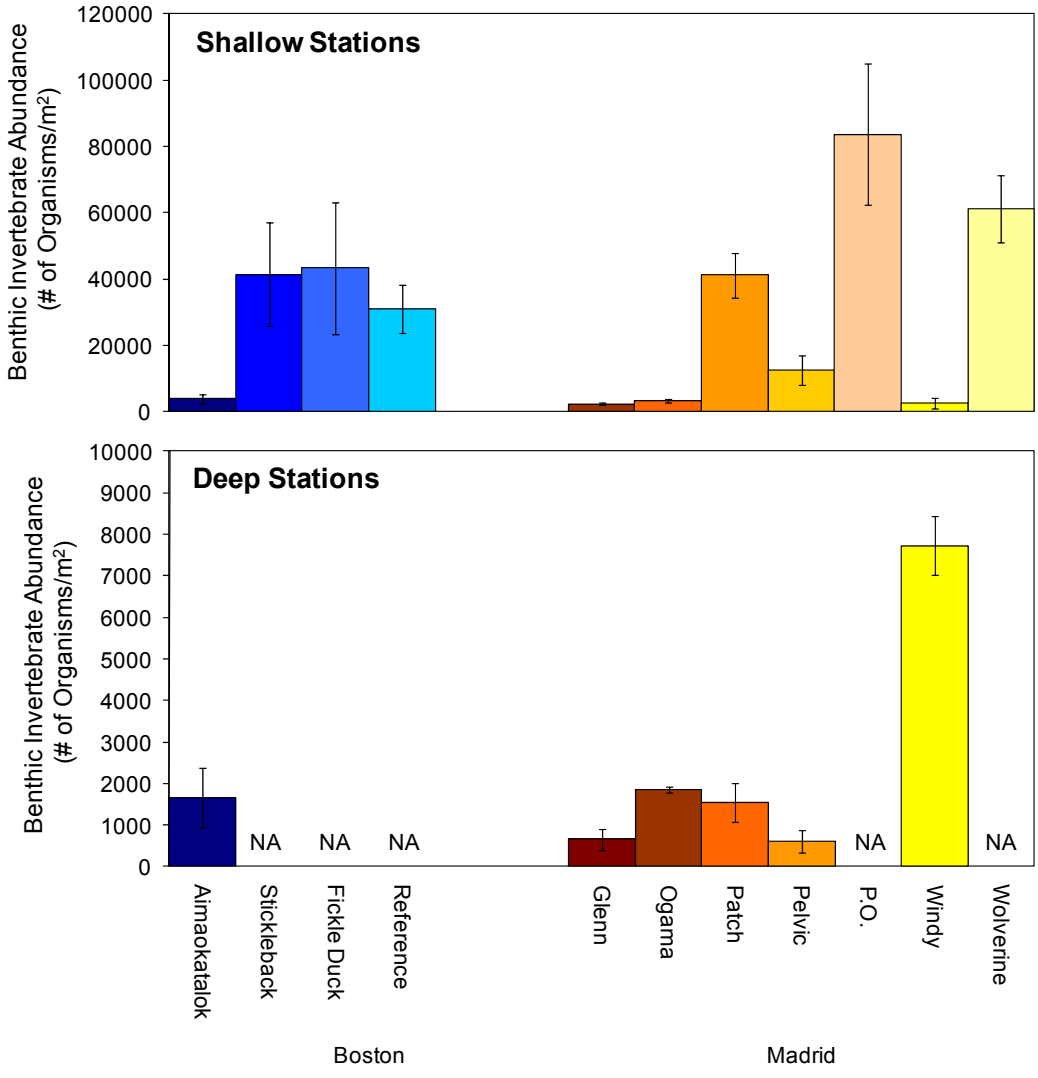
Influence of Environmental Variables

To analyze the effect of habitat variation on benthic invertebrate density, benthic invertebrate data were pooled across the entire Project area. Pearson product-moment correlation coefficients (Zar 1996) were generated between invertebrate

density and individual environmental variables (i.e., water depth, TOC, sand, silt, and clay). The analysis was conducted using SYSTAT™ 11 and correlations were considered significant at a Bonferfoni adjusted $p < 0.05$.

5.3.2 Results and Discussion

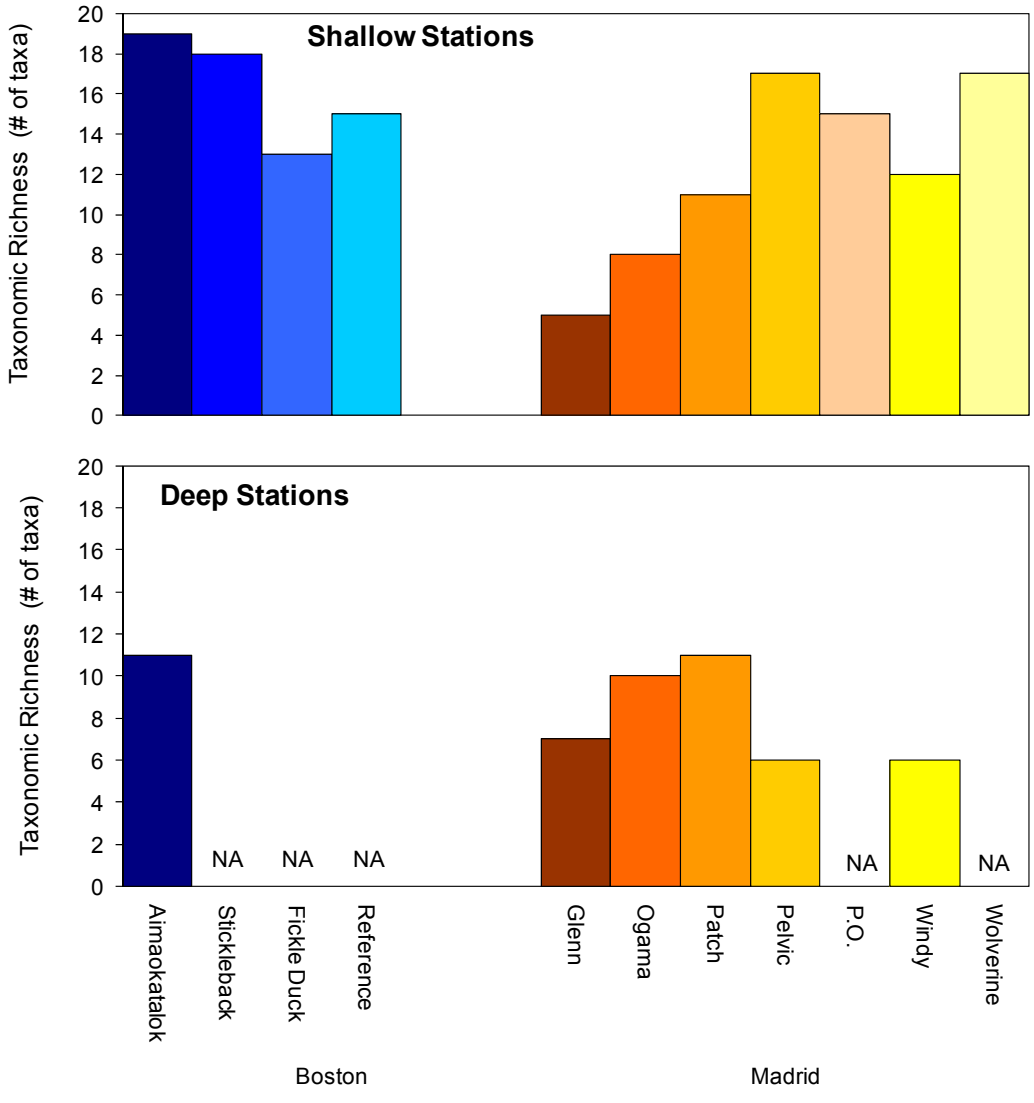
Benthic invertebrate abundance in lakes typically was substantially greater at the shallow stations than at the deep stations (Figure 5.44). Aimaokatalok, Glenn, Ogama (shallow station only) and Windy lakes had low abundances, whereas P.O. and Wolverine lakes had high abundances. Abundances were more variable in the Madrid Area lakes than the Boston Area lakes.



Note change in scale on the lower graph; NA = Not applicable; Error bars represent ± 1 SE

Figure 5.44 Benthic Invertebrate Abundance in Project Area Lakes, 2007

Benthic invertebrate taxonomic richness was also greater at the shallow stations than at the deep stations (Figure 5.45); however, Boston Area lakes had greater richness overall. Richness was variable within lakes (e.g., Patch shallow station had low richness whereas Patch deep station had high richness).



NA = not applicable

Figure 5.45 Benthic Invertebrate Taxonomic Richness in Project Area Lakes, 2007

5.3.2.1 Boston Project Area

Aimaokatalok Lake

The benthic invertebrate community in Aimaokatalok Lake was sampled at shallow (2.2 m) and deep (25.9 m) stations. The shallow station was located near the centre of the south arm of the lake, and the deep station was located at water quality Station 6. Sediment consisted mostly of silt and clay, and no detectable odour was observed. Average TOC was 0.9% (Appendix C1).

At the shallow station, Simpson's Diversity Index was the highest of all lakes and stations sampled, with a value of 0.85 (Table 5.5). As expected, taxonomic richness was also the highest, with 19 taxa. Evenness was second highest at 0.36. At the deep station, all community descriptors were lower, resulting from fewer taxa present in unequal abundances. Simpson's Diversity Index was 0.55, richness was 11, and evenness was 0.20. Bray-Curtis (B-C) index values indicate that the shallow station is more similar than the deep station to their respective reference medians.

Table 5.5 Simpson's Diversity Index, Taxonomic Richness, Evenness, and Bray-Curtis Index Values for Lakes in the Boston and Madrid Project Areas, 2007

Waterbody	Simpson's Diversity Index	Taxonomic Richness	Evenness	Bray-Curtis Index	Bray-Curtis Index (Mean ±1 SE)
Boston Project Area					
Shallow Stations					
Aimaokatalok Lake	0.85	19	0.36	0.43	0.41 ± 0.03
Fickle Duck Lake	0.73	13	0.29	0.34	
Reference Lake	0.60	15	0.17	0.47	
Stickleback Lake	0.56	18	0.13	0.40	
Deep Station					
Aimaokatalok Lake	0.55	11	0.2	0.53	0.53
Madrid Project Area					
Shallow Stations					
Glenn Lake	0.14	5	0.23	0.36	0.41 ± 0.07
Ogama Lake	0.30	8	0.18	0.48	
Patch Lake	0.57	11	0.21	0.39	
Pelvic Lake	0.69	17	0.19	0.80	
P.O. Lake	0.46	15	0.12	0.19	
Windy Lake	0.22	12	0.11	0.39	
Wolverine Lake	0.26	17	0.08	0.25	
Deep Stations					
Glenn Lake	0.43	7	0.25	0.54	0.55 ± 0.11
Ogama Lake	0.72	10	0.35	0.78	
Patch Lake	0.66	11	0.27	0.76	
Pelvic Lake	0.69	6	0.54	0.47	
Windy Lake	0.07	6	0.18	0.18	

Note: SE = standard error.

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The invertebrate community at the Aimaokatalok Lake shallow station was diverse, with Chironomidae (midges) as the dominant taxon (51.2% of relative abundance; Figure 5.46). The dominant Chironomidae tribe was Tanytarsini (Figure 5.46; Appendices D5 and D6). Nematoda (roundworms) was the next most abundant group, with a contribution of 22.5% of the relative abundance, followed by Ostracoda (seed shrimp) at 15.0%, and Oligochaeta (aquatic earthworms) at 9.4%. Dominant taxonomic groups were different at the deep location, with Ostracoda contributing 65.2% to relative abundance and Pelecypoda (clams) contributing 18.2% (Figure 5.46). Chironomidae contributed 13.4% to the relative abundance, and was co-dominated by Tanypodinae and Chironomini (Figure 5.46; Appendices D5 and D6). The average densities (±1 SE) of invertebrates were 3791 ± 1496 organisms/m^2 at the shallow station, and 1662 ± 719 organisms/m^2 at the deep station (Figure 5.46; Table 5.6; Appendix D6).

Table 5.6 Mean Total Invertebrate Density, and Densities of Chironomidae and Ostracoda in Lakes in the Boston and Madrid Project Areas, 2007

Waterbody	Sampling Location	Mean Total Density (organisms/m^2)	Chironomidae		Ostracoda	
			Mean Density (organisms/m^2)	Relative Abundance (%)	Mean Density (organisms/m^2)	Relative Abundance (%)
Boston Project Area						
Aimaokatalok Lake	shallow	3791	1942	51.2	569	15.0
	deep	1662	222	13.4	1084	65.2
Fickle Duck Lake	shallow	43258	33001	76.3	5163	11.9
Reference Lake	shallow	30969	8693	28.1	18853	60.9
Stickleback Lake	shallow	41340	5289	12.8	25082	60.7
Madrid Project Area						
Glenn Lake	shallow	2267	163	7.2	2104	92.8
	deep	658	151	23.0	489	74.3
Ogama Lake	shallow	3244	430	13.2	2681	82.6
	deep	1867	1378	73.8	415	22.2
Patch Lake	shallow	41261	11871	28.8	26054	63.1
	deep	1542	671	43.5	827	53.6
Pelvic Lake	shallow	12627	6111	48.4	5947	47.1
	deep	604	267	44.1	267	44.1
P.O. Lake	shallow	83653	22791	27.2	58649	70.1
Windy Lake	shallow	2444	222	9.1	2151	88.0
	deep	7733	222	2.9	7452	96.3
Wolverine Lake	shallow	61267	2456	4.0	52544	85.8

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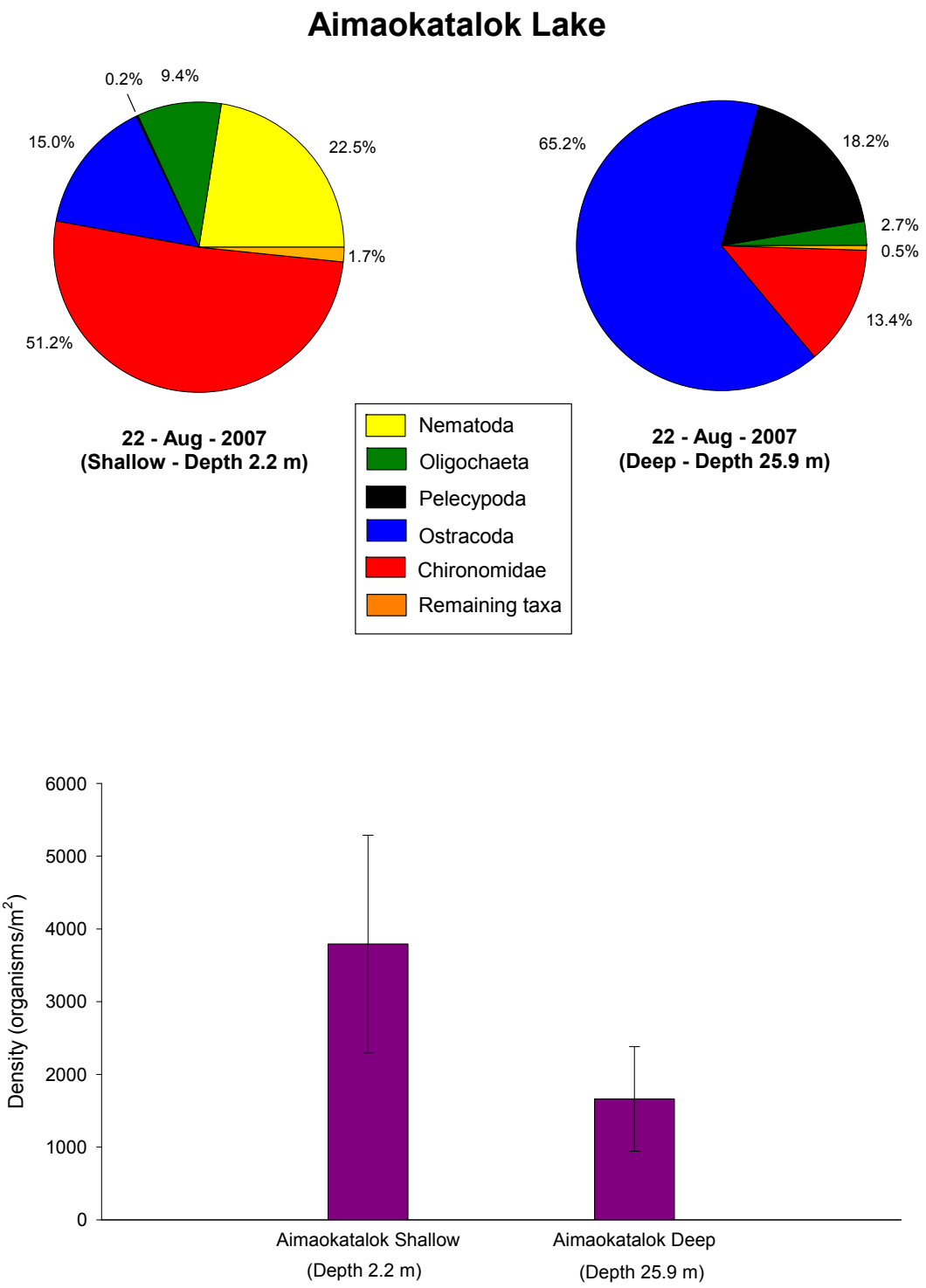


Figure 5.46 Relative Abundances of Major Taxonomic Groups and Total Density (mean ±1 SE) of Benthic Invertebrates at Shallow and Deep Stations in Aimaokatalok Lake, 2007

Fickle Duck Lake

Fickle Duck Lake benthic invertebrates were sampled at one shallow station (3.5 m), located at the water quality station. Sediment consisted mainly of sand, silt, and clay. There was a faint H_2S odour, and average TOC was 3.3% (Appendix C1).

Simpson's Diversity Index was 0.73, taxonomic richness was 13, and evenness was 0.29 (Table 5.5). This indicates that Fickle Duck Lake had a diverse benthic invertebrate community, with uneven distribution of species abundance. While the evenness value is low, it is the fourth highest of all of the lakes and stations sampled. The low-moderate B-C index value of 0.34 indicates that the invertebrate community at Fickle Duck Lake was similar to the reference median community.

Chironomidae was the most abundant benthic invertebrate group (76.2%), with Orthocladiinae and Tanytarsini as the dominant subfamily/tribe (Figure 5.47; Appendices D5 and D6). Ostracoda was the next most abundant group at 11.9%. The average invertebrate density (±1 SE) was 43 258 ± 19 814 organisms/m^2 (Figure 5.47; Table 5.6; Appendix D6).

Reference Lake

The Reference Lake benthic invertebrate community was sampled at a shallow station (3.3 m) only, located at the water quality station. Sediment consisted of sand, silt, and clay sized particles, and an odour was not detected. Average TOC was 2.4% (Appendix C1).

Simpson's Diversity Index was 0.60, taxonomic richness was 15, and evenness was 0.17 (Table 5.5). Reference Lake had a diverse community; however, taxa were not present in equal abundances. The B-C index of 0.47 indicates that the invertebrate community in this lake was the least similar of all shallow Boston Project Area stations to the shallow reference median station.

Ostracoda was the dominant invertebrate group, contributing 60.9% of the total number of organisms (Figure 5.47). The next most abundant group was Chironomidae, with a contribution of 28.1%, with Chironomini as the most abundant tribe (Figure 5.43; Appendices D5 and D6). The average density (±1 SE) of invertebrates at the Reference Lake was 30 969 ± 7298 organisms/m^2 (Table 5.6; Figure 5.47; Appendix D6).

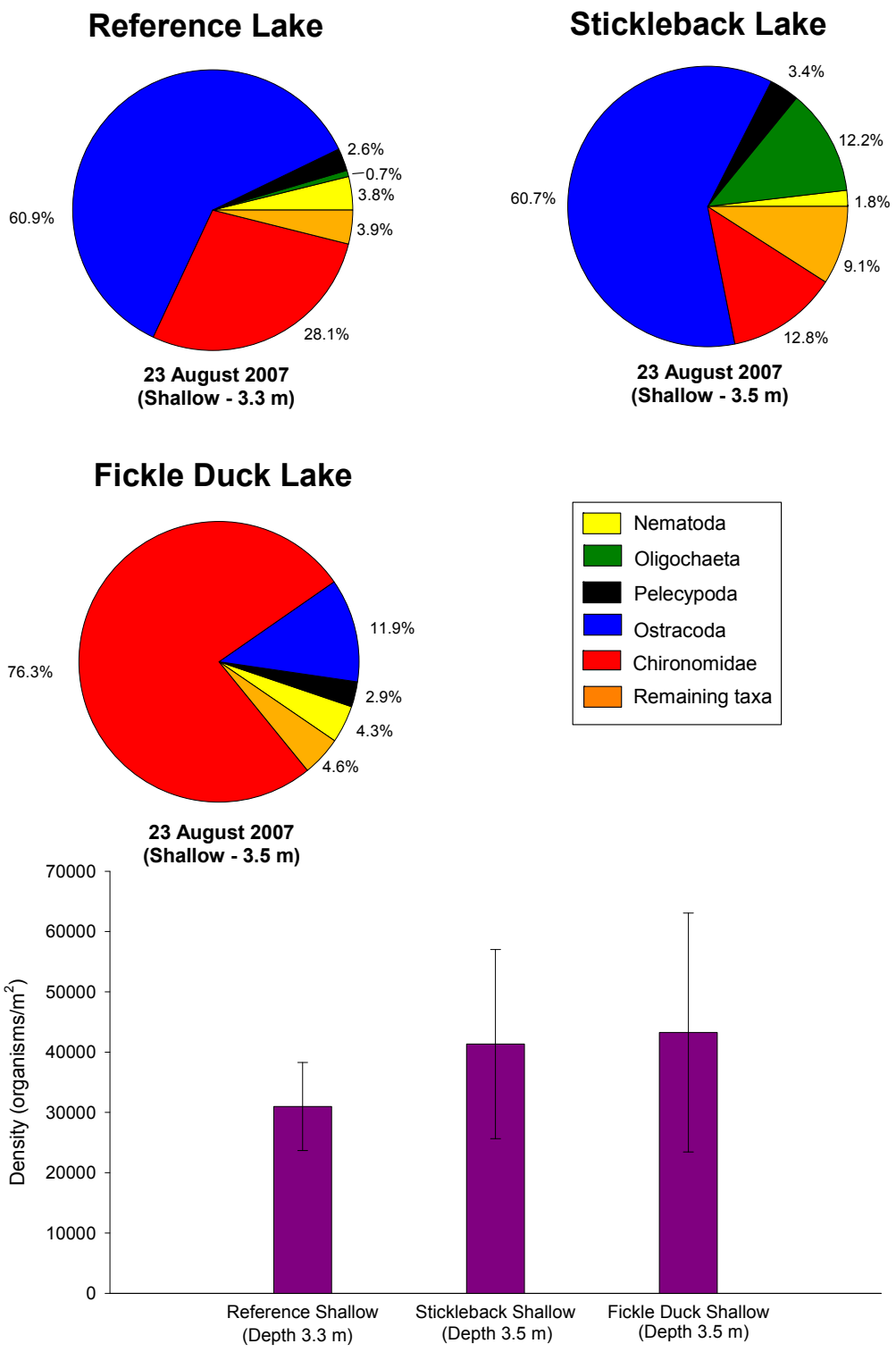


Figure 5.47 Relative Abundances of Major Taxonomic Groups and Total Density (mean ±1 SE) of Benthic Invertebrates at Shallow Stations in Reference, Stickleback, and Fickle Duck Lakes, 2007

Stickleback Lake

Benthic invertebrate samples were collected from Stickleback Lake at one shallow station (3.5 m) located in the northeast section of the lake. Sediment consisted of sand, silt, and clay, and had a strong H_2S odour. Average TOC was the highest of all lakes sampled, with an average of 10.1% (Appendix C1).

Simpson's Diversity Index was 0.56, taxonomic richness was 18, and evenness was 0.13 (Table 5.5). The benthic invertebrate community in Stickleback Lake was diverse; however, species abundance was not evenly distributed among taxa. A moderate B-C index of 0.40 indicates that the Stickleback Lake invertebrate community similarity to the reference median is average for the shallow stations.

The invertebrate taxa were dominated by Ostracoda, contributing 60.7% to the total abundance. Chironomidae and Oligochaeta contributed 12.8% and 12.2%, respectively (Figure 5.47). Tanytarsini was the most abundant chironomid tribe, whereas Naididae was the most abundant family of Oligochaeta (Appendices D5 and D6). The average invertebrate density (±1 SE) in Stickleback Lake was 41 340 ± 15 685 organisms/m^2 (Figure 5.47; Table 5.6; Appendix D6).

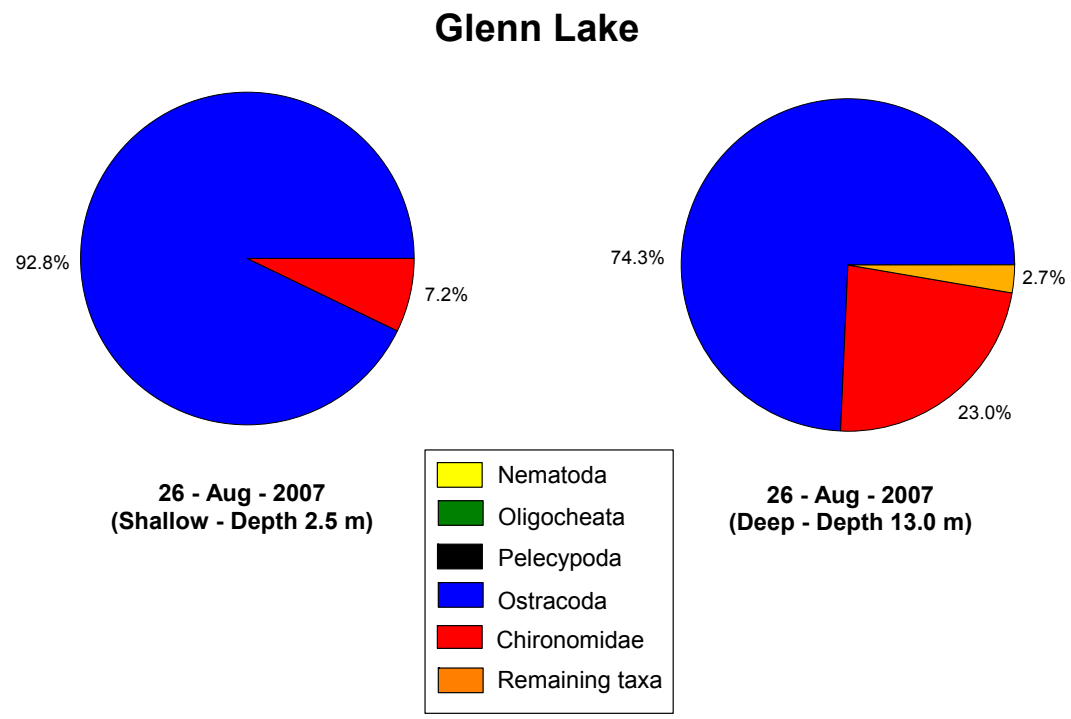
5.3.2.2 Madrid Project Area

Glenn Lake

Benthic invertebrates were sampled in Glenn Lake at shallow (2.5 m) and deep (13.0 m) stations. Both stations were located near the centre of the lake, with the shallow station on the east side and the deep station at the water quality station on the west side. Sediments were mainly fine-grained, though the shallow station had higher silt content than the deep station. Average TOC was 0.6%, the lowest of all lakes sampled (Appendix C1).

Simpson's Diversity Index was lower at the shallow station (0.14) than the deep station (0.43). Taxonomic richness was 5 at the shallow station and 7 at the deep station, and evenness was similar at both stations (0.23 at the shallow station and 0.25 at the deep station; Table 5.5). The benthic invertebrate community in Glenn Lake had low diversity, being dominated by a few species. The B-C indices for the shallow and deep stations (0.36 and 0.54, respectively) indicate that the shallow station is more similar to its reference median than the deep station.

Similar to the majority of the other lakes sampled, Ostracoda dominated the invertebrate community in Glenn Lake, contributing 92.8% at the shallow location and 74.3% at the deep location. Once again, Chironomidae was the second most abundant group, contributing 7.2% (shallow station) and 23.0% (deep station) towards the total abundance (Figure 5.48). Prodiamesinae was the



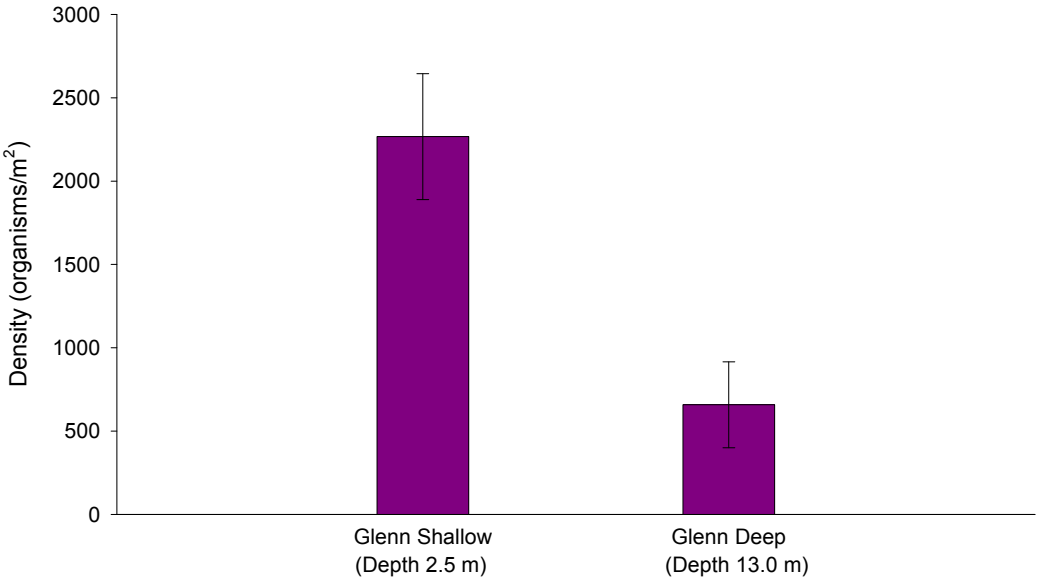


Figure 5.48 Relative Abundances of Major Taxonomic Groups and Total Density (mean ±1 SE) of Benthic Invertebrates at Shallow and Deep Stations in Glenn Lake, 2007

dominant chironomid subfamily at the shallow station and Orthocladiinae was dominant at the deep station (Appendices D5 and D6). With the exception of the deep station at Pelvic Lake, both shallow and deep stations at Glenn Lake had the lowest average invertebrate densities of all of the lakes. Average invertebrate density (±1 SE) was 2267 ± 378 organisms/m^2 at the shallow station and 658 ± 258 organisms/m^2 at the deep station (Figure 5.48; Table 5.6; Appendix D6).

Ogama Lake

Ogama Lake benthic invertebrates were sampled at shallow (2.5 m) and deep (6.0 m) stations, both of which were located in the southernmost section of the lake. Sediments consisted of sand, silt, and clay, with a faint H_2S odour. Average TOC was 2.3% (Appendix C1).

Simpson's Diversity Index was lower at the shallow station (0.30) than the deep station (0.72). Taxonomic richness was 8 at the shallow station and 10 at the deep station. Evenness was 0.18 at the shallow station and 0.35 at the deep station (Table 5.5). While richness was similar at both stations, the low evenness at the shallow station indicated that a small number of taxa (i.e., ostracods) were present in very high abundance.

The B-C index values were 0.48 at the shallow station and 0.78 at the deep station, indicating that neither invertebrate community was very similar to its reference median. Of all lakes and stations sampled in the Boston and Madrid Project areas, the Ogama Lake shallow station is one of the least similar to the reference median. This is due, in part, to the absence of the majority of Chironomidae taxa that were present at most of the other stations.

Ostracoda was most abundant at the shallow stations (82.5%), followed by Chironomidae (13.2%). Conversely, at the deep station, Chironomidae was the most abundant taxon (73.0%), followed by Ostracoda (22.2%) (Figure 5.49). At the shallow station, Tanytarsini was the dominant chironomid tribe, whereas at the deep station, Chironomini and Tanypodinae were present in equal abundance (Appendices D5 and D6). Average invertebrate density (±1 SE) was 3244 ± 515 organisms/m2 at the shallow station 1867 ± 68 organisms/m2 at the deep station (Figure 5.49; Table 5.6; Appendix D6).

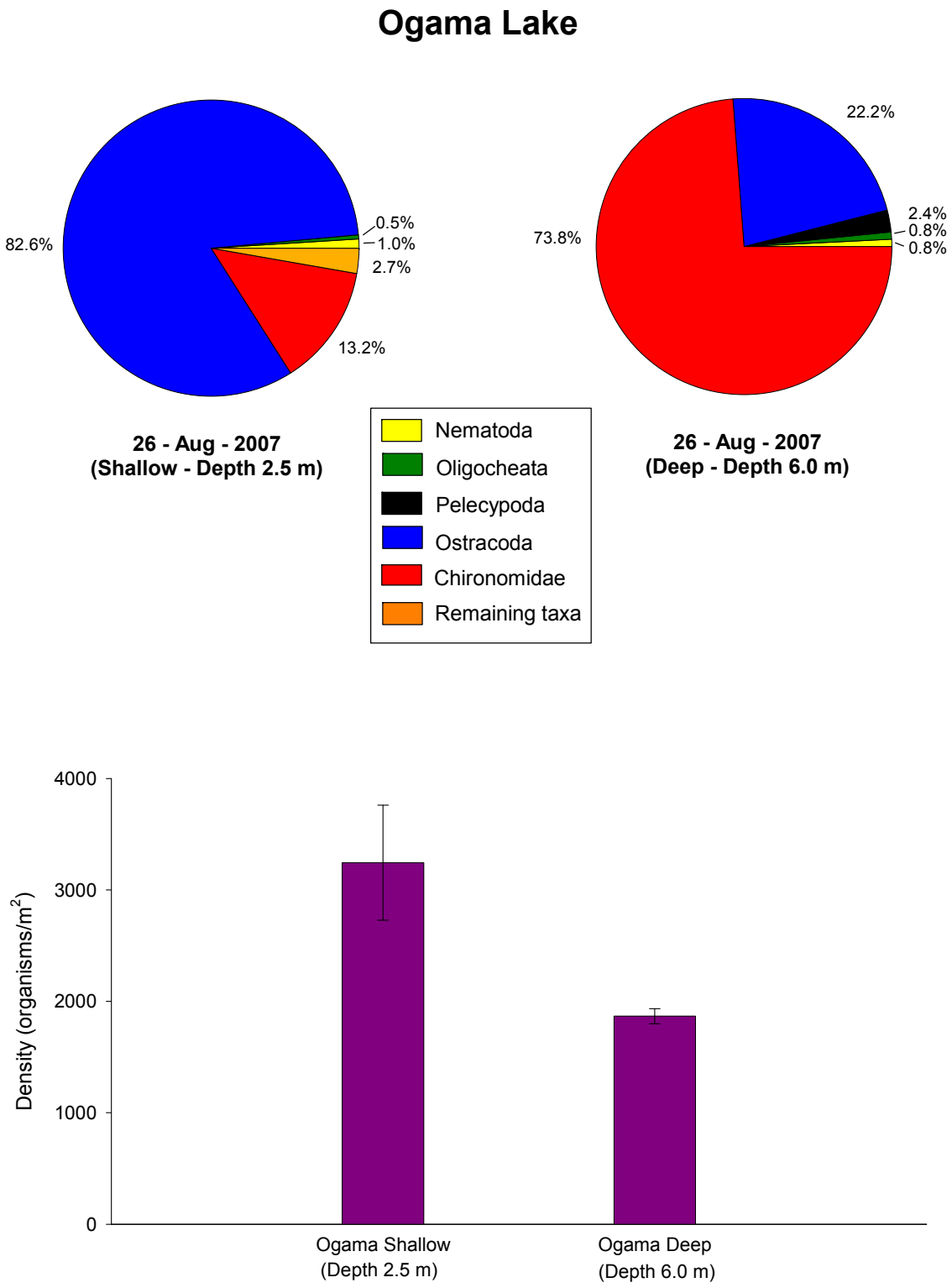


Figure 5.49 Relative Abundances of Major Taxonomic Groups and Total Density (mean ±1 SE) of Benthic Invertebrates at Shallow and Deep Stations in Ogama Lake, 2007

Patch Lake

Benthic invertebrate sampling at Patch Lake was conducted at a shallow station (3.1 m) located in the north section of the lake, and a deep station (13.7 m) located at the water quality station in the southern section of the lake. Sediment samples in the north portion of the lake were odourless, consisted of sand, silt, and clay, and had an average TOC of 2.4 %. Sediment taken from the south portion of the lake was odourless sand, silt, and clay, and the average TOC was 1.6% (Appendix C1).

Simpson's Diversity Index was slightly lower at the shallow station (0.57) than the deep station (0.66) (Table 5.5). Taxonomic richness was 11 at both stations. Evenness was 0.21 at the shallow station and 0.27 at the deep station. Species diversity, richness and evenness were moderate at both Patch Lake stations. This indicates that the benthic invertebrate communities were not evenly distributed among the taxa present at each station. The B-C index was lower for the shallow station (0.39) than for the deep station (0.76), indicating that the community of the shallow station was more similar to its reference median community.

Ostracoda was the dominant taxon at both stations, contributing 63.1% at the shallow location and 53.6% at the deep location. The second most abundant invertebrate taxon was Chironomidae, contributing 28.8% of abundance at shallow stations and 43.5% at deep stations (Figure 5.50; Appendices D5 and D6).

The most abundant Chironomidae groups were Chironomini at the shallow location and Tanypodinae at the deep location (Appendix D6). Overall, the density of invertebrates at the deep station was much lower than at the shallow station. The average invertebrate density (±1 SE) was 1542 ± 460 organisms/m^2 at the deep station and 41 261 ± 6733 organisms/m^2 at the shallow station (Figure 5.50; Table 5.6; Appendix D6).

Pelvic Lake

Benthic invertebrate samples were collected from Pelvic Lake at both shallow (4.2 m) and deep stations (15.0 m). Sediment was mainly silt and clay, and a pungent H_2S odour was present. Average TOC was 1.6% (Appendix C1).

Simpson's Diversity Index was the same at both stations (0.69) (Table 5.5). Taxonomic richness was 17 at the shallow station and 6 at the deep station; evenness was 0.19 at the shallow station and 0.54 at the deep station. This indicates that, although diversity was the same at both stations, total invertebrate abundance at the deep station was distributed more evenly across taxa than at the shallow station. The B-C index of 0.47 at the deep station indicates that the community at

this station was more similar to its reference median community than that at the shallow station, which had a B-C index of 0.80.

At the shallow station, Chironomidae (48.4%) and Ostracoda (47.1%) contributed a similar percentage towards benthic invertebrate abundance. Similarly, at the deep station, contribution by both groups was equal at 44.1%. Additionally, Oligochaeta (aquatic earthworms) contributed 11.8% of the benthic invertebrate abundance at the deep station (Figure 5.51). Tanytarsini and Chironomini tribes made up the majority of the chironomids at the shallow location, whereas Chironomini dominated at the deep station (Appendices D5 and D6). Average density (±1 SE) was much higher at the shallow station (12 627 ± 4435 organisms/m^2), than at the deep station (604 ± 260 organisms/m^2) (Figure 5.51; Table 5.6; Appendix D6).

P.O. Lake

Benthic invertebrates were sampled in P.O. Lake at one shallow station (4 m), located at the water quality station. Sediment consisted of silt and clay, and a moderate H_2S odour was present. Average TOC was 1.4 % (Appendix C1).

Simpson's Diversity Index was 0.46, taxonomic richness was 15, and evenness was 0.12 (Table 5.5), suggesting that a small number of taxa contributed towards the majority of invertebrate abundance. Of all lakes and stations sampled, this station was most similar to the reference median in terms of benthic community structure, with a B-C index of 0.19.

Ostracoda contributed 70.1% of the total abundance and Chironomidae contributed 27.2% (Figure 5.52). The Chironomini tribe contributed the majority of the chironomids (Appendices D5 and D6). Average invertebrate density (±1 SE) was 83 653 ± 21 315 organisms/m^2 (Figure 5.52; Table 5.6; Appendix D6), which was the highest of all lakes sampled.

Windy Lake

Benthic invertebrate samples were collected from Windy Lake at both shallow (3.5 m) and deep (18.0 m) locations. The shallow station was located in the north-west section of the lake, and the deep station was located at the water quality station. Sediment at the shallow station was dominated by silt, whereas sediment at the deep station was dominated by silt-clay. All sediment samples were odourless, and average TOC was 0.9 % (Appendix C1).

Simpson's Diversity Index was higher at the shallow station (0.22) than the deep station (0.07) (Table 5.5). Taxonomic richness was 12 at the shallow station and six at the deep station. Evenness was 0.11 at the shallow station and 0.18 at the deep station. Although the shallow station was more diverse and had more taxa present, invertebrate abundance was more evenly distributed across the taxa at the deep

station. The B-C index was 0.39 at the shallow station and 0.18 at the deep station, indicating that the shallow community is more similar to its reference median than the deep community.

Ostracoda was the dominant invertebrate taxon at both shallow and deep stations, with 88.0% of total abundance at the shallow station and 96.3% at the deep station (Figure 5.53). The next most abundant group was Chironomidae. This group contributed 9.1% at the shallow station and only 2.9% at the deep station (Figure 5.53). Several chironomid tribes contributed small percentages towards the total abundance of invertebrates (Appendices D5 and D6). Average density (±1 SE) of invertebrates was 2444 ± 1587 organisms/m^2 at the shallow station and 7733 ± 695 organisms/m^2 at the deep station (Figure 5.53; Table 5.6; Appendix D6).

Wolverine Lake

Wolverine Lake benthic invertebrates were sampled at a shallow (3.5 m) station located in the north section of the lake. Sediment was odourless and consisted of sand, silt, and clay. Average TOC was the second highest of all lakes sampled, at 4.2% (Appendix C1).

Simpson's Diversity Index was 0.26, taxonomic richness was 17, and evenness was 0.08 (Table 5.5). This suggests that, while Wolverine Lake had one of the highest species richness values of all lakes sampled, a small number of taxa contributed the majority of the invertebrate abundance. Wolverine Lake was the second most similar station to the shallow reference median, with a B-C index of 0.25.

The majority of invertebrates were of the order Ostracoda, contributing 85.8% of total benthic invertebrate abundance. The second most abundant group was Pelecypoda (7.4%), with *Pisidium* spp. dominating this group (Figure 5.52; Appendices D5 and D6). The average density (±1 SE) of invertebrates at Wolverine Lake was the second highest of all lakes sampled, with 61 267 ± 10 195 organisms/m^2 (Figure 5.52; Table 5.6; Appendix D6).

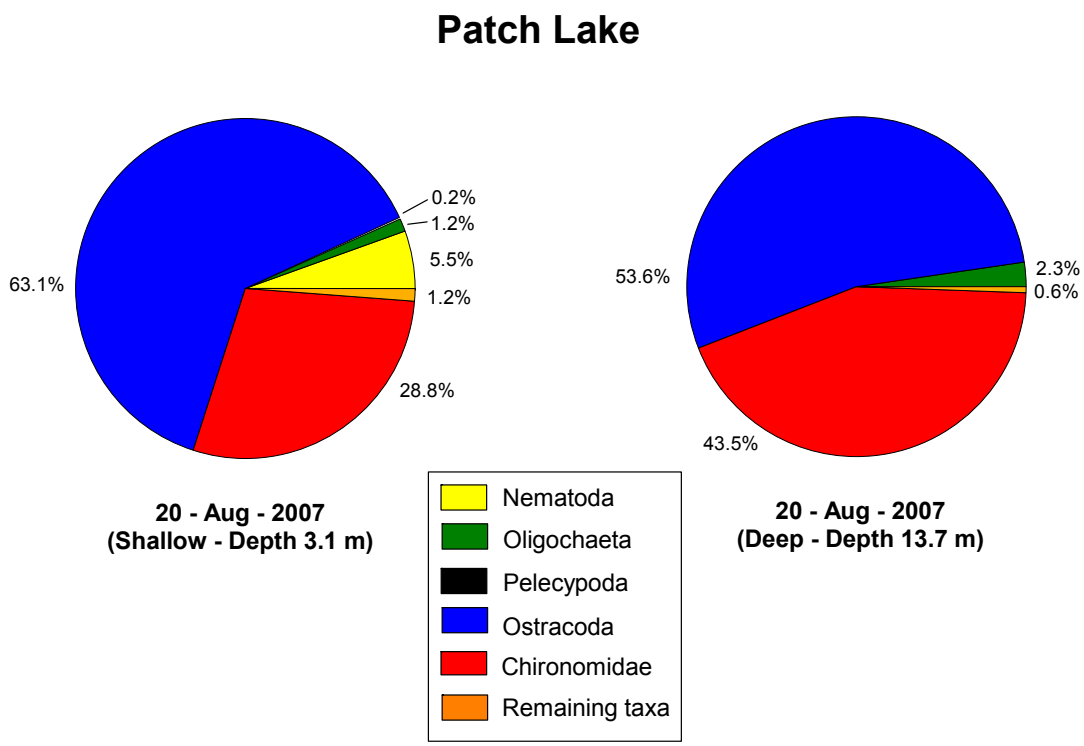


Figure 1.1a Relative abundance of major taxonomic groups of benthic invertebrates at shallow and deep sites in Patch Lake, 2007.

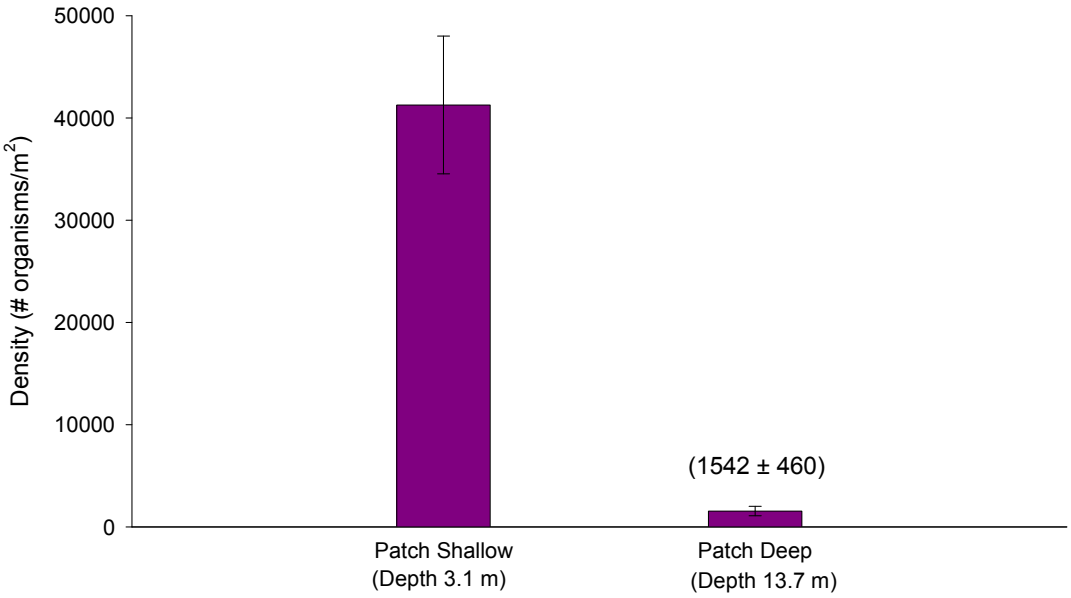


Figure 5.50 Relative Abundances of Major Taxonomic Groups and Total Density (mean ±1 SE) of Benthic Invertebrates at Shallow and Deep Stations in Patch Lake, 2007

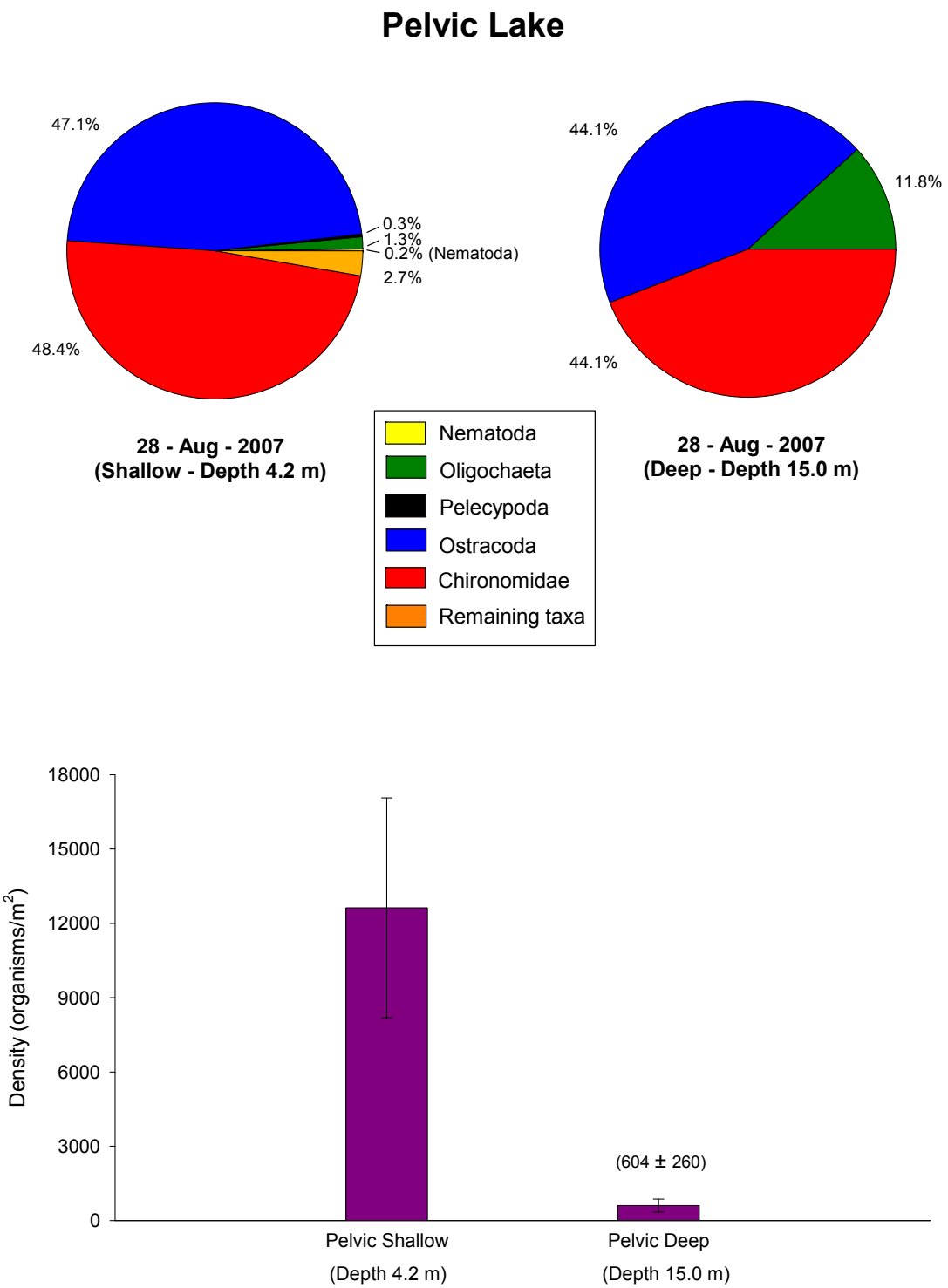
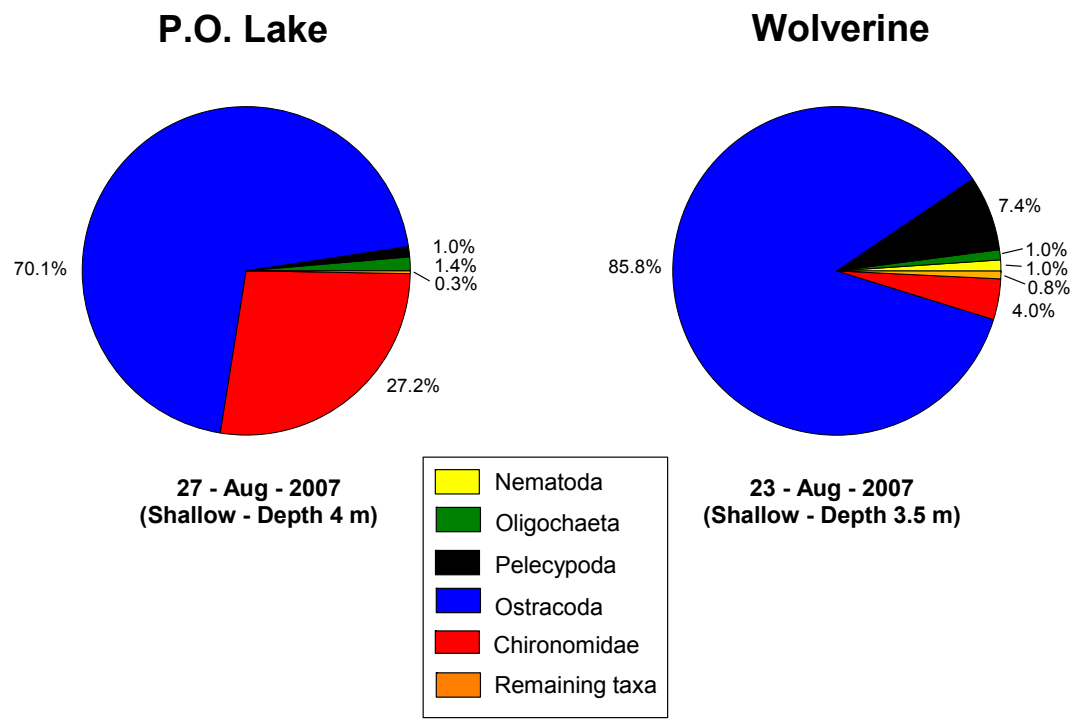


Figure 5.51 Relative Abundances of Major Taxonomic Groups and Total Density (mean ±1 SE) of Benthic Invertebrates at Shallow and Deep Stations in Pelvic Lake, 2007



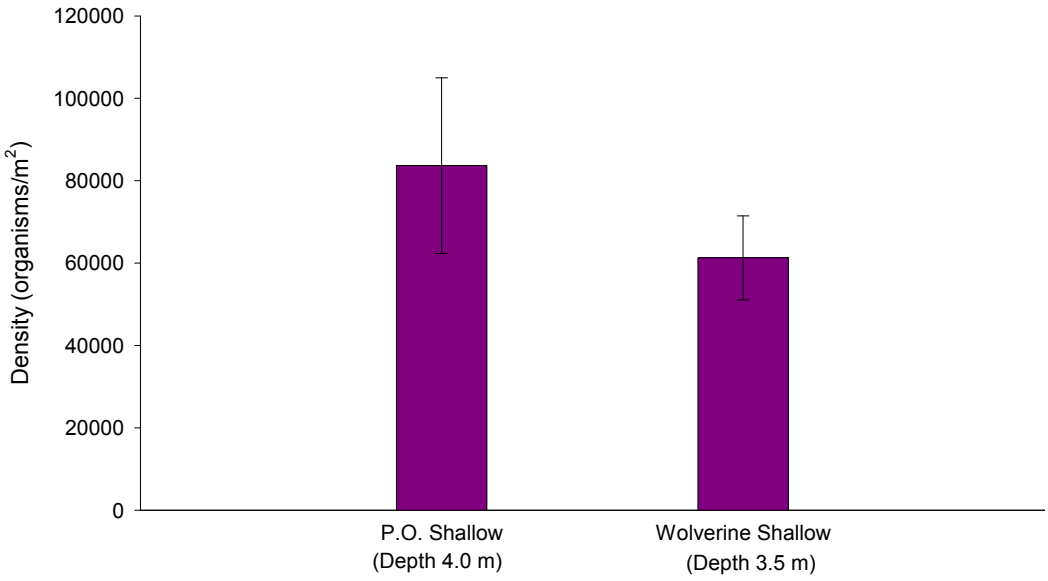


Figure 5.52 Relative Abundances of Major Taxonomic Groups and Total Density (mean ±1 SE) of Benthic Invertebrates at Shallow Stations in P.O. and Wolverine Lakes, 2007

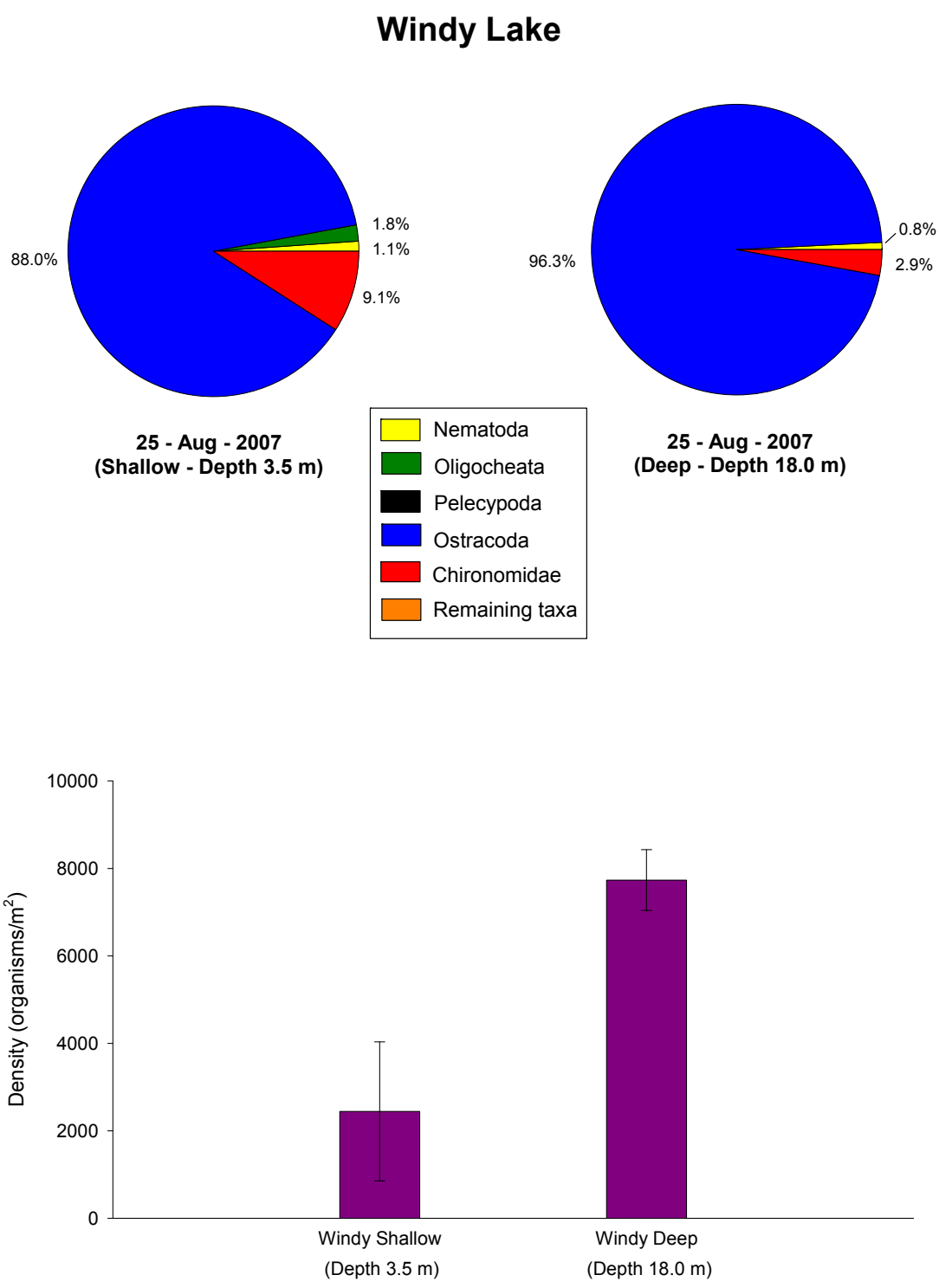


Figure 5.53 Relative Abundances of Major Taxonomic Groups and Total Density (mean ±1 SE) of Benthic Invertebrates at Shallow and Deep Stations in Windy Lake, 2007

5.3.2.3 Influence of Environmental Variables

Results of Pearson correlations indicated that invertebrate density was significantly correlated ($p<0.05$) with water depth, TOC, and silt (Table 5.7). Increasing water depth resulted in lower densities of invertebrates. Invertebrate density increased, however, with increasing amounts of TOC and silt. These results are consistent with typical relationships observed between invertebrate density and habitat variables in lakes (e.g., Kalff 2002).

Table 5.7 Pearson Correlation Coefficients between Invertebrate Density and Environmental Variables, 2007

Habitat Variable	Pearson Correlation Coefficient	p-value* (Bonferroni)
Water depth	-0.352	0.009
TOC	0.338	0.014
Sand	-0.166	0.757
Silt	0.337	0.015
Clay	-0.211	0.339

* Bonferroni $p < 0.05$ is statistically significant; n=17 pairs of observations.

5.3.3 Summary and Comparison to Previous Years

5.3.3.1 Summary for 2007 Lakes

Diversity of benthic invertebrate communities in the Boston and Madrid Project area lakes varied, as indicated by the wide range of Simpson's Diversity Indices (0.07 to 0.85). Taxonomic richness ranged from 5 to 19 taxa. Evenness was generally low, with all but one value at or below 0.36, indicating that a small number of taxa contributed the majority of invertebrate abundance at most stations. The shallow stations in both the Boston and Madrid Project areas were, on average, more similar to their reference medians than the deeps stations in both project areas (Table 5.5). The average for both Boston and Madrid shallow stations was 0.41 (standard error of ± 0.03 for Boston and ± 0.07 for Madrid). The value for the only Boston deep station was 0.53, and the Madrid average was 0.55 ± 0.11.

The most abundant invertebrates (i.e., taxonomic groups that comprised >10% of total abundance at any lake) included Nematoda (roundworms), Oligochaeta (aquatic earthworms), Pelecypoda (clams), Ostracoda (seed shrimp), and Chironomidae (midges). Either Ostracoda or Chironomidae were present in greatest abundance at all stations. Ostracoda was the dominant invertebrate group at 12 of the 17 sampling locations, whereas Chironomidae was the dominant group at four stations. At one sampling location (Pelvic Lake deep station;

Table 5.6), Ostracoda and Chironomidae were present in equal abundance. Overall, P.O. Lake had the highest total invertebrate density, whereas Glenn Lake had the lowest density.

Analysis of relationships between total invertebrate density and habitat variables indicated that water depth, TOC, and silt content had a significant influence on invertebrate density. Density declined with increasing water depth and increased with increasing TOC and silt content. These results are similar to the relationships normally observed between benthic invertebrate density and habitat variables in lakes (e.g., Kalff 2002).

5.3.3.2 *Comparison to Previous Years*

Overall, benthic invertebrate densities were considerably higher in 2007 than in previous years (RL&L/Golder 2002; Golder 2008a). Ostracoda were much more abundant than in previous years, and at the majority of sampling locations contributed the greatest percentage of the total abundance. Chironomidae, however, were less abundant in 2007 than in previous years.

Boston Project Area Lakes

Generally, Boston Project area lakes had more diverse invertebrate community assemblages than Madrid Project area lakes. Detailed comparisons of 2007 invertebrate communities to those present in previous years were difficult to make due to inconsistent trends in benthic invertebrate presence and abundance prior to 2007.

Compared to previous years, Chironomidae was present in greater abundance in Aimaokatalok Lake in 2007 and Ostracoda was present in greater abundance in Stickleback Lake. Fickle Duck Lake was the only waterbody to show consistent patterns across years. In this lake, Chironomidae was consistently the dominant benthic taxon; however, density was substantially higher in 2007. Ostracoda was common in all lakes in 2007, but was present in low abundance (< 6%) in previous years. In contrast, Pelecypoda was present in high abundance in previous years but present in low abundance in 2007.

Madrid Project Area Lakes

In the Madrid Project Area lakes, benthic invertebrates in previous years exhibited an overwhelming dominance by Chironomidae, regardless of depth or year (Rescan data from 1996, 1997, 2000; summarized in RL&L/Golder 2002). Ostracoda were present in low abundance in previous years, contributing a maximum of 10.6% of total abundance (Tail Lake, 19 July 2000; RL&L/Golder 2002).

During previous studies in Patch Lake (1996, 1997, and 2007), Chironomidae dominated invertebrate abundance (28.8% to 80.5%; RL&L/Golder 2002). Ostracoda, the dominant taxa in 2007, was present in low abundance in previous years. In Windy, Pelvic, and Ogama (shallow depth only) lakes, Chironomidae contribution to total abundance in 2007 was much lower than previous years. In Wolverine Lake, Pelecypoda was dominant during the previous sampling event (1997), whereas Ostracoda, dominant in 2007, was present in low abundance.

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6 FISH POPULATIONS

6.1 INTRODUCTION

The 2006 and 2007 field programs for the Boston and Madrid Project areas were designed to extend and update baseline data for future development monitoring requirements. The proposed studies would build upon, rather than duplicate, surveys conducted in some of the waterbodies during the 1992 to 2000 period. The 2006 field program included two specific objectives:

- determine fish species composition and relative abundance in potentially affected systems; and
- tag fish in Patch and Ogama lakes as well as three connecting lakes to facilitate future population estimates in this system.

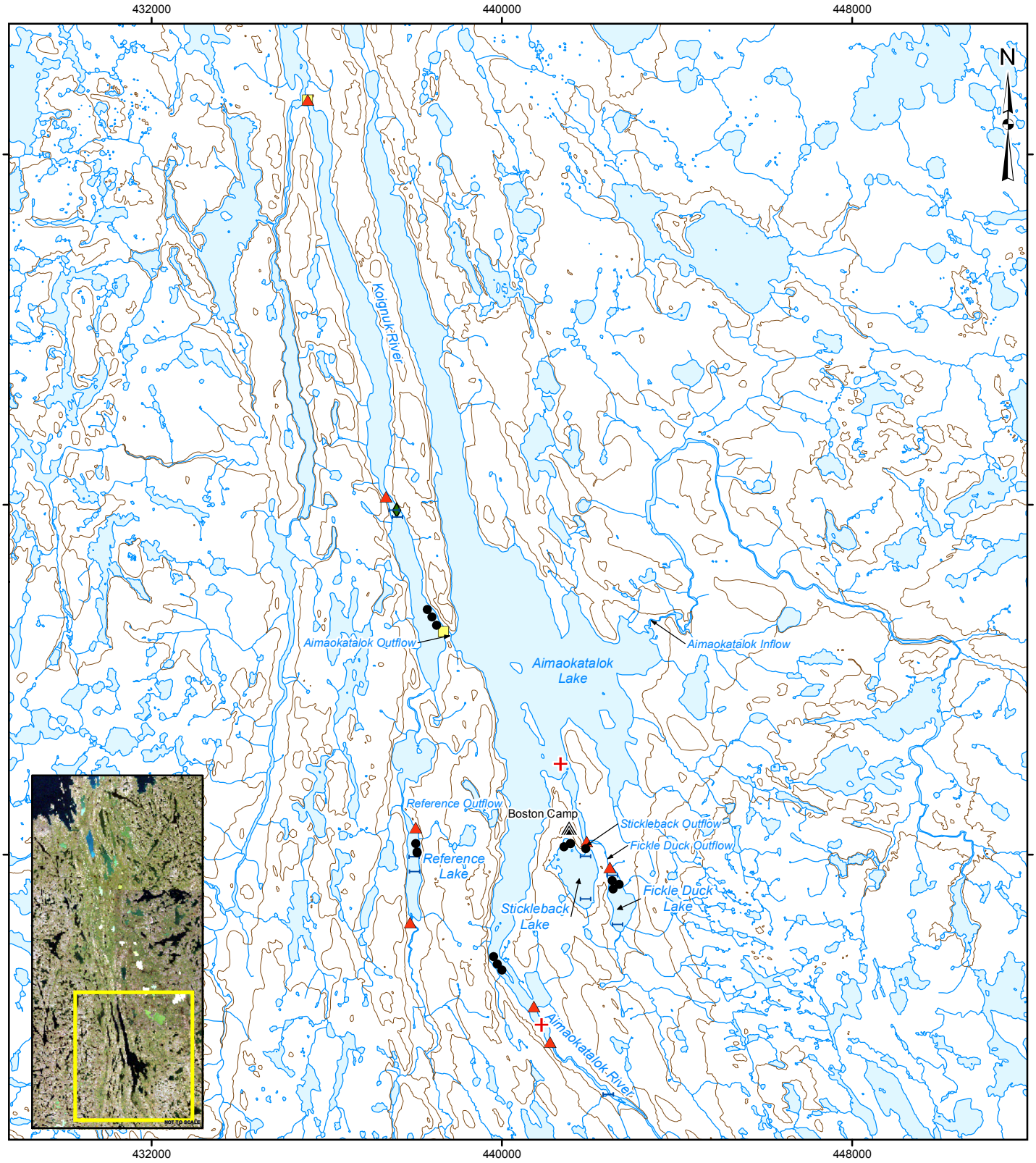
The 2007 program was designed to further develop the information collected in 2006. The specific objectives of the 2007 field program were as follows:

- conduct a fish population estimate in Patch Lake;
- sample fish in Wolverine Lake to confirm presence of least cisco;
- sample fish in Glenn Lake, targeting lake trout and Arctic char as part of Ms. Heidi Swanson's PhD thesis research;
- sample to determine fish species composition and relative abundance in the lower reaches of the Koignuk River; and
- conduct a habitat survey along the Koignuk River to identify potential Arctic grayling spawning habitat.

6.2 METHODS

6.2.1 Field Sampling Locations and Timing

In 2006, fish were sampled in the Boston Project area (Aimaokatalok Lake and River; Fickle Duck Lake, Inflow, and Outflow; Koignuk River; Reference Lake; and Stickleback Lake and Outflow) and the Patch-Ogama Lake system in the Madrid Project area (Patch, P.O., P.O. Connector, P.O. Inflow, and Ogama lakes and connecting streams). The 2007 fish sampling program included the Koignuk River, Patch Lake, and Wolverine Lake, as well as Glenn Lake, which was sampled as part of Ms. Swanson's Ph.D. thesis. Fish sampling was conducted between 16 July and 7 August 2006 and between 8 July and 23 August 2007.



LEGEND

- CAMP
- ANGLING
- BACKPACK ELECTROFISHING
- BEACH SEINING
- FYKE NETTING
- GILL NETTING
- MINNOW TRAPPING
- CONTOUR (20 m INTERVAL)
- WATERCOURSE
- WATERBODY

3500 0 3500

SCALE 1:125000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

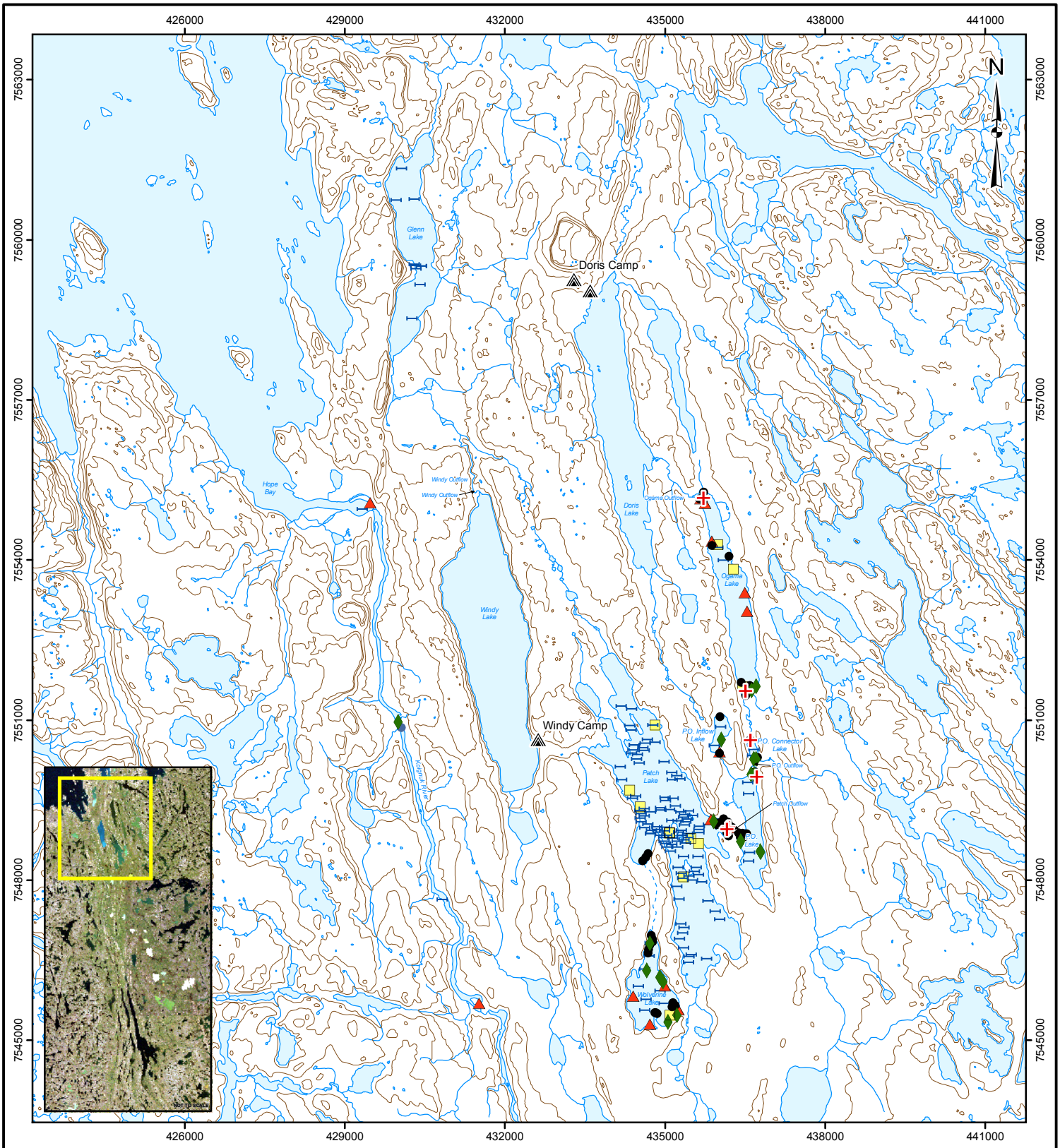
2006 FISH SAMPLING LOCATIONS BOSTON PROJECT AREA

Golder Associates Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	RC	11 Mar. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 6.1

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LEGEND

- CAMP
- ANGLING
- BACKPACK ELECTROFISHING
- BEACH SEINING
- FYKE NETTING
- GILL NETTING
- KICK NETTING
- MINNOW TRAPPING
- CONTOUR (20 m INTERVAL)
- INTERMITTENT STREAM
- WATERCOURSE
- WATERBODY

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT The Gold Company

HOPE BAY MINING LTD.

TITLE

2006 - 2007 FISH SAMPLING LOCATIONS MADRID PROJECT AREA

Golder Associates
Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	RC	11 Mar. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 6.2

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6.2.3 Fish Collection Methods

Fish sampling was conducted in selected lakes and streams using angling, backpack electrofishing, beach seining, fyke netting, gill netting, kick netting, and minnow trapping.

6.2.3.1 Angling

Angling was conducted by either casting from shore or boat, or by trolling behind a boat. Barbless lures were used, and captured fish were processed for life history information before being tagged and released. Other recorded data included date and time of capture, location, hours fished, and number of rods used.

6.2.3.2 Backpack Electrofishing

A Smith-Root Model 12B backpack electrofisher was used to collect fish in lakes and streams in the Boston and Madrid Project areas. The operator waded upstream and sampled in the vicinity of suspected fish holding areas (e.g., under boulders, undercut banks); the netter collected stunned fish and placed them in a holding bucket. Recorded information at each station included UTM coordinates, date and time of sampling, distance sampled, sampling effort (seconds), and electrofisher settings. Captured fish were allowed to recover, then were processed for life history information, and subsequently released into the area of capture.

6.2.3.3 Beach Seining

Beach seining for small fish was conducted in shallow areas of lakes and streams in the Boston and Madrid Project areas. Suitable habitat for beach seining was selected along lake shorelines and in areas of fine substrate. The beach seine was 9 m long, with a mesh size of 6 mm, and was equipped with a collection bag with a mesh size of 3 mm. The length and effective width of each haul was recorded to determine catch-per-unit-effort (CPUE). Similar to the other sampling methods, life history information, UTM coordinates, date, time, water temperature, and substrate type were recorded.

6.2.3.4 Fyke Netting

Modified Arctic fyke nets were used to sample fish in Aimaokatalok, Patch, P.O., P.O. Connector, and Ogama lakes. Fyke nets were generally set near the lake outflows or inflows to catch fish moving into or out of the lakes. This net consisted of a single trap net, two 7.6 m wings, and a 7.6 m lead to shore. The trap was 0.9 m wide and contained two throats (7.5 x 7.5 cm each). The trap, wings and lead were

constructed of 1.0 cm dark grey knotless nylon mesh. The wings and lead were 0.9 m deep. Wing net panels were attached to either side of the trap entrance and were stretched out parallel to shore. Fyke net sets were held in place by T-bar posts driven into the substrate.

Fyke nets were checked daily. Information recorded during each net check included date, check time, water temperature, and life history data from captured fish.

6.2.3.5 Gill Netting

Variable mesh experimental gill nets were employed to sample in the Koignuk River, and in Aimaokatalok, Fickle Duck, Ogama, P.O., P.O. Connector, P.O. Inflow, Patch, Reference, Stickleback, Wolverine, and Glenn lakes. In 2006, the experimental gill nets were composed of either one or two panels measuring 15.2 x 2.4 m each (mesh size 1.9 or 2.5 cm), or two panels measuring 15.2 x 1.8 m each (mesh size 3.8 or 6.4 cm). In 2007, each experimental gill net was composed of two or three panels measuring 15.2 x 1.8 m each. Mesh sizes in 2007 ranged from 2.5 to 6.4 cm. Set times were kept short to minimize capture related mortalities. Information recorded at each gill-net station included UTM coordinates, date and time of set and lift, water depth, and the number and species of fish captured.

6.2.3.6 Kick Netting

Kick sampling was conducted in an attempt to collect eggs of spring spawners (e.g., Arctic grayling) in selected high quality habitats in the Koignuk River. Kick sampling was performed by positioning a small canvas kick net directly downstream of an area of suitable spawning substrate. An area of about 1 m^2 was disturbed by kicking the bed material, causing looses material (e.g., eggs) to mobilize and drift downstream into the net.

6.2.3.7 Minnow Trapping

Gee^{TM} minnow traps were used to sample small fish in small lakes and streams in the Boston and Madrid Project areas. The traps (40 cm long, 23 cm diameter in the middle, 19 cm diameter at each end) were two-piece wire enclosures with inverted funnel openings. They were baited with pet food or sardines, and were set in near-shore habitats. Date, time, UTM coordinates, depth, water temperature, and substrate type were recorded for all minnow trap sets, and life history information was recorded for captured fish.

6.2.4 Habitat Surveys in the Lower Koignuk River

Instream habitats were assessed to identify potential Arctic grayling spawning habitat and other high quality fish habitats, such as rearing and feeding stations. Substrate types were visually assessed and recorded. The quality of habitat was assessed based on depth and availability of cover.

6.2.5 Life History Data Collection

Life history information was collected from most captured fish. Fish were identified to species, measured (fork or total length to the nearest millimetre), and weighed (grams). Additional life history data were collected from fish that died during sampling; data collected included sex and maturity, reproductive status, and stomach contents.

To facilitate data recording and presentation of results, all captured fish were assigned a four-letter species code. The common and scientific names of fish species captured in 2006 and 2007, as well as their coded abbreviations, are presented in Table 6.1.

Table 6.1 Common and Scientific Names of Fish Species Captured in the Boston and Madrid Project Areas, 2006 – 2007

Family	Common Name[a]	Scientific Name[a]	Code
Clupeidae	Pacific herring	*Clupea pallasii* Valenciennes	PCHR
Cottidae	Fourhorn sculpin	*Myoxocephalus quadricornis* (Linnaeus)	FRSC
	Slimy sculpin	*Cottus cognatus* Richardson	SLSC
Gasterosteidae	Ninespine stickleback	*Pungitius pungitius* (Linnaeus)	NNST
Gadidae	Saffron cod	*Eleginus gracilis* (Tilesius)	SFCD
Lotidae	Burbot	*Lota lota (*Linnaeus)	BURB
Pleuronectidae	Arctic flounder	*Pleuronectes glacialis* (Pallas)	ARFL
Salmonidae	Arctic char	*Salvelinus alpinus* (Linnaeus)	ARCH
	Arctic Grayling	*Thymallus arcticus* (Pallas)	ARGR
	Lake trout	*Salvelinus namaycush* (Walbaum)	LKTR
	Lake whitefish	*Coregonus clupeaformis* (Mitchill)	LKWH
	Broad whitefish	*Coregonus nasus* (Pallas)	BRWH
	Cisco	*Coregonus artedi* Lesueur	CISC
	Least cisco	*Coregonus sardinella* Valenciennes	LSCS

[a] From Nelson et al. (2004).

6.2.6 Fish Tagging

Fish captured in Patch, P.O., P.O. Connector, and Ogama lakes that were greater than 300 mm in fork length (FL) were tagged with a uniquely numbered PIT (passive integrated transponder) tag to aid in assessing population numbers and movements through subsequent recaptures. PIT tags and injectors were sterilized with diluted isopropyl alcohol prior to use with each fish. PIT tags were inserted into the body cavity of fish between the pelvic and pectoral girdles and scanned with a microchip reader to ensure proper function prior to the release of each fish (Columbia Basin Fish and Wildlife Authority PIT Tag Screening Committee 1999). In addition, fish greater than 500 mm in length were also given a uniquely numbered Hallprint™ T-bar anchor tag. Tags were placed just below the dorsal fin of suitably sized fish for quick visual identification.

6.2.7 Data Analysis

All life history data from individual fish were consolidated into tables (Appendix E1) and submitted to a thorough QA/QC procedure. The data were then used to calculate the following life history statistics:

- length-frequency distributions;
- length-weight relationships; and
- mean, standard deviation, and range of length, weight, and condition factor data.

As an index of relative abundance, CPUE values were calculated for each sampling method. CPUE values for fyke net and minnow trap catches are reported as number of fish captured per 24 hours of trap operation. CPUE values for gill net sets are reported as number of fish captured per 100 m^2 of each mesh panel set per 24 hours. CPUE values for angling are reported as number of fish captured per hour of angling with one rod. Backpack electrofishing CPUE values are reported as number of fish per 100 seconds, and beach seining CPUE units are reported as number of fish per 100 m^2 of area seined.

6.3 RESULTS

6.3.1 Boston Project Area Lake Communities

The catch and size statistics for fish sampled during the sampling program are summarized in Appendices E2 to E9; data from individual fish are presented in Appendix E1.

6.3.1.1 Aimaokatalok Lake

Fish sampling was conducted in Aimaokatalok Lake on 16 and 18 July 2006. Fish capture methods used to document species composition and abundance included backpack electrofishing, fyke netting, gill netting, and minnow trapping.

Species Composition and Relative Abundance

In total, 127 fish representing three species (lake trout, cisco, and ninespine stickleback) were captured in Aimaokatalok Lake (Table 6.2). Previous studies conducted by Rescan Environmental between 1993 and 1997 indicated the presence of lake trout, lake whitefish, cisco, and Arctic grayling in Aimaokatalok Lake (Golder 2008a). Lake whitefish and Arctic grayling were not captured during the 2006 sampling program. In 2006, ninespine stickleback was the predominant species in the overall catch (85.0%), followed by lake trout (13.4%) and cisco (1.6%). Most of the fish captured in Aimaokatalok Lake were small in size with the exception of one large lake trout (422 mm in fork length), which was captured during gill netting efforts. The fyke net in Aimaokatalok had the highest CPUE of all the fyke nets set in lakes during the 2006 and 2007 sampling programs (Appendix E5).

Table 6.2 Fish Species and Number Captured in Aimaokatalok Lake, 2006

Capture Method	Ninespine stickleback	Lake trout	Cisco	Total
Backpack electrofishing	6	14		**20**
Fyke nets	100	2	2	**104**
Gill nets		1		**1**
Minnow traps	2			**2**
Total	**108 (85.0%)**	**17 (13.4%)**	**2 (1.6%)**	**127 (100%)**

Life History Data

Lake Trout

Of the 17 lake trout captured in Aimaokatalok Lake, only three were measured. One fish was an adult; the fork length of the adult fish was 422 mm (Appendix E9). The remaining lake trout captured were juveniles and young-of-the-year (YOY), ranging in fork length from 25 to 85 mm. The adult lake trout had a weight of 852 g and condition factor of 1.13, which was slightly higher than the mean reported condition factor (1.08) from previous studies conducted by Rescan Environmental in Aimaokatalok Lake (Golder 2008a).

Ninespine Stickleback

In total, 108 ninespine stickleback were captured in Aimaokatalok Lake. Lengths were measured for 102 of the captured fish (Figure 6.3); fork lengths ranged from 30 to 55 mm (Appendix E9). The length-frequency distribution was unimodal, with 62% of captured fish measuring 35 to 40 mm (Figure 6.3).

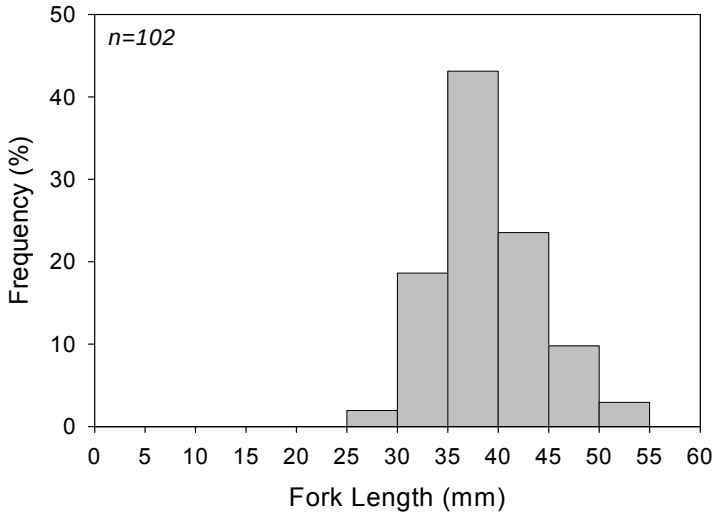


Figure 6.3 Length-Frequency Distribution for Ninespine Stickleback Captured in Aimaokatalok Lake, 2006

Cisco

Two juvenile cisco were captured in the fyke net near the inflow from Fickle Duck Lake. The fork lengths of these fish were 85 mm and 75 mm (Appendix E9).

6.3.1.2 Fickle Duck Lake

Fish sampling took place in Fickle Duck Lake on 18 July 2006. Both large and small fish were targeted during sampling, with capture methods including beach seining, gill netting, and minnow trapping.

Species Composition and Relative Abundance

Fish sampling in Fickle Duck Lake yielded a total of only nine fish of two species (lake trout and ninespine stickleback) (Table 6.3). Previous studies by Rescan Environmental reported the presence of only Arctic grayling in 1995 and 1996; however, this result is suspect since lake trout tissue samples were also reported as being collected during those studies, but were not reported as part of the catch (Golder 2008a). Arctic grayling were not captured in Fickle Duck Lake by Golder Associates Ltd. in 2006.

Table 6.3 Fish Species and Number Captured in Fickle Duck Lake, 2006

Capture Method	Ninespine Stickleback	Lake Trout	Total
Beach seine	1	1	2
Gill nets		2	2
Minnow traps	5		5
Total	**6 (66.7%)**	**3 (33.3%)**	**9 (100.0%)**

Ninespine stickleback were present in the largest numbers in the overall catch (66.7%), and lake trout contributed the remainder (33.3%). Adult lake trout were captured by gill netting, whereas the juvenile lake trout was collected by beach seining. Ninespine stickleback were captured by beach seining and minnow trapping (Table 6.3).

Life History Data

Lake Trout

Three lake trout were captured in Fickle Duck Lake. These included one juvenile (78 mm FL) and two adults (490 and 555 mm FL). The weights of the two adults were 1390 g and 2620 g, and the condition factors were 1.18 and 1.53 (Appendix E9).

Ninespine Stickleback

Six ninespine stickleback were captured in Fickle Duck Lake. Fork length ranged from 46 to 51 mm (Appendix E9).

6.3.1.3 Reference Lake

Fish sampling was conducted in Reference Lake on 19 July 2006. Both large and small bodied fish were targeted during sampling in Reference Lake. Fish capture methods included backpack electrofishing, gill netting, and minnow trapping. Reference Lake was not sampled during previous sampling programs.

Species Composition and Relative Abundance

Fish sampling in Reference Lake yielded a total of 14 fish representing three species (Table 6.4). Ninespine stickleback were present in the largest numbers in the overall catch (85.7%); lake trout (7.1%) and cisco (7.1%) contributed the remainder of the catch. One adult lake trout was captured in a gill net. Small sized fish (ninespine stickleback and cisco) were captured using a backpack electrofisher and minnow traps.

Table 6.4 Fish Species and Number Captured in Reference Lake, 2006

Capture Method	Ninespine stickleback	Lake trout	Cisco	Total
Backpack electrofisher	10		1	**11**
Gill nets		1		**1**
Minnow traps	2			**2**
Total	**12 (85.7%)**	**1 (7.1%)**	**1 (7.1%)**	**14 (100.0%)**

Life History Data

Lake Trout

Only one lake trout was captured during gill netting efforts in Reference Lake. This fish had a fork length of 195 mm, weighed 80 g and had a condition factor of 1.13 (Appendix E9). The condition of this fish was similar to the lake trout captured in Aimaokatalok Lake in 2006 (1.13) and was slightly lower than the reported condition factors for Fickle Duck Lake in 2006 (1.18 and 1.53) (Appendix E9).

Cisco

One YOY cisco (28 mm FL) was captured during backpack electrofishing conducted along the north end of the lake near the lake outflow.

Ninespine Stickleback

Ninespine stickleback captured in Reference Lake (n = 12) ranged in length from 30 to 50 mm (Appendix E9).

6.3.1.4 Stickleback Lake

Gill netting and minnow trapping were used to sample fish communities in Stickleback Lake on 17 July 2006. Similar to previous studies conducted by Rescan Environmental (Golder 2008a), ninespine stickleback was the only species captured during fish sampling efforts in Stickleback Lake (Appendix E1). Twenty-seven ninespine stickleback were captured in minnow traps; the fork lengths of these fish ranged from 40 to 82 mm (Appendix E9). Fish were not captured by gill netting in Stickleback Lake in this study or in previous studies (Golder 2008a). It is likely that ninespine stickleback is the only fish species inhabiting Stickleback Lake.

6.3.2 Boston Project Area Stream Communities

6.3.2.1 Aimaokatalok River

Backpack electrofishing was conducted on 16 July 2006 within the lowest reach of the Aimaokatalok River as it entered Aimaokatalok Lake (Figure 6.1). Fish data have not been collected for Aimaokatalok River previously. In total, 15 ninespine stickleback and nine YOY lake trout were captured (Appendix E1). The YOY lake trout were between 25 and 53 mm in fork length (Appendix E9). The mean length for the captured ninespine stickleback was 42 mm, and lengths for individual fish ranged from 31 to 64 mm (Appendix E9).

6.3.2.2 Fickle Duck Inflow

Fickle Duck Inflow was sampled using a backpack electrofisher on 18 July 2006. Eight ninespine stickleback were captured (Appendix E1). Lengths for the individual fish ranged from 35 to 50 mm (Appendix E9). Similarly, ninespine stickleback was the only fish species captured in this stream when it was sampled in 1997 (Golder 2008a). Total CPUE for backpack electrofishing was 1.7 fish/100 s of shocking (Appendix E3).

6.3.2.3 Fickle Duck Outflow

Fish sampling took place in Fickle Duck Outflow on 18 July 2006. Sampling in Fickle Duck Outflow consisted solely of backpack electrofishing.

Species Composition and Relative Abundance

Fish sampling in Fickle Duck Outflow yielded a total of nine fish representing three fish species (Table 6.5). Ninespine stickleback made up 78.0% of the catch; lake trout and burbot each contributed 11.0% to the total. Ninespine stickleback

and lake trout were also documented in this stream during previous studies (Golder 2008a).

Table 6.5 Fish Species and Number Captured in Fickle Duck Outflow, 2006

Capture Method	Ninespine stickleback	Lake trout	Burbot	Total
Backpack electrofishing	7	1	1	**9**
Total	**7 (78.0%)**	**1 (11.0%)**	**1 (11.0%)**	**9 (100.0%)**

Life History Data

Lake Trout

One lake trout was caught in Fickle Duck Outflow. The fish was a juvenile with a fork length of 85 mm (Appendix E9). One lake trout fry was captured in the outflow in 1994 (Golder 2008a). This stream does not appear to have suitable holding or spawning habitat for adult lake trout.

Burbot

One burbot was caught in Fickle Duck Outflow. Total length was measured to be 415 mm. The fish had a weight of 490 g and a condition factor of 0.69 (Appendix E9). Juvenile burbot were also captured in the Koignuk River in 2006, but were not reported in previous studies for the Hope Bay Belt waterbodies.

Ninespine Stickleback

Seven ninespine stickleback were captured in Fickle Duck Outflow. Fork lengths ranged from 35 to 51 mm, and the mean length was 42 mm (Appendix E9).

6.3.2.4 Koignuk River

Fish sampling took place within the Koignuk River downstream of the outflow from Aimaokatalok Lake on 19 and 20 July 2006, and in the lower reaches from the confluence at Hope Bay to the second set of rapids upstream of the bay on 8 July 2007. Both large and small fish were targeted during sampling in the Koignuk River. Fish capture methods included angling, backpack electrofishing, beach seining, gill netting, minnow trapping, and dip netting.

The 2007 sampling program was conducted in conjunction with a habitat assessment to identify potential Arctic grayling spawning areas and other high quality fish habitats in the lower Koignuk River. The following section of this report presents the fish capture information from all fish sampling conducted in

2006 and 2007. Results specific to the 2007 fisheries habitat assessment in the lower Koignuk River are presented in Section 6.5.

Species Composition and Relative Abundance

Fish sampling in the Koignuk River yielded a total of 201 fish representing 10 species in 2006 (n = 169) and 2007 (n = 32). Lake whitefish contributed the largest proportion of the overall catch (65.2%), followed by ninespine stickleback (14.4%), Arctic grayling (9.0%), lake trout (4.5%), Arctic flounder (3.0%), slimy sculpin (1.5%), burbot (1.0%), fourhorn sculpin (1.0%), and Arctic char (0.5%) (Table 6.6). In previous sampling programs, lake trout, Arctic grayling, lake whitefish, and Greenland cod were captured in the Koignuk River (Golder 2008a).

Table 6.6 Fish Species and Number of Fish Captured in Koignuk River, 2006 – 2007

Capture Method	Arctic char	Arctic flounder	Arctic grayling	Burbot	Fourhorn sculpin	Lake trout	Lake whitefish	Ninespine stickleback	Slimy sculpin	Total
Angling			5			8				**13**
Gill nets	1						5			**6**
Beach seine							120			**120**
Minnow traps										**0**
Backpack electrofishing		6	13	2	1	1	6	29	3	**61**
Dip net					1					**1**
Total	1	6	18	2	2	9	131	29	3	**201**
	(0.5%)	(3.0%)	(9.0%)	(1.0%)	(1.0%)	(4.5%)	(65.2%)	(14.4%)	(1.5%)	**(100.0%)**

Large numbers of YOY corregonids were captured and observed during beach seine efforts along the shoreline and shallow shoals in 2006, and several juveniles were captured or observed during backpack electrofishing efforts in 2007. Arctic grayling and lake trout were captured by angling in the tail-out areas of riffle/run habitats in 2006 and 2007. The CPUE for backpack electrofishing in the Koignuk River was 3.0 fish/100 s and beach seining was 11.1 fish/100 m^2. These were the highest CPUE for these fishing methods in the Boston and Madrid Project area streams (Appendices E3 and E4).

Young-of-the-year and juvenile corregonids (whitefish and cisco) are often difficult to identify to species level in the field; however, these fish are most likely lake whitefish as only adult lake whitefish have been documented in the Koignuk River (Appendix E1; Golder 2008a). For this report, these juvenile and YOY corregonids have been identified as lake whitefish.

Life History Data

Arctic Char

One adult Arctic char was captured in a gill net in the lower reach of the Koignuk River in 2007. This fish measured 605 mm in fork length, weighed 2538 g, and had a condition factor of 1.15 (Appendix E9). The condition of this fish was within the range of condition factors reported for other Hope Bay waterbodies (range from 0.50 to 1.62) (RL&L/Golder 2002; Golder 2007, 2008a, 2008b).

Arctic Grayling

Eighteen Arctic grayling were captured in the Koignuk River in 2006 and 2007. The Arctic grayling represented two distinct size-classes of fish. Of these, 12 were juveniles and YOY that ranged in fork length from 23 to 109 mm (mean 49 mm; Appendix E9). The condition factor for the one weighed juvenile fish was 1.00 (Appendix E9).

The mean fork length for the six adult Arctic grayling caught in the Koignuk River was 384 mm, and the lengths ranged from 350 to 400 mm (Appendix E9). The weights for two of these fish were 603 and 650 g and the condition factors were 0.96 and 1.14, respectively (Appendix E9). The mean condition factor for Arctic grayling was 1.03 in previous studies in the Koignuk River (Golder 2008a), which is similar to the mean condition factor of these two fish (1.05).

Lake Trout

There were nine lake trout captured in the Koignuk River in 2006. One juvenile lake trout (78 mm) was captured during backpack electrofishing efforts. The remaining eight fish ranged in fork length from 440 to 665 mm and had a mean fork length of 497 mm (Appendix E9). The mean weight for the adult lake trout was 1519 g (range from 1135 to 2750 g). The mean condition factor was 1.25, which is higher than the mean condition factor (1.09) reported by Rescan Environmental between 1995 and 1998 (Golder 2008a).

Lake Whitefish

In total, 126 lake whitefish were captured in the Koignuk River in 2006. Mean fork length for adult fish was calculated to be 498 mm. Most of lake whitefish (96%) were young-of-the-year, and they ranged in length from 30 to 40 mm. To reduce mortality of these YOY fish, the fork lengths were estimated as they were counted and released. In 2007, one juvenile lake whitefish (78 mm FL) was captured and five others were observed (Appendix E9). The five adult lake whitefish ranged in length from 480 to 520 mm. The weights for two of these fish were 1350 and 1375 g, and the condition factors were 1.10 and 1.22 (Appendix E9). During previous studies conducted by Rescan Environmental on the Koignuk

River, only one lake whitefish was captured and it had a condition factor of 0.98 (Golder 2008a).

Burbot

Two juvenile burbot were caught in the Koignuk River in 2006. These fish were 83 and 70 mm in total length. Burbot was also captured in Fickle Duck Outflow in 2006, but have not been captured during previous sampling programs in the Hope Bay Belt.

Arctic Flounder

Three Arctic flounder were captured, and three were observed, in the lower reach of the Koignuk River in 2007. The mean total length of captured fish was 103 mm (n = 3), and the lengths ranged from 76 to 139 mm. The weights for these three fish ranged from 6 to 42 g, and the condition factors ranged from 0.99 to 1.56 (Appendix E9). These condition factors are within the range reported for Arctic flounder from Roberts Bay, which had condition factors ranging from 0.84 to 2.41 in 2006 and 2007 (Golder 2007, 2008b).

Fourhorn Sculpin

Two fourhorn sculpin were captured in the lower Koignuk River in 2007. The total lengths of these fish were 16 mm and 83 mm. The weight of the larger fourhorn sculpin was 5 g, which resulted in a condition factor of 0.87 for the fish (Appendix E9). This condition factor is similar to those reported for fourhorn sculpin captured in Roberts Bay, which range from 0.81 to 1.34 (Golder 2007, 2008b).

Slimy Sculpin

Three slimy sculpin were captured in the Koignuk River in 2006. The total lengths for individual fish ranged from 46 to 57 mm (Appendix E9). Slimy sculpin were not captured previously in the Koignuk River (Golder 2008a).

Ninespine Stickleback

Twenty-nine ninespine stickleback were caught in the Koignuk River in 2006 and 2007. These fish ranged in fork length from 31 to 67 mm (Appendix E9).

6.3.2.5 Stickleback Outflow

Stickleback Outflow was sampled using backpack electrofishing on 17 July 2006. In total, 24 ninespine stickleback and one slimy sculpin were captured (Appendix E1). The mean fork length for the ninespine stickleback was 46 mm, ranging from 35 to 57 mm, and the slimy sculpin was 115 mm in total length

(Appendix E9). Ninespine stickleback was the only species captured in Stickleback Outflow during a previous sampling program in 1997 (Golder 2008a).

6.3.3 Madrid Project Area Lake Communities

6.3.3.1 Glenn Lake

Backpack electrofishing and gill netting were used to capture fish in Glenn Lake from 6 to 7 August 2007 and 22 to 23 August 2007. Fishing in Glenn Lake was conducted as part of Ms. Heidi Swanson's PhD thesis data collection. Lake trout and Arctic char were the target species for this research, and as such, length and weight were only recorded for the fish that were sacrificed and retained for further analysis by Ms. Swanson.

Species Composition and Relative Abundance

Fish sampling in Glenn Lake yielded a total of 425 fish consisting of four species (Table 6.7). Cisco made up the majority of the catch (89.2%), followed by lake trout (9.4%), Arctic char (0.9%), and ninespine stickleback (0.9%). Glenn Lake was not sampled during previous programs in the Hope Bay Belt.

Table 6.7 Fish Species and Number of Fish Captured in Glenn Lake, 2007

Capture Method	Arctic char	Cisco	Lake trout	Lake whitefish	Total
Backpack electrofishing	3		8		**11**
Gill nets	1	379	32	2	**414**
Total	**4 (0.9%)**	**379 (89.2%)**	**40 (9.4%)**	**2 (0.5%)**	**425 (100.0%)**

Life History Data

Arctic Char

Four juvenile Arctic char were captured in Glenn Lake. The fork lengths ranged from 193 to 241 mm ($n = 3$), and the weights ranged from 80 to 160 (mean of 1.32 g) (Appendix E9). The condition factor for these fish ranged from 1.11 to 1.19 (mean of 1.15) (Appendix E9), which was higher than the condition factors previously reported for Arctic char captured in the Doris Project area in 2006 and 2007 (Golder 2007, 2008b).

Lake Trout

Forty lake trout were captured in Glenn Lake. In general, the fork lengths were distributed evenly across size-classes, ranging from 152 to 750 mm ($n = 34$;

Figure 6.4). The 300 to 350 mm and 650 to 700 mm size-classes had higher length frequencies than the other size-classes. The weights for 32 of the lake trout ranged between 36 and 4753 g.

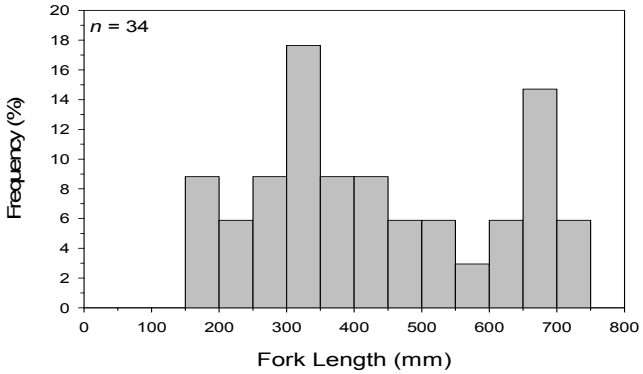


Figure 6.4 Length-Frequency Distribution for Lake Trout Captured in Glenn Lake, 2007

The length-weight relationship for lake trout captured in Glenn Lake (Figure 6.5) was described by the following equation, where W is weight in grams and L is fork length in millimetres:

$W = 7.26 \times 10^{-6} * L^{3.056}$ (n = 32, $r^2 = 0.97$)

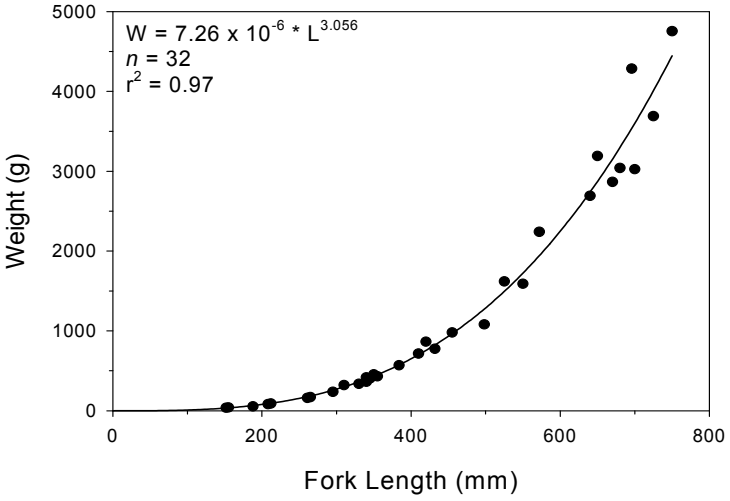


Figure 6.5 Length-Weight Relationship for Lake Trout in Glenn Lake, 2007

Condition factor for individual lake trout ranged from 0.83 to 1.27 (Appendix E9). The mean condition factor (1.01) is lower than the mean reported for lake trout

captured in Roberts Lake (1.12 in 2006 and 1.10 in 2007), which also contains both resident and anadromous lake trout (Golder 2007, 2008b).

Lake Whitefish

Two lake whitefish were captured in Glenn Lake. Fork lengths of the whitefish were 435 and 449 mm and weights were 1165 and 1345 g, respectively. The condition factors for these fish were 1.41 and 1.49 (Appendix E9), which are similar to those reported in other waterbodies sampled in 2006 and 2007 (Golder 2007, 2008b).

Cisco

In total, 379 cisco were captured in Glenn Lake. Life history measurements were recorded for only the six fish that were retained for tissue analysis as part of Ms. Swanson's PhD thesis research. These fish ranged in fork length from 213 to 250 mm and ranged in weight from 100 to 175 g (Appendix E9). The mean condition factor was 1.12 (range 1.03 to 1.19) (Appendix E9).

6.3.3.2 Ogama Lake

Angling, backpack electrofishing, beach seining, gill netting, and minnow trapping were used to capture fish in Ogama Lake from 2 to 6 August 2006.

Species Composition and Relative Abundance

Fish sampling in Ogama Lake yielded a total of 383 fish of four species (Table 6.8). Cisco made up the largest proportion of the catch (78.3%), followed by ninespine stickleback (11.2%), lake whitefish (9.7%), and lake trout (0.8%). Lake trout, lake whitefish, and cisco were captured during a study conducted by Rescan Environmental in 1996 (RL&L/Golder 2002).

Table 6.8 Fish Species and Number of Fish Captured in Ogama Lake, 2006

Capture Method	Cisco	Ninespine stickleback	Lake whitefish	Lake trout	Total
Angling				1	**1**
Backpack electrofishing		1	1		**2**
Beach seine	275		26		**301**
Gill nets	25		10	2	**37**
Minnow traps		42			**42**
Total	**300 (78.3%)**	**43 (11.2%)**	**37 (9.7%)**	**3 (0.8%)**	**383 (100.0%)**

Life History Data

Lake Trout

Three lake trout were captured in Ogama Lake. Fork lengths ranged from 550 to 665 mm. Lake trout weights ranged from 1455 to 3150 g, and the condition factors were between 0.84 and 1.07 (Appendix E9). The mean condition factor was 0.93, which was at the low end of the mean condition factors reported for lake trout captured in other waterbodies in 2006 and 2007 (means ranging from 0.94 to 1.36) (Appendix E9). Additional lake trout were also captured moving into and out of Ogama Lake through the streams at the north and south ends of the lake (see Sections 6.3.4.1 and 6.3.4.2).

Lake Whitefish

Of the 37 lake whitefish captured in Ogama Lake, 27 were YOY that ranged in fork length from 35 to 55 mm. To reduce mortality from handling stress, only two fish were measured (both 46 mm fork length) and the lengths of the remaing fish were estimated as they were counted and released. The 10 larger fish ranged in fork length from 294 to 346 mm and had a mean of 319 mm (Appendix E9). The weight range of these fish was 245 to 635 g (mean of 409 g), and the range of condition factors was 0.90 to 1.53 (mean 1.24) (Appendix E9). The mean condition factor of these fish was slightly lower than the mean condition factor of the lake whitefish captured Patch Lake (1.33) and P.O. Lake (1.36) in 2006 and 2007 (Appendix E9).

Cisco

Three hundred cisco from two distinct size-classes were captured in Ogama Lake. Most of the fish caught (92%) were YOY with estimated lengths between 35 and 60 mm (Appendix E1). The YOY cisco were counted and released with only estimating their lengths to reduce mortality caused by handling stress. Length measurements were taken for 25 larger fish; fork lengths for these larger fish ranged from 203 to 255 mm (Figure 6.6). The 25 larger cisco ranged in weight from 95 g to 195 g, and their condition factors ranged from 0.87 to 1.31 (Appendix E9). The mean condition factor for cisco captured in Ogama Lake was 1.13, which is only slightly higher than the mean condition factor reported for Patch Lake (1.11) and P.O. Lake (0.97) (Appendix E9).

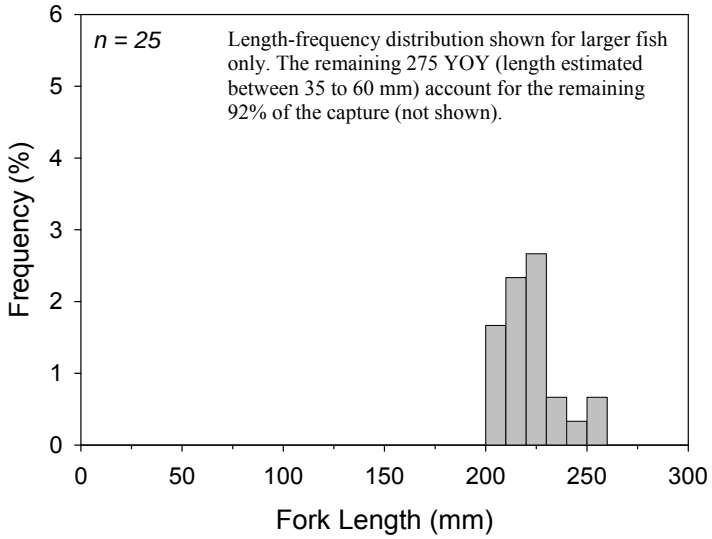


Figure 6.6 Length-Frequency Distribution for Larger Cisco Captured in Ogama Lake, 2006

Ninespine Stickleback

In total, 43 ninespine stickleback were captured in Ogama Lake. The fish ranged in length from 45 to 74 mm (Figure 6.7; Appendix E9). The majority (65%) of the fish were in the 50 to 60 mm length range (Figure 6.7).

6.3.3.3 Patch Lake

Angling, backpack electrofishing, fyke netting, gill netting, and minnow trapping were used to capture fish in Patch Lake on 25 to 28 July 2006, 9 to 18 July 2007, 12 to 19 and 28 August 2007 (Figures 6.2 and 6.8). The 2007 sampling was conducted to estimate the lake trout population size within the lake.

Species Composition and Relative Abundance

In total, 782 fish were captured during sampling efforts in Patch Lake in 2006 and 2007 (Table 6.9). Five fish species were identified in this study, wheras only lake trout, lake whitefish, and cisco were reported in previous studies by Rescan Environmental (RL&L/Golder 2002). Lake trout was the most common species in the catch (40.4%), followed by lake whitefish (29.8%), cisco (27.7%), a small number of least cisco (1.5%), and ninespine stickleback (0.5%). Gill nets were a very successful method for capturing fish in Patch Lake (Appendix E6).

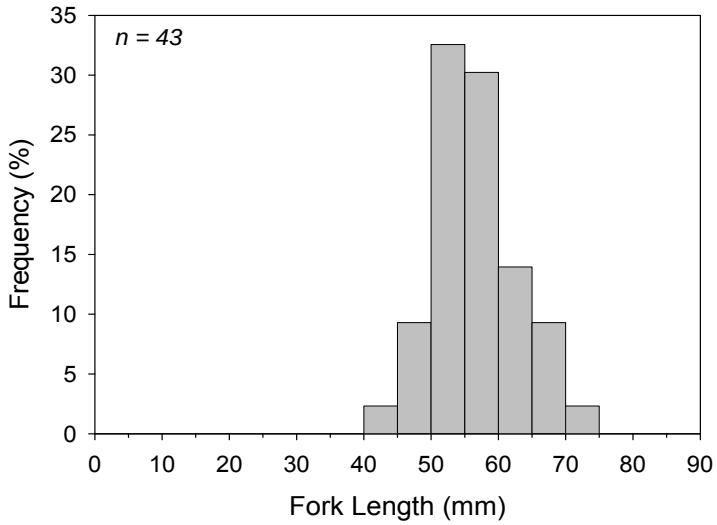
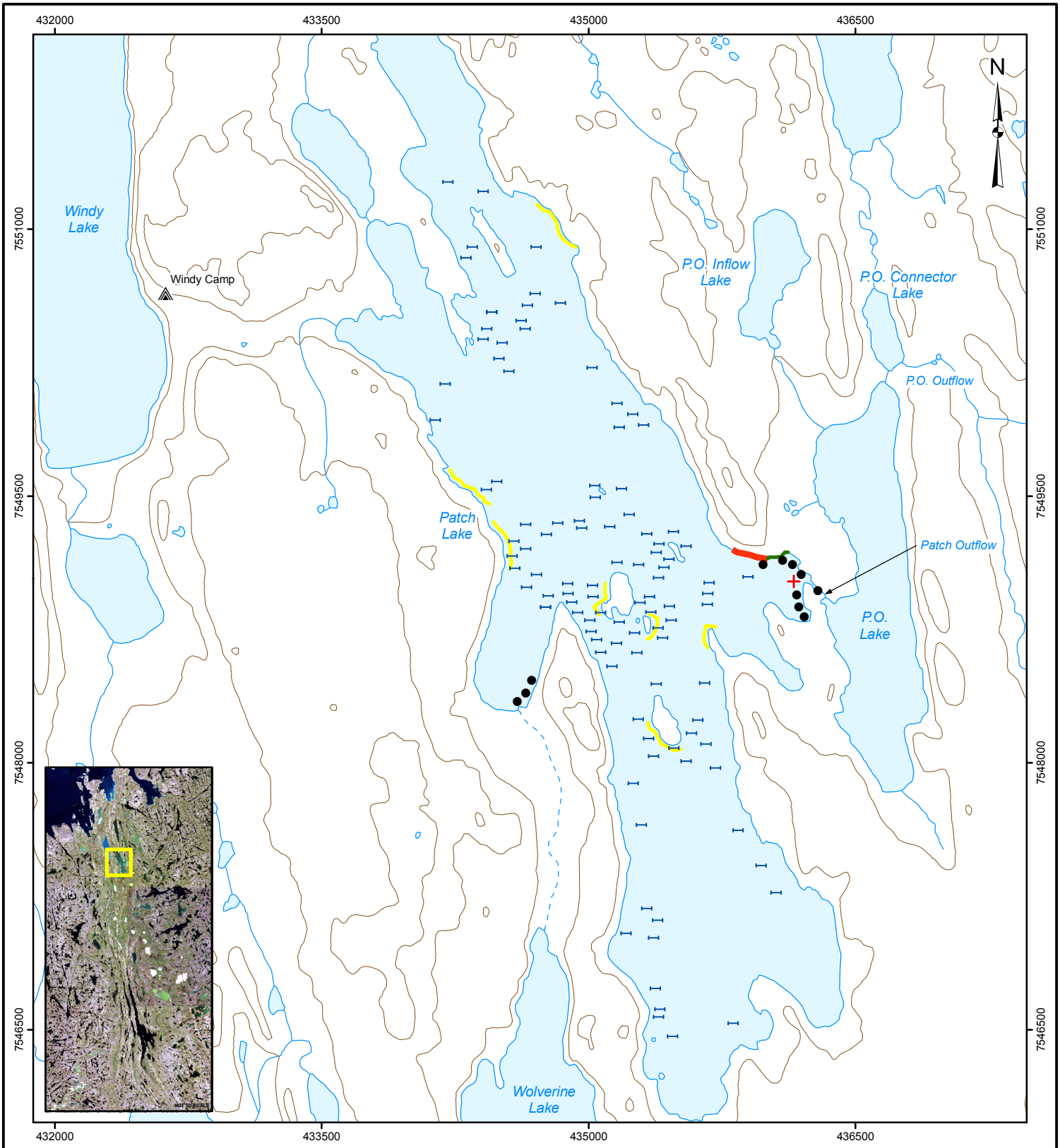


Figure 6.7 Length-Frequency Distribution for Ninespine Stickleback Captured in Ogama Lake, 2006

Table 6.9 Fish Species and Number of Fish Captured in Patch Lake, 2006 – 2007

Capture Method	Cisco	Lake trout	Lake whitefish	Least cisco	Ninespine stickleback	Total
Angling		9				**9**
Backpack electrofishing		1			1	**2**
Fyke nets	2	27	11			**40**
Gill nets	215	279	222	12		**728**
Minnow traps					3	**3**
Total	**217 (27.7%)**	**316 (40.4%)**	**233 (29.8%)**	**12 (1.5%)**	**4 (0.5%)**	**782 (100.0%)**



LEGEND

- CAMP
- ANGLING
- BACKPACK ELECTROFISHING
- BEACH SEINING
- FYKE NETTING
- GILL NETTING
- MINNOW TRAPPING
- CONTOUR (20 m INTERVAL)
- INTERMITTENT STREAM
- WATERCOURSE
- WATERBODY

750 0 750

SCALE 1:30000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT. The Gold Company

HOPE BAY MINING LTD.

TITLE

2007 FISH SAMPLING LOCATIONS IN PATCH LAKE MADRID PROJECT AREA

Golder Associates Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	28 Oct. 2008		
GIS	RC	11 Mar. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 6.8

M:\Projects\2008\1373\0026_HBML_Doris_North_Environmental_Programs\MapDocs\2007_Revised\Fig1_1_AQ_RF_ProjectLocation_09Jan2009.mxd

Life History Data

Lake Trout

In total, 316 lake trout were captured in Patch Lake. Fork lengths for 300 measured fish ranged from 277 to 980 mm, with a unimodal size distribution (Figure 6.9). The most frequently captured size-class was 700 to 710 mm (6.7% of the captured fish), and 56% of the captured fish were between 610 and 720 mm (Figure 6.9). Lake trout (*n* = 203) ranged in weight from 195 to 8695 g (Appendix E9).

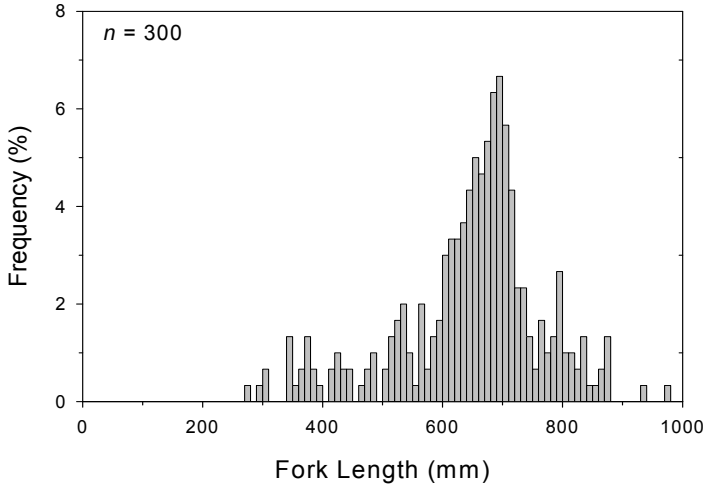


Figure 6.9 Length-Frequency Distribution for Lake Trout Captured in Patch Lake, 2006 – 2007

The length-weight relationship for lake trout captured in Patch Lake (Figure 6.10) was described by the following equation, where W is weight in grams and L is fork length in millimetres:

$$W = 2.84 \times 10^{-5} * L^{2.842} \qquad (n = 203, r^2 = 0.95)$$

Condition factors for individual lake trout ranged from 0.74 to 1.49 (Appendix E9), which was similar to the fish captured during previous studies in Patch Lake (ranging from 0.56 to 1.35) conducted by Rescan Environmental (RL&L/Golder 2002). The mean condition factor during the present study (1.03) was higher than the mean reported for P.O. Lake (0.84) (Appendix E9).

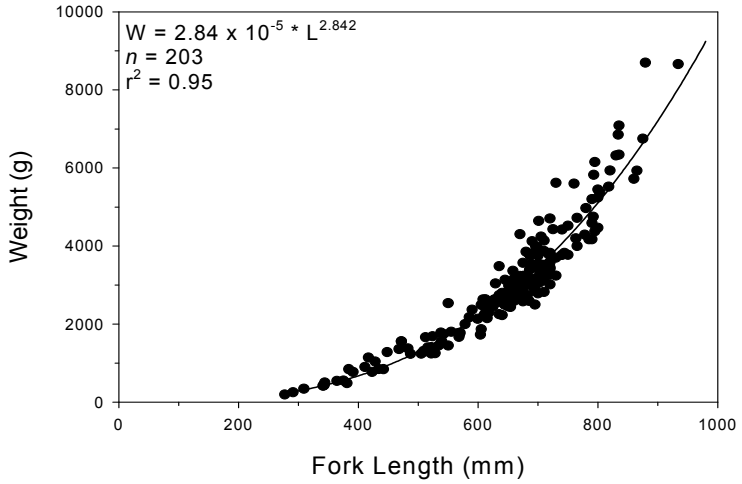


Figure 6.10 Length-Weight Relationship for Lake Trout in Patch Lake, 2006 – 2007

Lake Whitefish

In total, 233 lake whitefish were captured during fyke net and gill net sampling efforts in Patch Lake. Fork lengths for 225 of these fish ranged from 214 to 615 mm (Figure 6.11). The length-frequency distribution was unimodal, with the greatest number of fish captured in the 360 to 370 mm fork length size-class (9.8%). The majority of the captured fish were between 340 and 350 mm in fork length (Figure 6.11). Weights for the lake whitefish (n = 131) ranged from 158 to 1825 g (Appendix E9).

The length-weight relationship for lake whitefish captured in Patch Lake (Figure 6.12) was described by the following equation, where W is weight in grams and L is fork length in millimetres:

$W = 1.35 \times 10^{-6} * L^{2.996}$ (n = 131, $r^2 = 0.92$)

Condition factors for lake whitefish in Patch Lake ranged from 0.82 to 1.75, with a mean of 1.34 (Appendix E9), which was similar to the range previously reported for Patch Lake (0.84 to 1.73) (RL&L/Golder 2002). The mean condition factor was also similar to the mean condition factor reported for the connected P.O. Lake (1.36) in 2006 (Appendix E9).

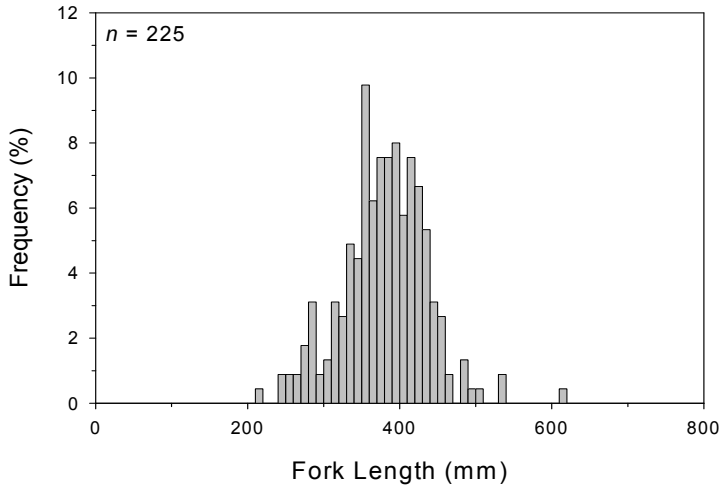


Figure 6.11 Length-Frequency Distribution for Lake Whitefish Captured in Patch Lake, 2006 – 2007

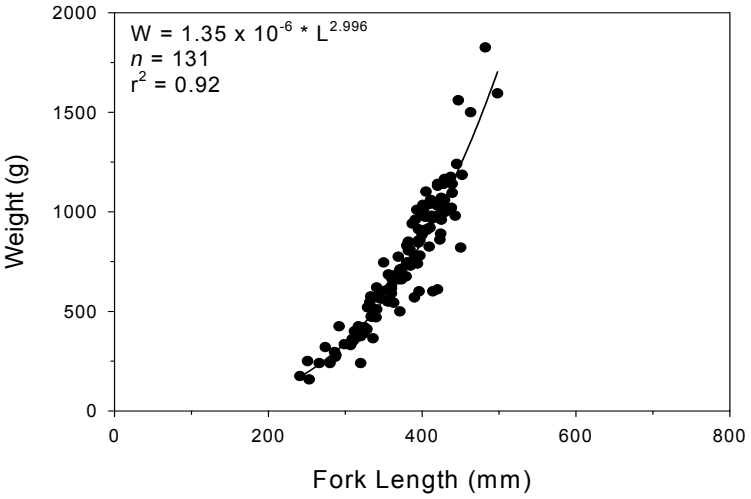


Figure 6.12 Length-Weight Relationship for Lake Whitefish in Patch Lake, 2006 – 2007

Cisco

In total, 217 cisco were captured in Patch Lake. Fork lengths of the cisco (n = 195) ranged from 85 to 450 mm, and the weights (n = 90) ranged from 13 to 378 g (Appendix E9). Most (95%) of cisco captured were less than 300 mm, and the most frequently captured size-class was 220 to 230 mm (13.3%) (Figure 6.13).

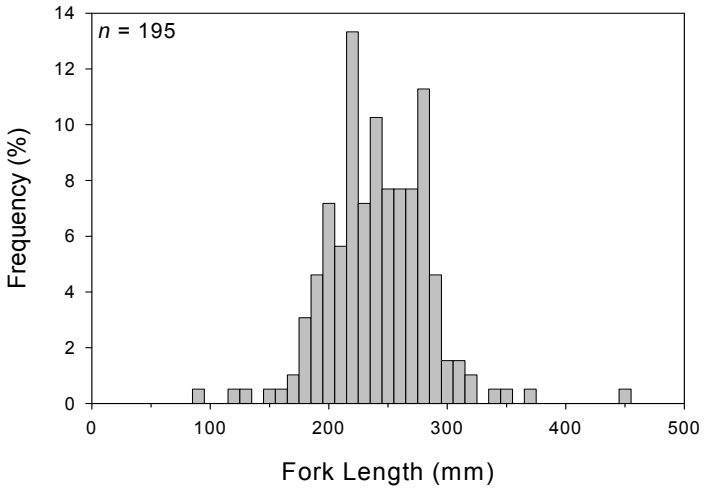


Figure 6.13 Length-Frequency Distribution for Cisco Captured in Patch Lake, 2006 – 2007

The length-weight relationship for cisco captured in Patch Lake (Figure 6.14) was described by the following equation, where W is weight in grams and L is fork length in millimetres:

$W = 2.71 \times 10^{-6} * L^{3.252}$ (n = 90, $r^2 = 0.94$)

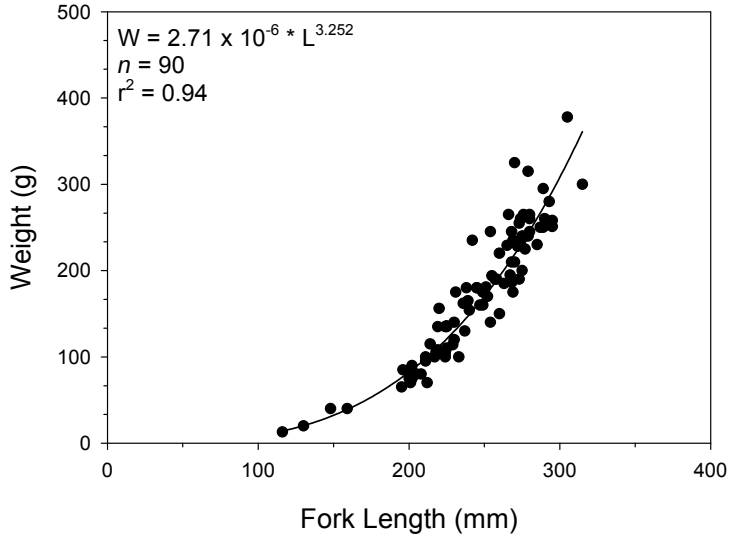


Figure 6.14 Length-Weight Relationship for Cisco in Patch Lake, 2006 – 2007

Condition factors for cisco caught in Patch Lake ranged from 0.73 to 1.50 (Appendix E9). The mean condition factor (1.09) for cisco in this study was higher than the mean condition factor reported in previous studies on Patch Lake (0.98) (RL&L/Golder 2002).

Least Cisco

Twelve least cisco were captured in Patch Lake. Fork lengths ranged between 204 and 253 mm (Appendix E9). Least cisco have not previously been reported in Patch Lake. Differentiating between cisco species is difficult due to the high degree of similarily between species and morphological variation within each species (Scott and Crossman 1973). It is possible that some of the cisco reported in previous years were, in fact, least cisco.

Ninespine Stickleback

Four ninespine stickleback, ranging in length between 45 and 73 mm, were captured in Patch Lake (Appendix E9).

6.3.3.4 Patch Lake Population Estimation

Methods

The lake trout population in Patch Lake was estimated from mark-recapture data collected from multiple sets of gill nets in summer 2007 (18 days in total from July to August with set locations throughout the area of the lake, though there was greater effort in the central deep areas of the lake; Figure 6.8). It was assumed that fish had not left or entered the lake, and had not given birth or died during the sampling period. Closed population models in program MARK (Cooch and White 2006) were used to evaluate the data. The program MARK and related guide to mark-recapture analyses are available online at no cost at http://www.phidot.org/software/ (visited 24 January 2008).

These models allow animals to have unique capture probabilities (i.e., heterogeneity) and, therefore, are the most realistic models to fit fisheries applications (Pine et al. 2003). Although the Schnabel model (Ricker 1975) can be easily applied in Microsoft Excel™ spreadsheet calculators, the Schnabel model assumes that capture probabilities among animals are equal (i.e., no heterogeneity). Further, MARK encompasses almost all currently used methods for analysis of marked individuals, and offers more flexibility and power in statistical modeling and hypothesis testing than other available programs. MARK can fit and evaluate several models, in addition to the Schnabel model, using Akaike's Information Criterion (Burnham and Anderson 2002). It is also important to note that if the monitoring program at Patch Lake was extended to a multi-year program, MARK has the option of robust population models for calculation of population sizes during short-term studies, as well as survival and recruitment to be estimated with a Jolly-Serber model for the intervals between the closed periods (Pollock 1982).

The model types used in analyses are described in detail in Otis et al. (1978). Specifically, six types of models were examined: M0, Mb, Mt, as well as M0,

Mb and Mt with heterogeneity (two mixtures). M0 is the simplest model for closed populations and does not allow for changes in capture probability due to heterogeneity, behavior, or time. Mh (heterogeneity model) allows each animal to have a unique capture probability (for example, due to size or sex), but this capture probability must remain constant among all sampling periods. The trap response/behaviour model Mb estimates an initial capture probability (pi) and recapture probability (ci) that may differ from each other. The model Mt allows capture probability to vary among sampling periods, but it must remain constant among individuals for each period. This model is also called the Schnabel model.

Information Theory, specifically Akaike's Information Criterion corrected for small sample sizes (AICc), (Burnham and Andersen 2002) was used to select models for estimating the population size of lake trout. The best model had the smallest AICc value ($AICc_{min}$; Appendix C10). Primary inference was drawn from this model and others within two units of $AICc_{min}$ (Burnham and Andersen 2002).

Results

In brief, AICc identified Mt as the top model. There were no models within two AICc units of the top model (i.e., Mt). Probability of capture varied among sampling occasions. The lowest capture probability was 0.0009 (sampling day 1), whereas the highest was 0.026 (sampling day 12). The overall mean probability of capture was low (0.012). The population size of lake trout greater than 300 mm in Patch Lake was estimated to be 1159 individuals (95% CI = 825 to 1680 individuals; Appendix E10).

6.3.3.5 P.O. Lake

Beach seines, fyke nets, gill nets, dip nets, and minnow traps were used to sample fish communities in P.O. Lake on 30 and 31 July 2006.

Species Composition and Relative Abundance

Fish sampling in P.O. Lake resulted in the capture of 102 fish consisting of four species (Table 6.10). Ninespine stickleback were captured the most frequently (76.5%), followed by lake trout (13.7%), lake whitefish (6.8%), and cisco (3.0%). P.O. Lake was not fished in previous studies. The majority (65%) of the ninespine stickleback sampled were collected by dip netting in a disconnected pool beside P.O. Lake. These fish were not included in the CPUE calculations or life history statistics.

Table 6.10 Fish Species and Number of Fish Captured in P.O. Lake, 2006

Capture Method	Ninespine stickleback	Lake trout	Lake whitefish	Cisco	Total
Beach seine	6				**6**
Dip Net	51				**51**
Fyke nets		9		1	**10**
Gill nets		5	7	2	**14**
Minnow traps	21				**21**
Total	**78 (76.5%)**	**14 (13.7%)**	**7 (6.8%)**	**3 (3.0%)**	**102 (100.0%)**

Lake trout and cisco were also captured in a fyke net set near the lake outflow. Ninespine stickleback were captured in beach seines and minnow traps set along the shoreline of the lake (Table 6.10). Abundant aquatic vegetation in these areas provided good habitat for forage fish species, such as ninespine stickleback.

Life History Data

Lake Trout

Fourteen lake trout were caught in P.O. Lake. Individual fish ranged in fork length from 304 to 725 mm, but the majority of fish (71%) were greater than 600 mm in length. Weights fell between 265 and 3000 g (mean of 1808 g) and condition factors ranged from 0.77 to 1.11 (mean of 0.92) (Appendix E9). The mean condition factor was lower than the mean condition factor reported for Patch Lake (1.03) and Ogama Lake (0.93) (Appendix E9).

Lake Whitefish

Seven lake whitefish were captured in P.O. Lake. The mean fork length for lake whitefish was 365 mm and the range was 300 to 434 mm. Fish weights ranged from 330 to 1365 g (n = 6), and the condition factors ranged from 1.22 to 1.67 (Appendix E9). The mean condition factor was 1.36, which was similar to the mean condition factor reported for lake whitefish in Patch Lake (1.33) and was slightly higher than the condition factor reported for Ogama Lake (1.24) (Appendix E9).

Ninespine Stickleback

Twenty-seven ninespine stickleback were captured in P.O. Lake, ranging in length from 21 to 65 mm (Appendix E9). Seventy percent of the ninespine stickleback were between 40 and 60 mm in length (Figure 6.15). Fifty-one additional ninespine stickleback were collected from a disconnected pool on the shore of P.O. Lake. The length of these fish was estimated to be 20 to 25 mm (Appendix E1).

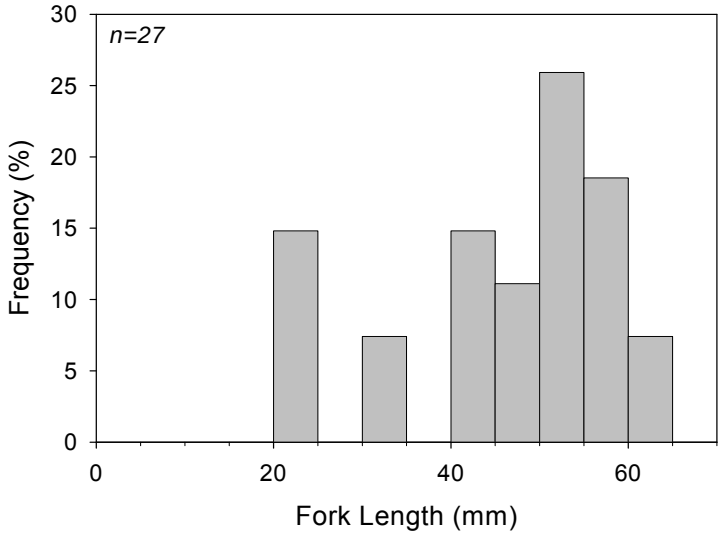


Figure 6.15 Length-Frequency Distribution for Ninespine Stickleback Captured in P.O. Lake, 2006

Cisco

Three cisco were captured in P.O. Lake. Fork lengths for individual fish ranged from 204 to 215 mm. Weights of these fish were between 80 and 95 g. The condition factors of these fish ranged between 0.88 and 1.12, with a mean of 0.97 (Appendix E9), which was slightly lower than the mean condition factor reported for Patch Lake (1.09) and Ogama Lake (1.13) (Appendix E9).

6.3.3.6 P.O. Connector Lake

P.O. Connector Lake is the small waterbody located between P.O. Lake and Ogama Lake (Figure 6.2). Beach seining, fyke netting, gill netting, minnow trapping, and dip netting were used to sample for fish species present in P.O. Connector Lake on 31 July and 1 to 2 August 2006.

Species Composition and Relative Abundance

Fish sampling in P.O. Connector Lake yielded a total of 114 fish representing three species (Table 6.11). Ninespine stickleback was the most frequently captured species (91.2%), followed by lake trout (6.1%), and lake whitefish (2.6%). P.O. Connector Lake had not been sampled during previous fish sampling programs. In 2006, ninespine stickleback were observed throughout aquatic vegetation along the north shore of the lake and appeared to be quite abundant. Several fish were captured opportunistically by dip netting in vegetated littoral areas.

Table 6.11 Fish Species and Number of Fish Captured in P.O. Connector Lake, 2006

Capture Method	Ninespine stickleback	Lake trout	Lake whitefish	Total
Beach seine		1		**1**
Dip nets	5	1		**6**
Fyke nets	27		1	**28**
Gill nets		5	2	**7**
Minnow traps	72			**72**
Total	**104 (91.2%)**	**7 (6.1%)**	**3 (2.6%)**	**114 (100.0%)**

Life History Data

Lake Trout

The seven lake trout caught in P.O. Connector Lake ranged in fork length from 349 to 710 mm. Only five of the captured lake trout were weighed; their weights ranged between 415 and 2985 g, and their condition factors ranged from 0.83 to 1.08 (Appendix E9). The mean condition factor was 0.94, which was similar to the mean reported condition factors for P.O. Lake (0.84) and Ogama Lake (0.93) (Appendix E9).

Lake Whitefish

The three lake whitefish caught in P.O. Connector Lake ranged in fork length from 74 to 367 mm. Two fish were weighed (465 and 590 g). These two fish were in good condition as indicated by their condition factors of 1.19 and 1.41 (Appendix E9). The condition factors for these fish were similar to the mean condition factor reported for P.O. Lake (1.36) and Ogama Lake (1.24) (Appendix E9).

Ninespine Stickleback

Ninespine stickleback (n = 104) from P.O. Connector Lake ranged in fork length from 35 to 70 mm (Appendix E9). The majority of captured fish (60.5%) were between 45 and 54 mm (Figure 6.16).

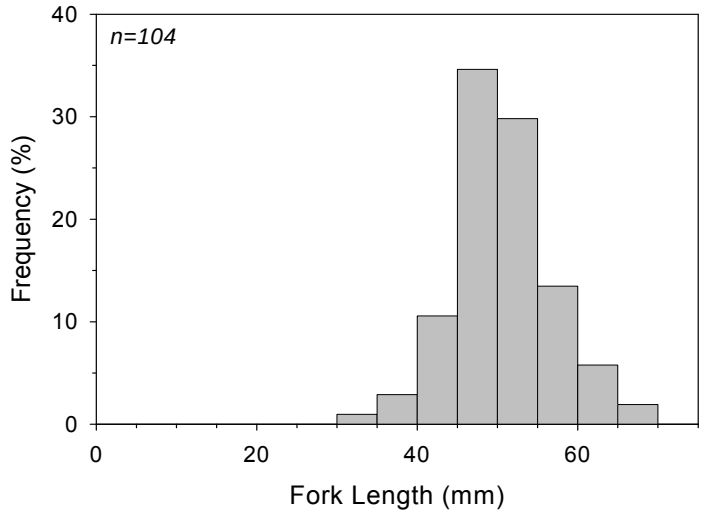


Figure 6.16 Length-Frequency Distribution for Ninespine Stickleback Captured in P.O. Connector Lake, 2006

6.3.3.7 P.O. Inflow Lake

P.O. Inflow Lake is the small waterbody located to the north-west of P.O. Lake and P.O. Connector Lake (Figure 6.2). This lake drains south-east into P.O. Lake. Backpack electrofishing, beach seining, gill netting, and minnow trapping were used to capture fish in P.O. Inflow Lake on 6 and 7 August 2006.

Species Composition and Relative Abundance

In total, 671 fish were captured in P.O. Inflow Lake (Table 6.12). Fish catch was comprised of two species. Ninespine stickleback was the most abundant species (68.4%) in the catch and cisco made up the remainder of the catch (31.6%). Of all the sampled lakes in the Boston and Madrid Project areas, P.O. Inflow Lake had the highest CPUE values for backpack electrofishing (11.9 fish/100 s) and beach seining (625.0 fish/100 m^2) (Appendices E3 and E4).

Table 6.12 Fish Species and Number of Fish Captured in P.O. Inflow Lake, 2006

Capture Method	Ninespine stickleback	Cisco	Total
Backpack electrofishing	121	12	**133**
Beach seine	300	200	**500**
Gill nets			
Minnow traps	38		**38**
Total	**459 (68.4%)**	**212 (31.6%)**	**671 (100.0%)**

Life History Data

Cisco

In total, 212 cisco were captured in P.O. Inflow Lake. Lengths were measured from a subset of cisco captured in the lake; mean fork length (n = 21) was 53 mm. Fork lengths for measured fish ranged from 35 to 79 mm (Appendix E9). The majority of cisco (62%) were between 40 and 60 mm in fork length (Figure 6.17).

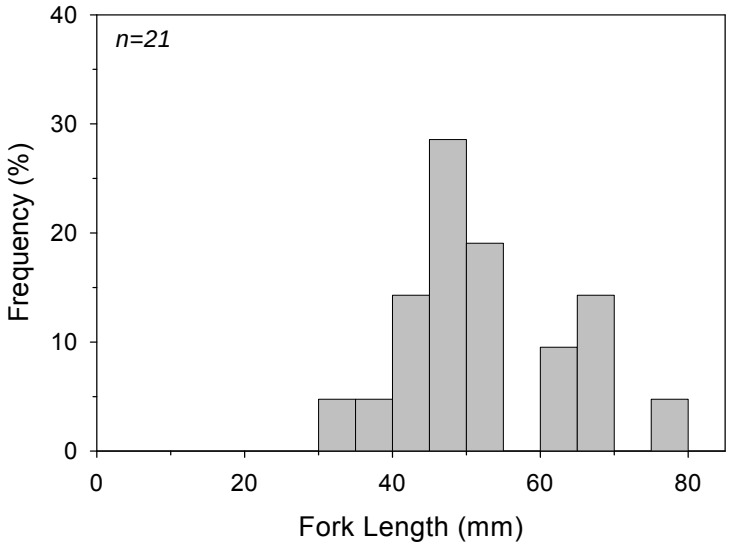


Figure 6.17 Length-Frequency Distribution for Cisco Captured in P.O. Inflow Lake, 2006

Ninespine Stickleback

In total, 459 ninespine stickleback were captured in P.O. Inflow Lake. Lengths were measured from a subset of the total catch. Fork length for measured fish (n = 169) ranged from 20 to 78 mm (Appendix E9). Most of the fish captured (81%) were between 40 and 60 mm in fork length (Figure 6.18).

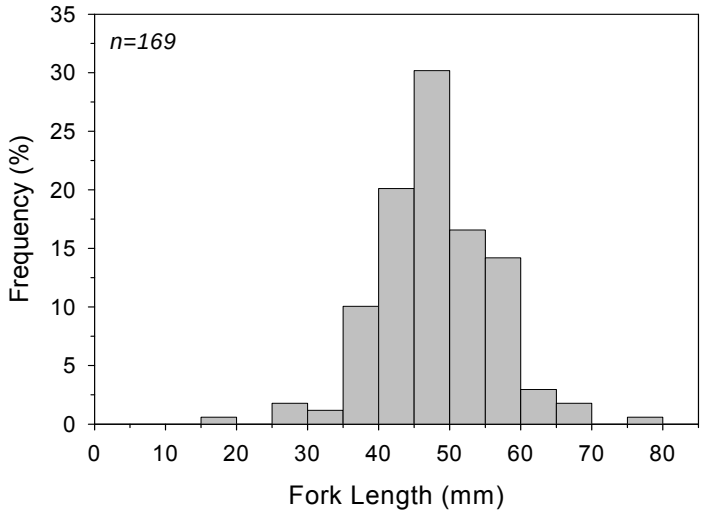


Figure 6.18 Length-Frequency Distribution for Ninespine Stickleback Captured in P.O. Inflow Lake, 2006

6.3.3.8 Wolverine Lake

Angling, backpack electrofishing, beach seining, gill netting, and minnow trapping were used to capture fish in Wolverine Lake on 23 and 24 July 2006, 7 August 2006, and 31 August 2007.

Species Composition and Relative Abundance

Fish sampling in Wolverine Lake yielded a total of 4389 individual fish consisting of two species (Table 6.13). Least cisco made up most of the catch (91.1%) and were captured primarily in two beach seine hauls in 2006. Ninespine stickleback (8.9%) made up the remainder of the catch. Beach seining was very successful for capturing fish (Table 6.13).

Table 6.13 Fish Species and Number of Fish Captured in Wolverine Lake, 2006 – 2007

Capture Method	Least cisco	Ninespine stickleback	Total
Backpack electrofishing		74	**74**
Beach seine	3997	214	**4211**
Gill nets		1	**1**
Minnow traps	3	100	**103**
Total	**4000 (91.1%)**	**389 (8.9%)**	**4389 (100.0%)**

Life History Data

Least Cisco

Large numbers (*n* = ~4000) of small least cisco were captured during beach seining efforts along the north-west shoreline of Wolverine Lake. Least cisco that were measured (*n* = 114) ranged from 35 to 85 mm in fork length (Figure 6.19; Appendix E9). The length-frequency distribution was bimodal with 46% of the cisco measuring between 40 and 54 mm and 32% measuring between 65 and 74 mm (Figure 6.19). The unmeasured fish were estimated to have fork lengths between 45 and 70 mm (Appendix E1).

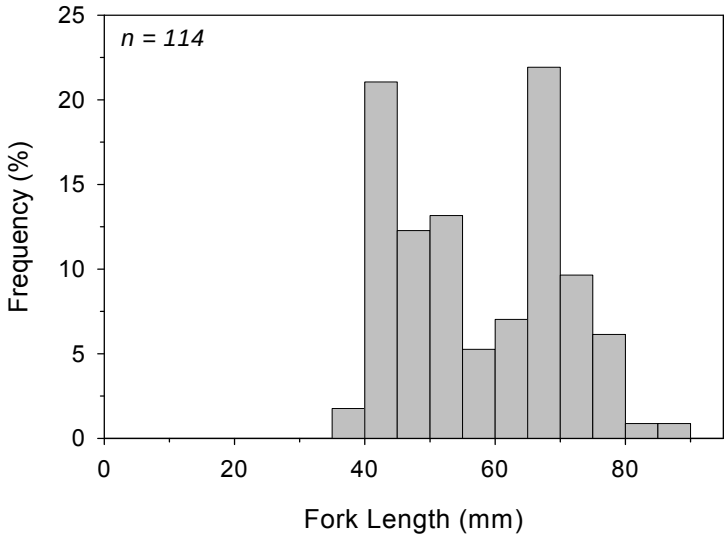


Figure 6.19 Length-Frequency Distribution for Least Cisco Captured in Wolverine Lake, 2006 – 2007

Differentiating between the various species of cisco is difficult for small fish. To accurately identify the cisco species present in Wolverine Lake, several of the least cisco were retained for dissection. During the dissections, Golder Associates Ltd. discovered that many of these small least cisco were actually mature adults. Wolverine Lake is a small, shallow lake that appears to have only intermittent stream flows connecting it to Patch Lake. These least cisco may have stunted growth as a result of the lake isolation, small size, and lack of predator fish species in the lake.

Ninespine Stickleback

In total, 389 ninespine stickleback were captured in Wolverine Lake. Lengths of 221 ninespine stickleback that were measured ranged from 10 to 65 mm (Figure 6.20; Appendix E9). The remaining unmeasured fish were estimated to

be between 30 and 70 mm (Appendix E1). The majority (87%) of the ninespine stickleback captured were between 40 and 65 mm (Figure 6.20).

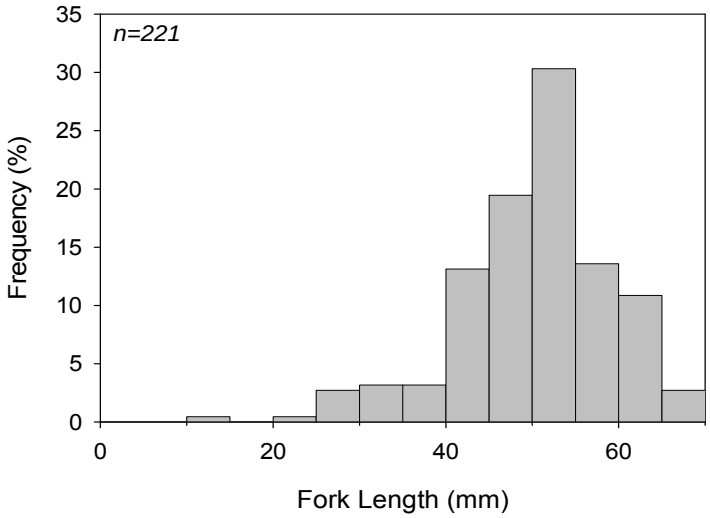


Figure 6.20 Length-Frequency Distribution for Ninespine Stickleback Captured in Wolverine Lake, 2006 – 2007

6.3.4 Madrid Project Area Stream Communities

6.3.4.1 Ogama Inflow

Fish sampling took place in Ogama Inflow, upstream of the confluence with Ogama Lake, on 2 to 4 August 2006. Fish capture methods included backpack electrofishing and minnow trapping. In addition, a fyke net was installed in the inflow to capture fish moving out of Ogama Lake.

Species Composition and Relative Abundance

Fish sampling in Ogama Inflow yielded a total of 60 fish representing three species. Ninespine stickleback contributed the largest proportion of the overall catch (68.3%), followed by lake trout (23.3%), and lake whitefish (8.3%) (Table 6.14). Earlier studies conducted by Rescan Environmental reported the presence of lake trout, lake whitefish, cisco, and ninespine stickleback in two Ogama inflows, including the main inflow from P.O. Lake (RL&L/Golder 2002). Fyke netting efforts in the present study resulted in the capture of all three species including fish of all sizes ranging from 21 to 790 mm in length (Appendix E1). Minnow trapping had a higher CPUE (10.3 fish/h) in Ogama Inflow than in the Koignuk River, which was the only other stream with minnow trapping effort in 2006 and 2007 (Appendix E7).

Table 6.14 Fish Species and Number of Fish Captured in Ogama Inflow, 2006

Capture Method	Ninespine stickleback	Lake whitefish	Lake trout	Total
Backpack electrofishing	2		2	**4**
Fyke nets	3	5	12	**20**
Minnow traps	36			**36**
Total	**41 (68.3%)**	**5 (8.3%)**	**14 (23.3%)**	**60 (100.0%)**

Life History Data

Lake Trout

Fourteen lake trout were caught in Ogama Inflow. The lake trout were primarily large in size and were captured during fyke netting efforts near the mouth at Ogama Lake. The fyke net was set across the entire channel to capture all fish moving upstream out of Ogama Lake. The lake trout captured ranged in fork length from 420 to 790 mm (Appendix E9). The weights of 12 of the captured fish ranged between 660 and 1440 g, and the condition factors ranged from 0.84 to 1.14. The mean condition factor was 0.96, which was similar to the mean condition of lake trout captured in Ogama Lake (0.93) in 2006 (Appendix E9) and during previous studies in Ogama Inflow (mean of 0.96) (RL&L/Golder 2002).

Lake Whitefish

There were five lake whitefish captured in Ogama Inflow. One larger lake whitefish was 342 mm in fork length (Appendix E9). The remaining four fish were YOY and ranged in length from 35 to 50 mm (Appendix E9).

Ninespine Stickleback

Forty-one ninespine stickleback were captured in Ogama Inflow. The mean fork length of the measured fish was 55 mm. The range in lengths for individual fish was 40 to 71 mm (Appendix E9), and the majority (78%) of the fish were between 50 and 69 mm (Figure 6.21).

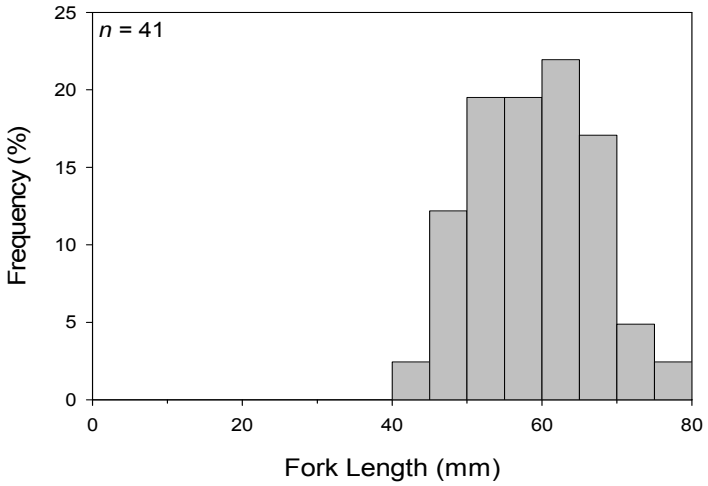


Figure 6.21 Length-Frequency Distribution for Ninespine Stickleback Captured in Ogama Inflow, 2006 – 2007

6.3.4.2 Ogama Outflow

Fish sampling took place within Ogama Outflow on 5 and 6 August 2006 using a backpack electrofisher and fyke net. The fyke net was set across the outflow to capture fish moving downstream out of Ogama Lake.

Species Composition and Relative Abundance

Fish sampling in Ogama Outflow yielded a total of 222 fish representing four species. Ninespine stickleback contributed the largest proportion of the overall catch (94.6%), followed by lake trout (3.2%), lake whitefish (1.8%), and cisco (0.5%) (Table 6.15). Previous sampling programs also reported the presence of these four species in Ogama Outflow (RL&L/Golder 2002).

Table 6.15 Fish Species and Number of Fish Captured in Ogama Outflow, 2006

Capture Method	Cisco	Ninespine stickleback	Lake whitefish	Lake trout	Total
Backpack electrofishing		27		2	**29**
Fyke nets	1	183	4	5	**193**
Total	**1 (0.5%)**	**210 (94.6%)**	**4 (1.8%)**	**7 (3.2%)**	**222 (100.0%)**

Life History Data

Lake Trout

Seven lake trout were captured in Ogama Outflow during electrofishing and fyke netting efforts near the outlet at Ogama Lake. Individual fish ranged in fork length from 283 to 539 mm (Appendix E9). Weights of the lake trout were between 280 and 1400 g, and the mean condition factor was 1.08 (ranging from 0.89 to 1.26) (Appendix E9). The mean condition factor for these fish was slightly higher than the condition of lake trout that were captured in Ogama Lake (0.93) and Ogama Inflow (0.96) (Appendix E9).

Lake Whitefish

Four lake whitefish ranging in lengths from 292 to 322 mm (Appendix E9) were caught in Ogama Outflow. The weights of the lake whitefish ranged from 400 to 500 g, and the condition factors ranged from 1.45 to 1.68, with a mean of 1.56 indicating the fish were robust (Appendix E9). The mean condition factor was higher in Ogama Outflow in this study than in previous studies by Rescan Environmental (mean of 1.16) (RL&L/Golder 2002). The mean condition factor was also higher than the mean condition factor reported for Ogama Lake (1.24) (Appendix E9). All lake whitefish were captured in the fyke net set across the outflow channel and were caught moving from Ogama Lake into the outflow.

Cisco

One cisco was caught in Ogama Outflow. This fish had a length of 231 mm and a weight of 145 g (Appendix E9). The condition factor was 1.18, which was similar to the reported mean condition factor for cisco captured in Ogama Lake (1.13) (Appendix E9).

Ninespine stickleback

In total, 210 ninespine stickleback were captured in the Ogama Outflow. Lengths of the fish (n = 150) ranged from 21 to 83 mm (Figure 6.22; Appendix E9). The majority (64%) of captured fish were between 30 and 45 mm (Figure 6.22).

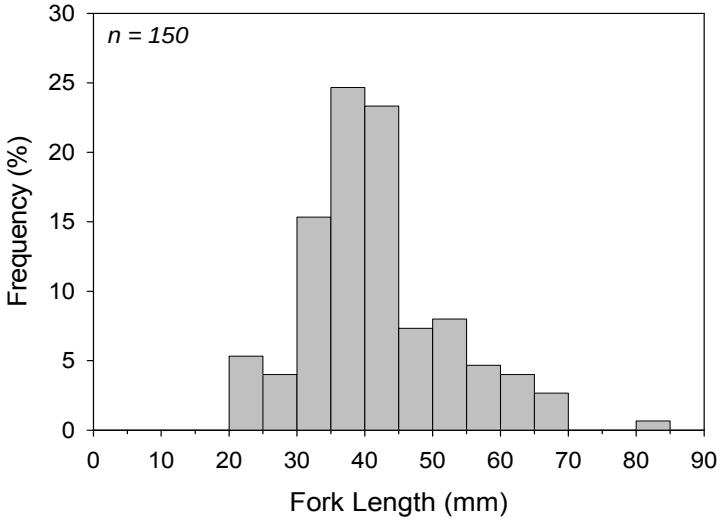


Figure 6.22 Length-Frequency Distribution for Ninespine Stickleback Captured in Ogama Outflow, 2006

6.3.4.3 Patch Outflow

Beach seining was conducted along the length of Patch Outflow on 27 July 2006 (Appendix E8). This was the first time Patch Outflow was sampled. Fish were not captured using this method; however, fish moving from Patch Outflow into Patch Lake were captured in a fyke net set in Patch Lake near the mouth of the outflow (See Section 6.4.3). One lake trout was observed but not captured during sampling efforts in Patch Outflow (Appendix E1).

6.3.4.4 P.O. Outflow

Fish sampling was conducted in P.O. Outflow (the stream connecting P.O. Lake to a small unnamed pond, P.O. Connector Lake, to the north between P.O. and Ogama lakes) on 30 July 2006. Fish sampling was conducted using beach seines and resulted in the capture of six ninespine stickleback (Appendix E4). Individual fork lengths ranged from 24 to 75 mm (Appendix E9). P.O. Outflow had not been sampled during previous studies.

6.4 SUMMARY

6.4.1 Boston Project Area

In total, 444 fish representing 10 species were encountered in the Boston Project area during fisheries surveys conducted in 2006 and 2007 (Tables 6.16 and 6.17). Fish sampling was conducted in five lakes as follows: Aimaokatalok Lake, Fickle Duck Lake, Reference Lake, and Stickleback Lake. Sampling was also conducted on the Koignuk and Aimaokatalok rivers and in three small streams including: Fickle Duck Outflow, Fickle Duck Inflow, and Stickleback Outflow. Overall, the most common fish species captured was ninespine stickleback (53.2%), followed by lake whitefish (29.5%), lake trout (9.0%), Arctic grayling (4.1%), Arctic flounder (1.4%), slimy sculpin (0.9%), burbot (0.7%), cisco (0.7%), fourhorn sculpin (0.5%), and Arctic char (0.2%) (Tables 6.16 and 6.17).

Table 6.16 Fish Species and Number of Fish Encountered in Lakes Sampled in the Boston Project Area, 2006

Species	Aimaokatalok Lake	Fickle Duck Lake	Reference Lake	Stickleback Lake	Total
Cisco	2		1		**3**
Lake trout	17	3	1		**21**
Ninespine stickleback	108	6	12	27	**153**
Total	**127**	**9**	**14**	**27**	**177**

Table 6.17 Fish Species and Number of Fish Encountered in Streams Sampled in the Boston Project Area, 2006 – 2007

Species	Aimaokatalok River	Fickle Duck Outflow	Fickle Duck Inflow	Koignuk River	Stickleback Outflow	Total
Arctic char				1		**1**
Arctic flounder				6		**6**
Arctic grayling				18		**18**
Burbot		**1**		2		**3**
Fourhorn sculpin				2		**2**
Lake trout	9	**1**		9		**19**
Lake whitefish				131		**131**
Ninespine stickleback	15	**7**	8	29	24	**83**
Slimy sculpin				3	1	**4**
Total	**24**	**9**	**8**	**201**	**25**	**267**

Based on the condition factors calculated for fish in the Boston Project area, the fish appear to be in good condition, and were in similar condition to other fish in the Hope Bay Belt (RL&L/Golder 2002; Golder 2007, 2008a, 2008b).

Lake Communities

In 2006, fish sampling was conducted in Aimaokatalok, Fickle Duck, Reference, and Stickleback lakes. Sampling methods included angling, backpack electrofishing, beach seining, fyke netting, gill netting, and minnow trapping.

During 2006, 177 fish representing three species were captured in the sampled lakes. Ninespine stickleback was the dominant species in the catch (86.4%); other species captured in the sampled lakes included lake trout (11.9%) and cisco (1.7%) (Table 6.16). In addition to these three species, lake whitefish and Arctic grayling were captured during previous studies in the Boston Project area lakes. (Golder 2008a). In a previous study conducted by Rescan, Arctic grayling were reported to have been captured in Fickle Duck Lake (Golder 2008a); however, this species was not captured in Fickle Duck Lake during the 2006 sampling program.

Stream Communities

In 2006, fish sampling was conducted in five streams/rivers in the Boston Project area. The streams flowing into and out of Fickle Duck Lake and the outflow from Stickleback Lake were sampled. The lowest reach of the Aimaokatalok River was sampled as it entered Aimaokatalok Lake, and the upper reaches of the Koignuk River downstream of Aimaokatalok Lake were sampled. In 2006 and 2007, the lower reaches of the Koignuk River, just upstream of the confluence at Hope Bay, also were sampled. Sampling methods included angling, backpack electrofishing, beach seining, gill netting, and minnow trapping.

In total, 267 fish representing nine species were captured. Lake whitefish was the dominant fish species (49.1%). This consisted primarily of young-of-the-year lake whitefish captured during beach seining efforts in the upper Koignuk River. Ninespine stickleback (31.1%), Arctic grayling (6.7%), lake trout (7.1%), slimy sculpin (1.5%), and burbot (1.1%) were also captured in these streams. The remaining 3.3% of the catch was composed of Arctic char, fourhorn sculpin, and Arctic flounder, which were only caught in the lower reaches of the Koignuk River (Table 6.17).

In 2006, burbot were captured in Fickle Duck Outflow and the Koignuk River, which were the first reported captures of this species in the Boston Project area. Fourhorn sculpin, Arctic flounder, Arctic char, and slimy sculpin were not captured during previous studies on the Koignuk River; however, these species

were captured in the lower reaches of the river in 2006 and 2007, which had not been sampled during the earlier sampling programs.

6.4.2 Madrid Project Area

In total, 7155 fish, representing six species, were encountered in the Madrid Project area during the fisheries surveys conducted in 2006 and 2007 (Tables 6.18 and 6.19). Fish sampling was conducted in seven lakes and four lake outflows/inflows. The lakes sampled included Glenn, Ogama, Patch, P.O., P.O. Connector, P.O. Inflow, and Wolverine lakes. The outflow streams from Ogama, Patch, and P.O. lakes, as well as the inflow stream to Ogama Lake were sampled. The most common fish species captured was least cisco (56.1%). Other species including ninespine stickleback (18.6%), cisco (15.5%), lake whitefish (4.1%), lake trout (5.6%), and Arctic char (0.1%) also were captured in lakes and streams in the area (Tables 6.18 and 6.19).

Table 6.18 Summary of Fish Species and Number of Fish Encountered in Lakes Sampled in the Madrid Project Area, 2006 – 2007

Species	Glenn Lake	Ogama Lake	Patch Lake	P.O. Lake	P.O. Connector Lake	P.O. Inflow Lake	Wolverine Lake	Total
Arctic char	4							**4**
Cisco	379	300	217	3		212		**1111**
Lake trout	40	3	316	14	7			**380**
Lake whitefish	2	37	233	7	3			**282**
Least cisco			12				4000	**4012**
Ninespine stickleback		43	4	78	104	459	389	**1077**
Total	**425**	**383**	**782**	**102**	**114**	**671**	**4389**	**6866**

Table 6.19 Summary of Fish Species and Number of Fish Encountered in Streams Sampled in the Madrid Project Area, 2006

Species	Ogama Inflow	Ogama Outflow	Patch Outflow	P.O. Lake Outflow	Total
Cisco		1			**1**
Lake trout	14	7	1		**22**
Lake whitefish	5	4			**9**
Ninespine stickleback	41	210		6	**257**
Total	**60**	**222**	**1**	**6**	**289**

In general, the fish captured in the Madrid Project area appeared to be in good condition and were within the reported ranges of condition factors for fish in the Hope Bay Belt (RL&L/Golder 2002; Golder 2007, 2008a, and 2008b).

Lake Communities

Fish sampling was conducted in Glenn, Ogama, Patch, P.O., P.O. Connector, P.O. Inflow, and Wolverine lakes. Glenn, P.O., P.O. Connector, P.O. Inflow, and Wolverine lakes were sampled for the first time during the 2006 – 2007 sampling program. Sampling methods included angling, backpack electrofishing, beach seining, fyke netting, gill netting, minnow trapping, and dip netting.

In total, 6866 fish comprising six species were captured in the sampled lakes. Least cisco was the most frequently captured species (58.4%), followed by cisco (16.2%), ninespine stickleback (15.7%), lake trout (5.5%), lake whitefish (4.1%), and Arctic char (0.1%). The large numbers of least cisco were due primarily to two large beach seine hauls collected in Wolverine Lake. Ninespine stickleback was the predominant species in three of the five lakes sampled: P.O., P.O. Connector, and P.O. Inflow. In Patch Lake, lake trout was the most commonly captured species and in Ogama Lake, cisco was the most common species. Lake trout were also captured in all of the lakes except for P.O. Inflow and Wolverine lakes (Table 6.18). In general, the species captured in the Madrid Project area lakes were typical of the area (RL&L/Golder 2002).

Wolverine Lake was found to have a unique stunted population of adult least cisco. The fork lengths ranged from only 35 to 85 mm yet dissections revealed that these fish were mature.

Stream Communities

Fish sampling was conducted in the streams flowing out of Ogama, Patch, and P.O. lakes, as well as the inflow to Ogama Lake. The inflow and outflow streams of P.O., P.O. Connector, and P.O. Inflow lakes, and Patch Outflow were sampled for the first time during the 2006 – 2007 studies. These streams were sampled using beach seines, backpack electrofishers, and fyke nets.

In total, 289 fish comprising four species were captured in the sampled streams. Ninespine stickleback was the most frequently captured species (88.9%), followed by lake trout (7.6%), lake whitefish (3.1%), and cisco (0.3%). Only ninespine stickleback was captured in P.O. Outflow, and a single lake trout was observed in Patch Lake Outflow (Table 6.19). Cisco was reported in Ogama Inflow during previous studies though this species was not captured in the 2006-2007 studies. The species captured in Ogama Outflow during the present study were the same as the species previously reported in the stream (RL&L/Golder 2002).

6.5 LOWER KOIGNUK RIVER ASSESSMENT

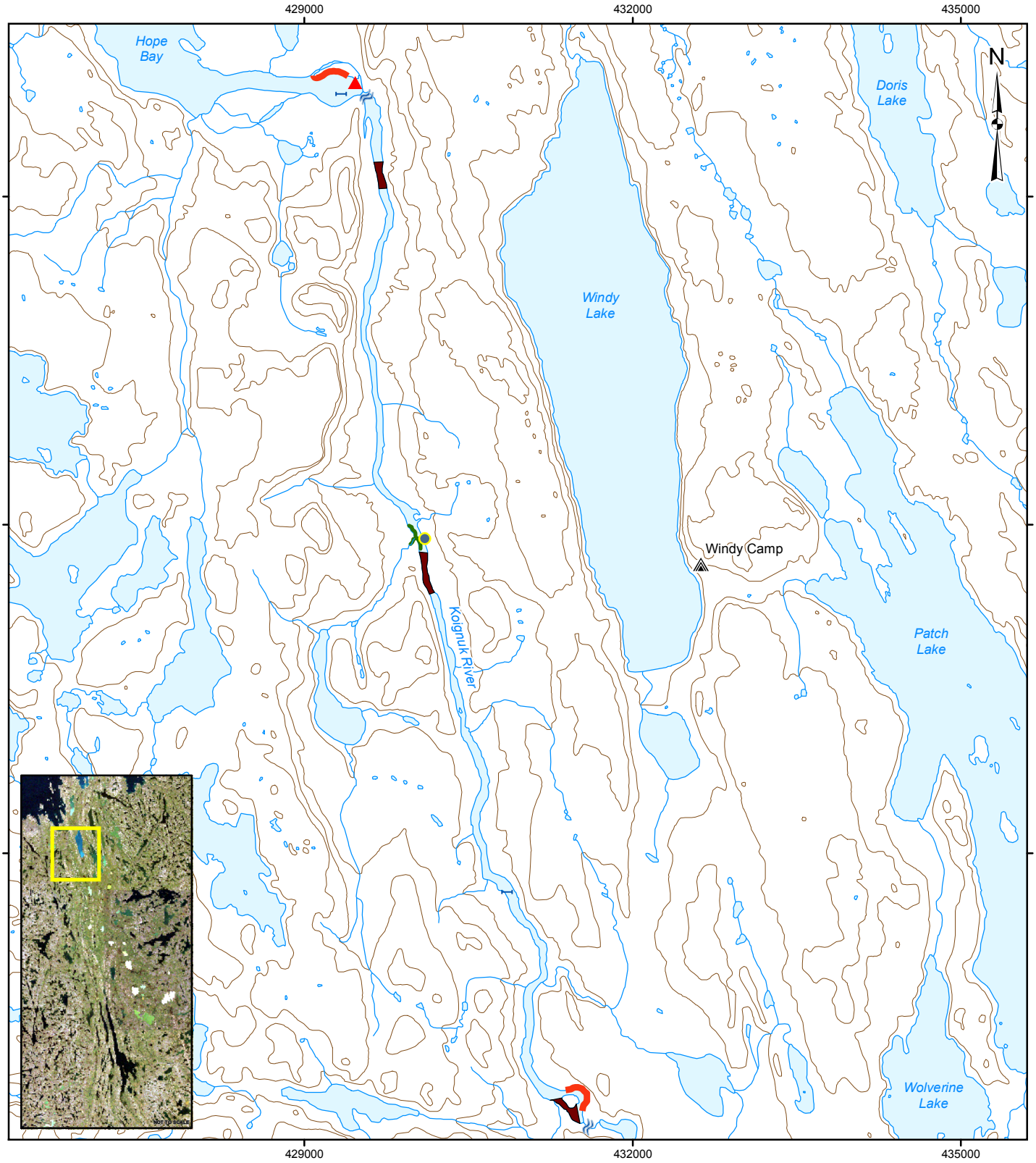
A cursory fish community and fish habitat assessment of the lower Koignuk River was conducted on 8 July 2007. The assessment involved a 10.5 km section of the Koignuk River, upstream from Hope Bay to the second set of substantial rapids (Figure 6.23). During the field visit, areas of potential Arctic grayling spawning habitat were identified, and fish sampling was conducted to determine fish species composition and relative abundance. Sampling methods included the use of a backpack electrofisher, beach seine, gill nets, dip net, and kick nets. Sampling location UTM coordinates are provided in Table 6.20.

Table 6.20 Koignuk River Fish Sampling Locations, 2006 – 2007

Sampling Station	Start Location (Zone 13W)	
	Easting	Northing
KNBP-1	431517	7545695
KNBP-2	429479	7555080
KNDN-1	429479	7555080
KNGN-1	430874	7547645
KNGN-2	429373	7554957
KNSN-1	430053	7550873
KNSN-2	430077	7550902
KNKN-1	430098	7550872

6.5.1 Lower Koignuk River Fisheries Assessment

The Koignuk River flows north into Hope Bay. The lower portion of the Koignuk River assessed by the study team exhibited primarily a straight channel pattern and was generally confined by valley walls on either side of the river. Bank material within this area was composed primarily of lacustrine silt and clay deposits. The average channel width was approximately 65 m. The channel width was notably constricted by bedrock outcrops at two locations. At both locations the constricted channel, in association was a sudden change in gradient, resulted in the formation of large rapids (Figure 6.23). The first set of rapids was located near the mouth of the Koignuk River. This rapid section was short, and the river dropped an estimated 1.5 m over a 20 m distance. At the time of the survey, the wetted channel width was approximately 15 m. The second set of rapids was located at the upstream limit of the survey area (Figure 6.23). The rapid section was 175 m in length and dropped an estimated 3.0 m over that distance. At the time of the survey, the wetted channel width was approximately 20 m.



LEGEND

- CAMP
- DIP NETTING
- GILL NETTING
- KICK NETTING
- BACKPACK ELECTROFISHING
- BEACH SEINING
- POTENTIAL ARCTIC GRAYLING SPAWNING HABITAT
- CONTOUR (20 M INTERVAL)
- WATERCOURSE
- WATERBODY
- RAPID

1500 0 1500

SCALE 1:50000 METRES

REFERENCE

Base data obtained from Government of Canada, Natural Resources Canada, Centre for Topographic Information (1:50 000). Landsat 7 imagery captured in 2007, obtained from CanImage. Field data collected by Golder Associates Ltd., 2008.
Projection: UTM Zone 13 Datum: NAD 83

PROJECT

NEWMONT. The Gold Company

HOPE BAY MINING LTD.

TITLE

2006-2007 LOWER KOIGNUK RIVER FISHERIES ASSESSMENT, BOSTON PROJECT AREA

Golder Associates Edmonton, Alberta

PROJECT NO. 07-1373-0019			SCALE AS SHOWN	REV. 0
DESIGN	AH	23 Oct. 2008		
GIS	BR	18 Feb. 2009		
CHECK	AH	16 Mar. 2009		
REVIEW	GA	16 Mar. 2009		

FIGURE: 6.23

M:\Projects\2008\1373\0026_HBML_Doris_North_Environmental_Programs\MapDocs\2007_Revised\Current\Fig6_23_AQ_SL_LowerKoignuk_Boston07_10March09.mxd

Most of the 10.5 km of river assessed consisted of deep slow-moving Flat habitat (maximum depth of 3.5 m). Three locations of potential Arctic grayling spawning habitat were identified within the study area (Figure 6.23). These areas were characterized by fast flowing Run habitat over gravel-cobble substrate. The highest quality Arctic grayling spawning habitat within the reach was situated directly downstream of the upstream set of rapids. In this area, a juvenile Arctic grayling (estimated to be 1 year old) was captured during sampling, inferring spawning within this reach of the river in the previous year. Areas of the river identified as potential Arctic grayling spawning habitat also provide good rearing habitat for juvenile Arctic grayling. Deeper sections of the river provide adequate over-wintering habitat for all species of fish within this reach.

6.5.2 Fish Sampling

Backpack Electrofishing

Backpack electrofishing was conducted at two locations (Figure 6.23). The first sample location (Station KNBP-1) was along the margin of a vegetated mid-channel gravel bar and in shallow run habitat associated with a tail-out area downstream of a large set of rapids. Sampling was conducted for a total of 446 seconds. The substrate at this station was gravel-cobble with some larger boulders. The willows on the gravel bar were partially submerged at the time of the field survey.

At Station KNBP-1, one adult (397 mm in fork length) and one juvenile (109 mm in fork length) Arctic grayling were captured, as well as two ninespine stickleback (31 and 39 mm in fork length) (Appendix E1). Both of the Arctic grayling captured were in good condition. The adult Arctic grayling weighed 603 g and had a condition factor of 1.00 and the juvenile Arctic grayling weighed 13 g and had a condition factor of 0.96 (Appendix E1).

The second backpack electrofishing station (Station KNBP-2) was along the right downstream bank (RDB) of the Koignuk River near the confluence with Hope Bay (Figure 6.23). The habitat at the sample station was shallow Flat habitat. Bed material was comprised of cobble-gravel with the occasional very large boulder. Thick deposition of silt was noted in backwater areas.

During sampling at KNBP-2 (effort 392 s), three Arctic flounder, three ninespine stickleback, one fourhorn sculpin, and one lake whitefish were captured (Appendix E1). In addition to captured fish, 3 Arctic flounder, 10 ninespine stickleback, and 5 lake whitefish were observed. Arctic flounder is primarily a marine species, whereas the lake whitefish and ninespine stickleback are primarily freshwater species.

All of the fish captured at KNBP-2 were small and in good condition. The three Arctic flounder were between 76 and 139 mm in total length, weighing between 6 and 42 g, and had condition factors ranging from 0.99 to 1.56 (Appendix E1). The three ninespine stickleback had total lengths between 43 and 52 mm (Appendix E1). The fourhorn sculpin was 78 mm in total length, weighed 5 g, and had a condition factor of 0.87 (Appendix E1). The lake whitefish had a fork length of 78 mm (Appendix E1).

Gill Net

Variable mesh experimental gill nets were employed to sample fish in the Koignuk River at two locations (Figure 6.23). Each experimental gill net was comprised of two panels measuring 15.2 by 1.8 m. Mesh sizes were 3.8 cm and 5.1 cm. Short duration sets (less than 1.5 h) were used to minimize capture related mortalities.

The first gill net (KNGN-1) was set in a wide, very slow moving section of the river, midpoint within the survey area. The net was set perpendicular to the flow. Maximum set depth was 3.4 m. Fish were not captured during the 1.0 hour set time.

The second gill net (KNGN-2) was set approximately 200 m downstream of the first set of rapids, near the transition area between the Koignuk River and Hope Bay. The net was set perpendicular to the flow from near the left downstream bank (LDB). Maximum set depth was 4.9 m. One Arctic char was captured during the 1.25 hour set. This fish was 605 mm in fork length and weighed 2538 g. This individual had a condition factor of 1.15, indicating that it was in good condition and likely had been feeding in the ocean prior to returning to freshwater.

Beach Seine

Beach seining for small fish was conducted at two stations within the survey area (Figure 6.23). Station KNSN-1 was established along the shore margin in shallow Run habitat (0.45 m deep) over gravel and cobble substrate. A total area of 350 m^2 was seined. The second seining station (KNSN-2) was within a slower moving backwater area with silt substrate. A total area of 280 m^2 was seined at KNSN-2. Fish were not catured during beach seining efforts.

Dip Net

Adjacent to Station KNBP-2, a small isolated shallow pool (1 m by 2 m) was situated onshore approximately 1.5 m back from the edge of the river. The pool contained an estimated 20 YOY fourhorn sculpin. A dip net was used to capture one fish for verification (16 mm in length). The fish were stranded in the pool.

Although not confirmed, it is suspected that the pool was the result of declining water levels after the peak flows of the spring freshet.

Kick Net

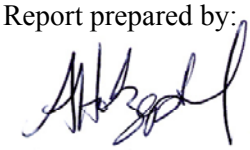
Kick sampling was conducted at one location in an attempt to collect eggs of spring spawners (e.g., Arctic grayling). An area of 10 m^2 was sampled within an area of potential Arctic grayling habitat (Figure 6.23). Eggs or recently hatched fish were not found within the sampled area.

7 CLOSURE

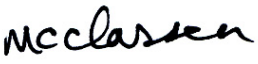
We trust the above meets your present requirements. If you have any questions or require additional details, please contact the undersigned.

GOLDER ASSOCIATES LTD.

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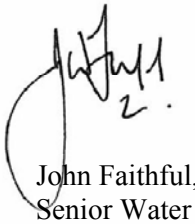


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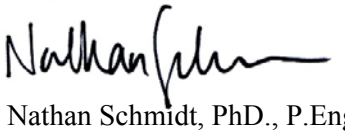
Report reviewed by:



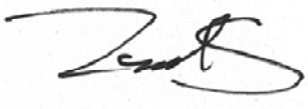
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8 REFERENCES

Alberta Environment. 1990. Selected methods for the monitoring of benthic invertebrates in Alberta rivers. Environmental Quality Monitoring Branch, Environmental Assessment Division. 41 p.

AMEC. 2003. Meteorology and hydrology baseline report. Doris North Project, Revision 1, Supporting Document "D" to the Final Environmental Impact Statement. Prepared for Miramar Hope Bay Ltd. by AMEC Earth and Environmental, Burnaby, BC. August 2003.

Brooks, J.L., and S.I. Dodson. 1965. Predation, body size, and composition of plankton. Science 150: 28-35.

Burnham, K.P., and D.R. Anderson 2002. Model selection and multimodel inference: A practical information-theoretic approach, 2nd ed. Springer-Verlag, New York, NY, USA.

Canadian Council of Ministers of the Environment (CCME). 1987. Canadian Water Quality Guidelines. http://www.ccme.ca/assets/pdf/ cwqg_pn_1040.pdf. Accessed on 8 Dec 2008.

Canadian Council of Ministers of the Environment (CCME). 1999. Canadian Environmental Quality Guidelines. Winnipeg, MB.

Canadian Council of Ministers of the Environment (CCME). 2002. Canadian sediment quality guidelines for the protection of aquatic life: Summary tables. Updated in: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.

Canadian Council of Ministers of the Environment. 2004. Canadian water quality guidelines for the protection of aquatic life. Phosphorus: Canadian guidance framework for the management of freshwater systems. In: Canadian environmental quality guidelines. Canadian Council of Ministers of the Environment. Winnipeg, MB.

Canadian Council of Ministers of the Environment (CCME). 2007a. Canadian water quality guidelines for the protection of aquatic life – summary table update 7.1. Winnipeg, MB.

Canadian Council of Ministers of the Environment (CCME). 2007b. Canadian guidance framework for the management of nutrients in nearshore marine systems - scientific supporting document. PN1387. Winnipeg, MB.

Clifford, H. 1991. Aquatic Invertebrates of Alberta. The University of Alberta Press, Edmonton, AB, 538 p.

Columbia Basin Fish and Wildlife Authority PIT Tag Steering Committee. 1999. PIT tag marking procedures manual. Version 2.0.

Cooch, W., and G. White. 2006. Program MARK: A gentle introduction, 6th edition. Colorado State University. Accessed at: http://www.phidot.org/software/mark/docs/book.

Environment Canada. 1997a. Biological test method: Test for survival and growth in sediment using the freshwater amphipod *Hyalella azteca*. Environment Canada. EPS 1/RM/33.

Environment Canada. 1997b. Biological test method: Test for survival and growth in sediment using the larvae of freshwater midges (*Chironomus tentans* or *Chironomus riparius*). Environment Canada. EPS 1/RM/32.

Environment Canada. 2002a. Biological test method: Reference method for determining the toxicity of sediment using luminescent bacteria in a sold-phase test. Environment Canada. EPS 1/RM/42.

Environment Canada. 2002b. Metal mining guidance document for aquatic environmental effects monitoring - Chapter 5: Benthic invertebrate community monitoring. EEM/2002.

Golder Associates Ltd. 2006. Doris North Project aquatic studies 2005. Prepared for Miramar Hope Bay Ltd., North Vancouver, BC by Golder Associates Ltd., Edmonton, AB. Golder Report No. 05-1373-014F: 108 p. + 3 app.

Golder Associates Ltd. 2007. Doris North Project aquatic studies 2006. Prepared for Miramar Hope Bay Ltd., North Vancouver, BC by Golder Associates Ltd., Edmonton, AB. Golder Report No. 06-1373-026F: 113 p. + 3 app.

Golder Associates Ltd. 2008a. Aquatic baseline studies Boston Project data compilation report 1992-2000. Prepared for Miramar Hope Bay Ltd., North

Vancouver, BC by Golder Associates Ltd., Edmonton, AB. Golder Report No. 06-1373-028-1500F: 210 p. + 5 app.

Golder Associates Ltd. 2008b. Doris North Project aquatic studies 2007. Prepared for Miramar Hope Bay Ltd., North Vancouver, BC by Golder Associates Ltd., Edmonton, AB. Golder Report No. 07-1373-0018: 116 p. + 3 app.

Graham, L.E., and L.W. Wilcox. 2000. Algae. Prentice-Hall Inc., Upper Saddle River, NJ. 640 p.

Hammer, U. T. 1986. Saline Lake Ecosystems of the World. Dr W Junk. The Hague, Netherlands. 616 p.

Improvision Ltd. 2002. Openlab. Version 4.0.1. Improvision a PerkinElmer Company. Coventry, England.

Kersten, M., and F. Smedes. 2002. Normalization procedures for sediment contaminants in spatial and temporal trend monitoring. Journal of Environmental Monitoring 4: 109-115.

McCauley, E. 1984. The estimation of the abundance and biomass of zooplankton in samples. Chapter 7 in J.A. Downing and F.H. Rigler (ed.). A manual of methods for the assessment of secondary productivity in freshwaters. Blackwell Scientific, London.

Merritt, R.W., and K.W. Cummins. (eds) 1996. An Introduction to the Aquatic Insercts of North America. 3rd Edition. Kendall/Hunt Publishing Company, Dubuque, Iowa. 862 p.

Mitchell, P., and E.E. Prepas. 1990. Atlas of Alberta lakes. The University of Alberta Press, Edmonton, AB. 690 p.

Moore, J.W. 1978a. Biological and water quality surveys at potential mines in the Northwest Territories: Part IV. The Texasgulf copper-zinc property, Itchen Lake. Environment Canada, Environmental Protection Service. MS Report NW-78-8: 23 p.

Moore, J.W. 1978b. Biological and water quality surveys at potential mines in the Northwest Territories. Part II. INCO gold property, Contwoyto Lake. Prepared by Environment Canada, Environmental Protection Service. MS Report NW-78-6. 39 p.

Moss, B. 1967a. A spectrophotometric method for the estimation of percentage degradation of chlorophyll *a* to phaeophytin in extracts of algae. Limnology and Oceanography 12: 335-340.

Moss, B. 1967b. A note on the estimation of chlorophyll *a* in freshwater algal communities. Limnology and Oceanography 12: 340-342.

Nelson, J.S., E.J. Crossman, H. Espinosa-Pérez, L.T. Findley, C.R. Gilbert, R.N. Lea, and J.D. Williams. 2004. Common and scientific names of fishes from the United States, Canada, and Mexico. American Fisheries Society, Special Publication 29, Bethesda, Maryland.

Newman, B.K., and R.J. Watling. 2007. Definition of baseline metal concentrations for assessing metal enrichment of sediment from the south-eastern Cape coastline of South Africa. Water SA. Volume 33: 675-691.

Oliver, D.R. and M.E. Roussel. 1983. The Genera of Larval Midges of Candada. Diptera: Chironomidae. Research Branch Agriculture Canada. Pub. 1746.

Orcutt, J.R. Jr., and K.G. Porter. 1983. Diel vertical migration by zooplankton: Constant and fluctuating temperatures effects on life history parameters of *Daphnia*. Limnology and Oceanography 28(4): 720-730.

Otis, D.L., K.P. Burnham, G.C. White, and D.R. Anderson. 1978. Statistical inference from capture data on closed animal populations. Wildlife Monographs 62: 1-135.

Pennak, R.W. 1989. Freshwater invertebrates of the United States. 3rd. Edition. J. Wiley and Sons, Inc., New York.

Pieters, R., and G.A. Lawrence. 2009. Effect of salt exclusion from lake ice on seasonal circulation. Limnology and Oceanography. 54: 401-412.

Pine, W.E., K.H. Pollock, J.E. Hightower, T.J. Kwak, and J.A. Rice. 2003. A review of tagging methods for estimating fish population size and components of mortality. Fisheries 28: 10-21.

Pollock, K.H. 1982. A capture-recapture design robust to unequal probability to capture. Journal of Wildlife Management 46:757-760.

Prescott, G.W. 1970. Algae of the western Great Lakes area. W.C. Brown Co. Publishers, Dubuque, Iowa. 977 p.

Puznicki, W.S. 1996. An overview of lake bottom sediment quality in the Slave Structural Province area, Northwest Territories. Prepared for the Department of Indian and Northern Affairs. Water Resources Division, Natural Resources and Environment Directorate, Department of Indian and Northern Affairs. 101p.

Resh, V.H., and D. M. Rosenberg (editors). 1984. The ecology of aquatic insects. Praeger Publishers, New York, New York. 625 p.

Ricker, W.E., 1975. Computation and interpretation of biological statistics of fish populations. Fisheries Research Board of Canada 191. 382 p.

RL&L Environmental Services Ltd. 1997. Jericho Diamond Project aquatic studies program (1996). Prepared for Canamera Geological Ltd. RL&L Report No. 501: 239 p. + 9 app.

RL&L Environmental Services Ltd. 1998. Meliadine West baseline aquatic studies – 1997 data report. Prepared for WMC International Ltd. RL&L Report No. 558 97: 128 p. + 3 app.

RL&L Environmental Services Ltd. 1999. Meliadine West baseline aquatic studies – 1998 data report. Prepared for WMC International Ltd. RL&L Report No. 558 98: 177 p. + 4 app.

RL&L Environmental Services Ltd. / Golder Associates Ltd. 2002. Aquatic baseline studies – Doris Hinge Project data compilation report, 1995-2000. Prepared for Miramar Hope Bay Ltd. RL&L/Golder Report No. 022-7009: 329 p. + 5 app.

Rosenberg, D. M, and V. H. Resh. 1993. Freshwater biomonitoring and benthic macroinvertebrates. Chapman & Hall, New York, New York. 488 p.

Saffran, K.A., and D.O. Trew. 1996. Sensitivity of Alberta lakes to acidifying deposition: An update of maps with emphasis on 109 northern lakes. Water Management Division. Alberta Environmental Protection. Edmonton, AB. 70 p.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada, Ottawa, Bulletin 184. 996 p.

Sommer, U., Z.M. Fliwicz, W. Lampert, and A. Duncan. 1986. The PEG-model of seasonal succession of planktonic events in freshwaters. Archic fur Hydrobiologie 106: 433-471.

Stewart, K.W. and M.W. Oswood. 2006. The Stoneflies (Plecoptera) of Alaska and Western Canada. The Caddis Press. Columus, Ohio. 325 p.

Taft, C.E., and C.W. Taft. 1971. The algae of western Lake Erie. Bulletin of the Ohio Biological Surveys 4: 1-189.

Terzl, F.A., T. Winkler, and B. Routledge. 1994. Hydrometric field and related manuals. Water Survey of Canada. Environment Canada, Ottawa.

Thorp, J.H., and A.P. Covich. 2001. 2nd. Edition. Ecology and classification of North American freshwater invertebrates. Academic Press, San Diego, CA.

United States Environmental Protection Agency (U.S. EPA). 1985. National primary drinking water regulations; Volatile synthetic organic chemicals. Federal Register, 50 (219): 46902-46933. OW-FRL-2819-4a.

United States Environmental Protection Agency (U.S. EPA). 2008. Current national recommended water quality criteria. Available at: http://www.epa.gov/waterscience/criteria/wqctable. Accessed 1 December 2008.

Wharton, R.A. Jr., C.P. McKay, G.D. Clow, and D.T. Andersen. 1993. Perennial ice covers and their influence on Antarctic lake ecosystems. Antarctic Research Series 59:53-70.

Washington State Department of Ecology. 2003. Sediment sampling and analysis plan appendix: Guidance on the development of sediment sampling and analysis plans meeting the requirements of the sediment management standards (Chapter 173-204 WAC). Ecology Publication Number 03-09-0.

Webber, C.I. 1971. A guide to the common diatoms of water pollution surveillance system stations. U.S. Environmental Protection Agency, National Environmental Research Center Analytical Quality Control Laboratory, Cincinnati, Ohio. 101 p.

Weiner, E.R. 2000. Applications of environmental chemistry: a practical guide for environmental professionals. Lewis Publishers, Boca Raton, FL. 288 p.

Wetzel, R.G. 2001. Limnology: Lake and river ecosystems. 3rd edition. Academic, San Diego, CA. 1006 p.

Wrona F.J., M. Culp, and R.W. Davies. 1982. Macroinvertebrate subsampling: A simplified apparatus and approach. Canadian Journal of Fisheries and Aquatic Sciences 39: 1051-1054.

Zar, J. H. 1996. Biostatistical analysis. 3rd edition. Prentice Hall, Upper Saddle River, NJ. 662 p.

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APPENDIX A

HYDROLOGY DATA

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PATCH LAKE
HYDROMETRIC STATION

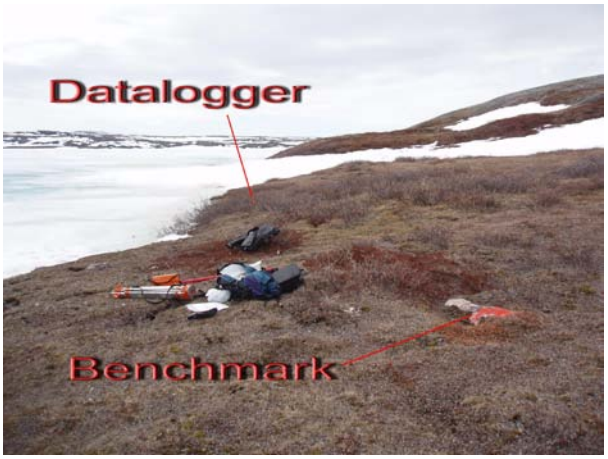
H81

FACTSHEET

LOCATION AND PURPOSE

Located on the right upstream bank of Patch Lake outflow, approximately within 100 m downstream of no name tributary of Patch Lake.

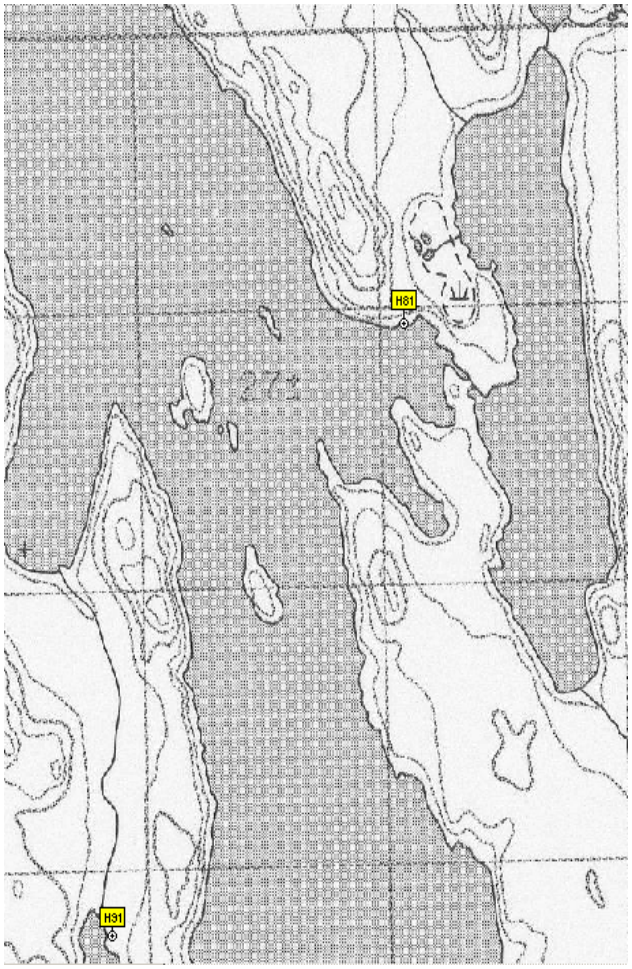
Operational:	2006 (1 June – 9 September)	2007 (23 May – 12 September)	
Benchmark:	Top of embedded boulder;	Drainage Area:	30.0 km^2
Coordinates:	UTM: 435993 m E, 7549169 m N (NAD83)	Lat/Long:	68°02’57” N, 106°32’04” W
Datalogger:	Optimum Instruments #1410(cold tested)	Transducer:	Keller #00920 (5 psi, 20 m)



Station H81 looking northwest (downstream) before snow melt.

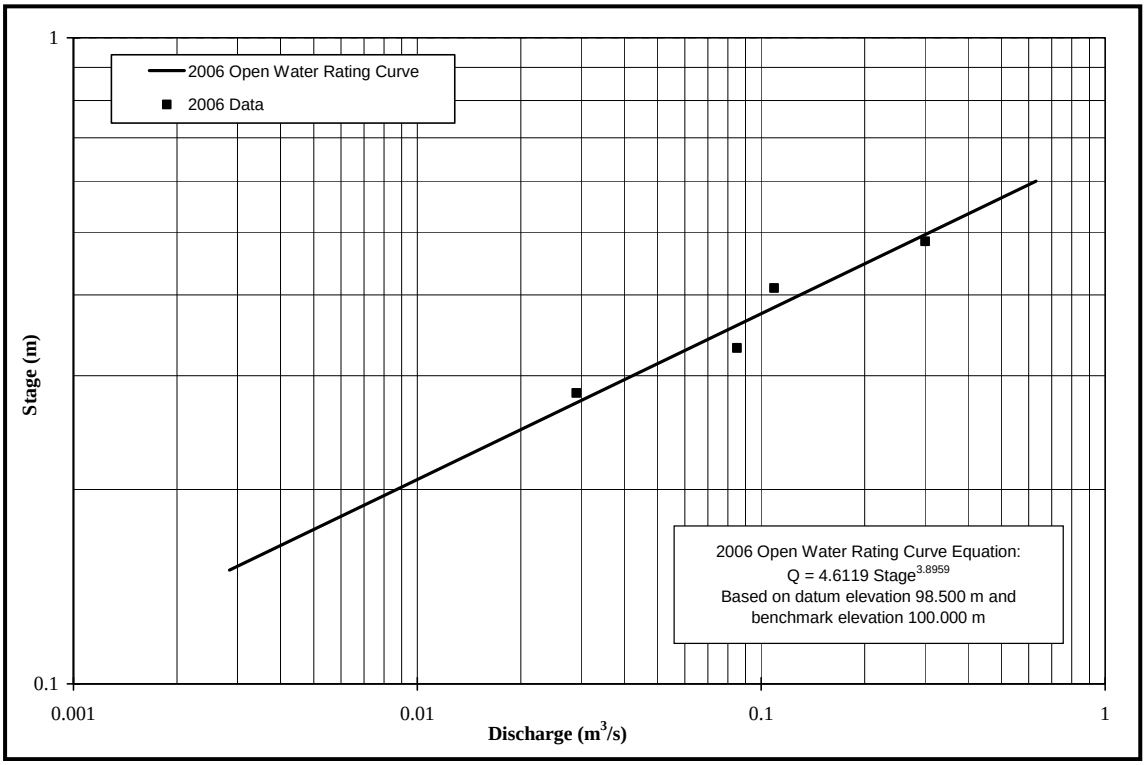


Station H81 looking southeast (upstream) before snowmelt.

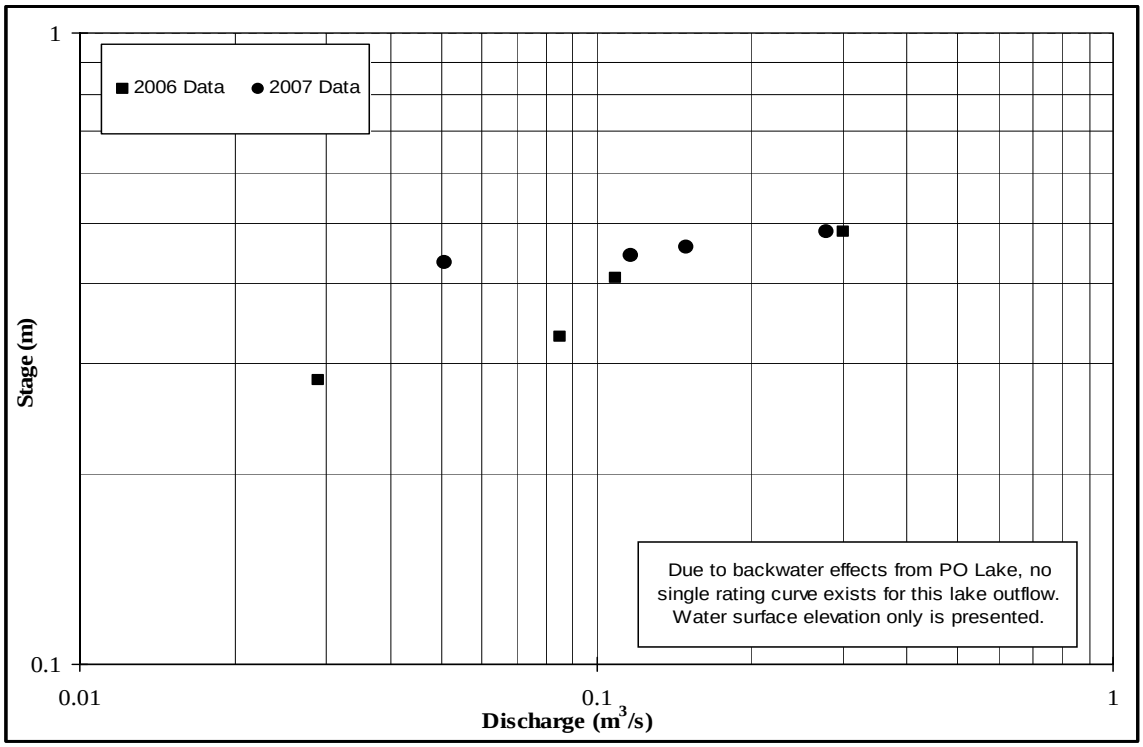


Station H81 location on the NTS Mapping of Patch Lake.

FACT-H81-2007.DOC



Patch Outflow Station H81 - Stage-Discharge Rating Curve (2006)



Patch Outflow Station H81 - Stage-Discharge Rating Curve (2007)

Patch Outflow Station H81 – Stage-Discharge Data (2006-2007)

Stage Datum 98.500 m

Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Water Surface Elevation (m)	Stage (m)	Measured Discharge (m^3/s)
01/06/2006 13:30	1.0741	-		-	-	-
03/07/2006 9:31	1.0879	97.896		98.984	0.484	0.300
22/07/2006 16:30	1.0317	-		*98.910*	0.410	0.109
12/08/2006 14:30	0.9706	97.860		98.831	0.331	0.085
09/09/2005 9:37	0.9038	-	97.878	*98.782*	0.282	0.029
03/07/2007 15:09	0.7132	98.283		98.996	0.496	n/a
10/07/2007 9:40	0.7123	98.272		98.984	0.484	0.279
19/07/2007 2:00	0.7339	98.224		98.958	0.458	0.149
14/07/2007 9:53	0.6884			*98.945*	0.445	0.117
12/07/2007 9:40	0.6847	98.247	98.256	98.932	0.432	0.051

H81 Patch Outflow - 2006
MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	0.205 P	0.243	0.105	0.035	-	-	-
2	-	-	-	-	-	0.222	0.240	0.104	0.033	-	-	-
3	-	-	-	-	-	0.253	0.242	0.103	0.033	-	-	-
4	-	-	-	-	-	0.276	0.227	0.100	0.033	-	-	-
5	-	-	-	-	-	0.299	0.213	0.097	0.032	-	-	-
6	-	-	-	-	-	0.324	0.203	0.090	0.030	-	-	-
7	-	-	-	-	-	0.342	0.195	0.086	0.031	-	-	-
8	-	-	-	-	-	0.351	0.184	0.084	0.031	-	-	-
9	-	-	-	-	-	0.337	0.180	0.083	0.032 P	-	-	-
10	-	-	-	-	-	0.318	0.175	0.082	-	-	-	-
11	-	-	-	-	-	0.335	0.178	0.078	-	-	-	-
12	-	-	-	-	-	0.335	0.177	0.073	-	-	-	-
13	-	-	-	-	-	0.311	0.172	0.071	-	-	-	-
14	-	-	-	-	-	0.347	0.174	0.067	-	-	-	-
15	-	-	-	-	-	0.336	0.164	0.063	-	-	-	-
16	-	-	-	-	-	0.339	0.153	0.062	-	-	-	-
17	-	-	-	-	-	0.319	0.144	0.060	-	-	-	-
18	-	-	-	-	-	0.315	0.136	0.059	-	-	-	-
19	-	-	-	-	-	0.302	0.142	0.057	-	-	-	-
20	-	-	-	-	-	0.292	0.147	0.055	-	-	-	-
21	-	-	-	-	-	0.287	0.148	0.052	-	-	-	-
22	-	-	-	-	-	0.279	0.142	0.051	-	-	-	-
23	-	-	-	-	-	0.278	0.137	0.047	-	-	-	-
24	-	-	-	-	-	0.269	0.138	0.048	-	-	-	-
25	-	-	-	-	-	0.261	0.132	0.048	-	-	-	-
26	-	-	-	-	-	0.261	0.129	0.046	-	-	-	-
27	-	-	-	-	-	0.259	0.122	0.043	-	-	-	-
28	-	-	-	-	-	0.258	0.113	0.041	-	-	-	-
29	-	-	-	-	-	0.252	0.114	0.040	-	-	-	-
30	-	-	-	-	-	0.241	0.110	0.038	-	-	-	-
31	-	-	-	-	0.000 E	-	0.107	0.036	-	-	-	-
MIN	-	-	-	-	0.000	0.205	0.107	0.036	0.030	-	-	-
MEAN	-	-	-	-	0.000	0.293	0.164	0.067	0.032	-	-	-
MAX	-	-	-	-	0.000	0.351	0.243	0.105	0.035	-	-	-

H81 Patch Outflow - 2006 (Continued)

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	98.950 P	98.970	98.878	98.785	-	-	-
2	-	-	-	-	-	98.959	98.968	98.878	98.782	-	-	-
3	-	-	-	-	-	98.975	98.969	98.877	98.780	-	-	-
4	-	-	-	-	-	98.985	98.962	98.874	98.780	-	-	-
5	-	-	-	-	-	98.995	98.954	98.871	98.779	-	-	-
6	-	-	-	-	-	99.006	98.948	98.864	98.775	-	-	-
7	-	-	-	-	-	99.012	98.944	98.860	98.776	-	-	-
8	-	-	-	-	-	99.015	98.937	98.858	98.778	-	-	-
9	-	-	-	-	-	99.011	98.935	98.856	98.780 P	-	-	-
10	-	-	-	-	-	99.003	98.932	98.855	-	-	-	-
11	-	-	-	-	-	99.009	98.933	98.851	-	-	-	-
12	-	-	-	-	-	99.010	98.933	98.845	-	-	-	-
13	-	-	-	-	-	98.999	98.930	98.843	-	-	-	-
14	-	-	-	-	-	99.015	98.931	98.837	-	-	-	-
15	-	-	-	-	-	99.010	98.925	98.833	-	-	-	-
16	-	-	-	-	-	99.012	98.917	98.830	-	-	-	-
17	-	-	-	-	-	99.004	98.911	98.828	-	-	-	-
18	-	-	-	-	-	99.002	98.904	98.827	-	-	-	-
19	-	-	-	-	-	98.997	98.909	98.823	-	-	-	-
20	-	-	-	-	-	98.993	98.913	98.820	-	-	-	
21	-	-	-	-	-	98.990	98.913	98.816	-	-	-	
22	-	-	-	-	-	98.987	98.909	98.815	-	-	-	
23	-	-	-	-	-	98.986	98.906	98.808	-	-	-	
24	-	-	-	-	-	98.982	98.906	98.810	-	-	-	
25	-	-	-	-	-	98.978	98.902	98.809	-	-	-	
26	-	-	-	-	-	98.978	98.899	98.806	-	-	-	
27	-	-	-	-	-	98.978	98.893	98.802	-	-	-	
28	-	-	-	-	-	98.977	98.886	98.797	-	-	-	
29	-	-	-	-	-	98.974	98.887	98.796	-	-	-	
30	-	-	-	-	-	98.969	98.883	98.791	-	-	-	
31	-	-	-	-	-	-	98.880	98.789	-	-	-	
MIN	-	-	-	-	-	98.950	98.880	98.789	98.775	-	-	
MEAN	-	-	-	-	-	98.992	98.922	98.834	98.779	-	-	
MAX	-	-	-	-	-	99.015	98.970	98.878	98.785	-	-	

E- ESTIMATED P – PARTIAL DAILY

H81 Patch Lake - 2007

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	98.970	98.948	98.986	-	-	-
2	-	-	-	-	-	-	98.971	98.941	98.981	-	-	-
3	-	-	-	-	-	-	98.968	98.938	98.981	-	-	-
4	-	-	-	-	-	-	98.966	98.933	98.973	-	-	-
5	-	-	-	-	-	-	98.966	98.926	98.969	-	-	-
6	-	-	-	-	-	-	98.970	98.921	98.967	-	-	-
7	-	-	-	-	-	-	98.969	98.917	98.966	-	-	-
8	-	-	-	-	-	-	98.971	98.918	98.962	-	-	-
9	-	-	-	-	-	-	98.969	98.920	98.954	-	-	-
10	-	-	-	-	-	-	98.970	98.922	98.947	-	-	-
11	-	-	-	-	-	-	98.969	98.927	98.942	-	-	-
12	-	-	-	-	-	-	98.970	98.933	98.942 P	-	-	-
13	-	-	-	-	-	-	98.969	98.939	-	-	-	-
14	-	-	-	-	-	-	98.973	98.944	-	-	-	-
15	-	-	-	-	-	-	98.979	98.946	-	-	-	-
16	-	-	-	-	-	-	98.979	98.944	-	-	-	-
17	-	-	-	-	-	-	98.984	98.947	-	-	-	-
18	-	-	-	-	-	-	98.988	98.947	-	-	-	-
19	-	-	-	-	-	-	98.992	98.966	-	-	-	-
20	-	-	-	-	-	-	98.986	98.985	-	-	-	-
21	-	-	-	-	-	-	98.994	98.991	-	-	-	-
22	-	-	-	-	-	-	98.989	98.993	-	-	-	-
23	-	-	-	-	-	-	98.974	98.994	-	-	-	-
24	-	-	-	-	-	-	98.968	98.993	-	-	-	-
25	-	-	-	-	-	98.899	98.966	98.992	-	-	-	-
26	-	-	-	-	-	98.918	98.967	98.990	-	-	-	-
27	-	-	-	-	-	98.931	98.961	98.988	-	-	-	-
28	-	-	-	-	-	98.945	98.960	98.985	-	-	-	-
29	-	-	-	-	-	98.957	98.957	98.985	-	-	-	-
30	-	-	-	-	-	98.965	98.957	98.984	-	-	-	-
31	-	-	-	-	-	-	98.957	98.986	-	-	-	-
MIN	-	-	-	-	-	98.899	98.957	98.917	98.942	-	-	-
MEAN	-	-	-	-	-	98.936	98.972	98.956	98.964	-	-	-
MAX	-	-	-	-	-	98.965	98.994	98.994	98.986	-	-	-

E- ESTIMATED P – PARTIAL DAILY

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Patch Outflow**
LOCATION: **Outlet of Patch Lake**
COORDINATES: **13W 0436058 E, 7549173 N (NAD 83)**

MEASUREMENT DATE: **3 July 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **KK**
COMPUTATIONS BY: **NS / TY**

MEASUREMENT START TIME: **0935 h est.**
MEASUREMENT END TIME: **0945 h est.**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.00			0.00	0.03	0.000
1	0.05		0.05			0.00	0.10	0.000
2	0.20		0.10			0.18	0.20	0.004
3	0.45		0.36			0.43	0.25	0.039
4	0.70		0.48			0.39	0.25	0.047
5	0.95		0.52			0.30	0.25	0.039
6	1.20		0.56			0.29	0.25	0.041
7	1.45		0.60			0.32	0.25	0.048
8	1.70		0.55			0.22	0.25	0.030
9	1.95		0.47			0.20	0.25	0.024
10	2.20		0.44			0.18	0.25	0.020
11	2.45		0.31			0.10	0.25	0.008
12	2.70		0.28			0.03	0.25	0.002
								0.300

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**

DISCHARGE DATA

STREAM NAME: **Patch Outflow**
LOCATION: **Outlet of Patch Lake**
COORDINATES: **13W 0436058 E, 7549173 N (NAD 83)**

MEASUREMENT DATE: **22 July 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **TA / PE**
COMPUTATIONS BY: **NS / TY**

MEASUREMENT START TIME: **1630 h est.**
MEASUREMENT END TIME: **1645 h est.**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.00			0.00	0.15	0.000
1	0.30		0.15			0.01	0.30	0.000
2	0.60		0.29			0.01	0.30	0.001
3	0.90		0.33			0.04	0.30	0.004
4	1.20		0.38			0.05	0.30	0.006
5	1.50		0.47			0.08	0.30	0.011
6	1.80		0.60			0.10	0.30	0.018
7	2.10		0.51			0.17	0.30	0.026
8	2.40		0.40			0.23	0.35	0.032
9	2.80		0.22			0.14	0.35	0.011
Left Bank	3.10		0.00			0.00	0.15	0.000
								0.109

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Patch Outflow**
LOCATION: **Outlet of Patch Lake**
COORDINATES: **13W 0436058 E, 7549173 N (NAD 83)**

MEASUREMENT DATE: **12 August 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **NS**
COMPUTATIONS BY: **NS / TY**

MEASUREMENT START TIME: **1400 h**
MEASUREMENT END TIME: **1419 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.05	0.000
1	0.10		0.23			0.06	0.10	0.001
2	0.20		0.22			0.15	0.10	0.003
3	0.30		0.22			0.21	0.10	0.005
4	0.40		0.20			0.22	0.10	0.004
5	0.50		0.20			0.28	0.10	0.006
6	0.60		0.20			0.31	0.10	0.006
7	0.70		0.19			0.30	0.10	0.006
8	0.80		0.17			0.41	0.10	0.007
9	0.90		0.16			0.44	0.10	0.007
10	1.00		0.16			0.36	0.10	0.006
11	1.10		0.16			0.37	0.10	0.006
12	1.20		0.16			0.40	0.10	0.006
13	1.30		0.15			0.39	0.10	0.006
14	1.40		0.16			0.29	0.10	0.005
15	1.50		0.16			0.22	0.10	0.004
16	1.60		0.15			0.19	0.10	0.003
17	1.70		0.14			0.15	0.10	0.002
18	1.80		0.15			0.07	0.10	0.001
19	1.90		0.15			0.04	0.15	0.001
20	2.10		0.13			0.02	0.20	0.001
21	2.30		0.11			0.00	0.20	0.000
22	2.50		0.09			0.00	0.20	0.000
Right Bank	2.70		0.00			0.00	0.10	0.000
								0.086

PROJECT NAME: **Miramar / EM2 Expansion / Patch Lake**

PROJECT NUMBER: **07 1373 0019 .4000**

DISCHARGE DATA

STREAM NAME: **Patch Lake Outflow**
LOCATION: **Outlet of Patch Lake**
COORDINATES: **13W 0436274 E, 7548997 N (NAD 83)**

MEASUREMENT DATE: **10 July 2007**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **TY**
COMPUTATIONS BY: **DC**

MEASUREMENT START TIME: **0925 h**
MEASUREMENT END TIME: **0941 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m) (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.12	0.000
1	0.25		0.09			0.00	0.23	0.000
2	0.45		0.18			0.01	0.25	0.000
3	0.75		0.21			0.01	0.30	0.001
4	1.05		0.23			0.08	0.30	0.006
5	1.35		0.34			0.09	0.30	0.009
6	1.65		0.24			0.12	0.30	0.009
7	1.95		0.30			0.13	0.30	0.012
8	2.25		0.30			0.19	0.30	0.017
9	2.55		0.60			0.21	0.30	0.038
10	2.85		0.37			0.29	0.20	0.021
11	2.95		0.36			0.28	0.10	0.010
12	3.05		0.38			0.36	0.10	0.014
13	3.15		0.41			0.30	0.10	0.012
14	3.25		0.42			0.28	0.10	0.012
15	3.35		0.26			0.32	0.10	0.008
16	3.45		0.22			0.32	0.10	0.007
17	3.55		0.18			0.26	0.10	0.005
18	3.65		0.18			0.27	0.10	0.005
19	3.75		0.38			0.17	0.10	0.006
20	3.85		0.39			0.16	0.10	0.006
21	3.95		0.34			0.10	0.10	0.003
22	4.05		0.35			0.14	0.10	0.005
23	4.15		0.30			0.17	0.10	0.005
24	4.25		0.30			0.21	0.15	0.009
25	4.45		0.30			0.17	0.25	0.013
26	4.75		0.27			0.13	0.30	0.011
27	5.05		0.25			0.11	0.30	0.008
28	5.35		0.26			0.12	0.30	0.009
29	5.65		0.25			0.07	0.30	0.005
30	5.95		0.24			0.03	0.30	0.002
31	6.25		0.20			0.03	0.30	0.002
32	6.55		0.21			0.01	0.30	0.001
33	6.85		0.20			0.06	0.30	0.004
34	7.15		0.20			0.01	0.30	0.001
35	7.45		0.18			0.04	0.30	0.002
36	7.75		0.17			0.01	0.30	0.001
37	8.05		0.14			0.01	0.25	0.000
38	8.25		0.14			0.00	0.20	0.000
39	8.45		0.11			0.00	0.20	0.000
Right Bank	8.65		0.00			0.00	0.10	0.000
								0.279

PROJECT NAME: **Miramar/EM2 Expansion/Patch Lake**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Patch Lake Outflow** **MEASUREMENT DATE:** **20 July 2007**
LOCATION: **Outlet of Patch Lake** **METER NUMBER:** **Marsh McBirney**
COORDINATES: **13W 0436274 E, 7548997 N (NAD 83)** **Flo-Mate Model 2000**

MEASUREMENT BY: **HS** **MEASUREMENT START TIME:** **2000 h**
COMPUTATIONS BY: **DC** **MEASUREMENT END TIME:** **2020 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.00			0.00	1.55	0.000
1	3.10		0.16			-0.01	1.65	-0.003
2	3.30		0.18			0.00	0.20	0.000
3	3.50		0.21			0.09	0.20	0.004
4	3.70		0.30			0.23	0.10	0.007
5	4.00		0.30			0.57	0.15	0.026
6	4.30		0.29			0.50	0.30	0.044
7	4.60		0.29			0.69	0.30	0.060
8	4.90		0.31			0.14	0.30	0.013
9	5.20		0.22			0.02	0.30	0.001
10	5.50		0.18			-0.01	1.15	-0.002
Left Bank	7.50		0.00			0.00	1.00	0.000
								0.149

PROJECT NAME: **Miramar / EM2 Expansion / Patch Lake**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Patch Lake Outflow** **MEASUREMENT DATE:** **14 August 2007**
LOCATION: **Outlet of Patch Lake** **METER NUMBER:** **Marsh McBirney**
COORDINATES: **13W 0436274 E, 7548997 N (NAD 83)** **Flo-Mate Model 2000**

MEASUREMENT BY: **TY** **MEASUREMENT START TIME:** **0909 h**
COMPUTATIONS BY: **TJ / DC** **MEASUREMENT END TIME:** **0952 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.10	0.000
1	0.20		0.02			0.00	0.20	0.000
2	0.40		0.06			0.00	0.20	0.000
3	0.60		0.12			-0.02	0.20	0.000
4	0.80		0.14			-0.02	0.20	-0.001
5	1.00		0.15			-0.01	0.20	0.000
6	1.20		0.16			-0.02	0.20	-0.001
7	1.40		0.17			-0.02	0.20	-0.001
8	1.60		0.18			-0.03	0.20	-0.001
9	1.80		0.19			-0.03	0.20	-0.001
10	2.00		0.20			-0.02	0.20	-0.001
11	2.20		0.20			-0.02	0.20	-0.001
12	2.40		0.20			-0.02	0.20	-0.001
13	2.60		0.20			-0.02	0.20	-0.001
14	2.80		0.22			0.00	0.20	0.000
15	3.00		0.23			-0.01	0.20	0.000
16	3.20		0.23			-0.02	0.20	-0.001
17	3.40		0.23			-0.01	0.20	0.000
18	3.60		0.24			0.04	0.20	0.002
19	3.80		0.28			0.02	0.20	0.001
20	4.00		0.03			-0.01	0.20	0.000
21	4.20		0.33			0.03	0.20	0.002
22	4.40		0.33			0.02	0.20	0.001
23	4.60		0.35			0.03	0.20	0.002
24	4.80		0.38			0.18	0.20	0.014
25	5.00		0.36			0.34	0.20	0.024
26	5.20		0.36			0.28	0.20	0.020
27	5.40		0.40			0.35	0.20	0.028
28	5.60		0.40			0.30	0.20	0.024
29	5.80		0.40			0.10	0.20	0.008
30	6.00		0.30			0.01	0.20	0.001
31	6.20		0.20			0.00	0.20	0.000
32	6.40		0.16			0.00	0.20	0.000
33	6.60		0.12			0.00	0.20	0.000
34	6.80		0.10			0.00	0.60	0.000
Right Bank	7.80		0.02			0.00	0.50	0.000
								0.117

PROJECT NAME: **Miramar / EM2 Expansion / Patch Lake**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

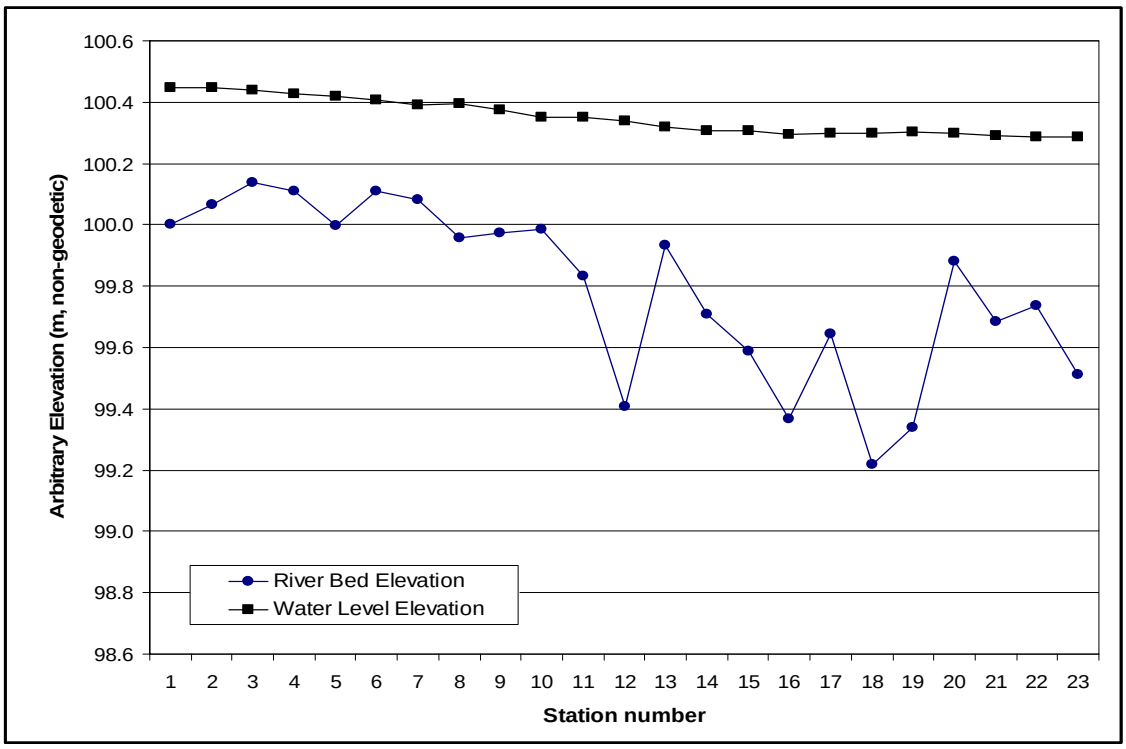
STREAM NAME: **Patch Lake Outflow**
LOCATION: **Outlet of Patch Lake**
COORDINATES: **13W 0436274 E, 7548997 N (NAD 83)**

MEASUREMENT DATE: **12 September 2007**
METER NUMBER: **Marsh McBirney**
Flo-Mate Model 2000

MEASUREMENT BY: **TY**
COMPUTATIONS BY: **DC**

MEASUREMENT START TIME: **0920 h**
MEASUREMENT END TIME: **0940 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.03			0.00	0.175	0.000
1	0.35		0.10			0.00	0.35	0.000
2	0.70		0.12			0.00	0.35	0.000
3	1.05		0.16			0.00	0.35	0.000
4	1.40		0.18			0.00	0.35	0.000
5	1.75		0.22			0.00	0.35	0.000
6	2.10		0.24			0.00	0.35	0.000
7	2.45		0.24			0.01	0.35	0.001
8	2.80		0.26			0.00	0.35	0.000
9	3.15		0.29			0.00	0.35	0.000
10	3.50		0.30			0.00	0.35	0.000
11	3.85		0.35			0.00	0.35	0.000
12	4.20		0.34			0.02	0.35	0.002
13	4.55		0.36			0.02	0.35	0.003
14	4.90		0.44			0.10	0.35	0.015
15	5.25		0.42			0.15	0.35	0.022
16	5.60		0.26			0.08	0.35	0.007
17	5.95		0.18			0.01	0.35	0.001
18	6.30		0.10			0.00	0.35	0.000
Left Bank	6.65		0.02			0.00	0.175	0.000
								0.051



Channel Survey between Patch Lake and PO Lake (2007)

OGAMA LAKE OUTFLOW HYDROMETRIC STATION

H82 FACTSHEET

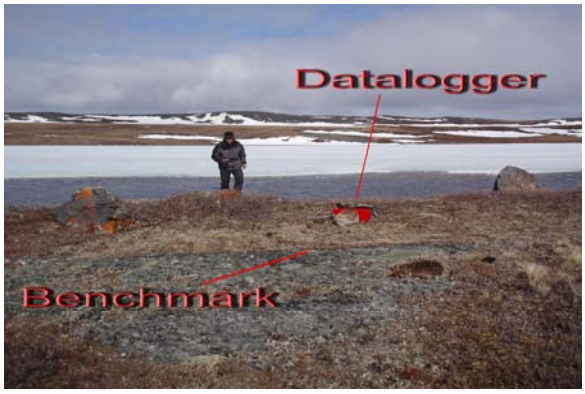
LOCATION AND PURPOSE

Located approximately 60 m upstream, of the left bank of Ogama Lake outflow.

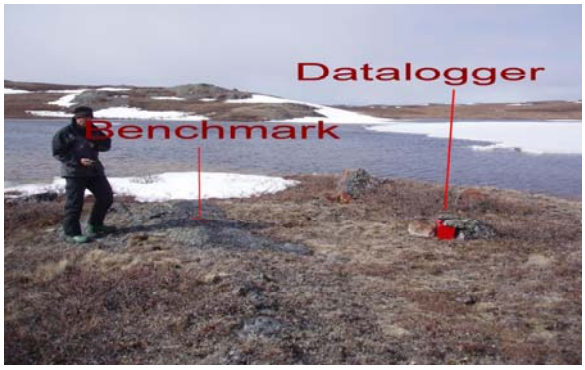
Operational:	2006 (31 May – 8 September)	2007 (23 May – 14 September)	
Benchmark:	Top of embedded boulder;	Drainage Area:	72.1 km^2
Coordinates:	UTM: 435648 m E, 7555130 m N (NAD83)	Lat/Long:	68°06'10" N, 106°32'47" W
Datalogger:	Optimum Instruments #1167	Transducer:	Keller #00900 (5 psi, 20 m)



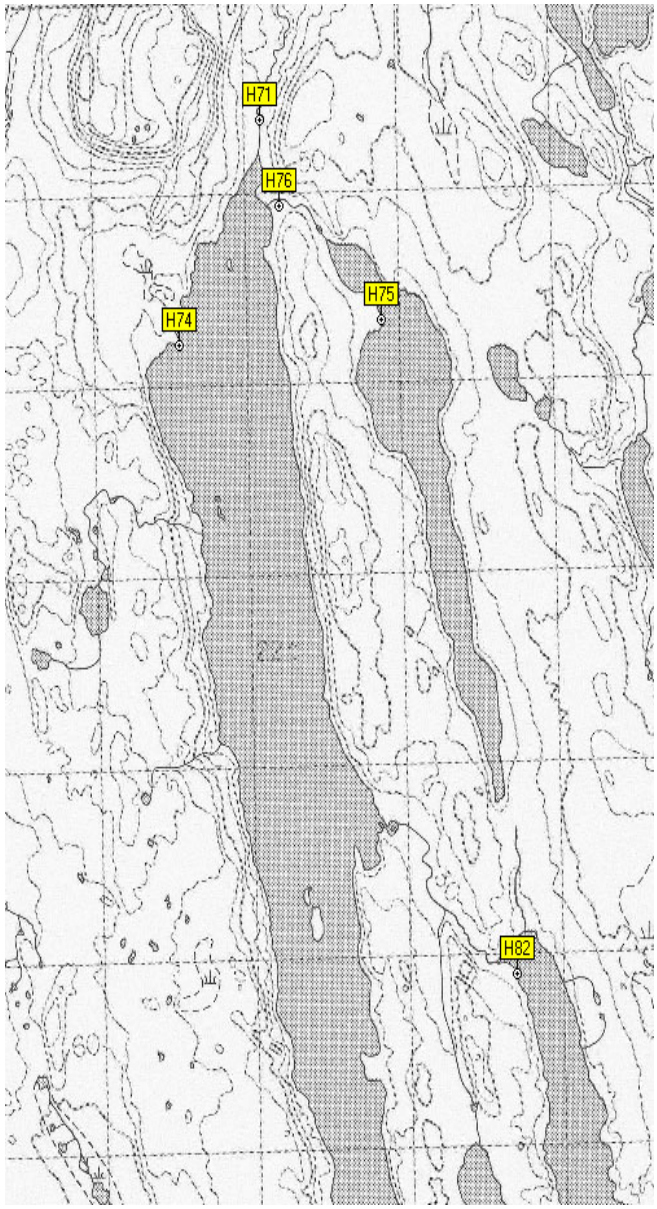
Station H82 looking east before snow melt.



Station H82 at the spot.

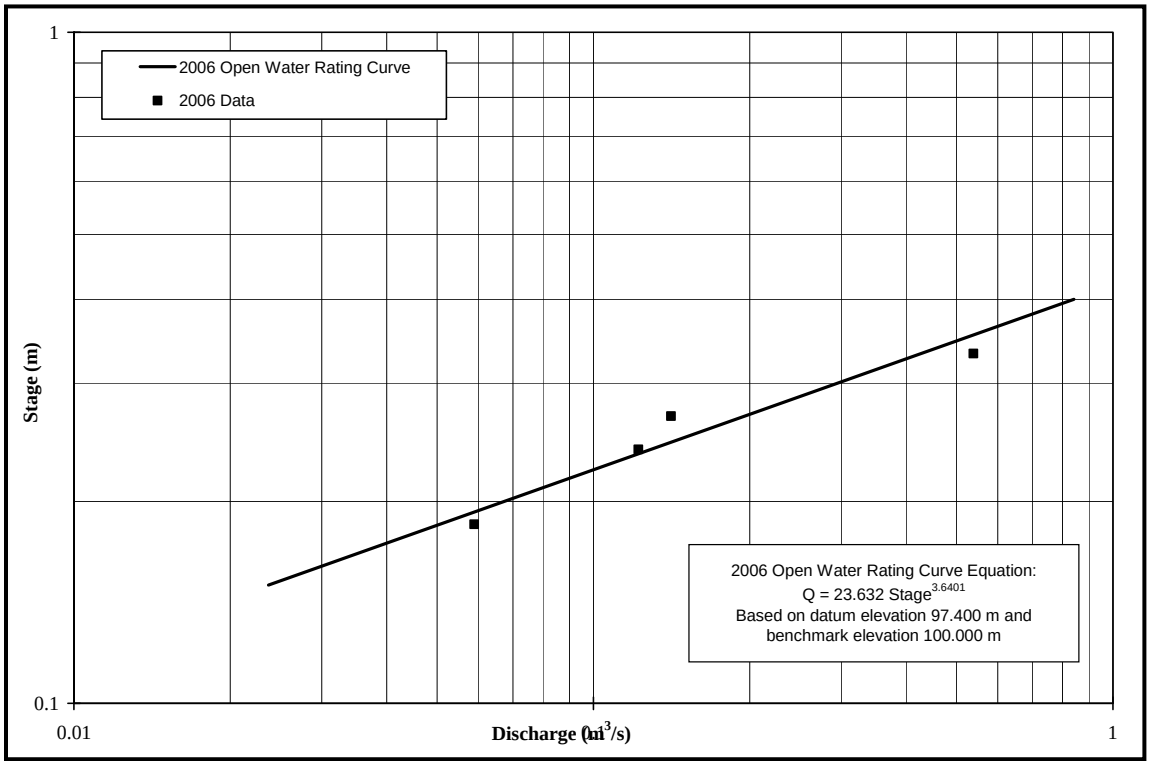


Station H82 looking northeast before snowmelt.

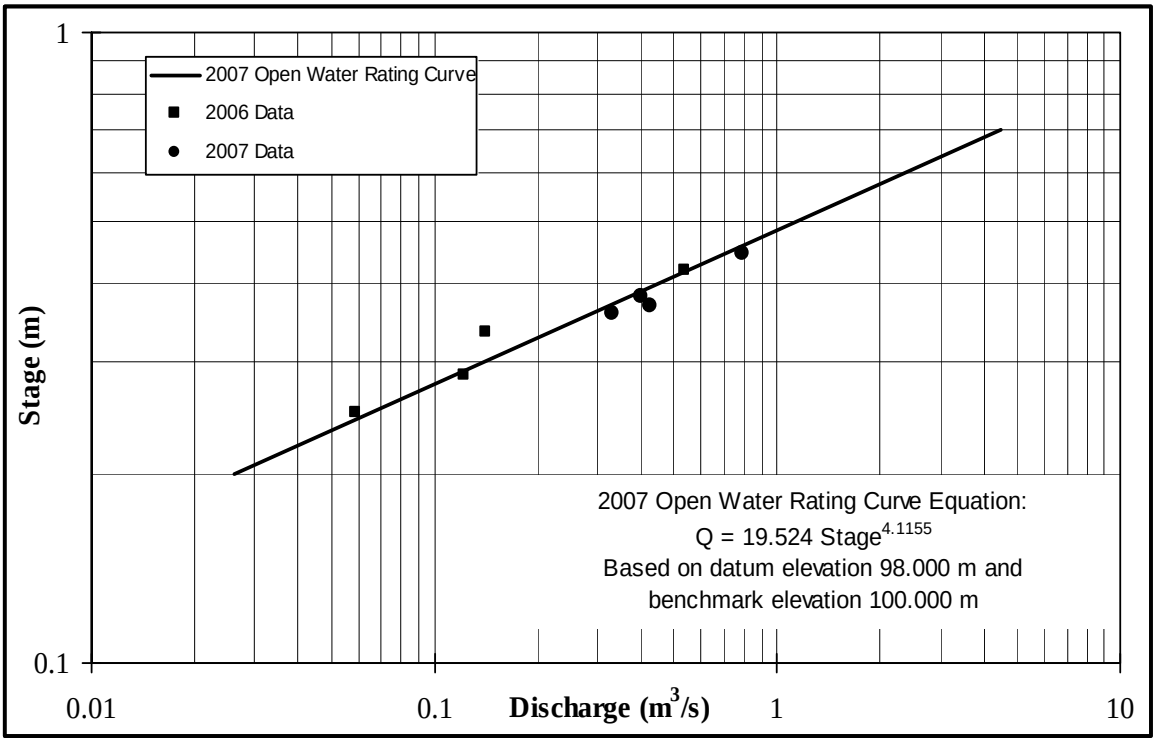


NTS Mapping of Area.

FACT-H82-2007.DOC



Ogama Outflow Station H82 - Stage-Discharge Rating Curve (2006)



Ogama Outflow Station H82 - Stage-Discharge Rating Curve (2007)

Ogama Outflow Station H82 – Stage-Discharge Data (2006-2007)

Stage Datum 97.400 m (non-geodetic)

Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Water Surface Elevation (m)	Stage (m)	Measured Discharge (m^3/s)
31/05/2006 16:27	0.9356	-		n/a	n/a	-
03/07/2006 10:10	1.1620	96.570		97.732	0.332	0.539
22/07/2006 15:30	1.0780	-		*97.668*	0.268	0.141
12/08/2006 15:30	1.0289	96.610		97.639	0.239	0.122
08/09/2006 16:09	0.9948	-	96.590	*97.585*	0.185	0.059
22/07/2007 11:20	1.0665		97.341	*98.408*	0.408	1.236
transducer shift down by 0.317 m on 22-Jun-2007 1830 h						
03/07/2007 11:30	1.4346	97.072		98.507	0.507	n/a
10/07/2007 14:00	1.3920	97.054		98.446	0.446	0.789
19/07/2007 00:05	1.3651	96.995		98.360	0.360	0.329
16/08/2007 14:10	1.4331	96.937		98.370	0.370	0.425
14/09/2007 10:10	1.4289	96.952	97.024	98.381	0.381	0.400

H82 Ogama Outflow - 2006
MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	0.039	0.580	0.146	0.040	-	-	-
2	-	-	-	-	-	0.334	0.560	0.137	0.040	-	-	-
3	-	-	-	-	-	0.947	0.530	0.132	0.043	-	-	-
4	-	-	-	-	-	2.002	0.490	0.130	0.042	-	-	-
5	-	-	-	-	-	3.122	0.466	0.127	0.043	-	-	-
6	-	-	-	-	-	3.514	0.426	0.123	0.043	-	-	-
7	-	-	-	-	-	3.497	0.404	0.116	0.045	-	-	-
8	-	-	-	-	-	3.388	0.378	0.111	0.045 P	-	-	-
9	-	-	-	-	-	3.281	0.356	0.108	-	-	-	-
10	-	-	-	-	-	3.119	0.344	0.105	-	-	-	-
11	-	-	-	-	-	2.901	0.338	0.098	-	-	-	-
12	-	-	-	-	-	2.726	0.329	0.095	-	-	-	-
13	-	-	-	-	-	2.568	0.308	0.093	-	-	-	-
14	-	-	-	-	-	2.380	0.306	0.092	-	-	-	-
15	-	-	-	-	-	2.101	0.305	0.086	-	-	-	-
16	-	-	-	-	-	1.881	0.290	0.079	-	-	-	-
17	-	-	-	-	-	1.721	0.269	0.076	-	-	-	-
18	-	-	-	-	-	1.530	0.242	0.075	-	-	-	-
19	-	-	-	-	-	1.393	0.236	0.069	-	-	-	-
20	-	-	-	-	-	1.246	0.240	0.068	-	-	-	-
21	-	-	-	-	-	1.140	0.229	0.068	-	-	-	-
22	-	-	-	-	-	1.043	0.211	0.068	-	-	-	-
23	-	-	-	-	-	0.981	0.207	0.068	-	-	-	-
24	-	-	-	-	-	0.866	0.206	0.061	-	-	-	-
25	-	-	-	-	-	0.794	0.203	0.059	-	-	-	-
26	-	-	-	-	-	0.795	0.190	0.055	-	-	-	-
27	-	-	-	-	-	0.808	0.152	0.051	-	-	-	-
28	-	-	-	-	-	0.702	0.157	0.053	-	-	-	-
29	-	-	-	-	-	0.630	0.157	0.052	-	-	-	-
30	-	-	-	-	-	0.590	0.160	0.051	-	-	-	-
31	-	-	-	-	0.017 P	-	0.149	0.045	-	-	-	-
MIN	-	-	-	-	0.017	0.039	0.149	0.045	0.040	-	-	-
MEAN	-	-	-	-	0.017	1.735	0.304	0.087	0.042	-	-	-
MAX	-	-	-	-	0.017	3.514	0.580	0.146	0.045	-	-	-

H82 Ogama Outflow - 2006 (Continued)
MEAN DAILY WATER LEVELS (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	97.569	97.761	97.647	97.573	-	-	-
2	-	-	-	-	-	97.699	97.758	97.643	97.573	-	-	-
3	-	-	-	-	-	97.811	97.752	97.640	97.577	-	-	-
4	-	-	-	-	-	97.906	97.745	97.639	97.576	-	-	-
5	-	-	-	-	-	97.973	97.740	97.638	97.576	-	-	-
6	-	-	-	-	-	97.992	97.732	97.636	97.577	-	-	-
7	-	-	-	-	-	97.992	97.727	97.632	97.578	-	-	-
8	-	-	-	-	-	97.986	97.721	97.629	97.579 P	-	-	-
9	-	-	-	-	-	97.981	97.716	97.628	-	-	-	-
10	-	-	-	-	-	97.973	97.713	97.626	-	-	-	-
11	-	-	-	-	-	97.962	97.711	97.621	-	-	-	-
12	-	-	-	-	-	97.952	97.709	97.620	-	-	-	-
13	-	-	-	-	-	97.943	97.703	97.618	-	-	-	-
14	-	-	-	-	-	97.932	97.703	97.618	-	-	-	-
15	-	-	-	-	-	97.914	97.703	97.614	-	-	-	-
16	-	-	-	-	-	97.899	97.698	97.609	-	-	-	-
17	-	-	-	-	-	97.887	97.692	97.607	-	-	-	-
18	-	-	-	-	-	97.871	97.684	97.606	-	-	-	-
19	-	-	-	-	-	97.859	97.682	97.601	-	-	-	-
20	-	-	-	-	-	97.845	97.683	97.600	-	-	-	-
21	-	-	-	-	-	97.835	97.680	97.601	-	-	-	-
22	-	-	-	-	-	97.824	97.673	97.600	-	-	-	-
23	-	-	-	-	-	97.817	97.672	97.600	-	-	-	-
24	-	-	-	-	-	97.803	97.672	97.595	-	-	-	-
25	-	-	-	-	-	97.794	97.670	97.593	-	-	-	-
26	-	-	-	-	-	97.794	97.666	97.589	-	-	-	-
27	-	-	-	-	-	97.795	97.649	97.585	-	-	-	-
28	-	-	-	-	-	97.780	97.652	97.587	-	-	-	-
29	-	-	-	-	-	97.769	97.652	97.587	-	-	-	-
30	-	-	-	-	-	97.763	97.653	97.585	-	-	-	-
31	-	-	-	-	97.536 P	-	97.649	97.578	-	-	-	-
MIN	-	-	-	-	97.536	97.569	97.649	97.578	97.573	-	-	-
MEAN	-	-	-	-	97.536	97.864	97.697	97.612	97.576	-	-	-
MAX	-	-	-	-	97.536	97.992	97.761	97.647	97.579	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE

H82 Ogama Outflow - 2007

MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	0.940	0.256	1.415	0.270 E	-	-
2	-	-	-	-	-	-	0.879	0.247	1.330	0.240 E	-	-
3	-	-	-	-	-	-	0.811	0.241	1.249	0.210 E	-	-
4	-	-	-	-	-	-	0.741	0.234	1.173	0.180 E	-	-
5	-	-	-	-	-	-	0.677	0.230	1.145	0.150 E	-	-
6	-	-	-	-	-	-	0.620	0.236	1.103	0.120 E	-	-
7	-	-	-	-	-	-	0.570	0.236	1.048	0.090 E	-	-
8	-	-	-	-	-	-	0.536	0.238	1.008	0.060 E	-	-
9	-	-	-	-	-	-	0.520	0.346	0.950	0.030 E	-	-
10	-	-	-	-	-	-	0.531	0.394	0.906	-	-	-
11	-	-	-	-	-	-	0.568	0.428	0.906	-	-	-
12	-	-	-	-	-	-	0.583	0.483	0.862	-	-	-
13	-	-	-	-	-	-	0.562	0.562	0.805	-	-	-
14	-	-	-	-	-	-	0.536	0.631	0.780 P	-	-	-
15	-	-	-	-	-	0.079 E	0.517	0.692	0.750 E	-	-	-
16	-	-	-	-	-	0.179 E	0.482	0.779	0.720 E	-	-	-
17	-	-	-	-	-	0.279 E	0.449	0.853	0.690 E	-	-	-
18	-	-	-	-	-	0.378 E	0.435	0.935	0.660 E	-	-	-
19	-	-	-	-	-	0.478 P	0.422	1.183	0.630 E	-	-	-
20	-	-	-	-	-	0.578	0.429	1.499	0.600 E	-	-	-
21	-	-	-	-	-	0.615	0.417	1.707	0.570 E	-	-	-
22	-	-	-	-	-	0.620	0.371	1.859	0.540 E	-	-	-
23	-	-	-	-	-	0.711	0.354	1.915	0.510 E	-	-	-
24	-	-	-	-	-	0.865	0.345	1.926	0.480 E	-	-	-
25	-	-	-	-	-	0.986	0.338	1.885	0.450 E	-	-	-
26	-	-	-	-	-	1.076	0.321	1.819	0.420 E	-	-	-
27	-	-	-	-	-	1.118	0.305	1.703	0.390 E	-	-	-
28	-	-	-	-	-	1.116	0.294	1.661	0.360 E	-	-	-
29	-	-	-	-	-	1.080	0.285	1.596	0.330 E	-	-	-
30	-	-	-	-	-	1.016	0.287	1.551	0.300 E	-	-	-
31	-	-	-	-	-	-	0.267	1.502	-	-	-	-
MIN	-	-	-	-	-	0.079	0.267	0.230	0.300	0.030	-	-
MEAN	-	-	-	-	-	0.698	0.497	0.962	0.769	0.150	-	-
MAX	-	-	-	-	-	1.118	0.940	1.926	1.415	0.270	-	-

MEAN DAILY WATER LEVELS (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	98.478	98.349	98.528	-	-	-
2	-	-	-	-	-	-	98.471	98.346	98.521	-	-	-
3	-	-	-	-	-	-	98.462	98.344	98.513	-	-	-
4	-	-	-	-	-	-	98.451	98.341	98.505	-	-	-
5	-	-	-	-	-	-	98.442	98.340	98.502	-	-	-
6	-	-	-	-	-	-	98.432	98.342	98.497	-	-	-
7	-	-	-	-	-	-	98.424	98.342	98.491	-	-	-
8	-	-	-	-	-	-	98.417	98.342	98.487	-	-	-
9	-	-	-	-	-	-	98.414	98.375	98.480	-	-	-
10	-	-	-	-	-	-	98.417	98.387	98.474	-	-	-
11	-	-	-	-	-	-	98.423	98.395	98.474	-	-	-
12	-	-	-	-	-	-	98.426	98.407	98.469	-	-	-
13	-	-	-	-	-	-	98.422	98.422	98.461	-	-	-
14	-	-	-	-	-	-	98.418	98.434	98.457 P	-	-	-
15	-	-	-	-	-	-	98.414	98.444	-	-	-	-
16	-	-	-	-	-	-	98.407	98.457	-	-	-	-
17	-	-	-	-	-	-	98.400	98.467	-	-	-	-
18	-	-	-	-	-	-	98.397	98.478	-	-	-	-
19	-	-	-	-	-	98.405 P	98.394	98.505	-	-	-	-
20	-	-	-	-	-	98.425	98.395	98.536	-	-	-	-
21	-	-	-	-	-	98.432	98.393	98.553	-	-	-	-
22	-	-	-	-	-	98.432	98.382	98.565	-	-	-	-
23	-	-	-	-	-	98.447	98.377	98.569	-	-	-	-
24	-	-	-	-	-	98.469	98.375	98.570	-	-	-	-
25	-	-	-	-	-	98.484	98.373	98.567	-	-	-	-
26	-	-	-	-	-	98.494	98.368	98.562	-	-	-	-
27	-	-	-	-	-	98.499	98.364	98.553	-	-	-	-
28	-	-	-	-	-	98.499	98.361	98.549	-	-	-	-
29	-	-	-	-	-	98.495	98.358	98.544	-	-	-	-
30	-	-	-	-	-	98.488	98.359	98.540	-	-	-	-
31	-	-	-	-	-	-	98.352	98.536	-	-	-	-
MIN	-	-	-	-	-	98.405	98.352	98.340	98.457	-	-	-
MEAN	-	-	-	-	-	98.464	98.405	98.457	98.490	-	-	-
MAX	-	-	-	-	-	98.499	98.478	98.570	98.528	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Ogama Outflow**
LOCATION: **Outlet of Ogama Lake**
COORDINATES: **13W 0435648 E, 7555130 N (NAD 83)**

MEASUREMENT DATE: **3 July 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **KK**
COMPUTATIONS BY: **NS / TJ**

MEASUREMENT START TIME: **1005 h est.**
MEASUREMENT END TIME: **1025 h est.**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.13	0.000
1	0.25		0.04			0.00	0.38	0.000
2	0.75		0.07			0.00	0.50	0.000
3	1.25		0.08			0.00	0.50	0.000
4	1.75		0.13			0.02	0.38	0.001
5	2.00		0.21			0.19	0.25	0.010
6	2.25		0.28			0.48	0.25	0.034
7	2.50		0.34			0.23	0.25	0.020
8	2.75		0.34			0.56	0.25	0.048
9	3.00		0.33			0.58	0.25	0.048
10	3.25		0.35			0.31	0.25	0.027
11	3.50		0.34			0.57	0.25	0.048
12	3.75		0.36			0.64	0.25	0.058
13	4.00		0.36			0.62	0.25	0.056
14	4.25		0.37			0.64	0.25	0.059
15	4.50		0.33			0.42	0.25	0.035
16	4.75		0.36			0.33	0.25	0.030
17	5.00		0.35			0.49	0.25	0.043
18	5.25		0.30			0.31	0.25	0.023
19	5.50		0.13			0.01	0.50	0.001
20	6.25		0.05			0.00	0.44	0.000
Right Bank	6.38		0.00			0.00	0.06	0.000
								0.539

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Ogama Outflow**
LOCATION: **Outlet of Ogama Lake**
COORDINATES: **13W 0435648 E, 7555130 N (NAD 83)**

MEASUREMENT DATE: **22 July 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **TA / PE**
COMPUTATIONS BY: **NS / TJ**

MEASUREMENT START TIME: **1530 h**
MEASUREMENT END TIME: **1545 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.51			0.04	0.35	0.007
1	0.70		0.37			0.10	0.70	0.026
2	1.40		0.52			0.07	0.70	0.025
3	2.10		0.36			0.17	0.70	0.043
4	2.80		0.30			0.12	0.70	0.025
5	3.50		0.26			0.02	0.70	0.004
6	4.20		0.19			0.06	0.70	0.008
7	4.90		0.24			0.01	0.70	0.002
8	5.60		0.19			0.01	0.70	0.001
Right Bank	6.30		0.00			0.00	0.35	0.000
								0.141

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Ogama Outflow**
LOCATION: **Outlet of Ogama Lake**
COORDINATES: **13W 0435648 E, 7555130 N (NAD 83)**

MEASUREMENT DATE: **12 August 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **NS / KM**
COMPUTATIONS BY: **NS / TJ**

MEASUREMENT START TIME: **1522 h**
MEASUREMENT END TIME: **1537 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.10	0.000
1	0.20		0.12			0.38	0.20	0.009
2	0.40		0.16			-0.05	0.15	-0.001
3	0.50		0.16			0.47	0.10	0.008
4	0.60		0.16			0.54	0.15	0.013
5	0.80		0.22			0.31	0.20	0.014
6	1.00		0.18			0.62	0.20	0.022
7	1.20		0.19			0.44	0.20	0.017
8	1.40		0.20			0.28	0.20	0.011
9	1.60		0.19			0.04	0.20	0.002
10	1.80		0.16			0.12	0.20	0.004
11	2.00		0.10			0.28	0.20	0.006
12	2.20		0.09			0.40	0.20	0.007
13	2.40		0.11			0.23	0.20	0.005
14	2.60		0.10			0.16	0.20	0.003
15	2.80		0.15			0.09	0.15	0.002
16	2.90		0.13			0.13	0.10	0.002
Right Bank	3.00		0.00			0.00	0.05	0.000
								0.122

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Ogama Outflow**
LOCATION: **Outlet of Ogama Lake**
COORDINATES: **13W 0435648 E, 7555130 N (NAD 83)**

MEASUREMENT DATE: **8 September 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **KK / PE**
COMPUTATIONS BY: **NS / TJ**

MEASUREMENT START TIME: **1620 h**
MEASUREMENT END TIME: **1640 h est.**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.01	0.000
1	0.02		0.08			0.00	0.16	0.000
2	0.32		0.14			0.00	0.30	0.000
3	0.62		0.23			0.02	0.30	0.001
4	0.92		0.16			0.09	0.30	0.004
5	1.22		0.40			0.06	0.30	0.007
6	1.52		0.42			0.14	0.30	0.018
7	1.82		0.38			0.05	0.30	0.006
8	2.12		0.28			0.09	0.30	0.008
9	2.42		0.30			0.10	0.30	0.009
10	2.72		0.22			0.08	0.30	0.005
11	3.02		0.20			0.01	0.30	0.001
12	3.32		0.18			0.00	0.30	0.000
13	3.62		0.02			0.00	0.16	0.000
Right Bank	3.64		0.00			0.00	0.01	0.000
								0.059

PROJECT NAME: **Miramar / M2 Program / Ogama Lake Outflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Ogama Lake Outflow** **MEASUREMENT DATE:** **22 June 2007**
LOCATION: **Outflow of Ogama Lake** **METER NUMBER:** **Marsh McBirney**
COORDINATES: **13W 0435648 E, 7555130 N (NAD 83)** **Flo-Mate Model 2000**

MEASUREMENT BY: **PE** **MEASUREMENT START TIME:** **1101 h**
COMPUTATIONS BY: **TJ/DC** **MEASUREMENT END TIME:** **1120 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.72			0.00	0.55	0.000
1	1.10		0.50			0.59	1.10	0.325
2	2.20		0.52			0.61	1.10	0.349
3	3.30		0.46			0.63	1.10	0.319
4	4.40		0.30			0.53	1.10	0.175
5	5.50		0.36			0.10	1.10	0.040
6	6.60		0.32			0.03	1.10	0.011
7	7.70		0.10			0.14	1.10	0.015
8	8.80		0.28			0.01	1.10	0.003
9	9.90		0.15			0.00	0.65	0.000
Right Bank	10.10		0.19			0.00	0.10	0.000
								1.236

PROJECT NAME: **Miramar / M2 Program / Ogama Lake Outflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Ogama Lake Outflow** **MEASUREMENT DATE:** **10 July 2007**
LOCATION: **Outflow of Ogama Lake** **METER NUMBER:** **Marsh-McBirney**
COORDINATES: **13W 0435648 E, 7555130 N (NAD 83)** **Flo-Mate Model 2000**

MEASUREMENT BY: **TY** **MEASUREMENT START TIME:** **1358 h**
COMPUTATIONS BY: **DC** **MEASUREMENT END TIME:** **1410 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.00			0.00	0.08	0.000
1	0.15		0.06			0.00	0.33	0.000
2	0.65		0.13			0.00	0.60	0.000
3	1.35		0.12			0.00	0.45	0.000
4	1.55		0.15			0.00	0.15	0.000
5	1.65		0.17			0.02	0.15	0.000
6	1.85		0.22			0.03	0.20	0.001
7	2.05		0.27			0.46	0.20	0.025
8	2.25		0.32			0.65	0.20	0.041
9	2.45		0.33			0.56	0.20	0.037
10	2.65		0.36			0.70	0.20	0.050
11	2.85		0.35			0.73	0.20	0.051
12	3.05		0.35			0.69	0.20	0.048
13	3.25		0.36			0.65	0.20	0.047
14	3.45		0.36			0.80	0.20	0.058
15	3.65		0.35			0.82	0.20	0.057
16	3.85		0.36			0.77	0.20	0.056
17	4.05		0.39			0.72	0.20	0.056
18	4.25		0.38			0.70	0.20	0.053
19	4.45		0.37			0.79	0.20	0.059
20	4.65		0.36			0.74	0.20	0.053
21	4.85		0.31			0.78	0.20	0.048
22	5.05		0.30			0.67	0.15	0.030
23	5.15		0.29			0.50	0.10	0.014
24	5.25		0.28			0.15	0.10	0.004
25	5.35		0.20			0.00	0.15	0.000
26	5.55		0.12			0.00	0.35	0.000
27	6.05		0.10			0.00	0.40	0.000
Left Bank	6.35		0.00			0.00	0.15	0.000
								0.789

PROJECT NAME: **Miramar / M2 Program / Ogama Lake Outflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Ogama Lake Outflow**
LOCATION: **Outflow of Ogama Lake**
COORDINATES: **13W 435648 E, 7555130 N (NAD 83)**

MEASUREMENT DATE: **19 July 2007**
METER NUMBER: **Marsh McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **MK/HS**
COMPUTATIONS BY: **DC**

MEASUREMENT START TIME: **2345 h**
MEASUREMENT END TIME: **0010 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.00			0.00	0.50	0.000
1	1.00		0.25			0.02	0.65	0.003
2	1.30		0.18			0.20	0.30	0.011
3	1.60		0.10			0.18	0.30	0.005
4	1.90		0.25			0.12	0.35	0.011
5	2.30		0.34			0.02	0.40	0.003
6	2.70		0.34			0.55	0.40	0.075
7	3.10		0.38			0.55	0.40	0.084
8	3.50		0.39			0.62	0.35	0.085
9	3.80		0.33			0.44	0.33	0.047
10	4.15		0.20			0.03	0.95	0.006
Left Bank	5.70		0.00			0.00	0.78	0.000
								0.329

PROJECT NAME: **Miramar / M2 Program / Ogama Lake Outflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Ogama Lake Outflow**
LOCATION: **Outflow of Ogama Lake**
COORDINATES: **13W 0435648 E, 7555130 N (NAD 83)**

MEASUREMENT DATE: **16 August 2007**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **TY**
COMPUTATIONS BY: **TJ / DC**

MEASUREMENT START TIME: **1420 h**
MEASUREMENT END TIME: **1450 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.00			0.00	0.10	0.000
1	0.20		0.05			0.00	0.20	0.000
2	0.40		0.07			-0.01	0.20	0.000
3	0.60		0.10			0.01	0.20	0.000
4	0.80		0.18			0.23	0.20	0.008
5	1.00		0.20			0.49	0.20	0.020
6	1.20		0.21			0.63	0.20	0.026
7	1.40		0.22			0.66	0.20	0.029
8	1.60		0.22			0.70	0.20	0.031
9	1.80		0.23			0.65	0.20	0.030
10	2.00		0.24			0.70	0.20	0.034
11	2.20		0.24			0.69	0.20	0.033
12	2.40		0.24			0.65	0.20	0.031
13	2.60		0.25			0.61	0.20	0.031
14	2.80		0.26			0.60	0.20	0.031
15	3.00		0.26			0.59	0.20	0.031
16	3.20		0.26			0.55	0.20	0.029
17	3.40		0.26			0.56	0.20	0.029
18	3.60		0.27			0.52	0.20	0.028
19	3.80		0.26			0.10	0.20	0.005
Left Bank	4.00		0.13			0.00	0.10	0.000
								0.425

PROJECT NAME: **Miramar / M2 Program / Ogama Lake Outflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Ogama Lake Outflow** **MEASUREMENT DATE:** **14 September 2007**
LOCATION: **Outflow of Ogama Lake** **METER NUMBER:** **Marsh McBirney**
COORDINATES: **13W 0435648 E, 7555130 N (NAD 83)** **Flo-Mate Model 2000**

MEASUREMENT BY: **TY** **MEASUREMENT START TIME:** **0955 h**
COMPUTATIONS BY: **DC** **MEASUREMENT END TIME:** **1015 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.02			0.00	0.15	0.000
1	0.30		0.07			0.00	0.30	0.000
2	0.60		0.20			0.00	0.30	0.000
3	0.90		0.28			0.02	0.30	0.002
4	1.20		0.28			0.11	0.30	0.009
5	1.50		0.27			0.17	0.30	0.014
6	1.80		0.26			0.15	0.30	0.012
7	2.10		0.28			0.21	0.30	0.018
8	2.40		0.31			0.18	0.30	0.017
9	2.70		0.29			0.04	0.30	0.003
10	3.00		0.31			0.22	0.30	0.020
11	3.30		0.37			0.10	0.30	0.011
12	3.60		0.34			0.04	0.30	0.004
13	3.90		0.34			0.14	0.30	0.014
14	4.20		0.34			0.39	0.30	0.040
15	4.50		0.28			0.48	0.30	0.040
16	4.80		0.32			0.37	0.30	0.036
17	5.10		0.34			0.18	0.30	0.018
18	5.40		0.29			0.35	0.30	0.030
19	5.70		0.40			0.41	0.30	0.049
20	6.00		0.36			0.18	0.30	0.019
21	6.30		0.32			0.18	0.30	0.017
26	6.60		0.45			0.19	0.30	0.026
27	6.90		0.36			0.00	0.20	0.000
Left Bank	7.00		0.00			0.00	0.05	0.000
								0.400

AIMAOKATALOK RIVER HYDROMETRIC STATION

H83

FACTSHEET

LOCATION AND PURPOSE

Located on the right upstream bank of Aimaokatalok River, approximately 200 m upstream of Aimaokatalok Lake.

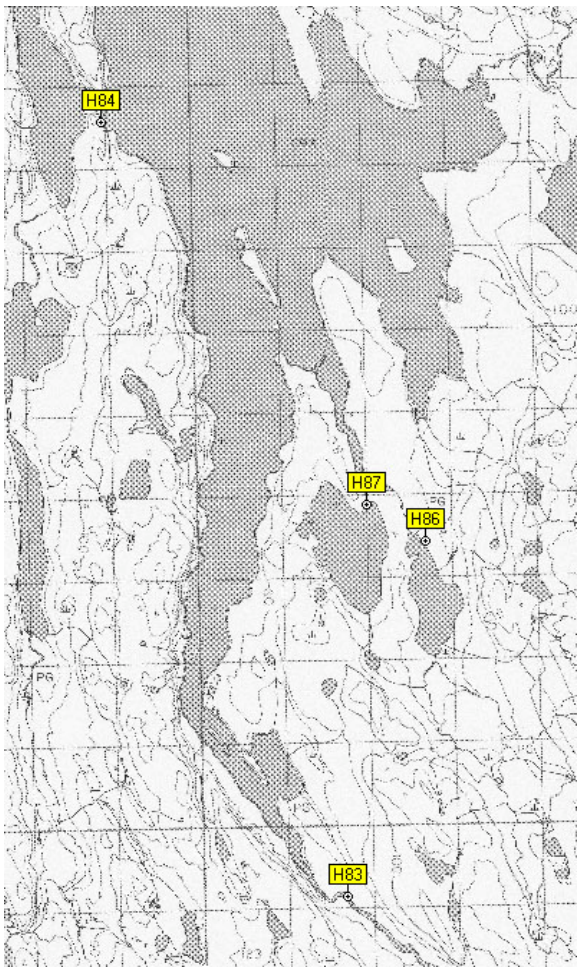
Operational:	2006 (2 June – 10 September)	2007 (26 May – 9 September)	
Benchmark:	Top of embedded boulder;	Drainage Area:	769 km^2
Coordinates:	UTM: 441634 m E, 7499360 m N (NAD83)	Lat/Long:	67°36'14" N, 106°22'22" W
Datalogger:	Optimum Instruments #628	Transducer:	Keller #202698 (5 psi, 15 m)



Station H83 looking West from right bank, with benchmark.

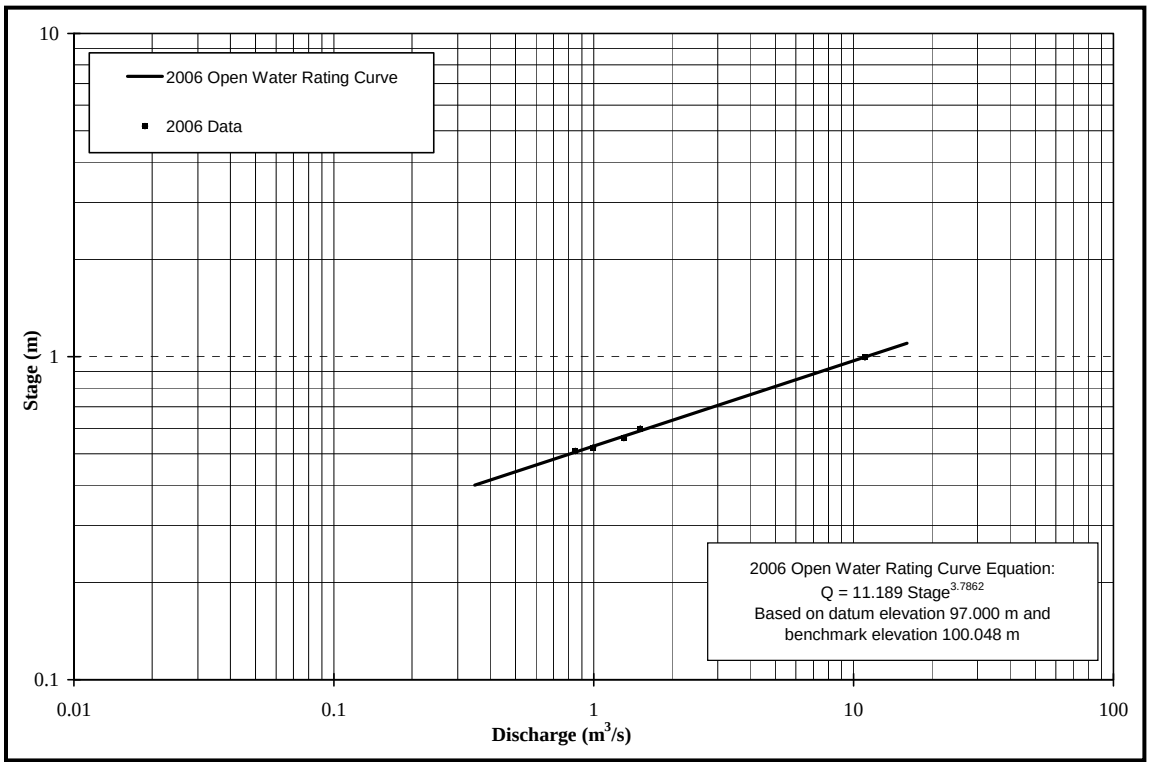


Station H83 looking north (downstream) during spring melt.



NTS Mapping of Area.

FACT-H83-2007.DOC



Aimaokatalok Inflow Station H83 - Stage-Discharge Rating Curve (2006)

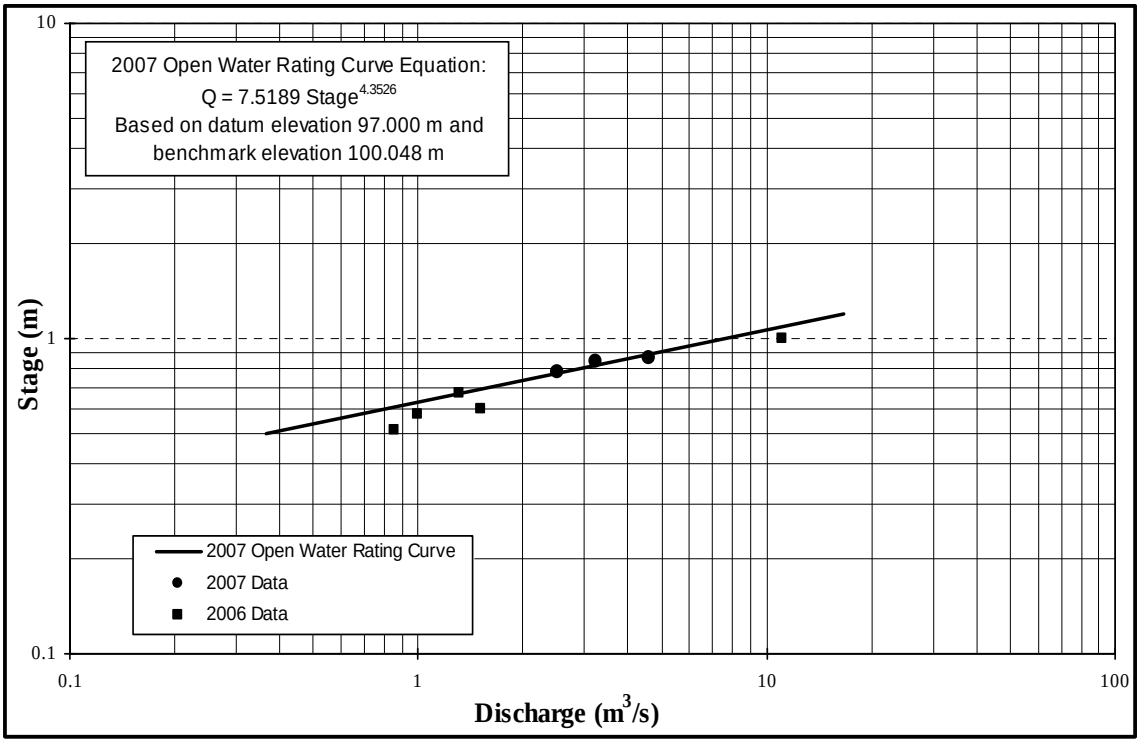


Figure I 1

Aimaokatalok River Station H83 - Stage-Discharge Rating Curve (2007)

Aimaokatalok River Station H83 – Stage-Discharge Data (2006-2007)

			Stage Datum	97.000 m	(assumed)	
Date & Time	Transducer Reading	Transducer Elevation	Average Transducer Elevation	Water Surface Elevation	Stage	Measured Discharge
	(m)	(m)	(m)	(m)	(m)	(m^3/s)
02/06/2006 17:07	0.9089	97.554		98.463	1.463	
23/06/2006 14:59	0.4884	97.507		97.995	0.995	11.060
17/07/2006 11:00	0.0691		97.530	*97.599*	0.599	
Transducer repositioned due to low water						
17/07/2006 11:15	0.6821			*97.589*	0.589	1.512
09/08/2006 16:35	0.6033	96.907		97.510	0.510	0.850
13/08/2006 13:10	0.6159			*97.523*	0.523	0.994
10/09/2006 15:17	0.6531		96.907	*97.560*	0.560	1.305
04/07/2007 09:45						6.697
transducer damaged 21 June; replaced below riffle on 21 Jul at 20:00 h						
21/07/2007 20:45	0.5322	97.3108		97.843	0.843	3.226
18/08/2007 12:01	0.5649			97.866	0.866	4.606
09/09/2007 15:46	0.4908	97.2922	97.301	97.783	0.783	2.503

H83 Aimaokatalok Inflow - 2006
MEAN DAILY DISCHARGE (m3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	6.823	1.123	0.968	-	-	-
2	-	-	-	-	-	-	6.201	1.114	0.954	-	-	-
3	-	-	-	-	-	-	5.711	1.081	0.919	-	-	-
4	-	-	-	-	-	-	5.322	1.063	0.928	-	-	-
5	-	-	-	-	-	-	4.858	1.041	1.011	-	-	-
6	-	-	-	-	-	-	4.476	1.006	1.016	-	-	-
7	-	-	-	-	-	-	4.091	0.979	1.014	-	-	-
8	-	-	-	-	-	-	3.564	0.953	1.064	-	-	-
9	-	-	-	-	-	-	3.299	0.932	1.185	-	-	-
10	-	-	-	-	-	-	3.216	0.891	1.194	-	-	-
11	-	-	-	-	-	-	2.877	0.873	1.223	-	-	-
12	-	-	-	-	-	-	2.605	0.860	1.248	-	-	-
13	-	-	-	-	-	-	2.437	0.864	1.246 P	-	-	-
14	-	-	-	-	-	-	2.245	0.889	-	-	-	-
15	-	-	-	-	-	-	2.093	1.014	-	-	-	-
16	-	-	-	-	-	-	1.975	0.963	-	-	-	-
17	-	-	-	-	-	-	1.874	0.880	-	-	-	-
18	-	-	-	-	-	-	1.789	0.852	-	-	-	-
19	-	-	-	-	-	-	1.695	0.826	-	-	-	-
20	-	-	-	-	-	-	1.515	0.814	-	-	-	-
21	-	-	-	-	-	-	1.388	0.832	-	-	-	-
22	-	-	-	-	-	-	1.324	0.799	-	-	-	-
23	-	-	-	-	-	-	1.237	0.776	-	-	-	-
24	-	-	-	-	-	-	1.162	0.763	-	-	-	-
25	-	-	-	-	-	-	1.096	0.736	-	-	-	-
26	-	-	-	-	-	11.648 P	1.115	0.727	-	-	-	-
27	-	-	-	-	-	10.903	1.103	0.853	-	-	-	-
28	-	-	-	-	-	9.783	1.118	0.974	-	-	-	-
29	-	-	-	-	-	8.720	1.073	0.974	-	-	-	-
30	-	-	-	-	-	7.745	1.010	0.982	-	-	-	-
31	-	-	-	-	-	-	1.161	0.996	-	-	-	-
MIN	-	-	-	-	-	7.745	1.010	0.727	0.919	-	-	-
MEAN	-	-	-	-	-	9.760	2.628	0.917	1.075	-	-	-
MAX	-	-	-	-	-	11.648	6.823	1.123	1.248	-	-	-

H83 Aimaokatalok Inflow – 2006 (Continued)

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.482 m (ASSUMED)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	97.822	97.537	97.518	-	-	-
2	-	-	-	-	-	98.526 P	97.802	97.534	97.530	-	-	-
3	-	-	-	-	-	98.624	97.785	97.529	97.531	-	-	-
4	-	-	-	-	-	98.776	97.767	97.526	97.530	-	-	-
5	-	-	-	-	-	98.787	97.739	97.522	97.537	-	-	-
6	-	-	-	-	-	98.861	97.724	97.519	97.553	-	-	-
7	-	-	-	-	-	98.809	97.719	97.513	97.554	-	-	-
8	-	-	-	-	-	98.820	97.698	97.510	97.557	-	-	-
9	-	-	-	-	-	98.770	97.680	97.508	97.560	-	-	-
10	-	-	-	-	-	98.715	97.669	97.508	97.560 P	-	-	-
11	-	-	-	-	-	98.649	97.654	97.512	-	-	-	-
12	-	-	-	-	-	98.587	97.642	97.530	-	-	-	-
13	-	-	-	-	-	98.523	97.633	97.523	-	-	-	-
14	-	-	-	-	-	98.462	97.624	97.511	-	-	-	-
15	-	-	-	-	-	98.395	97.616	97.507	-	-	-	-
16	-	-	-	-	-	98.336	97.607	97.502	-	-	-	-
17	-	-	-	-	-	98.275	97.590	97.500	-	-	-	-
18	-	-	-	-	-	98.227	97.576	97.503	-	-	-	-
19	-	-	-	-	-	98.176	97.569	97.498	-	-	-	-
20	-	-	-	-	-	98.125	97.559	97.494	-	-	-	-
21	-	-	-	-	-	98.080	97.550	97.492	-	-	-	-
22	-	-	-	-	-	98.051	97.541	97.487	-	-	-	-
23	-	-	-	-	-	98.018	97.544	97.486	-	-	-	-
24	-	-	-	-	-	97.993	97.542	97.507	-	-	-	-
25	-	-	-	-	-	97.965	97.544	97.525	-	-	-	-
26	-	-	-	-	-	97.936	97.538	97.525	-	-	-	-
27	-	-	-	-	-	97.907	97.530	97.526	-	-	-	-
28	-	-	-	-	-	97.877	97.550	97.528	-	-	-	-
29	-	-	-	-	-	97.856	97.545	97.524	-	-	-	-
30	-	-	-	-	-	97.837	97.544	97.522	-	-	-	-
31	-	-	-	-	-	-	97.539	97.517	-	-	-	-
MIN	-	-	-	-	-	97.837	97.530	97.486	97.518	-	-	-
MEAN	-	-	-	-	-	98.344	97.627	97.514	97.543	-	-	-
MAX	-	-	-	-	-	98.861	97.822	97.537	97.560	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED

H83 Aimaokatalok River - 2007

MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	1.833	3.153	1.124 E	-	-
2	-	-	-	-	-	-	-	1.745	3.084	1.051 E	-	-
3	-	-	-	-	-	-	-	1.651	3.050	0.978 E	-	-
4	-	-	-	-	-	-	6.697 E	1.576	3.122	0.905 E	-	-
5	-	-	-	-	-	-	6.480 E	1.506	2.909	0.832 E	-	-
6	-	-	-	-	-	-	6.260 E	1.502	2.863	0.759 E	-	-
7	-	-	-	-	-	-	6.050 E	1.479	2.839	0.686 E	-	-
8	-	-	-	-	-	-	5.850 E	1.458	2.803	0.613 E	-	-
9	-	-	-	-	-	-	5.660 E	1.805	2.736 P	0.540 E	-	-
10	-	-	-	-	-	-	5.470 E	2.338	2.657 E	0.467 E	-	-
11	-	-	-	-	-	-	5.280 E	2.970	2.584 E	0.394 E	-	-
12	-	-	-	-	-	-	5.090 E	3.648	2.511 E	0.321 E	-	-
13	-	-	-	-	-	-	4.900 E	4.076	2.438 E	0.248 E	-	-
14	-	-	-	-	-	-	4.710 E	4.039	2.365 E	0.175 E	-	-
15	-	-	-	-	-	-	4.520 E	4.329	2.292 E	0.102 E	-	-
16	-	-	-	-	-	-	4.330 E	4.306	2.219 E	0.029 E	-	-
17	-	-	-	-	-	-	4.140 E	4.244	2.146 E	-	-	-
18	-	-	-	-	-	-	3.950 E	4.085	2.073 E	-	-	-
19	-	-	-	-	-	-	3.760 E	4.268	2.000 E	-	-	-
20	-	-	-	-	-	-	3.570 E	4.371	1.927 E	-	-	-
21	-	-	-	-	-	-	3.380 E	4.111	1.854 E	-	-	-
22	-	-	-	-	-	-	3.349 P	3.744	1.781 E	-	-	-
23	-	-	-	-	-	-	2.915	3.616	1.708 E	-	-	-
24	-	-	-	-	-	-	2.830	3.495	1.635 E	-	-	-
25	-	-	-	-	-	-	2.636	3.377	1.562 E	-	-	-
26	-	-	-	-	-	-	2.504	3.296	1.489 E	-	-	-
27	-	-	-	-	-	-	2.395	3.212	1.416 E	-	-	-
28	-	-	-	-	-	-	2.236	3.240	1.343 E	-	-	-
29	-	-	-	-	-	-	2.118	3.281	1.270 E	-	-	-
30	-	-	-	-	-	-	2.019	3.254	1.197 E	-	-	-
31	-	-	-	-	-	-	1.914	3.201	-	-	-	-
MIN	-	-	-	-	-	-	1.914	1.458	1.197	0.029	-	-
MEAN	-	-	-	-	-	-	4.108	3.066	2.234	0.577	-	-
MAX	-	-	-	-	-	-	6.697	4.371	3.153	1.124	-	-

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.482 m (ASSUMED)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	97.723	97.819	-	-	-
2	-	-	-	-	-	-	-	97.715	97.815	-	-	-
3	-	-	-	-	-	-	-	97.706	97.813	-	-	-
4	-	-	-	-	-	-	-	97.698	97.817	-	-	-
5	-	-	-	-	-	-	-	97.691	97.804	-	-	-
6	-	-	-	-	-	-	-	97.691	97.801	-	-	-
7	-	-	-	-	-	-	-	97.688	97.800	-	-	-
8	-	-	-	-	-	-	-	97.686	97.797	-	-	-
9	-	-	-	-	-	-	-	97.720	97.793 P	-	-	-
10	-	-	-	-	-	-	-	97.763	-	-	-	-
11	-	-	-	-	-	-	-	97.808	-	-	-	-
12	-	-	-	-	-	-	-	97.845	-	-	-	-
13	-	-	-	-	-	-	-	97.869	-	-	-	-
14	-	-	-	-	-	-	-	97.867	-	-	-	-
15	-	-	-	-	-	-	-	97.881	-	-	-	-
16	-	-	-	-	-	-	-	97.880	-	-	-	-
17	-	-	-	-	-	-	-	97.877	-	-	-	-
18	-	-	-	-	-	-	-	97.869	-	-	-	-
19	-	-	-	-	-	-	-	97.878	-	-	-	-
20	-	-	-	-	-	-	-	97.883	-	-	-	-
21	-	-	-	-	-	-	-	97.870	-	-	-	-
22	-	-	-	-	-	-	97.830 P	97.852	-	-	-	-
23	-	-	-	-	-	-	97.804	97.845	-	-	-	-
24	-	-	-	-	-	-	97.799	97.839	-	-	-	-
25	-	-	-	-	-	-	97.786	97.832	-	-	-	-
26	-	-	-	-	-	-	97.777	97.827	-	-	-	-
27	-	-	-	-	-	-	97.769	97.823	-	-	-	-
28	-	-	-	-	-	-	97.757	97.824	-	-	-	-
29	-	-	-	-	-	-	97.747	97.827	-	-	-	-
30	-	-	-	-	-	-	97.739	97.825	-	-	-	-
31	-	-	-	-	-	-	97.730	97.822	-	-	-	-
MIN	-	-	-	-	-	-	97.730	97.686	97.793	-	-	-
MEAN	-	-	-	-	-	-	97.774	97.804	97.806	-	-	-
MAX	-	-	-	-	-	-	97.830	97.883	97.819	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED

PROJECT NAME: **Miramar/M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Aimaokatalok Inflow**
LOCATION: **Southern Inflow to Aimaokatalok Lake**
COORDINATES: **13W 0441607 E, 7499368 N (NAD 83)**

MEASUREMENT DATE: **23 June 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **KK / PE**
COMPUTATIONS BY: **TJ / NS**

MEASUREMENT START TIME: **1450 h**
MEASUREMENT END TIME: **1515 h est.**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.00			0.00	0.20	0.000
1	0.40		0.09			0.00	1.20	0.000
2	2.40		0.33			0.34	1.50	0.168
3	3.40		0.75			0.48	1.50	0.540
4	5.40		0.74			0.41	2.00	0.607
5	7.40		0.73			0.66	2.00	0.964
6	9.40		0.76			0.69	2.00	1.049
7	11.40		0.75			0.82	2.00	1.230
8	13.40		0.84			0.70	2.00	1.176
9	15.40		0.79			0.99	2.00	1.564
10	17.40		0.63			0.92	2.00	1.159
11	19.40		0.67			0.84	2.00	1.126
12	21.40		0.63			0.77	2.00	0.970
13	23.40		0.44			0.39	2.00	0.343
14	25.40		0.44			0.11	2.00	0.097
15	27.40		0.24			0.01	2.00	0.005
16	29.40		0.15			0.26	1.65	0.064
Left Bank	30.70		0.00			0.00	0.65	0.000
								11.06

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER.: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Aimaokatalok Inflow**
LOCATION: **Southern Inflow to Aimaokatalok Lake**
COORDINATES: **13W 0441607 E, 7499368 N (NAD 83)**

MEASUREMENT DATE: **17 July 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **HS / KM**
COMPUTATIONS BY: **TJ / NS**

MEASUREMENT START TIME: **1100 h**
MEASUREMENT END TIME: **1120 h est.**

STATION	DISTANCE FROM LEFT D/S BANK	ICE THICKNESS	DEPTH	VELOCITY			WIDTH	DISCHARGE
				0.2 Depth	0.8 Depth	0.6 Depth		
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)	(m)	(m^3/s)
Left Bank	0.00		0.00			0.00	0.55	0.000
19	1.10		0.40			0.00	1.05	0.000
18	2.10		0.20			0.00	1.00	0.000
17	3.10		0.09			0.10	1.00	0.009
16	4.10		0.10			0.07	1.00	0.007
15	5.10		0.20			0.12	1.00	0.024
14	6.10		0.25			0.02	1.00	0.005
13	7.10		0.25			0.22	1.00	0.055
12	8.10		0.32			0.33	1.00	0.106
11	9.10		0.36			0.32	1.00	0.115
10	10.10		0.31			0.27	1.00	0.084
9	11.10		0.29			0.46	1.00	0.133
8	12.10		0.44			0.40	1.00	0.176
7	13.10		0.44			0.47	1.00	0.207
6	14.10		0.39			0.48	1.00	0.187
5	15.10		0.45			0.41	1.00	0.185
4	16.10		0.47			0.34	1.00	0.160
3	17.10		0.35			0.13	1.00	0.046
2	18.10		0.28			0.05	1.00	0.014
1	19.10		0.22			0.00	0.70	0.000
Right Bank	19.50		0.00			0.00	0.20	0.000
								1.512

PROJECT NAME: **Miramar / M2 Program**

PROJECT NUMBER: **06 1373 027 .4000**

DISCHARGE DATA

STREAM NAME: **Aimaokatalok Inflow**
LOCATION: **Southern Inflow to Aimaokatalok Lake**
COORDINATES: **13W 0441607 E, 7499368 N (NAD 83)**

MEASUREMENT DATE: **9 August 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **NS / KM**
COMPUTATIONS BY: **TJ / NS**

MEASUREMENT START TIME: **1555 h**
MEASUREMENT END TIME: **1622 h est.**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.25	0.000
1	0.50		0.10			0.07	0.60	0.007
2	1.20		0.16			0.15	0.85	0.028
3	2.20		0.22			0.18	1.00	0.038
4	3.20		0.21			0.24	1.00	0.041
5	4.20		0.17			0.23	1.00	0.051
6	5.20		0.22			0.35	1.00	0.091
7	6.20		0.26			0.27	1.00	0.054
8	7.20		0.20			0.31	1.00	0.047
9	8.20		0.15			0.41	1.00	0.119
10	9.20		0.29			0.20	1.00	0.046
11	10.20		0.23			0.36	1.00	0.101
12	11.20		0.28			0.38	1.00	0.129
13	12.20		0.34			0.08	1.00	0.027
14	13.20		0.31			0.13	1.00	0.040
15	14.20		0.23			0.15	0.70	0.024
16	14.60		0.20			0.13	0.30	0.008
Right Bank	14.80		0.00			0.00	0.10	0.000
								0.850

PROJECT NAME: **Miramar / M2 Program**

PROJECT NUMBER: **06 1373 027 .4000**

DISCHARGE DATA

STREAM NAME: **Aimaokatalok Inflow**
LOCATION: **Southern Inflow to Aimaokatalok Lake**
COORDINATES: **13W 0441607 E, 7499368 N (NAD 83)**

MEASUREMENT DATE: **13 August 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **NS / KM**
COMPUTATIONS BY: **TJ / NS**

MEASUREMENT START TIME: **1310 h**
MEASUREMENT END TIME: **1325 h est.**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.05	0.000
1	0.10		0.10			0.00	0.20	0.000
2	0.40		0.17			0.01	0.35	0.001
3	0.80		0.18			0.08	0.45	0.006
4	1.30		0.23			0.21	0.50	0.024
5	1.80		0.23			0.20	0.50	0.023
6	2.30		0.28			0.25	0.50	0.035
7	2.80		0.18			0.26	0.50	0.023
8	3.30		0.16			0.30	0.50	0.024
9	3.80		0.24			0.24	0.50	0.029
10	4.30		0.25			0.23	0.50	0.029
11	4.80		0.25			0.33	0.50	0.041
12	5.30		0.31			0.36	0.50	0.056
13	5.80		0.31			0.23	0.50	0.036
14	6.30		0.24			0.43	0.50	0.052
15	6.80		0.23			0.47	0.50	0.054
16	7.30		0.30			0.21	0.50	0.032
17	7.80		0.31			0.44	0.50	0.068
18	8.30		0.34			0.27	0.50	0.046
19	8.80		0.29			0.23	0.50	0.033
20	9.30		0.29			0.00	0.50	0.000
21	9.80		0.24			0.32	0.50	0.038
22	10.30		0.29			0.39	0.50	0.057
23	10.80		0.26			0.46	0.45	0.054
24	11.20		0.31			0.26	0.30	0.024
25	11.40		0.13			0.36	0.30	0.014
26	11.80		0.14			0.38	0.45	0.024
27	12.30		0.19			0.31	0.50	0.029
28	12.80		0.35			0.24	0.50	0.042
29	13.30		0.33			0.22	0.50	0.036
30	13.80		0.37			0.32	0.50	0.059
31	14.30		0.18			0.08	0.35	0.005
32	14.50		0.13			0.02	0.15	0.000
33	14.60		0.17			-0.02	0.25	-0.001
Right Bank	15.00		0.00			0.00	0.20	0.000
								0.994

PROJECT NAME: **Miramar / M2 Program**

PROJECT NUMBER: **06 1373 027 .4000**

DISCHARGE DATA

STREAM NAME: **Aimaokatalok Inflow**
LOCATION: **Southern Inflow to Aimaokatalok Lake**
COORDINATES: **13W 0441607 E, 7499368 N (NAD 83)**

MEASUREMENT DATE: **10 September 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **KK / PE**
COMPUTATIONS BY: **TJ / NS**

MEASUREMENT START TIME: **1526 h**
MEASUREMENT END TIME: **1545 h est.**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.00			0.00	0.90	0.000
1	1.80		0.18			0.10	1.80	0.075
2	3.60		0.32			0.23	1.80	0.219
3	5.40		0.40			0.38	1.80	0.288
4	7.20		0.37			0.40	1.80	0.200
5	9.00		0.39			0.30	1.80	0.267
6	10.80		0.29			0.38	1.80	0.120
7	12.60		0.27			0.23	1.80	0.131
8	14.40		0.17			0.27	1.80	0.006
9	16.20		0.10			0.02	1.80	0.000
10	18.00		0.05			0.00	0.90	0.000
Left Bank	18.00		0.00			0.00	0.00	0.000
								1.306

PROJECT NAME: **Miramar / EM2 Expansion / Aimaokatalok Lake Inflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Aimaokatalok River** **MEASUREMENT DATE:** **4 July 2007**
LOCATION: **Inflow of Aimaokatalok Lake** **METER NUMBER:** **Marsh-McBirney**
COORDINATES: **13W 0443539 E, 7509431 N (NAD 83)** **Flo-Mate Model 2000**

MEASUREMENT BY: **PE** **MEASUREMENT START TIME:** **0735 h**
COMPUTATIONS BY: **TJ / DC** **MEASUREMENT END TIME:** **0813 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.20			0.00	0.45	0.000
1	0.90		0.40			0.30	1.00	0.120
2	2.00		0.52			0.40	1.05	0.218
3	3.00		0.51			0.46	1.00	0.235
4	4.00		0.56			0.37	1.00	0.207
5	5.00		0.48			0.56	1.00	0.269
6	6.00		0.58			0.55	1.00	0.319
7	7.00		0.52			0.62	1.00	0.322
8	8.00		0.61			0.63	1.00	0.384
9	9.00		0.54			0.59	1.00	0.319
10	10.00		0.71			0.61	1.00	0.433
11	11.00		0.61			0.66	1.00	0.403
12	12.00		0.48			0.76	1.00	0.365
13	13.00		0.46			0.81	1.00	0.373
14	14.00		0.54			0.76	1.00	0.410
15	15.00		0.56			0.86	1.00	0.482
16	16.00		0.46			0.90	1.00	0.414
17	17.00		0.59			0.74	1.00	0.437
18	18.00		0.58			0.15	1.00	0.087
19	19.00		0.50			0.81	1.00	0.405
20	20.00		0.42			0.44	1.00	0.185
21	21.00		0.31			0.23	1.00	0.071
22	22.00		0.36			0.27	1.00	0.097
23	23.00		0.40			0.23	1.00	0.092
24	24.00		0.20			0.25	1.00	0.050
25	25.00		0.04			0.00	1.00	0.000
26	26.00		0.04			0.02	1.00	0.001
Left Bank	27.00		0.02			0.00	0.50	0.000
								6.697

PROJECT NAME: **Miramar / EM2 Expansion / Aimaokatalok Lake Inflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Aimaokatalok Lake Inflow**
LOCATION: **Inflow of Aimaokatalok Lake**
COORDINATES: **13W 0443539 E, 7509431 N (NAD 83)**

MEASUREMENT DATE: **21 July 2007**
METER NUMBER: **Marsh McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **MK / HS**
COMPUTATIONS BY: **DC**

MEASUREMENT START TIME: **2040 hrs**
MEASUREMENT END TIME: **2100 hrs**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	2.45		0.00			0.00	0.33	0.000
1	3.10		0.09			-0.02	0.78	-0.001
2	4.00		0.08			-0.01	1.00	-0.001
3	5.10		0.10			0.02	1.05	0.002
4	6.10		0.06			-0.05	1.00	-0.003
5	7.10		0.15			0.02	1.00	0.003
6	8.10		0.16			0.01	1.45	0.002
7	10.00		0.29			0.44	1.95	0.249
8	12.00		0.40			0.42	2.00	0.336
9	14.00		0.55			0.46	2.00	0.506
10	16.00		0.69			0.42	2.00	0.580
11	18.00		0.55			0.40	2.00	0.440
12	20.00		0.52			0.37	2.00	0.385
13	22.00		0.52			0.40	2.00	0.416
14	24.00		0.44			0.31	2.00	0.273
15	26.00		0.38			0.09	1.15	0.039
Right Bank	26.30		0.00			0.00	0.15	0.000
								3.226

PROJECT NAME: **Miramar / EM2 Expansion / Aimaokatalok Lake Inflow**
PROJECT NUMBER: **07 1373 0019.4000**
DISCHARGE DATA

STREAM NAME: **Aimaokatalok Lake Inflow**
LOCATION: **Inflow of Aimaokatalok Lake**
COORDINATES: **13W 0443539 E, 7509431 N (NAD 83)**

MEASUREMENT DATE: **18 August 2007**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **TY**
COMPUTATIONS BY: **TJ / JV**

MEASUREMENT START TIME: **1330 h**
MEASUREMENT END TIME: **1402 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.04			0.00	0.50	0.000
1	1.00		0.18			0.00	1.00	0.000
2	2.00		0.52			0.35	1.00	0.182
3	3.00		0.82	0.36	-0.04	0.16	1.00	0.131
4	4.00		0.64			0.33	1.00	0.211
5	5.00		0.56			0.47	1.00	0.263
6	6.00		0.56			0.50	1.00	0.280
7	7.00		0.57			0.51	1.00	0.291
8	8.00		0.62			0.46	1.00	0.285
9	9.00		0.65			0.53	1.00	0.345
10	10.00		0.66			0.47	1.00	0.310
11	11.00		0.69			0.53	1.00	0.366
12	12.00		0.62			0.60	1.00	0.372
13	13.00		0.63			0.55	1.00	0.347
14	14.00		0.51			0.54	1.00	0.275
15	15.00		0.46			0.58	1.00	0.267
16	16.00		0.42			0.57	1.00	0.239
17	17.00		0.40			0.56	1.00	0.224
18	18.00		0.36			0.45	1.00	0.162
19	19.00		0.25			0.20	1.00	0.050
20	20.00		0.22			0.05	1.00	0.011
21	21.00		0.14			-0.02	1.00	-0.003
22	22.00		0.10			-0.02	1.00	-0.002
23	23.00		0.07			0.00	1.00	0.000
Left Bank	24.00		0.12			0.00	0.50	0.000
								4.606

PROJECT NAME: **Miramar / EM2 Expansion / Aimaokatalok Lake Inflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Aimaokatalok Lake Inflow** **MEASUREMENT DATE:** **09 Sept 2007**
LOCATION: **Inflow of Aimaokatalok Lake** **METER NUMBER:** **Marsh McBirney**
COORDINATES: **13W 0443539 E, 7509431 N (NAD 83)** **Flo-Mate Model 2000**

MEASUREMENT BY: **TY** **MEASUREMENT START TIME:** **1600 h**
COMPUTATIONS BY: **DC** **MEASUREMENT END TIME:** **1800h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.03			0.00	0.10	0.000
1	0.20		0.06			0.00	1.10	0.000
2	2.20		0.08			0.00	2.25	0.000
3	4.70		0.12			0.10	1.75	0.021
4	5.70		0.16			0.10	1.00	0.016
5	6.70		0.22			0.20	1.00	0.044
6	7.70		0.30			0.25	1.00	0.075
7	8.70		0.40			0.35	1.00	0.140
8	9.70		0.38			0.28	1.00	0.106
9	10.70		0.45			0.36	1.00	0.162
10	11.70		0.49			0.32	1.00	0.157
11	12.70		0.58			0.34	1.00	0.197
12	13.70		0.66			0.35	1.00	0.231
13	14.70		0.64			0.30	1.00	0.192
14	15.70		0.58			0.21	1.00	0.122
15	16.70		0.54			0.29	1.00	0.157
16	17.70		0.56			0.32	1.00	0.179
17	18.70		0.56			0.27	1.00	0.151
18	19.70		0.60			0.30	1.00	0.180
19	20.70		0.66			0.22	1.00	0.145
20	21.70		0.66			0.20	1.00	0.132
21	22.70		0.80			0.07	0.95	0.053
22	23.60		0.37			0.12	0.95	0.042
Right Bank	24.60		0.00			0.00	0.50	0.000
								2.503

AIMAOKATALOK LAKE OUTFLOW HYDROMETRIC STATION

H84

FACTSHEET

LOCATION AND PURPOSE

Located approximately 80 m upstream, on the left bank of Aimaokatalok Lake outflow.

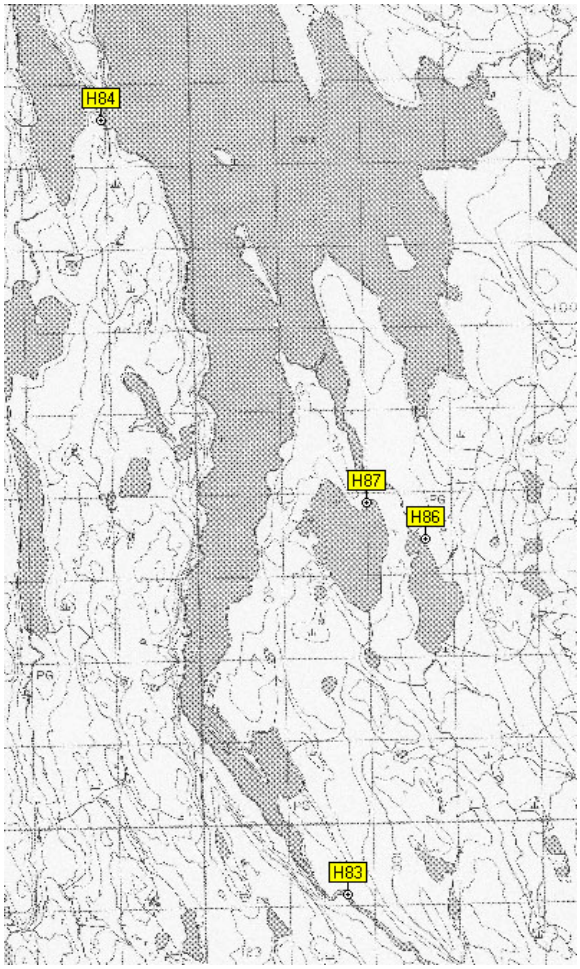
Operational:	2006 (2 June – 31 December)	2007 (1 January – 31 December)	
Benchmark:	Top of embedded boulder;	Drainage Area:	1241 km2
Coordinates:	UTM: 438892 m E, 7508794 m N (NAD83)	Lat/Long:	67°41'17" N, 106°26'33" W
Datalogger:	Optimum Instruments #0689 (cold tested)	Transducer:	Keller #00932 (5 psi, 20 m)



Station H84 looking North (downstream) from left bank, with benchmark.

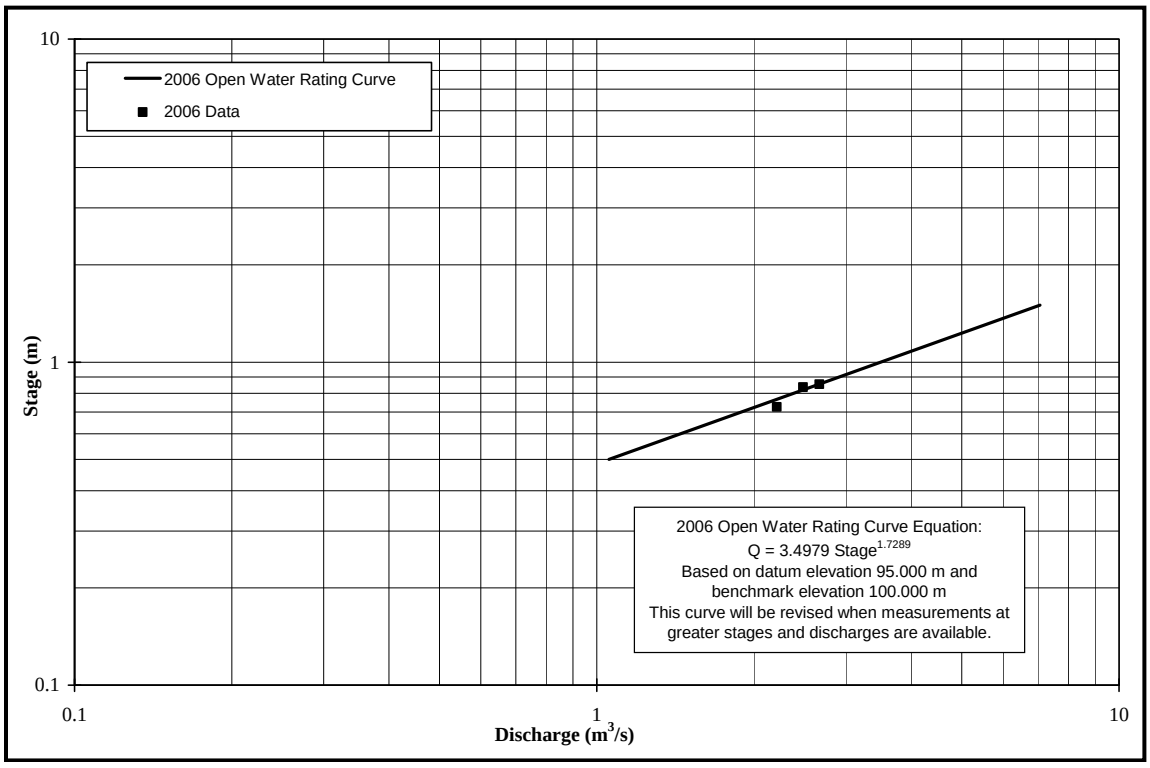


Station H84 looking south (upstream) during spring melt.

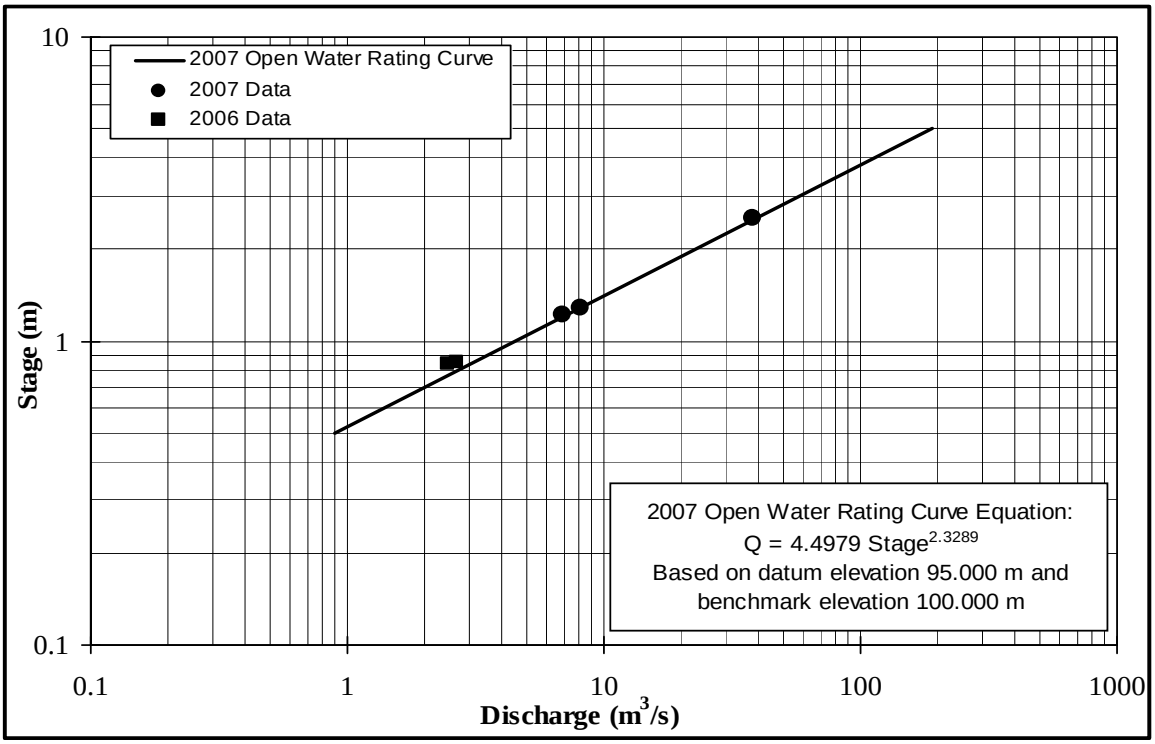


NTS Mapping of Area.

FACT-H84-2007.DOC



Aimaokatalok Outflow Station H84 - Stage-Discharge Rating Curve (2006)



Aimaokatalok Outflow Station H84 - Stage-Discharge Rating Curve (2007)

Aimaokatalok Outflow Station H84 – Survey Data (2006-2007)

Stage Datum 95.000 m non-geodetic

Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Water Surface Elevation (m)	Stage (m)	Measured Discharge (m^3/s)
02/06/2006 13:45	0.4500	96.846	96.846	97.296	2.296	-
transducer relocated into deeper water for overwintering						
08/07/2006 13:02	0.9165	-		*96.426*	1.426	-
09/08/2006 11:00	0.3452	95.510	95.510	95.855	0.855	2.668
09/08/2006 11:43	3.3820	92.473		95.855	0.855	2.668
13/08/2006 15:00	3.3633	-		*95.836*	0.836	2.482
10/09/2006 12:53	3.2535	-	92.473	*95.726*	0.726	-
04/07/2007 09:45	4.9069	92.6131		97.520	2.520	37.8
20/07/2007 08:55	4.1661	92.5539		96.720	1.720	-
18/08/2007 08:55	3.6740	92.7270		96.401	1.401	8.13
10/09/2007 10:55	3.6147	92.4673	92.590	96.082	1.082	6.88

H84 Aimaokatalok Outflow - 2006

MEAN DAILY WATER LEVELS (m) BASED ON BENCHMARK EL. 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	95.985	95.739	95.847	95.791	95.698
2	-	-	-	-	-	-	-	95.933	95.733	95.847	95.788	95.696
3	-	-	-	-	-	-	-	95.922	95.732	95.846	95.785	95.694
4	-	-	-	-	-	-	-	95.913	95.729	95.847	95.781	95.692
5	-	-	-	-	-	-	-	95.904	95.728	95.845	95.778	95.691
6	-	-	-	-	-	-	-	95.896	95.727	95.838	95.775	95.689
7	-	-	-	-	-	-	-	95.882	95.725	95.834	95.772	95.687
8	-	-	-	-	-	-	96.399 P	95.872	95.725	95.830	95.768	95.684
9	-	-	-	-	-	-	96.354	95.859	95.726	95.825	95.763	95.682
10	-	-	-	-	-	-	96.323	95.850	95.844	95.821	95.760	95.681
11	-	-	-	-	-	-	96.229	95.846	95.844	95.817	95.756	95.680
12	-	-	-	-	-	-	96.166	95.842	95.843	95.816	95.752	95.678
13	-	-	-	-	-	-	96.223	95.837	95.846	95.815	95.748	95.677
14	-	-	-	-	-	-	96.192	95.830	95.844	95.816	95.744	95.676
15	-	-	-	-	-	-	96.108	95.821	95.844	95.815	95.741	95.674
16	-	-	-	-	-	-	96.166	95.813	95.845	95.814	95.738	95.672
17	-	-	-	-	-	-	96.151	95.807	95.847	95.813	95.735	95.671
18	-	-	-	-	-	-	96.202	95.803	95.848	95.812	95.731	95.669
19	-	-	-	-	-	-	96.145	95.795	95.850	95.810	95.728	95.666
20	-	-	-	-	-	-	96.093	95.786	95.853	95.808	95.725	95.665
21	-	-	-	-	-	-	96.051	95.780	95.853	95.806	95.723	95.664
22	-	-	-	-	-	-	96.069	95.773	95.853	95.803	95.720	95.663
23	-	-	-	-	-	-	96.187	95.767	95.853	95.800	95.717	95.663
24	-	-	-	-	-	-	96.124	95.770	95.853	95.798	95.714	95.661
25	-	-	-	-	-	-	96.146	95.768	95.853	95.795	95.711	95.660
26	-	-	-	-	-	-	96.097	95.764	95.853	95.796	95.710	95.657
27	-	-	-	-	-	-	96.057	95.759	95.851	95.795	95.708	95.656
28	-	-	-	-	-	-	96.070	95.754	95.850	95.794	95.706	95.655
29	-	-	-	-	-	-	96.000	95.753	95.848	95.796	95.703	95.654
30	-	-	-	-	-	-	95.951	95.751	95.847	95.797	95.701	95.653
31	-	-	-	-	-	-	95.964	95.747	-	95.795	-	95.654
MIN	-	-	-	-	-	-	95.951	95.747	95.725	95.794	95.701	95.653
MEAN	-	-	-	-	-	-	96.145	95.825	95.813	95.816	95.742	95.673
MAX	-	-	-	-	-	-	96.399	95.985	95.853	95.847	95.791	95.698

H84 Aimaokatalok Outflow – 2006 (Continued)
MEAN DAILY DISCHARGES (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	3.415	2.076	-	-	-
2	-	-	-	-	-	-	-	3.104	2.044	-	-	-
3	-	-	-	-	-	-	-	3.043	2.038	-	-	-
4	-	-	-	-	-	-	-	2.991	2.027	-	-	-
5	-	-	-	-	-	-	-	2.940	2.019	-	-	-
6	-	-	-	-	-	-	-	2.891	2.015	-	-	-
7	-	-	-	-	-	-	-	2.816	2.008	-	-	-
8	-	-	-	-	-	-	6.249 P	2.759	2.006	-	-	-
9	-	-	-	-	-	-	5.911	2.690	2.011	-	-	-
10	-	-	-	-	-	-	5.679	2.640	2.013 P	-	-	-
11	-	-	-	-	-	-	5.012	2.618	-	-	-	-
12	-	-	-	-	-	-	4.582	2.597	-	-	-	-
13	-	-	-	-	-	-	4.965	2.571	-	-	-	-
14	-	-	-	-	-	-	4.749	2.535	-	-	-	-
15	-	-	-	-	-	-	4.212	2.488	-	-	-	-
16	-	-	-	-	-	-	4.580	2.445	-	-	-	-
17	-	-	-	-	-	-	4.483	2.416	-	-	-	-
18	-	-	-	-	-	-	4.815	2.396	-	-	-	-
19	-	-	-	-	-	-	4.441	2.351	-	-	-	-
20	-	-	-	-	-	-	4.116	2.309	-	-	-	-
21	-	-	-	-	-	-	3.844	2.278	-	-	-	-
22	-	-	-	-	-	-	3.939	2.241	-	-	-	-
23	-	-	-	-	-	-	4.707	2.211	-	-	-	-
24	-	-	-	-	-	-	4.286	2.227	-	-	-	-
25	-	-	-	-	-	-	4.432	2.214	-	-	-	-
26	-	-	-	-	-	-	4.120	2.196	-	-	-	-
27	-	-	-	-	-	-	3.856	2.169	-	-	-	-
28	-	-	-	-	-	-	3.937	2.149	-	-	-	-
29	-	-	-	-	-	-	3.510	2.141	-	-	-	-
30	-	-	-	-	-	-	3.221	2.132	-	-	-	-
31	-	-	-	-	-	-	3.290	2.112	-	-	-	-
MIN	-	-	-	-	-	-	3.221	2.112	2.006	-	-	-
MEAN	-	-	-	-	-	-	4.456	2.519	2.026	-	-	-
MAX	-	-	-	-	-	-	6.249	3.415	2.076	-	-	-

NOTES: D – DERIVED BASED ON DOWNSTREAM DISCHARGES E - ESTIMATED P – PARTIAL DAILY AVERAGE

H84 Aimaokatalok Outflow - 2007

MEAN DAILY WATER LEVELS (m) BASED ON BENCHMARK EL. 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	95.657	95.624	95.605	95.585	95.588	95.576	97.564	96.346	96.275	-	-	-
2	95.656	95.624	95.606	95.585	95.588	95.575	97.555	96.318	96.269	-	-	-
3	95.656	95.623	95.607	95.584	95.587	95.574	97.533	96.291	96.262	-	-	-
4	95.655	95.622	95.607	95.582	95.587	95.574	97.500	96.264	96.257	-	-	-
5	95.655	95.621	95.605	95.582	95.587	95.573	97.462	96.240	96.252	-	-	-
6	95.654	95.621	95.603	95.581	95.586	95.571	97.418	96.220	96.245	-	-	-
7	95.653	95.619	95.602	95.579	95.589	95.572	97.371	96.200	96.238	-	-	-
8	95.652	95.617	95.604	95.580	95.588	95.574	97.323	96.181	96.230	-	-	-
9	95.651	95.617	95.604	95.581	95.588	95.574	97.275	96.182	96.222	-	-	-
10	95.650	95.615	95.605	95.582	95.587	95.575	97.226	96.184	96.214 P	-	-	-
11	95.648	95.616	95.604	95.581	95.586	95.578	97.178	96.186	-	-	-	-
12	95.648	95.615	95.601	95.581	95.585	95.590	97.130	96.195	-	-	-	-
13	95.647	95.613	95.601	95.582	95.585	95.619	97.080	96.211	-	-	-	-
14	95.644	95.612	95.601	95.582	95.585	95.681	97.032	96.225	-	-	-	-
15	95.643	95.611	95.600	95.582	95.587	95.759	96.984	96.240	-	-	-	-
16	95.642	95.612	95.596	95.581	95.587	95.838	96.939	96.252	-	-	-	-
17	95.641	95.611	95.595	95.580	95.585	95.908	96.890	96.262	-	-	-	-
18	95.639	95.610	95.595	95.580	95.586	95.994	96.843	96.270	-	-	-	-
19	95.638	95.609	95.595	95.579	95.584	96.098	96.798	96.281	-	-	-	-
20	95.637	95.608	95.594	95.578	95.583	96.212	96.758	96.292	-	-	-	-
21	95.636	95.608	95.592	95.578	95.582	96.362	96.721	96.298	-	-	-	-
22	95.634	95.607	95.592	95.578	95.581	96.554	96.679	96.302	-	-	-	-
23	95.634	95.606	95.591	95.578	95.581	96.754	96.642	96.303	-	-	-	-
24	95.633	95.605	95.589	95.577	95.580	96.952	96.606	96.302	-	-	-	-
25	95.631	95.605	95.589	95.578	95.579	97.126	96.570	96.300	-	-	-	-
26	95.630	95.604	95.588	95.584	95.579	97.273	96.535	96.297	-	-	-	-
27	95.629	95.604	95.588	95.588	95.579	97.392	96.501	96.291	-	-	-	-
28	95.628	95.604	95.587	95.588	95.578	97.476	96.468	96.289	-	-	-	-
29	95.627	-	95.587	95.587	95.578	97.529	96.436	96.288	-	-	-	-
30	95.626	-	95.586	95.587	95.577	97.557	96.406	96.284	-	-	-	-
31	95.625	-	95.585	-	95.577	-	96.377	96.280	-	-	-	-
MIN	95.625	95.604	95.585	95.577	95.577	95.571	96.377	96.181	96.214	-	-	-
MEAN	95.642	95.613	95.597	95.582	95.584	96.166	96.961	96.260	96.246	-	-	-
MAX	95.657	95.624	95.607	95.588	95.589	97.557	97.564	96.346	96.275	-	-	-

MEAN DAILY DISCHARGES (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	40.308	8.986	7.919	-	-	-
2	-	-	-	-	-	-	39.958	8.562	7.834	-	-	-
3	-	-	-	-	-	-	39.167	8.154	7.732	-	-	-
4	-	-	-	-	-	-	37.993	7.768	7.665	-	-	-
5	-	-	-	-	-	-	36.667	7.428	7.593	-	-	-
6	-	-	-	-	-	-	35.157	7.150	7.498	-	-	-
7	-	-	-	-	-	-	33.605	6.879	7.399	-	-	-
8	-	-	-	-	-	-	32.043	6.631	7.281	-	-	-
9	-	-	-	-	-	-	30.502	6.643	7.169	-	-	-
10	-	-	-	-	-	-	28.997	6.672	7.068 P	-	-	-
11	-	-	-	-	-	-	27.559	6.688	-	-	-	-
12	-	-	-	-	-	-	26.159	6.813	-	-	-	-
13	-	-	-	-	-	1.472	24.774	7.026	-	-	-	-
14	-	-	-	-	-	1.842	23.457	7.209	-	-	-	-
15	-	-	-	-	-	2.367	22.186	7.417	-	-	-	-
16	-	-	-	-	-	2.985	21.023	7.590	-	-	-	-
17	-	-	-	-	-	3.597	19.822	7.735	-	-	-	-
18	-	-	-	-	-	4.439	18.679	7.845	-	-	-	-
19	-	-	-	-	-	5.599	17.638	8.007	-	-	-	-
20	-	-	-	-	-	7.051	16.744	8.164	-	-	-	-
21	-	-	-	-	-	9.255	15.928	8.257	-	-	-	-
22	-	-	-	-	-	12.577	15.040	8.310	-	-	-	-
23	-	-	-	-	-	16.672	14.268	8.330	-	-	-	-
24	-	-	-	-	-	21.391	13.558	8.319	-	-	-	-
25	-	-	-	-	-	26.060	12.866	8.288	-	-	-	-
26	-	-	-	-	-	30.458	12.206	8.240	-	-	-	-
27	-	-	-	-	-	34.308	11.576	8.160	-	-	-	-
28	-	-	-	-	-	37.153	10.998	8.128	-	-	-	-
29	-	-	-	-	-	39.032	10.456	8.107	-	-	-	-
30	-	-	-	-	-	40.065	9.954	8.056	-	-	-	-
31	-	-	-	-	-	-	9.477	7.992	-	-	-	-
MIN	-	-	-	-	-	1.472	9.477	6.631	7.068	-	-	-
MEAN	-	-	-	-	-	16.462	22.863	7.728	7.516	-	-	-
MAX	-	-	-	-	-	40.065	40.308	8.986	7.919	-	-	-

NOTES: D – DERIVED BASED ON DOWNSTREAM DISCHARGES E - ESTIMATED P – PARTIAL DAILY AVERAGE

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Aimaokatalok Outflow**
LOCATION: **Outlet of Aimaokatalok Lake**
COORDINATES: **13W 0438828 E, 7508926 N (NAD 83)**

MEASUREMENT DATE: **9 August 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **NS**
COMPUTATIONS BY: **NS / TJ**

MEASUREMENT START TIME: **1300 h**
MEASUREMENT END TIME: **1335 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.05	0.000
1	0.10		0.33			0.02	0.45	0.003
2	0.90		0.18			0.04	1.00	0.007
3	2.10		0.28			0.12	0.90	0.030
4	2.70		0.13			0.15	0.65	0.013
5	3.40		0.30			0.20	0.45	0.027
6	3.60		0.02			0.10	0.50	0.001
7	4.40		0.16			0.27	0.85	0.037
8	5.30		0.29			0.25	0.75	0.054
9	5.90		0.38			0.35	0.55	0.073
10	6.40		0.48			0.39	0.50	0.094
11	6.90		0.15			0.53	0.60	0.048
12	7.60		0.17			0.55	0.60	0.056
13	8.10		0.53			0.22	0.55	0.064
14	8.70		0.20			0.40	0.65	0.052
15	9.40		0.33			0.44	0.85	0.123
16	10.40		0.42			0.38	1.00	0.160
17	11.40		0.45			0.34	1.00	0.153
18	12.40		0.40			0.36	1.25	0.180
19	13.90		0.42			0.13	1.25	0.068
20	14.90		0.28			0.43	1.00	0.120
21	15.90		0.38			0.34	1.00	0.129
22	16.90		0.35			0.38	1.00	0.133
23	17.90		0.46			0.41	1.00	0.189
24	18.90		0.34			0.38	1.00	0.129
25	19.90		0.28			0.36	1.00	0.101
26	20.90		0.30			0.35	1.00	0.105
27	21.90		0.31			0.31	1.00	0.096
28	22.90		0.30			0.22	1.00	0.066
29	23.90		0.30			0.27	1.00	0.081
30	24.90		0.22			0.37	1.00	0.081
31	25.90		0.40			0.15	1.00	0.060
32	26.90		0.26			0.24	1.00	0.062
33	27.90		0.24			0.22	0.90	0.048
34	28.70		0.03			0.10	0.70	0.002
35	29.30		0.17			0.08	1.60	0.022
Right Bank	31.90		0.00			0.00	1.30	0.000
								2.668

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Aimaokatalok Outflow**
LOCATION: **Outlet of Aimaokatalok Lake**
COORDINATES: **13W 0438828 E, 7508926 N (NAD 83)**

MEASUREMENT DATE: **13 August 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **NS / KM**
COMPUTATIONS BY: **NS / TJ**

MEASUREMENT START TIME: **1444 h**
MEASUREMENT END TIME: **1502 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	17.05		0.00			0.00	0.07	0.000
1	17.20		0.20			0.00	0.17	0.000
2	17.40		0.18			0.04	0.25	0.002
3	17.70		0.29			0.07	0.30	0.006
4	18.00		0.19			0.13	0.35	0.009
5	18.40		0.16			0.29	0.35	0.016
6	18.70		0.20			0.23	0.30	0.014
7	19.00		0.22			-0.04	0.35	-0.003
8	19.40		0.23			0.20	0.35	0.016
9	19.70		0.17			0.24	0.40	0.016
10	20.20		0.32			0.17	0.50	0.027
11	20.70		0.18			0.24	0.60	0.026
12	21.40		0.22			0.20	0.75	0.033
13	22.20		0.30			0.19	0.65	0.037
14	22.70		0.42			0.31	0.65	0.085
15	23.50		0.69			0.14	0.65	0.063
16	24.00		0.48			0.32	0.75	0.115
17	25.00		0.36			0.40	1.00	0.144
18	26.00		0.63			0.17	1.00	0.107
19	27.00		0.54			0.23	1.00	0.124
20	28.00		0.42			0.17	1.00	0.071
21	29.00		0.36			0.22	1.00	0.079
22	30.00		0.35			0.30	1.00	0.105
23	31.00		0.39			0.40	1.00	0.156
24	32.00		0.42			0.39	1.00	0.164
25	33.00		0.30			0.40	1.00	0.120
26	34.00		0.43			0.32	1.00	0.138
27	35.00		0.31			0.50	1.00	0.155
28	36.00		0.30			0.44	1.00	0.132
29	37.00		0.29			0.31	1.00	0.090
30	38.00		0.31			0.15	0.80	0.037
31	38.60		0.37			0.12	0.50	0.022
32	39.00		0.24			-0.04	0.45	-0.004
33	39.50		0.32			0.02	0.50	0.003
34	40.00		0.32			0.28	0.75	0.067
35	41.00		0.30			0.40	1.00	0.120
36	42.00		0.22			0.29	1.00	0.064
37	43.00		0.18			0.15	1.00	0.027
38	44.00		0.07			0.35	1.00	0.025
39	45.00		0.15			0.31	1.00	0.047
40	46.00		0.10			0.21	1.00	0.021
41	47.00		0.08			0.12	0.75	0.007
42	47.50		0.10			0.03	0.50	0.002
43	48.00		0.09			0.01	0.55	0.000
44	48.60		0.10			0.01	0.35	0.000
Right Bank	48.70		0.00			0.00	0.05	0.000

2.485

PROJECT NAME: **Miramar / M2 Program**

PROJECT NUMBER: **06 1373 027 .4000**

DISCHARGE DATA

STREAM NAME: **Aimaokatalok Outflow**
LOCATION: **Outlet of Aimaokatalok Lake**
COORDINATES: **13W 0438828 E, 7508926 N (NAD 83)**

MEASUREMENT DATE: **10 September 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **KK**
COMPUTATIONS BY: **NS / TY**

MEASUREMENT START TIME: **1300 h**
MEASUREMENT END TIME: **1335 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.02			0.00	1.50	0.000
1	3.00		0.10			0.01	3.00	0.003
2	6.00		0.27			0.03	2.50	0.020
3	8.00		0.36			0.25	3.00	0.270
4	12.00		0.23			0.30	3.50	0.242
5	15.00		0.25			0.37	3.00	0.278
6	18.00		0.36			0.35	3.00	0.378
7	21.00		0.33			0.30	3.00	0.297
8	24.00		0.42			0.12	3.00	0.151
9	27.00		0.39			0.27	3.00	0.316
10	30.00		0.40			0.17	3.00	0.204
11	33.00		0.29			0.06	3.00	0.052
Right Bank	36.00		0.13			0.00	1.50	0.000
								2.211

PROJECT NAME: **Miramar / EM2 Expansion / Aimaokatalok Lake Outflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Aimaokatalok Lake Outflow**
LOCATION: **Ouflow of Aimaokatalok Lake**
COORDINATES: **13W 0434320 E, 7562920 N (NAD 27)**

MEASUREMENT DATE: **4 July 2007**
METER NUMBER: **Marsh McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **PE**
COMPUTATIONS BY: **TJ / DC**

MEASUREMENT START TIME: **1000 h**
MEASUREMENT END TIME: **1300 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.08			0.00	1.00	0.000
1	2.00		0.40			0.25	2.00	0.200
2	4.00		0.49			0.27	2.00	0.265
3	6.00		0.88	0.28	0.69	0.49	2.50	1.067
4	9.00		0.75	0.93	0.66	0.80	2.50	1.491
5	11.00		0.94	0.57	0.68	0.63	1.50	0.881
6	12.00		0.92	0.67	0.78	0.73	2.00	1.334
7	15.00		1.10	0.92	0.95	0.94	2.50	2.571
8	17.00		1.20	0.98	0.91	0.95	2.00	2.268
9	19.00		1.30	1.41	1.33	1.37	2.00	3.562
10	21.00		1.00	0.91	1.33	1.12	2.00	2.240
12	23.00		1.00	1.33	1.23	1.28	2.00	2.560
13	25.00		1.10	1.25	1.37	1.31	2.00	2.882
14	27.00		1.10	1.15	1.42	1.29	2.00	2.827
15	29.00		1.00	0.91	1.24	1.08	2.00	2.150
16	31.00		1.10	1.15	1.31	1.23	2.00	2.706
17	33.00		1.30	1.04	1.13	1.09	2.00	2.821
18	35.00		1.10	0.81	0.90	0.86	2.00	1.881
19	37.00		1.10	0.73	0.81	0.77	2.00	1.694
20	39.00		0.78	0.58	0.60	0.59	2.00	0.920
21	41.00		0.84	0.21	0.40	0.31	2.00	0.512
22	43.00		0.72	0.15	0.33	0.24	2.00	0.346
23	45.00		0.72			0.31	2.00	0.446
24	47.00		0.10			0.04	2.00	0.008
25	49.00		0.54			0.08	2.00	0.086
26	51.00		0.32			0.04	2.00	0.026
27	53.00		0.30			0.01	2.50	0.008
Right Bank	56.00		0.08			0.00	1.50	0.000
								37.8

PROJECT NAME: **Miramar / EM2 Expansion / Aimaokatalok Lake Outflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **AIM River Outflow**
LOCATION: **Ouflow of Aim River**
COORDINATES: **13W 0434320 E, 7562920 N (NAD 27)**

MEASUREMENT DATE: **18 August 2007**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **TY**
COMPUTATIONS BY: **TJ / JV**

MEASUREMENT START TIME: **0930 h**
MEASUREMENT END TIME: **1035 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	1.25	0.000
1	2.50		0.29			0.13	2.50	0.094
2	5.00		0.42			0.25	2.50	0.263
3	7.50		0.52			0.56	2.50	0.728
4	10.00		0.46			0.56	2.50	0.644
5	12.50		0.72			0.51	2.50	0.918
6	15.00		0.60			0.60	2.50	0.900
7	17.50		0.56			0.62	2.50	0.868
8	20.00		0.72			0.61	2.50	1.098
9	22.50		0.53			0.69	2.50	0.914
10	25.00		0.42			0.32	2.50	0.336
12	27.50		0.37			0.67	2.50	0.620
13	30.00		0.28			0.66	2.50	0.462
14	32.50		0.25			0.40	2.50	0.250
15	35.00		0.16			0.06	3.75	0.036
16	40.00		0.04			0.01	5.00	0.002
Right Bank	45.00		0.00			0.00	2.50	0.000

8.13

PROJECT NAME: **Miramar / EM2 Expansion / Aimaokatalok Lake Outflow**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Aimaokatalok Lake Outflow**
LOCATION: **Outflow of Aimaokatalok Lake**
COORDINATES: **13W 0434320 E, 7562920 N (NAD 27)**

MEASUREMENT DATE: **10 Sept 2007**
METER NUMBER: **Marsh McBirney**
Flo-Mate Model 2000

MEASUREMENT BY: **MK / HS**
COMPUTATIONS BY: **DC**

MEASUREMENT START TIME: **1035 h**
MEASUREMENT END TIME: **1100 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.18			0.03	1.00	0.005
1	2.00		0.21			0.33	2.00	0.139
2	4.00		0.40			0.33	2.15	0.284
3	6.30		0.42			0.41	2.00	0.344
4	8.00		0.58			0.33	1.75	0.335
5	9.80		0.46			0.36	2.40	0.397
6	12.80		0.60			0.45	2.50	0.675
7	14.80		0.58			0.50	2.00	0.580
8	16.80		0.50			0.51	2.00	0.510
9	18.80		0.62			0.51	2.15	0.680
10	21.10		0.42			0.53	2.15	0.479
11	23.10		0.70			0.56	2.25	0.882
12	25.60		0.66			0.50	2.35	0.776
13	27.80		0.64			0.28	2.35	0.421
14	30.30		0.50			0.15	2.40	0.180
15	32.60		0.36			0.25	1.80	0.162
16	33.90		0.20			0.13	1.20	0.031
17	35.00		0.16			0.02	1.00	0.003
Right Bank	35.90		0.00			0.00	0.90	0.000
								6.88

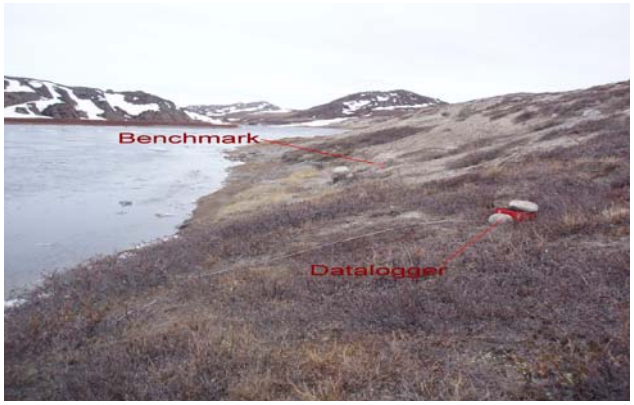
KOIGNUK RIVER HYDROMETRIC STATION

H85

FACTSHEET

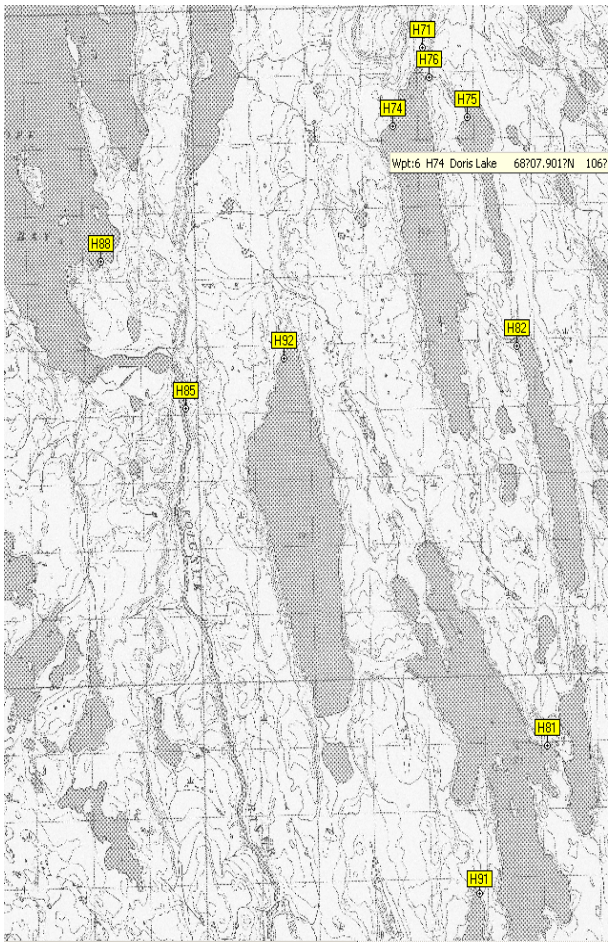
LOCATION AND PURPOSE

Operational:	2006 (3 June – 10 September)	2007 (26 May – 9 September)	
Benchmark:	Top of embedded boulder;	Drainage Area:	3192 km2
Coordinates:	UTM: 429739 m E, 7554336 m N (NAD83)	Lat/Long:	68°05'39" N, 106°41'16" W
Datalogger:	Optimum Instruments #741	Transducer:	Keller #912 (15 psi, 60 m)



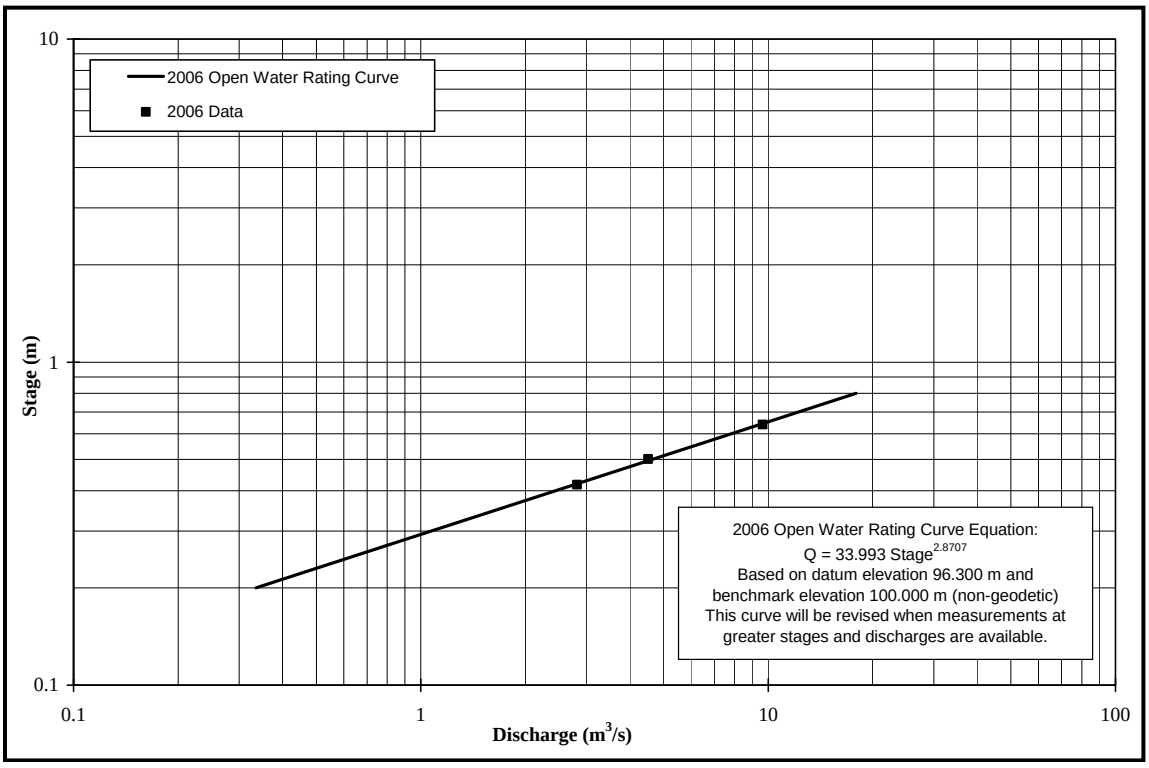


Station H85 looking south (upstream) during spring melt.

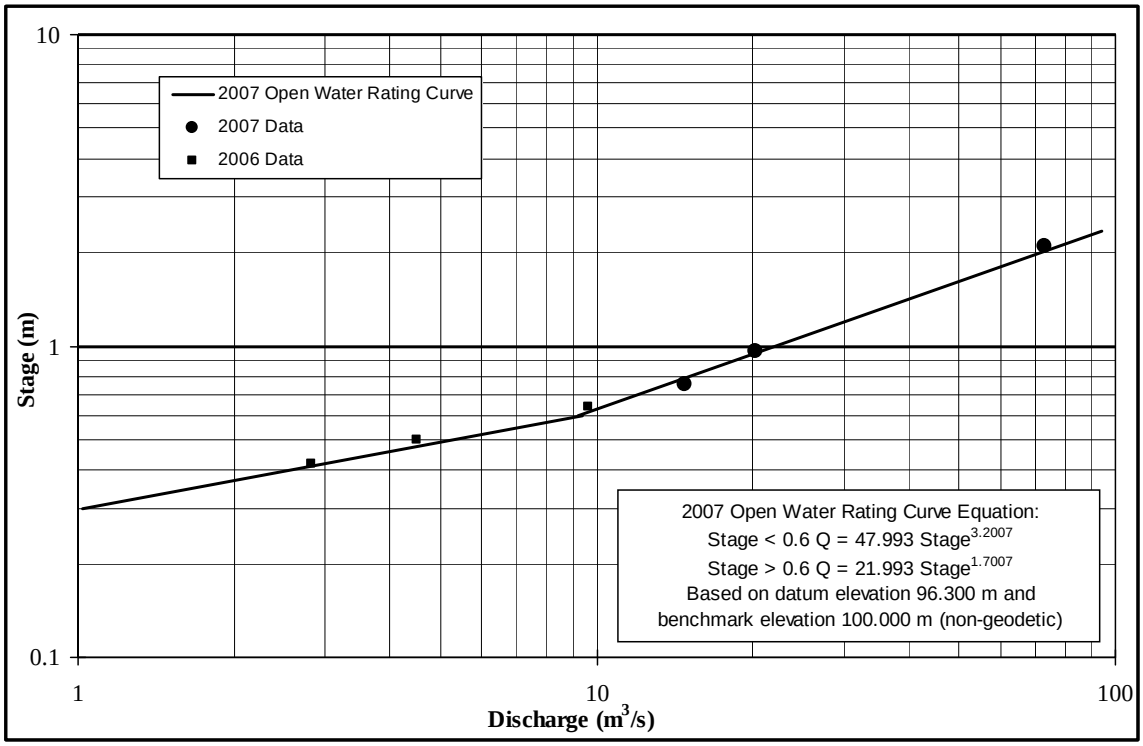


NTS Mapping of Area

FACT-H85-2007.DOC



Koignuk River Station H85 - Stage-Discharge Rating Curve (2006)



Koignuk River Station H85 - Stage-Discharge Rating Curve (2007)

Koignuk River Station H85 – Survey Data (2006-2007)

Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Stage Datum Staff Gauge Reading (m)	95.800 m Water Surface Elevation (m)	non-geodetic Stage (m)
29/05/2006 11:52	0.4538	97.072		97.526	1.726	-
03/07/2006 15:22	0.3075	97.089	97.080	97.396	1.596	-
transducer moved to deeper water						
03/07/2006 15:37	0.6775	96.718		97.396	1.596	-
21/07/2006 14:50	0.2640			*96.941*	1.141	9.640
14/08/2006 10:00	0.0619	96.739	96.729	96.801	1.001	4.511
transducer moved to deeper water						
14/08/2006 10:30	0.5135	96.287		96.801	1.001	4.511
08/09/2006 14:25	0.4711	96.246	96.267	96.717	0.917	2.817
07/02/2007 15:00	1.891	96.496		98.387	2.087	72.9
08/31/2007 14:45	0.872	96.393		97.265	0.965	20.2
09/13/2007 13:30	0.666	96.390	96.426	97.056	0.756	14.8

H85 Koignuk River - 2006

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	97.831	97.425	96.883	96.727	-	-	-
2	-	-	-	-	-	97.841	97.412	96.868	96.733	-	-	-
3	-	-	-	-	-	97.963	97.396	96.852	96.755	-	-	-
4	-	-	-	-	-	98.245	97.356	96.846	96.752	-	-	-
5	-	-	-	-	-	98.394	97.336	96.838	96.749	-	-	-
6	-	-	-	-	-	98.461	97.311	96.832	96.760	-	-	-
7	-	-	-	-	-	98.573	97.257	96.829	96.736	-	-	-
8	-	-	-	-	-	98.554	97.228	96.816	96.729 P	-	-	-
9	-	-	-	-	-	98.538	97.208	96.807	-	-	-	-
10	-	-	-	-	-	98.545	97.179	96.823	-	-	-	-
11	-	-	-	-	-	98.558	97.164	96.844	-	-	-	-
12	-	-	-	-	-	98.535	97.141	96.795	-	-	-	-
13	-	-	-	-	-	98.506	97.115	96.789	-	-	-	-
14	-	-	-	-	-	98.473	97.096	96.790	-	-	-	-
15	-	-	-	-	-	98.408	97.072	96.781	-	-	-	-
16	-	-	-	-	-	98.355	97.065	96.778	-	-	-	-
17	-	-	-	-	-	98.267	97.045	96.776	-	-	-	-
18	-	-	-	-	-	98.205	97.011	96.777	-	-	-	-
19	-	-	-	-	-	98.118	96.997	96.769	-	-	-	-
20	-	-	-	-	-	98.014	96.996	96.749	-	-	-	-
21	-	-	-	-	-	97.979	96.993	96.749	-	-	-	-
22	-	-	-	-	-	97.928	97.006	96.761	-	-	-	-
23	-	-	-	-	-	97.837	96.963	96.770	-	-	-	-
24	-	-	-	-	-	97.761	96.972	96.796	-	-	-	-
25	-	-	-	-	-	97.666	96.943	96.782	-	-	-	-
26	-	-	-	-	-	97.651	96.938	96.768	-	-	-	-
27	-	-	-	-	-	97.628	96.963	96.758	-	-	-	-
28	-	-	-	-	-	97.568	96.872	96.726	-	-	-	-
29	-	-	-	-	97.553 P	97.512	96.888	96.745	-	-	-	-
30	-	-	-	-	97.629	97.459	96.905	96.758	-	-	-	-
31	-	-	-	-	97.746	-	96.890	96.753	-	-	-	-
MIN	-	-	-	-	97.553	97.459	96.872	96.726	96.727	-	-	-
MEAN	-	-	-	-	97.642	98.112	97.101	96.794	96.743	-	-	-
MAX	-	-	-	-	97.746	98.573	97.425	96.883	96.760	-	-	-

H85 Koignuk River - 2006 (Continued)
MEAN DAILY DISCHARGES (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	7.217	2.956	-	-	-
2	-	-	-	-	-	-	-	6.700	3.110	-	-	-
3	-	-	-	-	-	-	-	6.183	3.585	-	-	-
4	-	-	-	-	-	-	-	5.992	3.488	-	-	-
5	-	-	-	-	-	-	-	5.743	3.435	-	-	-
6	-	-	-	-	-	-	-	5.544	3.709	-	-	-
7	-	-	-	-	-	-	-	5.465	3.142	-	-	-
8	-	-	-	-	-	-	-	5.078	3.002 P	-	-	-
9	-	-	-	-	-	-	-	4.830	-	-	-	-
10	-	-	-	-	-	-	-	5.372	-	-	-	-
11	-	-	-	-	-	-	-	6.143	-	-	-	-
12	-	-	-	-	-	-	-	4.552	-	-	-	-
13	-	-	-	-	-	-	-	4.371	-	-	-	-
14	-	-	-	-	-	-	-	4.396	-	-	-	-
15	-	-	-	-	-	-	-	4.162	-	-	-	-
16	-	-	-	-	-	-	-	4.077	-	-	-	-
17	-	-	-	-	-	-	-	4.043	-	-	-	-
18	-	-	-	-	-	-	-	4.072	-	-	-	-
19	-	-	-	-	-	-	-	3.874	-	-	-	-
20	-	-	-	-	-	-	-	3.416	-	-	-	-
21	-	-	-	-	-	-	12.007 P	3.421	-	-	-	-
22	-	-	-	-	-	-	12.633	3.680	-	-	-	-
23	-	-	-	-	-	-	10.506	3.898	-	-	-	-
24	-	-	-	-	-	-	10.918	4.666	-	-	-	-
25	-	-	-	-	-	-	9.601	4.275	-	-	-	-
26	-	-	-	-	-	-	9.363	3.893	-	-	-	-
27	-	-	-	-	-	-	10.849	3.623	-	-	-	-
28	-	-	-	-	-	-	6.942	2.948	-	-	-	-
29	-	-	-	-	-	-	7.411	3.325	-	-	-	-
30	-	-	-	-	-	-	8.034	3.625	-	-	-	-
31	-	-	-	-	-	-	7.475	3.501	-	-	-	-
MIN	-	-	-	-	-	-	6.942	2.948	2.956	-	-	-
MEAN	-	-	-	-	-	-	9.613	4.583	3.303	-	-	-
MAX	-	-	-	-	-	-	12.633	7.217	3.709	-	-	-

NOTES: P – PARTIAL DAILY AVERAGE E - ESTIMATED

H85 Koignuk River - 2007

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	97.071	97.288	-	-	-
2	-	-	-	-	-	-	98.279 P	97.069	97.248	-	-	-
3	-	-	-	-	-	-	98.221	97.056	97.242	-	-	-
4	-	-	-	-	-	-	98.147	97.037	97.204	-	-	-
5	-	-	-	-	-	-	98.127	97.018	97.214	-	-	-
6	-	-	-	-	-	-	98.070	97.010	97.206	-	-	-
7	-	-	-	-	-	-	97.991	97.012	97.198	-	-	-
8	-	-	-	-	-	-	97.914	97.040	97.163	-	-	-
9	-	-	-	-	-	-	97.847	97.089	97.148	-	-	-
10	-	-	-	-	-	-	97.788	97.052	97.122	-	-	-
11	-	-	-	-	-	-	97.734	97.048	97.119	-	-	-
12	-	-	-	-	-	-	97.685	97.064	97.129	-	-	-
13	-	-	-	-	-	-	97.631	97.157	97.097 P	-	-	-
14	-	-	-	-	-	-	97.587	97.267	-	-	-	-
15	-	-	-	-	-	-	97.553	97.328	-	-	-	-
16	-	-	-	-	-	-	97.511	97.354	-	-	-	-
17	-	-	-	-	-	-	97.463	97.400	-	-	-	-
18	-	-	-	-	-	-	97.430	97.411	-	-	-	-
19	-	-	-	-	-	-	97.410	97.450	-	-	-	-
20	-	-	-	-	-	-	97.376	97.501	-	-	-	-
21	-	-	-	-	-	-	97.370	97.501	-	-	-	-
22	-	-	-	-	-	-	97.308	97.483	-	-	-	-
23	-	-	-	-	-	-	97.274	97.461	-	-	-	-
24	-	-	-	-	-	-	97.238	97.439	-	-	-	-
25	-	-	-	-	-	-	97.230	97.420	-	-	-	-
26	-	-	-	-	-	-	97.208	97.395	-	-	-	-
27	-	-	-	-	-	-	97.185	97.366	-	-	-	-
28	-	-	-	-	-	-	97.176	97.329	-	-	-	-
29	-	-	-	-	-	-	97.152	97.326	-	-	-	-
30	-	-	-	-	-	-	97.135	97.308	-	-	-	-
31	-	-	-	-	-	-	97.118	97.307	-	-	-	-
MIN	-	-	-	-	-	-	97.118	97.010	97.097	-	-	-
MEAN	-	-	-	-	-	-	97.572	97.251	97.183	-	-	-
MAX	-	-	-	-	-	-	98.279	97.501	97.288	-	-	-

MEAN DAILY DISCHARGES (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	14.14	21.54	-	-	-
2	-	-	-	-	-	-	70.23 P	14.09	20.10	-	-	-
3	-	-	-	-	-	-	66.74	13.67	19.88	-	-	-
4	-	-	-	-	-	-	62.46	13.10	18.52	-	-	-
5	-	-	-	-	-	-	61.32	12.52	18.86	-	-	-
6	-	-	-	-	-	-	58.09	12.29	18.60	-	-	-
7	-	-	-	-	-	-	53.72	12.36	18.33	-	-	-
8	-	-	-	-	-	-	49.64	13.25	17.13	-	-	-
9	-	-	-	-	-	-	46.19	14.73	16.60	-	-	-
10	-	-	-	-	-	-	43.23	13.57	15.76	-	-	-
11	-	-	-	-	-	-	40.61	13.45	15.67	-	-	-
12	-	-	-	-	-	-	38.25	13.91	16.00	-	-	-
13	-	-	-	-	-	-	35.78	16.96	14.97 P	-	-	-
14	-	-	-	-	-	-	33.79	20.78	-	-	-	-
15	-	-	-	-	-	-	32.26	23.04	-	-	-	-
16	-	-	-	-	-	-	30.45	24.06	-	-	-	-
17	-	-	-	-	-	-	28.45	25.88	-	-	-	-
18	-	-	-	-	-	-	27.08	26.29	-	-	-	-
19	-	-	-	-	-	-	26.27	27.91	-	-	-	-
20	-	-	-	-	-	-	24.90	30.05	-	-	-	-
21	-	-	-	-	-	-	24.66	30.02	-	-	-	-
22	-	-	-	-	-	-	22.33	29.26	-	-	-	-
23	-	-	-	-	-	-	21.03	28.35	-	-	-	-
24	-	-	-	-	-	-	19.72	27.44	-	-	-	-
25	-	-	-	-	-	-	19.45	26.66	-	-	-	-
26	-	-	-	-	-	-	18.65	25.65	-	-	-	-
27	-	-	-	-	-	-	17.87	24.50	-	-	-	-
28	-	-	-	-	-	-	17.56	23.11	-	-	-	-
29	-	-	-	-	-	-	16.76	22.99	-	-	-	-
30	-	-	-	-	-	-	16.18	22.30	-	-	-	-
31	-	-	-	-	-	-	15.63	22.26	-	-	-	-
MIN	-	-	-	-	-	-	15.63	12.29	14.97	-	-	-
MEAN	-	-	-	-	-	-	34.64	20.60	17.84	-	-	-
MAX	-	-	-	-	-	-	70.23	30.05	21.54	-	-	-

NOTES: P – PARTIAL DAILY AVERAGE E - ESTIMATED

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**

DISCHARGE DATA

STREAM NAME: **Koignuk River**
LOCATION: **Near the mouth**
COORDINATES: **13W 0429739 E, 7554336 N (NAD 83)**

MEASUREMENT DATE: **21 July 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **TA / PE**
COMPUTATIONS BY: **NS / TJ**

MEASUREMENT START TIME: **1450 h**
MEASUREMENT END TIME: **1510 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	2.50	0.000
1	5.00		0.20			0.17	5.00	0.170
2	10.00		0.34			0.37	5.00	0.629
3	15.00		0.44			0.48	5.00	1.056
4	20.00		0.62			0.57	5.00	1.767
5	25.00		0.68			0.61	5.00	2.074
6	30.00		0.60			0.46	5.00	1.380
7	35.00		0.46			0.24	5.00	0.552
8	40.00		0.50			0.37	5.00	0.925
9	45.00		0.42			0.34	5.00	0.714
10	50.00		0.41			0.26	3.50	0.373
Right Bank	52.00		0.00			0.00	1.00	0.000
								9.640

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Koignuk River**
LOCATION: **Near the mouth**
COORDINATES: **13W 0429739 E, 7554336 N (NAD 83)**

MEASUREMENT DATE: **14 August 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **NS / HS**
COMPUTATIONS BY: **NS / TJ**

MEASUREMENT START TIME: **1011 h**
MEASUREMENT END TIME: **1029 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	38.10		0.00			0.00	0.30	0.000
1	37.50		0.12			-0.06	0.55	-0.004
2	37.00		0.19			-0.09	0.50	-0.009
3	36.50		0.20			-0.07	0.50	-0.007
4	36.00		0.28			0.03	0.75	0.006
5	35.00		0.38			0.43	1.00	0.163
6	34.00		0.55			0.64	1.00	0.352
7	33.00		0.66			0.64	1.00	0.422
8	32.00		0.67			0.82	1.00	0.549
9	31.00		0.66			0.88	1.00	0.581
10	30.00		0.59			0.88	1.00	0.519
11	29.00		0.50			0.71	1.00	0.355
12	28.00		0.47			0.79	1.00	0.371
13	27.00		0.42			0.74	1.00	0.311
14	26.00		0.40			0.60	1.00	0.240
15	25.00		0.37			0.50	1.00	0.185
16	24.00		0.30			0.47	1.00	0.141
17	23.00		0.26			0.34	1.00	0.088
18	22.00		0.22			0.38	1.00	0.084
19	21.00		0.20			0.23	1.00	0.046
20	20.00		0.20			0.18	1.00	0.036
21	19.00		0.20			0.20	1.00	0.040
22	18.00		0.19			0.15	1.00	0.029
23	17.00		0.17			0.08	1.00	0.014
24	16.00		0.14			0.00	1.00	0.000
25	15.00		0.15			-0.01	1.50	-0.002
26	13.00		0.06			0.00	1.65	0.000
Left Bank	11.70		0.00			0.00	0.65	0.000
								4.511

PROJECT NAME: **Miramar / M2 Program**
PROJECT NUMBER: **06 1373 027 .4000**
DISCHARGE DATA

STREAM NAME: **Koignuk River**
LOCATION: **Near the mouth**
COORDINATES: **13W 0429739 E, 7554336 N (NAD 83)**

MEASUREMENT DATE: **8 September 2006**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **KK / PE**
COMPUTATIONS BY: **NS / TJ**

MEASUREMENT START TIME: **1412 h**
MEASUREMENT END TIME: **1422 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.00			0.00	1.80	0.000
1	3.60		0.26			0.03	3.55	0.028
2	7.10		0.27			0.25	3.50	0.236
3	10.60		0.41			0.54	3.50	0.775
4	14.10		0.46			0.53	3.50	0.853
5	17.60		0.38			0.60	3.50	0.798
6	21.10		0.41			0.03	3.50	0.043
7	24.60		0.16			0.11	3.50	0.062
8	28.10		0.08			0.08	3.50	0.022
9	31.60		0.10			0.00	3.08	0.000
Left Bank	34.25		0.00			0.00	1.33	0.000
								2.817

PROJECT NAME: **Miramar / Doris North / Nunavut**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Koignuk River**
LOCATION: **Koignuk River**
COORDINATES: **13W 0429739 E, 7554336 N (NAD83)**

MEASUREMENT DATE: **1 July 2007**
METER NUMBER: **Marsh McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **PE**
COMPUTATIONS BY: **TJ / DC**

MEASUREMENT START TIME: **1230 h**
MEASUREMENT END TIME: **1600 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.01			0.00	1.985	0.000
1	3.97		0.62			0.57	3.89	1.375
2	7.78		1.00	0.77	0.74	0.755	4.205	3.175
3	12.38		1.50	0.61	0.95	0.78	4.275	5.002
4	16.33		1.70	0.61	0.67	0.64	4.045	4.401
5	20.47		1.90	0.29	0.47	0.38	3.74	2.700
6	23.81		2.20	0.91	1.10	1.005	3.775	8.347
7	28.02		2.50	0.32	0.86	0.59	3.815	5.627
8	31.44		2.37	0.57	0.74	0.655	4.45	6.908
9	36.92		1.65	1.01	1.02	1.015	4.445	7.444
10	40.33		1.65	0.57	1.03	0.8	3.935	5.194
11	44.79		1.25	0.71	0.79	0.75	3.94	3.694
12	48.21		1.19	0.59	1.05	0.82	3.6	3.513
13	51.99		1.15	0.28	0.61	0.445	4.21	2.154
14	56.63		1.15	0.29	1.02	0.655	4.015	3.024
15	60.02		1.06	0.46	1.01	0.735	3.73	2.906
16	64.09		1.00	0.44	0.81	0.625	3.785	2.366
17	67.59		0.90	0.57	0.68	0.625	3.905	2.197
18	71.90		0.65			0.69	4.435	1.989
19	76.46		0.38			0.48	4.225	0.771
20	80.35		0.21			0.17	4.205	0.150
Left Bank	84.87		0.01			0.00	2.26	0.000

72.9

PROJECT NAME: **Miramar / Doris North / Nunavut**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: **Koignuk River**
LOCATION: **Koignuk River**
COORDINATES: **13W 0429739 E, 7554336 N (NAD83)**

MEASUREMENT DATE: **31 Aug 2007**
METER NUMBER: **Marsh-McBirney Flo-Mate Model 2000**

MEASUREMENT BY: **PE**
COMPUTATIONS BY: **DC**

MEASUREMENT START TIME: **1200 h**
MEASUREMENT END TIME: **1520 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.05			0.00	1.50	0.000
1	3.00		0.68			0.14	3.00	0.286
2	6.00		0.86	0.15	0.14	0.15	3.00	0.374
3	9.00		0.93	0.25	0.07	0.16	3.00	0.446
4	12.00		1.00	0.31	0.22	0.27	3.00	0.795
5	15.00		0.84	0.40	0.28	0.34	3.00	0.857
6	18.00		0.88	0.53	0.41	0.47	3.00	1.241
7	21.00		0.83	0.57	0.48	0.53	3.00	1.307
8	24.00		0.84	0.73	0.59	0.66	3.00	1.663
9	27.00		0.92	0.79	0.57	0.68	3.00	1.877
10	30.00		0.90	0.85	0.51	0.68	3.00	1.836
11	33.00		0.92	0.80	0.75	0.78	3.00	2.139
12	36.00		0.68			0.61	3.00	1.244
13	39.00		0.45			0.47	3.00	0.635
14	42.00		0.36			0.68	3.00	0.734
15	45.00		0.34			0.59	3.00	0.602
16	48.00		0.32			0.57	3.00	0.547
17	51.00		0.32			0.56	3.00	0.538
18	54.00		0.32			0.58	3.00	0.557
19	57.00		0.25			0.45	3.00	0.338
20	60.00		0.22			0.42	3.00	0.277
21	63.00		0.15			0.44	3.00	0.198
22	66.00		0.18			0.45	3.00	0.243
23	69.00		0.16			0.51	3.00	0.245
24	72.00		0.18			0.44	3.00	0.238
25	75.00		0.25			0.19	3.00	0.143
26	78.00		0.38			0.33	3.00	0.376
27	81.00		0.27			0.44	3.00	0.356
28	84.00		0.17			0.26	2.50	0.111
Left Bank	86.00		0.25			0.00	1.00	0.000

20.2

PROJECT NAME: **Miramar/Doris North/Nunavut**
PROJECT NUMBER: **07 1373 0019 .4000**
DISCHARGE DATA

STREAM NAME: Koignuk River **MEASUREMENT DATE: 13 September 2007**
LOCATION: Koignuk River **METER NUMBER: Marsh-McBirney**
COORDINATES: 13W 0429739 E, 7554336 N (NAD83)

MEASUREMENT BY: PE **MEASUREMENT START TIME: 1045 h**
COMPUTATIONS BY: DC **MEASUREMENT END TIME: 13:00h**

STATION	DISTANCE FROM RIGHT D/S BANK	ICE THICKNESS	DEPTH	VELOCITY			WIDTH	DISCHARGE
				0.2 Depth	0.8 Depth	0.6 Depth		
	(m)	(m)	(m)	(m/s)	(m/s)	(m/s)	(m)	(m^3/s)
Right Bank	0.00		0.03			0.00	1.00	0.000
1	2.00		0.03			0.00	2.00	0.000
2	4.00		0.06			0.19	2.00	0.023
3	6.00		0.09			0.02	2.00	0.004
4	8.00		0.26			0.03	2.00	0.016
5	10.00		0.24			0.35	2.00	0.168
6	12.00		0.19			0.52	2.00	0.198
7	14.00		0.20			0.52	2.00	0.208
8	16.00		0.36			0.38	2.00	0.274
9	18.00		0.52			0.31	2.00	0.322
10	20.00		0.59			0.31	2.00	0.366
11	22.00		0.53			0.22	2.00	0.233
12	24.00		0.46			0.29	2.00	0.267
13	26.00		0.45			0.36	2.00	0.324
14	28.00		0.31			0.49	2.00	0.304
15	30.00		0.48			0.61	2.00	0.586
16	32.00		0.44			0.54	2.00	0.475
17	34.00		0.46			0.59	2.00	0.543
18	36.00		0.51			0.27	2.00	0.275
19	38.00		0.50			0.01	2.00	0.010
20	40.00		0.30			0.64	2.00	0.384
21	42.00		0.35			0.65	2.00	0.455
22	44.00		0.46			0.71	2.00	0.653
23	46.00		0.62			0.64	2.00	0.794
24	48.00		0.73			0.71	2.00	1.037
25	50.00		0.74			0.83	2.00	1.228
26	52.00		0.70			0.74	2.00	1.036
27	54.00		0.72			0.65	2.00	0.936
28	56.00		0.80	0.80	0.62	0.71	2.00	1.136
29	58.00		1.00	0.82	0.71	0.77	2.00	1.530
30	60.00		1.00	0.75	0.56	0.66	1.50	0.983
31	61.00		0.82	0.05	0.09	0.07	0.75	0.043
Left Bank	61.50		0.02			0.00	0.25	0.000

14.8

FICKLE DUCK LAKE OUTFLOW HYDROMETRIC STATION

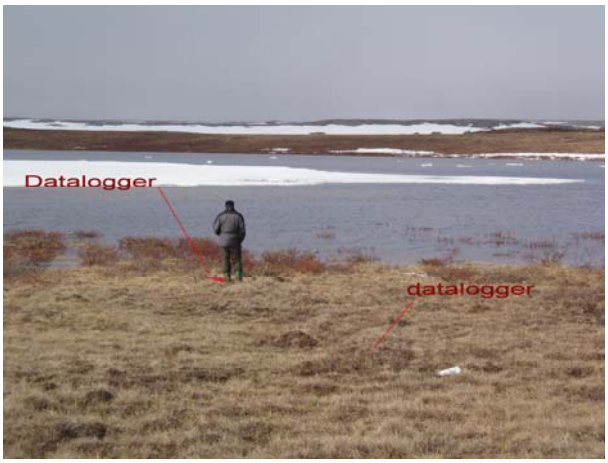
H86

FACTSHEET

LOCATION AND PURPOSE

Located approximately 50 m upstream, on the right bank of F ickle Duck Lake. F lood plain evidence found on both sides of the lake. Station temporally located on the flat flood plain, may need to move later during in the summer.

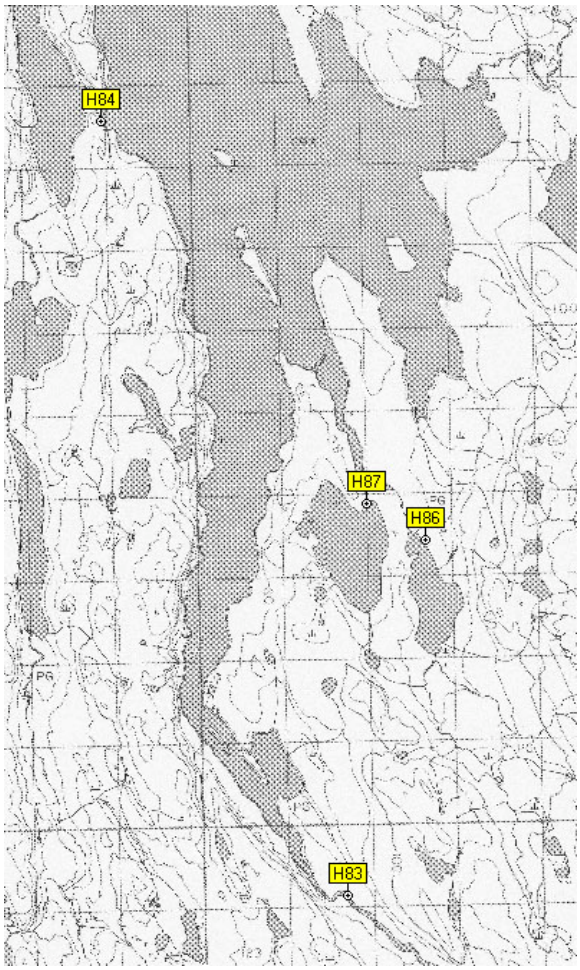
Operational:	2006 (2 June – 10 September)	2007 (26 May – 9 September)	
Benchmark:	Top of embedded boulder;	Drainage Area:	31.3 km2
Coordinates:	UTM: 442699 m E, 7503688 m N (NAD83)	Lat/Long:	67°38’35” N, 106°21’00” W
Datalogger:	Optimum Instruments #1382 (cold tested)	Transducer:	Keller #00942 (5 psi, 20 m)



Station H86 looking west from right bank, with benchmark.

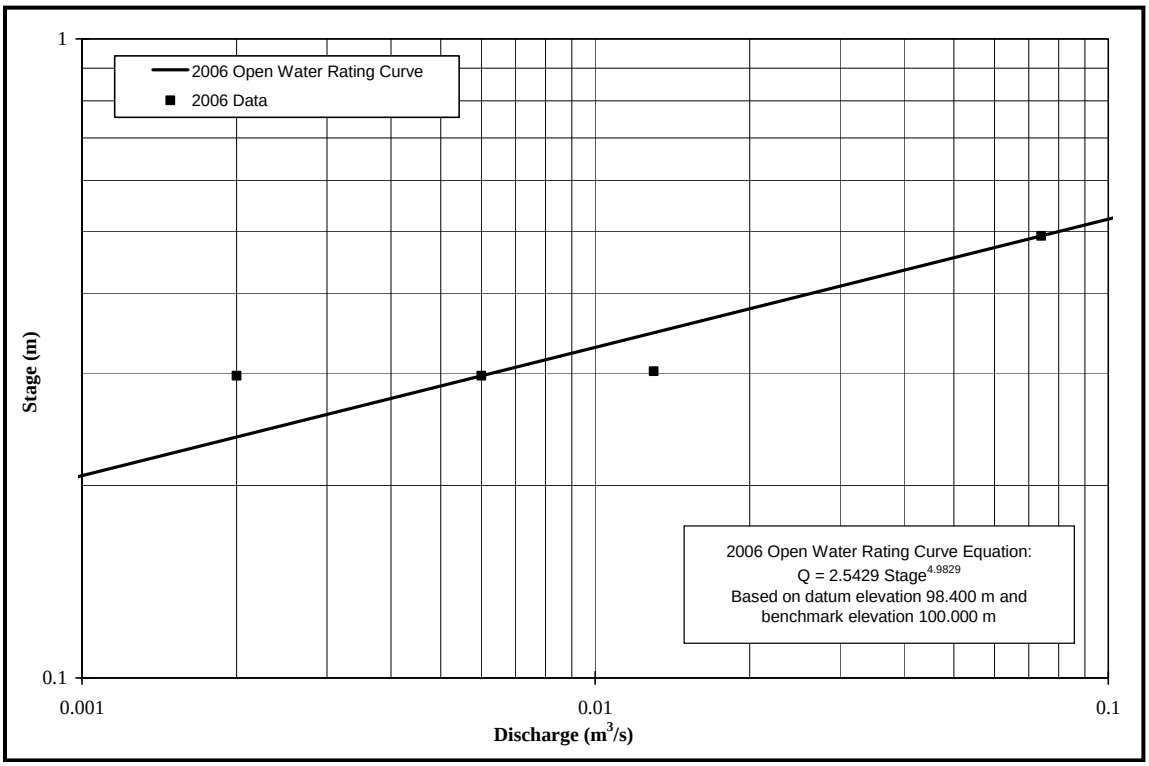


Station H86 looking northwest (downstream) during spring melt flood.

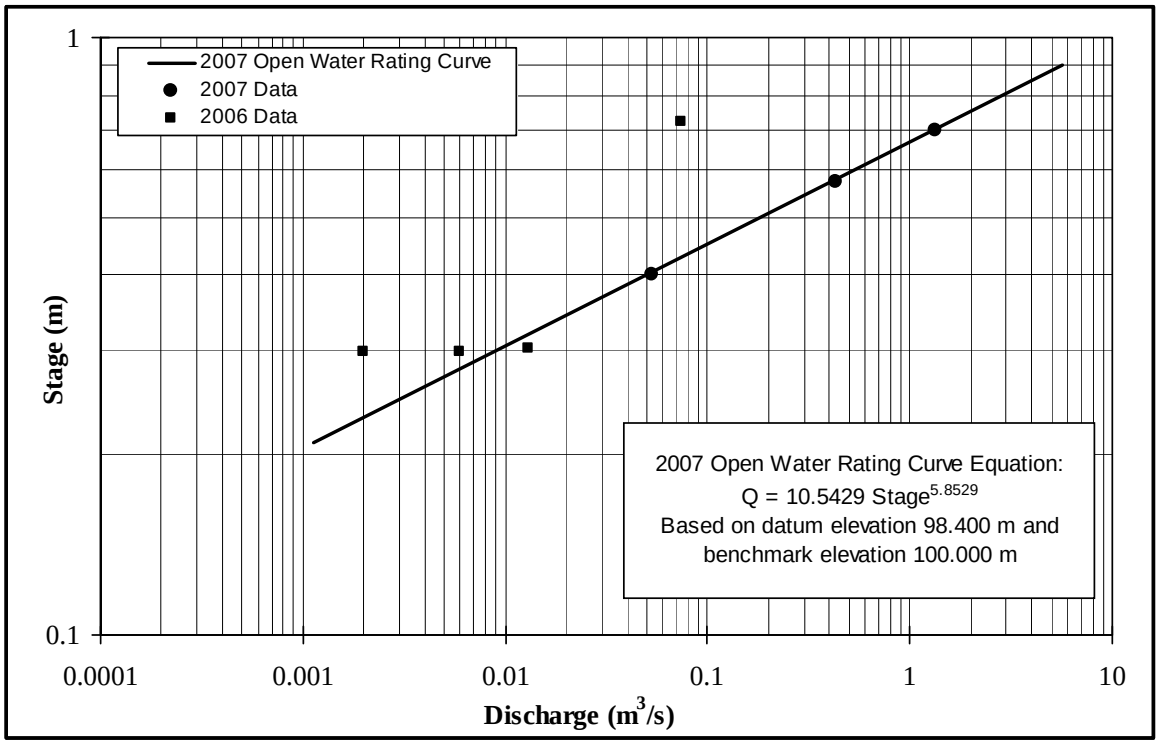


NTS Mapping of Area.

FACT-H86-2007.DOC



Fickle Duck Outflow Station H86 – Stage-Discharge Rating Curve (2006)



Fickle Duck Outflow Station H86 – Stage-Discharge Rating Curve (2007)

Fickle Duck Outflow Station H86 – Stage-Discharge Data (2006-2007)

Stage Datum 98.400 m (non-geodetic)

Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Water Surface Elevation (m)	Stage (m)	Measured Discharge (m^3/s)
03/06/2006 9:30	0.2211	98.866		99.087	0.687	-
24/06/2006 10:50	0.0258			*98.892*	0.492	0.074
08/07/2006 13:49	0.0042		98.866	98.697	0.297	0.002
transducer reset due to drop in water level						
08/07/2006 14:04	0.9438	97.753		98.697	0.297	0.002
17/07/2006 17:30	0.8861			*98.646*	0.246	0.000
13/08/2006 10:30	0.8956	97.801		98.697	0.297	0.006
10/09/2006 16:25	0.9778	97.724	97.760	98.702	0.302	0.013
23/06/2007 12:15				98.470	0.070	1.327
19/08/2007 10:25				98.972	0.572	0.427
09/09/2007 14:00				98.800	0.400	0.053

H86 Fickle Duck Outflow - 2006
MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
1	-	-	-	-	-	-	-	98.528	98.727	-	-
2	-	-	-	-	-	-	-	98.512	98.732	-	-
3	-	-	-	-	-	99.095 P	-	98.531	98.732	-	-
4	-	-	-	-	-	99.073	-	98.567	98.732	-	-
5	-	-	-	-	-	99.046	-	98.596	98.733	-	-
6	-	-	-	-	-	99.031	-	98.624	98.725	-	-
7	-	-	-	-	-	99.021	-	98.621	98.719	-	-
8	-	-	-	-	-	99.013	98.728 P	98.625	98.720	-	-
9	-	-	-	-	-	99.006	98.719	98.651	98.734	-	-
10	-	-	-	-	-	98.994	98.717	98.667	98.741 P	-	-
11	-	-	-	-	-	98.987	98.720	98.654	-	-	-
12	-	-	-	-	-	98.992	98.723	98.650	-	-	-
13	-	-	-	-	-	98.978	98.720	98.647	-	-	-
14	-	-	-	-	-	98.968	98.712	98.645	-	-	-
15	-	-	-	-	-	98.948	98.700	98.656	-	-	-
16	-	-	-	-	-	98.926	98.683	98.668	-	-	-
17	-	-	-	-	-	98.907	98.661	98.671	-	-	-
18	-	-	-	-	-	-	98.646	98.676	-	-	-
19	-	-	-	-	-	-	98.632	98.682	-	-	-
20	-	-	-	-	-	-	98.619	98.689	-	-	-
21	-	-	-	-	-	-	98.594	98.690	-	-	-
22	-	-	-	-	-	-	98.566	98.703	-	-	-
23	-	-	-	-	-	-	98.553	98.732	-	-	-
24	-	-	-	-	-	-	98.562	98.742	-	-	-
25	-	-	-	-	-	-	98.547	98.740	-	-	-
26	-	-	-	-	-	-	98.532	98.736	-	-	-
27	-	-	-	-	-	-	98.533	98.733	-	-	-
28	-	-	-	-	-	-	98.562	98.735	-	-	-
29	-	-	-	-	-	-	98.570	98.735	-	-	-
30	-	-	-	-	-	-	98.563	98.731	-	-	-
31	-	-	-	-	-	-	98.547	98.728	-	-	-
MIN	-	-	-	-	-	98.907	98.532	98.512	98.719	-	-
MEAN	-	-	-	-	-	98.999	98.630	98.663	98.730	-	-
MAX	-	-	-	-	-	99.095	98.728	98.742	98.741	-	-

H86 Fickle Duck Outflow – 2006 (Continued)
MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER
1	-	-	-	-	-	-	-	0.000	0.010	-	-
2	-	-	-	-	-	-	-	0.000	0.011	-	-
3	-	-	-	-	-	0.416 P	-	0.000	0.010	-	-
4	-	-	-	-	-	0.355	-	0.000	0.011	-	-
5	-	-	-	-	-	0.289	-	0.001	0.011	-	-
6	-	-	-	-	-	0.257	-	0.001	0.009	-	-
7	-	-	-	-	-	0.239	-	0.001	0.009	-	-
8	-	-	-	-	-	0.223	0.010 P	0.002	0.009	-	-
9	-	-	-	-	-	0.211	0.009	0.003	0.011	-	-
10	-	-	-	-	-	0.191	0.008	0.004	0.012 P	-	-
11	-	-	-	-	-	0.180	0.009	0.003	-	-	-
12	-	-	-	-	-	0.188	0.009	0.003	-	-	-
13	-	-	-	-	-	0.166	0.009	0.002	-	-	-
14	-	-	-	-	-	0.153	0.008	0.002	-	-	-
15	-	-	-	-	-	0.128	0.006	0.003	-	-	-
16	-	-	-	-	-	0.104	0.005	0.004	-	-	-
17	-	-	-	-	-	0.087	0.003	0.004	-	-	-
18	-	-	-	-	-	-	0.002	0.004	-	-	-
19	-	-	-	-	-	-	0.002	0.005	-	-	-
20	-	-	-	-	-	-	0.001	0.005	-	-	-
21	-	-	-	-	-	-	0.001	0.005	-	-	-
22	-	-	-	-	-	-	0.000	0.007	-	-	-
23	-	-	-	-	-	-	0.000	0.010	-	-	-
24	-	-	-	-	-	-	0.000	0.012	-	-	-
25	-	-	-	-	-	-	0.000	0.012	-	-	-
26	-	-	-	-	-	-	0.000	0.011	-	-	-
27	-	-	-	-	-	-	0.000	0.011	-	-	-
28	-	-	-	-	-	-	0.000	0.011	-	-	-
29	-	-	-	-	-	-	0.000	0.011	-	-	-
30	-	-	-	-	-	-	0.000	0.010	-	-	-
31	-	-	-	-	-	-	0.000	0.010	-	-	-
MIN	-	-	-	-	-	0.087	0.000	0.000	0.009	-	-
MEAN	-	-	-	-	-	0.212	0.004	0.005	0.010	-	-
MAX	-	-	-	-	-	0.416	0.010	0.012	0.012	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED

H86 Fickle Duck Outflow - 2007

MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	0.0002	-	-	-	-
2	-	-	-	-	-	-	-	0.0001	-	-	-	-
3	-	-	-	-	-	-	-	0.0001	-	-	-	-
4	-	-	-	-	-	-	-	0.0001	-	-	-	-
5	-	-	-	-	-	-	-	0.0001	-	-	-	-
6	-	-	-	-	-	-	-	0.0001	-	-	-	-
7	-	-	-	-	-	-	-	0.0001	-	-	-	-
8	-	-	-	-	-	-	-	0.0001	-	-	-	-
9	-	-	-	-	-	-	-	0.0003	-	-	-	-
10	-	-	-	-	-	-	-	0.0009	-	-	-	-
11	-	-	-	-	-	-	-	0.0041	-	-	-	-
12	-	-	-	-	-	-	-	0.0138	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	0.0003 P	-	-	-	-	-
24	-	-	-	-	-	-	0.0003	-	-	-	-	-
25	-	-	-	-	-	-	0.0002	-	-	-	-	-
26	-	-	-	-	-	-	0.0002	-	-	-	-	-
27	-	-	-	-	-	-	0.0002	-	-	-	-	-
28	-	-	-	-	-	-	0.0002	-	-	-	-	-
29	-	-	-	-	-	-	0.0002	-	-	-	-	-
30	-	-	-	-	-	-	0.0002	-	-	-	-	-
31	-	-	-	-	-	-	0.0002	-	-	-	-	-
MIN	-	-	-	-	-	-	0.0002	0.0001	-	-	-	-
MEAN	-	-	-	-	-	-	0.0002	0.0017	-	-	-	-
MAX	-	-	-	-	-	-	0.0003	0.0138	-	-	-	-

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	98.550	-	-	-	-
2	-	-	-	-	-	-	-	98.548	-	-	-	-
3	-	-	-	-	-	-	-	98.545	-	-	-	-
4	-	-	-	-	-	-	-	98.541	-	-	-	-
5	-	-	-	-	-	-	-	98.539	-	-	-	-
6	-	-	-	-	-	-	-	98.541	-	-	-	-
7	-	-	-	-	-	-	-	98.542	-	-	-	-
8	-	-	-	-	-	-	-	98.542	-	-	-	-
9	-	-	-	-	-	-	-	98.566	-	-	-	-
10	-	-	-	-	-	-	-	98.598	-	-	-	-
11	-	-	-	-	-	-	-	98.658	-	-	-	-
12	-	-	-	-	-	-	-	98.707 P	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	98.568 P	-	-	-	-	-
24	-	-	-	-	-	-	98.565	-	-	-	-	-
25	-	-	-	-	-	-	98.560	-	-	-	-	-
26	-	-	-	-	-	-	98.557	-	-	-	-	-
27	-	-	-	-	-	-	98.555	-	-	-	-	-
28	-	-	-	-	-	-	98.554	-	-	-	-	-
29	-	-	-	-	-	-	98.552	-	-	-	-	-
30	-	-	-	-	-	-	98.553	-	-	-	-	-
31	-	-	-	-	-	-	98.550	-	-	-	-	-
MIN	-	-	-	-	-	-	98.550	98.539	-	-	-	-
MEAN	-	-	-	-	-	-	98.557	98.573	-	-	-	-
MAX	-	-	-	-	-	-	98.568	98.707	-	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Fickle Duck Outflow
LOCATION: Outlet of Fickle Duck Lake
COORDINATES: 442609 m E, 7503658 m N (NAD 83)

MEASUREMENT DATE: 24 June 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: KK
COMPUTATIONS BY: NS/TJ

MEASUREMENT START TIME: 1050 h
MEASUREMENT END TIME: 1100 h est.

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	1.45		0.00			0	0.025	0.000
1	1.50		0.05			0	0.125	0.000
2	1.70		0.14			0.01	0.2	0.000
3	1.90		0.13			0.02	0.2	0.001
4	2.10		0.23			0.05	0.2	0.002
5	2.30		0.26			0.39	0.2	0.020
6	2.50		0.30			0.53	0.2	0.032
7	2.70		0.28			0.32	0.2	0.018
8	2.90		0.13			0.03	0.2	0.001
9	3.10		0.11			0.01	0.2	0.000
10	3.30		0.06			0	0.275	0.000
Right Bank	3.65		0.00			0	0.175	0.000
								0.074

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Fickle Duck Outflow
LOCATION: Outlet of Fickle Duck Lake
COORDINATES: 442609 m E, 7503658 m N (NAD 83)

MEASUREMENT DATE: 8 July 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: KK
COMPUTATIONS BY: NS/TJ

MEASUREMENT START TIME: 1630 h est.
MEASUREMENT END TIME: 1645 h est.

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.66		0.00			0	0.02	0.000
1	0.70		0.06			0	0.07	0.000
2	0.80		0.10			0	0.1	0.000
3	0.90		0.10			0	0.1	0.000
4	1.00		0.10			0	0.1	0.000
5	1.10		0.06			0.01	0.1	0.000
6	1.20		0.05			0.01	0.1	0.000
7	1.30		0.09			0.02	0.1	0.000
8	1.40		0.11			0.03	0.1	0.000
9	1.50		0.10			0.03	0.1	0.000
10	1.60		0.12			0.02	0.1	0.000
11	1.70		0.10			0.04	0.1	0.000
12	1.80		0.09			0.02	0.1	0.000
13	1.90		0.05			0	0.07	0.000
Right Bank	1.94		0.00			0	0.02	0.000
								0.002

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Fickle Duck Outflow **MEASUREMENT DATE: 17 July 2006**
LOCATION: Outlet of Fickle Duck Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 442609 m E, 7503658 m N (NAD 83)

MEASUREMENT BY: HS/KM **MEASUREMENT START TIME: 1700 h**
COMPUTATIONS BY: NS/TJ **MEASUREMENT END TIME: 1710 h est.**

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	2.60		0.08			0.00	0.05	0.000
1	2.50		0.01			0.00	0.1	0.000
2	2.40		0.06			0.00	0.1	0.000
3	2.30		0.04			0.00	0.1	0.000
4	2.20		0.09			0.00	0.1	0.000
5	2.10		0.06			0.00	0.1	0.000
6	2.00		0.05			0.00	0.1	0.000
7	1.90		0.04			0.00	0.125	0.000
Right Bank	1.75		0.00			0.00	0.075	0.000
								0.000

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Fickle Duck Outflow
LOCATION: Outlet of Fickle Duck Lake
COORDINATES: 442609 m E, 7503658 m N (NAD 83)

MEASUREMENT DATE: 13 August 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: NS
COMPUTATIONS BY: NS/TJ

MEASUREMENT START TIME: 1010 h
MEASUREMENT END TIME: 1020 h

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.80		0.00			0.00	0.1	0.000
1	1.00		0.10			0.00	0.15	0.000
2	1.10		0.10			0.00	0.1	0.000
3	1.20		0.10			0.04	0.1	0.000
4	1.30		0.12			0.03	0.1	0.000
5	1.40		0.13			0.12	0.1	0.002
6	1.50		0.14			0.10	0.1	0.001
7	1.60		0.13			0.10	0.1	0.001
8	1.70		0.13			0.05	0.1	0.001
9	1.80		0.13			0.03	0.1	0.000
10	1.90		0.14			0.01	0.1	0.000
11	2.00		0.10			0.02	0.125	0.000
Right Bank	2.15		0.00			0.00	0.075	0.000
								0.006

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Fickle Duck Outflow
LOCATION: Outlet of Fickle Duck Lake
COORDINATES: 442609 m E, 7503658 m N (NAD 83)

MEASUREMENT DATE: 10 September 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: KK/PE
COMPUTATIONS BY: NS/TJ

MEASUREMENT START TIME: 1625 h
MEASUREMENT END TIME: 1635 h

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	1.76		0.00			0.00	0.02	0.000
1	1.80		0.02			0.00	0.07	0.000
2	1.90		0.10			0.00	0.1	0.000
3	2.00		0.08			0.01	0.1	0.000
4	2.10		0.13			0.02	0.1	0.000
5	2.20		0.10			0.19	0.1	0.002
6	2.30		0.10			0.13	0.1	0.001
7	2.40		0.08			0.14	0.1	0.001
8	2.50		0.08			0.15	0.1	0.001
9	2.60		0.10			0.24	0.1	0.002
10	2.70		0.09			0.23	0.1	0.002
11	2.80		0.12			0.25	0.1	0.003
12	2.90		0.16			0.00	0.07	0.000
Right Bank	2.94		0.00			0.00	0.02	0.000
								0.013

PROJECT NUMBER: 07-1373-0019.4000

DISCHARGE DATA

STREAM NAME: Fickle Duck Lake Outflow **MEASUREMENT DATE: 23 June 2007**

LOCATION: Outlet of Fickle Duck Lake **METER NUMBER: Marsh McBirney**

COORDINATES: 442609 m E, 7503658 m N (NAD 83)

MEASUREMENT BY: TY **MEASUREMENT START TIME: 1130 h**

COMPUTATIONS BY: DC **MEASUREMENT END TIME: 1145 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Left Bank	1.90		0.19			0.02	0.95	0.004
1	3.80		0.31			0.09	1.9	0.053
2	5.70		0.32			0.3	1.9	0.182
3	7.60		0.40			0.02	1.9	0.015
4	9.50		0.46			0.05	1.9	0.044
5	11.40		0.52			0.31	1.9	0.306
6	13.30		0.44			0.84	1.9	0.702
7	15.20		0.18			0.06	1.9	0.021
19	17.10		0.13			0	1.9	0.000
Right Bank	19.00		0.05			0	0.95	0.000
								1.327

PROJECT NAME: Miramar/M2 Project/Fickle Duck Lake Outflow

PROJECT NUMBER: 07-1373-0019.4000

DISCHARGE DATA

STREAM NAME: Fickle Duck Lake Outflow **MEASUREMENT DATE: 19 August 2007**

LOCATION: Outlet of Fickle Duck Lake **METER NUMBER: Marsh McBirney**

COORDINATES: 442609 m E, 7503658 m N (NAD 83)

MEASUREMENT BY: TY **MEASUREMENT START TIME: 1036 h**

COMPUTATIONS BY: TJ/JV **MEASUREMENT END TIME: 1102 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Left Bank	6.00		0.28			0.06	0.15	0.003
1	6.30		0.15			0.1	0.3	0.005
2	6.60		0.42			0.03	0.3	0.004
3	6.90		0.49			0.15	0.3	0.022
4	7.20		0.44			0.04	0.3	0.005
5	7.50		0.49			0.04	0.3	0.006
6	7.80		0.54			0.09	0.3	0.015
7	8.10		0.56			0.47	0.3	0.079
8	8.40		0.56			0.52	0.3	0.087
9	8.70		0.44			0.23	0.3	0.030
10	9.00		0.43			0.31	0.3	0.040
11	9.30		0.40			0.29	0.3	0.035
12	9.60		0.36			0.51	0.3	0.055
13	9.90		0.33			0.23	0.3	0.023
14	10.20		0.26			0.08	0.3	0.006
15	10.50		0.22			0.06	0.4	0.005
16	11.00		0.16			0.05	0.5	0.004
17	11.50		0.16			0.07	0.5	0.006
18	12.00		0.15			-0.01	0.5	-0.001
19	12.50		0.10			-0.02	0.5	-0.001
Right Bank	13.00		0.00			0	0.25	0.000
								0.427

PROJECT NAME: Miramar/M2 Project/Fickle Duck Lake Outflow
PROJECT NUMBER: 07-1373-0019.4000
DISCHARGE DATA

STREAM NAME: Fickle Duck Lake Outflow **MEASUREMENT DATE: 09 Sept 2007**
LOCATION: Outlet of Fickle Duck Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 442609 m E, 7503658 m N (NAD 83)

MEASUREMENT BY: TY **MEASUREMENT START TIME: 1420 h**
COMPUTATIONS BY: DC **MEASUREMENT END TIME: 1445 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Left Bank	6.00		0.00			0	0.165	0.000
1	6.33		0.17			0.14	0.225	0.005
2	6.45		0.22			0.27	0.11	0.007
3	6.55		0.17			0.33	0.1	0.006
4	6.65		0.20			0.34	0.1	0.007
5	6.75		0.16			0.36	0.1	0.006
6	6.85		0.16			0.28	0.1	0.004
7	6.95		0.17			0.38	0.1	0.006
8	7.05		0.17			0.42	0.1	0.007
9	7.15		0.18			0.28	0.1	0.005
10	7.25		0.14			0.01	0.1	0.000
11	7.35		0.10			-0.04	0.15	-0.001
12	7.55		0.10			0.01	0.145	0.000
13	7.64		0.00			0	0.045	0.000
Right Bank							-3.82	0.000
								0.053

STICKLEBACK LAKE OUTFLOW HYDROMETRIC STATION

H87

FACTSHEET

LOCATION AND PURPOSE

Located approximately 20 m upstream, on the right bank of Stickleback Lake outflow, existing w ater control structure found on the outflow.

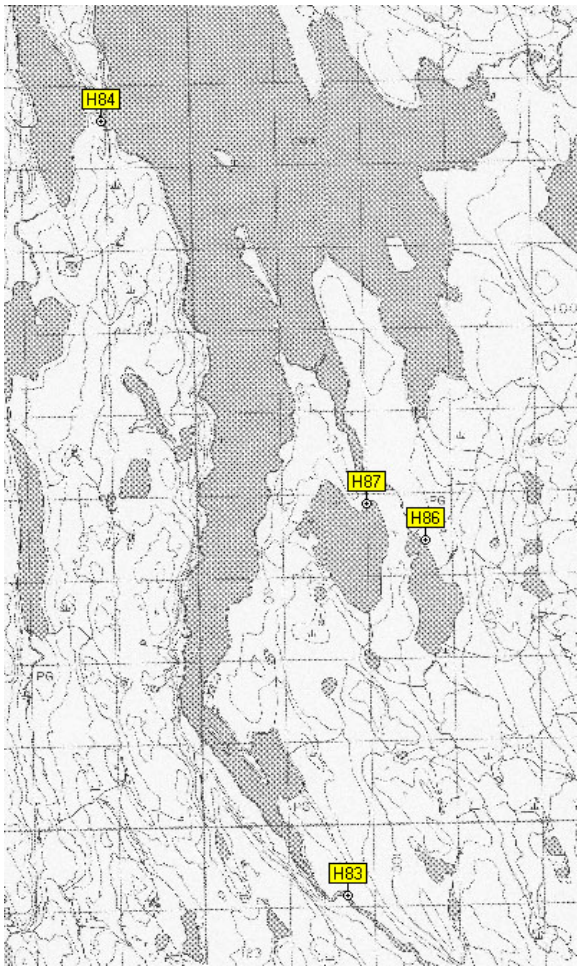
Operational:	2006 (3 June – 10 September)	2007 (25 May – 6 September)	
Benchmark:	Top of embedded boulder;	Drainage Area:	2.8 km^2
Coordinates:	UTM: 442009 m E, 7504121 m N (NAD83)	Lat/Long:	67°38'48" N, 106°22'00" W
Datalogger:	Optimum Instruments #0948	Transducer:	Keller #402787 (5 psi, 15 m)



Station H87 looking southwest from right bank, with benchmark.

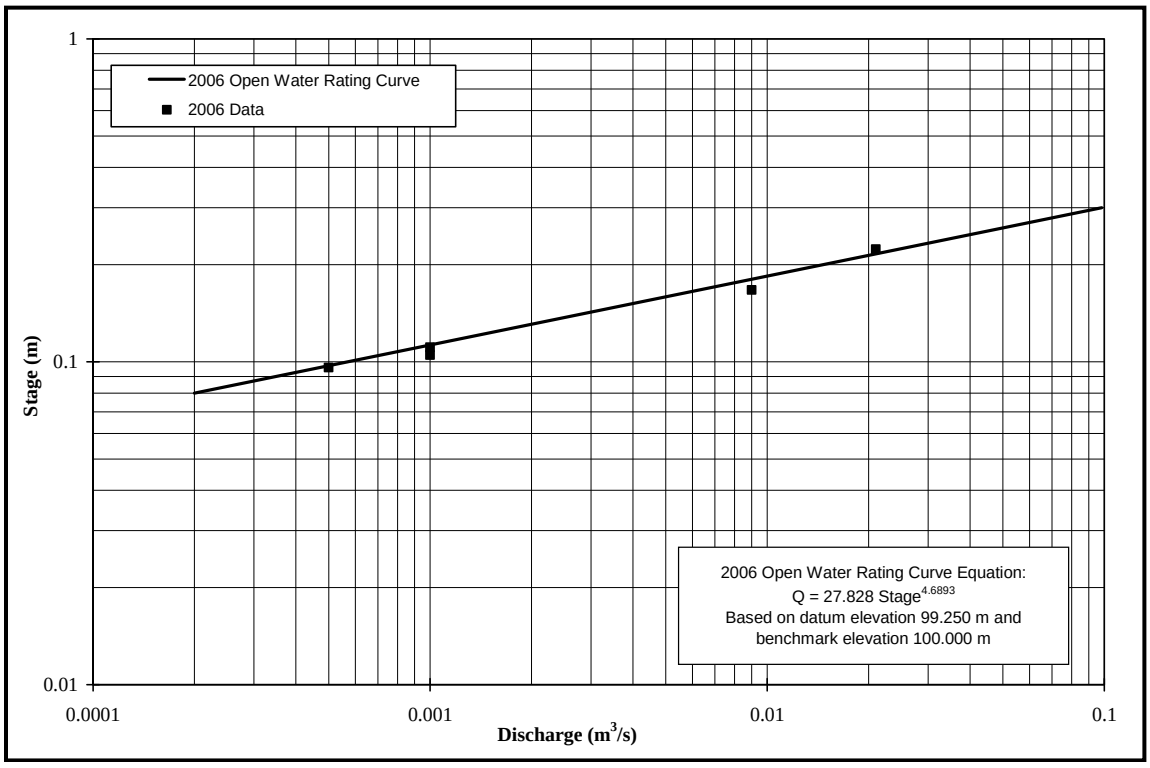


Existing water control structure on the outflow stream. Looking west from right bank.

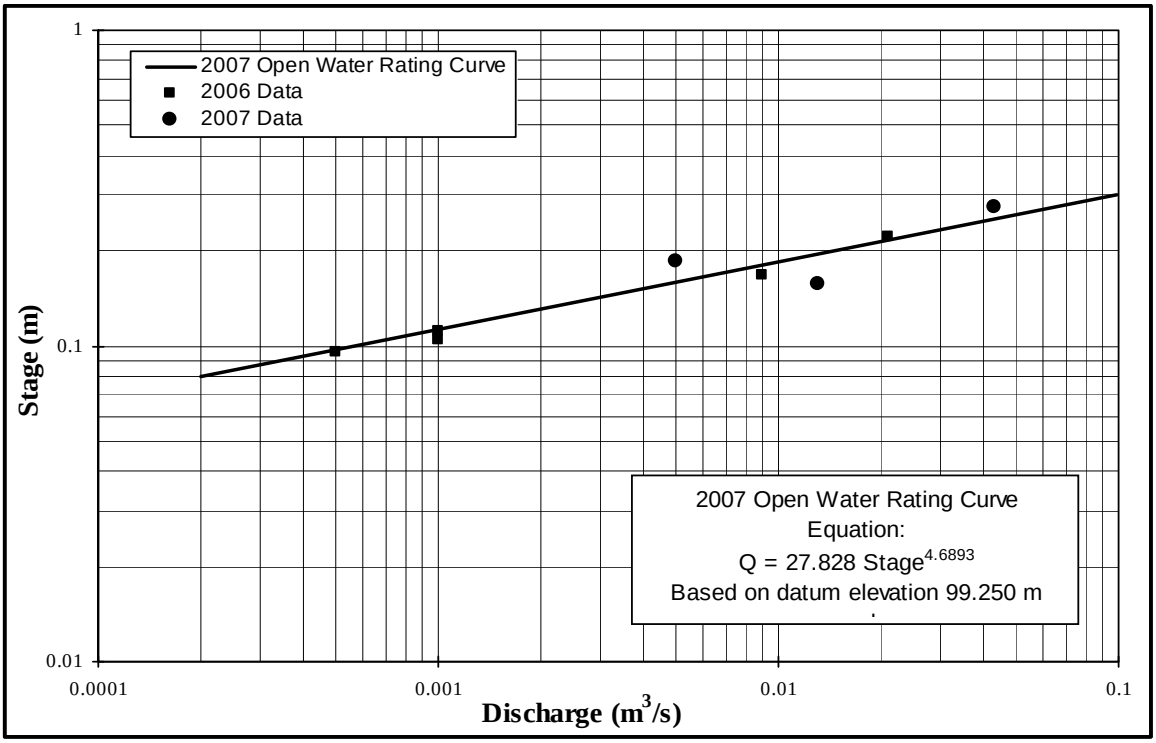


NTS Mapping of Area.

FACT-H87-2007.DOC



Stickleback Outflow Station H87 – Stage-Discharge Rating Curve (2006)



Stickleback Outflow Station H87 – Stage-Discharge Rating Curve (2007)

Stickleback Outflow Station H87 – Stage-Discharge Data (2006-2007)

Stage Datum 99.250 m (non-geodetic)

Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Water Surface Elevation (m)	Stage (m)	Measured Discharge (m^3/s)
02/06/2006 20:00	1.0620	98.436		99.498	0.248	-
24/06/2006 12:39	1.0416	98.431		99.473	0.223	0.021
08/07/2006 15:05	1.0073	98.410	98.426	99.417	0.167	0.009
transducer moved during field visit						
08/07/2006 15:05	1.0258	98.391		99.417	0.167	0.009
21/07/2006 14:00	0.9889	-		*99.355*	0.105	0.001
13/08/2006 9:24	0.9946	98.366		99.361	0.111	0.001
10/09/2006 16:45	1.0056	98.340	98.366	99.346	0.096	0.0005
06/23/2007 09:50	0.0889			98.876	0.276	0.043
08/19/2007 11:39	-0.0027	98.760		98.757	0.157	0.013
09/06/2007 11:15	-0.0292	98.814	98.787	98.785	0.185	0.005

H87 Stickleback Outflow - 2006

MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	0.010	0.003	0.003	-	-	-
2	-	-	-	-	-	0.024 P	0.009	0.002	0.003	-	-	-
3	-	-	-	-	-	0.024	0.009	0.002	0.004	-	-	-
4	-	-	-	-	-	0.026	0.008	0.002	0.004	-	-	-
5	-	-	-	-	-	0.030	0.007	0.002	0.004	-	-	-
6	-	-	-	-	-	0.032	0.007	0.002	0.004	-	-	-
7	-	-	-	-	-	0.028	0.006	0.002	0.003	-	-	-
8	-	-	-	-	-	0.026	0.006	0.002	0.004	-	-	-
9	-	-	-	-	-	0.028	0.006	0.002	0.004	-	-	-
10	-	-	-	-	-	0.029	0.006	0.002	0.004 P	-	-	-
11	-	-	-	-	-	0.028	0.006	0.002	-	-	-	-
12	-	-	-	-	-	0.028	0.005	0.002	-	-	-	-
13	-	-	-	-	-	0.028	0.005	0.002	-	-	-	-
14	-	-	-	-	-	0.026	0.005	0.002	-	-	-	-
15	-	-	-	-	-	0.024	0.004	0.002	-	-	-	-
16	-	-	-	-	-	0.023	0.004	0.002	-	-	-	-
17	-	-	-	-	-	0.021	0.004	0.002	-	-	-	-
18	-	-	-	-	-	0.021	0.003	0.002	-	-	-	-
19	-	-	-	-	-	0.020	0.003	0.002	-	-	-	-
20	-	-	-	-	-	0.019	0.003	0.002	-	-	-	-
21	-	-	-	-	-	0.018	0.003	0.002	-	-	-	-
22	-	-	-	-	-	0.017	0.002	0.002	-	-	-	-
23	-	-	-	-	-	0.016	0.002	0.002	-	-	-	-
24	-	-	-	-	-	0.015	0.003	0.003	-	-	-	-
25	-	-	-	-	-	0.013	0.003	0.003	-	-	-	-
26	-	-	-	-	-	0.013	0.003	0.003	-	-	-	-
27	-	-	-	-	-	0.012	0.003	0.003	-	-	-	-
28	-	-	-	-	-	0.011	0.003	0.003	-	-	-	-
29	-	-	-	-	-	0.010	0.003	0.003	-	-	-	-
30	-	-	-	-	-	0.010	0.003	0.003	-	-	-	-
31	-	-	-	-	-	-	0.003	0.003	-	-	-	-
MIN	-	-	-	-	-	0.010	0.002	0.002	0.003	-	-	-
MEAN	-	-	-	-	-	0.021	0.005	0.003	0.004	-	-	-
MAX	-	-	-	-	-	0.032	0.010	0.003	0.004	-	-	-

H87 Stickleback Outflow - 2006 (Continued)

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	99.432	99.387	99.396	-	-	-
2	-	-	-	-	-	99.472 P	99.430	99.387	99.396	-	-	-
3	-	-	-	-	-	99.472	99.429	99.386	99.398	-	-	-
4	-	-	-	-	-	99.476	99.425	99.385	99.397	-	-	-
5	-	-	-	-	-	99.483	99.422	99.384	99.398	-	-	-
6	-	-	-	-	-	99.486	99.421	99.383	99.397	-	-	-
7	-	-	-	-	-	99.479	99.418	99.382	99.397	-	-	-
8	-	-	-	-	-	99.477	99.417	99.381	99.399	-	-	-
9	-	-	-	-	-	99.479	99.417	99.381	99.399	-	-	-
10	-	-	-	-	-	99.481	99.415	99.379	99.399 P	-	-	-
11	-	-	-	-	-	99.480	99.413	99.383	-	-	-	-
12	-	-	-	-	-	99.479	99.410	99.385	-	-	-	-
13	-	-	-	-	-	99.479	99.408	99.385	-	-	-	-
14	-	-	-	-	-	99.475	99.406	99.385	-	-	-	-
15	-	-	-	-	-	99.472	99.405	99.385	-	-	-	-
16	-	-	-	-	-	99.470	99.401	99.385	-	-	-	-
17	-	-	-	-	-	99.466	99.398	99.385	-	-	-	-
18	-	-	-	-	-	99.465	99.394	99.386	-	-	-	-
19	-	-	-	-	-	99.464	99.392	99.386	-	-	-	-
20	-	-	-	-	-	99.461	99.389	99.385	-	-	-	-
21	-	-	-	-	-	99.459	99.387	99.384	-	-	-	-
22	-	-	-	-	-	99.455	99.384	99.385	-	-	-	-
23	-	-	-	-	-	99.454	99.387	99.387	-	-	-	-
24	-	-	-	-	-	99.450	99.394	99.394	-	-	-	-
25	-	-	-	-	-	99.446	99.394	99.395	-	-	-	-
26	-	-	-	-	-	99.444	99.394	99.395	-	-	-	-
27	-	-	-	-	-	99.440	99.390	99.393	-	-	-	-
28	-	-	-	-	-	99.439	99.394	99.394	-	-	-	-
29	-	-	-	-	-	99.434	99.396	99.395	-	-	-	-
30	-	-	-	-	-	99.434	99.395	99.394	-	-	-	-
31	-	-	-	-	-	-	99.391	99.394	-	-	-	-
MIN	-	-	-	-	-	99.434	99.384	99.379	99.396	-	-	-
MEAN	-	-	-	-	-	99.465	99.405	99.387	99.398	-	-	-
MAX	-	-	-	-	-	99.486	99.432	99.395	99.399	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED

H87 Stickleback Outflow - 2007

MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	0.014	0.002	0.007	-	-	-
2	-	-	-	-	-	-	0.013	0.002	0.007	-	-	-
3	-	-	-	-	-	-	0.013	0.002	0.007	-	-	-
4	-	-	-	-	-	-	0.013	0.001	0.006	-	-	-
5	-	-	-	-	-	-	0.012	0.001	0.006	-	-	-
6	-	-	-	-	-	-	0.011	0.001	0.006	-	-	-
7	-	-	-	-	-	-	0.011	0.001	0.006	-	-	-
8	-	-	-	-	-	0.006 E	0.011	0.001	0.005	-	-	-
9	-	-	-	-	-	0.008 E	0.011	0.003	0.005 P	-	-	-
10	-	-	-	-	-	0.011	0.011	0.004	0.004 E	-	-	-
11	-	-	-	-	-	0.013	0.011	0.005	0.004 E	-	-	-
12	-	-	-	-	-	0.030	0.011	0.006	0.004 E	-	-	-
13	-	-	-	-	-	0.075	0.010	0.008	0.003 E	-	-	-
14	-	-	-	-	-	0.145	0.010	0.008	0.003 E	-	-	-
15	-	-	-	-	-	0.184	0.009	0.009	0.003 E	-	-	-
16	-	-	-	-	-	0.143	0.009	0.009	0.002 E	-	-	-
17	-	-	-	-	-	0.077	0.008	0.008	0.002 E	-	-	-
18	-	-	-	-	-	0.038	0.007	0.008	0.001 E	-	-	-
19	-	-	-	-	-	0.039	0.007	0.010	0.001 E	-	-	-
20	-	-	-	-	-	0.068	0.006	0.010	-	-	-	-
21	-	-	-	-	-	0.091	0.007	0.009	-	-	-	-
22	-	-	-	-	-	0.083	0.005	0.010	-	-	-	-
23	-	-	-	-	-	0.066	0.004	0.009	-	-	-	-
24	-	-	-	-	-	0.061	0.004	0.009	-	-	-	-
25	-	-	-	-	-	0.036	0.003	0.008	-	-	-	-
26	-	-	-	-	-	0.037	0.003	0.008	-	-	-	-
27	-	-	-	-	-	0.022	0.004	0.007	-	-	-	-
28	-	-	-	-	-	0.015	0.003	0.007	-	-	-	-
29	-	-	-	-	-	0.014	0.003	0.007	-	-	-	-
30	-	-	-	-	-	0.014	0.003	0.007	-	-	-	-
31	-	-	-	-	-	-	0.003	0.007	-	-	-	-
MIN	-	-	-	-	-	0.006	0.003	0.001	0.001	-	-	-
MEAN	-	-	-	-	-	0.056	0.008	0.006	0.004	-	-	-
MAX	-	-	-	-	-	0.184	0.014	0.010	0.007	-	-	-

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	98.798	98.735	98.771	-	-	-
2	-	-	-	-	-	-	98.796	98.730	98.769	-	-	-
3	-	-	-	-	-	-	98.795	98.727	98.769	-	-	-
4	-	-	-	-	-	-	98.794	98.723	98.766	-	-	-
5	-	-	-	-	-	-	98.790	98.720	98.764	-	-	-
6	-	-	-	-	-	98.785 P	98.789	98.720	98.763	-	-	-
7	-	-	-	-	-	98.786	98.789	98.720	98.763	-	-	-
8	-	-	-	-	-	98.786	98.788	98.722	98.760	-	-	-
9	-	-	-	-	-	98.786	98.787	98.739	98.758 P	-	-	-
10	-	-	-	-	-	98.786	98.787	98.750	-	-	-	-
11	-	-	-	-	-	98.793	98.788	98.758	-	-	-	-
12	-	-	-	-	-	98.831	98.787	98.768	-	-	-	-
13	-	-	-	-	-	98.881	98.785	98.774	-	-	-	-
14	-	-	-	-	-	98.925	98.783	98.777	-	-	-	-
15	-	-	-	-	-	98.943	98.782	98.779	-	-	-	-
16	-	-	-	-	-	98.925	98.778	98.778	-	-	-	-
17	-	-	-	-	-	98.882	98.774	98.778	-	-	-	-
18	-	-	-	-	-	98.845	98.772	98.777	-	-	-	-
19	-	-	-	-	-	98.846	98.771	98.783	-	-	-	-
20	-	-	-	-	-	98.875	98.767	98.784	-	-	-	-
21	-	-	-	-	-	98.895	98.769	98.781	-	-	-	-
22	-	-	-	-	-	98.889	98.757	98.783	-	-	-	-
23	-	-	-	-	-	98.875	98.751	98.782	-	-	-	-
24	-	-	-	-	-	98.871	98.748	98.779	-	-	-	-
25	-	-	-	-	-	98.841	98.746	98.776	-	-	-	-
26	-	-	-	-	-	98.843	98.746	98.774	-	-	-	-
27	-	-	-	-	-	98.818	98.748	98.772	-	-	-	-
28	-	-	-	-	-	98.800	98.745	98.772	-	-	-	-
29	-	-	-	-	-	98.798	98.743	98.773	-	-	-	-
30	-	-	-	-	-	98.799	98.743	98.772	-	-	-	-
31	-	-	-	-	-	-	98.740	98.773	-	-	-	-
MIN	-	-	-	-	-	98.785	98.740	98.720	98.758	-	-	-
MEAN	-	-	-	-	-	98.844	98.772	98.761	98.765	-	-	-
MAX	-	-	-	-	-	98.943	98.798	98.784	98.771	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Stickleback Outflow **MEASUREMENT DATE: 24 June 2006**
LOCATION: Outlet of Stickleback Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 441934 m E, 7504127 m N (NAD 83)

MEASUREMENT BY: KK **MEASUREMENT START TIME: 1239 h**
COMPUTATIONS BY: NS/TJ **MEASUREMENT END TIME: 1246 h est.**

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.75		0.00			0.00	0.075	0.000
1	0.90		0.02			0.00	0.175	0.000
2	1.10		0.06			0.00	0.2	0.000
3	1.30		0.06			0.00	0.15	0.000
4	1.40		0.10			0.13	0.1	0.001
5	1.50		0.13			0.31	0.1	0.004
6	1.60		0.25			0.43	0.1	0.011
7	1.70		0.12			0.26	0.15	0.005
8	1.90		0.01			0.00	0.175	0.000
Right Bank	2.05		0.00			0.00	0.075	0.000
								0.021

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Stickleback Outflow
LOCATION: Outlet of Stickleback Lake
COORDINATES: 441934 m E, 7504127 m N (NAD 83)

MEASUREMENT DATE: 8 July 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: KK
COMPUTATIONS BY: NS/TJ

MEASUREMENT START TIME: 1505 h
MEASUREMENT END TIME: 1510 h

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.03	0.000
1	0.06		0.12			0.59	0.06	0.004
2	0.12		0.12			0.49	0.06	0.004
3	0.18		0.06			0.43	0.06	0.002
Right Bank	0.24		0.00			0.00	0.03	0.000
								0.009

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Stickleback Outflow
LOCATION: Stickleback Duck Lake
COORDINATES: 442609 m E, 7503658 m N (NAD 83)

MEASUREMENT DATE: 21 July 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: HS/KM
COMPUTATIONS BY: NS/TY

MEASUREMENT START TIME: 1429 h
MEASUREMENT END TIME: 1445 h

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	1.25		0.00			0.00	0.075	0.000
1	1.40		0.04			0.00	0.05	0.000
2	1.50		0.38			0.04	0.05	0.001
3	1.60		0.34			0.03	0.05	0.001
4	1.70		0.20			0.01	0.05	0.000
5	1.80		0.05			0.00	0.05	0.000
6	1.90		0.02			0.00	0.05	0.000
7	2.00		0.03			0.00	0.15	0.000
Right Bank	2.30		0.00			0.00	0.15	0.000
								0.001

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Stickleback Outflow
LOCATION: Outlet of Stickleback Lake
COORDINATES: 441934 m E, 7504127 m N (NAD 83)

MEASUREMENT DATE: 13 August 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: NS
COMPUTATIONS BY: NS/TJ

MEASUREMENT START TIME: 0945 h
MEASUREMENT END TIME: 0955 h

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.50		0.00			0.00	0.025	0.000
1	0.55		0.07			0.00	0.05	0.000
2	0.60		0.16			0.00	0.035	0.000
3	0.62		0.26			0.00	0.025	0.000
4	0.65		0.28			0.00	0.025	0.000
5	0.67		0.28			0.01	0.025	0.000
6	0.70		0.28			0.00	0.055	0.000
Right Bank	0.78		0.00			0.00	0.04	0.000
								0.000

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Stickleback Outflow
LOCATION: Outlet of Stickleback Lake
COORDINATES: 441934 m E, 7504127 m N (NAD 83)

MEASUREMENT DATE: 10 September 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: KK/PE
COMPUTATIONS BY: NS/TJ

MEASUREMENT START TIME: 1650 h
MEASUREMENT END TIME: 1650 h

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank								
1	No measurable flow							
Right Bank								
								0.000

PROJECT NUMBER: 07-1373-0019, 4000
DISCHARGE DATA

STREAM NAME: Stickleback Lake Outflow **MEASUREMENT DATE: 23 June 2007**
LOCATION: Outlet of Stickleback Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 441934 m E, 7504127 m N (NAD 83)

MEASUREMENT BY: TY **MEASUREMENT START TIME: 0906 h**
COMPUTATIONS BY: DC **MEASUREMENT END TIME: 0915 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Right Bank	3.40		0.04			0.00	0.15	0.000
1	3.10		0.24			0.20	0.3	0.014
2	2.80		0.28			0.23	0.3	0.019
3	2.50		0.21			0.14	0.3	0.009
4	2.20		0.15			0.01	0.3	0.000
5	1.90		0.14			0.01	0.3	0.000
6	1.60		0.08			0.00	0.3	0.000
7	1.30		0.06			0.00	0.3	0.000
8	1.00		0.04			0.00	0.3	0.000
Left Bank	0.70		0.02			0.00	0.15	0.000
								0.043

PROJECT NAME: Miramar/M2 Project/Stickleback Lake Outflow
PROJECT NUMBER: 07-1373-0019, 4000
DISCHARGE DATA

STREAM NAME: Stickleback Lake Outflow **MEASUREMENT DATE: 19 August 2007**
LOCATION: Outlet of Stickleback Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 441934 m E, 7504127 m N (NAD 83)

MEASUREMENT BY: TY **MEASUREMENT START TIME: 1150 h**
COMPUTATIONS BY: TJ/DC **MEASUREMENT END TIME: 1205 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m) (m)	DEPTH (m) (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m) (m)	DISCHARGE (m^3/s)
Right Bank	5.00		0.02			0.00	0.05	0.000
1	5.10		0.02			0.00	0.1	0.000
2	5.20		0.04			-0.02	0.1	0.000
3	5.30		0.08			-0.02	0.1	0.000
4	5.40		0.10			-0.01	0.1	0.000
5	5.50		0.13			-0.01	0.1	0.000
6	5.60		0.15			0.00	0.1	0.000
7	5.70		0.15			0.00	0.1	0.000
8	5.80		0.16			0.04	0.1	0.001
9	5.90		0.29			0.12	0.1	0.003
10	6.00		0.36			0.26	0.1	0.009
11	6.10		0.26			-0.01	0.1	0.000
Left Bank	6.20		0.06			-0.01	0.05	0.000
								0.013

PROJECT NAME: Miramar/M2 Project/Stickleback Lake Outflow
PROJECT NUMBER: 07-1373-0019, 4000
DISCHARGE DATA

STREAM NAME: Stickleback Lake Outflow **MEASUREMENT DATE: 06 Sept 2007**
LOCATION: Outlet of Stickleback Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 441934 m E, 7504127 m N (NAD 83)

MEASUREMENT BY: TY **MEASUREMENT START TIME: 1115hrs**
COMPUTATIONS BY:DC **MEASUREMENT END TIME: 1130hrs**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Right Bank	7.15					0.00	0.225	0.000
1	6.70		0.34			0.02	0.05	0.000
2	6.65		0.38			0.06	0.05	0.001
3	6.60		0.38			0.08	0.05	0.002
4	6.55		0.36			0.07	0.05	0.001
5	6.50		0.26			0.04	0.05	0.001
6	6.45		0.25			0.01	0.05	0.000
7	6.40		0.12			-0.02	0.075	0.000
8	6.35		0.10			-0.03	0.05	0.000
9	6.25		0.08			-0.02	0	0.000
Left Bank								0.000
								0.005

HOPE BAY TIDAL HYDROMETRIC STATION

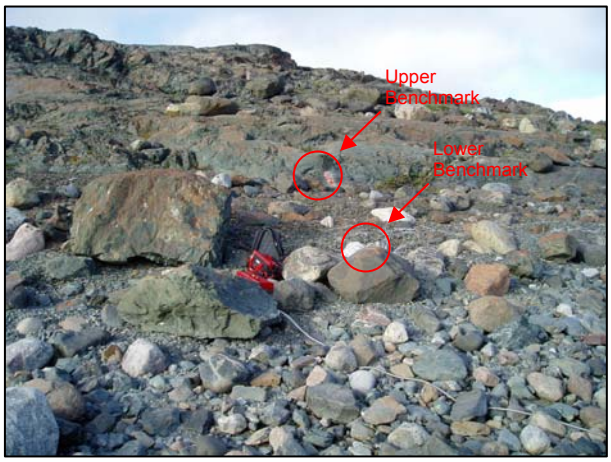
H88

FACTSHEET

LOCATION AND PURPOSE

Located on the south side of Hope Bay to characterize tidal variation. This station was operated for one open-water season only in 2006. Two benchmarks (high in bedrock; low on a boulder) were established at the site.

Operational:	2006 (3 July – 8 September)		
Benchmarks:	Top of embedded boulder; bedrock face	Drainage Area:	n/a
Coordinates:	UTM: 428367 m E, 7556545 m N (NAD83)	Lat/Long:	68°05'12" N, 106°43'12" W
Datalogger:	Optimum Instruments #0949 (cold tested)	Transducer:	Keller #0202699 (8 psi, 20 m)



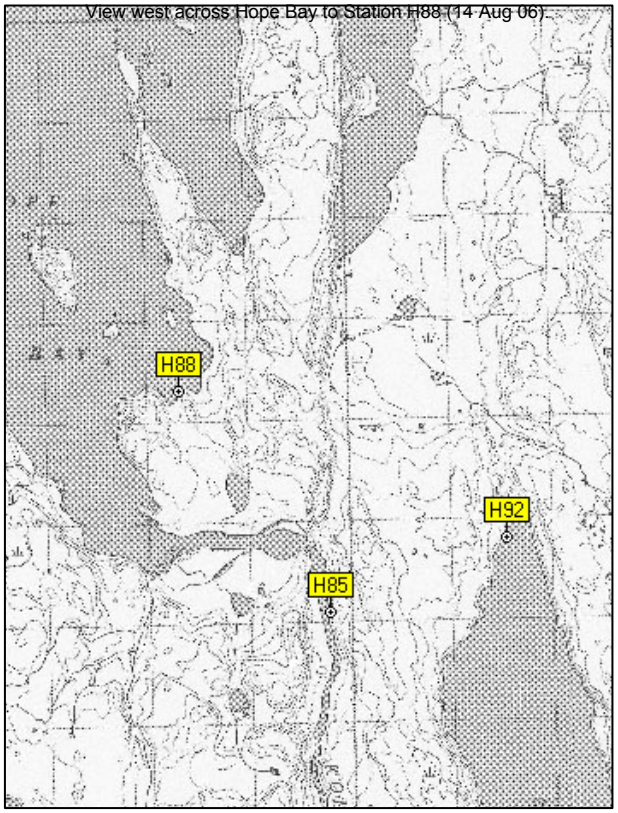
Station H88 looking west, showing benchmark locations (14 Aug 06).



View west across Hope Bay to Station H88 (14 Aug 06).



Station H88 aerial view from northwest (5 Jun 06).



Hope Bay Tide Gauge Station H88 – Stage Data (2006)

			Stage Datum	0.000 m	(non-geodetic)	
Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Water Surface Elevation (m)	Stage (m)	Measured Discharge (m^3/s)
03/07/2006 14:20	1.3295	-1.240		0.090	0.090	n/a
21/07/2006 14:20	1.3820	-		*0.106*	*0.106*	n/a
14/08/2006 8:45	1.0384	-1.276		-0.238	-0.238	n/a
08/09/2006 14:49	1.3666	-1.274	-1.263	0.093	0.093	n/a

H88 Hope Bay Tide Gauge - 2006

MAXIMUM DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 2.404 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	0.126	0.072	-	-	-
2	-	-	-	-	-	-	-	0.107	0.221	-	-	-
3	-	-	-	-	-	-	0.316 P	0.090	0.256	-	-	-
4	-	-	-	-	-	-	0.326	0.103	0.217	-	-	-
5	-	-	-	-	-	-	0.180	0.138	0.242	-	-	-
6	-	-	-	-	-	-	0.271	0.172	0.271	-	-	-
7	-	-	-	-	-	-	0.228	0.173	0.171	-	-	-
8	-	-	-	-	-	-	0.118	0.112	0.103 P	-	-	-
9	-	-	-	-	-	-	0.157	0.196	-	-	-	-
10	-	-	-	-	-	-	0.126	0.343	-	-	-	-
11	-	-	-	-	-	-	0.094	0.472	-	-	-	-
12	-	-	-	-	-	-	0.128	0.306	-	-	-	-
13	-	-	-	-	-	-	0.159	0.169	-	-	-	-
14	-	-	-	-	-	-	0.257	0.061	-	-	-	-
15	-	-	-	-	-	-	0.246	-0.022	-	-	-	-
16	-	-	-	-	-	-	0.225	0.042	-	-	-	-
17	-	-	-	-	-	-	0.256	0.082	-	-	-	-
18	-	-	-	-	-	-	0.239	0.108	-	-	-	-
19	-	-	-	-	-	-	0.239	0.168	-	-	-	-
20	-	-	-	-	-	-	0.152	0.116	-	-	-	-
21	-	-	-	-	-	-	0.157	0.024	-	-	-	-
22	-	-	-	-	-	-	0.431	0.081	-	-	-	-
23	-	-	-	-	-	-	0.361	0.211	-	-	-	-
24	-	-	-	-	-	-	0.394	0.357	-	-	-	-
25	-	-	-	-	-	-	0.258	0.345	-	-	-	-
26	-	-	-	-	-	-	0.314	0.296	-	-	-	-
27	-	-	-	-	-	-	0.551	0.256	-	-	-	-
28	-	-	-	-	-	-	0.434	0.145	-	-	-	-
29	-	-	-	-	-	-	0.187	0.025	-	-	-	-
30	-	-	-	-	-	-	0.205	-0.071	-	-	-	-
31	-	-	-	-	-	-	0.150	-0.015	-	-	-	-
MIN	-	-	-	-	-	-	0.094	-0.071	0.072	-	-	-
MEAN	-	-	-	-	-	-	0.247	0.152	0.194	-	-	-
MAX	-	-	-	-	-	-	0.551	0.472	0.271	-	-	-

MINIMUM DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 2.404 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	-0.185	-0.181	-	-	-
2	-	-	-	-	-	-	-	-0.183	-0.150	-	-	-
3	-	-	-	-	-	-	0.065 P	-0.197	0.011	-	-	-
4	-	-	-	-	-	-	-0.013	-0.205	-0.210	-	-	-
5	-	-	-	-	-	-	-0.141	-0.197	-0.178	-	-	-
6	-	-	-	-	-	-	-0.134	-0.178	-0.044	-	-	-
7	-	-	-	-	-	-	-0.084	-0.212	-0.175	-	-	-
8	-	-	-	-	-	-	-0.199	-0.287	-0.175 P	-	-	-
9	-	-	-	-	-	-	-0.238	-0.277	-	-	-	-
10	-	-	-	-	-	-	-0.221	-0.115	-	-	-	-
11	-	-	-	-	-	-	-0.295	-0.003	-	-	-	-
12	-	-	-	-	-	-	-0.312	-0.075	-	-	-	-
13	-	-	-	-	-	-	-0.264	-0.165	-	-	-	-
14	-	-	-	-	-	-	-0.199	-0.269	-	-	-	-
15	-	-	-	-	-	-	-0.165	-0.383	-	-	-	-
16	-	-	-	-	-	-	-0.231	-0.292	-	-	-	-
17	-	-	-	-	-	-	-0.199	-0.200	-	-	-	-
18	-	-	-	-	-	-	-0.178	-0.135	-	-	-	-
19	-	-	-	-	-	-	-0.135	-0.200	-	-	-	-
20	-	-	-	-	-	-	-0.200	-0.178	-	-	-	-
21	-	-	-	-	-	-	-0.149	-0.284	-	-	-	-
22	-	-	-	-	-	-	-0.085	-0.325	-	-	-	-
23	-	-	-	-	-	-	-0.051	-0.245	-	-	-	-
24	-	-	-	-	-	-	-0.011	-0.069	-	-	-	-
25	-	-	-	-	-	-	-0.101	-0.002	-	-	-	-
26	-	-	-	-	-	-	-0.177	-0.052	-	-	-	-
27	-	-	-	-	-	-	-0.059	-0.048	-	-	-	-
28	-	-	-	-	-	-	0.026	-0.113	-	-	-	-
29	-	-	-	-	-	-	-0.136	-0.191	-	-	-	-
30	-	-	-	-	-	-	-0.130	-0.272	-	-	-	-
31	-	-	-	-	-	-	-0.177	-0.335	-	-	-	-
MIN	-	-	-	-	-	-	-0.312	-0.383	-0.210	-	-	-
MEAN	-	-	-	-	-	-	-0.145	-0.189	-0.138	-	-	-
MAX	-	-	-	-	-	-	0.065	-0.002	0.011	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED

WOLVERINE LAKE OUTFLOW HYDROMETRIC STATION

H91

FACTSHEET

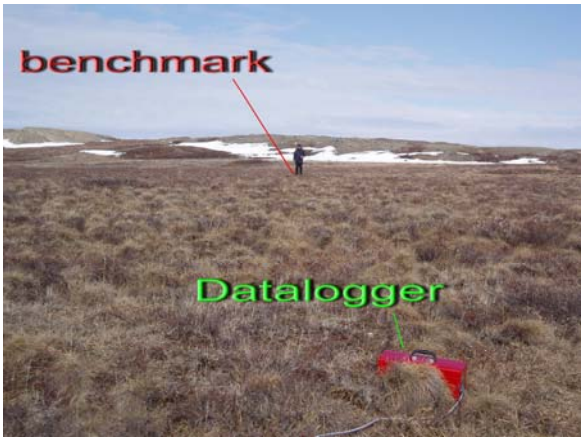
LOCATION AND PURPOSE

Located approximately 50 m upstream, on the right bank of W olverine Lake outflow. Benchmark w as made about 50 m offshore to the east, due to lack of bedrock near the Hydrostation.

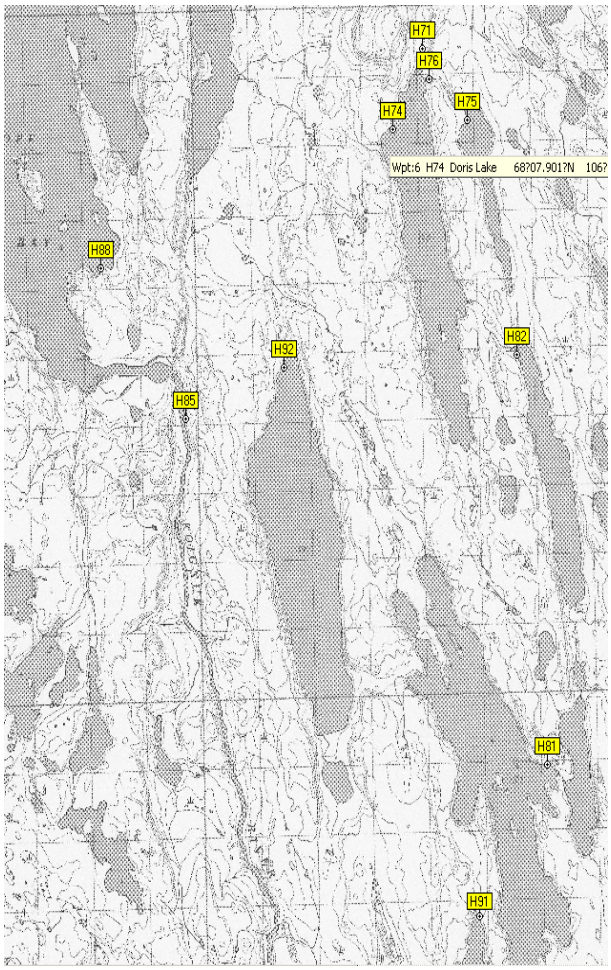
Operational:	2006 (1 Jun – 8 September)		2007 (23 May – 14 September)
Benchmark:	Top of embedded boulder;	Drainage Area:	1.97 km2
Coordinates:	UTM: 435222 m E, 7545888 m N (NAD83)	Lat/Long:	68°01'11" N, 106°33'03" W
Datalogger:	Optimum Instruments #1397	Transducer:	Keller #000900 (5 psi, 20 m)



Station H91 looking northwest, downstream of Wolverine Lake Outflow.



Station H91 looking east, offshore, with benchmark.



NTS Mapping of Area

FACT-H91-2007.DOC

Wolverine Outflow Station H91 – Stage-Discharge Data (2006-2007)

Stage Datum 97.700 m

Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Water Surface Elevation (m)	Stage (m)	Measured Discharge (m^3/s)
01/06/2006 16:02	0.7267	-		-	-	n/a
03/07/2006 8:32	0.8285	97.521		98.349	0.649	n/a
23/07/2006 10:30	0.7851	-		*98.293*	0.593	n/a
12/08/2006 13:30	0.7521	97.521		98.273	0.573	n/a
08/09/2006 17:08	0.7229	97.481	97.508	98.204	0.504	n/a
07/07/2007 21:15	0.7264	96.5276		97.254	-0.446	n/a
14/08/2007 12:25	0.7498	96.4032	96.4654	97.153	-0.547	n/a

H91 Wolverine Outflow - 2006

MEAN DAILY WATER LEVELS (m) BASED ON BENCHMARK EL. 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	98.237 P	98.335	98.267	98.186	-	-	-
2	-	-	-	-	-	98.244	98.335	98.268	98.182	-	-	-
3	-	-	-	-	-	98.256	98.335	98.271	98.183	-	-	-
4	-	-	-	-	-	98.264	98.325	98.273	98.186	-	-	-
5	-	-	-	-	-	98.269	98.318	98.275	98.192	-	-	-
6	-	-	-	-	-	98.278	98.311	98.276	98.197	-	-	-
7	-	-	-	-	-	98.282	98.303	98.277	98.200	-	-	-
8	-	-	-	-	-	98.282	98.295	98.278	98.202 P	-	-	-
9	-	-	-	-	-	98.289	98.289	98.280	-	-	-	-
10	-	-	-	-	-	98.300	98.285	98.276	-	-	-	-
11	-	-	-	-	-	98.302	98.285	98.270	-	-	-	-
12	-	-	-	-	-	98.309	98.290	98.257	-	-	-	-
13	-	-	-	-	-	98.315	98.294	98.252	-	-	-	-
14	-	-	-	-	-	98.321	98.296	98.247	-	-	-	-
15	-	-	-	-	-	98.324	98.300	98.241	-	-	-	-
16	-	-	-	-	-	98.322	98.299	98.238	-	-	-	-
17	-	-	-	-	-	98.325	98.296	98.236	-	-	-	-
18	-	-	-	-	-	98.322	98.290	98.238	-	-	-	-
19	-	-	-	-	-	98.317	98.287	98.231	-	-	-	-
20	-	-	-	-	-	98.312	98.292	98.226	-	-	-	-
21	-	-	-	-	-	98.311	98.294	98.225	-	-	-	-
22	-	-	-	-	-	98.314	98.292	98.225	-	-	-	-
23	-	-	-	-	-	98.321	98.289	98.225	-	-	-	-
24	-	-	-	-	-	98.318	98.287	98.223	-	-	-	-
25	-	-	-	-	-	98.320	98.282	98.222	-	-	-	-
26	-	-	-	-	-	98.326	98.276	98.218	-	-	-	-
27	-	-	-	-	-	98.337	98.262	98.211	-	-	-	-
28	-	-	-	-	-	98.339	98.256	98.205	-	-	-	-
29	-	-	-	-	-	98.339	98.258	98.204	-	-	-	-
30	-	-	-	-	-	98.335	98.259	98.201	-	-	-	-
31	-	-	-	-	-	-	98.264	98.193	-	-	-	-
MIN	-	-	-	-	-	98.237	98.256	98.193	98.182	-	-	-
MEAN	-	-	-	-	-	98.304	98.293	98.243	98.191	-	-	-
MAX	-	-	-	-	-	98.339	98.335	98.280	98.202	-	-	-

NOTES: P – PARTIAL DAILY AVERAGE

H91 Wolverine Outflow - 2007

MEAN DAILY WATER LEVELS (m) BASED ON BENCHMARK EL. 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	97.211	97.176	97.233	97.186	97.190	-
2	-	-	-	-	-	-	97.209	97.172	97.230	97.185	97.189	-
3	-	-	-	-	-	-	97.206	97.169	97.229	97.185	97.190	-
4	-	-	-	-	-	-	97.202	97.165	97.228	97.186	97.190	-
5	-	-	-	-	-	-	97.199	97.161	97.225	97.184	97.188	-
6	-	-	-	-	-	-	97.198	97.159	97.224	97.184	97.188	-
7	-	-	-	-	-	-	97.193	97.158	97.225	97.185	97.187	-
8	-	-	-	-	-	-	97.192	97.164	97.225	97.187	97.186	-
9	-	-	-	-	-	-	97.191	97.178	97.222	97.193	97.186	-
10	-	-	-	-	-	-	97.194	97.186	97.218	97.191	97.186	-
11	-	-	-	-	-	-	97.193	97.190	97.215	97.190	97.185	-
12	-	-	-	-	-	-	97.194	97.199	97.215	97.189	97.185	-
13	-	-	-	-	-	96.970	97.196	97.208	97.212	97.188	97.184	-
14	-	-	-	-	-	96.986	97.198	97.215	97.210	97.187	97.183	-
15	-	-	-	-	-	97.013	97.200	97.217	97.206	97.186	97.184	-
16	-	-	-	-	-	97.038	97.201	97.218	97.204	97.187	97.184	-
17	-	-	-	-	-	97.063	97.199	97.218	97.201	97.188	97.183	-
18	-	-	-	-	-	97.105	97.199	97.219	97.199	97.187	97.183	-
19	-	-	-	-	-	97.116	97.200	97.236	97.198	97.189	97.182	-
20	-	-	-	-	-	97.123	97.201	97.251	97.198	97.190	97.181	-
21	-	-	-	-	-	97.141	97.205	97.253	97.196	97.192	97.181	-
22	-	-	-	-	-	97.153	97.205	97.252	97.195	97.193	97.181	-
23	-	-	-	-	-	97.164	97.197	97.252	97.195	97.196	97.181	-
24	-	-	-	-	-	97.190	97.195	97.248	97.196	97.196	97.180	-
25	-	-	-	-	-	97.205	97.193	97.244	97.196	97.195	97.179	-
26	-	-	-	-	-	97.208	97.194	97.242	97.194	97.194	97.180	-
27	-	-	-	-	-	97.210	97.190	97.238	97.192	97.194	97.180	-
28	-	-	-	-	-	97.210	97.189	97.236	97.190	97.194	97.178	-
29	-	-	-	-	-	97.212	97.186	97.236	97.190	97.193	97.178	-
30	-	-	-	-	-	97.213	97.184	97.234	97.188	97.192	97.178	-
31	-	-	-	-	-	-	97.183	97.234	-	97.191	-	-
MIN	-	-	-	-	-	96.970	97.183	97.158	97.188	97.184	97.178	-
MEAN	-	-	-	-	-	97.129	97.197	97.211	97.208	97.190	97.184	-
MAX	-	-	-	-	-	97.213	97.211	97.253	97.233	97.196	97.190	-

NOTES: P – PARTIAL DAILY AVERAGE

WINDY LAKE OUTFLOW HYDROMETRIC STATION

H92

FACTSHEET

LOCATION AND PURPOSE

Located approximately 100 m upstream, on the left bank of Windy Lake outflow.

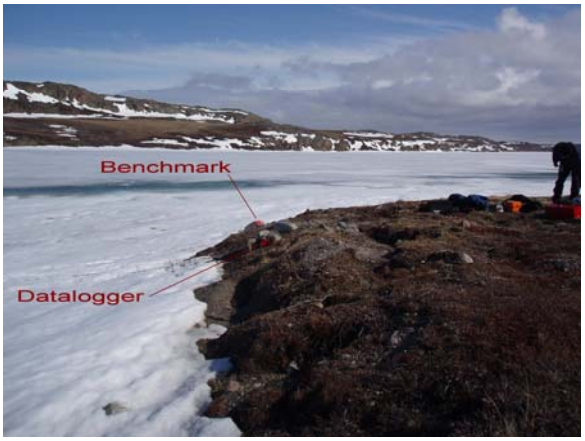
Operational:	2006 (29 May – 8 September)	2007 (24 May – 15 September)	
Benchmark:	Top of embedded boulder;	Drainage Area:	13.9 km2
Coordinates:	UTM: 431507 m E, 7555043 m N (NAD83)	Lat/Long:	68°06'04" N, 106°38'45" W
Datalogger:	Optimum Instruments #0639(cold tested)	Transducer:	Keller #402786 (5 psi, 15 m)



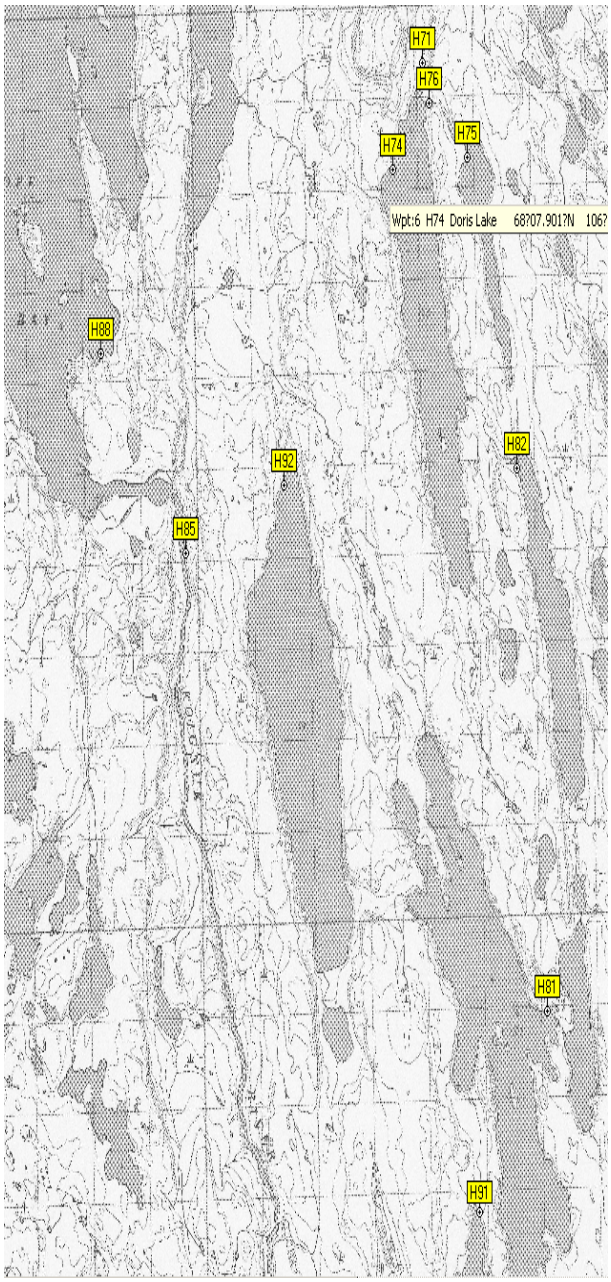
Station H92 aerial view, Looking North.



Station (circle) H92 aerial view, looking Northwest.



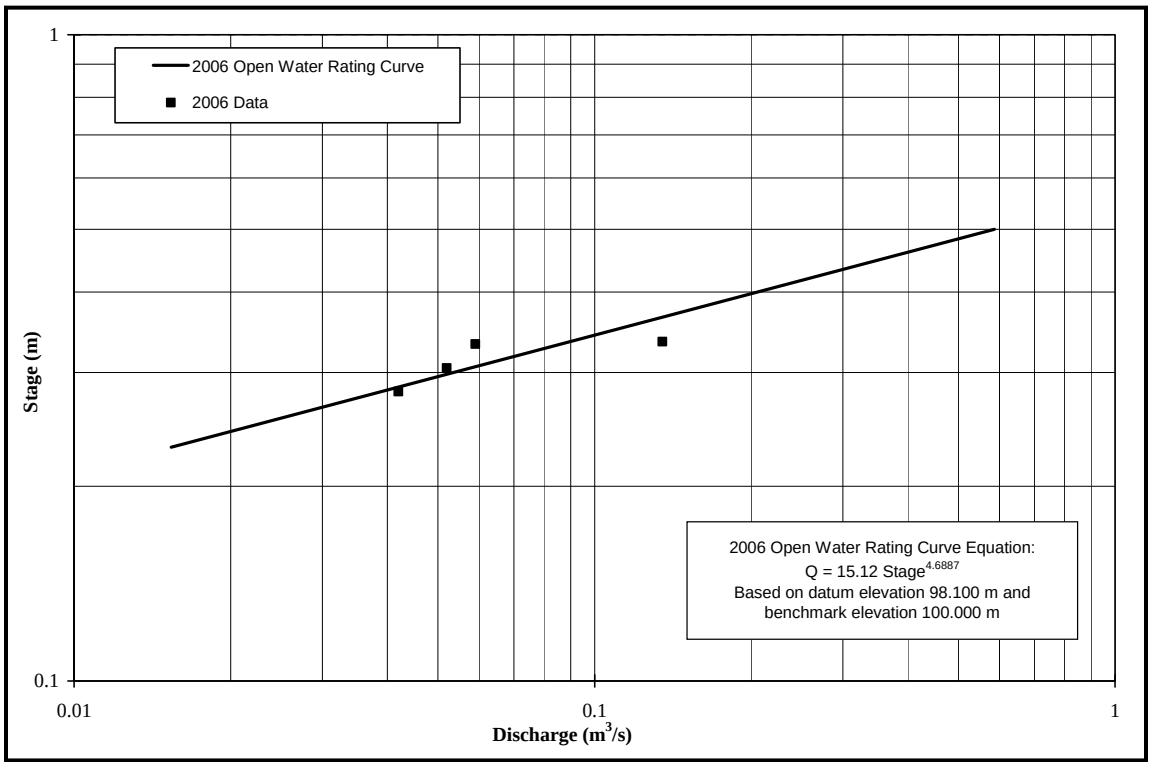
Station H92 looking east, with benchmark.



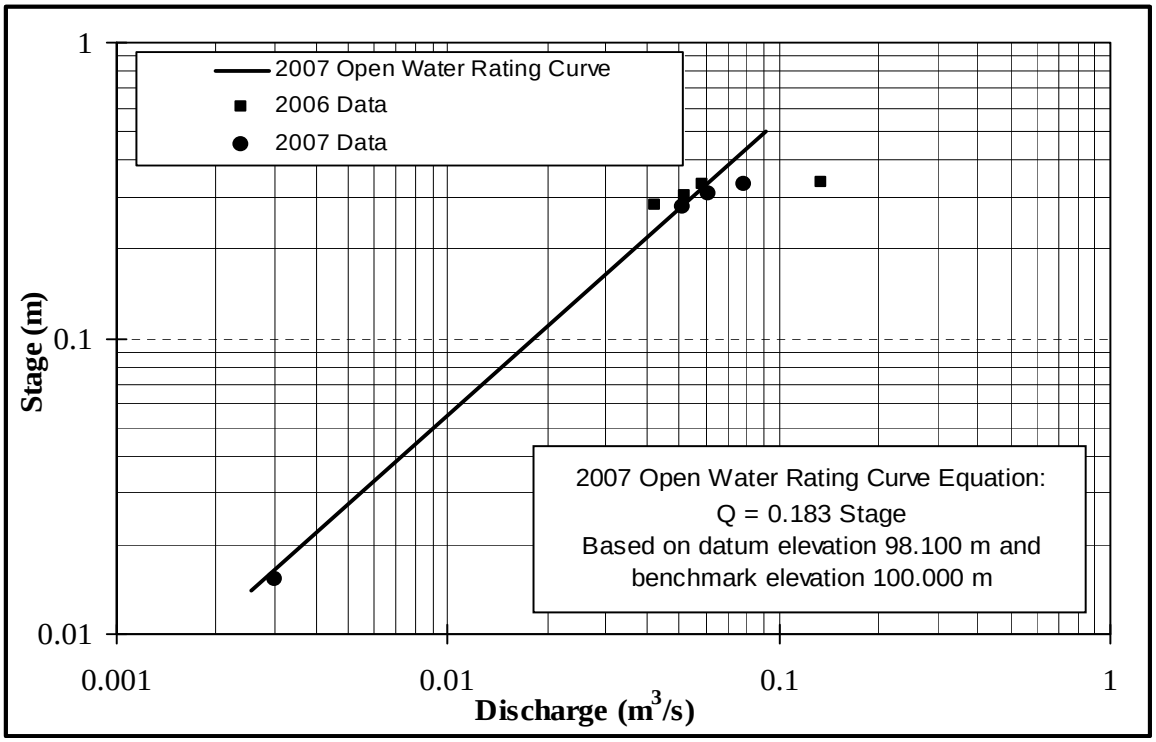
NTS Mapping of Area

FACT-H92-2007.DOC

Golder Associates



Windy Outflow Station H92 – Stage-Discharge Rating Curve (2006)



Windy Outflow Station H92 – Stage-Discharge Rating Curve (2007)

Windy Outflow Station H92 – Stage-Discharge Data (2006-2007)

Stage Datum 98.100m

Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Water Surface Elevation (m)	Stage (m)	Measured Discharge (m^3/s)
29/05/2006 16:14	0.4783	-		-	-	-
03/07/2006 16:00	0.6455	97.790		98.435	0.335	0.135
19/07/2006 18:30	0.6560	-		*98.411*	0.311	0.059
12/08/2006 16:26	0.6422	97.763		98.405	0.305	0.052
08/09/2006 15:14	0.6044	-	97.755	*98.381*	0.281	0.042
22/06/2007 09:35	0.0414			*98.115*	0.015	0.003
03/07/2007 11:10	0.3167					n/a
20/07/2007 15:00	0.3050	98.074		98.379	0.279	0.051
13/08/2007 12:20	n/a			98.432	0.332	0.078
15/09/2007 16:30	n/a		98.074	98.409	0.309	0.061

H92 Windy Outflow - 2006

MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	0.135 A	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	0.042 A	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	0.052 A	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	0.059 A	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	-	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-	-	-	-	-	-
MIN	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	-	-	-	-	-	-	-	-	-	-	-	-
MAX	-	-	-	-	-	-	-	-	-	-	-	-

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 26.301 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	-	98.435 A	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	-	-	-
7	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	98.317 A	-	-	-
9	-	-	-	-	-	-	-	-	-	-	-	-
10	-	-	-	-	-	-	-	-	-	-	-	-
11	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	98.405 A	-	-	-	-
13	-	-	-	-	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-	-	-	-	-
15	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
17	-	-	-	-	-	-	-	-	-	-	-	-
18	-	-	-	-	-	-	-	-	-	-	-	-
19	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-	-	-
21	-	-	-	-	-	-	-	-	-	-	-	-
22	-	-	-	-	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-	-	-	-	-
24	-	-	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-	-	-
26	-	-	-	-	-	-	-	-	-	-	-	-
27	-	-	-	-	-	-	-	-	-	-	-	-
28	-	-	-	-	-	-	-	-	-	-	-	-
29	-	-	-	-	98.364 A	-	-	-	-	-	-	-
30	-	-	-	-	-	-	-	-	-	-	-	-
31	-	-	-	-	-	-	-	-	-	-	-	-
MIN	-	-	-	-	-	-	-	-	-	-	-	-
MEAN	-	-	-	-	-	-	-	-	-	-	-	-
MAX	-	-	-	-	-	-	-	-	-	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED A – MANUAL MEASUREMENT

H92 Windy Outflow - 2007

MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	0.052	0.051	-	-	-	-
2	-	-	-	-	-	-	0.053	0.050	-	-	-	-
3	-	-	-	-	-	-	0.053	0.050	-	-	-	-
4	-	-	-	-	-	-	0.052	0.049	-	-	-	-
5	-	-	-	-	-	-	0.052	-	-	-	-	-
6	-	-	-	-	-	-	0.052	-	-	-	-	-
7	-	-	-	-	-	-	0.053	-	-	-	-	-
8	-	-	-	-	-	-	0.052	-	-	-	-	-
9	-	-	-	-	-	-	0.052	-	-	-	-	-
10	-	-	-	-	-	-	0.053	-	-	-	-	-
11	-	-	-	-	-	-	0.052	-	-	-	-	-
12	-	-	-	-	-	-	0.052	-	-	-	-	-
13	-	-	-	-	-	-	0.052	-	-	-	-	-
14	-	-	-	-	-	-	0.052	-	-	-	-	-
15	-	-	-	-	-	-	0.052	-	-	-	-	-
16	-	-	-	-	-	-	0.052	-	-	-	-	-
17	-	-	-	-	-	-	0.051	-	-	-	-	-
18	-	-	-	-	-	-	0.051	-	-	-	-	-
19	-	-	-	-	-	-	0.052	-	-	-	-	-
20	-	-	-	-	-	-	0.053	-	-	-	-	-
21	-	-	-	-	-	-	0.054	-	-	-	-	-
22	-	-	-	-	-	0.011 P	0.053	-	-	-	-	-
23	-	-	-	-	-	0.022	0.053	-	-	-	-	-
24	-	-	-	-	-	0.031	0.053	-	-	-	-	-
25	-	-	-	-	-	0.040	0.053	-	-	-	-	-
26	-	-	-	-	-	0.044	0.053	-	-	-	-	-
27	-	-	-	-	-	0.047	0.053	-	-	-	-	-
28	-	-	-	-	-	0.049	0.053	-	-	-	-	-
29	-	-	-	-	-	0.050	0.052	-	-	-	-	-
30	-	-	-	-	-	0.051	0.052	-	-	-	-	-
31	-	-	-	-	-	-	0.052	-	-	-	-	-
MIN	-	-	-	-	-	0.011	0.051	0.049	-	-	-	-
MEAN	-	-	-	-	-	0.038	0.052	0.050	-	-	-	-
MAX	-	-	-	-	-	0.051	0.054	0.051	-	-	-	-

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 26.301 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	98.387	98.377	-	-	-	-
2	-	-	-	-	-	-	98.387	98.376	-	-	-	-
3	-	-	-	-	-	-	98.387	98.373	-	-	-	-
4	-	-	-	-	-	-	98.386	98.374 P	-	-	-	-
5	-	-	-	-	-	-	98.386	-	-	-	-	-
6	-	-	-	-	-	-	98.387	-	-	-	-	-
7	-	-	-	-	-	-	98.387	-	-	-	-	-
8	-	-	-	-	-	-	98.387	-	-	-	-	-
9	-	-	-	-	-	-	98.387	-	-	-	-	-
10	-	-	-	-	-	-	98.387	-	-	-	-	-
11	-	-	-	-	-	-	98.386	-	-	-	-	-
12	-	-	-	-	-	-	98.384	-	-	-	-	-
13	-	-	-	-	-	-	98.384	-	-	-	-	-
14	-	-	-	-	-	-	98.383	-	-	-	-	-
15	-	-	-	-	-	-	98.384	-	-	-	-	-
16	-	-	-	-	-	-	98.383	-	-	-	-	-
17	-	-	-	-	-	-	98.380	-	-	-	-	-
18	-	-	-	-	-	-	98.381	-	-	-	-	-
19	-	-	-	-	-	-	98.385	-	-	-	-	-
20	-	-	-	-	-	-	98.387	-	-	-	-	-
21	-	-	-	-	-	-	98.396	-	-	-	-	-
22	-	-	-	-	-	98.160 P	98.387	-	-	-	-	-
23	-	-	-	-	-	98.218	98.387	-	-	-	-	-
24	-	-	-	-	-	98.271	98.390	-	-	-	-	-
25	-	-	-	-	-	98.318	98.391	-	-	-	-	-
26	-	-	-	-	-	98.340	98.390	-	-	-	-	-
27	-	-	-	-	-	98.355	98.389	-	-	-	-	-
28	-	-	-	-	-	98.367	98.388	-	-	-	-	-
29	-	-	-	-	-	98.375	98.386	-	-	-	-	-
30	-	-	-	-	-	98.381	98.387	-	-	-	-	-
31	-	-	-	-	-	-	98.383	-	-	-	-	-
MIN	-	-	-	-	-	98.160	98.380	98.373	-	-	-	-
MEAN	-	-	-	-	-	98.310	98.386	98.375	-	-	-	-
MAX	-	-	-	-	-	98.381	98.396	98.377	-	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED A – MANUAL MEASUREMENT

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-028.4000
DISCHARGE DATA

STREAM NAME: Windy Outflow **MEASUREMENT DATE: 3 July 2006**
LOCATION: Outlet of Windy Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 431507 m E, 7555043 m N (NAD 83)

MEASUREMENT BY: TA/PE **MEASUREMENT START TIME: 1613 h**
COMPUTATIONS BY: NS/TJ **MEASUREMENT END TIME: 1625 h est.**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	1.45		0.00			0.00	0.025	0.000
1	1.50		0.04			0.00	0.075	0.000
2	1.60		0.08			0.04	0.1	0.000
3	1.70		0.22			0.34	0.1	0.007
4	1.80		0.20			0.65	0.1	0.013
5	1.90		0.21			0.72	0.1	0.015
6	2.00		0.23			0.67	0.1	0.015
7	2.10		0.22			0.69	0.1	0.015
8	2.20		0.22			0.67	0.1	0.015
9	2.30		0.23			0.63	0.1	0.014
10	2.40		0.22			0.59	0.1	0.013
11	2.50		0.21			0.57	0.1	0.012
12	2.60		0.20			0.45	0.1	0.009
13	2.70		0.20			0.28	0.1	0.006
14	2.80		0.11			0.01	0.1	0.000
15	2.90		0.07			0.00	0.165	0.000
Right Bank	3.13		0.00			0.00	0.115	0.000
								0.135

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-028.4000
DISCHARGE DATA

STREAM NAME: Windy Outflow **MEASUREMENT DATE: 19 July 2006**
LOCATION: Outlet of Windy Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 431507 m E, 7555043 m N (NAD 83)

MEASUREMENT BY: HS/KM **MEASUREMENT START TIME: 1830 h**
COMPUTATIONS BY: NS/TJ **MEASUREMENT END TIME: 1850 h est.**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	14.50		0.02			0.00	0.5	0.000
1	13.50		0.02			0.00	1	0.000
2	12.50		0.05			0.00	0.75	0.000
3	12.00		0.08			0.00	0.5	0.000
4	11.50		0.10			0.00	0.5	0.000
5	11.00		0.13			0.00	0.5	0.000
6	10.50		0.16			0.00	0.5	0.000
7	10.00		0.31			0.00	0.375	0.000
8	9.75		0.32			0.01	0.25	0.001
9	9.50		0.34			0.02	0.25	0.002
10	9.25		0.35			0.13	0.25	0.011
11	9.00		0.36			0.17	0.25	0.015
12	8.75		0.44			0.20	0.25	0.022
13	8.50		0.36			0.06	0.25	0.005
14	8.25		0.38			0.03	0.25	0.003
15	8.00		0.30			0.00	0.25	0.000
16	7.75		0.30			0.00	0.25	0.000
17	7.50		0.22			0.00	0.375	0.000
18	7.00		0.16			0.00	0.5	0.000
19	6.50		0.12			0.00	0.5	0.000
20	6.00		0.30			0.00	0.5	0.000
21	5.50		0.01			0.00	0.5	0.000
22	5.00		0.03			0.00	0.5	0.000
23	4.50		0.05			0.00	0.5	0.000
24	4.00		0.05			0.00	0.5	0.000
25	3.50		0.06			0.00	0.5	0.000
26	3.00		0.04			0.00	0.5	0.000
27	2.50		0.01			0.00	0.35	0.000
Right Bank	2.30		0.00			0.00	0.1	0.000
								0.059

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-028.4000
DISCHARGE DATA

STREAM NAME: Windy Outflow **MEASUREMENT DATE: 12 August 2006**
LOCATION: Outlet of Windy Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 431507 m E, 7555043 m N (NAD 83)

MEASUREMENT BY: NS/KM **MEASUREMENT START TIME: 1640 h**
COMPUTATIONS BY: NS/TJ **MEASUREMENT END TIME: 1655 h**

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	2.00		0.00			0.00	0.2	0.000
1	2.40		0.16			0.00	0.35	0.000
2	2.70		0.22			0.00	0.3	0.000
3	3.00		0.26			0.05	0.25	0.003
4	3.20		0.26			0.15	0.2	0.008
5	3.40		0.30			0.14	0.2	0.008
6	3.60		0.32			0.18	0.2	0.012
7	3.80		0.34			0.16	0.2	0.011
8	4.00		0.34			0.11	0.2	0.007
9	4.20		0.33			0.02	0.2	0.001
10	4.40		0.31			0.02	0.2	0.001
11	4.60		0.26			0.00	0.2	0.000
12	4.80		0.25			0.01	0.2	0.001
13	5.00		0.22			0.00	0.4	0.000
Right Bank	5.60		0.00			0.00	0.3	0.000
								0.052

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-028.4000

DISCHARGE DATA

STREAM NAME: Windy Outflow **MEASUREMENT DATE: 8 September 2006**
LOCATION: Outlet of Windy Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 431507 m E, 7555043 m N (NAD 83)

MEASUREMENT BY: KK/PE **MEASUREMENT START TIME: 1529 h**
COMPUTATIONS BY: NS/TJ **MEASUREMENT END TIME: 1536 h**

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	1.58		0.00			0.00	0.01	0.000
1	1.60		0.01			0.00	0.085	0.000
2	1.75		0.10			0.03	0.15	0.000
3	1.90		0.18			0.22	0.15	0.006
4	2.05		0.19			0.31	0.15	0.009
5	2.20		0.14			0.41	0.15	0.009
6	2.35		0.10			0.40	0.15	0.006
7	2.50		0.20			0.30	0.15	0.009
8	2.65		0.18			0.11	0.15	0.003
9	2.80		0.07			0.01	0.15	0.000
10	2.95		0.02			0.00	0.095	0.000
Right Bank	2.99		0.00			0.00	0.02	0.000
								0.042

PROJECT NAME: Miramar/EM2 Project/Windy Lake Outflow

PROJECT NUMBER: 07 1373 0019.4000

DISCHARGE DATA

STREAM NAME: Windy Lake Outflow **MEASUREMENT DATE: 22 June 2007**

LOCATION: Outlet of Windy Lake **METER NUMBER: Marsh McBirney**

COORDINATES: 431507 m E, 7555043 m N (NAD 83)

MEASUREMENT BY: PE **MEASUREMENT START TIME: 0935 h**

COMPUTATIONS BY:TJ **MEASUREMENT END TIME: 0950 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m) (m)	DEPTH (m) (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m) (m)	DISCHARGE (m^3/s)
Right Bank	1.50		0.02			0.00	0.165	0.000
1	1.83		0.07			0.00	0.33	0.000
2	2.16		0.12			0.00	0.33	0.000
3	2.49		0.17			0.01	0.33	0.001
4	2.82		0.20			0.02	0.33	0.001
5	3.15		0.19			0.01	0.33	0.001
6	3.48		0.21			0.00	0.33	0.000
7	3.81		0.12			0.00	0.33	0.000
8	4.14		0.10			0.00	0.33	0.000
9	4.47		0.04			0.00	0.33	0.000
Left Bank	4.80		0.50			0.00	0.165	0.000
								0.003

PROJECT NAME: Miramar/EM2 Project/Windy Lake Outflow

PROJECT NUMBER: 07 1373 0019.4000

DISCHARGE DATA

STREAM NAME: Windy Lake Outflow **MEASUREMENT DATE: 20 July 2007**

LOCATION: Outlet of Windy Lake **METER NUMBER: Marsh McBirney**

COORDINATES: 431507 m E, 7555043 m N (NAD 83)

MEASUREMENT BY: MK **MEASUREMENT START TIME:**

COMPUTATIONS BY:DC **MEASUREMENT END TIME:**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Right Bank	7.70		0.22			-0.03	0.125	-0.001
1	7.95		0.38			0.00	0.25	0.000
2	8.20		0.40			0.09	0.25	0.009
3	8.45		0.45			0.11	0.25	0.012
4	8.70		0.44			0.18	0.25	0.020
5	8.95		0.50			0.15	0.25	0.019
6	9.20		0.39			0.04	0.25	0.004
7	9.45		0.35			0.00	0.25	0.000
8	9.70		0.34			-0.03	0.275	-0.003
9	10.00		0.22			-0.03	1.35	-0.009
Left Bank	12.40		0.00			0.00	1.2	0.000
								0.051

PROJECT NAME: Miramar/EM2 Project/Windy Lake Outflow
PROJECT NUMBER: 07 1373 0019.4000
DISCHARGE DATA

STREAM NAME: Windy Lake Outflow **MEASUREMENT DATE: 13 August 2007**
LOCATION: Outlet of Windy Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 431507 m E, 7555043 m N (NAD 83)

MEASUREMENT BY:TY **MEASUREMENT START TIME: 1045 h**
COMPUTATIONS BY:TJ **MEASUREMENT END TIME: 1206 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Right Bank	1.00		0.00			0.00	0.05	0.000
1	1.10		0.02			0.00	0.1	0.000
2	1.20		0.04			0.00	0.1	0.000
3	1.30		0.05			0.00	0.1	0.000
4	1.40		0.05			-0.03	0.1	0.000
5	1.50		0.17			-0.03	0.1	-0.001
6	1.60		0.30			-0.03	0.1	-0.001
7	1.70		0.32			0.09	0.1	0.003
8	1.80		0.34			0.17	0.1	0.006
9	1.90		0.35			0.21	0.1	0.007
10	2.00		0.35			0.22	0.1	0.008
11	2.10		0.34			0.27	0.1	0.009
12	2.20		0.34			0.25	0.1	0.008
13	2.30		0.35			0.28	0.1	0.010
14	2.40		0.35			0.30	0.1	0.011
15	2.50		0.33			0.27	0.1	0.009
16	2.60		0.32			0.18	0.1	0.006
17	2.70		0.30			0.12	0.1	0.004
18	2.80		0.30			0.06	0.1	0.002
19	2.90		0.31			-0.01	0.15	0.000
20	3.10		0.25			-0.03	0.2	-0.002
21	3.30		0.16			0.00	0.2	0.000
22	3.50		0.12			0.00	0.35	0.000
23	4.00		0.04			0.00	0.35	0.000
Left Bank	4.20		0.00			0.00	0.1	0.000
								0.078

PROJECT NAME: Miramar/EM2 Project/Windy Lake Outflow
PROJECT NUMBER: 07 1373 0019.4000
DISCHARGE DATA

STREAM NAME: Windy Lake Outflow **MEASUREMENT DATE: 15 September 2007**
LOCATION: Outlet of Windy Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 431507 m E, 7555043 m N (NAD 83)

MEASUREMENT BY:TY **MEASUREMENT START TIME: 1615 h**
COMPUTATIONS BY:DC **MEASUREMENT END TIME: 1640 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m) (m)	DEPTH (m) (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m) (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.02			0.00	0.2	0.000
1	0.40		0.02			0.00	0.4	0.000
2	0.80		0.02			0.00	0.4	0.000
	1.20		0.02			0.00	0.4	0.000
3	1.60		0.02			0.00	0.4	0.000
4	2.00		0.08			0.00	0.4	0.000
5	2.40		0.12			0.00	0.4	0.000
6	2.80		0.14			0.00	0.4	0.000
7	3.20		0.20			0.00	0.4	0.000
8	3.60		0.28			0.00	0.4	0.000
9	4.00		0.40			0.01	0.4	0.002
10	4.40		0.42			0.06	0.4	0.010
11	4.80		0.42			0.12	0.4	0.020
12	5.20		0.36			0.20	0.4	0.029
13	5.60		0.30			0.00	0.4	0.000
14	6.00		0.22			0.00	0.4	0.000
15	6.40		0.12			0.00	0.4	0.000
16	6.80		0.08			0.00	0.4	0.000
17	7.20		0.08			0.00	0.4	0.000
18	7.60		0.08			0.00	0.4	0.000
19	8.00		0.08			0.00	0.4	0.000
20	8.40		0.08			0.00	0.4	0.000
21	8.80		0.08			0.00	0.4	0.000
22	9.20		0.03			0.00	0.4	0.000
Left Bank	9.60		0.02			0.00	0.2	0.000
								0.061

GLENN LAKE OUTFLOW HYDROMETRIC STATION

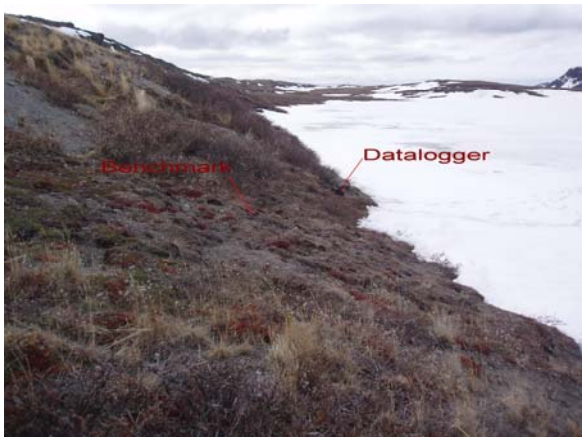
H93

FACTSHEET

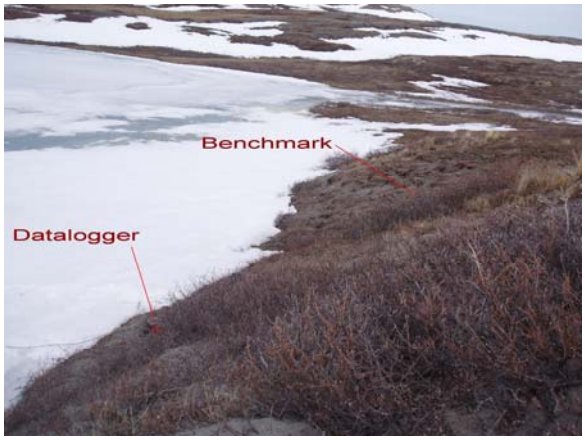
LOCATION AND PURPOSE

Located approximately 50 m upstream, on the right bank of Glenn Lake outflow.

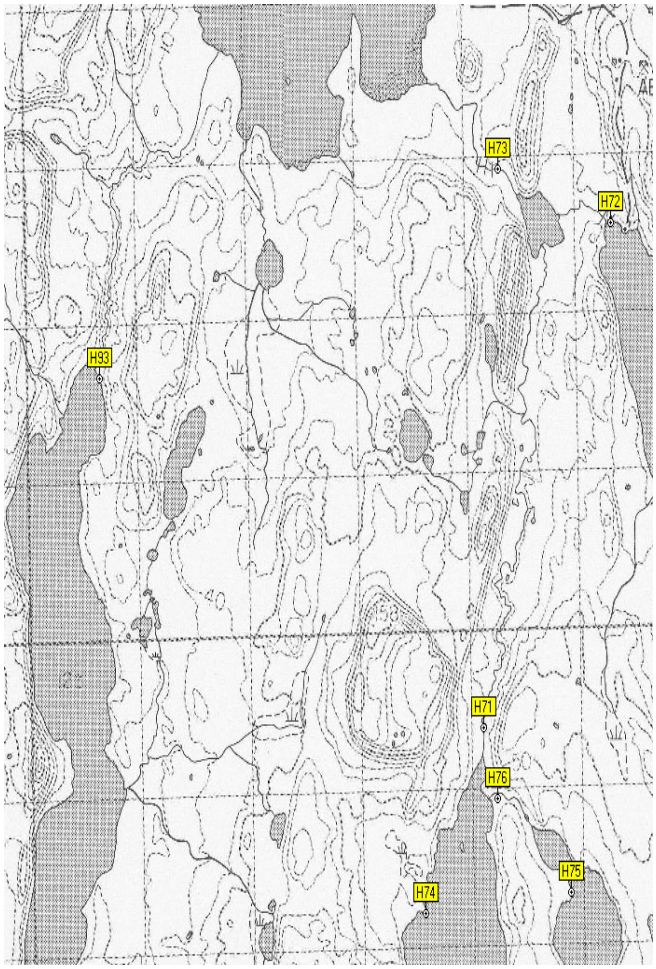
Operational:	2006 (29 May – 8 September)	2007 (24 May – 15 September)	
Benchmark:	Top of embedded boulder;	Drainage Area:	31.6 km^2
Coordinates:	UTM: 430512 m E, 7562013 m N (NAD83)	Lat/Long:	68°09'48" N, 106°40'27" W
Datalogger:	Optimum Instruments # 1382	Transducer:	Keller #000942 (5 psi, 20 m)



Station H93, Looking South(upstream), on the right bank.

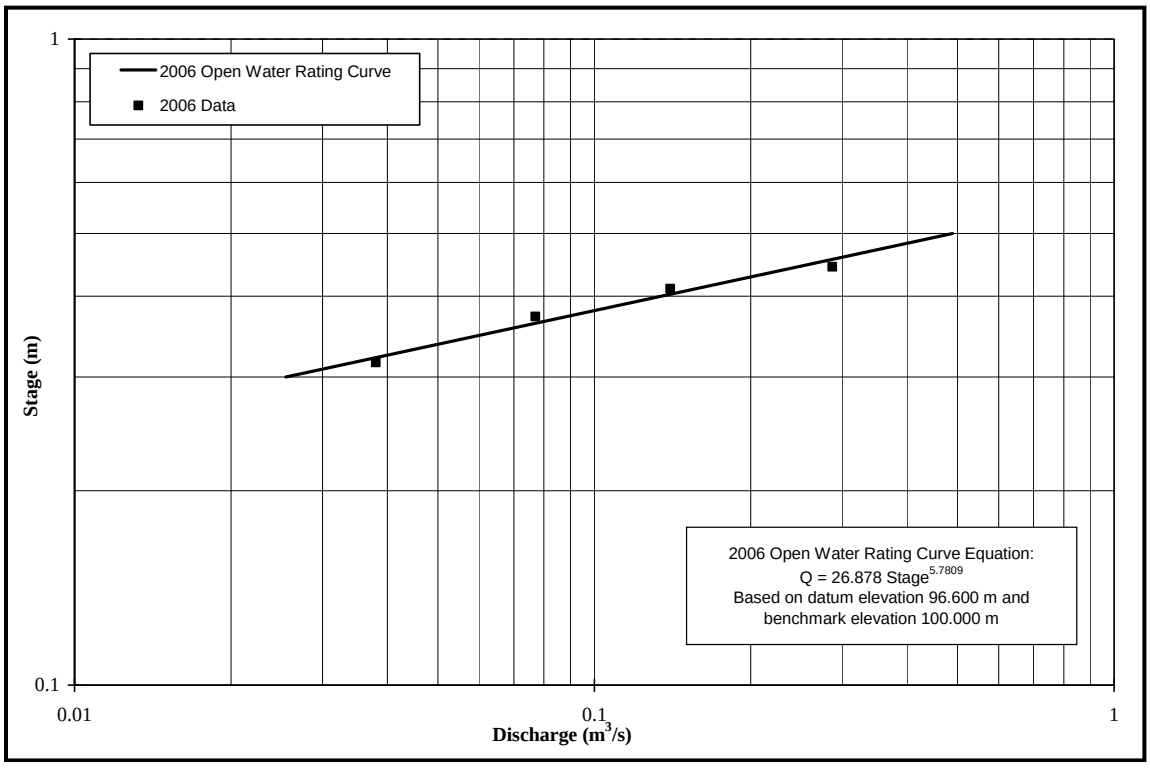


Station H93, Looking North (downstream), on the right bank.

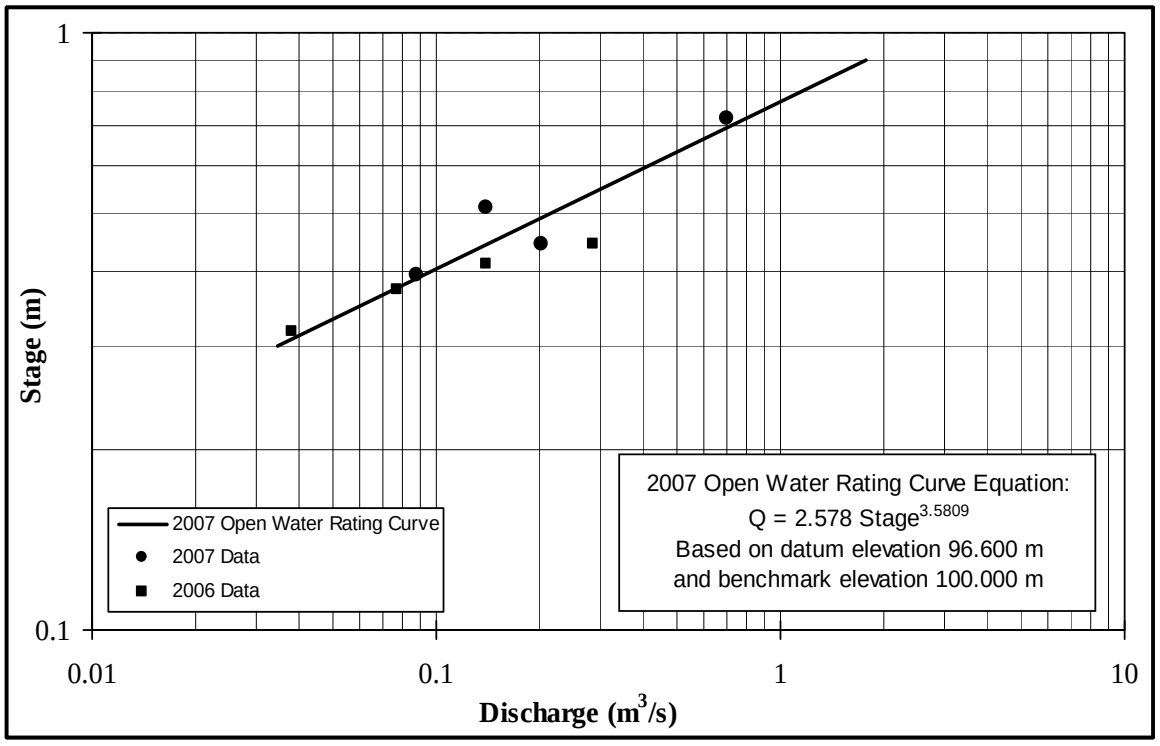


NTS Mapping of Area

FACT-H93-2007.DOC



Glenn Outflow Station H93 – Stage-Discharge Rating Curve (2006)



Glenn Outflow Station H93 – Stage-Discharge Rating Curve (2007)

Glenn Outflow Station H93 – Stage-Discharge Data (2006-2007)

Stage Datum 99.250 m (non-geodetic)

Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Water Surface Elevation (m)	Stage (m)	Measured Discharge (m^3/s)
29/05/2006 9:45	1.7642	95.436		97.200	0.600	n/a
16/06/2006 22:45	1.7061	*95.381*		*97.087*	0.487	n/a
transducer shifted by unknown disturbance						
17/06/2006 13:00	1.2041			*97.084*	0.484	n/a
25/06/2006 23:15	1.1790	*95.880*		*97.059*	0.459	n/a
transducer shifted by unknown disturbance						
25/06/2006 23:30	1.1258			*97.059*	0.459	n/a
03/07/2006 13:33	1.1193	95.925		97.044	0.444	0.287
21/07/2006 14:00	1.0776			*97.011*	0.411	0.140
12/08/2006 11:50	1.0388	95.933		96.972	0.372	0.077
08/09/2006 12:59	0.9811	95.935	95.931	96.916	0.316	0.038
22/06/2007 08:45	2.0429			*97.317*	0.717	0.695
07/07/2007 20:36	1.9331	95.274		97.207	0.607	n/a
19/07/2007 20:54	1.9233	95.119		97.042	0.442	0.201
16/08/2007 12:45	1.8819			96.994	0.394	0.088
15/09/2007 15:15	1.8023		95.274	97.108	0.508	0.139

H93 Glenn Outflow - 2006

MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	97.147	97.052	96.991	-	-	-	-
2	-	-	-	-	-	97.136	97.052	96.990	-	-	-	-
3	-	-	-	-	-	97.133	97.051	96.988	-	-	-	-
4	-	-	-	-	-	97.130	97.048	96.987	-	-	-	-
5	-	-	-	-	-	97.131	97.045	96.986	-	-	-	-
6	-	-	-	-	-	97.131	97.041	96.984	-	-	-	-
7	-	-	-	-	-	97.123	97.037	96.982	-	-	-	-
8	-	-	-	-	-	97.116	97.033	96.980	-	-	-	-
9	-	-	-	-	-	97.115	97.030	96.980	-	-	-	-
10	-	-	-	-	-	97.114	97.027	96.978	-	-	-	-
11	-	-	-	-	-	97.112	97.025	96.974	-	-	-	-
12	-	-	-	-	-	97.110	97.023	96.973	-	-	-	-
13	-	-	-	-	-	97.108	97.021	-	-	-	-	-
14	-	-	-	-	-	97.105	97.021	-	-	-	-	-
15	-	-	-	-	-	97.099	97.020	-	-	-	-	-
16	-	-	-	-	-	97.091	97.017	-	-	-	-	-
17	-	-	-	-	-	97.084	97.014	-	-	-	-	-
18	-	-	-	-	-	97.079	97.009	-	-	-	-	-
19	-	-	-	-	-	97.076	97.008	-	-	-	-	-
20	-	-	-	-	-	97.074	97.009	-	-	-	-	-
21	-	-	-	-	-	97.070	97.007	-	-	-	-	-
22	-	-	-	-	-	97.066	97.003	-	-	-	-	-
23	-	-	-	-	-	97.063	97.005	-	-	-	-	-
24	-	-	-	-	-	97.059	97.007	-	-	-	-	-
25	-	-	-	-	-	97.060	97.006	-	-	-	-	-
26	-	-	-	-	-	97.054	97.002	-	-	-	-	-
27	-	-	-	-	-	97.052	96.994	-	-	-	-	-
28	-	-	-	-	-	97.051	96.995	-	-	-	-	-
29	-	-	-	-	97.151 P	97.048	96.994	-	-	-	-	-
30	-	-	-	-	97.163	97.048	96.992	-	-	-	-	-
31	-	-	-	-	97.162	-	96.992	-	-	-	-	-
MIN	-	-	-	-	97.151	97.048	96.992	96.973	-	-	-	-
MEAN	-	-	-	-	97.159	97.093	97.019	96.983	-	-	-	-
MAX	-	-	-	-	97.163	97.147	97.052	96.991	-	-	-	-

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	0.819	0.272	0.118	-	-	-	-
2	-	-	-	-	-	0.732	0.272	0.116	-	-	-	-
3	-	-	-	-	-	0.705	0.269	0.113	-	-	-	-
4	-	-	-	-	-	0.687	0.261	0.111	-	-	-	-
5	-	-	-	-	-	0.693	0.249	0.109	-	-	-	-
6	-	-	-	-	-	0.693	0.236	0.106	-	-	-	-
7	-	-	-	-	-	0.634	0.225	0.103	-	-	-	-
8	-	-	-	-	-	0.585	0.214	0.100	-	-	-	-
9	-	-	-	-	-	0.579	0.203	0.100	-	-	-	-
10	-	-	-	-	-	0.577	0.195	0.097	-	-	-	-
11	-	-	-	-	-	0.561	0.190	0.091	-	-	-	-
12	-	-	-	-	-	0.545	0.186	0.089	-	-	-	-
13	-	-	-	-	-	0.534	0.182	-	-	-	-	-
14	-	-	-	-	-	0.516	0.180	-	-	-	-	-
15	-	-	-	-	-	0.484	0.178	-	-	-	-	-
16	-	-	-	-	-	0.441	0.170	-	-	-	-	-
17	-	-	-	-	-	0.404	0.164	-	-	-	-	-
18	-	-	-	-	-	0.383	0.152	-	-	-	-	-
19	-	-	-	-	-	0.369	0.152	-	-	-	-	-
20	-	-	-	-	-	0.357	0.153	-	-	-	-	-
21	-	-	-	-	-	0.340	0.148	-	-	-	-	-
22	-	-	-	-	-	0.324	0.141	-	-	-	-	-
23	-	-	-	-	-	0.313	0.144	-	-	-	-	-
24	-	-	-	-	-	0.300	0.149	-	-	-	-	-
25	-	-	-	-	-	0.304	0.146	-	-	-	-	-
26	-	-	-	-	-	0.278	0.139	-	-	-	-	-
27	-	-	-	-	-	0.273	0.124	-	-	-	-	-
28	-	-	-	-	-	0.268	0.125	-	-	-	-	-
29	-	-	-	-	0.858 P	0.258	0.123	-	-	-	-	-
30	-	-	-	-	0.967	0.260	0.120	-	-	-	-	-
31	-	-	-	-	0.962	-	0.119	-	-	-	-	-
MIN	-	-	-	-	0.858	0.258	0.119	0.089	-	-	-	-
MEAN	-	-	-	-	0.929	0.474	0.180	0.105	-	-	-	-
MAX	-	-	-	-	0.967	0.819	0.272	0.118	-	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED

H93 Glenn Outflow - 2007

MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	0.501	1.073	-	-	-	-	-
2	-	-	-	-	-	0.432	0.866	-	-	-	-	-
3	-	-	-	-	-	0.330	0.633	-	-	-	-	-
4	-	-	-	-	-	0.375	-	-	-	-	-	-
5	-	-	-	-	-	0.410	-	-	-	-	-	-
6	-	-	-	-	-	0.477	-	-	-	-	-	-
7	-	-	-	-	-	0.535	-	-	-	-	-	-
8	-	-	-	-	-	0.493	-	-	-	-	-	-
9	-	-	-	-	-	0.477	-	-	-	-	-	-
10	-	-	-	-	-	0.546	-	-	-	-	-	-
11	-	-	-	-	-	0.552	-	-	-	-	-	-
12	-	-	-	-	-	0.501	-	-	-	-	-	-
13	-	-	-	-	-	0.519	-	-	-	-	-	-
14	-	-	-	-	-	0.508	-	-	-	-	-	-
15	-	-	-	-	-	0.529	-	-	-	-	-	-
16	-	-	-	-	-	0.630	-	-	-	-	-	-
17	-	-	-	-	-	0.755	-	-	-	-	-	-
18	-	-	-	-	-	0.954	-	-	-	-	-	-
19	-	-	-	-	-	1.091	-	-	-	-	-	-
20	-	-	-	-	-	0.973	-	-	-	-	-	-
21	-	-	-	-	-	0.876	-	-	-	-	-	-
22	-	-	-	-	-	0.759	-	-	-	-	-	-
23	-	-	-	-	-	0.704	-	-	-	-	-	-
24	-	-	-	-	0.433 P	0.724	-	-	-	-	-	-
25	-	-	-	-	0.495	0.651	-	-	-	-	-	-
26	-	-	-	-	0.538	0.649	-	-	-	-	-	-
27	-	-	-	-	0.403	0.750	-	-	-	-	-	-
28	-	-	-	-	0.333	0.604	-	-	-	-	-	-
29	-	-	-	-	0.481	0.613	-	-	-	-	-	-
30	-	-	-	-	0.416	0.622	-	-	-	-	-	-
31	-	-	-	-	0.452	-	-	-	-	-	-	-
MIN	-	-	-	-	0.333	0.330	0.633	-	-	-	-	-
MEAN	-	-	-	-	0.444	0.618	0.857	-	-	-	-	-
MAX	-	-	-	-	0.538	1.091	1.073	-	-	-	-	-

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	97.233	97.367	-	-	-	-	-
2	-	-	-	-	-	97.207	97.334	-	-	-	-	-
3	-	-	-	-	-	97.163	97.273	-	-	-	-	-
4	-	-	-	-	-	97.184	-	-	-	-	-	-
5	-	-	-	-	-	97.198	-	-	-	-	-	-
6	-	-	-	-	-	97.224	-	-	-	-	-	-
7	-	-	-	-	-	97.244	-	-	-	-	-	-
8	-	-	-	-	-	97.230	-	-	-	-	-	-
9	-	-	-	-	-	97.224	-	-	-	-	-	-
10	-	-	-	-	-	97.248	-	-	-	-	-	-
11	-	-	-	-	-	97.250	-	-	-	-	-	-
12	-	-	-	-	-	97.232	-	-	-	-	-	-
13	-	-	-	-	-	97.238	-	-	-	-	-	-
14	-	-	-	-	-	97.235	-	-	-	-	-	-
15	-	-	-	-	-	97.242	-	-	-	-	-	-
16	-	-	-	-	-	97.275	-	-	-	-	-	-
17	-	-	-	-	-	97.309	-	-	-	-	-	-
18	-	-	-	-	-	97.356	-	-	-	-	-	-
19	-	-	-	-	-	97.386	-	-	-	-	-	-
20	-	-	-	-	-	97.362	-	-	-	-	-	-
21	-	-	-	-	-	97.339	-	-	-	-	-	-
22	-	-	-	-	-	97.310	-	-	-	-	-	-
23	-	-	-	-	-	97.292	-	-	-	-	-	-
24	-	-	-	-	97.208 P	97.298	-	-	-	-	-	-
25	-	-	-	-	97.230	97.277	-	-	-	-	-	-
26	-	-	-	-	97.245	97.276	-	-	-	-	-	-
27	-	-	-	-	97.194	97.297	-	-	-	-	-	-
28	-	-	-	-	97.164	97.261	-	-	-	-	-	-
29	-	-	-	-	97.225	97.265	-	-	-	-	-	-
30	-	-	-	-	97.201	97.269	-	-	-	-	-	-
31	-	-	-	-	97.215	-	-	-	-	-	-	-
MIN	-	-	-	-	97.164	97.163	97.273	-	-	-	-	-
MEAN	-	-	-	-	97.210	97.264	97.325	-	-	-	-	-
MAX	-	-	-	-	97.245	97.386	97.367	-	-	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-028.4000
DISCHARGE DATA

STREAM NAME: Glenn Outflow **MEASUREMENT DATE: 3 July 2006**
LOCATION: Outlet of Glenn Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 430616 m E, 7561906 m N (NAD 83)

MEASUREMENT BY: TA/PE **MEASUREMENT START TIME: 1333 h**
COMPUTATIONS BY: NS/TJ **MEASUREMENT END TIME: 1350 h est.**

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.79		0.00			0.00	0.105	0.000
1	1.00		0.02			0.00	0.355	0.000
2	1.50		0.05			0.00	0.5	0.000
3	2.00		0.12			0.00	0.375	0.000
4	2.25		0.17			0.00	0.25	0.000
5	2.50		0.18			0.06	0.25	0.003
6	2.75		0.26			0.47	0.25	0.031
7	3.00		0.32			0.53	0.25	0.042
8	3.25		0.32			0.63	0.25	0.050
9	3.50		0.33			0.70	0.25	0.058
10	3.75		0.27			0.67	0.25	0.045
11	4.00		0.35			0.52	0.25	0.046
12	4.25		0.23			0.21	0.25	0.012
13	4.50		0.03			0.00	0.19	0.000
Right Bank	4.63		0.00			0.00	0.065	0.000
								0.287

PROJECT NAME: Miramar/M2 Program
PROJECT NO.: 06-1373-028.4000
DISCHARGE DATA

STREAM NAME: Glenn Outflow
LOCATION: Outlet of Glenn Lake
COORDINATES: 430616 m E, 7561906 m N (NAD 83)

MEASUREMENT DATE: 21 July 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: TA/PE
COMPUTATIONS BY: NS/TJ

MEASUREMENT START TIME: 1400 h
MEASUREMENT END TIME: 1415 h

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	2.20		0.00			0.00	0.1	0.000
1	2.40		0.16			0.30	0.2	0.010
2	2.60		0.18			0.45	0.2	0.016
3	2.80		0.20			0.45	0.2	0.018
4	3.00		0.20			0.56	0.2	0.022
5	3.20		0.20			0.41	0.2	0.016
6	3.40		0.20			0.45	0.2	0.018
7	3.60		0.20			0.36	0.2	0.014
8	3.80		0.20			0.22	0.2	0.009
9	4.00		0.18			0.44	0.2	0.016
Right Bank	4.20		0.04			0.00	0.1	0.000
								0.140

PROJECT NAME: Miramar/M2 Program/ Glenn Lake Outflow
PROJECT NO.: 06-1373-028.4000
DISCHARGE DATA

STREAM NAME: Glenn Outflow
LOCATION: Outlet of Glenn Lake
COORDINATES: 430616 m E, 7561906 m N (NAD 83)

MEASUREMENT DATE: 12 August 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: NS
COMPUTATIONS BY: NS/TJ

MEASUREMENT START TIME: 1104 h
MEASUREMENT END TIME: 1119 h

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	2.90		0.00			0.00	0.05	0.000
1	3.00		0.05			0.00	0.1	0.000
2	3.10		0.09			0.27	0.1	0.002
3	3.20		0.10			0.25	0.1	0.003
4	3.30		0.11			0.29	0.1	0.003
5	3.40		0.14			0.29	0.1	0.004
6	3.50		0.18			0.42	0.1	0.008
7	3.60		0.16			0.52	0.1	0.008
8	3.70		0.15			0.56	0.1	0.008
9	3.80		0.14			0.54	0.1	0.008
10	3.90		0.15			0.40	0.1	0.006
11	4.00		0.15			0.26	0.1	0.004
12	4.10		0.15			0.18	0.1	0.003
13	4.20		0.14			0.14	0.1	0.002
14	4.30		0.13			0.09	0.1	0.001
15	4.40		0.12			0.27	0.1	0.003
16	4.50		0.11			0.37	0.1	0.004
17	4.60		0.08			0.29	0.1	0.002
18	4.70		0.09			0.26	0.1	0.002
19	4.80		0.09			0.27	0.1	0.002
20	4.90		0.05			0.23	0.1	0.001
21	5.00		0.08			0.21	0.075	0.001
Right Bank	5.05		0.00			0.00	0.025	0.000
								0.077

PROJECT NAME: Miramar/M2 Program/ Glenn Lake Outflow
PROJECT NO.: 06-1373-028.4000
DISCHARGE DATA

STREAM NAME: Glenn Outflow
LOCATION: Outlet of Glenn Lake
COORDINATES: 430616 m E, 7561906 m N (NAD 83)

MEASUREMENT DATE: 8 September 2006
METER NUMBER: Marsh-McBirney

MEASUREMENT BY: KK/PE
COMPUTATIONS BY: NS/TJ

MEASUREMENT START TIME: 1259 h
MEASUREMENT END TIME: 1320 h est.

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	2.20		0.00			0.00	0.1	0.000
1	2.40		0.05			0.00	0.2	0.000
2	2.60		0.08			0.00	0.2	0.000
3	2.80		0.17			0.01	0.2	0.000
4	3.00		0.18			0.04	0.2	0.001
5	3.20		0.22			0.10	0.2	0.004
6	3.40		0.23			0.31	0.2	0.014
7	3.60		0.21			0.23	0.2	0.010
8	3.80		0.20			0.12	0.2	0.005
9	4.00		0.19			0.07	0.2	0.003
10	4.20		0.16			0.01	0.15	0.000
11	4.30		0.03			0.00	0.055	0.000
Right Bank	4.31		0.00			0.00	0.005	0.000
								0.038

PROJECT NAME: Miramar/EM2 Expansion/Glenn Lake Outflow

PROJECT NUMBER: 07 1373 0019.4000

DISCHARGE DATA

STREAM NAME: Glenn Lake Outflow **MEASUREMENT DATE: 22 June 2007**

LOCATION: Outlet of Glenn Lake **METER NUMBER: Marsh McBirney**

COORDINATES: 430616 m E, 7561906 m N (NAD 83)

MEASUREMENT BY: PE **MEASUREMENT START TIME: 0838 h**

COMPUTATIONS BY: TJ/DC **MEASUREMENT END TIME: 0850 h**

STATION	DISTANCE FROM LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Left Bank	8.00		0.04			0.00	0.325	0.000
1	7.35		0.17			0.00	0.65	0.000
2	6.70		0.23			0.03	0.65	0.004
3	6.05		0.24			0.05	0.65	0.008
4	5.40		0.34			0.36	0.65	0.080
5	4.75		0.54			0.31	0.65	0.109
6	4.10		0.58			0.56	0.65	0.211
7	3.45		0.54			0.68	0.65	0.239
8	2.80		0.28			0.20	0.65	0.036
9	2.15		0.10			0.15	0.575	0.009
Right Bank	1.65		0.02			0.00	0.25	0.000
								0.695

PROJECT NAME: Miramar/EM2 Expansion/Glenn Lake Outflow
PROJECT NUMBER: 07 1373 0019.4000
DISCHARGE DATA

STREAM NAME: Glenn Lake Outflow **MEASUREMENT DATE: 19 July 2007**
LOCATION: Outlet of Glenn Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 430616 m E, 7561906 m N (NAD 83)

MEASUREMENT BY: MK/HS **MEASUREMENT START TIME: 2105h**
COMPUTATIONS BY: DC **MEASUREMENT END TIME: 2120h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Left Bank	0.68		0.00			0.00	0.03	0.000
1	0.74		0.02			-0.33	0.085	-0.001
2	0.85		0.09			0.25	0.105	0.002
3	0.95		0.16			0.21	0.1	0.003
4	1.05		0.28			0.33	0.1	0.009
5	1.15		0.33			0.39	0.1	0.013
6	1.25		0.34			0.52	0.1	0.018
7	1.35		0.34			0.49	0.1	0.017
8	1.45		0.36			0.62	0.1	0.022
9	1.55		0.35			0.57	0.1	0.020
10	1.65		0.32			0.55	0.1	0.018
11	1.75		0.32			0.48	0.1	0.015
12	1.85		0.31			0.41	0.1	0.013
13	1.95		0.29			0.40	0.1	0.012
14	2.05		0.29			0.38	0.1	0.011
15	2.15		0.28			0.26	0.1	0.007
16	2.25		0.28			0.18	0.1	0.005
17	2.35		0.22			0.17	0.1	0.004
18	2.45		0.24			0.22	0.1	0.005
19	2.55		0.23			0.14	0.1	0.003
20	2.65		0.24			0.10	0.1	0.002
21	2.75		0.18			0.08	0.1	0.001
22	2.85		0.08			0.03	0.1	0.000
Right Bank	2.95		0.02			0.00	0.05	0.000
								0.201

PROJECT NAME: Miramar/EM2 Expansion/Glenn Lake Outflow
PROJECT NUMBER: 07 1373 0019.4000
DISCHARGE DATA

STREAM NAME: Glenn Lake Outflow **MEASUREMENT DATE: 16 August 2007**
LOCATION: Outlet of Glenn Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 430616 m E, 7561906 m N (NAD 83)

MEASUREMENT BY: TY **MEASUREMENT START TIME: 1230 h**
COMPUTATIONS BY: TJ/DC **MEASUREMENT END TIME: 1258 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Right Bank	1.30		0.02			0.00	0.15	0.000
1	1.60		0.08			-0.03	0.30	-0.001
2	1.90		0.22			-0.03	0.30	-0.002
3	2.20		0.27			-0.03	0.30	-0.002
4	2.50		0.50			-0.04	0.30	-0.006
5	2.80		0.65			-0.04	0.30	-0.008
6	3.10		0.72			-0.04	0.30	-0.009
7	3.40		0.74			-0.03	0.30	-0.007
8	3.70		0.73			-0.03	0.30	-0.007
9	4.00		0.75	-0.03	-0.04	-0.04	0.30	-0.008
10	4.30		0.79	-0.01	0.03	0.01	0.30	0.002
11	4.60		0.88	0.03	0.01	0.02	0.30	0.005
12	4.90		0.86	0.08	0.07	0.08	0.30	0.019
13	5.20		0.83	0.11	0.09	0.10	0.30	0.025
14	5.50		0.80	0.16	0.09	0.13	0.30	0.030
15	5.80		0.77	0.19	0.14	0.17	0.30	0.038
16	6.10		0.70			0.15	0.30	0.032
17	6.40		0.70			0.04	0.30	0.008
18	6.70		0.68			0.00	0.30	0.000
19	7.00		0.68			-0.02	0.40	-0.005
20	7.50		0.60			-0.02	0.50	-0.006
21	8.00		0.42			-0.03	0.75	-0.009
22	9.00		0.19			-0.01	1.00	-0.002
LeftBank	10.00		0.02			0.00	0.50	0.000
								0.088

PROJECT NAME: Miramar/EM2 Expansion/Glenn Lake Outflow
PROJECT NUMBER: 07 1373 0019.4000
DISCHARGE DATA

STREAM NAME: Glenn Lake Outflow **MEASUREMENT DATE: 15 September 2007**
LOCATION: Outlet of Glenn Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 430616 m E, 7561906 m N (NAD 83)

MEASUREMENT BY: TY **MEASUREMENT START TIME: 1515 h**
COMPUTATIONS BY: DC **MEASUREMENT END TIME: 1530 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	0.00		0.02			0.00	0.1	0.000
1	0.20		0.18			0.01	0.2	0.000
2	0.40		0.22			0.02	0.2	0.001
3	0.60		0.24			0.05	0.2	0.002
4	0.80		0.28			0.05	0.2	0.003
5	1.00		0.28			0.14	0.2	0.008
6	1.20		0.27			0.16	0.2	0.009
7	1.40		0.29			0.19	0.2	0.011
8	1.60		0.24			0.31	0.2	0.015
9	1.80		0.28			0.38	0.2	0.021
10	2.00		0.26			0.36	0.2	0.019
11	2.20		0.26			0.41	0.2	0.021
12	2.40		0.26			0.36	0.2	0.019
13	2.60		0.24			0.21	0.2	0.010
LeftBank	2.80		0.04			0.00	0.1	0.000
								0.139

PO LAKE
HYDROMETRIC STATION

H89

FACTSHEET

LOCATION AND PURPOSE

Operational:	2007 (14 June – 14 September)		
Benchmarks:	Top of embedded boulder; bedrock face	Drainage Area:	64.9 km2
Coordinates:	UTM: 436565 m E, 7550014 m N (NAD83)	Lat/Long:	68°03'26" N, 106°31'16" W
Datalogger:	Optimum Instruments #1396	Transducer:	Keller #000932 (5 psi, 20 m)

PO Lake Hydrometric Station 1- Lake Station



Upstream PO Lake Outlet Station, looking downstream



Upstream PO Lake Outlet Station, looking offshore

PO Lake Hydrometric Station 2 – Outlet

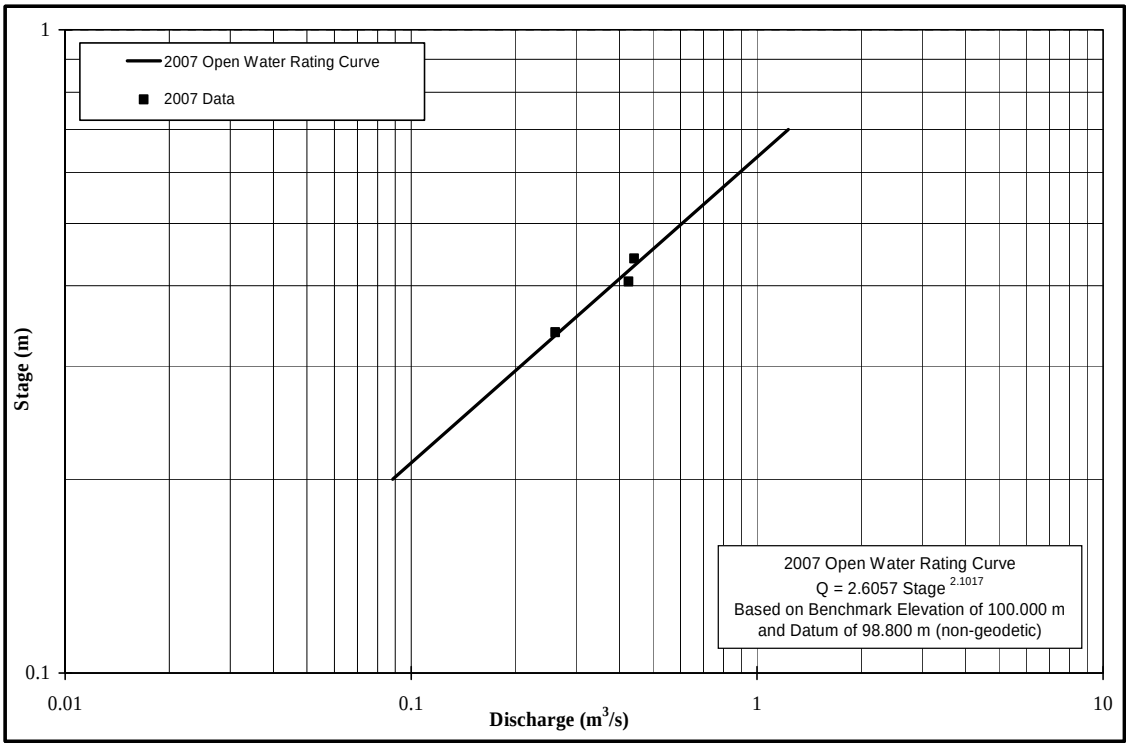


Downstream PO Lake outlet station showing location of temporary benchmark



Downstream PO Lake Outlet Station showing old staff gauge

FACT-H89-2007.DOC



PO Lake Outflow Station H89 – Stage-Discharge Rating Curve (2007)

PO Lake Outflow Station H89 – Stage-Discharge Data (2007)

			Stage Datum	98.800 m	(non-geodetic)	
Date & Time	Transducer Reading (m)	Transducer Elevation (m)	Average Transducer Elevation (m)	Water Surface Elevation (m)	Stage (m)	Measured Discharge (m^3/s)
22/07/2007 14:25						0.111
10/07//2007 12:50	0.5700	98.6710		99.241	0.441	0.441
14/08/2007 13:30	0.5350			*99.206*	0.406	0.425
14/09/2007 08:30	0.4676		98.6710	*99.139*	0.339	0.261

H89 PO Lake Outflow - 2007

MEAN DAILY DISCHARGE (m^3/s)

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	0.670	0.132	0.414	0.109 E	-	-
2	-	-	-	-	-	-	0.602	0.126	0.397	0.100 E	-	-
3	-	-	-	-	-	-	0.557	0.120	0.381	0.091 E	-	-
4	-	-	-	-	-	-	0.521	0.115	0.364	0.082 E	-	-
5	-	-	-	-	-	-	0.498	0.108	0.358	0.073 E	-	-
6	-	-	-	-	-	-	0.488	0.107	0.347	0.064 E	-	-
7	-	-	-	-	-	-	0.451	0.103	0.334	0.055 E	-	-
8	-	-	-	-	-	-	0.456	0.102	0.328	0.046 E	-	-
9	-	-	-	-	-	-	0.433	0.147	0.320	0.037 E	-	-
10	-	-	-	-	-	-	0.461	0.187	0.307	0.028 E	-	-
11	-	-	-	-	-	-	0.438	0.213	0.304	0.019 E	-	-
12	-	-	-	-	-	-	0.406	0.251	0.295	0.010 E	-	-
13	-	-	-	-	-	-	0.377	0.321	0.272	-	-	-
14	-	-	-	-	-	-	0.354	0.383	0.263	-	-	-
15	-	-	-	-	-	-	0.332	0.419	0.254 E	-	-	-
16	-	-	-	-	-	-	0.302	0.441	0.245 E	-	-	-
17	-	-	-	-	-	-	0.278	0.438	0.236 E	-	-	-
18	-	-	-	-	-	0.817 P	0.263	0.424	0.227 E	-	-	-
19	-	-	-	-	-	0.792	0.249	0.500	0.218 E	-	-	-
20	-	-	-	-	-	0.740	0.238	0.686	0.209 E	-	-	-
21	-	-	-	-	-	0.732	0.228	0.753	0.200 E	-	-	-
22	-	-	-	-	-	0.678	0.202	0.724	0.191 E	-	-	-
23	-	-	-	-	-	0.615	0.192	0.664	0.182 E	-	-	-
24	-	-	-	-	-	0.713	0.186	0.622	0.173 E	-	-	-
25	-	-	-	-	-	0.853	0.182	0.578	0.164 E	-	-	-
26	-	-	-	-	-	0.901	0.175	0.540	0.155 E	-	-	-
27	-	-	-	-	-	0.891	0.167	0.498	0.146 E	-	-	-
28	-	-	-	-	-	0.855	0.159	0.476	0.137 E	-	-	-
29	-	-	-	-	-	0.785	0.154	0.461	0.128 E	-	-	-
30	-	-	-	-	-	0.724	0.151	0.451	0.118 E	-	-	-
31	-	-	-	-	-	-	0.141	0.439	-	-	-	-
MIN	-	-	-	-	-	0.615	0.141	0.102	0.118	0.010	-	-
MEAN	-	-	-	-	-	0.777	0.333	0.372	0.255	0.060	-	-
MAX	-	-	-	-	-	0.901	0.670	0.753	0.414	0.109	-	-

MEAN DAILY WATER SURFACE ELEVATION (m) BASED ON BENCHMARK ELEVATION 100.000 m

DATE	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	-	-	-	-	-	-	99.086	99.042	99.217	-	-	-
2	-	-	-	-	-	-	99.084	99.037	99.208	-	-	-
3	-	-	-	-	-	-	99.079	99.032	99.200	-	-	-
4	-	-	-	-	-	-	99.073	99.026	99.192	-	-	-
5	-	-	-	-	-	-	99.068	99.020	99.189	-	-	-
6	-	-	-	-	-	-	99.062	99.019	99.183	-	-	-
7	-	-	-	-	-	-	99.059	99.015	99.176	-	-	-
8	-	-	-	-	-	-	99.054	99.014	99.173	-	-	-
9	-	-	-	-	-	-	99.045	99.054	99.169	-	-	-
10	-	-	-	-	-	-	99.239	99.085	99.162	-	-	-
11	-	-	-	-	-	-	99.228	99.104	99.160	-	-	-
12	-	-	-	-	-	-	99.213	99.128	99.154	-	-	-
13	-	-	-	-	-	-	99.198	99.169	99.141	-	-	-
14	-	-	-	-	-	-	99.187	99.201	99.136 P	-	-	-
15	-	-	-	-	-	-	99.175	99.219	-	-	-	-
16	-	-	-	-	-	-	99.158	99.229	-	-	-	-
17	-	-	-	-	-	-	99.145	99.228	-	-	-	-
18	-	-	-	-	-	99.235 P	99.136	99.222	-	-	-	-
19	-	-	-	-	-	99.221	99.127	99.255	-	-	-	-
20	-	-	-	-	-	99.206	99.120	99.330	-	-	-	-
21	-	-	-	-	-	99.192	99.114	99.354	-	-	-	-
22	-	-	-	-	-	99.181	99.096	99.344	-	-	-	-
23	-	-	-	-	-	99.167	99.089	99.322	-	-	-	-
24	-	-	-	-	-	99.151	99.085	99.306	-	-	-	-
25	-	-	-	-	-	99.139	99.082	99.288	-	-	-	-
26	-	-	-	-	-	99.132	99.077	99.273	-	-	-	-
27	-	-	-	-	-	99.123	99.071	99.255	-	-	-	-
28	-	-	-	-	-	99.118	99.064	99.245	-	-	-	-
29	-	-	-	-	-	99.104	99.060	99.238	-	-	-	-
30	-	-	-	-	-	99.093	99.058	99.234	-	-	-	-
31	-	-	-	-	-	-	99.049	99.228	-	-	-	-
MIN	-	-	-	-	-	99.093	99.045	99.014	99.136	-	-	-
MEAN	-	-	-	-	-	99.159	99.109	99.178	99.176	-	-	-
MAX	-	-	-	-	-	99.235	99.239	99.354	99.217	-	-	-

NOTES: P - PARTIAL DAILY AVERAGE E - ESTIMATED

PROJECT NAME: Miramar/EM2 Expansion/PO Lake
PROJECT NUMBER: 07 1373 0019.4000
DISCHARGE DATA

STREAM NAME: PO Lake Outflow **MEASUREMENT DATE: 22 June 2007**
LOCATION: Outlet of PO Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 13W 0436664 E 7550193 N

MEASUREMENT BY: PE/ **MEASUREMENT START TIME: 1330 h**
COMPUTATIONS BY: TJ/DC **MEASUREMENT END TIME: 1350 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Right Bank	0.00		0.10			0.00	1.025	0.000
1	2.05		0.27			0.00	2.05	0.000
2	4.10		0.29			0.01	2.05	0.006
3	6.15		0.28			0.04	2.05	0.023
4	8.20		0.26			0.02	2.05	0.011
5	10.25		0.26			0.02	1.8	0.009
6	11.80		0.00			0.00	1.025	0.000
7	12.30		0.72			0.09	0.7	0.045
8	13.20		0.00			0.00	1.025	0.000
9	14.35		0.31			0.01	1.6	0.005
10	16.40		0.28			0.02	2.05	0.011
11	18.45		0.24			0.00	2.05	0.000
12	20.50		0.14			0.00	1.275	0.000
Right Bank	21.00		0.10			0.00	0.25	0.000
								0.111

PROJECT NAME: Miramar/EM2 Expansion/PO Lake
PROJECT NUMBER: 07 1373 0019.4000
DISCHARGE DATA

STREAM NAME: PO Lake Outflow **MEASUREMENT DATE:10 July 2007**
LOCATION: Outlet of PO Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 13W 0436664 E 7550193 N

MEASUREMENT BY: NS **MEASUREMENT START TIME: 1230 h**
COMPUTATIONS BY:DC/NS **MEASUREMENT END TIME: 1245 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Left Bank	1.80		0.00			0.00	0.15	0.000
1	2.10		0.10			0.00	0.3	0.000
2	2.40		0.08			0.00	0.2	0.000
3	2.50		0.16			0.00	0.1	0.000
4	2.60		0.45		0.06	0.02	0.15	0.001
5	2.80		0.48		0.30	0.10	0.2	0.009
6	3.00		0.50		0.58	0.19	0.2	0.019
7	3.20		0.52		0.64	0.21	0.2	0.022
8	3.40		0.54		0.64	0.21	0.2	0.023
9	3.60		0.57		0.55	0.18	0.2	0.021
10	3.80		0.52		0.69	0.23	0.2	0.024
11	4.00		0.60		0.81	0.27	0.2	0.032
12	4.20		0.60		0.88	0.29	0.2	0.035
13	4.40		0.60		0.75	0.25	0.2	0.030
14	4.60		0.65		0.51	0.17	0.2	0.022
15	4.80		0.66		0.60	0.20	0.2	0.026
16	5.00		0.68		0.73	0.24	0.2	0.033
17	5.20		0.68		0.78	0.26	0.2	0.035
18	5.40		0.70		0.88	0.29	0.2	0.040
19	5.60		0.74		0.61	0.20	0.2	0.030
20	5.80		0.74		0.58	0.19	0.2	0.028
21	6.00		0.74		0.25	0.08	0.2	0.012
22	6.20		0.71		0.11	0.04	0.15	0.004
23	6.30		0.68		-0.07	-0.02	0.1	-0.002
24	6.40		0.30		-0.05	-0.02	0.2	-0.001
Right Bank	6.70		0.00		0	0.00	0.15	0.000
								0.441

PROJECT NAME: Miramar/EM2 Expansion/PO Lake

PROJECT NUMBER: 07 1373 0019.4000

DISCHARGE DATA

STREAM NAME: PO Lake Outflow **MEASUREMENT DATE:14 August 2007**

LOCATION: Outlet of PO Lake **METER NUMBER: Marsh McBirney**

COORDINATES: 13W 0436664 E 7550193 N

MEASUREMENT BY: TY/
COMPUTATIONS BY:
TJ/DC

MEASUREMENT START TIME: 1119 h

MEASUREMENT END TIME: 1154 h

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	7.50		0.00			0.00	0.25	0.000
1	7.00		0.14			0.00	0.75	0.000
2	6.00		0.14			-0.04	0.2	-0.001
3	6.60		0.20			-0.01	-0.1	0.000
4	6.20		0.20			-0.05	0.3	-0.003
5	6.00		0.52			-0.02	0.2	-0.002
6	5.80		0.56			0.08	0.25	0.011
7	5.50		0.60			0.01	0.25	0.002
8	5.30		0.65			0.12	0.2	0.016
9	5.10		0.69			0.16	0.2	0.022
10	4.90		0.62			0.20	0.2	0.025
11	4.70		0.70			0.11	0.2	0.015
12	4.50		0.73			0.22	0.2	0.032
13	4.30		0.70			0.29	0.2	0.041
14	4.10		0.70			0.20	0.2	0.028
15	3.90		0.65			0.18	0.2	0.023
16	3.70		0.64			0.18	0.2	0.023
17	3.50		0.64			0.26	0.2	0.033
18	3.30		0.62			0.26	0.2	0.032
19	3.10		0.62			0.21	0.2	0.026
20	2.90		0.60			0.21	0.3	0.038
21	2.50		0.60			0.21	0.3	0.038
22	2.30		0.66			0.13	0.2	0.017
23	2.10		0.54			0.05	0.2	0.005
24	1.90		0.56			0.03	0.2	0.003
Right Bank	1.70		0.56			0.00	0.1	0.000
								0.425

PROJECT NAME: Miramar/EM2 Expansion/PO Lake
PROJECT NUMBER: 07 1373 0019.4000
DISCHARGE DATA

STREAM NAME: PO Lake Outflow **MEASUREMENT DATE: 14 September 2007**
LOCATION: Outlet of PO Lake **METER NUMBER: Marsh McBirney**
COORDINATES: 13W 0436664 E 7550193 N

MEASUREMENT BY: PE **MEASUREMENT START TIME: 1025 h**
COMPUTATIONS BY: DC **MEASUREMENT END TIME: 1040 h**

STATION	DISTANCE FROM RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY			WIDTH (m)	DISCHARGE (m^3/s)
				0.2 Depth (m/s)	0.8 Depth (m/s)	0.6 Depth (m/s)		
Left Bank	0.00		0.02			0.00	0.125	0.000
1	0.25		0.08			0.00	0.25	0.000
2	0.50		0.12			0.00	0.25	0.000
3	0.75		0.14			0.00	0.25	0.000
4	1.00		0.14			0.00	0.25	0.000
5	1.25		0.49			0.04	0.25	0.005
6	1.50		0.51			0.07	0.25	0.009
7	1.75		0.48			0.07	0.25	0.008
8	2.00		0.50			0.08	0.25	0.010
9	2.25		0.54			0.14	0.25	0.019
10	2.50		0.66			0.10	0.25	0.017
11	2.75		0.65			0.16	0.25	0.026
12	3.00		0.62			0.12	0.25	0.019
13	3.25		0.64			0.18	0.25	0.029
14	3.50		0.62			0.20	0.25	0.031
15	3.75		0.60			0.17	0.25	0.026
16	4.00		0.58			0.18	0.25	0.026
17	4.25		0.54			0.14	0.25	0.019
18	4.50		0.54			0.10	0.25	0.014
19	4.75		0.52			0.02	0.25	0.003
20	5.00		0.50			0.01	0.25	0.001
21	5.25		0.48			0.01	0.25	0.001
Right Bank	5.50		0.42			0.00	0.125	0.000
								0.261

MISCELLANEOUS ADDITIONAL STREAM DISCHARGE MEASUREMENTS

PROJECT NAME: Miramar M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Aimaokatalok East Inflow **MEASUREMENT DATE: 23 June 2006**
LOCATION: East Inflow of Aimaokatalok Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 443539 m E, 7509431 m N (NAD 83)

MEASUREMENT BY: KK/PE **MEASUREMENT START TIME: 1100 h**
COMPUTATIONS BY: TJ/NS **MEASUREMENT END TIME: 1110 h**

STATION	DISTANCE TO LEFT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.90	0.000
1	1.80		0.00			0.00	1.00	0.000
2	2.00		0.14			0.03	0.60	0.003
3	3.00		0.27			0.66	1.00	0.178
4	4.00		0.52			0.71	1.00	0.369
5	5.00		0.69			0.92	1.00	0.635
6	6.00		0.48			1.61	1.00	0.773
7	7.00		0.58			1.05	1.00	0.609
8	8.00		0.56			0.58	1.00	0.325
9	9.00		0.63			1.21	1.00	0.762
10	10.00		0.41			1.15	1.00	0.472
11	11.00		0.19			0.59	0.60	0.067
Right Bank	11.20		0.00			0.00	0.10	0.000
								4.192

PROJECT NAME: Miramar M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Aimaokatalok East Inflow **MEASUREMENT DATE: 16 July 2006**
LOCATION: East Inflow of Aimaokatalok Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 443539 m E, 7509431 m N (NAD 83)

MEASUREMENT BY: KK/PE **MEASUREMENT START TIME: 1100 h**
COMPUTATIONS BY: TJ/NS **MEASUREMENT END TIME: 1110 h**

STATION	DISTANCE TO RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	1.80		0.16			0.00	0.35	0.000
1	2.50		0.26			0.08	0.60	0.012
2	3.00		0.42			0.10	0.65	0.027
3	3.80		0.48			0.15	0.75	0.054
4	4.50		0.56			0.20	0.60	0.067
5	5.00		0.45			0.15	0.50	0.034
6	5.50		0.72			0.17	0.50	0.061
7	6.00		0.72			0.20	0.50	0.072
8	6.50		0.70			0.20	0.50	0.070
9	7.00		0.61			0.15	0.50	0.046
10	7.50		0.53			0.25	0.50	0.066
11	8.00		0.53			0.10	0.50	0.027
12	8.50		0.68			0.10	0.80	0.054
13	9.60		0.15			0.05	1.20	0.009
Left Bank	10.90		0.00			0.00	0.65	0.000
								0.600

PROJECT NAME: Miramar M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Aimaokatalok East Inflow **MEASUREMENT DATE: 13 August 2006**
LOCATION: East Inflow of Aimaokatalok Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 443539 m E, 7509431 m N (NAD 83)

MEASUREMENT BY: NS/KM **MEASUREMENT START TIME: 1533 h**
COMPUTATIONS BY: TJ/NS **MEASUREMENT END TIME: 1552 h**

STATION	DISTANCE TO RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Right Bank	13.00		0.00			0.00	0.10	0.000
1	12.80		0.10			-0.02	0.30	-0.001
2	12.40		0.15			0.03	0.30	0.001
3	12.20		0.13			0.01	0.30	0.000
4	11.80		0.18			0.03	0.25	0.001
5	11.70		0.38			0.03	0.20	0.002
6	11.40		0.41			0.02	0.35	0.003
7	11.00		0.45			0.06	0.45	0.012
8	10.50		0.50			0.06	0.50	0.015
9	10.00		0.55			0.08	0.40	0.018
10	9.70		0.59			0.05	0.30	0.009
11	9.40		0.59			0.02	0.35	0.004
12	9.00		0.63			0.09	0.45	0.026
13	8.50		0.52			0.19	0.50	0.049
14	8.00		0.61			0.18	0.50	0.055
15	7.50		0.59			0.10	0.50	0.030
16	7.00		0.49			0.10	0.50	0.025
17	6.50		0.36			0.08	0.50	0.014
18	6.00		0.43			0.08	0.50	0.017
19	5.50		0.41			0.10	0.50	0.021
20	5.00		0.24			0.05	0.50	0.006
21	4.50		0.20			0.03	0.50	0.003
22	4.00		0.18			0.01	0.50	0.001
Left Bank	3.50		0.00			0.00	0.25	0.000
								0.311

PROJECT NAME: Miramar M2 Program
PROJECT NO.: 06-1373-027.4000
DISCHARGE DATA

STREAM NAME: Aimaokatalok East Inflow **MEASUREMENT DATE: 10 September 2006**
LOCATION: East Inflow of Aimaokatalok Lake **METER NUMBER: Marsh-McBirney**
COORDINATES: 443539 m E, 7509431 m N (NAD 83)

MEASUREMENT BY: KK/PE **MEASUREMENT START TIME: 1113 h**
COMPUTATIONS BY: TJ/NS **MEASUREMENT END TIME: 1135 h**

STATION	DISTANCE TO RIGHT D/S BANK (m)	ICE THICKNESS (m)	DEPTH (m)	VELOCITY 0.2 Depth (m/s)	VELOCITY 0.8 Depth (m/s)	VELOCITY 0.6 Depth (m/s)	WIDTH (m)	DISCHARGE (m^3/s)
Left Bank	0.00		0.00			0.00	0.35	0.000
1	0.70		0.48			0.45	0.70	0.151
2	1.40		0.26			0.18	0.70	0.033
3	2.10		0.23			0.28	0.70	0.045
4	2.80		0.21			0.39	0.70	0.057
5	3.50		0.18			0.50	0.70	0.063
6	4.20		0.32			0.31	0.70	0.069
7	4.90		0.14			0.09	0.70	0.009
8	5.60		0.07			0.55	0.70	0.027
9	6.30		0.17			0.12	0.70	0.014
10	7.00		0.05			0.32	0.50	0.008
11	7.30		0.02			0.13	0.17	0.000
Right Bank	7.33		0.00			0.00	0.02	0.000
								0.477

Snow Course Survey Raw Data – Open Lake Plots (2006-2007)

Location	OL-06-1		**Location**	OL-06-2		**Location**	OL-06-3	
Date:	01-May-06		**Date:**	01-May-06		**Date:**	01-May-06	
Density			**Density**			**Density**		
Depth	**Weight**	**Density**	**Depth**	**Weight**	**Density**	**Depth**	**Weight**	**Density**
[cm]	[kg]	[g/cm^3]	[cm]	[kg]	[g/cm^3]	[cm]	[kg]	[g/cm^3]
21.0	2.30	0.292	18.5	2.32	0.351	15.5	2.32	0.419
24.5	2.38	0.309	24.5	2.42	0.339	11.0	2.04	0.131
29.7	2.44	0.292	24.5	2.36	0.295	14.0	2.18	0.284
Average:		**0.298**	**Average:**		**0.328**	**Average:**		**0.278**

Depth	**Snow Water Equivalent**		**Depth**	**Snow Water Equivalent**		**Depth**	**Snow Water Equivalent**	
[cm]	[mm]		[cm]	[mm]		[cm]	[mm]	
30	89.3		18	59.1		17	47.3	
25	74.4		18	59.1		17	47.3	
18	53.6		14	45.9		19	52.8	
15	44.7		23	75.5		16	44.5	
13	38.7		29	95.2		13	36.1	
11	32.7		26	85.3		10	27.8	
14	41.7		21	68.9		9	25.0	
16	47.6		16	52.5		11	30.6	
13	38.7		15	49.2		10	27.8	
11	32.7		18	59.1		8	22.2	
20	59.5		17	55.8		8	22.2	
24	71.5		22	72.2		10	27.8	
26	77.4		31	101.7		9	25.0	
34	101.2		27	88.6		7	19.5	
37	110.2		27	88.6		8	22.2	
35	104.2		23	75.5		14	38.9	
33	98.2		25	82.0		12	33.4	
28	83.4		24	78.8		7	19.5	
26	77.4		25	82.0		16	44.5	
29	86.3		22	72.2		17	47.3	
31	92.3		24	78.8		16	44.5	
30	89.3		24	78.8		15	41.7	
28	83.4		27	88.6		7	19.5	
28	83.4		27	88.6		7	19.5	
26	77.4		19	62.4		9	25.0	
24	71.5		19	62.4		6	16.7	
18	53.6		21	68.9		9	25.0	
33	98.2		29	95.2		8	22.2	
26	77.4		28	91.9		9	25.0	
26	77.4		23	75.5		15	41.7	
24.3	**72.2**	**Average**	**22.7**	**74.6**	**Average**	**11.3**	**31.4**	**Average**

Snow Course Survey Raw Data – Open Lake Plots (2006-2007) (continued)

Location	OL-07-1				Location	OL-07-02				Location	OL-07-03			
Date:		04-May-07		(m)	Date:		28-Apr-07		(m)	Date:		28-Apr-07		(m)
Depth		Weight	Tare	Density	Depth		Weight	Tare	Density	Depth		Weight	Tare	Density
[cm]		[kg]	[kg]	[g/cm^3]	[cm]		[kg]	[kg]	[g/cm^3]	[cm]		[kg]	[kg]	[g/cm^3]
	23	2.21	1.90	0.243		34	3.19	2.51	0.361		16	2.61	2.50	0.124
	15	2.12	1.90	0.265		34	3.18	2.51	0.356		20	2.61	2.50	0.099
	13	2.00	1.90	0.139		64	3.91	2.51	0.395		21	2.63	2.50	0.112
Average:				**0.216**	**Average:**				**0.370**	**Average:**				**0.112**

Depth	Snow Water Equivalent		Depth	Snow Water Equivalent		Depth	Snow Water Equivalent	
[cm]	[mm]		[cm]	[mm]		[cm]	[mm]	
27	58.2		35	129.6		17	19.0	
28	60.4		35	129.6		16	17.9	
12	25.9		25	92.6		18	20.1	
14	30.2		25	92.6		17	19.0	
13	28.0		24	88.9		24	26.8	
14	30.2		20	74.1		26	29.0	
14	30.2		20	74.1		20	22.3	
14	30.2		35	129.6		20	22.3	
15	32.3		25	92.6		14	15.6	
28	60.4		45	166.7		22	24.6	
26	56.0		35	129.6		15	16.8	
27	58.2		27	100.0		11	12.3	
24	51.7		35	129.6		16	17.9	
25	53.9		36	133.3		20	22.3	
36	77.6		21	77.8		15	16.8	
27	58.2		15	55.6		21	23.5	
25	53.9		28	103.7		21	23.5	
17	36.6		38	140.8		17	19.0	
20	43.1		19	70.4		25	27.9	
13	28.0		30	111.1		20	22.3	
13	28.0		25	92.6		17	19.0	
14	30.2		15	55.6		14	15.6	
15	32.3		18	66.7		11	12.3	
13	28.0		28	103.7		10	11.2	
42	90.5		25	92.6		13	14.5	
27	58.2		21	77.8		17	19.0	
25	53.9		29	107.4		18	20.1	
32	69.0		24	88.9		20	22.3	
25	53.9		24	88.9		18	20.1	
34	73.3		19	70.4		23	25.7	
22.0	**47.4**	**Average**	**26.7**	**98.9**	**Average**	**17.9**	**20.0**	**Average**

Snow Course Survey Raw Data – Exposed Lowland Plots (2006-2007)

Location	EL-06-01		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
35.7	2.34	1.96	0.192
27.0	2.36	1.96	0.267
30.5	2.12	1.96	0.095
Average:			**0.185**

Depth	**Snow Water Equivalent**
[cm]	[mm]
32	59.1
23	42.5
29	53.6
40	73.9
35	64.6
31	57.3
46	85.0
40	73.9
44	81.3
39	72.0
39	72.0
45	83.1
38	70.2
41	75.7
39	72.0
43	79.4
50	92.3
45	83.1
39	72.0
39	72.0
51	94.2
48	88.7
33	60.9
34	62.8
35	64.6
35	64.6
33	60.9
41	75.7
37	68.3
39	72.0
38.8	**71.6** **Average**

Location	EL-06-02		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
38.0	2.46	1.96	0.237
26.5	2.28	1.96	0.218
38.0	2.56	1.96	0.285
Average:			**0.247**

Depth	**Snow Water Equivalent**
[cm]	[mm]
41	101.2
34	83.9
47	116.0
42	103.6
37	91.3
45	111.0
35	86.4
27	66.6
38	93.8
39	96.2
29	71.6
26	64.2
38	93.8
25	61.7
37	91.3
31	76.5
28	69.1
37	91.3
38	93.8
31	76.5
34	83.9
25	61.7
30	74.0
34	83.9
36	88.8
39	96.2
52	128.3
37	91.3
40	98.7
43	106.1
35.8	**88.4** **Average**

Location	EL-06-03		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
33.5	2.42	1.96	0.248
17.0	2.26	1.96	0.318
11.0	2.18	1.96	0.361
Average:			**0.309**

Depth	**Snow Water Equivalent**
[cm]	[mm]
9	27.8
14	43.3
5	15.5
13	40.2
11	34.0
29	89.6
39	120.5
57	176.2
43	132.9
46	142.2
47	145.2
39	120.5
36	111.3
39	120.5
41	126.7
25	77.3
27	83.4
23	71.1
28	86.5
17	52.5
20	61.8
26	80.3
14	43.3
10	30.9
11	34.0
14	43.3
18	55.6
8	24.7
10	30.9
11	34.0
24.3	**75.2** **Average**

Snow Course Survey Raw Data – Exposed Lowland Plots (2006-2007) (continued)

Location	EL-07-01		
Date:	04-May-07		(m)
Depth	Weight	Tare	Density
[cm]	[kg]	[kg]	[g/cm^3]
32	2.12	1.88	0.135
39	2.21	1.88	0.153
46	2.45	1.88	0.224
Average:			**0.171**

Depth	Snow Water Equivalent	
[cm]	[mm]	
34	58.0	
39	66.5	
36	61.4	
39	66.5	
46	78.4	
26	44.3	
32	54.6	
40	68.2	
46	78.4	
53	90.4	
40	68.2	
40	68.2	
36	61.4	
35	59.7	
36	61.4	
59	100.6	
31	52.9	
38	64.8	
41	69.9	
40	68.2	
26	44.3	
35	59.7	
45	76.7	
50	85.3	
51	87.0	
50	85.3	
34	58.0	
35	59.7	
45	76.7	
45	76.7	
40.1	**68.4**	**Average**

Location	EL-07-02		
Date:	28-Apr-07		(m)
Depth	Weight	Tare	Density
[cm]	[kg]	[kg]	[g/cm^3]
22	2.58	2.5	0.066
28	2.67	2.5	0.110
30	2.66	2.5	0.096
Average:			**0.090**

Depth	Snow Water Equivalent	
[cm]	[mm]	
21	19.0	
51	46.1	
23	20.8	
29	26.2	
51	46.1	
23	20.8	
36	32.6	
36	32.6	
39	35.3	
37	33.5	
41	37.1	
37	33.5	
34	30.8	
36	32.6	
48	43.4	
25	22.6	
38	34.4	
21	19.0	
50	45.2	
35	31.7	
37	33.5	
28	25.3	
39	35.3	
41	37.1	
43	38.9	
44	39.8	
41	37.1	
42	38.0	
48	43.4	
29	26.2	
36.8	**33.3**	**Average**

Location	EL-07-03		
Date:	28-Apr-07		(m)
Depth	Weight	Tare	Density
[cm]	[kg]	[kg]	[g/cm^3]
23	2.66	2.63	0.024
45	2.74	2.63	0.044
44	2.89	2.63	0.107
Average:			**0.058**

Depth	Snow Water Equivalent	
[cm]	[mm]	
17	9.9	
33	19.2	
32	18.6	
10	5.8	
12	7.0	
22	12.8	
1	0.6	
21	12.2	
17	9.9	
56	32.5	
15	8.7	
11	6.4	
15	8.7	
26	15.1	
36	20.9	
30	17.4	
32	18.6	
28	16.3	
5	2.9	
20	11.6	
7	4.1	
21	12.2	
18	10.5	
18	10.5	
21	12.2	
28	16.3	
25	14.5	
11	6.4	
44	25.6	
14	8.1	
21.5	**12.5**	**Average**

Snow Course Survey Raw Data – Sheltered Lowland Plots (2006-2007)

Location	SL-06-01		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
18.0	2.10	1.96	0.140
25.5	2.26	1.96	0.212
26.3	2.28	1.96	0.220
Average:			**0.191**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
23	43.9	
9	17.2	
25	47.7	
22	42.0	
26	49.6	
40	76.3	
31	59.1	
33	62.9	
35	66.8	
41	78.2	
45	85.8	
53	101.1	
62	118.3	
47	89.6	
66	125.9	
63	120.2	
35	66.8	
29	55.3	
17	32.4	
23	43.9	
16	30.5	
8	15.3	
7	13.4	
19	36.2	
13	24.8	
26	49.6	
18	34.3	
27	51.5	
17	32.4	
21	40.1	
29.9	**57.0**	**Average**

Location	SL-06-02		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
38.0	2.52	1.96	0.266
19.0	2.20	1.96	0.228
24.3	2.32	1.96	0.267
Average:			**0.254**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
40	101.5	
40	101.5	
49	124.3	
27	68.5	
40	101.5	
42	106.6	
40	101.5	
36	91.3	
43	109.1	
17	43.1	
12	30.4	
14	35.5	
13	33.0	
18	45.7	
26	66.0	
13	33.0	
31	78.7	
70	177.6	
62	157.3	
42	106.6	
30	76.1	
26	66.0	
48	121.8	
44	111.6	
13	33.0	
16	40.6	
28	71.0	
1	2.5	
19	48.2	
27	68.5	
30.9	**78.4**	**Average**

Location	SL-06-03		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
26.0	2.34	1.96	0.264
30.5	2.28	1.96	0.189
31.5	2.36	1.96	0.229
Average:			**0.227**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
23	52.3	
26	59.1	
27	61.4	
30	68.2	
26	59.1	
31	70.5	
13	29.6	
26	59.1	
29	65.9	
31	70.5	
28	63.7	
25	56.8	
25	56.8	
18	40.9	
16	36.4	
12	27.3	
19	43.2	
11	25.0	
14	31.8	
19	43.2	
21	47.8	
28	63.7	
22	50.0	
25	56.8	
24	54.6	
23	52.3	
25	56.8	
19	43.2	
16	36.4	
11	25.0	
22.1	**50.3**	**Average**

Snow Course Survey Raw Data – Sheltered Lowland Plots (2006-2007) (continued)

Location	SL-07-01		
Date:		04-May-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
22.0	1.97	1.87	0.082
56.0	2.37	1.87	0.161
66.0	2.66	1.87	0.216
Average:			**0.153**

Depth	**SWE**	
[cm]	[mm]	
41	62.7	
30	45.9	
20	30.6	
61	93.4	
26	39.8	
26	39.8	
40	61.2	
35	53.6	
31	47.4	
31	47.4	
34	52.0	
47	71.9	
40	61.2	
32	49.0	
36	55.1	
74	113.3	
111	169.9	
48	73.5	
51	78.1	
46	70.4	
35	53.6	
45	68.9	
26	39.8	
27	41.3	
22	33.7	
24	36.7	
48	73.5	
92	140.8	
81	124.0	
64	97.9	
44.1	**67.5**	**Average**

Location	SL-07-02		
Date:		05-May-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
24.0	2.01	1.83	0.133
42.0	1.96	1.83	0.056
27.5	2.12	1.83	0.190
Average:			**0.126**

Depth	**SWE**	
[cm]	[mm]	
53	67.0	
54	68.3	
36	45.5	
49	61.9	
60	75.8	
33	41.7	
51	64.5	
53	67.0	
42	53.1	
34	43.0	
48	60.7	
29	36.7	
44	55.6	
29	36.7	
33	41.7	
43	54.4	
35	44.2	
45	56.9	
48	60.7	
37	46.8	
50	63.2	
60	75.8	
38	48.0	
50	63.2	
45	56.9	
35	44.2	
20	25.3	
38	48.0	
19	24.0	
25	31.6	
41.2	**52.1**	**Average**

Location	SL-07-03		
Date:		02-May-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
45.0	2.27	1.94	0.132
21.0	2.01	1.94	0.058
27.0	2.01	1.94	0.045
Average:			**0.079**

Depth	**SWE**	
[cm]	[mm]	
34	26.7	
34	26.7	
25	19.6	
34	26.7	
36	28.3	
39	30.6	
33	25.9	
33	25.9	
35	27.5	
40	31.4	
39	30.6	
22	17.3	
25	19.6	
42	33.0	
26	20.4	
31	24.3	
23	18.1	
13	10.2	
20	15.7	
24	18.8	
25	19.6	
28	22.0	
30	23.6	
22	17.3	
54	42.4	
25	19.6	
24	18.8	
36	28.3	
36	28.3	
28	22.0	
30.5	**24.0**	**Average**

Snow Course Survey Raw Data – North Aspect Plots (2006-2007)

Location	NA-06-01		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
37.0	2.52	1.96	0.273
35.8	2.56	1.96	0.302
44.7	2.72	1.96	0.307
Average:			**0.294**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
40	117.6	
35	102.9	
31	91.2	
47	138.2	
36	105.9	
38	111.8	
43	126.5	
41	120.6	
39	114.7	
42	123.5	
50	147.1	
44	129.4	
40	117.6	
40	117.6	
40	117.6	
46	135.3	
36	105.9	
27	79.4	
43	126.5	
43	126.5	
55	161.8	
43	126.5	
54	158.8	
29	85.3	
35	102.9	
29	85.3	
41	120.6	
59	173.5	
42	123.5	
39	114.7	
40.9	**120.3**	**Average**

Location	NA-06-02		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
38.0	2.58	1.96	0.294
13.5	2.16	1.96	0.267
39.2	2.64	1.96	0.313
Average:			**0.292**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
50	145.8	
40	116.6	
72	209.9	
76	221.6	
66	192.4	
54	157.5	
38	110.8	
39	113.7	
22	64.1	
19	55.4	
19	55.4	
13	37.9	
20	58.3	
21	61.2	
15	43.7	
33	96.2	
63	183.7	
53	154.5	
33	96.2	
35	102.1	
42	122.5	
54	157.5	
70	204.1	
58	169.1	
69	201.2	
41	119.6	
37	107.9	
23	67.1	
36	105.0	
45	131.2	
41.9	**122.1**	**Average**

Location	NA-06-03		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
41.0	2.76	1.96	0.352
33.0	2.58	1.96	0.339
27.0	2.48	1.96	0.348
Average:			**0.346**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
68	235.4	
55	190.4	
55	190.4	
47	162.7	
52	180.0	
35	121.2	
50	173.1	
60	207.7	
35	121.2	
27	93.5	
27	93.5	
37	128.1	
48	166.2	
46	159.3	
35	121.2	
32	110.8	
32	110.8	
43	148.9	
47	162.7	
34	117.7	
47	162.7	
65	225.0	
52	180.0	
45	155.8	
70	242.4	
38	131.6	
34	117.7	
30	103.9	
22	76.2	
28	96.9	
43.2	**129.6**	**Average**

Snow Course Survey Raw Data – North Aspect Plots (2006-2007) (continued)

Location	NA-07-01		
Date:		04-May-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
25	1.97	1.73	0.173
27	1.94	1.73	0.140
16	1.96	1.73	0.259
Average:			**0.191**

Depth	**SWE**	
[cm]	[mm]	
20	38.2	
14	26.7	
31	59.2	
22	42.0	
23	43.9	
26	49.7	
48	91.7	
19	36.3	
23	43.9	
23	43.9	
22	42.0	
7	13.4	
23	43.9	
27	51.6	
39	74.5	
32	61.1	
10	19.1	
16	30.6	
19	36.3	
12	22.9	
42	80.2	
36	68.8	
39	74.5	
35	66.8	
42	80.2	
31	59.2	
18	34.4	
20	38.2	
21	40.1	
23	43.9	
25.4	**48.6**	**Average**

Location	NA-07-02		
Date:		02-May-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
25.5	2.04	1.79	0.177
14	1.93	1.79	0.180
20	1.90	1.79	0.099
Average:			**0.152**

Depth	**SWE**	
[cm]	[mm]	
56	85.2	
3	4.6	
24	36.5	
25	38.1	
48	73.1	
25	38.1	
15	22.8	
15	22.8	
2	3.0	
70	106.5	
51	77.6	
40	60.9	
30	45.7	
31	47.2	
24	36.5	
37	56.3	
21	32.0	
23	35.0	
12	18.3	
33	50.2	
44	67.0	
19	28.9	
25	38.1	
12	18.3	
27	41.1	
31	47.2	
29	44.1	
36	54.8	
14	21.3	
57	86.8	
29.3	**44.6**	**Average**

Location	NA-07-03		
Date:		28-Apr-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
49	3.32	2.49	0.306
56	3.34	2.49	0.274
79	3.46	2.49	0.222
Average:			**0.267**

Depth	**SWE**	
[cm]	[mm]	
54	144.2	
52	138.9	
35	93.5	
36	96.1	
37	98.8	
45	120.2	
51	136.2	
25	66.8	
67	178.9	
26	69.4	
52	138.9	
16	42.7	
42	112.2	
42	112.2	
44	117.5	
42	112.2	
43	114.8	
45	120.2	
37	98.8	
36	96.1	
49	130.8	
31	82.8	
44	117.5	
57	152.2	
35	93.5	
38	101.5	
19	50.7	
30	80.1	
40	106.8	
42	112.2	
40.4	**107.9**	**Average**

Snow Course Survey Raw Data – East Aspect Plots (2006-2007)

Location	EA-06-01		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
12.0	2.18	1.96	0.331
32.0	2.42	1.96	0.259
20.5	2.24	1.96	0.246
Average:			**0.279**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
30	83.7	
23	64.1	
28	78.1	
37	103.2	
29	80.9	
30	83.7	
44	122.7	
38	106.0	
24	66.9	
21	58.6	
15	41.8	
17	47.4	
14	39.0	
15	41.8	
9	25.1	
22	61.4	
17	47.4	
26	72.5	
22	61.4	
17	47.4	
34	94.8	
16	44.6	
11	30.7	
35	97.6	
32	89.2	
19	53.0	
20	55.8	
4	11.2	
10	27.9	
27	75.3	
22.9	**63.8**	**Average**

Location	EA-06-02		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
28.0	2.22	1.96	0.168
27.0	2.30	1.96	0.227
17.5	2.20	1.96	0.247
Average:			**0.214**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
31	66.4	
20	42.8	
42	89.9	
20	42.8	
24	51.4	
13	27.8	
11	23.5	
20	42.8	
34	72.8	
44	94.2	
41	87.8	
58	124.2	
73	156.3	
58	124.2	
47	100.6	
40	85.6	
22	47.1	
25	53.5	
12	25.7	
20	42.8	
19	40.7	
26	55.7	
27	57.8	
31	66.4	
27	57.8	
41	87.8	
29	62.1	
38	81.4	
19	40.7	
21	45.0	
31.1	**66.6**	**Average**

Location	EA-06-03		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
28.0	2.32	1.96	0.232
9.0	2.14	1.96	0.361
13.0	2.24	1.96	0.389
Average:			**0.327**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
8	26.2	
30	98.2	
18	58.9	
21	68.7	
36	117.8	
60	196.3	
40	130.9	
35	114.5	
30	98.2	
29	94.9	
26	85.1	
21	68.7	
22	72.0	
17	55.6	
6	19.6	
5	16.4	
5	16.4	
11	36.0	
7	22.9	
10	32.7	
21	68.7	
19	62.2	
8	26.2	
22	72.0	
27	88.3	
27	88.3	
47	153.8	
26	85.1	
23	75.3	
24	78.5	
22.7	**74.3**	**Average**

Snow Course Survey Raw Data – East Aspect Plots (2006-2007) **(continued)**

Location	EA-07-01		
Date:		04-May-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
26	2.02	1.85	0.118
29.5	1.99	1.85	0.086
18	1.93	1.85	0.080
Average:			**0.095**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
41	38.8	
22	20.8	
18	17.0	
19	18.0	
30	28.4	
27	25.5	
14	13.2	
26	24.6	
11	10.4	
30	28.4	
29	27.4	
33	31.2	
35	33.1	
25	23.7	
17	16.1	
28	26.5	
20	18.9	
25	23.7	
21	19.9	
26	24.6	
26	24.6	
34	32.2	
20	18.9	
31	29.3	
40	37.8	
36	34.1	
37	35.0	
24	22.7	
19	18.0	
25	23.7	
26.3	**24.9**	**Average**

Location	EA-07-02		
Date:		28-Apr-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
45	2.98	2.56	0.168
47	2.88	2.56	0.123
54	3.003	2.56	0.148
Average:			**0.146**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
35	51.3	
27	39.5	
38	55.6	
57	83.5	
63	92.3	
54	79.1	
56	82.0	
44	64.4	
25	36.6	
60	87.9	
54	79.1	
76	111.3	
73	106.9	
52	76.1	
45	65.9	
47	68.8	
56	82.0	
35	51.3	
40	58.6	
54	79.1	
56	82.0	
60	87.9	
72	105.4	
54	79.1	
93	136.2	
28	41.0	
88	128.9	
80	117.1	
109	159.6	
79	115.7	
57.0	**83.5**	**Average**

Location	EA-07-3		
Date:		04-May-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
22	1.98	1.87	0.090
42	2.22	1.87	0.150
45	2.26	1.87	0.156
Average:			**0.132**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
35	46.3	
40	52.9	
37	49.0	
40	52.9	
45	59.5	
15	19.8	
12	15.9	
33	43.7	
39	51.6	
10	13.2	
15	19.8	
45	59.5	
48	63.5	
35	46.3	
35	46.3	
36	47.6	
19	25.1	
34	45.0	
21	27.8	
33	43.7	
35	46.3	
15	19.8	
20	26.5	
24	31.8	
34	45.0	
40	52.9	
31	41.0	
44	58.2	
25	33.1	
56	74.1	
31.7	**41.9**	**Average**

Snow Course Survey Raw Data – South Aspect Plots (2006-2007)

Location	SA-06-01		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
38.0	2.52	1.96	0.266
19.0	2.20	1.96	0.228
24.3	2.32	1.96	0.267
Average:			**0.254**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
21	53.3	
16	40.6	
24	60.9	
16	40.6	
26	66.0	
18	45.7	
26	66.0	
14	35.5	
26	66.0	
9	22.8	
27	68.5	
28	71.0	
11	27.9	
31	78.7	
39	99.0	
39	99.0	
45	114.2	
57	144.6	
43	109.1	
58	147.2	
64	162.4	
68	172.5	
19	48.2	
23	58.4	
31	78.7	
16	40.6	
14	35.5	
19	48.2	
20	50.7	
19	48.2	
28.9	**73.3**	**Average**

Location	SA-06-02		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
7.00	2.06	1.96	0.258
12.0	2.12	1.96	0.241
19.0	2.22	1.96	0.247
Average:			**0.248**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
8	19.9	
1	2.5	
6	14.9	
11	27.3	
11	27.3	
19	47.2	
7	17.4	
11	27.3	
6	14.9	
17	42.2	
29	72.0	
8	19.9	
19	47.2	
7	17.4	
15	37.3	
6	14.9	
2	5.0	
11	27.3	
6	14.9	
4	9.9	
13	32.3	
13	32.3	
9	22.4	
7	17.4	
4	9.9	
6	14.9	
11	27.3	
4	9.9	
9	22.4	
13	32.3	
9.8	**24.3**	**Average**

Location	SA-06-03		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
18.5	2.18	1.96	0.215
38.5	2.62	1.96	0.309
25.0	2.46	1.96	0.361
Average:			**0.295**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
27	79.6	
19	56.0	
18	53.1	
31	91.4	
21	61.9	
44	129.8	
19	56.0	
13	38.3	
7	20.6	
27	79.6	
22	64.9	
32	94.4	
0	0.0	
44	129.8	
47	138.6	
53	156.3	
63	185.8	
47	138.6	
44	129.8	
14	41.3	
19	56.0	
13	38.3	
5	14.7	
7	20.6	
43	126.8	
45	132.7	
76	224.2	
46	135.7	
54	159.3	
49	144.5	
31.6	**93.3**	**Average**

Snow Course Survey Raw Data – South Aspect Plots (2006-2007) (continued)

Location	SA-07-01		
Date:		04-May-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
35	2.34	1.90	0.227
30	2.01	1.90	0.066
25	1.99	1.90	0.065
Average:			**0.119**

Depth	**SWE**	
[cm]	[mm]	
41	48.9	
38	45.3	
48	57.3	
38	45.3	
30	35.8	
34	40.6	
40	47.7	
32	38.2	
21	25.1	
22	26.3	
29	34.6	
43	51.3	
41	48.9	
36	43.0	
43	51.3	
43	51.3	
39	46.5	
32	38.2	
32	38.2	
32	38.2	
45	53.7	
31	37.0	
13	15.5	
23	27.4	
16	19.1	
31	37.0	
46	54.9	
48	57.3	
37	44.2	
45	53.7	
35.0	**41.7**	**Average**

Location	SA-07-02		
Date:		28-Apr-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
30	2.76	2.48	0.168
29	2.66	2.48	0.112
48	2.76	2.48	0.105
Average:			**0.129**

Depth	**SWE**	
[cm]	[mm]	
7	9.0	
27	34.7	
74	95.1	
26	33.4	
23	29.6	
39	50.1	
21	27.0	
13	16.7	
1	1.3	
3	3.9	
18	23.1	
18	23.1	
13	16.7	
27	34.7	
38	48.9	
28	36.0	
4	5.1	
14	18.0	
18	23.1	
48	61.7	
38	48.9	
29	37.3	
33	42.4	
24	30.9	
14	18.0	
51	65.6	
25	32.1	
18	23.1	
12	15.4	
19	24.4	
24.1	**31.0**	**Average**

Location	SA-07-03		
Date:		04-May-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
25	1.90	1.82	0.058
36	2.33	1.82	0.256
30	2.21	1.82	0.235
Average:			**0.183**

Depth	**SWE**	
[cm]	[mm]	
24	43.8	
13	23.7	
4	7.3	
48	87.7	
48	87.7	
43	78.5	
11	20.1	
9	16.4	
20	36.5	
11	20.1	
4	7.3	
2	3.7	
17	31.1	
44	80.4	
31	56.6	
105	191.8	
2	3.7	
22	40.2	
57	104.1	
70	127.9	
30	54.8	
30	54.8	
9	16.4	
15	27.4	
16	29.2	
77	140.6	
44	80.4	
9	16.4	
19	34.7	
13	23.7	
28.2	**51.6**	**Average**

Snow Course Survey Raw Data – West Aspect Plots (2006-2007)

Location	WA-06-01		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
18.0	2.16	1.96	0.200
16.7	2.18	1.96	0.238
16.0	2.12	1.96	0.180
Average:			**0.280**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
27	55.7	
29	59.8	
30	61.9	
37	76.3	
10	20.6	
9	18.6	
7	14.4	
6	12.4	
10	20.6	
7	14.4	
14	28.9	
20	41.2	
17	35.1	
17	35.1	
11	22.7	
10	20.6	
20	41.2	
7	14.4	
16	33.0	
25	51.6	
21	43.3	
18	37.1	
32	66.0	
23	47.4	
25	51.6	
15	30.9	
24	49.5	
14	28.9	
2	4.1	
1	2.1	
16.8	**34.6**	**Average**

Location	WA-06-02		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
77.0	3.24	1.96	0.300
30.0	2.44	1.96	0.289
26.5	2.48	1.96	0.354
Average:			**0.250**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
36	113.1	
34	106.8	
23	72.3	
14	44.0	
35	110.0	
76	238.8	
73	229.4	
55	172.8	
46	144.6	
38	119.4	
30	94.3	
34	106.8	
36	113.1	
33	103.7	
49	154.0	
74	232.5	
71	223.1	
90	282.8	
28	88.0	
7	22.0	
26	81.7	
37	116.3	
55	172.8	
66	207.4	
83	260.8	
73	229.4	
72	226.3	
40	125.7	
20	62.9	
20	62.9	
45.8	**143.9**	**Average**

Location	WA-05-03		
Date:	01-May-06		
Density			
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
85.5	3.36	1.96	0.295
28.0	2.28	1.96	0.206
18.0	2.26	1.96	0.301
Average:			**0.244**

Depth	**Snow Water Equivalent**	
[cm]	[mm]	
88	235.4	
38	101.6	
15	40.1	
14	37.4	
24	64.2	
32	85.6	
37	99.0	
21	56.2	
26	69.5	
41	109.7	
56	149.8	
88	235.4	
59	157.8	
56	149.8	
88	235.4	
36	96.3	
27	72.2	
33	88.3	
20	53.5	
13	34.8	
22	58.8	
27	72.2	
16	42.8	
13	34.8	
26	69.5	
41	109.7	
63	168.5	
93	248.8	
32	85.6	
28	74.9	
39.1	**104.6**	**Average**

Snow Course Survey Raw Data – West Aspect Plots (2006-2007) **(continued)**

Location	WA-07-01		
Date:		29-Apr-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
14	1.91	1.82	0.116
25	2.03	1.82	0.152
18	1.96	1.82	0.140
Average:			**0.136**

Depth	**SWE**	
[cm]	[mm]	
24	32.6	
17	23.1	
21	28.6	
30	40.8	
34	46.2	
29	39.4	
14	19.0	
36	49.0	
18	24.5	
20	27.2	
35	47.6	
43	58.5	
36	49.0	
33	44.9	
14	19.0	
12	16.3	
22	29.9	
16	21.8	
20	27.2	
45	61.2	
34	46.2	
44	59.8	
31	42.2	
57	77.5	
48	65.3	
20	27.2	
36	49.0	
29	39.4	
32	43.5	
42	57.1	
29.7	**40.4**	**Average**

Location	WA-07-02		
Date:		28-Apr-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
29	2.69	2.47	0.137
40	2.98	2.47	0.230
35	2.77	2.47	0.155
Average:			**0.174**

Depth	**SWE**	
[cm]	[mm]	
34	59.1	
46	80.0	
62	107.8	
83	144.3	
31	53.9	
16	27.8	
49	85.2	
34	59.1	
66	114.8	
42	73.0	
16	27.8	
16	27.8	
48	83.5	
24	41.7	
16	27.8	
20	34.8	
8	13.9	
24	41.7	
82	142.6	
66	114.8	
16	27.8	
69	120.0	
37	64.3	
20	34.8	
44	76.5	
73	126.9	
58	100.8	
71	123.5	
75	130.4	
105	182.6	
45.0	**78.3**	**Average**

Location	WA-07-03		
Date:		28-Apr-07	(m)
Depth	**Weight**	**Tare**	**Density**
[cm]	[kg]	[kg]	[g/cm^3]
80	3.006	2.49	0.116
79	3.48	2.49	0.226
72	3.35	2.49	0.216
Average:			**0.186**

Depth	**SWE**	
[cm]	[mm]	
111	206.5	
112	208.3	
114	212.1	
100	186.0	
57	106.0	
54	100.4	
56	104.2	
65	120.9	
77	143.2	
114	212.1	
112	208.3	
121	225.1	
102	189.7	
87	161.8	
59	109.8	
120	223.2	
120	223.2	
121	225.1	
50	93.0	
38	70.7	
40	74.4	
47	87.4	
36	67.0	
44	81.8	
39	72.5	
64	119.1	
53	98.6	
67	124.6	
110	204.6	
130	241.8	
80.7	**150.1**	**Average**

APPENDIX B

WATER QUALITY

APPENDIX B1

WATER QUALITY GUIDELINES, TROPHIC CLASSIFICATION, AND PHYSICO-CHEMICAL CLASSIFICATION

B1.0 WATER QUALITY GUIDELINES, TROPHIC CLASSIFICATIONS, AND PHYSICO-CHEMICAL CLASSIFICATIONS

The following descriptions are provided to give a brief explanation of the water quality guidelines used and the toxicity modifying factors (i.e., pH, temperature, hardness), when applicable, as well as the trophic status and physico-chemical classifications for lakes.

B1.1 WATER QUALITY GUIDELINES

B1.1.1 Aluminum

The freshwater CWQG for aluminum is dependent on the pH of the waterbody as follows (CCME 1999, 2007a):

- 5.0 micrograms per litre (µg/L) for waters with pH < 6.5; and
- 100 µg/L for waters with pH ≥ 6.5.

B1.1.2 Ammonia

The freshwater CWQGs for ammonia are dependent on water temperature and pH (Table B1-1). Ammonia is highly soluble in water, and these two environmental parameters affect whether it is present in an un-ionized (NH_3) or ionized (NH_4^+) form (CCME 1999, 2007a). The speciation of ammonia is important, as the un-ionized form is more toxic to aquatic life than the ionized form due to its ability to diffuse across biological membranes more easily (CCME 1999). An increase of one pH unit can cause un-ionized ammonia concentrations to increase nearly ten-fold; a 5°C temperature increase can cause a 40 to 50% increase in un-ionized ammonia (CCME 1999). The term 'total ammonia' is the sum of NH_3 and NH_4^+. CWQGs for total ammonia were as follows:

Table B1-1 Canadian Water Quality Guidelines for Total Ammonia

pH	Water Temperature (°C)	CWQG – Ammonia (mg N/L)	CWQG Application
6.0	5	122.4	temperature 3 to 7°C; pH 5.3 to 6.2
	10	81.6	temperature 8 to 12°C; pH 5.3 to 6.2
	15	55.8	temperature 13 to 17°C; pH 5.3 to 6.2
6.5	5	38.6	temperature 3 to 7°C; pH 6.3 to 6.7
	10	25.9	temperature 8 to 12°C; pH 6.3 to 6.7
	15	17.6	temperature 13 to 17°C; pH 6.3 to 6.7
7.0	5	12.4	temperature 3 to 7°C; pH 6.8 to 7.2
	10	8.2	temperature 8 to 12°C; pH 6.8 to 7.2
	15	5.6	temperature 13 to 17°C; pH 6.8 to 7.2
7.5	5	3.9	temperature 3 to 7°C; pH 7.3 to 7.7
	10	2.6	temperature 8 to 12°C; pH 7.3 to 7.7
	15	1.8	temperature 13 to 17°C; pH 7.3 to 7.7
8.0	5	1.2	temperature 3 to 7°C; pH 7.8 to 8.2
	10	0.8	temperature 8 to 12°C; pH 7.8 to 8.2
	15	0.6	temperature 13 to 17°C; pH 7.8 to 8.2
8.5	5	0.4	temperature 3 to 7°C; pH 8.3 to 8.7
	10	0.3	temperature 8 to 12°C; pH 8.3 to 8.7
	15	0.2	temperature 13 to 17°C; pH 8.3 to 8.7

Notes: CWQG = Canadian Water Quality Guideline; °C = degrees Celsius; mg/L = milligrams per litre.
Source: CCME 1999.

B1.1.3 Cadmium

The freshwater CWQG for cadmium is dependent on water hardness. Site specific guidelines can be calculated by the following formula:

$$\text{CWQG cadmium} = 10^{\{0.86[\log(\text{hardness})]-3.2\}}$$

where the CWQG is measured in µg/L and hardness is measured as calcium carbonate ($CaCO_3$) equivalents in mg/L (CCME 1999, 2007a) (Table B1-2).

Table B1-2 Hardness-Adjusted Total Cadmium Guidelines

Total Hardness (mg $CaCO_3$/L)	CWQG Total Cadmium (µg/L)	Total Hardness (mg $CaCO_3$/L)	CWQG Total Cadmium (µg/L)
5.0 to 7.3	0.003	87.5 to 90.8	0.030
7.4 to 9.8	0.004	90.9 to 94.3	0.031
9.9 to 12.4	0.005	94.4 to 97.8	0.032
12.5 to 15.0	0.006	97.9 to 101.3	0.033
15.1 to 17.7	0.007	101.4 to 104.8	0.034
17.8 to 20.5	0.008	104.9 to 108.4	0.035
20.6 to 23.4	0.009	109.3 to 111.9	0.036
23.5 to 26.3	0.010	112.0 to 115.5	0.037
26.4 to 29.2	0.011	115.6 to 119.1	0.038
29.3 to 32.2	0.012	119.2 to 122.7	0.039
32.3 to 35.2	0.013	122.8 to 126.3	0.040
35.3 to 38.2	0.014	126.4 to 130.0	0.041
38.3 to 41.3	0.015	131.1 to 133.6	0.042
41.4 to 44.4	0.016	133.7 to 137.3	0.043
44.5 to 47.6	0.017	137.4 to 141.0	0.044
47.7 to 50.8	0.018	141.1 to 144.7	0.045
50.9 to 54.0	0.019	144.8 to 148.4	0.046
54.1 to 57.2	0.020	148.5 to 152.1	0.047
57.3 to 60.5	0.021	152.2 to 155.8	0.048
60.6 to 63.8	0.022	155.9 to 159.5	0.049
63.9 to 67.1	0.023	159.6 to 163.3	0.050
67.2 to 70.4	0.024	163.4 to 167.1	0.051
70.5 to 73.8	0.025	167.2 to 170.9	0.052
73.9 to 77.1	0.026	171.0 to 174.6	0.053
77.2 to 80.5	0.027	175.0 to 178.4	0.054
80.6 to 83.9	0.028	178.5 to 182.3	0.055
84.0 to 87.4	0.029	182.4 to 186.1	0.056

Notes: $CaCO_3$ = Calcium Carbonate; CWQG = Canadian Water Quality Guideline; mg/L = milligrams per litre; µg/L = micrograms per litre

The marine CWQG for total cadmium is 0.12 µg/L (CCME 2007a). Site specific guidelines are not calculated for marine systems.

B1.1.4 Chromium

The CWQGs for chromium are based on oxidation states, with trivalent (Cr[III]) being the most stable and hexavalent (Cr[VI]) being strongly oxidizing (CCME 1999). Cr(VI) is very soluble and mobile, with potentially long residence times in surface water and aerobic soils. Cr(VI) is generally more toxic than Cr(III) because of its high oxidizing potential, high solubility, and ease at which it can permeate biological membranes. In addition, up to 60% of chromium in surface waters can exist in the Cr(VI) state. Cr(III) is less toxic in comparison to Cr(VI) because it forms highly insoluble compounds that have a tendency to adsorb to surfaces (CCME 1999).

In addition, total chromium includes particulate chromium because the samples are not filtered. This can be problematic, particularly in spring when erosion and turbidity are high, as chromium measurements may exceed guidelines, but biota do not suffer any adverse effects (CCME 1999).

The following guidelines were used for assessing total chromium concentrations:

- 1.0 µg/L for sublethal toxicity effects (CCME 2007a); and
- 16 µg/L for acute toxicity effects (USEPA 2008).

B1.1.5 Copper

The CWQGs for copper are dependent on water hardness (measured as $CaCO_3$) as follows (Table B1-3) (CCME 1999, 2007a):

Table B1-3 Canadian Water Quality Guidelines for Copper

Water Hardness (mg $CaCO_3$/L)	CWQG – Copper (µg/L)
<120	2
120 to 180	3
>180	4

Notes: CWQG = Canadian Water Quality Guideline; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; µg/L = micrograms per litre. Source: CCME 1999.

B1.1.6 Lead

The CWQGs for lead are dependent on water hardness (measured as $CaCO_3$) as follows (Table B1-4) (CCME 1999, 2007a):

Table B1-4 Canadian Water Quality Guidelines for Lead

Water Hardness (mg $CaCO_3$/L)	CWQG – Lead (µg/L)
0 to 60	1
60 to 120	2
120 to 180	4
>180	7

Notes: CWQG = Canadian Water Quality Guideline; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; µg/L = micrograms per litre. Source: CCME 1999.

B1.1.7 Nickel

The CWQGs for nickel are dependant on water hardness (measured as $CaCO_3$) as follows (Table B1-5) (CCME 1999, 2007a):

Table B1-5 Canadian Water Quality Guidelines for Nickel

Water Hardness (mg $CaCO_3$/L)	CWQG – Nickel (µg/L)
0 to 60	25
60 to 120	65
120 to 180	110
>180	150

Notes: CWQG = Canadian Water Quality Guideline; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; µg/L = micrograms per litre. Source: CCME 1999.

B1.1.8 Zinc

Both sublethal and acute guidelines for zinc were compared to existing concentrations in waterbodies within the Project area. For sublethal toxicity, the CWQG of 30 µg/L (CCME 2007a) was used. While this guideline is conservative, it does not take into account water hardness. Therefore, the USEPA (2008) guideline, which is adjusted for water hardness, was included for acute toxicity. Zinc concentrations were adjusted for water hardness based on the following equation:

$$\text{WQG total zinc} = \exp\{0.8473*[\ln(\text{hardness})]+0.884\}$$

Acute toxicity values for ranges of water hardness found in the waterbodies within the Project Area are summarized in (Table B1-6).

Table B1-6 Hardness-Adjusted Total Zinc Acute Toxicity Guidelines

Total Hardness (mg $CaCO_3$/L)	WQG - Total Zinc (µg/L)	Total Hardness (mg $CaCO_3$/L)	WQG - Total Zinc (µg/L)	Total Hardness (mg $CaCO_3$/L)	WQG - Total Zinc (µg/L)	Total Hardness (mg $CaCO_3$/L)	WQG - Total Zinc (µg/L)
7.0 to 7.5	13	43.8 to 44.5	60	87.0 to 88.0	107	134.0 to 134.9	154
7.6 to 8.2	14	44.6 to 45.4	61	88.1 to 88.9	108	135.0 to 135.9	155
8.3 to 8.9	15	45.5 to 46.3	62	88.9 to 89.8	109	136.0 to 137.0	156
9.0 to 9.5	16	46.4 to 47.2	63	89.9 to 90.8	110	137.1 to 138.0	157
9.6 to 10.2	17	47.3 to 48.1	64	90.9 to 91.8	111	138.1 to 139.0	158
10.3 to 10.9	18	48.2 to 48.9	65	91.9 to 92.7	112	139.1 to 140.1	159
11.0 to 11.6	19	49.0 to 49.8	66	92.8 to 93.7	113	140.2 to 141.1	160
11.7 to 12.4	20	49.9 to 50.7	67	93.8 to 94.7	114	141.2 to 142.1	161
12.5 to 13.1	21	50.8 to 51.6	68	94.8 to 95.7	115	142.2 to 143.2	162
13.2 to 13.8	22	51.7 to 52.5	69	95.8 to 96.6	116	143.3 to 144.2	163
13.9 to 14.5	23	52.6 to 53.4	70	96.7 to 97.6	117	144.3 to 145.3	164
14.6 to 15.3	24	53.5 to 54.3	71	97.7 to 98.6	118	145.4 to 146.4	165
15.4 to 16.0	25	54.4 to 55.2	72	98.7 to 99.6	119	146.4 to 147.3	166
16.1 to 16.8	26	55.3 to 56.1	73	99.7 to 100.6	120	147.4 to 148.4	167
16.9 to 17.5	27	56.2 to 57.0	74	100.7 to 101.6	121	148.5 to 149.4	168
17.6 to 18.3	28	57.1 to 57.9	75	101.7 to 102.5	122	149.5 to 150.5	169
18.4 to 19.0	29	58.0 to 58.8	76	102.6 to 103.5	123	150.6 to 151.5	170
19.1 to 19.8	30	58.9 to 59.7	77	103.6 to 104.5	124	151.6 to 152.6	171
19.9 to 20.6	31	59.8 to 60.6	78	104.6 to 105.5	125	152.7 to 153.6	172
20.7 to 21.4	32	60.7 to 61.5	79	105.6 to 106.5	126	153.7 to 154.7	173
21.5 to 22.1	33	61.6 to 62.4	80	106.6 to 107.5	127	154.8 to 155.7	174
22.2 to 22.9	34	62.5 to 63.4	81	107.6 to 108.5	128	155.8 to 156.8	175
23.0 to 23.7	35	63.5 to 64.3	82	108.6 to 109.5	129	156.9 to 157.9	176
23.8 to 24.5	36	64.4 to 65.2	83	109.6 to 110.5	130	158.0 to 158.9	177
24.6 to 25.3	37	65.3 to 66.1	84	110.6 to 111.5	131	159.0 to 160.0	178
25.4 to 26.1	38	66.2 to 67.1	85	111.6 to 112.5	132	160.1 to 161.0	179
26.2 to 26.9	39	67.2 to 68.0	86	112.6 to 113.5	133	161.1 to 162.1	180
27.0 to 27.7	40	68.1 to 68.9	87	113.6 to 114.5	134	162.2 to 163.2	181
27.8 to 28.5	41	69.0 to 69.8	88	114.6 to 115.5	135	163.3 to 164.2	182
28.6 to 29.3	42	69.9 to 70.8	89	115.6 to 116.5	136	164.3 to 165.3	183
29.4 to 30.2	43	70.9 to 71.7	90	116.6 to 117.5	137	165.4 to 166.3	184
30.3 to 31.0	44	71.8 to 72.6	91	117.6 to 118.6	138	166.4 to 167.4	185
31.1 to 31.8	45	72.7 to 73.6	92	119.7 to 119.6	139	167.5 to 168.5	186
31.9 to 32.6	46	73.7 to 74.5	93	119.7 to 120.6	140	168.6 to 169.5	187
32.7 to 33.5	47	74.6 to 75.4	94	120.7 to 121.6	141	169.6 to 170.6	188
33.6 to 34.3	48	75.5 to 76.4	95	121.7 to 122.6	142	170.7 to 171.7	189
34.4 to 35.1	49	76.5 to 77.4	96	122.7 to 123.6	143	171.8 to 172.7	190
35.2 to 36.0	50	77.5 to 78.3	97	123.7 to 124.6	144	172.8 to 173.8	191
36.1 to 36.8	51	78.4 to 79.3	98	124.7 to 125.7	145	173.9 to 174.9	192
36.9 to 37.7	52	79.4 to 80.2	99	125.8 to 126.7	146	175.0 to 176.0	193
37.8 to 38.5	53	80.3 to 81.2	100	126.8 to 127.7	147	176.1 to 177.0	194
38.6 to 39.4	54	81.3 to 82.1	101	127.8 to 128.7	148	177.1 to 178.1	195
39.5 to 40.2	55	82.2 to 83.1	102	128.8 to 129.9	149	178.2 to 179.2	196
40.3 to 41.1	56	83.2 to 84.0	103	129.9 to 130.8	150	179.3 to 180.3	197
41.2 to 41.9	57	84.1 to 85.0	104	130.9 to 131.8	151	180.4 to 181.3	198
42.0 to 42.8	58	85.1 to 86.0	105	131.9 to 132.8	152	181.4 to 182.4	199
42.9 to 43.7	59	86.1 to 86.9	106	132.9 to 133.9	153	182.5 to 183.5	200

B1.2 TROPHIC STATUS CLASSIFICATION

Nutrient concentrations (i.e., phosphorus, nitrogen) and productivity (e.g., Chl *a*) can be used to classify lakes into trophic categories. Classifying lakes based on trophic status is useful for assessing potential effects resulting from nutrient loading.

At present, there are no CWQGs for total phosphorus. There are also no CWQGs for total phosphorus toxicity. CCME suggests the following series of Trigger Ranges for the prevention of eutrophication (Table B1-7), but not toxicity (CCME 2004):

Table B1-7 Canadian Council of Ministers for the Environment Trigger Ranges for Phosphorus

Productivity	Total Phosphorus Trigger Ranges (µg/L)
ultra-oligotrophic	<4
oligotrophic	4 to 10
mesotrophic	10 to 20
meso-eutrophic	20 to 35
eutrophic	35 to 100
hyper-eutrophic	>100

Notes: µg/L = micrograms per litre. Source: CCME 2004

There are no guidelines for Chl *a* because this is a measure of algal productivity within the water column and is not related to toxicity. The Organisation for Economic Co-operation and Development (OECD) developed a classification system based on a worldwide study of lake fertility (Mitchell and Prepas 1990). The OECD trophic classification system is based on the following maximum Chl *a* concentrations (Table B1-8):

Table B1-8 OECD Productivity Classification System based on Maximum Chlorophyll *a* Concentrations

Productivity	Chlorophyll *a* (µg/L)
oligotrophic	<8
oligo-mesotrophic	occasionally over 8
mesotrophic	8 to 25
eutrophic	26 to 75
hyper-eutrophic	>75

Notes: µg/L = micrograms per litre. Source: Mitchell and Prepas 1990.

In marine systems, nitrogen is often the limiting nutrient rather than phosphorus, which is typically the limiting nutrient in freshwater systems (CCME 2007b). Phosphorus may be limiting in marine environments during periods of high freshwater flows, but these effects are temporary (CCME 2007b).

A similar approach to classifying marine trophic status is based on the Trophic Index for Marine Systems (TRIX) (CCME 2007b). While there are other marine classification systems (e.g., National Oceanographic and Atmospheric Administration Index, OSPAR Comprehensive Procedure Index), the TRIX has been applied to the Project because of its similarity to the freshwater classification system. TRIX is based on the following criteria (Table B1-9):

Table B1-9 Trophic Index for Marine Systems based on Total Nitrogen, Total Phosphorus, Chlorophyll *a,* and Secchi Depth

Trophic Status	Total Nitrogen (mg/m^3)	Total Phosphorus (mg/m^3)	Chlorophyll *a* (µg/L)	Secchi Depth (m)
Oligotrophic	<260	<10	<1	>6
Mesotrophic	≥260 to 350	≥10 to 30	≥1 to 3	3 to ≤6
Eutrophic	≥350 to 400	≥30 to 40	≥3 to 5	1.5 to ≤3
Hyper-eutrophic	>400	>40	>5	<1.5

mg/m^3= milligrams per cubic metre; µg/L = micrograms per litre; m = metre; > = greater than; ≥ = greater than or equal to; < = less than; ≤ = less than or equal to. Source: CCME 2007b

B1.3 PHYSICO-CHEMICAL CLASSIFICATION

B1.3.1 Salinity

The analysis of total dissolved solids (TDS) is used to provide a measure of the total major ion content of water, which is indicative of salinity. Salinity was assessed on the following scale (Table B1-10) (Mitchell and Prepas 1990):

Table B1-10 Salinity Classification Based Total Dissolved Solids Concentration

Salinity Classification	Total Dissolved Solids (mg/L)
fresh	<500
slightly saline	500 to 1000
moderately saline	1000 to 5000
saline	>5000

Notes: mg/L = milligrams per litre; < = less than; > = greater than. Source: Mitchell and Prepas 1990.

B1.3.2 Water Hardness

Water hardness is primary caused by the presence of calcium and magnesium salts in water, although other polyvalent ions can contribute to total hardness. Water hardness was assessed on the following scale (Table B1-11) (Weiner 2000):

Table B1-11 Calcium Carbonate Water Hardness Classification

Water Hardness Classification	Calcium Carbonate (mg $CaCO_3$/L)
soft	<75
moderately hard	75 to 120
hard	120 to 200
very hard	>200

Notes: $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; < = less than; > = greater than.
Source: Weiner 2000.

B1.3.3 Acid Neutralizing Capacity

Total alkalinity is a common measure of the acid neutralizing capacity of water. As such, it can be used to provide an indication of the sensitivity of a waterbody to acid deposition. According to Saffran and Trew (1996), acid sensitivity ranges of lakes are based on total alkalinity measured as $CaCO_3$; however, these sensitivity ranges are based solely on lentic data (standing waters), and there is no information for lotic (flowing) waters. Acid sensitivity ranges of lakes are defined as follows (Table B1-12):

Table B1-12 Acid Neutralizing Capacity based on Calcium Carbonate Alkalinity

Acid Neutralizing Capacity	Alkalinity (mg $CaCO_3$/L)
high acid sensitivity	<10
moderate acid sensitivity	11 to 20
low acid sensitivity	21 to 40
negligible acid sensitivity	>40

Notes: $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; < = less than; > = greater than.
Source: Saffran and Trew 1996.

APPENDIX B2
QUALITY ASSURANCE / QUALITY CONTROL

Appendix B2 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance/quality control (QA/QC) procedures and requirements are an important aspect of any field or laboratory testing program. The objective of good QA/QC practices is having appropriate methodology in place so that field sampling, data entry, data analysis, and report preparation produce technically sound and scientifically defensible results.

B2.1 QA/QC METHODS

Detailed specific work instructions (SWIs) outlining each field task were provided to the field personnel prior to the field program. Samples were collected by experienced personnel and were labelled, preserved, and shipped according to Golder's Technical Procedures 8.23-0: *Basic Limnology and Bathymetric Procedures* and 8.3-1: *Surface Water Sampling Methods* (unpublished file information). Additionally, the calibration and routine testing of all field equipment (i.e., water meter) was regularly conducted according to the manufacturer's recommendations.

In addition, detailed field notes were recorded in pencil in waterproof field notebooks. Field data were checked at the end of each day for completeness and accuracy. Chain-of-Custody (COC) forms were used to track all sample shipments from the field to the applicable analytical laboratory.

Blank and duplicate samples were included as part of the water quality QA/QC for lakes and rivers (Table 3.8 in report text).

Field blanks and equipment blanks were used to determine if sample contamination might have occurred during water sample collection, sample handling, or laboratory analytical procedures. Field blanks are a set of separate sample bottles filled in the field with a sample of deionized water, which are then shipped to the laboratiory with the field samples. Equipment blanks are also separate sample bottles filled in the field with deionized water that has been poured through decontaminated field equipment, such as the Kemmerer water sampler, prior to the collection of field samples.

A duplicate water sample (duplicate) is a second water sample collected at a sampling station using the same methods as the first field sample. Duplicates are collected to assess variability introduced during sample collection, sample handling, and laboratory analytical procedures. In 2006, duplicates were taken at the top of the water column on each of the Stickleback Lake sampling dates, as well as at Windy Ouflow on the September sampling date. In 2007, duplicates

were taken at the top of the water column on each of the Stickleback Lake sampling dates, as well as at Windy Ouflow (July), Pelvic Outflow (August) and Ogama Outflow (September).

All blank and duplicate samples were submitted to appropriate laboratories and tested for the same major parameters as the field samples.

Although parameter results should not have been detected in the field or equipment blanks, parameter concentrations were considered notable if they were greater than five times the corresponding MRV. This threshold is based on the Practical Quantitation Limit defined by USEPA (1985), which takes into account the potential for data accuracy error when parameter concentrations approach or are below MRVs.

Notable results observed in the blanks were evaluated relative to parameter concentrations observed in field samples collected during the corresponding sampling trip to determine if sample contamination was limited to that particular QC sample or was apparent in other samples collected at that time. If, based on this comparison, sample contamination did not appear to have been an isolated error, field data were flagged and interpreted with this limitation in mind.

For all calculations, including relative percent difference (RPD), values below the MRV were set to half the MRV. Differences between parameter concentrations in the duplicate water samples were considered notable if:

- the RPD was greater than 20 percent (%); and
- the concentration was greater than five times the relevant reported MRV.

This threshold takes into account the potential for analytical uncertainty when concentrations approach MRVs (Weiner 2000). These criteria are consistent with those used by analytical laboratories for their internal QC procedures. Variability between duplicate and internal laboratory split samples was rated as follows:

- ***low***, if less than 10% of the parameters included in the duplicate or split sample analysis were notably different from one another;
- ***moderate***, if 10 to 30% of the parameters included in the duplicate or split sample analysis were notably different from one another; and
- ***high***, if more than 30% of the parameters included in the duplicate or split sample analysis were notably different from one another.

B2.2 QA/QC RESULTS

Field and equipment blanks were analyzed for physical parameters (e.g., lab pH, lab conductivity), total and dissolved nutrients, organic carbon, major ions, total and dissolved metals, radium-226, totals cyanide, fluoride, and sulphide. Laboratory results are presented in Table B2-2. Notables in the blanks were common (Table B2-1; only parameters with reported MRVs are presented); however, greater than half of the notables had concentrations far less than the corresponding parameter concentrations from the field samples. Notables with concentrations similar to corresponding field samples rarely occurred for parameters of concern, such as ammonia, aluminum, mercury, etc. This suggests that contamination of field samples had little effect on interpretation of the data.

Duplicate samples were analyzed for the same parameters as field and equipment blanks, with the exception of three dissolved metals (thallium, tin, and titanium) (Table B2-2; only parameters with reported MRVs are presented). Thirteen percent of all parameters showed differences greater than 20%, indicating that laboratory variability was moderate.

Table B2-1. Analytical results for QA/QC samples, 2006-2007

Parameter	Units	Fickle Duck Lake Field Blank (Ant Lake)						Reference Outflow Equipment Blank (Bug Lake)		
		18-Jul-06	17-Aug-06	10-Sep-06	21-Jul-07	20-Aug-07	9-Sep-07	18-Jul-06	17-Aug-06	11-Sep-06
Physical Parameters										
Alkalinity, Total ($CaCO_3$)	mg/L	1.8	2.0	2.0	2.5	2.2	2.6	1.8	2.3	3.1
Hardness, Total ($CaCO_3$)	mg/L	0.1	0.13	0.09	0.09	0.09	0.05	0.05	0.09	0.04
Conductivity	µS/cm	1.4	1.4	1.4	1.0	1.1	1.6	1.2	1.0	1.6
pH	units	5.6	5.6	5.7	-	-	-	5.6	6.0	6.6
TDS (Calculated)	mg/L	4.4	4.0	4.0	6.0	5.6	4.3	3.9	4.1	4.6
Total Suspended Solids	mg/L	<1	<1	<1	<1	1	<1	<1	<1	<1
Color, True	TCU	<1	<1	<1	< 1	< 1	< 1	<1	7	<1
Nutrients										
Phosphorus, Total	mg/L	0.013	0.011	0.019	0.001	0.001	0.002	0.006	0.006	0.014
Total Kjeldahl Nitrogen	mg/L	0.09	<0.01	<0.01	< 0.01	< 0.01	0.01	0.01	<0.01	<0.01
Ammonia-N	mg/L	0.026	0.006	0.003	0.009	0.006	0.006	0.002	0.003	0.002
Nitrite-N	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N	mg/L	0.005	0.013	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005
Organics										
Carbon Part	mg/L	<0.02	0.06	<0.02	< 0.2	< 0.2	0.04	<0.02	<0.02	<0.02
Dissolved Organic Carbon	mg/L	0.4	0.2	<0.2	< 0.001	0.3	< 0.001	0.3	0.4	<0.2
Major Ions										
Calcium (Total)	mg/L	0.0065	0.0558	<0.004	0.0122	< 0.004	0.0172	0.0146	0.0080	0.0135
Calcium (Dissolved)	mg/L	0.0049	0.0174	<0.004	0.0078	< 0.004	0.0170	<0.004	<0.004	0.0061
Chloride (Cl)	mg/L	0.6	<0.3	<0.3	0.4	< 0.3	< 0.3	<0.3	<0.3	<0.3
Magnesium (Total)	mg/L	0.0006	0.0033	0.0004	0.0018	0.0010	0.0041	0.0032	0.0015	0.0034
Magnesium (Dissolved)	mg/L	0.0002	0.0019	0.0001	0.0018	0.0010	0.0040	0.0017	0.0001	0.0025
Potassium (Total)	mg/L	<0.002	<0.002	<0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002
Potassium (Dissolved)	mg/L	<0.002	<0.002	<0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002
Sodium (Total)	mg/L	<0.002	<0.002	<0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002
Sodium (Dissolved)	mg/L	<0.002	<0.002	<0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002
Sulphate (SO_4)	mg/L	<3	<3	<3	< 3	< 3	< 3	<3	<3	<3
Anions	meq/L	0.10	0.09	0.09	0.10	0.09	0.10	0.08	0.09	0.11
Cations	meq/L	0.03	0.03	0.02	0.09	0.09	0.02	0.02	0.02	0.02
Ion Balance	N/A	0.30	0.29	0.28	0.83	0.95	0.24	0.28	0.26	0.21
Total Metals										
Aluminum (Al)	µg/L	0.6	<0.5	<0.5	0.8	< 0.5	0.7	0.6	0.6	<0.5
Antimony (Sb)	µg/L	0.001	0.003	0.002	0.003	0.001	0.003	0.002	0.003	<0.0005
Arsenic (As)	µg/L	0.009	<0.002	<0.002	0.003	< 0.02	0.019	<0.002	<0.002	0.006
Barium (Ba)	µg/L	0.034	0.281	0.012	0.025	0.016	0.092	0.084	0.042	0.062
Beryllium (Be)	µg/L	<0.003	<0.003	0.008	< 0.003	< 0.003	< 0.003	<0.003	<0.003	<0.003
Bismuth (Bi)	µg/L	0.002	0.012	<0.001	< 0.001	< 0.001	< 0.001	0.004	0.004	0.004
Boron (B)	µg/L	0.55	0.21	0.34	0.30	0.28	0.93	0.35	0.31	0.40
Cadmium (Cd)	µg/L	0.0053	0.0031	<0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	0.0030
Chromium (Cr)	µg/L	0.09	<0.03	<0.03	0.06	< 0.03	0.08	<0.04	<0.03	0.04
Cobalt (Co)	µg/L	0.001	0.006	<0.001	< 0.001	< 0.001	< 0.001	<0.001	0.001	0.003
Copper (Cu)	µg/L	0.10	0.33	0.06	< 0.05	0.06	0.06	<0.05	0.06	0.06
Iron (Fe)	µg/L	<2	<2	<2	< 2	< 2	< 2	<2	<2	<2
Lead (Pb)	µg/L	0.013	0.187	0.007	< 0.001	0.048	0.041	0.017	0.012	0.103
Manganese (Mn)	µg/L	0.005	0.067	0.015	0.034	0.059	0.328	0.020	0.021	0.048
Mercury (Hg)	ng/L	<0.6	<0.6	1.7	2.0	< 0.6	< 0.6	<0.6	3.6	1.4
Molybdenum (Mo)	µg/L	0.003	0.068	<0.001	<0.001	0.002	0.002	0.004	0.045	0.004
Nickel (Ni)	µg/L	0.034	0.289	0.015	< 0.005	< 0.005	0.020	0.011	0.256	0.129
Selenium (Se)	µg/L	<0.1	<0.04	0.2	< 0.1	< 0.1	< 0.1	<0.1	<0.04	<0.1
Silver (Ag)	µg/L	0.0022	0.0063	0.0015	0.0010	0.0026	0.0016	0.0016	0.0077	0.0012
Strontium (Sr)	µg/L	0.0490	0.3170	0.0106	0.0122	0.0178	0.0656	0.0498	0.0258	0.0577
Thallium (Tl)	µg/L	0.0064	<0.0003	0.0031	0.0005	<0.0003	<0.0003	0.0036	<0.0003	0.0047
Tin (Sn)	µg/L	<0.03	<0.03	<0.03	1.52	0.05	0.10	0.13	0.34	0.50
Uranium (U)	µg/L	0.0003	0.0007	0.0001	0.0001	<0.0001	0.0003	0.0003	0.0002	0.0003
Vanadium (V)	µg/L	0.017	0.080	0.013	0.017	< 0.01	0.027	<0.005	<0.01	0.042
Zinc (Zn)	µg/L	0.27	0.41	0.42	0.40	0.37	0.31	0.31	0.33	0.39
Dissolved Metals										
Aluminum (Al)	µg/L	<0.2	<0.2	<0.2	<0.02	<0.02	0.2	<0.2	<0.2	<0.2
Antimony (Sb)	µg/L	0.001	0.003	0.002	0.003	0.001	0.003	0.002	0.003	<0.0005
Arsenic (As)	µg/L	0.009	<0.002	<0.002	0.003	0.006	0.019	<0.002	<0.002	0.006
Barium (Ba)	µg/L	<0.004	0.054	<0.004	< 0.004	0.006	0.091	<0.004	<0.004	0.007
Beryllium (Be)	µg/L	<0.003	<0.003	<0.003	< 0.003	< 0.003	< 0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L	0.28	0.18	0.28	0.07	0.26	0.20	0.29	0.27	0.31
Cadmium (Cd)	µg/L	0.0024	<0.002	<0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L	<0.04	<0.03	<0.03	0.06	< 0.03	0.08	<0.04	<0.03	0.04
Cobalt (Co)	µg/L	<0.001	0.001	<0.001	< 0.001	< 0.001	0.005	0.001	<0.001	<0.001
Copper (Cu)	µg/L	<0.05	0.22	0.06	< 0.05	0.06	0.06	<0.05	<0.05	0.06
Iron (Fe)	µg/L	<2	<2	<2	< 2	< 2	< 2	<2	<2	<2
Lead (Pb)	µg/L	0.004	0.004	0.007	< 0.001	< 0.001	0.017	0.004	<0.001	0.008
Manganese (Mn)	µg/L	<0.003	0.008	0.014	< 0.003	0.032	0.325	<0.003	<0.003	0.041
Molybdenum (Mo)	µg/L	0.003	0.011	<0.001	< 0.001	< 0.001	0.002	0.001	0.006	0.004
Nickel (Ni)	µg/L	0.013	<0.005	<0.005	< 0.005	< 0.005	0.020	0.005	<0.005	0.022
Selenium (Se)	µg/L	<0.1	<0.04	<0.1	< 0.1	< 0.1	< 0.1	<0.1	<0.04	<0.1
Silver (Ag)	µg/L	0.0011	0.0036	0.0010	0.0010	0.0026	< 0.0005	0.0013	0.0045	<0.0005
Strontium (Sr)	µg/L	0.049	0.169	0.010	0.012	0.018	0.065	0.014	<0.004	0.030
Uranium (U)	µg/L	0.0001	0.0003	0.0001	0.0001	< 0.0001	< 0.0001	0.0003	<0.0001	0.0001
Vanadium (V)	µg/L	0.02	<0.005	0.01	< 0.01	< 0.01	0.03	<0.005	<0.01	0.01
Zinc (Zn)	µg/L	0.24	0.21	0.35	0.30	0.26	0.21	0.21	0.26	0.26
Other										
Cyanide, Total	mg/L	0.001	<0.001	<0.001	< 0.02	< 0.02	< 0.02	<0.001	<0.001	<0.001
Fluoride (F)	mg/L	0.01	<0.01	<0.01	< 0.01	< 0.01	< 0.01	<0.01	<0.01	<0.01
Sulphide	mg/L	<0.001	<0.001	<0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001

Rep - Replicate sample

Table B2-1. Analytical results for QA/QC samples, 2006-2007

Parameter	Units	Reference Outflow Equipment Blank (Bug Lake)				Patch Lake Equipment Blank (Slim Lake)						
		23-Jun-07	21-Jul-07	20-Aug-07	9-Sep-07	22-Jul-06	15-Aug-06	8-Sep-06	24-May-07	18-Jul-07	18-Aug-07	13-Sep-07
Physical Parameters												
Alkalinity, Total ($CaCO_3$)	mg/L	1.9	2.3	2.1	2.3	2.0	2.0	2.0	2.1	2.3	2.5	2.3
Hardness, Total ($CaCO_3$)	mg/L	0.03	0.08	0.08	0.02	0.08	0.05	0.03	0.08	0.56	0.2	0.06
Conductivity	µS/cm	1.2	1.0	1.3	1.2	1.3	1.3	1.4	1.6	1.2	4.2	1.7
pH	units	-	-	-	-	5.8	5.5	5.8	-	-	-	-
TDS (Calculated)	mg/L	4.8	5.9	5.7	4.3	4.0	3.8	4.2	5.6	7.4	7.1	4.2
Total Suspended Solids	mg/L	<1	<1	<1	<1	1	<1	<1	< 1	< 1	< 1	< 1
Color, True	TCU	< 1	< 1	< 1	< 1	<1	3	<1	< 1	< 1	< 1	< 1
Nutrients												
Phosphorus, Total	mg/L	< 0.001	0.003	0.001	0.001	0.005	0.012	0.013	0.001	0.003	0.002	< 0.001
Total Kjeldahl Nitrogen	mg/L	< 0.01	0.01	< 0.01	< 0.01	0.01	0.01	<0.01	0.02	0.02	0.02	< 0.01
Ammonia-N	mg/L	0.009	0.008	0.008	0.005	0.002	0.005	0.005	0.005	0.012	0.009	0.008
Nitrite-N	mg/L	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nitrate-N	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	< 0.005	< 0.005	< 0.005	< 0.005
Organics												
Carbon Part	mg/L	< 0.2	< 0.2	< 0.2	0.05	<0.02	<0.02	0.05	< 0.2	< 0.2	0.30	< 0.2
Dissolved Organic Carbon	mg/L	< 0.001	< 0.001	0.3	0.3	0.3	0.3	0.3	< 0.001	< 0.001	< 0.001	< 0.001
Major Ions												
Calcium (Total)	mg/L	0.0152	0.0049	< 0.004	0.0333	0.0162	0.0158	0.0057	0.0204	0.0953	0.0172	< 0.004
Calcium (Dissolved)	mg/L	0.0059	0.0048	< 0.004	0.0227	0.0051	<0.004	<0.004	< 0.004	0.0818	0.0118	< 0.004
Chloride (Cl)	mg/L	< 0.3	0.4	< 0.3	0.4	<0.3	<0.3	0.3	0.5	0.5	1.1	< 0.3
Magnesium (Total)	mg/L	0.0016	0.0004	0.0006	0.0015	0.0043	0.0052	0.0033	0.0031	0.078	0.0446	0.0055
Magnesium (Dissolved)	mg/L	0.0012	0.0004	0.0006	0.0015	0.0025	0.0023	0.0020	0.0008	0.0676	0.0301	0.0043
Potassium (Total)	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002	< 0.002	0.03	< 0.002	< 0.002
Potassium (Dissolved)	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002	< 0.002	0.03	< 0.002	< 0.002
Sodium (Total)	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002	< 0.002	0.4	0.3	< 0.002
Sodium (Dissolved)	mg/L	< 0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002	< 0.002	0.4	0.3	< 0.002
Sulphate (SO_4)	mg/L	< 3	< 3	< 3	< 3	<3	<3	<3	< 3	< 3	< 3	< 3
Anions	meq/L	0.09	0.11	0.09	0.10	0.09	0.08	0.09	0.1	0.11	0.12	0.09
Cations	meq/L	0.06	0.09	0.09	0.02	0.02	0.02	0.02	0.08	0.16	0.11	0.03
Ion Balance	N/A	0.67	0.82	1.05	0.24	0.28	0.29	0.25	0.81	1.42	0.92	0.29
Total Metals												
Aluminum (Al)	µg/L	< 0.5	0.9	0.6	1.0	0.5	<0.5	<0.5	< 0.5	10.9	11.2	< 0.5
Antimony (Sb)	µg/L	0.010	0.002	0.004	0.002	0.004	0.002	0.003	0.0038	0.0038	0.0044	0.0012
Arsenic (As)	µg/L	0.006	0.005	0.019	< 0.002	0.044	0.025	0.013	< 0.02	0.0181	0.0314	0.0045
Barium (Ba)	µg/L	0.010	0.039	0.024	0.093	0.033	0.096	0.021	0.0246	0.0827	0.0809	0.0589
Beryllium (Be)	µg/L	< 0.003	< 0.003	< 0.003	< 0.003	<0.003	<0.003	<0.003	< 0.003	< 0.003	< 0.003	< 0.003
Bismuth (Bi)	µg/L	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	0.002	<0.001	< 0.001	< 0.001	< 0.001	< 0.001
Boron (B)	µg/L	0.29	0.78	<0.05	0.33	0.35	0.33	0.28	0.36	0.552	0.307	0.07
Cadmium (Cd)	µg/L	< 0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002	< 0.002	< 0.002	< 0.002	< 0.002
Chromium (Cr)	µg/L	0.09	0.09	< 0.03	< 0.03	0.07	<0.03	0.04	0.059	< 0.03	0.209	< 0.03
Cobalt (Co)	µg/L	< 0.001	0.002	< 0.001	0.004	<0.001	0.001	<0.001	0.0036	0.0046	0.0073	< 0.001
Copper (Cu)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	0.25	0.06	0.07	0.0542	< 0.05	< 0.05	< 0.05
Iron (Fe)	µg/L	< 2	< 2	< 2	< 2	<2	<2	<2	< 2	< 2	8.3	< 2
Lead (Pb)	µg/L	< 0.001	< 0.001	0.004	0.037	0.014	0.011	0.015	0.0306	< 0.001	0.0047	0.0081
Manganese (Mn)	µg/L	0.103	0.007	< 0.003	0.154	0.032	0.052	0.041	0.0192	0.077	0.151	< 0.003
Mercury (Hg)	ng/L	< 0.6	< 0.6	< 0.6	< 0.6	3.6	1.0	0.9	< 0.6	< 0.6	< 0.6	1.1
Molybdenum (Mo)	µg/L	0.065	<0.001	<0.001	<0.001	0.002	0.002	0.002	0.0051	0.0346	0.0179	0.0074
Nickel (Ni)	µg/L	0.020	< 0.005	< 0.005	0.016	0.023	0.006	0.022	0.0144	< 0.005	< 0.005	0.0076
Selenium (Se)	µg/L	< 0.1	0.1	< 0.1	< 0.1	0.3	<0.04	<0.1	< 0.04	< 0.1	< 0.1	< 0.1
Silver (Ag)	µg/L	0.0015	0.0110	< 0.0005	0.0013	0.0029	0.0023	0.0011	0.001	0.034	< 0.0005	0.0108
Strontium (Sr)	µg/L	0.0488	0.0218	0.0231	0.1050	0.0645	0.0877	0.0497	0.0345	0.465	0.29	0.0652
Thallium (Tl)	µg/L	0.0007	0.0009	<0.0003	0.0011	0.0050	0.0033	0.0051	< 0.0003	< 0.0003	0.0003	< 0.0003
Tin (Sn)	µg/L	< 0.03	< 0.03	< 0.03	< 0.03	0.31	0.44	0.28	< 0.03	2	0.405	0.0468
Uranium (U)	µg/L	0.0002	0.0002	<0.0001	0.0003	<0.0001	0.0001	0.0001	0.0004	0.0019	0.0106	0.0003
Vanadium (V)	µg/L	0.050	0.033	< 0.01	0.008	0.019	<0.01	<0.01	0.0676	0.0262	0.0757	0.0655
Zinc (Zn)	µg/L	0.16	0.42	0.46	0.33	0.38	0.40	0.35	0.346	3.77	0.15	0.355
Dissolved Metals												
Aluminum (Al)	µg/L	<0.02	<0.02	<0.02	<0.02	0.4	<0.2	<0.2	< 0.2	< 0.2	< 0.2	< 0.2
Antimony (Sb)	µg/L	0.010	0.002	0.004	0.002	0.004	0.002	0.003	0.00375	0.00374	0.0044	0.00114
Arsenic (As)	µg/L	0.005	0.005	0.019	< 0.002	0.044	0.024	0.012	< 0.02	0.0179	< 0.002	0.00448
Barium (Ba)	µg/L	0.006	< 0.004	< 0.004	0.030	<0.004	0.013	0.006	< 0.004	0.0224	< 0.004	< 0.004
Beryllium (Be)	µg/L	< 0.003	< 0.003	< 0.003	< 0.003	<0.003	<0.003	<0.003	< 0.003	< 0.003	< 0.003	< 0.003
Boron (B)	µg/L	0.24	0.17	< 0.03	0.06	0.31	0.27	0.27	0.276	0.097	0.282	< 0.03
Cadmium (Cd)	µg/L	< 0.002	< 0.002	< 0.002	< 0.002	<0.002	<0.002	<0.002	< 0.002	< 0.002	< 0.002	< 0.002
Chromium (Cr)	µg/L	0.08	0.08	< 0.03	0.08	0.06	<0.03	0.04	< 0.03	< 0.03	0.047	< 0.03
Cobalt (Co)	µg/L	< 0.001	0.002	< 0.001	0.003	<0.001	<0.001	<0.001	< 0.001	0.0034	< 0.001	< 0.001
Copper (Cu)	µg/L	< 0.05	< 0.05	< 0.05	< 0.05	0.14	<0.05	0.07	0.0537	< 0.05	< 0.05	< 0.05
Iron (Fe)	µg/L	< 2	< 2	< 2	< 2	<2	<2	<2	< 2	< 2	< 2	< 2
Lead (Pb)	µg/L	< 0.001	< 0.001	< 0.001	0.007	0.008	0.004	0.015	0.019	< 0.001	< 0.001	0.008
Manganese (Mn)	µg/L	0.102	< 0.003	< 0.003	0.152	0.017	0.027	0.041	< 0.003	0.0301	< 0.003	< 0.003
Molybdenum (Mo)	µg/L	0.014	< 0.001	< 0.001	0.012	<0.001	0.002	0.002	0.0018	0.0335	0.0047	< 0.001
Nickel (Ni)	µg/L	0.007	< 0.005	< 0.005	0.016	0.008	<0.005	0.021	0.0143	< 0.005	< 0.005	0.0075
Selenium (Se)	µg/L	< 0.1	< 0.1	< 0.1	< 0.1	0.3	<0.04	<0.1	< 0.04	< 0.1	< 0.1	< 0.1
Silver (Ag)	µg/L	0.0008	0.0010	< 0.0005	0.0009	0.0024	0.0015	0.0005	0.001	0.009	< 0.0005	0.0072
Strontium (Sr)	µg/L	0.048	0.022	0.023	0.102	0.026	0.025	0.050	0.0281	0.46	0.307	0.0645
Uranium (U)	µg/L	< 0.0001	< 0.0001	< 0.0001	< 0.0001	0.0001	0.0001	0.0001	< 0.0001	0.0005	< 0.0001	< 0.0001
Vanadium (V)	µg/L	< 0.01	0.01	< 0.01	< 0.01	<0.01	<0.01	<0.01	0.0121	< 0.01	< 0.01	0.0648
Zinc (Zn)	µg/L	< 0.05	0.31	0.30	0.22	0.24	0.20	0.25	0.271	1.85	0.13	0.254
Other												
Cyanide, Total	mg/L	< 0.02	< 0.02	< 0.02	< 0.02	<0.001	<0.001	<0.001	0.09	< 0.02	< 0.02	0.07
Fluoride (F)	mg/L	0.08	0.14	< 0.01	< 0.01	<0.01	<0.01	<0.01	< 0.01	0.13	< 0.01	< 0.01
Sulphide	mg/L	< 0.001	< 0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	< 0.001	< 0.001	< 0.001	< 0.001

Rep - Replicate sample

Table B2-1. Analytical results for QA/QC samples, 2006-2007

Parameter	Units	Patch Outflow Field Blank (Wolf Outflow)		Stickleback Lake Duplicate (Fly Lake)							
		22-Jul-06	22-Jun-07	17-Jul-06		17-Aug-06		10-Sep-06		21-Jul-07	21-Jul-07
				Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2
Physical Parameters											
Alkalinity, Total ($CaCO_3$)	mg/L	2.0	1.9	32.9	32.8	33.8	33.9	33.6	33.7	35.9	35.8
Hardness, Total ($CaCO_3$)	mg/L	0.08	0.08	66.8	67.6	70.7	71.3	70.9	69.2	70	70.5
Conductivity	µS/cm	1.1	1.4	239.0	239.0	242.0	241.0	252.0	252.0	248.0	247.0
pH	units	5.7	-	7.7	7.7	7.7	7.7	7.6	7.7	-	-
TDS (Calculated)	mg/L	3.9	5.1	111.0	111.0	117.0	118.0	118.0	117.0	125.0	125.0
Total Suspended Solids	mg/L	1	< 1	<1	<1	<1	<1	<1	<1	<1	<1
Color, True	TCU	<1	3	<1	<1	<1	14	<1	<1	5	5
Nutrients											
Phosphorus, Total	mg/L	<0.001	< 0.001	0.013	0.014	0.03	0.028	0.033	0.025	0.013	0.015
Total Kjeldahl Nitrogen	mg/L	0.01	< 0.01	0.40	0.33	0.40	0.39	0.36	0.36	0.39	0.37
Ammonia-N	mg/L	0.004	0.01	0.01	0.007	0.013	0.01	0.008	0.005	0.015	0.012
Nitrite-N	mg/L	<0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N	mg/L	<0.005	< 0.005	<0.005	<0.005	<0.005	0.005	0.012	<0.005	<0.005	<0.005
Organics											
Carbon Part	mg/L	<0.02	0.30	0.17	0.20	0.26	0.22	0.30	0.30	0.31	0.22
Dissolved Organic Carbon	mg/L	0.4	< 0.001	4.2	4.4	4.7	4.9	4.5	4.5	4.4	4.3
Major Ions											
Calcium (Total)	mg/L	<0.004	< 0.004	17.1000	16.9000	17.6000	17.6000	18.3000	17.5000	17.4000	17.5000
Calcium (Dissolved)	mg/L	<0.004	< 0.004	15.6000	15.9000	16.5000	16.1000	17.0000	17.3000	16.4000	16.9000
Chloride (Cl)	mg/L	<0.3	< 0.3	51.1	50.9	53.1	53.7	55.1	54.5	58.4	< 0.3
Magnesium (Total)	mg/L	0.0005	0.0007	6.2200	6.2000	6.3700	6.4500	6.6600	6.2200	6.2000	6.1700
Magnesium (Dissolved)	mg/L	0.0004	0.0004	5.6600	5.8500	5.7900	5.6000	6.1400	6.1600	5.8800	5.9000
Potassium (Total)	mg/L	<0.002	< 0.002	1.71	1.70	1.77	1.80	1.88	1.78	1.79	1.78
Potassium (Dissolved)	mg/L	<0.002	< 0.002	1.55	1.61	1.65	1.61	1.72	1.75	1.67	1.70
Sodium (Total)	mg/L	<0.002	< 0.002	14.7	14.7	15.5	15.1	15.9	14.8	14.9	14.7
Sodium (Dissolved)	mg/L	<0.002	< 0.002	13.6	14.0	13.9	13.3	14.7	14.8	14.2	14.0
Sulphate (SO_4)	mg/L	<3	< 3	<3	<3	<3	<3	<3	<3	< 3	< 3
Anions	meq/L	0.09	0.09	2.14	2.14	2.21	2.23	2.27	2.25	2.43	2.43
Cations	meq/L	0.02	0.07	1.99	2.00	2.12	2.15	2.12	2.07	2.20	2.20
Ion Balance	N/A	0.29	0.79	0.93	0.93	0.96	0.96	0.94	0.92	0.91	0.91
Total Metals											
Aluminum (Al)	µg/L	0.6	< 0.5	7.4	5.0	12.2	9.6	12.1	13.0	6.3	10.0
Antimony (Sb)	µg/L	0.002	0.0025	0.006	0.006	0.008	0.008	0.007	0.012	0.005	0.005
Arsenic (As)	µg/L	0.017	0.008	0.377	0.370	0.451	0.490	0.481	0.435	0.458	0.441
Barium (Ba)	µg/L	0.015	0.0591	5.450	5.260	5.410	5.500	5.570	5.310	6.320	6.390
Beryllium (Be)	µg/L	<0.003	< 0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	< 0.003	<0.003
Bismuth (Bi)	µg/L	<0.001	0.0099	0.002	0.002	0.004	0.003	0.002	<0.001	< 0.001	<0.001
Boron (B)	µg/L	0.45	1.05	16.30	17.30	18.70	18.20	19.30	18.80	18.40	18.20
Cadmium (Cd)	µg/L	<0.002	< 0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0027	< 0.002	<0.002
Chromium (Cr)	µg/L	<0.03	0.041	0.12	0.11	0.10	0.11	0.11	0.06	0.11	0.12
Cobalt (Co)	µg/L	<0.001	< 0.001	0.022	0.025	0.035	0.033	0.021	0.020	0.023	0.033
Copper (Cu)	µg/L	0.29	< 0.05	0.50	0.47	0.89	2.02	0.82	0.33	0.31	0.23
Iron (Fe)	µg/L	<2	< 2	53.3	51.0	105.0	106.0	31.9	28.8	65.7	99.3
Lead (Pb)	µg/L	0.033	< 0.001	0.046	0.049	0.114	0.114	0.051	0.038	0.236	0.002
Manganese (Mn)	µg/L	0.010	< 0.003	5.970	6.460	11.300	11.700	4.760	4.430	7.440	12.700
Mercury (Hg)	ng/L	-	0.7	<0.6	<0.6	47.0	14.0	7.0	7.0	1.5	2.1
Molybdenum (Mo)	µg/L	0.003	0.0185	0.039	0.035	0.234	0.055	0.050	0.050	0.011	0.016
Nickel (Ni)	µg/L	0.010	< 0.005	<0.005	<0.005	0.199	0.059	0.095	0.082	0.057	0.016
Selenium (Se)	µg/L	<0.1	< 0.1	0.4	0.4	0.6	0.5	0.6	0.5	0.6	0.7
Silver (Ag)	µg/L	0.0020	0.0009	<0.0005	0.0009	0.0011	0.0018	0.0009	0.0006	0.0010	0.0010
Strontium (Sr)	µg/L	0.0092	0.016	99.5000	97.0000	102.0000	101.0000	103.0000	100.0000	98.2000	99.5000
Thallium (Tl)	µg/L	0.0015	0.0017	0.0122	0.0129	0.0026	0.0069	0.0136	0.0124	0.0048	0.0048
Tin (Sn)	µg/L	<0.03	< 0.03	17.00	24.90	3.10	6.14	2.01	0.17	1.25	0.98
Uranium (U)	µg/L	0.0001	0.0004	0.0111	0.0110	0.0102	0.0103	0.0099	0.0104	0.0082	0.0085
Vanadium (V)	µg/L	<0.01	< 0.01	0.039	0.045	0.168	0.028	0.036	0.020	< 0.01	0.021
Zinc (Zn)	µg/L	0.40	0.384	2.22	0.85	3.74	6.63	1.54	0.78	2.06	3.63
Dissolved Metals											
Aluminum (Al)	µg/L	<0.2	< 0.2	0.9	1.0	0.4	0.5	0.6	0.5	<0.02	<0.02
Antimony (Sb)	µg/L	0.002	0.0025	0.006	0.006	0.008	0.008	0.007	0.011	0.005	0.005
Arsenic (As)	µg/L	0.017	0.0079	0.311	0.345	0.367	0.406	0.395	0.386	0.411	0.368
Barium (Ba)	µg/L	<0.004	< 0.004	4.730	4.820	4.780	4.770	5.120	5.070	5.870	5.970
Beryllium (Be)	µg/L	<0.003	< 0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	< 0.003	<0.003
Boron (B)	µg/L	0.33	-	14.50	15.60	16.70	15.40	17.10	17.30	17.00	16.90
Cadmium (Cd)	µg/L	<0.002	< 0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0021	< 0.002	<0.002
Chromium (Cr)	µg/L	<0.03	0.03	0.12	0.11	0.10	0.07	0.11	0.05	0.11	0.10
Cobalt (Co)	µg/L	<0.001	< 0.001	0.006	0.009	0.015	0.012	0.005	0.007	0.009	0.010
Copper (Cu)	µg/L	<0.05	< 0.05	0.35	0.39	0.64	1.34	0.63	0.32	0.21	0.18
Iron (Fe)	µg/L	<2	< 2	<2	<2	<2	<2	<2	<2	3.5	3.1
Lead (Pb)	µg/L	0.033	< 0.001	0.033	0.034	0.093	0.091	0.039	0.037	< 0.001	<0.001
Manganese (Mn)	µg/L	0.010	< 0.003	0.098	0.101	0.134	0.150	0.241	0.252	0.076	0.103
Molybdenum (Mo)	µg/L	<0.001	0.0074	0.029	0.035	0.048	0.047	0.047	0.046	0.011	0.010
Nickel (Ni)	µg/L	0.010	< 0.005	<0.005	<0.005	0.026	0.048	<0.005	0.018	0.010	<0.005
Selenium (Se)	µg/L	<0.1	< 0.1	0.4	0.4	0.4	0.3	0.6	0.5	0.6	0.5
Silver (Ag)	µg/L	0.0005	0.0007	<0.0005	<0.0005	0.0009	0.0009	<0.0005	<0.0005	0.0010	0.0010
Strontium (Sr)	µg/L	0.008	0.0158	90.1	92.1	94.2	92.4	98.3	99.9	95.5	96.2
Uranium (U)	µg/L	<0.0001	0.0004	0.0078	0.0080	0.0072	0.0068	0.0057	0.0059	0.0063	0.0064
Vanadium (V)	µg/L	<0.01	< 0.01	0.04	0.04	<0.01	<0.01	0.04	0.02	< 0.01	0.02
Zinc (Zn)	µg/L	0.32	< 0.05	2.14	0.74	2.49	2.43	1.52	0.78	1.14	2.30
Other											
Cyanide, Total	mg/L	<0.001	0.1	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	< 0.02	<0.001
Fluoride (F)	mg/L	<0.01	0.07	0.04	0.04	0.03	0.01	0.05	0.05	0.37	0.38
Sulphide	mg/L	<0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	< 0.001	<0.001

Rep - Replicate sample

Table B2-1. Analytical results for QA/QC samples, 2006-2007

Parameter	Units	Stickleback Lake Duplicate (Fly Lake)				Windy Outflow Duplicate (Hope Outflow)		Windy Outflow Duplicate (Hope Outflow)		Pelvic Outflow Duplicate (Hope Outflow)	
		20-Aug-07	20-Aug-07	9-Sep-07	9-Sep-07	9-Sep-06		19-Jul-07		18-Aug-07	
		Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2	Rep 1	Rep 2
Physical Parameters											
Alkalinity, Total ($CaCO_3$)	mg/L	34.2	34.2	34.4	34.9	48.0	48.0	39.2	39.7	22.3	22.5
Hardness, Total ($CaCO_3$)	mg/L	70.9	70.5	71.2	69	68.2	68.6	52.4	54.4	34.8	35.4
Conductivity	µS/cm	246.0	246.0	250.0	248.0	437.0	437.0	327.0	329.0	248.0	251.0
pH	units	-	-	-	-	8.1	8.0	-	-	-	-
TDS (Calculated)	mg/L	122.0	122.0	122.0	122.0	214.0	211.0	169.0	168.0	126.0	126.0
Total Suspended Solids	mg/L	1	1	<1	<1	<1	<1	< 1	<1	8	8
Color, True	TCU	< 1	<1	< 1	<1	<1	<1	7	7	9	6
Nutrients											
Phosphorus, Total	mg/L	0.011	0.012	0.011	0.011	0.019	0.024	0.004	0.007	0.045	0.041
Total Kjeldahl Nitrogen	mg/L	0.37	0.38	0.39	0.4	0.11	0.11	0.1	0.11	0.65	0.61
Ammonia-N	mg/L	0.01	0.012	0.009	0.034	0.002	0.003	0.009	0.008	0.008	0.009
Nitrite-N	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	< 0.001	<0.001	< 0.001	<0.001
Nitrate-N	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	< 0.005	<0.005	< 0.005	<0.005
Organics											
Carbon Part	mg/L	0.35	0.32	0.40	0.17	0.14	0.07	1.2	0.08	5.2	1.61
Dissolved Organic Carbon	mg/L	4.2	4.5	4.7	4.6	1.9	2.0	< 0.001	1.5	< 0.001	5.9
Major Ions											
Calcium (Total)	mg/L	17.0000	16.8000	17.2000	17.6000	11.5000	11.8000	8.9300	9.0500	4.3900	4.4900
Calcium (Dissolved)	mg/L	16.6000	16.5000	16.8000	16.9000	11.2000	11.2000	8.7800	8.6400	4.2500	4.3200
Chloride (Cl)	mg/L	54.9	< 0.3	56.5	< 0.3	95.8	94.9	78.8	78.5	60.5	61.2
Magnesium (Total)	mg/L	6.6200	6.4800	6.6400	6.9000	9.5800	9.5000	6.9000	7.2500	5.7700	6.1800
Magnesium (Dissolved)	mg/L	6.4200	6.2400	6.5000	6.5700	9.5200	9.1700	6.8300	6.9100	5.7600	6.0500
Potassium (Total)	mg/L	1.79	1.76	1.88	1.94	3.89	3.94	2.77	2.77	2.10	2.13
Potassium (Dissolved)	mg/L	1.74	1.73	1.83	1.84	3.83	3.79	2.72	2.63	1.88	1.91
Sodium (Total)	mg/L	16.3	15.9	16.1	16.8	55.3	54.8	38.6	39.2	30.6	30.8
Sodium (Dissolved)	mg/L	15.9	15.3	16.0	16.5	55.1	53.0	38.4	37.7	30.6	30.5
Sulphate (SO_4)	mg/L	< 3	< 3	< 3	< 3	11	9	5	4	5	5
Anions	meq/L	2.28	2.28	2.32	2.37	3.90	3.84	3.12	3.17	2.26	2.27
Cations	meq/L	2.25	2.25	2.21	2.11	3.76	3.75	2.95	2.97	2.24	2.25
Ion Balance	N/A	0.99	0.99	0.95	0.89	0.96	0.98	0.95	0.94	0.99	0.99
Total Metals											
Aluminum (Al)	µg/L	10.8	10.4	9.3	10.5	48.7	65.4	34.0	26.8	307	380
Antimony (Sb)	µg/L	0.006	0.035	0.005	0.009	0.056	0.056	0.041	0.042	0.018	0.017
Arsenic (As)	µg/L	0.440	0.450	0.472	0.466	0.650	0.722	0.418	0.452	0.638	0.692
Barium (Ba)	µg/L	6.010	6.110	5.710	5.880	2.350	2.520	2.050	1.890	4.910	6.290
Beryllium (Be)	µg/L	< 0.003	<0.003	< 0.003	<0.003	<0.003	<0.003	0.005	<0.003	0.010	0.010
Bismuth (Bi)	µg/L	< 0.001	<0.001	< 0.001	<0.001	0.005	0.002	< 0.001	0.003	0.002	0.011
Boron (B)	µg/L	16.10	15.70	17.90	17.40	46.50	48.00	37.40	40.90	22.50	26.50
Cadmium (Cd)	µg/L	< 0.002	<0.002	0.0026	0.0049	0.0039	0.0037	< 0.002	<0.002	0.0063	0.0053
Chromium (Cr)	µg/L	0.04	0.07	0.15	0.18	0.29	0.35	0.22	0.27	0.64	0.69
Cobalt (Co)	µg/L	0.033	0.032	0.035	0.034	0.019	0.029	0.027	0.015	0.112	0.129
Copper (Cu)	µg/L	0.32	1.03	0.34	0.85	0.83	0.89	0.59	0.57	1.45	1.50
Iron (Fe)	µg/L	64.3	58.6	49.7	40.4	66.5	80.7	77.1	49.6	333.0	421.0
Lead (Pb)	µg/L	0.008	0.014	0.022	0.028	0.045	0.050	0.022	0.008	0.109	0.128
Manganese (Mn)	µg/L	8.750	8.520	7.530	7.570	1.450	1.630	1.960	1.120	38.400	48.200
Mercury (Hg)	ng/L	< 0.6	<0.6	0.8	<0.6	<0.6	<0.6	< 0.6	<0.6	< 0.6	< 0.6
Molybdenum (Mo)	µg/L	0.027	0.025	0.034	0.042	0.676	0.704	0.397	0.402	0.187	1.400
Nickel (Ni)	µg/L	0.163	0.121	0.134	0.017	0.104	0.112	0.083	0.082	0.532	0.207
Selenium (Se)	µg/L	0.5	0.5	0.7	0.8	2.0	2.2	1.0	1.3	0.8	0.6
Silver (Ag)	µg/L	0.0011	<0.0005	0.0016	0.0026	0.0012	0.0011	0.0200	<0.0005	< 0.0005	< 0.0005
Strontium (Sr)	µg/L	101.0000	101.0000	99.9000	102.0000	58.3000	58.9000	44.9000	44.9000	32.0000	33.9000
Thallium (Tl)	µg/L	<0.0003	<0.0003	<0.0003	0.0012	0.0125	0.0116	< 0.0003	0.0044	0.0053	0.0066
Tin (Sn)	µg/L	0.11	0.85	0.11	1.16	0.04	0.04	< 0.03	<0.03	0.03	<0.03
Uranium (U)	µg/L	0.0086	0.0085	0.0101	0.0099	0.2480	0.2590	0.0531	0.0454	0.0503	0.0534
Vanadium (V)	µg/L	< 0.01	0.020	< 0.01	0.058	0.082	0.134	0.049	0.044	0.505	0.676
Zinc (Zn)	µg/L	2.06	1.65	1.34	1.62	0.80	1.35	0.78	0.94	1.44	2.05
Dissolved Metals											
Aluminum (Al)	µg/L	<0.02	<0.02	0.2	0.6	5.5	5.4	2.8	2.5	12.0	12.5
Antimony (Sb)	µg/L	0.006	0.034	0.005	0.008	0.056	0.056	0.041	0.042	0.018	0.017
Arsenic (As)	µg/L	0.402	0.387	0.412	0.406	0.580	0.657	0.361	0.396	0.483	0.458
Barium (Ba)	µg/L	5.680	5.650	5.320	5.350	1.830	1.800	1.710	1.620	1.290	1.320
Beryllium (Be)	µg/L	< 0.003	<0.003	< 0.003	<0.003	<0.003	<0.003	0.004	<0.003	< 0.003	<0.003
Boron (B)	µg/L	15.50	14.70	15.40	15.80	44.80	45.40	36.60	37.90	22.50	22.90
Cadmium (Cd)	µg/L	< 0.002	<0.002	< 0.002	0.0049	0.0039	0.0037	< 0.002	<0.002	< 0.002	<0.002
Chromium (Cr)	µg/L	0.04	0.06	0.15	0.18	0.29	0.35	0.22	0.21	0.12	0.12
Cobalt (Co)	µg/L	0.010	0.013	0.013	0.013	0.003	0.005	0.006	0.005	0.002	0.002
Copper (Cu)	µg/L	0.31	0.78	0.34	0.84	0.79	0.76	0.49	0.38	0.94	1.06
Iron (Fe)	µg/L	2.9	2.0		<2	6.3	11.0	7.7	9.7	31.4	30.9
Lead (Pb)	µg/L	0.004	<0.001	0.005	0.014	0.030	0.028	< 0.001	<0.001	0.003	0.003
Manganese (Mn)	µg/L	0.094	0.100	0.312	0.293	0.108	0.101	0.104	0.059	< 0.003	<0.003
Molybdenum (Mo)	µg/L	0.020	0.022	0.034	0.042	0.669	0.678	0.393	0.396	0.178	0.191
Nickel (Ni)	µg/L	0.114	0.120	0.058	0.012	0.064	0.058	0.082	0.056	0.120	0.123
Selenium (Se)	µg/L	0.4	0.5	0.6	0.5	1.5	1.4	0.8	0.9	0.6	0.7
Silver (Ag)	µg/L	< 0.0005	<0.0005	< 0.0005	<0.0005	<0.0005	<0.0005	0.0198	<0.0005	< 0.0005	<0.0005
Strontium (Sr)	µg/L	98.7	98.6	99.8	102.0	56.8	56.2	44.5	43.9	32.0	32.9
Uranium (U)	µg/L	0.0071	0.0069	0.0072	0.0080	0.1530	0.1480	0.0336	0.0322	0.0202	0.0208
Vanadium (V)	µg/L	< 0.01	<0.01	< 0.01	0.03	0.08	0.07	< 0.01	<0.01	0.03	0.05
Zinc (Zn)	µg/L	2.04	1.63	1.33	1.60	0.79	0.63	0.77	0.93	1.43	1.64
Other											
Cyanide, Total	mg/L	< 0.02	<0.001	< 0.02	<0.001	<0.001	<0.001	0.120	<0.005	1.980	<0.005
Fluoride (F)	mg/L	0.03	0.02	0.04	0.04	0.09	0.08	0.18	1.65	0.05	0.04
Sulphide	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	< 0.001	<0.001	< 0.001	<0.001

Rep - Replicate sample

Table B2-1. Analytical results for QA/QC samples, 2006-2007

Parameter	Units	Ogama Outflow Duplicate (Hope Outflow)	
		17-Sep-07	
		Rep 1	Rep 2
Physical Parameters			
Alkalinity, Total ($CaCO_3$)	mg/L	24.8	27.5
Hardness, Total ($CaCO_3$)	mg/L	47.7	46.8
Conductivity	µS/cm	283.0	285.0
pH	units	-	-
TDS (Calculated)	mg/L	143.0	143.0
Total Suspended Solids	mg/L	5	4
Color, True	TCU	32	32
Nutrients			
Phosphorus, Total	mg/L	0.030	0.030
Total Kjeldahl Nitrogen	mg/L	0.64	0.65
Ammonia-N	mg/L	0.018	0.016
Nitrite-N	mg/L	< 0.001	<0.001
Nitrate-N	mg/L	< 0.005	<0.005
Organics			
Carbon Part	mg/L	7.7	1.54
Dissolved Organic Carbon	mg/L	< 0.001	8.0
Major Ions			
Calcium (Total)	mg/L	7.3900	7.2500
Calcium (Dissolved)	mg/L	7.0800	7.1200
Chloride (Cl)	mg/L	71.6	71.1
Magnesium (Total)	mg/L	6.8700	6.8400
Magnesium (Dissolved)	mg/L	6.6600	6.6900
Potassium (Total)	mg/L	2.36	2.33
Potassium (Dissolved)	mg/L	2.20	2.21
Sodium (Total)	mg/L	33.7	33.5
Sodium (Dissolved)	mg/L	32.9	32.9
Sulphate (SO_4)	mg/L	4	4
Anions	meq/L	2.60	2.63
Cations	meq/L	2.56	2.53
Ion Balance	N/A	0.99	0.96
Total Metals			
Aluminum (Al)	µg/L	198	221
Antimony (Sb)	µg/L	0.017	0.016
Arsenic (As)	µg/L	0.456	0.469
Barium (Ba)	µg/L	5.390	5.630
Beryllium (Be)	µg/L	< 0.003	0.008
Bismuth (Bi)	µg/L	0.002	0.001
Boron (B)	µg/L	23.00	22.50
Cadmium (Cd)	µg/L	0.0064	0.0040
Chromium (Cr)	µg/L	0.43	0.44
Cobalt (Co)	µg/L	0.067	0.077
Copper (Cu)	µg/L	1.68	1.67
Iron (Fe)	µg/L	181.0	209.0
Lead (Pb)	µg/L	0.119	0.097
Manganese (Mn)	µg/L	12.800	15.000
Mercury (Hg)	ng/L	< 0.6	< 0.6
Molybdenum (Mo)	µg/L	0.323	0.229
Nickel (Ni)	µg/L	0.883	0.915
Selenium (Se)	µg/L	0.7	0.7
Silver (Ag)	µg/L	0.0025	0.0010
Strontium (Sr)	µg/L	44.6000	44.4000
Thallium (Tl)	µg/L	0.0031	0.0027
Tin (Sn)	µg/L	< 0.03	<0.03
Uranium (U)	µg/L	0.0541	0.0556
Vanadium (V)	µg/L	0.829	0.880
Zinc (Zn)	µg/L	1.07	1.01
Dissolved Metals			
Aluminum (Al)	µg/L	51.2	49.4
Antimony (Sb)	µg/L	0.017	0.016
Arsenic (As)	µg/L	0.426	0.399
Barium (Ba)	µg/L	3.040	3.080
Beryllium (Be)	µg/L	< 0.003	0.006
Boron (B)	µg/L	21.40	21.50
Cadmium (Cd)	µg/L	0.0034	0.0035
Chromium (Cr)	µg/L	0.29	0.26
Cobalt (Co)	µg/L	0.019	0.019
Copper (Cu)	µg/L	1.50	1.37
Iron (Fe)	µg/L	45.0	42.4
Lead (Pb)	µg/L	0.118	0.096
Manganese (Mn)	µg/L	0.796	0.558
Molybdenum (Mo)	µg/L	0.215	0.210
Nickel (Ni)	µg/L	0.600	0.609
Selenium (Se)	µg/L	0.6	0.5
Silver (Ag)	µg/L	< 0.0005	<0.0005
Strontium (Sr)	µg/L	42.8	42.4
Uranium (U)	µg/L	0.0458	0.0450
Vanadium (V)	µg/L	0.61	0.57
Zinc (Zn)	µg/L	1.06	0.36
Other			
Cyanide, Total	mg/L	0.520	0.001
Fluoride (F)	mg/L	0.06	0.06
Sulphide	mg/L	< 0.001	<0.001

Rep - Replicate sample

Table B2-2. Notable results for QA/QC equipment blank and field blank samples, 2006-2007

Parameter	Units	MRV	Fickle Duck Lake Field Blank (Ant Lake)						Reference Outflow Equipment Blank (Bug Lake)		
			18-Jul-06	17-Aug-06	10-Sep-06	21-Jul-07	20-Aug-07	9-Sep-07	18-Jul-06	17-Aug-06	11-Sep-06
Physical Parameters											
Alkalinity, Total (CaCO3)	mg/L	1	0	0	0	0	0	0	0	0	0
Conductivity	µS/cm	0.1	1.4	1.4	1.4	1	1.1	1.6	1.2	1	1.6
pH	pH	0.1	5.6	5.6	5.7	0	0	0	5.6	6.0	6.6
TDS (calculated)	mg/L	0.1	4.4	4	4	6	5.6	4.3	3.9	4.1	4.6
Total Suspended Solids	mg/L	1	0	0	0	0	0	0	0	0	0
Color, True	TCU	1	0	0	0	0	0	0	0	7	0
Nutrients											
Phosphorus, Total (TP)	mg/L	0.001	0.013	0.011	0.019	0	0	0	0.006	0.006	0.014
Total Kjeldahl Nitrogen	mg/L	0.01	0.09	0	0	0	0	0	0	0	0
Ammonia-N (NH3-N)	mg/L	0.001	0.026	0.006	0	0.009	0.006	0.006	0	0	0
Nitrite-N (NO2-N)	mg/L	0.001	0	0	0	0	0	0	0	0	0
Nitrate-N (NO3-N	mg/L	0.005	0	0	0	0	0	0	0	0	0
Organics											
Dissolved Organic Carbon	mg/L	0.2	0	0	0	0	0	0	0	0	0
Major Ions											
Calcium (Ca) (total)	mg/L	0.004	0	0.0558	0	0	0	0	0	0	0
Calcium (Ca) (dissolved)	mg/L	0.004	0	0	0	0	0	0	0	0	0
Chloride (Cl)	mg/L	0.3	0	0	0	0	0	0	0	0	0
Magnesium (Mg) (total)	mg/L	0.0001	0.0006	0.0033	0	0.0018	0.001	0.0041	0.0032	0.0015	0.0034
Magnesium (Mg) (dissolved)	mg/L	0.0001	0	0.0019	0	0.0018	0.001	0.004	0.0017	0	0.0025
Potassium (K) (total)	µg/L	2	0	0	0	0	0	0	0	0	0
Potassium (K) (dissolved)	µg/L	2	0	0	0	0	0	0	0	0	0
Sodium (Na) (total)	µg/L	2	0	0	0	0	0	0	0	0	0
Sodium (Na) (dissolved)	µg/L	2	0	0	0	0	0	0	0	0	0
Sulphate (SO4)	mg/L	3.00	0	0	0	0	0	0	0	0	0
Total Metals											
Aluminum (Al)	µg/L	0.5	0	0	0	0	0	0	0	0	0
Antimony (Sb)	µg/L	0.0005	0	0.0033	0	0.0034	0	0.003	0	0.0033	0
Arsenic (As)	µg/L	0.002	0	0	0	0	0	0.0193	0	0	0
Barium (Ba)	µg/L	0.004	0.0341	0.281	0	0.025	0	0.0915	0.0835	0.042	0.062
Beryllium (Be)	µg/L	0.003	0	0	0	0	0	0	0	0	0
Bismuth (Bi)	µg/L	0.001	0	0.0119	0	0	0	0	0	0	0
Boron (B)	µg/L	0.05	0.55	0	0.337	0.297	0.28	0.925	0.35	0.306	0.399
Cadmium (Cd)	µg/L	0.002	0	0	0	0	0	0	0	0	0
Chromium (Cr)	µg/L	0.03	0	0	0	0	0	0	0	0	0
Cobalt (Co)	µg/L	0.001	0	0.0062	0	0	0	0	0	0	0
Copper (Cu)	µg/L	0.05	0	0.329	0	0	0	0	0	0	0
Iron (Fe)	µg/L	2	0	0	0	0	0	0	0	0	0
Lead (Pb)	µg/L	0.001	0.0133	0.187	0.007	0	0.0478	0.0412	0.0165	0.0124	0.103
Manganese (Mn)	µg/L	0.003	0	0.0673	0	0.0338	0.0591	0.328	0.0203	0.0207	0.0483
Molybdenum (Mo)	µg/L	0.001	0	0.0678	0	0	0	0	0	0.0451	0
Trace Mercury (Hg)	ng/L	0.03	0	0	0	2	0	0	0	3.6	0
Nickel (Ni)	µg/L	0.6	0.0341	0.289	0	0	0	0	0	0.256	0.129
Selenium (Se)	µg/L	0.005	0	0	0	0	0	0	0	0	0
Silver (Ag)	µg/L	0.10	0	0.0063	0	0	0	0	0	0.0077	0
Strontium (Sr)	µg/L	0.0005	0.049	0.317	0	0.0122	0.0178	0.0656	0.0498	0.0258	0.0577
Thallium (Tl)	µg/L	0.004	0.0064	0	0.0031	0	0	0	0.0036	0	0.0047
Tin (Sn)	µg/L	0.0003	0	0	0	1.52	0.0516	0.099	0	0.335	0.502
Uranium (U)	µg/L	0.0001	0	0.0007	0	0	0	0	0	0	0
Vanadium (V)	µg/L	0.01	0	0.08	0	0	0	0	0	0	0
Zinc (Zn)	µg/L	0.01	0.273	0.414	0.424	0.396	0.372	0.308	0.31	0.326	0.388
Dissolved Metals											
Aluminum (Al)	µg/L	0.2	0	0	0	0	0	0	0	0	0
Antimony (Sb)	µg/L	0.0005	0	0.0033	0	0.0034	0	0.00297	0	0.0033	0
Arsenic (As)	µg/L	0.002	0	0	0	0	0	0.0191	0	0	0
Barium (Ba)	µg/L	0.004	0	0.0543	0	0	0	0.0906	0	0	0
Beryllium (Be)	µg/L	0.003	0	0	0	0	0	0	0	0	0
Boron (B)	µg/L	0.03	0.281	0.178	0.275	0	0.256	0.201	0.29	0.27	0.314
Cadmium (Cd)	µg/L	0.002	0	0	0	0	0	0	0	0	0
Chromium (Cr)	µg/L	0.03	0	0	0	0	0	0	0	0	0
Cobalt (Co)	µg/L	0.001	0	0	0	0	0	0	0	0	0
Copper (Cu)	µg/L	0.05	0	0	0	0	0	0	0	0	0
Iron (Fe)	µg/L	2	0	0	0	0	0	0	0	0	0
Lead (Pb)	µg/L	0.001	0	0	0.0069	0	0	0.0174	0	0	0.0075
Manganese (Mn)	µg/L	0.003	0	0	0	0	0.0323	0.325	0	0	0.0414
Molybdenum (Mo)	µg/L	0.001	0	0.0107	0	0	0	0	0	0.0056	0
Nickel (Ni)	µg/L	0.005	0	0	0	0	0	0	0	0	0
Selenium (Se)	µg/L	0.1	0	0	0	0	0	0	0	0	0
Silver (Ag)	µg/L	0.0005	0	0.0036	0	0	0.0026	0	0	0.0045	0
Strontium (Sr)	µg/L	0.004	0.0487	0.169	0	0	0	0.065	0	0	0.0296
Uranium (U)	µg/L	0.0001	0	0	0	0	0	0	0	0	0
Vanadium (V)	µg/L	0.01	0	0	0	0	0	0	0	0	0
Zinc (Zn)	µg/L	0.05	0	0	0.346	0.296	0.264	0	0	0.264	0.26
Other											
Cyanide, Total	mg/L	0.001	0	0	0	0	0	0	0	0	0
Fluoride (F)	mg/L	0.01	0	0	0	0	0	0	0	0	0

Notables are > 5 times the MRV.
Notables are highlighted in yellow if concentrations are > 10% of the corresponding field value concentrations.
There were no notables for radium-226 or Dissolved Organic Carbon blanks.

Table B2-2. Notable results for QA/QC equipment blank and field blank samples, 2006-2007

Parameter	Units	MRV	Reference Outflow Equipment Blank (Bug Lake)				Patch Lake Equipment Blank (Slim Lake)				
			23-Jun-07	21-Jul-07	20-Aug-07	9-Sep-07	22-Jul-06	15-Aug-06	8-Sep-06	24-May-07	18-Jul-07
Physical Parameters											
Alkalinity, Total (CaCO3)	mg/L	1	0	0	0	0				0	0
Conductivity	µS/cm	0.1	1.2	1	1.3	1.2	1.3	1.3	1.4	1.6	1.2
pH	pH	0.1	0	0	0	0	5.8	5.5	5.8	0	0
TDS (calculated)	mg/L	0.1	4.8	5.9	5.7	4.3	4.0	3.8	4.2	5.6	7.4
Total Suspended Solids	mg/L	1	0	0	0	0				0	0
Color, True	TCU	1	0	0	0	0				0	0
Nutrients											
Phosphorus, Total (TP)	mg/L	0.001	0	0	0	0		0.012	0.013	0	0
Total Kjeldahl Nitrogen	mg/L	0.01	0	0	0	0				0	0
Ammonia-N (NH3-N)	mg/L	0.001	0.009	0.008	0.008	0				0	0.012
Nitrite-N (NO2-N)	mg/L	0.001	0	0	0	0				0	0
Nitrate-N (NO3-N	mg/L	0.005	0	0	0	0				0	0
Organics											
Dissolved Organic Carbon	mg/L	0.2	0	0	0	0				0	0
Major Ions											
Calcium (Ca) (total)	mg/L	0.004	0	0	0	0.0333				0.0204	0.0953
Calcium (Ca) (dissolved)	mg/L	0.004	0	0	0	0.0227				0	0.0818
Chloride (Cl)	mg/L	0.3	0	0	0	0				0	0
Magnesium (Mg) (total)	mg/L	0.0001	0.0016	0	0.0006	0.0015	0.0043	0.0052	0.0033	0.0031	0.078
Magnesium (Mg) (dissolved)	mg/L	0.0001	0.0012	0	0.0006	0.0015	0.0025	0.0023	0.0020	0.0008	0.0676
Potassium (K) (total)	µg/L	2	0	0	0	0				0	27.7
Potassium (K) (dissolved)	µg/L	2	0	0	0	0				0	25
Sodium (Na) (total)	µg/L	2	0	0	0	0				0	379
Sodium (Na) (dissolved)	µg/L	2	0	0	0	0				0	375
Sulphate (SO4)	mg/L	3.00	0	0	0	0				0	0
Total Metals											
Aluminum (Al)	µg/L	0.5	0	0	0	0				0	10.9
Antimony (Sb)	µg/L	0.0005	0.0104	0	0.0038	0	0.004		0.003	0.0038	0.0038
Arsenic (As)	µg/L	0.002	0	0	0.0187	0	0.044	0.025	0.013	0	0.0181
Barium (Ba)	µg/L	0.004	0	0.0386	0.0239	0.0932	0.033	0.096	0.021	0.0246	0.0827
Beryllium (Be)	µg/L	0.003	0	0	0	0				0	0
Bismuth (Bi)	µg/L	0.001	0	0	0	0				0	0
Boron (B)	µg/L	0.05	0.292	0.776	0	0.33	0.354	0.331	0.279	0.360	0.552
Cadmium (Cd)	µg/L	0.002	0	0	0	0				0	0
Chromium (Cr)	µg/L	0.03	0	0	0	0				0	0
Cobalt (Co)	µg/L	0.001	0	0	0	0				0	0
Copper (Cu)	µg/L	0.05	0	0	0	0				0	0
Iron (Fe)	µg/L	2	0	0	0	0				0	0
Lead (Pb)	µg/L	0.001	0	0	0	0.0369	0.014	0.011	0.015	0.0306	0
Manganese (Mn)	µg/L	0.003	0.103	0	0	0.154	0.032	0.052	0.041	0.0192	0.077
Molybdenum (Mo)	µg/L	0.001	0.0646	0	0	0				0.0051	0.0346
Trace Mercury (Hg)	ng/L	0.03	0	0	0	0	3.6	1.0	0.9	0	0
Nickel (Ni)	µg/L	0.6	0	0	0	0				0	0
Selenium (Se)	µg/L	0.005	0	0.119	0	0	0.3			0	0
Silver (Ag)	µg/L	0.10	0	0	0	0				0	0
Strontium (Sr)	µg/L	0.0005	0.0488	0.0218	0.0231	0.105	0.0645	0.0877	0.0497	0.0345	0.465
Thallium (Tl)	µg/L	0.004	0	0	0	0				0	0
Tin (Sn)	µg/L	0.0003	0	0	0	0	0.31	0.44	0.28	0	2
Uranium (U)	µg/L	0.0001	0	0	0	0				0	0.0019
Vanadium (V)	µg/L	0.01	0	0	0	0				0.0676	0
Zinc (Zn)	µg/L	0.01	0.161	0.42	0.458	0.325	0.38	0.40	0.35	0.346	3.77
Dissolved Metals											
Aluminum (Al)	µg/L	0.2	0	0	0	0				0	0
Antimony (Sb)	µg/L	0.0005	0.0103	0	0.0037	0	0.004		0.003	0.00375	0.00374
Arsenic (As)	µg/L	0.002	0	0	0.0185	0	0.044	0.024	0.012	0	0.0179
Barium (Ba)	µg/L	0.004	0	0	0	0.0302				0	0.0224
Beryllium (Be)	µg/L	0.003	0	0	0	0				0	0
Boron (B)	µg/L	0.03	0.239	0.169	0	0	0.31	0.27	0.27	0.276	0
Cadmium (Cd)	µg/L	0.002	0	0	0	0				0	0
Chromium (Cr)	µg/L	0.03	0	0	0	0				0	0
Cobalt (Co)	µg/L	0.001	0	0	0	0				0	0
Copper (Cu)	µg/L	0.05	0	0	0	0				0	0
Iron (Fe)	µg/L	2	0	0	0	0				0	0
Lead (Pb)	µg/L	0.001	0	0	0	0.007	0.008		0.015	0.019	0
Manganese (Mn)	µg/L	0.003	0.102	0	0	0.152	0.017	0.027	0.041	0	0.0301
Molybdenum (Mo)	µg/L	0.001	0.014	0	0	0.0117				0	0.0335
Nickel (Ni)	µg/L	0.005	0	0	0	0				0	0
Selenium (Se)	µg/L	0.1	0	0	0	0				0	0
Silver (Ag)	µg/L	0.0005	0	0	0	0				0	0.009
Strontium (Sr)	µg/L	0.004	0.0483	0.0216	0.0229	0.102	0.026	0.025	0.050	0.0281	0.46
Uranium (U)	µg/L	0.0001	0	0	0	0				0	0
Vanadium (V)	µg/L	0.01	0	0	0	0				0	0
Zinc (Zn)	µg/L	0.05	0	0.311	0.297	0			0.25	0.271	1.85
Other											
Cyanide, Total	mg/L	0.001	0	0	0	0				0.09	0
Fluoride (F)	mg/L	0.01	0.08	0.14	0	0				0	0.13

Notables are > 5 times the MRV.
Notables are highlighted in yellow if concentrations are > 10% of the corresponding field value concentrations.
There were no notables for radium-226 or Dissolved Organic blanks.

Table B2-2. Notable results for QA/QC equipment blank and field blank samples, 2006-2007

Parameter	Units	MRV	Patch Lake Equipment Blank (Slim Lake)		Patch Outflow Field Blank (Wolf Outflow)	
			18-Aug-07	13-Sep-07	22-Jul-06	22-Jun-07
Physical Parameters						
Alkalinity, Total (CaCO3)	mg/L	1	0	0	0	0
Conductivity	µS/cm	0.1	4.2	1.7	1.1	1.4
pH	pH	0.1	0	0	5.7	0
TDS (calculated)	mg/L	0.1	7.1	4.2	3.9	5.1
Total Suspended Solids	mg/L	1	0	0	0	0
Color, True	TCU	1	0	0	0	0
Nutrients						
Phosphorus, Total (TP)	mg/L	0.001	0	0	0	0
Total Kjeldahl Nitrogen	mg/L	0.01	0	0	0	0
Ammonia-N (NH3-N)	mg/L	0.001	0.009	0.008	0	0.01
Nitrite-N (NO2-N)	mg/L	0.001	0	0	0	0
Nitrate-N (NO3-N	mg/L	0.005	0	0	0	0
Organics						
Dissolved Organic Carbon	mg/L	0.2	0	0	0	0
Major Ions						
Calcium (Ca) (total)	mg/L	0.004	0	0	0	0
Calcium (Ca) (dissolved)	mg/L	0.004	0	0	0	0
Chloride (Cl)	mg/L	0.3	0	0	0	0
Magnesium (Mg) (total)	mg/L	0.0001	0.0446	0.0055	0.0005	0.0007
Magnesium (Mg) (dissolved)	mg/L	0.0001	0.0301	0.0043	0	0
Potassium (K) (total)	µg/L	2	0	0	0	0
Potassium (K) (dissolved)	µg/L	2	0	0	0	0
Sodium (Na) (total)	µg/L	2	304	0	0	0
Sodium (Na) (dissolved)	µg/L	2	290	0	0	0
Sulphate (SO4)	mg/L	3.00	0	0	0	0
Total Metals						
Aluminum (Al)	µg/L	0.5	11.2	0	0	0
Antimony (Sb)	µg/L	0.0005	0.0044	0	0	0
Arsenic (As)	µg/L	0.002	0.0314	0	0.017	0
Barium (Ba)	µg/L	0.004	0.0809	0.0589	0	0.0591
Beryllium (Be)	µg/L	0.003	0	0	0	0
Bismuth (Bi)	µg/L	0.001	0	0	0	0.0099
Boron (B)	µg/L	0.05	0.307	0	0.45	1.05
Cadmium (Cd)	µg/L	0.002	0	0	0	0
Chromium (Cr)	µg/L	0.03	0.209	0	0	0
Cobalt (Co)	µg/L	0.001	0.0073	0	0	0
Copper (Cu)	µg/L	0.05	0	0	0	0
Iron (Fe)	µg/L	2	0	0	0	0
Lead (Pb)	µg/L	0.001	0	0.0081	0	0
Manganese (Mn)	µg/L	0.003	0.151	0	0	0
Molybdenum (Mo)	µg/L	0.001	0.0179	0.0074	0	0.0185
Trace Mercury (Hg)	ng/L	0.03	0	1.1	0	0.7
Nickel (Ni)	µg/L	0.6	0	0	0	0
Selenium (Se)	µg/L	0.005	0	0	0	0
Silver (Ag)	µg/L	0.10	0	0	0	0
Strontium (Sr)	µg/L	0.0005	0.29	0.0652	0.0092	0.016
Thallium (Tl)	µg/L	0.004	0	0	0	0
Tin (Sn)	µg/L	0.0003	0.405	0.0468	0	0
Uranium (U)	µg/L	0.0001	0.0106	0	0	0
Vanadium (V)	µg/L	0.01	0.0757	0.0655	0	0
Zinc (Zn)	µg/L	0.01	0.15	0.355	0.40	0.384
Dissolved Metals						
Aluminum (Al)	µg/L	0.2	0	0	0	0
Antimony (Sb)	µg/L	0.0005	0.0044	0	0	0
Arsenic (As)	µg/L	0.002	0	0	0.017	0
Barium (Ba)	µg/L	0.004	0	0	0	0
Beryllium (Be)	µg/L	0.003	0	0	0	0
Boron (B)	µg/L	0.03	0.282	0	0	
Cadmium (Cd)	µg/L	0.002	0	0	0	0
Chromium (Cr)	µg/L	0.03	0	0	0	0
Cobalt (Co)	µg/L	0.001	0	0	0	0
Copper (Cu)	µg/L	0.05	0	0	0	0
Iron (Fe)	µg/L	2	0	0	0	0
Lead (Pb)	µg/L	0.001	0	0.008	0	0
Manganese (Mn)	µg/L	0.003	0	0	0	0
Molybdenum (Mo)	µg/L	0.001	0	0	0	0.0074
Nickel (Ni)	µg/L	0.005	0	0	0	0
Selenium (Se)	µg/L	0.1	0	0	0	0
Silver (Ag)	µg/L	0.0005	0	0.0072	0	0
Strontium (Sr)	µg/L	0.004	0.307	0.0645	0	0
Uranium (U)	µg/L	0.0001	0	0	0	0
Vanadium (V)	µg/L	0.01	0	0.0648	0	0
Zinc (Zn)	µg/L	0.05	0	0.254	0	0
Other						
Cyanide, Total	mg/L	0.001	0	0.07	0	0.1
Fluoride (F)	mg/L	0.01	0	0	0	0.07

Notables are > 5 times the MRV.
Notables are highlighted in yellow if concentrations are > 10% of the corresponding field value concentrations.
There were no notables for radium-226 or Dissolved Organic blanks.

Table B2-3. Notable results for QA/QC field duplicate samples, 2006-2007

Parameter	Units	MRV	Stickleback Lake Duplicate (Fly Lake)								
			17-Jul-06			17-Aug-06			10-Sep-06		
			Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD
Physical Parameters											
Alkalinity, Total ($CaCO_3$)	mg/L	1	32.9	32.8	0%	33.8	33.9	0%	33.6	33.7	0%
Conductivity	µS/cm	0.1	239	239	0%	242	241	0%	252	252	0%
pH	Units	0.1	7.67	7.69	0%	7.71	7.65	1%	7.62	7.7	1%
TDS (Calculated)	mg/L	0.1	111	111	0%	117	118	1%	118	117	1%
Total Suspended Solids	mg/L	1	<1	<1	-	<1	<1	-	<1	<1	-
Color, True	TCU	1	<1	<1	-	<1	14	-	<1	<1	-
Nutrients											
Phosphorus, Total	mg/L	0.001	0.013	0.014	7%	0.03	0.028	7%	0.033	0.025	**28%**
Total Kjeldahl Nitrogen	mg/L	0.01	0.4	0.33	19%	0.4	0.39	3%	0.36	0.36	0%
Ammonia-N	mg/L	0.001	0.01	<0.03	-	0.013	0.01	**26%**	0.008	0.005	-
Nitrite-N	mg/L	0.001	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.001	-
Nitrate-N	mg/L	0.005	<0.005	<0.005	-	<0.005	0.005	-	0.012	<0.005	-
Organics											
Dissolved Organic Carbon	mg/L	0.2	4.2	4.4	5%	4.7	4.9	4%	4.5	4.5	0%
Dissolved Anions											
Calcium (Ca) (total)	mg/L	0.004	17.1	16.9	1%	17.6	17.6	0%	18.3	17.5	4%
Calcium (Ca) (dissolved)	mg/L	0.004	15.6	15.9	2%	16.5	16.1	2%	17	17.3	2%
Chloride (Cl)	mg/L	0.3	51.1	50.9	0%	53.1	53.7	1%	55.1	54.5	1%
Magnesium (Mg) (total)	mg/L	0.0001	6.22	6.2	0%	6.37	6.45	1%	6.66	6.22	7%
Magnesium (Mg) (dissolved)	mg/L	0.0001	5.66	5.85	3%	5.79	5.6	3%	6.14	6.16	0%
Potassium (K) (total)	mg/L	0.002	1.71	1.70	1%	1.77	1.80	2%	1.88	1.78	5%
Potassium (K) (dissolved)	mg/L	0.002	1.55	1.61	4%	1.65	1.61	2%	1.72	1.75	2%
Sodium (Na) (total)	mg/L	0.002	14.7	14.7	0%	15.5	15.1	3%	15.9	14.8	7%
Sodium (Na) (dissolved)	mg/L	0.002	13.6	14.0	3%	13.9	13.3	4%	14.7	14.8	1%
Sulphate (SO_4)	mg/L	3.00	<3	<3	-	<3	<3	-	<3	<3	-
Total Metals											
Aluminum (Al)	µg/L	0.5	7.39	4.96	**39%**	12.2	9.6	**24%**	12.1	13	7%
Antimony (Sb)	µg/L	0.0005	0.0064	0.0064	0%	0.0077	0.0082	6%	0.0074	0.0115	**43%**
Arsenic (As)	µg/L	0.002	0.377	0.37	2%	0.451	0.49	8%	0.481	0.435	10%
Barium (Ba)	µg/L	0.004	5.45	5.26	4%	5.41	5.5	2%	5.57	5.31	5%
Beryllium (Be)	µg/L	0.003	<0.003	<0.003	-	<0.003	<0.003	-	<0.003	<0.003	-
Bismuth (Bi)	µg/L	0.001	0.0019	0.0016	-	0.0039	0.0034	-	0.0022	<0.001	-
Boron (B)	µg/L	0.05	16.3	17.3	6%	18.7	18.2	3%	19.3	18.8	3%
Cadmium (Cd)	µg/L	0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	0.0027	-
Chromium (Cr)	µg/L	0.03	0.124	0.108	-	0.101	0.106	-	0.112	0.056	-
Cobalt (Co)	µg/L	0.001	0.0218	0.0252	14%	0.0348	0.0334	4%	0.0205	0.0195	5%
Copper (Cu)	µg/L	0.05	0.502	0.465	8%	0.885	2.02	**78%**	0.815	0.325	**86%**
Iron (Fe)	µg/L	2	53.3	51	4%	105	106	1%	31.9	28.8	10%
Lead (Pb)	µg/L	0.001	0.046	0.0488	6%	0.114	0.114	0%	0.0513	0.0379	**30%**
Manganese (Mn)	µg/L	0.003	5.97	6.46	8%	11.3	11.7	3%	4.76	4.43	7%
Molybdenum (Mo)	µg/L	0.001	0.0386	0.0354	9%	0.234	0.0549	**124%**	0.0497	0.0502	1%
Mercury (Hg)	µg/L	0.6	<0.6	<0.6	-	47	14	**108%**	7	7	0%
Nickel (Ni)	µg/L	0.005	<0.005	<0.005	-	0.199	0.059	**109%**	0.095	0.082	15%
Selenium (Se)	µg/L	0.10	0.361	0.383	-	0.571	0.538	6%	0.592	0.51	15%
Silver (Ag)	µg/L	0.0005	<0.0005	0.0009	-	0.0011	0.0018	-	0.0009	0.0006	-
Strontium (Sr)	µg/L	0.004	99.5	97	3%	102	101	1%	103	100	3%
Thallium (Tl)	µg/L	0.0003	0.0122	0.0129	6%	0.0026	0.0069	**91%**	0.0136	0.0124	9%
Tin (Sn)	µg/L	0.03	17	24.9	**38%**	3.1	6.14	**66%**	2.01	0.171	**169%**
Uranium (U)	µg/L	0.0001	0.0111	0.011	1%	0.0102	0.0103	1%	0.0099	0.0104	5%
Vanadium (V)	µg/L	0.01	0.0393	0.0448	-	0.168	0.028	-	0.0362	0.02	-
Zinc (Zn)	µg/L	0.01	2.22	0.85	**89%**	3.74	6.63	**56%**	1.54	0.782	**65%**
Dissolved Metals											
Aluminum (Al)	µg/L	0.2	0.914	1.03	-	0.449	0.501	-	0.647	0.52	-
Antimony (Sb)	µg/L	0.0005	0.0064	0.0064	0%	0.0077	0.0082	6%	0.0073	0.0111	**41%**
Arsenic (As)	µg/L	0.002	0.311	0.345	10%	0.367	0.406	10%	0.395	0.386	2%
Barium (Ba)	µg/L	0.004	4.73	4.82	2%	4.78	4.77	0%	5.12	5.07	1%
Beryllium (Be)	µg/L	0.003	<0.003	<0.003	-	<0.003	<0.003	-	<0.003	<0.003	-
Boron (B)	µg/L	0.03	14.5	15.6	7%	16.7	15.4	8%	17.1	17.3	1%
Cadmium (Cd)	µg/L	0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	0.0021	-
Chromium (Cr)	µg/L	0.03	0.115	0.107	-	0.0975	0.065	-	0.106	0.052	-
Cobalt (Co)	µg/L	0.001	0.0063	0.0087	**32%**	0.0151	0.012	**23%**	0.0051	0.0074	**37%**
Copper (Cu)	µg/L	0.05	0.349	0.39	11%	0.641	1.34	**71%**	0.634	0.318	**66%**
Iron (Fe)	µg/L	2	<2	<2	-	<2	<2	-	<2	<2	-
Lead (Pb)	µg/L	0.001	0.0327	0.0335	2%	0.0925	0.0912	1%	0.0391	0.0367	6%
Manganese (Mn)	µg/L	0.003	0.0982	0.101	3%	0.134	0.15	11%	0.241	0.252	4%
Molybdenum (Mo)	µg/L	0.001	0.0287	0.0346	19%	0.0481	0.0467	3%	0.0469	0.0461	2%
Nickel (Ni)	µg/L	0.005	<0.005	<0.005	-	0.026	0.048	**59%**	<0.005	0.018	-
Selenium (Se)	µg/L	0.1	0.355	0.35	-	0.408	0.264	-	0.585	0.504	15%
Silver (Ag)	µg/L	0.0005	<0.0005	<0.0005	-	0.0009	0.0009	-	<0.0005	<0.0005	-
Strontium (Sr)	µg/L	0.004	90.1	92.1	2%	94.2	92.4	2%	98.3	99.9	2%
Uranium (U)	µg/L	0.0001	0.0078	0.008	3%	0.0072	0.0068	6%	0.0057	0.0059	3%
Vanadium (V)	µg/L	0.01	0.0385	0.0445	-	<0.01	<0.01	-	0.036	0.0197	-
Zinc (Zn)	µg/L	0.05	2.14	0.735	**98%**	2.49	2.43	2%	1.52	0.781	**64%**
Other											
Cyanide, Total	mg/L	0.001	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.001	-
Fluoride (F)	mg/L	0.01	0.04	0.04	-	0.03	0.01	-	0.05	0.05	-

Values in bold indicate that samples and duplicates are greater than five times the MRV, and greater than 20% different. '-' indicates that samples and/or duplicates are not greater than five times the MRV.

Table B2-3. Notable results for QA/QC field duplicate samples, 2006-2007

Parameter	Units	MRV	Stickleback Lake Duplicate (Fly Lake)								
			21-Jul-07			20-Aug-07			9-Sep-07		
			Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD
Physical Parameters											
Alkalinity, Total ($CaCO_3$)	mg/L	1	35.9	35.8	0%	34.2	34.2	0%	34.4	34.9	1%
Conductivity	µS/cm	0.1	70	70.5	1%	70.9	70.5	1%	71.2	69	3%
pH	Units	0.1	248	247	0%	246	246	0%	250	248	1%
TDS (Calculated)	mg/L	0.1	125	125	0%	122	122	0%	122	122	0%
Total Suspended Solids	mg/L	1	<1	<1	-	1	1	-	<1	<1	-
Color, True	TCU	1	5	5	-	<1	<1	-	<1	<1	-
Nutrients					-			-			-
Phosphorus, Total	mg/L	0.001	0.013	0.015	14%	0.011	0.012	9%	0.011	0.011	0%
Total Kjeldahl Nitrogen	mg/L	0.01	0.39	0.37	5%	0.37	0.38	3%	0.39	0.4	3%
Ammonia-N	mg/L	0.001	0.015	0.012	**22%**	0.01	0.012	18%	0.009	0.034	**116%**
Nitrite-N	mg/L	0.001	<0.005	<0.005	-	<0.005	<0.005	-	<0.005	<0.005	-
Nitrate-N	mg/L	0.005	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.001	-
Organics					-			-			-
Dissolved Organic Carbon	mg/L	0.2	4.4	4.3	2%	4.2	4.5	7%	4.7	4.6	2%
Dissolved Anions					-			-			-
Calcium (Ca) (total)	mg/L	0.004	17.4	17.5	1%	17	16.8	1%	17.2	17.6	2%
Calcium (Ca) (dissolved)	mg/L	0.004	16.4	16.9	3%	16.6	16.5	1%	16.8	16.9	1%
Chloride (Cl)	mg/L	0.3	58.4	<0.3	-	54.9	<0.3	-	56.5	<0.3	-
Magnesium (Mg) (total)	mg/L	0.0001	6.2	6.17	0%	6.62	6.48	2%	6.64	6.9	4%
Magnesium (Mg) (dissolved)	mg/L	0.0001	5.88	5.9	0%	6.42	6.24	3%	6.5	6.57	1%
Potassium (K) (total)	mg/L	0.002	1.79	1.78	1%	1.79	1.76	2%	1.88	1.94	3%
Potassium (K) (dissolved)	mg/L	0.002	1.67	1.70	2%	1.74	1.73	1%	1.83	1.84	1%
Sodium (Na) (total)	mg/L	0.002	14.9	14.7	1%	16.3	15.9	2%	16.1	16.8	4%
Sodium (Na) (dissolved)	mg/L	0.002	14.2	14.0	-	15.9	15.3	4%	16.0	16.5	3%
Sulphate (SO_4)	mg/L	3.00	<3	<3	-	<3	<3	-	<3	<3	-
Total Metals					-			-			-
Aluminum (Al)	µg/L	0.5	6.25	9.98	**46%**	10.8	10.4	4%	9.25	10.5	13%
Antimony (Sb)	µg/L	0.0005	0.005	0.0046	-	0.0058	0.0345	**142%**	0.005	0.0085	-
Arsenic (As)	µg/L	0.002	0.458	0.441	4%	0.44	0.45	2%	0.472	0.466	1%
Barium (Ba)	µg/L	0.004	6.32	6.39	1%	6.01	6.11	2%	5.71	5.88	3%
Beryllium (Be)	µg/L	0.003	<0.003	<0.003	-	<0.003	<0.003	-	<0.003	<0.003	-
Bismuth (Bi)	µg/L	0.001	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.001	-
Boron (B)	µg/L	0.05	18.4	18.2	1%	16.1	15.7	3%	17.9	17.4	3%
Cadmium (Cd)	µg/L	0.002	<0.002	<0.002	-	<0.002	<0.002	-	0.0026	0.0049	-
Chromium (Cr)	µg/L	0.03	0.106	0.124	16%	0.0387	0.0738	**62%**	0.15	0.177	17%
Cobalt (Co)	µg/L	0.001	0.0226	0.0327	**37%**	0.033	0.0323	2%	0.035	0.0343	2%
Copper (Cu)	µg/L	0.05	0.308	0.233	**28%**	0.317	1.03	**106%**	0.341	0.852	**86%**
Iron (Fe)	µg/L	2	65.7	99.3	**41%**	64.3	58.6	9%	49.7	40.4	**21%**
Lead (Pb)	µg/L	0.001	0.236	0.0016	-	0.0082	0.0137	-	0.0219	0.0283	-
Manganese (Mn)	µg/L	0.003	7.44	12.7	**52%**	8.75	8.52	3%	7.53	7.57	1%
Molybdenum (Mo)	µg/L	0.001	0.0106	0.0161	**41%**	0.0272	0.0252	8%	0.0341	0.0423	**21%**
Mercury (Hg)	µg/L	0.6	1.5	2.1	**33%**	<0.6	<0.6	-	0.8	<0.6	-
Nickel (Ni)	µg/L	0.005	0.057	0.0163	-	0.163	0.121	**30%**	0.134	0.017	-
Selenium (Se)	µg/L	0.10	0.591	0.674	13%	0.47	0.47	0%	0.735	0.76	3%
Silver (Ag)	µg/L	0.0005	0.001	0.001	-	0.0011	<0.0005	-	0.0016	0.0026	-
Strontium (Sr)	µg/L	0.004	98.2	99.5	1%	101	101	0%	99.9	102	2%
Thallium (Tl)	µg/L	0.0003	0.0048	0.0048	-	<0.0003	<0.0003	-	<0.0003	0.0012	-
Tin (Sn)	µg/L	0.03	1.25	0.982	**24%**	0.111	0.85	**154%**	0.107	1.16	**166%**
Uranium (U)	µg/L	0.0001	0.0082	0.0085	-	0.0086	0.0085	-	0.0101	0.0099	-
Vanadium (V)	µg/L	0.01	<0.01	0.021	-	<0.01	0.02	-	<0.01	0.058	-
Zinc (Zn)	µg/L	0.01	2.06	3.63	**55%**	2.06	1.65	**22%**	1.34	1.62	19%
Dissolved Metals					-			-			-
Aluminum (Al)	µg/L	0.2	<0.02	<0.02	-	<0.02	<0.02	-	0.208	0.63	**101%**
Antimony (Sb)	µg/L	0.0005	0.005	0.0046	-	0.0057	0.0342	-	0.0049	0.0084	-
Arsenic (As)	µg/L	0.002	0.411	0.368	11%	0.402	0.387	4%	0.412	0.406	1%
Barium (Ba)	µg/L	0.004	5.87	5.97	2%	5.68	5.65	1%	5.32	5.35	1%
Beryllium (Be)	µg/L	0.003	<0.003	<0.003	-	<0.003	<0.003	-	<0.003	<0.003	-
Boron (B)	µg/L	0.03	17	16.9	1%	15.5	14.7	5%	15.4	15.8	3%
Cadmium (Cd)	µg/L	0.002	<0.002	<0.002	-	<0.002	<0.002	-	<0.002	0.0049	-
Chromium (Cr)	µg/L	0.03	0.105	0.104	1%	0.0383	0.0567	**39%**	0.149	0.175	16%
Cobalt (Co)	µg/L	0.001	0.0088	0.0096	-	0.0097	0.0125	-	0.0134	0.0129	-
Copper (Cu)	µg/L	0.05	0.205	0.176	15%	0.314	0.775	**85%**	0.338	0.843	**86%**
Iron (Fe)	µg/L	2	3.5	3.1	12%	2.9	2	**37%**		<2	-
Lead (Pb)	µg/L	0.001	<0.001	<0.001	-	0.0035	<0.001	-	0.0054	0.0139	-
Manganese (Mn)	µg/L	0.003	0.076	0.103	**30%**	0.0943	0.0997	6%	0.312	0.293	6%
Molybdenum (Mo)	µg/L	0.001	0.0105	0.0099	-	0.0199	0.0215	-	0.0338	0.0419	**21%**
Nickel (Ni)	µg/L	0.005	0.0098	<0.005	-	0.114	0.12	5%	0.0579	0.0119	**132%**
Selenium (Se)	µg/L	0.1	0.585	0.473	**21%**	0.36	0.465	**25%**	0.578	0.53	9%
Silver (Ag)	µg/L	0.0005	0.001	0.00099	-	<0.0005	<0.0005	-	<0.0005	<0.0005	-
Strontium (Sr)	µg/L	0.004	95.5	96.2	1%	98.7	98.6	0%	99.8	102	2%
Uranium (U)	µg/L	0.0001	0.0063	0.0064	2%	0.0071	0.0069	3%	0.0072	0.008	11%
Vanadium (V)	µg/L	0.01	<0.01	0.015	-	<0.01	<0.01	-	<0.01	0.033	-
Zinc (Zn)	µg/L	0.05	1.14	2.3	**67%**	2.04	1.63	**22%**	1.33	1.6	18%
Other					-			-			-
Cyanide, Total	mg/L	0.001	<0.02	<0.001	-	<0.02	<0.001	-	<0.02	<0.001	-
Fluoride (F)	mg/L	0.01	0.37	0.38	3%	0.03	0.02	**40%**	0.04	0.04	0%

Table B2-3. Notable results for QA/QC field duplicate samples, 2006-2007

Parameter	Units	MRV	Windy Outflow Duplicate (Hope Outflow)						Pelvic Outflow Duplicate (Hope Outflow)		
			9-Sep-06			19-Jul-07			18-Aug-07		
			Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD
Physical Parameters											
Alkalinity, Total ($CaCO_3$)	mg/L	1	48	48	0%	39.2	39.7	1%	22.3	22.5	1%
Conductivity	µS/cm	0.1	437	437	0%	327	329	1%	248	251	1%
pH	Units	0.1	8.05	8.04	0%						
TDS (Calculated)	mg/L	0.1	214	211	1%	169	168	1%	126	126	0%
Total Suspended Solids	mg/L	1	<1	<1	-	<1	<1	-	8	8	0%
Color, True	TCU	1	<1	<1	-	7	7	0%	9	6	**40%**
Nutrients											
Phosphorus, Total	mg/L	0.001	0.019	0.024	**23%**	0.004	0.007	**55%**	0.045	0.041	9%
Total Kjeldahl Nitrogen	mg/L	0.01	0.11	0.11	0%	0.1	0.11	10%	0.65	0.61	6%
Ammonia-N	mg/L	0.001	0.002	0.003	-	0.009	0.008	-	0.008	0.009	-
Nitrite-N	mg/L	0.001	<0.005	<0.005	-	<0.001	<0.001	-	<0.001	<0.001	-
Nitrate-N	mg/L	0.005	<0.001	<0.001	-	<0.005	<0.005	-	<0.005	<0.005	-
Organics											
Dissolved Organic Carbon	mg/L	0.2	1.9	2	5%	<0.001	1.5	-	<0.001	5.9	-
Dissolved Anions											
Calcium (Ca) (total)	mg/L	0.004	11.5	11.8	3%	8.93	9.05	1%	4.39	4.49	2%
Calcium (Ca) (dissolved)	mg/L	0.004	11.2	11.2	0%	8.78	8.64	2%	4.25	4.32	2%
Chloride (Cl)	mg/L	0.3	95.8	94.9	1%	78.8	78.5	0%	60.5	61.2	1%
Magnesium (Mg) (total)	mg/L	0.0001	9.58	9.5	1%	6.9	7.25	5%	5.77	6.18	7%
Magnesium (Mg) (dissolved)	mg/L	0.0001	9.52	9.17	4%	6.831	6.91	1%	5.76	6.05	5%
Potassium (K) (total)	mg/L	0.002	3.89	3.94	1%	2.77	2.77	0%	2.10	2.13	1%
Potassium (K) (dissolved)	mg/L	0.002	3.83	3.79	1%	2.72	2.63	3%	1.88	1.91	2%
Sodium (Na) (total)	mg/L	0.002	55.3	54.8	1%	38.6	39.2	2%	30.6	30.8	1%
Sodium (Na) (dissolved)	mg/L	0.002	55.1	53.0	4%	38.4	37.7	2%	30.6	30.5	0%
Sulphate (SO_4)	mg/L	3.00	11	9	-	5	4	**22%**	5	5	0%
Total Metals											
Aluminum (Al)	µg/L	0.5	48.7	65.4	**29%**	34	26.8	**24%**	307	380	**21%**
Antimony (Sb)	µg/L	0.0005	0.0562	0.0557	1%	0.0412	0.0419	-	0.0176	0.017	-
Arsenic (As)	µg/L	0.002	0.65	0.722	10%	0.418	0.452	8%	0.638	0.692	8%
Barium (Ba)	µg/L	0.004	2.35	2.52	7%	2.05	1.89	8%	4.91	6.29	**25%**
Beryllium (Be)	µg/L	0.003	<0.003	<0.003	-	0.0045	<0.003	-	0.0099	0.0098	-
Bismuth (Bi)	µg/L	0.001	0.0046	0.0015	-	<0.001	0.0026	-	0.0022	0.0112	-
Boron (B)	µg/L	0.05	46.5	48	3%	37.4	40.9	9%	22.5	26.5	16%
Cadmium (Cd)	µg/L	0.002	0.0039	0.0037	-	<0.002	<0.002	-	0.0063	0.0053	-
Chromium (Cr)	µg/L	0.03	0.294	0.35	17%	0.217	0.267	**21%**	0.638	0.694	8%
Cobalt (Co)	µg/L	0.001	0.019	0.0285	**40%**	0.0267	0.0149	-	0.112	0.129	-
Copper (Cu)	µg/L	0.05	0.828	0.892	7%	0.594	0.572	4%	1.45	1.5	3%
Iron (Fe)	µg/L	2	66.5	80.7	19%	77.1	49.6	**43%**	333	421	**23%**
Lead (Pb)	µg/L	0.001	0.0452	0.0503	11%	0.0215	0.008	-	0.109	0.128	-
Manganese (Mn)	µg/L	0.003	1.45	1.63	12%	1.96	1.12	**55%**	38.4	48.2	**23%**
Molybdenum (Mo)	µg/L	0.001	0.676	0.704	4%	0.397	0.402	1%	0.187	0.207	10%
Mercury (Hg)	µg/L	0.6	<0.6	<0.6	-	<0.6	<0.6	-	<0.6	<0.6	-
Nickel (Ni)	µg/L	0.005	0.104	0.112	7%	0.083	0.082	1%	0.532	0.619	15%
Selenium (Se)	µg/L	0.10	2	2.17	8%	0.996	1.29	-	0.773	0.983	-
Silver (Ag)	µg/L	0.0005	0.0012	0.0011	-	0.02	<0.0005	-	<0.0005	<0.0005	-
Strontium (Sr)	µg/L	0.004	58.3	58.9	1%	44.9	44.9	0%	32.0	33.9	6%
Thallium (Tl)	µg/L	0.0003	0.0125	0.0116	7%	<0.0003	0.0044	-	0.0053	0.0066	**22%**
Tin (Sn)	µg/L	0.03	0.0388	0.0448	-	<0.03	<0.03	-	0.033	<0.03	-
Uranium (U)	µg/L	0.0001	0.248	0.259	4%	0.0531	0.0454	-	0.0503	0.0534	-
Vanadium (V)	µg/L	0.01	0.082	0.134	**48%**	0.049	0.0444	10%	0.505	0.676	**29%**
Zinc (Zn)	µg/L	0.01	0.797	1.35	**52%**	0.775	0.943	20%	1.44	2.05	**35%**
Dissolved Metals											
Aluminum (Al)	µg/L	0.2	5.48	5.39	2%	2.83	2.53	11%	12	12.5	4%
Antimony (Sb)	µg/L	0.0005	0.0562	0.0557	1%	0.0408	0.0415	-	0.0175	0.0168	-
Arsenic (As)	µg/L	0.002	0.58	0.657	12%	0.361	0.396	9%	0.483	0.458	5%
Barium (Ba)	µg/L	0.004	1.83	1.8	2%	1.71	1.62	5%	1.29	1.32	2%
Beryllium (Be)	µg/L	0.003	<0.003	<0.003	-	0.00442	<0.003	-	<0.003	<0.003	-
Boron (B)	µg/L	0.03	44.8	45.4	1%	36.6	37.9	3%	22.5	22.9	2%
Cadmium (Cd)	µg/L	0.002	0.0039	0.0037	-	<0.002	<0.002	-	<0.002	<0.002	-
Chromium (Cr)	µg/L	0.03	0.291	0.35	18%	0.215	0.21	2%	0.124	0.124	0%
Cobalt (Co)	µg/L	0.001	0.0026	0.0049	-	0.0061	0.0045	-	0.0017	0.002	-
Copper (Cu)	µg/L	0.05	0.788	0.762	3%	0.486	0.378	**25%**	0.937	1.06	12%
Iron (Fe)	µg/L	2	6.26	11	-	7.7	9.67	**23%**	31.4	30.9	2%
Lead (Pb)	µg/L	0.001	0.0304	0.0282	8%	<0.001	<0.001	-	0.0028	0.0034	-
Manganese (Mn)	µg/L	0.003	0.108	0.101	7%	0.104	0.0587	**56%**	<0.003	<0.003	-
Molybdenum (Mo)	µg/L	0.001	0.669	0.678	1%	0.393	0.396	1%	0.178	0.191	7%
Nickel (Ni)	µg/L	0.005	0.0639	0.058	10%	0.082	0.056	**38%**	0.12	0.123	2%
Selenium (Se)	µg/L	0.1	1.51	1.36	10%	0.822	0.903	9%	0.644	0.662	3%
Silver (Ag)	µg/L	0.0005	<0.0005	<0.0005	-	0.0198	<0.0005	-	<0.0005	<0.0005	-
Strontium (Sr)	µg/L	0.004	56.8	56.2	1%	44.5	43.9	1%	32	32.9	3%
Uranium (U)	µg/L	0.0001	0.153	0.148	3%	0.0336	0.0322	4%	0.0202	0.0208	3%
Vanadium (V)	µg/L	0.01	0.0788	0.0732	7%	<0.01	<0.01	-	0.03	0.05	**50%**
Zinc (Zn)	µg/L	0.05	0.794	0.632	**23%**	0.767	0.934	20%	1.43	1.64	14%
Other											
Cyanide, Total	mg/L	0.001	<0.001	<0.001	-	<0.001	<0.001	-	<0.001	<0.001	-
Fluoride (F)	mg/L	0.01	0.09	0.08	12%	0.18	1.65	**161%**	0.05	0.04	**22%**

Table B2-3. Notable results for QA/QC field duplicate samples, 2006-2007

Parameter	Units	MRV	Ogama Outflow Duplicate (Hope Outflow)		
			17-Sep-07		
			Rep 1	Rep 2	RPD
Physical Parameters					
Alkalinity, Total ($CaCO_3$)	mg/L	1	24.8	27.5	10%
Conductivity	µS/cm	0.1	283	285	1%
pH	Units	0.1			
TDS (Calculated)	mg/L	0.1	143	143	0%
Total Suspended Solids	mg/L	1	5	4	**22%**
Color, True	TCU	1	32	32	0%
Nutrients					
Phosphorus, Total	mg/L	0.001	0.03	0.03	0%
Total Kjeldahl Nitrogen	mg/L	0.01	0.64	0.65	2%
Ammonia-N	mg/L	0.001	0.018	0.016	-
Nitrite-N	mg/L	0.001	<0.001	<0.001	-
Nitrate-N	mg/L	0.005	<0.005	<0.005	-
Organics					
Dissolved Organic Carbon	mg/L	0.2	<0.001	8	-
Dissolved Anions					
Calcium (Ca) (total)	mg/L	0.004	7.39	7.25	2%
Calcium (Ca) (dissolved)	mg/L	0.004	7.08	7.12	1%
Chloride (Cl)	mg/L	0.3	71.6	71.1	1%
Magnesium (Mg) (total)	mg/L	0.0001	6.87	6.84	0%
Magnesium (Mg) (dissolved)	mg/L	0.0001	6.66	6.69	0%
Potassium (K) (total)	mg/L	0.002	2.36	2.33	1%
Potassium (K) (dissolved)	mg/L	0.002	2.20	2.21	0%
Sodium (Na) (total)	mg/L	0.002	33.7	33.5	1%
Sodium (Na) (dissolved)	mg/L	0.002	32.9	32.9	0%
Sulphate (SO_4)	mg/L	3.00	4	4	0%
Total Metals					
Aluminum (Al)	µg/L	0.5	198	221	11%
Antimony (Sb)	µg/L	0.0005	0.0172	0.0162	-
Arsenic (As)	µg/L	0.002	0.456	0.469	3%
Barium (Ba)	µg/L	0.004	5.39	5.63	4%
Beryllium (Be)	µg/L	0.003	<0.003	0.0077	-
Bismuth (Bi)	µg/L	0.001	0.002	0.0013	-
Boron (B)	µg/L	0.05	23	22.5	2%
Cadmium (Cd)	µg/L	0.002	0.0064	0.004	-
Chromium (Cr)	µg/L	0.03	0.43	0.44	2%
Cobalt (Co)	µg/L	0.001	0.0666	0.0766	-
Copper (Cu)	µg/L	0.05	1.68	1.67	1%
Iron (Fe)	µg/L	2	181	209	14%
Lead (Pb)	µg/L	0.001	0.119	0.0967	-
Manganese (Mn)	µg/L	0.003	12.8	15	16%
Molybdenum (Mo)	µg/L	0.001	0.323	0.229	**34%**
Mercury (Hg)	µg/L	0.6	<0.6	<0.6	-
Nickel (Ni)	µg/L	0.005	0.883	0.915	4%
Selenium (Se)	µg/L	0.10	0.661	0.673	-
Silver (Ag)	µg/L	0.0005	0.0025	0.0007	-
Strontium (Sr)	µg/L	0.004	44.6	44.4	0%
Thallium (Tl)	µg/L	0.0003	0.0031	0.0027	14%
Tin (Sn)	µg/L	0.03	<0.03	<0.03	-
Uranium (U)	µg/L	0.0001	0.0541	0.0556	-
Vanadium (V)	µg/L	0.01	0.829	0.88	6%
Zinc (Zn)	µg/L	0.01	1.07	1.01	6%
Dissolved Metals					
Aluminum (Al)	µg/L	0.2	51.2	49.4	4%
Antimony (Sb)	µg/L	0.0005	0.017	0.016	-
Arsenic (As)	µg/L	0.002	0.426	0.399	7%
Barium (Ba)	µg/L	0.004	3.04	3.08	1%
Beryllium (Be)	µg/L	0.003	<0.003	0.0058	-
Boron (B)	µg/L	0.03	21.4	21.5	0%
Cadmium (Cd)	µg/L	0.002	0.0034	0.0035	-
Chromium (Cr)	µg/L	0.03	0.29	0.26	11%
Cobalt (Co)	µg/L	0.001	0.0188	0.0187	-
Copper (Cu)	µg/L	0.05	1.5	1.37	9%
Iron (Fe)	µg/L	2	45	42.4	6%
Lead (Pb)	µg/L	0.001	0.118	0.0957	-
Manganese (Mn)	µg/L	0.003	0.796	0.558	**35%**
Molybdenum (Mo)	µg/L	0.001	0.215	0.21	2%
Nickel (Ni)	µg/L	0.005	0.6	0.609	1%
Selenium (Se)	µg/L	0.1	0.597	0.535	11%
Silver (Ag)	µg/L	0.0005	<0.0005	<0.0005	-
Strontium (Sr)	µg/L	0.004	42.8	42.4	1%
Uranium (U)	µg/L	0.0001	0.0458	0.045	2%
Vanadium (V)	µg/L	0.01	0.605	0.565	7%
Zinc (Zn)	µg/L	0.05	1.06	0.361	**98%**
Other					
Cyanide, Total	mg/L	0.001	<0.001	<0.001	-
Fluoride (F)	mg/L	0.01	0.06	0.06	0%

APPENDICES B3 AND B4

FIELD MEASUREMENTS
PHYSICAL LIMNOLOGY

Appendix B3. Dissolved oxygen, pH, water temperature, secchi depth, and water depth for all waterbodies sampled in 2006 and 2007

Waterbody	Date	Dissolved Oxygen (mg/L)	pH	Water Temperature (°C)	Secchi Depth (m)	Water Depth (m)	Notes
Boston Project Area							
Aimaokatalok River	23-Jun-06	12.2	7.2	11.6			
	17-Jul-06	9.3	6.9	14.9			
	13-Aug-06	11.2	6.6	13.2			
	10-Sep-06	11.6	7.0	10.6			
	23-Jun-07	13.0	***6.0***	0.9			
	21-Jul-07	9.7	***6.3***	20.7			
	20-Aug-07	10.9	6.5	9.9			
	9-Sep-07		***6.3***	3.5			DO probe malfunction
Aimaokatalok Inflow	23-Jun-06	12.0	7.4	10.1			
	16-Jul-06	10.0	7.2	16.9			
	13-Aug-06	10.6	7.2	15.4			
	10-Sep-06	11.0	7.1	9.8			
	23-Jun-07	10.7	***6.3***	9.0			
	20-Jul-07	9.8	6.6	19.1			
	20-Aug-07	10.9	6.5	9.7			
	10-Sep-07		***6.1***	2.1			DO probe malfunction
Aimaokatalok Lake Site 4	2-Jun-06		6.7				
	16-Jul-06	10.7	6.8	14.5	4.25		
	17-Aug-06	10.1	7.3	15.1	4.1		
	10-Sep-06	11.1	7.3	9.3	3.1		
	24-May-07	15.4	7.0	0.1		6.0	
	21-Jul-07	12.4	***6.0***	7.8	2.8	6.0	
	19-Aug-07	12.3	***6.2***	10.2	3.2	5.9	
	8-Sep-07	14.5	***6.0***	7.2	3.4	5.9	
Aimaokatalok Lake Site 6	3-Jun-06		6.9				
	16-Jul-06	10.9	6.9	11.8	3.5		
	17-Aug-06	9.8	7.3	14.2	4.6		
	10-Sep-06	11.4	7.4	7.6	3.1		
	24-May-07	15.5	7.8	0.2		27.2	
	20-Jul-07	12.8	***6.0***	9.1	2.4	28.0	
	19-Aug-07	12.0	***6.1***	10.0	2.8	25.9	
	8-Sep-07	14.7	***6.1***	7.0	3.0	30.3	
Aimaokatalok Outflow	23-Jun-06	12.9	7.1	3.7			
	16-Jul-06	11.1	6.7	13.1			
	13-Aug-06	9.7	6.5	15.1			
	10-Sep-06	11.5	6.8	8.9			
	23-Jun-07	12.4	***6.1***	3.0			
	20-Jul-07	12.6	***6.2***	7.6			
	19-Aug-07	12.0	***6.2***	10.1			
	10-Sep-07		***6.0***	6.5			DO probe malfunction
Fickle Duck Lake	18-Jul-06	10.0	7.0	13.6	1.9		
	17-Aug-06	10.7	8.0	15.0	1.75		
	10-Sep-06	11.6	7.7	10.0	1.0		
	24-May-07	6.3	6.9	0.0		1.8	
	22-Jul-07	10.5	7.3	17.5	1.2	3.0	
	20-Aug-07	10.3	6.8	9.9	1.2	2.7	
	9-Sep-07		6.6	4.6	1.8	2.7	DO probe malfunction
Fickle Duck Outflow	24-Jun-06	10.2	7.1	13.9			
	17-Jul-06	7.5	6.5	14.7			
	13-Aug-06	7.6	6.3	13.6			
	10-Sep-06	10.4	6.7	10.7			
	23-Jun-07	11.3	***6.2***	3.4			
	20-Jul-07	1.6	***6.0***	15.9			
	20-Aug-07	10.2	6.5	10.0			
	9-Sep-07		6.5	4.7			DO probe malfunction
Koignuk River	2-Jul-07	12.5	6.5	8.3			
	19-Jul-07	10.9	6.6	17.1			
	18-Aug-07	12.7	6.8	9.8			
	16-Sep-07	12.1	6.9	1.0			
Reference Lake	3-Jun-06		6.9				
	18-Jul-06	10.2	6.4	14.3	1.3		
	17-Aug-06	10.7	7.4	15.3	1.75		
	11-Sep-06	11.2	7.7	9.6	1.25		
	26-May-07	13.2	6.7	0.9		2.3	
	21-Jul-07	10.3	6.8	19.2	1.0	2.5	
	20-Aug-07	10.4	6.5	9.9	1.7	2.9	
	9-Sep-07			4.6	2.5	3.1	DO and pH probe malfunction

Appendix B3. Dissolved oxygen, pH, water temperature, secchi depth, and water depth for all waterbodies sampled in 2006 and 2007

Waterbody	Date	Dissolved Oxygen (mg/L)	pH	Water Temperature (°C)	Secchi Depth (m)	Water Depth (m)	Notes
Reference Outflow	23-Jun-06	11.6	7.5	11.3			
	18-Jul-06	11.4	6.6	13.5			
	13-Aug-06	12.9	7.8	17.4			
	10-Sep-06	11.7	7.2	11.3			
	23-Jun-07	11.9	***6.1***	4.9			
	20-Jul-07	8.8	6.7	19.5			
	20-Aug-07	9.8	6.5	9.7			
	9-Sep-07		***6.4***	4.5			DO probe malfunction
Stickleback Lake	2-Jun-06		6.7				
	17-Jul-06	10.9	7.8	15.7	2.7		
	17-Aug-06	10.4	8.2	15.7	2.4		
	10-Sep-06	11.8	8.1	9.7	2.8		
	24-May-07	0.5	7.3	0.1		2.4	
	21-Jul-07	10.0	7.4	18.4	2.6	2.6	
	20-Aug-07	10.5	6.8	9.9	2.7	2.7	
	9-Sep-07		6.5	4.6	3.0	3.0	DO probe malfunction
Stickleback Outflow	24-Jun-06	12.4	7.1	8.2			
	17-Jul-06	6.1	6.9	15.5			
	13-Aug-06	4.5	6.5	12.7			
	10-Sep-06	5.4	6.3	9.6			
	23-Jun-07	11.4	***6.0***	0.9			
	22-Jul-07	7.0	6.8	16.2			
	20-Aug-07	9.8	6.5	9.4			
	9-Sep-07	nd	6.7	4.7			DO probe malfunction
Madrid Project Area							
Glenn Lake	24-May-07	13.7	7.4	0.1		8.8	
	16-Jul-07	14.7	7.3	8.9	3.0	18.0	
	17-Aug-07	13.9	7.2	9.0	1.0	16.0	
	15-Sep-07	11.4		4.9	1.2	10.0	pH probe malfunction
Glenn Outflow	22-Jun-07	13.8	6.9	2.3			
	19-Jul-07	12.5	7.5	16.0			
	12-Aug-07		7.1	8.9			DO probe malfunction
	15-Sep-07	11.2		5.0			pH probe malfunctioning at low temps
Ogama Lake	1-Jun-06		6.5				
	21-Jul-06	10.4	7.3	18.8	1.7		
	15-Aug-06	10.6	8.3	15.6	1.4		
	8-Sep-06	11.8	8.0	8.1	1.4		
	22-May-07	6.0	7.1	0.1		7.0	
	16-Jul-07	11.5	7.0	17.8	1.3	7.0	
	16-Aug-07	12.5	7.1	9.0	0.9	7.4	
	11-Sep-07	13.6	7.1	3.6	1.0	7.7	
Ogama Outflow	19-Jun-06	11.3	6.6	3.3			
	21-Jul-06	10.5	7.7	17.8			
	12-Aug-06	10.1	7.5	16.5			
	9-Sep-06	12.9	7.5	8.7			
	22-Jun-07	11.2	6.9	2.6			
	17-Jul-07	11.5	7.3	12.2			
	12-Aug-07		6.9	16.5			DO probe malfunction
	17-Sep-07	10.4	6.8	1.4			
Patch Lake	2-Jun-06		6.8				
	22-Jul-06	10.6	7.6	16.2			
	23-Jul-06	10.2	7.0	14.7			
	8-Sep-06	11.5	8.1	7.9	4.25		
	23-May-07	12.3	7.4	0.2		13.2	
	17-Jul-07	13.1	7.1	14.3	2.2	14.0	
	15-Aug-07	11.1	7.0	9.8	1.25	13.7	
	11-Sep-07	13.1	nd	4.7	1.5	14.4	pH probe malfunction
Patch Outflow	19-Jun-06	12.6	6.6	4.6			
	22-Jul-06	9.5	7.7	19.1			
	12-Aug-06	9.5	6.8	16.2			
	9-Sep-06	10.6	7.6	9.2			
	22-Jun-07	8.7	***5.6***	4.5			
	19-Jul-07	12.7	7.5	15.2			
	12-Aug-07		6.8	9.7			DO probe malfunction
	17-Sep-07	10.5	6.9	1.4			
Pelvic Lake	1-Jun-06		6.5				
	21-Jul-06	11.2	8.6	18.6	1.0		
	16-Aug-06	10.4	8.2	14.1	1.1		
	9-Sep-06	11.8	8.2	8.6	0.75		
	23-May-07	10.8	7.7	0.2		14.3	
	16-Jul-07	12.4	6.9	16.8	1.0	14.0	
	16-Aug-07	13.0	6.7	9.5	0.8	14.7	
	13-Sep-07	12.6		4.7	1.0	15.3	pH probe malfunction
Pelvic Outflow	19-Jun-06	11.4	6.6	3.6			
	21-Jul-06	12.1	8.8	15.4			
	16-Aug-06	10.4	7.9	14.1			
	22-Jun-07	9.1	6.5	2.1			
	19-Jul-07	12.0	7.5	20.1			
	18-Aug-07	11.9	7.0	9.7			
	16-Sep-07	11.3	6.7	3.0			

Appendix B3. Dissolved oxygen, pH, water temperature, secchi depth, and water depth for all waterbodies sampled in 2006 and 2007

Waterbody	Date	Dissolved Oxygen (mg/L)	pH	Water Temperature (°C)	Secchi Depth (m)	Water Depth (m)	Notes
P.O. Lake	23-Jul-06	10.0	7.4	14.8			
	15-Aug-06	10.3	8.3	15.3	2.5		
	8-Sep-06	12.1	8.3	7.4	2.2		
	23-May-07						frozen to bottom
	17-Jul-07	11.8	7.4	16.9	2.0	3.0	
	15-Aug-07	11.4	7.0	9.6	1.0	2.6	
	11-Sep-07	13.9	7.1	3.6	1.0	3.7	
P.O. Outflow	19-Jun-06	10.4	6.6	7.6			
	24-Jul-06	10.0	7.1	15.1			
	15-Aug-06	11.0	8.2	16.6			
	9-Sep-06	12.9	7.7	9.5			
	22-Jun-07	11.7	***5.6***	3.5			
	19-Jul-07	10.5	7.3	19.7			
	12-Aug-07		7.2	9.5			DO probe malfunction
	17-Sep-07	10.5	6.8	0.7			
Windy Lake	2-Jun-06		6.7				
	24-Jul-06	11.3	6.9	11.5	4.25		
	18-Aug-06	10.6	8.2	13.0	4.0		
	9-Sep-06	10.7	8.1	11.0	6.25		
	24-May-07	14.0	7.5	0.2		17.3	
	18-Jul-07	13.8	7.3	7.3	4.9	17.0	
	20-Aug-07	10.7	***6.4***	9.4	3.0	17.6	
	15-Sep-07	11.3		5.3	3.2	17.1	pH probe malfunction
Windy Outflow	19-Jun-06	13.3	7.0	4.8			
	23-Jul-06	11.9	7.5	15.2			
	12-Aug-06	12.8	7.8	11.8			
	9-Sep-06	11.3	6.9	14.2			
	22-Jun-07	11.2	7.2	4.2			
	19-Jul-07	7.9	6.9	14.0			
	12-Aug-07		7.1	9.2			DO probe malfunction
	15-Sep-07	11.5		4.3			pH probe malfunctioning at low temps,
Wolverine Lake	1-Jun-06		6.6				
	22-Jul-06	10.4	8.1	17.2	3.7		
	12-Aug-06	9.6	7.8	15.8	1.9		
	8-Sep-06	12.1	8.3	7.7	3.0		
	23-May-07	1.9	7.3	0.1		2.3	
	17-Jul-07	12.4	7.8	17.7	2.4	2.4	
	15-Aug-07	11.0	6.8	9.6	1.5	2.6	
	11-Sep-07	13.2		3.1	3.4	3.4	pH probe malfunction
Marine							
Hope Bay	27-May-07		7.6	-1.5		15.2	DO probe malfunction
	23-Jul-07	10.9	7.8	13.3	1.5	16.0	
	17-Aug-07	15.5		8.6	1.2	9.9	pH probe malfunction
	15-Sep-07	11.5		1.9	1.2	16.0	pH probe malfunction

values in bold and italicized are outside the CWQG pH range

Appendix B4. Dissolved Oxygen and Water Temperature Profiles for the Boston and Madrid Project Water Quality Sites, 2006-2007.

BOSTON PROJECT AREA

AIMAOKATALOK LAKE (SITE 4) 13W 438988E 7508924N NAD83											
02 Jun 2006			16 Jul 2006			17 Aug 2006			10 Sep 2006		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.5	ice	ice	0.0	10.6	15.1	0.0	10.1	15.2	0.0	11.1	9.4
1.0	ice	ice	0.5	10.8	14.8	0.5	10.1	15.1	0.5	11.2	9.3
1.5	ice	ice	1.0	10.7	14.5	1.0	10.1	15.1	1.0	11.1	9.3
2.0	12.3	1.7	1.5	10.8	14.3	1.5	10.1	15.0	1.5	11.1	9.3
2.5	12.9	1.9	2.0	10.9	14.1	2.0	10.0	14.9	2.0	11.1	9.3
3.0	12.9	2.0	2.5	11.0	13.9	2.5	10.1	14.8	2.5	11.1	9.3
3.5	12.9	2.0	3.0	11.0	13.8	3.0	10.1	14.8	3.0	11.1	9.3
4.0	12.9	2.1	3.5	10.9	13.7	3.5	10.0	14.7	3.5	11.2	9.3
4.5	12.9	2.1	4.0	11.0	13.5	4.0	10.0	14.5	4.0	11.1	9.2
5.0	12.9	2.1	4.5	11.1	13.5	4.5	10.1	14.5	4.5	11.2	9.2
5.5	12.9	2.2	5.0	11.0	13.3	5.0	10.1	14.4	5.0	11.1	9.2
6.0	13.0	2.2	5.5	11.1	13.0	5.5	10.2	14.4	5.5	11.2	9.2
6.5	13.2	2.2	6.0	10.9	12.2	6.0	10.2	14.3	6.0	11.2	9.2
7.0	13.7	2.4	6.5	10.5	10.7						

AIMAOKATALOK LAKE (SITE 4) (13W 438988E 7508924N NAD83)											
24 May 2007			21 Jul 2007			19 Aug 2007			08 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.0	15.4		0.0	12.4	7.8	0.0	12.3	10.2	0.0	14.5	7.2
0.5	16.2		1.0	12.3	7.8	0.5	11.0	10.2	0.5	14.5	7.2
1.0	16.6		2.0	12.4	7.8	1.0	11.1	10.2	1.0	14.4	7.2
1.5	17.0		3.0	12.3	7.8	1.5	12.0	10.2	1.5	14.4	7.2
2.0	16.8	1.0	4.0	12.3	7.8	2.0	12.0	10.2	2.0	14.4	7.2
2.5	16.0	1.4	5.0	12.2	7.8	2.5	12.0	10.2	2.5	14.3	7.2
3.0	15.2	1.5				3.0	12.0	10.2	3.0	14.3	7.2
3.5	14.3	1.6				3.5	12.1	10.2	3.5	14.3	7.2
4.0	13.6	1.6				4.0	12.1	10.2	4.0	14.3	7.1
4.5	13.0	1.6				4.5	12.3	10.2	4.5	14.2	7.1
5.0	12.9	1.6				5.0	11.1	10.2			
5.5	12.9	1.6									
6.0	12.7	1.8									

AIMAOKATALOK LAKE (SITE 6) 13W 440429E 7509045N NAD83											
03 Jun 2006			16 Jul 2006			17 Aug 2006			10 Sep 2006		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
1.0	ice	ice	0.0	11.0	11.8	0.0	9.8	14.2	Not measured		
2.0	12.1	1.5	0.5	10.9	11.8	1.0	9.8	14.2			
3.0	12.1	1.7	1.0	10.9	11.8	2.0	9.9	14.2			
4.0	12.1	1.8	1.5	10.9	11.8	3.0	9.8	14.1			
5.0	12.2	1.8	2.0	10.9	11.8	4.0	10.0	14.1			
6.0	12.2	1.8	2.5	10.9	11.8	5.0	10.0	14.1			
7.0	12.3	1.9	3.0	10.9	11.7	6.0	10.1	14.1			
8.0	12.4	1.9	3.5	11.0	11.7	7.0	10.2	14.1			
9.0	12.5	1.9	4.0	11.0	11.6	8.0	10.3	14.1			
10.0	12.6	1.9	4.5	11.0	11.5	9.0	10.3	14.1			
11.0	12.6	1.9	5.0	11.1	11.3	10.0	10.3	14.1			
12.0	12.7	1.9	5.5	11.1	11.2	11.0	10.3	14.0			
13.0	12.2	1.9	6.0	11.0	10.7	12.0	10.3	14.0			
14.0	12.4	1.9	6.5	11.0	10.4	13.0	10.3	13.9			
15.0	12.6	2.0	7.0	11.1	10.1	14.0	10.3	13.9			
16.0	12.1	2.0	7.5	11.1	10.0	15.0	10.3	13.8			
17.0	11.8	2.0	8.0	11.2	9.9	16.0	10.3	13.8			
18.0	12.5	2.0	8.5	11.2	9.8	17.0	10.1	13.7			
19.0	12.2	2.0	9.0	11.3	9.6	18.0	10.0	13.5			
20.0	10.9	2.0	9.5	11.3	9.5	19.0	9.8	13.1			
21.0	11.0	2.0	10.0	11.4	9.5	20.0	9.7	12.5			
22.0	12.3	2.0	10.5	11.3	9.4	21.0	9.9	12.3			
23.0	12.4	2.0	11.0	11.4	9.1	22.0	9.7	11.9			
24.0	12.4	2.0	11.5	11.4	8.9	23.0	9.7	11.8			
25.0	12.4	2.0	12.0	11.5	8.8	24.0	9.6	11.7			
26.0	12.5	2.1	12.5	11.4	8.8	25.0	9.7	11.6			
27.0	12.6	2.1	13.0	11.4	8.7	26.0	9.7	11.5			
28.0	12.8	2.1	13.5	11.4	8.6	27.0	9.2	11.4			
29.0	12.9	2.1	14.0	11.5	8.6	28.0	8.4	11.3			
30.0	6.5	2.1	14.5	11.5	8.4						
			15.0	11.6	8.3						
			15.5	11.5	8.1						
			16.0	11.6	8.1						
			16.5	11.6	8.0						
			17.0	11.7	7.9						
			17.5	11.7	7.9						
			18.0	11.8	7.9						
			18.5	11.8	7.8						
			19.0	11.8	7.8						
			19.5	11.9	7.8						
			20.0	11.9	7.7						
			20.5	11.9	7.7						
			21.0	11.9	7.7						
			21.5	11.9	7.7						
			22.0	11.9	7.7						
			22.5	11.9	7.6						
			23.0	11.9	7.6						
			23.5	11.9	7.6						
			24.0	11.8	7.6						
			24.5		7.6						

AIMAOKATALOK LAKE (SITE 6) (13W 440429E 7509045N NAD83)

24 May 2007			20 Jul 2007			19 Aug 2007			08 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.0	15.5		0.0	12.8	9.1	0.0	12.0	10.0	0.0	14.7	7.0
0.5	15.6		1.0	12.8	9.1	1.0	12.0	10.0	1.0	14.7	7.0
1.0	15.8		2.0	12.8	9.1	2.0	12.0	10.0	2.0	14.7	7.0
2.0	15.8	1.0	3.0	12.7	9.0	3.0	12.0	10.0	3.0	14.7	7.0
3.0	15.4	1.4	4.0	12.7	8.6	4.0	12.0	10.0	4.0	14.6	7.0
4.0	13.1	1.5	5.0	12.7	8.5	5.0	12.0	10.0	5.0	14.7	7.0
5.0	12.6	1.6	6.0	12.6	8.5	6.0	12.0	10.0	6.0	14.6	7.0
6.0	12.4	1.6	7.0	12.6	8.2	7.0	12.0	9.9	7.0	14.6	7.0
7.0	12.2	1.6	8.0	12.8	7.4	8.0	12.0	10.0	8.0	14.6	7.0
8.0	12.0	1.6	9.0	12.8	7.3	9.0	12.0	9.9	9.0	14.6	7.0
9.0	11.6	1.7	10.0	12.7	7.2	10.0	12.2	9.9	10.0	14.6	7.0
10.0	11.3	1.7	11.0	12.6	7.1	11.0	10.9	9.9	11.0	14.6	7.0
11.0	11.2	1.7	12.0	12.5	7.0	12.0	11.9	9.9	12.0	14.5	7.0
12.0	10.8	1.7	13.0	12.4	7.0	13.0	11.9	9.9	13.0	14.6	7.0
13.0	10.8	1.8	14.0	12.2	6.9	14.0	11.9	9.9	14.0	14.5	7.0
14.0	10.5	1.9	15.0	12.2	6.2	15.0	11.9	9.9	15.0	14.6	7.0
15.0	9.9	2.0	16.0	12.2	5.9	16.0	11.9	9.9	16.0	14.5	7.0
16.0	9.6	2.0	17.0	12.2	5.8	17.0	11.9	9.9	17.0	14.5	7.0
17.0	9.1	2.0	18.0	12.2	5.5	18.0	11.9	9.9	18.0	14.5	7.0
18.0	8.5	2.1	19.0	12.2	5.5	19.0	11.9	9.9	19.0	14.5	6.9
19.0	7.8	2.1	20.0	12.1	5.4	20.0	11.9	9.9	20.0	14.5	7.0
20.0	7.6	2.2	21.0	12.2	5.3	21.0	11.9	9.9	21.0	14.4	7.0
21.0	7.1	2.2	22.0	12.2	5.3	22.0	11.9	9.9	22.0	14.4	7.0
22.0	6.7	2.2	23.0	12.2	5.3	23.0	11.9	9.9	23.0	14.4	7.0
23.0	6.4	2.2	24.0	12.2	5.3	24.0	12.0	9.9	24.0	14.3	7.0
24.0	6.2	2.4	25.0	12.2	5.3	25.0	12.0	9.9	25.0	14.3	7.0
25.0	5.8	2.5	26.0	12.2	5.3				26.0	14.2	7.0
26.0	4.4	2.7							27.0	14.0	6.9
27.0	3.0	2.8							28.0	12.9	7.0
27.2	1.7	2.8							29.0	12.6	7.0

FICKLE DUCK LAKE (13W 0442654E 7502915N NAD83)

			18 Jul 2006			17 Aug 2006			10 Sep 2006		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
Frozen to Bottom			0.0	12.9	10.3	0.0	10.6	15.2	0.0	11.6	10.3
			0.5	10.2	13.4	0.5	10.6	15.0	0.5	11.6	10.1
			1.0	10.0	13.6	1.0	10.7	15.0	1.0	11.6	10.0
			1.5	10.0	13.8	1.5	10.7	14.8	1.5	11.6	9.9
			2.0	10.0	13.9	2.0	10.7	14.7	2.0	11.6	9.8
			2.5	9.9	14.0	2.5	10.7	14.6	2.5	11.6	9.7
			3.0	10.0	14.0	3.0	10.7	14.5	3.0	11.7	9.7
			3.5	10.0	14.0	3.5	10.7	14.4	3.5	11.6	9.6
			4.0		13.9	3.8		14.3			

FICKLE DUCK LAKE (13W 0442654E 7502915N NAD83)

24 May 2007			22 Jul 2007			20 Aug 2007			09 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.0			0.0	10.5	17.5	0.0	10.3	9.9	0.0	nd	4.6
0.5			0.5	10.4	17.5	0.5	10.2	9.9	0.5	nd	4.6
1.0	0.2	0.2	1.0	10.4	17.5	1.0	10.2	9.9	1.0	nd	4.5
1.5	0.0	0.4	1.5	10.3	17.5	1.5	10.2	9.9	1.5	nd	4.6
1.8	0.0	0.9	2.0	10.0	17.5	2.0	10.3	9.9	2.0	nd	4.6

REFERENCE LAKE (13W 437989E 7503665N NAD83)

03 Jun 2006			18 Jul 2006			17 Aug 2006			11 Sep 2006		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.5	ice	ice	0.0	10.3	14.2	0.0	10.7	15.4	0.0	11.1	10.0
1.0	ice	ice	0.5	10.2	14.3	0.5	10.7	15.4	0.5	11.2	9.8
1.5	12.3	1.6	1.0	10.2	14.3	1.0	10.7	15.3	1.0	11.2	9.6
2.0	12.4	2.1	1.5	10.2	14.4	1.5	10.8	15.3	1.5	11.3	9.6
2.5	12.2	2.6	2.0	10.0	14.4	2.0	10.8	15.2	2.0	11.3	9.5
2.7	11.9	2.8	2.5	10.0	14.4	2.5	10.5	14.8	2.5	11.0	9.4
						3.0	10.7	14.5			

REFERENCE LAKE (13W 437989E 7503665N NAD83)

26 May 2007			21 Jul 2007			20 Aug 2007			09 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.0			0.0	10.3	19.2	0.0	10.4	9.9	0.0	nd	4.6
0.5			0.5	10.2	19.2	0.5	10.4	9.9	0.5	nd	4.6
1.0	13.1	0.1	1.0	10.2	19.2	1.0	10.4	9.9	1.0	nd	4.6
1.5	9.0	0.9	1.5	10.1	19.2	1.5	10.3	9.9	1.5	nd	4.6
2.3	5.0	0.9				2.0	10.4	9.9	2.0	nd	4.6
						2.5	10.4	9.8	2.5	nd	4.6

STICKLEBACK LAKE (13W 441723E 7503526N NAD83)

02 Jun 2006			17 Jul 2006			17 Aug 2006			10 Sep 2006		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.5	ice	ice	0.0	10.7	15.9	0.0	10.4	16.0	0.0	11.7	9.9
1.0	ice	ice	0.5	10.9	15.8	0.5	10.5	15.8	0.5	11.7	9.8
1.5	8.1	2.1	1.0	10.9	15.7	1.0	10.4	15.7	1.0	11.8	9.7
2.0	6.4	3.6	1.5	11.1	15.6	1.5	10.5	15.6	1.5	11.7	9.6
2.5	6.3	4.1	2.0	11.1	15.6	2.0	10.5	15.5	2.0	11.7	9.6
2.8	4.7	4.4	2.5	11.2	15.5	2.5	10.6	15.5	2.5	11.7	9.5
			2.7			2.7	10.9	15.4	3.0	11.7	9.5
									3.5	11.5	9.5

Appendix B4. Dissolved Oxygen and Water Temperature Profiles for the Boston and Madrid Project Water Quality Sites, 2006-2007.

STICKLEBACK LAKE (13W 441723E 7503526N NAD83)											
24 May 2007			21 Jul 2007			20 Aug 2007			09 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.0			0.0	10.0	18.4	0.0	10.5	9.9	0.0	nd	4.6
0.5			0.5	10.0	18.4	0.5	10.5	10.0	0.5	nd	4.6
1.0		0.1	1.0	10.0	18.4	1.0	10.5	10.0	1.0	nd	4.6
1.5		0.6	1.5	9.7	18.4	1.5	10.5	10.0	1.5	nd	4.6
2.0	0.5	1.7	2.0	9.8	18.4	2.0	10.6	10.0	2.0	nd	4.7
2.4	0.0	1.8				2.4	10.8	10.0			

MADRID PROJECT AREA

GLENN LAKE (13W 0430323E 7560232N NAD83)											
24 May 2007			16 Jul 2007			17-Aug--07			15 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.0			0.0	nd	nd	0.0	13.9	9.0	0.0	11.4	4.9
0.5			1.0	14.7	8.9	1.0	13.8	9.0	1.0	11.3	4.9
1.0			2.0	14.7	8.8	2.0	13.8	9.0	2.0	11.3	4.9
2.0	13.8	0.3	3.0	14.7	8.6	3.0	13.8	9.0	3.0	11.3	4.9
3.0	13.8	0.6	4.0	14.7	8.3	4.0	13.8	9.0	4.0	11.2	4.9
4.0	13.8	0.7	5.0	14.8	8.1	5.0	13.8	9.0	5.0	11.2	4.9
5.0	13.6	0.7	6.0	15.1	7.0	6.0	13.8	9.0	6.0	11.1	4.9
6.0	13.4	0.7	7.0	15.5	5.6	7.0	13.7	9.0	7.0	11.0	4.9
7.0	13.4	0.7	8.0	15.6	5.0	8.0	13.8	9.0	8.0	10.5	4.9
8.0	13.5	0.8	9.0	15.6	4.5	9.0	13.7	9.0	9.0	11.2	4.9
8.8	13.5	0.8	10.0	15.6	4.3	10.0	13.8	9.0	10.0	10.1	4.9
			11.0	15.4	4.1	11.0	13.7	9.0			
			12.0	15.7	3.3	12.0	13.8	9.0			
			13.0	15.6	3.1	13.0	13.8	9.0			
			14.0	15.5	2.9	14.0	13.8	9.0			
			15.0	15.4	3.0	15.0	13.8	9.0			
			16.0	15.4	2.9						
			17.0	15.5	2.9						

OGAMA LAKE (13W 436618E 7551843N NAD83)											
01 Jun 2006			21 Jul 2006			15 Aug 2006			08 Sep 2006		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.5	ice	ice	0.0	10.0	19.2	0.0	10.6	15.7	0.0	11.8	8.7
1.0	ice	ice	0.5	10.3	18.9	0.5	10.6	15.7	0.5	11.9	8.4
1.5	ice	ice	1.0	10.4	18.8	1.0	10.6	15.6	1.0	11.8	8.1
2.0	12.2	1.2	1.5	10.3	18.5	1.5	10.6	15.6	1.5	12.1	7.9
2.5	11.0	1.5	2.0	10.4	18.1	2.0	10.7	15.6	2.0	11.9	7.8
3.0	9.3	1.8	2.5	10.4	17.3	2.5	10.7	15.5	2.5	12.0	7.8
3.5	9.3	2.2	3.0	10.5	16.9	3.0	10.7	15.5	3.0	11.9	7.6
4.0	8.8	2.3	3.5	10.3	16.2	3.5	10.7	15.5	3.5	12.0	7.5
4.5	7.6	2.4	4.0	10.0	15.9	4.0	10.8	15.5	4.0	12.0	7.4
5.0	6.7	2.4	4.5	9.9	15.5	4.5	10.8	15.5	4.5		
5.5	5.4	2.4	5.0	9.3	15.3	5.0	10.7	15.4	5.0		
6.0	2.5	2.3	5.5	9.1	15.0	5.5	10.7	15.2	5.5		
6.5	0.3	2.3	6.0	8.3	14.7	6.0	10.7	15.2			
7.0	0.1	2.3									
7.5	0.1	2.3									

OGAMA LAKE (13W 436618E 7551843N NAD83)											
22 May 2007			16 Jul 2007			16 Aug 2007			11 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.0			0.0	11.5	17.8	0.0	12.5	9.0	0.0	13.6	3.6
0.5			1.0	11.1	17.7	0.5	12.8	9.0	1.0	13.8	3.6
1.0			2.0	10.4	17.7	1.0	12.8	9.0	2.0	13.8	3.6
1.5			3.0	10.3	11.2	1.5	12.8	9.0	3.0	13.8	3.6
2.0	5.5	1.0	4.0	9.5	8.0	2.0	12.4	9.0	4.0	13.9	3.6
2.5	4.9	1.4	5.0	7.3	5.5	2.5	12.4	9.0	5.0	13.9	3.6
3.0	4.1	1.6	6.0	5.0	5.2	3.0	12.7	9.0	6.0	14.0	3.6
3.5	3.7	1.8	6.5	5.4	5.2	3.5	12.7	9.0	7.0	14.1	3.6
4.0	3.4	1.9				4.0	12.3	9.0			
4.5	2.6	1.9				4.5	12.6	9.0			
5.0	1.8	2.0				5.0	12.5	8.9			
5.5	1.5	2.2				5.5	12.5	8.9			
6.0	0.6	2.3				6.0	12.1	8.9			
6.5	0.2	2.5				6.5	12.3	8.8			
7.0	0.0	2.6									

Appendix B4. Dissolved Oxygen and Water Temperature Profiles for the Boston and Madrid Project Water Quality Sites, 2006-2007.

PATCH LAKE (13W 435156E 7549509N NAD83)

02 Jun 2006			23 Jul 2006			15 Aug 2006			08 Sep 2006		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.5			0.0	10.1	14.5	Not measured			0.0	11.4	8.0
1.0			0.5	10.3	14.6				0.5	11.6	7.9
1.5			1.0	10.2	14.7				1.0	11.5	7.9
2.0	14.5	3.7	1.5	10.2	14.7				2.0	11.5	7.9
2.5	16.0	4.7	2.0	10.2	14.9				3.0	11.4	7.8
3.0	15.1	4.7	2.5	10.1	15.0				4.0	11.5	7.8
3.5	16.3	4.8	3.0	10.0	15.1				5.0	11.4	7.7
			3.5	10.1	14.1				6.0	11.5	7.7
			4.0	10.1	15.1				7.0	11.4	7.7
Station was not the same as open water station			4.5	10.0	15.2				8.0	11.8	7.7
			5.0	10.1	15.2				9.0	11.7	7.7
			5.5	10.0	15.1				10.0	11.9	7.6
			6.0	10.2	15.1				11.0	11.8	7.6
			6.5	10.1	15.0				12.0	12.0	7.6
			7.0	10.1	15.0				13.0	11.9	7.5
			7.5	10.2	15.1				14.0	12.1	7.5
			8.0	10.1	15.2				15.0	12.0	7.4
			8.5	10.1	15.2						
			9.0	10.1	15.2						
			9.5	10.1	15.1						
			10.0	10.2	15.0						
			10.5	10.2	15.0						
			11.0	10.2	14.9						
			11.5	10.1	14.9						
			12.0	10.1	14.8						
			12.5	9.4	14.7						

PATCH LAKE (13W 435156E 7549509N NAD83)

23 May 2007			17 Jul 2007			15 Aug 2007			11 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.0			0.0	13.1	14.3	0.0	11.1	9.8	0.0	13.1	4.7
0.5			1.0	13.1	14.3	1.0	11.1	9.8	1.0	13.1	4.7
1.0			2.0	13.0	14.3	2.0	11.1	9.8	2.0	13.1	4.7
1.5	12.2	0.4	3.0	12.5	14.2	3.0	11.0	9.8	3.0	13.1	4.7
2.0	12.2	0.6	4.0	13.3	12.0	4.0	11.0	9.8	4.0	13.1	4.6
3.0	11.9	1.9	5.0	13.7	6.7	5.0	11.0	9.8	5.0	13.1	4.7
4.0	12.0	2.1	6.0	13.0	5.2	6.0	11.0	9.8	6.0	13.1	4.6
5.0	11.6	2.1	7.0	11.9	4.2	7.0	11.0	9.8	7.0	13.2	4.6
6.0	11.3	2.1	8.0	10.9	3.7	8.0	11.0	9.8	8.0	13.2	4.6
7.0	11.1	2.1	9.0	10.3	3.7	9.0	11.0	9.8	9.0	13.2	4.6
8.0	10.8	2.1	10.0	10.4	3.7	10.0	10.9	9.8	10.0	13.2	4.6
9.0	10.4	2.2	11.0	10.3	3.6	11.0	10.8	9.8	11.0	13.2	4.6
10.0	10.1	2.3	12.0	9.4	3.6	12.0	10.3	9.8	12.0	13.2	4.6
11.0	9.7	2.4	13.0	8.0	3.8				13.0	13.2	4.5
12.0	9.3	2.5									
13.0	8.9	2.7									
13.2	7.7	2.8									

PELVIC LAKE (13W 439637E 7552552N NAD83)

01 Jun 2006			21 Jul 2006			16 Aug 2006			09 Sep 2006		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.5	ice	ice	0.0	11.0	19.5	0.0	10.4	13.7	0.0	11.7	8.9
1.0	ice	ice	0.5	11.0	19.2	0.5	10.4	14.0	0.5	11.8	8.8
1.5	ice	ice	1.0	11.2	18.6	1.0	10.4	14.1	1.0	11.8	8.6
2.0	12.0	1.8	1.5	10.7	16.5	1.5	10.3	14.2	1.5	11.9	8.6
2.5	10.0	1.6	2.0	11.4	16.0	2.0	10.3	14.3	2.0	11.8	8.5
3.0	9.8	1.6	2.5	11.4	15.5	2.5	10.3	14.3	2.5	11.9	8.4
3.5	9.8	1.6	3.0	11.4	15.4	3.0	10.3	14.4	3.0	11.8	8.4
4.0	9.8	1.6	3.5	11.2	15.0	3.5	10.3	14.4	3.5	11.9	8.4
4.5	9.6	1.7	4.0	10.9	14.7	4.0	10.3	14.5	4.0	11.8	8.3
5.0	9.6	1.7	4.5	11.0	14.3	4.5	10.2	14.5	4.5	11.9	8.3
5.5	9.3	1.7	5.0	10.9	14.2	5.0	10.2	14.5	5.0	11.9	8.3
6.0	9.3	1.7	5.5	10.7	13.9	5.5	10.2	14.5	5.5	11.9	8.3
6.5	9.6	1.7	6.0	10.4	13.7	6.0	10.2	14.5	6.0	11.9	8.2
7.0	9.8	1.7	6.5	10.2	13.5	6.5	10.1	14.5	6.5	12.0	8.2
7.5	10.0	1.7	7.0	9.8	13.3	7.0	9.6	14.5	7.0	12.0	8.2
8.0	9.8	1.7	7.5	9.2	13.0				7.5	12.0	8.2
8.5	10.3	1.8							8.0	11.8	8.2
9.0	10.4	1.8							8.5	10.5	8.2
9.5	10.6	1.8								10.8	8.1
10.0	9.7	1.8									
10.5	9.4	1.8									
11.0	9.3	1.8									
11.5	8.5	1.8									
12.0	7.7	1.8									
12.5	3.0	1.8									
13.0	2.0	1.8									
13.5	0.7	1.9									
14.0	0.3	1.9									
14.5	0.1	2.0									
15.0											

Appendix B4. Dissolved Oxygen and Water Temperature Profiles for the Boston and Madrid Project Water Quality Sites, 2006-2007.

PELVIC LAKE (13W 439637E 7552552N NAD83)												
23 May 2007			16 Jul 2007			16 Aug 2007			13 Sep 2007			
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	
0.0			0.0	12.4	16.8	0.0	13.0	9.5	0.0	12.6	4.7	
0.5			1.0	12.2	16.7	1.0	12.7	9.5	1.0	12.6	4.7	
1.0			2.0	12.0	16.6	2.0	13.0	9.5	2.0	12.5	4.7	
2.0	10.7	0.9	3.0	12.3	13.5	3.0	13.0	9.5	3.0	12.5	4.7	
3.0	9.8	1.5	4.0	8.1	6.4	4.0	12.8	9.5	4.0	12.5	4.7	
4.0	8.4	1.7	5.0	7.8	6.0	5.0	12.8	9.5	5.0	12.5	4.7	
5.0	7.1	1.7	6.0	5.9	5.0	6.0	13.0	9.4	6.0	12.4	4.7	
6.0	5.8	1.7	7.0	5.8	4.9	7.0	12.8	9.4	7.0	12.4	4.7	
7.0	5.0	1.7	8.0	5.5	4.8	8.0	12.8	9.4	8.0	12.3	4.7	
8.0	4.3	1.8	9.0	4.6	4.4	9.0	12.7	9.4	9.0	12.3	4.7	
9.0	3.5	1.8	10.0	3.9	4.1	10.0	12.7	9.4	10.0	12.2	4.7	
10.0	3.3	1.9	11.0	2.3	3.7	11.0	12.8	9.4	11.0	12.2	4.7	
11.0	2.6	1.9	12.0	0.0	3.5	12.0	12.7	9.4	12.0	12.1	4.7	
12.0	2.1	2.1	13.0	0.0	3.2	13.0	12.5	9.4	13.0	11.9	4.7	
13.0	1.3	2.2	14.0	0.0	3.1	14.0	12.3	9.3	14.0	11.7	4.7	
14.0	0.7	2.5										
14.3	0.0	2.5										

PO LAKE (13W 435585E 7547768N NAD83)												
			23 Jul 2006			15 Aug 2006			08 Sep 2006			
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	
Not measured			0.0	9.8	14.3	0.0	10.3	15.3	0.0	12.1	7.8	
			0.5	10.1	14.6	0.5	10.3	15.3	0.5	12.3	7.6	
			1.0	10.0	14.8	1.0	10.3	15.3	1.0	12.1	7.4	
			1.5	10.0	15.0	1.5	10.3	15.3	1.5	12.3	7.3	
			2.0	9.9	15.1	2.0	10.3	15.2	2.0	12.3	7.2	
			2.5	10.0	15.1	2.5	10.3	15.2	2.5	12.3	7.1	
			3.0	10.1	15.1	3.0	10.3	15.2	3.0	12.3	7.0	
			3.5	8.8	15.1	3.5	10.3	15.2	3.5	12.3	7.0	
						4.0	10.4	15.2	4.0	12.3	6.9	
						4.5						

PO LAKE (13W 435585E 7547768N NAD83)												
23 May 2007			17 Jul 2007			15 Aug 2007			11 Sep 2007			
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	
Not measured			0.0	11.8	16.9	0.0	11.4	9.6	0.0	13.9	3.6	
			0.5	11.8	16.9	0.5	11.3	9.6	0.5	14.0	3.6	
			1.0	11.8	16.8	1.0	11.3	9.6	1.0	14.1	3.5	
			1.5	11.8	16.9	1.5	11.2	9.6	1.5	14.1	3.6	
			2.0	11.7	16.8	2.0	11.2	9.6	2.0	14.3	3.6	
			2.5	11.7	16.8	2.5	11.2	9.6	2.5	14.4	3.6	
									3.0	14.6	3.6	

WINDY LAKE (13W 431586 7553247N NAD83)												
02 Jun 2006			24 Jul 2006			18 Aug 2006			09 Sep 2006			
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	
0.5	ice	ice	0.0	11.2	11.5	0.0	10.6	12.7	0.0	10.9	11.4	
1.0	ice	ice	0.5	11.3	11.5	0.5	10.6	13.0	1.0	11.0	10.7	
1.5	ice	ice	1.0	11.3	11.5	1.0	10.6	13.0	2.0	11.1	10.6	
2.0	15.4	1.2	1.5	11.3	11.5	1.5	10.5	13.1	3.0	11.0	10.4	
2.5	15.5	1.5	2.0	11.3	11.5	2.0	10.5	13.1	4.0	11.1	10.3	
3.0	15.5	1.6	2.5	11.3	11.5	2.5	10.4	13.2	5.0	11.1	10.3	
3.5	15.5	1.7	3.0	11.3	11.5	3.0	10.4	13.2	6.0	11.2	10.2	
4.0	15.5	1.7	3.5	11.3	11.5	3.5	10.4	13.2	7.0	11.2	10.1	
4.5	15.5	1.7	4.0	11.3	11.5	4.0	10.4	13.3	8.0	11.3	10.0	
5.0	15.5	1.8	4.5	11.3	11.5	4.5	10.4	13.3	9.0	11.3	9.9	
5.5	15.5	1.8	5.0	11.3	11.5	5.0	10.5	13.3	10.0	11.4	9.9	
6.0	15.6	1.8	5.5	11.3	11.5	5.5	10.5	13.3	11.0	11.4	9.8	
6.5	15.6	1.8	6.0	11.3	11.5	6.0	10.5	13.3	12.0	11.5	9.8	
7.0	15.7	1.8	6.5	11.4	11.5	6.5	10.5	13.3	13.0	11.5	9.7	
7.5	15.7	1.8	7.0	11.4	11.5	7.0	10.5	13.3	14.0	11.7	9.7	
8.0	15.7	1.8	7.5	11.5	11.5	7.5	10.5	13.3	15.0	11.7	9.7	
8.5	15.8	1.8	8.0	11.5	11.5	8.0	10.6	13.3	16.0	11.9	9.7	
9.0	15.8	1.8	8.5	11.5	11.5	8.5	10.5	13.3	17.0	11.9	9.6	
9.5	15.9	1.9	9.0	11.6	11.4	9.0	10.6	13.3	18.0	11.6	9.6	
10.0	15.9	1.9	9.5	11.6	11.3	9.5	10.6	13.2				
10.5	16.0	1.9	10.0	11.7	11.3	10.0	10.8	13.1				
11.0	16.0	1.9	10.5	11.7	11.3	10.5	10.8	12.9				
11.5	16.0	1.9	11.0	11.7	11.2	11.0	11.0	12.5				
12.0	16.1	1.9	11.5	11.7	11.2	11.5	11.2	12.1				
12.5	16.1	1.9	12.0	11.9	11.1	12.0	11.1	11.9				
13.0	16.2	1.9	12.5	11.5	10.3	12.5	11.3	11.8				
13.5	16.2	1.9	13.0	12.3	9.5	13.0	11.2	11.6				
14.0	16.2	1.9	13.5	12.1	9.4	13.5						
14.5	15.0	1.9	14.0	12.3	9.1							
15.0	15.8	2.0	14.5	12.3	9.0							
15.5	15.9	2.1	15.0	10.0	9.0							
16.0	15.6	2.1	15.5	12.4	8.8							
16.5	13.8	2.2	16.0	12.4	8.8							
17.0	13.0	2.4	16.5	12.5	8.8							
17.5	3.5	2.6	17.0	11.9	8.8							

Appendix B4. Dissolved Oxygen and Water Temperature Profiles for the Boston and Madrid Project Water Quality Sites, 2006-2007.

WINDY LAKE (13W 431586E 7553247N NAD83)											
25 May 2007			18 Jul 2007			21 Aug 2007			15 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.0			0.0	13.8	7.3	0.0	10.7	9.4	0.0	11.3	5.3
0.5			1.0	13.8	7.2	1.0	10.7	9.4	1.0	11.3	5.3
1.0			2.0	13.7	7.1	2.0	10.7	9.4	2.0	11.3	5.4
1.5			3.0	13.8	6.7	3.0	10.7	9.4	3.0	11.3	5.3
2.0	13.9	0.3	4.0	13.8	6.4	4.0	10.7	9.4	4.0	11.3	5.4
3.0	13.9	0.5	5.0	14.1	6.2	5.0	10.6	9.5	5.0	11.3	5.4
4.0	13.9	0.6	6.0	14.3	6.2	6.0	10.7	9.4	6.0	11.3	5.4
5.0	13.9	0.6	7.0	15.5	6.0	7.0	10.7	9.4	7.0	11.2	5.3
6.0	13.9	0.6	8.0	15.9	5.4	8.0	10.6	9.4	8.0	11.2	5.4
7.0	13.9	0.6	9.0	16.1	5.1	9.0	10.7	9.5	9.0	11.2	5.3
8.0	13.7	0.6	10.0	16.1	5.0	10.0	10.7	9.4	10.0	11.2	5.4
9.0	13.6	0.7	11.0	16.0	5.0	11.0	10.7	9.5	11.0	11.2	5.3
10.0	13.4	0.9	12.0	16.1	5.0	12.0	10.7	9.4	12.0	11.1	5.3
11.0	13.3	1.0	13.0	16.1	4.9	13.0	10.7	9.4	13.0	11.1	5.4
12.0	13.1	1.1	14.0	16.2	4.8	14.0	10.6	9.4	14.0	11.0	5.3
13.0	12.9	1.2	15.0	16.2	4.7	15.0	10.6	9.4	15.0	10.9	5.3
14.0	12.3	1.4	16.0	16.2	4.5	16.0	10.4	9.4	16.0	10.7	5.4
15.0	12.0	1.6	17.0	16.3	4.4	17.0	9.6	9.4	17.0	10.3	5.4
16.0	11.4	1.9									
17.0	10.3	2.2									

WOLVERINE LAKE (13W 434855E 7545873N NAD83)											
01 Jun 2006			22 Jul 2006			12 Aug 2006			09 Sep 2006		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.5	ice	ice	0.0	10.5	17.0	0.0	9.7	15.7	0.0	12.1	8.2
1.0	ice	ice	0.5	10.4	17.1	0.5	9.7	15.7	0.5	12.0	7.9
1.5	11.3	2.2	1.0	10.4	17.2	1.0	9.6	15.8	1.0	12.1	7.7
2.0	14.4	3.5	1.5	10.4	17.3	1.5	9.6	15.8	1.5	12.2	7.5
2.5	13.6	4.0	2.0	10.4	17.3	2.0	9.6	15.9	2.0	12.1	7.4
			2.5	10.3	17.3	2.5	9.6	15.9	2.5	12.2	7.3
			3.0	10.3	17.4	3.0	9.6	15.9	3.0	12.2	7.2
			3.5	10.3	17.4	3.5	9.6	15.9		12.0	7.1
			4.0	10.4	17.3						

WOLVERINE LAKE (13W 434632E 7545592N NAD83)											
23 May 2007			17 Jul 2007			15 Aug 2007			11 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
0.0			0.0	12.4	17.7	0.0	11.0	9.6	0.0	13.2	3.1
0.5			0.5	12.5	17.7	0.5	11.0	9.6	0.5	13.2	3.1
1.0			1.0	12.4	17.7	1.0	11.0	9.5	1.0	13.3	3.1
1.5	1.5	0.2	1.5	12.2	17.6	1.5	10.6	9.6	1.5	13.3	3.1
2.0	1.4	0.9	2.0	11.2	17.3	2.0	6.6	9.4	2.0	13.4	3.1
									2.5	13.5	3.1
									3.0	13.4	3.4

MARINE BAYS

HOPE BAY (13W 427587E 7555296N NAD83)											
27 May 2007			23 Jul 2007			17 Aug 2007			15 Sep 2007		
Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)	Depth (m)	DO (mg/L)	Temp (°C)
			0.0	10.9	13.3	0.0	15.5	8.6	0.0	11.5	1.9
Not measured			1.0	10.9	13.3	1.0	15.3	8.4	1.0	11.9	2.0
			2.0	11.1	13.1	2.0	13.5	7.8	2.0	8.6	5.4
			3.0	10.6	11.9	3.0	13.5	7.6	3.0	8.7	5.0
			4.0	10.5	11.9	4.0	13.5	7.5	4.0	8.7	5.0
			5.0	10.4	11.8	5.0	13.5	7.3	5.0	8.7	5.0
			6.0	10.7	9.8	6.0	13.7	7.1	6.0	8.7	4.9
			6.5	10.5	11.7	7.0	13.9	6.7	7.0	8.6	4.6
			7.0	10.3	3.9	8.0	14.1	6.4	8.0	8.5	4.9
			8.0	10.0	1.3	9.0	14.4	6.0	9.0	8.4	4.5
			9.0	10.0	0.8				10.0	8.3	4.1
			10.0	9.9	0.6				11.0	8.3	2.7
			11.0	9.7	0.4				12.0	8.1	2.3
			12.0	9.7	0.2				13.0	8.1	1.7
			13.0	9.7	0.1				14.0	7.9	1.4
									15.0	7.2	1.2

APPENDIX B5

ANALYTICAL RESULTS
FOR FRESHWATER
WATER QUALITY SAMPLES

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Aimaokatalok River							
			23-Jun-06	17-Jul-06	13-Aug-06	10-Sep-06	23-Jun-07	21-Jul-07	20-Aug-07	9-Sep-07
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		6.3	7.2	9.1	9.6	7.7	8.1	9.8	8.4
Hardness, Total ($CaCO_3$)	mg/L		6.8	10.5	11.1	13.5	10.0	10.3	15.3	12.9
Conductivity	µS/cm		28.4	36.0	45.3	53.4	42.1	40.2	56.1	49.8
Field pH	units	6.5-9.0	7.2	6.9	6.6	7.0	**6.0**	**6.3**	6.5	**6.3**
TDS (Calculated)	mg/L		15.3	17.8	20.9	23.9	21.4	22.1	30.4	24.8
Total Suspended Solids	mg/L		<1	1	<1	2	5	<1	<1	<1
Color, True	TCU		13	12	11	<1	29	11	12	9
Nutrients										
Phosphorus, Total	mg/L		0.009	0.009	0.020	0.018	0.016	0.009	0.008	0.007
Total Kjeldahl Nitrogen	mg/L		0.28	0.25	0.31	0.27	0.32	0.28	0.35	0.32
Ammonia-N	mg/L	0.2-122.4	0.004	0.008	0.008	0.006	0.016	0.012	0.009	0.006
Nitrite-N	mg/L	0.06	0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.005	<0.005
Nitrate-N (calculated)	mg/L	2.9	<0.005	0.011	0.007	0.014	0.010	0.021	0.005	0.010
Organics										
Carbon Part	mg/L		0.21	0.29	0.57	0.30	0.67	0.28	0.35	0.49
Dissolved Organic Carbon	mg/L		3.4	3.9	4.1	4.3	5.8	3.7	5.5	4.5
Chlorophyll a	µg/L		-	-	-	-	-	-	-	-
Major Ions										
Calcium (Total)	mg/L		1.38	1.65	2.37	2.77	1.85	1.86	3.15	2.33
Calcium (Dissolved)	mg/L		1.14	1.48	2.10	2.63	1.77	1.76	3.06	2.21
Chloride (Cl)	mg/L		3.90	5.10	6.20	7.60	-	-	-	-
Magnesium (Total)	mg/L		0.94	1.19	1.30	1.67	1.31	1.34	1.78	1.73
Magnesium (Dissolved)	mg/L		0.78	1.09	1.15	1.55	1.25	1.31	1.75	1.64
Potassium (Total)	mg/L		0.46	0.54	0.59	0.63	0.81	0.61	0.55	0.61
Potassium (Dissolved)	mg/L		0.40	0.50	0.53	0.59	0.75	0.59	0.53	0.59
Sodium (Total)	mg/L		2.08	2.77	3.14	3.90	3.04	2.87	4.14	4.03
Sodium (Dissolved)	mg/L		1.84	2.68	2.84	3.71	3.01	2.87	4.10	4.02
Sulphate (SO_4)	mg/L		3	<3	<3	<3	<3	<3	4	<3
Anions	meq/L		0.30	0.33	0.40	0.45	0.38	0.39	0.52	0.47
Cations	meq/L		0.23	0.33	0.37	0.44	0.41	0.43	0.59	0.45
Ion Balance	N/A		0.78	0.98	0.92	0.98	1.07	1.09	1.12	0.97
Total Metals										
Aluminum (Al)	µg/L	5, 100	35.7	24.9	26.1	25.1	**153**	**16.3**	35.8	**20.3**
Antimony (Sb)	µg/L		0.003	0.003	0.004	0.006	0.0035	0.0035	0.0046	0.0052
Arsenic (As)	µg/L	5	0.084	0.113	0.142	0.136	0.164	0.147	0.163	0.161
Barium (Ba)	µg/L		1.87	1.63	2.22	2.27	4.49	1.80	2.46	2.01
Beryllium (Be)	µg/L		0.006	<0.003	<0.003	<0.003	0.0031	<0.003	<0.003	<0.003
Bismuth (Bi)	µg/L		0.003	<0.001	0.002	<0.001	0.0030	0.0013	<0.001	<0.001
Boron (B)	µg/L		2.57	4.01	3.95	3.62	3.53	4.46	1.17	5.13
Cadmium (Cd)	µg/L	0.003-0.055	**0.004**	<0.002	0.002	<0.002	0.004	<0.002	0.002	<0.002
Chromium (Cr)	µg/L	1, 16	0.154	<0.03	0.170	0.111	0.4	0.2	0.2	0.3
Cobalt (Co)	µg/L		0.0298	0.0501	0.0761	0.0475	0.3580	0.0573	0.0648	0.0446
Copper (Cu)	µg/L	2-4	0.75	0.97	1.28	1.06	0.9	0.9	1.3	1.0
Iron (Fe)	µg/L	300	110	85	175	120	**375**	166	138	103
Lead (Pb)	µg/L	1-7	0.0240	0.0184	0.0407	0.0299	0.0688	0.0319	0.0320	0.0954
Manganese (Mn)	µg/L		1.62	2.89	5.08	2.68	38.70	3.35	2.90	1.99
Mercury (Hg)	ng/L	26	<0.6	<0.6	1.0	<0.6	2.3	<0.6	1.9	<0.6
Molybdenum (Mo)	µg/L	73	0.025	0.048	0.046	0.042	0.0546	0.0215	0.0191	0.0407
Nickel (Ni)	µg/L	25-150	0.263	0.297	0.328	0.306	0.620	0.308	0.482	0.352
Selenium (Se)	µg/L	1	<0.1	<0.1	0.2	0.2	0.3	0.1	<0.1	<0.1
Silver (Ag)	µg/L	0.1	0.0013	<0.0005	0.0015	0.0016	0.0035	0.0074	0.0011	<0.0005
Strontium (Sr)	µg/L		7.6	9.1	11.9	12.6	10.9	10.6	13.6	11.8
Thallium (Tl)	µg/L	0.8000	0.0041	0.0080	0.0101	0.0151	0.0055	0.0033	<0.0003	0.0004
Tin (Sn)	µg/L		<0.03	0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.118
Uranium (U)	µg/L		0.0160	0.0141	0.0194	0.0294	0.0286	0.0186	0.0325	0.0236
Vanadium (V)	µg/L		0.125	0.060	0.107	0.048	0.3390	0.1140	0.1030	0.0950
Zinc (Zn)	µg/L	3, 13-198	6.55	1.88	**26.10**	1.86	2.80	0.53	1.96	1.76
Dissolved Metals										
Aluminum (Al)	µg/L		6.0	3.0	4.2	3.4	17.4	4.7	11.7	4.8
Antimony (Sb)	µg/L		0.0029	0.0024	0.0043	0.0055	0.0034	0.0035	0.0046	0.0052
Arsenic (As)	µg/L		0.071	0.113	0.127	0.127	0.136	0.146	0.163	0.159
Barium (Ba)	µg/L		1.27	1.27	1.73	1.93	2.63	1.54	2.13	1.76
Beryllium (Be)	µg/L		0.006	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		2.43	3.31	3.17	3.55	3.11	2.97	1.16	2.79
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.15	<0.03	0.10	0.11	0.235	0.184	0.206	0.279
Cobalt (Co)	µg/L		0.0131	0.0150	0.0262	0.0176	0.0248	0.0283	0.0306	0.0241
Copper (Cu)	µg/L		0.57	0.78	0.90	0.93	0.76	0.76	1.21	1.00
Iron (Fe)	µg/L		39.7	19.0	30.2	21.1	92.0	72.2	51.5	35.4
Lead (Pb)	µg/L		0.015	0.006	0.018	0.025	0.006	<0.001	0.010	0.016
Manganese (Mn)	µg/L		0.42	0.74	0.62	0.33	3.51	0.44	0.68	0.71
Molybdenum (Mo)	µg/L		0.018	0.047	0.037	0.034	0.0276	0.0198	0.0174	0.0284
Nickel (Ni)	µg/L		0.192	0.190	0.273	0.248	0.460	0.228	0.467	0.348
Selenium (Se)	µg/L		<0.1	<0.1	0.1	0.2	0.166	0.101	<0.1	<0.1
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	0.0007	0.0013	<0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		6.3	8.1	10.6	12.3	10.8	10.5	13.3	11.7
Uranium (U)	µg/L		0.0084	0.0077	0.0078	0.0125	0.0193	0.0114	0.0246	0.0152
Vanadium (V)	µg/L		0.06	<0.01	0.03	<0.01	0.090	0.069	0.052	0.078
Zinc (Zn)	µg/L		2.42	0.84	21.80	1.64	1.86	0.52	1.94	1.74
Other										
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.02	0.03	<0.01	0.03	0.12	0.03	0.01	0.03
Sulphide	mg/L		<0.001	<0.001	<0.001	-	0.001	<0.001	0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Aimaokatalok Inflow							
			23-Jun-06	16-Jul-06	13-Aug-06	10-Sep-06	23-Jun-07	20-Jul-07	20-Aug-07	10-Sep-07
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		10.1	11.5	14.1	17.0	9.3	13.4	13.4	14.3
Hardness, Total ($CaCO_3$)	mg/L		14.0	16.1	18.8	26.1	13.1	19.5	21.6	24.2
Conductivity	µS/cm		71.4	89.2	107.0	131.0	63.6	94.1	97.1	109.0
Field pH	units	6.5-9.0	7.4	7.2	7.2	7.1	-	6.6	6.5	**6.1**
TDS (Calculated)	mg/L		33.7	41.3	50.4	63.4	32.0	49.2	51.7	57.2
Total Suspended Solids	mg/L		2	4	4	4	23	3	4	3
Color, True	TCU		28	21	23	18	48	15	52	26
Nutrients										
Phosphorus, Total	mg/L		0.019	0.027	0.050	0.060	0.040	0.032	0.027	0.030
Total Kjeldahl Nitrogen	mg/L		0.40	0.50	0.58	0.71	0.48	0.54	1.34	0.74
Ammonia-N	mg/L	0.2-122.4	0.030	0.020	0.009	0.007	0.040	0.020	0.031	0.015
Nitrite-N	mg/L	0.06	0.002	0.002	0.001	<0.001	0.002	<0.005	<0.001	0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	<0.005	<0.005	0.006	0.008	<0.001	0.005
Organics										
Carbon Part	mg/L		0.55	0.66	1.01	1.68	1.84	0.79	1.35	1.77
Dissolved Organic Carbon	mg/L		5.8	6.7	7.0	8.7	7.8	6.3	10.8	9.0
Chlorophyll a	µg/L		-	-	-	-	-	-	-	-
Major Ions										
Calcium (Total)	mg/L		2.79	3.10	3.86	5.27	2.47	3.41	3.95	3.94
Calcium (Dissolved)	mg/L		2.53	2.77	3.53	4.87	2.30	3.31	3.82	3.51
Chloride (Cl)	mg/L		13.80	17.90	22.30	26.50	-	-	-	-
Magnesium (Total)	mg/L		1.96	2.27	2.35	3.43	1.75	2.60	2.80	3.36
Magnesium (Dissolved)	mg/L		1.77	2.06	2.20	3.25	1.62	2.48	2.70	3.05
Potassium (Total)	mg/L		0.79	0.91	0.89	1.09	1.19	0.87	0.72	0.90
Potassium (Dissolved)	mg/L		0.68	0.80	0.80	0.97	0.94	0.82	0.63	0.78
Sodium (Total)	mg/L		7.08	9.04	10.80	13.90	5.67	9.25	9.44	12.30
Sodium (Dissolved)	mg/L		6.60	8.40	10.30	13.40	5.61	9.19	9.24	11.40
Sulphate (SO_4)	mg/L		<3	<3	<3	5	<3	3	5	3
Anions	meq/L		0.63	0.78	0.95	1.20	0.57	0.90	0.92	1.05
Cations	meq/L		0.58	0.71	0.86	1.08	0.61	0.89	0.95	1.04
Ion Balance	N/A		0.92	0.92	0.90	0.90	1.06	0.98	1.03	0.99
Total Metals										
Aluminum (Al)	µg/L	5, 100	**176**	**135**	72.0	**120**	**728**	87.4	**206**	**144**
Antimony (Sb)	µg/L		0.006	0.008	0.009	0.008	0.0084	0.0072	0.1230	0.0097
Arsenic (As)	µg/L	5	0.252	0.309	0.422	0.448	0.327	0.398	0.343	0.417
Barium (Ba)	µg/L		4.26	3.90	2.85	4.12	10.90	3.57	5.52	5.36
Beryllium (Be)	µg/L		0.010	0.006	<0.003	0.009	0.0289	0.0091	0.0097	0.0125
Bismuth (Bi)	µg/L		0.014	0.012	0.003	<0.001	0.0108	0.0018	<0.001	<0.001
Boron (B)	µg/L		5.54	9.66	8.33	10.40	6.01	9.17	4.87	8.00
Cadmium (Cd)	µg/L	0.003-0.055	0.006	**0.010**	0.005	0.003	**0.007**	0.004	0.004	<0.002
Chromium (Cr)	µg/L	1, 16	0.418	0.381	0.379	0.472	**1.4**	0.5	0.7	0.7
Cobalt (Co)	µg/L		0.0995	0.1340	0.1380	0.1310	0.5790	0.1710	0.1490	0.1240
Copper (Cu)	µg/L	2-4	0.89	1.29	1.31	1.38	1.2	0.9	1.6	1.4
Iron (Fe)	µg/L	300	**450**	**417**	**544**	**573**	**1020**	**521**	**393**	**329**
Lead (Pb)	µg/L	1-7	0.0896	0.0924	0.1280	0.0864	0.2630	0.0485	0.0939	0.0738
Manganese (Mn)	µg/L		7.33	14.30	16.20	14.60	63.90	17.90	11.60	10.80
Mercury (Hg)	ng/L	26	<0.6	<0.6	<0.6	21.0	2.9	<0.6	<0.6	<0.6
Molybdenum (Mo)	µg/L	73	0.077	0.122	0.146	0.126	0.1060	0.0874	0.0732	0.0878
Nickel (Ni)	µg/L	25-150	0.563	0.505	0.554	0.711	0.999	0.554	1.100	0.887
Selenium (Se)	µg/L	1	0.2	0.2	0.4	0.6	0.4	0.4	0.3	0.6
Silver (Ag)	µg/L	0.1	0.0017	0.0021	0.0021	<0.0005	0.0066	0.0010	0.0021	0.0026
Strontium (Sr)	µg/L		16.8	19.7	24.0	29.8	17.0	21.5	24.1	25.5
Thallium (Tl)	µg/L	0.8000	0.0092	0.0201	0.0116	0.0122	0.0125	0.0049	<0.0003	<0.0003
Tin (Sn)	µg/L		<0.03	0.14	0.03	0.04	<0.03	<0.03	<0.03	<0.03
Uranium (U)	µg/L		0.0296	0.0372	0.0353	0.0734	0.0646	0.0361	0.0514	0.0511
Vanadium (V)	µg/L		0.594	0.460	0.392	0.367	1.4400	0.4430	0.4850	0.4000
Zinc (Zn)	µg/L	3, 13-198	3.57	4.52	1.53	0.91	4.48	1.87	3.20	1.20
Dissolved Metals										
Aluminum (Al)	µg/L		25.3	26.7	17.5	20.9	26.9	13.9	62.5	27.3
Antimony (Sb)	µg/L		0.0058	0.0080	0.0091	0.0080	0.0084	0.0071	0.1220	0.0096
Arsenic (As)	µg/L		0.194	0.237	0.349	0.351	0.217	0.340	0.275	0.347
Barium (Ba)	µg/L		2.31	2.10	1.81	2.60	2.77	2.49	3.49	3.31
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	0.003	0.005	0.008
Boron (B)	µg/L		4.85	5.67	7.33	7.96	5.49	7.09	3.77	6.44
Cadmium (Cd)	µg/L		<0.002	0.010	<0.002	<0.002	0.003	<0.002	0.003	<0.002
Chromium (Cr)	µg/L		0.28	0.21	0.29	0.45	0.304	0.293	0.487	0.698
Cobalt (Co)	µg/L		0.0280	0.0333	0.0506	0.0459	0.0377	0.0495	0.0575	0.0573
Copper (Cu)	µg/L		0.74	1.00	1.05	1.31	0.84	0.76	1.46	1.36
Iron (Fe)	µg/L		195	110	190	177	193	166	159	106
Lead (Pb)	µg/L		0.035	0.039	0.088	0.046	0.018	0.008	0.028	0.033
Manganese (Mn)	µg/L		1.64	0.67	0.95	1.31	5.42	0.57	1.76	3.02
Molybdenum (Mo)	µg/L		0.077	0.112	0.130	0.115	0.0670	0.0805	0.0655	0.0601
Nickel (Ni)	µg/L		0.446	0.402	0.457	0.561	0.484	0.425	0.930	0.682
Selenium (Se)	µg/L		0.2	0.2	0.4	0.5	0.238	0.266	0.183	0.397
Silver (Ag)	µg/L		0.0007	<0.0005	<0.0005	<0.0005	0.0012	<0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		15.3	17.1	21.6	27.5	16.1	20.9	23.0	24.0
Uranium (U)	µg/L		0.0198	0.0220	0.0208	0.0419	0.0292	0.0236	0.0421	0.0366
Vanadium (V)	µg/L		0.26	0.14	0.16	0.14	0.185	0.141	0.197	0.186
Zinc (Zn)	µg/L		1.97	2.60	1.19	0.91	1.94	1.85	2.89	1.19
Other										
Cyanide, Total	mg/L		<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.03	0.06	0.02	0.04	0.10	0.04	0.02	0.03
Sulphide	mg/L		<0.001	<0.001	<0.001	0.001	0.002	0.001	0.001	0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Aimaokatalok Lake Site 4							
			2-Jun-06		16-Jul-06		17-Aug-06		10-Sep-06	
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		9.4	10.5	8.7	8.8	9.3	9.2	9.4	9.5
Hardness, Total ($CaCO_3$)	mg/L		12.3	13.9	10.6	10.6	11.3	11.2	12.0	11.8
Conductivity	µS/cm		55.4	60.9	48.8	48.8	49.5	49.2	52.4	52.3
Field pH	units	6.5-9.0	6.7	-	6.8	-	7.3	-	7.3	-
TDS (Calculated)	mg/L		26.7	29.6	22.8	23.1	24.5	24.1	24.8	24.7
Total Suspended Solids	mg/L		<1	<1	2	<1	<1	1	1	<1
Color, True	TCU		8	8	21	18	19	19	7	8
Nutrients										
Phosphorus, Total	mg/L		0.017	0.012	0.013	0.012	0.019	0.016	0.011	0.027
Total Kjeldahl Nitrogen	mg/L		0.31	0.24	0.25	0.28	0.25	0.24	0.24	0.24
Ammonia-N	mg/L	0.2-122.4	0.009	0.013	0.009	0.008	0.008	0.007	0.007	0.008
Nitrite-N	mg/L	0.06	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	0.026	0.025	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Organics										
Carbon Part	mg/L		0.11	0.22	0.27	0.26	0.23	0.22	0.29	0.36
Dissolved Organic Carbon	mg/L		4.2	4.5	4.2	4.1	4.3	4.1	3.9	4.1
Chlorophyll a	µg/L		-	-	-	-	-	-	8.8	-
Major Ions										
Calcium (Total)	mg/L		2.62	2.96	2.19	2.25	2.33	2.30	2.37	2.39
Calcium (Dissolved)	mg/L		2.32	2.73	1.95	2.01	1.99	2.08	2.22	2.28
Chloride (Cl)	mg/L		9.60	10.70	7.80	7.90	8.40	8.20	8.60	8.60
Magnesium (Total)	mg/L		1.58	1.86	1.40	1.41	1.34	1.30	1.54	1.53
Magnesium (Dissolved)	mg/L		1.48	1.75	1.25	1.29	1.14	1.18	1.41	1.42
Potassium (Total)	mg/L		0.71	0.82	0.68	0.69	0.72	0.72	0.74	0.75
Potassium (Dissolved)	mg/L		0.68	0.79	0.61	0.62	0.62	0.64	0.68	0.70
Sodium (Total)	mg/L		4.67	5.37	4.17	4.11	4.31	4.23	4.38	4.42
Sodium (Dissolved)	mg/L		4.43	5.22	3.85	3.89	3.84	3.88	4.21	4.25
Sulphate (SO_4)	mg/L		<3	<3	<3	<3	<3	<3	<3	<3
Anions	meq/L		0.50	0.56	0.44	0.44	0.46	0.46	0.47	0.48
Cations	meq/L		0.46	0.52	0.39	0.39	0.42	0.42	0.43	0.43
Ion Balance	N/A		0.92	0.94	0.88	0.89	0.91	0.91	0.91	0.90
Total Metals										
Aluminum (Al)	µg/L	5, 100	15.8	18.0	33.4	36.1	42.1	43.2	70.4	66.5
Antimony (Sb)	µg/L		0.007	0.006	0.007	0.005	0.007	0.005	0.009	0.009
Arsenic (As)	µg/L	5	0.145	0.155	0.134	0.121	0.148	0.130	0.180	0.150
Barium (Ba)	µg/L		1.49	1.76	1.95	2.03	1.90	1.92	2.07	2.08
Beryllium (Be)	µg/L		<0.003	<0.003	0.003	<0.003	<0.003	<0.003	0.004	<0.003
Bismuth (Bi)	µg/L		<0.001	<0.001	<0.001	0.002	0.002	0.002	<0.001	0.003
Boron (B)	µg/L		4.53	5.27	5.43	4.94	4.80	4.30	5.02	4.70
Cadmium (Cd)	µg/L	0.003-0.055	<0.002	<0.002	<0.002	<0.002	**0.006**	0.003	<0.002	<0.002
Chromium (Cr)	µg/L	1, 16	0.123	0.190	<0.030	0.247	0.213	0.215	0.182	0.169
Cobalt (Co)	µg/L		0.0134	0.0156	0.0284	0.0307	0.0335	0.0331	0.0339	0.0317
Copper (Cu)	µg/L	2-4	0.92	1.00	0.91	0.98	1.83	1.02	1.06	1.06
Iron (Fe)	µg/L	300	10.3	15.4	77.8	85.2	51.1	57.5	66.3	65.9
Lead (Pb)	µg/L	1-7	0.0089	0.0072	0.0343	0.0458	0.0613	0.0371	0.0383	0.1310
Manganese (Mn)	µg/L		2.89	4.09	6.36	6.27	5.22	5.85	6.73	6.70
Mercury (Hg)	ng/L	26			1.6	<0.6	4.8	6.8	26.0	5.6
Molybdenum (Mo)	µg/L	73	0.031	0.034	0.029	0.039	0.045	0.057	0.073	0.045
Nickel (Ni)	µg/L	25-150	0.322	0.369	0.322	0.352	0.420	0.366	0.379	4.260
Selenium (Se)	µg/L	1	0.3	0.1	0.1	0.2	0.2	0.2	0.1	0.2
Silver (Ag)	µg/L	0.1	0.0010	0.0013	<0.0005	0.0016	0.0017	0.0013	0.0011	0.0016
Strontium (Sr)	µg/L		13.2	15.2	11.6	11.9	12.3	12.3	12.7	12.5
Thallium (Tl)	µg/L	0.8000	0.0004	0.0008	0.0081	0.0133	0.0087	0.0063	0.0127	0.0108
Tin (Sn)	µg/L		7.76	4.85	12.90	3.19	3.48	0.26	2.14	1.40
Uranium (U)	µg/L		0.0177	0.0241	0.0178	0.0191	0.0198	0.0203	0.0204	0.0206
Vanadium (V)	µg/L		0.064	0.068	0.041	0.094	0.114	0.110	0.138	0.117
Zinc (Zn)	µg/L	3, 13-198	7.89	3.11	2.08	2.11	7.21	6.26	2.15	2.22
Dissolved Metals										
Aluminum (Al)	µg/L		4.0	5.0	6.1	6.4	5.7	6.0	6.7	6.7
Antimony (Sb)	µg/L		0.0066	0.0063	0.0071	0.0050	0.0070	0.0054	0.0089	0.0087
Arsenic (As)	µg/L		0.144	0.143	0.103	0.102	0.142	0.124	0.165	0.116
Barium (Ba)	µg/L		1.21	1.48	1.38	1.48	1.27	1.27	1.28	1.28
Beryllium (Be)	µg/L		<0.003	<0.003	0.003	<0.003	<0.003	<0.003	0.004	<0.003
Boron (B)	µg/L		4.08	4.65	3.84	3.61	4.15	3.99	4.64	4.23
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.11	0.19	<0.03	0.17	0.19	0.17	0.17	0.15
Cobalt (Co)	µg/L		0.0105	0.0109	0.0098	0.0105	0.0102	0.0112	0.0114	0.0138
Copper (Cu)	µg/L		0.84	0.93	0.74	0.68	1.16	0.66	0.88	1.00
Iron (Fe)	µg/L		2.9	4.1	10.2	22.1	9.0	10.2	10.3	9.4
Lead (Pb)	µg/L		<0.001	<0.001	0.009	0.011	0.040	0.024	0.021	0.016
Manganese (Mn)	µg/L		0.46	0.82	0.14	0.11	0.58	0.51	0.60	0.55
Molybdenum (Mo)	µg/L		0.030	0.034	0.021	0.035	0.037	0.039	0.039	0.038
Nickel (Ni)	µg/L		0.295	0.321	0.310	0.299	0.292	0.274	0.301	0.273
Selenium (Se)	µg/L		0.2	0.1	<0.1	<0.1	0.1	0.1	<0.1	<0.1
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	<0.0005	0.0008
Strontium (Sr)	µg/L		12.5	15.1	10.2	10.5	10.5	10.7	12.1	11.8
Uranium (U)	µg/L		0.0086	0.0115	0.0119	0.0138	0.0110	0.0110	0.0099	0.0097
Vanadium (V)	µg/L		0.05	0.06	<0.01	0.06	0.01	0.04	0.04	0.04
Zinc (Zn)	µg/L		7.84	3.03	2.08	2.02	3.75	0.85	2.14	2.18
Other										
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.04	0.04	0.03	0.03	0.01	0.01	0.02	0.03
Sulphide	mg/L		<0.001	0.001	<0.001	-	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Aimaokatalok Lake Site 4							
			24-May-07		21-Jul-07		19-Aug-07		8-Sep-07	9-Sep-07
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		11.6	11.0	9.6	9.6	9.4	9.4	10.0	9.8
Hardness, Total ($CaCO_3$)	mg/L		15.1	14.4	12.3	12.2	12.4	12.3	13.2	13.5
Conductivity	µS/cm		66.1	64.2	52.8	52.7	51.9	52.2	54.0	53.4
Field pH	units	6.5-9.0	7.0	-	**6.0**	**-**	**6.2**	**-**	**6.0**	-
TDS (Calculated)	mg/L		34.6	44.4	29.2	29.5	29.0	27.4	27.0	26.9
Total Suspended Solids	mg/L		<1	<1	<1	<1	<1	<1	<1	<1
Color, True	TCU		6	6	12	12	6	9	12	13
Nutrients										
Phosphorus, Total	mg/L		0.009	0.027	0.013	0.011	0.009	0.025	0.010	0.010
Total Kjeldahl Nitrogen	mg/L		0.28	1.49	0.28	0.28	0.23	0.26	0.27	0.27
Ammonia-N	mg/L	0.2-122.4	0.012	0.083	0.014	0.015	0.008	0.009	0.006	0.009
Nitrite-N	mg/L	0.06	<0.005	0.004	<0.005	<0.005	<0.005	<0.001	<0.005	<0.005
Nitrate-N (calculated)	mg/L	2.9	0.009	0.132	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Organics										
Carbon Part	mg/L		0.15	0.17	0.30	0.32	0.25	0.29	0.43	0.38
Dissolved Organic Carbon	mg/L		4.8	4.5	4.4	4.5	3.8	3.9	4.4	4.2
Chlorophyll a	µg/L		-	-	2.2	-	1.1	-	2.3	-
Major Ions										
Calcium (Total)	mg/L		4.10	3.30	2.36	2.34	2.23	2.29	2.52	2.46
Calcium (Dissolved)	mg/L		4.01	3.09	2.23	2.20	2.21	2.21	2.39	2.34
Chloride (Cl)	mg/L			-	-	-	-	-	-	-
Magnesium (Total)	mg/L		1.95	1.69	1.47	1.50	1.52	1.56	1.70	1.64
Magnesium (Dissolved)	mg/L		1.88	1.61	1.40	1.42	1.52	1.50	1.63	1.56
Potassium (Total)	mg/L		1.14	0.91	0.67	0.69	0.68	0.70	0.77	0.75
Potassium (Dissolved)	mg/L		1.11	0.86	0.64	0.66	0.68	0.66	0.73	0.72
Sodium (Total)	mg/L		7.08	5.73	4.13	4.22	4.30	4.39	4.92	4.65
Sodium (Dissolved)	mg/L		6.90	5.48	4.00	4.05	4.26	4.32	4.87	4.60
Sulphate (SO_4)	mg/L		<3	12	3	4	4	<3	<3	<3
Anions	meq/L		0.61	0.82	0.53	0.54	0.51	0.48	0.51	0.50
Cations	meq/L		0.67	0.66	0.54	0.53	0.53	0.54	0.48	0.49
Ion Balance	N/A		1.09	0.80	1.00	0.99	1.04	1.12	0.95	0.98
Total Metals										
Aluminum (Al)	µg/L	5, 100	41.3	21.0	**31.7**	30.8	**43.7**	40.9	**42.9**	45.7
Antimony (Sb)	µg/L		0.4400	0.0918	0.0046	0.0053	0.1290	0.0695	0.0087	0.0190
Arsenic (As)	µg/L	5	0.328	0.231	0.136	0.142	0.138	0.141	0.160	0.198
Barium (Ba)	µg/L		3.08	1.86	1.83	1.80	1.89	1.89	1.92	1.95
Beryllium (Be)	µg/L		0.0036	0.0085	0.0034	0.0046	<0.003	<0.003	<0.003	<0.003
Bismuth (Bi)	µg/L		0.0030	0.0032	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron (B)	µg/L		7.23	5.13	4.45	4.72	1.97	2.70	4.97	4.41
Cadmium (Cd)	µg/L	0.003-0.055	**0.024**	**0.009**	<0.002	<0.002	<0.002	<0.002	<0.002	0.006
Chromium (Cr)	µg/L	1, 16	1.0	**1.2**	0.2	0.2	0.2	0.2	0.3	0.4
Cobalt (Co)	µg/L		0.0670	0.0340	0.0390	0.0388	0.0252	0.0256	0.0279	0.0320
Copper (Cu)	µg/L	2-4	**2.3**	1.3	1.1	0.9	1.0	1.1	1.0	1.4
Iron (Fe)	µg/L	300	36.0	14.7	83.4	83.4	61.2	58.4	64.4	72.8
Lead (Pb)	µg/L	1-7	0.6940	0.1690	0.0078	0.0164	0.0192	0.0163	0.0401	0.0651
Manganese (Mn)	µg/L		2.75	2.34	13.50	13.60	5.47	5.15	5.11	4.91
Mercury (Hg)	ng/L	26	2.3	<0.6	1.7	<0.6	<0.6	<0.6	<0.6	<0.6
Molybdenum (Mo)	µg/L	73	0.0745	0.0533	0.0195	0.0187	0.0131	0.0140	0.0328	0.0445
Nickel (Ni)	µg/L	25-150	0.941	0.512	0.302	0.362	0.324	0.355	0.369	0.428
Selenium (Se)	µg/L	1	0.4	0.3	0.1	0.2	<0.1	<0.1	<0.1	<0.1
Silver (Ag)	µg/L	0.1	0.0031	0.0054	0.0010	0.0010	0.0011	0.0021	0.0012	0.0007
Strontium (Sr)	µg/L		17.1	15.9	12.3	12.5	12.5	12.9	13.3	13.1
Thallium (Tl)	µg/L	0.8000	<0.0003	<0.0003	0.0033	0.0032	<0.0003	<0.0003	0.0008	0.0020
Tin (Sn)	µg/L		0.323	0.234	0.085	1.040	1.200	0.869	0.981	0.749
Uranium (U)	µg/L		0.0210	0.0215	0.0172	0.0172	0.0170	0.0179	0.0196	0.0213
Vanadium (V)	µg/L		0.1020	0.3380	0.0974	0.0970	0.0858	0.0846	0.1200	0.1380
Zinc (Zn)	µg/L	3, 13-198	16.00	16.00	2.30	3.11	2.01	1.85	2.11	2.15
Dissolved Metals										
Aluminum (Al)	µg/L		9.3	4.2	6.2	6.2	7.9	5.9	8.0	7.3
Antimony (Sb)	µg/L		0.4360	0.0909	0.0046	0.0052	0.1280	0.0688	0.0086	0.0188
Arsenic (As)	µg/L		0.238	0.139	0.130	0.121	0.132	0.135	0.146	0.186
Barium (Ba)	µg/L		2.46	1.63	1.47	1.45	1.46	1.43	1.42	1.44
Beryllium (Be)	µg/L		0.004	<0.003	0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		6.49	4.59	4.01	4.10	1.90	1.79	3.92	4.17
Cadmium (Cd)	µg/L		0.021	0.006	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.264	1.230	0.156	0.198	0.216	0.163	0.269	0.376
Cobalt (Co)	µg/L		0.0563	0.0245	0.0131	0.0098	0.0131	0.0096	0.0155	0.0184
Copper (Cu)	µg/L		2.19	1.17	0.52	0.57	1.00	0.96	1.02	1.39
Iron (Fe)	µg/L		12.0	2.9	18.5	19.4	17.5	12.6	14.9	18.1
Lead (Pb)	µg/L		0.607	0.075	<0.001	<0.001	0.003	0.001	0.010	0.014
Manganese (Mn)	µg/L		2.54	1.28	0.32	0.32	1.01	0.44	0.52	0.55
Molybdenum (Mo)	µg/L		0.0572	0.0506	0.0124	0.0185	0.0130	0.0100	0.0325	0.0400
Nickel (Ni)	µg/L		0.932	0.506	0.270	0.284	0.321	0.326	0.364	0.424
Selenium (Se)	µg/L		0.278	0.189	0.124	0.156	<0.1	<0.1	<0.1	<0.1
Silver (Ag)	µg/L		0.0012	0.0018	<0.0005	0.0010	0.0011	0.0021	<0.0005	0.0007
Strontium (Sr)	µg/L		16.9	15.6	12.2	12.4	12.4	12.3	13.2	13.0
Uranium (U)	µg/L		0.0166	0.0175	0.0135	0.0130	0.0131	0.0132	0.0146	0.0165
Vanadium (V)	µg/L		0.036	0.335	0.035	0.038	0.038	0.015	0.062	0.094
Zinc (Zn)	µg/L		15.80	13.20	1.57	2.11	1.99	1.83	2.09	2.13
Other										
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.02	0.16	0.21	0.19		0.02	0.02	0.02
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Aimaokatalok Lake Site 6								
			3-Jun-06			16-Jul-06		17-Aug-06		10-Sep-06	
			Top	Middle	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
Physical											
Alkalinity, Total ($CaCO_3$)	mg/L		10.7	10.8	13.7	8.7	9.0	9.1	9.3	9.4	9.4
Hardness, Total ($CaCO_3$)	mg/L		14.0	14.0	17.6	10.5	11.0	11.0	11.3	12.0	12.0
Conductivity	µS/cm		64.5	64.7	71.7	48.9	50.4	49.2	51.9	53.2	53.1
Field pH	units	6.5-9.0	6.9	-	-	6.9	-	7.3	-	7.4	-
TDS (Calculated)	mg/L		31.0	30.9	33.6	23.0	23.8	24.1	25.7	25.0	27.6
Total Suspended Solids	mg/L		<1	<1	2	1	<1	1	3	<1	1
Color, True	TCU		10	9	30	21	21	19	19	6	8
Nutrients											
Phosphorus, Total	mg/L		0.012	0.011	0.023	0.013	0.011	0.020	0.028	0.022	0.025
Total Kjeldahl Nitrogen	mg/L		0.36	0.25	0.37	0.28	0.25	0.23	0.29	0.22	0.24
Ammonia-N	mg/L	0.2-122.4	0.008	0.013	0.009	0.005	0.011	0.009	0.020	0.005	0.006
Nitrite-N	mg/L	0.06	<0.001	<0.001	0.002	0.001	0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	0.035	0.037	0.025	<0.005	<0.005	<0.005	0.015	<0.005	<0.005
Organics											
Carbon Part	mg/L		0.19	0.17	0.36	0.19	0.23	0.26	0.42	0.34	0.29
Dissolved Organic Carbon	mg/L		5.0	4.8	6.9	4.2	4.1	4.0	4.0	3.7	4.2
Chlorophyll a	µg/L		-	-	-	-	-	-	-	4.7	-
Major Ions											
Calcium (Total)	mg/L		3.10	3.09	4.18	2.26	2.25	2.30	2.32	2.35	2.41
Calcium (Dissolved)	mg/L		2.93	2.82	3.83	1.98	2.09	2.04	2.02	2.24	2.25
Chloride (Cl)	mg/L		11.30	11.20	11.00	8.00	8.20	8.20	9.10	8.70	8.60
Magnesium (Total)	mg/L		1.98	1.97	1.96	1.44	1.41	1.30	1.31	1.48	1.53
Magnesium (Dissolved)	mg/L		1.91	1.84	1.86	1.29	1.37	1.17	1.17	1.36	1.41
Potassium (Total)	mg/L		0.93	0.89	1.06	0.69	0.69	0.72	0.74	0.70	0.74
Potassium (Dissolved)	mg/L		0.88	0.81	0.97	0.62	0.66	0.63	0.63	0.67	0.69
Sodium (Total)	mg/L		5.65	5.58	5.18	4.29	4.27	4.25	4.35	4.29	4.39
Sodium (Dissolved)	mg/L		5.58	5.26	4.93	3.99	4.25	3.88	4.02	4.29	4.20
Sulphate (SO_4)	mg/L		<3	<3	<3	<3	<3	<3	<3	<3	5
Anions	meq/L		0.58	0.58	0.63	0.44	0.46	0.46	0.49	0.48	0.53
Cations	meq/L		0.55	0.54	0.61	0.39	0.41	0.42	0.44	0.44	0.43
Ion Balance	N/A		0.95	0.94	0.97	0.88	0.89	0.91	0.91	0.92	0.82
Total Metals											
Aluminum (Al)	µg/L	5, 100	28.5	28.8	**192**	35.2	48.1	41.3	94.5	64.0	83.0
Antimony (Sb)	µg/L		0.008	0.010	0.010	0.005	0.009	0.005	0.075	0.007	0.008
Arsenic (As)	µg/L	5	0.155	0.201	0.224	0.154	0.174	0.137	0.154	0.168	0.170
Barium (Ba)	µg/L		2.18	2.09	4.81	1.97	2.19	1.83	2.83	1.92	2.16
Beryllium (Be)	µg/L		<0.003	0.005	0.017	0.005	<0.003	<0.003	0.004	<0.003	<0.003
Bismuth (Bi)	µg/L		<0.001	0.002	0.002	<0.001	0.005	0.002	0.002	0.002	<0.001
Boron (B)	µg/L		5.91	5.86	5.65	5.18	6.36	4.37	5.27	5.37	5.44
Cadmium (Cd)	µg/L	0.003-0.055	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002	0.005
Chromium (Cr)	µg/L	1, 16	0.225	0.226	0.411	0.085	0.159	0.190	0.271	0.234	0.176
Cobalt (Co)	µg/L		0.0387	0.0281	0.1800	0.0332	0.0412	0.0301	0.0569	0.0299	0.0349
Copper (Cu)	µg/L	2-4	1.01	1.26	1.48	0.95	1.02	0.95	1.48	0.88	0.95
Iron (Fe)	µg/L	300	42.6	34.5	274	92.5	110	52.8	118	71.6	71.5
Lead (Pb)	µg/L	1-7	0.0367	0.0368	0.1030	0.0297	0.1990	0.0331	0.0661	0.0415	0.0429
Manganese (Mn)	µg/L		8.04	6.66	31.30	6.27	8.99	5.13	12.60	6.81	7.07
Mercury (Hg)	ng/L	26				1.5	<0.6	3.4	3.4	6.7	22.0
Molybdenum (Mo)	µg/L	73	0.044	0.044	0.083	0.028	0.026	0.044	0.042	0.051	0.048
Nickel (Ni)	µg/L	25-150	0.417	0.387	0.671	0.330	0.347	0.358	0.397	0.335	0.378
Selenium (Se)	µg/L	1	<0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.3	0.1
Silver (Ag)	µg/L	0.1	0.0005	0.0017	0.0017	<0.0005	<0.0005	0.0020	0.0021	0.0006	0.0011
Strontium (Sr)	µg/L		16.6	16.4	19.5	11.7	11.8	12.2	12.6	12.0	12.5
Thallium (Tl)	µg/L	0.8000	0.0005	0.0021	0.0032	0.0103	0.0124	0.0064	0.0071	0.0147	0.0111
Tin (Sn)	µg/L		3.34	11.50	3.56	3.38	3.00	2.05	3.80	1.85	0.30
Uranium (U)	µg/L		0.0240	0.0235	0.0340	0.0190	0.0186	0.0199	0.0227	0.0209	0.0221
Vanadium (V)	µg/L		0.101	0.060	0.365	0.079	0.106	0.089	0.165	0.100	0.130
Zinc (Zn)	µg/L	3, 13-198	3.88	6.09	5.30	1.72	2.85	2.14	10.20	1.15	5.11
Dissolved Metals											
Aluminum (Al)	µg/L		7.5	6.6	17.0	6.7	7.4	5.8	7.7	6.6	7.3
Antimony (Sb)	µg/L		0.0080	0.0096	0.0097	0.0046	0.0089	0.0052	0.0746	0.0065	0.0074
Arsenic (As)	µg/L		0.138	0.158	0.180	0.139	0.171	0.121	0.114	0.148	0.135
Barium (Ba)	µg/L		1.73	1.61	2.59	1.41	1.54	1.27	1.55	1.28	1.30
Beryllium (Be)	µg/L		<0.003	<0.003	0.008	0.005	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		5.46	5.68	5.03	4.20	5.05	3.80	4.31	3.47	4.18
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.004
Chromium (Cr)	µg/L		0.22	0.16	0.22	0.09	0.08	0.19	0.15	0.23	0.17
Cobalt (Co)	µg/L		0.0199	0.0107	0.0797	0.0115	0.0105	0.0118	0.0124	0.0114	0.0144
Copper (Cu)	µg/L		0.95	1.03	1.18	0.72	0.70	0.69	1.05	0.87	0.81
Iron (Fe)	µg/L		17.2	10.8	95.4	18.6	23.7	10.4	9.0	14.3	9.4
Lead (Pb)	µg/L		0.001	<0.001	0.014	0.009	0.034	0.019	0.026	0.022	0.016
Manganese (Mn)	µg/L		4.13	2.98	17.90	0.14	0.37	0.57	0.37	0.73	0.45
Molybdenum (Mo)	µg/L		0.043	0.032	0.046	0.023	0.026	0.036	0.034	0.034	0.036
Nickel (Ni)	µg/L		0.355	0.359	0.538	0.282	0.313	0.296	0.393	0.316	0.284
Selenium (Se)	µg/L		<0.1	0.1	<0.1	0.1	0.2	0.1	<0.1	0.3	0.1
Silver (Ag)	µg/L		<0.0005	0.0007	0.0007	<0.0005	<0.0005	0.0019	0.0007	<0.0005	<0.0005
Strontium (Sr)	µg/L		15.5	16.4	18.7	10.3	10.8	10.7	10.9	12.0	11.7
Uranium (U)	µg/L		0.0167	0.0136	0.0222	0.0135	0.0124	0.0117	0.0098	0.0099	0.0096
Vanadium (V)	µg/L		0.09	0.03	0.10	0.02	0.01	0.04	0.04	0.07	0.02
Zinc (Zn)	µg/L		3.84	1.95	4.35	1.41	2.66	2.07	1.22	1.06	4.90
Other											
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.03	0.03	0.03	0.03	0.03	0.03	<0.01	0.03	0.02
Sulphide	mg/L		<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Aimaokatalok Lake Site 6								
			24-May-07			20-Jul-07		19-Aug-07		8-Sep-07	
			Top	Middle	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
Physical											
Alkalinity, Total ($CaCO_3$)	mg/L		10.6	12.8	11.2	9.4	9.5	9.8	9.5	10.0	9.9
Hardness, Total ($CaCO_3$)	mg/L		13.9	16.3	14.7	12.1	12.4	12.4	12.4	13.5	13.3
Conductivity	µS/cm		61.6	71.6	72.3	50.8	52.2	53.7	52.4	55.3	55.5
Field pH	units	6.5-9.0	7.8	-	-	**6.0**	**-**	**6.1**	**-**	**6.1**	-
TDS (Calculated)	mg/L		32.4	38.6	38.5	27.1	27.7	29.1	27.6	27.4	27.1
Total Suspended Solids	mg/L		<1	<1	<1	<1	<1	2	1	<1	<1
Color, True	TCU		18	13	6	14	15	9	9	13	13
Nutrients											
Phosphorus, Total	mg/L		0.007	0.006	0.014	0.011	0.015	0.012	0.010	0.012	0.011
Total Kjeldahl Nitrogen	mg/L		0.25	0.25	0.20	0.26	0.27	0.27	0.27	0.31	0.29
Ammonia-N	mg/L	0.2-122.4	0.004	0.006	0.006	0.010	0.016	0.018	0.008	0.009	0.014
Nitrite-N	mg/L	0.06	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Nitrate-N (calculated)	mg/L	2.9	0.021	0.093	0.171	<0.001	<0.001	<0.001	<0.001	0.005	0.005
Organics											
Carbon Part	mg/L		0.18	0.15	0.20	0.29	0.24	0.35	0.30	0.37	0.67
Dissolved Organic Carbon	mg/L		3.9	4.4	3.7	4.1	4.0	3.6	3.9	4.7	4.8
Chlorophyll a	µg/L		-	-	-	1.4	-	1.2	-	2.2	-
Major Ions											
Calcium (Total)	mg/L		2.92	3.47	3.03	2.30	2.32	2.31	2.32	2.56	2.58
Calcium (Dissolved)	mg/L		2.73	3.26	2.89	2.28	2.24	2.16	2.13	2.19	2.47
Chloride (Cl)	mg/L		-	-	-	-	-	-	-	-	-
Magnesium (Total)	mg/L		1.69	2.00	1.80	1.49	1.49	1.57	1.55	1.72	1.73
Magnesium (Dissolved)	mg/L		1.61	1.93	1.73	1.49	1.44	1.46	1.45	1.48	1.65
Potassium (Total)	mg/L		0.85	1.01	0.88	0.70	0.69	0.70	0.70	0.76	0.77
Potassium (Dissolved)	mg/L		0.82	0.96	0.83	0.69	0.66	0.65	0.64	0.65	0.73
Sodium (Total)	mg/L		5.56	8.81	6.40	4.23	4.26	4.40	4.39	4.96	4.97
Sodium (Dissolved)	mg/L		5.37	8.58	6.35	4.19	4.11	4.17	4.18	4.67	4.92
Sulphate (SO_4)	mg/L		<3	<3	<3	<3	<3	3	<3	<3	<3
Anions	meq/L		0.57	0.69	0.68	0.48	0.49	0.51	0.48	0.52	0.52
Cations	meq/L		0.63	0.73	0.72	0.52	0.53	0.55	0.54	0.49	0.48
Ion Balance	N/A		1.10	1.06	1.07	1.09	1.08	1.06	1.13	0.96	0.92
Total Metals											
Aluminum (Al)	µg/L	5, 100	13.9	31.1	60.2	**36.2**	32.9	**48.1**	60.3	**59.8**	73.0
Antimony (Sb)	µg/L		0.0056	0.0085	0.0063	0.0052	0.0047	0.0044	0.0051	0.0088	0.0082
Arsenic (As)	µg/L	5	0.240	0.238	0.200	0.177	0.157	0.170	0.161	0.186	0.168
Barium (Ba)	µg/L		1.74	2.11	2.50	2.01	1.88	2.05	2.11	2.10	2.24
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	0.0056	<0.003	0.0046	<0.003	<0.003
Bismuth (Bi)	µg/L		0.0012	0.0013	0.0013	<0.001	0.0014	<0.001	<0.001	<0.001	<0.001
Boron (B)	µg/L		5.45	7.73	6.23	5.11	4.52	3.79	2.52	5.67	7.14
Cadmium (Cd)	µg/L	0.003-0.055	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002
Chromium (Cr)	µg/L	1, 16	0.3	0.2	0.2	0.3	0.3	0.2	0.2	0.3	0.3
Cobalt (Co)	µg/L		0.0170	0.0227	0.0269	0.0469	0.0514	0.0276	0.0354	0.0361	0.0403
Copper (Cu)	µg/L	2-4	1.0	1.1	1.0	1.0	0.7	0.9	1.2	1.0	1.1
Iron (Fe)	µg/L	300	13.7	31.4	48.3	103	105	59.4	72.7	83.0	96.3
Lead (Pb)	µg/L	1-7	0.0128	0.0509	0.0240	0.0177	0.0147	0.0185	0.0254	0.0859	0.2080
Manganese (Mn)	µg/L		2.16	4.55	11.40	12.30	18.30	5.74	6.75	5.86	6.92
Mercury (Hg)	ng/L	26	0.9	1.4	1.2	0.7	0.9	<0.6	<0.6	<0.6	<0.6
Molybdenum (Mo)	µg/L	73	0.0404	0.0420	0.0216	0.0209	0.0301	0.0132	0.0156	0.0308	0.0345
Nickel (Ni)	µg/L	25-150	0.325	0.357	0.267	0.390	0.350	0.341	0.364	0.361	0.425
Selenium (Se)	µg/L	1	0.5	0.4	0.5	0.3	0.2	0.2	0.2	<0.1	<0.1
Silver (Ag)	µg/L	0.1	0.0032	0.0034	0.0032	0.0200	0.0200	0.0081	0.0031	<0.0005	0.0025
Strontium (Sr)	µg/L		14.7	17.5	16.0	12.6	12.5	13.0	13.0	13.3	13.6
Thallium (Tl)	µg/L	0.8000	<0.0003	<0.0003	<0.0003	0.0038	0.0038	<0.0003	<0.0003	0.0004	0.0014
Tin (Sn)	µg/L		1.870	1.310	0.199	1.010	1.470	0.937	1.180	0.894	2.310
Uranium (U)	µg/L		0.0194	0.0207	0.0184	0.0189	0.0177	0.0181	0.0188	0.0226	0.0234
Vanadium (V)	µg/L		0.0523	0.0670	0.0530	0.1160	0.1010	0.0800	0.1090	0.1390	0.1870
Zinc (Zn)	µg/L	3, 13-198	2.30	2.19	5.56	1.75	2.44	0.91	1.39	1.85	3.15
Dissolved Metals											
Aluminum (Al)	µg/L		2.5	6.4	10.5	8.6	7.7	6.6	6.0	9.4	10.5
Antimony (Sb)	µg/L		0.0056	0.0084	0.0062	0.0052	0.0047	0.0044	0.0051	0.0087	0.0081
Arsenic (As)	µg/L		0.205	0.173	0.150	0.175	0.145	0.155	0.135	0.134	0.156
Barium (Ba)	µg/L		1.45	1.74	1.96	1.68	1.45	1.43	1.38	1.35	1.51
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	0.005	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		5.40	6.00	5.65	5.00	4.40	2.58	1.57	3.67	4.08
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002
Chromium (Cr)	µg/L		0.238	0.237	0.172	0.267	0.210	0.130	0.107	0.290	0.318
Cobalt (Co)	µg/L		0.0148	0.0182	0.0193	0.0132	0.0127	0.0119	0.0094	0.0193	0.0179
Copper (Cu)	µg/L		1.00	1.04	0.92	0.80	0.61	0.74	1.04	0.96	1.04
Iron (Fe)	µg/L		8.5	7.7	7.1	32.8	28.7	15.6	12.8	17.3	19.8
Lead (Pb)	µg/L		0.013	0.005	0.008	<0.001	<0.001	<0.001	0.002	0.020	0.023
Manganese (Mn)	µg/L		0.45	3.27	9.27	0.37	0.81	0.69	0.31	0.68	0.78
Molybdenum (Mo)	µg/L		0.0400	0.0408	0.0214	0.0182	0.0172	0.0131	0.0123	0.0305	0.0342
Nickel (Ni)	µg/L		0.322	0.335	0.249	0.324	0.299	0.315	0.338	0.339	0.407
Selenium (Se)	µg/L		0.318	0.375	0.319	0.280	0.190	0.205	<0.1	<0.1	<0.1
Silver (Ag)	µg/L		0.0011	0.0011	0.0016	<0.0005	0.0200	0.0021	0.0021	<0.0005	<0.0005
Strontium (Sr)	µg/L		14.6	17.3	15.8	12.5	12.0	12.2	12.1	13.2	13.5
Uranium (U)	µg/L		0.0149	0.0143	0.0124	0.0149	0.0134	0.0127	0.0124	0.0150	0.0163
Vanadium (V)	µg/L		0.049	0.041	0.027	0.049	0.059	0.016	<0.01	0.097	0.054
Zinc (Zn)	µg/L		2.28	2.17	1.06	1.41	1.34	0.90	1.38	1.83	3.12
Other											
Cyanide, Total	mg/L		<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.02	0.02	0.02	0.02	0.03	0.02	0.02	0.02	0.02
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Aimaokatalok Outflow							
			23-Jun-06	16-Jul-06	13-Aug-06	10-Sep-06	23-Jun-07	20-Jul-07	19-Aug-07	10-Sep-07
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		9.9	8.7	8.9	9.4	10.6	9.8	9.4	10.0
Hardness, Total ($CaCO_3$)	mg/L		12.7	10.6	10.5	11.8	13.7	12.4	12.4	13.1
Conductivity	µS/cm		58.9	48.8	49.6	52.1	61.8	53.2	51.8	53.5
Field pH	units	6.5-9.0	7.1	6.7	6.5	6.8	**6.1**	**6.2**	**6.2**	**6.0**
TDS (Calculated)	mg/L		28.4	22.9	23.5	27.1	30.5	31.9	28.7	27.1
Total Suspended Solids	mg/L		1	1	<1	7	2	<1	<1	<1
Color, True	TCU		21	19	17	8	17	15	6	11
Nutrients										
Phosphorus, Total	mg/L		0.014	0.016	0.023	0.019	0.009	0.011	0.010	0.011
Total Kjeldahl Nitrogen	mg/L		0.38	0.28	0.27	0.25	0.27	0.26	0.25	0.28
Ammonia-N	mg/L	0.2-122.4	0.017	0.006	0.005	0.005	0.010	0.008	0.015	0.006
Nitrite-N	mg/L	0.06	0.001	0.001	<0.001	<0.001	<0.005	<0.005	<0.005	<0.005
Nitrate-N (calculated)	mg/L	2.9	0.013	<0.005	<0.005	0.009	0.024	<0.001	<0.001	<0.001
Organics										
Carbon Part	mg/L		0.45	0.29	0.25	0.33	0.17	0.19	0.23	0.46
Dissolved Organic Carbon	mg/L		4.7	4.5	4.4	4.0	4.7	3.5	3.9	4.5
Chlorophyll a	µg/L		-	-	-	-	-	-	-	-
Major Ions										
Calcium (Total)	mg/L		2.70	2.18	2.27	2.45	2.88	2.40	2.30	2.40
Calcium (Dissolved)	mg/L		2.41	1.97	2.06	2.24	2.75	2.27	2.20	2.10
Chloride (Cl)	mg/L		9.80	7.80	8.10	8.40	-	-	-	-
Magnesium (Total)	mg/L		1.64	1.38	1.26	1.51	1.70	1.55	1.55	1.77
Magnesium (Dissolved)	mg/L		1.47	1.24	1.13	1.35	1.62	1.47	1.49	1.55
Potassium (Total)	mg/L		0.82	0.67	0.69	0.74	0.87	0.71	0.70	0.73
Potassium (Dissolved)	mg/L		0.73	0.62	0.63	0.67	0.84	0.68	0.66	0.65
Sodium (Total)	mg/L		4.89	4.03	4.24	4.75	5.17	4.48	4.40	5.12
Sodium (Dissolved)	mg/L		4.48	3.75	3.92	4.38	5.01	4.33	4.32	4.89
Sulphate (SO_4)	mg/L		<3	<3	<3	5	<3	6	4	<3
Anions	meq/L		0.52	0.44	0.45	0.52	0.56	0.58	0.50	0.51
Cations	meq/L		0.52	0.39	0.40	0.43	0.57	0.54	0.54	0.48
Ion Balance	N/A		1.01	0.89	0.89	0.82	1.02	0.93	1.07	0.94
Total Metals										
Aluminum (Al)	µg/L	5, 100	46.6	31.9	32.3	72.4	**27.3**	**30.5**	**42.7**	**59.8**
Antimony (Sb)	µg/L		0.006	0.004	0.006	0.005	0.0085	0.0055	0.0730	0.0043
Arsenic (As)	µg/L	5	0.145	0.158	0.160	0.163	0.165	0.141	0.140	0.182
Barium (Ba)	µg/L		2.19	1.94	1.84	2.03	1.89	1.80	2.03	2.23
Beryllium (Be)	µg/L		0.005	0.005	<0.003	0.003	<0.003	0.0035	0.0055	0.0063
Bismuth (Bi)	µg/L		0.005	0.004	0.001	<0.001	0.0035	<0.001	<0.001	<0.001
Boron (B)	µg/L		5.16	3.82	4.56	4.61	5.12	4.83	2.09	6.04
Cadmium (Cd)	µg/L	0.003-0.055	**0.008**	0.002	<0.002	<0.002	<0.002	**0.009**	0.004	0.002
Chromium (Cr)	µg/L	1, 16	0.224	0.068	0.231	0.247	0.2	0.3	0.2	0.5
Cobalt (Co)	µg/L		0.0624	0.0327	0.0300	0.0305	0.0452	0.0398	0.0273	0.0335
Copper (Cu)	µg/L	2-4	0.96	0.81	0.91	0.84	0.8	0.7	0.8	0.9
Iron (Fe)	µg/L	300	117	82.5	58.6	79.7	42.7	77.2	60.9	73.6
Lead (Pb)	µg/L	1-7	0.0333	0.0291	0.0449	0.0345	0.0105	0.0111	0.0211	0.0352
Manganese (Mn)	µg/L		18.20	6.51	5.45	7.59	11.00	14.50	5.69	5.73
Mercury (Hg)	ng/L	26	<0.6	<0.6	<0.6	14.0	0.7	<0.6	<0.6	<0.6
Molybdenum (Mo)	µg/L	73	0.047	0.029	0.041	0.053	0.0492	0.0213	0.0158	0.0022
Nickel (Ni)	µg/L	25-150	0.431	0.345	0.332	0.390	0.333	0.345	0.338	0.439
Selenium (Se)	µg/L	1	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.3
Silver (Ag)	µg/L	0.1	0.0010	<0.0005	0.0009	<0.0005	0.0028	0.0010	0.0011	0.0013
Strontium (Sr)	µg/L		14.2	11.4	12.2	12.6	15.0	12.5	12.9	13.3
Thallium (Tl)	µg/L	0.8000	0.0061	0.0152	0.0097	0.0083	0.0026	0.0032	<0.0003	<0.0003
Tin (Sn)	µg/L		<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Uranium (U)	µg/L		0.0205	0.0181	0.0219	0.0222	0.0211	0.0175	0.0181	0.0222
Vanadium (V)	µg/L		0.197	0.045	0.104	0.155	0.0840	0.0885	0.0847	0.1670
Zinc (Zn)	µg/L	3, 13-198	6.04	2.16	4.38	0.94	2.38	2.34	1.37	0.82
Dissolved Metals										
Aluminum (Al)	µg/L		8.6	5.8	6.4	6.5	5.6	6.4	5.2	7.8
Antimony (Sb)	µg/L		0.0056	0.0039	0.0060	0.0053	0.0084	0.0054	0.0723	0.0043
Arsenic (As)	µg/L		0.124	0.139	0.146	0.134	0.164	0.135	0.123	0.165
Barium (Ba)	µg/L		1.52	1.41	1.29	1.21	1.51	1.44	1.46	1.50
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	0.003	<0.003	0.004	<0.003	<0.003
Boron (B)	µg/L		4.69	3.23	4.05	4.08	4.56	4.34	1.79	4.05
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002
Chromium (Cr)	µg/L		0.14	0.07	0.18	0.19	0.218	0.209	0.118	0.460
Cobalt (Co)	µg/L		0.0281	0.0101	0.0124	0.0068	0.0159	0.0128	0.0095	0.0172
Copper (Cu)	µg/L		0.71	0.71	0.72	0.75	0.78	0.65	0.72	0.88
Iron (Fe)	µg/L		35.4	20.1	9.5	5.5	10.5	18.2	11.2	19.3
Lead (Pb)	µg/L		0.013	0.020	0.045	0.016	<0.001	<0.001	0.001	0.019
Manganese (Mn)	µg/L		11.40	0.16	0.38	0.35	1.77	0.26	0.28	0.76
Molybdenum (Mo)	µg/L		0.036	0.026	0.040	0.027	0.0339	0.0140	0.0124	0.0022
Nickel (Ni)	µg/L		0.307	0.286	0.305	0.263	0.323	0.252	0.335	0.435
Selenium (Se)	µg/L		<0.1	0.1	0.1	0.2	0.223	0.116	0.102	0.264
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	0.0009	0.0010	<0.0005	0.0007
Strontium (Sr)	µg/L		12.5	10.2	10.8	11.5	14.8	12.1	12.4	13.2
Uranium (U)	µg/L		0.0141	0.0134	0.0117	0.0104	0.0159	0.0123	0.0126	0.0150
Vanadium (V)	µg/L		0.11	<0.01	0.06	0.04	0.029	0.053	<0.01	0.109
Zinc (Zn)	µg/L		2.60	1.21	2.90	0.84	0.84	1.11	1.36	0.81
Other										
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.03	0.03	<0.01	0.03	0.09	0.02		0.02
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Fickle Duck Lake						
			18-Jul-06	17-Aug-06	10-Sep-06	24-May-07	22-Jul-07	20-Aug-07	9-Sep-07
			Top	Top	Top	Top	Top	Top	Top
Physical									
Alkalinity, Total ($CaCO_3$)	mg/L		14.8	18.3	20.2	79.6	16.7	19.3	20.5
Hardness, Total ($CaCO_3$)	mg/L		17.8	22.6	25.5	104.0	21.1	26.5	29.0
Conductivity	µS/cm		65.4	78.9	90.3	332.0	71.8	80.9	81.9
Field pH	units	6.5-9.0	7.0	8.0	7.7	6.9	7.3	6.8	6.6
TDS (Calculated)	mg/L		32.2	40.0	45.9	221	39.2	42.6	41.6
Total Suspended Solids	mg/L		2	3	4	1	2	<1	1
Color, True	TCU		29	28	24	119	30	40	42
Nutrients									
Phosphorus, Total	mg/L		0.016	0.039	0.037	0.038	0.024	0.039	0.033
Total Kjeldahl Nitrogen	mg/L		0.38	0.66	0.64	1.28	0.47	0.58	0.52
Ammonia-N	mg/L	0.2-122.4	0.012	0.013	0.006	0.260	0.010	0.012	0.008
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	0.02	<0.005	<0.001	<0.005
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	<0.005	1.060	<0.001	<0.001	<0.001
Organics									
Carbon Part	mg/L		0.52	1.02	0.86	0.71	0.38	0.75	0.69
Dissolved Organic Carbon	mg/L		5.9	7.7	7.8	19.7	5.8	8.2	8.4
Chlorophyll a	µg/L		-	-	24.9	-	3.4	5.7	5.1
Major Ions									
Calcium (Total)	mg/L		4.83	6.07	7.00	27.90	5.41	6.91	7.38
Calcium (Dissolved)	mg/L		4.46	5.35	6.65	26.40	5.16	6.67	7.08
Chloride (Cl)	mg/L		9.70	12.50	13.20	-	-	-	-
Magnesium (Total)	mg/L		1.57	1.69	2.16	8.11	1.77	2.06	2.14
Magnesium (Dissolved)	mg/L		1.45	1.54	2.07	7.70	1.67	1.98	2.06
Potassium (Total)	mg/L		0.48	0.58	0.63	1.92	0.50	0.52	0.55
Potassium (Dissolved)	mg/L		0.42	0.49	0.55	1.81	0.45	0.45	0.52
Sodium (Total)	mg/L		4.70	5.70	6.91	23.40	5.04	5.13	5.12
Sodium (Dissolved)	mg/L		4.48	5.36	6.75	22.30	4.83	5.11	5.07
Sulphate (SO_4)	mg/L		<3	<3	5	48	4	4	3
Anions	meq/L		0.61	0.76	0.89	4.21	0.73	0.75	0.77
Cations	meq/L		0.58	0.73	0.78	3.37	0.73	0.86	0.82
Ion Balance	N/A		0.95	0.96	0.88	0.80	1.00	1.14	1.07
Total Metals									
Aluminum (Al)	µg/L	5, 100	**122**	97.9	**172**	44.1	**114**	**155**	**112**
Antimony (Sb)	µg/L		0.007	0.009	0.009	0.0408	0.0052	0.0060	0.0151
Arsenic (As)	µg/L	5	0.201	0.292	0.336	0.808	0.230	0.231	0.304
Barium (Ba)	µg/L		3.81	4.20	5.20	14.20	3.90	5.77	5.43
Beryllium (Be)	µg/L		0.007	<0.003	0.010	0.0148	0.0043	0.0114	0.0114
Bismuth (Bi)	µg/L		0.002	0.006	0.002	0.0049	0.0081	<0.001	<0.001
Boron (B)	µg/L		7.07	4.79	6.69	13.20	5.30	5.33	4.71
Cadmium (Cd)	µg/L	0.003-0.055	<0.002	0.003	<0.002	<0.002	<0.002	0.002	<0.002
Chromium (Cr)	µg/L	1, 16	0.374	0.376	0.534	**1.8**	0.4	0.3	0.6
Cobalt (Co)	µg/L		0.0414	0.0852	0.0726	0.6900	0.0641	0.0986	0.0756
Copper (Cu)	µg/L	2-4	1.23	1.51	1.54	**2.6**	1.0	1.5	**2.3**
Iron (Fe)	µg/L	300	**364**	**501**	**532**	**2810**	**357**	**317**	298
Lead (Pb)	µg/L	1-7	0.0839	0.1080	0.1320	0.1590	0.0571	0.0692	0.0908
Manganese (Mn)	µg/L		2.54	10.80	4.26	187.00	4.88	6.06	4.29
Mercury (Hg)	ng/L	26	<0.6	3.3	9.7	3.4	0.8	<0.6	<0.6
Molybdenum (Mo)	µg/L	73	0.058	0.082	0.079	0.1400	0.0451	0.0526	0.0656
Nickel (Ni)	µg/L	25-150	0.564	0.766	0.838	1.830	0.599	0.862	0.869
Selenium (Se)	µg/L	1	0.2	0.2	0.3	0.6	0.2	<0.1	0.3
Silver (Ag)	µg/L	0.1	0.0019	0.0029	0.0012	0.0067	0.0096	0.0048	0.0042
Strontium (Sr)	µg/L		22.2	28.7	30.6	118.0	24.8	27.9	28.6
Thallium (Tl)	µg/L	0.8000	0.0156	0.0107	0.0147	<0.0003	0.0057	0.0016	0.0021
Tin (Sn)	µg/L		0.43	0.21	2.02	1.230	0.267	0.081	1.040
Uranium (U)	µg/L		0.0309	0.0455	0.0478	0.0686	0.0248	0.0323	0.0358
Vanadium (V)	µg/L		0.382	0.488	0.581	0.7610	0.3600	0.3590	0.3900
Zinc (Zn)	µg/L	3, 13-198	1.83	4.55	3.06	2.83	1.05	1.46	2.59
Dissolved Metals									
Aluminum (Al)	µg/L		25.4	26.7	37.6	14.7	10.8	21.8	21.4
Antimony (Sb)	µg/L		0.0068	0.0086	0.0090	0.0404	0.0052	0.0059	0.0149
Arsenic (As)	µg/L		0.170	0.251	0.293	0.765	0.189	0.193	0.267
Barium (Ba)	µg/L		2.46	2.65	3.25	13.30	2.58	3.99	4.17
Beryllium (Be)	µg/L		<0.003	<0.003	0.006	<0.003	<0.003	0.005	0.004
Boron (B)	µg/L		4.29	4.28	5.27	12.00	3.98	4.86	3.74
Cadmium (Cd)	µg/L		0.003	0.003	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.29	0.32	0.53	1.740	0.259	0.225	0.607
Cobalt (Co)	µg/L		0.0136	0.0272	0.0263	0.5340	0.0226	0.0281	0.0382
Copper (Cu)	µg/L		1.02	1.26	1.35	2.44	0.77	1.34	2.27
Iron (Fe)	µg/L		160	222	223	2130	141	110	120
Lead (Pb)	µg/L		0.039	0.072	0.068	0.095	0.009	0.018	0.037
Manganese (Mn)	µg/L		0.39	0.76	0.93	164.00	0.31	0.40	0.69
Molybdenum (Mo)	µg/L		0.051	0.075	0.073	0.1290	0.0446	0.0521	0.0649
Nickel (Ni)	µg/L		0.437	0.552	0.595	1.790	0.490	0.752	0.860
Selenium (Se)	µg/L		0.2	0.2	0.3	0.610	0.190	<0.1	0.343
Silver (Ag)	µg/L		0.0005	0.0012	<0.0005	0.0044	0.0048	0.0033	0.0008
Strontium (Sr)	µg/L		20.4	25.7	29.2	117.0	24.4	26.9	28.3
Uranium (U)	µg/L		0.0214	0.0300	0.0299	0.0603	0.0181	0.0242	0.0275
Vanadium (V)	µg/L		0.19	0.25	0.31	0.727	0.179	0.107	0.230
Zinc (Zn)	µg/L		1.65	1.59	1.31	2.80	1.04	1.45	2.56
Other									
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.04	0.03	0.04	0.37	0.26	0.02	0.03
Sulphide	mg/L		0.001	<0.001	0.001	0.002	<0.001	0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Fickle Duck Outflow							
			24-Jun-06	17-Jul-06	13-Aug-06	10-Sep-06	23-Jun-07	20-Jul-07	20-Aug-07	9-Sep-07
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		13.5	24.3	18.8	20.7	14.4	31.6	19.0	20.4
Hardness, Total ($CaCO_3$)	mg/L		15.3	26.7	22.7	25.7	16.6	32.8	26.3	28.0
Conductivity	µS/cm		47.7	81.9	83.5	92.0	50.4	98.2	82.0	82.4
Field pH	units	6.5-9.0	7.1	6.5	**6.3**	6.7	**6.2**	**6.0**	6.5	6.5
TDS (Calculated)	mg/L		27.6	39.6	40.0	47.7	25.8	55.3	42.9	42.6
Total Suspended Solids	mg/L		2	51	10	3	2	8	2	<1
Color, True	TCU		36	40	39	21	43	44	38	41
Nutrients										
Phosphorus, Total	mg/L		0.018	0.051	0.054	0.037	0.015	0.099	0.020	0.017
Total Kjeldahl Nitrogen	mg/L		0.36	0.51	0.61	0.61	0.40	0.96	0.56	0.51
Ammonia-N	mg/L	0.2-122.4	0.044	0.038	0.014	0.010	0.013	0.097	0.015	0.014
Nitrite-N	mg/L	0.06	0.001	0.003	0.001	0.001	0.001	0.003	<0.005	0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	0.004	<0.005	<0.005	0.009	0.005	<0.001	0.007
Organics										
Carbon Part	mg/L		0.28	1.51	1.87	0.75	0.49	1.16	0.73	0.55
Dissolved Organic Carbon	mg/L		5.0	7.1	6.9	7.7	7.5	6.9	8.2	8.4
Chlorophyll a	µg/L		-	-	-	-	-	-	-	-
Major Ions										
Calcium (Total)	mg/L		4.38	7.39	6.29	7.28	4.82	8.79	6.97	7.33
Calcium (Dissolved)	mg/L		4.01	6.56	5.54	6.80	4.62	8.47	6.66	7.22
Chloride (Cl)	mg/L		5.10	8.80	12.30	13.60	-	-	-	-
Magnesium (Total)	mg/L		1.21	2.21	1.77	2.22	1.14	2.50	2.09	2.11
Magnesium (Dissolved)	mg/L		1.07	1.90	1.60	2.10	1.10	2.42	2.04	2.06
Potassium (Total)	mg/L		0.48	0.62	0.66	0.65	0.81	0.56	0.52	0.54
Potassium (Dissolved)	mg/L		0.35	0.31	0.48	0.56	0.77	0.44	0.47	0.52
Sodium (Total)	mg/L		2.77	4.72	6.19	7.32	2.48	4.68	5.38	5.08
Sodium (Dissolved)	mg/L		2.65	4.26	5.91	6.90	2.45	4.66	5.27	5.03
Sulphate (SO_4)	mg/L		6	<3	<3	6	<3	6	4	4
Anions	meq/L		0.54	0.78	0.77	0.92	0.46	1.08	0.76	0.79
Cations	meq/L		0.43	0.73	0.72	0.79	0.52	0.97	0.85	0.80
Ion Balance	N/A		0.81	0.94	0.94	0.86	1.13	0.90	1.12	1.01
Total Metals										
Aluminum (Al)	µg/L	5, 100	**275**	**666**	**407**	**158**	**80.4**	**274**	**125**	79.5
Antimony (Sb)	µg/L		0.006	0.011	0.009	0.009	0.0064	0.0108	0.0073	0.0083
Arsenic (As)	µg/L	5	0.177	0.588	0.587	0.342	0.133	0.703	0.235	0.226
Barium (Ba)	µg/L		5.20	12.10	7.81	5.10	3.63	8.77	5.37	4.99
Beryllium (Be)	µg/L		0.015	0.028	0.017	0.011	0.0039	0.0192	0.0057	0.0038
Bismuth (Bi)	µg/L		0.003	0.005	0.007	<0.001	0.0018	0.0049	<0.001	<0.001
Boron (B)	µg/L		3.44	6.95	6.14	6.37	3.38	5.01	5.39	4.61
Cadmium (Cd)	µg/L	0.003-0.055	0.005	**0.011**	0.003	0.002	<0.002	0.007	0.003	0.004
Chromium (Cr)	µg/L	1, 16	0.6	**1.2**	1.0	0.5	0.3	0.8	0.3	0.6
Cobalt (Co)	µg/L		0.1230	0.7010	0.4000	0.1340	0.1280	1.4200	0.0936	0.0847
Copper (Cu)	µg/L	2-4	1.05	1.81	1.60	1.49	1.2	1.2	1.5	1.5
Iron (Fe)	µg/L	300	**605**	**2760**	**1630**	**671**	243	**3460**	**312**	299
Lead (Pb)	µg/L	1-7	0.1140	0.4770	0.2520	0.1110	0.0253	0.1350	0.0641	0.0480
Manganese (Mn)	µg/L		4.54	43.40	24.80	6.72	7.16	139.00	5.92	4.39
Mercury (Hg)	ng/L	26	<0.6	<0.6	<0.6	**55.0**	2.4	1.4	<0.6	<0.6
Molybdenum (Mo)	µg/L	73	0.051	0.092	0.093	0.087	0.1030	0.0690	0.0613	0.0624
Nickel (Ni)	µg/L	25-150	0.693	1.610	1.270	0.816	0.645	1.450	0.869	0.866
Selenium (Se)	µg/L	1	<0.1	0.2	0.5	0.2	0.2	0.3	<0.1	0.2
Silver (Ag)	µg/L	0.1	0.0026	0.0033	0.0045	<0.0005	0.0020	0.0010	0.0068	0.0019
Strontium (Sr)	µg/L		17.1	31.8	28.4	32.5	16.0	37.3	28.5	28.5
Thallium (Tl)	µg/L	0.8000	0.0066	0.0175	0.0165	0.0139	0.0030	0.0070	0.0019	0.0011
Tin (Sn)	µg/L		<0.03	0.05	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Uranium (U)	µg/L		0.0297	0.0710	0.0554	0.0442	0.0228	0.0505	0.0319	0.0342
Vanadium (V)	µg/L		0.742	1.710	1.150	0.559	0.2180	1.1700	0.2990	0.3450
Zinc (Zn)	µg/L	3, 13-198	7.34	2.92	5.35	1.24	1.83	8.06	3.28	1.89
Dissolved Metals										
Aluminum (Al)	µg/L		22.7	35.8	26.9	27.8	16.8	24.2	19.1	20.2
Antimony (Sb)	µg/L		0.0061	0.0107	0.0093	0.0087	0.0063	0.0107	0.0072	0.0082
Arsenic (As)	µg/L		0.150	0.398	0.402	0.272	0.125	0.416	0.199	0.216
Barium (Ba)	µg/L		2.32	3.92	3.26	3.27	2.84	4.91	3.84	4.14
Beryllium (Be)	µg/L		0.004	0.004	0.006	0.006	0.004	0.005	0.006	0.004
Boron (B)	µg/L		3.13	3.77	5.79	5.12	3.08	4.67	5.20	3.86
Cadmium (Cd)	µg/L		<0.002	0.003	<0.002	<0.002	<0.002	<0.002	<0.002	0.004
Chromium (Cr)	µg/L		0.29	0.40	0.41	0.46	0.262	0.453	0.139	0.580
Cobalt (Co)	µg/L		0.0215	0.0387	0.0385	0.0247	0.0247	0.0512	0.0305	0.0461
Copper (Cu)	µg/L		0.85	1.15	1.04	1.32	1.09	0.81	1.34	1.50
Iron (Fe)	µg/L		153	1060	532	231	70.3	952	121	144
Lead (Pb)	µg/L		0.030	0.072	0.146	0.060	<0.001	0.020	0.023	0.022
Manganese (Mn)	µg/L		0.76	0.60	0.72	0.63	0.29	1.00	0.41	0.98
Molybdenum (Mo)	µg/L		0.042	0.064	0.073	0.066	0.0554	0.0339	0.0560	0.0618
Nickel (Ni)	µg/L		0.526	1.000	0.778	0.627	0.550	1.080	0.774	0.857
Selenium (Se)	µg/L		<0.1	<0.1	0.3	0.2	<0.1	0.173	<0.1	0.130
Silver (Ag)	µg/L		<0.0005	<0.0005	0.0009	<0.0005	0.0013	0.0010	0.0029	<0.0005
Strontium (Sr)	µg/L		15.0	26.4	24.5	30.0	15.0	35.9	27.2	28.2
Uranium (U)	µg/L		0.0177	0.0336	0.0285	0.0313	0.0180	0.0265	0.0252	0.0280
Vanadium (V)	µg/L		0.28	0.48	0.27	0.25	0.106	0.330	0.095	0.215
Zinc (Zn)	µg/L		4.69	2.62	1.93	1.24	1.40	3.93	2.64	1.87
Other										
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001
Fluoride (F)	mg/L		0.03	0.04	0.02	0.04	0.13	0.03	0.02	0.03
Sulphide	mg/L		0.001	0.002	<0.001	0.001	<0.001	0.002	0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Koignuk River				Reference Lake				
			2-Jul-07	19-Jul-07	18-Aug-07	16-Sep-07	3-Jun-06	18-Jul-06	17-Aug-06	11-Sep-06	26-May-07
							Bottom	Top	Top	Top	Top
Physical											
Alkalinity, Total ($CaCO_3$)	mg/L		10.4	10.8	28.3	13.2	12.5	11.8	15.0	17.2	71.0
Hardness, Total ($CaCO_3$)	mg/L		13.1	14.3	21.6	20.5	14.7	12.5	15.9	20.6	86.1
Conductivity	µS/cm		58.0	59.3	87.0	78.1	53.7	45.5	53.3	68.8	270
Field pH	units	6.5-9.0	6.5	6.6	6.8	6.9	6.9	6.4	7.4	7.7	6.7
TDS (Calculated)	mg/L		31.8	31.1	54.2	39.8	26.3	22.0	28.6	36.6	144
Total Suspended Solids	mg/L		5	1	3	5	1	3	2	2	10
Color, True	TCU		22	12	22	18	34	19	16	14	58
Nutrients											
Phosphorus, Total	mg/L		0.015	0.012	0.019	0.015	0.018	0.022	0.042	0.034	0.162
Total Kjeldahl Nitrogen	mg/L		0.30	0.25	0.40	0.31	0.38	0.42	0.49	0.44	1.49
Ammonia-N	mg/L	0.2-122.4	0.009	0.01	0.008	0.007	0.013	0.006	0.011	0.005	0.012
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	<0.005	<0.005	0.004	0.005	<0.005	<0.005	<0.001
Organics											
Carbon Part	mg/L		0.44	0.18	0.56	0.55	0.31	0.78	0.67	0.76	2.09
Dissolved Organic Carbon	mg/L		4.3	3.8	6.0	4.9	7.3	5.2	6.0	5.8	16.8
Chlorophyll a	µg/L		-	-	-	-	-	-	-	7.1	-
Major Ions											
Calcium (Total)	mg/L		2.92	2.77	4.45	4.16	3.86	3.24	4.16	5.41	22.20
Calcium (Dissolved)	mg/L		2.74	2.69	4.28	4.05	3.62	2.93	3.79	5.14	21.80
Chloride (Cl)	mg/L		9.00	10.50	15.50	14.10	7.40	5.10	6.30	9.10	-
Magnesium (Total)	mg/L		1.81	1.67	2.77	2.30	1.53	1.19	1.29	1.76	7.19
Magnesium (Dissolved)	mg/L		1.68	1.62	2.65	2.22	1.38	1.07	1.18	1.62	7.11
Potassium (Total)	mg/L		0.82	0.71	0.97	0.81	0.82	0.48	0.55	0.58	1.99
Potassium (Dissolved)	mg/L		0.67	0.67	0.72	0.66	0.73	0.41	0.48	0.51	1.90
Sodium (Total)	mg/L		4.70	4.76	7.28	6.49	3.81	2.93	3.63	4.83	19.60
Sodium (Dissolved)	mg/L		4.67	4.69	7.21	6.43	3.68	2.77	3.44	4.74	19.50
Sulphate (SO_4)	mg/L		6	<3	4	4	<3	<3	4	5	12
Anions	meq/L		0.58	0.56	1.09	0.74	0.50	0.42	0.56	0.70	2.71
Cations	meq/L		0.54	0.60	0.87	0.71	0.47	0.39	0.48	0.64	2.67
Ion Balance	N/A		0.92	1.07	0.80	0.95	0.94	0.92	0.87	0.92	0.98
Total Metals											
Aluminum (Al)	µg/L	5, 100	**317**	**112**	**650**	**403**	**191**	**173**	**101**	**156**	55.9
Antimony (Sb)	µg/L		0.0082	0.0055	0.0188	0.0089	0.007	0.014	0.015	0.012	0.0349
Arsenic (As)	µg/L	5	0.214	0.204	0.354	0.234	0.183	0.246	0.386	0.300	0.853
Barium (Ba)	µg/L		5.26	2.61	10.80	6.37	5.06	3.54	3.43	4.21	14.10
Beryllium (Be)	µg/L		0.0066	0.0057	0.0278	0.0055	0.009	<0.003	0.004	<0.003	0.0094
Bismuth (Bi)	µg/L		0.0018	0.0077	0.0042	0.0113	0.002	0.019	0.007	0.002	0.0026
Boron (B)	µg/L		4.99	5.11	8.07	6.49	4.57	5.89	5.20	9.57	20.70
Cadmium (Cd)	µg/L	0.003-0.055	0.003	<0.002	**0.024**	0.004	0.002	<0.002	0.004	<0.002	<0.002
Chromium (Cr)	µg/L	1, 16	0.7	0.3	1.0	0.7	0.415	0.450	0.347	0.581	**1.2**
Cobalt (Co)	µg/L		0.135	0.0672	0.207	0.174	0.1620	0.0768	0.0965	0.0816	0.4910
Copper (Cu)	µg/L	2-4	1.1	1.0	1.8	1.4	1.13	1.79	1.96	1.59	**2.5**
Iron (Fe)	µg/L	300	**313**	152	**523**	**366**	**402**	238	301	296	**1790**
Lead (Pb)	µg/L	1-7	0.11	0.04	0.30	0.17	0.1010	0.1520	0.1050	0.1130	0.0624
Manganese (Mn)	µg/L		8.7	6.8	15.1	9.2	11.00	4.89	12.00	5.73	125.00
Mercury (Hg)	ng/L	26	1.6	0.6	<0.6	<0.6		<0.6	2.8	6.0	<0.6
Molybdenum (Mo)	µg/L	73	0.0554	0.0301	0.086	0.0746	0.049	0.078	0.111	0.105	0.1160
Nickel (Ni)	µg/L	25-150	0.677	0.370	1.040	0.828	0.568	0.478	0.633	0.661	1.230
Selenium (Se)	µg/L	1	0.2	0.2	0.4	<0.1	0.1	<0.1	0.2	0.2	0.9
Silver (Ag)	µg/L	0.1	<0.0005	0.001	0.001	0.014	0.0017	0.0027	0.0031	0.0008	0.0045
Strontium (Sr)	µg/L		14.9	14.4	22.7	19.6	12.8	10.2	12.9	15.8	62.7
Thallium (Tl)	µg/L	0.8000	0.0104	0.0065	0.0067	0.0069	0.0028	0.0170	0.0110	0.0111	<0.0003
Tin (Sn)	µg/L		0.076	<0.03	0.033	<0.03	3.33	11.40	1.69	2.21	0.352
Uranium (U)	µg/L		0.034	0.025	0.056	0.043	0.0260	0.0355	0.0457	0.0444	0.0486
Vanadium (V)	µg/L		0.611	0.236	0.995	0.865	0.457	0.421	0.419	0.440	0.5410
Zinc (Zn)	µg/L	3, 13-198	3.50	2.80	3.86	1.22	8.92	6.15	3.11	1.00	2.37
Dissolved Metals											
Aluminum (Al)	µg/L		24.6	13.1	57.3	20.6	19.1	12.5	12.4	13.7	4.1
Antimony (Sb)	µg/L		0.0082	0.0054	0.0186	0.0088	0.0070	0.0129	0.0145	0.0117	0.0346
Arsenic (As)	µg/L		0.158	0.178	0.214	0.166	0.152	0.178	0.305	0.242	0.727
Barium (Ba)	µg/L		1.86	1.52	2.74	1.99	2.99	1.81	2.19	2.56	12.60
Beryllium (Be)	µg/L		<0.003	0.005	<0.003	<0.003	0.009	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		4.2	4.7	6.4	6.4	4.09	5.87	4.75	5.17	19.50
Cadmium (Cd)	µg/L		<0.002	<0.002	0.012	<0.002	<0.002	<0.002	0.004	<0.002	<0.002
Chromium (Cr)	µg/L		0.250	0.208	0.221	0.210	0.23	0.26	0.28	0.42	1.190
Cobalt (Co)	µg/L		0.0209	0.0203	0.0132	0.0190	0.0438	0.0207	0.0289	0.0250	0.3570
Copper (Cu)	µg/L		0.9	0.8	1.3	1.4	0.96	1.44	1.57	1.46	2.22
Iron (Fe)	µg/L		50.6	38.0	56.0	34.0	177	27.9	50.4	53.1	1030
Lead (Pb)	µg/L		0.0174	<0.001	0.0340	0.0199	0.033	0.033	0.100	0.031	0.034
Manganese (Mn)	µg/L		0.705	0.284	0.426	0.699	2.64	0.18	0.35	0.23	116.00
Molybdenum (Mo)	µg/L		0.041	0.030	0.074	0.060	0.042	0.063	0.107	0.075	0.0988
Nickel (Ni)	µg/L		0.447	0.277	0.598	0.403	0.420	0.456	0.485	0.488	1.120
Selenium (Se)	µg/L		0.2	0.2	0.4	<0.1	<0.1	<0.1	0.1	0.2	0.815
Silver (Ag)	µg/L		<0.0005	0.0010	<0.0005	0.0137	0.001	<0.0005	0.0012	<0.0005	0.0018
Strontium (Sr)	µg/L		13	14	20	19	11.6	9.5	11.4	14.2	61.0
Uranium (U)	µg/L		0.019	0.017	0.021	0.022	0.0180	0.0219	0.0252	0.0220	0.0322
Vanadium (V)	µg/L		0.10	0.09	0.10	0.18	0.19	0.10	0.14	0.14	0.452
Zinc (Zn)	µg/L		3.0	1.7	2.3	0.5	8.92	4.97	3.02	1.00	1.23
Other											
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.07	0.11	0.03	0.03	0.04	0.02	0.02	0.03	0.07
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Reference Lake			Reference Outflow					
			21-Jul-07	20-Aug-07	9-Sep-07	23-Jun-06	18-Jul-06	13-Aug-06	10-Sep-06	23-Jun-07	20-Jul-07
			Top	Top	Top						
Physical											
Alkalinity, Total ($CaCO_3$)	mg/L		12.7	14.3	15.3	10.1	12.1	12.3	17.3	11.9	13.0
Hardness, Total ($CaCO_3$)	mg/L		14.0	18.7	19.2	11.1	15.3	13.3	20.2	15.1	14.1
Conductivity	µS/cm		46.5	58.1	63.0	38.0	44.8	48.6	70.6	56.6	47.0
Field pH	units	6.5-9.0	6.8	6.5	-	7.5	6.6	7.8	7.2	**6.1**	6.7
TDS (Calculated)	mg/L		27.4	31.6	30.5	23.3	22.8	23.7	36.9	28.1	28.8
Total Suspended Solids	mg/L		4	<1	4	3	2	3	1	3	3
Color, True	TCU		23	28	28	29	19	17	14	38	22
Nutrients											
Phosphorus, Total	mg/L		0.025	0.015	0.012	0.017	0.022	0.034	0.039	0.016	0.027
Total Kjeldahl Nitrogen	mg/L		0.39	0.44	0.41	0.34	0.43	0.50	0.44	0.43	0.42
Ammonia-N	mg/L	0.2-122.4	0.012	0.012	0.008	0.021	0.009	0.016	0.007	0.027	0.014
Nitrite-N	mg/L	0.06	<0.005	0.001	<0.005	<0.001	0.001	<0.001	<0.001	0.001	<0.005
Nitrate-N (calculated)	mg/L	2.9	<0.001	-	<0.001	<0.005	<0.005	<0.005	<0.005	0.014	<0.001
Organics											
Carbon Part	mg/L		0.49	0.60	0.51	0.38	0.94	0.78	0.72	0.51	0.55
Dissolved Organic Carbon	mg/L		4.7	6.6	6.9	5.1	5.7	6.2	6.2	6.8	4.6
Chlorophyll a	µg/L		4.2	3.1	1.9	-	-	-	-	-	-
Major Ions											
Calcium (Total)	mg/L		3.41	4.83	4.72	2.95	3.51	3.58	5.27	3.86	3.50
Calcium (Dissolved)	mg/L		3.31	4.51	4.67	2.56	3.14	3.21	4.99	3.62	3.26
Chloride (Cl)	mg/L		-	-	-	4.40	5.00	5.90	8.30	-	-
Magnesium (Total)	mg/L		1.23	1.52	1.61	0.98	1.23	1.08	1.72	1.39	1.21
Magnesium (Dissolved)	mg/L		1.15	1.45	1.59	0.83	1.11	0.96	1.62	1.31	1.15
Potassium (Total)	mg/L		0.49	0.45	0.49	0.47	0.42	0.51	0.54	0.81	0.46
Potassium (Dissolved)	mg/L		0.41	0.41	0.49	0.36	0.42	0.43	0.48	0.72	0.39
Sodium (Total)	mg/L		2.98	3.75	4.24	2.52	3.38	3.47	4.96	3.94	2.99
Sodium (Dissolved)	mg/L		2.92	3.69	4.20	2.26	3.32	3.32	4.83	3.87	2.88
Sulphate (SO_4)	mg/L		4	4	<3	6	<3	<3	6	<3	5
Anions	meq/L		0.51	0.55	0.58	0.45	0.42	0.45	0.71	0.51	0.54
Cations	meq/L		0.51	0.62	0.58	0.34	0.44	0.42	0.61	0.55	0.52
Ion Balance	N/A		1.01	1.13	1.00	0.74	1.02	0.94	0.85	1.08	0.96
Total Metals											
Aluminum (Al)	µg/L	5, 100	**211**	85.2	61.9	**178**	81.8	**154**	**118**	**173**	**160**
Antimony (Sb)	µg/L		0.0081	0.0095	0.0103	0.005	0.010	0.011	0.011	0.0053	0.0073
Arsenic (As)	µg/L	5	0.252	0.226	0.217	0.162	0.234	0.349	0.276	0.207	0.323
Barium (Ba)	µg/L		4.42	3.86	3.24	3.71	2.71	3.08	3.73	4.73	4.31
Beryllium (Be)	µg/L		0.0089	0.0107	<0.003	0.006	<0.003	0.005	0.005	0.0048	0.0056
Bismuth (Bi)	µg/L		0.0023	<0.001	<0.001	0.003	0.009	0.002	<0.001	0.0017	0.0041
Boron (B)	µg/L		5.44	5.42	5.89	3.63	5.33	6.01	6.28	5.41	6.36
Cadmium (Cd)	µg/L	0.003-0.055	<0.002	0.004	0.006	0.004	0.003	0.004	<0.002	0.003	<0.002
Chromium (Cr)	µg/L	1, 16	0.5	0.1	0.3	0.428	0.347	0.458	0.358	0.5	0.4
Cobalt (Co)	µg/L		0.1170	0.0819	0.0731	0.0861	0.0907	0.1390	0.0872	0.1590	0.1180
Copper (Cu)	µg/L	2-4	1.3	**3.1**	1.5	1.14	1.44	1.66	1.41	1.0	1.1
Iron (Fe)	µg/L	300	**340**	167	154	254	**324**	**369**	271	**356**	**506**
Lead (Pb)	µg/L	1-7	0.0819	0.0430	0.0486	0.0814	0.0449	0.0954	0.0697	0.0699	0.0642
Manganese (Mn)	µg/L		8.20	4.87	4.76	3.68	7.09	10.30	6.12	11.40	10.30
Mercury (Hg)	ng/L	26	0.6	<0.6	<0.6	<0.6	1.1	<0.6	9.8	1.0	1.5
Molybdenum (Mo)	µg/L	73	0.0465	0.0520	0.0400	0.047	0.227	0.103	0.084	0.0470	0.0451
Nickel (Ni)	µg/L	25-150	0.516	0.617	0.543	0.460	0.414	0.593	0.538	0.538	0.476
Selenium (Se)	µg/L	1	0.2	<0.1	0.3	<0.1	<0.1	0.2	0.2	0.2	0.1
Silver (Ag)	µg/L	0.1	0.0010	0.0054	0.0005	0.0019	0.0024	0.0023	<0.0005	0.0028	0.0110
Strontium (Sr)	µg/L		11.3	13.4	13.3	9.1	10.6	11.1	15.0	12.5	11.1
Thallium (Tl)	µg/L	0.8000	0.0052	0.0018	0.0014	0.0055	0.0137	0.0094	0.0096	0.0047	0.0067
Tin (Sn)	µg/L		1.120	1.370	1.130	<0.03	0.10	0.03	<0.03	<0.03	<0.03
Uranium (U)	µg/L		0.0312	0.0288	0.0237	0.0264	0.0342	0.0440	0.0366	0.0266	0.0245
Vanadium (V)	µg/L		0.5310	0.1810	0.2080	0.457	0.302	0.565	0.336	0.4230	0.4330
Zinc (Zn)	µg/L	3, 13-198	3.21	2.82	2.36	2.09	1.43	13.20	0.64	1.54	10.20
Dissolved Metals											
Aluminum (Al)	µg/L		9.8	19.0	13.7	18.9	13.2	16.6	11.3	19.0	9.0
Antimony (Sb)	µg/L		0.0081	0.0094	0.0102	0.0052	0.0100	0.0109	0.0108	0.0052	0.0072
Arsenic (As)	µg/L		0.195	0.207	0.212	0.123	0.195	0.269	0.227	0.170	0.259
Barium (Ba)	µg/L		2.05	2.99	2.80	1.81	1.56	1.38	2.44	2.84	2.38
Beryllium (Be)	µg/L		0.006	0.004	<0.003	0.005	<0.003	<0.003	0.003	0.003	0.003
Boron (B)	µg/L		4.63	5.37	4.05	2.98	5.19	4.51	6.06	4.05	5.72
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	0.003	<0.002	<0.002	0.002	<0.002
Chromium (Cr)	µg/L		0.251	0.088	0.334	0.16	0.26	0.26	0.35	0.249	0.211
Cobalt (Co)	µg/L		0.0195	0.0266	0.0308	0.0164	0.0356	0.0379	0.0253	0.0252	0.0234
Copper (Cu)	µg/L		0.96	2.57	1.45	0.87	1.23	1.28	1.25	0.92	0.79
Iron (Fe)	µg/L		60.5	46.2	49.2	48.9	85.7	63.4	42.8	103	118
Lead (Pb)	µg/L		0.029	0.008	0.023	0.014	0.027	0.033	0.025	0.012	0.003
Manganese (Mn)	µg/L		0.21	0.30	0.51	0.35	0.64	0.46	0.22	1.66	0.31
Molybdenum (Mo)	µg/L		0.0376	0.0420	0.0396	0.039	0.221	0.097	0.069	0.0414	0.0344
Nickel (Ni)	µg/L		0.356	0.555	0.538	0.320	0.413	0.414	0.418	0.381	0.363
Selenium (Se)	µg/L		0.158	<0.1	0.172	<0.1	<0.1	0.1	0.1	0.154	0.133
Silver (Ag)	µg/L		0.0010	0.0032	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0022	0.0010
Strontium (Sr)	µg/L		10.4	12.8	13.2	7.5	9.4	9.6	14.1	11.4	10.2
Uranium (U)	µg/L		0.0183	0.0229	0.0208	0.0154	0.0229	0.0246	0.0195	0.0178	0.0152
Vanadium (V)	µg/L		0.141	0.044	0.140	0.12	0.12	0.15	0.12	0.123	0.093
Zinc (Zn)	µg/L		1.56	2.33	2.34	2.05	1.34	11.00	0.64	1.21	6.90
Other											
Cyanide, Total	mg/L		<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.24	0.02	0.02	0.01	0.02	<0.01	0.03	0.10	0.33
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Reference Outflow		Stickleback Lake					
			20-Aug-07	9-Sep-07	2-Jun-06	17-Jul-06	17-Aug-06	10-Sep-06	24-May-07	21-Jul-07
					Bottom	Top	Top	Top	Top	Top
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		14.4	14.4	25.9	32.9	33.9	33.7	106.0	35.8
Hardness, Total ($CaCO_3$)	mg/L		17.5	18.9	42.2	66.8	71.3	69.2	202.0	70.5
Conductivity	µS/cm		57.2	61.3	167	239	241	252	643	247
Field pH	units	6.5-9.0	6.5	**6.4**	6.7	7.8	8.2	8.1	7.3	7.4
TDS (Calculated)	mg/L		29.0	31.6	80.5	111	118	117	326	125
Total Suspended Solids	mg/L		<1	2	<1	<1	<1	<1	2	<1
Color, True	TCU		31	25	8	<1	<1	<1	5	5
Nutrients										
Phosphorus, Total	mg/L		0.017	0.012	0.018	0.013	0.028	0.025	0.026	0.015
Total Kjeldahl Nitrogen	mg/L		0.47	0.40	0.36	0.40	0.39	0.36	0.77	0.37
Ammonia-N	mg/L	0.2-122.4	0.018	0.009	0.038	0.010	0.010	0.005	0.016	0.012
Nitrite-N	mg/L	0.06	<0.005	<0.005	0.001	<0.001	<0.001	<0.001	0.004	<0.005
Nitrate-N (calculated)	mg/L	2.9	<0.001	<0.001	0.007	0.005	<0.005	<0.005	0.005	<0.001
Organics										
Carbon Part	mg/L		0.57	0.47	0.31	0.17	0.22	0.30	0.91	0.22
Dissolved Organic Carbon	mg/L		7.2	6.7	4.3	4.2	4.9	4.5	10.1	4.3
Chlorophyll a	µg/L		-	-	-	-	-	4.2	-	2.0
Major Ions										
Calcium (Total)	mg/L		4.68	4.65	11.30	17.10	17.60	17.50	48.00	17.50
Calcium (Dissolved)	mg/L		4.52	4.42	10.20	15.60	16.10	17.30	47.20	16.90
Chloride (Cl)	mg/L		-	-	35.90	51.10	53.70	54.50	-	-
Magnesium (Total)	mg/L		1.49	1.72	3.89	6.22	6.45	6.22	17.20	6.17
Magnesium (Dissolved)	mg/L		1.44	1.65	3.61	5.66	5.60	6.16	16.60	5.90
Potassium (Total)	mg/L		0.43	0.48	1.25	1.71	1.80	1.78	4.78	1.78
Potassium (Dissolved)	mg/L		0.40	0.47	1.16	1.55	1.61	1.75	4.69	1.70
Sodium (Total)	mg/L		3.63	4.59	8.85	14.70	15.10	14.80	40.90	14.70
Sodium (Dissolved)	mg/L		3.58	4.54	8.29	13.60	13.30	14.80	39.50	14.00
Sulphate (SO_4)	mg/L		<3	4	<3	<3	<3	<3	<3	<3
Anions	meq/L		0.50	0.59	1.58	2.14	2.23	2.25	6.07	2.43
Cations	meq/L		0.61	0.58	1.35	1.99	2.15	2.07	6.18	2.20
Ion Balance	N/A		1.20	0.99	0.86	0.93	0.96	0.92	1.02	0.91
Total Metals										
Aluminum (Al)	µg/L	5, 100	65.7	**54.2**	6.3	7.4	9.6	13.0	14.6	10.0
Antimony (Sb)	µg/L		0.0319	0.0086	0.009	0.006	0.008	0.012	0.0112	0.0046
Arsenic (As)	µg/L	5	0.198	0.204	0.283	0.377	0.490	0.435	1.210	0.441
Barium (Ba)	µg/L		3.44	3.50	5.23	5.45	5.50	5.31	24.00	6.39
Beryllium (Be)	µg/L		0.0073	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Bismuth (Bi)	µg/L		<0.001	<0.001	0.002	0.002	0.003	<0.001	0.0022	<0.001
Boron (B)	µg/L		5.71	6.20	9.06	16.30	18.20	18.80	37.60	18.20
Cadmium (Cd)	µg/L	0.003-0.055	0.003	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	<0.002
Chromium (Cr)	µg/L	1, 16	0.1	0.5	0.093	0.124	0.106	0.056	1.0	0.1
Cobalt (Co)	µg/L		0.0804	0.0682	0.0910	0.0218	0.0334	0.0195	0.7570	0.0327
Copper (Cu)	µg/L	2-4	1.6	1.6	0.44	0.50	2.02	0.33	0.5	0.2
Iron (Fe)	µg/L	300	145	140	82.7	53.3	106	28.8	**574**	99.3
Lead (Pb)	µg/L	1-7	0.0302	0.0411	0.0545	0.0460	0.1140	0.0379	0.0279	0.0016
Manganese (Mn)	µg/L		5.20	3.94	94.80	5.97	11.70	4.43	957.00	12.70
Mercury (Hg)	ng/L	26	<0.6	<0.6		<0.6	14.0	7.0	1.8	2.1
Molybdenum (Mo)	µg/L	73	0.0493	0.0239	0.024	0.039	0.055	0.050	0.0694	0.0161
Nickel (Ni)	µg/L	25-150	0.599	0.640	0.073	<0.005	0.059	0.082	<0.005	0.016
Selenium (Se)	µg/L	1	<0.1	0.1	0.4	0.4	0.5	0.5	**2.0**	0.7
Silver (Ag)	µg/L	0.1	0.0061	0.0059	0.0010	<0.0005	0.0018	0.0006	0.0027	0.0010
Strontium (Sr)	µg/L		12.9	13.8	64.0	99.5	101.0	100.0	301.0	99.5
Thallium (Tl)	µg/L	0.8000	0.0011	<0.0003	<0.0003	0.0122	0.0069	0.0124	<0.0003	0.0048
Tin (Sn)	µg/L		<0.03	<0.03	4.86	17.00	6.14	0.17	1.350	0.982
Uranium (U)	µg/L		0.0272	0.0260	0.0050	0.0111	0.0103	0.0104	0.0182	0.0085
Vanadium (V)	µg/L		0.1270	0.2440	0.012	0.039	0.028	0.020	0.1950	0.0210
Zinc (Zn)	µg/L	3, 13-198	1.37	1.85	4.75	2.22	6.63	0.78	2.01	3.63
Dissolved Metals										
Aluminum (Al)	µg/L		17.7	13.9	1.3	0.9	0.5	0.5	-	-
Antimony (Sb)	µg/L		0.0316	0.0085	0.0085	0.0064	0.0082	0.0111	0.0111	0.0046
Arsenic (As)	µg/L		0.177	0.195	0.269	0.311	0.406	0.386	0.820	0.368
Barium (Ba)	µg/L		2.71	2.95	4.54	4.73	4.77	5.07	21.80	5.97
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		4.17	4.19	8.78	14.50	15.40	17.30	36.10	16.90
Cadmium (Cd)	µg/L		0.003	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.067	0.527	0.09	0.12	0.07	0.05	0.968	0.104
Cobalt (Co)	µg/L		0.0268	0.0328	0.0349	0.0063	0.0120	0.0074	0.2090	0.0096
Copper (Cu)	µg/L		1.45	1.57	0.36	0.35	1.34	0.32	0.40	0.18
Iron (Fe)	µg/L		49.2	53.6	21.2	<2.0	<2.0	<2.0	<2.0	3.1
Lead (Pb)	µg/L		0.007	0.017	0.004	0.033	0.091	0.037	0.003	<0.001
Manganese (Mn)	µg/L		0.37	0.62	59.60	0.10	0.15	0.25	726.00	0.10
Molybdenum (Mo)	µg/L		0.0422	0.0237	0.020	0.029	0.047	0.046	0.0589	0.0099
Nickel (Ni)	µg/L		0.543	0.635	0.073	<0.005	0.048	0.018	<0.005	<0.005
Selenium (Se)	µg/L		<0.1	0.120	0.4	0.4	0.3	0.5	0.927	0.473
Silver (Ag)	µg/L		0.0042	0.0013	<0.0005	<0.0005	0.0009	<0.0005	0.0017	0.0010
Strontium (Sr)	µg/L		12.7	13.7	59.7	90.1	92.4	99.9	295.0	96.2
Uranium (U)	µg/L		0.0229	0.0211	0.0030	0.0078	0.0068	0.0059	0.0147	0.0064
Vanadium (V)	µg/L		0.048	0.198	0.01	0.04	<0.01	0.02	0.193	0.015
Zinc (Zn)	µg/L		1.36	1.83	4.72	2.14	2.43	0.78	1.99	2.30
Other										
Cyanide, Total	mg/L		<0.001	<0.001	0.001	<0.001	<0.001	<0.001	0.002	<0.001
Fluoride (F)	mg/L		0.02	0.02	0.04	0.04	0.01	0.05	0.09	0.38
Sulphide	mg/L		<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Stickleback Lake		Stickleback Outflow					
			20-Aug-07	9-Sep-07	24-Jun-06	17-Jul-06	13-Aug-06	10-Sep-06	23-Jun-07	22-Jul-07
			Top	Top						
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		34.2	34.9	33.9	32.8	35.7	37.1	6.5	36.0
Hardness, Total ($CaCO_3$)	mg/L		70.5	69.0	67.4	69.6	72.3	75.8	9.7	71.6
Conductivity	µS/cm		246	248	238	240	251	263	41.3	251.0
Field pH	units	6.5-9.0	6.8	6.5	7.1	6.9	6.5	**6.3**	**6.0**	6.8
TDS (Calculated)	mg/L		122	122	115	112	118	125	21.8	126
Total Suspended Solids	mg/L		1	<1	<1	3	2	<1	1	1
Color, True	TCU		<1	<1	10	13	10	8	10	8
Nutrients										
Phosphorus, Total	mg/L		0.012	0.011	0.024	0.028	0.024	0.026	0.017	0.020
Total Kjeldahl Nitrogen	mg/L		0.38	0.40	0.46	0.46	0.36	0.30	0.19	0.42
Ammonia-N	mg/L	0.2-122.4	0.012	0.034	0.020	0.025	0.012	0.011	0.020	0.029
Nitrite-N	mg/L	0.06	<0.005	<0.005	<0.001	0.004	0.001	<0.001	<0.005	0.002
Nitrate-N (calculated)	mg/L	2.9	<0.001	<0.001	<0.005	0.037	0.024	0.008	0.006	0.024
Organics										
Carbon Part	mg/L		0.32	0.17	0.17	0.58	0.29	0.23	0.36	0.23
Dissolved Organic Carbon	mg/L		4.5	4.6	4.2	4.8	4.5	4.3	1.7	4.1
Chlorophyll a	µg/L		1.4	1.7	-	-	-	-	-	-
Major Ions										
Calcium (Total)	mg/L		16.80	17.60	17.60	17.10	18.00	19.10	2.35	17.60
Calcium (Dissolved)	mg/L		16.50	16.90	16.50	16.00	16.80	18.30	2.31	17.20
Chloride (Cl)	mg/L		-	-	50.40	50.60	53.30	56.20	-	-
Magnesium (Total)	mg/L		6.48	6.90	5.85	6.24	6.65	7.11	0.96	6.38
Magnesium (Dissolved)	mg/L		6.24	6.57	5.58	5.76	6.11	6.84	0.94	6.24
Potassium (Total)	mg/L		1.76	1.94	1.68	1.65	1.69	1.63	0.54	1.69
Potassium (Dissolved)	mg/L		1.73	1.84	1.61	1.51	1.59	1.58	0.53	1.64
Sodium (Total)	mg/L		15.90	16.80	13.50	14.90	15.80	16.60	2.78	15.70
Sodium (Dissolved)	mg/L		15.30	16.50	13.00	13.90	14.60	16.00	2.75	15.10
Sulphate (SO_4)	mg/L		<3	<3	5	<3	<3	4	<3	<3
Anions	meq/L		2.28	2.37	2.20	2.13	2.26	2.40	0.40	2.45
Cations	meq/L		2.25	2.11	2.01	2.04	2.14	2.21	0.39	2.23
Ion Balance	N/A		0.99	0.89	0.91	0.96	0.95	0.92	0.98	0.91
Total Metals										
Aluminum (Al)	µg/L	5, 100	10.4	10.5	6.7	**116**	20.5	**13.6**	**30.2**	22.5
Antimony (Sb)	µg/L		0.0345	0.0085	0.005	0.007	0.007	0.006	0.0036	0.0060
Arsenic (As)	µg/L	5	0.450	0.466	0.407	0.546	0.629	0.531	0.144	0.520
Barium (Ba)	µg/L		6.11	5.88	6.76	7.92	6.33	8.97	2.06	7.04
Beryllium (Be)	µg/L		<0.003	<0.003	0.005	0.005	<0.003	<0.003	<0.003	<0.003
Bismuth (Bi)	µg/L		<0.001	<0.001	<0.001	0.004	0.004	<0.001	<0.001	0.0034
Boron (B)	µg/L		15.70	17.40	14.30	16.00	20.60	17.00	3.63	17.30
Cadmium (Cd)	µg/L	0.003-0.055	<0.002	0.005	0.005	0.003	0.003	<0.002	0.003	0.009
Chromium (Cr)	µg/L	1, 16	0.1	0.2	0.153	0.190	0.180	0.086	0.1	0.1
Cobalt (Co)	µg/L		0.0323	0.0343	0.0269	0.2060	0.1420	0.5480	0.1570	0.0994
Copper (Cu)	µg/L	2-4	1.0	0.9	0.32	0.53	0.33	0.21	0.3	1.1
Iron (Fe)	µg/L	300	58.6	40.4	65.3	**602**	264	**1030**	123	159
Lead (Pb)	µg/L	1-7	0.0137	0.0283	0.0205	0.0994	0.1470	0.0414	0.0335	0.0398
Manganese (Mn)	µg/L		8.52	7.57	8.72	82.80	60.60	166.00	152.00	31.50
Mercury (Hg)	ng/L	26	<0.6	<0.6	<0.6	<0.6	<0.6	9.8	1.1	<0.6
Molybdenum (Mo)	µg/L	73	0.0252	0.0423	0.024	0.043	0.217	0.015	0.0270	0.0299
Nickel (Ni)	µg/L	25-150	0.121	0.017	0.097	0.065	0.223	0.235	0.148	0.102
Selenium (Se)	µg/L	1	0.5	0.8	0.7	0.5	0.7	1.0	0.1	0.6
Silver (Ag)	µg/L	0.1	<0.0005	0.0026	0.0007	0.0008	0.0025	<0.0005	0.0011	0.0051
Strontium (Sr)	µg/L		101.0	102.0	99.4	98.3	105.0	103.0	14.2	103.0
Thallium (Tl)	µg/L	0.8000	<0.0003	0.0012	0.0041	0.0146	0.0120	0.0083	0.0022	0.0059
Tin (Sn)	µg/L		0.850	1.160	<0.03	<0.03	0.07	0.06	<0.03	<0.03
Uranium (U)	µg/L		0.0085	0.0099	0.0063	0.0206	0.0069	0.0063	0.0091	0.0086
Vanadium (V)	µg/L		0.0200	0.0580	0.374	0.200	0.100	0.033	0.0659	0.0760
Zinc (Zn)	µg/L	3, 13-198	1.65	1.62	6.71	2.25	4.29	1.59	0.72	1.79
Dissolved Metals										
Aluminum (Al)	µg/L		-	0.6	0.4	1.0	0.9	2.6	6.7	1.1
Antimony (Sb)	µg/L		0.0342	0.0084	0.0051	0.0071	0.0074	0.0064	0.0036	0.0059
Arsenic (As)	µg/L		0.387	0.406	0.346	0.389	0.533	0.430	0.125	0.431
Barium (Ba)	µg/L		5.65	5.35	5.99	5.39	5.35	8.03	1.08	6.28
Beryllium (Be)	µg/L		<0.003	<0.003	0.004	0.004	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		14.70	15.80	13.10	13.80	17.60	15.90	3.24	15.90
Cadmium (Cd)	µg/L		<0.002	0.005	0.002	0.003	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.057	0.175	0.08	0.04	0.16	0.09	0.148	0.091
Cobalt (Co)	µg/L		0.0125	0.0129	0.0108	0.0117	0.0184	0.0505	0.0082	0.0148
Copper (Cu)	µg/L		0.78	0.84	0.26	0.31	0.24	0.20	0.19	0.22
Iron (Fe)	µg/L		2.0	<2.0	9.3	13.3	38.1	278	17.8	22.0
Lead (Pb)	µg/L		<0.001	0.014	0.009	0.036	0.132	0.036	<0.001	<0.001
Manganese (Mn)	µg/L		0.10	0.29	2.51	0.26	2.75	74.00	1.52	0.31
Molybdenum (Mo)	µg/L		0.0215	0.0419	0.019	0.043	0.042	0.008	0.0107	0.0236
Nickel (Ni)	µg/L		0.120	0.012	0.040	<0.005	0.104	0.211	0.059	0.040
Selenium (Se)	µg/L		0.465	0.530	0.5	0.5	0.5	0.7	0.103	0.467
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0050
Strontium (Sr)	µg/L		98.6	102.0	92.4	91.0	98.4	96.5	14.1	99.1
Uranium (U)	µg/L		0.0069	0.0080	0.0021	0.0047	0.0031	0.0027	0.0059	0.0050
Vanadium (V)	µg/L		<0.01	0.033	0.28	<0.01	0.01	0.03	0.027	0.012
Zinc (Zn)	µg/L		1.63	1.60	4.41	1.48	1.38	1.54	0.71	1.31
Other										
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.02	0.04	0.04	0.04	0.03	0.05	0.08	0.38
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Stickleback Outflow		Glenn Lake					
			20-Aug-07	9-Sep-07	24-May-07		16-Jul-07		17-Aug-07	
					Top	Bottom	Top	Bottom	Top	Bottom
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		34.0	20.5	60.5	60.3	41.4	57.3	49.3	49.4
Hardness, Total ($CaCO_3$)	mg/L		75.2	73.5	87.7	87.0	57.1	80.8	67.9	68.9
Conductivity	µS/cm		260	247	457	455	331	464	394	394
Field pH	units	6.5-9.0	6.5	6.7	7.4	-	7.3	-	7.2	-
TDS (Calculated)	mg/L		127	114	242	244	162	234	199	198
Total Suspended Solids	mg/L		<1	<1	2	<1	2	<1	3	3
Color, True	TCU		<1	4	7	7	13	8	11	6
Nutrients										
Phosphorus, Total	mg/L		0.013	0.014	0.007	0.005	0.008	0.005	0.017	0.012
Total Kjeldahl Nitrogen	mg/L		0.39	0.36	0.25	0.23	0.23	0.23	0.21	0.20
Ammonia-N	mg/L	0.2-122.4	0.015	0.014	0.011	0.008	0.008	0.011	0.01	0.009
Nitrite-N	mg/L	0.06	<0.005	<0.005	0.001	0.002	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.001	0.008	0.020	0.022	<0.005	0.010	<0.005	<0.005
Organics										
Carbon Part	mg/L		0.40	0.48	0.09	0.10	0.14	0.13	0.13	0.18
Dissolved Organic Carbon	mg/L		4.1	4.5	3.5	3.7	3.0	3.6	3.5	3.3
Chlorophyll a	µg/L		-	-	-	-	0.9	-	1.0	-
Major Ions										
Calcium (Total)	mg/L		18.30	17.10	15.40	15.60	10.10	13.90	11.90	11.70
Calcium (Dissolved)	mg/L		17.50	15.70	15.00	14.80	9.73	13.90	11.60	11.40
Chloride (Cl)	mg/L		-	-	99.60	101.00	68.00	105.00	82.90	83.30
Magnesium (Total)	mg/L		7.02	6.62	12.30	12.40	8.18	11.20	9.23	9.34
Magnesium (Dissolved)	mg/L		6.64	6.09	11.90	12.00	7.95	10.80	8.92	8.73
Potassium (Total)	mg/L		1.83	1.88	4.61	4.66	3.18	4.20	3.50	3.46
Potassium (Dissolved)	mg/L		1.72	1.72	4.46	4.42	3.01	4.10	3.30	3.25
Sodium (Total)	mg/L		17.40	16.00	58.90	59.80	37.30	52.50	39.90	38.90
Sodium (Dissolved)	mg/L		16.40	14.80	57.40	59.20	36.90	51.80	39.50	38.51
Sulphate (SO_4)	mg/L		<3	<3	12	12	7	10	12	11
Anions	meq/L		2.37	2.07	4.26	4.30	2.90	4.32	3.58	3.57
Cations	meq/L		2.37	2.18	4.58	4.60	2.97	4.14	3.60	3.60
Ion Balance	N/A		1.00	1.05	1.07	1.07	1.02	0.96	1.01	1.01
Total Metals										
Aluminum (Al)	µg/L	5, 100	26.3	13.8	54.0	54.6	**112**	**125**	**457**	**458**
Antimony (Sb)	µg/L		0.0044	0.0190	0.0517	0.0507	0.0362	0.0496	0.0433	0.0406
Arsenic (As)	µg/L	5	0.470	0.475	0.703	0.765	0.457	0.708	0.533	0.568
Barium (Ba)	µg/L		7.04	5.90	5.17	4.26	3.72	5.04	8.67	8.31
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	0.0083	<0.003	0.0150	0.0120
Bismuth (Bi)	µg/L		<0.001	<0.001	0.0063	0.0035	0.0012	0.0034	0.0025	0.0025
Boron (B)	µg/L		19.90	16.30	52.5	53.8	32.9	49.1	37.5	36.5
Cadmium (Cd)	µg/L	0.003-0.055	<0.002	0.007	<0.002	<0.002	<0.002	0.002	0.016	0.010
Chromium (Cr)	µg/L	1, 16	<0.03	0.3	0.2	0.2	0.3	0.4	0.8	0.8
Cobalt (Co)	µg/L		0.0722	0.0670	0.0131	0.0169	0.045	0.0417	0.165	0.163
Copper (Cu)	µg/L	2-4	0.3	0.4	**3.0**	**2.9**	**2.2**	**2.8**	**3.1**	**2.8**
Iron (Fe)	µg/L	300	129	105	<2.0	3.1	85.1	71.5	**327**	**325**
Lead (Pb)	µg/L	1-7	0.0221	0.0620	0.02	0.02	0.05	0.05	0.21	0.17
Manganese (Mn)	µg/L		17.80	14.10	0.9	0.5	2.0	1.7	5.0	5.0
Mercury (Hg)	ng/L	26	<0.6	<0.6	1.1	<0.6	0.7	0.7	<0.6	<0.6
Molybdenum (Mo)	µg/L	73	0.0394	0.0405	0.86	0.863	0.575	0.783	0.666	0.647
Nickel (Ni)	µg/L	25-150	0.328	0.203	0.705	0.589	0.592	0.621	2.060	0.960
Selenium (Se)	µg/L	1	0.4	0.6	**1.7**	**2.0**	**1.1**	**1.9**	**1.1**	**1.2**
Silver (Ag)	µg/L	0.1	0.0061	<0.0005	0.003	0.002	0.002	0.001	<0.0005	<0.0005
Strontium (Sr)	µg/L		111.0	100.0	78.8	79.6	53.5	75.9	65.4	65.3
Thallium (Tl)	µg/L	0.8000	0.0031	0.0012	<0.0003	<0.0003	0.0066	0.0061	0.0068	0.0060
Tin (Sn)	µg/L		0.039	0.064	0.227	0.085	1.670	0.212	0.757	0.629
Uranium (U)	µg/L		0.0107	0.0091	0.291	0.296	0.227	0.323	0.257	0.264
Vanadium (V)	µg/L		<0.01	0.0750	0.325	0.321	0.332	0.374	1.030	1.040
Zinc (Zn)	µg/L	3, 13-198	0.70	1.62	1.86	1.06	1.53	1.63	4.85	1.62
Dissolved Metals										
Aluminum (Al)	µg/L		-	0.7	8.7	11.4	15.0	12.1	31.9	32.8
Antimony (Sb)	µg/L		0.0043	0.0190	0.0512	0.0502	0.0358	0.0491	0.0429	0.0402
Arsenic (As)	µg/L		0.397	0.410	0.571	0.667	0.375	0.613	0.398	0.418
Barium (Ba)	µg/L		6.39	5.49	4.54	3.62	2.48	3.76	3.04	3.01
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.004	<0.003
Boron (B)	µg/L		18.30	14.60	49.2	50.0	31.2	46.8	36.7	36.1
Cadmium (Cd)	µg/L		<0.002	0.007	<0.002	<0.002	<0.002	0.002	0.004	<0.002
Chromium (Cr)	µg/L		<0.03	0.255	0.216	0.220	0.294	0.379	0.354	0.203
Cobalt (Co)	µg/L		0.0144	0.0219	0.0110	0.0116	0.0106	0.0045	0.0092	0.0059
Copper (Cu)	µg/L		0.25	0.39	2.7	2.8	1.9	2.4	2.3	2.2
Iron (Fe)	µg/L		10.3	13.7	<2.0	<2.0	7.1	<2.0	10.9	10.8
Lead (Pb)	µg/L		<0.001	0.021	0.0120	0.0147	0.0141	0.0128	0.0166	0.0148
Manganese (Mn)	µg/L		0.36	3.91	0.244	0.195	0.394	0.199	0.358	0.239
Molybdenum (Mo)	µg/L		0.0361	0.0401	0.845	0.835	0.544	0.775	0.664	0.641
Nickel (Ni)	µg/L		0.144	0.199	0.559	0.584	0.460	0.543	0.590	0.585
Selenium (Se)	µg/L		0.299	0.509	1.3	1.6	0.9	1.5	0.9	0.8
Silver (Ag)	µg/L		0.0044	<0.0005	0.0008	0.0014	<0.0005	<0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		105.0	99.0	79	79	53	75	65	65
Uranium (U)	µg/L		0.0078	0.0067	0.274	0.271	0.201	0.297	0.218	0.226
Vanadium (V)	µg/L		<0.01	0.049	0.32	0.32	0.21	0.30	0.34	0.30
Zinc (Zn)	µg/L		0.70	1.60	1.8	1.1	1.5	1.6	2.9	1.6
Other										
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.03	0.04	0.09	0.09	0.10	0.12	0.07	0.07
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Glenn Outflow						Ogama Lake	
			15-Sep-07		22-Jun-07	19-Jul-07	12-Aug-07	15-Sep-07	1-Jun-06	
			Top	Bottom					Top	Bottom
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		49.1	49.1	40.9	40.4	49.8	49.6	28.5	56.0
Hardness, Total ($CaCO_3$)	mg/L		71.6	69.7	56.1	55.3	68.9	75.9	46.3	110.0
Conductivity	µS/cm		373	375	315	317	370	371	323	701
Field pH	units	6.5-9.0	-	-	6.9	7.5	7.1	-	6.5	-
TDS (Calculated)	mg/L		196	193	125	161	195	196	161	358
Total Suspended Solids	mg/L		4	2	1	8	9	3	3	4
Color, True	TCU		22	22	30	7	14	3	58	26
Nutrients										
Phosphorus, Total	mg/L		0.016	0.018	0.012	0.015	0.013	0.016	0.037	0.034
Total Kjeldahl Nitrogen	mg/L		0.20	0.22	0.26	0.18	0.19	0.20	0.58	0.63
Ammonia-N	mg/L	0.2-122.4	0.008	0.009	0.011	0.008	0.005	0.007	0.019	0.108
Nitrite-N	mg/L	0.06	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	0.002	0.003
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	0.017	<0.005	0.006	<0.005	<0.005	0.074
Organics										
Carbon Part	mg/L		0.29	0.39	0.26	0.18	0.20	0.32	0.71	0.51
Dissolved Organic Carbon	mg/L		3.7	3.6	4.5	2.8	3.3	3.0	10.2	7.3
Chlorophyll a	µg/L		0.8	-	-	-	-	-	-	-
Major Ions										
Calcium (Total)	mg/L		12.00	11.70	10.30	9.94	12.70	11.90	6.91	15.90
Calcium (Dissolved)	mg/L		11.40	11.50	10.10	9.56	12.30	11.70	6.36	12.80
Chloride (Cl)	mg/L		82.50	81.60	37.90	71.70	81.80	82.60	79.00	180.00
Magnesium (Total)	mg/L		9.35	9.86	8.30	7.59	10.30	10.10	7.09	18.00
Magnesium (Dissolved)	mg/L		8.90	9.67	8.06	7.28	10.10	9.91	5.85	15.00
Potassium (Total)	mg/L		3.83	3.73	3.19	3.07	3.92	3.79	3.21	4.63
Potassium (Dissolved)	mg/L		3.47	3.49	3.07	2.82	3.65	3.53	2.80	4.34
Sodium (Total)	mg/L		42.40	41.90	36.70	34.20	47.50	42.10	37.10	86.40
Sodium (Dissolved)	mg/L		41.40	41.48	36.20	33.86	47.50	41.68	34.80	81.30
Sulphate (SO_4)	mg/L		11	11	6	7	10	12	4	6
Anions	meq/L		3.55	3.52	2.01	2.98	3.51	3.58	2.88	6.32
Cations	meq/L		3.53	3.45	2.76	2.86	3.58	3.55	2.94	6.71
Ion Balance	N/A		1.00	0.98	1.37	0.96	1.02	0.99	1.02	1.06
Total Metals										
Aluminum (Al)	µg/L	5, 100	**650**	**593**	**195**	**611**	**570**	**694**	**495**	**120**
Antimony (Sb)	µg/L		0.0563	0.0489	0.0359	0.0325	0.0430	0.0404	0.0158	0.0332
Arsenic (As)	µg/L	5	0.542	0.517	0.583	0.563	0.598	0.553	0.742	1.400
Barium (Ba)	µg/L		11.20	10.70	5.04	9.52	10.10	11.50	10.10	9.76
Beryllium (Be)	µg/L		0.0128	0.0194	0.0075	0.0229	0.0136	0.0221	0.016	<0.003
Bismuth (Bi)	µg/L		0.0065	0.0057		0.0012	<0.001	0.0036	0.006	0.001
Boron (B)	µg/L		40.1	43.1	38.4	32.1	46.1	41.9	25.7	51.6
Cadmium (Cd)	µg/L	0.003-0.055	0.012	0.007	0.006	0.005	<0.002	0.003	<0.002	0.006
Chromium (Cr)	µg/L	1, 16	**1.1**	1.0	0.5	**1.2**	0.9	**1.2**	0.986	0.57
Cobalt (Co)	µg/L		0.232	0.206	0.0729	0.249	0.174	0.226	0.381	0.394
Copper (Cu)	µg/L	2-4	**3.8**	**3.7**	**2.6**	**2.4**	**2.9**	**4.1**	**2.20**	**2.99**
Iron (Fe)	µg/L	300	**436**	**391**	117	**550**	**357**	**457**	**728**	**823**
Lead (Pb)	µg/L	1-7	0.49	0.48	0.06	0.22	0.20	0.28	0.238	0.162
Manganese (Mn)	µg/L		7.0	6.3	3.0	8.7	5.9	7.9	58.4	261.0
Mercury (Hg)	ng/L	26	1.0	0.6	1.4	<0.6	1.5	<0.6		
Molybdenum (Mo)	µg/L	73	0.697	0.681	0.592	0.527	0.697	0.72	0.207	0.299
Nickel (Ni)	µg/L	25-150	1.110	0.995	0.721	1.010	0.988	1.110	1.590	1.150
Selenium (Se)	µg/L	1	0.8	0.9	**1.5**	**1.4**	**1.3**	0.9	**1.7**	**3.6**
Silver (Ag)	µg/L	0.1	0.009	0.007		0.020	<0.0005	0.005	0.0050	0.0023
Strontium (Sr)	µg/L		66.4	65.5	55.8	54.8	71.2	66.2	44.2	96.2
Thallium (Tl)	µg/L	0.8000	0.0123	0.0107	0.0020	0.0036	0.0010	0.0102	0.0052	0.0013
Tin (Sn)	µg/L		3.660	2.380		<0.03	0.124	0.111	3.32	5.98
Uranium (U)	µg/L		0.300	0.291	0.211	0.233	0.271	0.299	0.0703	0.0701
Vanadium (V)	µg/L		1.340	1.230	0.433	1.300	1.100	1.370	0.840	0.141
Zinc (Zn)	µg/L	3, 13-198	4.37	4.76	1.01	2.78	2.37	3.30	7.22	6.90
Dissolved Metals										
Aluminum (Al)	µg/L		72.4	70.0	30.6	35.1	32.0	69.1	114.0	12.1
Antimony (Sb)	µg/L		0.0557	0.0484	0.0356	0.0322	0.0426	0.04	0.0154	0.0326
Arsenic (As)	µg/L		0.452	0.415	0.517	0.459	0.448	0.455	0.587	1.170
Barium (Ba)	µg/L		3.80	3.67	3.13	2.54	3.43	3.69	4.75	7.38
Beryllium (Be)	µg/L		<0.003	<0.003	0.005	0.005	0.003	0.005	0.007	<0.003
Boron (B)	µg/L		36.9	38.6	37.8	31.3	43.8	40.5	23.0	48.4
Cadmium (Cd)	µg/L		<0.002	0.004	0.003	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.342	0.245	0.398	0.230	0.505	0.334	0.602	0.499
Cobalt (Co)	µg/L		0.0255	0.0211	0.0137	0.0191	0.0011	0.0233	0.0559	0.0747
Copper (Cu)	µg/L		2.7	2.7	2.3	1.7	2.3	2.5	1.95	2.63
Iron (Fe)	µg/L		35.5	30.3	14.4	27.3	8.5	29.1	320	248
Lead (Pb)	µg/L		0.0639	0.0583	0.0084	0.0211	0.0140	0.0525	0.088	0.031
Manganese (Mn)	µg/L		0.576	0.508	0.442	0.372	0.106	0.692	7.170	126.000
Molybdenum (Mo)	µg/L		0.690	0.674	0.586	0.512	0.690	0.683	0.178	0.257
Nickel (Ni)	µg/L		0.624	0.662	0.608	0.477	0.612	0.662	1.190	0.976
Selenium (Se)	µg/L		0.8	0.6	1.3	1.2	0.9	0.8	1.6	3.3
Silver (Ag)	µg/L		0.0083	0.0040	<0.0005	0.0200	<0.0005	<0.0005	0.0008	<0.0005
Strontium (Sr)	µg/L		62	63	55	51	69	64	44.2	91.5
Uranium (U)	µg/L		0.250	0.254	0.187	0.175	0.236	0.254	0.0476	0.0457
Vanadium (V)	µg/L		0.38	0.35	0.26	0.14	0.38	0.36	0.288	0.097
Zinc (Zn)	µg/L		1.7	1.2	0.8	0.7	1.3	1.9	7.19	2.44
Other										
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002
Fluoride (F)	mg/L		0.07	0.07	0.13	0.18	0.07	0.08	0.06	0.09
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Ogama Lake							
			21-Jul-06		15-Aug-06		8-Sep-06		22-May-07	16-Jul-07
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Top
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		23.2	23.5	26.1	26.0	27.7	28.3	55.7	25.5
Hardness, Total ($CaCO_3$)	mg/L		39.1	38.8	43.2	43.3	45.0	45.5	98.7	42.5
Conductivity	µS/cm		252	254	276	276	295	295	602	280
Field pH	units	6.5-9.0	7.3	-	8.3	-	8.0	-	7.1	7.0
TDS (Calculated)	mg/L		120	113	132	132	141	143	270	140
Total Suspended Solids	mg/L		3	5	4	3	4	4	1	3
Color, True	TCU		19	19	13	17	6	<1	14	18
Nutrients										
Phosphorus, Total	mg/L		0.023	0.027	0.039	0.039	0.049	0.046	0.024	0.021
Total Kjeldahl Nitrogen	mg/L		0.40	0.40	0.55	0.57	0.62	0.54	0.54	0.42
Ammonia-N	mg/L	0.2-122.4	0.009	0.009	0.006	0.006	0.006	0.005	0.009	0.008
Nitrite-N	mg/L	0.06	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.042	<0.005
Organics										
Carbon Part	mg/L		0.62	0.68	1.18	1.06	1.24	1.31	0.50	0.46
Dissolved Organic Carbon	mg/L		5.3	5.6	5.3	5.3	5.3	5.6	7.6	4.8
Chlorophyll a	µg/L		-	-	-	-	6.8	-	-	3.4
Major Ions										
Calcium (Total)	mg/L		6.10	5.99	6.89	6.81	6.99	7.03	14.50	6.52
Calcium (Dissolved)	mg/L		5.57	5.26	6.43	6.34	6.69	6.68	14.00	6.45
Chloride (Cl)	mg/L		60.00	53.30	65.00	65.00	70.30	70.40	129.00	74.00
Magnesium (Total)	mg/L		6.08	6.06	7.30	7.04	6.68	6.80	15.40	6.52
Magnesium (Dissolved)	mg/L		5.56	5.27	6.81	6.68	6.39	6.33	14.90	6.37
Potassium (Total)	mg/L		2.17	2.17	2.45	2.43	2.40	2.38	4.77	2.30
Potassium (Dissolved)	mg/L		1.94	1.83	2.26	2.23	2.20	2.20	4.59	2.18
Sodium (Total)	mg/L		30.00	29.50	36.90	35.80	34.60	34.40	81.90	33.20
Sodium (Dissolved)	mg/L		27.60	26.10	35.10	34.00	33.10	32.50	78.40	31.90
Sulphate (SO_4)	mg/L		<3	<3	3	3	4	5	4	<3
Anions	meq/L		2.20	2.02	2.43	2.43	2.62	2.66	4.84	2.64
Cations	meq/L		2.13	2.12	2.34	2.35	2.46	2.46	5.08	2.36
Ion Balance	N/A		0.97	1.05	0.96	0.97	0.94	0.92	1.05	0.89
Total Metals										
Aluminum (Al)	µg/L	5, 100	**186**	**263**	**117**	**139**	**172**	**184**	63.4	**200**
Antimony (Sb)	µg/L		0.0139	0.0126	0.0146	0.0165	0.0163	0.0183	0.0297	0.0145
Arsenic (As)	µg/L	5	0.390	0.418	0.715	0.742	0.574	0.619	1.160	0.464
Barium (Ba)	µg/L		4.52	5.40	3.62	4.03	4.42	4.61	6.24	5.03
Beryllium (Be)	µg/L		0.004	<0.003	0.005	0.005	0.011	0.008	0.0069	0.0061
Bismuth (Bi)	µg/L		0.003	0.005	<0.001	<0.001	0.004	0.003	0.0029	0.0016
Boron (B)	µg/L		21.4	20.8	23.2	22.6	23.2	24.2	44.5	22.5
Cadmium (Cd)	µg/L	0.003-0.055	<0.002	<0.002	<0.002	<0.002	0.009	0.002	<0.002	<0.002
Chromium (Cr)	µg/L	1, 16	0.428	0.53	0.486	0.494	0.459	0.435	0.4	0.5
Cobalt (Co)	µg/L		0.046	0.078	0.056	0.063	0.069	0.071	0.0453	0.0897
Copper (Cu)	µg/L	2-4	1.66	1.80	1.84	2.02	1.77	1.76	**2.5**	1.4
Iron (Fe)	µg/L	300	138	242	111	134	156	165	179	**319**
Lead (Pb)	µg/L	1-7	0.104	0.132	0.163	0.168	0.121	0.103	0.04	0.09
Manganese (Mn)	µg/L		7.0	11.4	19.9	21.1	20.2	20.0	82.4	61.6
Mercury (Hg)	ng/L	26	9.8	1.9	1.3	7.2	1.2	3.1	<0.6	<0.6
Molybdenum (Mo)	µg/L	73	0.148	0.150	0.233	0.208	0.263	0.257	0.271	0.152
Nickel (Ni)	µg/L	25-150	0.549	0.650	0.637	0.640	0.643	0.661	0.829	0.818
Selenium (Se)	µg/L	1	0.6	0.6	**1.9**	**1.7**	**1.4**	**1.4**	**3.1**	0.9
Silver (Ag)	µg/L	0.1	0.0007	0.0016	<0.0005	<0.0005	0.0016	0.0015	0.008	0.002
Strontium (Sr)	µg/L		37.7	37.8	43.7	42.5	44.6	44.2	92.2	42.1
Thallium (Tl)	µg/L	0.8000	0.0252	0.0249	0.0074	0.0099	0.0147	0.0142	<0.0003	0.0069
Tin (Sn)	µg/L		22.40	5.77	2.98	18.00	1.12	1.83	0.143	1.100
Uranium (U)	µg/L		0.0522	0.0524	0.0551	0.0550	0.0577	0.0560	0.056	0.039
Vanadium (V)	µg/L		0.278	0.456	0.202	0.215	0.291	0.274	<0.01	0.307
Zinc (Zn)	µg/L	3, 13-198	1.81	2.00	3.59	1.50	3.46	3.57	1.63	2.38
Dissolved Metals										
Aluminum (Al)	µg/L		25.7	23.9	5.2	5.5	12.3	19.3	7.0	13.2
Antimony (Sb)	µg/L		0.0139	0.0125	0.0146	0.0165	0.0163	0.0183	0.0294	0.0144
Arsenic (As)	µg/L		0.369	0.346	0.579	0.569	0.468	0.457	0.984	0.377
Barium (Ba)	µg/L		2.34	2.23	2.06	2.12	2.25	2.32	5.31	2.41
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	0.004	<0.003	<0.003
Boron (B)	µg/L		19.1	18.5	21.9	21.3	21.3	21.7	42.8	20.3
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	0.009	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.246	0.339	0.327	0.361	0.356	0.334	0.398	0.286
Cobalt (Co)	µg/L		0.0124	0.0119	0.0119	0.0123	0.0106	0.0110	0.0159	0.0138
Copper (Cu)	µg/L		1.36	1.32	1.38	1.56	1.42	1.51	2.3	1.2
Iron (Fe)	µg/L		27.3	21.3	3.1	3.5	<2.0	4.4	17.1	72.8
Lead (Pb)	µg/L		0.045	0.042	0.131	0.131	0.121	0.043	0.0141	0.0175
Manganese (Mn)	µg/L		0.360	0.305	0.209	0.211	0.229	0.738	31.000	0.556
Molybdenum (Mo)	µg/L		0.131	0.139	0.177	0.185	0.241	0.253	0.260	0.141
Nickel (Ni)	µg/L		0.369	0.386	0.383	0.393	0.370	0.408	0.769	0.581
Selenium (Se)	µg/L		0.6	0.4	1.1	1.1	1.0	0.9	2.8	0.8
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		34.0	32.6	39.7	40.0	43.5	42.5	92	41
Uranium (U)	µg/L		0.0274	0.0267	0.0329	0.0313	0.0256	0.0296	0.039	0.026
Vanadium (V)	µg/L		0.089	0.129	0.021	0.063	0.084	0.110	<0.01	0.05
Zinc (Zn)	µg/L		1.79	1.95	3.55	0.74	3.46	2.90	1.6	1.2
Other										
Cyanide, Total	mg/L		<0.001	<0.001	0.001	0.001	0.001	<0.001	0.001	<0.001
Fluoride (F)	mg/L		0.05	0.05	0.05	0.05	0.06	0.06	0.09	0.12
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Ogama Lake				Ogama Outflow			
			16-Aug-07		11-Sep-07	12-Sep-07	19-Jun-06	21-Jul-06	12-Aug-06	9-Sep-06
			Top	Bottom	Top	Bottom				
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		27.7	27.2	27.7	25.8	23.4	22.9	25.3	27.5
Hardness, Total ($CaCO_3$)	mg/L		46.3	45.7	46.2	46.1	37.8	40.7	42.9	45.2
Conductivity	µS/cm		298	295	286	287	240	251	272	297
Field pH	units	6.5-9.0	7.1	-	7.1	-	6.6	7.7	7.5	7.5
TDS (Calculated)	mg/L		148	148	143	141	124	119	131	144
Total Suspended Solids	mg/L		7	7	5	5	3	3	4	3
Color, True	TCU		20	20	30	30	36	15	20	6
Nutrients										
Phosphorus, Total	mg/L		0.035	0.035	0.031	0.028	0.019	0.026	0.037	0.041
Total Kjeldahl Nitrogen	mg/L		0.59	0.58	0.63	0.61	0.38	0.40	0.56	0.53
Ammonia-N	mg/L	0.2-122.4	0.008	0.009	0.01	0.01	0.035	0.010	0.014	0.005
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	<0.001	0.002	0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Organics										
Carbon Part	mg/L		1.17	1.23	1.53	1.56	0.44	0.71	0.95	1.26
Dissolved Organic Carbon	mg/L		6.6	7.0	7.6	7.3	6.9	5.3	5.3	5.7
Chlorophyll a	µg/L		4.7	-	5.5	-	-	-	-	-
Major Ions										
Calcium (Total)	mg/L		6.96	6.91	7.36	7.44	5.79	5.76	6.43	6.87
Calcium (Dissolved)	mg/L		6.69	6.72	6.93	7.13	5.52	5.49	6.12	6.59
Chloride (Cl)	mg/L		72.80	71.60	74.00	70.80	61.10	59.40	64.70	70.70
Magnesium (Total)	mg/L		6.95	6.66	7.56	7.69	5.23	5.90	6.70	6.82
Magnesium (Dissolved)	mg/L		6.73	6.49	7.22	7.45	5.03	5.64	6.29	6.52
Potassium (Total)	mg/L		2.30	2.27	2.40	2.42	2.11	2.13	2.30	2.37
Potassium (Dissolved)	mg/L		2.12	2.10	2.18	2.24	1.95	1.97	2.14	2.21
Sodium (Total)	mg/L		33.10	32.50	34.30	35.00	28.90	30.40	33.60	35.40
Sodium (Dissolved)	mg/L		32.77	32.40	33.20	34.10	25.90	29.60	32.50	33.70
Sulphate (SO_4)	mg/L		3	5	<3	<3	5	<3	3	7
Anions	meq/L		2.67	2.66	2.69	2.56	2.30	2.18	2.39	2.70
Cations	meq/L		2.68	2.66	2.48	2.55	2.14	2.13	2.33	2.43
Ion Balance	N/A		1.00	1.00	0.92	1.00	0.93	0.98	0.97	0.90
Total Metals										
Aluminum (Al)	µg/L	5, 100	**336**	**375**	**306**	**305**	**290**	**181**	92.2	**119**
Antimony (Sb)	µg/L		0.0160	0.0199	0.0185	0.0161	0.0126	0.0123	0.0157	0.0155
Arsenic (As)	µg/L	5	0.545	0.533	0.460	0.489	0.454	0.405	0.641	0.673
Barium (Ba)	µg/L		6.76	7.38	6.51	6.42	6.04	4.60	3.30	3.76
Beryllium (Be)	µg/L		0.0054	0.0161	0.0086	0.0132	0.012	0.006	<0.003	0.006
Bismuth (Bi)	µg/L		0.0017	0.0029	<0.001	<0.001	0.004	0.003	0.002	0.002
Boron (B)	µg/L		22.7	23.8	25.9	25.5	20.7	21.6	22.0	23.7
Cadmium (Cd)	µg/L	0.003-0.055	0.005	0.012	0.003	<0.002	<0.002	0.002	0.003	0.003
Chromium (Cr)	µg/L	1, 16	0.6	0.7	0.8	0.8	0.497	0.336	0.381	0.381
Cobalt (Co)	µg/L		0.118	0.128	0.0968	0.0947	0.105	0.054	0.064	0.061
Copper (Cu)	µg/L	2-4	1.9	**2.2**	1.8	**2.6**	1.55	1.49	1.67	1.62
Iron (Fe)	µg/L	300	282	**320**	238	246	**323**	173	127	129
Lead (Pb)	µg/L	1-7	0.12	0.18	0.15	0.13	0.102	0.093	0.136	0.069
Manganese (Mn)	µg/L		17.1	17.4	14.0	14.4	22.5	12.3	26.0	23.7
Mercury (Hg)	ng/L	26	<0.6	<0.6	<0.6	1.3	<0.6	<0.6	<0.6	1.3
Molybdenum (Mo)	µg/L	73	0.224	0.229	0.232	0.259	0.129	0.180	0.205	0.262
Nickel (Ni)	µg/L	25-150	0.937	1.060	0.942	0.927	0.907	0.599	0.601	0.589
Selenium (Se)	µg/L	1	1.0	1.0	0.9	1.0	1.0	0.7	**1.3**	**2.0**
Silver (Ag)	µg/L	0.1	<0.0005	<0.0005	0.003	0.001	0.0021	0.0010	0.0023	0.0012
Strontium (Sr)	µg/L		44.6	44.6	45.2	45.3	38.4	36.2	40.4	43.7
Thallium (Tl)	µg/L	0.8000	0.0048	0.0047	0.0026	0.0022	0.0062	0.0136	0.0067	0.0137
Tin (Sn)	µg/L		0.920	1.030	0.092	1.930	0.05	0.09	0.06	<0.03
Uranium (U)	µg/L		0.043	0.051	0.057	0.057	0.0394	0.0452	0.0512	0.0524
Vanadium (V)	µg/L		0.587	0.612	0.502	0.540	0.338	0.263	0.169	0.201
Zinc (Zn)	µg/L	3, 13-198	2.22	11.10	3.86	1.68	4.99	0.64	2.06	2.28
Dissolved Metals										
Aluminum (Al)	µg/L		36.8	42.1	48.1	49.9	52.5	30.2	6.9	11.5
Antimony (Sb)	µg/L		0.0158	0.0197	0.0183	0.0159	0.0126	0.0115	0.0157	0.0155
Arsenic (As)	µg/L		0.399	0.389	0.373	0.380	0.366	0.325	0.529	0.564
Barium (Ba)	µg/L		2.60	2.66	2.97	3.04	3.18	2.41	1.98	2.10
Beryllium (Be)	µg/L		0.005	<0.003	0.003	0.005	0.006	<0.003	<0.003	<0.003
Boron (B)	µg/L		21.1	20.2	21.4	22.3	19.5	19.2	21.8	21.9
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.003	0.003
Chromium (Cr)	µg/L		0.313	0.215	0.520	0.620	0.337	0.218	0.300	0.372
Cobalt (Co)	µg/L		0.0076	0.0111	0.0195	0.0197	0.0294	0.0120	0.0139	0.0117
Copper (Cu)	µg/L		1.5	1.7	1.8	2.1	1.39	1.21	1.24	1.53
Iron (Fe)	µg/L		36.4	43.5	40.0	43.2	103	29.5	2.4	8.2
Lead (Pb)	µg/L		0.0143	0.0204	0.0363	0.0364	0.030	0.063	0.104	0.033
Manganese (Mn)	µg/L		0.112	0.253	0.398	0.389	8.300	0.408	0.215	0.241
Molybdenum (Mo)	µg/L		0.194	0.201	0.196	0.201	0.114	0.176	0.189	0.242
Nickel (Ni)	µg/L		0.523	0.555	0.612	0.580	0.733	0.456	0.385	0.439
Selenium (Se)	µg/L		0.7	0.8	0.6	0.8	0.9	0.6	0.7	1.0
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	0.0008	<0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		42	43	42	43	36.7	33.9	40.1	41.8
Uranium (U)	µg/L		0.030	0.031	0.041	0.043	0.0268	0.0316	0.0294	0.0271
Vanadium (V)	µg/L		0.12	0.13	0.16	0.21	0.058	0.085	0.024	0.073
Zinc (Zn)	µg/L		1.4	8.3	0.9	0.7	3.16	0.63	1.59	1.52
Other										
Cyanide, Total	mg/L		<0.001	0.002	<0.001	<0.001	0.001	<0.001	0.001	<0.001
Fluoride (F)	mg/L		0.06	0.06	0.06	0.06	0.05	0.06	0.04	0.07
Sulphide	mg/L		<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Ogama Outflow				Patch Lake				
			22-Jun-07	17-Jul-07	12-Aug-07	17-Sep-07	2-Jun-06	23-Jul-06		15-Aug-06	16-Aug-06
							Bottom	Top	Bottom	Top	Bottom
Physical											
Alkalinity, Total ($CaCO_3$)	mg/L		27.3	25.9	27.7	27.5	49.9	34.2	34.3	35.2	35.1
Hardness, Total ($CaCO_3$)	mg/L		45.3	42.1	45.7	46.8	86.6	58.5	61.6	60.7	60.4
Conductivity	µS/cm		290	285	281	285	458	328	325	333	333
Field pH	units	6.5-9.0	6.9	7.3	6.9	6.8	6.8	7.6	-	7.0	-
TDS (Calculated)	mg/L		141	138	149	143	231	156	156	162	159
Total Suspended Solids	mg/L		3	6	5	4	<1	2	1	1	<1
Color, True	TCU		48	20	14	32	<1	<1	<1	7	<1
Nutrients											
Phosphorus, Total	mg/L		0.028	0.065	0.034	0.030	0.009	0.012	0.011	0.018	0.019
Total Kjeldahl Nitrogen	mg/L		0.51	0.66	0.57	0.65	0.26	0.24	0.26	0.31	0.21
Ammonia-N	mg/L	0.2-122.4	0.016	0.011	0.006	0.016	0.025	0.005	0.005	0.006	0.005
Nitrite-N	mg/L	0.06	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Organics											
Carbon Part	mg/L		0.49	1.01	1.28	1.54	0.14	0.13	0.08	0.22	0.15
Dissolved Organic Carbon	mg/L		8.4	5.4	5.5	8.0	4.6	3.3	3.6	3.7	3.5
Chlorophyll a	µg/L		-	-	-	-	-	-	-	-	-
Major Ions											
Calcium (Total)	mg/L		7.04	6.18	7.19	7.25	16.60	10.70	10.80	11.10	11.20
Calcium (Dissolved)	mg/L		6.76	6.12	7.01	7.12	14.00	9.96	9.68	10.50	9.99
Chloride (Cl)	mg/L		70.80	68.00	73.60	71.10	109.00	75.20	74.60	77.80	76.30
Magnesium (Total)	mg/L		7.42	6.52	7.58	6.84	11.10	7.83	7.83	8.41	8.58
Magnesium (Dissolved)	mg/L		7.05	6.46	7.50	6.69	10.10	7.28	7.03	8.10	7.69
Potassium (Total)	mg/L		2.79	2.26	2.51	2.33	3.82	2.85	2.84	2.94	3.00
Potassium (Dissolved)	mg/L		2.64	2.22	2.36	2.21	3.48	2.59	2.53	2.81	2.65
Sodium (Total)	mg/L		36.00	32.90	38.40	33.50	52.10	37.30	37.00	40.60	41.40
Sodium (Dissolved)	mg/L		34.60	32.57	38.20	32.90	46.90	35.10	33.60	38.80	37.10
Sulphate (SO_4)	mg/L		<3	3	<3	4	4	<3	<3	4	3
Anions	meq/L		2.59	2.51	2.67	2.63	4.15	2.85	2.83	2.98	2.92
Cations	meq/L		2.51	2.48	2.72	2.53	4.31	2.85	2.88	2.92	2.87
Ion Balance	N/A		0.97	0.99	1.02	0.96	1.04	1.00	1.02	0.98	0.98
Total Metals											
Aluminum (Al)	µg/L	5, 100	**150**	**198**	**258**	**221**	67.7	**138**	89.7	83.2	89.2
Antimony (Sb)	µg/L		0.0157	0.0135	0.0154	0.0162	0.0342	0.0190	0.0190	0.0195	0.0194
Arsenic (As)	µg/L	5	0.583	0.543	0.540	0.469	0.743	0.410	0.421	0.597	0.670
Barium (Ba)	µg/L		4.42	5.14	6.19	5.63	5.40	4.36	3.90	3.71	3.74
Beryllium (Be)	µg/L		0.0084	0.0106	0.0042	0.0077	<0.003	0.004	<0.003	<0.003	<0.003
Bismuth (Bi)	µg/L		<0.001	0.0025	<0.001	0.0013	<0.001	0.002	0.002	<0.001	<0.001
Boron (B)	µg/L		25.5	20.1	24.5	22.5	39.2	24.9	24.4	27.1	28.3
Cadmium (Cd)	µg/L	0.003-0.055	0.006	0.003	<0.002	0.004	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L	1, 16	0.5	0.4	0.5	0.4	0.338	0.48	0.42	0.32	0.361
Cobalt (Co)	µg/L		0.113	0.0969	0.0873	0.0766	0.028	0.047	0.032	0.030	0.033
Copper (Cu)	µg/L	2-4	1.8	1.3	1.5	1.7	**2.18**	1.24	1.47	1.41	1.51
Iron (Fe)	µg/L	300	199	**368**	235	209	56.1	108	77.8	50.5	57.0
Lead (Pb)	µg/L	1-7	0.05	0.08	0.09	0.10	0.137	0.112	0.094	0.167	0.148
Manganese (Mn)	µg/L		90.8	62.5	26.6	15.0	4.6	4.5	4.5	4.3	5.0
Mercury (Hg)	ng/L	26	2.8	<0.6	1.0	<0.6		1.1	2.5	**44**	16
Molybdenum (Mo)	µg/L	73	0.138	0.138	0.235	0.229	0.222	0.180	0.178	0.181	0.190
Nickel (Ni)	µg/L	25-150	1.180	0.802	0.850	0.915	0.526	0.322	0.286	0.514	0.364
Selenium (Se)	µg/L	1	**1.6**	**1.1**	1.0	0.7	**1.8**	0.9	0.9	**1.6**	**1.8**
Silver (Ag)	µg/L	0.1	<0.0005	0.002	<0.0005	0.001	0.0011	0.0028	0.0020	<0.0005	<0.0005
Strontium (Sr)	µg/L		45.0	39.5	47.1	44.4	106.0	69.5	70.4	71.9	72.6
Thallium (Tl)	µg/L	0.8000	0.0008	0.0066	<0.0003	0.0027	<0.0003	0.0113	0.0104	0.0072	0.0063
Tin (Sn)	µg/L		<0.03	0.061	<0.03	<0.03	13.50	13.20	5.37	2.78	21.90
Uranium (U)	µg/L		0.035	0.037	0.044	0.056	0.1030	0.0745	0.0646	0.0807	0.0834
Vanadium (V)	µg/L		0.158	0.275	0.368	0.880	0.150	0.278	0.200	0.137	0.134
Zinc (Zn)	µg/L	3, 13-198	2.90	2.58	1.73	1.01	19.10	1.67	1.65	7.82	2.19
Dissolved Metals											
Aluminum (Al)	µg/L		22.0	14.5	32.7	49.4	5.1	12.2	8.9	11.3	11.2
Antimony (Sb)	µg/L		0.0155	0.0134	0.0152	0.016	0.0334	0.0184	0.0183	0.0195	0.0194
Arsenic (As)	µg/L		0.496	0.503	0.409	0.399	0.638	0.313	0.353	0.526	0.534
Barium (Ba)	µg/L		2.40	2.31	2.70	3.08	4.03	2.71	2.56	2.69	2.59
Beryllium (Be)	µg/L		<0.003	<0.003	0.003	0.006	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		24.6	19.9	23.8	21.5	35.8	22.3	21.7	26.2	25.1
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	0.004	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.379	0.339	0.468	0.260	0.329	0.382	0.413	0.260	0.273
Cobalt (Co)	µg/L		0.0162	0.0133	0.0031	0.0187	0.0013	0.0028	0.0036	0.0063	0.0070
Copper (Cu)	µg/L		1.5	1.1	1.3	1.4	1.66	0.95	1.14	1.02	1.13
Iron (Fe)	µg/L		40.8	77.8	31.9	42.4	<2.0	<2.0	<2.0	<20	2.0
Lead (Pb)	µg/L		0.0027	0.0151	0.0498	0.0957	0.024	0.039	0.036	0.133	0.124
Manganese (Mn)	µg/L		5.130	0.669	0.064	0.558	0.382	0.248	0.209	0.206	0.204
Molybdenum (Mo)	µg/L		0.120	0.137	0.210	0.210	0.212	0.163	0.156	0.179	0.167
Nickel (Ni)	µg/L		0.825	0.541	0.498	0.609	0.367	0.194	0.204	0.267	0.252
Selenium (Se)	µg/L		1.3	1.1	0.7	0.5	1.7	0.6	0.7	1.0	1.1
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0005	0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		43	38	45	42	96.1	64.5	62.7	67.5	64.9
Uranium (U)	µg/L		0.030	0.025	0.032	0.045	0.0203	0.0354	0.0163	0.0442	0.0242
Vanadium (V)	µg/L		0.02	0.03	0.15	0.57	0.029	0.113	0.098	0.021	0.041
Zinc (Zn)	µg/L		1.5	1.5	0.7	0.4	3.50	1.03	1.35	4.14	0.78
Other											
Cyanide, Total	mg/L		<0.001	<0.001	0.001	0.001	0.001	<0.001	<0.001	0.002	0.001
Fluoride (F)	mg/L		0.14	0.13	0.05	0.06	0.08	0.06	0.06	0.05	0.06
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Patch Lake							
			8-Sep-06		23-May-07		17-Jul-07		15-Aug-07	
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		36.1	36.2	51.3	57.1	53.1	55.7	36.7	36.5
Hardness, Total ($CaCO_3$)	mg/L		59.1	58.1	86.2	96.9	74.3	92.7	61.4	60.7
Conductivity	µS/cm		339	341	463	514	506	531	348	356
Field pH	units	6.5-9.0	8.1	-	7.4	-	7.1	-	7.0	-
TDS (Calculated)	mg/L		160	163	239	247	247	263	172	175
Total Suspended Solids	mg/L		<1	<1	<1	<1	<1	<1	3	4
Color, True	TCU		<1	<1	<5	<5	8	8	4	<5
Nutrients										
Phosphorus, Total	mg/L		0.019	0.023	0.004	0.004	0.007	0.009	0.012	0.060
Total Kjeldahl Nitrogen	mg/L		0.22	0.18	0.28	0.28	0.29	0.28	0.21	0.24
Ammonia-N	mg/L	0.2-122.4	0.007	0.005	0.016	0.007	0.013	0.013	0.008	0.008
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	0.007	0.006	<0.005	<0.005	<0.005	<0.005
Organics										
Carbon Part	mg/L		0.09	0.08	0.13	0.07	0.16	0.14	0.20	0.18
Dissolved Organic Carbon	mg/L		3.7	3.4	4.0	4.0	4.1	4.2	3.6	3.4
Chlorophyll a	µg/L		1.0	-	-	-	0.6	-	0.7	-
Major Ions										
Calcium (Total)	mg/L		11.00	10.80	16.30	17.80	13.60	16.90	11.30	11.30
Calcium (Dissolved)	mg/L		10.60	10.60	15.50	17.30	13.50	16.60	10.90	10.90
Chloride (Cl)	mg/L		78.40	77.70	111.00	113.00	125.00	132.00	82.10	84.30
Magnesium (Total)	mg/L		7.68	7.56	11.40	13.20	9.83	12.40	8.47	8.53
Magnesium (Dissolved)	mg/L		7.35	7.49	10.80	12.60	9.73	12.30	8.32	8.24
Potassium (Total)	mg/L		2.80	2.76	3.99	4.44	3.57	4.38	3.00	3.01
Potassium (Dissolved)	mg/L		2.63	2.71	3.77	4.27	3.55	4.24	2.83	2.81
Sodium (Total)	mg/L		36.80	36.70	55.90	63.50	47.00	59.80	39.30	39.80
Sodium (Dissolved)	mg/L		35.30	36.70	52.70	61.50	46.53	58.20	39.20	39.60
Sulphate (SO_4)	mg/L		<3	5	3	5	4	<3	<3	<3
Anions	meq/L		2.98	3.03	4.24	4.42	4.66	4.88	3.09	3.15
Cations	meq/L		2.84	2.83	4.55	4.69	4.18	4.67	3.19	3.23
Ion Balance	N/A		0.95	0.93	1.07	1.06	0.90	0.96	1.03	1.03
Total Metals										
Aluminum (Al)	µg/L	5, 100	89.1	89	39.9	41.4	69.3	36.4	**306**	**351**
Antimony (Sb)	µg/L		0.0187	0.0190	0.0803	0.0251	0.0246	0.0252	0.0204	0.0207
Arsenic (As)	µg/L	5	0.509	0.653	0.721	0.760	0.576	0.623	0.520	0.535
Barium (Ba)	µg/L		3.69	3.57	4.99	4.56	4.39	4.84	6.84	7.41
Beryllium (Be)	µg/L		0.004	0.004	<0.003	<0.003	<0.003	<0.003	0.0079	0.0078
Bismuth (Bi)	µg/L		0.001	<0.001	0.0054	0.0039	0.0026	0.0034	0.0032	0.0043
Boron (B)	µg/L		29.7	28.3	37.9	40.6	29.9	37.4	27.2	26.6
Cadmium (Cd)	µg/L	0.003-0.055	<0.002	<0.002	0.012	<0.002	<0.002	<0.002	0.009	<0.002
Chromium (Cr)	µg/L	1, 16	0.271	0.293	0.5	0.4	0.3	0.3	0.6	0.7
Cobalt (Co)	µg/L		0.030	0.029	0.0367	0.0154	0.034	0.0214	0.0926	0.113
Copper (Cu)	µg/L	2-4	1.20	1.08	1.9	1.4	1.7	1.3	**2.2**	**3.8**
Iron (Fe)	µg/L	300	62.3	73.6	10.3	33.5	59.8	37.5	220	257
Lead (Pb)	µg/L	1-7	0.064	0.063	0.29	0.02	0.06	0.03	0.14	0.16
Manganese (Mn)	µg/L		3.6	4.0	2.1	7.5	11.1	16.8	6.9	8.3
Mercury (Hg)	ng/L	26	1.3	3.9	3.8	<0.6	2.9	1.4	<0.6	0.8
Molybdenum (Mo)	µg/L	73	0.208	0.202	0.233	0.186	0.155	0.17	0.196	0.163
Nickel (Ni)	µg/L	25-150	0.321	0.290	7.010	0.232	0.318	0.320	0.547	0.591
Selenium (Se)	µg/L	1	**1.3**	**1.8**	**1.9**	**2.1**	**1.4**	**1.6**	**1.2**	**1.3**
Silver (Ag)	µg/L	0.1	0.0015	0.0012	0.005	0.005	0.001	0.002	<0.0005	<0.0005
Strontium (Sr)	µg/L		71.6	70.3	101.0	114.0	85.3	108.0	74.3	74.1
Thallium (Tl)	µg/L	0.8000	0.0112	0.0124	0.0003	<0.0003	0.0047	0.0040	0.0050	0.0056
Tin (Sn)	µg/L		4.50	0.76	0.385	0.187	22.500	1.660	4.730	9.350
Uranium (U)	µg/L		0.0809	0.0759	0.066	0.061	0.056	0.056	0.060	0.057
Vanadium (V)	µg/L		0.145	0.119	0.100	0.040	0.103	0.048	0.518	0.607
Zinc (Zn)	µg/L	3, 13-198	1.60	1.00	17.80	1.26	1.60	1.67	2.84	2.20
Dissolved Metals										
Aluminum (Al)	µg/L		8.1	8.7	3.6	1.6	3.2	1.0	10.8	10.1
Antimony (Sb)	µg/L		0.0187	0.0190	0.0795	0.0248	0.0244	0.0249	0.0202	0.0205
Arsenic (As)	µg/L		0.398	0.595	0.704	0.689	0.518	0.591	0.380	0.381
Barium (Ba)	µg/L		2.57	2.60	4.32	4.09	3.66	4.18	3.09	3.06
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		25.1	26.9	34.2	38.6	29.6	34.1	26.5	25.3
Cadmium (Cd)	µg/L		<0.002	<0.002	0.012	<0.002	<0.002	<0.002	0.002	<0.002
Chromium (Cr)	µg/L		0.271	0.291	0.449	0.378	0.277	0.249	0.202	0.099
Cobalt (Co)	µg/L		0.0029	0.0038	0.0306	0.0041	0.0085	0.0059	<0.001	<0.001
Copper (Cu)	µg/L		0.98	0.98	1.6	1.3	1.5	1.1	1.1	2.2
Iron (Fe)	µg/L		<2.0	3.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Lead (Pb)	µg/L		0.031	0.035	0.1110	0.0033	0.0108	0.0089	0.0015	0.0018
Manganese (Mn)	µg/L		0.120	0.106	1.580	1.570	4.410	5.460	<0.003	<0.003
Molybdenum (Mo)	µg/L		0.188	0.193	0.216	0.180	0.153	0.168	0.159	0.161
Nickel (Ni)	µg/L		0.218	0.251	0.713	0.161	0.297	0.239	0.253	0.286
Selenium (Se)	µg/L		0.8	1.0	1.6	1.9	1.3	1.6	0.8	0.8
Silver (Ag)	µg/L		<0.0005	<0.0005	0.0008	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		67.8	68.0	98	113	84	104	70	70
Uranium (U)	µg/L		0.0366	0.0336	0.050	0.047	0.046	0.044	0.044	0.045
Vanadium (V)	µg/L		0.057	0.078	0.10	0.03	0.05	<0.01	0.05	0.06
Zinc (Zn)	µg/L		1.51	1.00	17.4	1.3	1.6	1.7	1.7	0.9
Other										
Cyanide, Total	mg/L		0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.06	0.06	0.08	0.09	0.18	0.12	0.05	0.05
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Patch Lake		Patch Outflow					
			11-Sep-07		19-Jun-06	22-Jul-06	12-Aug-06	9-Sep-06	22-Jun-07	19-Jul-07
			Top	Bottom						
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		36.2	36.2	19.7	34.5	35.1	36.0	10.4	32.0
Hardness, Total ($CaCO_3$)	mg/L		59.5	59.3	29.4	59.7	60.2	62.0	12.1	55.1
Conductivity	µS/cm		336	337	173	333	338	345	54.9	302
Field pH	units	6.5-9.0	-	-	6.6	7.7	6.8	7.6	**5.6**	7.5
TDS (Calculated)	mg/L		166	166	87.1	158	166	167	28	153
Total Suspended Solids	mg/L		3	2	1	3	5	<1	4	<1
Color, True	TCU		7	7	8	11	12	1	95	7
Nutrients										
Phosphorus, Total	mg/L		0.008	0.009	0.007	0.012	0.026	0.018	0.048	0.007
Total Kjeldahl Nitrogen	mg/L		0.18	0.20	0.18	0.20	0.24	0.20	0.63	0.19
Ammonia-N	mg/L	0.2-122.4	0.006	0.009	0.016	0.005	0.010	0.005	0.033	0.01
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.008	<0.005
Organics										
Carbon Part	mg/L		0.17	0.24	0.24	0.10	0.21	0.10	1.46	0.11
Dissolved Organic Carbon	mg/L		3.1	3.5	2.7	3.1	3.8	3.7	9.6	3.1
Chlorophyll a	µg/L		0.6	-	-	-	-	-	-	-
Major Ions										
Calcium (Total)	mg/L		11.90	11.50	6.11	11.00	10.90	11.70	1.79	9.78
Calcium (Dissolved)	mg/L		11.20	11.40	5.43	9.88	10.20	10.90	1.65	9.70
Chloride (Cl)	mg/L		82.30	82.80	41.70	75.60	81.10	80.00	8.80	76.70
Magnesium (Total)	mg/L		8.39	8.15	3.95	8.51	8.16	8.66	2.10	6.92
Magnesium (Dissolved)	mg/L		7.95	8.07	3.54	7.44	7.45	8.08	1.95	6.67
Potassium (Total)	mg/L		3.02	2.91	1.67	3.01	2.97	3.01	1.74	2.51
Potassium (Dissolved)	mg/L		2.79	2.91	1.47	2.65	2.67	2.78	1.57	2.49
Sodium (Total)	mg/L		38.90	37.80	17.80	41.10	38.50	41.90	4.54	33.30
Sodium (Dissolved)	mg/L		37.30	37.42	17.60	36.50	36.20	39.90	4.45	32.10
Sulphate (SO_4)	mg/L		<3	<3	3	<3	<3	6	<3	<3
Anions	meq/L		3.09	3.10	1.64	2.87	3.03	3.09	0.50	2.93
Cations	meq/L		2.94	2.89	1.46	2.92	3.00	2.93	0.53	2.69
Ion Balance	N/A		0.95	0.93	0.89	1.02	0.99	0.95	1.05	0.92
Total Metals										
Aluminum (Al)	µg/L	5, 100	**195**	**179**	**135**	**253**	**441**	73.6	**320**	84.0
Antimony (Sb)	µg/L		0.0203	0.0169	0.0100	0.0161	0.0203	0.0183	0.0323	0.0132
Arsenic (As)	µg/L	5	0.434	0.401	0.275	0.584	0.866	0.508	0.407	0.435
Barium (Ba)	µg/L		5.48	5.17	3.21	5.35	7.75	3.38	4.88	3.51
Beryllium (Be)	µg/L		0.0088	0.0049	0.005	0.007	0.017	0.004	0.0225	0.0034
Bismuth (Bi)	µg/L		0.0015	<0.001	0.002	0.002	0.003	<0.001	<0.001	0.0038
Boron (B)	µg/L		28.3	28.5	15.5	30.8	27.8	27.7	8.25	24
Cadmium (Cd)	µg/L	0.003-0.055	0.002	0.003	<0.002	<0.002	0.004	<0.002	0.008	<0.002
Chromium (Cr)	µg/L	1, 16	0.7	0.6	0.331	0.488	0.949	0.285	0.9	0.3
Cobalt (Co)	µg/L		0.0667	0.0626	0.074	0.089	0.175	0.028	0.683	0.0439
Copper (Cu)	µg/L	2-4	1.6	1.3	0.83	1.28	1.40	1.02	**3.0**	0.7
Iron (Fe)	µg/L	300	148	124	116	207	**376**	65.9	**497**	87.1
Lead (Pb)	µg/L	1-7	0.09	0.09	0.051	0.120	0.260	0.056	0.11	0.03
Manganese (Mn)	µg/L		5.0	4.8	5.9	5.4	9.4	4.0	141.0	4.9
Mercury (Hg)	ng/L	26	<0.6	0.9	<0.6	1	<0.6	1.4	1.9	2.3
Molybdenum (Mo)	µg/L	73	0.187	0.161	0.112	0.182	0.203	0.185	0.251	0.116
Nickel (Ni)	µg/L	25-150	0.519	0.450	0.402	0.395	0.712	0.304	1.970	0.328
Selenium (Se)	µg/L	1	0.9	0.9	0.6	**1.4**	**1.5**	**1.2**	0.4	1.0
Silver (Ag)	µg/L	0.1	0.011	0.005	0.0019	0.0021	0.0031	<0.0005	0.002	0.010
Strontium (Sr)	µg/L		75.3	73.7	42.2	70.6	71.9	72.3	11.7	63.2
Thallium (Tl)	µg/L	0.8000	0.0028	0.0026	0.0055	0.0109	0.0101	0.0064	0.0022	0.0056
Tin (Sn)	µg/L		1.210	0.384	<0.03	<0.03	0.05	0.05	0.054	<0.03
Uranium (U)	µg/L		0.064	0.063	0.0471	0.0859	0.1000	0.0858	0.106	0.053
Vanadium (V)	µg/L		0.426	0.395	0.213	0.498	0.805	0.136	0.633	0.176
Zinc (Zn)	µg/L	3, 13-198	0.91	1.35	3.92	3.69	3.40	2.25	3.92	2.07
Dissolved Metals										
Aluminum (Al)	µg/L		18.4	18.5	13.9	21.4	37.5	8.7	92.5	6.4
Antimony (Sb)	µg/L		0.0201	0.0167	0.0099	0.0159	0.0203	0.0183	0.032	0.0131
Arsenic (As)	µg/L		0.363	0.391	0.233	0.417	0.562	0.389	0.380	0.358
Barium (Ba)	µg/L		3.26	3.38	1.74	2.65	3.01	2.50	1.99	2.74
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.015	<0.003
Boron (B)	µg/L		25.0	26.7	14.0	27.3	26.4	26.1	8.0	22.6
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.008	<0.002
Chromium (Cr)	µg/L		0.390	0.480	0.137	0.217	0.236	0.279	0.683	0.227
Cobalt (Co)	µg/L		0.0035	0.0060	0.0125	0.0079	0.0098	<0.001	0.1680	0.0063
Copper (Cu)	µg/L		1.2	1.2	0.72	0.94	0.91	0.93	2.8	0.7
Iron (Fe)	µg/L		5.0	4.5	11.1	4.3	13.4	<2.0	212	5.3
Lead (Pb)	µg/L		0.0205	0.0210	0.006	0.040	0.121	0.033	0.0380	0.0091
Manganese (Mn)	µg/L		0.109	0.097	1.970	0.195	0.251	0.120	65.800	0.098
Molybdenum (Mo)	µg/L		0.171	0.159	0.102	0.168	0.195	0.183	0.212	0.115
Nickel (Ni)	µg/L		0.276	0.312	0.272	0.254	0.256	0.213	1.730	0.278
Selenium (Se)	µg/L		0.8	0.7	0.6	1.1	0.9	0.8	0.4	0.7
Silver (Ag)	µg/L		0.0106	0.0048	0.0009	0.0007	<0.0005	<0.0005	<0.0005	0.0099
Strontium (Sr)	µg/L		71	73	38.1	62.9	66.1	67.0	12	63
Uranium (U)	µg/L		0.052	0.054	0.0199	0.0282	0.0492	0.0397	0.088	0.043
Vanadium (V)	µg/L		0.11	0.13	0.019	0.094	0.074	0.084	0.26	0.01
Zinc (Zn)	µg/L		0.9	1.3	3.84	1.96	1.39	1.40	3.9	1.8
Other										
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.06	0.06	0.04	0.06	0.05	0.06	0.10	1.63
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Patch Outflow		Pelvic Lake					
			12-Aug-07	17-Sep-07	1-Jun-06		21-Jul-06		16-Aug-06	
					Top	Bottom	Top	Bottom	Top	Bottom
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		35.7	36.3	24.9	30.9	20.0	20.3	21.2	21.2
Hardness, Total ($CaCO_3$)	mg/L		59.3	64.7	43.3	51.9	32.8	32.2	34.4	34.1
Conductivity	µS/cm		311	333	285	360	232	229	239	240
Field pH	units	6.5-9.0	6.8	6.9	6.5	-	8.6	-	8.2	-
TDS (Calculated)	mg/L		163	170	144	182	110	107	123	115
Total Suspended Solids	mg/L		7	2	3	1	5	4	7	7
Color, True	TCU		19	7	22	17	19	15	7	10
Nutrients										
Phosphorus, Total	mg/L		0.012	0.006	0.041	0.038	0.045	0.034	0.058	0.060
Total Kjeldahl Nitrogen	mg/L		0.21	0.20	0.73	0.52	0.64	0.54	0.84	0.81
Ammonia-N	mg/L	0.2-122.4	0.007	0.005	0.019	0.088	0.006	0.008	0.009	0.009
Nitrite-N	mg/L	0.06	<0.001	<0.001	0.001	0.002	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	<0.005	0.270	<0.005	<0.005	0.009	0.009
Organics										
Carbon Part	mg/L		0.34	0.21	1.77	0.61	1.94	1.61	2.41	2.20
Dissolved Organic Carbon	mg/L		4.1	3.5	6.8	5.7	4.8	4.6	4.5	4.7
Chlorophyll a	µg/L		-	-	-	-	-	-	-	-
Major Ions										
Calcium (Total)	mg/L		11.20	12.00	5.41	6.59	4.16	4.09	4.49	4.39
Calcium (Dissolved)	mg/L		10.90	11.50	4.92	6.41	3.91	3.73	4.03	4.15
Chloride (Cl)	mg/L		78.00	82.40	69.10	87.20	55.50	53.90	59.30	57.30
Magnesium (Total)	mg/L		8.28	7.97	7.18	8.66	5.66	5.47	6.06	6.00
Magnesium (Dissolved)	mg/L		8.20	7.70	5.76	7.07	5.35	4.98	5.44	5.70
Potassium (Total)	mg/L		3.10	2.96	2.63	2.80	1.87	1.82	2.03	1.98
Potassium (Dissolved)	mg/L		2.85	2.79	2.41	2.70	1.70	1.63	1.73	1.79
Sodium (Total)	mg/L		37.70	37.10	36.90	45.00	28.30	28.50	31.00	31.30
Sodium (Dissolved)	mg/L		37.32	36.10	34.80	43.50	26.80	26.20	28.60	30.00
Sulphate (SO_4)	mg/L		<3	4	5	5	3	<3	6	3
Anions	meq/L		2.96	3.14	2.55	3.21	2.04	1.97	2.22	2.11
Cations	meq/L		2.98	3.01	2.66	3.34	1.93	1.89	2.18	2.03
Ion Balance	N/A		1.01	0.96	1.05	1.04	0.95	0.96	0.98	0.96
Total Metals										
Aluminum (Al)	µg/L	5, 100	**763**	**214**	36.2	58.2	99.4	93.7	75.9	78.8
Antimony (Sb)	µg/L		0.0233	0.0206	0.0281	0.0239	0.0156	0.0154	0.0160	0.0166
Arsenic (As)	µg/L	5	0.611	0.407	0.654	0.831	0.367	0.378	0.663	0.679
Barium (Ba)	µg/L		12.80	5.85	2.88	5.18	2.66	2.76	2.40	2.41
Beryllium (Be)	µg/L		0.0328	0.0055	<0.003	<0.003	<0.003	0.005	<0.003	0.004
Bismuth (Bi)	µg/L		<0.001	0.0026	0.003	0.002	0.005	0.004	0.005	0.007
Boron (B)	µg/L		30.4	26.5	28.8	33.8	22.2	21.4	22.2	24.0
Cadmium (Cd)	µg/L	0.003-0.055	0.003	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L	1, 16	**1.2**	0.5	0.413	0.336	0.292	0.256	0.365	0.416
Cobalt (Co)	µg/L		0.215	0.0743	0.069	0.206	0.050	0.044	0.057	0.061
Copper (Cu)	µg/L	2-4	1.6	1.1	**2.65**	1.77	1.49	**2.44**	1.64	1.83
Iron (Fe)	µg/L	300	**491**	165	48.5	**407**	91.2	104	88.1	96.6
Lead (Pb)	µg/L	1-7	0.23	0.10	0.098	0.049	0.069	0.087	0.160	0.761
Manganese (Mn)	µg/L		12.1	4.7	25.5	346.0	11.8	15.5	42.8	42.4
Mercury (Hg)	ng/L	26	<0.6	<0.6	-	-	1.8	<0.6	<0.6	6.6
Molybdenum (Mo)	µg/L	73	0.192	0.241	0.124	0.139	0.106	0.093	0.125	0.448
Nickel (Ni)	µg/L	25-150	0.956	0.437	0.691	0.352	0.387	0.309	0.419	0.990
Selenium (Se)	µg/L	1	**1.3**	0.7	**1.5**	**2.0**	0.6	0.6	**1.5**	**1.5**
Silver (Ag)	µg/L	0.1	<0.0005	0.002	0.0508	0.0038	0.0012	0.0009	<0.0005	0.0011
Strontium (Sr)	µg/L		76.7	76.9	39.1	49.5	29.7	29.3	32.3	32.0
Thallium (Tl)	µg/L	0.8000	<0.0003	0.0045	0.0007	0.0007	0.0215	0.0132	0.0116	0.0128
Tin (Sn)	µg/L		0.071	<0.03	6.59	3.43	7.32	4.97	2.16	5.62
Uranium (U)	µg/L		0.079	0.070	0.0434	0.0425	0.0442	0.0355	0.0447	0.0462
Vanadium (V)	µg/L		1.180	0.937	0.078	0.049	0.213	0.185	0.129	0.378
Zinc (Zn)	µg/L	3, 13-198	2.33	0.73	9.30	5.97	8.33	3.04	1.76	4.74
Dissolved Metals										
Aluminum (Al)	µg/L		119	19.9	8.0	4.9	9.6	8.5	3.3	3.6
Antimony (Sb)	µg/L		0.0231	0.0204	0.0272	0.0236	0.0153	0.0149	0.0160	0.0166
Arsenic (As)	µg/L		0.460	0.342	0.574	0.772	0.341	0.300	0.579	0.566
Barium (Ba)	µg/L		4.38	3.37	2.30	4.22	1.51	1.49	1.31	1.38
Beryllium (Be)	µg/L		0.005	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		30.1	25.2	27.1	32.3	20.7	18.7	19.9	22.6
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.613	0.150	0.275	0.332	0.160	0.125	0.273	0.384
Cobalt (Co)	µg/L		0.0141	0.0069	0.0219	0.1340	0.0168	0.0110	0.0164	0.0183
Copper (Cu)	µg/L		1.2	0.9	2.10	1.77	1.21	1.81	1.22	1.43
Iron (Fe)	µg/L		65.7	<2.0	17.4	201	9.6	6.3	3.6	5.2
Lead (Pb)	µg/L		0.0318	0.0178	0.006	0.011	0.029	0.038	0.150	0.137
Manganese (Mn)	µg/L		0.329	0.137	8.970	285.000	0.221	0.195	0.264	0.252
Molybdenum (Mo)	µg/L		0.183	0.176	0.105	0.114	0.081	0.081	0.099	0.125
Nickel (Ni)	µg/L		0.521	0.289	0.277	0.285	0.081	0.055	0.094	0.166
Selenium (Se)	µg/L		0.8	0.7	1.5	2.0	0.5	0.5	0.8	0.8
Silver (Ag)	µg/L		<0.0005	0.0006	<0.0005	0.0016	<0.0005	<0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		75	74	38.5	49.5	27.7	26.6	29.1	29.9
Uranium (U)	µg/L		0.056	0.057	0.0274	0.0241	0.0237	0.0207	0.0195	0.0229
Vanadium (V)	µg/L		0.29	0.51	0.077	0.041	0.062	0.054	0.012	<0.01
Zinc (Zn)	µg/L		1.3	0.7	6.75	5.88	1.51	2.78	1.71	4.68
Other										
Cyanide, Total	mg/L		<0.001	<0.001	0.001	0.001	<0.001	<0.001	0.001	0.001
Fluoride (F)	mg/L		0.07	0.06	0.05	0.06	0.04	0.05	0.03	0.03
Sulphide	mg/L		<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Pelvic Lake							
			9-Sep-06		23-May-07		16-Jul-07		16-Aug-07	
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		22.1	22.1	29.1	33.7	20.0	30.3	22.3	22.5
Hardness, Total ($CaCO_3$)	mg/L		35.7	34.1	47.7	52.1	31.5	42.1	34.4	36.0
Conductivity	µS/cm		247	247	323	353	226	313	246	246
Field pH	units	6.5-9.0	8.2	-	7.7	-	6.9	-	6.7	-
TDS (Calculated)	mg/L		122	119	164	181	114	161	123	120
Total Suspended Solids	mg/L		7	7	11	5	2	9	6	6
Color, True	TCU		6	<1	10	25	8	49	8	8
Nutrients										
Phosphorus, Total	mg/L		0.062	0.059	0.062	0.042	0.027	0.128	0.042	0.044
Total Kjeldahl Nitrogen	mg/L		0.72	0.75	0.96	0.74	0.49	1.05	0.61	0.70
Ammonia-N	mg/L	0.2-122.4	0.007	0.008	0.012	0.38	0.007	0.52	0.006	0.035
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	0.016	<0.001	0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	0.010	<0.005	0.105	<0.005	0.006	<0.005	<0.005
Organics										
Carbon Part	mg/L		3.30	3.31	1.74	0.66	0.98	1.11	1.55	1.44
Dissolved Organic Carbon	mg/L		5.2	4.9	7.5	5.4	4.2	4.8	5.2	5.5
Chlorophyll a	µg/L		19.1	-	-	-	6.5	-	11.0	-
Major Ions										
Calcium (Total)	mg/L		4.51	4.42	5.94	6.27	4.02	5.45	4.41	4.47
Calcium (Dissolved)	mg/L		4.23	4.13	5.67	6.19	3.93	5.29	4.29	4.10
Chloride (Cl)	mg/L		59.10	58.60	80.70	87.00	59.30	81.40	59.70	58.80
Magnesium (Total)	mg/L		5.94	5.60	8.28	8.55	5.39	6.90	5.71	5.60
Magnesium (Dissolved)	mg/L		5.51	5.15	7.89	8.52	5.37	6.67	5.56	5.33
Potassium (Total)	mg/L		2.04	1.96	2.74	2.82	1.87	2.38	1.99	1.97
Potassium (Dissolved)	mg/L		1.82	1.73	2.56	2.76	1.74	2.28	1.83	1.75
Sodium (Total)	mg/L		30.90	29.40	44.30	45.80	27.80	35.00	28.20	27.70
Sodium (Dissolved)	mg/L		29.10	27.00	42.30	45.80	27.70	34.65	27.92	26.90
Sulphate (SO_4)	mg/L		7	5	4	4	<3	5	3	3
Anions	meq/L		2.26	2.20	2.94	3.21	2.12	3.01	2.20	2.17
Cations	meq/L		2.06	2.03	3.02	3.35	1.97	2.70	2.22	2.19
Ion Balance	N/A		0.91	0.93	1.03	1.04	0.93	0.90	1.01	1.01
Total Metals										
Aluminum (Al)	µg/L	5, 100	**103**	**133**	26.8	60.8	**186**	**111**	**201**	**178**
Antimony (Sb)	µg/L		0.0167	0.0423	0.0225	0.0202	0.0165	0.0183	0.0156	0.0191
Arsenic (As)	µg/L	5	0.742	0.681	0.802	1.300	0.529	1.190	0.534	0.536
Barium (Ba)	µg/L		2.67	3.28	2.57	9.07	4.15	5.14	4.04	4.16
Beryllium (Be)	µg/L		<0.003	0.003	<0.003	0.0033	<0.003	0.0030	0.0034	0.0035
Bismuth (Bi)	µg/L		<0.001	0.002	0.0014	0.0020	0.0023	0.0023	0.0041	0.0049
Boron (B)	µg/L		25.6	24.9	30.6	30.7	21.6	26.4	22.3	19.6
Cadmium (Cd)	µg/L	0.003-0.055	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.006
Chromium (Cr)	µg/L	1, 16	0.351	0.408	0.3	0.2	0.6	0.3	0.4	0.5
Cobalt (Co)	µg/L		0.067	0.074	0.0393	0.449	0.0806	0.331	0.0811	0.128
Copper (Cu)	µg/L	2-4	1.64	**2.27**	1.8	1.6	1.4	1.3	1.9	**3.0**
Iron (Fe)	µg/L	300	137	158	19.3	**1100**	229	**2760**	291	**429**
Lead (Pb)	µg/L	1-7	0.068	0.241	0.02	0.05	0.08	0.06	0.07	0.11
Manganese (Mn)	µg/L		26.4	26.7	10.5	1160.0	92.8	642.0	73.6	120.0
Mercury (Hg)	ng/L	26	3.6	3.2	<0.6	0.8	1.0	1.6	<0.6	2.2
Molybdenum (Mo)	µg/L	73	0.166	0.182	0.154	0.288	0.13	0.192	0.167	0.164
Nickel (Ni)	µg/L	25-150	0.456	0.502	0.436	0.213	0.485	0.385	0.496	0.526
Selenium (Se)	µg/L	1	**1.9**	**1.6**	**2.1**	**2.0**	**1.1**	**1.1**	0.8	0.6
Silver (Ag)	µg/L	0.1	0.0007	0.0014	0.002	0.003	0.002	0.001	<0.0005	<0.0005
Strontium (Sr)	µg/L		32.8	33.1	43.9	47.9	29.9	41.6	32.4	32.6
Thallium (Tl)	µg/L	0.8000	0.0144	0.0133	<0.0003	<0.0003	0.0071	0.0059	0.0056	0.0056
Tin (Sn)	µg/L		3.77	5.96	1.620	0.674	2.570	1.060	1.150	2.230
Uranium (U)	µg/L		0.0406	0.0429	0.037	0.033	0.038	0.040	0.030	0.039
Vanadium (V)	µg/L		0.139	0.156	0.056	0.116	0.208	0.346	0.288	0.476
Zinc (Zn)	µg/L	3, 13-198	1.05	2.53	2.04	0.98	2.58	3.73	0.79	3.66
Dissolved Metals										
Aluminum (Al)	µg/L		4.1	4.5	1.5	3.9	12.6	9.0	17.4	12.8
Antimony (Sb)	µg/L		0.0167	0.0423	0.0223	0.02	0.0163	0.0181	0.0154	0.0189
Arsenic (As)	µg/L		0.680	0.541	0.667	0.905	0.509	1.040	0.498	0.399
Barium (Ba)	µg/L		1.33	1.50	2.31	4.92	1.80	2.81	1.44	1.36
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		23.1	22.8	28.5	30.3	21.4	26.1	19.4	19.0
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.347	0.264	0.332	0.244	0.228	0.306	0.164	0.169
Cobalt (Co)	µg/L		0.0124	0.0137	0.0197	0.1740	0.0116	0.1580	0.0048	0.0026
Copper (Cu)	µg/L		1.35	1.66	1.6	1.4	1.2	1.0	1.5	2.9
Iron (Fe)	µg/L		2.7	<2.0	3.1	515	41.7	1670	59.3	45.8
Lead (Pb)	µg/L		0.031	0.031	0.0048	0.0121	0.0178	0.0248	0.0054	0.0131
Manganese (Mn)	µg/L		0.127	0.141	4.340	761	11.600	423	0.595	0.227
Molybdenum (Mo)	µg/L		0.163	0.151	0.134	0.232	0.121	0.154	0.154	0.144
Nickel (Ni)	µg/L		0.097	0.073	0.064	0.140	0.177	0.200	0.123	0.142
Selenium (Se)	µg/L		0.9	0.8	1.7	1.6	1.1	1.1	0.8	0.6
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		32.3	30.4	44	47	30	41	32	31
Uranium (U)	µg/L		0.0150	0.0180	0.024	0.022	0.026	0.026	0.017	0.017
Vanadium (V)	µg/L		0.049	<0.01	0.02	0.06	<0.01	0.13	0.02	0.04
Zinc (Zn)	µg/L		1.05	1.49	2.0	1.0	2.0	2.7	0.7	1.6
Other										
Cyanide, Total	mg/L		0.001	0.001	0.002	0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.05	0.05	0.06	0.06	0.13	0.09	0.04	0.04
Sulphide	mg/L		0.001	0.001	<0.001	0.051	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Pelvic Lake		Pelvic Outflow						
			13-Sep-07		19-Jun-06	21-Jul-06	16-Aug-06	22-Jun-07	19-Jul-07	18-Aug-07	16-Sep-07
			Top	Bottom							
Physical											
Alkalinity, Total ($CaCO_3$)	mg/L		21.8	21.7	20.7	19.9	21.4	20.3	21.0	22.5	21.7
Hardness, Total ($CaCO_3$)	mg/L		35.0	35.2	30.4	33.1	35.2	32.3	33.0	35.4	36.4
Conductivity	µS/cm		233	235	207	233	249	223	235	251	233
Field pH	units	6.5-9.0	-	-	6.6	8.8	7.9	6.5	7.5	7.0	6.7
TDS (Calculated)	mg/L		116	119	107	109	121	108	119	126	119
Total Suspended Solids	mg/L		8	7	5	7	9	3	3	8	9
Color, True	TCU		13	13	16	8	10	32	12	6	18
Nutrients											
Phosphorus, Total	mg/L		0.042	0.040	0.035	0.053	0.069	0.032	0.039	0.041	0.047
Total Kjeldahl Nitrogen	mg/L		0.67	0.68	0.60	0.71	0.88	0.53	0.52	0.61	0.75
Ammonia-N	mg/L	0.2-122.4	0.009	0.009	0.011	0.009	0.011	0.009	0.01	0.009	0.008
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	<0.005	<0.005	<0.005	0.033	<0.005	<0.005	<0.005
Organics											
Carbon Part	mg/L		1.99	2.45	1.31	2.22	2.11	0.70	1.20	1.61	2.76
Dissolved Organic Carbon	mg/L		6.5	5.9	5.2	4.7	4.8	6.3	3.9	5.9	5.2
Chlorophyll a	µg/L		14.4	-	-	-	-	-	-	-	-
Major Ions											
Calcium (Total)	mg/L		4.54	4.50	4.16	4.27	4.46	4.24	4.24	4.49	4.48
Calcium (Dissolved)	mg/L		4.14	4.26	3.82	3.90	4.16	4.19	4.03	4.32	4.24
Chloride (Cl)	mg/L		58.40	58.40	52.50	54.00	59.80	53.70	61.40	61.20	58.90
Magnesium (Total)	mg/L		6.44	6.45	4.81	5.75	6.02	5.53	5.46	6.18	5.62
Magnesium (Dissolved)	mg/L		5.96	6.17	4.53	5.34	5.65	5.37	5.09	6.05	5.34
Potassium (Total)	mg/L		2.10	2.09	1.84	1.95	2.02	2.05	1.93	2.13	2.05
Potassium (Dissolved)	mg/L		1.80	1.87	1.67	1.73	1.81	1.98	1.78	1.91	1.83
Sodium (Total)	mg/L		29.80	29.70	25.60	29.00	32.10	28.00	29.10	30.80	28.80
Sodium (Dissolved)	mg/L		27.80	29.00	23.50	27.20	30.20	26.90	27.60	30.49	27.60
Sulphate (SO_4)	mg/L		3	5	4	4	5		<3	5	4
Anions	meq/L		2.16	2.19	1.98	2.00	2.21	1.97	2.20	2.27	2.19
Cations	meq/L		2.00	2.07	1.85	1.93	2.10	1.94	2.06	2.25	2.08
Ion Balance	N/A		0.93	0.95	0.93	0.96	0.95	0.98	0.94	0.99	0.95
Total Metals											
Aluminum (Al)	µg/L	5, 100	**258**	**262**	**119**	**135**	**143**	80.4	**128**	**380**	**220**
Antimony (Sb)	µg/L		0.0232	0.0186	0.0138	0.0139	0.0158	0.0162	0.0119	0.0170	0.0171
Arsenic (As)	µg/L	5	0.540	0.541	0.406	0.433	0.764	0.529	0.519	0.692	0.498
Barium (Ba)	µg/L		4.70	4.65	3.45	3.23	3.16	3.68	3.33	6.29	4.48
Beryllium (Be)	µg/L		0.0066	0.0068	<0.003	<0.003	0.003	0.0050	0.0115	0.0098	0.0083
Bismuth (Bi)	µg/L		0.0134	0.0024	0.007	0.002	0.018	<0.001	<0.001	0.0112	0.0058
Boron (B)	µg/L		23.3	25.1	22.5	23.2	23.7	23.5	21.7	26.5	23.1
Cadmium (Cd)	µg/L	0.003-0.055	0.005	0.007	<0.002	0.005	<0.002	0.003	0.002	0.005	0.008
Chromium (Cr)	µg/L	1, 16	0.5	0.5	0.453	0.351	0.496	0.3	0.3	0.7	0.4
Cobalt (Co)	µg/L		0.0862	0.0797	0.082	0.064	0.091	0.131	0.0783	0.129	0.0825
Copper (Cu)	µg/L	2-4	1.8	1.4	1.55	1.43	1.58	1.5	1.2	1.5	1.4
Iron (Fe)	µg/L	300	233	230	149	134	178	176	233	**421**	218
Lead (Pb)	µg/L	1-7	0.21	0.11	0.045	0.098	0.173	0.02	0.04	0.13	0.16
Manganese (Mn)	µg/L		17.3	17.6	55.1	20.9	39.9	160.0	84.3	48.2	17.9
Mercury (Hg)	ng/L	26	<0.6	<0.6	<0.6	<0.6	<0.6	1.8	1.8	1.4	<0.6
Molybdenum (Mo)	µg/L	73	0.2	0.225	0.110	0.113	0.284	0.129	0.122	0.207	0.183
Nickel (Ni)	µg/L	25-150	0.627	0.570	0.706	0.403	0.524	0.529	0.419	0.619	0.573
Selenium (Se)	µg/L	1	0.5	0.5	0.9	0.7	**1.6**	**1.3**	**1.1**	1.0	0.5
Silver (Ag)	µg/L	0.1	0.007	0.004	0.0015	<0.0005	0.0018	<0.0005	0.010	<0.0005	0.006
Strontium (Sr)	µg/L		33.4	33.2	32.0	30.8	33.1	32.1	31.1	33.9	32.4
Thallium (Tl)	µg/L	0.8000	0.0053	0.0040	0.0064	0.0253	0.0138	0.0013	<0.0003	0.0066	0.0041
Tin (Sn)	µg/L		0.654	0.756	<0.03	0.14	0.08	<0.03	<0.03	<0.03	<0.03
Uranium (U)	µg/L		0.052	0.050	0.0339	0.0432	0.0510	0.033	0.033	0.053	0.052
Vanadium (V)	µg/L		0.371	0.348	0.190	0.287	0.303	0.106	0.221	0.676	0.803
Zinc (Zn)	µg/L	3, 13-198	1.88	0.90	4.41	0.67	2.02	0.65	1.38	2.05	1.93
Dissolved Metals											
Aluminum (Al)	µg/L		30.0	30.7	15.8	5.8	4.7	21.0	4.3	12.5	25.9
Antimony (Sb)	µg/L		0.023	0.0184	0.0134	0.0139	0.0158	0.016	0.0118	0.0168	0.0169
Arsenic (As)	µg/L		0.402	0.440	0.358	0.363	0.566	0.463	0.417	0.458	0.427
Barium (Ba)	µg/L		1.70	1.68	2.00	1.41	1.41	2.51	1.47	1.32	1.63
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	0.005	<0.003	<0.003	<0.003
Boron (B)	µg/L		20.4	22.0	21.7	21.4	21.6	22.4	20.1	22.9	21.0
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	0.003	<0.002	<0.002	0.004
Chromium (Cr)	µg/L		0.211	0.168	0.252	0.207	0.438	0.289	0.191	0.124	0.160
Cobalt (Co)	µg/L		0.0163	0.0138	0.0219	0.0143	0.0135	0.0331	0.0153	0.0020	0.0157
Copper (Cu)	µg/L		1.5	1.2	1.35	1.14	1.22	1.4	0.9	1.1	1.1
Iron (Fe)	µg/L		29.1	28.6	21.2	4.2	5.0	58.2	11.6	30.9	23.7
Lead (Pb)	µg/L		0.0691	0.1060	0.016	0.033	0.118	<0.001	<0.001	0.0034	0.0205
Manganese (Mn)	µg/L		0.269	0.248	33.900	0.228	0.226	83.800	1.020	<0.003	0.281
Molybdenum (Mo)	µg/L		0.167	0.156	0.081	0.105	0.144	0.108	0.115	0.191	0.175
Nickel (Ni)	µg/L		0.095	0.095	0.258	0.036	0.094	0.410	0.137	0.123	0.111
Selenium (Se)	µg/L		0.3	0.4	0.9	0.5	0.8	1.1	0.7	0.7	0.4
Silver (Ag)	µg/L		0.0065	0.0027	0.0006	<0.0005	<0.0005	<0.0005	0.0100	<0.0005	0.0054
Strontium (Sr)	µg/L		30	32	30.1	27.8	30.4	32	31	33	31
Uranium (U)	µg/L		0.032	0.033	0.0208	0.0257	0.0212	0.028	0.018	0.021	0.034
Vanadium (V)	µg/L		0.05	0.02	0.018	0.094	0.079	<0.01	0.01	0.05	0.46
Zinc (Zn)	µg/L		1.9	0.5	4.37	0.67	0.61	0.6	0.8	1.6	1.2
Other											
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.05	0.05	0.05	0.05	0.04	0.11	0.16	0.04	0.05
Sulphide	mg/L		<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	P.O. Lake						P.O. Outflow		
			23-Jul-06	15-Aug-06	8-Sep-06	17-Jul-07	15-Aug-07	11-Sep-07	19-Jun-06	24-Jul-06	15-Aug-06
Physical											
Alkalinity, Total ($CaCO_3$)	mg/L		30.1	32.0	33.8	32.0	34.2	34.6	17.8	28.3	31.3
Hardness, Total ($CaCO_3$)	mg/L		51.2	55.9	56.3	51.9	57.4	55.0	24.3	50.6	54.1
Conductivity	µS/cm		306	329	350	322	356	346	159	300	328
Field pH	units	6.5-9.0	7.4	8.3	8.3	7.4	7.0	7.1	6.6	7.1	8.2
TDS (Calculated)	mg/L		147	161	168	154	177	171	84.0	144	159
Total Suspended Solids	mg/L		<1	1	<1	<1	3	4	<1	1	<1
Color, True	TCU		<1	7	<1	8	4	13	51	11	10
Nutrients											
Phosphorus, Total	mg/L		0.008	0.020	0.019	0.010	0.014	0.188	0.008	0.010	0.021
Total Kjeldahl Nitrogen	mg/L		0.19	0.35	0.20	0.27	0.21	0.27	0.46	0.26	0.25
Ammonia-N	mg/L	0.2-122.4	0.005	0.011	0.007	0.016	0.009	0.014	0.087	0.006	0.008
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	0.014	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Organics											
Carbon Part	mg/L		0.17	0.12	0.12	0.20	0.19	0.34	0.27	0.08	0.18
Dissolved Organic Carbon	mg/L		3.4	3.7	3.4	3.4	3.9	4.4	8.4	4.0	4.1
Chlorophyll a	µg/L		-	-	1.3	1.2	1.3	2.5	-	-	-
Major Ions											
Calcium (Total)	mg/L		8.69	9.57	9.55	9.08	9.51	10.10	3.56	8.37	9.32
Calcium (Dissolved)	mg/L		7.78	8.82	9.03	8.57	9.48	9.87	3.40	7.01	8.73
Chloride (Cl)	mg/L		72.20	78.00	82.40	75.00	85.70	84.90	38.20	71.40	78.30
Magnesium (Total)	mg/L		7.12	8.23	7.88	7.71	8.34	8.63	3.72	7.65	8.35
Magnesium (Dissolved)	mg/L		6.45	7.67	7.58	7.21	8.32	8.57	3.62	6.26	7.83
Potassium (Total)	mg/L		2.63	2.87	2.76	2.93	3.08	3.20	1.33	2.56	2.67
Potassium (Dissolved)	mg/L		2.35	2.64	2.56	2.80	2.94	2.97	1.26	2.09	2.50
Sodium (Total)	mg/L		35.40	42.50	41.10	39.30	41.40	41.10	18.90	39.20	42.40
Sodium (Dissolved)	mg/L		32.40	39.60	40.30	37.80	40.99	40.69	17.10	32.20	40.00
Sulphate (SO_4)	mg/L		<3	4	5	<3	4	<3	7	<3	3
Anions	meq/L		2.68	2.93	3.10	2.81	3.18	3.13	1.58	2.62	2.91
Cations	meq/L		2.66	2.89	2.96	2.79	3.23	3.04	1.38	2.60	2.83
Ion Balance	N/A		0.99	0.98	0.96	0.99	1.02	0.97	0.87	0.99	0.97
Total Metals											
Aluminum (Al)	µg/L	5, 100	**106**	**115**	**176**	**121**	**369**	**527**	**192**	**115**	79.7
Antimony (Sb)	µg/L		0.0154	0.0268	0.0202	0.0133	0.0225	0.0228	0.0090	0.0142	0.0187
Arsenic (As)	µg/L	5	0.419	0.599	0.705	0.589	0.591	0.518	0.338	0.407	0.744
Barium (Ba)	µg/L		2.89	3.07	3.54	3.57	7.10	9.75	4.44	3.01	2.77
Beryllium (Be)	µg/L		<0.003	0.003	0.006	0.0055	0.0101	0.0235	0.006	0.005	<0.003
Bismuth (Bi)	µg/L		0.002	0.002	0.001	0.0011	0.0031	<0.001	0.002	0.011	<0.001
Boron (B)	µg/L		22.3	27.6	31.8	23.7	29	32.4	13.2	29.1	26.1
Cadmium (Cd)	µg/L	0.003-0.055	0.004	<0.002	0.003	<0.002	<0.002	<0.002	0.003	<0.002	0.002
Chromium (Cr)	µg/L	1, 16	0.444	0.358	0.5	0.3	0.7	1.0	0.395	0.222	0.353
Cobalt (Co)	µg/L		0.035	0.046	0.073	0.0631	0.108	0.12	0.071	0.045	0.066
Copper (Cu)	µg/L	2-4	1.10	1.36	1.09	0.8	1.4	2.0	1.95	1.03	1.31
Iron (Fe)	µg/L	300	94.2	104	176	195	285	**314**	258	168	221
Lead (Pb)	µg/L	1-7	0.082	0.183	0.106	0.07	0.13	0.21	0.095	0.068	0.162
Manganese (Mn)	µg/L		4.8	12.8	13.4	41.7	11.0	7.6	3.0	10.4	15.4
Mercury (Hg)	ng/L	26	1.2	20	15	3.4	0.8	1.8	<0.6	<0.6	<0.6
Molybdenum (Mo)	µg/L	73	0.198	0.268	0.305	0.142	0.249	0.802	0.139	0.205	0.374
Nickel (Ni)	µg/L	25-150	0.322	0.377	0.422	0.465	0.594	0.801	1.280	0.311	0.760
Selenium (Se)	µg/L	1	0.8	**1.5**	**2.2**	**1.3**	**1.3**	**1.2**	0.5	0.7	**2.0**
Silver (Ag)	µg/L	0.1	0.0023	<0.0005	0.0014	0.003	<0.0005	0.004	0.0013	0.0018	<0.0005
Strontium (Sr)	µg/L		56.7	61.9	63.1	57.4	64.1	66.3	21.9	53.2	59.8
Thallium (Tl)	µg/L	0.8000	0.0097	0.0085	0.0124	0.0059	0.0053	0.0053	0.0052	0.0141	0.0061
Tin (Sn)	µg/L		0.45	2.32	0.15	2.590	2.060	1.040	<0.03	<0.03	0.14
Uranium (U)	µg/L		0.0727	0.0843	0.0806	0.046	0.049	0.069	0.0283	0.0617	0.0779
Vanadium (V)	µg/L		0.260	0.225	0.331	0.164	0.632	0.793	0.183	0.171	0.400
Zinc (Zn)	µg/L	3, 13-198	2.30	4.29	1.35	5.89	2.28	1.41	11.30	0.90	2.74
Dissolved Metals											
Aluminum (Al)	µg/L		17.3	18.3	8.5	7.5	21.9	95.5	66.7	20.2	18.4
Antimony (Sb)	µg/L		0.0149	0.0268	0.0202	0.0132	0.0223	0.0226	0.0089	0.0136	0.0187
Arsenic (As)	µg/L		0.346	0.523	0.552	0.491	0.439	0.424	0.319	0.297	0.630
Barium (Ba)	µg/L		1.65	1.68	1.55	2.14	2.75	3.72	3.11	1.65	1.82
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	0.005	<0.003	<0.003	<0.003
Boron (B)	µg/L		19.5	24.9	28.2	22.0	28.6	30.4	12.9	21.7	24.3
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002
Chromium (Cr)	µg/L		0.294	0.234	0.360	0.094	0.145	0.480	0.387	0.169	0.242
Cobalt (Co)	µg/L		0.0031	0.0088	0.0043	0.0064	<0.001	0.0247	0.0512	0.0122	0.0155
Copper (Cu)	µg/L		0.81	0.99	0.89	0.7	0.8	1.3	1.92	0.77	0.84
Iron (Fe)	µg/L		7.9	5.7	2.3	36.0	9.6	48.4	149	52.0	55.8
Lead (Pb)	µg/L		0.040	0.142	0.030	0.0143	0.0051	0.0645	0.094	0.042	0.130
Manganese (Mn)	µg/L		0.182	0.235	0.128	0.545	<0.003	0.503	2.230	0.626	0.350
Molybdenum (Mo)	µg/L		0.175	0.249	0.274	0.136	0.233	0.243	0.139	0.202	0.227
Nickel (Ni)	µg/L		0.143	0.229	0.225	0.321	0.313	0.438	1.090	0.273	0.300
Selenium (Se)	µg/L		0.7	1.2	1.0	1.2	0.8	0.9	0.5	0.6	1.2
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0006	0.0011	<0.0005	<0.0005
Strontium (Sr)	µg/L		50.2	56.6	59.5	55	62	63	21.0	44.1	58.0
Uranium (U)	µg/L		0.0289	0.0451	0.0405	0.037	0.032	0.048	0.0216	0.0190	0.0443
Vanadium (V)	µg/L		0.111	0.056	0.090	<0.01	0.02	0.22	0.103	0.084	<0.01
Zinc (Zn)	µg/L		0.49	0.86	1.12	4.5	1.5	0.7	11.10	0.90	0.82
Other											
Cyanide, Total	mg/L		<0.001	0.002	0.001	<0.001	<0.001	<0.001	0.001	<0.001	0.002
Fluoride (F)	mg/L		0.05	0.05	0.06	0.15	0.05	0.06	0.06	0.05	0.05
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG			P.O. Outflow			Windy Lake			
			9-Sep-06	22-Jun-07	19-Jul-07	12-Aug-07	17-Sep-07	2-Jun-06		24-Jul-06	
								Top	Bottom	Top	Bottom
Physical											
Alkalinity, Total ($CaCO_3$)	mg/L		33.2	16.7	32.5	33.5	30.3	55.8	57.2	48.4	48.4
Hardness, Total ($CaCO_3$)	mg/L		57.2	23.4	53.1	56.3	52.3	76.0	77.4	69.2	67.9
Conductivity	µS/cm		349	140	321	327	312	484	503	433	434
Field pH	units	6.5-9.0	7.7	**5.6**	7.3	7.2	6.8	6.7	-	6.9	-
TDS (Calculated)	mg/L		167	66.1	164	169	156	245	250	210	210
Total Suspended Solids	mg/L		7	3	1	4	2	<1	<1	1	<1
Color, True	TCU		5	73	9	5	28	<1	<1	11	<1
Nutrients											
Phosphorus, Total	mg/L		0.028	0.029	0.010	0.014	0.012	0.006	0.011	0.008	0.007
Total Kjeldahl Nitrogen	mg/L		0.24	0.50	0.27	0.23	0.30	0.09	0.10	0.16	0.11
Ammonia-N	mg/L	0.2-122.4	0.003	0.022	0.015	0.006	0.01	0.022	0.018	0.025	0.004
Nitrite-N	mg/L	0.06	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	0.026	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Organics											
Carbon Part	mg/L		0.14	0.70	0.15	0.27	0.41	0.04	0.05	<0.02	0.03
Dissolved Organic Carbon	mg/L		4.1	9.5	3.3	3.1	5.8	1.9	1.9	3.6	1.4
Chlorophyll a	µg/L		-	-	-	-	-	-	-	-	-
Major Ions											
Calcium (Total)	mg/L		9.51	4.18	9.06	9.61	8.38	13.40	13.50	11.60	11.50
Calcium (Dissolved)	mg/L		9.51	3.98	8.90	9.47	8.11	12.80	12.90	10.70	10.30
Chloride (Cl)	mg/L		82.30	30.50	84.30	82.40	79.10	109.00	115.00	95.30	95.20
Magnesium (Total)	mg/L		8.61	3.77	7.18	8.29	7.18	13.00	12.60	10.60	9.80
Magnesium (Dissolved)	mg/L		8.56	3.60	6.97	8.18	6.95	12.20	11.90	9.92	8.78
Potassium (Total)	mg/L		2.66	2.39	2.81	3.10	2.71	4.42	4.44	4.02	3.88
Potassium (Dissolved)	mg/L		2.66	2.26	2.71	2.96	2.53	4.23	4.24	7.70	3.45
Sodium (Total)	mg/L		42.70	16.20	37.50	42.00	36.30	64.30	63.10	61.10	55.50
Sodium (Dissolved)	mg/L		42.70	15.80	36.10	41.58	35.50	60.90	61.10	57.50	50.00
Sulphate (SO_4)	mg/L		5	<3	<3	<3	3	10	10	6	7
Anions	meq/L		3.09	1.24	3.08	3.04	2.91	4.39	4.61	3.78	3.79
Cations	meq/L		2.92	1.17	2.83	3.10	2.73	4.47	4.37	3.86	3.83
Ion Balance	N/A		0.95	0.94	0.92	1.02	0.94	1.02	0.95	1.02	1.01
Total Metals											
Aluminum (Al)	µg/L	5, 100	**113**	**275**	**106**	**318**	**321**	5.64	9.19	62.0	61.4
Antimony (Sb)	µg/L		0.0172	0.0118	0.0129	0.0246	0.0211	0.0691	0.0693	0.0564	0.0603
Arsenic (As)	µg/L	5	0.624	0.388	0.523	0.581	0.406	0.572	0.596	0.451	0.493
Barium (Ba)	µg/L		3.09	5.58	3.40	6.67	7.28	2.35	2.40	2.39	2.61
Beryllium (Be)	µg/L		0.005	0.0123	0.0034	0.0060	0.0036	<0.003	<0.003	0.005	<0.003
Bismuth (Bi)	µg/L		0.012	<0.001	<0.001	0.0130	0.0041	0.004	0.002	0.004	0.001
Boron (B)	µg/L		25.2	15.3	24.5	27.4	25.1	56.3	53.0	57.5	46.5
Cadmium (Cd)	µg/L	0.003-0.055	0.003	0.007	<0.002	0.003	0.010	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L	1, 16	0.343	0.7	0.3	0.6	0.6	0.351	0.26	0.227	0.471
Cobalt (Co)	µg/L		0.046	0.22	0.0575	0.15	0.0957	0.004	0.005	0.023	0.023
Copper (Cu)	µg/L	2-4	0.93	1.5	0.7	0.9	1.8	0.92	0.97	1.23	0.92
Iron (Fe)	µg/L	300	177	**346**	196	**479**	251	<2.0	<2.0	44.4	52.2
Lead (Pb)	µg/L	1-7	0.071	0.09	0.04	0.19	0.32	0.036	0.004	0.075	0.067
Manganese (Mn)	µg/L		9.1	92.9	31.0	26.8	6.0	0.6	0.7	2.0	2.1
Mercury (Hg)	ng/L	26	5.2	3.9	<0.6	<0.6	<0.6			<0.6	6.7
Molybdenum (Mo)	µg/L	73	0.256	0.164	0.137	0.26	0.214	0.802	0.796	0.645	0.670
Nickel (Ni)	µg/L	25-150	0.395	1.210	0.412	0.631	1.080	0.062	0.088	0.041	0.182
Selenium (Se)	µg/L	1	**1.8**	0.8	**1.1**	**1.2**	0.7	**1.7**	**1.6**	**1.1**	**1.3**
Silver (Ag)	µg/L	0.1	0.0014	<0.0005	0.050	<0.0005	0.003	0.0012	0.0012	0.0013	0.0019
Strontium (Sr)	µg/L		60.4	25.8	57.5	62.7	53.1	69.0	69.3	57.7	58.4
Thallium (Tl)	µg/L	0.8000	0.0146	0.0016	<0.0003	0.0066	0.0043	0.0036	0.0014	0.0100	0.0085
Tin (Sn)	µg/L		0.04	<0.03	0.065	<0.03	<0.03	2.51	0.86	1.32	1.91
Uranium (U)	µg/L		0.0685	0.041	0.044	0.047	0.053	0.2400	0.2930	0.2210	0.2420
Vanadium (V)	µg/L		0.208	0.467	0.232	0.584	1.020	0.023	0.046	0.102	0.172
Zinc (Zn)	µg/L	3, 13-198	0.95	4.67	2.95	6.63	2.64	13.20	1.66	1.09	1.68
Dissolved Metals											
Aluminum (Al)	µg/L		9.4	45.8	7.1	10.4	72.2	1.2	1.1	3.4	3.0
Antimony (Sb)	µg/L		0.0172	0.0117	0.0128	0.0244	0.0209	0.0683	0.0693	0.0564	0.0603
Arsenic (As)	µg/L		0.460	0.325	0.428	0.370	0.360	0.571	0.585	0.398	0.417
Barium (Ba)	µg/L		2.11	2.40	2.24	2.63	3.63	2.19	2.20	1.69	1.76
Beryllium (Be)	µg/L		<0.003	0.008	0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		25.2	14.5	22.7	26.8	24.3	52.3	51.7	53.7	39.4
Cadmium (Cd)	µg/L		0.003	0.003	<0.002	<0.002	0.004	<0.002	<0.002	0.014	0.008
Chromium (Cr)	µg/L		0.301	0.352	0.218	0.130	0.300	0.344	0.253	0.227	0.469
Cobalt (Co)	µg/L		0.0103	0.0360	0.0111	0.0033	0.0264	<0.001	0.0028	0.0028	<0.001
Copper (Cu)	µg/L		0.92	1.3	0.5	0.6	1.1	0.74	0.69	0.66	0.64
Iron (Fe)	µg/L		10.4	100	23.1	10.1	63.7	<2.0	<2.0	<2.0	<2.0
Lead (Pb)	µg/L		0.034	0.0124	<0.001	0.0069	0.0523	<0.001	<0.001	0.036	0.039
Manganese (Mn)	µg/L		0.200	10.800	0.238	0.067	1.300	0.023	0.022	0.173	0.150
Molybdenum (Mo)	µg/L		0.251	0.130	0.134	0.240	0.209	0.774	0.795	0.609	0.594
Nickel (Ni)	µg/L		0.329	0.900	0.285	0.301	0.643	0.062	0.074	0.041	<0.005
Selenium (Se)	µg/L		1.3	0.6	0.9	0.7	0.6	1.7	1.6	1.0	1.0
Silver (Ag)	µg/L		<0.0005	<0.0005	0.0500	<0.0005	<0.0005	0.0009	<0.0005	0.0006	<0.0005
Strontium (Sr)	µg/L		60.2	25	57	61	51	66.8	67.0	52.8	51.5
Uranium (U)	µg/L		0.0388	0.034	0.029	0.031	0.039	0.0409	0.0382	0.0441	0.0395
Vanadium (V)	µg/L		0.092	0.12	<0.01	0.04	0.61	0.022	0.043	0.049	0.107
Zinc (Zn)	µg/L		0.95	4.6	1.8	3.4	2.6	13.10	1.61	1.04	1.32
Other											
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.06	0.08	0.18	0.07	0.06	0.08	0.10	0.07	0.07
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Windy Lake							
			18-Aug-06		9-Sep-06		24-May-07		18-Jul-07	
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
Physical										
Alkalinity, Total ($CaCO_3$)	mg/L		48.7	48.7	49.3	49.0	57.9	57.8	23.2	57.5
Hardness, Total ($CaCO_3$)	mg/L		68.7	68.6	70.0	69.4	80.7	80.7	53.5	78.7
Conductivity	µS/cm		428	428	438	439	481	480	153	508
Field pH	units	6.5-9.0	8.2	-	8.1	-	7.5	-	7.3	-
TDS (Calculated)	mg/L		211	210	215	209	259	253	88.9	254
Total Suspended Solids	mg/L		1	<1	<1	<1	<1	<1	<1	<1
Color, True	TCU		<1	<1	<1	<1	<5	<5	<5	<5
Nutrients										
Phosphorus, Total	mg/L		0.015	0.018	0.019	0.022	0.004	0.003	0.005	0.004
Total Kjeldahl Nitrogen	mg/L		0.11	0.11	0.12	0.09	0.12	0.10	0.07	0.10
Ammonia-N	mg/L	0.2-122.4	0.006	0.006	0.003	0.003	0.009	0.004	0.014	0.013
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	<0.005	<0.005	<0.005	0.015	<0.005	<0.005
Organics										
Carbon Part	mg/L		0.18	0.12	0.10	0.05	0.09	0.05	0.03	0.05
Dissolved Organic Carbon	mg/L		1.8	1.7	1.8	1.7	1.4	1.4	1.2	1.4
Chlorophyll a	µg/L		-	-	0.9	-	-	-	0.3	-
Major Ions										
Calcium (Total)	mg/L		11.70	11.70	11.70	11.80	13.90	13.60	8.72	13.70
Calcium (Dissolved)	mg/L		10.70	10.90	11.00	11.00	13.60	13.20	8.53	13.20
Chloride (Cl)	mg/L		94.80	94.90	96.10	94.50	115.00	112.00	33.10	116.00
Magnesium (Total)	mg/L		9.89	9.82	9.90	9.85	11.70	11.40	7.16	11.00
Magnesium (Dissolved)	mg/L		9.06	9.21	9.31	9.31	11.70	11.10	6.98	10.89
Potassium (Total)	mg/L		3.99	3.96	3.99	4.03	4.71	4.57	2.87	4.55
Potassium (Dissolved)	mg/L		3.62	36.70	3.72	3.72	4.59	4.41	2.81	4.43
Sodium (Total)	mg/L		55.80	55.50	56.40	56.10	67.30	65.10	40.60	61.10
Sodium (Dissolved)	mg/L		50.90	51.80	53.50	52.70	67.00	64.00	39.90	60.49
Sulphate (SO_4)	mg/L		7	6	11	8	8	8	6	8
Anions	meq/L		3.79	3.79	3.93	3.81	4.59	4.49	1.52	4.59
Cations	meq/L		3.85	3.84	3.80	3.75	4.81	4.70	1.91	4.61
Ion Balance	N/A		1.02	1.01	0.97	0.99	1.05	1.05	1.25	1.00
Total Metals										
Aluminum (Al)	µg/L	5, 100	65.2	82.4	41.8	39.1	12.9	17.2	91.1	66.7
Antimony (Sb)	µg/L		0.0640	0.0695	0.0603	0.0602	0.0682	0.0597	0.0441	0.0661
Arsenic (As)	µg/L	5	0.551	0.622	0.716	0.728	0.731	0.757	0.386	0.616
Barium (Ba)	µg/L		2.51	2.79	2.34	2.37	2.23	2.50	2.29	2.76
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	0.004	<0.003	<0.003	0.0069	0.0035
Bismuth (Bi)	µg/L		0.003	0.002	0.003	<0.001	0.0023	0.0018	<0.001	<0.001
Boron (B)	µg/L		50.1	50.2	49.6	50.9	57.1	54.3	34.9	52
Cadmium (Cd)	µg/L	0.003-0.055	0.004	0.013	<0.002	<0.002	0.004	<0.002	0.002	0.003
Chromium (Cr)	µg/L	1, 16	0.358	0.401	0.351	0.329	0.3	0.3	0.3	0.3
Cobalt (Co)	µg/L		0.035	0.035	0.013	0.013	0.0062	0.0031	0.0226	0.014
Copper (Cu)	µg/L	2-4	0.98	1.80	0.90	0.93	1.0	0.8	0.8	0.8
Iron (Fe)	µg/L	300	44.1	60.0	33.4	33.4	<2.0	<2.0	42.1	30.2
Lead (Pb)	µg/L	1-7	0.133	0.311	0.044	0.046	0.05	0.01	0.02	0.01
Manganese (Mn)	µg/L		1.8	2.4	1.6	1.7	0.7	1.2	1.7	2.0
Mercury (Hg)	ng/L	26	5	4.2	0.6	5.9	<0.6	1.4	1.7	1.9
Molybdenum (Mo)	µg/L	73	0.743	0.695	0.678	0.688	0.815	0.662	0.461	0.713
Nickel (Ni)	µg/L	25-150	0.220	0.156	0.127	0.088	0.199	0.022	0.155	0.063
Selenium (Se)	µg/L	1	**1.5**	**1.7**	**2.1**	**2.3**	**2.2**	**2.3**	0.9	**1.6**
Silver (Ag)	µg/L	0.1	0.0026	0.0021	0.0011	0.0012	0.002	0.002	0.040	<0.0005
Strontium (Sr)	µg/L		59.3	58.6	59.7	60.4	67.4	67.1	44.5	68.0
Thallium (Tl)	µg/L	0.8000	0.0020	0.0027	0.0125	0.0115	<0.0003	<0.0003	<0.0003	<0.0003
Tin (Sn)	µg/L		1.56	5.64	3.18	0.92	0.397	1.000	1.340	0.962
Uranium (U)	µg/L		0.2200	0.2260	0.2120	0.2380	0.199	0.161	0.137	0.212
Vanadium (V)	µg/L		0.209	0.160	0.076	0.098		0.028	0.238	0.145
Zinc (Zn)	µg/L	3, 13-198	8.19	8.35	0.77	1.25	2.91	1.25	3.53	1.35
Dissolved Metals										
Aluminum (Al)	µg/L		3.6	3.2	3.0	2.4	1.8	1.4	2.6	1.9
Antimony (Sb)	µg/L		0.0640	0.0695	0.0603	0.0602	0.0675	0.0591	0.0437	0.0654
Arsenic (As)	µg/L		0.431	0.507	0.620	0.578	0.693	0.633	0.354	0.536
Barium (Ba)	µg/L		1.76	1.88	1.82	1.86	2.20	2.49	1.46	2.13
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		45.1	46.4	45.4	46.8	56.6	52.9	32.8	51.7
Cadmium (Cd)	µg/L		<0.002	0.009	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.245	0.366	0.348	0.324	0.266	0.338	0.127	0.227
Cobalt (Co)	µg/L		0.0027	0.0034	0.0010	<0.001	0.0061	0.0030	0.0033	0.0070
Copper (Cu)	µg/L		0.59	0.97	0.85	0.69	0.9	0.8	0.5	0.6
Iron (Fe)	µg/L		<2.0	<2.0	4.0	3.3	<2.0	<2.0	<2.0	<2.0
Lead (Pb)	µg/L		0.101	0.108	0.031	0.025	0.0041	0.0049	<0.001	<0.001
Manganese (Mn)	µg/L		0.134	0.136	0.090	0.087	0.215	0.225	0.046	0.126
Molybdenum (Mo)	µg/L		0.639	0.636	0.651	0.653	0.770	0.655	0.452	0.706
Nickel (Ni)	µg/L		0.020	0.048	0.081	0.070	<0.005	<0.005	0.016	0.005
Selenium (Se)	µg/L		1.3	1.3	1.4	1.5	1.9	1.8	0.8	1.3
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	0.0011	0.0016	0.0400	0.0400
Strontium (Sr)	µg/L		54.3	55.1	55.1	56.1	67	66	43	66
Uranium (U)	µg/L		0.1590	0.1260	0.1010	0.1070	0.186	0.144	0.118	0.193
Vanadium (V)	µg/L		0.025	0.049	0.076	0.066	0.08	<0.01	<0.01	<0.01
Zinc (Zn)	µg/L		1.16	2.22	0.77	1.18	2.1	1.2	1.1	0.7
Other										
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.06	0.06	0.09	0.07	0.08	0.08	0.18	0.25
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Windy Lake				Windy Outflow				
			20-Aug-07		15-Sep-07		19-Jun-06	23-Jul-06	12-Aug-06	16-Aug-06	9-Sep-06
			Top	Bottom	Top	Bottom					
Physical											
Alkalinity, Total ($CaCO_3$)	mg/L		49.1	49.2	49.5	49.3	52.3	48.3	47.8	21.4	48.1
Hardness, Total ($CaCO_3$)	mg/L		67.2	65.3	70.4	70.0	69.1	68.7	67.7	35.3	68.2
Conductivity	µS/cm		427	426	417	416	435	433	431	-	437
Field pH	units	6.5-9.0	**6.4**	**6.4**	-	-	7.0	7.5	7.8	-	6.9
TDS (Calculated)	mg/L		212	213	212	181	221	211	212	121	214
Total Suspended Solids	mg/L		1	<1	5	1	<1	<1	<1	10	<1
Color, True	TCU		<5	<5	<5	<5	2	<1	<1	7	<1
Nutrients											
Phosphorus, Total	mg/L		0.006	0.006	0.005	0.007	0.003	0.009	0.021	0.073	0.019
Total Kjeldahl Nitrogen	mg/L		0.11	0.12	0.08	0.09	0.12	0.14	0.14	0.97	0.11
Ammonia-N	mg/L	0.2-122.4	0.008	0.009	0.005	0.008	0.016	0.006	0.009	0.010	0.002
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.005	<0.005
Organics											
Carbon Part	mg/L		0.07	0.17	0.16	0.45	0.10	0.11	0.13	2.40	0.14
Dissolved Organic Carbon	mg/L		1.6	1.6	1.2	1.9	1.8	1.8	2.0	4.7	1.9
Chlorophyll a	µg/L		1.1	-	0.8	-	-	-	-	-	-
Major Ions											
Calcium (Total)	mg/L		11.20	11.00	11.10	11.50	12.10	11.60	11.70	4.53	11.50
Calcium (Dissolved)	mg/L		10.80	10.80	11.00	10.70	11.10	10.30	10.70	4.06	11.20
Chloride (Cl)	mg/L		94.60	96.00	96.00	78.90	102.00	94.70	95.50	59.30	95.80
Magnesium (Total)	mg/L		9.82	9.69	9.35	9.62	9.68	10.60	9.76	6.18	9.58
Magnesium (Dissolved)	mg/L		9.62	9.47	9.26	9.52	8.70	9.57	9.10	5.49	9.52
Potassium (Total)	mg/L		3.72	3.69	3.83	3.95	3.93	3.97	3.92	2.11	3.89
Potassium (Dissolved)	mg/L		3.60	3.59	3.75	3.70	3.54	3.56	3.65	1.80	3.83
Sodium (Total)	mg/L		55.40	55.00	51.90	53.20	53.80	60.50	55.00	32.30	55.30
Sodium (Dissolved)	mg/L		54.60	53.90	51.60	50.80	48.40	55.40	51.40	29.20	55.10
Sulphate (SO_4)	mg/L		5	6	8	9	9	7	9	6	11
Anions	meq/L		3.76	3.82	3.87	3.40	4.12	3.79	3.85	2.22	3.90
Cations	meq/L		3.96	3.91	3.80	3.18	3.78	3.86	3.79	2.10	3.76
Ion Balance	N/A		1.05	1.02	0.98	0.94	0.92	1.02	0.99	0.95	0.96
Total Metals											
Aluminum (Al)	µg/L	5, 100	**89.7**	**93.3**	**110**	**146**	27.0	26.5	35.6	**204**	48.7
Antimony (Sb)	µg/L		0.0862	0.1010	0.0909	0.0835	0.0586	0.0540	0.0591	0.0156	0.0562
Arsenic (As)	µg/L	5	0.513	0.477	0.433	0.494	0.554	0.457	0.676	0.726	0.650
Barium (Ba)	µg/L		2.86	2.89	3.06	3.64	2.37	2.16	2.07	3.82	2.35
Beryllium (Be)	µg/L		0.0075	0.0067	<0.003	<0.003	<0.003	<0.003	<0.003	0.004	<0.003
Bismuth (Bi)	µg/L		<0.001	<0.001	0.0012	0.0018	0.010	0.002	0.002	0.004	0.005
Boron (B)	µg/L		49.6	48.7	46.8	49.1	51.3	57.6	46.8	22.9	46.5
Cadmium (Cd)	µg/L	0.003-0.055	0.010	<0.002	0.003	0.017	<0.002	0.003	0.002	0.004	0.004
Chromium (Cr)	µg/L	1, 16	0.1	0.2	0.4	0.5	0.219	0.183	0.298	0.6	0.294
Cobalt (Co)	µg/L		0.0317	0.0353	0.0354	0.0675	0.019	0.010	0.021	0.115	0.019
Copper (Cu)	µg/L	2-4	1.2	1.1	1.3	1.9	0.92	0.85	0.84	1.71	0.83
Iron (Fe)	µg/L	300	63.7	72.4	88.3	125	25.3	31.0	58.0	247	66.5
Lead (Pb)	µg/L	1-7	0.04	0.04	0.18	0.24	0.022	0.048	0.114	0.215	0.045
Manganese (Mn)	µg/L		2.9	3.1	3.6	4.3	1.6	1.3	1.4	49.2	1.5
Mercury (Hg)	ng/L	26	<0.6	<0.6	<0.6	1.0	<0.6	0.8	<0.6	<0.6	<0.6
Molybdenum (Mo)	µg/L	73	0.608	0.611	0.651	0.675	0.703	0.627	0.679	0.159	0.676
Nickel (Ni)	µg/L	25-150	0.304	0.180	0.236	0.250	0.063	0.028	0.099	0.708	0.104
Selenium (Se)	µg/L	1	**1.1**	0.9	0.9	1.0	**1.5**	**1.2**	**1.8**	**1.7**	**2.0**
Silver (Ag)	µg/L	0.1	0.006	0.009	0.002	0.003	0.0014	0.0015	0.0021	<0.0005	0.0012
Strontium (Sr)	µg/L		58.3	57.8	56.9	59.0	65.0	58.0	58.2	33.7	58.3
Thallium (Tl)	µg/L	0.8000	0.0013	0.0016	0.0040	0.0038	0.0067	0.0084	0.0050	0.0110	0.0125
Tin (Sn)	µg/L		0.554	0.899	1.660	2.560	<0.03	0.20	0.08	0.03	0.04
Uranium (U)	µg/L		0.186	0.184	0.187	0.197	0.2600	0.1870	0.2970	0.0533	0.2480
Vanadium (V)	µg/L		0.072	0.057	0.206	0.290	0.026	<0.01	0.060	0.344	0.082
Zinc (Zn)	µg/L	3, 13-198	2.99	1.14	1.42	4.22	1.62	1.27	4.11	3.43	0.80
Dissolved Metals											
Aluminum (Al)	µg/L		4.3	1.6	4.8	7.4	2.8	2.6	5.0	4.4	5.5
Antimony (Sb)	µg/L		0.0853	0.1	0.09	0.0827	0.0524	0.0533	0.0591	0.0156	0.0562
Arsenic (As)	µg/L		0.445	0.392	0.358	0.420	0.470	0.386	0.560	0.563	0.580
Barium (Ba)	µg/L		1.89	1.92	1.92	2.04	1.89	1.63	1.59	1.33	1.83
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		48.9	47.0	45.9	45.3	44.8	52.0	42.1	20.7	44.8
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	0.007	<0.002	0.003	0.002	0.002	0.004
Chromium (Cr)	µg/L		0.091	<0.003	0.241	0.247	0.218	0.181	0.256	0.300	0.291
Cobalt (Co)	µg/L		<0.001	0.0013	0.0028	<0.001	0.0036	0.0020	0.0078	0.0155	0.0026
Copper (Cu)	µg/L		0.7	0.7	0.9	1.1	0.78	0.60	0.61	1.17	0.79
Iron (Fe)	µg/L		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	4.3	4.1	6.3
Lead (Pb)	µg/L		<0.001	<0.001	0.0985	0.0301	0.005	0.030	0.107	0.149	0.030
Manganese (Mn)	µg/L		0.037	0.054	0.075	0.089	0.473	0.132	0.152	0.332	0.108
Molybdenum (Mo)	µg/L		0.602	0.611	0.644	0.643	0.663	0.583	0.642	0.115	0.669
Nickel (Ni)	µg/L		0.084	0.112	0.082	0.104	0.063	0.017	0.034	0.114	0.064
Selenium (Se)	µg/L		0.9	0.7	0.8	0.8	1.2	1.0	1.4	0.9	1.5
Silver (Ag)	µg/L		0.0029	0.0031	0.0016	<0.0005	<0.0005	0.0005	<0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		56	56	56	55	60.3	51.2	54.0	29.4	56.8
Uranium (U)	µg/L		0.168	0.173	0.175	0.168	0.0684	0.0205	0.1880	0.0197	0.1530
Vanadium (V)	µg/L		<0.01	<0.01	0.02	<0.01	0.018	<0.01	<0.01	0.035	0.079
Zinc (Zn)	µg/L		1.4	0.8	0.7	2.2	1.57	0.54	1.64	3.16	0.79
Other											
Cyanide, Total	mg/L		0.001	<0.001	<0.001	<0.001	0.002	<0.001	0.002	0.002	<0.001
Fluoride (F)	mg/L		0.07	0.06	0.07	0.07	0.08	0.06	0.05	0.03	0.09
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Windy Outflow				Wolverine Lake				
			22-Jun-07	19-Jul-07	12-Aug-07	15-Sep-07	1-Jun-06	22-Jul-06		12-Aug-06	8-Sep-06
							Bottom	Top	Bottom	Top	Top
Physical											
Alkalinity, Total ($CaCO_3$)	mg/L		24.2	39.7	48.2	49.0	23.2	35.6	35.7	36.9	38.0
Hardness, Total ($CaCO_3$)	mg/L		24.9	54.4	69.4	72.8	35.8	55.4	55.9	57.1	58.1
Conductivity	µS/cm		86.0	329	389	411	215	348	348	372	375
Field pH	units	6.5-9.0	7.2	6.9	7.1	-	6.6	8.1	-	7.8	8.3
TDS (Calculated)	mg/L		43.1	168	204	214	108	166	168	181	181
Total Suspended Solids	mg/L		4	<1	<1	<1	1	2	2	<1	<1
Color, True	TCU		48	7	11	<5	31	11	11	7	1
Nutrients											
Phosphorus, Total	mg/L		0.016	0.007	0.005	0.004	0.024	0.014	0.014	0.027	0.024
Total Kjeldahl Nitrogen	mg/L		0.35	0.11	0.12	0.08	0.40	0.36	0.37	0.35	0.35
Ammonia-N	mg/L	0.2-122.4	0.02	0.008	0.003	0.007	0.025	0.007	0.007	0.007	0.006
Nitrite-N	mg/L	0.06	0.002	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	0.011	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Organics											
Carbon Part	mg/L		0.77	0.08	0.10	0.50	0.59	0.35	0.32	0.25	0.52
Dissolved Organic Carbon	mg/L		5.8	1.5	2.3	1.6	7.0	4.9	4.6	4.8	4.8
Chlorophyll a	µg/L		-	-	-	-	-	-	-	-	4.5
Major Ions											
Calcium (Total)	mg/L		5.82	9.05	12.90	11.90	5.40	8.14	8.21	8.41	8.50
Calcium (Dissolved)	mg/L		5.64	8.64	12.40	11.30	4.89	7.42	7.47	7.68	7.94
Chloride (Cl)	mg/L		8.90	78.50	89.60	95.90	52.70	81.10	82.40	89.00	88.80
Magnesium (Total)	mg/L		2.71	7.25	10.30	9.53	5.47	9.24	9.47	9.34	8.95
Magnesium (Dissolved)	mg/L		2.70	6.91	10.10	9.44	4.43	8.45	8.58	8.71	8.47
Potassium (Total)	mg/L		1.28	2.77	3.59	3.86	2.04	2.40	2.43	2.42	2.24
Potassium (Dissolved)	mg/L		1.22	2.63	3.50	3.69	1.81	2.17	2.20	2.22	2.09
Sodium (Total)	mg/L		5.53	39.20	53.40	52.70	28.00	47.20	48.10	46.90	46.10
Sodium (Dissolved)	mg/L		5.48	37.70	52.80	50.60	25.20	43.50	44.20	43.90	43.60
Sulphate (SO_4)	mg/L		3	4	8	9	<3	<3	<3	4	4
Anions	meq/L		0.81	3.17	3.65	3.87	1.99	3.04	3.08	3.33	3.36
Cations	meq/L		0.83	2.97	3.75	3.90	1.94	3.03	3.06	3.20	3.19
Ion Balance	N/A		1.03	0.94	1.03	1.01	0.97	1.00	0.99	0.96	0.95
Total Metals											
Aluminum (Al)	µg/L	5, 100	62.5	26.8	32.1	27.1	41.7	25.7	52.8	63.9	59.8
Antimony (Sb)	µg/L		0.0374	0.0419	0.0571	0.0584	0.0154	0.0072	0.0084	0.0112	0.0121
Arsenic (As)	µg/L	5	0.316	0.452	0.432	0.420	0.399	0.541	0.546	0.815	0.603
Barium (Ba)	µg/L		2.97	1.89	2.41	2.20	3.98	3.52	3.71	4.32	4.14
Beryllium (Be)	µg/L		0.0058	<0.003	0.0044	<0.003	<0.003	0.005	0.003	<0.003	<0.003
Bismuth (Bi)	µg/L		<0.001	0.0026	<0.001	<0.001	0.001	0.002	0.003	0.002	0.005
Boron (B)	µg/L		16.8	40.9	50	47.8	13.6	21.8	23.2	23.0	21.9
Cadmium (Cd)	µg/L	0.003-0.055	0.008	<0.002	<0.002	<0.002	**0.016**	<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L	1, 16	0.3	0.3	0.1	0.3	0.293	0.142	0.166	0.346	0.264
Cobalt (Co)	µg/L		0.604	0.0149	0.00106	0.0092	0.055	0.023	0.025	0.061	0.032
Copper (Cu)	µg/L	2-4	**2.2**	0.6	0.8	0.7	1.01	0.57	0.67	1.23	0.71
Iron (Fe)	µg/L	300	128	49.6	25.0	15.2	120	70.1	94.0	182	105
Lead (Pb)	µg/L	1-7	0.02	0.01	0.01	0.03	0.089	0.038	0.044	0.134	0.056
Manganese (Mn)	µg/L		166.0	1.1	0.6	1.0	20.8	10.6	13.9	42.1	8.3
Mercury (Hg)	ng/L	26	2.3	<0.6	<0.6	<0.6		13	7.8	9.7	3.8
Molybdenum (Mo)	µg/L	73	0.343	0.402	0.585	0.674	0.126	0.080	0.080	0.105	0.097
Nickel (Ni)	µg/L	25-150	0.783	0.082	0.103	0.087	0.458	0.221	0.220	0.371	0.323
Selenium (Se)	µg/L	1	0.5	**1.3**	1.0	0.8	0.9	**1.1**	**1.3**	**1.5**	**1.4**
Silver (Ag)	µg/L	0.1	<0.0005	<0.0005	<0.0005	0.001	<0.0005	0.0012	0.0012	0.0019	0.0010
Strontium (Sr)	µg/L		26.9	44.9	65.4	59.5	28.1	43.2	43.4	45.8	46.0
Thallium (Tl)	µg/L	0.8000	0.0040	0.0044	<0.0003	0.0020	<0.0003	0.0082	0.0085	0.0055	0.0126
Tin (Sn)	µg/L		<0.03	<0.03	<0.03	0.096	3.92	0.18	3.25	3.79	2.23
Uranium (U)	µg/L		0.132	0.045	0.138	0.225	0.0141	0.0352	0.0336	0.0424	0.0340
Vanadium (V)	µg/L		0.268	0.044	0.012	0.037	0.107	0.040	0.085	0.156	0.107
Zinc (Zn)	µg/L	3, 13-198	1.80	0.94	1.28	0.17	19.50	1.69	1.82	1.27	1.19
Dissolved Metals											
Aluminum (Al)	µg/L		16.0	2.5	2.6	3.7	3.6	4.6	4.9	4.0	3.8
Antimony (Sb)	µg/L		0.037	0.0415	0.0565	0.0578	0.0146	0.0072	0.0084	0.0112	0.0121
Arsenic (As)	µg/L		0.313	0.396	0.363	0.385	0.368	0.463	0.455	0.678	0.555
Barium (Ba)	µg/L		1.45	1.62	2.10	1.90	2.98	2.81	2.83	3.15	3.25
Beryllium (Be)	µg/L		0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		16.5	37.9	46.7	44.4	11.6	20.7	21.8	21.3	19.0
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.261	0.210	0.134	0.263	0.287	0.136	0.158	0.234	0.261
Cobalt (Co)	µg/L		0.0218	0.0045	<0.001	<0.001	0.0095	0.0083	0.0088	0.0135	0.0084
Copper (Cu)	µg/L		2.0	0.4	0.7	0.7	0.53	0.47	0.53	0.85	0.67
Iron (Fe)	µg/L		49.3	9.7	<2.0	<2.0	27.4	5.1	6.9	6.9	<2.0
Lead (Pb)	µg/L		<0.001	<0.001	0.0113	0.0240	0.012	0.037	0.036	0.106	0.032
Manganese (Mn)	µg/L		0.796	0.059	<0.003	0.068	4.240	0.143	0.141	0.201	0.167
Molybdenum (Mo)	µg/L		0.244	0.396	0.579	0.652	0.110	0.080	0.080	0.105	0.093
Nickel (Ni)	µg/L		0.563	0.056	0.102	0.086	0.350	0.191	0.185	0.259	0.228
Selenium (Se)	µg/L		0.3	0.9	0.9	0.8	0.8	1.0	1.0	0.9	0.7
Silver (Ag)	µg/L		<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Strontium (Sr)	µg/L		26	44	65	58	26.0	39.1	40.0	42.1	43.1
Uranium (U)	µg/L		0.114	0.032	0.128	0.199	0.0064	0.0101	0.0218	0.0200	0.0178
Vanadium (V)	µg/L		0.18	<0.01	<0.01	<0.01	0.105	<0.01	0.039	0.019	0.038
Zinc (Zn)	µg/L		1.8	0.9	1.3	0.2	7.84	1.35	0.85	0.89	1.19
Other											
Cyanide, Total	mg/L		<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002	0.001
Fluoride (F)	mg/L		0.11	1.65	0.06	0.07	0.04	0.03	0.05	0.04	0.06
Sulphide	mg/L		<0.001	<0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

Appendix B5. Analytical results for freshwater water quality samples, 2006-2007

Parameters	Units	CWQG	Wolverine Lake			
			23-May-07	17-Jul-07	15-Aug-07	11-Sep-07
Physical						
Alkalinity, Total ($CaCO_3$)	mg/L		98.4	25.3	38.8	38.6
Hardness, Total ($CaCO_3$)	mg/L		148.0	53.2	58.5	58.4
Conductivity	µS/cm		880	340	378	364
Field pH	units	6.5-9.0	7.3	7.8	6.8	-
TDS (Calculated)	mg/L		355	158	187	185
Total Suspended Solids	mg/L		2	<1	2	<1
Color, True	TCU		10	8	4	7
Nutrients						
Phosphorus, Total	mg/L		0.048	0.011	0.017	0.011
Total Kjeldahl Nitrogen	mg/L		0.82	0.31	0.33	0.33
Ammonia-N	mg/L	0.2-122.4	0.007	0.01	0.009	0.009
Nitrite-N	mg/L	0.06	<0.001	<0.001	<0.001	<0.001
Nitrate-N (calculated)	mg/L	2.9	0.186	<0.005	<0.005	<0.005
Organics						
Carbon Part	mg/L		0.63	0.27	0.30	0.33
Dissolved Organic Carbon	mg/L		8.8	4.1	4.9	4.8
Chlorophyll a	µg/L		-	1.5	1.5	1.8
Major Ions						
Calcium (Total)	mg/L		21.00	7.67	8.44	8.62
Calcium (Dissolved)	mg/L		20.60	7.53	8.28	8.19
Chloride (Cl)	mg/L		157.00	80.00	91.00	91.10
Magnesium (Total)	mg/L		23.40	8.50	9.72	9.58
Magnesium (Dissolved)	mg/L		23.20	8.27	9.50	9.09
Potassium (Total)	mg/L		5.27	2.31	2.34	2.26
Potassium (Dissolved)	mg/L		5.09	2.20	2.27	2.14
Sodium (Total)	mg/L		115.00	42.40	48.00	47.80
Sodium (Dissolved)	mg/L		110.00	41.40	47.80	45.80
Sulphate (SO_4)	mg/L		<3	<3	<3	<3
Anions	meq/L		6.46	2.81	3.39	3.39
Cations	meq/L		6.86	2.96	3.42	3.35
Ion Balance	N/A		1.06	1.05	1.01	0.99
Total Metals						
Aluminum (Al)	µg/L	5, 100	19.6	39.2	**168**	69.1
Antimony (Sb)	µg/L		0.0232	0.0069	0.0116	0.0124
Arsenic (As)	µg/L	5	1.720	0.579	0.578	0.482
Barium (Ba)	µg/L		16.10	3.81	5.90	4.50
Beryllium (Be)	µg/L		0.0041	<0.003	0.0044	<0.003
Bismuth (Bi)	µg/L		0.0029	<0.001	0.0012	<0.001
Boron (B)	µg/L		42.1	16.7	20.5	21
Cadmium (Cd)	µg/L	0.003-0.055	0.004	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L	1, 16	0.5	0.1	0.4	0.5
Cobalt (Co)	µg/L		0.201	0.0218	0.0499	0.028
Copper (Cu)	µg/L	2-4	0.6	0.5	0.5	1.3
Iron (Fe)	µg/L	300	209	62.2	154	96.2
Lead (Pb)	µg/L	1-7	0.08	0.02	0.07	0.06
Manganese (Mn)	µg/L		292.0	8.2	10.2	7.7
Mercury (Hg)	ng/L	26	1.8	12.0	0.9	0.9
Molybdenum (Mo)	µg/L	73	0.0577	0.0551	0.0757	0.0952
Nickel (Ni)	µg/L	25-150	0.663	0.236	0.369	0.416
Selenium (Se)	µg/L	1	**4.4**	**1.3**	**1.1**	1.0
Silver (Ag)	µg/L	0.1	0.006	0.002	<0.0005	0.003
Strontium (Sr)	µg/L		116.0	41.0	46.9	46.2
Thallium (Tl)	µg/L	0.8000	<0.0003	0.0044	0.0021	0.0006
Tin (Sn)	µg/L		0.623	0.437	0.233	0.716
Uranium (U)	µg/L		0.036	0.029	0.025	0.032
Vanadium (V)	µg/L		0.013	0.042	0.292	0.200
Zinc (Zn)	µg/L	3, 13-198	2.69	1.94	2.00	1.05
Dissolved Metals						
Aluminum (Al)	µg/L		0.3	4.1	30.0	6.5
Antimony (Sb)	µg/L		0.023	0.0069	0.0115	0.0123
Arsenic (As)	µg/L		1.310	0.500	0.471	0.412
Barium (Ba)	µg/L		14.80	3.21	3.95	3.56
Beryllium (Be)	µg/L		<0.003	<0.003	<0.003	<0.003
Boron (B)	µg/L		41.7	16.4	19.9	18.7
Cadmium (Cd)	µg/L		<0.002	<0.002	<0.002	<0.002
Chromium (Cr)	µg/L		0.509	0.120	0.355	0.420
Cobalt (Co)	µg/L		0.1120	0.0081	0.0060	0.0076
Copper (Cu)	µg/L		0.6	0.5	0.5	0.9
Iron (Fe)	µg/L		<2.0	8.5	6.7	8.1
Lead (Pb)	µg/L		0.0089	0.0105	0.0030	0.0498
Manganese (Mn)	µg/L		253	0.111	0.062	0.098
Molybdenum (Mo)	µg/L		0.055	0.055	0.075	0.070
Nickel (Ni)	µg/L		0.593	0.208	0.252	0.277
Selenium (Se)	µg/L		3.1	1.0	0.8	0.9
Silver (Ag)	µg/L		0.0012	<0.0005	<0.0005	0.0015
Strontium (Sr)	µg/L		112	41	46	46
Uranium (U)	µg/L		0.026	0.027	0.020	0.026
Vanadium (V)	µg/L		0.01	0.04	0.10	0.09
Zinc (Zn)	µg/L		1.9	1.9	1.4	0.5
Other						
Cyanide, Total	mg/L		0.002	<0.001	<0.001	<0.001
Fluoride (F)	mg/L		0.10	0.10	0.06	0.06
Sulphide	mg/L		0.001	<0.001	<0.001	<0.001

[a]Guidelines are explained in Appendix B1.
bold and highlighted values were above the CWQG

APPENDIX B6

ANALYTICAL RESULTS FOR MARINE WATER QUALITY SAMPLES

Appendix B6. Analytical Results for marine water quality samples, 2007

Parameter	Units	CWQG	Hope Bay							
			27-May-07		23-Jul-07		17-Aug-07		15-Sep-07	
			Top	Bottom	Top	Bottom	Top	Bottom	Top	Bottom
Physical Parameters										
Alkalinity, Total ($CaCO_3$)	mg/L		98.4	98.1	21.5	110.0	29.2	48.1	28.1	115.0
Hardness, Total ($CaCO_3$)	mg/L				607	4910	1200	4020	1120	4750
Conductivity	µS/cm		40300	40000	6070	41000	11700	32200	10300	38700
Field pH	pH	7.0-8.7	7.70	7.70	7.58	7.85	7.51	7.71	7.53	7.67
Salinity	g/L				3.3	26.6	6.8	20.5	6.1	25.7
TDS (calculated)	mg/L		28900	28900	3440	30600	6900	23300	6150	29300
Total suspended solids	mg/L		17.0	14.0	4.9	3.6	5.5	<3	4.9	7.6
Color, True	TCU		5.0	5.0	8.6	<5.0	14.3	<5.0	9.8	<5.0
Nutrients										
Phosphorus, Total	mg/L		0.028	0.032	0.012	0.032	0.018	0.025	0.014	0.031
Total Kjeldahl Nitrogen	mg/L		0.130	0.070	0.299	0.267	0.343	0.139	0.248	0.208
Ammonia-N	mg/L		0.034	0.031	0.051	<0.020	<0.20	0.025	<0.20	<0.20
Nitrite-N	mg/L		<0.005	<0.005	<0.010	<0.010	0.096	0.54	<0.010	<0.10
Nitrate-N	mg/L	16	0.03	0.03	<0.50	<0.50	<0.10	<0.50	<0.50	<0.50
Organics										
Dissolved Organic Carbon	mg/L		1.10	1.30	3.72	1.46	4.74	1.32	5.14	1.33
Chlorophyll *a*	µg/L		-	-	0.90	-	0.51	-	0.45	-
Major Ions										
Calcium (Total)	mg/L				37.9	320	794	239	75.1	315
Calcium (Dissolved)	mg/L				40.3	315.0	76.9	238.0	74.9	315.0
Chloride (Cl)	mg/L		16700	17000	1810	15200	3760	11300	3290	14400
Magnesium (Total)	mg/L				116	1020	252	839	227	1020
Magnesium (Dissolved)	mg/L				123	1000	244	831	226	962
Potassium (Total)	mg/L				38	331	81	259	70	335
Potassium (Dissolved)	mg/L				40	328	78	258	69	321
Sodium (Total)	mg/L				946	8520	2120	6310	1880	7880
Sodium (Dissolved)	mg/L				1000	8430	2070	6340	1860	7580
Sulfate (SO_4)	mg/L		2230	2230	262	2100	499	1460	454	1940
Anions	meq/L				56.9	475	117	350	103	449
Cations	meq/L				56.7	473	116	363	105	433
Ion Balance	N/A				-0.3	-0.2	-0.5	1.7	1.0	-2.0
Total Metals										
Aluminum (Al)	µg/L				132	<100	<250	<100	<150	<100
Antimony (Sb)	µg/L				<1	<10	<5	<10	<5	<10
Arsenic (As)	µg/L	12.50	0.80	0.60	<0.20	0.78	0.38	0.80	<0.20	0.88
Barium (Ba)	µg/L				3.3	8.3	6.6	7.3	4.3	10.4
Beryllium (Be)	µg/L				<5	<50	<25	<50	<25	<50
Bismuth (Bi)	µg/L				<5	<50	<25	<50	<25	<50
Boron (B)	µg/L		3100	3000	420	3400	860	2900	790	3200
Cadmium (Cd)	µg/L	0.120	0.100	0.100	<0.020	0.033	<0.020	0.033	0.021	0.037
Chromium (Cr)	µg/L		<0.5	<0.5	<5	<50	<25	<50	<25	<50
Cobalt (Co)	µg/L		<0.100	<0.100	0.089	<0.050	0.081	<0.050	0.072	<0.050
Copper (Cu)	µg/L		2.60	0.90	1.25	0.71	1.04	2.10	1.33	0.42
Iron (Fe)	µg/L		6	8	191	16	145	23	123	13
Lead (Pb)	µg/L		<50.00	<0.100	0.568	<0.050	<0.050	<0.050	0.116	<0.050
Lithium	µg/L				<50	<500	<250	<500	<250	<500
Manganese (Mn)	µg/L		<1.00	<1.00	7.62	1.06	4.76	3.26	3.61	1.42
Mercury (Hg)	ng/L	16	<10	<10	<10	<10	<0.6	0.7	1.3	1.8
Molybdenum (Mo)	µg/L				1.0	8.7	<2.5	8.5	<2.5	8.7
Nickel (Ni)	µg/L		<0.50	0.60	0.52	0.41	0.77	0.49	0.52	0.42
Selenium (Se)	µg/L				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver (Ag)	µg/L		<0.1	<0.1	<0.10	<1.0	<0.50	<1.0	<0.50	<1.0
Strontium (Sr)	µg/L		5600	5600	705	5710	1480	5060	1320	5620
Thallium (Tl)	µg/L				<1	<10	<5	<10	<5	<10
Tin (Sn)	µg/L				<1	<10	<5	<10	<5	<10
Titanium	µg/L				<50	<100	<100	<100	<100	<100
Uranium (U)	µg/L				0.26	1.97	0.52	1.61	0.48	1.56
Vanadium (V)	µg/L				<10	<100	<50	<100	<50	<100
Zinc (Zn)	µg/L		<1.0	<1.0	1.2	0.6	1.0	5.0	1.4	<0.5
Dissolved Metals										
Aluminum (Al)	µg/L				<10	<100	<250	<100	<50	<100
Antimony (Sb)	µg/L				<1	<10	<5	<10	<5	<10
Arsenic (As)	µg/L				<0.20	0.85	0.35	0.60	<0.20	0.82
Barium (Ba)	µg/L				2.4	8.2	5.1	6.5	3.3	10.3
Beryllium (Be)	µg/L				<5	<50	<25	<50	<25	<50
Bismuth (Bi)	µg/L				<5	<50	<25	<50	<25	<50
Boron (B)	µg/L		3000	3100	420	3500	840	2800	830	3300
Cadmium (Cd)	µg/L				<0.020	0.030	<0.020	0.033	<0.020	0.037
Chromium (Cr)	µg/L				<50	<50	<25	<50	<25	<50
Cobalt (Co)	µg/L				<0.050	<0.050	0.107	0.068	<0.050	<0.050
Copper (Cu)	µg/L				0.797	0.456	1.440	1.360	0.853	0.442
Iron (Fe)	µg/L				<10	<10	180	27	<10	<10
Lead (Pb)	µg/L				<0.050	<0.050	0.056	<0.050	<0.050	<0.050
Lithium	µg/L				<50	<500	<250	<500	<250	<500
Manganese (Mn)	µg/L				2.66	0.73	5.18	3.32	1.71	0.53
Molybdenum (Mo)	µg/L				1.0	8.5	<2.5	5.4	<2.5	8.3
Nickel (Ni)	µg/L				0.361	0.442	0.875	0.520	0.442	0.451
Selenium (Se)	µg/L				<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Silver (Ag)	µg/L				<0.10	<1.0	<0.50	<1.0	<0.50	<1.0
Strontium (Sr)	µg/L		5700	5900	716	5870	1430	4490	1330	5730
Thallium (Tl)	µg/L				<1	<10	<5	<10	<5	<10
Tin (Sn)	µg/L				<1	<10	<5	<10	<5	<10
Titanium	µg/L				<50	<100	<100	<100	<100	<100
Uranium (U)	µg/L				0.22	1.13	0.55	1.52	0.48	1.58
Vanadium (V)	µg/L				<10	<100	<50	<100	<50	<100
Zinc (Zn)	µg/L				0.62	<0.50	1.63	0.80	<0.50	<0.50
Other										
Cyanide (Total)	mg/L		<0.5	<0.5	<5.0	<5.0	0.0058	<0.0050	<0.0050	<0.0050
Fluoride	mg/L		0.84	0.85	<0.20	0.77	0.43	<2.00	<0.20	<2.00
Silicon (Total)	µg/L				390	<500	900	<500	580	<500
Silicon (Dissolved)	µg/L				<250	<500	1150	<500	<500	<500
Sulphide	mg/L		0.007	<0.005	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020

[a]Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999, 2007).

APPENDIX C

SEDIMENT CHEMISTRY

APPENDIX C1

SEDIMENT PARTICLE SIZE AND CHEMISTRY FOR FRESHWATER SAMPLES

Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Aimaokatalok Lake						
			Gravity Core					Ekman	
	ISQG (TEL)	PEL	#1	#2	#3	#4	#5	Shallow	Deep
			22-Aug-07	22-Aug-07	22-Aug-07	22-Aug-07	22-Aug-07	22-Aug-07	22-Aug-07
TOC (g/kg)	-	-	1.1	1.1	0.87	0.78	0.75	0.42	0.82
Sand by hydrometer (%)	-	-	4	4	11	7	22	63	4
Silt by hydrometer (%)	-	-	37	43	47	40	37	29	42
Clay Content (%)	-	-	59	52	42	53	41	8	55
Texture	-	-	CLAY	SILTY CLAY	SILTY CLAY	SILTY CLAY	CLAY	SANDY LOAM	SILTY CLAY
Sieve - #10 (>2.00mm) (%)	-	-	0.5	1.4	<0.1	0.9	0.6	0.4	0.2
Sieve - #30 (>0.60mm) (%)	-	-	25	22	12	26	24	1.5	19
Sieve - #50 (>0.300 mm) (%)	-	-	20	20	21	21	20	1.3	21
(%)	-	-	15	15	19	16	16	3.7	16
Sieve - #270 (>0.053mm) (%)	-	-	20	19	22	21	21	78	28
Sieve - #400 (>0.030 mm) (%)	-	-	6.9	6.9	7.5	7.1	7.8	6.4	7.3
Sieve - Pan (%)	-	-	12	15	18	8.2	11	9	7.9
Moisture (%)	-	-	44.5	42.2	44.7	46.0	47.4	19.4	48.3
Total Metals (mg/kg)									
Total Aluminum (Al)	-	-	18100	17900	18100	20000	19200	3640	19100
Total Antimony (Sb)	-	-	0.1	<0.1	0.1	0.1	0.1	<0.1	<0.1
Total Arsenic (As)	**5.9**	**17**	2.4	4.3	3.6	3.6	3.9	0.7	3.4
Total Barium (Ba)	-	-	108	106	113	120	112	15.7	108
Total Beryllium (Be)	-	-	0.6	0.6	0.5	0.6	0.6	<0.1	0.5
Total Bismuth (Bi)	-	-	0.2	0.2	0.2	0.2	0.2	<0.1	0.2
Total Cadmium (Cd)	**0.6**	**3.5**	0.25	0.10	0.08	0.10	0.26	<0.05	0.07
Total Chromium (Cr)	**37.3**	**90**	**55**	**52**	**55**	**60**	**56**	10	**55**
Total Cobalt (Co)	-	-	12.8	14.1	15.5	14.1	12.9	2.8	11.4
Total Copper (Cu)	**35.7**	**197**	22.2	20.5	23.0	25.4	24.2	5.2	21.6
Total Iron (Fe)	-	-	22700	22500	26200	28300	26700	6360	25300
Total Lead (Pb)	**35**	**91.3**	8.1	7.7	8.4	9.0	8.5	2.2	8.4
Total Magnesium (Mg)	-	-	10700	10300	11300	12600	11100	2000	10400
Total Manganese (Mn)	-	-	346	322	373	390	413	75.5	381
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	1.0	1.4	1.2	1.1	0.7	0.2	0.4
Total Nickel (Ni)	-	-	29.1	27.7	31.7	33.8	31.2	5.2	29.1
Total Phosphorus (P)	-	-	620	574	616	663	819	451	796
Total Potassium (K)	-	-	4500	3980	4710	5400	4680	553	4290
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.12	0.12	0.14	0.15	0.13	<0.05	0.10
Total Sodium (Na)	-	-	566	602	668	778	565	105	518
Total Strontium (Sr)	-	-	29.1	27.5	30.3	35.5	30.1	7.0	29.8
Total Thallium (Tl)	-	-	0.21	0.18	0.19	0.23	0.22	<0.05	0.16
Total Tin (Sn)	-	-	0.8	0.7	0.8	0.8	0.8	0.1	0.8
Total Titanium (Ti)	-	-	1050	1010	1070	1190	1090	234	1030
Total Vanadium (V)	-	-	58	54	56	63	58	11	52
Total Zinc (Zn)	**123**	**315**	105	85	81	86	94	19	96
Total Zirconium (Zr)	-	-	3.6	4.4	6.2	7.2	5.3	0.6	3.6

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Bold and highlighted values area above the TEL

Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Fickle Duck Lake					
			Gravity Core					Ekman
	ISQG (TEL)	PEL	#1	#2	#3	#4	#5	Shallow
			23-Aug-07	23-Aug-07	23-Aug-07	23-Aug-07	23-Aug-07	23-Aug-07
TOC (g/kg)	-	-	3.4	2.4	3.7	4.0	3.2	3.2
Sand by hydrometer (%)	-	-	N.D.	N.D.	N.D.	6	2	<2
Silt by hydrometer (%)	-	-	N.D.	N.D.	N.D.	68	73	82
Clay Content (%)	-	-	N.D.	N.D.	N.D.	27	24	16
Texture	-	-	N.D.	N.D.	N.D.	SILT LOAM	SILT LOAM	SILT LOAM
Sieve - #10 (>2.00mm) (%)	-	-	1.5	0.6	1.4	<0.1	0.4	0.1
Sieve - #30 (>0.60mm) (%)	-	-	15	9.7	16	12	17	13
Sieve - #50 (>0.300 mm) (%)	-	-	12	10	12	13	14	13
(%)	-	-	8.7	11	9.7	11	11	11
Sieve - #270 (>0.053mm) (%)	-	-	15	23	17	21	18	16
Sieve - #400 (>0.030 mm) (%)	-	-	7	15	5.9	12	12	6.3
Sieve - Pan (%)	-	-	41	31	38	31	28	42
Moisture (%)	-	-	50.5	56.7	55.2	44.4	50.5	39.0
Total Metals (mg/kg)								
Total Aluminum (Al)	-	-	12600	16200	13900	15100	13800	13100
Total Antimony (Sb)	-	-	<0.1	0.1	0.1	0.1	0.1	<0.1
Total Arsenic (As)	**5.9**	**17**	2.5	3.7	3.0	3.9	3.7	2.2
Total Barium (Ba)	-	-	64.2	81.5	70.8	75.4	71.4	65.5
Total Beryllium (Be)	-	-	0.4	0.7	0.4	0.3	0.4	0.4
Total Bismuth (Bi)	-	-	0.1	0.2	0.1	0.2	0.2	0.1
Total Cadmium (Cd)	**0.6**	**3.5**	0.08	0.11	0.09	0.10	0.09	0.08
Total Chromium (Cr)	**37.3**	**90**	**40**	**55**	**46**	**50**	**47**	**39**
Total Cobalt (Co)	-	-	7.9	10.2	9.0	9.7	8.7	7.8
Total Copper (Cu)	**35.7**	**197**	19.2	26.9	22.1	24.7	22.8	18.8
Total Iron (Fe)	-	-	18100	22900	20500	22500	20200	18300
Total Lead (Pb)	**35**	**91.3**	6.1	8.0	6.8	7.5	6.8	5.9
Total Magnesium (Mg)	-	-	6750	9230	7860	8650	7470	7100
Total Manganese (Mn)	-	-	153	199	169	184	171	151
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	0.7	0.8	0.7	0.8	0.8	0.7
Total Nickel (Ni)	-	-	21.0	27.8	23.5	26.0	23.7	21.1
Total Phosphorus (P)	-	-	593	592	648	626	668	691
Total Potassium (K)	-	-	2310	3130	2470	3060	2710	2310
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.10	0.14	0.10	0.13	0.10	0.08
Total Sodium (Na)	-	-	346	461	371	452	415	355
Total Strontium (Sr)	-	-	24.5	31.5	26.8	29.0	27.4	25.3
Total Thallium (Tl)	-	-	0.07	0.12	0.09	0.11	0.08	0.07
Total Tin (Sn)	-	-	0.5	0.7	0.6	0.6	0.6	0.5
Total Titanium (Ti)	-	-	788	1010	873	950	889	785
Total Vanadium (V)	-	-	41	55	47	51	46	40
Total Zinc (Zn)	**123**	**315**	61	77	69	74	67	65
Total Zirconium (Zr)	-	-	4.4	7.6	4.7	6.5	5.2	3.1

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Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Reference Lake					
			Gravity Core					Ekman
	ISQG (TEL)	PEL	#1	#2	#3	#4	#5	Shallow
			23-Aug-07	23-Aug-07	23-Aug-07	23-Aug-07	23-Aug-07	23-Aug-07
TOC (g/kg)	-	-	2.1	2.6	2.6	2.3	2.6	2.5
Sand by hydrometer (%)	-	-	3	6	3	3	5	16
Silt by hydrometer (%)	-	-	76	75	72	71	70	62
Clay Content (%)	-	-	21	19	26	26	25	21
Texture	-	-	SILT LOAM	SILT LOAM	SILT LOAM	SILT LOAM	SILT LOAM	SILT LOAM
Sieve - #10 (>2.00mm) (%)	-	-	0.8	0.7	0.9	2.5	8.2	4.9
Sieve - #30 (>0.60mm) (%)	-	-	15	34	19	17	31	25
Sieve - #50 (>0.300 mm) (%)	-	-	15	17	15	13	12	14
(%)	-	-	8.9	11	9.9	9.5	7.6	8.8
Sieve - #270 (>0.053mm) (%)	-	-	12	13	13	15	10	11
Sieve - #400 (>0.030 mm) (%)	-	-	5.4	4.2	6.5	14	5.5	5.6
Sieve - Pan (%)	-	-	43	21	37	28	25	31
Moisture (%)	-	-	41.5	44.9	53.9	47.0	44.1	49.8
Total Metals (mg/kg)								
Total Aluminum (Al)	-	-	15500	16800	17000	15800	16700	17300
Total Antimony (Sb)	-	-	0.1	<0.1	0.1	<0.1	0.1	0.1
Total Arsenic (As)	**5.9**	**17**	2.6	2.1	2.3	2.1	2.2	2.9
Total Barium (Ba)	-	-	77.6	81.9	81.4	77.7	81.4	82.4
Total Beryllium (Be)	-	-	0.5	0.5	0.5	0.6	0.5	0.5
Total Bismuth (Bi)	-	-	0.2	0.2	0.2	0.2	0.2	0.2
Total Cadmium (Cd)	**0.6**	**3.5**	0.13	0.11	0.12	0.11	0.12	0.12
Total Chromium (Cr)	**37.3**	**90**	**50**	**52**	**53**	**50**	**52**	**53**
Total Cobalt (Co)	-	-	10.2	10.9	10.5	10.3	10.9	10.9
Total Copper (Cu)	**35.7**	**197**	21.2	22.9	22.5	20.9	22.9	22.6
Total Iron (Fe)	-	-	22800	23700	24600	23500	24200	24300
Total Lead (Pb)	**35**	**91.3**	7.0	7.4	7.2	7.1	7.4	7.2
Total Magnesium (Mg)	-	-	8770	9090	9050	8650	9310	9600
Total Manganese (Mn)	-	-	201	207	207	199	208	217
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	0.7	0.7	0.7	0.7	0.7	0.7
Total Nickel (Ni)	-	-	23.6	25.1	25.3	23.8	24.9	26.1
Total Phosphorus (P)	-	-	644	590	673	669	642	680
Total Potassium (K)	-	-	2940	3060	3150	2930	3130	3170
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.11	0.11	0.11	0.10	0.11	0.11
Total Sodium (Na)	-	-	309	319	309	298	323	321
Total Strontium (Sr)	-	-	20.6	21.1	21.4	20.8	21.7	22.0
Total Thallium (Tl)	-	-	0.14	0.15	0.14	0.13	0.14	0.17
Total Tin (Sn)	-	-	0.6	0.6	0.7	0.6	0.7	0.7
Total Titanium (Ti)	-	-	959	984	997	972	992	1010
Total Vanadium (V)	-	-	51	53	50	51	52	53
Total Zinc (Zn)	**123**	**315**	79	82	82	77	82	84
Total Zirconium (Zr)	-	-	4.4	4.9	4.0	4.5	4.8	4.6

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Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Stickleback Lake					
			Gravity Core					Ekman
	ISQG (TEL)	PEL	#1	#2	#3	#4	#5	Shallow
			23-Aug-07	23-Aug-07	23-Aug-07	23-Aug-07	23-Aug-07	23-Aug-07
TOC (g/kg)	-	-	9.5	9.9	10	12	9.2	11
Sand by hydrometer (%)	-	-	17	11	11	26	21	7
Silt by hydrometer (%)	-	-	83	89	89	74	79	93
Clay Content (%)	-	-	<2	<2	<2	<2	<2	<2
Texture	-	-	SILT	SILT	SILT	SILT LOAM	SILT LOAM	SILT
Sieve - #10 (>2.00mm) (%)	-	-	2.3	0.5	17	11	8.5	2.3
Sieve - #30 (>0.60mm) (%)	-	-	41	55	45	52	41	21
Sieve - #50 (>0.300 mm) (%)	-	-	18	16	12	12	16	21
(%)	-	-	12	10	8	8.2	10	18
Sieve - #270 (>0.053mm) (%)	-	-	15	12	9.8	9.1	13	21
Sieve - #400 (>0.030 mm) (%)	-	-	4.3	2.9	2.7	2.6	3.6	5.9
Sieve - Pan (%)	-	-	7.2	4.1	4.9	4.9	7.7	11
Moisture (%)	-	-	87.7	84.2	82.7	87.4	88.0	89.8
Total Metals (mg/kg)								
Total Aluminum (Al)	-	-	11900	11800	12000	11100	13000	12400
Total Antimony (Sb)	-	-	0.1	0.1	0.1	0.1	0.1	0.2
Total Arsenic (As)	**5.9**	**17**	4.9	4.6	4.2	4.5	4.6	4.6
Total Barium (Ba)	-	-	58.1	58.5	61.5	56.1	62.1	61.4
Total Beryllium (Be)	-	-	0.4	0.4	0.4	0.4	0.4	0.4
Total Bismuth (Bi)	-	-	0.1	0.1	0.1	0.1	0.1	0.1
Total Cadmium (Cd)	**0.6**	**3.5**	0.12	0.12	0.33	0.18	0.13	0.13
Total Chromium (Cr)	**37.3**	**90**	**38**	36	35	34	**38**	**38**
Total Cobalt (Co)	-	-	9.5	9.0	9.2	9.1	9.8	9.7
Total Copper (Cu)	**35.7**	**197**	**37.7**	**36.0**	34.6	**36.7**	**39.0**	**39.1**
Total Iron (Fe)	-	-	18400	18300	17300	17100	18900	19500
Total Lead (Pb)	**35**	**91.3**	5.3	5.4	5.2	5.3	5.7	5.7
Total Magnesium (Mg)	-	-	6770	6500	6530	6390	6980	7120
Total Manganese (Mn)	-	-	217	206	194	203	218	233
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	1.7	1.4	1.5	1.6	1.7	1.5
Total Nickel (Ni)	-	-	27.2	27.4	26.1	26.2	28.9	28.6
Total Phosphorus (P)	-	-	632	702	652	594	689	700
Total Potassium (K)	-	-	2560	2360	2580	2450	2760	2600
Total Selenium (Se)	-	-	<0.5	0.6	0.7	<0.5	<0.5	0.5
Total Silver (Ag)	-	-	0.09	0.08	0.08	0.09	0.10	0.09
Total Sodium (Na)	-	-	529	494	501	480	539	572
Total Strontium (Sr)	-	-	26.5	28.9	25.5	23.8	27.2	32.4
Total Thallium (Tl)	-	-	0.09	0.21	0.17	0.13	0.13	0.07
Total Tin (Sn)	-	-	0.5	0.4	0.4	0.5	0.5	0.5
Total Titanium (Ti)	-	-	653	589	640	605	658	605
Total Vanadium (V)	-	-	39	36	37	35	40	38
Total Zinc (Zn)	**123**	**315**	61	60	57	59	65	61
Total Zirconium (Zr)	-	-	3.4	2.6	2.7	2.8	3.1	3.4

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Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Glenn Lake						
			Gravity Core					Ekman	
	ISQG (TEL)	PEL	#1	#2	#3	#4	#5	Shallow	Deep
			26-Aug-07	26-Aug-07	26-Aug-07	26-Aug-07	26-Aug-07	26-Aug-07	26-Aug-07
TOC (g/kg)	-	-	0.65	0.59	0.61	0.59	0.61	0.46	0.66
Sand by hydrometer (%)	-	-	10	9	10	8	<2	21	14
Silt by hydrometer (%)	-	-	25	29	26	29	39	45	26
Clay Content (%)	-	-	65	62	64	64	61	34	60
Texture	-	-	CLAY	CLAY	CLAY	CLAY	CLAY	CLAY LOAM	CLAY
Sieve - #10 (>2.00mm) (%)	-	-	4.8	6.9	0.5	1.3	0.3	0.9	0.7
Sieve - #30 (>0.60mm) (%)	-	-	28	33	25	19	17	13	24
Sieve - #50 (>0.300 mm) (%)	-	-	18	18	22	24	25	15	24
(%)	-	-	15	14	17	18	18	13	17
Sieve - #270 (>0.053mm) (%)	-	-	16	15	18	21	20	38	25
Sieve - #400 (>0.030 mm) (%)	-	-	5.5	4.7	8.1	6.3	6	9.6	3.3
Sieve - Pan (%)	-	-	12	8.1	9.4	9.7	13	10	5.5
Moisture (%)	-	-	52.3	52.0	53.5	51.9	54.2	47.2	37.9
Total Metals (mg/kg)									
Total Aluminum (Al)	-	-	31100	27800	28800	28400	26300	18300	27000
Total Antimony (Sb)	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Arsenic (As)	**5.9**	**17**	2.8	2.5	2.3	2.8	2.4	2.7	2.5
Total Barium (Ba)	-	-	165	155	158	155	142	92.7	155
Total Beryllium (Be)	-	-	0.9	0.8	0.8	0.9	0.8	0.4	0.8
Total Bismuth (Bi)	-	-	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Total Cadmium (Cd)	**0.6**	**3.5**	0.09	0.08	0.09	0.08	0.08	0.05	0.08
Total Chromium (Cr)	**37.3**	**90**	**82**	**76**	**76**	**73**	**70**	**49**	**73**
Total Cobalt (Co)	-	-	18.8	17.5	17.6	17.2	16.1	12.3	17.3
Total Copper (Cu)	**35.7**	**197**	**39.8**	**37.3**	**37.7**	**36.7**	34.6	30.0	**37.9**
Total Iron (Fe)	-	-	42800	39500	40300	38900	36000	26900	38500
Total Lead (Pb)	**35**	**91.3**	10.7	9.9	10.1	9.8	9.2	6.7	9.7
Total Magnesium (Mg)	-	-	22200	20900	21000	20800	18700	13000	19500
Total Manganese (Mn)	-	-	674	480	492	480	447	344	482
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	1.0	0.8	0.8	0.8	0.8	0.6	0.8
Total Nickel (Ni)	-	-	45.1	42.5	41.8	41.2	39.2	29.2	42.0
Total Phosphorus (P)	-	-	757	696	711	677	638	614	696
Total Potassium (K)	-	-	8820	8670	8250	8000	7550	5160	8050
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.13	0.12	0.11	0.12	0.11	0.09	0.12
Total Sodium (Na)	-	-	1560	1360	1370	1340	1310	904	1320
Total Strontium (Sr)	-	-	39.8	35.7	35.7	35.1	34.1	25.1	34.7
Total Thallium (Tl)	-	-	0.31	0.30	0.32	0.31	0.29	0.18	0.32
Total Tin (Sn)	-	-	1.2	1.1	1.2	1.1	1.0	0.7	1.1
Total Titanium (Ti)	-	-	1910	1740	1740	1730	1650	1190	1700
Total Vanadium (V)	-	-	86	78	79	77	73	54	77
Total Zinc (Zn)	**123**	**315**	105	97	97	97	90	64	100
Total Zirconium (Zr)	-	-	5.3	4.7	4.5	4.5	4.3	2.6	4.3

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Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Ogama Lake						
			Gravity Core					Ekman	
	ISQG (TEL)	PEL	#1	#2	#3	#4	#5	Shallow	Deep
			26-Aug-07	26-Aug-07	26-Aug-07	26-Aug-07	26-Aug-07	26-Aug-07	26-Aug-07
TOC (g/kg)	-	-	2.7	2.2	2.3	1.9	2.3	0.45	2.7
Sand by hydrometer (%)	-	-	17	35	10	5	20	19	12
Silt by hydrometer (%)	-	-	51	42	54	56	50	49	53
Clay Content (%)	-	-	32	22	37	40	30	32	35
Texture	-	-	SLTY CL LM	LOAM	SLTY CL LM	SLTY CL LM	CLAY LOAM	SLTY CL LM	SLTY CL LM
Sieve - #10 (>2.00mm) (%)	-	-	1.2	1.3	0.7	0.8	<0.1	9	0.7
Sieve - #30 (>0.60mm) (%)	-	-	12	16	15	14	13	26	17
Sieve - #50 (>0.300 mm) (%)	-	-	15	17	16	17	17	11	19
(%)	-	-	15	14	14	15	14	9	14
Sieve - #270 (>0.053mm) (%)	-	-	22	21	23	24	24	21	20
Sieve - #400 (>0.030 mm) (%)	-	-	9.9	10	11	11	10	6.8	8.9
Sieve - Pan (%)	-	-	24	21	20	18	21	16	21
Moisture (%)	-	-	55.9	52.8	54.5	49.6	51.1	36.7	57.1
Total Metals (mg/kg)									
Total Aluminum (Al)	-	-	19700	20000	19900	19800	20700	15100	20600
Total Antimony (Sb)	-	-	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1
Total Arsenic (As)	**5.9**	**17**	2.3	3.3	2.6	2.8	3.2	1.9	2.4
Total Barium (Ba)	-	-	99.6	103	101	98.5	106	72.9	98.6
Total Beryllium (Be)	-	-	0.7	0.4	0.6	0.7	0.7	0.5	0.7
Total Bismuth (Bi)	-	-	0.2	0.2	0.2	0.2	0.2	0.1	0.2
Total Cadmium (Cd)	**0.6**	**3.5**	0.07	0.08	0.08	0.08	0.08	<0.05	0.06
Total Chromium (Cr)	**37.3**	**90**	**60**	**60**	**60**	**59**	**61**	**44**	**60**
Total Cobalt (Co)	-	-	12.1	12.6	12.7	12.7	13.0	9.0	12.2
Total Copper (Cu)	**35.7**	**197**	26.8	26.4	25.4	25.1	27.0	19.5	25.6
Total Iron (Fe)	-	-	30600	34100	32300	29200	32900	20600	32400
Total Lead (Pb)	**35**	**91.3**	7.9	8.3	8.4	7.9	8.7	6.0	7.8
Total Magnesium (Mg)	-	-	12900	12600	12700	12900	13000	9940	12800
Total Manganese (Mn)	-	-	307	348	321	303	343	216	332
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	0.9	0.8	0.9	1.1	0.9	0.9	0.7
Total Nickel (Ni)	-	-	32.2	33.7	33.1	32.8	34.0	23.4	31.5
Total Phosphorus (P)	-	-	779	891	814	783	824	631	837
Total Potassium (K)	-	-	4850	4870	4950	4960	5280	4250	4750
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.10	0.11	0.11	0.10	0.11	0.08	0.09
Total Sodium (Na)	-	-	808	878	972	966	852	632	799
Total Strontium (Sr)	-	-	26.2	27.0	26.9	26.1	27.8	20.1	25.8
Total Thallium (Tl)	-	-	0.19	0.37	0.24	0.19	0.22	0.12	0.19
Total Tin (Sn)	-	-	0.8	0.8	0.8	0.8	0.9	0.6	0.8
Total Titanium (Ti)	-	-	1260	1240	1230	1240	1290	968	1240
Total Vanadium (V)	-	-	63	59	60	60	62	49	63
Total Zinc (Zn)	**123**	**315**	77	78	78	76	79	52	75
Total Zirconium (Zr)	-	-	3.6	3.3	3.6	3.9	3.8	4.3	3.6

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Bold and highlighted values area above the TEL

Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Patch Lake South					
			Gravity Core					Ekman
	ISQG (TEL)	PEL	#1 South	#2 South	#3 South	#4 South	#5 South	Deep
			20-Aug-07	20-Aug-07	20-Aug-07	20-Aug-07	20-Aug-07	20-Aug-07
TOC (g/kg)	-	-	1.6	1.6	1.5	1.6	1.6	1.7
Sand by hydrometer (%)	-	-	<2	<2	<2	<2	2	2
Silt by hydrometer (%)	-	-	58	51	55	53	55	57
Clay Content (%)	-	-	42	49	45	47	43	41
Texture	-	-	SILTY CLAY	SILTY CLAY	SILTY CLAY	SILTY CLAY	SILTY CLAY	SILTY CLAY
Sieve - #10 (>2.00mm) (%)	-	-	2.7	1.7	5.3	2.4	1.6	2.2
Sieve - #30 (>0.60mm) (%)	-	-	33	32	33	28	28	32
Sieve - #50 (>0.300 mm) (%)	-	-	17	18	16	18	18	19
(%)	-	-	13	12	12	14	14	14
Sieve - #270 (>0.053mm) (%)	-	-	15	15	15	18	16	15
Sieve - #400 (>0.030 mm) (%)	-	-	4.9	5.6	5.9	6	6	3.9
Sieve - Pan (%)	-	-	14	15	12	13	16	15
Moisture (%)	-	-	60.3	56.1	59.7	62.9	60.1	61.6
Total Metals (mg/kg)								
Total Aluminum (Al)	-	-	22800	23700	24400	24300	23600	23500
Total Antimony (Sb)	-	-	0.1	0.1	0.1	0.1	0.1	0.1
Total Arsenic (As)	**5.9**	**17**	4.6	3.8	4.4	5.0	3.8	5.6
Total Barium (Ba)	-	-	125	137	131	135	133	136
Total Beryllium (Be)	-	-	0.7	0.8	0.6	0.8	0.6	0.9
Total Bismuth (Bi)	-	-	0.2	0.2	0.2	0.2	0.2	0.2
Total Cadmium (Cd)	**0.6**	**3.5**	0.08	0.09	0.08	0.08	0.09	0.08
Total Chromium (Cr)	**37.3**	**90**	**65**	**70**	**72**	**70**	**69**	**68**
Total Cobalt (Co)	-	-	14.9	16.0	15.6	16.0	15.7	15.4
Total Copper (Cu)	**35.7**	**197**	30.9	33.8	33.9	33.4	32.9	32.6
Total Iron (Fe)	-	-	36600	39300	37700	39600	38000	42000
Total Lead (Pb)	**35**	**91.3**	9.4	10.2	9.9	10.0	9.8	9.5
Total Magnesium (Mg)	-	-	14000	14700	14700	14900	14800	15000
Total Manganese (Mn)	-	-	760	660	645	733	673	802
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	1.4	1.4	1.3	1.3	1.5	1.1
Total Nickel (Ni)	-	-	40.1	42.8	42.1	43.5	42.5	41.1
Total Phosphorus (P)	-	-	942	886	894	909	855	1030
Total Potassium (K)	-	-	5530	5640	5720	5770	5830	6250
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.11	0.11	0.10	0.11	0.10	0.11
Total Sodium (Na)	-	-	1000	1050	1050	1120	1090	1050
Total Strontium (Sr)	-	-	27.3	29.4	29.3	29.9	28.4	28.4
Total Thallium (Tl)	-	-	0.22	0.25	0.22	0.32	0.28	0.26
Total Tin (Sn)	-	-	0.9	1.0	0.9	1.0	0.9	0.9
Total Titanium (Ti)	-	-	1280	1400	1390	1390	1340	1360
Total Vanadium (V)	-	-	67	70	70	71	69	70
Total Zinc (Zn)	**123**	**315**	81	87	86	86	84	87
Total Zirconium (Zr)	-	-	3.2	3.6	3.5	3.4	3.3	3.1

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Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Patch Lake North					
			Gravity Core					Ekman
	ISQG (TEL)	PEL	#1 North	#2 North	#3 North	#4 North	#5 North	Shallow
			20-Aug-07	20-Aug-07	20-Aug-07	20-Aug-07	20-Aug-07	20-Aug-07
TOC (g/kg)	-	-	2.5	2.5	2.1	3.0	2.1	8.9
Sand by hydrometer (%)	-	-	3	30	12	7	30	21
Silt by hydrometer (%)	-	-	65	39	55	60	48	73
Clay Content (%)	-	-	32	31	34	32	22	6
Texture	-	-	SLTY CL LM	CLAY LOAM	SLTY CL LM	SLTY CL LM	LOAM	SILT LOAM
Sieve - #10 (>2.00mm) (%)	-	-	1.8	12	9.9	10	5.2	16
Sieve - #30 (>0.60mm) (%)	-	-	41	32	35	33	40	22
Sieve - #50 (>0.300 mm) (%)	-	-	19	17	16	19	17	13
(%)	-	-	12	13	12	14	12	13
Sieve - #270 (>0.053mm) (%)	-	-	12	13	13	13	12	21
Sieve - #400 (>0.030 mm) (%)	-	-	3.7	3.3	3.4	3.1	3.8	5.5
Sieve - Pan (%)	-	-	10	10	11	7.9	9.8	9.9
Moisture (%)	-	-	74.1	72.1	68.6	75.4	66.9	83.7
Total Metals (mg/kg)								
Total Aluminum (Al)	-	-	28600	26400	28100	26600	26800	19500
Total Antimony (Sb)	-	-	0.1	0.1	0.2	0.1	0.2	0.2
Total Arsenic (As)	**5.9**	**17**	3.7	3.8	4.5	4.4	5.2	3.5
Total Barium (Ba)	-	-	139	129	145	131	135	89
Total Beryllium (Be)	-	-	1.1	0.8	1.1	0.8	0.8	0.7
Total Bismuth (Bi)	-	-	0.2	0.2	0.3	0.2	0.2	0.2
Total Cadmium (Cd)	**0.6**	**3.5**	0.11	0.10	0.12	0.12	0.12	0.18
Total Chromium (Cr)	**37.3**	**90**	**79**	**75**	**82**	**74**	**78**	**64**
Total Cobalt (Co)	-	-	14.8	14.6	15.6	14.3	15.9	11.9
Total Copper (Cu)	**35.7**	**197**	**55.1**	**53.8**	**53.4**	**50.9**	**54.0**	**58.3**
Total Iron (Fe)	-	-	35000	34200	36200	34300	36200	25400
Total Lead (Pb)	**35**	**91.3**	10.3	9.8	10.7	9.9	10.0	8.2
Total Magnesium (Mg)	-	-	17300	16400	18100	15800	17400	12300
Total Manganese (Mn)	-	-	324	318	335	322	328	261
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	2.0	1.9	2.2	2.0	2.1	1.9
Total Nickel (Ni)	-	-	46.1	44.6	47.5	44.1	47.5	39.1
Total Phosphorus (P)	-	-	813	809	790	787	734	1170
Total Potassium (K)	-	-	7020	6660	7320	6700	6680	6110
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.11	0.10	0.11	0.10	0.11	0.15
Total Sodium (Na)	-	-	1500	1340	1500	1430	1360	1180
Total Strontium (Sr)	-	-	33.8	32.6	35.6	32.0	35.1	31.7
Total Thallium (Tl)	-	-	0.27	0.25	0.37	0.32	0.34	0.17
Total Tin (Sn)	-	-	1.0	1.0	1.0	1.0	1.0	0.8
Total Titanium (Ti)	-	-	1550	1450	1620	1460	1550	1090
Total Vanadium (V)	-	-	79	76	82	76	80	60
Total Zinc (Zn)	**123**	**315**	98	92	96	91	96	76
Total Zirconium (Zr)	-	-	3.3	2.9	3.7	3.1	3.3	2.4

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Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Pelvic Lake						
			Gravity Core					Ekman	
	ISQG (TEL)	PEL	#1	#2	#3	#4	#5	Shallow	Deep
			27-Aug-07	27-Aug-07	27-Aug-07	27-Aug-07	27-Aug-07	27-Aug-07	27-Aug-07
TOC (g/kg)	-	-	1.6	1.5	1.7	1.4	1.6	1.3	1.5
Sand by hydrometer (%)	-	-	3	<2	8	2	10	16	17
Silt by hydrometer (%)	-	-	51	47	45	49	46	54	41
Clay Content (%)	-	-	46	52	47	49	44	30	42
Texture	-	-	SILTY CLAY	SILTY CLAY	SILTY CLAY	SILTY CLAY	SILTY CLAY	SLTY CL LM	CLAY
Sieve - #10 (>2.00mm) (%)	-	-	4.2	1.2	<0.1	2	1	0.8	0.7
Sieve - #30 (>0.60mm) (%)	-	-	37	34	32	38	38	29	46
Sieve - #50 (>0.300 mm) (%)	-	-	17	20	19	19	18	12	17
(%)	-	-	12	14	14	13	12	10	11
Sieve - #270 (>0.053mm) (%)	-	-	13	13	14	13	13	29	11
Sieve - #400 (>0.030 mm) (%)	-	-	4	4.5	4.8	4	3.9	5.7	3.5
Sieve - Pan (%)	-	-	14	14	17	11	14	14	11
Moisture (%)	-	-	54.6	62.3	65.1	60.6	56.2	47.1	59.4
Total Metals (mg/kg)									
Total Aluminum (Al)	-	-	23000	21600	24700	21700	22600	14800	23800
Total Antimony (Sb)	-	-	0.1	0.1	0.1	<0.1	<0.1	<0.1	0.1
Total Arsenic (As)	**5.9**	**17**	3.0	3.0	3.5	2.8	3.1	1.5	3.1
Total Barium (Ba)	-	-	120	112	125	108	115	73.2	122
Total Beryllium (Be)	-	-	0.6	0.7	1.1	0.7	0.7	0.5	0.8
Total Bismuth (Bi)	-	-	0.2	0.2	0.2	0.2	0.2	0.1	0.2
Total Cadmium (Cd)	**0.6**	**3.5**	0.07	0.06	0.08	0.07	0.07	0.06	0.09
Total Chromium (Cr)	**37.3**	**90**	**64**	**62**	**68**	**59**	**64**	**41**	**68**
Total Cobalt (Co)	-	-	13.2	12.8	13.9	12.4	13.4	8.8	14.3
Total Copper (Cu)	**35.7**	**197**	31.5	30.3	33.3	29.6	30.8	20.1	33.1
Total Iron (Fe)	-	-	34100	32200	36000	31000	34400	20200	36200
Total Lead (Pb)	**35**	**91.3**	9.0	8.5	9.2	8.2	8.6	5.8	8.9
Total Magnesium (Mg)	-	-	14100	13300	14900	13300	14300	9210	14800
Total Manganese (Mn)	-	-	405	418	432	377	401	278	476
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	1.0	1.0	1.2	1.0	1.0	0.8	1.2
Total Nickel (Ni)	-	-	35.7	35.8	39.2	33.8	35.5	23.3	38.5
Total Phosphorus (P)	-	-	912	888	1020	853	789	662	985
Total Potassium (K)	-	-	5240	5350	5670	5170	5370	3470	5700
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.10	0.10	0.11	0.10	0.10	0.06	0.11
Total Sodium (Na)	-	-	1040	982	1100	939	990	567	1010
Total Strontium (Sr)	-	-	26.0	25.7	27.9	23.6	25.3	18.1	27.5
Total Thallium (Tl)	-	-	0.21	0.21	0.22	0.19	0.20	0.10	0.24
Total Tin (Sn)	-	-	0.9	0.8	0.9	0.8	0.8	0.6	0.9
Total Titanium (Ti)	-	-	1290	1260	1390	1220	1310	894	1350
Total Vanadium (V)	-	-	65	64	70	61	66	43	71
Total Zinc (Zn)	**123**	**315**	84	79	85	75	80	53	85
Total Zirconium (Zr)	-	-	3.3	3.2	3.6	3.3	3.7	1.8	3.7

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Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		P.O. Lake					
			Gravity Core					Ekman
	ISQG (TEL)	PEL	#1	#2	#3	#4	#5	Shallow
			27-Aug-07	27-Aug-07	27-Aug-07	27-Aug-07	27-Aug-07	27-Aug-07
TOC (g/kg)	-	-	1.3	1.7	1.4	1.3	1.3	2.1
Sand by hydrometer (%)	-	-	5	<2	9	7	3	16
Silt by hydrometer (%)	-	-	41	37	43	43	30	39
Clay Content (%)	-	-	54	62	48	51	67	45
Texture	-	-	SILTY CLAY	CLAY	SILTY CLAY	SILTY CLAY	CLAY	CLAY
Sieve - #10 (>2.00mm) (%)	-	-	2.3	3.1	1.5	1.7	6	4.8
Sieve - #30 (>0.60mm) (%)	-	-	37	31	37	37	34	18
Sieve - #50 (>0.300 mm) (%)	-	-	19	19	18	18	17	16
(%)	-	-	14	15	13	13	13	18
Sieve - #270 (>0.053mm) (%)	-	-	13	15	14	14	14	23
Sieve - #400 (>0.030 mm) (%)	-	-	3.8	4	3.7	3.3	3.7	5.7
Sieve - Pan (%)	-	-	11	14	13	13	13	13
Moisture (%)	-	-	53.4	67.8	62.4	63.2	57.3	62.9
Total Metals (mg/kg)								
Total Aluminum (Al)	-	-	22200	24900	23700	25700	25200	21300
Total Antimony (Sb)	-	-	0.1	0.1	0.1	0.1	0.1	0.1
Total Arsenic (As)	**5.9**	**17**	3.8	4.8	4.9	4.1	4.8	**8.2**
Total Barium (Ba)	-	-	118	149	136	145	146	127
Total Beryllium (Be)	-	-	0.7	0.9	0.7	0.7	1.0	0.6
Total Bismuth (Bi)	-	-	0.2	0.3	0.2	0.2	0.2	0.2
Total Cadmium (Cd)	**0.6**	**3.5**	0.07	0.10	0.09	0.09	0.10	0.09
Total Chromium (Cr)	**37.3**	**90**	**65**	**76**	**69**	**71**	**74**	**63**
Total Cobalt (Co)	-	-	13.3	15.6	14.8	15.2	15.5	13.6
Total Copper (Cu)	**35.7**	**197**	29.3	34.8	32.5	32.6	33.4	31.1
Total Iron (Fe)	-	-	33200	39900	35700	38300	39100	41100
Total Lead (Pb)	**35**	**91.3**	8.7	10.1	9.5	9.7	10.0	8.5
Total Magnesium (Mg)	-	-	14500	16600	15900	16100	16700	14200
Total Manganese (Mn)	-	-	439	522	509	502	506	538
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	1.3	1.7	1.6	1.7	1.7	1.6
Total Nickel (Ni)	-	-	36.1	44.3	40.6	42.4	43.4	37.8
Total Phosphorus (P)	-	-	775	932	820	879	898	1080
Total Potassium (K)	-	-	5880	6850	6320	6460	6810	6370
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.11	0.12	0.11	0.11	0.12	0.09
Total Sodium (Na)	-	-	929	1160	1060	1050	1100	1090
Total Strontium (Sr)	-	-	24.7	30.4	27.8	29.0	28.3	27.3
Total Thallium (Tl)	-	-	0.22	0.26	0.23	0.24	0.28	0.23
Total Tin (Sn)	-	-	0.9	1.0	0.9	1.0	1.0	0.9
Total Titanium (Ti)	-	-	1350	1500	1440	1450	1480	1270
Total Vanadium (V)	-	-	69	77	74	76	77	67
Total Zinc (Zn)	**123**	**315**	81	92	85	90	91	78
Total Zirconium (Zr)	-	-	4.6	4.9	4.8	4.8	5.2	3.5

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Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Windy Lake						
			Gravity Core					Ekman	
	ISQG (TEL)	PEL	#1	#2	#3	#4	#5	Shallow	Deep
			25-Aug-07	25-Aug-07	25-Aug-07	25-Aug-07	25-Aug-07	23-Aug-07	25-Aug-07
TOC (g/kg)	-	-	0.84	0.82	0.89	0.73	0.97	0.67	1.0
Sand by hydrometer (%)	-	-	5	<2	<2	<2	2	22	<2
Silt by hydrometer (%)	-	-	45	47	47	47	49	59	20
Clay Content (%)	-	-	50	51	52	53	49	20	48
Texture	-	-	SILTY CLAY	SILTY CLAY	SILTY CLAY	SILTY CLAY	SILTY CLAY	SILT LOAM	SILTY CLAY
Sieve - #10 (>2.00mm) (%)	-	-	0.3	0.7	2.1	0.9	1.4	0.7	1.7
Sieve - #30 (>0.60mm) (%)	-	-	27	24	28	22	21	11	30
Sieve - #50 (>0.300 mm) (%)	-	-	21	21	20	22	22	7.8	19
(%)	-	-	15	16	15	16	16	6.4	14
Sieve - #270 (>0.053mm) (%)	-	-	17	17	16	20	19	40	19
Sieve - #400 (>0.030 mm) (%)	-	-	5.8	5.5	7.5	7.7	6.8	14	5.4
Sieve - Pan (%)	-	-	15	15	12	12	14	21	10
Moisture (%)	-	-	58.6	62.5	62.7	61.3	59.1	38.9	61.8
Total Metals (mg/kg)									
Total Aluminum (Al)	-	-	26300	26100	25700	26400	27000	10700	26100
Total Antimony (Sb)	-	-	0.2	0.2	0.2	0.2	0.2	<0.1	0.2
Total Arsenic (As)	**5.9**	**17**	4.9	5.8	4.9	5.6	5.2	2.6	**6.1**
Total Barium (Ba)	-	-	144	142	141	144	145	54.7	139
Total Beryllium (Be)	-	-	0.7	0.9	0.8	0.8	0.7	0.2	0.8
Total Bismuth (Bi)	-	-	0.3	0.3	0.3	0.3	0.3	0.1	0.3
Total Cadmium (Cd)	**0.6**	**3.5**	0.11	0.10	0.10	0.11	0.10	<0.05	0.08
Total Chromium (Cr)	**37.3**	**90**	**76**	**73**	**73**	**73**	**75**	34	**74**
Total Cobalt (Co)	-	-	16.3	15.9	15.8	15.6	15.8	7.5	15.8
Total Copper (Cu)	**35.7**	**197**	**43.7**	**41.3**	**41.5**	**40.6**	**40.7**	20.5	**42.3**
Total Iron (Fe)	-	-	38000	36100	35300	35100	36800	17400	36700
Total Lead (Pb)	**35**	**91.3**	10.8	10.6	10.6	10.6	10.7	4.9	10.7
Total Magnesium (Mg)	-	-	18000	17300	17600	17300	17500	7190	17100
Total Manganese (Mn)	-	-	475	466	472	432	453	197	452
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	1.1	1.5	1.4	1.4	1.5	0.7	1.4
Total Nickel (Ni)	-	-	43.4	43.8	41.5	42.7	42.3	18.6	41.4
Total Phosphorus (P)	-	-	864	771	804	774	835	557	898
Total Potassium (K)	-	-	7140	6920	6820	7020	6930	2650	6650
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.12	0.12	0.12	0.13	0.12	0.05	0.12
Total Sodium (Na)	-	-	1320	1270	1270	1240	1270	478	1220
Total Strontium (Sr)	-	-	34.7	33.7	33.8	33.9	33.6	15.7	34.3
Total Thallium (Tl)	-	-	0.28	0.29	0.27	0.30	0.28	0.07	0.28
Total Tin (Sn)	-	-	1.0	1.0	1.1	1.1	1.0	0.4	1.0
Total Titanium (Ti)	-	-	1580	1510	1500	1520	1510	701	1480
Total Vanadium (V)	-	-	77	74	73	73	75	36	75
Total Zinc (Zn)	**123**	**315**	96	90	92	93	91	38	90
Total Zirconium (Zr)	-	-	3.6	4.0	3.5	3.8	3.6	1.6	3.3

*Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life
TEL - Threshold Effect Level
PEL - Probable Effects Level
ISQG - Interim Sediment Quality Guideline
Bold and highlighted values area above the TEL

Appendix C1. Sediment particle size and chemistry for freshwater lakes, 2007.

	CCME - SQG*		Wolverine Lake					
			Gravity Core					Ekman
	ISQG (TEL)	PEL	#1	#2	#3	#4	#5	Shallow
			21-Aug-07	21-Aug-07	21-Aug-07	21-Aug-07	21-Aug-07	21-Aug-07
TOC (g/kg)	-	-	4.4	4.9	3.6	4.5	3.8	3.5
Sand by hydrometer (%)	-	-	2	3	<2	2	2	3
Silt by hydrometer (%)	-	-	49	59	63	62	63	64
Clay Content (%)	-	-	49	38	36	36	35	32
Texture	-	-	SILTY CLAY	SLTY CL LM	SLTY CL LM	SLTY CL LM	SLTY CL LM	SLTY CL LM
Sieve - #10 (>2.00mm) (%)	-	-	<0.1	0.1	0.3	0.4	<0.1	2.8
Sieve - #30 (>0.60mm) (%)	-	-	9.8	10	11	12	6.7	20
Sieve - #50 (>0.300 mm) (%)	-	-	15	17	18	18	15	15
(%)	-	-	16	16	16	16	16	12
Sieve - #270 (>0.053mm) (%)	-	-	24	21	21	20	23	19
Sieve - #400 (>0.030 mm) (%)	-	-	8.2	8.4	8.3	8.9	11	8
Sieve - Pan (%)	-	-	26	27	26	24	28	24
Moisture (%)	-	-	70.7	71.5	66.8	70.3	65.2	69.5
Total Metals (mg/kg)								
Total Aluminum (Al)	-	-	25700	22900	21700	21600	21900	19500
Total Antimony (Sb)	-	-	0.1	0.1	0.1	0.1	0.1	0.1
Total Arsenic (As)	**5.9**	**17**	3.5	3.2	3.1	3.1	3.2	3.5
Total Barium (Ba)	-	-	126	118	112	114	119	116
Total Beryllium (Be)	-	-	0.9	0.8	0.6	0.6	0.6	0.6
Total Bismuth (Bi)	-	-	0.2	0.2	0.2	0.2	0.2	0.2
Total Cadmium (Cd)	**0.6**	**3.5**	0.08	0.09	0.08	0.07	0.08	0.08
Total Chromium (Cr)	**37.3**	**90**	**71**	**67**	**63**	**65**	**65**	**59**
Total Cobalt (Co)	-	-	13.4	12.7	11.9	12.5	12.3	12.9
Total Copper (Cu)	**35.7**	**197**	32.6	32.1	29.1	31.3	30.7	28.0
Total Iron (Fe)	-	-	31400	29700	26900	29200	30600	35300
Total Lead (Pb)	**35**	**91.3**	9.5	9.3	8.9	8.9	9.2	9.0
Total Magnesium (Mg)	-	-	15400	14100	13400	13200	13700	11400
Total Manganese (Mn)	-	-	340	317	300	315	319	332
Total Mercury (Hg)	**0.17**	**0.486**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Total Molybdenum (Mo)	-	-	1.2	1.2	1.1	1.1	1.2	1.1
Total Nickel (Ni)	-	-	39.9	38.3	34.2	37.1	37.1	33.9
Total Phosphorus (P)	-	-	784	714	628	678	632	1150
Total Potassium (K)	-	-	5980	5600	4990	5250	5030	4650
Total Selenium (Se)	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Silver (Ag)	-	-	0.13	0.11	0.11	0.10	0.11	0.10
Total Sodium (Na)	-	-	1400	1410	1170	1300	1280	780
Total Strontium (Sr)	-	-	32.2	31.6	28.5	30.6	30.5	25.3
Total Thallium (Tl)	-	-	0.24	0.23	0.20	0.21	0.21	0.20
Total Tin (Sn)	-	-	1.0	0.9	0.8	0.9	0.9	0.8
Total Titanium (Ti)	-	-	1450	1360	1260	1310	1300	1190
Total Vanadium (V)	-	-	70	64	62	63	64	59
Total Zinc (Zn)	**123**	**315**	84	81	73	77	79	72
Total Zirconium (Zr)	-	-	5.1	4.7	4.6	4.5	4.8	4.3

*Sediment Quality Guidelines for the Protection of Freshwater Aquatic Life
TEL - Threshold Effect Level
PEL - Probable Effects Level
ISQG - Interim Sediment Quality Guideline
Bold and highlighted values area above the TEL

APPENDIX C2

SUMMARY STATISTICS FOR GRAVITY CORE SAMPLES

Appendix C2. Summary statistics for gravity core samples in freshwater lakes, 2007

	CCME - SQG[3]		Aimaokatalok Lake				Fickle Duck Lake				Reference Lake				Stickleback Lake			
	ISQG	PEL	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Physical																		
Moisture (%)			45	1.9	42.2	47.4	51.5	4.8	44.4	56.7	46.3	4.7	41.5	53.9	86	2.4	82.7	88
Organic																		
TOC (g/kg)			9.2	1.7	7.5	11	33	6	24	40	24	2	21	26	101	11	92	120
Total Metals																		
Total Aluminum (Al)			18660	907	17900	20000	14320	1374	12600	16200	16360	666	15500	17000	11960	680	11100	13000
Total Arsenic (As)	5.9	17	3.6	0.7	2.4	4.3	3.4	0.6	2.5	3.9	2.3	0.2	2.1	2.6	4.6	0.3	4.2	4.9
Total Cadmium (Cd)	0.6	3.5	0.16	0.09	0.08	0.26	0.09	0.01	0.08	0.11	0.12	0.01	0.11	0.13	0.18	0.09	0.12	0.33
Total Chromium (Cr)	37.3	90	***56***	3	***52***	***60***	***48***	6	***40***	***55***	***51***	1	***50***	***53***	36	2	34	***38***
Total Copper (Cu)	35.7	197	23.1	1.9	20.5	25.4	23.1	2.9	19.2	26.9	22.1	1	20.9	22.9	***36.8***	1.7	34.6	***39***
Total Iron (Fe)			25280	2567	22500	28300	20840	1939	18100	22900	23760	688	22800	24600	18000	768	17100	18900
Total Lead (Pb)	35	91.3	8.3	0.5	7.7	9	7	0.7	6.1	8	7.2	0.2	7	7.4	5.4	0.2	5.2	5.7
Total Mercury (Hg)	0.17	0.486	<0.05	0	<0.05	<0.05	<0.05	0	<0.05	<0.05	<0.05	0	<0.05	<0.05	<0.05	0	<0.05	<0.05
Total Selenium (Se)			<0.5	0	<0.5	<0.5	<0.5	0	<0.5	<0.5	<0.5	0	<0.5	<0.5	0.4	0.2	<0.5	0.7
Total Silver (Ag)			0.13	0.01	0.12	0.15	0.11	0.02	0.1	0.14	0.11	0.004	0.1	0.11	0.09	0.008	0.08	0.1
Total Zinc (Zn)	123	315	90	10	81	105	70	6	61	77	80	2	77	82	60	3	57	65

Appendix C2. Summary statistics for gravity core samples in freshwater lakes, 2007

Glenn Lake				Ogama Lake				Patch Lake South				Patch Lake North				Pelvic Lake			
Mean	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**	**Mean**	**SD**	**Min**	**Max**
52.8	1	51.9	54.2	52.8	2.5	49.6	55.9	59.8	2.4	56.1	62.9	71.4	3.6	66.9	75.4	59.8	4.3	54.6	65.1
6.1	0.2	5.9	6.5	23	3	19	27	16	0.4	15	16	24	4	21	30	16	1	14	17
28480	1746	26300	31100	20020	396	19700	20700	23760	643	22800	24400	27300	985	26400	28600	22720	1256	21600	24700
2.6	0.2	2.3	2.8	2.8	0.4	2.3	3.3	4.3	0.5	3.8	5	4.3	0.6	3.7	5.2	3.1	0.3	2.8	3.5
0.08	0.01	0.08	0.09	0.08	0.004	0.07	0.08	0.08	0.01	0.08	0.09	0.11	0.01	0.1	0.12	0.07	0.007	0.06	0.08
75	4	***70***	***82***	***60***	0.7	***59***	***61***	***69***	3	***65***	***72***	***78***	3	***74***	***82***	***63***	3	***59***	***68***
37.2	1.9	34.6	***39.8***	26.1	0.8	25.1	27	33	1.2	30.9	33.9	***53.4***	1.6	***50.9***	***55.1***	31.1	1.4	29.6	33.3
39500	2457	36000	42800	31820	1933	29200	34100	38240	1226	36600	39600	35180	981	34200	36200	33540	1959	31000	36000
9.9	0.5	9.2	10.7	8.2	0.3	7.9	8.7	9.9	0.3	9.4	10.2	10.1	0.4	9.8	10.7	8.7	0.4	8.2	9.2
<0.05	0	<0.05	<0.05	<0.05	0	<0.05	<0.05	<0.05	-	<0.05	<0.05	<0.05	0	<0.05	<0.05	<0.05	0	<0.05	<0.05
<0.5	0	<0.5	<0.5	<0.5	0	<0.5	<0.5	<0.5	-	<0.5	<0.5	<0.5	0	<0.5	<0.5	<0.5	0	<0.5	<0.5
0.12	0.008	0.11	0.13	0.11	0.005	0.1	0.11	0.11	0.005	0.1	0.11	0.11	0.005	0	0.11	0.1	0.004	0.1	0.11
97	5	90	105	78	1	76	79	85	2	81	87	95	3	91	98	81	4	75	85

Appendix C2. Summary statistics for gravity core samples in freshwater lakes, 2007

P.O. Lake				Windy Lake				Wolverine Lake			
Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
60.8	5.6	53.4	67.8	60.8	1.9	58.6	62.7	68.9	2.7	65.2	71.5
14	2	13	17	8.5	0.9	7.3	9.7	42	5	36	49
24340	1405	22200	25700	26300	474	25700	27000	22760	1723	21600	25700
4.5	0.5	3.8	4.9	5.3	0.4	4.9	5.8	3.2	0.2	3.1	3.5
0.09	0.01	0.07	0.1	0.1	0.01	0.1	0.11	0.08	0.01	0.07	0.09
71	4	***65***	***76***	***74***	1	***73***	***76***	***66***	3	***63***	***71***
32.5	2	29.3	34.8	***41.6***	1.3	***40.6***	***43.7***	31.2	1.4	29.1	32.6
37240	2755	33200	39900	36260	1184	35100	38000	29560	1710	26900	31400
9.6	0.6	8.7	10.1	10.7	0.1	10.6	10.8	9.2	0.3	8.9	9.5
<0.05	-	<0.05	<0.05	<0.05	0	<0.05	<0.05	<0.05	0	<0.05	<0.05
<0.5	-	<0.5	<0.5	<0.5	0	<0.5	<0.5	<0.5	0	<0.5	<0.5
0.11	0.005	0.11	0.12	0.12	0.004	0.12	0.13	0.11	0.01	0.1	0.13
88	5	81	92	92	2	90	96	79	4	73	84

APPENDIX D

PRIMARY PRODUCERS

APPENDIX D1

PHYTOPLANKTON BIOVOLUME

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Doris Lake			Little Roberts Lake		
	16-Jul-07	16-Aug-07	13-Sep-07	15-Jul-07	18-Aug-07	14-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Achnanthes minutissima				P	287	P
Achnanthes minutissima v. cryptocephala						
Amphipleura sp.						
Amphiprora alata						
Amphora sp.						167
Amphora ovalis						
Asterionalla formosa	108643	215425	7812	61582	171995	39080
Caloneis ventricosa						
Cocconeis sp.						
Cocconeis pediculus						
Cocconeis placentula						
Cyclotella sp.						
Cymatopleura solea						
Cymbella minuta		P			P	
Cymbella sp.						
Diatoma elongatum	44881	P	1128	52865	24834	P
Diploneis sp.		P				
Epithemia sp.						
Epithemia sorex			P			
Eunotia sp.				5626		
Fragilaria sp.		5688	P		P	
Fragilaria crotonensis						
Fragilaria construens						
Frustulia vulgaris						
Gomphonema sp.						
Gyrosigma sp.		P	P		P	P
Hannaea arcus						
Licmophora sp.						
Mastigloia sp.						
Melosira sp.	75037	90788	66157	41147	165915	57334
Melosira sp. large					P	P
Melosira sp. larger						
Melosira varians						
Navicula sp.		P	3729			
Navicula sp. 2	P		123			
Navicula sp. 2 larger					P	
Navicula cryptocephala						
Navicula lanceolata		P				
Nitzschia sp. 1					P	P
Nitzschia sp. 2						
Nitzschia acicularis	P					323
Nitzschia dissipata						
Nitzschia filiformis			P			
Nitzschia palea						
Nitzschia sigmoidea						P
Nitzschia tryblionella						P
Pinnularia sp.				P		P
Pinnularia maior						
Rhizosolenia longiseta	P		1004			13677
Rhopalodia sp.	P					
Rhoicosphenia curvata						
Stauroneis sp.						
Stauroneis smithii						
Stephanodiscus astraea			19794		45483	34855
Surirella sp.						
Surirella ovata						P
Synedra sp.			981			
Synedra sp. smaller	P	P			4505	4268
Synedra acus	P	45618		P	P	
Synedra ulna						
Tabellaria fenestrata						
Tabellaria flocculosa				P	P	
Unidentified diatom						
Unidentified pennate diatom			P			
Unidentified pennate diatom			P			
Unidentified centric diatom						
Unidentified centric diatom						
Unidentified centric small				7274		3358
Unidentified centric diatom (small)	84699					
Unidentified centric diatom (medium)		17532				
Total Bacillariophyta	**313260**	**375050**	**100727**	**168494**	**413018**	**153063**
Cyanomonas sp.			4787			P
Crypyochrysis commutata			1566			
Cryptomonas sp.		P	11355		17105	4053
Cryptomonas curvata		P	15086		P	26641
Cryptomonas erosa				33375	16207	
Cryptomonas ovata	26433	12161	21604	69548	36022	27471
Cryptomonas reflexa	25352	P	6330	51323	P	19743
Katablepharis ovalis	10491	P	13821	4921	5343	6371
Rhodomonas lens		12208	7896	279575	42231	28200
Rhodomonas minuta	94318	26636	2213			
Total Cryptophyta	**156595**	**51005**	**84659**	**438742**	**116908**	**112480**
Ankistrodesmus convolutus	P	P	616	145	845	457
Ankistrodesmus falcatus						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Doris Lake			Little Roberts Lake		
	16-Jul-07	16-Aug-07	13-Sep-07	15-Jul-07	18-Aug-07	14-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Ankistrodesmus falcatus v. acicularis		P			P	
Ankistrodesmus falcatus v. spiralis	P	P	1209		P	807
Arthrodesmus incus						
Botryococcus sp.						P
Characium sp.						
Chlamydomonas sp. a			1549	1481	1303	4488
Chlamydomonas sp. b	142900	P	12879	42703	13933	4268
Closterium sp.					P	
Coelastrum microporum				P	P	
Cosmarium sp.		5932			P	P
Cosmarium tetraopthalmum						
Crucigenia fenestrata						
Crucigenia quadrata				706		P
Cylindrocystis sp.						
Dictyosphaerium ehrenbergianum			P		4321	1092
Dispora crucigenioides						
Elakatothrix gelatinosa			288		674	1576
Elakatothrix viridis						
Euastrum binale						
Euastrum elegans						
Franceia ovalis						
Gloeotila pelagica						
Kirchneriella lunaris						
Kirchneriella sp.						
Monoraphidium						
Monoraphidium sp.	8730	6470	828	4153	2563	4715
Mougeotia sp.						
Oocystis sp.					P	1239
Oocystis solitaria v. major						
Pediastrum boryanum						
Pediastrum duplex						
Pediastrum tetras		P				
Scenedesmus sp.						
Scenedesmus acuminatus						
Scenedesmus bijuga				966	4946	1251
Scenedesmus quadricauda		2534	1475		P	
Scenedesmus spinosus						
Schroederia setigera						
Sphaerocystis schroeteri	P	6993			6146	4662
Spondylosium planum			1389			
Staurastrum sp. 1		P				
Staurastrum sp. 2						
Staurastrum sp. 3						
Staurastrum hexacerum						
Staurodesmus sp.						
Tetraedron arthrodesmiforme		634	84	P	268	124
Tetraedron caudatum						
Tetraedron incus			P			
Tetraedron limneticum						
Tetraedron minimum			P			
Tetraedron muticum					P	
Tetrastrum staurogeniaeforme				P		P
Tetraedron trigonum						
Tetraedron tumidulum						
Tetrastrum elegans						
Tetrastrum muticum						
Tetrastrum staurogeniaeforme				P		P
Tetrastrum triangulare						
Trigonum tumidulum						
Unidentified quadriflagellate						P
Unidentified filament						
Unidentified filament #1						3849
Unidentified filament #2						P
Total Chlorophyta	**151631**	**22563**	**20318**	**50154**	**34999**	**28527**
Euglena sp.		P			P	P
Lepocinclis sp.				P		
Phacus sp.			P			P
Trachelomonas sp.	P	P	P		P	P
Trachelomonas hispida						
Total Euglenophyta						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Doris Lake			Little Roberts Lake		
	16-Jul-07	16-Aug-07	13-Sep-07	15-Jul-07	18-Aug-07	14-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Bicoeca sp.						
Bitrichia longispina						
Chromulina sp.		P	5426			4887
Chrysidastrum catenatum						
Chrysochromulina parva						1396
Chrysococcus sp.		39264	21268	12085	28454	8197
Chrysoikos skujai						
Chrysosphaerella rodhei						2197
Dinobryon crenulatum						P
Dinobryon divergens					112261	15233
Dinobryon sertularia	389473	35419	3397	333608		
Dinobryon sociale	666776	10097	2984	179896	80633	162810
Dinobryon tabellariae	104919	27251	26051	27929	14267	P
Ishtmochloron trispinatum						
Kephyrion boreale				P		
Kephyrion obliquum		7294	456	1342	4232	1739
Kephyrion petasatum						
Kephyrion spirale		P			18996	
Keriopsis sp.						
Mallomonas sp.						
Ochromonas sp. a						
Ochromonas sp. b						
Ochromonas stellaris	P	44324		P	P	
Ophiocytium sp.						
Pseudokephyrion sp.					P	549
Stelexmonas dichotoma						3085
Stichogloea doederleinii						
Synura sp.	139875	58600	1951	45441	77955	13810
Unidentified statospore	226745	22562	2651	166994	11851	5998
Total Chrysophyta	**1527788**	**244810**	**63729**	**767296**	**348649**	**219900**
Ceratium hirudinella						
Glenodinium sp.	P		3314	P	1981	31724
Gymnodinium sp. a		44218		84102	P	42165
Gymnodinium sp. b						
Gymnodinium helveticum		P	P		P	
Gymnodinium uberrimum	P					
Peridinium aciculiferum				P		
Peridinium sp.	P		P		P	
Unidentified cyst				P		
Total Pyrrophyta		**44218**	**3314**	**84102**	**1981**	**73889**
Anabaena sp.			786	12098	1384	
Anabaena sp. akinete						
Anabaena circinalis						
Anabaena solitaria						
Anabaena solitaria akinete						
Aphanizomenon gracile		568748	387376	1875		323824
Aphanizomenon gracile akinete						
Aphanocapsa elachista v. planctonica						
Aphanothece clathrata		P	303	P	1224	2483
Calothrix sp.						
Chamaesiphon sp.						P
Chroococcus dispersus						
Chroococcus sp.					P	P
Gomphosphaeria aponina						
Gomphosphaeria naegelianum					P	
Lyngbya agardhii						
Lyngbya contorta		1457	P	227	3227	38582
Lyngbya limnetica			P			
Merismopedia sp.						
Merismopedia minima	P		939	28	15	644
Merismopedia punctata						
Microcystis sp.				P		
Nostoc sp.						
Oscillatoria agardhii	1691584	282904	4316743	1014489	1672945	2331315
Oscillatoria limnetica				28506	39810	47829
Oscillatoria limosa						
Pseudanabaena sp.		P			207207	4821
Unidentified akinete						
Unidentified cyanobacteria	30243	64731	120105			
Total Cyanobacteria	**1721827**	**917839**	**4826252**	**1057222**	**#N/A**	**2749497**
Total Biovolume (µm³ /mL)	**3,871,101**	**1,655,486**	**5,098,998**	**2,566,010**	**2,841,367**	**3,337,356**
Total Number of Taxa per Sample	**31**	**48**	**54**	**45**	**62**	**70**

P = taxon present

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Roberts Lake			Tail Lake		
	15-Jul-07	18-Aug-07	14-Sep-07	20-Jul-07	16-Aug-07	13-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Achnanthes minutissima			P	489	76	P
Achnanthes minutissima v. cryptocephala				P		
Amphipleura sp.						
Amphiprora alata						
Amphora sp.						
Amphora ovalis						
Asterionalla formosa	70507	111291	39054	P	P	100308
Caloneis ventricosa						
Cocconeis sp.			P		P	
Cocconeis pediculus						
Cocconeis placentula						
Cyclotella sp.						
Cymatopleura solea						
Cymbella minuta	P		P			P
Cymbella sp.		P				
Diatoma elongatum	69805	62863	13159		981	P
Diploneis sp.		P	P			P
Epithemia sp.						
Epithemia sorex						
Eunotia sp.						
Fragilaria sp.		554	P		P	
Fragilaria crotonensis						
Fragilaria construens						
Frustulia vulgaris					P	P
Gomphonema sp.						
Gyrosigma sp.					P	
Hannaea arcus		P	P		138	P
Licmophora sp.						
Mastigloia sp.						
Melosira sp.	73853	78973	56777			
Melosira sp. large						
Melosira sp. larger	123226		25564			
Melosira varians						
Navicula sp.			P	P		
Navicula sp. 2		P	P		P	
Navicula sp. 2 larger						
Navicula cryptocephala						
Navicula lanceolata						
Nitzschia sp. 1		P				P
Nitzschia sp. 2						
Nitzschia acicularis					76	
Nitzschia dissipata						
Nitzschia filiformis			P			
Nitzschia palea	P					
Nitzschia sigmoidea						
Nitzschia tryblionella						
Pinnularia sp.		P				P
Pinnularia maior						
Rhizosolenia longiseta			29257			12305
Rhopalodia sp.						
Rhoicosphenia curvata						
Stauroneis sp.						
Stauroneis smithii		P				
Stephanodiscus astraea			P			53625
Surirella sp.					P	
Surirella ovata						
Synedra sp.	4031	3837	P		1359	
Synedra sp. smaller	434	P	808	347		324
Synedra acus					P	
Synedra ulna						
Tabellaria fenestrata					P	P
Tabellaria flocculosa			12388		P	P
Unidentified diatom						
Unidentified pennate diatom				540		
Unidentified pennate diatom						
Unidentified centric diatom				14037	170811	22520
Unidentified centric diatom						
Unidentified centric small						
Unidentified centric diatom (small)	23695	20150				
Unidentified centric diatom (medium)	57619	14677	P			
Total Bacillariophyta	**423171**	**292345**	**177007**	**15414**	**173442**	**189082**
Cyanomonas sp.						
Crypyochrysis commutata						
Cryptomonas sp.		12512	3625			
Cryptomonas curvata		19455	P			
Cryptomonas erosa						
Cryptomonas ovata	89467	29278	P		P	
Cryptomonas reflexa	15531	26836	P	4083	1896	
Katablepharis ovalis	P	7165	2593	12435	445	2625
Rhodomonas lens		56639	38335			
Rhodomonas minuta	264786			40916	4455	43495
Total Cryptophyta	**369784**	**151884**	**44553**	**57434**	**6796**	**46121**
Ankistrodesmus convolutus	536	741	817			
Ankistrodesmus falcatus						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Roberts Lake			Tail Lake		
	15-Jul-07	18-Aug-07	14-Sep-07	20-Jul-07	16-Aug-07	13-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Ankistrodesmus falcatus v. acicularis						
Ankistrodesmus falcatus v. spiralis			1796			
Arthrodesmus incus						
Botryococcus sp.		P			P	65196
Characium sp.						
Chlamydomonas sp. a	2244		2088	1640	761	966
Chlamydomonas sp. b	76414	78621	56462	P		
Closterium sp.		6842				6772
Coelastrum microporum						
Cosmarium sp.	4299	4256	P			4854
Cosmarium tetraopthalmum						
Crucigenia fenestrata						
Crucigenia quadrata					389	
Cylindrocystis sp.						
Dictyosphaerium ehrenbergianum		10628	2018		1624	2060
Dispora crucigenioides						
Elakatothrix gelatinosa		1938	766	482	980	4335
Elakatothrix viridis						
Euastrum binale						
Euastrum elegans					10006	
Franceia ovalis	1983					
Gloeotila pelagica			27260			
Kirchneriella lunaris						
Kirchneriella sp.						
Monoraphidium						
Monoraphidium sp.	2228	1893	707	244	233	P
Mougeotia sp.						
Oocystis sp.		12968	3189	436	19817	8418
Oocystis solitaria v. major						
Pediastrum boryanum						
Pediastrum duplex						
Pediastrum tetras						
Scenedesmus sp.		3035				
Scenedesmus acuminatus						
Scenedesmus bijuga	2995	2365	3245		43	
Scenedesmus quadricauda		P	P			
Scenedesmus spinosus						
Schroederia setigera					67	7464
Sphaerocystis schroeteri		2275		P	7190	3652
Spondylosium planum					718	
Staurastrum sp. 1					P	
Staurastrum sp. 2						
Staurastrum sp. 3						
Staurastrum hexacerum						
Staurodesmus sp.						
Tetraedron arthrodesmiforme		P	67		21	
Tetraedron caudatum				646		
Tetraedron incus						
Tetraedron limneticum						
Tetraedron minimum						
Tetraedron muticum						
Tetrastrum staurogeniaeforme						
Tetraedron trigonum						
Tetraedron tumidulum						
Tetrastrum elegans	P		P			
Tetrastrum muticum						
Tetrastrum staurogeniaeforme						
Tetrastrum triangulare						
Trigonum tumidulum						
Unidentified quadriflagellate						
Unidentified filament						
Unidentified filament #1		397	806		P	
Unidentified filament #2		7066			2792	
Total Chlorophyta	**90699**	**133025**	**99222**	**3448**	**44642**	**103716**
Euglena sp.		68350	P		P	
Lepocinclis sp.						
Phacus sp.						
Trachelomonas sp.			P		7999	
Trachelomonas hispida						
Total Euglenophyta		**68350**			**7999**	

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Roberts Lake			Tail Lake		
	15-Jul-07	18-Aug-07	14-Sep-07	20-Jul-07	16-Aug-07	13-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Bicoeca sp.						
Bitrichia longispina						
Chromulina sp.						
Chrysidastrum catenatum			26183			
Chrysochromulina parva	626	657	167		352	2176
Chrysococcus sp.	14246	136902	80421	6148	10230	452
Chrysoikos skujai						
Chrysosphaerella rodhei						34780
Dinobryon crenulatum						
Dinobryon divergens		149405	45644	50907	20811	11965
Dinobryon sertularia	21650		P	107070	6959	
Dinobryon sociale	184476	331075	48790	166461	16077	2788
Dinobryon tabellariae	37832	40863				
Ishtmochloron trispinatum			P	P		
Kephyrion boreale						
Kephyrion obliquum		10014	558			
Kephyrion petasatum						
Kephyrion spirale	P					
Keriopsis sp.						
Mallomonas sp.	P					
Ochromonas sp. a			2456			
Ochromonas sp. b						
Ochromonas stellaris		20206				
Ophiocytium sp.				1539	P	
Pseudokephyrion sp.						16186
Stelexmonas dichotoma		P		P		
Stichogloea doederleinii				720		P
Synura sp.	11884	88500	30335	P	1611	12629
Unidentified statospore	125479	51744	5573	23684	2468	5737
Total Chrysophyta	**396193**	**829366**	**240127**	**356527**	**58509**	**86713**
Ceratium hirudinella						
Glenodinium sp.	3517		6545	11906		3533
Gymnodinium sp. a	7212	104277	43978	23410		
Gymnodinium sp. b						
Gymnodinium helveticum			P	P	P	P
Gymnodinium uberrimum						
Peridinium aciculiferum						
Peridinium sp.		P		P	32893	
Unidentified cyst						
Total Pyrrophyta	**10729**	**104277**	**50523**	**35316**	**32893**	**3533**
Anabaena sp.		37632	3383			
Anabaena sp. akinete						
Anabaena circinalis						
Anabaena solitaria						
Anabaena solitaria akinete						
Aphanizomenon gracile			178609		3069	
Aphanizomenon gracile akinete						
Aphanocapsa elachista v. planctonica						
Aphanothece clathrata		889	7508		366	2797
Calothrix sp.						
Chamaesiphon sp.						
Chroococcus dispersus						
Chroococcus sp.						
Gomphosphaeria aponina						
Gomphosphaeria naegelianum						2483
Lyngbya agardhii						
Lyngbya contorta	546	37957	72152			
Lyngbya limnetica						
Merismopedia sp.						
Merismopedia minima	3314	164	68			
Merismopedia punctata						
Microcystis sp.						
Nostoc sp.						
Oscillatoria agardhii	142877	356416	765929		302	
Oscillatoria limnetica	11904	56274		P	370	
Oscillatoria limosa		P				
Pseudanabaena sp.			2091		269	P
Unidentified akinete	4147	19031				
Unidentified cyanobacteria						
Total Cyanobacteria	**162788**	**508363**	**1029741**		**4376**	**5280**
Total Biovolume (µm³ /mL)	**1,453,365**	**2,087,610**	**1,641,173**	**468,139**	**328,656**	**434,445**
Total Number of Taxa per Sample	**37**	**57**	**62**	**32**	**52**	**40**

P = taxon present

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Roberts Bay			Glenn Lake		
	23-Jul-07	17-Aug-07	14-Sep-07	16-Jul-07	17-Aug-07	15-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Achnanthes minutissima	60					
Achnanthes minutissima v. cryptocephala		P				
Amphipleura sp.						
Amphiprora alata					P	P
Amphora sp.			P	P		P
Amphora ovalis						
Asterionalla formosa		P	8618			
Caloneis ventricosa						
Cocconeis sp.						
Cocconeis pediculus						
Cocconeis placentula						
Cyclotella sp.						
Cymatopleura solea						
Cymbella minuta		P				
Cymbella sp.					P	
Diatoma elongatum	P	P	1154	P	P	
Diploneis sp.						
Epithemia sp.					P	
Epithemia sorex						
Eunotia sp.						P
Fragilaria sp.						
Fragilaria crotonensis						
Fragilaria construens						
Frustulia vulgaris						
Gomphonema sp.	335		P			
Gyrosigma sp.	P				P	P
Hannaea arcus						
Licmophora sp.						
Mastigloia sp.			P			
Melosira sp.	862	6868	5991	9700	P	83363
Melosira sp. large						
Melosira sp. larger			P			P
Melosira varians	P					
Navicula sp.	P				P	
Navicula sp. 2		P			P	
Navicula sp. 2 larger						
Navicula cryptocephala						
Navicula lanceolata			511			
Nitzschia sp. 1	P					
Nitzschia sp. 2						
Nitzschia acicularis		P	P			
Nitzschia dissipata						
Nitzschia filiformis	P		P			
Nitzschia palea				P		
Nitzschia sigmoidea						
Nitzschia tryblionella			P			
Pinnularia sp.						
Pinnularia maior						
Rhizosolenia longiseta						
Rhopalodia sp.						
Rhoicosphenia curvata						
Stauroneis sp.						
Stauroneis smithii						
Stephanodiscus astraea	3395	P	P	10989		29587
Surirella sp.						
Surirella ovata						
Synedra sp.			316	P	P	
Synedra sp. smaller	152	198		30	1034	308
Synedra acus			P			
Synedra ulna					P	
Tabellaria fenestrata						
Tabellaria flocculosa						
Unidentified diatom						
Unidentified pennate diatom	P		P			
Unidentified pennate diatom	P		P			
Unidentified centric diatom						
Unidentified centric diatom						
Unidentified centric small						
Unidentified centric diatom (small)		141	P	15320	92730	
Unidentified centric diatom (medium)					57761	P
Total Bacillariophyta	**4804**	**7207**	**16589**	**36039**	**151524**	**113258**
Cyanomonas sp.					P	
Crypyochrysis commutata						
Cryptomonas sp.						
Cryptomonas curvata						
Cryptomonas erosa						
Cryptomonas ovata					P	13806
Cryptomonas reflexa	1115	P	P	2763	13320	30534
Katablepharis ovalis				592		1034
Rhodomonas lens					23670	
Rhodomonas minuta	11105	3444	613	15225	50106	67937
Total Cryptophyta	**12220**	**3444**	**613**	**18580**	**87096**	**113311**
Ankistrodesmus convolutus	234	75	115	8	25	205
Ankistrodesmus falcatus						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Roberts Bay			Glenn Lake		
	23-Jul-07	17-Aug-07	14-Sep-07	16-Jul-07	17-Aug-07	15-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Ankistrodesmus falcatus v. acicularis						
Ankistrodesmus falcatus v. spiralis		63	P			
Arthrodesmus incus						
Botryococcus sp.			12567			
Characium sp.						
Chlamydomonas sp. a				P		19774
Chlamydomonas sp. b	2341		3398		15820	1579
Closterium sp.						
Coelastrum microporum						
Cosmarium sp.	1067	1705	P		P	P
Cosmarium tetraopthalmum						
Crucigenia fenestrata						
Crucigenia quadrata						
Cylindrocystis sp.						
Dictyosphaerium ehrenbergianum						
Dispora crucigenioides						
Elakatothrix gelatinosa	P	116			882	1029
Elakatothrix viridis						
Euastrum binale						
Euastrum elegans						
Franceia ovalis	518					
Gloeotila pelagica						
Kirchneriella lunaris					704	
Kirchneriella sp.					3694	
Monoraphidium						
Monoraphidium sp.	135	168	467	326	508	743
Mougeotia sp.						
Oocystis sp.	1139					
Oocystis solitaria v. major						
Pediastrum boryanum						
Pediastrum duplex						
Pediastrum tetras						
Scenedesmus sp.						
Scenedesmus acuminatus						
Scenedesmus bijuga	278	P	152	70	1184	1514
Scenedesmus quadricauda						
Scenedesmus spinosus						
Schroederia setigera	63	55				
Sphaerocystis schroeteri					31704	1155
Spondylosium planum						
Staurastrum sp. 1						
Staurastrum sp. 2						
Staurastrum sp. 3						
Staurastrum hexacerum						
Staurodesmus sp.						
Tetraedron arthrodesmiforme	11	34		153	P	14
Tetraedron caudatum						
Tetraedron incus						
Tetraedron limneticum						
Tetraedron minimum						
Tetraedron muticum						
Tetrastrum staurogeniaeforme						
Tetraedron trigonum						
Tetraedron tumidulum						
Tetrastrum elegans			P	244		203
Tetrastrum muticum						
Tetrastrum staurogeniaeforme						
Tetrastrum triangulare						
Trigonum tumidulum						
Unidentified quadriflagellate						
Unidentified filament						
Unidentified filament #1						
Unidentified filament #2						
Total Chlorophyta	**5786**	**2216**	**16699**	**802**	**54520**	**26215**
Euglena sp.		P			2761	
Lepocinclis sp.						
Phacus sp.						
Trachelomonas sp.			P			
Trachelomonas hispida						
Total Euglenophyta					**2761**	

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Roberts Bay			Glenn Lake		
	23-Jul-07	17-Aug-07	14-Sep-07	16-Jul-07	17-Aug-07	15-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Bicoeca sp.						
Bitrichia longispina						
Chromulina sp.						3298
Chrysidastrum catenatum						
Chrysochromulina parva					166	4358
Chrysococcus sp.	876	5549	654	2475		P
Chrysoikos skujai						
Chrysosphaerella rodhei						9441
Dinobryon crenulatum						
Dinobryon divergens		2291	P			
Dinobryon sertularia	2811	878	P	15278		
Dinobryon sociale	1782	P	P	P		
Dinobryon tabellariae	5571	2318	P	7134	6033	11165
Ishtmochloron trispinatum					P	P
Kephyrion boreale				1665		
Kephyrion obliquum	659	49	242			679
Kephyrion petasatum						
Kephyrion spirale						
Keriopsis sp.						
Mallomonas sp.						
Ochromonas sp. a		P		2295		
Ochromonas sp. b						
Ochromonas stellaris						
Ophiocytium sp.						
Pseudokephyrion sp.						
Stelexmonas dichotoma						3586
Stichogloea doederleinii						
Synura sp.	5350					3562
Unidentified statospore	1531	1266	P	5649		4685
Total Chrysophyta	**18580**	**12351**	**896**	**34494**	**6199**	**40776**
Ceratium hirudinella						
Glenodinium sp.	6574	672	P		3027	1986
Gymnodinium sp. a	P	2854		2819	10702	
Gymnodinium sp. b						
Gymnodinium helveticum	9205	P		P		P
Gymnodinium uberrimum						
Peridinium aciculiferum						
Peridinium sp.	103412					
Unidentified cyst						
Total Pyrrophyta	**119192**	**3526**		**2819**	**13729**	**1986**
Anabaena sp.	P					
Anabaena sp. akinete		573	447			
Anabaena circinalis						
Anabaena solitaria						
Anabaena solitaria akinete						
Aphanizomenon gracile		524	13557		309	
Aphanizomenon gracile akinete						
Aphanocapsa elachista v. planctonica				178	222	154
Aphanothece clathrata						89
Calothrix sp.					6018	
Chamaesiphon sp.						
Chroococcus dispersus						
Chroococcus sp.						
Gomphosphaeria aponina						
Gomphosphaeria naegelianum						
Lyngbya agardhii						
Lyngbya contorta		60	2383			
Lyngbya limnetica	113					
Merismopedia sp.						
Merismopedia minima	29	66	147	118		60
Merismopedia punctata						
Microcystis sp.						
Nostoc sp.						
Oscillatoria agardhii	59391	65766	370003	9064		
Oscillatoria limnetica	661	1603	8782		85	
Oscillatoria limosa						
Pseudanabaena sp.		2014	551			
Unidentified akinete						
Unidentified cyanobacteria						
Total Cyanobacteria	**60194**	**70607**	**395871**	**9360**	**6635**	**304**
Total Biovolume (µm³ /mL)	**220,776**	**99,350**	**430,668**	**102,095**	**322,464**	**295,850**
Total Number of Taxa per Sample	**40**	**39**	**42**	**28**	**37**	**37**

P = taxon present

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Ogama Lake			Patch Lake		
	23-Jul-07	16-Aug-07	11-Sep-07	17-Jul-07	15-Aug-07	11-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Achnanthes minutissima						
Achnanthes minutissima v. cryptocephala						
Amphipleura sp.					P	
Amphiprora alata		P				
Amphora sp.	P					
Amphora ovalis			P	P	P	
Asterionalla formosa	176124	P	55318	P	P	P
Caloneis ventricosa						
Cocconeis sp.						
Cocconeis pediculus						
Cocconeis placentula						
Cyclotella sp.						
Cymatopleura solea		P	P		P	
Cymbella minuta		P		P	P	P
Cymbella sp.		P	P			
Diatoma elongatum	22018		5738		P	617
Diploneis sp.		P	P		P	
Epithemia sp.						
Epithemia sorex						
Eunotia sp.						
Fragilaria sp.			P	1801		305
Fragilaria crotonensis					P	
Fragilaria construens						
Frustulia vulgaris						
Gomphonema sp.	P					
Gyrosigma sp.		P	P		P	8536
Hannaea arcus					P	
Licmophora sp.						
Mastigloia sp.						
Melosira sp.	9945		20490		P	P
Melosira sp. large						
Melosira sp. larger						
Melosira varians						
Navicula sp.					P	P
Navicula sp. 2		P	P	P	414	
Navicula sp. 2 larger						
Navicula cryptocephala			P			
Navicula lanceolata					122	
Nitzschia sp. 1		P		41	98	
Nitzschia sp. 2	P					
Nitzschia acicularis					1304	
Nitzschia dissipata					127	123
Nitzschia filiformis						
Nitzschia palea						
Nitzschia sigmoidea					P	
Nitzschia tryblionella						
Pinnularia sp.						
Pinnularia maior						
Rhizosolenia longiseta			16251			
Rhopalodia sp.						
Rhoicosphenia curvata						
Stauroneis sp.						
Stauroneis smithii						
Stephanodiscus astraea		P	33831		P	9705
Surirella sp.		1841	P			
Surirella ovata						P
Synedra sp.	136960		3382	77	524	1243
Synedra sp. smaller		17496	1488	201	227	413
Synedra acus						764
Synedra ulna		P			P	
Tabellaria fenestrata						
Tabellaria flocculosa						P
Unidentified diatom	P					
Unidentified pennate diatom						
Unidentified pennate diatom						
Unidentified centric diatom	P		11735	P		
Unidentified centric diatom				P	394	P
Unidentified centric small						
Unidentified centric diatom (small)						
Unidentified centric diatom (medium)						
Total Bacillariophyta	**345047**	**19336**	**148235**	**2120**	**3210**	**21706**
Cyanomonas sp.						
Crypyochrysis commutata						
Cryptomonas sp.	12322			P	3818	2668
Cryptomonas curvata		P	P			P
Cryptomonas erosa		P				
Cryptomonas ovata			13891			1199
Cryptomonas reflexa	9015		15470	P	2264	1559
Katablepharis ovalis	13189	29638	5677	427	P	1980
Rhodomonas lens						
Rhodomonas minuta	27041	4640	25289	3705	17459	12252
Total Cryptophyta	**61568**	**34278**	**60328**	**4133**	**23541**	**19658**
Ankistrodesmus convolutus	539	140	890			
Ankistrodesmus falcatus						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Ogama Lake			Patch Lake		
	23-Jul-07	16-Aug-07	11-Sep-07	17-Jul-07	15-Aug-07	11-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Ankistrodesmus falcatus v. acicularis						
Ankistrodesmus falcatus v. spiralis		P	2672		P	75
Arthrodesmus incus						
Botryococcus sp.						2676
Characium sp.						
Chlamydomonas sp. a			4111		P	259
Chlamydomonas sp. b		56817	11105			1225
Closterium sp.		P				
Coelastrum microporum						
Cosmarium sp.	4736	P		938	1364	
Cosmarium tetraopthalmum						
Crucigenia fenestrata						
Crucigenia quadrata					132	981
Cylindrocystis sp.						
Dictyosphaerium ehrenbergianum	P	16972	1068			1484
Dispora crucigenioides						
Elakatothrix gelatinosa		P	1425	484		
Elakatothrix viridis						
Euastrum binale						
Euastrum elegans						
Franceia ovalis						
Gloeotila pelagica						
Kirchneriella lunaris						
Kirchneriella sp.						
Monoraphidium	6215	P	518			
Monoraphidium sp.				485	279	787
Mougeotia sp.	103003					
Oocystis sp.	3891		8439	2100	2571	3638
Oocystis solitaria v. major						
Pediastrum boryanum						
Pediastrum duplex						
Pediastrum tetras		P	P			
Scenedesmus sp.				P		P
Scenedesmus acuminatus						
Scenedesmus bijuga				281	P	
Scenedesmus quadricauda	P	P	2769			
Scenedesmus spinosus			P			
Schroederia setigera						
Sphaerocystis schroeteri		P	P		P	7931
Spondylosium planum			15997		2321	2367
Staurastrum sp. 1	P	334500				
Staurastrum sp. 2						
Staurastrum sp. 3						
Staurastrum hexacerum						
Staurodesmus sp.						
Tetraedron arthrodesmiforme	512	484	66	524	42	192
Tetraedron caudatum	2053		1692	P		
Tetraedron incus						
Tetraedron limneticum	P					
Tetraedron minimum						
Tetraedron muticum			9557		1215	
Tetrastrum staurogeniaeforme						
Tetraedron trigonum				27		
Tetraedron tumidulum			P			
Tetrastrum elegans		P	P			P
Tetrastrum muticum		P				
Tetrastrum staurogeniaeforme						
Tetrastrum triangulare						
Trigonum tumidulum						
Unidentified quadriflagellate		P				
Unidentified filament						
Unidentified filament #1			5098		P	446
Unidentified filament #2						605
Total Chlorophyta	**120948**	**408913**	**65407**	**4838**	**7924**	**22666**
Euglena sp.	P	P			P	P
Lepocinclis sp.						
Phacus sp.						
Trachelomonas sp.			P			
Trachelomonas hispida						
Total Euglenophyta						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Ogama Lake			Patch Lake		
	23-Jul-07	16-Aug-07	11-Sep-07	17-Jul-07	15-Aug-07	11-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Bicoeca sp.			P			
Bitrichia longispina						
Chromulina sp.		9833				607
Chrysidastrum catenatum			6984			
Chrysochromulina parva		2449				
Chrysococcus sp.	51154	90569	27476	27848	23839	13561
Chrysoikos skujai						
Chrysosphaerella rodhei						
Dinobryon crenulatum						4855
Dinobryon divergens			6646			1629
Dinobryon sertularia	52068			5768	P	2656
Dinobryon sociale	668658	23662	113447	23467	42199	114308
Dinobryon tabellariae	40339		14433	1794	16313	1762
Ishtmochloron trispinatum	P			1100		
Kephyrion boreale						
Kephyrion obliquum	1019			11594	1637	1652
Kephyrion petasatum						
Kephyrion spirale		20868	P	16779	4007	
Keriopsis sp.						
Mallomonas sp.						
Ochromonas sp. a						539
Ochromonas sp. b						
Ochromonas stellaris	P		P			
Ophiocytium sp.						
Pseudokephyrion sp.						
Stelexmonas dichotoma			3331			9800
Stichogloea doederleinii						825
Synura sp.	309722		5038	210		P
Unidentified statospore	53479		12883	14495	4651	6038
Total Chrysophyta	**1176439**	**147381**	**190239**	**103055**	**92645**	**158234**
Ceratium hirudinella						
Glenodinium sp.	23601	P	20716	6884	P	991
Gymnodinium sp. a	94542	P	22152	40785	11238	
Gymnodinium sp. b						
Gymnodinium helveticum	P	P	P	62641	37397	P
Gymnodinium uberrimum		202239	P			
Peridinium aciculiferum	P					
Peridinium sp.		P	P			
Unidentified cyst						
Total Pyrrophyta	**118143**	**202239**	**42867**	**110309**	**48635**	**991**
Anabaena sp.	P	P	34174			
Anabaena sp. akinete			3098			
Anabaena circinalis						
Anabaena solitaria						
Anabaena solitaria akinete						
Aphanizomenon gracile	229126	755383	622627		P	286
Aphanizomenon gracile akinete		21836				
Aphanocapsa elachista v. planctonica					700	P
Aphanothece clathrata		P	80	259	270	209
Calothrix sp.						
Chamaesiphon sp.						
Chroococcus dispersus					P	
Chroococcus sp.						
Gomphosphaeria aponina						
Gomphosphaeria naegelianum		P	262			
Lyngbya agardhii						
Lyngbya contorta		1029	4245			
Lyngbya limnetica						
Merismopedia sp.						
Merismopedia minima		P	49810			
Merismopedia punctata						
Microcystis sp.						
Nostoc sp.						
Oscillatoria agardhii	622867	2104754	3592639		1561	P
Oscillatoria limnetica		250358	950248		297	95
Oscillatoria limosa						
Pseudanabaena sp.		102662		P		
Unidentified akinete						
Unidentified cyanobacteria						
Total Cyanobacteria	**851993**	**3236021**	**5257184**	**259**	**2828**	**590**
Total Biovolume (µm³ /mL)	**2,674,138**	**4,048,168**	**5,764,259**	**224,715**	**178,783**	**223,844**
Total Number of Taxa per Sample	**40**	**53**	**66**	**36**	**55**	**56**

P = taxon present

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Pelvic Lake			P.O. Lake		
	16-Jul-07	16-Aug-07	13-Sep-07	17-Jul-07	15-Aug-07	11-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Achnanthes minutissima		P				126
Achnanthes minutissima v. cryptocephala						
Amphipleura sp.						
Amphiprora alata			P			
Amphora sp.			P			
Amphora ovalis						
Asterionalla formosa	P	210597	26942			P
Caloneis ventricosa						
Cocconeis sp.						
Cocconeis pediculus						
Cocconeis placentula						
Cyclotella sp.						
Cymatopleura solea						
Cymbella minuta			P			P
Cymbella sp.			P	P	P	
Diatoma elongatum	62588		7700	786		P
Diploneis sp.						
Epithemia sp.						P
Epithemia sorex			P			
Eunotia sp.						
Fragilaria sp.		P	2769			P
Fragilaria crotonensis						
Fragilaria construens		P				
Frustulia vulgaris						
Gomphonema sp.			P		544	P
Gyrosigma sp.			P			P
Hannaea arcus			P			
Licmophora sp.						
Mastigloia sp.						
Melosira sp.		52216	101128			P
Melosira sp. large						
Melosira sp. larger						
Melosira varians						
Navicula sp.		P			P	
Navicula sp. 2		P	P			P
Navicula sp. 2 larger						
Navicula cryptocephala						
Navicula lanceolata			P			
Nitzschia sp. 1		P	P		P	P
Nitzschia sp. 2						
Nitzschia acicularis					P	
Nitzschia dissipata						
Nitzschia filiformis						P
Nitzschia palea						
Nitzschia sigmoidea						
Nitzschia tryblionella			P			
Pinnularia sp.						
Pinnularia maior						
Rhizosolenia longiseta		97015	36479			
Rhopalodia sp.						
Rhoicosphenia curvata						
Stauroneis sp.			P			
Stauroneis smithii						P
Stephanodiscus astraea		57375	P			P
Surirella sp.		P	P			
Surirella ovata						
Synedra sp.		777	543			
Synedra sp. smaller	3641	3547	1120	333	396	440
Synedra acus			P			
Synedra ulna		P	117797			
Tabellaria fenestrata						
Tabellaria flocculosa						
Unidentified diatom						
Unidentified pennate diatom	P	P	P	P	P	
Unidentified pennate diatom	P	P	P	P	P	
Unidentified centric diatom						
Unidentified centric diatom						
Unidentified centric small						
Unidentified centric diatom (small)		310		1252	321	807
Unidentified centric diatom (medium)				15756	22187	
Total Bacillariophyta	**66229**	**421837**	**294478**	**18127**	**23448**	**1373**
Cyanomonas sp.						
Crypyochrysis commutata						
Cryptomonas sp.		P	4485	P	6030	11745
Cryptomonas curvata		30413	14982	P		
Cryptomonas erosa		206		6276		
Cryptomonas ovata	P	150216	34379	1896		P
Cryptomonas reflexa	8276	22139	28682	4635	2296	43485
Katablepharis ovalis	733	1276	16095	2649	7255	14817
Rhodomonas lens		5064	2293		P	
Rhodomonas minuta	43211	14004		5466	2849	184821
Total Cryptophyta	**52219**	**223319**	**100917**	**20922**	**18430**	**254867**
Ankistrodesmus convolutus					21	574
Ankistrodesmus falcatus						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Pelvic Lake			P.O. Lake		
	16-Jul-07	16-Aug-07	13-Sep-07	17-Jul-07	15-Aug-07	11-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Ankistrodesmus falcatus v. acicularis						
Ankistrodesmus falcatus v. spiralis		P	157		P	P
Arthrodesmus incus					2248	
Botryococcus sp.						P
Characium sp.						
Chlamydomonas sp. a	1084	4130	725	569		1615
Chlamydomonas sp. b		43416	15438	2798	22863	7843
Closterium sp.						
Coelastrum microporum						
Cosmarium sp.	P			P		
Cosmarium tetraopthalmum						
Crucigenia fenestrata						
Crucigenia quadrata					P	P
Cylindrocystis sp.						
Dictyosphaerium ehrenbergianum		465	354			P
Dispora crucigenioides						
Elakatothrix gelatinosa		915	387		2094	1036
Elakatothrix viridis						
Euastrum binale						
Euastrum elegans						
Franceia ovalis						
Gloeotila pelagica						
Kirchneriella lunaris						
Kirchneriella sp.			233	17		
Monoraphidium						
Monoraphidium sp.	P	7152	8363	829	447	1161
Mougeotia sp.						
Oocystis sp.	7999	708	466		294	3802
Oocystis solitaria v. major						
Pediastrum boryanum						
Pediastrum duplex						
Pediastrum tetras		817				
Scenedesmus sp.						
Scenedesmus acuminatus						
Scenedesmus bijuga			P			
Scenedesmus quadricauda	P	P	364			
Scenedesmus spinosus						
Schroederia setigera					580	649
Sphaerocystis schroeteri		15447			P	7950
Spondylosium planum	2573	5807	1941		P	2997
Staurastrum sp. 1						
Staurastrum sp. 2						
Staurastrum sp. 3						
Staurastrum hexacerum						
Staurodesmus sp.						
Tetraedron arthrodesmiforme		116	67	71	40	112
Tetraedron caudatum						
Tetraedron incus						
Tetraedron limneticum						
Tetraedron minimum						
Tetraedron muticum		33411	3148			
Tetrastrum staurogeniaeforme						
Tetraedron trigonum						
Tetraedron tumidulum						
Tetrastrum elegans						
Tetrastrum muticum						
Tetrastrum staurogeniaeforme						
Tetrastrum triangulare						
Trigonum tumidulum						
Unidentified quadriflagellate						
Unidentified filament						
Unidentified filament #1		10909	5982			
Unidentified filament #2						
Total Chlorophyta	**11657**	**123294**	**37625**	**4284**	**28586**	**27740**
Euglena sp.	P	19612	P			
Lepocinclis sp.			2907			
Phacus sp.						
Trachelomonas sp.		P	P	P	P	26579
Trachelomonas hispida						
Total Euglenophyta		**19612**	**2907**			**26579**

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Pelvic Lake			P.O. Lake		
	16-Jul-07	16-Aug-07	13-Sep-07	17-Jul-07	15-Aug-07	11-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Bicoeca sp.						P
Bitrichia longispina						
Chromulina sp.		P	7330			3866
Chrysidastrum catenatum		6984				
Chrysochromulina parva						802
Chrysococcus sp.		62656	26453	5626	27897	31560
Chrysoikos skujai						
Chrysosphaerella rodhei						
Dinobryon crenulatum						
Dinobryon divergens			P			
Dinobryon sertularia	240697	P	3600	100804		
Dinobryon sociale	317403	79150	59197	249206		3507
Dinobryon tabellariae	18811	P	4628	5550		5286
Ishtmochloron trispinatum	P					
Kephyrion boreale						
Kephyrion obliquum		1925	637	3158	2155	4895
Kephyrion petasatum						
Kephyrion spirale						
Keriopsis sp.						
Mallomonas sp.						
Ochromonas sp. a				83881		
Ochromonas sp. b						
Ochromonas stellaris	P	38408	3159			
Ophiocytium sp.						
Pseudokephyrion sp.						
Stelexmonas dichotoma			8336			
Stichogloea doederleinii					P	P
Synura sp.	2607	67588	P			
Unidentified statospore	248229	10128	1727	20157	2616	19336
Total Chrysophyta	**827747**	**266839**	**115067**	**468382**	**32668**	**69252**
Ceratium hirudinella						
Glenodinium sp.		20349	815		4058	4086
Gymnodinium sp. a	28232		4522	8363		16571
Gymnodinium sp. b						
Gymnodinium helveticum	118170	P	94635			
Gymnodinium uberrimum		P				P
Peridinium aciculiferum	P		P	P		
Peridinium sp.		32566				
Unidentified cyst		P		P		
Total Pyrrophyta	**146402**	**52914**	**99972**	**8363**	**4058**	**20657**
Anabaena sp.		3198	2253193		1261	
Anabaena sp. akinete		1693				
Anabaena circinalis						
Anabaena solitaria						
Anabaena solitaria akinete						
Aphanizomenon gracile		638407	36702		P	135
Aphanizomenon gracile akinete						
Aphanocapsa elachista v. planctonica		128				3802
Aphanothece clathrata		P	37			P
Calothrix sp.						
Chamaesiphon sp.						
Chroococcus dispersus						
Chroococcus sp.						
Gomphosphaeria aponina						
Gomphosphaeria naegelianum			P			
Lyngbya agardhii						
Lyngbya contorta						
Lyngbya limnetica			P			
Merismopedia sp.						
Merismopedia minima	51			20		31
Merismopedia punctata						
Microcystis sp.						
Nostoc sp.						
Oscillatoria agardhii	2532726	1828898	4784126	4037		P
Oscillatoria limnetica		8496		P	447	180
Oscillatoria limosa						
Pseudanabaena sp.	P	24392		288841	P	
Unidentified akinete						
Unidentified cyanobacteria						
Total Cyanobacteria	**2532777**	**2505212**	**7074058**	**292898**	**1708**	**4147**
Total Biovolume (µm³ /mL)	**3,637,032**	**3,613,027**	**7,725,023**	**812,976**	**108,897**	**404,614**
Total Number of Taxa per Sample	**28**	**63**	**69**	**34**	**36**	**53**

P = taxon present

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Windy Lake			Wolverine Lake		
	18-Jul-07	21-Aug-07	15-Sep-07	17-Jul-07	15-Aug-07	9-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Achnanthes minutissima		P		69	81	P
Achnanthes minutissima v. cryptocephala				266		
Amphipleura sp.						
Amphiprora alata						
Amphora sp.			P			
Amphora ovalis	P			P		
Asterionalla formosa	P	P		3091	P	3241
Caloneis ventricosa						
Cocconeis sp.				P	P	
Cocconeis pediculus						
Cocconeis placentula	P					
Cyclotella sp.						
Cymatopleura solea						
Cymbella minuta		P		P		P
Cymbella sp.				P		
Diatoma elongatum	166			3252	24816	10668
Diploneis sp.	P		P			P
Epithemia sp.		P	P			
Epithemia sorex						
Eunotia sp.	834					
Fragilaria sp.			P			
Fragilaria crotonensis						
Fragilaria construens						
Frustulia vulgaris					P	
Gomphonema sp.						P
Gyrosigma sp.	P	P	P			
Hannaea arcus	P					
Licmophora sp.						
Mastigloia sp.						
Melosira sp.		P				
Melosira sp. large						
Melosira sp. larger						
Melosira varians						
Navicula sp.					P	P
Navicula sp. 2	39	P	P	P	P	P
Navicula sp. 2 larger						
Navicula cryptocephala						
Navicula lanceolata				P		
Nitzschia sp. 1	P		P		P	
Nitzschia sp. 2						
Nitzschia acicularis						P
Nitzschia dissipata						
Nitzschia filiformis						
Nitzschia palea						
Nitzschia sigmoidea			P			
Nitzschia tryblionella			P			
Pinnularia sp.			P			
Pinnularia maior						
Rhizosolenia longiseta						
Rhopalodia sp.						
Rhoicosphenia curvata	P					
Stauroneis sp.						
Stauroneis smithii						
Stephanodiscus astraea	9818	17113	21557			
Surirella sp.			345			
Surirella ovata						
Synedra sp.		80		6779	2109	3722
Synedra sp. smaller	12	139	29	352		355
Synedra acus				47204		113794
Synedra ulna						
Tabellaria fenestrata						
Tabellaria flocculosa					P	
Unidentified diatom					P	
Unidentified pennate diatom	P		30			
Unidentified pennate diatom	P					
Unidentified centric diatom						
Unidentified centric diatom						
Unidentified centric small						
Unidentified centric diatom (small)	7904	3755	6276			
Unidentified centric diatom (medium)		23716				
Total Bacillariophyta	**18774**	**44803**	**28237**	**61013**	**27007**	**131780**
Cyanomonas sp.						
Crypyochrysis commutata						
Cryptomonas sp.					9094	2918
Cryptomonas curvata					19242	
Cryptomonas erosa					P	
Cryptomonas ovata	P			10239	94011	79250
Cryptomonas reflexa				4312	P	5623
Katablepharis ovalis	3712			5632	1741	1660
Rhodomonas lens		703			13895	
Rhodomonas minuta	7076	4027	3155	11074	573	1863
Total Cryptophyta	**10788**	**4729**	**3155**	**31257**	**138556**	**91313**
Ankistrodesmus convolutus	235	1265	1776	P	P	P
Ankistrodesmus falcatus						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Windy Lake			Wolverine Lake		
	18-Jul-07	21-Aug-07	15-Sep-07	17-Jul-07	15-Aug-07	9-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Ankistrodesmus falcatus v. acicularis				239	62949	
Ankistrodesmus falcatus v. spiralis					132	132
Arthrodesmus incus						
Botryococcus sp.						P
Characium sp.						
Chlamydomonas sp. a						
Chlamydomonas sp. b	1920			13131	41025	21006
Closterium sp.						
Coelastrum microporum						
Cosmarium sp.						
Cosmarium tetraopthalmum						
Crucigenia fenestrata						
Crucigenia quadrata						
Cylindrocystis sp.						
Dictyosphaerium ehrenbergianum						
Dispora crucigenioides						
Elakatothrix gelatinosa		784	275		274	96
Elakatothrix viridis						
Euastrum binale						
Euastrum elegans						
Franceia ovalis					1786	P
Gloeotila pelagica						
Kirchneriella lunaris						
Kirchneriella sp.		33				
Monoraphidium					1810	3465
Monoraphidium sp.	107	228	685			
Mougeotia sp.			P			
Oocystis sp.	480	507	2544	P	5680	1660
Oocystis solitaria v. major						
Pediastrum boryanum						
Pediastrum duplex						
Pediastrum tetras						
Scenedesmus sp.				P	727	
Scenedesmus acuminatus						
Scenedesmus bijuga	74			1154		
Scenedesmus quadricauda					P	
Scenedesmus spinosus						
Schroederia setigera						
Sphaerocystis schroeteri		1517			1164	1517
Spondylosium planum				P	2400	4739
Staurastrum sp. 1				P		P
Staurastrum sp. 2						
Staurastrum sp. 3						
Staurastrum hexacerum						
Staurodesmus sp.						
Tetraedron arthrodesmiforme	P	67	34	1404	796	606
Tetraedron caudatum				3211	P	
Tetraedron incus						
Tetraedron limneticum						
Tetraedron minimum		128			407	
Tetraedron muticum						
Tetrastrum staurogeniaeforme						
Tetraedron trigonum				P		
Tetraedron tumidulum						
Tetrastrum elegans				175		
Tetrastrum muticum						
Tetrastrum staurogeniaeforme						
Tetrastrum triangulare						
Trigonum tumidulum						
Unidentified quadriflagellate						
Unidentified filament			P			
Unidentified filament #1						
Unidentified filament #2						
Total Chlorophyta	**2815**	**4529**	**5314**	**19314**	**119150**	**33222**
Euglena sp.	1443	1061	P	44997	16527	P
Lepocinclis sp.						
Phacus sp.					P	
Trachelomonas sp.						
Trachelomonas hispida					19770	P
Total Euglenophyta	**1443**	**1061**		**44997**	**36297**	

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Windy Lake			Wolverine Lake		
	18-Jul-07	21-Aug-07	15-Sep-07	17-Jul-07	15-Aug-07	9-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Bicoeca sp.						
Bitrichia longispina						
Chromulina sp.			1330			
Chrysidastrum catenatum						P
Chrysochromulina parva			99			
Chrysococcus sp.	18100	2161	2028	150928	119097	24619
Chrysoikos skujai						633
Chrysosphaerella rodhei	P					105009
Dinobryon crenulatum				16113	21697	49189
Dinobryon divergens						165820
Dinobryon sertularia	P	1241		8121	21872	
Dinobryon sociale	3069	P	950	408866	P	100385
Dinobryon tabellariae	1726	8808	18928			P
Ishtmochloron trispinatum	2040	P	P			
Kephyrion boreale				14686	1824	1179
Kephyrion obliquum						
Kephyrion petasatum		P				
Kephyrion spirale	P	2951	P			868253
Keriopsis sp.						
Mallomonas sp.						
Ochromonas sp. a						
Ochromonas sp. b						
Ochromonas stellaris						
Ophiocytium sp.						
Pseudokephyrion sp.						
Stelexmonas dichotoma			24905			2064
Stichogloea doederleinii						P
Synura sp.	51687	1031		34967	76790	126447
Unidentified statospore	756	3335	972	P		3815
Total Chrysophyta	**77379**	**19528**	**49211**	**633681**	**241280**	**1447414**
Ceratium hirudinella						
Glenodinium sp.	7071	P		1498	4881	
Gymnodinium sp. a	31775	7053	5019	67789	99548	10789
Gymnodinium sp. b						
Gymnodinium helveticum	916	45182	26012	44249	96145	30602
Gymnodinium uberrimum			12025	103402	P	55339
Peridinium aciculiferum						
Peridinium sp.				291129	32218	
Unidentified cyst						
Total Pyrrophyta	**39762**	**52235**	**43056**	**508067**	**232792**	**96729**
Anabaena sp.		11218	2044	P		
Anabaena sp. akinete		11519	1111			
Anabaena circinalis						
Anabaena solitaria						
Anabaena solitaria akinete						
Aphanizomenon gracile		960				
Aphanizomenon gracile akinete						
Aphanocapsa elachista v. planctonica		180			902	24
Aphanothece clathrata			1217		2389	316
Calothrix sp.						
Chamaesiphon sp.						
Chroococcus dispersus			1740		P	
Chroococcus sp.						
Gomphosphaeria aponina						
Gomphosphaeria naegelianum						
Lyngbya agardhii				P	P	2843
Lyngbya contorta						
Lyngbya limnetica	11	9			990	79
Merismopedia sp.						
Merismopedia minima	3		3	24		
Merismopedia punctata						
Microcystis sp.	886					
Nostoc sp.						
Oscillatoria agardhii	P	P	402			
Oscillatoria limnetica	50			1634		
Oscillatoria limosa						
Pseudanabaena sp.	P				P	P
Unidentified akinete					601	
Unidentified cyanobacteria						
Total Cyanobacteria	**950**	**23886**	**6517**	**1658**	**4882**	**3261**
Total Biovolume (µm³ /mL)	**151,910**	**150,773**	**135,490**	**1,299,987**	**799,963**	**1,803,720**
Total Number of Taxa per Sample	**43**	**40**	**41**	**45**	**54**	**52**

P = taxon present

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Aimaokatalok Lake Site 4			Aimaokatalok Lake Site 6		
	21-Jul-07	19-Aug-07	8-Sep-07	22-Jul-07	19-Aug-07	8-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Achnanthes minutissima	902				1187	P
Achnanthes minutissima v. cryptocephala						
Amphipleura sp.						
Amphiprora alata						
Amphora sp.						
Amphora ovalis						
Asterionalla formosa	P	406	18493	P	P	45798
Caloneis ventricosa						
Cocconeis sp.				P		
Cocconeis pediculus						
Cocconeis placentula						
Cyclotella sp.	13008	4970	2376			1209
Cymatopleura solea						
Cymbella minuta					P	P
Cymbella sp.						
Diatoma elongatum	17781	P	P	P		P
Diploneis sp.						
Epithemia sp.	P					
Epithemia sorex						
Eunotia sp.						
Fragilaria sp.	1122					
Fragilaria crotonensis						
Fragilaria construens						
Frustulia vulgaris		P				P
Gomphonema sp.						
Gyrosigma sp.	P					
Hannaea arcus			P			
Licmophora sp.						
Mastigloia sp.						
Melosira sp.	28697	57051	7060	25744	16813	13780
Melosira sp. large	P		P			
Melosira sp. larger						P
Melosira varians					P	
Navicula sp.	P	P			P	
Navicula sp. 2						
Navicula sp. 2 larger						
Navicula cryptocephala						
Navicula lanceolata		P				
Nitzschia sp. 1	P			P		P
Nitzschia sp. 2						
Nitzschia acicularis						
Nitzschia dissipata						
Nitzschia filiformis					P	P
Nitzschia palea						
Nitzschia sigmoidea						P
Nitzschia tryblionella						
Pinnularia sp.	P	P	P			P
Pinnularia maior	P					
Rhizosolenia longiseta			P			
Rhopalodia sp.						
Rhoicosphenia curvata	P					
Stauroneis sp.						
Stauroneis smithii						
Stephanodiscus astraea	P	41137	17251			P
Surirella sp.			P			P
Surirella ovata						
Synedra sp.				P		
Synedra sp. smaller	367	1360	2350		231	
Synedra acus						1618
Synedra ulna						
Tabellaria fenestrata						P
Tabellaria flocculosa		P	P			P
Unidentified diatom	359					
Unidentified pennate diatom					P	P
Unidentified pennate diatom					P	P
Unidentified centric diatom						
Unidentified centric diatom						
Unidentified centric small						
Unidentified centric diatom (small)				23131	12872	
Unidentified centric diatom (medium)					15846	
Total Bacillariophyta	**62235**	**104925**	**47531**	**48875**	**46950**	**62406**
Cyanomonas sp.	4941					
Crypyochrysis commutata						
Cryptomonas sp.	29078		912		5578	P
Cryptomonas curvata	P	13492				
Cryptomonas erosa	14773	P	P	8726	16810	
Cryptomonas ovata	45210	P	25725	73346	19240	2348
Cryptomonas reflexa	P	4830	13455	56480	16428	7306
Katablepharis ovalis	24479	2512	1179	23371	918	757
Rhodomonas lens	57056	37710	41845		18922	71553
Rhodomonas minuta		6237		27540	30639	12485
Total Cryptophyta	**175537**	**64780**	**83116**	**189462**	**108533**	**94449**
Ankistrodesmus convolutus		330	279	310	461	167
Ankistrodesmus falcatus						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Aimaokatalok Lake Site 4			Aimaokatalok Lake Site 6		
	21-Jul-07	19-Aug-07	8-Sep-07	22-Jul-07	19-Aug-07	8-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Ankistrodesmus falcatus v. acicularis	121					
Ankistrodesmus falcatus v. spiralis		309	238		P	328
Arthrodesmus incus			P		P	P
Botryococcus sp.		P	11379		P	22601
Characium sp.						
Chlamydomonas sp. a		373	1948		P	985
Chlamydomonas sp. b	8798	6651	7416	14068	P	6023
Closterium sp.						
Coelastrum microporum						
Cosmarium sp.	10823	P	P	P	P	P
Cosmarium tetraopthalmum						
Crucigenia fenestrata			960		P	P
Crucigenia quadrata	P	3854	2328		6638	6188
Cylindrocystis sp.						
Dictyosphaerium ehrenbergianum		548	5201			1262
Dispora crucigenioides						
Elakatothrix gelatinosa	P	1109	462		2184	234
Elakatothrix viridis		2999				
Euastrum binale						
Euastrum elegans		P				P
Franceia ovalis						
Gloeotila pelagica						
Kirchneriella lunaris						
Kirchneriella sp.	122	431	2636	P	375	684
Monoraphidium						
Monoraphidium sp.	1087	452	436	1993	849	966
Mougeotia sp.						11446
Oocystis sp.	2251	4372	21844	P	4531	11702
Oocystis solitaria v. major	5917					
Pediastrum boryanum						
Pediastrum duplex						P
Pediastrum tetras	P	376	P	P	P	P
Scenedesmus sp.						
Scenedesmus acuminatus			P			
Scenedesmus bijuga	368	721	1057	986	647	488
Scenedesmus quadricauda	145	P	P	P	P	P
Scenedesmus spinosus						
Schroederia setigera						
Sphaerocystis schroeteri		4014	1095	P	3604	30356
Spondylosium planum		1247	P		3572	P
Staurastrum sp. 1				P		P
Staurastrum sp. 2				P		P
Staurastrum sp. 3						
Staurastrum hexacerum						
Staurodesmus sp.						
Tetraedron arthrodesmiforme	P	188	84	123	129	46
Tetraedron caudatum						
Tetraedron incus						
Tetraedron limneticum						
Tetraedron minimum						
Tetraedron muticum	2510					P
Tetrastrum staurogeniaeforme						
Tetraedron trigonum						
Tetraedron tumidulum						
Tetrastrum elegans				219		
Tetrastrum muticum						
Tetrastrum staurogeniaeforme						
Tetrastrum triangulare						
Trigonum tumidulum						
Unidentified quadriflagellate						
Unidentified filament						
Unidentified filament #1						
Unidentified filament #2		5034				
Total Chlorophyta	**32143**	**33007**	**57363**	**17699**	**22989**	**93477**
Euglena sp.						
Lepocinclis sp.						
Phacus sp.						
Trachelomonas sp.						
Trachelomonas hispida						
Total Euglenophyta						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Aimaokatalok Lake Site 4			Aimaokatalok Lake Site 6		
	21-Jul-07	19-Aug-07	8-Sep-07	22-Jul-07	19-Aug-07	8-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Bicoeca sp.						
Bitrichia longispina		P	770	404	P	346
Chromulina sp.	12537			4333		
Chrysidastrum catenatum						
Chrysochromulina parva		3961	1297	P	1943	1727
Chrysococcus sp.	29078		11859	59084	2636	31525
Chrysoikos skujai				687		
Chrysosphaerella rodhei			2063			
Dinobryon crenulatum						
Dinobryon divergens			P			
Dinobryon sertularia	269744	40345		383522	55126	5242
Dinobryon sociale	192827	51507	11521	261178	57802	20467
Dinobryon tabellariae	30111	P		30749		
Ishtmochloron trispinatum	P	P			P	
Kephyrion boreale	P		5385	6742	3247	
Kephyrion obliquum	1490			62321		
Kephyrion petasatum						
Kephyrion spirale	P					
Keriopsis sp.						
Mallomonas sp.				P		6332
Ochromonas sp. a	9278		1702	38285	3688	
Ochromonas sp. b						
Ochromonas stellaris	13309	13045		35812	6500	P
Ophiocytium sp.	P	P				1946
Pseudokephyrion sp.		1330	604	2525	P	512
Stelexmonas dichotoma	P	P	112288	7869	10638	104003
Stichogloea doederleinii	884	39100	34705	1844	7327	
Synura sp.	14896	3350	P		5678	4346
Unidentified statospore	62772	P	P	48542	15585	P
Total Chrysophyta	**636926**	**152637**	**182196**	**943898**	**170170**	**176446**
Ceratium hirudinella						
Glenodinium sp.	5379	P	6686	P		P
Gymnodinium sp. a	55119	15309	8522	17412	8386	
Gymnodinium sp. b						
Gymnodinium helveticum	P					
Gymnodinium uberrimum				P		
Peridinium aciculiferum				P		
Peridinium sp.	104245	P		P		
Unidentified cyst						
Total Pyrrophyta	**164744**	**15309**	**15208**	**17412**	**8386**	
Anabaena sp.		P	4621			1651
Anabaena sp. akinete			6931		4378	9371
Anabaena circinalis						
Anabaena solitaria						
Anabaena solitaria akinete						
Aphanizomenon gracile		P	552		P	3142
Aphanizomenon gracile akinete						
Aphanocapsa elachista v. planctonica		5774	11421	7456	2048	2154
Aphanothece clathrata	1402	7350	10821		6066	11167
Calothrix sp.						
Chamaesiphon sp.						
Chroococcus dispersus					184	
Chroococcus sp.						
Gomphosphaeria aponina						
Gomphosphaeria naegelianum		1496	4664	P	P	22577
Lyngbya agardhii	9582	P			P	P
Lyngbya contorta			P		P	P
Lyngbya limnetica	1589	2913	3258		269	70
Merismopedia sp.					4969	
Merismopedia minima		169	1271			167
Merismopedia punctata	140					
Microcystis sp.						33432
Nostoc sp.						
Oscillatoria agardhii			P			
Oscillatoria limnetica				27	24	
Oscillatoria limosa						
Pseudanabaena sp.	501					
Unidentified akinete						
Unidentified cyanobacteria						
Total Cyanobacteria	**13215**	**17703**	**43540**	**7483**	**17939**	**83731**
Total Biovolume (µm³ /mL)	**1,084,800**	**388,360**	**428,953**	**1,224,830**	**374,968**	**510,509**
Total Number of Taxa per Sample	**63**	**62**	**63**	**50**	**63**	**74**

P = taxon present

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Fickle Duck Lake			Reference Lake		
	22-Jul-07	20-Aug-07	9-Sep-07	21-Jul-07	20-Aug-07	9-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Achnanthes minutissima	P	P	610		121	226
Achnanthes minutissima v. cryptocephala						
Amphipleura sp.	P	P				
Amphiprora alata						
Amphora sp.	P					P
Amphora ovalis		P	P	P		
Asterionalla formosa	P	16687	22208	28643	P	P
Caloneis ventricosa						
Cocconeis sp.				P		
Cocconeis pediculus						
Cocconeis placentula						
Cyclotella sp.						
Cymatopleura solea						
Cymbella minuta			P	P	P	
Cymbella sp.	P	P	P			
Diatoma elongatum	P	P	10496	P	4050	P
Diploneis sp.	P	P	P	P		
Epithemia sp.						
Epithemia sorex						
Eunotia sp.				P		
Fragilaria sp.		P	P	P	P	
Fragilaria crotonensis		P		P		
Fragilaria construens						2261
Frustulia vulgaris						
Gomphonema sp.						
Gyrosigma sp.	P	P	P			
Hannaea arcus						
Licmophora sp.						
Mastigloia sp.						
Melosira sp.						
Melosira sp. large						
Melosira sp. larger						
Melosira varians						
Navicula sp.	P	P	P	P	P	P
Navicula sp. 2		P				P
Navicula sp. 2 larger						
Navicula cryptocephala						
Navicula lanceolata						
Nitzschia sp. 1		P	P	P		
Nitzschia sp. 2						
Nitzschia acicularis	P					
Nitzschia dissipata						
Nitzschia filiformis	P				P	P
Nitzschia palea						
Nitzschia sigmoidea	P		P			
Nitzschia tryblionella						
Pinnularia sp.	P	P	P	P	P	P
Pinnularia maior						
Rhizosolenia longiseta			P			7802
Rhopalodia sp.						
Rhoicosphenia curvata						
Stauroneis sp.						
Stauroneis smithii	P	P				P
Stephanodiscus astraea						
Surirella sp.						
Surirella ovata						
Synedra sp.	P	2555	31012		20940	14545
Synedra sp. smaller	4201	817	428	2757	2664	1009
Synedra acus				10046		
Synedra ulna						
Tabellaria fenestrata						
Tabellaria flocculosa	P	P	P	P	P	P
Unidentified diatom						
Unidentified pennate diatom	569			646		
Unidentified pennate diatom						
Unidentified centric diatom						
Unidentified centric diatom						
Unidentified centric small						
Unidentified centric diatom (small)						P
Unidentified centric diatom (medium)						
Total Bacillariophyta	**4770**	**20059**	**64754**	**42092**	**27775**	**25844**
Cyanomonas sp.						
Crypyochrysis commutata			11754			
Cryptomonas sp.		59951	39269		P	8726
Cryptomonas curvata					P	
Cryptomonas erosa		P		48085	43657	P
Cryptomonas ovata	18359	16515	63494	12396	39304	9244
Cryptomonas reflexa		P	16300	45516	13792	6524
Katablepharis ovalis	12915	39233	23444	8361	2885	16730
Rhodomonas lens						
Rhodomonas minuta	26806	78820	162104	23598	14472	9517
Total Cryptophyta	**58080**	**194519**	**316365**	**137957**	**114111**	**50741**
Ankistrodesmus convolutus	141	P	263	2038	156	233
Ankistrodesmus falcatus						

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Fickle Duck Lake			Reference Lake		
	22-Jul-07	20-Aug-07	9-Sep-07	21-Jul-07	20-Aug-07	9-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Ankistrodesmus falcatus v. acicularis				P	763	P
Ankistrodesmus falcatus v. spiralis		1124	896			633
Arthrodesmus incus	P	P	P			
Botryococcus sp.		P				
Characium sp.						
Chlamydomonas sp. a	1325	104058	29345		52236	6866
Chlamydomonas sp. b	34450	12077	61943	41025		70590
Closterium sp.			P			
Coelastrum microporum					P	
Cosmarium sp.				31480		P
Cosmarium tetraopthalmum						
Crucigenia fenestrata						P
Crucigenia quadrata			418	931	5990	11178
Cylindrocystis sp.						
Dictyosphaerium ehrenbergianum	1498	17539	444		3537	P
Dispora crucigenioides						
Elakatothrix gelatinosa	246	2293	3830	139	1746	599
Elakatothrix viridis						
Euastrum binale						
Euastrum elegans		P				
Franceia ovalis			P			
Gloeotila pelagica						
Kirchneriella lunaris		104	320			
Kirchneriella sp.				2124	441	
Monoraphidium						
Monoraphidium sp.	3256	3076	4945	3528	1682	1415
Mougeotia sp.			P			
Oocystis sp.	P	16233	9625	18001	9395	3990
Oocystis solitaria v. major						
Pediastrum boryanum					P	
Pediastrum duplex						
Pediastrum tetras	14057	32963	6334	3691	442	
Scenedesmus sp.		441		205	P	
Scenedesmus acuminatus				2559		
Scenedesmus bijuga	P	168	P	1539	856	P
Scenedesmus quadricauda	7491	P	P		P	P
Scenedesmus spinosus						
Schroederia setigera	3969	49782			P	
Sphaerocystis schroeteri	16868		51022			442
Spondylosium planum	19853	30516	41718		944	P
Staurastrum sp. 1		P			P	
Staurastrum sp. 2					P	
Staurastrum sp. 3						
Staurastrum hexacerum						
Staurodesmus sp.			34259			
Tetraedron arthrodesmiforme		282			P	57
Tetraedron caudatum	1778	1550		P	P	
Tetraedron incus						
Tetraedron limneticum	P			P		
Tetraedron minimum						
Tetraedron muticum	P	P	P	P		
Tetrastrum staurogeniaeforme						
Tetraedron trigonum					P	
Tetraedron tumidulum	8139	P				
Tetrastrum elegans					P	126
Tetrastrum muticum						
Tetrastrum staurogeniaeforme						
Tetrastrum triangulare				640		
Trigonum tumidulum						
Unidentified quadriflagellate						
Unidentified filament						
Unidentified filament #1		9449			1767	P
Unidentified filament #2						
Total Chlorophyta	**113072**	**281655**	**245361**	**107900**	**79956**	**96128**
Euglena sp.		89758	P	12810	P	P
Lepocinclis sp.						
Phacus sp.		P				P
Trachelomonas sp.	P	72315	9751	21908	20089	
Trachelomonas hispida						
Total Euglenophyta		**162073**	**9751**	**34718**	**20089**	

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Fickle Duck Lake			Reference Lake		
	22-Jul-07	20-Aug-07	9-Sep-07	21-Jul-07	20-Aug-07	9-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Bicoeca sp.						
Bitrichia longispina		2804				P
Chromulina sp.			7569		4380	11249
Chrysidastrum catenatum			6553			P
Chrysochromulina parva		2783	12119		5830	5710
Chrysococcus sp.	111496	112105	60890	27266	80707	30868
Chrysoikos skujai			5552			1232
Chrysosphaerella rodhei						
Dinobryon crenulatum	84069		14341		P	P
Dinobryon divergens		35445	17595			
Dinobryon sertularia	33144				19255	4266
Dinobryon sociale	210420	125693	154860	24204	45652	38846
Dinobryon tabellariae					P	30190
Ishtmochloron trispinatum				2367		
Kephyrion boreale	5458	2717	24937	11679	54732	87306
Kephyrion obliquum	1606	1760	49422		15003	4439
Kephyrion petasatum						
Kephyrion spirale	32931	3401				3061
Keriopsis sp.						
Mallomonas sp.						P
Ochromonas sp. a			24767	4779		
Ochromonas sp. b						1390
Ochromonas stellaris	P	23236		5358	P	
Ophiocytium sp.		P	3591	3930		
Pseudokephyrion sp.			3390			1533
Stelexmonas dichotoma						3240
Stichogloea doederleinii						
Synura sp.		6261	11499	2740	P	6561
Unidentified statospore	57788	386908	110324			10639
Total Chrysophyta	**536911**	**703113**	**507408**	**82322**	**225560**	**240531**
Ceratium hirudinella						
Glenodinium sp.	5877	20013	129611	36273	3976	22471
Gymnodinium sp. a	39425	241336	121878	91684	P	10860
Gymnodinium sp. b						
Gymnodinium helveticum						
Gymnodinium uberrimum	P	26212		52290	P	
Peridinium aciculiferum						
Peridinium sp.	P	27789	P		47270	P
Unidentified cyst						
Total Pyrrophyta	**45301**	**315350**	**251489**	**180247**	**51246**	**33331**
Anabaena sp.		140764			34425	P
Anabaena sp. akinete					59740	313
Anabaena circinalis				45400		
Anabaena solitaria	512328	277565	125750			
Anabaena solitaria akinete		85133	28955			
Aphanizomenon gracile		381				12164
Aphanizomenon gracile akinete						3131
Aphanocapsa elachista v. planctonica	854	800				
Aphanothece clathrata	3361	4026	1485		6476	3339
Calothrix sp.						
Chamaesiphon sp.						
Chroococcus dispersus						
Chroococcus sp.					P	
Gomphosphaeria aponina	P					
Gomphosphaeria naegelianum	6129		P	P		P
Lyngbya agardhii						
Lyngbya contorta						
Lyngbya limnetica						
Merismopedia sp.		P				
Merismopedia minima				10		
Merismopedia punctata						
Microcystis sp.						
Nostoc sp.						
Oscillatoria agardhii						P
Oscillatoria limnetica	261		P	141848	33440	
Oscillatoria limosa						
Pseudanabaena sp.	1646	273		P	1204	P
Unidentified akinete						
Unidentified cyanobacteria						
Total Cyanobacteria	**524579**	**508943**	**156190**	**187258**	**135284**	**18948**
Total Biovolume (µm³ /mL)	**1,282,714**	**2,185,712**	**1,551,319**	**772,495**	**654,023**	**465,523**
Total Number of Taxa per Sample	**59**	**74**	**68**	**55**	**64**	**71**

P = taxon present

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Stickleback Lake			Hope Bay		
	21-Jul-07	20-Aug-07	9-Sep-07	23-Jul-07	17-Aug-07	15-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Achnanthes minutissima	527	P	P	179	77	24
Achnanthes minutissima v. cryptocephala						
Amphipleura sp.						
Amphiprora alata						
Amphora sp.		P				
Amphora ovalis	P		P	P	P	
Asterionalla formosa		P	26080	P	8399	564
Caloneis ventricosa						
Cocconeis sp.						
Cocconeis pediculus	P					
Cocconeis placentula						
Cyclotella sp.						P
Cymatopleura solea						
Cymbella minuta				P	P	
Cymbella sp.		P				P
Diatoma elongatum	17397	32523	4795	7273	1748	948
Diploneis sp.						
Epithemia sp.						
Epithemia sorex						
Eunotia sp.			P	P		
Fragilaria sp.		P	P			
Fragilaria crotonensis					P	
Fragilaria construens						
Frustulia vulgaris						
Gomphonema sp.						
Gyrosigma sp.	P		P			P
Hannaea arcus						P
Licmophora sp.						970
Mastigloia sp.						
Melosira sp.						
Melosira sp. large						
Melosira sp. larger						
Melosira varians				46355	P	
Navicula sp.	P		P	P	P	
Navicula sp. 2	P		P	P	P	P
Navicula sp. 2 larger						
Navicula cryptocephala						
Navicula lanceolata						184
Nitzschia sp. 1						P
Nitzschia sp. 2		1690	P			
Nitzschia acicularis				65		
Nitzschia dissipata						
Nitzschia filiformis				P	P	122
Nitzschia palea						
Nitzschia sigmoidea						
Nitzschia tryblionella				P		
Pinnularia sp.			P	P	P	
Pinnularia maior						
Rhizosolenia longiseta			13166			
Rhopalodia sp.						
Rhoicosphenia curvata						
Stauroneis sp.						
Stauroneis smithii			P			
Stephanodiscus astraea						3411
Surirella sp.						P
Surirella ovata						
Synedra sp.	P	5762	775	97	481	289
Synedra sp. smaller	160	P		242		422
Synedra acus						766
Synedra ulna					P	P
Tabellaria fenestrata						
Tabellaria flocculosa			P	P	P	P
Unidentified diatom						
Unidentified pennate diatom					240	
Unidentified pennate diatom						
Unidentified centric diatom	1534		4406			
Unidentified centric diatom						
Unidentified centric small						
Unidentified centric diatom (small)				16095		
Unidentified centric diatom (medium)			20385	454		
Total Bacillariophyta	**19618**	**39975**	**69607**	**70762**	**10945**	**7700**
Cyanomonas sp.						
Crypyochrysis commutata			P	6747	34126	35915
Cryptomonas sp.		4944	41733	P		
Cryptomonas curvata	P	P	29809			
Cryptomonas erosa	7842		59204			
Cryptomonas ovata	14657	P	18541	P		
Cryptomonas reflexa	10335	58295	35772	633	728	
Katablepharis ovalis	9592	4960	7849			
Rhodomonas lens						
Rhodomonas minuta	49419	95558	37413	11595	1801	619
Total Cryptophyta	**91845**	**163758**	**230321**	**18975**	**36654**	**36534**
Ankistrodesmus convolutus	29	1053	1460	1155	358	
Ankistrodesmus falcatus						152

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Stickleback Lake			Hope Bay		
	21-Jul-07	20-Aug-07	9-Sep-07	23-Jul-07	17-Aug-07	15-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Ankistrodesmus falcatus v. acicularis				P		
Ankistrodesmus falcatus v. spiralis					598	106
Arthrodesmus incus					P	798
Botryococcus sp.		P				
Characium sp.						
Chlamydomonas sp. a		23261			P	360
Chlamydomonas sp. b	P		23040	1076	1240	
Closterium sp.					P	
Coelastrum microporum						
Cosmarium sp.			P	P	42321	P
Cosmarium tetraopthalmum						1331
Crucigenia fenestrata						
Crucigenia quadrata	P		2150		987	
Cylindrocystis sp.						1507
Dictyosphaerium ehrenbergianum					2407	P
Dispora crucigenioides						
Elakatothrix gelatinosa		610	175		182	
Elakatothrix viridis						
Euastrum binale					P	30
Euastrum elegans					P	
Franceia ovalis	4326					
Gloeotila pelagica						
Kirchneriella lunaris					144	205
Kirchneriella sp.		590	501			
Monoraphidium						
Monoraphidium sp.	188		P	847	513	292
Mougeotia sp.			P			
Oocystis sp.	P		21329	1474	1515	P
Oocystis solitaria v. major					P	
Pediastrum boryanum		P				P
Pediastrum duplex						
Pediastrum tetras	362		P	P	P	
Scenedesmus sp.		2535		P	P	
Scenedesmus acuminatus		P				
Scenedesmus bijuga	2637	6698	14095	206	800	63
Scenedesmus quadricauda	1042	P	P	487	P	
Scenedesmus spinosus						
Schroederia setigera						
Sphaerocystis schroeteri		16968	10856		7070	958
Spondylosium planum	464		2035		P	2399
Staurastrum sp. 1				P		
Staurastrum sp. 2						52641
Staurastrum sp. 3						P
Staurastrum hexacerum					P	
Staurodesmus sp.						
Tetraedron arthrodesmiforme	239	1468	148			
Tetraedron caudatum						
Tetraedron incus						
Tetraedron limneticum						
Tetraedron minimum				71	165	
Tetraedron muticum					228	
Tetrastrum staurogeniaeforme			P			
Tetraedron trigonum	P	P				
Tetraedron tumidulum						
Tetrastrum elegans	1405	3741	10029			
Tetrastrum muticum						
Tetrastrum staurogeniaeforme			P			
Tetrastrum triangulare		6522				
Trigonum tumidulum	1082	P				
Unidentified quadriflagellate						
Unidentified filament						
Unidentified filament #1					583	P
Unidentified filament #2					763	P
Total Chlorophyta	**11774**	**63445**	**85818**	**5317**	**59872**	**60841**
Euglena sp.						2562
Lepocinclis sp.						
Phacus sp.						
Trachelomonas sp.		P	P		P	P
Trachelomonas hispida						
Total Euglenophyta						**2562**

Appendix D1. Phytoplankton Biovolume (µm³/mL) in Samples Collected from the Boston, Doris, and Madrid Project areas, 2007

Taxon	Stickleback Lake			Hope Bay		
	21-Jul-07	20-Aug-07	9-Sep-07	23-Jul-07	17-Aug-07	15-Sep-07
	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL	µm³ /mL
Bicoeca sp.						
Bitrichia longispina						549
Chromulina sp.	3010		P	504		
Chrysidastrum catenatum	P		P			
Chrysochromulina parva		P	3135			
Chrysococcus sp.	134735		39257	16352	15929	3196
Chrysoikos skujai		499	1995			
Chrysosphaerella rodhei						
Dinobryon crenulatum	61274		30206		1079	
Dinobryon divergens			23259		1221	
Dinobryon sertularia	236943	7043	P	P		P
Dinobryon sociale	100493	31377	85512	1984	6920	4506
Dinobryon tabellariae	3182	P	P			
Ishtmochloron trispinatum						
Kephyrion boreale				2988	6911	2230
Kephyrion obliquum	6320	73801	2336	1734	1090	
Kephyrion petasatum						
Kephyrion spirale		10853	22961			2152
Keriopsis sp.					1033	
Mallomonas sp.		P	3351			
Ochromonas sp. a		60601			2148	4943
Ochromonas sp. b						
Ochromonas stellaris		10781	15094			4549
Ophiocytium sp.						
Pseudokephyrion sp.			2357			456
Stelexmonas dichotoma						3682
Stichogloea doederleinii						
Synura sp.	P		P		P	
Unidentified statospore			7406	1169	P	
Total Chrysophyta	**545957**	**194955**	**236869**	**24732**	**36331**	**26263**
Ceratium hirudinella					P	
Glenodinium sp.	6470	16484	4782	P	8940	
Gymnodinium sp. a	61306	31967	52185	P	15043	11060
Gymnodinium sp. b		9306				
Gymnodinium helveticum	P	P	P			5125
Gymnodinium uberrimum			P			
Peridinium aciculiferum						
Peridinium sp.	P	P	P	47182		6077
Unidentified cyst						
Total Pyrrophyta	**67776**	**57757**	**56967**	**47182**	**23983**	**22261**
Anabaena sp.	4616		P		P	P
Anabaena sp. akinete						
Anabaena circinalis						
Anabaena solitaria						
Anabaena solitaria akinete						
Aphanizomenon gracile					132	7
Aphanizomenon gracile akinete						
Aphanocapsa elachista v. planctonica			2471	P	392	681
Aphanothece clathrata		25961	20309		611	1189
Calothrix sp.						
Chamaesiphon sp.						
Chroococcus dispersus						
Chroococcus sp.						
Gomphosphaeria aponina						
Gomphosphaeria naegelianum	P	9357	P		P	
Lyngbya agardhii						
Lyngbya contorta						
Lyngbya limnetica					473	589
Merismopedia sp.						
Merismopedia minima	1910			1140	6	
Merismopedia punctata						
Microcystis sp.						
Nostoc sp.				3533		
Oscillatoria agardhii	P	P	P	313		
Oscillatoria limnetica	1070		77	52	99	
Oscillatoria limosa						
Pseudanabaena sp.		P	P	535	285	
Unidentified akinete						
Unidentified cyanobacteria						
Total Cyanobacteria	**7595**	**35319**	**22857**	**5574**	**1999**	**2467**
Total Biovolume (µm³ /mL)	**744,565**	**555,208**	**702,438**	**172,541**	**169,784**	**158,629**
Total Number of Taxa per Sample	**47**	**50**	**72**	**50**	**69**	**60**

P = taxon present

APPENDIX D2

PHYTOPLANKTON BIOMASS

Appendix D2. Biomass (µg/L) and Percent Composition of Major Phytoplankton Taxa Collected in the Boston, Doris, and Madrid Project areas, 2007.

Lake	Date	Bacillariophyta		Cryptophyta		Chrysophyta		Pyrrophyta		Euglenopyta		Chlorophyta		Cyanobacteria		Total Biovolume
		Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	
Boston Project																
Aimaokatalok Lake Site 4	21-Jul	**62**	5.7	**176**	16.2	**637**	58.7	**165**	15.2	**0**	0.0	**32**	3.0	**13**	1.2	1,085
	19-Aug	**105**	27.0	**65**	16.7	**153**	39.3	**15**	3.9	**0**	0.0	**33**	8.5	**18**	4.6	388
	8-Sep	**48**	11.1	**83**	19.4	**182**	42.5	**15**	3.5	**0**	0.0	**57**	13.4	**44**	10.2	429
Aimaokatalok Lake Site 6	22-Jul	**49**	4.0	**189**	15.5	**944**	77.1	**17**	1.4	**0**	0.0	**18**	1.4	**7**	0.6	1,225
	19-Aug	**47**	12.5	**109**	28.9	**170**	45.4	**8**	2.2	**0**	0.0	**23**	6.1	**18**	4.8	375
	8-Sep	**62**	12.2	**94**	18.5	**176**	34.6	**0**	0.0	**0**	0.0	**93**	18.3	**84**	16.4	511
Fickle Duck Lake	22-Jul	**5**	0.4	**58**	4.5	**537**	41.9	**45**	3.5	**0**	0.0	**113**	8.8	**525**	40.9	1,283
	20-Aug	**20**	0.9	**195**	8.9	**703**	32.2	**315**	14.4	**162**	7.4	**282**	12.9	**509**	23.3	2,186
	9-Sep	**65**	4.2	**316**	20.4	**507**	32.7	**251**	16.2	**10**	0.6	**245**	15.8	**156**	10.1	1,551
Reference Lake	21-Jul	**42**	5.4	**138**	17.9	**82**	10.7	**180**	23.3	**35**	4.5	**108**	14.0	**187**	24.2	772
	20-Aug	**28**	4.2	**114**	17.4	**226**	34.5	**51**	7.8	**20**	3.1	**80**	12.2	**135**	20.7	654
	9-Sep	**26**	5.6	**51**	10.9	**241**	51.7	**33**	7.2	**0**	0.0	**96**	20.6	**19**	4.1	466
Stickleback Lake	21-Jul	**20**	2.6	**92**	12.3	**546**	73.3	**68**	9.1	**0**	0.0	**12**	1.6	**8**	1.0	745
	20-Aug	**40**	7.2	**164**	29.5	**195**	35.1	**58**	10.4	**0**	0.0	**63**	11.4	**35**	6.4	555
	9-Sep	**70**	9.9	**230**	32.8	**237**	33.7	**57**	8.1	**0**	0.0	**86**	12.2	**23**	3.3	702
Hope Bay	23-Jul	**71**	41.0	**19**	11.0	**25**	14.3	**47**	27.3	**0**	0.0	**5**	3.1	**6**	3.2	173
	17-Aug	**11**	6.4	**37**	21.6	**36**	21.4	**24**	14.1	**0**	0.0	**60**	35.3	**2**	1.2	170
	15-Sep	**8**	4.9	**37**	23.0	**26**	16.6	**22**	14.0	**3**	1.6	**61**	38.4	**2**	1.6	159
Doris North Project																
Doris Lake	16-Jul	**313**	8.1	**157**	4.0	**1528**	39.5	**0**	0.0	**0**	0.0	**152**	3.9	**1722**	44.5	3,871
	16-Aug	**375**	22.7	**51**	3.1	**245**	14.8	**44**	2.7	**0**	0.0	**23**	1.4	**918**	55.4	1,655
	13-Sep	**101**	2.0	**85**	1.7	**64**	1.2	**3**	0.1	**0**	0.0	**20**	0.4	**4826**	94.7	5,099
Little Roberts Lake	15-Jul	**168**	6.6	**439**	17.1	**767**	29.9	**84**	3.3	**0**	0.0	**50**	2.0	**1057**	41.2	2,566
	18-Aug	**413**	14.5	**117**	4.1	**349**	12.3	**2**	0.1	**0**	0.0	**35**	1.2	**1926**	67.8	2,841
	14-Sep	**153**	4.6	**112**	3.4	**220**	6.6	**74**	2.2	**0**	0.0	**29**	0.9	**2749**	82.4	3,337
Roberts Lake	15-Jul	**423**	29.1	**370**	25.4	**396**	27.3	**11**	0.7	**0**	0.0	**91**	6.2	**163**	11.2	1,453
	18-Aug	**292**	14.0	**152**	7.3	**829**	39.7	**104**	5.0	**68**	3.3	**133**	6.4	**508**	24.4	2,088
	14-Sep	**177**	10.8	**45**	2.7	**240**	14.6	**51**	3.1	**0**	0.0	**99**	6.0	**1030**	62.7	1,641
Tail Lake	20-Jul	**15**	3.3	**57**	12.3	**357**	76.2	**35**	7.5	**0**	0.0	**3**	0.7	**0**	0.0	468
	16-Aug	**173**	52.8	**7**	2.1	**59**	17.8	**33**	10.0	**8**	2.4	**45**	13.6	**4**	1.3	329
	13-Sep	**189**	43.5	**46**	10.6	**87**	20.0	**4**	0.8	**0**	0.0	**104**	23.9	**5**	1.2	434
Roberts Bay	23-Jul	**5**	2.2	**12**	5.5	**19**	8.4	**119**	54.0	**0**	0.0	**6**	2.6	**60**	27.3	221
	17-Aug	**7**	7.3	**3**	3.5	**12**	12.4	**4**	3.5	**0**	0.0	**2**	2.2	**71**	71.1	99
	14-Sep	**17**	3.9	**1**	0.1	**1**	0.2	**0**	0.0	**0**	0.0	**17**	3.9	**396**	91.9	431

Appendix D2. Biomass (µg/L) and Percent Composition of Major Phytoplankton Taxa Collected in the Boston, Doris, and Madrid Project areas, 2007.

Lake	Date	Bacillariophyta		Cryptophyta		Chrysophyta		Pyrrophyta		Euglenopyta		Chlorophyta		Cyanobacteria		Total Biovolume
		Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	Mean	%	
Madrid Project																
Glenn Lake	16-Jul	**36**	35.3	**19**	18.2	**34**	33.8	**3**	2.8	**0**	0.0	**1**	0.8	**9**	9.2	102
	17-Aug	**152**	47.0	**87**	27.0	**6**	1.9	**14**	4.3	**3**	0.9	**55**	16.9	**7**	2.1	322
	15-Sep	**113**	38.3	**113**	38.3	**41**	13.8	**2**	0.7	**0**	0.0	**26**	8.9	**0**	0.1	296
Ogama Lake	23-Jul	**345**	12.9	**62**	2.3	**1176**	44.0	**118**	4.4	**0**	0.0	**121**	4.5	**852**	31.9	2,674
	16-Aug	**19**	0.5	**34**	0.8	**147**	3.6	**202**	5.0	**0**	0.0	**409**	10.1	**3236**	79.9	4,048
	11-Sep	**148**	2.6	**60**	1.0	**190**	3.3	**43**	0.7	**0**	0.0	**65**	1.1	**5257**	91.2	5,764
Patch Lake	17-Jul	**2**	0.9	**4**	1.8	**103**	45.9	**110**	49.1	**0**	0.0	**5**	2.2	**0**	0.1	225
	15-Aug	**3**	1.8	**24**	13.2	**93**	51.8	**49**	27.2	**0**	0.0	**8**	4.4	**3**	1.6	179
	11-Sep	**22**	9.7	**20**	8.8	**158**	70.7	**1**	0.4	**0**	0.0	**23**	10.1	**1**	0.3	224
Pelvic Lake	16-Jul	**66**	1.8	**52**	1.4	**828**	22.8	**146**	4.0	**0**	0.0	**12**	0.3	**2533**	69.6	3,637
	16-Aug	**422**	11.7	**223**	6.2	**267**	7.4	**53**	1.5	**20**	0.5	**123**	3.4	**2505**	69.3	3,613
	13-Sep	**294**	3.8	**101**	1.3	**115**	1.5	**100**	1.3	**3**	0.0	**38**	0.5	**7074**	91.6	7,725
P.O. Lake	17-Jul	**18**	2.2	**21**	2.6	**468**	57.6	**8**	1.0	**0**	0.0	**4**	0.5	**293**	36.0	813
	15-Aug	**23**	21.5	**18**	16.9	**33**	30.0	**4**	3.7	**0**	0.0	**29**	26.3	**2**	1.6	109
	11-Sep	**1**	0.3	**255**	63.0	**69**	17.1	**21**	5.1	**27**	6.6	**28**	6.9	**4**	1.0	405
Windy Lake	18-Jul	**19**	12.4	**11**	7.1	**77**	50.9	**40**	26.2	**1**	0.9	**3**	1.9	**1**	0.6	152
	21-Aug	**45**	29.7	**5**	3.1	**20**	13.0	**52**	34.6	**1**	0.7	**5**	3.0	**24**	15.8	151
	15-Sep	**28**	20.8	**3**	2.3	**49**	36.3	**43**	31.8	**0**	0.0	**5**	3.9	**7**	4.8	135
Wolverine Lake	17-Jul	**61**	4.7	**31**	2.4	**634**	48.7	**508**	39.1	**45**	3.5	**19**	1.5	**2**	0.1	1,300
	15-Aug	**27**	3.4	**139**	17.3	**241**	30.2	**233**	29.1	**36**	4.5	**119**	14.9	**5**	0.6	800
	9-Sep	**132**	7.3	**91**	5.1	**1447**	80.2	**97**	5.4	**0**	0.0	**33**	1.8	**3**	0.2	1,804

APPENDIX D3

ZOOPLANKTON BIOMASS

Appendix D3. Zooplankton Biomass (µg/m^3) in Boston and Madrid Project Area Lakes, 2007

Taxa / species	Stage	Aimaokatalok Lake Site 4			Aimaokatalok Lake Site 6			Fickle Duck Lake			Reference Lake[1]		
		21 Jul	19 Aug	8 Sep	22 Jul	19 Aug	8 Sep	22 Jul	20 Aug	9 Sep	21 Jul	20 Aug	9 Sep
		5.5 m	5.5 m	3.5 m	20 m	15 m	20 m	horizontal tow [2]			horizontal tow [2]		
Phylum Rotifera													
Asplanchna sp. *a*								13416	3372	17841	68322	4552	2162
Asplanchna sp. *b*											21267	12634	5841
Brachionus calyciflorus												7	
Conochilus hippocrepis											536		
Conochilus nataus								320	2				
Kellicottia longispina		18	103	32	4	34	24	89	123	348	1	4	7
Keratella cochlearis													
Keratella hiemalis													
Keratella quadrata											550		
Trichocera sp.												3	
Phylum Arthropoda													
Subphylum Crustacea													
Class Branchiopoda													
Order Cladocera													
Alonella sp.													
Bosmina longirostris						2558	1057	8105	15471	27863		191	285
Chydorus sphericus									33	117		34	63
Daphnia longiremis			6963	9887		8794	18990	1179	172	2931	112		
Holopedium gibberum			152831	3930		13754	12438	1297			141		
Class Maxillopoda													
Subclass Copepoda													
Calanoida													
Diaptomus tyrelli	female										24		
Epischura lacustris	adult										1924	83	
Epischura lacustris	C1-C2												
Epischura lacustris	C3-C5										252		
Limnocalanus macrurus	adult	5093	11178	17295	9927	18687	26612	4805	640				
Limnocalanus macrurus	C1-C2		231	323	165	288	89	48					
Limnocalanus macrurus	C3-C5		2557	4018	1208	553	487						
unidentified Calanoida	nauplius				47	31	8			67	14	9	26
Cyclopoida													
Cyclops bicuspidatus thomasi	adult	3792	45343	3851	109943	116938	27092	3261	1427	2058	1109	1513	783
Cyclops sp.	C1-C2	291	394		277	67	215	124	31	191	124	15	69
Cyclops sp.	C3-C5	196	189	390	761	786	810	255	61	138			11
Mesocyclops edax	adult					31426	36563						
unidentified Cyclopoida	nauplius												
Order Diptera													
Chironomidae													
unidentified Chironomidae									1		5	4	1
Class Arachnida													
unidentified Arachnida									1				
Class Ostracoda													
Order Podocopa													
Ostracod sp a (small)											91	22	
Ostracod sp b (large)								34			224	34	
TOTAL		**9391**	**219789**	**39725**	**122331**	**193917**	**124385**	**32899**	**21333**	**51554**	**94379**	**19045**	**9248**

Shaded rows indicate non planktonic (i.e., benthic) forms of aquatic invertebrates, which were excluded from the total. Biomass for these taxa was not calculated, and their values are in number of individuals per sample.

[1] 9 Sep sample was poorly preserved.

[2] Due to shallow depths (<3 m), a 50 m horizontal tow was performed instead of a vertical haul.

Appendix D3. Zooplankton Biomass (µg/m^3) in Boston and Madrid Project Area Lakes, 2007

Taxa / species	Stage	Stickleback Lake			Hope Bay			Glenn Lake			Ogama Lake		
		21 Jul	20 Aug	9 Sep	23 Jul	17 Aug	15 Sep	16 Jul	17 Aug	15 Sep	16 Jul	16 Aug	11 Sep
		horizontal tow [2]			10 m	7 m	13 m	15 m	15.5 m	9 m	4 m	5 m	5 m
Phylum Rotifera													
Asplanchna sp. *a*		23271	10500	4813									
Asplanchna sp. *b*													
Brachionus calyciflorus													
Conochilus hippocrepis		195											
Conochilus nataus									14833	628			
Kellicottia longispina			2	1	169	122	13	23	38	15	189	527	716
Keratella cochlearis		17											16
Keratella hiemalis									2				21830
Keratella quadrata													
Trichocera sp.													
Phylum Arthropoda													
Subphylum Crustacea													
Class Branchiopoda													
Order Cladocera													
Alonella sp.													
Bosmina longirostris		621	437		298	4200	633				922	24332	5434
Chydorus sphericus				17							62	3598	1141
Daphnia longiremis											151	2443	
Holopedium gibberum													
Class Maxillopoda													
Subclass Copepoda													
Calanoida													
Diaptomus tyrelli	female												
Epischura lacustris	adult	6234		578	361							19683	7678
Epischura lacustris	C1-C2	35											
Epischura lacustris	C3-C5	35											
Limnocalanus macrurus	adult					174550	3580	40837	45756	7924			
Limnocalanus macrurus	C1-C2				903	1743	82						
Limnocalanus macrurus	C3-C5				7248	12723	1298	73	33	144			
unidentified Calanoida	nauplius	24	42		249	436	28	28	35	12			21
Cyclopoida													
Cyclops bicuspidatus thomasi	adult	20670	9044	787				76			30724	49255	241040
Cyclops sp.	C1-C2	812	56	87	93							196	428
Cyclops sp.	C3-C5	461	90	95									
Mesocyclops edax	adult	1260											
unidentified Cyclopoida	nauplius												85
Order Diptera													
Chironomidae													
unidentified Chironomidae		1											
Class Arachnida													
unidentified Arachnida													
Class Ostracoda													
Order Podocopa													
Ostracod sp a (small)											2		
Ostracod sp b (large)		559	17	4									
TOTAL		**53635**	**20171**	**6378**	**9321**	**193774**	**5633**	**41038**	**60697**	**8724**	**32048**	**100033**	**278389**

Shaded rows indicate non planktonic (i.e., benthic) forms of aquatic invertebrates, which were excluded from the total. Biomass for these taxa was not calculated, and their values are in number of individuals per sample.

[1] 9 Sep sample was poorly preserved.

[2] Due to shallow depths (<3 m), a 50 m horizontal tow was performed instead of a vertical haul.

Appendix D3. Zooplankton Biomass (µg/m^3) in Boston and Madrid Project Area Lakes, 2007

Taxa / species	Stage	Patch Lake			Pelvic Lake			P.O. Lake			Windy Lake		
		17 Jul	15 Aug	11 Sep	16 Jul	16 Aug	13 Sep	17 Jul	15 Aug	11 Sep	18 Jul	21 Aug	15 Sep
		6 m	10 m	10 m	7 m	10 m	10 m	horizontal tow [2]			15 m	17 m	16.5 m
Phylum Rotifera													
Asplanchna sp. *a*													
Asplanchna sp. *b*													
Brachionus calyciflorus													
Conochilus hippocrepis													
Conochilus nataus		1451											
Kellicottia longispina		100	149	8			0	19		3	2	3	8
Keratella cochlearis					298	154	334						
Keratella hiemalis					958	580	740						
Keratella quadrata													
Trichocera sp.													
Phylum Arthropoda													
Subphylum Crustacea													
Class Branchiopoda													
Order Cladocera													
Alonella sp.													
Bosmina longirostris			2241	3685	6820	24884	3467	1232	993	492	40		
Chydorus sphericus													
Daphnia longiremis						9153	174	7652	10551	10447			
Holopedium gibberum		973	8370					2051	189				
Class Maxillopoda													
Subclass Copepoda													
Calanoida													
Diaptomus tyrelli	female							86					
Epischura lacustris	adult							2088	18054	4451			
Epischura lacustris	C1-C2												
Epischura lacustris	C3-C5								548	296			
Limnocalanus macrurus	adult	6013	11676	17944							5528	10200	10709
Limnocalanus macrurus	C1-C2										20		
Limnocalanus macrurus	C3-C5		1226										
unidentified Calanoida	nauplius	14						14	10		9		
Cyclopoida													
Cyclops bicuspidatus thomasi	adult	1137	3487	6883	10064	94444	6171	4105	6861	2740			
Cyclops sp.	C1-C2	266	1629	409	607	379	89	70					
Cyclops sp.	C3-C5	171	2451	691	1502	868	257						
Mesocyclops edax	adult												
unidentified Cyclopoida	nauplius				26								
Order Diptera													
Chironomidae													
unidentified Chironomidae													
Class Arachnida													
unidentified Arachnida													
Class Ostracoda													
Order Podocopa													
Ostracod sp a (small)													
Ostracod sp b (large)								54	113				
TOTAL		**10126**	**31229**	**29620**	**20274**	**130462**	**11232**	**17317**	**37206**	**18428**	**5599**	**10203**	**10717**

Shaded rows indicate non planktonic (i.e., benthic) forms of aquatic invertebrates, which were excluded from the total. Biomass for these taxa was not calculated, and their values are in number of individuals per sample.

[1] 9 Sep sample was poorly preserved.

[2] Due to shallow depths (<3 m), a 50 m horizontal tow was performed instead of a vertical haul.

Appendix D3. Zooplankton Biomass (µg/m^3) in Boston and Madrid Project Area Lakes, 2007

Taxa / species	Stage	Wolverine Lake		
		17 Jul	15 Aug	9 Sep
		horizontal tow [2]		
Phylum Rotifera				
Asplanchna sp. *a*		1545	5526	15498
Asplanchna sp. *b*				
Brachionus calyciflorus				28
Conochilus hippocrepis		10284	5234	2985
Conochilus nataus				
Kellicottia longispina		9	5	25
Keratella cochlearis				239
Keratella hiemalis				
Keratella quadrata				1
Trichocera sp.				94
Phylum Arthropoda				
Subphylum Crustacea				
Class Branchiopoda				
Order Cladocera				
Alonella sp.				
Bosmina longirostris		492	969	1461
Chydorus sphericus		40	114	
Daphnia longiremis				
Holopedium gibberum				
Class Maxillopoda				
Subclass Copepoda				
Calanoida				
Diaptomus tyrelli	female			
Epischura lacustris	adult			
Epischura lacustris	C1-C2			
Epischura lacustris	C3-C5			
Limnocalanus macrurus	adult			
Limnocalanus macrurus	C1-C2			
Limnocalanus macrurus	C3-C5			
unidentified Calanoida	nauplius			
Cyclopoida				
Cyclops bicuspidatus thomasi	adult	668	3505	7056
Cyclops sp.	C1-C2	387	20	273
Cyclops sp.	C3-C5			
Mesocyclops edax	adult			
unidentified Cyclopoida	nauplius		5	209
Order Diptera				
Chironomidae				
unidentified Chironomidae				
Class Arachnida				
unidentified Arachnida				
Class Ostracoda				
Order Podocopa				
Ostracod sp a (small)		717		
Ostracod sp b (large)		164		
TOTAL		**13426**	**15379**	**27870**

Shaded rows indicate non planktonic (i.e., benthic) forms of aquatic invertebrates, which were excluded from the total. Biomass for these taxa was not calculated, and their values are in number of individuals per sample.

[1] 9 Sep sample was poorly preserved.

[2] Due to shallow depths (<3 m), a 50 m horizontal tow was performed instead of a vertical haul.

APPENDIX D4

ZOOPLANKTON BIOMASS AND PERCENT COMPOSITION

Appendix D4. Biomass (µg/m^3) and Percent Composition of Major Zooplankton Taxa Collected in the Boston and Madrid Project areas, 2007.

Lake	Date	Rotifera		Cladocera		Calanoida		Cyclopoida		All Taxa
		Biomass (µg/m^3)	% composition	Biomass (µg/m^3)	% composition	Biomass (µg/m^3)	% composition	Biomass (µg/m^3)	% composition	Biomass (µg/m^3)
Aimaokatalok Lake Station 4	21-Jul-07	**18**	0.2			**5093**	54.2	**4279**	45.6	**9391**
	19-Aug-07	**103**	< 0.1	**159794**	72.7	**13966**	6.4	**45926**	20.9	**219789**
	8-Sep-07	**32**	0.1	**13817**	34.8	**21636**	54.5	**4241**	10.7	**39725**
Aimaokatalok Lake Station 6	22-Jul-07	**4**	< 0.1			**11347**	9.3	**110980**	90.7	**122331**
	19-Aug-07	**34**	< 0.1	**25106**	12.9	**19559**	10.1	**149218**	76.9	**193917**
	8-Sep-07	**24**	< 0.1	**32485**	26.1	**27195**	21.9	**64681**	52.0	**124385**
Fickle Duck Lake	22-Jul-07	**13825**	42.0	**10581**	32.2	**4853**	14.8	**3640**	11.1	**32899**
	20-Aug-07	**3496**	16.4	**15677**	73.5	**640**	3.0	**1519**	7.1	**21333**
	9-Sep-07	**18190**	35.3	**30910**	60.0	**67**	0.1	**2387**	4.6	**51554**
Reference Lake	21-Jul-07	**90677**	96.1	**253**	0.3	**2215**	2.3	**1233**	1.3	**94379**
	20-Aug-07	**17200**	90.3	**225**	1.2	**91**	0.5	**1528**	8.0	**19045**
	9-Sept-07 [1]	**8010**	86.6	**349**	3.8	**26**	0.3	**863**	9.3	**9248**
Stickleback Lake	21-Jul-07	**23483**	43.8	**621**	1.2	**6328**	11.8	**23203**	43.3	**53635**
	20-Aug-07	**10502**	52.1	**437**	2.2	**42**	0.2	**9191**	45.6	**20171**
	9-Sep-07	**4814**	75.5	**17**	0.3	**578**	9.1	**969**	15.2	**6378**
Hope Bay	23-Jul-07	**169**	1.8	**298**	3.2	**8760**	94.0	**93**	1.0	**9321**
	17-Aug-07	**122**	0.1	**4200**	2.2	**189452**	97.8			**193774**
	15-Sep-07	**13**	0.2	**633**	11.2	**4988**	88.5			**5633**
Glenn Lake	16-Jul-07	**23**	0.1			**40939**	99.8	**76**	0.2	**41038**
	17-Aug-07	**14874**	24.5			**45824**	75.5			**60697**
	15-Sep-07	**643**	7.4			**8080**	92.6			**8724**
Ogama Lake	16-Jul-07	**189**	0.6	**1136**	3.5			**30724**	95.9	**32048**
	16-Aug-07	**527**	0.5	**30373**	30.4	**19683**	19.7	**49451**	49.4	**100033**
	11-Sep-07	**22562**	8.1	**6575**	2.4	**7700**	2.8	**241552**	86.8	**278389**
Patch Lake	17-Jul-07	**1551**	15.3	**973**	9.6	**6027**	59.5	**1574**	15.5	**10126**
	15-Aug-07	**149**	0.5	**10611**	34.0	**12902**	41.3	**7566**	24.2	**31229**
	11-Sep-07	**8**	< 0.1	**3685**	12.4	**17944**	60.6	**7983**	27.0	**29620**
Pelvic Lake	16-Jul-07	**1256**	6.2	**6820**	33.6			**12198**	60.2	**20274**
	16-Aug-07	**734**	0.6	**34037**	26.1			**95691**	73.3	**130462**
	13-Sep-07	**1074**	9.6	**3641**	32.4			**6516**	58.0	**11232**
P.O. Lake	17-Jul-07	**19**	0.1	**10935**	63.1	**2188**	12.6	**4175**	24.1	**17317**
	15-Aug-07			**11733**	31.5	**18612**	50.0	**6861**	18.4	**37206**
	11-Sep-07	**3**	< 0.1	**10939**	59.4	**4747**	25.8	**2740**	14.9	**18428**
Windy Lake	18-Jul-07	**2**	< 0.1	**40**	0.7	**5557**	99.3			**5599**
	21-Aug-07	**3**	< 0.1			**10200**	100.0			**10203**
	15-Sep-07	**8**	0.1			**10709**	99.9			**10717**
Wolverine Lake	17-Jul-07	**11838**	88.2	**532**	4.0			**1056**	7.9	**13426**
	15-Aug-07	**10766**	70.0	**1083**	7.0			**3530**	23.0	**15379**
	9-Sep-07	**18871**	67.7	**1461**	5.2			**7538**	27.0	**27870**

[1]Poorly preserved sample.

APPENDIX D5

BENTHIC INVERTEBRATE BIOMASS

Appendix D5. Abundance (# organisms/m^2) for the Main Taxonomic Groups of Benthic Invertebrates in Samples Collected in the Boston and Madrid Project Areas, 2007

Taxa / Species	Stage*	Aimaokatalok Shallow					Aimaokatalok Deep					Fickle Duck Shallow				
		Replicate					Replicate					Replicate				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
NEMATODA		133	400	756	756	2222						7244	1116	267	711	
OLIGOCHAETA				89												
Lumbriculidae		44				111										44
Naididae						111	44									
Tubificidae		667			89	667			44	133						
GASTROPODA	i/d												440	44		
Valvatidae																
Valvata sincera helicoidea														89		44
PELECYPODA																
Sphaeriidae	i/d								89							
Pisidium								178	356	356		400	2133	1022	222	667
Sphaerium		44						133	222	89	89		1440	222	133	
HYDRACHNIDA		133			44											
Aturidae								44								
Feltriidae																
Lebertiidae			44		89									44		
Oxidae																
CLADOCERA																
Chydoridae		222				333							147			
Bosminidae																
Bosmina																1182
Macrothricidae																
COPEPODA																
Calanoida						1222										
Cyclopoida					89				44			1778	44			1773
Harpacticoida												4444	293	89	222	4138
OSTRACODA		1289	444	44	400	667	89	222	1600	3378	133	8044	3960	2089	489	11231
DECAPODA																
Reptantia																
Orconectes virilis																
AMPHIPODA	i/d															
Gammarus lacustrus																
PLECOPTERA	i/d															
TRICHOPTERA	i/d															
Limnephilidae																
Ecclisomyia																
DIPTERA																
Chironomidae	pupae	89														
	i/d	89				1111										44
Tanypodinae		222			44	111	133	311			44	7378	1013	667		4671
Chironomini		711	133	89	444		178	89	44	178		3911	956	711	444	1627
Tanytarsini		1067		44	89	3156	44					25067	6542	1778	1022	31169
Orthocladiinae		444	133	133	133	267	44		44			40222	2409	1067	2222	32084
Prodiamesinae																
Monodiamesa		133				222										
Prodiamesa			133	44	133											
Diamesinae				44	44	222										
Protanypus						222										
Tipulidae																
Gonomyodes																
Grand Total		5067	1289	1244	2267	9089	533	978	2400	4133	267	96711	20302	8089	5467	85720

*all individuals are larvae unless otherwise noted

i/d = immature/damaged

Shaded rows indicate non-benthic taxa that are not included in the total (e.g., all Cladocera, Calanoida, and Cyclopoida copepods)

Appendix D5. Abundance (# organisms/m^2) for the Main Taxonomic Groups of Benthic Invertebrates in Samples Collected in the Boston and Madrid Project Areas, 2007

Taxa / Species	Stage*	Reference Shallow					Stickleback Shallow				
		Replicate					Replicate				
		1	2	3	4	5	1	2	3	4	5
NEMATODA		356	711	578	2889	1422	444	1489		924	933
OLIGOCHAETA								596		1173	
Lumbriculidae							622				178
Naididae		356					711			147	16000
Tubificidae		356		44		356	2933	89		44	2756
GASTROPODA	i/d		89								
Valvatidae											
Valvata sincera helicoidea		133	400	222	711	444	1156	400	133	622	756
PELECYPODA											
Sphaeriidae	i/d										
Pisidium		222	1289	489	933	267	2044	889	311	400	1778
Sphaerium		89	222	44	400	44			89	89	1467
HYDRACHNIDA					2889	356					
Aturidae											
Feltriidae											
Lebertiidae			44	89	133				137		
Oxidae											
CLADOCERA											
Chydoridae											
Bosminidae											
Bosmina											
Macrothricidae											
COPEPODA											
Calanoida											
Cyclopoida						356	711	298		293	
Harpacticoida			89	89		356	356	1191	1232	1907	9778
OSTRACODA		21378	7867	10044	28044	26933	25600	23524	12046	9973	54267
DECAPODA											
Reptantia											
Orconectes virilis											
AMPHIPODA	i/d							44			
Gammarus lacustrus							356	89			267
PLECOPTERA	i/d										
TRICHOPTERA	i/d										
Limnephilidae											
Ecclisomyia							89	44		44	133
DIPTERA											
Chironomidae	pupae		44								
	i/d						533		274	147	
Tanypodinae		1867	667		1511	2044		298		44	222
Chironomini		6178	1822	178	6756	4444	3200	1707	44	947	2133
Tanytarsini		2178	178		400	400	3022	298		778	6578
Orthocladiinae		4800	1956	178	4000	3867	1244	893	44	484	3556
Prodiamesinae											
Monodiamesa											
Prodiamesa											
Diamesinae											
Protanypus											
Tipulidae											
Gonomyodes											
Grand Total		37911	15378	11956	48667	40933	42311	31551	14311	17724	100800

*all individuals are larvae unless otherwise noted

i/d = immature/damaged

Shaded rows indicate non-benthic taxa that are not included in the total (e.g., all Cladocera, Calanoida, and Cyclopoida copepods)

Appendix D5. Abundance (# organisms/m^2) for the Main Taxonomic Groups of Benthic Invertebrates in Samples Collected in the Boston and Madrid Project Areas, 2007

Taxa / Species	Stage*	Glenn Shallow			Glenn Deep					Ogama Shallow			Ogama Deep		
		Replicate			Replicate					Replicate			Replicate		
		2	3	4	1	2	3	4	5	2	3	4	2	3	4
NEMATODA											44	44	44		
OLIGOCHAETA															
Lumbriculidae															
Naididae															
Tubificidae												44			44
GASTROPODA	i/d														
Valvatidae															
Valvata sincera helicoidea															
PELECYPODA															
Sphaeriidae	i/d														
Pisidium													89		
Sphaerium													44		
HYDRACHNIDA															
Aturidae															
Feltriidae															
Lebertiidae															
Oxidae										44	44	178			
CLADOCERA															
Chydoridae															
Bosminidae															
Bosmina															
Macrothricidae										44	44				
COPEPODA															
Calanoida															
Cyclopoida					44							89	178	222	
Harpacticoida															
OSTRACODA		1289	2533	2489	356	44	533	89	1422	3378	1778	2889	622	356	267
DECAPODA															
Reptantia															
Orconectes virilis															
AMPHIPODA	i/d														
Gammarus lacustrus															
PLECOPTERA	i/d														
TRICHOPTERA	i/d				44										
Limnephilidae															
Ecclisomyia															
DIPTERA															
Chironomidae	pupae										44				
	i/d				44				44					44	
Tanypodinae					133								133	933	800
Chironomini					178			44		44			978	356	622
Tanytarsini		44	44							356	311	444		222	
Orthocladiinae		44	44				133	89	89				44		
Prodiamesinae															
Monodiamesa															
Prodiamesa		133	44	89						44		44			
Diamesinae				44											
Protanypus															
Tipulidae															
Gonomyodes						44									
Grand Total		1511	2667	2622	756	89	667	222	1556	3867	2222	3644	1956	1911	1733

*all individuals are larvae unless otherwise noted
i/d = immature/damaged
Shaded rows indicate non-benthic taxa that are not included in the total (e.g., all Cladocera, Calanoida, and Cyclopoida copepods)

Appendix D5. Abundance (# organisms/m^2) for the Main Taxonomic Groups of Benthic Invertebrates in Samples Collected in the Boston and Madrid Project Areas, 2007

Taxa / Species	Stage*	Patch Shallow					Patch Deep					Pelvic Shallow				
		Replicate					Replicate					Replicate				
		1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
NEMATODA		5689	89	1422	4149									133		
OLIGOCHAETA		889						44								
Lumbriculidae																
Naididae						356									137	
Tubificidae		1244						89			44	296		44		356
GASTROPODA	i/d															
Valvatidae																
Valvata sincera helicoidea																
PELECYPODA																
Sphaeriidae	i/d															
Pisidium						356						44			44	44
Sphaerium													44			
HYDRACHNIDA															274	
Aturidae																
Feltriidae															137	
Lebertiidae													89			
Oxidae												296		133	684	
CLADOCERA																
Chydoridae						889									137	356
Bosminidae																
Bosmina												593				
Macrothricidae															137	
COPEPODA																
Calanoida																
Cyclopoida		73778	68267	21422	101147	50667	8111	622	267	578	5689	2075	267	178	3012	1422
Harpacticoida			711			1778										
OSTRACODA		32889	25600	9244	34624	27911	1778	889	311	489	667	16601	1333	1511	6023	4267
DECAPODA																
Reptantia																
Orconectes virilis										44				44	44	
AMPHIPODA	i/d															
Gammarus lacustrus																
PLECOPTERA	i/d															
TRICHOPTERA	i/d															
Limnephilidae																
Ecclisomyia																
DIPTERA																
Chironomidae	pupae															
	i/d			1422		356	111					889		44	274	44
Tanypodinae			1422	1244	4268	2489	444	133	311	267	44	682	44	356	681	889
Chironomini		4622	1067	622	6757	6400	333	489		89	133	3824	889	1200	2816	4089
Tanytarsini		1244	2133	2578	3319	5156	111					4447	267	533	2005	5733
Orthocladiinae		1422	2133	2578	3675	4444	111	178	44	133	44	44			181	89
Prodiamesinae																
Monodiamesa							333					44		133	89	267
Prodiamesa									44							
Diamesinae																
Protanypus																
Tipulidae																
Gonomyodes																
Grand Total		48000	33156	19111	56793	49244	3222	1822	711	1022	933	27169	2667	4133	13390	15778

*all individuals are larvae unless otherwise noted

i/d = immature/damaged

Shaded rows indicate non-benthic taxa that are not included in the total (e.g., all Cladocera, Calanoida, and Cyclopoida copepods)

Appendix D5. Abundance (# organisms/m^2) for the Main Taxonomic Groups of Benthic Invertebrates in Samples Collected in the Boston and Madrid Project Areas, 2007

Taxa / Species	Stage*	Pelvic Deep					P.O. Shallow				
		Replicate					Replicate				
		1	2	3	4	5	1	2	3	4	5
NEMATODA											44
OLIGOCHAETA									44	933	444
Lumbriculidae							89				578
Naididae									444		489
Tubificidae		178			89	89	1956	44			578
GASTROPODA	i/d										
Valvatidae											
Valvata sincera helicoidea											
PELECYPODA											
Sphaeriidae	i/d										
Pisidium							178	133	44	89	44
Sphaerium							978	1778	44	933	44
HYDRACHNIDA										44	
Aturidae											
Feltriidae											
Lebertiidae											
Oxidae											
CLADOCERA				44							
Chydoridae											
Bosminidae											
Bosmina		311			178	311					
Macrothricidae									222		
COPEPODA											
Calanoida											
Cyclopoida		6889	578	2356	2889	2889	8978	2667	2667	4489	12444
Harpacticoida											
OSTRACODA		1067		133	89	44	104444	70978	16267	73467	28089
DECAPODA											
Reptantia											
Orconectes virilis											
AMPHIPODA	i/d										
Gammarus lacustrus											
PLECOPTERA	i/d							889	222		
TRICHOPTERA	i/d										
Limnephilidae											
Ecclisomyia											
DIPTERA											
Chironomidae	pupae										
	i/d	89					2756	889			444
Tanypodinae			44				178	889			44
Chironomini		89	89	133	267	311	30311	21511	9156	23422	10756
Tanytarsini		178				133	5156	1156	667	2089	4000
Orthocladiinae							178		89	133	133
Prodiamesinae											
Monodiamesa											
Prodiamesa											
Diamesinae											
Protanypus											
Tipulidae											
Gonomyodes											
Grand Total		1600	133	267	444	578	146222	98267	26978	101111	45689

*all individuals are larvae unless otherwise noted
i/d = immature/damaged

Shaded rows indicate non-benthic taxa that are not included in the total (e.g., all Cladocera, Calanoida, and Cyclopoida copepods)

Appendix D5. Abundance (# organisms/m^2) for the Main Taxonomic Groups of Benthic Invertebrates in Samples Collected in the Boston and Madrid Project Areas, 2007

Taxa / Species	Stage*	Windy Shallow					Windy Deep			Wolverine Shallow			
		Replicate					Replicate			Replicate			
		1	2	3	4	5	2	3	4	1	2	3	4
NEMATODA			133				89		89		489	2044	89
OLIGOCHAETA											444		
Lumbriculidae										356			
Naididae						44							
Tubificidae		178								1244	222	89	89
GASTROPODA	i/d										44		
Valvatidae													
Valvata sincera helicoidea													44
PELECYPODA													
Sphaeriidae	i/d												
Pisidium										2844	2978	4000	2800
Sphaerium										1067	400	3111	933
HYDRACHNIDA											889		
Aturidae													
Feltriidae													
Lebertiidae											44		
Oxidae													
CLADOCERA													
Chydoridae						44							
Bosminidae													
Bosmina													
Macrothricidae													
COPEPODA													
Calanoida													
Cyclopoida						89				1067			
Harpacticoida													
OSTRACODA		7956	578	133	222	1867	6978	8933	6444	42400	50089	77333	40356
DECAPODA													
Reptantia													
Orconectes virilis													
AMPHIPODA	i/d												
Gammarus lacustrus													
PLECOPTERA	i/d									711			
TRICHOPTERA	i/d												
Limnephilidae													
Ecclisomyia											44	44	44
DIPTERA													
Chironomidae	pupae	44											
	i/d	133						89	44				
Tanypodinae						44	44		89	1511	44	933	400
Chironomini		44				44	44		222	978	2000	2178	356
Tanytarsini			44			44					44	44	
Orthocladiinae		178				89	44	89		89	133	1067	44
Prodiamesinae													
Monodiamesa		44	178		89	89							
Prodiamesa													
Diamesinae													
Protanypus		44											
Tipulidae													
Gonomyodes													
Grand Total		8622	933	133	311	2222	7200	9111	6889	51200	57867	90844	45156

*all individuals are larvae unless otherwise noted
i/d = immature/damaged
Shaded rows indicate non-benthic taxa that are not included in the total (e.g., all Cladocera, Calanoida, and Cyclopoida copepods)

APPENDIX D6

BENTHIC INVERTEBRATE BIOMASS AND PERCENT COMPOSITION

Appendix D6. Abundance (# organisms/m^2) and Percent Composition for the Main Taxonomic Groups of Benthic Invertebrates in Samples Collected in the Boston and Madrid Project Areas, 2007

Lake	Depth	#	Nematoda			Oligochaeta			Pelecypoda			Ostracoda			Tanypodinae		
		Reps	Mean	SE	%	Mean	SE	%	Mean	SE	%	Mean	SE	%	Mean	SE	%
Aimaokatalok Lake	Shallow	5	853	362	22.51	356	184	9.38	9	9	0.23	569	206	15.01	76	42	1.99
	Deep	5				44	24	2.67	302	120	18.18	1084	639	65.24	98	59	5.88
Fickle Duck Lake	Shallow	5	1868	1358	4.32	9	9	0.02	1248	603	2.89	5163	1973	11.93	2746	1415	6.35
Reference Lake	Shallow	5	1191	460	3.85	222	139	0.72	800	259	2.58	18853	4210	60.88	1218	386	3.93
Stickleback Lake	Shallow	5	758	252	1.83	5050	3546	12.22	1413	543	3.42	25082	7914	60.67	113	62	0.27
Glenn Lake	Shallow	3										2104	408	92.81			
	Deep	5										489	250	74.32	27	27	4.05
Ogama Lake	Shallow	3	30	15	0.91	15	15	0.46				2681	473	82.65			
	Deep	3	15	15	0.79	15	15	0.79	44	44	2.38	415	107	22.22	622	247	33.33
Patch Lake	Shallow	5	2270	1137	5.50	498	415	1.21	71	71	0.17	26054	4508	63.14	1885	715	4.57
	Deep	5				36	26	2.31				827	256	53.60	240	70	15.56
Pelvic Lake	Shallow	5	27	27	0.21	167	69	1.32	36	9	0.28	5947	2804	47.10	530	148	4.20
	Deep	5				71	33	11.76				267	201	44.12	9	9	1.47
P.O. Lake	Shallow	5	9	9	0.01	1120	411	1.34	853	347	1.02	58649	16123	70.11	222	170	0.27
Windy Lake	Shallow	5	27	27	1.09	44	34	1.82				2151	1484	88.00	9	9	0.36
	Deep	3	59	30	0.77							7452	757	96.36	44	26	0.57
Wolverine Lake	Shallow	4	656	475	1.07	611	357	1.00	4533	866	7.40	52544	8524	85.76	722	320	1.18

Lake	Depth	#	Chironomini			Tanytarsini			Orthocladiinae			Remaining Chironomidae			Remaining taxa			Total	
		Reps	Mean	SE	%	Mean	SE	%	Mean	SE	%	Mean	SE	%	Mean	SE	%	Mean	SE
Aimaokatalok Lake	Shallow	5	276	132	7.27	871	605	22.98	222	61	5.86	498	322	13.13	62	30	1.64	3791	1496
	Deep	5	98	36	5.88	9	9	0.53	18	11	1.07			0.00	9	9	0.53	1662	719
Fickle Duck Lake	Shallow	5	1530	627	3.54	13116	6272	30.32	15601	8492	36.06	9	9	0.02	1970	962	4.55	43258	19814
Reference Lake	Shallow	5	3876	1261	12.51	631	394	2.04	2960	838	9.56	9	9	0.03	1209	653	3.90	30969	7298
Stickleback Lake	Shallow	5	1606	534	3.89	2135	1231	5.16	1244	612	3.01	191	100	0.46	3747	1805	9.06	41340	15685
Glenn Lake	Shallow	3				30	15	1.31	30	15	1.31	104	30	4.58				2267	378
	Deep	5	44	34	6.76				62	27	9.46	18	11	2.70	18	11	2.70	658	258
Ogama Lake	Shallow	3	15	15	0.46	370	39	11.42				44	0	1.37	89	44	2.74	3244	515
	Deep	3	652	180	34.92	74	74	3.97	15	15	0.79	15	15	0.79				1867	68
Patch Lake	Shallow	5	3894	1298	9.44	2886	659	6.99	2850	541	6.91	356	275	0.86	498	348	1.21	41261	6733
	Deep	5	209	89	13.54	22	22	1.44	102	26	6.63	98	87	6.34	9	9	0.58	1542	460
Pelvic Lake	Shallow	5	2564	657	20.30	2597	1079	20.57	63	34	0.50	357	157	2.83	341	206	2.70	12627	4435
	Deep	5	178	47	29.41	62	39	10.29				18	18	2.94				604	260
P.O. Lake	Shallow	5	19031	3992	22.75	2613	854	3.12	107	30	0.13	818	512	0.98	231	169	0.28	83653	21315
Windy Lake	Shallow	5	18	11	0.73	18	11	0.73	53	36	2.18	124	45	5.09				2444	1587
	Deep	3	89	68	1.15				44	26	0.57	44	26	0.57				7733	695
Wolverine Lake	Shallow	4	1378	431	2.25	22	13	0.04	333	245	0.54			0.00	467	240	0.76	61267	10195

Note: 'Remaining Chironomidae' are unidentified Chironomidae, Prodiamesinae, and Diamesinae, each of which contributed <10% of total abundance. 'Remaining Taxa' are the remaining taxonomic groups, each of which contributed <10% of total individuals at a sampling depth in any lake. Due to rounding, the total numbers may not match the sums of the individual taxonomic groups. SE = standard error.

APPENDIX E

FISH POPULATIONS

APPENDIX E1

INDIVIDUAL FISH CAPTURE DATA

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
1	LKTR	35						EF	16-Jul-06	AREF-01	Aimaokatalok River				
2	LKTR	32						EF	16-Jul-06	AREF-01	Aimaokatalok River				
3	LKTR	53						EF	16-Jul-06	AREF-01	Aimaokatalok River				
4	LKTR	25						EF	16-Jul-06	AREF-01	Aimaokatalok River				
5	LKTR	26						EF	16-Jul-06	AREF-01	Aimaokatalok River				
6	LKTR	26						EF	16-Jul-06	AREF-01	Aimaokatalok River				
7	LKTR	27						EF	16-Jul-06	AREF-01	Aimaokatalok River				
8	LKTR	25						EF	16-Jul-06	AREF-01	Aimaokatalok River				
9	LKTR	26						EF	16-Jul-06	AREF-01	Aimaokatalok River				
10	NNST	38						EF	16-Jul-06	AREF-01	Aimaokatalok River				
11	NNST	42						EF	16-Jul-06	AREF-01	Aimaokatalok River				
12	NNST	64						EF	16-Jul-06	AREF-01	Aimaokatalok River				
13	NNST	49						EF	16-Jul-06	AREF-01	Aimaokatalok River				
14	NNST	51						EF	16-Jul-06	AREF-01	Aimaokatalok River				
15	NNST	36						EF	16-Jul-06	AREF-01	Aimaokatalok River				
16	NNST	31						EF	16-Jul-06	AREF-01	Aimaokatalok River				
17	NNST	44						EF	16-Jul-06	AREF-01	Aimaokatalok River				
18	NNST	41						EF	16-Jul-06	AREF-01	Aimaokatalok River				
19	NNST	46						EF	16-Jul-06	AREF-01	Aimaokatalok River				
20	NNST	36						EF	16-Jul-06	AREF-01	Aimaokatalok River				
21	NNST	32						EF	16-Jul-06	AREF-01	Aimaokatalok River				
22	NNST	38						EF	16-Jul-06	AREF-01	Aimaokatalok River				
23	NNST	36						EF	16-Jul-06	AREF-01	Aimaokatalok River				
24	NNST	40						EF	16-Jul-06	AREF-01	Aimaokatalok River				
25	NNST	45						MT	16-Jul-06	SLMT-03	Aimaokatalok Lake				
26	NNST	55						MT	16-Jul-06	SLMT-03	Aimaokatalok Lake				
27-40	LKTR							EF	16-Jul-06	SLEF-01	Aimaokatalok Lake				14 LKTR captured; Observed approx 40 YOY LKTR
41-46	NNST							EF	16-Jul-06	SLEF-01	Aimaokatalok Lake				6 NNST captured; Observed approx 100 NNST
47	LKTR	422	852	1.13				GN	16-Jul-06	SLGN-01	Aimaokatalok Lake	SC			fish died
48	LKTR	30						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
49	LKTR	85						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
50	NNST	50						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
51	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
52	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
53	NNST	44						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
54	NNST	46						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
55	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
56	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
57	NNST	38						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
58	NNST	39						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
59	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
60	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
61	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
62	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
63	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
64	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
65	NNST	42						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
66	NNST	43						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
67	NNST	50						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
68	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
69	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
70	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
71	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
72	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
73	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
74	NNST	50						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
75	NNST	51						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
76	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
77	NNST	42						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
78	NNST	42						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
79	NNST	43						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
80	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
81	NNST	42						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
82	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
83	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
84	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
85	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
86	NNST	36						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
87	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
88	NNST	41						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
89	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
90	NNST	42						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
91	NNST	43						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
92	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
93	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
94	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
95	NNST	55						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
96	NNST	50						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
97	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
98	NNST	41						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
99	NNST	42						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
100	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
101	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
102	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
103	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
104	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
105	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
106	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
107	NNST	50						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
108	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
109	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
110	NNST	36						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
111	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
112	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
113	NNST	36						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
114	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
115	NNST	50						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
116	NNST	50						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
117	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
118	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
119	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
120	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
121	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
122	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
123	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
124	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
125	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
126	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
127	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
128	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
129	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
130	NNST	46						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
131	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
132	NNST	30						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
133	NNST	30						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
134	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
135	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
136	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
137	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
138	NNST	45						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
139	NNST	40						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
140	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
141	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
142	NNST	35						FN	17-Jul-06	SLFN-01	Aimaokatalok Lake				
143	NNST	55						MT	17-Jul-06	SLMT-01	Stickleback Lake				NNST with parasites
144	NNST	50						MT	17-Jul-06	SLMT-01	Stickleback Lake				NNST with parasites
145	NNST	52						MT	17-Jul-06	SLMT-01	Stickleback Lake				NNST with parasites
146	NNST	50						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites
147	NNST	71						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites
148	NNST	48						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites
149	NNST	56						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites
150	NNST	55						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites
151	NNST	49						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites
152	NNST	50						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
153	NNST	52						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites
154	NNST	49						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites
155	NNST	56						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites
156	NNST	51						MT	17-Jul-06	SLMT-02	Stickleback Lake				NNST with parasites
157	NNST	82						MT	17-Jul-06	SLMT-03	Stickleback Lake				NNST with parasites
158	NNST	51						MT	17-Jul-06	SLMT-03	Stickleback Lake				NNST with parasites
159	NNST	80						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
160	NNST	63						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
161	NNST	62						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
162	NNST	46						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
163	NNST	56						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
164	NNST	50						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
165	NNST	55						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
166	NNST	66						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
167	NNST	40						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
168	NNST	50						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
169	NNST	40						MT	17-Jul-06	SLMT-04	Stickleback Lake				NNST with parasites
170	NNST	41						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
171	NNST	50						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
172	NNST	55						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
173	NNST	35						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
174	NNST	52						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
175	NNST	36						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
176	NNST	49						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
177	NNST	57						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
178	NNST	35						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
179	NNST	50						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
180	NNST	42						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
181	NNST	50						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
182	NNST	46						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
183	NNST	47						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
184	NNST	53						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
185	NNST	50						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
186	NNST	40						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
187	NNST	39						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
188	NNST	52						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
189	NNST	42						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
190	NNST	47						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
191	NNST	52						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
192	NNST	42						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
193	NNST	47						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
194	SLSC	115						EF	17-Jul-06	SOEF-01	Stickleback Outflow				
195	LKTR	78						BS	18-Jul-06	FLBS-01	Fickle Duck Lake				
196	NNST	50						BS	18-Jul-06	FLBS-01	Fickle Duck Lake				
197	NNST	50						EF	18-Jul-06	FIEF-01	Fickle Duck Inflow				
198	NNST	35						EF	18-Jul-06	FIEF-01	Fickle Duck Inflow				
199	NNST	45						EF	18-Jul-06	FIEF-01	Fickle Duck Inflow				
200	NNST	45						EF	18-Jul-06	FIEF-01	Fickle Duck Inflow				
201	NNST	40						EF	18-Jul-06	FIEF-01	Fickle Duck Inflow				
202	NNST	40						EF	18-Jul-06	FIEF-01	Fickle Duck Inflow				
203	NNST	35						EF	18-Jul-06	FIEF-01	Fickle Duck Inflow				
204	NNST	35						EF	18-Jul-06	FIEF-01	Fickle Duck Inflow				
205	LKTR	490	1390	1.18			985120031599570	GN	18-Jul-06	FLGN-01	Fickle Duck Lake				
206	LKTR	555	2620	1.53			985120013632453	GN	18-Jul-06	FLGN-01	Fickle Duck Lake				
207	NNST	48						MT	18-Jul-06	FLMT-03	Fickle Duck Lake				
208	NNST	51						MT	18-Jul-06	FLMT-03	Fickle Duck Lake				
209	NNST	49						MT	18-Jul-06	FLMT-03	Fickle Duck Lake				
210	NNST	50						MT	18-Jul-06	FLMT-03	Fickle Duck Lake				
211	NNST	46						MT	18-Jul-06	FLMT-03	Fickle Duck Lake				
212	BURB	415	490	0.69				EF	18-Jul-06	FOEF-01	Fickle Duck Outflow				
213	LKTR	85	4	0.65				EF	18-Jul-06	FOEF-01	Fickle Duck Outflow				
214	NNST	35						EF	18-Jul-06	FOEF-01	Fickle Duck Outflow				
215	NNST	36						EF	18-Jul-06	FOEF-01	Fickle Duck Outflow				
216	NNST	40						EF	18-Jul-06	FOEF-01	Fickle Duck Outflow				
217	NNST	40						EF	18-Jul-06	FOEF-01	Fickle Duck Outflow				
218	NNST	50						EF	18-Jul-06	FOEF-01	Fickle Duck Outflow				
219	NNST	51						EF	18-Jul-06	FOEF-01	Fickle Duck Outflow				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
220	NNST	45						EF	18-Jul-06	FOEF-01	Fickle Duck Outflow				
389	ARGR	69						EF	20-Jul-06	KREF-02	Koignuk River				
222	LKTR	665	2750	0.94				AN	19-Jul-06	KRAN-01	Koignuk River				At Narrows
223	LKTR	470	1510	1.45				AN	19-Jul-06	KRAN-01	Koignuk River				At Narrows
6	ARFL	139	42	1.56				EF	8-Jul-07	KNBP-02	Koignuk River		C		
225	LKTR	450	1350	1.48				AN	19-Jul-06	KRAN-01	Koignuk River				At Narrows
226	LKTR	455	1135	1.20				AN	19-Jul-06	KRAN-01	Koignuk River				At Narrows
227	LKTR	480	1380	1.25				AN	19-Jul-06	KRAN-01	Koignuk River				At Narrows
228	LKTR	480	1340	1.21				AN	19-Jul-06	KRAN-01	Koignuk River				At Narrows
229	LKTR	535	1395	0.91				AN	19-Jul-06	KRAN-01	Koignuk River				At Narrows
230	NNST	67						EF	19-Jul-06	KREF-01	Koignuk River				
231	NNST	52						EF	19-Jul-06	KREF-01	Koignuk River				
232	NNST	46						EF	19-Jul-06	KREF-01	Koignuk River				
233	NNST	39						EF	19-Jul-06	KREF-01	Koignuk River				
234	SLSC	52						EF	19-Jul-06	KREF-01	Koignuk River				
235	SLSC	57						EF	19-Jul-06	KREF-01	Koignuk River				
236	SLSC	46						EF	19-Jul-06	KREF-01	Koignuk River				
237	LKWH	480	1350	1.22				GN	19-Jul-06	KRGN-01	Koignuk River				
238	LKWH	500	1375	1.10				GN	19-Jul-06	KRGN-01	Koignuk River				
239	NNST	50						EF	19-Jul-06	RLEF-01	Reference Lake				
240	NNST	45						EF	19-Jul-06	RLEF-01	Reference Lake				
241	NNST	45						EF	19-Jul-06	RLEF-01	Reference Lake				
242	CISC	28						EF	19-Jul-06	RLEF-02	Reference Lake				Kept for ID, believed to be CISC or LKWH
243	NNST	50						EF	19-Jul-06	RLEF-02	Reference Lake				
244	NNST	45						EF	19-Jul-06	RLEF-02	Reference Lake				
245	NNST	46						EF	19-Jul-06	RLEF-02	Reference Lake				
246	NNST	30						EF	19-Jul-06	RLEF-02	Reference Lake				
247	NNST	35						EF	19-Jul-06	RLEF-02	Reference Lake				
248	NNST	35						EF	19-Jul-06	RLEF-02	Reference Lake				
249	NNST	36						EF	19-Jul-06	RLEF-02	Reference Lake				
250	LKTR	195	80	1.08				GN	19-Jul-06	RLGN-01	Reference Lake	SC			
251	NNST	50						MT	19-Jul-06	RLMT-03	Reference Lake				
252	NNST	40						MT	19-Jul-06	RLMT-03	Reference Lake				
253	CISC	85						FN	19-Jul-06	SLFN-02	Aimaokatalok Lake				where fickleduck flows into Spyder
254	CISC	75						FN	19-Jul-06	SLFN-02	Aimaokatalok Lake				where fickleduck flows into Spyder
255	NNST	40						FN	19-Jul-06	SLFN-02	Aimaokatalok Lake				where fickleduck flows into Spyder
256	NNST	39						FN	19-Jul-06	SLFN-02	Aimaokatalok Lake				where fickleduck flows into Spyder
257	NNST	40						FN	19-Jul-06	SLFN-02	Aimaokatalok Lake				where fickleduck flows into Spyder
258	NNST	40						FN	19-Jul-06	SLFN-02	Aimaokatalok Lake				where fickleduck flows into Spyder
259	NNST	39						FN	19-Jul-06	SLFN-02	Aimaokatalok Lake				where fickleduck flows into Spyder
260	NNST	40						FN	19-Jul-06	SLFN-02	Aimaokatalok Lake				where fickleduck flows into Spyder
261	NNST	50						FN	19-Jul-06	SLFN-02	Aimaokatalok Lake				where fickleduck flows into Spyder
387	ARGR	70						EF	20-Jul-06	KREF-02	Koignuk River				
263	ARGR	400						AN	20-Jul-06	KRAN-02	Koignuk River				At Narrows
388	ARGR	72						EF	20-Jul-06	KREF-02	Koignuk River				
386	ARGR	79						EF	20-Jul-06	KREF-02	Koignuk River				
266-385	LKWH	30-40						BS	20-Jul-06	KRBS-01	Koignuk River				120 LKWH captured
3	ARGR	109	13	1.00				EF	8-Jul-07	KNBP-01	Koignuk River		C		
265	ARGR	350						AN	20-Jul-06	KRAN-02	Koignuk River				At Narrows
262	ARGR	380						AN	20-Jul-06	KRAN-02	Koignuk River				At Narrows
221	ARGR	385	650	1.14				AN	19-Jul-06	KRAN-01	Koignuk River				At Narrows
390	ARGR	25						EF	20-Jul-06	KREF-02	Koignuk River				
391	ARGR	23						EF	20-Jul-06	KREF-02	Koignuk River				
392	ARGR	25						EF	20-Jul-06	KREF-02	Koignuk River				
393	ARGR	23						EF	20-Jul-06	KREF-02	Koignuk River				
394	ARGR	34						EF	20-Jul-06	KREF-02	Koignuk River				
395	ARGR	30						EF	20-Jul-06	KREF-02	Koignuk River				
396	ARGR	25						EF	20-Jul-06	KREF-02	Koignuk River				
397	BURB	83						EF	20-Jul-06	KREF-02	Koignuk River				
398	BURB	70						EF	20-Jul-06	KREF-02	Koignuk River				
399	LKTR	78						EF	20-Jul-06	KREF-02	Koignuk River				
400	NNST	60						EF	20-Jul-06	KREF-02	Koignuk River				
401	NNST	55						EF	20-Jul-06	KREF-02	Koignuk River				
402	NNST	49						EF	20-Jul-06	KREF-02	Koignuk River				
403	NNST	51						EF	20-Jul-06	KREF-02	Koignuk River				
404	NNST	35						EF	20-Jul-06	KREF-02	Koignuk River				
405	NNST	37						EF	20-Jul-06	KREF-02	Koignuk River				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
406	NNST	38						EF	20-Jul-06	KREF-02	Koignuk River				
407	NNST	40						EF	20-Jul-06	KREF-02	Koignuk River				
408	NNST	46						EF	20-Jul-06	KREF-02	Koignuk River				
409	NNST	35						EF	20-Jul-06	KREF-02	Koignuk River				
410	LKWH	490						GN	20-Jul-06	KRGN-02	Koignuk River	SC			ageing structure taken
411	LKWH	520						GN	20-Jul-06	KRGN-02	Koignuk River	SC			ageing structure taken
412	LKWH	500						GN	20-Jul-06	KRGN-02	Koignuk River	SC			ageing structure taken
413	NNST	39						EF	23-Jul-06	WLEF-01	Wolverine Lake				
414	NNST	36						EF	23-Jul-06	WLEF-01	Wolverine Lake				
415	NNST	40						EF	23-Jul-06	WLEF-01	Wolverine Lake				
416	NNST	55						EF	23-Jul-06	WLEF-01	Wolverine Lake				
417	NNST	49						EF	23-Jul-06	WLEF-01	Wolverine Lake				
418	NNST	50						EF	23-Jul-06	WLEF-01	Wolverine Lake				
419	NNST	45						EF	23-Jul-06	WLEF-01	Wolverine Lake				
420	NNST	37						EF	23-Jul-06	WLEF-01	Wolverine Lake				
421	NNST	60						EF	23-Jul-06	WLEF-01	Wolverine Lake				
422	NNST	55						EF	23-Jul-06	WLEF-01	Wolverine Lake				
423	NNST	45						EF	23-Jul-06	WLEF-01	Wolverine Lake				
424	NNST	45						EF	23-Jul-06	WLEF-01	Wolverine Lake				
425	NNST	45						EF	23-Jul-06	WLEF-01	Wolverine Lake				
426	NNST	35						EF	23-Jul-06	WLEF-01	Wolverine Lake				
427	NNST	40						EF	23-Jul-06	WLEF-01	Wolverine Lake				
428	NNST	42						EF	23-Jul-06	WLEF-01	Wolverine Lake				
429	NNST	52						EF	23-Jul-06	WLEF-01	Wolverine Lake				
430	NNST	50						EF	23-Jul-06	WLEF-01	Wolverine Lake				
431	NNST	49						EF	23-Jul-06	WLEF-01	Wolverine Lake				
432	NNST	45						EF	23-Jul-06	WLEF-01	Wolverine Lake				
433	NNST	45						EF	23-Jul-06	WLEF-01	Wolverine Lake				
434	NNST	40						EF	23-Jul-06	WLEF-01	Wolverine Lake				
435	NNST	40						EF	23-Jul-06	WLEF-01	Wolverine Lake				
436	NNST	50						EF	23-Jul-06	WLEF-01	Wolverine Lake				
437	NNST	51						EF	23-Jul-06	WLEF-01	Wolverine Lake				
438	NNST	50						EF	23-Jul-06	WLEF-02	Wolverine Lake				
439	NNST	50						EF	23-Jul-06	WLEF-02	Wolverine Lake				
440	NNST	45						EF	23-Jul-06	WLEF-02	Wolverine Lake				
441	NNST	45						EF	23-Jul-06	WLEF-02	Wolverine Lake				
442	NNST	35						EF	23-Jul-06	WLEF-02	Wolverine Lake				
443	NNST	50						EF	23-Jul-06	WLEF-02	Wolverine Lake				
444	NNST	55						EF	23-Jul-06	WLEF-02	Wolverine Lake				
445	NNST	49						EF	23-Jul-06	WLEF-02	Wolverine Lake				
446	NNST	46						EF	23-Jul-06	WLEF-02	Wolverine Lake				
447	NNST	41						EF	23-Jul-06	WLEF-02	Wolverine Lake				
448	NNST	50						GN	23-Jul-06	WLGN-02	Wolverine Lake				
449	NNST	50						EF	24-Jul-06	WLEF-03	Wolverine Lake				
450	NNST	50						EF	24-Jul-06	WLEF-03	Wolverine Lake				
451	NNST	45						EF	24-Jul-06	WLEF-03	Wolverine Lake				
452	NNST	25						EF	24-Jul-06	WLEF-03	Wolverine Lake				
453	NNST	30						EF	24-Jul-06	WLEF-03	Wolverine Lake				
454	NNST	50						EF	24-Jul-06	WLEF-03	Wolverine Lake				
455	NNST	40						EF	24-Jul-06	WLEF-03	Wolverine Lake				
456	NNST	42						EF	24-Jul-06	WLEF-03	Wolverine Lake				
457	NNST	47						EF	24-Jul-06	WLEF-03	Wolverine Lake				
458	NNST	60						EF	24-Jul-06	WLEF-03	Wolverine Lake				
459	NNST	62						EF	24-Jul-06	WLEF-03	Wolverine Lake				
460	NNST	48						EF	24-Jul-06	WLEF-03	Wolverine Lake				
461	NNST	44						EF	24-Jul-06	WLEF-03	Wolverine Lake				
462	NNST	50						EF	24-Jul-06	WLEF-03	Wolverine Lake				
463	NNST	39						EF	24-Jul-06	WLEF-03	Wolverine Lake				
464	NNST	60						EF	24-Jul-06	WLEF-03	Wolverine Lake				
465	NNST	50						EF	24-Jul-06	WLEF-03	Wolverine Lake				
466	NNST	55						EF	24-Jul-06	WLEF-03	Wolverine Lake				
467	NNST	48						EF	24-Jul-06	WLEF-03	Wolverine Lake				
468	NNST	43						EF	24-Jul-06	WLEF-03	Wolverine Lake				
469	NNST	40						EF	24-Jul-06	WLEF-03	Wolverine Lake				
470	NNST	40						EF	24-Jul-06	WLEF-03	Wolverine Lake				
471	NNST	47						EF	24-Jul-06	WLEF-03	Wolverine Lake				
472	NNST	58						EF	24-Jul-06	WLEF-03	Wolverine Lake				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
473	NNST	44						EF	24-Jul-06	WLEF-03	Wolverine Lake				
474	NNST	45						EF	24-Jul-06	WLEF-03	Wolverine Lake				
475	NNST	45						EF	24-Jul-06	WLEF-03	Wolverine Lake				
476	NNST	50						EF	24-Jul-06	WLEF-03	Wolverine Lake				
477	NNST	50						EF	24-Jul-06	WLEF-04	Wolverine Lake				
478	NNST	55						EF	24-Jul-06	WLEF-04	Wolverine Lake				
479	NNST	49						EF	24-Jul-06	WLEF-04	Wolverine Lake				
480	NNST	25						EF	24-Jul-06	WLEF-04	Wolverine Lake				
481	NNST	30						EF	24-Jul-06	WLEF-04	Wolverine Lake				
482	NNST	55						EF	24-Jul-06	WLEF-04	Wolverine Lake				
483	NNST	45						EF	24-Jul-06	WLEF-04	Wolverine Lake				
484	NNST	46						EF	24-Jul-06	WLEF-04	Wolverine Lake				
485	NNST	58						EF	24-Jul-06	WLEF-04	Wolverine Lake				
486	NNST	50						EF	24-Jul-06	WLEF-04	Wolverine Lake				
487	NNST	45						EF	24-Jul-06	WLEF-04	Wolverine Lake				
488	NNST	60						MT	24-Jul-06	WLMT-01	Wolverine Lake				
489	NNST	55						MT	24-Jul-06	WLMT-01	Wolverine Lake				
490	NNST	40						MT	24-Jul-06	WLMT-01	Wolverine Lake				
491	NNST	55						MT	24-Jul-06	WLMT-01	Wolverine Lake				
492	NNST	50						MT	24-Jul-06	WLMT-01	Wolverine Lake				
493	NNST	57						MT	24-Jul-06	WLMT-01	Wolverine Lake				
494	NNST	45						MT	24-Jul-06	WLMT-01	Wolverine Lake				
495	NNST	50						MT	24-Jul-06	WLMT-01	Wolverine Lake				
496	NNST	60						MT	24-Jul-06	WLMT-02	Wolverine Lake				
497	NNST	61						MT	24-Jul-06	WLMT-02	Wolverine Lake				
498	NNST	55						MT	24-Jul-06	WLMT-02	Wolverine Lake				
499	NNST	40						MT	24-Jul-06	WLMT-02	Wolverine Lake				
500	NNST	45						MT	24-Jul-06	WLMT-02	Wolverine Lake				
501	NNST	52						MT	24-Jul-06	WLMT-02	Wolverine Lake				
502	NNST	60						MT	24-Jul-06	WLMT-02	Wolverine Lake				
503	NNST	57						MT	24-Jul-06	WLMT-02	Wolverine Lake				
504	NNST	45						MT	24-Jul-06	WLMT-02	Wolverine Lake				
505	NNST	50						MT	24-Jul-06	WLMT-02	Wolverine Lake				
506	NNST	55						MT	24-Jul-06	WLMT-02	Wolverine Lake				
507	NNST	55						MT	24-Jul-06	WLMT-02	Wolverine Lake				
508	NNST	50						MT	24-Jul-06	WLMT-02	Wolverine Lake				
509	NNST	45						MT	24-Jul-06	WLMT-02	Wolverine Lake				
510	NNST	48						MT	24-Jul-06	WLMT-02	Wolverine Lake				
511	NNST	62						MT	24-Jul-06	WLMT-02	Wolverine Lake				
512	NNST	60						MT	24-Jul-06	WLMT-02	Wolverine Lake				
513	NNST	57						MT	24-Jul-06	WLMT-02	Wolverine Lake				
514	NNST	45						MT	24-Jul-06	WLMT-02	Wolverine Lake				
515	NNST	45						MT	24-Jul-06	WLMT-02	Wolverine Lake				
516	NNST	50						MT	24-Jul-06	WLMT-02	Wolverine Lake				
517	NNST	52						MT	24-Jul-06	WLMT-02	Wolverine Lake				
518	NNST	55						MT	24-Jul-06	WLMT-02	Wolverine Lake				
519	NNST	60						MT	24-Jul-06	WLMT-03	Wolverine Lake				
520	NNST	55						MT	24-Jul-06	WLMT-03	Wolverine Lake				
521	NNST	50						MT	24-Jul-06	WLMT-03	Wolverine Lake				
522	NNST	57						MT	24-Jul-06	WLMT-03	Wolverine Lake				
523	NNST	58						MT	24-Jul-06	WLMT-03	Wolverine Lake				
524	NNST	45						MT	24-Jul-06	WLMT-03	Wolverine Lake				
525	NNST	40						MT	24-Jul-06	WLMT-03	Wolverine Lake				
526	NNST	47						MT	24-Jul-06	WLMT-03	Wolverine Lake				
527	NNST	48						MT	24-Jul-06	WLMT-03	Wolverine Lake				
528	NNST	55						MT	24-Jul-06	WLMT-03	Wolverine Lake				
529	NNST	60						MT	24-Jul-06	WLMT-03	Wolverine Lake				
530	NNST	50						MT	24-Jul-06	WLMT-03	Wolverine Lake				
531	NNST	55						MT	24-Jul-06	WLMT-03	Wolverine Lake				
532	NNST	50						MT	24-Jul-06	WLMT-03	Wolverine Lake				
533	NNST	55						MT	24-Jul-06	WLMT-03	Wolverine Lake				
534	NNST	45						MT	24-Jul-06	WLMT-03	Wolverine Lake				
535	NNST	55						MT	24-Jul-06	WLMT-03	Wolverine Lake				
536	NNST	50						MT	24-Jul-06	WLMT-03	Wolverine Lake				
537	NNST	50						MT	24-Jul-06	WLMT-03	Wolverine Lake				
538	NNST	45						MT	24-Jul-06	WLMT-03	Wolverine Lake				
539	NNST	47						MT	24-Jul-06	WLMT-03	Wolverine Lake				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
540	NNST	50						MT	24-Jul-06	WLMT-06	Wolverine Lake				
541	NNST	55						MT	24-Jul-06	WLMT-06	Wolverine Lake				
542	NNST	50						MT	24-Jul-06	WLMT-06	Wolverine Lake				
543	NNST	55						MT	24-Jul-06	WLMT-07	Wolverine Lake				
544	NNST	65						MT	24-Jul-06	WLMT-08	Wolverine Lake				
545	NNST	50						MT	24-Jul-06	WLMT-08	Wolverine Lake				
33	LKTR	505	1240	0.96			985120031569662	GN	9-Jul-07	PLGN-02	Patch Lake		C		
34	LKTR	730	3240	0.83			985120031630896	GN	10-Jul-07	PLGN-07	Patch Lake		C		
35	LKTR	744	3825	0.93			985120031631607	GN	10-Jul-07	PLGN-11	Patch Lake		C		
36	LKTR	670	3060	1.02			985120031549764	GN	10-Jul-07	PLGN-12	Patch Lake		C		
37	LKTR	528	1255	0.85			985120031622641	GN	10-Jul-07	PLGN-12	Patch Lake		C		
38	CISC	289	250	1.04				GN	10-Jul-07	PLGN-11	Patch Lake		M		Mortality (fish collected for Heidi)
39	LKTR	710	2820	0.79				GN	10-Jul-07	PLGN-11	Patch Lake		C		
40	LKTR	700	3420	1.00			985120031570667	GN	10-Jul-07	PLGN-11	Patch Lake		R	2006	Previously PIT tagged in 2006
41	CISC	270	210	1.07				GN	10-Jul-07	PLGN-11	Patch Lake		M		Mortality (fish collected for Heidi)
42	CISC	252	170	1.06				GN	10-Jul-07	PLGN-11	Patch Lake		M		Mortality (fish collected for Heidi)
43	CISC	116	13	0.83				GN	11-Jul-07	PLGN-13	Patch Lake		C		adipose clip
44	LKTR	645	2630	0.98			985120031578898	GN	11-Jul-07	PLGN-16	Patch Lake		C		
45	LKTR	555	1800	1.05			985120031580517	GN	11-Jul-07	PLGN-16	Patch Lake		C		
46	LKTR	740	4420	1.09			985120031618957	GN	11-Jul-07	PLGN-16	Patch Lake		C		
47	LKTR	685	3795	1.18			985120031562875	GN	11-Jul-07	PLGN-16	Patch Lake		C		
48	LKWH	430	1000	1.26			985120031625596	GN	11-Jul-07	PLGN-16	Patch Lake		C		
49	LKWH	380	745	1.36				GN	11-Jul-07	PLGN-16	Patch Lake		M		Mortality (fish collected for Heidi)
50	CISC	293	280	1.11				GN	11-Jul-07	PLGN-16	Patch Lake		M		Mortality (fish collected for Heidi)
51	CISC	214	115	1.17				GN	11-Jul-07	PLGN-16	Patch Lake		M		Mortality (fish collected for Heidi)
52	CISC	148	40	1.23				GN	11-Jul-07	PLGN-13	Patch Lake		M		
53	LKTR	686	3390	1.05			985120031452321	GN	11-Jul-07	PLGN-13	Patch Lake		M		Mortality (fish collected for Heidi)
54	LKTR	710	3425	0.96				GN	11-Jul-07	PLGN-13	Patch Lake		M		Mortality (fish collected for Heidi)
55	LKTR	381	485	0.88				GN	11-Jul-07	PLGN-15	Patch Lake		M		Mortality (fish collected for Heidi)
56	LKTR	375	550	1.04				GN	11-Jul-07	PLGN-15	Patch Lake		M		Mortality (fish collected for Heidi)
57	LKTR	660	2590	0.90			985120031625855	GN	11-Jul-07	PLGN-16	Patch Lake		C		
58	LKTR	663	2905	1.00			985120031604652	GN	11-Jul-07	PLGN-16	Patch Lake		C		
59	LKTR	651	2735	0.99			985120031632465	GN	11-Jul-07	PLGN-13	Patch Lake		C		
60	LKTR	730	3700	0.95			985120031586600	GN	11-Jul-07	PLGN-13	Patch Lake		C		
61	LKTR	875	6750	1.01			985120031562670	GN	11-Jul-07	PLGN-13	Patch Lake		C		
62	LKWH	350	745	1.74			985120031565709	GN	11-Jul-07	PLGN-17	Patch Lake		C		
63	LKTR	658	3365	1.18			985120031586613	GN	11-Jul-07	PLGN-17	Patch Lake		C		
64	LKTR	720	3410	0.91			985120031583006	GN	11-Jul-07	PLGN-17	Patch Lake		C		
65	LKTR	538	1780	1.14			985120031625127	GN	11-Jul-07	PLGN-17	Patch Lake		C		
66	LKWH	405	1101	1.66			985120031564212	GN	11-Jul-07	PLGN-17	Patch Lake		C		
67	LKWH	391	960	1.61			985120031564213	GN	11-Jul-07	PLGN-17	Patch Lake		C		
68	LKWH	401	1035	1.61			985120031657142	GN	11-Jul-07	PLGN-17	Patch Lake		C		
69	LKWH	345	575	1.40			985120031620753	GN	11-Jul-07	PLGN-17	Patch Lake		C		
70	LKWH	333	575	1.56			985120031581019	GN	11-Jul-07	PLGN-17	Patch Lake		C		
71	CISC	273	255	1.25				GN	11-Jul-07	PLGN-17	Patch Lake		C		Adipose fin clip
72	LKWH	292	425	1.71				GN	11-Jul-07	PLGN-17	Patch Lake		C		Adipose fin clip
73	CISC	274	260	1.26				GN	11-Jul-07	PLGN-17	Patch Lake		C		Adipose fin clip
224	LKTR	440	1295	1.52				AN	19-Jul-06	KRAN-01	Koignuk River				At Narrows
74	LKWH	332	545	1.49				GN	11-Jul-07	PLGN-17	Patch Lake		C		Adipose fin clip
75	LKWH	329	520	1.46				GN	11-Jul-07	PLGN-17	Patch Lake		C		Adipose fin clip
76	LKWH	371	710	1.39				GN	11-Jul-07	PLGN-17	Patch Lake		C		Adipose fin clip
77	LKWH	345	595	1.45				GN	11-Jul-07	PLGN-17	Patch Lake		C		Adipose fin clip
974	LKWH	346	635	1.53				GN	4-Aug-06	OLGN-01	Ogama Lake				
78	LKWH	401	980	1.52				GN	11-Jul-07	PLGN-17	Patch Lake		C		Adipose fin clip
1354	CISC	231	145	1.18				FN	6-Aug-06	OOFN-03	Ogama Outflow				
79	LKWH	341	620	1.56				GN	11-Jul-07	PLGN-17	Patch Lake		C		Adipose fin clip
80	LKWH	380	830	1.51				GN	11-Jul-07	PLGN-17	Patch Lake		C		
81	CISC	130	20	0.91				GN	11-Jul-07	PLGN-17	Patch Lake		C		
82	LKWH	310	350	1.17				GN	11-Jul-07	PLGN-13	Patch Lake		C		
83	LKTR	700	3542	1.03			985120031633582	GN	11-Jul-07	PLGN-13	Patch Lake		C		
84	LKTR	696	3870	1.15			985120031569891	GN	11-Jul-07	PLGN-16	Patch Lake		C		
601	LKTR							OBS	27-Jul-06	POBS-01	Patch Outflow		O		
85	LKTR	803	5380	1.04			985120031592199	GN	12-Jul-07	PLGN-20	Patch Lake		C		
86	LKTR						985120031520753	AN	12-Jul-07	PLAF-01	Patch Lake		C		LKWH PIT tag # 620753 in stomach of LKTR.
87	CISC	269	175	0.90				GN	12-Jul-07	PLGN-18	Patch Lake		C		
88	LKTR	825					985120031618686	GN	12-Jul-07	PLGN-18	Patch Lake		C		
89	LKTR	578	2000	1.04			985120031617041	GN	12-Jul-07	PLGN-18	Patch Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
90	LKTR	694	2900	0.87			985120031564074	GN	12-Jul-07	PLGN-21	Patch Lake		C		
91	LKTR	638	2620	1.01			985120031578753	GN	12-Jul-07	PLGN-21	Patch Lake		C		
92	LKTR	790	5200	1.05			985120031609695	GN	12-Jul-07	PLGN-21	Patch Lake		C		
93	LKTR	720	4700	1.26			985120031578753	GN	12-Jul-07	PLGN-21	Patch Lake		C		
94	LKTR	277	195	0.92				GN	12-Jul-07	PLGN-21	Patch Lake		M		Sacrificed for Heidi
95	LKTR	569	1740	0.94			985120031445177	GN	12-Jul-07	PLGN-18	Patch Lake		C		
96	LKTR	604	1730	0.79			985120031617450	GN	12-Jul-07	PLGN-18	Patch Lake		C		
97	LKTR	627	2630	1.07			985120031454134	GN	12-Jul-07	PLGN-20	Patch Lake		C		
98	LKTR	550	1450	0.87			985120031566658	GN	12-Jul-07	PLGN-21	Patch Lake		C		
99	LKTR	605	2490	1.12			985120031458344	GN	12-Jul-07	PLGN-21	Patch Lake		C		
1011	LKTR	283	280	1.24				FN	5-Aug-06	OLFN-02	Ogama Outflow				
100	LKTR	690	4120	1.25			985120031626313	GN	13-Jul-07	PLGN-23	Patch Lake		C		
101	LKTR	818	5520	1.01			985120031565169	GN	13-Jul-07	PLGN-23	Patch Lake		C		
102	CISC	212	70	0.73				GN	13-Jul-07	PLGN-23	Patch Lake	OT	M		
103	LKTR	637	2570	0.99			985120031578900	GN	13-Jul-07	PLGN-24	Patch Lake		C		
104	LKTR	795	6150	1.22			985120031615918	GN	13-Jul-07	PLGN-24	Patch Lake		C		
105	LKTR	309	340	1.15			985120031617733	GN	13-Jul-07	PLGN-25	Patch Lake		C		
106	LKTR	720	3265	0.87			985120031586600	GN	13-Jul-07	PLGN-22	Patch Lake		R		
107	LKWH	463	1500	1.51				GN	13-Jul-07	PLGN-22	Patch Lake		C		Adipose fin clip
108	CISC	224	100	0.89				GN	13-Jul-07	PLGN-23	Patch Lake		C		
109	CISC	201	70	0.86				GN	13-Jul-07	PLGN-23	Patch Lake		C		
110	CISC	230	120	0.99				GN	13-Jul-07	PLGN-23	Patch Lake		C		
713	LKWH	434	1365	1.67				GN	30-Jul-06	POLGN-02	P.O. Lake				
111	CISC	195	65	0.88				GN	13-Jul-07	PLGN-23	Patch Lake		C		
112	CISC	159	40	1.00				GN	13-Jul-07	PLGN-23	Patch Lake		C		
113	LKTR	423	775	1.02			985120031562349	AN	14-Jul-07	PLAF-05	Patch Lake		C		
114	LKTR	696	3995	1.18			985120031600800	GN	14-Jul-07	PLGN-26	Patch Lake		C		
115	LKTR	697	3175	0.94			985120031630427	GN	14-Jul-07	PLGN-26	Patch Lake		C		
116	LKTR	688	2995	0.92			985120031586799	GN	14-Jul-07	PLGN-29	Patch Lake		C		
117	LKWH	400	885	1.38				GN	14-Jul-07	PLGN-29	Patch Lake		M		Died in net - kept for Heidi
118	LKTR	765	4720	1.05			985120031623245	GN	14-Jul-07	PLGN-30	Patch Lake		C		
119	LKTR	599	2135	0.99			985120031578383	GN	14-Jul-07	PLGN-27	Patch Lake		C		Really tangled in net
120	LKTR	608	2630	1.17			985120031585242	GN	14-Jul-07	PLGN-29	Patch Lake		C		
121	LKTR	710	4140	1.16			985120031579900	GN	14-Jul-07	PLGN-29	Patch Lake		C		
122	LKTR	699	3950	1.16			985120031563138	GN	14-Jul-07	PLGN-27	Patch Lake		C		
123	LKTR	835	6340	1.09			985120031558587	GN	14-Jul-07	PLGN-27	Patch Lake		C		
124	LKTR	705	4240	1.21			985120031551546	GN	14-Jul-07	PLGN-26	Patch Lake		C		
125	LKTR	778	4290	0.91			985120031632713	GN	14-Jul-07	PLGN-26	Patch Lake		C		
126	LKTR	834	6850	1.18			985120031584754	GN	14-Jul-07	PLGN-26	Patch Lake		C		
127	LKTR	654	2435	0.87			985120031574982	GN	14-Jul-07	PLGN-28	Patch Lake		C		
128	LKTR	676	3235	1.05			985120031608728	GN	14-Jul-07	PLGN-28	Patch Lake		C		
129	LKTR	534	1450	0.95			985120031583455	GN	14-Jul-07	PLGN-28	Patch Lake		C		
130	LKTR	687	3510	1.08			985120031655401	GN	14-Jul-07	PLGN-28	Patch Lake		C		Dark green colouration
131	LKTR	630	2640	1.06			985120031623553	AN	14-Jul-07	PLAF-05	Patch Lake		C		
132	LKTR	701	4645	1.35			985120031618038	AN	14-Jul-07	PLAF-05	Patch Lake		C		
133	LKTR	651	2980	1.08			985120031603546	GN	14-Jul-07	PLGN-28	Patch Lake		C		
134	LKTR	730	5620	1.44			985120031603804	GN	14-Jul-07	PLGN-28	Patch Lake		C		
135	LKTR	860	5720	0.90			985120031628394	GN	14-Jul-07	PLGN-26	Patch Lake		C		
136	LKTR	790	4170	0.85			985120031656643	GN	14-Jul-07	PLGN-26	Patch Lake		C		
137	LKTR	800	5240	1.02	Green	4612	985120031568544	GN	14-Jul-07	PLGN-26	Patch Lake		R	2005	
657-707	NNST	20-25						DN	30-Jul-06	POLDN-01	P.O. Lake				51 fish captured; stranded in puddle
708	CISC	204	95	1.12				GN	30-Jul-06	POLGN-01	P.O. Lake				
709	CISC	209	80	0.88				GN	30-Jul-06	POLGN-01	P.O. Lake				
710	LKTR	596	2050	0.97			985120031625606	GN	30-Jul-06	POLGN-01	P.O. Lake				
711	LKTR	426	765	0.99			985120031626677	GN	30-Jul-06	POLGN-01	P.O. Lake				
712	LKTR	702	3000	0.87			985120031623708	GN	30-Jul-06	POLGN-01	P.O. Lake				
138	LKTR	687	3750	1.16			985120031619419	GN	14-Jul-07	PLGN-29	Patch Lake		C		
714	LKTR	494	1130	0.94			985120031542781	GN	30-Jul-06	POLGN-03	P.O. Lake				
715	LKWH	390						GN	30-Jul-06	POLGN-03	P.O. Lake				
716	LKWH	304	355	1.26				GN	30-Jul-06	POLGN-03	P.O. Lake				Mortality
717	LKWH	300	330	1.22				GN	30-Jul-06	POLGN-03	P.O. Lake				
718	LKTR	304	265	0.94				GN	30-Jul-06	POLGN-04	P.O. Lake	FR, OT			dead in net
719	LKWH	340	530	1.35				GN	30-Jul-06	POLGN-04	P.O. Lake				
720	LKWH	395	820	1.33				GN	30-Jul-06	POLGN-04	P.O. Lake				
721	LKWH	390	780	1.31				GN	30-Jul-06	POLGN-04	P.O. Lake				
722	NNST	31						BS	30-Jul-06	POLBS-01	P.O. Lake				
723	NNST	25						BS	30-Jul-06	POLBS-01	P.O. Lake				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
724	NNST	24						BS	30-Jul-06	POLBS-01	P.O. Lake				
725	NNST	21						BS	30-Jul-06	POLBS-01	P.O. Lake				
726	NNST	33						BS	30-Jul-06	POLBS-01	P.O. Lake				
727	NNST	23						BS	30-Jul-06	POLBS-01	P.O. Lake				
728	NNST	35						BS	30-Jul-06	POOTBS-01	P.O. Outflow				
729	NNST	30						BS	30-Jul-06	POOTBS-01	P.O. Outflow				
730	NNST	75						BS	30-Jul-06	POOTBS-01	P.O. Outflow				
731	NNST	25						BS	30-Jul-06	POOTBS-01	P.O. Outflow				
732	NNST	25						BS	30-Jul-06	POOTBS-01	P.O. Outflow				
733	NNST	24						BS	30-Jul-06	POOTBS-01	P.O. Outflow				
734	LKTR	415	770	1.08				GN	31-Jul-06	POCLGN-01	P.O. Connector Lake	FR			
735	LKTR	710	2985	0.83			985120031603780	GN	31-Jul-06	POCLGN-01	P.O. Connector Lake	FR			
736	LKTR	400						GN	31-Jul-06	POCLGN-01	P.O. Connector Lake				Fish escaped as net was pulled into boat
737	LKTR	349	415	0.98				GN	31-Jul-06	POCLGN-01	P.O. Connector Lake	FR			
738	LKTR	400						GN	31-Jul-06	POCLGN-02	P.O. Connector Lake				Fish escaped as net was pulled into boat
739	LKWH	367	590	1.19				GN	31-Jul-06	POCLGN-02	P.O. Connector Lake	SC			
740	LKWH	321	465	1.41				GN	31-Jul-06	POCLGN-02	P.O. Connector Lake	SC			
741	CISC	215	90	0.91				FN	31-Jul-06	POLFN-01	P.O. Lake				
742	LKTR	630	1970	0.79			985120031586320	FN	31-Jul-06	POLFN-01	P.O. Lake	FR			ageing structure taken
743	LKTR	680	1995	0.63			985120031557326	FN	31-Jul-06	POLFN-01	P.O. Lake	FR			perished, tag recovered later,
744	LKTR	720	2150	0.58			985120031572244	FN	31-Jul-06	POLFN-01	P.O. Lake	FR			ageing structure taken
745	LKTR	690	2230	0.68			985120031581007	FN	31-Jul-06	POLFN-01	P.O. Lake	FR			ageing structure taken
746	LKTR	665	1975	0.67			985120031453157	FN	31-Jul-06	POLFN-01	P.O. Lake	FR			ageing structure taken
747	LKTR	725	2950	0.77			985120031602978	FN	31-Jul-06	POLFN-01	P.O. Lake	FR			ageing structure taken
748	LKTR	645	2970	1.11			985120031587345	FN	31-Jul-06	POLFN-01	P.O. Lake	FR			ageing structure taken
749	LKTR	470	980	0.94			985120031565483	FN	31-Jul-06	POLFN-01	P.O. Lake	FR			ageing structure taken
750	LKTR	605	2000	0.90			985120031453621	FN	31-Jul-06	POLFN-01	P.O. Lake	FR			ageing structure taken
751	NNST	41						MT	31-Jul-06	POLMT-01	P.O. Lake				
752	NNST	51						MT	31-Jul-06	POLMT-01	P.O. Lake				
753	NNST	55						MT	31-Jul-06	POLMT-01	P.O. Lake				
754	NNST	45						MT	31-Jul-06	POLMT-01	P.O. Lake				
755	NNST	59						MT	31-Jul-06	POLMT-01	P.O. Lake				
756	NNST	47						MT	31-Jul-06	POLMT-01	P.O. Lake				
757	NNST	53						MT	31-Jul-06	POLMT-02	P.O. Lake				
758	NNST	57						MT	31-Jul-06	POLMT-02	P.O. Lake				
759	NNST	50						MT	31-Jul-06	POLMT-02	P.O. Lake				
760	NNST	57						MT	31-Jul-06	POLMT-02	P.O. Lake				
761	NNST	53						MT	31-Jul-06	POLMT-02	P.O. Lake				
762	NNST	47						MT	31-Jul-06	POLMT-02	P.O. Lake				
763	NNST	55						MT	31-Jul-06	POLMT-02	P.O. Lake				
764	NNST	45						MT	31-Jul-06	POLMT-02	P.O. Lake				
765	NNST	52						MT	31-Jul-06	POLMT-02	P.O. Lake				
766	NNST	65						MT	31-Jul-06	POLMT-03	P.O. Lake				
767	NNST	65						MT	31-Jul-06	POLMT-03	P.O. Lake				
768	NNST	55						MT	31-Jul-06	POLMT-03	P.O. Lake				
769	NNST	56						MT	31-Jul-06	POLMT-03	P.O. Lake				
770	NNST	56						MT	31-Jul-06	POLMT-03	P.O. Lake				
771	NNST	45						MT	31-Jul-06	POLMT-03	P.O. Lake				
772	LKTR	426	740	0.96			98520031579436	DN	1-Aug-06	POCDN-01	P.O. Connector Lake	FR			FR taken
773	NNST	50						DN	1-Aug-06	POCDN-01	P.O. Connector Lake				Hundreds more NNST observed
774	NNST	35						DN	1-Aug-06	POCDN-01	P.O. Connector Lake				Hundreds more NNST observed
775	NNST	40						DN	1-Aug-06	POCDN-01	P.O. Connector Lake				Hundreds more NNST observed
776	NNST	50						DN	1-Aug-06	POCDN-01	P.O. Connector Lake				Hundreds more NNST observed
777	NNST	56						DN	1-Aug-06	POCDN-01	P.O. Connector Lake				Hundreds more NNST observed
778	LKWH	74						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
779	NNST	64						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
780	NNST	56						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
781	NNST	53						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
782	NNST	62						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
783	NNST	49						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
784	NNST	40						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
785	NNST	45						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
786	NNST	41						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
787	NNST	52						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
788	NNST	50						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
789	NNST	60						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
790	NNST	46						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
791	NNST	49						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
792	NNST	46						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
793	NNST	49						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
794	NNST	52						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
795	NNST	55						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
796	NNST	50						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
797	NNST	44						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
798	NNST	53						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
799	NNST	40						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
800	NNST	46						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
801	NNST	43						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
802	NNST	43						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
803	NNST	46						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
804	NNST	50						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
805	NNST	54						FN	1-Aug-06	POCLFN-01	P.O. Connector Lake				
806	NNST	50						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
807	NNST	49						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
808	NNST	57						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
809	NNST	50						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
810	NNST	48						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
811	NNST	52						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
812	NNST	70						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
813	NNST	61						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
814	NNST	55						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
815	NNST	51						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
816	NNST	60						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
817	NNST	55						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
818	NNST	54						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
819	NNST	50						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
820	NNST	48						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
821	NNST	46						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
822	NNST	50						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
823	NNST	52						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
824	NNST	49						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
825	NNST	60						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
826	NNST	45						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
827	NNST	45						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
828	NNST	50						MT	1-Aug-06	POCMT-01	P.O. Connector Lake				
829	NNST	53						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
830	NNST	52						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
831	NNST	44						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
832	NNST	62						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
833	NNST	53						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
834	NNST	45						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
835	NNST	49						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
836	NNST	57						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
837	NNST	49						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
838	NNST	50						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
839	NNST	48						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
840	NNST	61						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
841	NNST	45						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
842	NNST	51						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
843	NNST	55						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
844	NNST	47						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
845	NNST	55						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
846	NNST	48						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
847	NNST	56						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
848	NNST	55						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
849	NNST	62						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
850	NNST	52						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
851	NNST	55						MT	1-Aug-06	POCMT-02	P.O. Connector Lake				
852	NNST	50						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
853	NNST	50						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
854	NNST	60						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
855	NNST	45						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
856	NNST	52						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
857	NNST	47						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
858	NNST	56						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
859	NNST	69						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
860	NNST	46						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
861	NNST	56						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
862	NNST	55						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
863	NNST	52						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
864	NNST	46						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
865	NNST	48						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
866	NNST	55						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
867	NNST	54						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
868	NNST	53						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
869	NNST	54						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
870	NNST	56						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
871	NNST	51						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
872	NNST	53						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
873	NNST	55						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
874	NNST	60						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
875	NNST	57						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
876	NNST	50						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
877	NNST	48						MT	1-Aug-06	POCMT-03	P.O. Connector Lake				
878	LKTR	655	2360	0.84				AN	2-Aug-06	OLAN-02	Ogama Lake	FR, OT			
879	LKTR	400-500						FN	2-Aug-06	OIFN-01	Ogama Inflow				Fish not length/weighed, captured just u/s of fyke net
880	LKTR	640	2240	0.85			985120031583337	BS	2-Aug-06	POCLBS-02	P.O. Connector Lake	FR			fish caught facing towards SE inflow
881	LKTR	730	3710	0.95			985120031630216	FN	3-Aug-06	OIFN-01	Ogama Inflow	FR			Ageing structure taken, captured just u/s of fyke net
882	LKTR	497	1405	1.14			985120031601416	FN	3-Aug-06	OIFN-01	Ogama Inflow	FR			
883	LKTR	420	660	0.89			985120031571691	FN	3-Aug-06	OIFN-01	Ogama Inflow	SC, FR			
884	LKTR	554	1405	0.83			985120031601655	FN	3-Aug-06	OIFN-01	Ogama Inflow	FR			
885	LKWH	342						FN	3-Aug-06	OIFN-01	Ogama Inflow	SC			
886	NNST	53						FN	3-Aug-06	OIFN-01	Ogama Inflow				
887	NNST	50						MT	3-Aug-06	OIMT-01	Ogama Inflow				
888	NNST	45						MT	3-Aug-06	OIMT-01	Ogama Inflow				
889	NNST	45						MT	3-Aug-06	OIMT-02	Ogama Inflow				
890	NNST	56						MT	3-Aug-06	OIMT-02	Ogama Inflow				
891	NNST	65						MT	3-Aug-06	OIMT-02	Ogama Inflow				
892	NNST	65						MT	3-Aug-06	OIMT-02	Ogama Inflow				
893	NNST	70						MT	3-Aug-06	OIMT-02	Ogama Inflow				
894	NNST	56						MT	3-Aug-06	OIMT-02	Ogama Inflow				
895	NNST	58						MT	3-Aug-06	OIMT-02	Ogama Inflow				
896	NNST	50						MT	3-Aug-06	OIMT-02	Ogama Inflow				
897	NNST	62						MT	3-Aug-06	OIMT-02	Ogama Inflow				
898	NNST	42						MT	3-Aug-06	OIMT-02	Ogama Inflow				
899	NNST	53						MT	3-Aug-06	OIMT-02	Ogama Inflow				
900	NNST	48						MT	3-Aug-06	OIMT-02	Ogama Inflow				
901	NNST	48						MT	3-Aug-06	OIMT-02	Ogama Inflow				
902	NNST	56						MT	3-Aug-06	OIMT-02	Ogama Inflow				
903	NNST	56						MT	3-Aug-06	OIMT-02	Ogama Inflow				
904	NNST	64						MT	3-Aug-06	OIMT-02	Ogama Inflow				
905	NNST	53						MT	3-Aug-06	OIMT-02	Ogama Inflow				
906	NNST	61						MT	3-Aug-06	OIMT-02	Ogama Inflow				
907	NNST	50						MT	3-Aug-06	OIMT-02	Ogama Inflow				
908	NNST	49						MT	3-Aug-06	OIMT-02	Ogama Inflow				
909	NNST	44						MT	3-Aug-06	OIMT-02	Ogama Inflow				
910	NNST	48						MT	3-Aug-06	OIMT-02	Ogama Inflow				
911	NNST	55						MT	3-Aug-06	OIMT-02	Ogama Inflow				
912	NNST	40						MT	3-Aug-06	OIMT-02	Ogama Inflow				
913	NNST	56						MT	3-Aug-06	OIMT-03	Ogama Inflow				
914	NNST	59						MT	3-Aug-06	OIMT-03	Ogama Inflow				
915	NNST	64						MT	3-Aug-06	OIMT-03	Ogama Inflow				
916	NNST	53						MT	3-Aug-06	OIMT-03	Ogama Inflow				
917	NNST	53						MT	3-Aug-06	OIMT-03	Ogama Inflow				
918	NNST	47						MT	3-Aug-06	OIMT-03	Ogama Inflow				
919	NNST	54						MT	3-Aug-06	OIMT-03	Ogama Inflow				
920	NNST	57						MT	3-Aug-06	OIMT-03	Ogama Inflow				
921	NNST	68						MT	3-Aug-06	OIMT-03	Ogama Inflow				
922	NNST	62						MT	3-Aug-06	OIMT-03	Ogama Inflow				
923	LKTR	454	820	0.88				EF	4-Aug-06	OIEF-01	Ogama Inflow				
924	LKTR	610	2430	1.07				EF	4-Aug-06	OIEF-01	Ogama Inflow				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
925	NNST	59						EF	4-Aug-06	OIEF-01	Ogama Inflow				
926	NNST	71						EF	4-Aug-06	OIEF-01	Ogama Inflow				
927	LKWH	46						EF	4-Aug-06	OLEF-01	Ogama Lake		O		observed
928	NNST	70						EF	4-Aug-06	OLEF-01	Ogama Lake				
929	LKTR	547	1380	0.84			985120031570755	FN	4-Aug-06	OIFN-01	Ogama Inflow	FR			
930	LKTR	568	2025	1.11			985120031567456	FN	4-Aug-06	OIFN-01	Ogama Inflow	FR			
931	LKTR	710	3835	1.07			985120031557326	FN	4-Aug-06	OIFN-01	Ogama Inflow	FR		2005	Floy 4520
932	LKTR	518	1320	0.95			985120031573867	FN	4-Aug-06	OIFN-01	Ogama Inflow	FR			
933	LKTR	505	1110	0.86			985120031567710	FN	4-Aug-06	OIFN-01	Ogama Inflow	FR			
934	LKTR	790	4410	0.89			985120031371559	FN	4-Aug-06	OIFN-01	Ogama Inflow	FR			
935	LKTR	650					985120031584826	FN	4-Aug-06	OIFN-01	Ogama Inflow	FR			
936	LKWH	35						FN	4-Aug-06	OIFN-01	Ogama Inflow				
937	LKWH	39						FN	4-Aug-06	OIFN-01	Ogama Inflow				
938	LKWH	50						FN	4-Aug-06	OIFN-01	Ogama Inflow				
939	LKWH	45						FN	4-Aug-06	OIFN-01	Ogama Inflow				
940	NNST	55						FN	4-Aug-06	OIFN-01	Ogama Inflow				
941	NNST	42						FN	4-Aug-06	OIFN-01	Ogama Inflow				
942	CISC	235	140	1.08				GN	4-Aug-06	OLGN-01	Ogama Lake				
943	CISC	224	120	1.07				GN	4-Aug-06	OLGN-01	Ogama Lake				
944	CISC	216	125	1.24				GN	4-Aug-06	OLGN-01	Ogama Lake				
945	CISC	226	125	1.08				GN	4-Aug-06	OLGN-01	Ogama Lake				
946	CISC	222	115	1.05				GN	4-Aug-06	OLGN-01	Ogama Lake				
947	CISC	221	125	1.16				GN	4-Aug-06	OLGN-01	Ogama Lake				
948	CISC	220	125	1.17				GN	4-Aug-06	OLGN-01	Ogama Lake				
949	CISC	255	145	0.87				GN	4-Aug-06	OLGN-01	Ogama Lake				
950	CISC	226	120	1.04				GN	4-Aug-06	OLGN-01	Ogama Lake				
951	CISC	216	120	1.19				GN	4-Aug-06	OLGN-01	Ogama Lake				
952	CISC	213	120	1.24				GN	4-Aug-06	OLGN-01	Ogama Lake				
953	CISC	212	125	1.31				GN	4-Aug-06	OLGN-01	Ogama Lake				
954	CISC	253	195	1.20				GN	4-Aug-06	OLGN-01	Ogama Lake				
955	CISC	203	95	1.14				GN	4-Aug-06	OLGN-01	Ogama Lake				
956	CISC	208	100	1.11				GN	4-Aug-06	OLGN-01	Ogama Lake				
957	CISC	222	125	1.14				GN	4-Aug-06	OLGN-01	Ogama Lake				
958	CISC	228	135	1.14				GN	4-Aug-06	OLGN-01	Ogama Lake				
959	CISC	209	100	1.10				GN	4-Aug-06	OLGN-01	Ogama Lake				
960	CISC	205	105	1.22				GN	4-Aug-06	OLGN-01	Ogama Lake				
961	CISC	216	130	1.29				GN	4-Aug-06	OLGN-01	Ogama Lake				
962	CISC	217	120	1.17				GN	4-Aug-06	OLGN-01	Ogama Lake				
963	LKTR	550	1455	0.87				GN	4-Aug-06	OLGN-01	Ogama Lake				
964	LKTR	665	3150	1.07				GN	4-Aug-06	OLGN-01	Ogama Lake				
965	LKWH	320	345	1.05				GN	4-Aug-06	OLGN-01	Ogama Lake				
966	LKWH	322	385	1.15				GN	4-Aug-06	OLGN-01	Ogama Lake				
967	LKWH	320	425	1.30				GN	4-Aug-06	OLGN-01	Ogama Lake				
968	LKWH	317	415	1.30				GN	4-Aug-06	OLGN-01	Ogama Lake				
969	LKWH	294	315	1.24				GN	4-Aug-06	OLGN-01	Ogama Lake				
970	LKWH	301	245	0.90				GN	4-Aug-06	OLGN-01	Ogama Lake				
971	LKWH	336	470	1.24				GN	4-Aug-06	OLGN-01	Ogama Lake				
972	LKWH	314	385	1.24				GN	4-Aug-06	OLGN-01	Ogama Lake				
973	LKWH	321	465	1.41				GN	4-Aug-06	OLGN-01	Ogama Lake				
139	LKTR	680	3850	1.22			985120031581473	GN	14-Jul-07	PLGN-29	Patch Lake		C		
975	CISC	235	120	0.92				GN	4-Aug-06	OLGN-02	Ogama Lake				
976	CISC	226	120	1.04				GN	4-Aug-06	OLGN-02	Ogama Lake				
977	CISC	206	105	1.20				GN	4-Aug-06	OLGN-02	Ogama Lake				
978	CISC	243	160	1.12				GN	4-Aug-06	OLGN-02	Ogama Lake				
979	NNST	55						MT	4-Aug-06	OLMT-01	Ogama Lake				
980	NNST	60						MT	4-Aug-06	OLMT-02	Ogama Lake				
1013	LKWH	292	400	1.61				FN	5-Aug-06	OLFN-02	Ogama Outflow				
1015	LKWH	306	480	1.68				FN	5-Aug-06	OLFN-02	Ogama Outflow	SC			
983	NNST	83						EF	5-Aug-06	OOEF-01	Ogama Outflow				
984	NNST	24						EF	5-Aug-06	OOEF-01	Ogama Outflow				
985	NNST	24						EF	5-Aug-06	OOEF-01	Ogama Outflow				
986	NNST	42						EF	5-Aug-06	OOEF-01	Ogama Outflow				
987	NNST	23						EF	5-Aug-06	OOEF-01	Ogama Outflow				
988	NNST	31						EF	5-Aug-06	OOEF-01	Ogama Outflow				
989	NNST	32						EF	5-Aug-06	OOEF-01	Ogama Outflow				
990	NNST	29						EF	5-Aug-06	OOEF-01	Ogama Outflow				
991	NNST	35						EF	5-Aug-06	OOEF-01	Ogama Outflow				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
992	NNST	33						EF	5-Aug-06	OOEF-01	Ogama Outflow				
993	NNST	42						EF	5-Aug-06	OOEF-01	Ogama Outflow				
994	NNST	23						EF	5-Aug-06	OOEF-01	Ogama Outflow				
995	NNST	27						EF	5-Aug-06	OOEF-01	Ogama Outflow				
996	NNST	22						EF	5-Aug-06	OOEF-01	Ogama Outflow				
997	NNST	35						EF	5-Aug-06	OOEF-01	Ogama Outflow				
998	NNST	32						EF	5-Aug-06	OOEF-01	Ogama Outflow				
999	NNST	37						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1000	NNST	22						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1001	NNST	28						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1002	NNST	30						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1003	NNST	26						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1004	NNST	35						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1005	NNST	21						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1006	NNST	34						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1007	NNST	40						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1008	NNST	33						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1009	NNST	27						EF	5-Aug-06	OOEF-01	Ogama Outflow				
1355	LKTR	307	280	0.97				FN	6-Aug-06	OOFN-03	Ogama Outflow				
1012	LKWH	308	425	1.45				FN	5-Aug-06	OLFN-02	Ogama Outflow	SC			
1014	LKWH	322	500	1.50				FN	5-Aug-06	OLFN-02	Ogama Outflow				
140	LKTR	542	1745	1.10			985120031584134	GN	14-Jul-07	PLGN-27	Patch Lake		C		
982	LKTR	395	775	1.26				EF	5-Aug-06	OOEF-01	Ogama Outflow				
141	LKTR	487	1235	1.07			985120031569860	FN	15-Jul-07	PLFT-01	Patch Lake		C		Captured fish moving into Patch Lk from PO Lk
1016	NNST	53						FN	5-Aug-06	OLFN-02	Ogama Outflow				
1017	NNST	22						FN	5-Aug-06	OLFN-02	Ogama Outflow				
1018	NNST	60						FN	5-Aug-06	OLFN-02	Ogama Outflow				
1019	NNST	57						MT	5-Aug-06	OLMT-03	Ogama Lake				
1020	NNST	58						MT	5-Aug-06	OLMT-03	Ogama Lake				
1021	NNST	54						MT	5-Aug-06	OLMT-03	Ogama Lake				
1022	NNST	67						MT	5-Aug-06	OLMT-03	Ogama Lake				
1023	NNST	63						MT	5-Aug-06	OLMT-03	Ogama Lake				
1024	NNST	55						MT	5-Aug-06	OLMT-05	Ogama Lake				
1025	NNST	53						MT	5-Aug-06	OLMT-05	Ogama Lake				
1026	NNST	59						MT	5-Aug-06	OLMT-05	Ogama Lake				
1027	NNST	58						MT	5-Aug-06	OLMT-05	Ogama Lake				
1028	NNST	62						MT	5-Aug-06	OLMT-05	Ogama Lake				
1029	NNST	45						MT	5-Aug-06	OLMT-05	Ogama Lake				
1030	NNST	52						MT	5-Aug-06	OLMT-05	Ogama Lake				
1031	NNST	57						MT	5-Aug-06	OLMT-05	Ogama Lake				
1032	NNST	58						MT	5-Aug-06	OLMT-05	Ogama Lake				
1033	NNST	54						MT	5-Aug-06	OLMT-05	Ogama Lake				
1034	NNST	55						MT	5-Aug-06	OLMT-05	Ogama Lake				
1035	NNST	50						MT	5-Aug-06	OLMT-05	Ogama Lake				
1036	NNST	64						MT	5-Aug-06	OLMT-05	Ogama Lake				
1037	NNST	49						MT	5-Aug-06	OLMT-05	Ogama Lake				
1038	NNST	52						MT	5-Aug-06	OLMT-05	Ogama Lake				
1039	NNST	54						MT	5-Aug-06	OLMT-05	Ogama Lake				
1040	NNST	50						MT	5-Aug-06	OLMT-05	Ogama Lake				
1041	NNST	61						MT	5-Aug-06	OLMT-05	Ogama Lake				
1042	NNST	60						MT	5-Aug-06	OLMT-05	Ogama Lake				
1043	NNST	58						MT	5-Aug-06	OLMT-05	Ogama Lake				
1044	NNST	56						MT	5-Aug-06	OLMT-05	Ogama Lake				
1045	NNST	51						MT	5-Aug-06	OLMT-05	Ogama Lake				
1046	NNST	54						MT	5-Aug-06	OLMT-05	Ogama Lake				
1047	NNST	53						MT	5-Aug-06	OLMT-05	Ogama Lake				
1048	NNST	64						MT	5-Aug-06	OLMT-06	Ogama Lake				
1049	NNST	70						MT	5-Aug-06	OLMT-06	Ogama Lake				
1050	NNST	68						MT	5-Aug-06	OLMT-07	Ogama Lake				
1051	NNST	57						MT	5-Aug-06	OLMT-07	Ogama Lake				
1052	NNST	74						MT	5-Aug-06	OLMT-08	Ogama Lake				
1053	LKWH	46						BS	6-Aug-06	OLBS-01	Ogama Lake				
1054-1328	CISC	35-60						BS	6-Aug-06	OLBS-02	Ogama Lake				274 CISC Captured
1329-1353	LKWH	35-55						BS	6-Aug-06	OLBS-02	Ogama Lake				25 LKWH Captured
981	LKTR	403	780	1.19				EF	5-Aug-06	OOEF-01	Ogama Outflow				
1356	LKTR	441	860	1.00				FN	6-Aug-06	OOFN-03	Ogama Outflow				
1357	LKTR	485	1135	0.99				FN	6-Aug-06	OOFN-03	Ogama Outflow				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
1010	LKTR	539	1400	0.89				FN	5-Aug-06	OLFN-02	Ogama Outflow				
1358	NNST	42						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1359	NNST	42						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1360	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1361	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1362	NNST	70						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1363	NNST	42						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1364	NNST	52						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1365	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1366	NNST	52						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1367	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1368	NNST	63						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1369	NNST	42						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1370	NNST	39						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1371	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1372	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1373	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1374	NNST	43						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1375	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1376	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1377	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1378	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1379	NNST	37						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1380	NNST	42						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1381	NNST	60						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1382	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1383	NNST	50						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1384	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1385	NNST	50						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1386	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1387	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1388	NNST	65						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1389	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1390	NNST	48						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1391	NNST	47						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1392	NNST	51						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1393	NNST	43						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1394	NNST	37						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1395	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1396	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1397	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1398	NNST	53						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1399	NNST	42						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1400	NNST	43						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1401	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1402	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1403	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1404	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1405	NNST	43						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1406	NNST	57						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1407	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1408	NNST	69						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1409	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1410	NNST	43						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1411	NNST	39						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1412	NNST	39						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1413	NNST	41						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1414	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1415	NNST	48						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1416	NNST	48						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1417	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1418	NNST	43						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1419	NNST	37						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1420	NNST	70						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1421	NNST	50						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1422	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1423	NNST	60						FN	6-Aug-06	OOFN-03	Ogama Outflow				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
1424	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1425	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1426	NNST	60						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1427	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1428	NNST	55						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1429	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1430	NNST	52						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1431	NNST	52						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1432	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1433	NNST	50						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1434	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1435	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1436	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1437	NNST	42						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1438	NNST	68						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1439	NNST	42						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1440	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1441	NNST	52						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1442	NNST	44						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1443	NNST	46						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1444	NNST	44						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1445	NNST	32						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1446	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1447	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1448	NNST	39						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1449	NNST	38						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1450	NNST	32						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1451	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1452	NNST	61						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1453	NNST	61						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1454	NNST	42						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1455	NNST	41						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1456	NNST	52						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1457	NNST	53						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1458	NNST	57						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1459	NNST	58						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1460	NNST	36						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1461	NNST	36						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1462	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1463	NNST	48						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1464	NNST	35						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1465	NNST	41						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1466	NNST	39						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1467	NNST	39						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1468	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1469	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1470	NNST	46						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1471	NNST	45						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1472	NNST	65						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1473	NNST	52						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1474	NNST	33						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1475	NNST	40						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1476	NNST	41						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1477	NNST	65						FN	6-Aug-06	OOFN-03	Ogama Outflow				
1478-1537	NNST	35-70						FN	6-Aug-06	OOFN-03	Ogama Outflow				60 NNST Captured
1538	NNST	57						MT	6-Aug-06	OLMT-09	Ogama Lake				
1539	NNST	55						MT	6-Aug-06	OLMT-09	Ogama Lake				
1540	NNST	50						MT	6-Aug-06	OLMT-10	Ogama Lake				
1541	NNST	55						MT	6-Aug-06	OLMT-10	Ogama Lake				
1542	NNST	63						MT	6-Aug-06	OLMT-14	Ogama Lake				
1543	NNST	57						MT	6-Aug-06	OLMT-14	Ogama Lake				
1544	NNST	48						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1545	NNST	56						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1546	NNST	49						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1547	NNST	70						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1548	NNST	61						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1549	NNST	55						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
1550	NNST	46						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1551	NNST	56						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1552	NNST	30						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1553	NNST	49						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1554	NNST	45						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1555	NNST	37						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1556	NNST	20						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1557	NNST	51						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1558	NNST	78						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1559	NNST	52						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1560	NNST	53						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1561	NNST	57						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1562	NNST	49						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1563	NNST	68						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1564	NNST	45						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1565	NNST	52						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1566	NNST	42						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1567	NNST	54						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1568	NNST	50						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1569	NNST	57						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1570	NNST	61						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1571	NNST	53						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1572	NNST	56						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1573	NNST	51						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1574	NNST	61						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1575	NNST	59						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1576	NNST	54						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1577	NNST	59						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1578	NNST	49						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1579	NNST	38						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1580	NNST	54						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1581	NNST	53						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1582	NNST	58						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1583	NNST	55						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1584	NNST	47						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1585	NNST	56						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1586	NNST	56						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1587	NNST	49						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1588	NNST	45						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1589	NNST	35						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1590	NNST	39						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1591	NNST	28						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1592	NNST	42						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1593	NNST	39						EF	6-Aug-06	POILEF-01	P.O. Inflow Lake				
1594	CISC	50						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1595	CISC	47						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1596	CISC	45						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1597	CISC	49						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1598	CISC	53						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1599	CISC	48						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1600	CISC	38						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1601	CISC	35						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1602	CISC	45						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1603	CISC	48						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1604	CISC	49						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1605	CISC	42						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				Kept for samples
1606	NNST	50						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1607	NNST	58						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1608	NNST	43						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1609	NNST	44						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1610	NNST	46						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1611	NNST	45						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1612	NNST	45						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1613	NNST	49						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1614	NNST	49						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1615	NNST	49						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1616	NNST	45						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
1617	NNST	44						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1618	NNST	43						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1619	NNST	53						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1620	NNST	50						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1621	NNST	58						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1622	NNST	34						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1623	NNST	42						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1624	NNST	38						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1625	NNST	46						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1626	NNST	39						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1627	NNST	51						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1628	NNST	57						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1629	NNST	59						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1630	NNST	59						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1631	NNST	56						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1632	NNST	37						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1633	NNST	62						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1634	NNST	49						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1635	NNST	40						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1636	NNST	44						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1637	NNST	46						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1638	NNST	55						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1639	NNST	57						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1640	NNST	41						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1641	NNST	46						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1642	NNST	50						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1643	NNST	50						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1644	NNST	59						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1645	NNST	51						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1646	NNST	57						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1647	NNST	53						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1648	NNST	46						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1649	NNST	45						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1650	NNST	38						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1651	NNST	47						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1652	NNST	47						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1653	NNST	45						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1654	NNST	37						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1655	NNST	42						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1656	NNST	48						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1657	NNST	49						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1658	NNST	38						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1659	NNST	44						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1660	NNST	30						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1661	NNST	45						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1662	NNST	39						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1663	NNST	51						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1664	NNST	43						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1665	NNST	40						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1666	NNST	57						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1667	NNST	45						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1668	NNST	39						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1669	NNST	46						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1670	NNST	54						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1671	NNST	42						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1672	NNST	46						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1673	NNST	50						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1674	NNST	38						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1675	NNST	53						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1676	NNST	36						EF	6-Aug-06	POILEF-02	P.O. Inflow Lake				
1677	CISC	66						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1678	CISC	65						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1679	CISC	79						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1680	CISC	69						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1681	CISC	52						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1682	CISC	66						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1683	CISC	52						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)

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Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
1684	CISC	55						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1685	CISC	65						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1686-1876	CISC							BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				190 CISC Captured;see photos of seine haul
1877	NNST	66						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1878	NNST	45						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1879	NNST	45						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1880	NNST	49						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1881	NNST	55						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1882	NNST	50						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1883	NNST	55						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1884	NNST	43						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1885	NNST	52						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1886	NNST	47						BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				Representative size range (~500 fish)
1887-2176	NNST							BS	6-Aug-06	POINLBS-01	P.O. Inflow Lake				290 NNST Captured;see photos of seine haul
2177	NNST	50						MT	7-Aug-06	POINMT-01	P.O. Inflow Lake				
2178	NNST	50						MT	7-Aug-06	POINMT-01	P.O. Inflow Lake				
2179	NNST	45						MT	7-Aug-06	POINMT-01	P.O. Inflow Lake				
2180	NNST	49						MT	7-Aug-06	POINMT-01	P.O. Inflow Lake				
2181	NNST	50						MT	7-Aug-06	POINMT-01	P.O. Inflow Lake				
2182	NNST	48						MT	7-Aug-06	POINMT-01	P.O. Inflow Lake				
2183	NNST	45						MT	7-Aug-06	POINMT-01	P.O. Inflow Lake				
2184	NNST	61						MT	7-Aug-06	POINMT-02	P.O. Inflow Lake				
2185	NNST	57						MT	7-Aug-06	POINMT-02	P.O. Inflow Lake				
2186	NNST	55						MT	7-Aug-06	POINMT-02	P.O. Inflow Lake				
2187	NNST	45						MT	7-Aug-06	POINMT-02	P.O. Inflow Lake				
2188	NNST	49						MT	7-Aug-06	POINMT-02	P.O. Inflow Lake				
2189	NNST	50						MT	7-Aug-06	POINMT-02	P.O. Inflow Lake				
2190	NNST	49						MT	7-Aug-06	POINMT-03	P.O. Inflow Lake				
2191	NNST	56						MT	7-Aug-06	POINMT-03	P.O. Inflow Lake				
2192	NNST	55						MT	7-Aug-06	POINMT-05	P.O. Inflow Lake				
2193	NNST	50						MT	7-Aug-06	POINMT-05	P.O. Inflow Lake				
2194	NNST	45						MT	7-Aug-06	POINMT-05	P.O. Inflow Lake				
2195	NNST	40						MT	7-Aug-06	POINMT-05	P.O. Inflow Lake				
2196	NNST	45						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2197	NNST	45						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2198	NNST	47						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2199	NNST	55						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2200	NNST	50						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2201	NNST	52						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2202	NNST	60						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2203	NNST	55						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2204	NNST	47						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2205	NNST	42						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2206	NNST	50						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2207	NNST	49						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2208	NNST	56						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2209	NNST	50						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2210	NNST	50						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2211	NNST	45						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2212	NNST	46						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2213	NNST	50						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2214	NNST	49						MT	7-Aug-06	POINMT-06	P.O. Inflow Lake				
2215	LSCS	85						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2216	LSCS	70						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2217	LSCS	60						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2218	LSCS	50						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2219	LSCS	45						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2220	LSCS	49						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2221	LSCS	48						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2222	LSCS	63						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2223	LSCS	63						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2224	LSCS	65						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2225	LSCS	70						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2226	LSCS	57						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2227	LSCS	45						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2228	LSCS	49						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2229	LSCS	46						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
2230	LSCS	51						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2231	LSCS	49						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2232	LSCS	47						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2233	LSCS	48						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2234	LSCS	47						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2235	LSCS	50						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2236	LSCS	48						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2237	LSCS	51						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2238	LSCS	52						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2239	LSCS	46						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2240	LSCS	47						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2241	LSCS	47						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2242	LSCS	45						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
2243-6316	LSCS	45-70						BS	7-Aug-06	WLBS-01	Wolverine Lake				3875 NNST 4.5 Kg of juvenille fish see photos of numbers
4115	NNST	54						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4116	NNST	56						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4117	NNST	60						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4118	NNST	65						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4119	NNST	58						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4120	NNST	40						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4121	NNST	36						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4122	NNST	42						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4123	NNST	43						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4124	NNST	48						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4125	NNST	40						BS	7-Aug-06	WLBS-01	Wolverine Lake				4.5 Kg of juvenille fish see photos of numbers
4126-4216	NNST	40-65						BS	7-Aug-06	WLBS-01	Wolverine Lake				91 NNST out of 4.5 Kg catured were assessed for length range
4217	NNST	45						BS	7-Aug-06	WLBS-02	Wolverine Lake				
4218	NNST	49						BS	7-Aug-06	WLBS-02	Wolverine Lake				
4219	NNST	50						BS	7-Aug-06	WLBS-02	Wolverine Lake				
4220	NNST	55						BS	7-Aug-06	WLBS-02	Wolverine Lake				
4221	NNST	45						BS	7-Aug-06	WLBS-03	Wolverine Lake				
4222	NNST	46						BS	7-Aug-06	WLBS-03	Wolverine Lake				
4223	NNST	47						BS	7-Aug-06	WLBS-03	Wolverine Lake				
4224	NNST	48						BS	7-Aug-06	WLBS-03	Wolverine Lake				
4225	NNST	50						BS	7-Aug-06	WLBS-03	Wolverine Lake				
4226	NNST	45						BS	7-Aug-06	WLBS-03	Wolverine Lake				
4227	NNST	40						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4228	NNST	60						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4229	NNST	55						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4230	NNST	56						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4231	NNST	39						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4232	NNST	45						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4233	NNST	50						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4234	NNST	49						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4235	NNST	53						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4236	NNST	55						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4237	NNST	50						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4238	NNST	45						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4239	NNST	46						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4240	NNST	39						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4241	NNST	40						BS	7-Aug-06	WLBS-04	Wolverine Lake				
4242	NNST	65						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4243	NNST	50						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4244	NNST	37						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4245	NNST	41						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4246	NNST	43						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4247	NNST	50						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4248	NNST	45						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4249	NNST	10						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4250	NNST	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4251	NNST	30						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4252	NNST	35						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4253	NNST	50						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4254	NNST	50						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4255	NNST	28						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4256	NNST	50						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4257	NNST	30						BS	7-Aug-06	WLBS-05	Wolverine Lake				

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Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
4258	NNST	41						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4259	NNST	48						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4260	NNST	52						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4261	NNST	25						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4262	NNST	25						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4263	NNST	35						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4264	NNST	30						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4265	NNST	39						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4266	NNST	45						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4267	NNST	50						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4268	NNST	45						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4269	NNST	35						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4270	NNST	45						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4271	NNST	35						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4272	NNST	25						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4273	NNST	25						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4274	NNST	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4275	NNST	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4276	NNST	20						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4277	NNST	50						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4278	NNST	32						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4279	LSCS	38						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4280	LSCS	42						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4281	LSCS	43						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4282	LSCS	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4283	LSCS	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4284	LSCS	36						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4285	LSCS	41						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4286	LSCS	39						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4287	LSCS	39						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4288	LSCS	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4289	LSCS	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4290	LSCS	45						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4291	LSCS	43						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4292	LSCS	39						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4293	LSCS	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4294	LSCS	38						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4295	LSCS	41						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4296	LSCS	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4297	LSCS	37						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4298	LSCS	45						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4299	LSCS	45						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4300	LSCS	45						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4301	LSCS	38						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4302	LSCS	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4303	LSCS	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4304	LSCS	37						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4305	LSCS	35						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4306	LSCS	38						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4307	LSCS	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4308	LSCS	39						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4309	LSCS	38						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4310	LSCS	38						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4311	LSCS	38						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4312	LSCS	40						BS	7-Aug-06	WLBS-05	Wolverine Lake				
4313	LSCS	35						BS	7-Aug-06	WLBS-05	Wolverine Lake				
6317	NNST	50						BS	7-Aug-06	WLBS-07	Wolverine Lake				
6318	NNST	49						BS	7-Aug-06	WLBS-07	Wolverine Lake				
6319	NNST	45						BS	7-Aug-06	WLBS-07	Wolverine Lake				
6320	NNST	50						BS	7-Aug-06	WLBS-07	Wolverine Lake				
6321	NNST	36						BS	7-Aug-06	WLBS-07	Wolverine Lake				
6322	LSCS	55						MT	7-Aug-06	WLMT-12	Wolverine Lake				
6323-6355	NNST	30-60						MT	7-Aug-06	WLMT-10	Wolverine Lake				33 NNST Captured
6356	LSCS	60						MT	7-Aug-06	WLMT-12	Wolverine Lake				
6357	LSCS	63						MT	7-Aug-06	WLMT-12	Wolverine Lake				
6358	NNST	50						MT	7-Aug-06	WLMT-12	Wolverine Lake				
6359	NNST	56						MT	7-Aug-06	WLMT-12	Wolverine Lake				

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Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
6360	NNST	40						MT	7-Aug-06	WLMT-12	Wolverine Lake				
6361	NNST	46						MT	7-Aug-06	WLMT-12	Wolverine Lake				
6362	NNST	47						MT	7-Aug-06	WLMT-12	Wolverine Lake				
6363	NNST	55						MT	7-Aug-06	WLMT-12	Wolverine Lake				
6364	NNST	57						MT	7-Aug-06	WLMT-12	Wolverine Lake				
6365	NNST	60						MT	7-Aug-06	WLMT-12	Wolverine Lake				
6366	NNST	39						MT	7-Aug-06	WLMT-12	Wolverine Lake				
264	ARGR	390						AN	20-Jul-06	KRAN-02	Koignuk River				At Narrows
2	NNST	31						EF	8-Jul-07	KNBP-01	Koignuk River		C		
1	ARGR	397	603	0.96				EF	8-Jul-07	KNBP-01	Koignuk River		C		
4	NNST	39						EF	8-Jul-07	KNBP-01	Koignuk River		C		
5	FRSC	16						DN	8-Jul-07	KNDN-01	Koignuk River		C		Dip netted in small stranded pool ~ 30 more in pool
142	LKTR	570	1775	0.96			985120031585388	FN	15-Jul-07	PLFT-01	Patch Lake		C		Captured fish moving into Patch Lk from PO Lk
7	ARFL	76	6	1.37				EF	8-Jul-07	KNBP-02	Koignuk River		C		
8	LKWH	78	4	0.84				EF	8-Jul-07	KNBP-02	Koignuk River		C		
9	ARFL	93	8	0.99				EF	8-Jul-07	KNBP-02	Koignuk River		C		
10	NNST	52	1	0.71				EF	8-Jul-07	KNBP-02	Koignuk River		C		
11	FRSC	83	5	0.87				EF	8-Jul-07	KNBP-02	Koignuk River		C		
12	NNST	44						EF	8-Jul-07	KNBP-02	Koignuk River		C		
13	NNST	43						EF	8-Jul-07	KNBP-02	Koignuk River		C		
14	ARCH	605	2538	1.15				GN	8-Jul-07	KNGN-02	Koignuk River		C		
15	ARFL							EF	8-Jul-07	KNBP-02	Koignuk River		O		
16	ARFL							EF	8-Jul-07	KNBP-02	Koignuk River		O		
17	ARFL							EF	8-Jul-07	KNBP-02	Koignuk River		O		
18	NNST							EF	8-Jul-07	KNBP-02	Koignuk River		O		
19	NNST							EF	8-Jul-07	KNBP-02	Koignuk River		O		
20	NNST							EF	8-Jul-07	KNBP-02	Koignuk River		O		
21	NNST							EF	8-Jul-07	KNBP-02	Koignuk River		O		
22	NNST							EF	8-Jul-07	KNBP-02	Koignuk River		O		
23	NNST							EF	8-Jul-07	KNBP-02	Koignuk River		O		
24	NNST							EF	8-Jul-07	KNBP-02	Koignuk River		O		
25	NNST							EF	8-Jul-07	KNBP-02	Koignuk River		O		
26	NNST							EF	8-Jul-07	KNBP-02	Koignuk River		O		
27	NNST							EF	8-Jul-07	KNBP-02	Koignuk River		O		
28	LKWH							EF	8-Jul-07	KNBP-02	Koignuk River		O		
29	LKWH							EF	8-Jul-07	KNBP-02	Koignuk River		O		
30	LKWH							EF	8-Jul-07	KNBP-02	Koignuk River		O		
31	LKWH							EF	8-Jul-07	KNBP-02	Koignuk River		O		
32	LKWH							EF	8-Jul-07	KNBP-02	Koignuk River		O		
143	LKTR	779	3035	0.64			985120031585098	FN	15-Jul-07	PLFT-01	Patch Lake		C		Captured fish moving into Patch Lk from PO Lk
144	LKTR	835	3680	0.63			985120031560189	FN	15-Jul-07	PLFT-01	Patch Lake		C		Captured fish moving into Patch Lk from PO Lk
145	LKTR	615	2150	0.92			985120031605135	FN	15-Jul-07	PLFT-01	Patch Lake		C		Captured fish moving into Patch Lk from PO Lk
146	LKTR	629	2550	1.02			985120031585878	FN	15-Jul-07	PLFT-01	Patch Lake		C		Captured fish moving into Patch Lk from PO Lk
147	LKTR	705	3330	0.95			985120031601433	FN	15-Jul-07	PLFT-01	Patch Lake		C		Captured fish moving into Patch Lk from PO Lk
148	LKTR	364	545	1.13			985120031658790	GN	15-Jul-07	PLGN-31	Patch Lake		C		
149	LKTR	522	1405	0.99			985120031655044	GN	15-Jul-07	PLGN-34	Patch Lake		C		
150	LKWH	498	1595	1.29				GN	15-Jul-07	PLGN-35	Patch Lake		C		Adipose fin clip
151	LKWH	447	1560	1.75				GN	15-Jul-07	PLGN-35	Patch Lake		C		Adipose fin clip
152	LKWH	437	1175	1.41				GN	15-Jul-07	PLGN-35	Patch Lake		C		Adipose fin clip
153	LKWH	409	825	1.21				GN	15-Jul-07	PLGN-35	Patch Lake		C		Adipose fin clip
154	LKWH	439	1095	1.29				GN	15-Jul-07	PLGN-35	Patch Lake		C		Adipose fin clip
155	LKTR	417					985120031613080	AN	15-Jul-07	PLAF-06	Patch Lake		C		
156	LKTR	656	2805	0.99			985120031625986	GN	15-Jul-07	PLGN-31	Patch Lake		C		
157	LKTR	630	2620	1.05				GN	15-Jul-07	PLGN-31	Patch Lake		M		Mortality-sample kept for Heidi
158	LKTR	795	4375	0.87			985120031657003	GN	15-Jul-07	PLGN-33	Patch Lake		C		
159	LKTR	635	2740	1.07			985120031592937	GN	15-Jul-07	PLGN-34	Patch Lake		C		
160	LKTR	705	3525	1.01			985120031626621	GN	15-Jul-07	PLGN-34	Patch Lake		C		
161	LKTR	635	3480	1.36			985120031613311	GN	15-Jul-07	PLGN-34	Patch Lake		C		
162	LKTR	760	5600	1.28			985120031624571	GN	15-Jul-07	PLGN-34	Patch Lake		C		
163	LKTR	793	5820	1.17			985120031597775	GN	15-Jul-07	PLGN-34	Patch Lake		C		
164	LKTR	635	2655	1.04			985120031564182	GN	15-Jul-07	PLGN-35	Patch Lake		C		
165	LKWH	411	1060	1.53				GN	15-Jul-07	PLGN-35	Patch Lake		C		
166	LKTR	668	2695	0.90			985120031554695	GN	15-Jul-07	PLGN-35	Patch Lake		C		Fish appeared skinny
167	LKTR	765	4001	0.89			985120031630249	GN	15-Jul-07	PLGN-35	Patch Lake		C		Fish appeared skinny
168	LKTR	865	5930	0.92			985120031565169	GN	15-Jul-07	PLGN-35	Patch Lake		R		
169	LKTR	660	3160	1.10			985120031564522	GN	15-Jul-07	PLGN-35	Patch Lake		C		
170	LKTR	655	2870	1.02			985120031587749	GN	15-Jul-07	PLGN-35	Patch Lake		C		

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Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
171	LKWH	393	1010	1.66				GN	15-Jul-07	PLGN-35	Patch Lake		M		Mortality-sample kept for Heidi
172	CISC	85						FN	16-Jul-07	PLFT-01	Patch Lake		C		Captured fish moving into Patch Lk from PO Lk
173	LKTR	567	1770	0.97			985120031633047	GN	16-Jul-07	PLGN-36	Patch Lake		C		
174	LKTR	800	5445	1.06			985120031592199	GN	16-Jul-07	PLGN-36	Patch Lake		R		
175	LKWH	424	890	1.17				GN	16-Jul-07	PLGN-36	Patch Lake		C		Adipose fin clip
176	LKTR	720	3825	1.02			985120031586170	GN	16-Jul-07	PLGN-36	Patch Lake		C		
177	LKTR	690	3025	0.92			985120031578749	GN	16-Jul-07	PLGN-39	Patch Lake		C		
178	LKWH	429	1165	1.48				GN	16-Jul-07	PLGN-39	Patch Lake		C		
179	LKWH	404	975	1.48				GN	16-Jul-07	PLGN-39	Patch Lake		C		
180	LKTR	645	3135	1.17			985120031581270	GN	16-Jul-07	PLGN-39	Patch Lake		C		
181	LKTR	665	2920	0.99			985120031580790	GN	16-Jul-07	PLGN-39	Patch Lake		C		
182	LKTR	715	3465	0.95			985120031628609	GN	16-Jul-07	PLGN-39	Patch Lake		M		Mortality
183	CISC	280	245	1.12				GN	16-Jul-07	PLGN-39	Patch Lake		M		Mortality
184	CISC	225	135	1.19				GN	16-Jul-07	PLGN-39	Patch Lake		M		Mortality
185	LKWH	384	810	1.43				GN	16-Jul-07	PLGN-39	Patch Lake		C		
186	LKTR	522	1245	0.88			985120031599265	GN	16-Jul-07	PLGN-40	Patch Lake		C		
187	LKTR	702	3056	0.88			985120031585842	AN	16-Jul-07	PLAF-07	Patch Lake		C		
188	LKTR	718	3785	1.02			985120031616920	AN	16-Jul-07	PLAF-07	Patch Lake		C		
189	LKTR	700	3170	0.92			985120031583952	GN	16-Jul-07	PLGN-38	Patch Lake		C		
190	LKTR	609	2550	1.13			985120031576802	GN	16-Jul-07	PLGN-38	Patch Lake		C		
191	LKTR	652	2855	1.03			985120031607811	GN	16-Jul-07	PLGN-38	Patch Lake		C		
192	LKWH	445	1240	1.41				GN	16-Jul-07	PLGN-38	Patch Lake		C		
193	CISC	276	265	1.26				GN	16-Jul-07	PLGN-38	Patch Lake		C		
194	LKTR	629	3040	1.22			985120031630523	GN	16-Jul-07	PLGN-39	Patch Lake		C		
195	LKWH	435	1165	1.42				GN	16-Jul-07	PLGN-39	Patch Lake		C		Adipose fin clip
196	LKTR	792	4750	0.96			985120031623245	GN	16-Jul-07	PLGN-39	Patch Lake		R		
197	LKTR	673	3135	1.03			985120031576331	GN	16-Jul-07	PLGN-39	Patch Lake		C		
198	LKTR	611	2260	0.99			985120031633633	GN	16-Jul-07	PLGN-39	Patch Lake		C		
199	LKTR	934	8660	1.06			985120031608372	GN	16-Jul-07	PLGN-39	Patch Lake		C		
200	LKWH	414	970	1.37				GN	16-Jul-07	PLGN-39	Patch Lake		M		Mortality
201	LKWH	428	1140	1.45				GN	16-Jul-07	PLGN-39	Patch Lake		C		Adipose fin clip
202	CISC	219	135	1.29				GN	16-Jul-07	PLGN-37	Patch Lake		C		Adipose fin clip
203	CISC	238	180	1.34				GN	16-Jul-07	PLGN-37	Patch Lake		C		Adipose fin clip
204	CISC	279	315	1.45				GN	16-Jul-07	PLGN-37	Patch Lake		M		Mortality
205	CISC	270						GN	16-Jul-07	PLGN-36	Patch Lake		M		Mortality
206	CISC	239	165	1.21				GN	16-Jul-07	PLGN-36	Patch Lake		C		
207	CISC	218						GN	16-Jul-07	PLGN-36	Patch Lake		C		Adipose fin clip
208	CISC	231	175	1.42				GN	16-Jul-07	PLGN-36	Patch Lake		M		Mortality
209	CISC	254	245	1.50				GN	16-Jul-07	PLGN-36	Patch Lake		M		Mortality
210	CISC	266	265	1.41				GN	16-Jul-07	PLGN-36	Patch Lake		M		Mortality
211	LKTR	654	3075	1.10			985120031631274	GN	16-Jul-07	PLGN-36	Patch Lake		C		
212	LKTR	524	1685	1.17			985120031563900	GN	16-Jul-07	PLGN-36	Patch Lake		C		
213	LKTR	620	2475	1.04			985120031594206	GN	16-Jul-07	PLGN-36	Patch Lake		C		
214	LKTR	434	850	1.04			985120031562349	GN	16-Jul-07	PLGN-36	Patch Lake		R		
215	LKTR	659	2670	0.93			985120031620921	GN	16-Jul-07	PLGN-36	Patch Lake		C		
216	LKTR	682	2740	0.86			985120031565361	GN	16-Jul-07	PLGN-36	Patch Lake		R		
217	CISC	276	240	1.14				GN	16-Jul-07	PLGN-36	Patch Lake		M		Mortality
218	CISC	280	265	1.21				GN	16-Jul-07	PLGN-36	Patch Lake		M		Mortality
219	CISC	242						GN	16-Jul-07	PLGN-36	Patch Lake		M		Mortality
220	CISC	178						GN	16-Jul-07	PLGN-40	Patch Lake		M		Mortality
221	LKWH	320	375	1.14				FN	17-Jul-07	PLFT-01	Patch Lake		C		Adipose fin clip
222	LKWH	321	395	1.19				FN	17-Jul-07	PLFT-01	Patch Lake		C		Adipose fin clip
223	LKWH	324	390	1.15				FN	17-Jul-07	PLFT-01	Patch Lake		C		Adipose fin clip
224	LKTR	667	2675	0.90	Orange	909	985120031566730	FN	17-Jul-07	PLFT-01	Patch Lake		R		
225	LKTR	605	1865	0.84			985120031614982	FN	17-Jul-07	PLFT-01	Patch Lake		C		
226	LKTR	568	1670	0.91			985120031633242	FN	17-Jul-07	PLFT-01	Patch Lake		C		
227	LKTR	780	4970	1.05			985120031573454	FN	17-Jul-07	PLFT-01	Patch Lake		C		
228	LKWH	341	510	1.29				FN	17-Jul-07	PLFT-01	Patch Lake		C		Adipose fin clip
229	LKWH	356	550	1.22				FN	17-Jul-07	PLFT-01	Patch Lake		C		Adipose fin clip
230	LKWH	369	660	1.31				FN	17-Jul-07	PLFT-01	Patch Lake		C		Adipose fin clip
231	LKWH	328	410	1.16				FN	17-Jul-07	PLFT-01	Patch Lake		C		Adipose fin clip
232	LKTR	710	3120	0.87			985120031575894	FN	17-Jul-07	PLFT-01	Patch Lake		C		
233	LKTR	685	2590	0.81			985120031566490	FN	17-Jul-07	PLFT-01	Patch Lake		C		
234	LKTR	675	2580	0.84			985120031633133	FN	17-Jul-07	PLFT-01	Patch Lake		C		
235	LKTR	720	3575	0.96			985120031566628	FN	17-Jul-07	PLFT-01	Patch Lake		C		
236	LKTR	725	4430	1.16			985120031620053	GN	17-Jul-07	PLGN-43	Patch Lake		C		
237	LKTR	585	2175	1.09			985120031602402	GN	17-Jul-07	PLGN-43	Patch Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
238	LKTR	879	8695	1.28			985120031623262	GN	17-Jul-07	PLGN-42	Patch Lake		C		
239	LKTR	689	3530	1.08			985120031600310	GN	17-Jul-07	PLGN-42	Patch Lake		C		
240	LKTR	425					985120031613659	GN	17-Jul-07	PLGN-42	Patch Lake		C		
241	LKTR	710	3515	0.98		140	985120031628526	GN	17-Jul-07	PLGN-42	Patch Lake		R		
242	CISC	280	260	1.18				GN	17-Jul-07	PLGN-42	Patch Lake		M		
243	CISC	269	235	1.21				GN	17-Jul-07	PLGN-42	Patch Lake		M		
244	CISC	268	245	1.27				GN	17-Jul-07	PLGN-42	Patch Lake		M		
245	LKWH	425	960	1.25				GN	17-Jul-07	PLGN-42	Patch Lake		C		Adipose fin clip
246	LKTR	703	3220	0.93			985120031579683	GN	17-Jul-07	PLGN-42	Patch Lake		C		
247	LKTR	714	3460	0.95			985120031620823	GN	17-Jul-07	PLGN-42	Patch Lake		C		
248	LKTR	675	3565	1.16			985120031627292	GN	17-Jul-07	PLGN-42	Patch Lake		C		
249	LKTR	618	2295	0.97			985120031622167	GN	17-Jul-07	PLGN-42	Patch Lake		C		
250	LKTR	672	2940	0.97			985120031577557	GN	17-Jul-07	PLGN-42	Patch Lake		C		
251	LKTR	763	4195	0.94			985120031585176	GN	17-Jul-07	PLGN-42	Patch Lake		C		
252	LKTR	835	7085	1.22			985120031629252	GN	17-Jul-07	PLGN-44	Patch Lake		C		
253	LKTR	520	1375	0.98			985120031657610	GN	17-Jul-07	PLGN-44	Patch Lake		C		
254	LKWH	435						GN	17-Jul-07	PLGN-43	Patch Lake		C		Adipose fin clip
255	LKTR	442	845	0.98			985120031585784	FN	18-Jul-07	PLFT-01	Patch Lake		C		
256	LKTR	639	2595	0.99			985120031626582	FN	18-Jul-07	PLFT-01	Patch Lake		C		
257	LKTR	391	775	1.30			985120031561267	GN	18-Jul-07	PLGN-47	Patch Lake		C		
258	LKTR	448	1280	1.42			985120031579422	GN	18-Jul-07	PLGN-47	Patch Lake		C		
259	LKWH	410	920	1.33				GN	18-Jul-07	PLGN-47	Patch Lake		M		Mortality-sample kept for Heidi
260	LKWH	420	1030	1.39				GN	18-Jul-07	PLGN-47	Patch Lake		M		Mortality-sample kept for Heidi
261	LKWH	439	1140	1.35				GN	18-Jul-07	PLGN-48	Patch Lake		C		Adipose fin clip
262	LKWH	438	1020	1.21				GN	18-Jul-07	PLGN-48	Patch Lake		C		Adipose fin clip
263	LKWH	428	1020	1.30				GN	18-Jul-07	PLGN-48	Patch Lake		C		Adipose fin clip
264	LKWH	420	1050	1.42				GN	18-Jul-07	PLGN-48	Patch Lake		C		Adipose fin clip
265	LKWH	482	1825	1.63				GN	18-Jul-07	PLGN-48	Patch Lake		M		Mortality-sample kept for Heidi
266	LKWH	411	1040	1.50				GN	18-Jul-07	PLGN-48	Patch Lake		M		Mortality
267	LKWH	382	850	1.52				GN	18-Jul-07	PLGN-48	Patch Lake		M		Mortality
268	LKWH	413	965	1.37				GN	18-Jul-07	PLGN-48	Patch Lake		M		Mortality
269	LKWH	420	1130	1.53				GN	18-Jul-07	PLGN-48	Patch Lake		M		Mortality
270	LKTR	341	420	1.06				GN	18-Jul-07	PLGN-48	Patch Lake		M		Mortality-sample kept for Heidi
271	LKTR	609	2200	0.97			985120031566434	GN	18-Jul-07	PLGN-50	Patch Lake		C		
272	LKTR	384	845	1.49			985120031626282	GN	18-Jul-07	PLGN-51	Patch Lake		C		
273	LKTR	343	440	1.09			985120031605128	GN	18-Jul-07	PLGN-51	Patch Lake		C		
274	LKTR	344	500	1.23			985120031628730	GN	18-Jul-07	PLGN-51	Patch Lake		C		
275	LKTR	539	1560	1.00			985120031567964	GN	18-Jul-07	PLGN-51	Patch Lake		C		
276	LKTR	472	1555	1.48			985120031454495	GN	18-Jul-07	PLGN-49	Patch Lake		C		
277	LKTR	675	3180	1.03			985120031445669	GN	18-Jul-07	PLGN-48	Patch Lake		C		
278	LKTR	675	3225	1.05			985120031571002	GN	18-Jul-07	PLGN-48	Patch Lake		C		
279	LKTR	428	1038	1.32			985120031597597	GN	18-Jul-07	PLGN-47	Patch Lake		C		
280	LKTR	411	900	1.30			985120031565760	GN	18-Jul-07	PLGN-47	Patch Lake		C		
281	LKTR	613	2400	1.04			985120031632679	GN	18-Jul-07	PLGN-47	Patch Lake		C		
282	LKWH	429	1060	1.34				GN	18-Jul-07	PLGN-47	Patch Lake		M		Mortality-sample kept for Heidi
283	LKTR	342	425	1.06				GN	18-Jul-07	PLGN-47	Patch Lake		M		Mortality-sample kept for Heidi
284	LKTR	677	3015	0.97			985120031606421	AN	18-Jul-07	PLAF-08	Patch Lake		C		
285	LKTR	643	2745	1.03			985120031568319	AN	18-Jul-07	PLAF-09	Patch Lake		C		
286	LKTR	640	2230	0.85			985120031607846	GN	18-Jul-07	PLGN-47	Patch Lake		C		
287	LKTR	710	3870	1.08			985120031569851	GN	18-Jul-07	PLGN-47	Patch Lake		R		
288	LKTR	665	2825	0.96				GN	18-Jul-07	PLGN-47	Patch Lake		M		Mortality-sample kept for Heidi
289	LKWH	423	860	1.14				GN	18-Jul-07	PLGN-47	Patch Lake		M		Mortality
290	LKTR	830	6320	1.11			985120031631446	GN	18-Jul-07	PLGN-48	Patch Lake		M		Mortality-sample kept for Heidi. Fish 599265 in stomach
291	LKTR	690	3520	1.07			985120031567012	GN	18-Jul-07	PLGN-48	Patch Lake		C		
292	LKTR	670	3230	1.07			985120031445669	GN	18-Jul-07	PLGN-48	Patch Lake		R		
293	LKTR	625	2450	1.00				GN	18-Jul-07	PLGN-48	Patch Lake		M		Mortality-sample kept for Heidi
294	LKTR	468	1360	1.33			985120031630383	GN	18-Jul-07	PLGN-51	Patch Lake		C		
295	LKTR	483	1375	1.22			985120031600316	GN	18-Jul-07	PLGN-51	Patch Lake		C		
296	LKTR	472	1555	1.48			985120031575844	GN	18-Jul-07	PLGN-51	Patch Lake		C		
491	LKWH	360	590	1.26				GN	12-Aug-07	PLGN-52	Patch Lake		C		
492	LKWH	383	745	1.33				GN	12-Aug-07	PLGN-52	Patch Lake		C		
493	LKWH	309	360	1.22				GN	12-Aug-07	PLGN-52	Patch Lake		C		
494	CISC	218	106	1.02				GN	12-Aug-07	PLGN-52	Patch Lake		C		
495	LKWH	406	909	1.36				GN	12-Aug-07	PLGN-52	Patch Lake		C		
496	LKWH	358	560	1.22				GN	12-Aug-07	PLGN-52	Patch Lake		C		
497	LKWH	395	855	1.39				GN	12-Aug-07	PLGN-52	Patch Lake		C		
498	LKWH	422	975	1.30				GN	12-Aug-07	PLGN-52	Patch Lake		M		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
499	LKTR	720	3014	0.81			985120031628609	GN	12-Aug-07	PLGN-52	Patch Lake		R		
500	LKTR	750	3772	0.89			985120031457762	GN	12-Aug-07	PLGN-52	Patch Lake		C		
501	LKWH							GN	12-Aug-07	PLGN-52	Patch Lake		E		
502	LKWH							GN	12-Aug-07	PLGN-52	Patch Lake		E		
503	CISC	220	156	1.47				GN	12-Aug-07	PLGN-53	Patch Lake		C		
504	CISC	217						GN	12-Aug-07	PLGN-53	Patch Lake		C		
505	CISC	217						GN	12-Aug-07	PLGN-53	Patch Lake		C		
506	CISC	236	162	1.23				GN	12-Aug-07	PLGN-53	Patch Lake		C		
507	LKWH	288	279	1.17				GN	12-Aug-07	PLGN-53	Patch Lake		C		
508	CISC	237	130	0.98				GN	12-Aug-07	PLGN-53	Patch Lake		M		
509	CISC	219	108	1.03				GN	12-Aug-07	PLGN-53	Patch Lake		C		
510	LKWH	320	240	0.73				GN	12-Aug-07	PLGN-53	Patch Lake		C		
511	LKWH	363	543	1.14				GN	12-Aug-07	PLGN-53	Patch Lake		C		
512	CISC	229	114	0.95				GN	12-Aug-07	PLGN-53	Patch Lake		C		
513	LKWH	360	614	1.32				GN	12-Aug-07	PLGN-53	Patch Lake		C		
514	LKWH	405	911	1.37				GN	12-Aug-07	PLGN-53	Patch Lake		C		
515	CISC	305	378	1.33				GN	12-Aug-07	PLGN-53	Patch Lake		M		
516	LKTR	675	2632	0.86			985120031643066	GN	12-Aug-07	PLGN-53	Patch Lake		R		
517	LKWH							GN	12-Aug-07	PLGN-53	Patch Lake		E		
518	LKTR							GN	12-Aug-07	PLGN-53	Patch Lake		E		
519	LKTR	790	4587	0.93			985120031618957	GN	12-Aug-07	PLGN-52	Patch Lake		R		
520	LKWH	334	473	1.27				GN	12-Aug-07	PLGN-52	Patch Lake		C		
521	LKWH	353	606	1.38				GN	12-Aug-07	PLGN-52	Patch Lake		C		
522	LKWH	266	240	1.28				GN	12-Aug-07	PLGN-52	Patch Lake		C		
523	CISC	240	154	1.11				GN	12-Aug-07	PLGN-52	Patch Lake		C		
524	LKTR	700	3753	1.09			985120031457762	GN	12-Aug-07	PLGN-52	Patch Lake		R		
525	LKTR	635	2251	0.88			985120031629890	GN	12-Aug-07	PLGN-52	Patch Lake		C		
526	LKWH	287	271	1.15				GN	12-Aug-07	PLGN-52	Patch Lake		M		
527	LKTR	690	3120	0.95			985120031610496	GN	12-Aug-07	PLGN-53	Patch Lake		C		
528	CISC	249	175	1.13				GN	12-Aug-07	PLGN-53	Patch Lake		C		
529	LKWH	390	570	0.96				GN	12-Aug-07	PLGN-53	Patch Lake		C		
530	LKWH	361	661	1.41				GN	12-Aug-07	PLGN-53	Patch Lake		C		
531	LKWH	368	677	1.36				GN	12-Aug-07	PLGN-53	Patch Lake		C		
532	LKWH	420	1140	1.54				GN	12-Aug-07	PLGN-53	Patch Lake		C		
533	LKWH	387	740	1.28				GN	12-Aug-07	PLGN-53	Patch Lake		C		
534	LKWH	366	683	1.39				GN	12-Aug-07	PLGN-53	Patch Lake		C		
535	LKWH	335	512	1.36				GN	12-Aug-07	PLGN-53	Patch Lake		M		
536	CISC	267	195	1.02				GN	12-Aug-07	PLGN-53	Patch Lake		M		
537	CISC	295	251	0.98				GN	12-Aug-07	PLGN-53	Patch Lake		M		
538	CISC	272	228	1.13				GN	12-Aug-07	PLGN-53	Patch Lake		M		
539	LKWH	325	420	1.22				GN	12-Aug-07	PLGN-53	Patch Lake		C		
540	LKWH	397	857	1.37				GN	12-Aug-07	PLGN-53	Patch Lake		M		
541	LKWH	395	845	1.37				GN	12-Aug-07	PLGN-53	Patch Lake		M		
542	LKTR	570					985120031623262	GN	12-Aug-07	PLGN-52	Patch Lake		R		
543	LKWH	434	1015	1.24				GN	12-Aug-07	PLGN-52	Patch Lake		C		
544	LKWH	395	912	1.48				GN	12-Aug-07	PLGN-52	Patch Lake		C		
545	LKWH	360	671	1.44				GN	12-Aug-07	PLGN-52	Patch Lake		C		
546	LKTR	640	2800	1.07			985120031576486	EF	25-Jul-06	PLEF-01	Patch Lake	SC			had floy tag #
546	LKWH	369	774	1.54				GN	12-Aug-07	PLGN-52	Patch Lake		C		
547	NNST	50						EF	25-Jul-06	PLEF-01	Patch Lake				
547	LKWH	425	1070	1.39				GN	12-Aug-07	PLGN-52	Patch Lake		C		
548	LKTR	700	3180	0.93	Green	4520	985120031631177	GN	25-Jul-06	PLGN-01	Patch Lake	SC	R	2005	originally tagged in Doris floy tag 4520
548	LKTR	700	3523	1.03			985120031574647	GN	12-Aug-07	PLGN-52	Patch Lake		C		
549	LKTR	800	4466	0.87			985120031562754	GN	25-Jul-06	PLGN-01	Patch Lake	SC			
549	CISC	251	181	1.14				GN	12-Aug-07	PLGN-53	Patch Lake		C		
550	LKTR	677	2680	0.86			985120031578841	GN	25-Jul-06	PLGN-01	Patch Lake	SC			
550	CISC	268	186	0.97				GN	12-Aug-07	PLGN-53	Patch Lake		C		
551	LKTR	650	2455	0.89			985120031633066	GN	25-Jul-06	PLGN-01	Patch Lake	SC			
551	CISC	276	239	1.14				GN	12-Aug-07	PLGN-53	Patch Lake		C		
552	LKTR	695	2845	0.85			985120031612378	GN	25-Jul-06	PLGN-01	Patch Lake	SC			
552	CISC	255	194	1.17				GN	12-Aug-07	PLGN-53	Patch Lake		C		
553	LKTR	720	3450	0.92			985120031612895	GN	25-Jul-06	PLGN-01	Patch Lake	SC			
553	LKWH	345	564	1.37				GN	12-Aug-07	PLGN-53	Patch Lake		C		
554	LKWH	379	675	1.24				GN	25-Jul-06	PLGN-01	Patch Lake				
554	LKWH	425	1050	1.37				GN	12-Aug-07	PLGN-53	Patch Lake		C		
555	LKWH	336	477	1.26				GN	12-Aug-07	PLGN-53	Patch Lake		C		
555	LKWH	452	1185	1.28				GN	25-Jul-06	PLGN-01	Patch Lake				

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
556	LKWH	394	740	1.21				GN	25-Jul-06	PLGN-01	Patch Lake				
556	LKWH	358	683	1.49				GN	12-Aug-07	PLGN-53	Patch Lake		C		
557	LKWH	420	980	1.32				GN	25-Jul-06	PLGN-01	Patch Lake				
557	LKWH	411	1053	1.52				GN	12-Aug-07	PLGN-53	Patch Lake		C		
558	LKWH	355	550	1.23				GN	25-Jul-06	PLGN-01	Patch Lake				
558	LKWH	412	980	1.40				GN	12-Aug-07	PLGN-53	Patch Lake		M		
559	CISC	230	140	1.15				GN	26-Jul-06	PLGN-03	Patch Lake				
559	LKWH							GN	12-Aug-07	PLGN-53	Patch Lake		E		
560	CISC	245	180	1.22				GN	26-Jul-06	PLGN-03	Patch Lake				
560	LKWH							GN	12-Aug-07	PLGN-53	Patch Lake		E		
561	CISC	245	180	1.22				GN	26-Jul-06	PLGN-03	Patch Lake				
561	LKTR							GN	12-Aug-07	PLGN-53	Patch Lake		E		
562	CISC	260	150	0.85				GN	26-Jul-06	PLGN-03	Patch Lake				aged
562	CISC	273						GN	13-Aug-07	PLGN-54	Patch Lake		C		
563	LKTR	509	1310	0.99				GN	26-Jul-06	PLGN-03	Patch Lake				aged #114
563	CISC	272						GN	13-Aug-07	PLGN-54	Patch Lake		C		
564	LKTR	685	3180	0.99				GN	26-Jul-06	PLGN-03	Patch Lake				aged
564	LKWH	408						GN	13-Aug-07	PLGN-54	Patch Lake		M		
565	LKWH	443	980	1.13				GN	26-Jul-06	PLGN-03	Patch Lake				aged #115
565	LKWH	380						GN	13-Aug-07	PLGN-54	Patch Lake		M		
566	LKWH	312	400	1.32				GN	26-Jul-06	PLGN-03	Patch Lake				aged
566	LKTR	650					985120031603559	GN	13-Aug-07	PLGN-54	Patch Lake		C		
567	CISC	279	240	1.11				GN	26-Jul-06	PLGN-04	Patch Lake				
567	LKTR	880					985120031619152	GN	13-Aug-07	PLGN-54	Patch Lake		C		
568	CISC	258	190	1.11				GN	26-Jul-06	PLGN-04	Patch Lake				
568	LKWH	350						GN	13-Aug-07	PLGN-55	Patch Lake		C		
569	CISC	249	160	1.04				GN	26-Jul-06	PLGN-04	Patch Lake				
569	LKWH	327						GN	13-Aug-07	PLGN-55	Patch Lake		M		
570	CISC	260	220	1.25				GN	26-Jul-06	PLGN-04	Patch Lake				
570	CISC	248						GN	13-Aug-07	PLGN-55	Patch Lake		C		
571	CISC	265	229	1.23				GN	26-Jul-06	PLGN-04	Patch Lake				
571	LKTR	539					985120031568180	GN	13-Aug-07	PLGN-55	Patch Lake		C		
572	CISC	247	160	1.06				GN	26-Jul-06	PLGN-04	Patch Lake				
572	LKTR	581					985120031632690	GN	13-Aug-07	PLGN-55	Patch Lake		C		
573	CISC	277	225	1.06				GN	26-Jul-06	PLGN-04	Patch Lake				aged
297	ARCH	235	155	1.19				EF	6-Aug-07	GLBP-H1	Glenn Lake		M		Kept for Heidi
298	ARCH	241	160	1.14				EF	6-Aug-07	GLBP-H1	Glenn Lake		M		Kept for Heidi
299	CISC	245	175	1.19				GN	6-Aug-07	GLGN-H1	Glenn Lake		M		Kept for Heidi
300	CISC	218	115	1.11				GN	6-Aug-07	GLGN-H1	Glenn Lake		M		Kept for Heidi
301	CISC	225	130	1.14				GN	6-Aug-07	GLGN-H1	Glenn Lake		M		Kept for Heidi
302	CISC	213	100	1.03				GN	6-Aug-07	GLGN-H1	Glenn Lake		M		Kept for Heidi
303	CISC	250	130	0.83				GN	6-Aug-07	GLGN-H1	Glenn Lake		M		Kept for Heidi
304	CISC	249	120	0.78				GN	6-Aug-07	GLGN-H3	Glenn Lake		M		Kept for Heidi
305	LKTR	345	405	0.99				EF	6-Aug-07	GLBP-H1	Glenn Lake		M		Kept for Heidi
306	LKTR	340	415	1.06				EF	6-Aug-07	GLBP-H1	Glenn Lake		M		Kept for Heidi
307	LKTR	420	865	1.17				EF	6-Aug-07	GLBP-H1	Glenn Lake		M		Kept for Heidi
308	LKTR	208	82	0.91				EF	6-Aug-07	GLBP-H1	Glenn Lake		M		Kept for Heidi
309	LKTR	410	715	1.04				EF	6-Aug-07	GLBP-H1	Glenn Lake		M		Kept for Heidi
310	LKTR	152	36	1.03				EF	6-Aug-07	GLBP-H1	Glenn Lake		M		Kept for Heidi
311	LKTR	725	3690	0.97				GN	6-Aug-07	GLGN-H1	Glenn Lake		M		Kept for Heidi
312	LKTR	650	3190	1.16				GN	6-Aug-07	GLGN-H1	Glenn Lake		M		Kept for Heidi
313	LKTR	700	3025	0.88				GN	6-Aug-07	GLGN-H1	Glenn Lake		M		Kept for Heidi
314	LKTR	670	2865	0.95				GN	6-Aug-07	GLGN-H2	Glenn Lake		M		Kept for Heidi
315	LKTR	525	1620	1.12				GN	6-Aug-07	GLGN-H2	Glenn Lake		M		Kept for Heidi
316	LKTR	498	1080	0.87				GN	6-Aug-07	GLGN-H2	Glenn Lake		M		Kept for Heidi
317	LKTR	384	570	1.01				GN	6-Aug-07	GLGN-H2	Glenn Lake		M		Kept for Heidi
318	LKWH	449	1345	1.49				GN	6-Aug-07	GLGN-H4	Glenn Lake		M		Kept for Heidi
1179	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1180	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1181	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1182	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1183	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1184	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1185	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1186	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1187	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1188	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
1189	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1190	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1191	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1192	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1193	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1194	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1195	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1196	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1197	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1198	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1199	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1200	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1201	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1202	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1203	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1204	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1205	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1206	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1207	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1208	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1209	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1210	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1211	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1212	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1213	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1214	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1215	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1216	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1217	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1218	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1219	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1220	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1221	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1222	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1223	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1224	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1225	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1226	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1227	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1228	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1229	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1230	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1231	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1232	LSCS							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1233	NNST							BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
490	LKTR							EF	7-Aug-07	GLBP-H3	Glenn Lake		C		
319	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
320	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
321	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
322	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
323	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
324	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
325	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
326	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
327	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
328	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
329	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
330	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
331	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
332	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
333	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
334	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
335	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
336	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
337	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
338	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
339	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
340	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
341	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
342	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
343	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
344	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
345	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
346	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
347	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
348	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
349	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
350	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
351	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
352	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
353	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
354	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
355	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
356	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
357	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
358	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
359	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
360	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
361	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
362	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
363	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
364	CISC							GN	6-Aug-07	GLGN-H2	Glenn Lake		C		
365	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
366	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
367	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
368	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
369	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
370	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
371	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
372	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
373	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
374	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
375	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
376	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
377	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
434	ARCH	193	80	1.11				EF	7-Aug-07	GLBP-H3	Glenn Lake		M		Kept for Heidi
435	LKTR	310	320	1.07				EF	7-Aug-07	GLBP-H3	Glenn Lake		M		Kept for Heidi
436	LKWH	435	1165	1.42				GN	7-Aug-07	GLGN-H6	Glenn Lake		M		Kept for Heidi
378	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
379	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
380	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
381	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
382	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
383	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
384	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
385	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
386	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
387	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
388	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
389	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
390	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
391	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
392	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
393	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
394	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
395	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
396	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
397	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
398	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
399	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
400	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
401	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
402	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
403	CISC							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
404	LKTR							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
405	LKTR							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
406	LKTR							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
407	LKTR							GN	6-Aug-07	GLGN-H3	Glenn Lake		C		
408	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
409	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
410	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
411	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
412	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
413	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
414	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
415	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
416	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
417	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
418	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
419	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
420	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
421	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
422	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
423	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
424	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
425	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
426	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
427	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
428	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
429	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
430	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
431	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
573	LKTR	652					985120031576244	GN	13-Aug-07	PLGN-55	Patch Lake		C		
574	CISC	285	230	0.99				GN	26-Jul-06	PLGN-04	Patch Lake				aged
574	CISC	183						GN	13-Aug-07	PLGN-56	Patch Lake		C		
575	CISC	257	190	1.12				GN	26-Jul-06	PLGN-04	Patch Lake				aged
575	CISC	189						GN	13-Aug-07	PLGN-56	Patch Lake		C		
576	CISC	274	230	1.12				GN	26-Jul-06	PLGN-04	Patch Lake				aged
576	CISC	208						GN	13-Aug-07	PLGN-56	Patch Lake		C		
577	CISC	263	185	1.02				GN	26-Jul-06	PLGN-04	Patch Lake				aged
577	CISC	205						GN	13-Aug-07	PLGN-56	Patch Lake		C		
578	CISC	273	190	0.93				GN	26-Jul-06	PLGN-04	Patch Lake				aged
578	CISC	197						GN	13-Aug-07	PLGN-56	Patch Lake		C		
579	CISC	290	260	1.07				GN	26-Jul-06	PLGN-04	Patch Lake				aged
579	LKWH	355						GN	13-Aug-07	PLGN-56	Patch Lake		C		
580	CISC	202	75	0.91				GN	26-Jul-06	PLGN-04	Patch Lake				aged
580	CISC	225						GN	13-Aug-07	PLGN-56	Patch Lake		C		
581	CISC	224	104	0.93				GN	26-Jul-06	PLGN-04	Patch Lake				aged
581	CISC	187						GN	13-Aug-07	PLGN-56	Patch Lake		M		
582	NNST	73						MT	26-Jul-06	PLMT-01	Patch Lake				
582	LKTR	660					985120031564522	GN	13-Aug-07	PLGN-56	Patch Lake		R		
583	LKWH	415						GN	27-Jul-06	PLGN-05	Patch Lake				
583	LKTR	690					985120031575236	GN	13-Aug-07	PLGN-56	Patch Lake		C		
584	CISC	287	250	1.06				GN	27-Jul-06	PLGN-05	Patch Lake				
584	CISC	181						GN	13-Aug-07	PLGN-56	Patch Lake		M		
585	CISC	350						GN	27-Jul-06	PLGN-05	Patch Lake				
585	LKTR	620					985120031575236	GN	13-Aug-07	PLGN-56	Patch Lake		C		
586	LKWH	390	780	1.31				GN	27-Jul-06	PLGN-05	Patch Lake				
586	CISC	198						GN	13-Aug-07	PLGN-56	Patch Lake		M		
587	LKWH	274	320	1.56				GN	27-Jul-06	PLGN-05	Patch Lake				
587	CISC	191						GN	13-Aug-07	PLGN-56	Patch Lake		M		
588	CISC	225	110	0.97				GN	27-Jul-06	PLGN-05	Patch Lake				
588	LKTR	700					985120031455598	GN	13-Aug-07	PLGN-56	Patch Lake		C		
589	CISC	200	75	0.94				GN	27-Jul-06	PLGN-05	Patch Lake				
589	CISC	191						GN	13-Aug-07	PLGN-56	Patch Lake		M		
590	CISC	220	105	0.99				GN	27-Jul-06	PLGN-05	Patch Lake				
590	CISC	219						GN	13-Aug-07	PLGN-56	Patch Lake		M		
591	CISC	218	105	1.01				GN	27-Jul-06	PLGN-05	Patch Lake				
591	LKTR	680					985120031582570	GN	13-Aug-07	PLGN-56	Patch Lake		C		
592	LKWH	387	940	1.62				GN	27-Jul-06	PLGN-05	Patch Lake				
592	CISC	215						GN	13-Aug-07	PLGN-56	Patch Lake		M		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
593	LKWH	368	680	1.36				GN	27-Jul-06	PLGN-05	Patch Lake				
593	CISC	205						GN	13-Aug-07	PLGN-56	Patch Lake		M		
594	LKWH	356	685	1.52				GN	27-Jul-06	PLGN-05	Patch Lake				
594	CISC	247						GN	13-Aug-07	PLGN-56	Patch Lake		M		
595	LKWH	360	625	1.34				GN	27-Jul-06	PLGN-05	Patch Lake				
595	CISC	215						GN	13-Aug-07	PLGN-56	Patch Lake		M		
596	LKWH	391	755	1.26				GN	27-Jul-06	PLGN-05	Patch Lake				
596	CISC	254						GN	13-Aug-07	PLGN-54	Patch Lake		C		
597	CISC	202	90	1.09				GN	27-Jul-06	PLGN-05	Patch Lake				
597	LKWH	425						GN	13-Aug-07	PLGN-54	Patch Lake		C		
598	CISC	205	80	0.93				GN	27-Jul-06	PLGN-05	Patch Lake				
598	LKTR	740					985120031567053	GN	13-Aug-07	PLGN-54	Patch Lake		C		
599	LKWH	307	330	1.14				GN	27-Jul-06	PLGN-05	Patch Lake				
599	LKTR	750					985120031624571	GN	13-Aug-07	PLGN-54	Patch Lake		R		
600	LKTR	440						FN	27-Jul-06	PLFN-01	Patch Lake				kept fo analysis, see envelope
600	LKTR	740					985120031604788	GN	13-Aug-07	PLGN-54	Patch Lake		C		
601	LKTR	870					985120031556794	GN	13-Aug-07	PLGN-54	Patch Lake		C		
602	CISC	275	240	1.15				GN	28-Jul-06	PLGN-07	Patch Lake				mortality
602	LKTR	620					985120031633082	GN	13-Aug-07	PLGN-54	Patch Lake		C		
603	LKTR	820	5935	1.08				GN	28-Jul-06	PLGN-07	Patch Lake				Kept
603	CISC							GN	13-Aug-07	PLGN-55	Patch Lake		M		
604	LKWH	450	820	0.90				GN	28-Jul-06	PLGN-07	Patch Lake				
604	CISC							GN	13-Aug-07	PLGN-55	Patch Lake		M		
605	LKWH	313	365	1.19				GN	28-Jul-06	PLGN-07	Patch Lake				mortality
605	CISC							GN	13-Aug-07	PLGN-55	Patch Lake		M		
606	LKWH	382	805	1.44				GN	28-Jul-06	PLGN-07	Patch Lake				mortality
606	CISC							GN	13-Aug-07	PLGN-55	Patch Lake		M		
607	LKWH	319	420	1.29				GN	28-Jul-06	PLGN-07	Patch Lake				mortality
607	CISC							GN	13-Aug-07	PLGN-55	Patch Lake		M		
608	LKWH	334	475	1.27				GN	28-Jul-06	PLGN-07	Patch Lake				mortality
608	LKTR	688					985120031570230	GN	13-Aug-07	PLGN-55	Patch Lake		C		
609	LKWH	336	365	0.96				GN	28-Jul-06	PLGN-07	Patch Lake				mortality
609	LKTR	980					985120031584754	GN	13-Aug-07	PLGN-55	Patch Lake		R		
610	LKTR	785	4170	0.86				GN	28-Jul-06	PLGN-08	Patch Lake				Kept
610	LKTR	770					985120031562056	GN	13-Aug-07	PLGN-55	Patch Lake		C		
611	LKTR	740	3770	0.93				GN	28-Jul-06	PLGN-08	Patch Lake				Kept
611	LKTR	720					985120031598907	GN	13-Aug-07	PLGN-55	Patch Lake		C		
612	LKWH	420	610	0.82				GN	28-Jul-06	PLGN-08	Patch Lake				
612	LKTR	740					985120031602617	GN	13-Aug-07	PLGN-55	Patch Lake		C		
613	CISC	289	295	1.22				GN	28-Jul-06	PLGN-09	Patch Lake				
613	LKTR	645					985153000021285	GN	13-Aug-07	PLGN-55	Patch Lake		C		
614	LKTR	644	2495	0.93				GN	28-Jul-06	PLGN-09	Patch Lake				
614	LKTR	566					985153000021240	GN	13-Aug-07	PLGN-55	Patch Lake		C		
615	LKTR	675	2965	0.96				GN	28-Jul-06	PLGN-09	Patch Lake				
615	LKTR	664					985153000021277	GN	13-Aug-07	PLGN-55	Patch Lake		C		
616	LKWH	374	715	1.37				GN	28-Jul-06	PLGN-09	Patch Lake				
616	LKTR	651					985153000021249	GN	13-Aug-07	PLGN-55	Patch Lake		C		
617	LKWH	402	1015	1.56				GN	28-Jul-06	PLGN-09	Patch Lake				
617	LKTR	594					985153000021230	GN	13-Aug-07	PLGN-55	Patch Lake		C		
618	CISC	200	85	1.06				GN	28-Jul-06	PLGN-11	Patch Lake				
618	LKTR	370						GN	13-Aug-07	PLGN-55	Patch Lake		M		
619	CISC	224	135	1.20				GN	28-Jul-06	PLGN-11	Patch Lake				
619	LKTR	667	2675	0.90	Orange	909	985120031566730	GN	13-Aug-07	PLGN-56	Patch Lake		R		
620	CISC	254	140	0.85				GN	28-Jul-06	PLGN-11	Patch Lake				
620	LKTR	360						GN	13-Aug-07	PLGN-56	Patch Lake		C		
621	CISC	268	210	1.09				GN	28-Jul-06	PLGN-11	Patch Lake				
621	LKTR	720					985153000021260	GN	13-Aug-07	PLGN-56	Patch Lake		C		
622	CISC	211	100	1.06				GN	28-Jul-06	PLGN-11	Patch Lake				
622	LKTR	670					985153000021223	GN	13-Aug-07	PLGN-56	Patch Lake		C		
623	CISC	196	85	1.13				GN	28-Jul-06	PLGN-11	Patch Lake				
623	LKTR	676					985153000021284	GN	13-Aug-07	PLGN-56	Patch Lake		C		
624	CISC	211	95	1.01				GN	28-Jul-06	PLGN-11	Patch Lake				
624	LKTR	692					985120031578749	GN	13-Aug-07	PLGN-56	Patch Lake		R		recap tag read= 5820031578749
625	CISC	225	136	1.19				GN	28-Jul-06	PLGN-11	Patch Lake				
625	LKTR							GN	13-Aug-07	PLGN-56	Patch Lake		E		
626	LKTR	612	2635	1.15				GN	28-Jul-06	PLGN-11	Patch Lake				
626	LKTR							GN	13-Aug-07	PLGN-56	Patch Lake		E		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
627	LKTR	636	2700	1.05				GN	28-Jul-06	PLGN-11	Patch Lake				
627	CISC							GN	13-Aug-07	PLGN-56	Patch Lake		M		
628	LKWH	280	240	1.09				GN	28-Jul-06	PLGN-11	Patch Lake				
628	CISC							GN	13-Aug-07	PLGN-56	Patch Lake		M		
629	LKWH	251	250	1.58				GN	28-Jul-06	PLGN-11	Patch Lake				
629	CISC							GN	13-Aug-07	PLGN-56	Patch Lake		M		
630	LKWH	286	295	1.26				GN	28-Jul-06	PLGN-11	Patch Lake				
630	CISC							GN	13-Aug-07	PLGN-56	Patch Lake		M		
631	LKWH	253	158	0.98				GN	28-Jul-06	PLGN-11	Patch Lake				
631	CISC							GN	13-Aug-07	PLGN-56	Patch Lake		M		
632	LKWH	299	335	1.25				GN	28-Jul-06	PLGN-11	Patch Lake				
632	CISC							GN	13-Aug-07	PLGN-56	Patch Lake		M		
633	LKWH	241	175	1.25				GN	28-Jul-06	PLGN-11	Patch Lake				
633	CISC							GN	13-Aug-07	PLGN-56	Patch Lake		M		
634	LKWH	356	550	1.22				GN	28-Jul-06	PLGN-11	Patch Lake				
634	CISC	180						GN	14-Aug-07	PLGN-57	Patch Lake		C		
635	LKWH	317	425	1.33				GN	28-Jul-06	PLGN-11	Patch Lake				
635	CISC	232						GN	14-Aug-07	PLGN-57	Patch Lake		C		
636	CISC	295	258	1.00				GN	28-Jul-06	PLGN-12	Patch Lake				
636	CISC	230						GN	14-Aug-07	PLGN-57	Patch Lake		C		
637	CISC	208	80	0.89				GN	28-Jul-06	PLGN-12	Patch Lake				
637	CISC	250						GN	14-Aug-07	PLGN-57	Patch Lake		C		
638	CISC	315	300	0.96				GN	28-Jul-06	PLGN-12	Patch Lake				
638	CISC	235						GN	14-Aug-07	PLGN-57	Patch Lake		C		
639	LKTR	647	2630	0.97			985120031451085	GN	28-Jul-06	PLGN-12	Patch Lake				
639	CISC	212						GN	14-Aug-07	PLGN-57	Patch Lake		C		
640	LKTR	550					985120031618244	GN	28-Jul-06	PLGN-12	Patch Lake				
640	CISC	187						GN	14-Aug-07	PLGN-57	Patch Lake		C		
641	LKTR	644	2735	1.02			985120031643066	GN	28-Jul-06	PLGN-12	Patch Lake				
641	LKTR	535					985129931569662	GN	14-Aug-07	PLGN-57	Patch Lake		R		
642	LKWH	340	470	1.20				GN	28-Jul-06	PLGN-12	Patch Lake				
642	LKTR	650					985120031629890	GN	14-Aug-07	PLGN-57	Patch Lake		R		
643	LKWH	397	780	1.25				FN	28-Jul-06	PLFN-01	Patch Lake				
643	CISC	185						GN	14-Aug-07	PLGN-57	Patch Lake		C		
644	LKWH	373	660	1.27				FN	28-Jul-06	PLFN-01	Patch Lake				
644	CISC	250						GN	14-Aug-07	PLGN-57	Patch Lake		C		
645	LKTR	291	250	1.01				FN	28-Jul-06	PLFN-01	Patch Lake				
645	CISC	193						GN	14-Aug-07	PLGN-57	Patch Lake		C		
646	LKTR	810	3605	0.68				FN	28-Jul-06	PLFN-01	Patch Lake				
646	LKWH	340						GN	14-Aug-07	PLGN-58	Patch Lake		C		
647	CISC	217	100	0.98				FN	29-Jul-06	PLFN-01	Patch Lake				caught in trap from P.O. Lake
647	LKWH	535						GN	14-Aug-07	PLGN-58	Patch Lake		C		
648	LKTR	675	2900	0.94			985120031573771	FN	29-Jul-06	PLFN-01	Patch Lake				caught in trap from P.O. Lake
648	LKWH	410						GN	14-Aug-07	PLGN-58	Patch Lake		C		
649	LKTR	590	2365	1.15			985120031590988	FN	29-Jul-06	PLFN-01	Patch Lake				caught in trap from P.O. Lake
649	CISC	290						GN	14-Aug-07	PLGN-58	Patch Lake		C		
650	LKTR	700	2785	0.81			985120031609687	FN	29-Jul-06	PLFN-01	Patch Lake				caught in trap from P.O. Lake
650	LKWH	358						GN	14-Aug-07	PLGN-58	Patch Lake		C		
651	LKTR	700	3420	1.00			985120031559909	FN	29-Jul-06	PLFN-01	Patch Lake				caught in trap from Patch Lake
651	CISC	279						GN	14-Aug-07	PLGN-58	Patch Lake		C		
652	LKTR	750	4520	1.07			985120031630474	FN	29-Jul-06	PLFN-01	Patch Lake				caught in trap from Patch Lake
652	LKWH	403						GN	14-Aug-07	PLGN-58	Patch Lake		C		
653	LKTR	695	2500	0.74			985120031608363	FN	29-Jul-06	PLFN-01	Patch Lake				caught in trap from Patch Lake
653	LKTR	595					985153000021218	GN	14-Aug-07	PLGN-58	Patch Lake		C		
654	LKTR	512	1662	1.24			985120031659013	FN	29-Jul-06	PLFN-01	Patch Lake				caught in trap from Patch Lake
654	LKTR	645					985153000021254	GN	14-Aug-07	PLGN-58	Patch Lake		C		
655	LKWH	385	730	1.28				FN	29-Jul-06	PLFN-01	Patch Lake				caught in trap from P.O. Lake
655	CISC	279						GN	14-Aug-07	PLGN-59	Patch Lake		C		
656	LKWH	359	620	1.34				FN	29-Jul-06	PLFN-01	Patch Lake				caught in trap from Patch Lake
656	CISC	220						GN	14-Aug-07	PLGN-59	Patch Lake		C		
657	LKWH	394						GN	14-Aug-07	PLGN-59	Patch Lake		C		
658	LKWH	382						GN	14-Aug-07	PLGN-59	Patch Lake		C		
659	CISC	267						GN	14-Aug-07	PLGN-59	Patch Lake		C		
660	LKTR	764					985153000021273	GN	14-Aug-07	PLGN-59	Patch Lake		C		
661	LKTR	672					985153000021281	GN	14-Aug-07	PLGN-59	Patch Lake		C		
662	LKTR	704					985153000021243	GN	14-Aug-07	PLGN-59	Patch Lake		C		
663	LKTR	740					985153000021229	GN	14-Aug-07	PLGN-59	Patch Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
664	LKTR	760					985153000021252	GN	14-Aug-07	PLGN-59	Patch Lake		C		
665	CISC	240						GN	14-Aug-07	PLGN-57	Patch Lake		C		
666	CISC	195						GN	14-Aug-07	PLGN-57	Patch Lake		C		
667	CISC	218						GN	14-Aug-07	PLGN-57	Patch Lake		C		
668	CISC	183						GN	14-Aug-07	PLGN-57	Patch Lake		C		
669	CISC	227						GN	14-Aug-07	PLGN-57	Patch Lake		C		
670	CISC	224						GN	14-Aug-07	PLGN-57	Patch Lake		C		
671	CISC	219						GN	14-Aug-07	PLGN-57	Patch Lake		C		
672	CISC	263						GN	14-Aug-07	PLGN-57	Patch Lake		C		
673	CISC	176						GN	14-Aug-07	PLGN-57	Patch Lake		C		
674	CISC	252						GN	14-Aug-07	PLGN-57	Patch Lake		C		
675	LKWH	452						GN	14-Aug-07	PLGN-57	Patch Lake		C		
676	LKWH	367						GN	14-Aug-07	PLGN-57	Patch Lake		C		
677	CISC	262						GN	14-Aug-07	PLGN-58	Patch Lake		C		
678	LKWH	352						GN	14-Aug-07	PLGN-58	Patch Lake		C		
679	CISC	236						GN	14-Aug-07	PLGN-58	Patch Lake		C		
680	LKWH	314						GN	14-Aug-07	PLGN-58	Patch Lake		C		
681	LKWH	284						GN	14-Aug-07	PLGN-58	Patch Lake		C		
682	LKWH	383						GN	14-Aug-07	PLGN-58	Patch Lake		C		
683	LKTR							GN	14-Aug-07	PLGN-58	Patch Lake		E		
684	LKTR	875					985153000021242	GN	14-Aug-07	PLGN-59	Patch Lake		C		
685	LKTR	799					985153000021289	GN	14-Aug-07	PLGN-59	Patch Lake		C		
686	LKTR	687					985153000021244	GN	14-Aug-07	PLGN-59	Patch Lake		C		
687	LKTR	690					985153000021216	GN	14-Aug-07	PLGN-59	Patch Lake		C		
688	CISC	242						GN	14-Aug-07	PLGN-59	Patch Lake		M		partially eaten by LKTR
689	LKWH	347						GN	14-Aug-07	PLGN-59	Patch Lake		C		
690	LKWH	368						GN	14-Aug-07	PLGN-59	Patch Lake		C		red rash around anus
691	LKWH	433						GN	14-Aug-07	PLGN-59	Patch Lake		M		
692	CISC	213						GN	14-Aug-07	PLGN-57	Patch Lake		C		
693	CISC	234						GN	14-Aug-07	PLGN-57	Patch Lake		C		
694	CISC	243						GN	14-Aug-07	PLGN-57	Patch Lake		C		
695	CISC	167						GN	14-Aug-07	PLGN-57	Patch Lake		C		
696	CISC	218						GN	14-Aug-07	PLGN-57	Patch Lake		C		
697	LKWH	484						GN	14-Aug-07	PLGN-57	Patch Lake		C		
698	CISC	178						GN	14-Aug-07	PLGN-57	Patch Lake		C		
699	CISC	235						GN	14-Aug-07	PLGN-57	Patch Lake		C		
700	CISC	178						GN	14-Aug-07	PLGN-57	Patch Lake		C		
701	CISC	198						GN	14-Aug-07	PLGN-57	Patch Lake		C		
702	LKWH	485						GN	14-Aug-07	PLGN-58	Patch Lake		C		
703	CISC	217						GN	14-Aug-07	PLGN-58	Patch Lake		C		
704	LKTR						985120031630249	GN	14-Aug-07	PLGN-59	Patch Lake		R		
705	LKTR						985120031633066	GN	14-Aug-07	PLGN-59	Patch Lake		R		
706	LKTR	604					985153000021262	GN	14-Aug-07	PLGN-59	Patch Lake		C		
707	LKTR	630					985153000021300	GN	14-Aug-07	PLGN-59	Patch Lake		C		
708	LKTR	575					985153000021236	GN	14-Aug-07	PLGN-59	Patch Lake		C		
709	LKWH	242						GN	14-Aug-07	PLGN-59	Patch Lake		M		
710	CISC	280						GN	14-Aug-07	PLGN-59	Patch Lake		C		
711	CISC	255						GN	14-Aug-07	PLGN-59	Patch Lake		M		
712	CISC	237						GN	14-Aug-07	PLGN-59	Patch Lake		M		
713	CISC	232						GN	14-Aug-07	PLGN-59	Patch Lake		M		
714	CISC	220						GN	14-Aug-07	PLGN-59	Patch Lake		M		
715	CISC	265						GN	14-Aug-07	PLGN-59	Patch Lake		M		
716	NNST	45						MT	14-Aug-07	PLMB-05	Patch Lake		C		
717	NNST	45						MT	14-Aug-07	PLMB-02	Patch Lake		C		
718	LKWH	350						GN	15-Aug-07	PLGN-60	Patch Lake		C		
719	CISC	245						GN	15-Aug-07	PLGN-60	Patch Lake		M		
720	CISC	240						GN	15-Aug-07	PLGN-60	Patch Lake		M		
721	LKTR	695					985153000021279	GN	15-Aug-07	PLGN-60	Patch Lake		C		
722	LKTR							GN	15-Aug-07	PLGN-60	Patch Lake		E		
723	LKWH							GN	15-Aug-07	PLGN-60	Patch Lake		E		
724	CISC	240						GN	15-Aug-07	PLGN-61	Patch Lake		M		
725	LKWH	279						GN	15-Aug-07	PLGN-61	Patch Lake		M		
726	LKWH	288						GN	15-Aug-07	PLGN-61	Patch Lake		C		
727	CISC	244						GN	15-Aug-07	PLGN-61	Patch Lake		C		
728	CISC	218						GN	15-Aug-07	PLGN-61	Patch Lake		C		
729	LKWH	374						GN	15-Aug-07	PLGN-61	Patch Lake		C		
730	LKWH	343						GN	15-Aug-07	PLGN-61	Patch Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
731	LKWH	264						GN	15-Aug-07	PLGN-61	Patch Lake		C		
732	CISC	199						GN	15-Aug-07	PLGN-61	Patch Lake		C		
733	LKTR	590					985153000021221	GN	15-Aug-07	PLGN-62	Patch Lake		C		
734	LKWH	355						GN	15-Aug-07	PLGN-62	Patch Lake		M		
735	LKWH	360						GN	15-Aug-07	PLGN-62	Patch Lake		C		
736	LKWH	442						GN	15-Aug-07	PLGN-62	Patch Lake		C		
737	CISC	175						GN	15-Aug-07	PLGN-62	Patch Lake		M		
738	CISC	188						GN	15-Aug-07	PLGN-62	Patch Lake		C		
739	CISC	191						GN	15-Aug-07	PLGN-62	Patch Lake		M		
740	CISC	202						GN	15-Aug-07	PLGN-62	Patch Lake		C		
741	CISC	188						GN	15-Aug-07	PLGN-62	Patch Lake		C		
742	LKWH	281						GN	15-Aug-07	PLGN-62	Patch Lake		C		
743	LKWH	285						GN	15-Aug-07	PLGN-62	Patch Lake		C		
744	CISC	204						GN	15-Aug-07	PLGN-62	Patch Lake		C		
745	CISC	196						GN	15-Aug-07	PLGN-62	Patch Lake		C		
746	CISC	201						GN	15-Aug-07	PLGN-62	Patch Lake		C		
747	CISC	163						GN	15-Aug-07	PLGN-62	Patch Lake		C		
748	LKWH	367						GN	17-Aug-07	PLGN-63	Patch Lake		C		
749	LKWH	365						GN	17-Aug-07	PLGN-63	Patch Lake		C		
750	CISC	257						GN	17-Aug-07	PLGN-63	Patch Lake		C		
751	CISC	235						GN	17-Aug-07	PLGN-63	Patch Lake		C		
752	CISC	231						GN	17-Aug-07	PLGN-64	Patch Lake		C		
753	CISC	369						GN	17-Aug-07	PLGN-64	Patch Lake		C		
754	LKWH	452						GN	17-Aug-07	PLGN-64	Patch Lake		C		
755	LKTR	725					985153000021226	GN	17-Aug-07	PLGN-65	Patch Lake		C		
756	LKWH	425						GN	17-Aug-07	PLGN-65	Patch Lake		C		
757	LKWH	394						GN	17-Aug-07	PLGN-65	Patch Lake		C		
758	LKWH	420						GN	17-Aug-07	PLGN-65	Patch Lake		C		
759	LKWH	392						GN	17-Aug-07	PLGN-65	Patch Lake		C		
760	LKWH	385						GN	17-Aug-07	PLGN-65	Patch Lake		C		
761	LKTR						985120031554695	GN	17-Aug-07	PLGN-66	Patch Lake		R		
762	LKTR	665					985153000021204	GN	17-Aug-07	PLGN-66	Patch Lake		C		
763	LKTR	710					985153000021294	GN	17-Aug-07	PLGN-66	Patch Lake		C		
764	LKTR	705					985153000021208	GN	17-Aug-07	PLGN-66	Patch Lake		C		
765	LKTR	540					985153000021239	GN	17-Aug-07	PLGN-66	Patch Lake		C		
766	CISC	310						GN	17-Aug-07	PLGN-66	Patch Lake		C		
767	LSCS	220						GN	17-Aug-07	PLGN-66	Patch Lake		C		
768	CISC	315						GN	17-Aug-07	PLGN-66	Patch Lake		C		
769	CISC	284						GN	17-Aug-07	PLGN-66	Patch Lake		C		
770	CISC	302						GN	17-Aug-07	PLGN-66	Patch Lake		C		
771	LKWH	355						GN	17-Aug-07	PLGN-66	Patch Lake		C		
772	LKWH	383						GN	17-Aug-07	PLGN-66	Patch Lake		C		
773	LKTR	695					985153000021267	GN	17-Aug-07	PLGN-67	Patch Lake		C		
774	LKTR	670					985153000021275	GN	17-Aug-07	PLGN-67	Patch Lake		C		
775	LKTR	685					985153000021268	GN	17-Aug-07	PLGN-67	Patch Lake		C		
776	LKTR	730					985153000021258	GN	17-Aug-07	PLGN-67	Patch Lake		C		
777	LKTR	710					985153000021234	GN	17-Aug-07	PLGN-67	Patch Lake		C		
778	LKTR	720					985153000021206	GN	17-Aug-07	PLGN-67	Patch Lake		C		
779	LKTR	695					985153000021231	GN	17-Aug-07	PLGN-67	Patch Lake		C		
780	LKWH							GN	17-Aug-07	PLGN-67	Patch Lake		M		
781	LKWH							GN	17-Aug-07	PLGN-67	Patch Lake		M		
782	CISC							GN	17-Aug-07	PLGN-67	Patch Lake		M		
783	CISC							GN	17-Aug-07	PLGN-67	Patch Lake		M		
784	CISC							GN	17-Aug-07	PLGN-67	Patch Lake		M		
785	CISC							GN	17-Aug-07	PLGN-67	Patch Lake		M		
786	CISC							GN	17-Aug-07	PLGN-67	Patch Lake		M		
787	CISC							GN	17-Aug-07	PLGN-67	Patch Lake		M		
788	CISC							GN	17-Aug-07	PLGN-67	Patch Lake		M		
789	CISC							GN	17-Aug-07	PLGN-67	Patch Lake		M		
790	CISC							GN	17-Aug-07	PLGN-67	Patch Lake		M		
791	CISC							GN	17-Aug-07	PLGN-67	Patch Lake		M		
792	LKTR						985120031616920	GN	17-Aug-07	PLGN-68	Patch Lake		R		
793	LKTR	595					985153000021272	GN	17-Aug-07	PLGN-68	Patch Lake		C		
794	LKTR	630					985153000021205	GN	17-Aug-07	PLGN-68	Patch Lake		C		
795	LKTR	645					985153000021278	GN	17-Aug-07	PLGN-68	Patch Lake		C		
796	LKWH	456						GN	17-Aug-07	PLGN-68	Patch Lake		C		
797	LKWH	370						GN	17-Aug-07	PLGN-68	Patch Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
798	LKWH	400						GN	17-Aug-07	PLGN-68	Patch Lake		M		
799	LKWH	452						GN	17-Aug-07	PLGN-68	Patch Lake		C		
800	LKWH	375						GN	17-Aug-07	PLGN-68	Patch Lake		M		
801	LSCS	243						GN	17-Aug-07	PLGN-68	Patch Lake		C		
802	LKWH	214						GN	17-Aug-07	PLGN-68	Patch Lake		C		
803	LSCS	229						GN	17-Aug-07	PLGN-68	Patch Lake		C		
804	CISC	284						GN	17-Aug-07	PLGN-68	Patch Lake		C		
805	LSCS	211						GN	17-Aug-07	PLGN-68	Patch Lake		C		
806	LSCS	249						GN	17-Aug-07	PLGN-68	Patch Lake		C		
807	LSCS	233						GN	17-Aug-07	PLGN-68	Patch Lake		C		
808	CISC	224						GN	17-Aug-07	PLGN-68	Patch Lake		C		
809	LSCS	251						GN	17-Aug-07	PLGN-68	Patch Lake		C		
810	LKTR	645					985153000021207	GN	17-Aug-07	PLGN-69	Patch Lake		C		
811	LKWH	438						GN	17-Aug-07	PLGN-69	Patch Lake		C		
812	LKWH	274						GN	17-Aug-07	PLGN-69	Patch Lake		C		
813	LKWH	449						GN	17-Aug-07	PLGN-69	Patch Lake		M		
814	LKWH	383						GN	17-Aug-07	PLGN-69	Patch Lake		M		
815	CISC	337						GN	17-Aug-07	PLGN-69	Patch Lake		M		
816	LKWH	504						GN	17-Aug-07	PLGN-70	Patch Lake		C		
817	LSCS	204						GN	17-Aug-07	PLGN-70	Patch Lake		C		
818	LKWH	411						GN	17-Aug-07	PLGN-71	Patch Lake		C		
819	LKWH	378						GN	17-Aug-07	PLGN-71	Patch Lake		C		
820	LKWH	432						GN	17-Aug-07	PLGN-71	Patch Lake		M		
821	LKWH	367						GN	17-Aug-07	PLGN-71	Patch Lake		C		
822	LKWH	434						GN	17-Aug-07	PLGN-71	Patch Lake		C		
823	LKWH	335						GN	17-Aug-07	PLGN-71	Patch Lake		M		
824	LKWH	394						GN	17-Aug-07	PLGN-71	Patch Lake		C		
825	LKWH	390						GN	17-Aug-07	PLGN-71	Patch Lake		C		
826	LKTR						985120031600310	GN	18-Aug-07	PLGN-72	Patch Lake		R		
827	LKTR	850					985153000021296	GN	18-Aug-07	PLGN-72	Patch Lake		C		
828	LKTR	660					985153000021269	GN	18-Aug-07	PLGN-72	Patch Lake		C		
829	LKTR	704					985153000021250	GN	18-Aug-07	PLGN-72	Patch Lake		C		
830	LKTR	721					985153000021214	GN	18-Aug-07	PLGN-72	Patch Lake		C		
831	LKTR	597					985153000021210	GN	18-Aug-07	PLGN-72	Patch Lake		C		
832	LKTR	681					985153000021298	GN	18-Aug-07	PLGN-72	Patch Lake		C		
833	LKWH	615						GN	18-Aug-07	PLGN-72	Patch Lake		C		
834	LKWH	436						GN	18-Aug-07	PLGN-72	Patch Lake		C		
835	LKWH	410						GN	18-Aug-07	PLGN-72	Patch Lake		C		
836	LKWH	400						GN	18-Aug-07	PLGN-72	Patch Lake		M		
837	LKWH	374						GN	18-Aug-07	PLGN-72	Patch Lake		M		
838	LKWH	383						GN	18-Aug-07	PLGN-72	Patch Lake		M		
839	LKWH	371						GN	18-Aug-07	PLGN-72	Patch Lake		M		
840	LKWH	446						GN	18-Aug-07	PLGN-72	Patch Lake		M		
841	LKWH	415						GN	18-Aug-07	PLGN-72	Patch Lake		M		
842	LKWH	383						GN	18-Aug-07	PLGN-72	Patch Lake		M		
843	LKTR	630					985153000021202	GN	18-Aug-07	PLGN-73	Patch Lake		C		
844	CISC	243						GN	18-Aug-07	PLGN-73	Patch Lake		C		
845	LKWH	424						GN	18-Aug-07	PLGN-73	Patch Lake		M		
846	LKTR						985120031562875	GN	18-Aug-07	PLGN-74	Patch Lake		R		
847	LKTR						985120031587749	GN	18-Aug-07	PLGN-74	Patch Lake		R		
848	LKTR	630					985153000021274	GN	18-Aug-07	PLGN-74	Patch Lake		R		
849	LKTR	610					985153000021232	GN	18-Aug-07	PLGN-74	Patch Lake		C		
850	LKTR	611						GN	18-Aug-07	PLGN-74	Patch Lake		C		
851	LSCS	205						GN	18-Aug-07	PLGN-74	Patch Lake		C		
852	LSCS	225						GN	18-Aug-07	PLGN-74	Patch Lake		C		
853	LKTR	309					985153000021282	GN	18-Aug-07	PLGN-75	Patch Lake		C		
854	LKWH	374						GN	19-Aug-07	PLGN-76	Patch Lake		C		
855	LKWH	372						GN	19-Aug-07	PLGN-76	Patch Lake		C		
856	CISC	259						GN	19-Aug-07	PLGN-76	Patch Lake		C		
857	CISC	450						GN	19-Aug-07	PLGN-76	Patch Lake		C		
858	LSCS	219						GN	19-Aug-07	PLGN-76	Patch Lake		C		
859	LKWH	395						GN	19-Aug-07	PLGN-77	Patch Lake		C		
860	LKWH	428						GN	19-Aug-07	PLGN-78	Patch Lake		C		
861	LKTR	635					985153000021255	GN	19-Aug-07	PLGN-78	Patch Lake		C		
862	LKTR	815					985153000021283	GN	19-Aug-07	PLGN-78	Patch Lake		C		
863	LKTR	734					985153000021230	GN	19-Aug-07	PLGN-78	Patch Lake		C		
864	LKWH	534						GN	19-Aug-07	PLGN-79	Patch Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
865	LKTR	810					985153000021257	GN	19-Aug-07	PLGN-79	Patch Lake		C		
866	LKWH	377						GN	19-Aug-07	PLGN-79	Patch Lake		C		
867	LKWH	366						GN	19-Aug-07	PLGN-79	Patch Lake		C		
868	LKWH	333						GN	19-Aug-07	PLGN-79	Patch Lake		M		
869	LKWH	355						GN	19-Aug-07	PLGN-79	Patch Lake		C		
870	CISC	289						GN	19-Aug-07	PLGN-79	Patch Lake		C		
871	CISC	239						GN	19-Aug-07	PLGN-79	Patch Lake		C		
872	CISC	275						GN	19-Aug-07	PLGN-79	Patch Lake		C		
873	CISC	254						GN	19-Aug-07	PLGN-79	Patch Lake		M		
874	LKTR	372						GN	19-Aug-07	PLGN-80	Patch Lake		C		
875	LKTR	670					985153000021261	GN	19-Aug-07	PLGN-80	Patch Lake		C		
876	LKTR	620					985153000021299	GN	19-Aug-07	PLGN-80	Patch Lake		C		
877	LKTR	528					985153000021235	GN	19-Aug-07	PLGN-80	Patch Lake		C		
878	LKTR	610					985153000021264	GN	19-Aug-07	PLGN-81	Patch Lake		C		
879	LKTR	372						GN	19-Aug-07	PLGN-81	Patch Lake		C		
880	LKWH	379						GN	19-Aug-07	PLGN-81	Patch Lake		M		
881	LKWH	354						GN	19-Aug-07	PLGN-82	Patch Lake		C		
882	LKWH	355						GN	19-Aug-07	PLGN-82	Patch Lake		C		
883	LKWH	440						GN	19-Aug-07	PLGN-82	Patch Lake		M		
884	LKTR	482					985153000021270	GN	19-Aug-07	PLGN-83	Patch Lake		C		
885	LSCS	253						GN	19-Aug-07	PLGN-83	Patch Lake		C		
886	LKTR	379						GN	22-Aug-07	GLGN-H7	Glenn Lake		M		Kept for Heidi
887	LKTR	340	360	0.92				GN	22-Aug-07	GLGN-H7	Glenn Lake		M		Kept for Heidi
888	LKTR	350	455	1.06				GN	22-Aug-07	GLGN-H7	Glenn Lake		M		Kept for Heidi
889	LKTR	295	235	0.92				GN	22-Aug-07	GLGN-H7	Glenn Lake		M		Kept for Heidi
890	LKTR	640	2690	1.03				GN	22-Aug-07	GLGN-H8	Glenn Lake		M		Kept for Heidi
891	LKTR	212	90	0.94				GN	22-Aug-07	GLGN-H8	Glenn Lake		M		Kept for Heidi
892	LKTR	155	40	1.07				GN	22-Aug-07	GLGN-H8	Glenn Lake		M		Kept for Heidi
432	CISC							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
433	LKTR							GN	6-Aug-07	GLGN-H4	Glenn Lake		C		
437	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
438	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
439	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
440	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
441	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
442	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
443	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
444	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
445	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
446	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
447	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
448	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
449	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
450	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
451	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
452	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
453	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
454	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
455	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
456	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
457	CISC							GN	7-Aug-07	GLGN-H5	Glenn Lake		C		
458	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
459	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
460	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
461	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
462	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
463	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
464	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
465	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
466	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
467	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
468	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
469	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
470	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
471	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
472	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
473	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
474	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
475	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
476	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
477	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
478	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
479	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
480	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
481	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
482	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
483	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
484	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
485	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
486	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
487	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
488	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
489	CISC							GN	7-Aug-07	GLGN-H6	Glenn Lake		C		
893	ARCH							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
894	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
895	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
896	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
897	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
953	LKTR	696	4285	1.27				GN	23-Aug-07	GLGN-H10	Glenn Lake		M		Kept for Heidi
954	LKTR	750	4753	1.13				GN	23-Aug-07	GLGN-H11	Glenn Lake		M		Kept for Heidi
955	LKTR	670						GN	23-Aug-07	GLGN-H12	Glenn Lake		M		Kept for Heidi
956	LKTR	550	1590	0.96				GN	23-Aug-07	GLGN-H12	Glenn Lake		M		Kept for Heidi
957	LKTR	680	3040	0.97				GN	23-Aug-07	GLGN-H12	Glenn Lake		M		Kept for Heidi
958	LKTR	572	2240	1.20				GN	23-Aug-07	GLGN-H12	Glenn Lake		M		Kept for Heidi
959	LKTR	455	980	1.04				GN	23-Aug-07	GLGN-H12	Glenn Lake		M		Kept for Heidi
960	LKTR	432	775	0.96				GN	23-Aug-07	GLGN-H11	Glenn Lake		M		Kept for Heidi
961	LKTR	355	430	0.96				GN	23-Aug-07	GLGN-H11	Glenn Lake		M		Kept for Heidi
962	LKTR	330	335	0.93				GN	23-Aug-07	GLGN-H11	Glenn Lake		M		Kept for Heidi
963	LKTR	261	160	0.90				GN	23-Aug-07	GLGN-H11	Glenn Lake		M		Kept for Heidi
964	LKTR	265	170	0.91				GN	23-Aug-07	GLGN-H11	Glenn Lake		M		Kept for Heidi
965	LKTR	188	55	0.83				GN	23-Aug-07	GLGN-H12	Glenn Lake		M		Kept for Heidi
898	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
899	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
900	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
901	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
902	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
903	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
904	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
905	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
906	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
907	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
908	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
909	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
910	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
911	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
912	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
913	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
914	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
915	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
916	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
917	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
918	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
919	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
920	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
921	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
922	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
923	CISC							GN	22-Aug-07	GLGN-H7	Glenn Lake		C		
924	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
925	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
926	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
927	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
928	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
929	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
930	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
931	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
932	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
933	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
934	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
935	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
936	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
937	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
938	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
939	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
940	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
941	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
942	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
943	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
944	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
945	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
946	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
947	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
948	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
949	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
950	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
951	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
952	CISC							GN	22-Aug-07	GLGN-H8	Glenn Lake		C		
966	CISC							GN	23-Aug-07	GLGN-H9	Glenn Lake		C		
967	CISC							GN	23-Aug-07	GLGN-H9	Glenn Lake		C		
968	CISC							GN	23-Aug-07	GLGN-H9	Glenn Lake		C		
969	CISC							GN	23-Aug-07	GLGN-H9	Glenn Lake		C		
970	CISC							GN	23-Aug-07	GLGN-H9	Glenn Lake		C		
971	CISC							GN	23-Aug-07	GLGN-H9	Glenn Lake		C		
972	CISC							GN	23-Aug-07	GLGN-H9	Glenn Lake		C		
973	CISC							GN	23-Aug-07	GLGN-H9	Glenn Lake		C		
974	CISC							GN	23-Aug-07	GLGN-H9	Glenn Lake		C		
975	CISC							GN	23-Aug-07	GLGN-H9	Glenn Lake		C		
976	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
977	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
978	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
979	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
980	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
981	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
982	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
983	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
984	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
985	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
986	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
987	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
988	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
989	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
990	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
991	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
992	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
993	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
994	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
995	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
996	CISC							GN	23-Aug-07	GLGN-H10	Glenn Lake		C		
997	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
998	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
999	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1000	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1001	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1002	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1003	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1004	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1005	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1006	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1007	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1008	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1009	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1010	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
1011	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1012	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1013	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1014	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1015	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1016	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1017	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1018	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1019	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1020	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1021	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1022	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1023	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1024	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1025	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1026	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1027	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1028	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1029	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1030	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1031	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1032	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1033	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1034	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1035	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1036	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1037	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1038	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1039	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1040	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1041	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1042	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1043	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1044	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1045	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1046	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1047	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1048	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1049	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1050	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1051	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1052	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1053	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1054	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1055	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1056	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1057	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1058	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1059	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1060	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1061	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1117	LKTR						985153000021257	GN	28-Aug-07	PLGN-84	Patch Lake		R		
1118	CISC	275	200	0.96				GN	28-Aug-07	PLGN-84	Patch Lake		C		
1119	LKWH	414	600	0.85				GN	28-Aug-07	PLGN-84	Patch Lake		C		
1120	LKWH	354						GN	28-Aug-07	PLGN-84	Patch Lake		C		
1121	LKWH	396	600	0.97				GN	28-Aug-07	PLGN-84	Patch Lake		C		
1122	LKWH	371	500	0.98				GN	28-Aug-07	PLGN-84	Patch Lake		C		
1123	CISC	233	100	0.79				GN	28-Aug-07	PLGN-85	Patch Lake		C		
1124	LKTR						985120031573454	GN	28-Aug-07	PLGN-87	Patch Lake		R		
1125	LKTR	516	1400	1.02			985153000021288	GN	28-Aug-07	PLGN-89	Patch Lake		C		
1126	LKTR	670	4300	1.43			985120031620053	GN	28-Aug-07	PLGN-92	Patch Lake		C		
1127	LKWH	468						GN	28-Aug-07	PLGN-92	Patch Lake		C		
1128	LKTR	375						GN	28-Aug-07	PLGN-92	Patch Lake		C		
1129	LKTR	513	1300	0.96				GN	28-Aug-07	PLGN-96	Patch Lake		C		
1130	LSCS	66						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1131	LSCS	74						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1132	LSCS	44						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
1133	LSCS	75						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1134	LSCS	43						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1135	LSCS	48						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1136	LSCS	63						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1137	LSCS	54						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1138	LSCS	61						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1139	LSCS	64						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1140	LSCS	56						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1141	LSCS	64						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1142	LSCS	65						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1143	LSCS	63						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1144	LSCS	58						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1145	LSCS	66						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1146	LSCS	62						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1147	LSCS	59						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1148	LSCS	62						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1149	LSCS	78						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1150	LSCS	64						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1151	LSCS	53						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1152	LSCS	66						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1153	NNST	26						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1154	LSCS	71						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1155	LSCS	66						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1156	LSCS	72						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1157	LSCS	61						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1158	LSCS	66						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1159	LSCS	62						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1160	LSCS	64						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1161	LSCS	66						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1162	LSCS	61						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1163	LSCS	62						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1164	LSCS	66						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1165	LSCS	65						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1166	LSCS	68						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1167	LSCS	64						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1168	LSCS	61						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1169	LSCS	63						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1170	LSCS	61						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1171	LSCS	62						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1172	LSCS	60						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1173	LSCS	75						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1174	LSCS	72						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1175	LSCS	59						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1176	LSCS	71						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1177	LSCS	67						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1178	LSCS	64						BS	31-Aug-07	WLSN-01	Wolverine Lake		C		
1062	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1063	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1064	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1065	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1066	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1067	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1068	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1069	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1070	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1071	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1072	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1073	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1074	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1075	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1076	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1077	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1078	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1079	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1080	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1081	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1082	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		

Appendix E1. Data for Individual Fish Captured in the Boston and Madrid Project area, 2006 - 2007

Sample	Species	Fork Length (mm)	Weight (g)	Condition Factor	Floy Tag Colour	Floy Tag Number	PIT Tag No.	Capture Method	Date	Site	Location	Ageing Structures	Capture Code	Tag year	Comments
1083	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1084	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1085	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1086	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1087	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1088	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1089	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1090	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1091	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1092	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1093	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1094	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1095	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1096	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1097	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1098	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1099	CISC							GN	23-Aug-07	GLGN-H11	Glenn Lake		C		
1100	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1101	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1102	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1103	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1104	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1105	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1106	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1107	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1108	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1109	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1110	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1111	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1112	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1113	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1114	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1115	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		
1116	CISC							GN	23-Aug-07	GLGN-H12	Glenn Lake		C		

CODES:

Method:

BS	Beach Seine
EF	Backpack Electrofishing
FN	Fyke Net
MT	Minnow Trap
DN	Dip Net
AN	Angling

Species:

ARCH	Arctic char	BURB	Burbot
ARFL	Arctic flounder	ARGR	Arctic Grayling
CISC	Cisco	BRWH	Broad Whitefish
FHSC	Fourhorn sculpin	SFCD	Saffron cod
LKTR	Lake trout	GRCD	Greenland Cod
LKWH	Lake whitefish	LSCS	Least Cisco
NNST	Ninespine stickleback		
SLSC	Slimy Sculpin		

Sex:

F	Female
M	Male

Capture Codes:

C = First time capture, with live release
R = re-capture, with live release.
M = Mortality
E = Escaped prior to data collection.
O = Observed (associated with sampling activities)

Condition Factor = Weight [in g] X 10^5/ (FL [in mm])^3

Tag Colour: B = Blue G = Green W = White

APPENDIX E2 TO E8

FISHING EFFORT, CAPTURE AND CPUE DATA

Appendix E2. Angling Locations, Effort, Catch and CPUE in the Madrid Area, 2007

Waterbody	Site ID	UTM (13W) NAD83		Date	Effort			Number of Fish Captured / CPUE (fish/h)			
								LKTR		Total	
		Easting	Northing		No. of rods	(h)	Total Effort (h)	n	CPUE	n	CPUE
Patch Lake	PLAF-01	435354	7548063	12-Jul-07	2	0.75	1.5	1	16.0	1	16.0
	PLAF-02	435085	7548889	12-Jul-07	2	0.50	1.0			0	0.0
	PLAF-03	435562	7549220	13-Jul-07	2	4.47	8.9			0	0.0
	PLAF-04	435486	7548787	13-Jul-07	2	0.75	1.5			0	0.0
	PLAF-05	435088	7548897	14-Jul-07	2	1.00	2.0	3	36.0	3	36.0
	PLAF-06	435088	7548897	15-Jul-07	2	1.00	2.0	1	12.0	1	12.0
	PLAF-07	434805	7549414	16-Jul-07	2	0.75	1.5	2	32.0	2	32.0
	PLAF-08	434719	7550901	18-Jul-07	2	0.75	1.5	1	16.0	1	16.0
	PLAF-09	434857	7549708	18-Jul-07	1	0.50	0.5	1	48.0	1	48.0
	Total					**10.47**	**20.4**	**9**	**10.6**	**9**	**10.6**

NOTES:

n = number of captured fish

CPUE = catch per unit effort (fish/24 h)

Appendix E3. Backpack Electrofishing Sampling Locations, Effort, Catch, and CPUE in the Boston and Madrid Project Areas, 2006 and 2007

Waterbody	Site ID	Date	Start UTM (13W) NAD 83		End UTM (13W) NAD 83		Effort		Number of Fish Captured/CPUE (fish/100s)																			
									ARCH		ARFL		ARGR		BURB		CISC		FRSC		LKTR		LKWH		SLSC		NNST		Total	
			Easting	Northing	Easting	Northing	(m)	(s)	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE
Aimaokatalok Lake	SLEF-01	16-Jul-06	440735	7500540			82	273													14	5.1					6	2.2	20.00	7.3
	Total							**273**													**14**	**5.1**					**6**	**2.2**	20.00	**7.3**
Reference Lake	RLEF-01	19-Jul-06	437906	7502461	437879	7502637	180	305																			3	1.0	3.00	1.0
	RLEF-02	19-Jul-06	438038	7504630	437956	7504736	130	609									1	0.2									7	1.1	8.00	1.3
	Total							**914**									**1**	**0.1**									**10**	**1.1**	11.00	**1.2**
Aimaokatalok River	AREF-01	16-Jul-06	441104	7499729	441208	7499485	264	958													9	0.9					15	1.6	24.00	2.5
	Total							**958**													**9**	**0.9**					**15**	**1.6**	24.00	**2.5**
Fickle Duck Inflow	FIEF-01	18-Jul-06	442700	7502297	442579	7501872	450	459																			8	1.7	8.00	1.7
	Total							**459**																			**8**	**1.7**	8.00	**1.7**
Fickle Duck Outflow	FOEF-01	18-Jul-06	442474	7503713	442361	7504069	374	409							1	0.2					1	0.2					7	1.7	9.00	2.2
	Total							**409**							**1**	**0.2**					**1**	**0.2**					**7**	**1.7**	9.00	**2.2**
Koignuk River	KREF-01	19-Jul-06	437359	7512181	437392	7512120	69	380																	3	0.8	4	1.1	7.00	1.8
	KREF-02	20-Jul-06	435573	7521246	435514	7521280	132	798					11	1.4	2	0.3					1	0.1					10	1.3	24.00	3.0
	KNBP-01	8-Jul-07	431517	7545695	431459	7545664	89	446					2	0.4													2	0.4	4.00	0.9
	KNBP-02	8-Jul-07	429479	7555080				392			6	1.5							1	0.3			6	1.5			13	3.3	26.00	6.6
	Total							**2016**			**6**	**0.3**	**13**	**0.6**	**2**	**0.1**			**1**	**0.0**	**1**	**0.0**	**6**	**0.3**	**3**	**0.1**	**29**	**1.4**	61.00	**3.0**
Stickleback Outflow	SOEF-01	17-Jul-06	441938	7504310	442282	7504224	479	800																	1	0.1	24	3.0	25.00	3.1
	Total							**800**																	**1**	**0.1**	**24**	**3.0**	25.00	**3.1**
Glenn Lake	GLBP-H1	6-Aug-07						311	2	0.6											6	1.9							8.00	2.6
	GLBP-H2	7-Aug-07						258																						
	GLBP-H3	7-Aug-07						150	1	0.7											2	1.3							3.00	2.0
	Total							**719**	**3**	**0.4**											**8**	**1.1**							11.00	**1.5**
Ogama Lake	OLEF-01	4-Aug-06	435646	7555102	435644	7555105	125	505															1	0.2			1	0.2	2.00	0.4
	OLEF-02	5-Aug-06	435830	7554354	435819	7554173	175	572																						
	OLEF-03	5-Aug-06	436559	7553393	436562	7553280	150	439																						
	Total							**1516**															**1**	**0.1**			**1**	**0.1**	2.00	**0.1**
Patch Lake	PLEF-01	25-Jul-06	436231	7549022			100	343													1	0.3					1	0.3	2.00	0.6
	PLEF-02	27-Jul-06	435904	7549173	436097	7549181	200	889																						
	Total							**1232**													**1**	**0.1**					**1**	**0.1**	2.00	**0.2**
P.O. Inflow Lake	POILEF-01	6-Aug-06	435677	7536218	436158	7551053	180	637																			50	7.8	50.00	7.8
	POILEF-02	6-Aug-06	436080	7550370	436014	7550377	150	479									12	2.5									71	14.8	83.00	17.3
	Total							**1116**									**12**	**1.1**									**121**	**10.8**	133.00	**11.9**
Wolverine Lake	WLEF-01	23-Jul-06	434694	7545256			100	626																			25	4.0	25.00	4.0
	WLEF-02	23-Jul-06	435041	7546124			30	90																			10	11.1	10.00	11.1
	WLEF-03	23-Jul-06	435298	7545459	435140	7545475	160	880																			28	3.2	28.00	3.2
	WLEF-04	23-Jul-06	434342	7545835	434288	7545768	110	720																			11	1.5	11.00	1.5
	Total							**2316**																			**74**	**3.2**	74.00	**3.2**
Ogama Inflow	OIEF-01	4-Aug-06	436601	7553043	436493	7551309	315	778													2	0.3					2	0.3	4.00	0.5
	Total							**778**													**2**	**0.3**					**2**	**0.3**	4.00	**0.5**
Ogama Outflow	OOEF-01	5-Aug-06	435521	7555188	435253	7555385	300	1160													2	0.2					27	2.3	29.00	2.5
	Total							**1160**													**2**	**0.2**					**27**	**2.3**	29.00	**2.5**

NOTES:
n = number of captured fish
CPUE = catch per unit effort (fish/100s)
Total CPUE = total n / total (s) *100

Appendix E4. Beach Seine Sampling Locations, Effort, and CPUE in the Boston and Madrid Project Areas, 2006 and 2007

Waterbody	Site ID.	UTM (13W) NAD83		Date	Effort (m^2)	Number of Fish Captured/CPUE (fish/100 m^2)											
		Easting	Northing			LKTR		LKWH		CISC		LSCS		NNST		Total	
						n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE
Fickle Duck Lake	FLBS-01	442711	7502212	18-Jul-06	180	1	0.6							1	0.6	2	1.1
	Total				**180**	**1**	**0.6**							**1**	**0.6**	**2**	**1.1**
Koignuk River	KRBS-01	437392	7512120	20-Jul-06	450			120	26.7							120	26.7
	KNSN-01	430053	7550873	8-Jul-07	350												
	KNSN-02	430077	7550902	8-Jul-07	280												
	Total				**1080**			**120**	**11.1**							**120**	**11.1**
Ogama Lake	OLBS-01	436622	7551451	6-Aug-06	630			1	0.2							1	0.2
	OLBS-02	436704	7551528	6-Aug-06	560			25	4.5	275	49.1					300	53.6
	Total				**1190**			**26**	**2.2**	**275**	**23.1**					**301**	**25.3**
P.O. Lake	POLBS-01	436677	7550148	30-Jul-06	200									6	3.0	6	3.0
	POLBS-02	436887	7548541	30-Jul-06	450												
	POLBS-03	436876	7548557	30-Jul-06	200												
	Total				**850**									**6**	**0.7**	**6**	**0.7**
P.O. Connector Lake	POCLBS-01	436723	7550215	2-Aug-06	210												
	POCLBS-02	436764	7550216	2-Aug-06	240	1	0.4									1	0.4
	Total				**450**	**1**	**0.2**									**1**	**0.2**
PO Inflow Lake	POINLBS-01	436091	7550606	6-Aug-06	80					200	250.0			300	375.0	500	625.0
	Total				**80**					**200**	**250.0**			**300**	**375.0**	**500**	**625.0**
Wolverine Lake	WLBS-01	434666	7546853	7-Aug-06	350							1900	542.9	102	29.1	2002	572.0
	WLBS-02	435030	7546104	7-Aug-06	400									4	1.0	4	1.0
	WLBS-03	435002	7546207	7-Aug-06	460									6	1.3	6	1.3
	WLBS-04	435226	7545412	7-Aug-06	210									15	7.1	15	7.1
	WLBS-05	435100	7545346	7-Aug-06	150							35	23.3	37	24.7	72	48.0
	WLBS-06	434684	7546637	7-Aug-06	160							1960	1225.0	43	26.9	2003	1251.9
	WLBS-07	434893	7546758	7-Aug-06	800									5	0.6	5	0.6
	WLSN-01	434654	7546314	31-Aug-07	1584							102	6.4	2	0.1	104	6.6
	Total				**4114**							**3997**	**97.2**	**214**	**5.2**	**4211**	**102.4**
Patch Outflow	POBS-01	436347	7548742	27-Jul-06	450												
	POBS-02	436347	7548742	27-Jul-06	90												
	POBS-03	435967	7549173	27-Jul-06	90												
	Total				**630**												
P.O. Outflow	POOTBS-01	436641	7550178	30-Jul-06	180									6	3.3	6	3.3
	Total				**180**									**6**	**3.3**	**6**	**3.3**

NOTES:

n = number of captured fish

CPUE = catch per unit effort

Total CPUE = total n / effort

Appendix E5. Location, Effort, Catch, and CPUE Data for Fyke Nets in the Boston and Madrid Project Areas, 2006 and 2007

Water-body	Site ID	UTM (13W) NAD83		Set Date	Set Time	Pull Date	Pull Time	Set Period (h)	Number of Fish Captured/CPUE (fish/24 h)									
									CISC		LKTR		LKWH		NNST		Total	
		Easting	Northing						n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE
Aimaokatalok Lake	SLFN-01	441110	7499753	16-Jul-06	13:31	17-Jul-06	11:16	21.75			2	2.21			93	102.62	95	104.83
	SLFN-02	441554	7505990	18-Jul-06	18:16	19-Jul-06	18:38	24.25	2	1.98					7	6.93	9	8.91
	Total							**46**	**2**	**1.04**	**2**	**1.04**			**100**	**52.17**	**104**	**54.26**
Patch Lake	PLFN-01	436214	7548996	26-Jul-06	13:35	29-Jul-06	16:00	74.4	1	0.32	10	3.23	4	1.29			15	4.84
	PLFT-01	436229	7549020	14-Jul-07	15:22	15-Jul-07	14:00	22.6			7	7.42					7	7.42
	PLFT-01	436229	7549020	15-Jul-07	14:00	16-Jul-07	14:00	24.0	1	1.00							1	1.00
	PLFT-01	436229	7549020	16-Jul-07	14:00	17-Jul-07	15:00	25.0			8	7.68	7	6.72			15	14.40
	PLFT-01	436229	7549020	17-Jul-07	15:00	18-Jul-07	10:00	19.0			2	2.53					2	2.53
	PLFT-02	436234	7549026	13-Aug-07	8:50	14-Aug-07	9:00	24.2										
	PLFT-02	436234	7549026	14-Aug-07	9:00	15-Aug-07	10:40	25.7										
	Total							**214.9**	**2**	**0.22**	**27**	**3.02**	**11**	**1.23**			**40**	**4.47**
P.O. Lake	POLFN-01	436676	7550158	30-Jul-06	10:30	31-Jul-06	10:30	24	1	1.00	9	9.00					10	10.00
	Total							**24**	**1**	**1.00**	**9**	**9.00**					**10**	**10.00**
P.O. Connector Lake	POCLFN-01	436603	7550627	31-Jul-06	14:19	1-Aug-06	15:36	25.25					1	0.95	27	25.66	28	26.61
	Total							**25.25**					**1**	**0.95**	**27**	**25.66**	**28**	**26.61**
Ogama Inflow	OLFN-01	436477	7551422	2-Aug-06	14:00	4-Aug-06	8:30	42.5			12	6.78	5	2.82	3	1.69	20	11.29
	Total							**42.5**			**12**	**6.78**	**5**	**2.82**	**3**	**1.69**	**20**	**11.29**
Ogama Outflow	OLFN-02	435581	7555193	4-Aug-06	10:28	5-Aug-06	8:43	22.25			2	2.16	4	4.31	3	3.24	9	9.71
	OLFN-03	435581	7555193	5-Aug-06	8:43	6-Aug-06	8:40	24	1	1.00	3	3.00			180	180.00	184	184.00
	Total							**46.25**	**1**	**0.52**	**5**	**2.59**	**4**	**2.08**	**183**	**94.96**	**193**	**100.15**

NOTES:

n = number of captured fish

CPUE = catch per unit effort

Total CPUE = total n / total (h) *24

Appendix E6. Gill Net Locations, Effort, Catch, and CPUE in the Boston and Madrid Project Areas, 2006 and 2007

Water-body	Site ID	Set No.	UTM (13W) NAD83		Set Date	Set Time	Pull Date	Pull Time	Water Depth (m) min	Water Depth (m) max	Set Period (h)	Net Area (m^2)	No. Panels	Net Units[a]	Mesh Sizes (cm)	ARCH		CISC		LKTR		LKWH		LSCS		NNST		Total	
			Easting	Northing												n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE
Aimaokatalok Lake	SLGN	1	442497	7498530	7/16/2006	16:40	7/16/2006	18:06	2.5	2.5	1.4	27.36	2	0.03	3.8, 6.4					1	30.6							1	30.6
	Total										**1.4**			**0.03**						**1**	**30.6**							**1**	**30.6**
Fickle Duck Lake	FLGN-01	1	442592	7503539	7/18/2006	10:09	7/18/2006	16:05	2.1	2.1	5.9	27.36	2	0.14	3.8, 6.4					2	14.784							2	14.784
	FLGN-02	2	442700	7502297	7/18/2006	11:00	7/18/2006	16:32	1.9	2.4	5.5	37.1	2	0.17	1.9, 2.5														
	Total										**11.5**			**0.3**						**2**	**6.5284**							**2**	**6.5284**
Reference Lake	RLGN-01	1	437911	7503912	7/19/2006	10:12	7/19/2006	12:40	3	3	2.5	27.36	2	0.06	3.8, 6.4					1	17.781							1	17.781
	RLGN-02	2	437909	7503630	7/19/2006	10:34	7/19/2006	12:54	2.7	3.1	2.3	37.1	2	0.07	1.9, 2.5														
	Total										**4.8**			**0.13**						**1**	**7.7894**							**1**	**7.7894**
Stickleback Lake	SLGN-01	1	441972	7504014	7/17/2006	12:56	7/18/2006	8:40	2.6	2.6	19.7	27.36	2	0.45	3.8, 6.4														
	SLGN-02	2	441977	7502994	7/17/2006	14:27	7/17/2006	17:30	8.6	8.6	3.0	37.1	1	0.05	2.5														
	Total										**22.8**			**0.50**														
Koignuk River	KRGN-01	1	437442	7512010	7/19/2006	16:16	7/19/2006	17:06	3.5	3.5	0.8	27.36	2	0.02	3.8, 6.4							2	105.26					2	105.26
	KRGN-02	1	437392	7512120	7/20/2006	10:17	7/20/2006	11:15	3.1	3.4	1.0	27.36	2	0.02	3.8, 6.4							3	136.12					3	136.12
	KNGN-01	1	430874	7547645	7/8/2007	11:30	7/8/2007	12:30			1.0	27.36	3	0.03															
	KNGN-02	1	429373	7554957	7/8/2007	13:45	7/8/2007	15:00			1.3	27.36	3	0.04		1	23.4											1	23.4
	Total										**4.1**			**0.12**		**1**	**8.5**					**5**	**42.4**					**6**	**50.9**
Glenn Lake	GLGN-H1	1	429925	7560756	8/6/2007	11:05	8/6/2007	12:30	5.7	16.7	1.4	27.36	3	0.05				10	206.4	3	61.9							13	268.3
	GLGN-H2	1	430108	7561346	8/6/2007	11:15	8/6/2007	12:45	3.5	12.7	1.5	27.36	3	0.05				46	896.7	4	78.0							50	974.7
	GLGN-H3	1	430340	7559241	8/6/2007	13:30	8/6/2007	15:30	3.5	4.9	2.0	27.36	3	0.07				40	584.8	4	58.5							44	643.3
	GLGN-H4	1	430343	7559549	8/6/2007	13:40	8/6/2007	15:45	2.5	3.6	2.1	27.36	3	0.07				25	350.9	1	14.0	1	14.0					27	378.9
	GLGN-H5	1			8/7/2007	13:50	8/7/2007	15:00	4.1	5.5	1.2	27.36	3	0.04				21	526.3									21	526.3
	GLGN-H6	1	434932	7548877	8/7/2007	14:06	8/7/2007	15:20	4.1	4.7	1.2	27.36	3	0.04				32	758.7			1	23.7					33	782.4
	GLGN-H7	1	430370	7559526	8/22/2007	13:00	8/22/2007	15:15			2.3	27.36	3	0.08		1	13.0	30	389.9	4	52.0							35	454.8
	GLGN-H8	1	430383	7559467	8/22/2007	13:10	8/22/2007	15:30			2.3	27.36	3	0.08				29	363.4	3	37.6							32	401.0
	GLGN-H9	1	430348	7560772	8/23/2007	9:35	8/23/2007	11:40			2.1	27.36	3	0.07				10	140.4									10	140.4
	GLGN-H10	1	430300	7558535	8/23/2007	9:45	8/23/2007	11:25			1.7	27.36	3	0.06				21	368.4	1	17.5							22	386.0
	GLGN-H11	1	430375	7559520	8/23/2007	11:50	8/23/2007	14:05			2.3	27.36	3	0.08				46	597.8	2	26.0							48	623.8
	GLGN-H11	2	430375	7559520	8/23/2007	14:20	8/23/2007	15:50			1.5	27.36	3	0.05				31	604.3	5	97.5							36	701.8
	GLGN-H12	1	434468	7550535	8/23/2007	12:00	8/23/2007	14:40			2.7	27.36	3	0.09				26	285.1	5	54.8							31	339.9
	GLGN-H12	2	434468	7550535	8/23/2007	14:30	8/23/2007	16:00			1.5	27.36	3	0.05				17	331.4	1	19.5							18	350.9
	Total										**25.7**			**0.88**		**1**	**1.1**	**384**	**437.7**	**33**	**37.6**	**2**	**2.3**					**420**	**478.8**
Ogama Lake	OLGN-01	1	436137	7554001	8/4/2006	14:43	8/4/2006	16:20	3	3	1.6	27.36	2	0.04	3.8, 6.4			21	569.72	2	54.259	10	271.3					33	895.28
	OLGN-02	2	436040	7554238	8/4/2006	14:52	8/4/2006	15:57	3.5	5	1.1	37.1	2	0.03	1.9, 2.5			4	119.43									4	119.43
	Total										**2.7**			**0.07**				**25**	**355.35**	**2**	**28.428**	**10**	**142.14**					**37**	**525.92**
Patch Lake	PLGN-01	1	434951	7548951	7/25/2006	12:34	7/25/2006	16:31	3	3	4.0	27.36	2	0.09	3.8, 6.4					6	66.622	5	55.519					11	122.14
	PLGN-02	1	435348	7549128	7/25/2006	12:52	7/25/2006	16:45	4.2	5.9	3.9	37.1	2	0.12	1.9, 2.5														
	PLGN-03	1	435728	7547971	7/26/2006	14:18	7/26/2006	16:09	2.9	4	1.9	27.36	2	0.04	3.8, 6.4			4	94.832	2	47.416	2	47.416					8	189.66
	PLGN-04	1	435984	7547424	7/26/2006	14:29	7/26/2006	15:44	4	7.7	1.2	37.1	2	0.04	1.9, 2.5			15	388.14									15	388.14
	PLGN-05	1	435909	7549046	7/27/2006	12:47	7/27/2006	15:10	2.8	2.8	2.4	27.36	2	0.05	3.8, 6.4			8	147.22			9	165.62					17	312.85
	PLGN-06	1	436093	7548989	7/27/2006	12:58	7/27/2006	15:20	2.6	2.6	2.4	37.1	2	0.07	1.9, 2.5														
	PLGN-07	1	434811	7550587	7/28/2006	9:27	7/28/2006	11:41	4.7	5.8	2.2	27.36	2	0.05	3.8, 6.4			1	19.639	1	19.639	6	117.83					8	157.11
	PLGN-08	1	434257	7551285	7/28/2006	10:14	7/28/2006	12:56	3	3	2.7	37.1	2	0.08	1.9, 2.5					2	23.959	1	11.98					3	35.939
	PLGN-09	1	434511	7550275	7/28/2006	13:15	7/28/2006	14:30	3.5	3.5	1.2	27.36	2	0.03	3.8, 6.4			1	35.088	2	70.175	2	70.175					5	175.44
	PLGN-10	1	434567	7550204	7/28/2006	13:25	7/28/2006	14:45	4	4	1.3	37.1	2	0.04	1.9, 2.5														
	PLGN-11	1	434898	7548926	7/28/2006	14:59	7/28/2006	15:50	3	3	0.8	27.36	2	0.02	3.8, 6.4			8	412.8	2	103.2	8	412.8					18	928.79
	PLGN-12	1	435020	7548802	7/28/2006	15:09	7/28/2006	15:35	3	3	0.4	37.1	2	0.01	1.9, 2.5			3	223.93	3	223.93	1	74.642					7	522.5
	PLGN-01	1	435225	7547042	7/9/2007	9:34	7/9/2007	10:30	2.4	3.0	1.9	27.36	2	0.04	3.8,5.1														
	PLGN-02	1	435374	7546579	7/9/2007	10:23	7/9/2007	12:45	2.9	3.4	3.3	27.36	2	0.08	2.5,5.1					1	13.3							1	13.3
	PLGN-03	1	435340	7547183	7/9/2007	10:43	7/9/2007	11:15	3.9	4.6	1.5	27.36	2	0.03	3.8,5.1														
	PLGN-04	1	435485	7546463	7/9/2007	11:34	7/9/2007	13:30	2.9	3.6	2.9	27.36	2	0.07	3.8,5.1														
	PLGN-05	1	435264	7547886	7/9/2007	13:18	7/9/2007	15:34	5.9	7.0	3.2	27.36	3	0.11	2.5,5.1,6.4														
	PLGN-06	1	435854	7547621	7/9/2007	14:04	7/9/2007	15:12	7.0	13.9	2.1	27.36	3	0.07	2.5,3.8,5.1														
	PLGN-07	1	435289	7547055	7/10/2007	8:58	7/10/2007	15:45	3.1	3.4	6.8	27.36	3	0.23	2.5,5.1,6.4					1	4.3							1	4.3
	PLGN-08	1	435401	7547115	7/10/2007	9:05	7/10/2007	15:49	4.1	5.6	6.7	27.36	3	0.23	2.5,3.8,5.1														
	PLGN-09	1	435414	7546616	7/10/2007	10:25	7/10/2007	12:36	2.8	3.3	2.2	27.36	3	0.07	2.5,5.1,6.4														
	PLGN-10	1	435825	7546536	7/10/2007	10:30	7/10/2007	12:28	2.6	2.8	2.0	27.36	3	0.07	2.5,5.1,6.4														
	PLGN-11	1	435379	7548039	7/10/2007	12:44	7/10/2007	15:40	4.1	5.0	2.9	27.36	3	0.10	2.5,5.1,6.4					3	29.9			3	29.9			6	59.8
	PLGN-12	1	435557	7548125	7/10/2007	12:51	7/10/2007	15:44	5.0	10.3	2.9	27.36	3	0.10	2.5,5.1,6.4					2	20.3							2	20.3
	PLGN-13	1	435352	7548137	7/11/2007	8:25	7/11/2007	15:30	2.5	4.7	7.1	27.36	3	0.24	2.5,5.1,6.4					6	24.8	1	4.1	2	8.3			9	37.2
	PLGN-14	1	435593	7548167	7/11/2007	8:30	7/11/2007	15:34	5.7	7.2	7.1	27.36	3	0.24	2.5,3.8,5.1														
	PLGN-15	1	435395	7548445	7/11/2007	8:40	7/11/2007	12:55	2.7	3.0	4.3	27.36	3	0.15	2.5,5.1,6.4					2	13.8							2	13.8
	PLGN-16	1	435421	7548784	7/11/2007	8:45	7/11/2007	15:37	4.8	5.9	6.9	27.36	3	0.23	2.5,5.1,6.4					7	29.8	2	8.5	2	8.5			11	46.8
	PLGN-17	1	435031	7548749	7/11/2007	13:06	7/11/2007	15:20	3.4	5.7	2.2	27.36	3	0.08	2.5,5.1,6.4					3	39.3	14	183.3	3	39.3			20	261.8
	PLGN-18	1	435062	7548796	7/12/2007	8:30	7/12/2007	14:30	3.4	4.4	6.0	27.36	3	0.21	2.5,5.1,6.4					4	19.5			1	4.9			5	24.4
	PLGN-19	1	435604	7548115	7/12/2007	8:38	7/12/2007	14:20	5.3	9.4	5.7	27.36	3	0.19	2.5,3.8,5.1														
	PLGN-20	1	435665	7548451	7/12/2007	8:42	7/12/2007	14:15	3.4	3.5	5.5	27.36	3	0.19	2.5,5.1,6.4					2	10.5							2	10.5
	PLGN-21	1	435379	7548796	7/12/2007	8:49	7/12/2007	14:05	4.4	5.4	5.3	27.36	3	0.18						7	38.9							7	38.9
	PLGN-22	1	435027	7548739	7/13/2007	12:45	7/13/2007	18:41	3.7	4.1	5.9	27.36	3	0.20						1	4.9	1	4.9					2	9.9
	PLGN-23	1	435383	7548798	7/13/2007	12:55	7/13/2007	18:51	3.6	5.2	5.9	27.36	3	0.20	2.5,3.8,5.1					2	9.9			6	29.6			8	39.4

Appendix E6. Gill Net Locations, Effort, Catch, and CPUE in the Boston and Madrid Project Areas, 2006 and 2007

Water-body	Site ID	Set No.	UTM (13W) NAD83		Set Date	Set Time	Pull Date	Pull Time	Water Depth (m) min	Water Depth (m) max	Set Period (h)	Net Area (m^2)	No. Panels	Net Units[a]	Mesh Sizes (cm)	ARCH		CISC		LKTR		LKWH		LSCS		NNST		Total	
			Easting	Northing												n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE
Patch Lake	PLGN-24	1	435418	7549221	7/13/2007	13:48	7/13/2007	18:27	3.0	4.5	4.7	27.36	3	0.16	5.1,6.4,6.4					2	12.6							2	12.6
	PLGN-25	2	435516	7548794	7/13/2007	18:27	7/13/2007	19:12	4.5	4.9	0.8	27.36	3	0.03	3.8,5.1,6.4					1	39.0							1	39.0
	PLGN-26	1	434988	7548879	7/14/2007	9:13	7/14/2007	18:19	3.2	3.4	9.1	27.36	3	0.31	5.1,6.4,6.4					8	25.7							8	25.7
	PLGN-27	1	435404	7548759	7/14/2007	9:20	7/14/2007	19:00	4.4	5.5	9.7	27.36	3	0.33	3.8,5.1,6.4					4	12.1							4	12.1
	PLGN-28	1	434895	7549008	7/14/2007	10:53	7/14/2007	18:15	3.0	3.1	7.4	27.36	3	0.25	3.8,3.8,3.8					6	23.8							6	23.8
	PLGN-29	1	435421	7549204	7/14/2007	10:58	7/14/2007	18:40	3.1	5.7	7.7	27.36	3	0.26	5.1,6.4,6.4					5	19.0	1	3.8					6	22.8
	PLGN-30	1	435515	7549239	7/14/2007	11:04	7/14/2007	18:49	4.1	4.7	7.8	27.36	3	0.27	3.8,5.1,6.4					1	3.8							1	3.8
	PLGN-31	1	434932	7548877	7/15/2007	13:00	7/15/2007	17:29	2.8	2.9	4.5	27.36	3	0.15	5.1,6.4,6.4					3	19.6							3	19.6
	PLGN-32	1	434788	7548939	7/15/2007	13:07	7/15/2007	17:35	4.8	6.7	4.5	27.36	3	0.15	3.8,3.8,3.8														
	PLGN-33	1	434572	7549142	7/15/2007	13:12	7/15/2007	17:49	6.2	10.9	4.6	27.36	3	0.16	3.8,5.1,6.4					1	6.3							1	6.3
	PLGN-34	1	434839	7549350	7/15/2007	13:15	7/15/2007	18:05	6.8	9.7	4.8	27.36	3	0.17	3.8,5.1,6.4					6	36.3							6	36.3
	PLGN-35	1	435394	7549183	7/15/2007	13:30	7/15/2007	18:28	4.0	6.7	5.0	27.36	3	0.17	3.8,5.1,6.4					6	35.3	7	41.2					13	76.5
	PLGN-36	1	434951	7548845	7/16/2007	12:51	7/16/2007	18:15	3.0	3.0	5.4	27.36	3	0.18	5.1,6.4,6.4					9	48.7	1	5.4	9	48.7			19	102.9
	PLGN-37	1	434566	7549225	7/16/2007	12:58	7/16/2007	17:33	8.1	9.2	4.6	27.36	3	0.16	3.8,3.8,3.8									3	19.1			3	19.1
	PLGN-38	1	434777	7549285	7/16/2007	13:07	7/16/2007	17:30	5.8	7.8	4.4	27.36	3	0.15	5.1,6.4,6.4					3	20.0	1	6.7	1	6.7			5	33.4
	PLGN-39	1	434974	7549321	7/16/2007	13:14	7/16/2007	18:09	4.1	4.1	4.9	27.36	3	0.17	3.8,5.1,6.4					9	53.5	6	35.7	2	11.9			17	101.1
	PLGN-40	1	435242	7549397	7/16/2007	13:18	7/16/2007	18:45	3.2	4.7	5.4	27.36	3	0.19	3.8,5.1,6.4					1	5.4			1	5.4			2	10.7
	PLGN-41	1	434593	7549248	7/17/2007	12:50	7/17/2007	18:00	5.9	9.9	5.2	27.36	3	0.18	3.8,3.8,3.8														
	PLGN-42	1	434770	7549318	7/17/2007	13:05	7/17/2007	15:56	6.1	8.3	2.9	27.36	3	0.10	5.1,6.4,6.4					10	102.6	1	10.3	3	30.8			14	143.6
	PLGN-43	1	434961	7549361	7/17/2007	13:10	7/17/2007	17:54	4.2	4.3	4.7	27.36	3	0.16	3.8,5.1,6.4					2	12.4	1	6.2					3	18.5
	PLGN-44	1	435430	7548704	7/17/2007	13:18	7/17/2007	17:31	2.9	3.1	4.2	27.36	3	0.14	5.1,6.4,6.4					2	13.9							2	13.9
	PLGN-45	1	435285	7548621	7/17/2007	13:25	7/17/2007	17:29	2.8	3.0	4.1	27.36	3	0.14	3.8,5.1,6.4														
	PLGN-46	1	434720	7549059	7/17/2007	16:14	7/17/2007	18:12	6.1	7.8	2.0	27.36	3	0.07	5.1,6.4,6.4														
	PLGN-47	1	434128	7549928	7/18/2007	10:23	7/18/2007	17:01	2.9	7.1	6.6	27.36	3	0.23	5.1,6.4,6.4					9	39.7	4	17.6					13	57.3
	PLGN-48	1	434207	7550132	7/18/2007	10:29	7/18/2007	17:15	2.9	5.9	6.8	27.36	3	0.23	5.1,6.4,6.4					7	30.2	9	38.9					16	69.1
	PLGN-49	1	434395	7550411	7/18/2007	10:32	7/18/2007	17:34	3.9	4.8	7.0	27.36	3	0.24	3.8,5.1,6.4					1	4.2							1	4.2
	PLGN-50	1	434468	7550535	7/18/2007	10:36	7/18/2007	17:38	3.4	4.1	7.0	27.36	3	0.24	3.8,3.8,3.8					1	4.2							1	4.2
	PLGN-51	1	434719	7550901	7/18/2007	10:43	7/18/2007	17:45	5.4	6.2	7.0	27.36	3	0.24	3.8,5.1,6.4					7	29.1							7	29.1
	PLGN-52	1	435202	7548730	8/12/2007	9:40	8/12/2007	15:30	2.5	2.9	5.8	27.36	3	0.20	3.8,5.1,6.4			2	10.0	7	35.1	18	90.2					27	135.3
	PLGN-53	1	435058	7548693	8/12/2007	9:50	8/12/2007	16:30	3.0	4.3	6.7	27.36	3	0.23	3.8,5.1,6.4			16	70.2	4	17.5	24	105.3					44	193.0
	PLGN-54	1	434918	7548904	8/13/2007	10:15	8/13/2007	14:15			4.0	27.36	3	0.14	3.8,5.1,6.4			3	21.9	7	51.2	3	21.9					13	95.0
	PLGN-55	1	434666	7548989	8/13/2007	10:20	8/13/2007	15:15			4.9	27.36	3	0.17	3.8,5.1,6.4			6	35.7	14	83.3	2	11.9					22	130.8
	PLGN-56	1	435132	7549329	8/13/2007	10:30	8/13/2007	16:25			5.9	27.36	3	0.20	3.8,5.1,6.4			23	113.7	13	64.2	1	4.9					37	182.9
	PLGN-57	1	435293	7548246	8/14/2007	10:05	8/14/2007	16:00	4.7	5.2	5.9	27.36	3	0.20	3.8,5.1,6.4			29	143.3	2	9.9	3	14.8					34	168.0
	PLGN-58	1	435493	7548085	8/14/2007	10:10	8/14/2007	16:30	2.2	4.3	6.3	27.36	3	0.22	3.8,5.1,6.4			5	23.1	3	13.9	10	46.2					18	83.1
	PLGN-59	1	435629	7548242	8/14/2007	10:15	8/14/2007	17:00	3.7	4.4	6.8	27.36	3	0.23	3.8,5.1,6.4			10	43.3	14	60.6	6	26.0					30	130.0
	PLGN-60	1	435311	7547653	8/15/2007	9:49	15/08/2007	12:30	9.4	9.5	2.7	27.36	3	0.09	3.8,5.1,6.4			2	21.8	2	21.8	2	21.8					6	65.4
	PLGN-61	1	435390	7546733	8/15/2007	10:10	15/08/2007	13:10	5.0	5.0	3.0	27.36	3	0.10	3.8,5.1,6.4			4	39.0			5	48.7					9	87.7
	PLGN-62	1	436068	7547272	8/15/2007	10:25	15/08/2007	13:45	5.6	6.1	3.3	27.36	3	0.11	3.8,5.1,6.4			9	78.9	1	8.8	5	43.9					15	131.6
	PLGN-63	1	435263	7549961	8/17/2007	8:20	17/08/2007	9:40			1.3	27.36	3	0.05	3.8,5.1,6.4			2	43.9			2	43.9					4	87.7
	PLGN-64	1	435223	7549926	8/17/2007	8:25	17/08/2007	9:55			1.5	27.36	3	0.05	3.8,5.1,6.4			2	39.0			1	19.5					3	58.5
	PLGN-65	1	435185	7549889	8/17/2007	8:30	17/08/2007	10:30			2.0	27.36	3	0.07	3.8,5.1,6.4							1	14.6	5	73.1			6	87.7
	PLGN-66	1	434438	7549537	8/17/2007	11:10	17/08/2007	12:45			1.6	27.36	3	0.05	3.8,5.1,6.4			4	73.9	5	92.3	2	36.9	1	18.5			12	221.6
	PLGN-67	1	434498	7549584	8/17/2007	11:15	17/08/2007	13:45			2.5	27.36	3	0.09	3.8,5.1,6.4			10	117.0	7	81.9	2	23.4					19	222.2
	PLGN-68	1	434584	7549164	8/17/2007	11:30	17/08/2007	14:30			3.0	27.36	3	0.10	3.8,5.1,6.4			2	19.5	4	39.0	6	58.5	6	58.5			18	175.4
	PLGN-69	1	435111	7549542	8/17/2007	15:25	17/08/2007	16:35			1.2	27.36	3	0.04	3.8,5.1,6.4			1	25.1	1	25.1	4	100.3					6	150.4
	PLGN-70	1	435048	7549559	8/17/2007	15:30	17/08/2007	17:15			1.7	27.36	3	0.06	3.8,5.1,6.4							1	16.7	1	16.7			2	33.4
	PLGN-71	1	435051	7549495	8/17/2007	15:35	17/08/2007	17:25			1.8	27.36	3	0.06	3.8,5.1,6.4							8	127.6					8	127.6
	PLGN-72	1	435302	7548902	8/18/2007	12:20	18/08/2007	14:50			2.5	27.36	3	0.09	3.8,5.1,6.4					7	81.9	10	117.0					17	198.8
	PLGN-73	1	435273	7548731	8/18/2007	13:10	18/08/2007	15:45			2.6	27.36	3	0.09	3.8,5.1,6.4			1	11.3	1	11.3	1	11.3					3	34.0
	PLGN-74	1	435210	7548738	8/18/2007	13:15	18/08/2007	16:15			3.0	27.36	3	0.10	3.8,5.1,6.4					5	48.7			2	19.5			7	68.2
	PLGN-75	1	435144	7548545	8/18/2007	13:30	18/08/2007	16:50			3.3	27.36	3	0.11	3.8,6.4,3.8					1	8.8							1	8.8
	PLGN-76	1	435465	7549146	8/19/2007	11:15	19/08/2007	12:40			1.4	27.36	3	0.05	3.8,5.1,6.4			2	41.3			2	41.3	1	20.6			5	103.2
	PLGN-77	1	435438	7549099	8/19/2007	11:19	19/08/2007	13:00			1.7	27.36	3	0.06	3.8,6.4,3.8							1	17.4					1	17.4
	PLGN-78	1	435407	7549041	8/19/2007	11:25	8/19/2007	13:20			1.9	27.36	3	0.07	3.8,5.1,6.4					3	45.8	1	15.3					4	61.0
	PLGN-79	1	435355	7548935	8/19/2007	11:30	8/19/2007	14:10			2.7	27.36	3	0.09	3.8,5.1,6.4			4	43.9	1	11.0	5	54.8					10	109.6
	PLGN-80	1	435173	7549127	8/19/2007	14:45	8/19/2007	16:00			1.2	27.36	3	0.04	3.8,5.1,6.4					4	93.6							4	93.6
	PLGN-81	1	435681	7548892	8/19/2007	14:50	8/19/2007	16:30			1.7	27.36	3	0.06	3.8,5.1,6.4					2	35.1	1	17.5					3	52.6
	PLGN-82	1	435683	7548953	8/19/2007	14:55	8/19/2007	16:50			1.9	27.36	3	0.07	3.8,6.4,3.8							3	45.8					3	45.8
	PLGN-83	1	435690	7549014	8/19/2007	15:00	8/19/2007	17:10			2.2	27.36	3	0.07	3.8,5.1,6.4					1	13.5			1	13.5			2	27.0
	PLGN-84	1	435174	7550022	8/28/2007	9:05	8/28/2007	10:40			1.6	27.36	3	0.05	3.8,5.1,6.4			1	18.5	1	18.5	4	73.9					6	110.8
	PLGN-85	1	435033	7550223	8/28/2007	9:15	8/28/2007	11:10			1.9	27.36	3	0.07	3.8,5.1,6.4			1	15.3									1	15.3
	PLGN-86	1	434635	7550488	8/28/2007	9:25	8/28/2007	11:40			2.3	27.36	3	0.08	3.8,6.4,3.8														
	PLGN-87	1	434658	7550441	8/28/2007	9:30	8/28/2007	11:50			2.3	27.36	3	0.08	3.8,5.1,6.4					1	12.5							1	12.5
	PLGN-88	1	434422	7550384	8/28/2007	11:20	8/28/2007	12:50			1.5	27.36	3	0.05	3.8,5.1,6.4														
	PLGN-89	1	434442	7550423	8/28/2007	11:30	8/28/2007	13:00			1.5	27.36	3	0.05	3.8,5.1,6.4					1	19.5							1	19.5
	PLGN-90	1	434671	7550574	8/28/2007	11:50	8/28/2007	13:45			1.9	27.36	3	0.07	3.8,5.1,3.8														
	PLGN-91	1	434725	7550589	8/28/2007	12:00	8/28/2007	13:45			1.7	27.36	3	0.06	3.8,5.1,6.4														
	PLGN-92	1	434371	7550859	8/28/2007	13:10	8/28/2007	14:55			1.8	27.36	3	0.06	3.8,5.1,6.4					2	33.4	1	16.7					3	50.1
	PLGN-93	1	434324	7550841	8/28/2007	13:15	8/28/2007	15:00			1.7	27.36	3	0.06	3.8,5.1,6.4														
	PLGN-94	1	434422	7551213	8/28/2007	13:50	8/28/2007	15:40			1.8	27.36	3	0.06	3.8,5.1,3.8														
	PLGN-95	1	434378	7551198	8/28/2007	14:00	8/28/2007	15:45			1.7	27.36	3	0.06	3.8,5.1,6.4														
	PLGN-96	1	434176	7551257	8/28/2007	15:20	8/28/2007	16:30			1.2	27.36	3	0.04						1	25.1							1	25.1
	PLGN-97	1	434222	7551267	8/28/2007	15:30	8/28/2007	16:40			1.2	27.36	3	0.04															
	Total										**399.5**			**13.37**				**179**	**13.4**	**278**	**20.8**	**218**	**16.3**	**53**	**4.0**			**728**	**54.4**

Appendix E6. Gill Net Locations, Effort, Catch, and CPUE in the Boston and Madrid Project Areas, 2006 and 2007

Water-body	Site ID	Set No.	UTM (13W) NAD83		Set Date	Set Time	Pull Date	Pull Time	Water Depth (m) min	Water Depth (m) max	Set Period (h)	Net Area (m^2)	No. Panels	Net Units[a]	Mesh Sizes (cm)	ARCH		CISC		LKTR		LKWH		LSCS		NNST		Total	
			Easting	Northing												n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE	n	CPUE
P.O. Lake	POGN-01	1	436626	7548527	7/30/2006	11:56	7/30/2006	13:48	2.5	2.5	1.9	27.36	2	0.04	3.8, 6.4			2	46.992	3	70.489							5	117.48
	POGN-02	2	436458	7548421	7/30/2006	12:04	7/30/2006	13:56	1	2.6	1.9	37.1	2	0.06	1.9, 2.5							1	17.328					1	17.328
	POGN-03	3	436613	7549624	7/30/2006	14:33	7/30/2006	16:04	2.7	3.2	1.5	37.1	2	0.05	1.9, 2.5					1	21.326	3	63.979					4	85.306
	POGN-04	4	436597	7549835	7/30/2006	14:40	7/30/2006	15:39	2.8	3.7	1.0	27.36	2	0.02	3.8, 6.4					1	44.603	3	133.81					4	178.41
	Total										**6.2**			**0.17**				**2**	**11.794**	**5**	**29.484**	**7**	**41.278**					**14**	**82.556**
P.O. Connector Lake	POCLGN-01	1	436688	7550347	7/31/2006	13:45	7/31/2006	15:40	2.7	3.3	1.9	27.36	2	0.04	3.8, 6.4					4	91.533							4	91.533
	POCLGN-02	2	436711	7550451	7/31/2006	13:50	7/31/2006	15:35	3.7	3.8	1.7	37.1	2	0.05	1.9, 2.5					1	18.483	2	36.966					3	55.449
	Total										**3.7**			**0.10**						**5**	**51.123**	**2**	**20.449**					**7**	**71.572**
P.O. Inflow Lake	POILGN-01	1	435986	7550829	8/6/2006	12:40	8/6/2006	16:40	3	5	4.0	37.1	2	0.12	1.9, 2.5														
	POILGN-02	2	436045	7550746	8/6/2006	12:50	8/6/2006	16:50	4	4	4.0	27.36	2	0.09	3.8, 6.4														
	POILGN-03	1	436029	7550879	8/8/2006	8:35	8/8/2006	10:40	4.8	4.8	2.1	27.36	2	0.05	3.8, 6.4														
	POILGN-04	2	435933	7550540	8/8/2006	8:43	8/8/2006	10:54	3.7	3.7	2.2	37.1	2	0.07	1.9, 2.5														
	Total										**12.3**			**0.33**														
Wolverine Lake	WLGN-01	1	434728	7546891	7/23/2006	11:33	7/23/2006	16:35	4.6	4.6	5.0	27.36	2	0.11	3.8, 6.4														
	WLGN-02	2	434954	7545935	7/23/2006	11:50	7/23/2006	16:20	3.4	3.4	4.5	37.1	2	0.14	1.9, 2.5											1	7.1878	1	7.1878
	WLGN-03	1	434545	7546016	7/24/2006	9:12	7/24/2006	13:11	3	3	4.0	27.36	2	0.09	3.8, 6.4														
	WLGN-04	2	434689	7545772	7/24/2006	9:28	7/24/2006	13:19	3.5	4	3.8	37.1	2	0.12	1.9, 2.5														
	WLGN-05	3	435028	7545696	7/24/2006	13:29	7/24/2006	16:28	4	4	3.0	37.1	2	0.09	1.9, 2.5														
	WLGN-06	4	434669	7545566	7/24/2006	13:38	7/24/2006	16:38	2.9	2.9	3.0	27.36	2	0.07	3.8, 6.4														
	WLGN-07	1	434747	7546587	8/7/2006	13:17	8/7/2006	16:59	2.3	2.3	3.7	27.36	2	0.08	3.8, 6.4														
	WLGN-08	2	434667	7546339	8/7/2006	13:20	8/7/2006	16:52	2.6	2.6	3.5	37.1	2	0.11	1.9, 2.5														
	Total										**30.6**			**0.8**												**1**	**1.2225**	**1**	**1.2225**

NOTES:

n = number of captured fish

CPUE = fish / Net Unit[a]

[a] one net unit equals 100 m^2 of net set for the equivalent of 24 hours

Total CPUE = (total (n) / (100 m^2 * total h)) *24

Appendix E7. Location, Effort, Catch, and CPUE Data for Minnow Trap Sets in the Boston and Madrid Project Areas, 2006 and 2007

Waterbody	Site ID	UTM (13W) NAD83		Set Date	Set Time	Pull Date	Pull Time	Set Period (h)	Number of Fish Captured / CPUE (fish/24 h)					
									LSCS		NNST		Total	
		Easting	Northing						n	CPUE	n	CPUE	n	CPUE
Aimaokatalok Lake	SLMT-01	439878	7501415	16/07/2006	11:04	16/07/2006	19:03	8.0						
	SLMT-02	439885	7501445	16/07/2006	11:06	16/07/2006	19:04	8.0						
	SLMT-03	439953	7501443	16/07/2006	11:11	16/07/2006	19:00	7.8			2	6.14	2	6.14
	Total							**23.8**			**2**	**2.02**	**2**	**2.02**
Fickle Duck Lake	FLMT-01	442469	7503382	18/07/2006	9:35	18/07/2006	16:42	7.1						
	FLMT-02	442500	7503397	18/07/2006	9:35	18/07/2006	16:41	7.1						
	FLMT-03	442520	7503406	18/07/2006	9:35	18/07/2006	16:42	7.1			5	16.86	5	16.86
	Total							**21.3**			**5**	**5.62**	**5**	**5.62**
Reference Lake	RLMT-01	438117	7504098	19/07/2006	9:55	19/07/2006	13:09	3.2						
	RLMT-02	438126	7504079	19/07/2006	9:54	19/07/2006	13:10	3.3						
	RLMT-03	438128	7504064	19/07/2006	9:56	19/07/2006	13:11	3.2			2	14.77	2	14.77
	Total							**9.8**			**2**	**4.92**	**2**	**4.92**
Stickleback Lake	SLMT-01	441486	7504373	17/07/2006	12:35	17/07/2006	17:42	5.1			4	18.76	4	18.76
	SLMT-02	441509	7504364	17/07/2006	12:30	17/07/2006	17:44	5.2			10	45.86	10	45.86
	SLMT-03	441509	7504364	17/07/2006	12:32	17/07/2006	17:46	5.2			2	9.17	2	9.17
	SLMT-04	441915	7504144	17/07/2006	13:16	17/07/2006	15:44	2.5			11	107.03	11	107.03
	Total							**18.0**			**27**	**35.90**	**27**	**35.90**
Koignuk River	KRMT-01	438496	7509472	19/07/2006	14:01	19/07/2006	17:19	3.3						
	KRMT-02	438516	7509442	19/07/2006	14:03	19/07/2006	17:19	3.3						
	KRMT-03	438442	7509527	19/07/2006	14:06	19/07/2006	17:19	3.2						
	Total							**9.8**					**0**	**0.00**
Ogama Lake	OLMT-01	436560	7551446	03/08/2006	8:46	04/08/2006	13:39	28.9			1	0.83	1	0.83
	OLMT-02	436585	7551434	03/08/2006	8:47	04/08/2006	13:38	28.9			1	0.83	1	0.83
	OLMT-03	435596	7555174	04/08/2006	15:05	05/08/2006	13:29	22.4			5	5.36	5	5.36
	OLMT-04	435604	7555170	04/08/2006	15:05	05/08/2006	13:30	22.4						
	OLMT-05	435617	7555152	04/08/2006	15:06	05/08/2006	15:33	24.5			24	23.56	24	23.56
	OLMT-06	435552	7555187	04/08/2006	15:10	05/08/2006	9:27	18.3			2	2.63	2	2.63
	OLMT-07	435537	7555188	04/08/2006	15:11	05/08/2006	9:28	18.3			2	2.63	2	2.63
	OLMT-08	435512	7555179	04/08/2006	15:11	05/08/2006	9:28	18.3			1	1.31	1	1.31
	OLMT-09	435651	7555321	05/08/2006	13:51	06/08/2006	9:20	19.5			2	2.46	2	2.46
	OLMT-10	435690	7555337	05/08/2006	13:52	06/08/2006	9:21	19.5			2	2.46	2	2.46
	OLMT-11	435802	7554312	05/08/2006	14:01	06/08/2006	9:34	19.5						
	OLMT-12	435796	7554282	05/08/2006	14:02	06/08/2006	9:34	19.5						
	OLMT-13	436222	7554082	05/08/2006	14:46	06/08/2006	9:42	18.9						
	OLMT-14	436215	7554068	05/08/2006	14:47	06/08/2006	9:42	18.9			2	2.54	2	2.54
	Total							**297.8**			**42**	**3.39**	**42**	**3.39**
Patch Lake	PLMT-01	434679	7548357	25/07/2006	12:01	26/07/2006	10:06	22.1			1	1.09	1	1.09
	PLMT-02	434682	7548369	25/07/2006	12:02	26/07/2006	10:08	22.1						
	PLMT-03	434687	7548382	25/07/2006	12:04	26/07/2006	10:08	22.1						
	PLMT-04	436245	7549012	26/07/2006	10:54	27/07/2006	9:45	22.8						
	PLMT-05	436235	7549010	26/07/2006	10:55	27/07/2006	9:45	22.8						
	PLMT-06	436214	7548996	26/07/2006	10:56	27/07/2006	9:45	22.8						
	PLMT-07	435986	7549156	27/07/2006	12:34	29/07/2006	14:06	49.5						
	PLMT-08	435994	7549143	27/07/2006	13:33	29/07/2006	14:05	48.5						
	PLMT-09	436002	7549139	27/07/2006	13:32	29/07/2006	14:07	48.6						
	PLMT-01	436172	7549151	8/13/2007	9:14	14/08/2007	9:12	24.0						
	PLMT-02	436187	7549139	8/13/2007	9:16	14/08/2007	9:16	24.0			1	1.00	1	1.00
	PLMT-03	436243	7549061	8/13/2007	9:20	14/08/2007	9:18	24.0						
	PLMT-04	436255	7549001	8/13/2007	9:12	14/08/2007	9:20	24.1						
	PLMT-05	436250	7548861	8/13/2007	9:18	14/08/2007	9:16	24.0			1	1.00	1	1.00
	PLMT-06	436275	7548831	8/13/2007	9:22	14/08/2007	9:18	23.9						
	Total							**425.4**			**3**	**0.17**	**3**	**0.17**
P.O. Lake	POLMT-01	436333	7548884	30/07/2006	9:10	31/07/2006	9:15	24.1			6	5.98	6	5.98
	POLMT-02	436345	7548896	30/07/2006	9:11	31/07/2006	9:15	24.1			9	8.98	9	8.98
	POLMT-03	436341	7548899	30/07/2006	9:12	31/07/2006	9:15	24.0			6	5.99	6	5.99
	POLMT-04	436701	7550113	30/07/2006	11:10	31/07/2006	9:00	21.8						
	POLMT-05	436689	7550123	30/07/2006	11:11	31/07/2006	9:00	21.8						
	POLMT-06	436694	7550131	30/07/2006	11:12	31/07/2006	9:00	21.8						
	Total							**137.6**			**21**	**3.66**	**21**	**3.66**

Appendix E7. Location, Effort, Catch, and CPUE Data for Minnow Trap Sets in the Boston and Madrid Project Areas, 2006 and 2007

Waterbody	Site ID	UTM (13W) NAD83		Set Date	Set Time	Pull Date	Pull Time	Set Period (h)	Number of Fish Captured / CPUE (fish/24 h)					
									LSCS		NNST		Total	
		Easting	Northing						n	CPUE	n	CPUE	n	CPUE
P.O. Connector Lake	POCMT-01	436600	7550622	31/07/2006	14:20	01/08/2006	15:48	25.5			23	21.68	23	21.68
	POCMT-02	436602	7550618	31/07/2006	14:23	01/08/2006	15:48	25.4			23	21.72	23	21.72
	POCMT-03	436598	7550635	31/07/2006	14:25	01/08/2006	15:48	25.4			26	24.58	26	24.58
	POCMT-04	436742	7550219	31/07/2006	15:14	01/08/2006	15:11	24.0						
	POCMT-05	436811	7550223	31/07/2006	15:15	01/08/2006	15:10	23.9						
	POCMT-06	436793	7550219	31/07/2006	15:16	01/08/2006	15:09	23.9						
	Total							**148.0**			**72**	**11.67**	**72**	**11.67**
PO Inflow Lake	POINMT-01	436032	7551094	06/08/2006	11:56	07/08/2006	11:14	23.3			7	7.21	7	7.21
	POINMT-02	436025	7551088	06/08/2006	11:56	07/08/2006	11:16	23.3			6	6.17	6	6.17
	POINMT-03	436018	7551084	06/08/2006	11:57	07/08/2006	11:18	23.3			2	2.06	2	2.06
	POINMT-04	436080	7550344	06/08/2006	13:00	07/08/2006	11:06	22.1						
	POINMT-05	436081	7550338	06/08/2006	13:02	07/08/2006	11:06	22.1			4	4.35	4	4.35
	POINMT-06	436072	7550331	06/08/2006	13:04	07/08/2006	11:07	22.0			19	20.68	19	20.68
	Total							**136.2**			**38**	**6.70**	**38**	**6.70**
Wolverine Lake	WLMT-01	434761	7547030	23/07/2006	11:05	24/07/2006	8:34	21.5			8	8.94	8	8.94
	WLMT-02	434773	7547007	23/07/2006	11:07	24/07/2006	8:38	21.5			23	25.65	23	25.65
	WLMT-03	434774	7546964	23/07/2006	11:11	24/07/2006	8:45	21.6			21	23.37	21	23.37
	WLMT-04	434847	7545439	23/07/2006	12:23	24/07/2006	9:38	21.2						
	WLMT-05	434809	7545454	23/07/2006	12:24	24/07/2006	9:39	21.2						
	WLMT-06	434824	7545459	23/07/2006	12:26	24/07/2006	9:39	21.2			3	3.39	3	3.39
	WLMT-07	435319	7545498	24/07/2006	10:05	24/07/2006	16:16	6.2			1	3.88	1	3.88
	WLMT-08	435322	7545491	24/07/2006	10:06	24/07/2006	16:17	6.2			2	7.76	2	7.76
	WLMT-09	435296	7545461	24/07/2006	10:08	24/07/2006	16:19	6.2						
	WLMT-10	434670	7546831	07/08/2006	12:05	07/08/2006	17:07	5.0			21	100.13	21	100.13
	WLMT-11	434666	7546847	07/08/2006	12:06	07/08/2006	17:07	5.0			12	57.41	12	57.41
	WLMT-12	434689	7546872	07/08/2006	12:08	07/08/2006	17:10	5.0	3	14.30	9	42.91	12	57.22
	Total							**15.1**	**3**	**4.77**	**100**	**159.12**	**103**	**163.89**
Ogama Inflow	OIMT-01	436489	7551399	02/08/2006	14:25	04/08/2006	13:40	47.3			2	1.02	2	1.02
	OIMT-02	436476	7551450	02/08/2006	14:27	03/08/2006	8:38	18.2			24	31.68	24	31.68
	OIMT-03	436489	7551389	02/08/2006	14:28	03/08/2006	8:39	18.2			10	13.20	10	13.20
	Total							**83.6**			**36**	**10.33**	**36**	**10.33**

NOTES:

n = number of captured fish

CPUE = catch per unit effort (fish/24 h)

Appendix E8 . Number of Fish Captured with Kick Nets and Dip Nets in Boston Project Area, 2007

Waterbody	Site ID	UTM (13W) NAD27		Date	Number of Fish	
					NNST	Total
		Easting	Northing		*n*	*n*
Koignuk River	KNDIPNET-01	429479	7555080	7/8/2007	51	**51**
	KNKN-01	430098	7550872	7/8/2007		**0**

APPENDIX E9

FISH LIFE HISTORY
SUMMARY STATISTICS

Appendix E9. Length, Weight, and Condition Factor Statistics for Fish Captured, 2006 - 2007

Waterbody	Species	Fork Length (mm)					Weight (g)					Condition Factor				
		n	**Mean**	SD	Min	Max	*n*	**Mean**	SD	Min	Max	*n*	**Mean**	SD	Min	Max
Aimaokatalok Lake	Lake Trout	*3*	**179**	212	30	422	*1*	**852**	-	-	-	*1*	**1.13**	-	-	-
	Cisco	*2*	**80**	7	75	85	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*102*	**41**	5	30	55	-	-	-	-	-	-	-	-	-	-
Fickle Duck Lake	Lake Trout	*3*	**374**	259	78	555	*2*	**2005**	870	1390	2620	*2*	**1.36**	0.25	1.18	1.53
	Ninespine Stickleback	*6*	**49**	2	46	51	-	-	-	-	-	-	-	-	-	-
Reference Lake	Lake Trout	*1*	**195**	-	-	-	*1*	**80**	-	-	-	*1*	**1.08**	-	-	-
	Cisco	*1*	**28**	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*12*	**42**	7	30	50	-	-	-	-	-	-	-	-	-	-
Stickleback Lake	Ninespine Stickleback	*27*	**55**	10	40	82	-	-	-	-	-	-	-	-	-	-
Aimaokatalok River	Lake Trout	*9*	**31**	9	25	53	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*15*	**42**	8	31	64	-	-	-	-	-	-	-	-	-	-
Fickle Duck Inflow	Ninespine Stickleback	*8*	**41**	6	35	50	-	-	-	-	-	-	-	-	-	-
Fickle Duck Outflow	Lake Trout	*1*	**85**	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*7*	**42**	6	35	51	-	-	-	-	-	-	-	-	-	-
	Burbot	*1*	**415**	-	-	-	*1*	**490**	-	-	-	*1*	**0.69**	-	-	-
Koignuk River	Arctic Char	*1*	**605**	-	-	-	*1*	**2538**	-	-	-	*1*	**1.15**	-	-	-
	Arctic Flounder	*3*	**103**	33	76	139	3	**19**	20	6	42	3	**1.31**	0.29	0.99	1.56
	Arctic Grayling**	*6*	**384**	18	350	400	*2*	**627**	33	603	650	*2*	**1.05**	0.12	0.96	1.14
	Arctic Grayling***	*12*	**49**	29	23	109	1	**13**	-	-	-	1	**1.00**	-	-	-
	Burbot	*2*	**77**	9	70	83	-	-	-	-	-	-	-	-	-	-
	Fourhorn Sculpin	*2*	**50**	47	16	83	*1*	**5**	-	-	-	*1*	**0.87**	-	-	-
	Lake Trout**	*8*	**497**	74	440	665	*8*	**1519**	508	1135	2750	*8*	**1.25**	0.23	0.91	1.52
	Lake Trout***	*1*	**78**	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lake Whitefish**	*5*	**498**	15	480	520	*2*	**1363**	18	1350	1375	*2*	**1.16**	0.08	1.10	1.22
	Lake Whitefish***	*121*	**30-40**[a]	-	30-40	78	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*29*	**45**	9	31	67	-	-	-	-	-	-	-	-	-	-
	Slimy Sculpin	*3*	**52**	6	46	57	-	-	-	-	-	-	-	-	-	-
Stickleback Outflow	Slimy Sculpin	*1*	**115**	-	115	115	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*24*	**46**	6	35	57	-	-	-	-	-	-	-	-	-	-
Glenn Lake	Arctic Char	*3*	**223**	26	193	241	*3*	**132**	45	80	160	*3*	**1.15**	0.04	1.11	1.19
	Cisco	*6*	**233**	17	213	250	*4*	**130**	32	100	175	*4*	**1.12**	0.07	1.03	1.19
	Lake Trout	*34*	**439**	182	152	750	*32*	**1299**	1395	36	4753	*32*	**1.01**	0.10	0.83	1.27
	Lake Whitefish	*2*	**442**	10	435	449	*2*	**1255**	127	1165	1345	*2*	**1.45**	0.05	1.41	1.49
Ogama Lake	Lake Trout	*3*	**623**	64	550	665	*3*	**2322**	848	1455	3150	*3*	**0.93**	0.12	0.84	1.07
	Lake Whitefish**	*10*	**319**	15	294	346	*10*	**409**	105	245	635	*10*	**1.24**	0.18	0.90	1.53
	Lake Whitefish***	*27*	**35-55**[a]	-	-	-	-	-	-	-	-	-	-	-	-	-
	Cisco**	*25*	**222**	14	203	255	*25*	**125**	21	95	195	*25*	**1.13**	0.01	0.87	1.31
	Cisco***	*275*	**35-60**[a]	-	-	-	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*43*	**58**	6	45	74	-	-	-	-	-	-	-	-	-	-
Patch Lake	Cisco	*195*	**238**	43	85	450	*90*	**172**	75	13	378	*90*	**1.09**	0.16	0.73	1.50
	Lake Trout	*300*	**650**	121	277	980	*203*	**3037**	1485	195	8695	*203*	**1.03**	0.14	0.74	1.49
	Lake Whitefish	*225*	**380**	56	214	615	*131*	**751**	308	158	1825	*131*	**1.34**	0.18	0.82	1.75
	Least Cisco	*12*	**229**	18	204	253	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*4*	**53**	13	45	73	-	-	-	-	-	-	-	-	-	-
P.O. Lake	Lake Trout	*14*	**597**	126	304	725	*10*	**1808**	989	265	3000	*10*	**0.92**	0.10	0.77	1.11
	Lake Whitefish	*7*	**365**	51	300	434	*6*	**697**	387	330	1365	*6*	**1.36**	0.16	1.22	1.67
	Cisco	*3*	**209**	6	204	215	*3*	**88**	8	80	95	*3*	**0.97**	0.13	0.88	1.12
	Ninespine Stickleback	*27*	**47**	13	21	65	-	-	-	-	-	-	-	-	-	-
P.O. Connector Lake	Lake Trout	*7*	**477**	139	349	710	*5*	**1430**	1120	415	2985	*5*	**0.94**	0.10	0.83	1.08
	Lake Whitefish	*3*	**254**	158	74	367	*2*	**528**	88	465	590	*2*	**1.30**	0.15	1.19	1.41
	Ninespine Stickleback	*104*	**52**	6	35	70	-	-	-	-	-	-	-	-	-	-
P.O. Inflow Lake	Cisco	*21*	**53**	11	35	79	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*169*	**49**	8	20	78	-	-	-	-	-	-	-	-	-	-
Wolverine Lake	Least Cisco	*114*	**54**	12	35	85	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*221*	**47**	9	10	65	-	-	-	-	-	-	-	-	-	-
Ogama Inflow	Lake Trout	*14*	**581**	111	420	790	*12*	**2043**	1272	660	4410	*12*	**0.96**	0.11	0.83	1.14
	Lake Whitefish**	*1*	**342**	-	-	-	-	-	-	-	-	-	-	-	-	-
	Lake Whitefish***	*4*	**42**	7	35	50	-	-	-	-	-	-	-	-	-	-
	Ninespine Stickleback	*41*	**55**	8	40	71	-	-	-	-	-	-	-	-	-	-
Ogama Outflow	Lake Trout	*7*	**408**	92	283	539	*7*	**787**	412	280	1400	*7*	**1.08**	0.15	0.89	1.26
	Lake Whitefish	*4*	**307**	12	292	322	*4*	**451**	47	400	500	*4*	**1.56**	0.10	1.45	1.68
	Cisco	*1*	**231**	-	-	-	*1*	**145**	-	-	-	*1*	**1.18**	-	-	-
	Ninespine Stickleback	*150*	**43**	11	21	83	-	-	-	-	-	-	-	-	-	-
P.O. Lake Outflow	Ninespine Stickleback	*6*	**36**	20	24	75	-	-	-	-	-	-	-	-	-	-

** Adult fish only

*** Juvenile fish only

[a] estimated length range; fish not measured to reduce mortality due to handling

APPENDIX E10

PATCH LAKE
POPULATION ESTIMATE

Table E10.1 Summary of Model Selection Results from Program MARK for Lake Trout Captured at Patch Lake During 2007 (n = 234 Fish Captured over 18 Occasions)

Model Type	ΔAICc	AICc	Akaike Weight	Likelihood	No. of parameters	Deviance
M_t (time)*	-539.91	0	0.732	1	19	105.25
M_{th} (time & heterogeneity)	-537.89	2.02	0.267	0.364	20	105.25
M_o	-459.13	80.78	0	0	2	220.21
M_b (behaviour)	-457.21	82.71	0	0	3	220.13
M_h (heterogeneity)	-457.13	82.79	0	0	3	220.21
M_{bh} (heterogeneity & behaviour)	-453.20	86.72	0	0	5	220.13

* best model of those examined.

Table E10.2 Summary of Parameters Estimated with M_t Model in Program Mark for Lake Trout Captured During 2007 (n = 234 Fish Captured over 18 Occasions)

Parameter	Estímate	SE	95% Lower CI	95% Upper CI
1:*p*	0.0009	0.0009	0.0001	0.0063
2:*p*	0.0035	0.0018	0.0012	0.0098
3:*p*	0.0129	0.0041	0.0070	0.0240
4:*p*	0.0104	0.0035	0.0053	0.0202
5:*p*	0.0052	0.0023	0.0022	0.0124
6:*p*	0.0233	0.0062	0.0138	0.0390
7:*p*	0.0199	0.0055	0.0115	0.0340
8:*p*	0.0190	0.0053	0.0109	0.0328
9:*p*	0.0190	0.0053	0.0109	0.0328
10:*p*	0.0224	0.0060	0.0132	0.0378
11:*p*	0.0069	0.0027	0.0032	0.0150
12:*p*	0.0259	0.0067	0.0156	0.0428
13:*p*	0.0147	0.0045	0.0081	0.0265
14:*p*	0.0017	0.0013	0.0004	0.0072
15:*p*	0.0155	0.0046	0.0086	0.0278
16:*p*	0.0112	0.0037	0.0058	0.0214
17:*p*	0.0078	0.0030	0.0037	0.0163
18:*p*	0.0035	0.0018	0.0012	0.0098
N	1158.6	213.7	825.2	1680.0

Note: (*p* = Probability of Capture; *N*=Population Estimate)