CONTWOYTO LAKE WEST
DIAMOND PROJECT
AQUATIC STUDIES PROGRAM (1999)
- DATA REPORT -

Prepared for

TAHERA CORPORATION
1408 Crown Street
North Vancouver, British Columbia
V7J 1G5

Prepared by

R.L. & L. ENVIRONMENTAL SERVICES LTD.
17312 - 106 Avenue
Edmonton, Alberta
T5S 1H9
Phone: (780) 483-3499

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1.0 INTRODUCTION

1.1 BACKGROUND

The Contwoyto Lake West Diamond Project was initiated by Tahera Corporation (formerly Lytton Minerals Ltd.) in 1998 based on the discovery of a kimberlite deposit adjacent to Contwoyto Lake in the vicinity of Echo Bay Mines Ltd. Lupin production facility (Nunavut).

In anticipation of the possible development of this deposit, Tahera Corporation initiated a baseline inventory program in 1999. This involved collection of data on meteorological conditions, water quality, hydrology, wildlife, and aquatic biota. R.L. & L. Environmental Services Ltd. was contracted to complete the aquatic biota component of the baseline inventory programs, which focused on the aquatic community within the immediate vicinity of the deposit.

1.2 STUDY OBJECTIVES

The objectives of the aquatic studies program were as follows:

- to describe the physical characteristics (morphology and water quality) of waterbodies;
- to describe the abundance, distribution and biological characteristics of nonvertebrate communities (benthic macroinvertebrates, zooplankton, phytoplankton, and periphyton);
- to describe the seasonal abundance, distribution, and biological characteristics of fish species in the study area, as well as the habitat used by these fish; and,
- to present raw data in a data report.

1.3 STUDY AREA

The study area is located approximately 400 km northeast of Yellowknife in the general vicinity of Echo Bay Mines Ltd. Lupin production facility. The Contwoyto Lake study site is situated approximately 10 km northeast of Lupin (66^{o} 00' N, 111^{o} 29') in Nunavut Territory (Figure 1.1). The study area (referred to as the Contwoyto Lake West Study Area) encompasses lakes and streams in the immediate vicinity of a kimberlite deposit (Figure 1.2 and Table 1.1).

Table 1.1 Waterbodies investigated and tasks completed during the aquatic studies program in the Contwoyto Lake West Study Area, 1999.

Task	Waterbody				
	Contwoyto Lake Bay	Lake P1	Lake P2	Stream P1	Stream P2
Lake Characteristics					
Morphology	✓				
Limnology	✓				
Stream Characteristics					
Structure and Discharge				✓	✓
Temperature				✓	
Water Quality	✓	✓	✓	✓	✓
Nonvertebrates					
Zooplankton	✓	✓	✓		
Phytoplankton	✓	✓	✓		
Periphyton	✓	✓	✓	✓	✓
Benthic Macroinvertebrates	✓	✓	✓		
Fish					
Species Composition and Abundance	✓	✓	✓	✓	✓
Biological Characteristics/Feeding Habits	✓	✓	✓	✓	✓
Movements	✓	✓	✓	✓	✓
Habitat Characteristics	✓	✓	✓	✓	✓

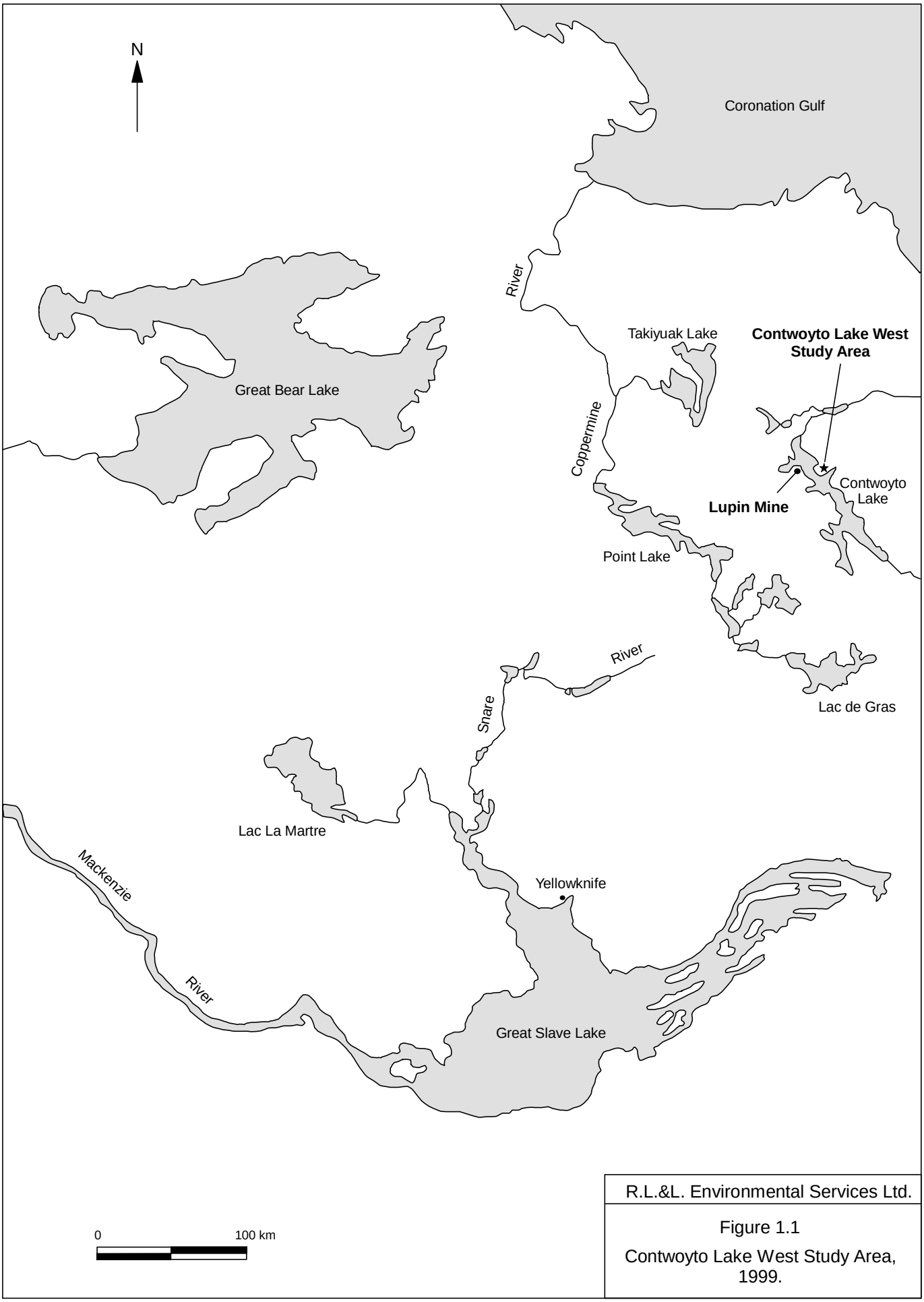
1.4 TIMING AND LOGISTICS OF SAMPLING

The 1999 field program was conducted on a seasonal basis (spring, summer, and fall). The spring session, which was conducted between 8 and 15 June, was designed to determine fish use of streams for spawning and rearing, and to establish sampling sites for the summer and fall sessions.

The summer field period commenced on 13 July and was completed on 3 August, and involved several sampling components. Tributary investigations included collection of fish and habitat data from streams and lakes, as well as collection of periphyton and water quality samples from selected locations. Lake work involved collection of limnological data, and samples of phytoplankton, zooplankton, periphyton, and benthic macroinvertebrates. Fish species distribution and abundance were investigated.

The fall session (31 August-7 September) involved documentation of fish distribution and abundance in lakes, as well as identification of potential spawning areas.

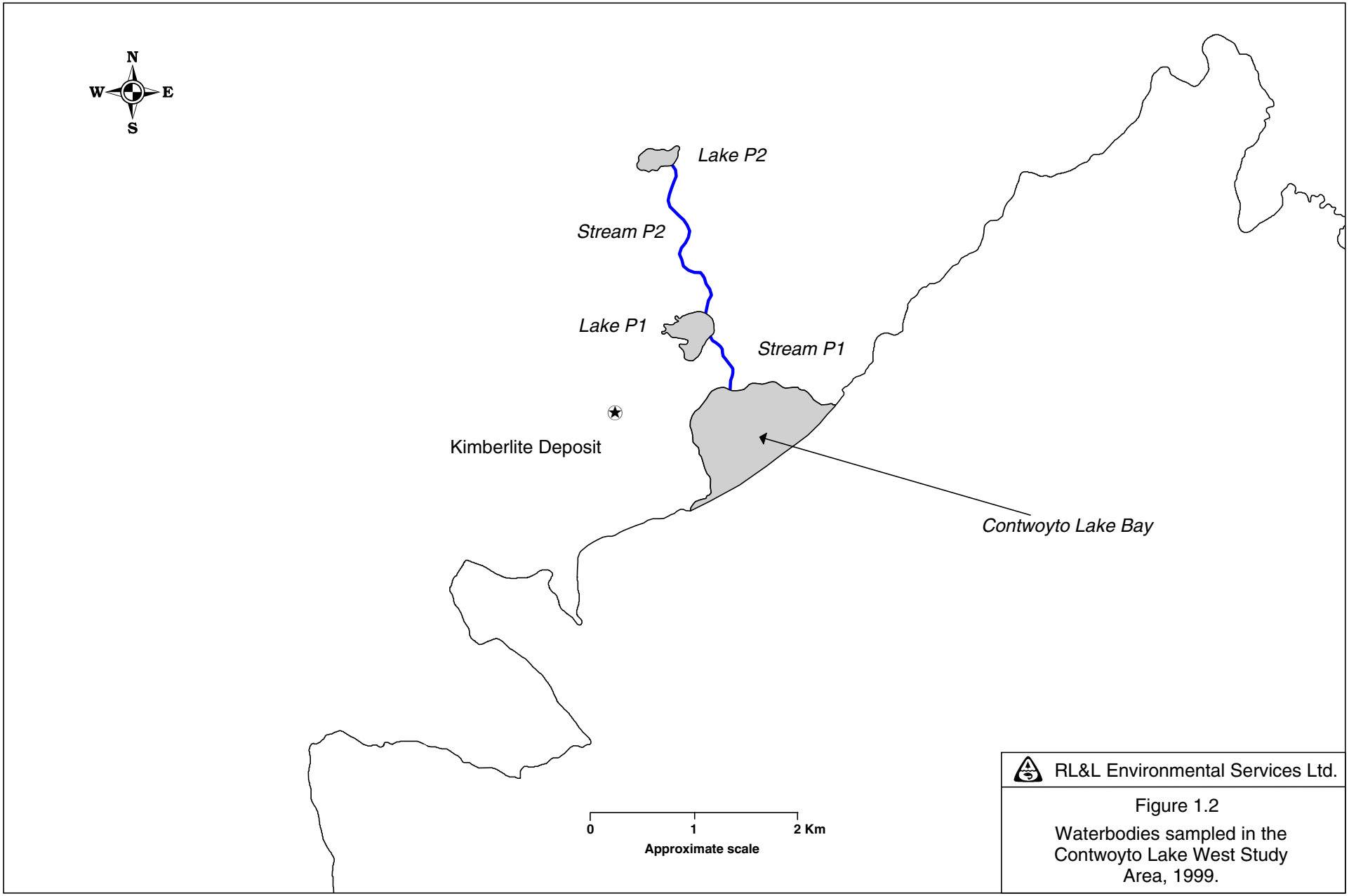
Access to the site was by fixed-wing aircraft from Yellowknife. Accommodations were at the Tahera Corporation exploration camp located on the east shore of Carat Lake or at the Lupin Mine owned by Echo Bay Mines Ltd. Transportation of personnel and equipment to sampling sites was provided by helicopter.



R.L.&L. Environmental Services Ltd.

Figure 1.1

Contwoyto Lake West Study Area, 1999.



RL&L Environmental Services Ltd.

Figure 1.2

Waterbodies sampled in the Contwoyto Lake West Study Area, 1999.

2.0 METHODOLOGY

2.1 FIELD SAMPLING

2.1.1 Physical Environment

2.1.1.1 Lake Morphometry

Bathymetric surveys of selected lakes were conducted in summer 1999. The surveys were carried out using a Lowrance (Model X16) echo sounder, which provided a graphic output of depth measurements. The resulting depth database was merged with the digital location data generated from transect locations identified on the digitized maps.

2.1.1.2 Limnology and Water Quality

To document the limnology and general water quality characteristics of waterbodies in the study area, water chemistry, water temperature (^{o}C) and dissolved oxygen concentrations (mg/L) were measured at selected locations. At lake sites, a H20 Hydrolab with a Surveyor3 Data Logger was used to record vertical profiles of water temperature, oxygen, pH, conductivity, and turbidity. Water transparency was measured to the nearest 0.1 m using a standard Secchi disk (20 cm diameter). At stream sites, parameters measured at the water surface included conductivity (Oakton TDS Testr meter) and water temperature (^{o}C).

Water temperature was continuously monitored from one stream (Stream P1) during the open water period (mid-June to mid-September). This provided a database of seasonal changes and daily temperature fluctuations. An Onset Optic StowAway Temp^{TM} thermograph was deployed to electronically record water temperatures at 30 minute intervals.

Water samples were collected during summer at selected waterbodies to document existing water quality characteristics. Stream water samples were collected from approximately 0.1 m below the water surface (surface grab). Lake water samples were collected at established sites using a prewashed 4 L Van Dorn bottle submerged to a depth of 1 m. Polyethylene gloves were worn during water collection to prevent contamination of the samples. Appropriate premeasured preservatives were added to the samples (if needed) and the samples were placed on ice and shipped to Enviro-Test Laboratories in Edmonton for analyses within 48 hrs of collection.

As part of the quality assurance / quality control (QA/QC) program, a water sample was split (i.e., collected from the same site but labelled as different sites) and submitted to the lab as a blind control. In addition, a sample consisting of distilled water was submitted for analyses. These QA/QC procedures were designed to document possible contamination of the samples from the bottles or the laboratory process.

2.1.1.3 Stream Discharge

Stream discharge was measured at selected stream locations to characterize the seasonal variation in the availability and quality of fish habitat. Velocity was recorded with a direct-readout meter (Swoffer Model 2100); readings were taken along a tag line positioned perpendicular to the flow. Water depth and mean column velocities (at 0.6 depth) were measured at vertical stations located along the cross-section, each of which encompassed no more than 10% of the water flow (Buchanan and Somers 1969).

In addition to the measurements of discharge conducted by the study team, continuous monitoring of discharge and water levels at key sites in the Jericho Study Area were carried out by Tahera Corporation.

2.1.2 Nonvertebrates

2.1.2.1 Periphyton

The periphyton communities in lakes and streams were sampled during summer to assess the algal community composition, and to measure chlorophyll *a* and ash-free dry mass (AFDM). To ascertain productivity levels of selected waterbodies, additional chlorophyll *a* and ash-free dry mass (AFDM) samples were collected from selected locations (total of three at each site) throughout the open water period.

Each sample consisted of a composite of five scrapings following the methods described in Charlton et al. (1981) and Hickman et al. (1982). Each scraping (4 cm^2) was collected from a stone, selected at random, from the lake or stream bottom. Samples used for algal identification and enumeration were placed in individually labelled 20 mL dark containers and preserved with 5% acid-Lugol's solution. Shortly after collection, two drops of 100% formalin were added to each of these samples to prevent growth of bacteria and fungi. Samples destined for chlorophyll *a* analysis were filtered (5 mL) onto Whatman GF/C filter paper, covered with anhydrous $MgCO_3$, and frozen. Samples for AFDM were subsampled in the laboratory, from the acid-Lugol's preserved samples.

2.1.2.2 Phytoplankton

Phytoplankton were collected from lakes once during summer to characterize the community (species composition and chlorophyll *a*). Samples were collected from the euphotic zone, which is equal to the depth of 1% light penetration (approximately two times the Secchi depth). A sample consisted of a composite of five discrete vertical collections within this zone, which were made using a weighted plastic tube. In lakes that were shallower than two times the Secchi depth, phytoplankton hauls encompassed the entire water column to 1 m above the lake bottom (to avoid contamination of the sample with sediment). Samples were placed in labelled 500 mL containers, preserved with 5% acid-Lugol's solution, and stored in the dark. Three drops of 100% formalin were added to each sample to prevent growth of bacteria and fungi during storage. Prior to preservation, samples destined for chlorophyll *a* analysis were filtered (5 mL) onto Whatman GF/C filter paper, covered with anhydrous $MgCO_3$, and frozen. Samples for AFDM were subsampled in the laboratory, from the acid-Lugol's preserved samples. Equipment was thoroughly rinsed before and after sampling at each site to prevent contamination. To ascertain productivity levels of selected

lakes, additional chlorophyll *a* samples were collected from selected locations (total of three at each site) throughout the open water period.

2.1.2.3 Zooplankton

To characterize the zooplankton community in study area lakes, zooplankton samples also were collected from lakes once during summer. Each sample consisted of a composite of five vertical hauls, each of which were taken from a depth that was equal to the euphotic zone (approximately two times the Secchi depth). In lakes that were shallower than three times the Secchi depth, zooplankton hauls encompassed the entire water column to 1 m above the lake bottom (to avoid contamination of the sample with sediment). Zooplankton collections were made with a Wisconsin plankton net constructed with Nitex® mesh (net mouth diameter 130 mm; 0.064 x 0.064 mm mesh). To prevent predation by cyclopoid copepods, each sample was immediately preserved in 5% formalin and stored in labelled 500 mL polyethylene bottles. Equipment was thoroughly rinsed before and after sampling at each site to prevent contamination.

2.1.2.4 Benthic Macroinvertebrates

Benthic macroinvertebrates were sampled once from sites located in littoral (< 5.0 m depth) and profundal (> 5.0 m depth) zones of selected lakes during summer. The samples were used to characterize the nonvertebrate community in each of these zones. An Ekman grab sampler (aperture area equal to 0.023 m^2) was used to collect a composite of three grabs for each sample. Samples were then sieved through a 0.243 mm mesh net to remove excess sediments, placed in labelled polyethylene sample bags, and preserved in 10% formalin.

2.1.3 Fish

Fish sampling focussed on determining species composition, relative abundance, and seasonal use of lakes and streams. In addition, captured fish of selected species not required for other aspects of the program (fish tissues) were tagged using individually numbered Floy anchor tags. The type of sampling technique employed was dependent on the habitats sampled and size-classes of fish targeted.

2.1.3.1 Backpack Electrofishing

Shallow-water habitats in streams and lake margins were sampled during spring and summer using a Smith-Root Type XII high output backpack electrofisher. The electrofisher operator waded along the banks and sampled in the vicinity of suspected fish holding areas (undercut banks, boulder cover, etc.). The netter, who was positioned immediately downstream, collected the stunned fish and placed them in a holding bucket. Recorded information at each sampled site included UTM coordinates, date and time of day, water temperature and conductivity, distance sampled (m), sampling effort (s), electrofisher settings, and the number and species of fish captured or observed.

2.1.3.2 Gill Netting

Variable-mesh standard gill net sets were employed to sample deep-water habitats in lakes during the summer and fall field sessions. Each standard gill net set was comprised of 15.2 × 1.8 m panels of 2.5, 3.8, 6.4, 8.9, 11.4, and 14.0 cm mesh sizes (stretched measure). These sets were used to sample a wide range of fish size-classes and to allow comparison of catch rates.

During summer, a variety of habitats were sampled. During fall, sampling sites were chosen based on their potential as spawning habitat for lake trout, Arctic char, and round whitefish. Pertinent data recorded at each gill net site included set/pull time, set location/orientation, water depth, and substrate type.

2.1.3.3 Minnow Traps

To capture smaller size-classes of fish in habitats not effectively sampled by gillnetting, standard minnow traps (gee type) baited with cat food were used in rocky shoreline areas. Dimensions of standard gee traps were 0.4 m length x 0.2 m diameter with an aperture of 0.02 m. Data recorded at each site included set/pull time, location/orientation, water depth, and substrate type.

2.1.3.4 Biological Characteristics

All captured fish were identified to species. Data recorded for each fish included fork length (to the nearest 1 mm), weight (to the nearest 5 g), sex, and maturity. An appropriate ageing structure was also collected (Mackay et al. 1990) from fish that succumbed during sampling. Data were recorded on standardized record sheets to facilitate data analyses in the laboratory.

To determine feeding habits, stomach contents of fish that succumbed during sampling were analysed in the field using the method described by Thompson (1959), which is a modification of the numerical method used by Hynes (1950). Each stomach was examined and evaluated for fullness, and allotted a designated number of fullness points (i.e., 20 points for a full stomach and 0 points for an empty stomach). After points were allocated for the degree of fullness, the stomach was opened and the points allotted to individual food categories based on their volume. To account for the presence of empty stomachs, values of zero were incorporated into the analysis.

2.1.4 Fish Habitat

2.1.4.1 Lakes

The shoreline habitat characteristics of major lakes in the study area were described using a standardized habitat classification system developed by R.L. & L. Environmental Services Ltd. (Appendix A). The classification system categorized shoreline habitat into discrete habitat types based on two variables: slope and substrate type. Lake habitat assessments were accomplished by circumnavigating each lake by boat. In addition to categorizing lake shoreline

into habitat types, important features such as high quality rearing and spawning areas were identified based on visual assessments by qualified field personnel.

2.1.4.2 Streams

The physical habitat available to fish in study area streams was examined during spring and summer to ascertain their importance to fish (habitat quality). Surveys were undertaken using a variety of methods. The physical habitat provided by streams was described using a classification system specifically developed for this purpose by R.L. & L. Environmental Services Ltd. (Appendix A). The classification system categorizes stream habitat into discrete habitat types (e.g., Run, Pool, Riffle). Once the stream was described using this system, several parameters were quantified. Cross-sectional transects within the stream channel were used to measure water depth, water velocity, substrate type, instream cover and stream width. Velocity was measured using a Swoffer Model 2100 digital flow meter and water depths were measured using a calibrated wading rod. Substrate characteristics were recorded according to the modified Wentworth Classification System (Appendix A).

2.2 OFFICE ANALYSES

2.2.1 Physical Environment

2.2.1.1 Water Quality

The water chemistry constituents measured in the Contwoyto Lake West Study Area and their detection limits are listed in Table 2.1.

Table 2.1 Water chemistry constituents and their detection limits, Contwoyto Lake West Study Area, 1999.

Constituent	Unit	Detection Limit	Constituent	Unit	Detection Limit
Conductivity	µS/cm	0.2	Total Dissolved Solids	mg/L	1
Total Alkalinity	mg/L	1	Total Hardness	mg/L	1
Carbonate (CO_3)	mg/L	1	Hydroxide	mg/L	1
Calcium	mg/L	0.05	Total Kjeldahl-N	mg/L	0.05
Bicarbonate	mg/L	1	Ammonia-N	mg/L	0.005
Magnesium	mg/L	0.01	Total Phosphorus	mg/L	0.001
Potassium	mg/L	0.01	Dissolved Phosphorus	mg/L	0.001
Sodium	mg/L	0.1	Ortho-Phosphorus	mg/L	0.001
Chloride	mg/L	0.05	Total Carbon	mg/L	0.5
Sulphate	mg/L	0.05	Total Organic Carbon	mg/L	0.5
Reactive Silica	mg/L	0.003	Total Inorganic Carbon	mg/L	0.5
Turbidity	NTU	0.1	Cation/Anion Balance	%	1
Total Suspended Solids	mg/L	3			

2.2.1.2 Stream Discharge

Stream discharge (m^3/s) was determined using the mid-section method utilized by the United States Geological Survey at gauging stations to calibrate the stage-discharge relationship. This method is described in detail in Buchanan and Somers (1969).

2.2.2 Nonvertebrates

2.2.2.1 Periphyton

In the laboratory, the periphytic algal samples were processed as outlined in Lund et al. (1958). Samples were first mixed and then subjected to serial dilutions (generally 0 to 1000 fold dilutions depending on algal and organic debris in the original sample). Subsequently, 1 to 10 mL subsamples were dispensed into sedimentation chambers. After a 12 h settling period, the basal area of each chamber was scanned qualitatively with an inverted Lietz™ microscope to identify the best dilution factor for subsequent quantitative analyses and to obtain a comprehensive species list. Once the appropriate dilution factor was established, taxonomic groups within the sample were identified and enumerated.

Taxonomic keys of Smith (1950), Prescott (1970), and Webber (1971) were used for species identification. Counts were made at a magnification of approximately 450× along horizontal transects across the diameter of the chamber; a minimum of 200 algal units were examined. Species that were encountered, but not enumerated during routine transect counts, were recorded as present.

To identify and enumerate diatoms, subsamples were treated with a mixture of concentrated sulphuric acid, potassium dichromate, and hydrogen peroxide followed by repeated washes in distilled water. The cleaned frustules were then dried on cover glasses and mounted in Storax™.

Chlorophyll *a* analysis was conducted on all five replicates using the spectrophotometric-acetone extraction method described by Moss (1967a, 1967b). The AFDM subsamples were removed from the five replicate acid-Lugol's preserved samples and filtered onto pre-washed and pre-weighed Whatman™ GF/C filters. They were subsequently dried (at 105˚C for 24 h) and weighed. The dried samples were then ashed in a muffle furnace (at 550˚C for 1 h) and cooled in a desiccator. The difference between dry mass and ash mass is ash-free dry mass (APHA 1992).

2.2.2.2 Phytoplankton

Prior to analyses, the phytoplankton samples were gently inverted, and 10 to 100 mL subsamples were dispensed into sedimentation chambers (Lund et al. 1958). After a 24 h sedimentation period, samples were processed. To obtain a comprehensive species list, the entire basal area of the chamber was scanned qualitatively with an inverted microscope (Wild™ M-40). Taxonomic keys used for identification included Prescott (1970), Taft and Taft (1971), and Webber (1971).

Once a comprehensive species list was established, cell density was assessed. To calculate cell density (cells/mL), individual cells were enumerated within a specified area of the sedimentation chamber. This was accomplished by counting the number of cells along horizontal transects placed across the specified area. To calculate the cell density of each species in the sample, the number of cells within the specified area was extrapolated to the subsample, and then to the entire sample.

Cell biovolume ($\mu m^3/m^3$) was calculated by first measuring the physical dimensions (length, width, and depth) of 10 to 30 cells of each species in the sample. Estimates of cell biovolume were then generated by multiplying the mean dimension of cells of a particular species by the number of cells enumerated for that species. The mean cell biovolume estimate for the subsample was then extrapolated to the entire sample. Species that were encountered during the qualitative assessment, but not enumerated (i.e., very low numbers or located outside the enumeration transects) were recorded as present.

For diatom identification and enumeration, a separate subsample was concentrated, dried onto a coverslip, ashed in a muffle furnace to remove organic matter, and mounted in Storax™.

2.2.2.3 Zooplankton

Zooplankton counts were conducted using a dissecting stereo-microscope (Wild™-5); identifications were made using a compound microscope equipped with a phase-contrast condenser (Wild™-20). Taxonomic keys used for crustacean plankton were Brooks, Wilson, and Yeatman (in Edmondson 1959), supplemented by the keys of Brooks (1957), Smirnov (1971), Brandlova et al. (1972), Flössner (1972), and Kiefer (1978). The taxonomic key used for identification of rotifers was the Voigt revision by Koste (1978), supplemented by keys of Ahlstrom (1943) and Ruttner-Kolisko (1974). Chaoboridae were identified using the keys of Cook (1956) and Saether (1970). Specimens were identified to the lowest taxonomic level possible.

Enumeration of zooplankton involved different techniques that were dependent on taxonomic group. Cladocerans and copepods (all stages) were enumerated either from three 15 mL subsamples or from the entire sample using a dissecting microscope at 12× to 50× magnification. For cladocerans and copepods, subsampling was performed (using an automatic pipette) on samples that contained large numbers of specimens. All samples were subsampled (using an automatic pipette) for rotifer enumeration; however, each subsample was allowed to settle for 24 h before processing. An inverted microscope (100× or 200× magnification) was used to enumerate rotifers by counting either six fields (one field = 0.02625 cm^2) or the entire counting chamber (4.907 cm^2). Subsamples were continually removed from the original sample until approximately 200 mature or identifiable rotifer organisms were processed. Once numbers of organisms within each sample were established, these values were converted to densities per cubic metre. This was accomplished by dividing the number of organisms encountered in a sample by the total volume filtered (i.e., net mouth area × depth of haul × number of hauls).

The biomass of major taxonomic groups within each sample was also determined. To calculate biomass, lengths were measured from the first 30 individuals observed in a sample. Lengths of larger zooplankton were measured directly with a microscope connected to a calibrated Sigma Scan™ digitizing tablet. Smaller zooplankton, such as rotifers, were measured using an eyepiece graticule and corrected for magnification. Using length measurements from individual organisms, weights were calculated from published length-weight regression equations (Table 2.2). For each sample, a mean individual weight was calculated by averaging the estimated weights generated from the

length-weight regression equation (it is important to average weights and not lengths; Bird and Prairie 1985). Biomass for each taxonomic group was calculated by multiplying the number enumerated for that sample by the mean individual weight.

Table 2.2 Length-weight regression equations used to calculate zooplankton weights.

Organism	Equation	Reference
Copepods (N1-Adult)	$\ln W(\mu g) = 1.9526 + 2.399 \cdot \ln L(mm)$	Bottrell et al. (1976)
Daphnia spp.	$\ln W(\mu g) = 1.6 + 2.84 \cdot \ln L(mm)$	Bottrell et al. (1976)
Bosmina and *Eubosmina* spp.	$\ln W(\mu g) = 3.0896 + 3.0395 \cdot \ln L(mm)$	Bottrell et al. (1976)
Chydorus sphaericus	$\ln W(\mu g) = 4.543 + 3.636 \cdot \ln L(mm)$	Downing and Rigler (1984)
Holopedium spp.	$\ln W(\mu g) = 6.4957 + 3.190 \cdot \ln L(mm)$	Downing and Rigler (1984)
Rotifers	$\ln W(\mu g) = -10.3815 + 1.574 \cdot \ln L(\mu m)$	Stemberger and Gilbert (1987)

2.2.2.4 Benthic Macroinvertebrates

In the laboratory, samples were first processed to remove all extraneous substrate and organic matter. Individual samples were washed to remove the preservative and repeatedly elutriated to remove excess silt, sand, and gravel (i.e., inorganic materials). This procedure was continued until nonvertebrates were no longer observed in the elutriated water. The sample was then subsampled using the method described in Wrona et al. 1982; only one third of the sample was used to enumerate the macroinvertebrates.

Using a dissecting microscope (6 to 42× magnification), nonvertebrates were then sorted by major taxonomic group and identified to the lowest practical taxonomic level (genus or species where possible). More difficult groups, such as nematodes, were identified to a higher taxonomic level. Keys used for identification included Wiggins (1977), Merritt and Cummins (1984), and Clifford (1991). As part of the quality assurance / quality control (QA/QC) program, discarded sample material (material thrown out after being examined and sorted for macroinvertebrates) was thoroughly checked by an independent individual.

2.2.3 Fish

2.2.3.1 Ageing

Fish ageing followed the protocol outlined in Mackay et al. (1990). Otoliths were used to age lake trout, Arctic char, and round whitefish. Otoliths, which had been stored dry in labelled envelopes, were first lightly ground and polished with emery cloth (400 grit) to allow sufficient light transmission. Then a binocular dissecting microscope, equipped with a transmitted light source, was used to obtain an age from each structure. Each structure was aged by two independent readers. When discrepancies in the assigned age occurred, the two readers conferred to arrive at a consensus. A third independent reader conducted a random check of selected structures to ensure quality control.

2.2.3.2 Calculations

Relative abundance of fish was calculated in terms of catch-per-unit-effort (CPUE) based on the number of captured fish per unit of effort that was dependent on the sampling method. For backpack electrofishing, the units of effort included minutes of sampling time. For gill nets, catch rates were assessed by using a net-unit approach (i.e., 100 m^2 surface area of net fished for the equivalent of a 12-hour period constitutes one net-unit of effort). Catch-per-unit-effort (CPUE) was expressed as the number of fish (by species) per net-unit.

To facilitate data recording and presentation of the results, all captured fish species were assigned a four-letter code in accordance with Mackay et al. (1990). The common and scientific names of all fish species mentioned in this report, as well as their corresponding coded abbreviations, are presented in Table 2.3.

Table 2.3 Common and scientific names of fish species (and coded abbreviations) recorded in the Contwoyto Lake West Study Area, 1999.

Common Name	Scientific Name	Code[a]
Arctic char	*Salvelinus alpinus* (Linnaeus)	ARCH
Lake trout	*Salvelinus namaycush* (Walbaum)	LKTR
Arctic grayling	*Thymallus arcticus* (Pallas)	ARGR
Round whitefish	*Prosopium cylindraceum* (Pallas)	RNWH
Burbot	*Lota lota* (Linnaeus)	BURB
Slimy sculpin	*Cottus cognatus* Richardson	SLSC
Ninespine stickleback	*Pungitius pungitius* (Linnaeus)	NNST

[a] According to Mackay et al. (1990).

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APPENDIX A

METHODOLOGY

APPENDIX A

STREAM HABITAT CLASSIFICATION SYSTEM

Provides a qualitative assessment of the physical characteristics of a stream and its potential as fish habitat.

Riffle - Portion of channel with increased velocity relative to Run and Pool habitat types; broken water surface due to effects of submerged or exposed bed materials; shallow (less than 25 cm). Limited value as habitat for larger juveniles and adults (i.e., feeding), but may be used extensively by young-of-the-year and small juveniles.

RF - Typical riffle habitat type; provides limited cover for all life stages.

RF/BG - Riffle habitat type with abundance of large cobble and boulder substrates. Limited cover for juveniles and adults; but, may be used extensively by young-of-the-year fish.

Rapids (RA) - Portion of channel with highest velocity relative to other habitat types. Deep (>25 cm); often formed by channel constriction. Substrate extremely coarse; dominated by large cobble and boulder substrates. Habitat provided for juveniles and adults in pocket eddies associated with substrate.

Run - Portion of channel characterized by moderate to high current velocity relative to Pool and Flat habitats; water surface largely unbroken. Potentially high habitat value for all life stages. Can be differentiated into five types based on depth and cover.

R1 - Maximum depth exceeding 1.5 m; average depth 1.0 m. High cover at all flow conditions. Highest quality habitat for larger juveniles and adults; limited value for young-of-the-year-fish.

R2/BG - Maximum depth reaching 1.0 m and generally exceeding 0.75 m; presence of large cobble or boulder substrates in channel. High cover at all flows. Moderate to high quality habitat for larger juveniles and adults.

R2 - Maximum depth reaching 1.0 m and generally exceeding 0.75 m. High cover during most flows, but not during base flows. Moderate quality habitat for juveniles and adults; limited value for young-of-the-year-fish.

R3/BG - Maximum depth of 0.75 m, but averaging <0.50 m; presence of large cobble or boulder substrates in channel. Moderate cover at all flows. Moderate quality habitat for juveniles and adults; but, the value to young-of-the-year-fish is potentially high.

R3 - Maximum depth of 0.75 m, but averaging <0.50 m. Low cover at all flows. Lowest quality habitat for juveniles and adults; but, the value to young-of-the-year-fish is potentially high.

Flat - Area of channel characterized by low current velocities (relative to RF and Run cover types); near-laminar (i.e., non-turbulent) flow. Depositional area dominated sand/silt substrates. Differentiated from Pool habitat type by high channel uniformity and lack of direct association with riffle/run complex. Potential habitat value for all life stages is moderate to high. Can be differentiated into five types based on depth and cover.

F1 - Maximum depth exceeding 1.5 m; average depth 1.0 m or greater. High cover at all flows. Highest quality habitat for larger juveniles and adults; limited value for young-of-the-year-fish.

F2/BG - Maximum depth reaching 1.0 m and generally exceeding 0.75 m; presence of large cobble or boulder substrates in channel. High cover at all flows. Moderate to high quality habitat for larger juveniles and adults.

F2 - Maximum depth exceeding 1.0 m; generally exceeding 0.75 m. High cover during most flows, but not during base flows. Moderate quality habitat for juveniles and adults; limited value for young-of-the-year-fish.

F3/BG - Maximum depth of 0.75 m, but averaging <0.50 m; presence of large cobble or boulder substrates in channel. Moderate cover at all flows. Moderate quality habitat for juveniles and adults; but, the value to young-of-the-year-fish is potentially high.

F3 - Maximum depth of 0.75 m, averaging less than 0.50 m. Low cover at all flows. Lowest quality habitat for juveniles and adults; but, the value to young-of-the-year-fish is potentially high.

Pool - Discrete portion of channel featuring increased depth and reduced velocity (downstream oriented) relative to Riffle and Run habitat types. Normally featuring Riffle/Run associations. Principal habitat value for all life stages is cover. When in close association with Riffle/Run habitats, value can be very high. Can be differentiated into three types based on depth.

P1 - Maximum depth exceeding 1.5 m; average depth 1.0 m or greater; high cover at all flow conditions. Often intergrades with deep-slow type of R1. Highest quality habitat for larger juveniles and adults; limited value for young-of-the-year-fish.

P2 - Maximum depth reaching or exceeding 1.0 m, generally exceeding 0.75 m. High cover at all but base flows. Moderate quality habitat for juveniles and adults; limited value for young-of-the-year-fish.

P3 - Maximum depth of 0.75 m, averaging <0.50 m. Low instream cover; includes small pocket eddies. Lowest quality habitat for all life stages.

Dispersed (DIS) - Portion of stream exhibiting no defined channel. Water depth rarely exceeding 0.25 m and often dispersed over boulder fields. Very limited value as fish habitat.

Habitat Features - Includes the following instream features:

Chutes (CH) - Area of channel constriction; generally resulting in channel deepening and increased velocity. Associated habitat types are Pool, Run, and Rapid.

Ledges (LG) - Areas of bedrock intrusion into the channel; often creates Chutes and Pool habitat.

Falls (FAL) - Area of channel exhibiting rapid vertical decent over boulder and bedrock. Often a barrier to fish passage.

Cascade (CAS) - Area of channel exhibiting rapid decent over boulder and bedrock, but, with no well defined vertical decent (i.e., falls). Often a barrier to fish passage.

Outlet/Inlet (Out) - Confluence of stream and lake; can be the outlet or inlet.

Channel Type - Includes the following categories:

Single (C1) - Entire water flow of stream through one active channel.
Multiple (C2) - Water flow of stream through more than one active channel.
Dispersed (C3) - No defined channel.

Bank Type - Includes the following categories:

Well-defined (D1) - Well-defined boundary at water-bank interface of active stream channel.
Ill-defined (D2) - Poorly defined boundary at water-bank interface of active stream channel.

LAKE SHORELINE HABITAT CLASSIFICATION SYSTEM

Provides a qualitative assessment of the physical characteristics of the littoral zone (zone of visible light penetration to bottom) and its potential as critical fish habitat (spawning and rearing).

Slope - The slope of the visible portion of the lake bottom adjacent to the shoreline. The lower the slope, the greater the amount of shallow water (littoral zone) available for use by smaller juveniles and young-of-the-year fish. Visual estimation of slope using three categories.

Low - 0 to 10%
Moderate - 11 to 30%
High - >30%

Substrate - The dominant substrate in the visible portion of the lake bottom adjacent to the shoreline. The presence of rock (cobbles, boulders) indicates potential as a spawning habitat; presence of fines (organics, clay, silt, sand, gravel) indicates the potential as rearing habitat (enhances growth of macrophytes); presence of bedrock indicates limited value as fish habitat. Visual estimation of the percent cover by each substrate size and then grouping into three categories based on the following criteria:

Fines - >40% of bottom consists of organics, clays, silts, or gravel substrates.
Rock - >60% of bottom consists of cobbles or boulders.
Bedrock - > 40% of bottom consists of bedrock.

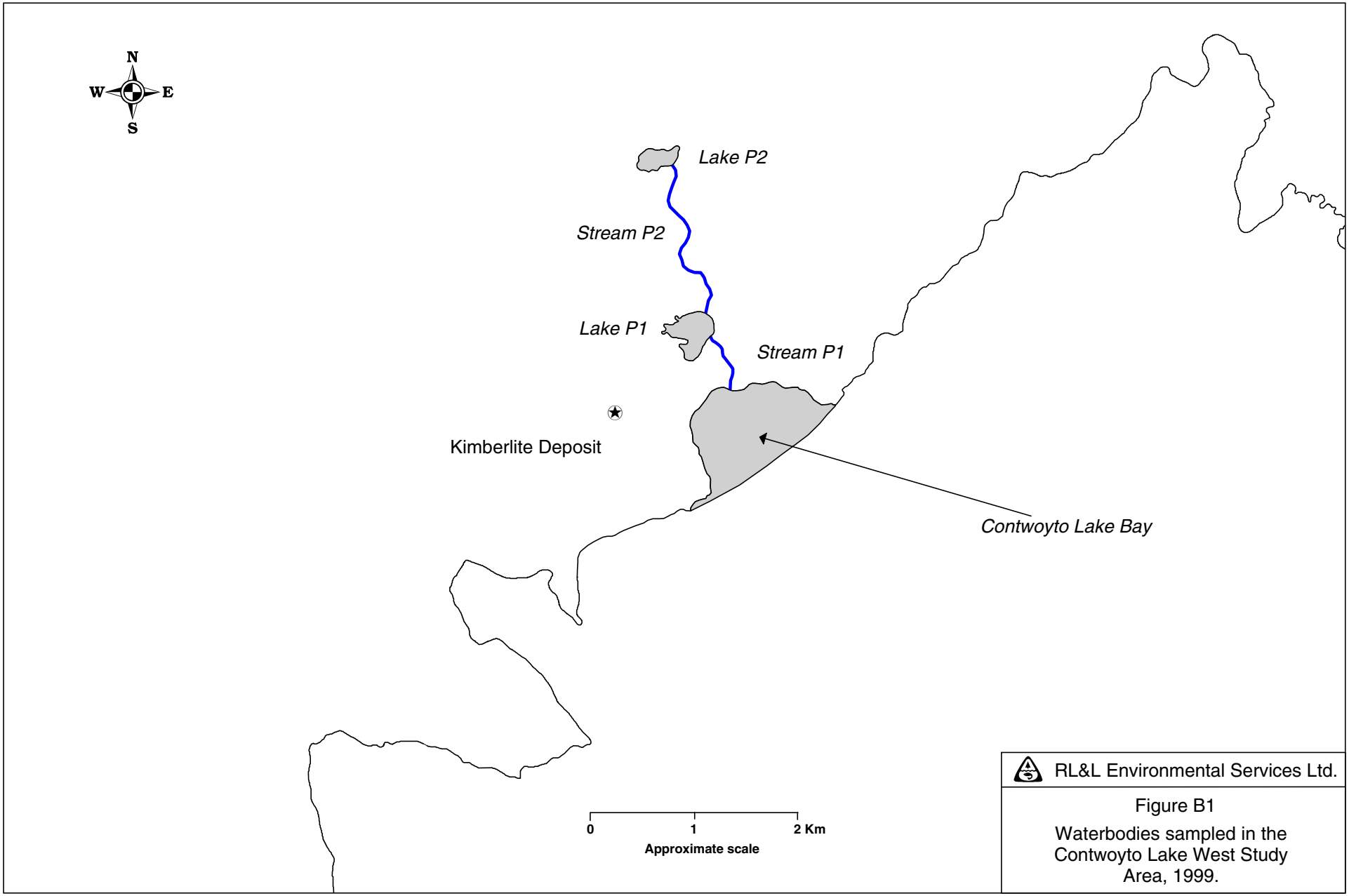
SUBSTRATE CLASSIFICATION SYSTEM

Modified Wentworth classification for substrate particle sizes

CLASSIFICATION	PARTICLE SIZE RANGE (mm)
Bedrock	-
Boulder	>256
Cobble	32 - 256
Gravel	1 - 32
Sand	0.0625 - 0.2-1
Silt	0.0039-0.0625
Clay	<0.0039
Organics	-

APPENDIX B

PHYSICAL CHARACTERISTICS



RL&L Environmental Services Ltd.

Figure B1

Waterbodies sampled in the Contwoyto Lake West Study Area, 1999.

Appendix B Table B1. Information for sites sampled in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Site Type	Zone	Easting	Northing
Contwoyto Lake						
	BELLCTW01	BEL-1	Benthos	12W	509111	7296242
	BEPLCTW01	BEP-1	Benthos	12W	509941	7297281
	EFLCTW01		Backpack electrofishing	12W	509728	7297531
	GNLCTW01		Gill Net	12W	509726	7297498
	GNLCTW02		Gill Net	12W	509571	7296538
	GNLCTW03		Gill Net	12W	509444	7297315
	GNLCTW04		Gill Net	12W	509948	7297546
	GTLCTW01		Gee Trap	12W	509557	7296592
	GTLCTW02		Gee Trap	12W	509369	7297211
	GTLCTW03		Gee Trap	12W	509685	7297526
	GTLCTW04		Gee Trap	12W	510035	7297561
	HYLCTW01	LM-1	Hydrolab	12W	508965	7296223
	HYLCTW02	LM-2	Hydrolab	12W	509423	7297246
	HYLCTW03	LM-3	Hydrolab	12W	509707	7297457
	PELCTW01	PE-1	Periphyton	12W	509831	7297523
	PHLCTW01	PL-1	Phytoplankton	12W	509941	7297281
	WCLCTW01	WC-1	Water Chemistry	12W	510078	7297134
	ZOLCTW01	PL-1	Zooplankton	12W	509941	7297281
Lake P1						
	BELLP0101	BEL-2	Benthos	12W	509426	7298074
	EFLP0101		Backpack electrofishing	12W	509461	7298284
	GNLP0101		Gill Net	12W	509484	7298169
	GNLP0102		Gill Net	12W	509479	7298013
	GTLP0101		Gee Trap	12W	509526	7298049
	GTLP0102		Gee Trap	12W	509561	7298167
	GTLP0103		Gee Trap	12W	509488	7298268
	GTLP0104		Gee Trap	12W	509324	7298011
	PELP0101	PE-3	Periphyton	12W	509540	7298061
	PHLP0101	PL-2	Phytoplankton	12W	509426	7298074
	WCLP0101	WC-2	Water Chemistry	12W	509383	7298173
	ZOLP0101	PL-2	Zooplankton	12W	509426	7298074
Lake P2						
	BELLP0201	BEL-3	Benthos	12W	509005	7299767
	EFLP0201		Backpack electrofishing	12W	509130	7299700
	GNLP0201		Gill Net	12W	508936	7299808
	GNLP0202		Gill Net	12W	509057	7299724
	GTLP0201		Gee Trap	12W	508908	7299668
	GTLP0202		Gee Trap	12W	508952	7299859
	GTLP0203		Gee Trap	12W	509128	7299841
	GTLP0204		Gee Trap	12W	509129	7299707
	PELP0201	PE-5	Periphyton	12W	509051	7299695

Appendix B Table B1. Information for sites sampled in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Site Type	Zone	Easting	Northing
Lake P2						
	PHLP0201	PL-3	Phytoplankton	12W	509005	7299767
	WCLP0201	WC-3	Water Chemistry	12W	509088	7299757
	ZOLP0201	PL-3	Zooplankton	12W	509005	7299767
Stream P1						
	EFTP0102		Backpack electrofishing	12W	509728	7297548
	EFTP0103		Backpack electrofishing	12W	509740	7297756
	PETP0101	PE-2	Periphyton	12W	509731	7297583
	SHTP0101		Stream Habitat	12W	509728	7297532
	SHTP0102		Stream Habitat	12W	509728	7297548
	SHTP0103		Stream Habitat	12W	509740	7297756
	WCTP0101	WC-4	Water Chemistry	12W	509731	7297583
	WTTP0101		Water Temperature	12W	509743	7297651
Stream P2						
	EFTP0201		Backpack electrofishing	12W	509493	7298272
	EFTP0202		Backpack electrofishing	12W	509509	7298351
	PETP0201	PE-4	Periphyton	12W	509546	7298448
	SHTP0201		Stream Habitat	12W	509493	7298272
	SHTP0202		Stream Habitat	12W	509509	7298351
	WCTP0201	WC-5	Water Chemistry	12W	509546	7298448

Appendix B Table B2. Data used to generate bathymetric isobaths in lakes of the Contwoyto Lake West Study Area, 1999.

Waterbody	Transect	Depth (m)	Zone	Easting	Northing
Contwoyto Lake					
	1	0.0	12W	509540	7296529
	1	1.5	12W	509572	7296552
	1	2.0	12W	509581	7296558
	1	2.5	12W	509587	7296562
	1	2.5	12W	509593	7296567
	1	3.0	12W	509601	7296572
	1	3.5	12W	509616	7296583
	1	4.0	12W	509661	7296615
	1	4.0	12W	509686	7296633
	1	4.0	12W	509692	7296637
	1	4.5	12W	509709	7296649
	1	4.5	12W	509715	7296654
	1	5.0	12W	509734	7296667
	1	5.5	12W	509751	7296679
	1	6.0	12W	509763	7296687
	1	6.0	12W	509767	7296690
	1	6.0	12W	509773	7296695
	1	6.0	12W	509782	7296701
	1	6.0	12W	509804	7296717
	1	6.5	12W	509817	7296726
	1	7.0	12W	509827	7296733
	1	7.0	12W	509833	7296738
	1	7.5	12W	509850	7296749
	1	7.5	12W	509858	7296755
	1	8.0	12W	509877	7296769
	1	8.5	12W	509892	7296779
	1	8.5	12W	509900	7296785
	1	9.0	12W	509916	7296797
	1	9.5	12W	509921	7296800
	1	10.0	12W	509950	7296820
	1	10.5	12W	509966	7296832
	1	11.0	12W	509999	7296856
	1	11.5	12W	510033	7296879
	1	11.5	12W	510109	7296934
	1	12.0	12W	510198	7296997
	1	12.0	12W	510263	7297043
	1	11.0	12W	510275	7297052
	1	10.5	12W	510285	7297059
	1	10.0	12W	510302	7297071

Appendix B Table B2. Data used to generate bathymetric isobaths in lakes of the Contwoyto Lake West Study Area, 1999.

Waterbody	Transect	Depth (m)	Zone	Easting	Northing
Contwoyto Lake					
	1	9.5	12W	510312	7297078
	1	9.0	12W	510323	7297086
	1	8.5	12W	510327	7297089
	1	8.0	12W	510352	7297106
	1	7.5	12W	510366	7297117
	1	7.5	12W	510368	7297118
	1	7.0	12W	510400	7297140
	1	7.0	12W	510418	7297153
	1	6.5	12W	510437	7297167
	1	6.0	12W	510460	7297183
	1	6.0	12W	510507	7297217
	1	5.5	12W	510514	7297221
	1	5.5	12W	510522	7297227
	1	5.0	12W	510547	7297245
	1	4.5	12W	510561	7297255
	1	4.0	12W	510580	7297268
	1	4.0	12W	510603	7297285
	1	4.0	12W	510617	7297295
	1	4.0	12W	510628	7297302
	1	3.5	12W	510644	7297314
	1	3.5	12W	510669	7297332
	1	3.5	12W	510671	7297333
	1	3.0	12W	510686	7297344
	1	3.0	12W	510690	7297347
	1	3.0	12W	510692	7297348
	1	3.0	12W	510698	7297352
	1	2.5	12W	510702	7297355
	1	2.0	12W	510706	7297358
	1	1.5	12W	510711	7297361
	1	1.5	12W	510721	7297369
	1	0.0	12W	510745	7297386
	2	11.5	12W	510241	7296960
	2	11.5	12W	510084	7297076
	2	11.5	12W	510070	7297087
	2	11.5	12W	510057	7297096
	2	11.5	12W	510048	7297103
	2	11.0	12W	510019	7297124
	2	10.5	12W	510015	7297127
	2	10.0	12W	510011	7297130

Appendix B Table B2. Data used to generate bathymetric isobaths in lakes of the Contwoyto Lake West Study Area, 1999.

Waterbody	Transect	Depth (m)	Zone	Easting	Northing
Contwoyto Lake					
	2	9.5	12W	510003	7297136
	2	9.0	12W	509995	7297142
	2	8.5	12W	509989	7297146
	2	8.0	12W	509983	7297151
	2	7.5	12W	509976	7297156
	2	7.0	12W	509956	7297171
	2	6.5	12W	509926	7297193
	2	6.0	12W	509909	7297206
	2	5.5	12W	509781	7297301
	2	5.5	12W	509776	7297304
	2	5.0	12W	509764	7297314
	2	4.5	12W	509758	7297318
	2	4.0	12W	509752	7297323
	2	4.0	12W	509697	7297363
	2	4.0	12W	509614	7297425
	2	4.0	12W	509585	7297446
	2	3.5	12W	509575	7297454
	2	3.0	12W	509567	7297460
	2	2.5	12W	509561	7297465
	2	2.0	12W	509558	7297467
	2	1.5	12W	509552	7297471
	2	0.0	12W	509528	7297490
	3	0.0	12W	510156	7297608
	3	1.5	12W	510126	7297554
	3	2.0	12W	510101	7297510
	3	2.0	12W	510099	7297506
	3	2.5	12W	510087	7297484
	3	3.0	12W	510080	7297471
	3	3.5	12W	510069	7297453
	3	4.0	12W	510058	7297432
	3	4.5	12W	510051	7297419
	3	5.0	12W	510043	7297405
	3	5.0	12W	510041	7297401
	3	5.5	12W	510020	7297364
	3	5.5	12W	510016	7297357
	3	6.0	12W	509979	7297290
	3	6.0	12W	509966	7297266
	3	6.0	12W	509964	7297263
	3	6.5	12W	509942	7297224

Appendix B Table B2. Data used to generate bathymetric isobaths in lakes of the Contwoyto Lake West Study Area, 1999.

Waterbody	Transect	Depth (m)	Zone	Easting	Northing
Contwoyto Lake					
	3	7.0	12W	509916	7297176
	3	7.5	12W	509884	7297119
	3	8.0	12W	509833	7297029
	3	8.0	12W	509823	7297010
	3	7.5	12W	509795	7296959
	3	7.0	12W	509779	7296931
	3	6.5	12W	509778	7296929
	3	6.5	12W	509772	7296918
	3	6.0	12W	509770	7296915
	3	5.5	12W	509761	7296898
	3	5.0	12W	509687	7296765
	3	4.5	12W	509678	7296749
	3	4.0	12W	509667	7296730
	3	3.5	12W	509658	7296714
	3	3.0	12W	509637	7296675
	3	2.5	12W	509618	7296642
	3	2.0	12W	509615	7296636
	3	2.0	12W	509609	7296625
	3	2.0	12W	509605	7296618
	3	1.5	12W	509585	7296583
	3	0.0	12W	509564	7296544
	4	0.0	12W	509389	7297325
	4	1.5	12W	509433	7297326
	4	2.0	12W	509437	7297326
	4	2.5	12W	509439	7297326
	4	3.0	12W	509453	7297326
	4	3.5	12W	509462	7297326
	4	4.0	12W	509480	7297327
	4	4.5	12W	509506	7297327
	4	5.0	12W	509517	7297328
	4	5.0	12W	509531	7297328
	4	5.0	12W	509535	7297328
	4	5.0	12W	509543	7297328
	4	5.5	12W	509563	7297329
	4	5.0	12W	509665	7297331
	4	4.5	12W	509687	7297332
	4	4.0	12W	509708	7297332
	4	4.0	12W	509813	7297335
	4	4.5	12W	509828	7297335

Appendix B Table B2. Data used to generate bathymetric isobaths in lakes of the Contwoyto Lake West Study Area, 1999.

Waterbody	Transect	Depth (m)	Zone	Easting	Northing
Contwoyto Lake					
	4	5.0	12W	509838	7297336
	4	5.0	12W	509907	7297337
	4	5.0	12W	509913	7297338
	4	5.0	12W	509921	7297338
	4	4.5	12W	510167	7297344
	4	4.0	12W	510214	7297345
	4	3.5	12W	510255	7297346
	4	3.0	12W	510306	7297347
	4	2.5	12W	510357	7297349
	4	2.5	12W	510424	7297350
	4	2.0	12W	510509	7297352
	4	2.0	12W	510542	7297353
	4	2.5	12W	510556	7297353
	4	2.5	12W	510621	7297355
	4	2.0	12W	510666	7297356
	4	1.5	12W	510672	7297356
	4	1.0	12W	510680	7297357
	4	0.0	12W	510719	7297358
	5	0.0	12W	509393	7297001
	5	1.5	12W	509464	7297039
	5	2.0	12W	509477	7297047
	5	2.5	12W	509488	7297052
	5	3.0	12W	509523	7297071
	5	3.5	12W	509588	7297106
	5	4.0	12W	509599	7297112
	5	4.5	12W	509627	7297127
	5	5.0	12W	509635	7297132
	5	5.5	12W	509659	7297145
	5	6.0	12W	509696	7297165
	5	6.5	12W	509739	7297188
	5	6.0	12W	509886	7297268
	5	5.5	12W	509994	7297327
	5	5.0	12W	510040	7297351
	5	4.5	12W	510064	7297364
	5	4.5	12W	510070	7297368
	5	4.0	12W	510083	7297375
	5	3.5	12W	510126	7297398
	5	3.0	12W	510195	7297436
	5	2.5	12W	510230	7297454

Appendix B Table B2. Data used to generate bathymetric isobaths in lakes of the Contwoyto Lake West Study Area, 1999.

Waterbody	Transect	Depth (m)	Zone	Easting	Northing
Contwoyto Lake					
	5	2.5	12W	510284	7297484
	5	2.0	12W	510306	7297495
	5	1.5	12W	510323	7297505
	5	0.0	12W	510395	7297544

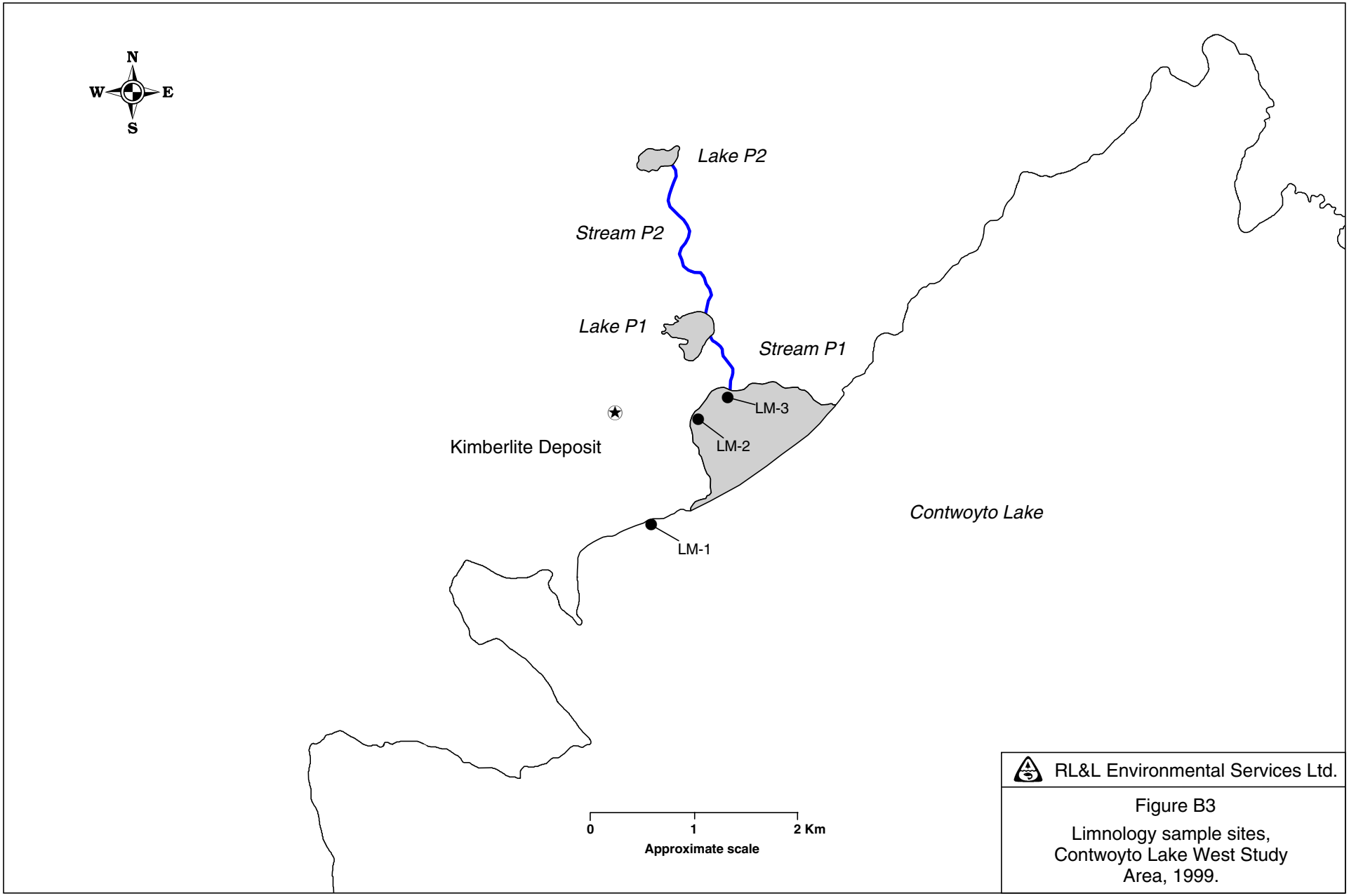


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Figure B3

Limnology sample sites, Contwoyto Lake West Study Area, 1999.

Appendix B Table B3. Temperature and dissolved oxygen profile data from sampled lakes of the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Date	Method	Depth Sampled (m)	DO (mg/L)	Temp (C)
Contwoyto Lake							
	HYLCTW01	LM-1	22-Jul-99	H20 Hydrolab			
					0.0	12.26	7.30
					0.5	11.85	7.27
					1.0	11.86	6.86
					1.5	11.93	6.54
					2.0	11.97	6.33
					2.5	11.94	6.21
					3.0	11.98	6.11
					3.5	11.97	6.08
					4.0	11.99	6.08
					4.5	12.02	6.04
					5.0	11.98	5.97
					5.5	12.00	5.96
					6.0	11.99	5.96
	HYLCTW02	LM-2	22-Jul-99	H20 Hydrolab			
					0.0	11.54	7.91
					0.5	11.60	7.84
					1.0	11.56	7.84
					1.5	11.53	7.84
					2.0	11.52	7.84
	HYLCTW03	LM-3	22-Jul-99	H20 Hydrolab			
					0.1	12.27	7.79
					0.5	11.65	7.77
					1.0	11.58	7.78
					1.5	11.58	7.69
					2.1	11.54	7.74
					2.5	11.55	7.59
					3.0	11.53	7.52
					3.5	11.55	7.39

Appendix B Table B4. Channel characteristics measured during stream surveys in the Contwoyto Lake West Study Area, 1999.

Waterbody	Reach	Date	Slope (^{o})	Length (m)	Wetted Width (m)	Max. Depth (m)	Channel Type	Bank Type	Substrate Type [1] (%)						
									OM	SI	SA	GR	CO	BO	BE
Stream P1															
	1														
		11-Jun-99	3.0	15											
						0.3	Subsurface		10					90	
						0.43	Subsurface		10					90	
						0.25	Subsurface		10					90	
						0.64	Subsurface		10					90	
						0.33	Subsurface		10					90	
						0.21	Subsurface		10					90	
						0.39	Subsurface		10					90	
						0.56	Subsurface		10					90	
						0.54	Subsurface		10					90	
						0.55	Subsurface		10					90	
		28-Jul-99	3.0	15											
						0.39	Subsurface		10					90	
						0.36	Subsurface		10					90	
						0.37	Subsurface		10					90	
	2														
		11-Jun-99	3.0	210											
					1	0.3	Multiple	Defined			30	60	10		
					1.16	0.63	Multiple	Defined						100	
					1.46	0.33	Multiple	Defined						100	
					1.56	0.42	Multiple	Defined						100	
					1.78	0.14	Multiple	Defined			20	60	15	5	
					2.14	0.3	Multiple	Defined					20	80	

Appendix B Table B4. Channel characteristics measured during stream surveys in the Contwoyto Lake West Study Area, 1999.

Waterbody	Reach	Date	Slope (^{o})	Length (m)	Wetted Width (m)	Max. Depth (m)	Channel Type	Bank Type	Substrate Type [1] (%)						
									OM	SI	SA	GR	CO	BO	BE
Stream P1															
	2														
		28-Jul-99	3.0	210											
					1.21	0.22	Multiple	Defined						100	
					1.26	0.29	Multiple	Defined						100	
					1.97	0.1	Multiple	Defined						100	
	3														
		12-Jun-99	1.0	373											
					5.12	0.2	Single	Defined		10		25	20	45	
					7.47	0.25	Single	Ill-defined		5		50	30	15	
					8.19	0.26	Multiple	Ill-defined				30	40	30	
					13.96	0.33	Multiple	Ill-defined		10		25	25	40	
					13.98	0.38	Multiple	Ill-defined	10	10		20	25	35	
					17.97	0.19	Multiple	Ill-defined	10	10			20	60	
					45	0.35	Multiple	Ill-defined	30	30		10		30	
		28-Jul-99	1.0	373											
					1.58	0.21	Multiple	Defined				50	20	30	
					1.98	0.18	Multiple	Ill-defined		5			5	90	
					2	0.07	Multiple	Ill-defined						100	
Stream P2															
	1														
		11-Jun-99	1.0	15											
					1.27	0.34	Multiple	Ill-defined			20	40	20	20	
					1.5	0.36	Multiple	Ill-defined			10	65	5	20	
					2.12	0.47	Multiple	Ill-defined	10	10	65	15			
					3.77	0.34	Multiple	Ill-defined	45		15	40			

Appendix B Table B4. Channel characteristics measured during stream surveys in the Contwoyto Lake West Study Area, 1999.

Waterbody	Reach	Date	Slope (^{o})	Length (m)	Wetted Width (m)	Max. Depth (m)	Channel Type	Bank Type	Substrate Type [1] (%)						
									OM	SI	SA	GR	CO	BO	BE
Stream P2															
	1														
		11-Jun-99	1.0	15											
					4.18	0.29	Multiple	Ill-defined	40	10	10	40			
					4.21	0.6	Single	Ill-defined			30	10	10	50	
					5.82	0.43	Single	Ill-defined			65	25		10	
		28-Jul-99	1.0	15											
					1.99	0.45	Single	Defined		30		40		30	
	2														
		11-Jun-99	2.0	60											
					1.24	0.18	Single	Defined					40	60	
					1.64	0.21	Multiple	Defined			10	5	15	70	
					1.65	0.21	Multiple	Defined			10	20	40	30	
					1.79	0.22	Multiple	Defined	10			30		60	
					1.82	0.32	Multiple	Defined				10	10	80	
					1.85	0.27	Multiple	Defined			10	10	20	60	
		28-Jul-99	2.0	60											
					1.32	0.16	Single	Defined		60		40			
					1.37	0.24	Single	Defined		20		80			
					1.48	0.15	Single	Defined		50	20	20	10		
					1.53	0.17	Single	Defined		10	10	80			

[1] See Appendix A for definitions

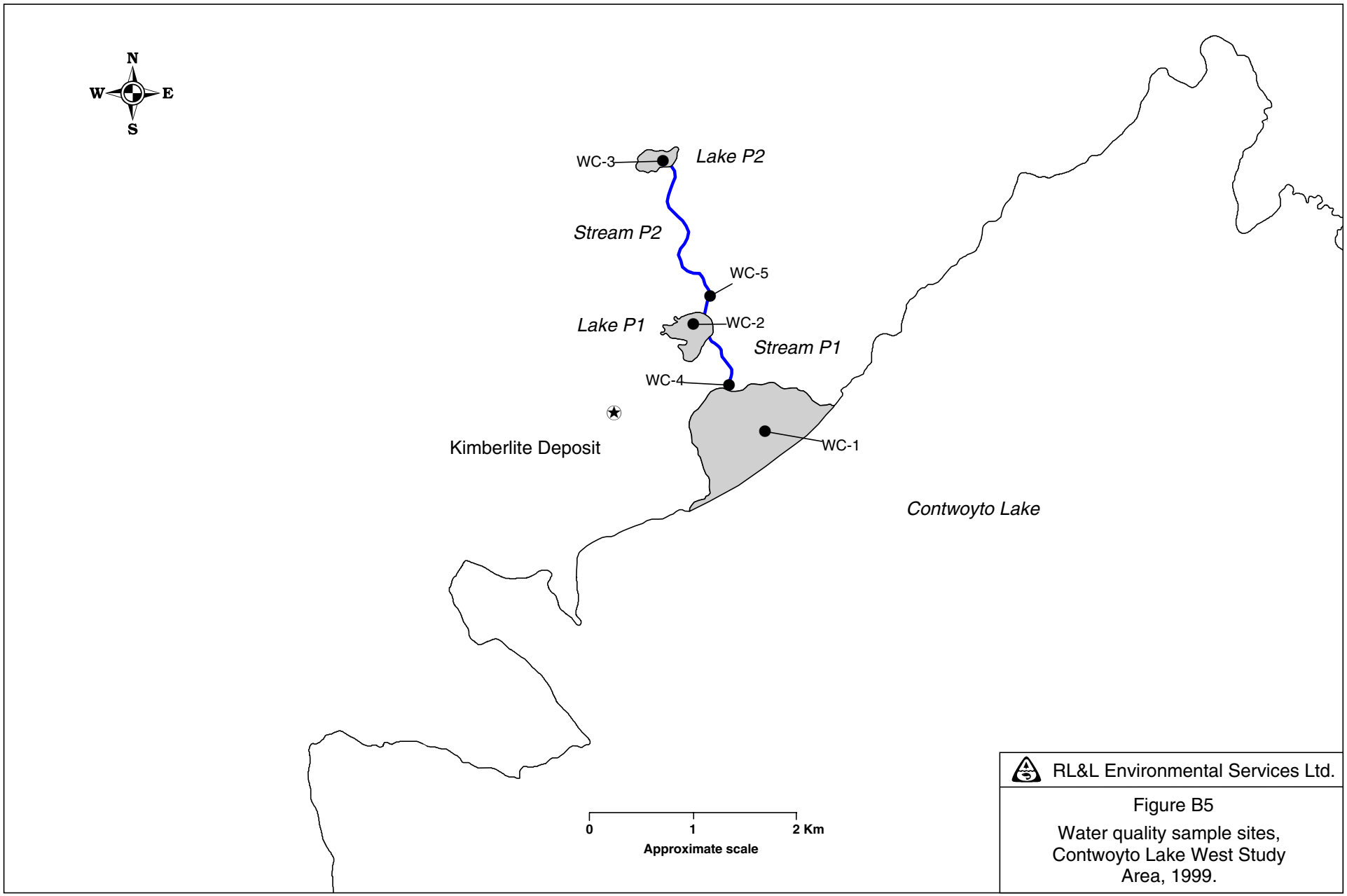

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Figure B5

Water quality sample sites, Contwoyto Lake West Study Area, 1999.

Appendix B Table B5. Results for constituents analyzed in water samples collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Date	Analytical Test	Value	
Contwoyto Lake	WCLCTW01	WC-1				
			25-Jul-99			
				Alkalinity, Total (T Alk)	2.000	mg/L
				Ammonia-N	0.005	mg/L
				Balance	98.000	%
				Bicarbonate (HCO3)	3.000	mg/L
				Calcium (Ca)	0.740	mg/L
				Carbonate (CO3)	0.500	mg/L
				Chloride (Cl)	0.340	mg/L
				Conductance (EC)	13.600	uS/cm
				Hardness	3.000	mg/L
				Hydroxide in Water	0.500	mg/L
				Magnesium (Mg)	0.380	mg/L
				Nitrate/Nitrite-N	0.011	mg/L
				Nitrate-N	0.011	mg/L
				Orthophosphate	0.001	mg/L
				pH in Water	6.400	pH
				Phosphorus, Dissolved	0.002	mg/L
				Phosphorus, Total	0.005	mg/L
				Potassium (K)	0.410	mg/L
				Silica, Reactive (as Si)	0.102	mg/L
				Sodium (Na)	0.400	mg/L
				Sulfate (SO4)	1.850	mg/L
				TDS (Calculated)	5.000	mg/L
				Total Carbon	2.900	mg/L
				Total Inorganic Carbon	0.700	mg/L
				Total Kjeldahl Nitrogen	0.180	mg/L
				Total Organic Carbon	2.200	mg/L
				Total Suspended Solids	4.000	mg/L
				Turbidity	0.270	NTU
Lake P1	WCLP0101	WC-2				
			25-Jul-99			
				Alkalinity, Total (T Alk)	2.000	mg/L
				Ammonia-N	0.007	mg/L
				Balance	101.000	%
				Bicarbonate (HCO3)	3.000	mg/L
				Calcium (Ca)	4.340	mg/L
				Carbonate (CO3)	0.500	mg/L
				Chloride (Cl)	0.440	mg/L

Appendix B Table B5. Results for constituents analyzed in water samples collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Date	Analytical Test	Value	
Lake P1	WCLP0101	WC-2				
			25-Jul-99			
				Conductance (EC)	65.300	uS/cm
				Hardness	21.000	mg/L
				Hydroxide in Water	0.500	mg/L
				Magnesium (Mg)	2.490	mg/L
				Nitrate/Nitrite-N	0.022	mg/L
				Nitrate-N	0.022	mg/L
				Orthophosphate	0.001	mg/L
				pH in Water	6.200	pH
				Phosphorus, Dissolved	0.002	mg/L
				Phosphorus, Total	0.003	mg/L
				Potassium (K)	0.440	mg/L
				Silica, Reactive (as Si)	0.536	mg/L
				Sodium (Na)	1.300	mg/L
				Sulfate (SO4)	20.300	mg/L
				TDS (Calculated)	31.000	mg/L
				Total Kjeldahl Nitrogen	0.230	mg/L
				Total Suspended Solids	1.500	mg/L
				Turbidity	0.790	NTU
Lake P2	WCLP0201	WC-3				
			25-Jul-99			
				Alkalinity, Total (T Alk)	3.000	mg/L
				Ammonia-N	0.008	mg/L
				Balance	100.000	%
				Bicarbonate (HCO3)	3.000	mg/L
				Calcium (Ca)	2.730	mg/L
				Carbonate (CO3)	0.500	mg/L
				Chloride (Cl)	0.450	mg/L
				Conductance (EC)	48.000	uS/cm
				Hardness	15.000	mg/L
				Hydroxide in Water	0.500	mg/L
				Magnesium (Mg)	1.990	mg/L
				Nitrate/Nitrite-N	0.009	mg/L
				Nitrate-N	0.009	mg/L
				Orthophosphate	0.001	mg/L
				pH in Water	6.300	pH
				Phosphorus, Dissolved	0.002	mg/L
				Phosphorus, Total	0.003	mg/L

Appendix B Table B5. Results for constituents analyzed in water samples collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Date	Analytical Test	Value	
Lake P2	WCLP0201	WC-3				
			25-Jul-99			
				Potassium (K)	0.560	mg/L
				Silica, Reactive (as Si)	0.459	mg/L
				Sodium (Na)	1.100	mg/L
				Sulfate (SO4)	14.500	mg/L
				TDS (Calculated)	23.000	mg/L
				Total Carbon	4.000	mg/L
				Total Inorganic Carbon	0.500	mg/L
				Total Kjeldahl Nitrogen	0.230	mg/L
				Total Organic Carbon	3.500	mg/L
				Total Suspended Solids	1.500	mg/L
				Turbidity	0.510	NTU
Stream P1	WCTP0101	WC-4				
			26-Jul-99			
				Alkalinity, Total (T Alk)	2.000	mg/L
				Ammonia-N	0.005	mg/L
				Balance	108.000	%
				Bicarbonate (HCO3)	3.000	mg/L
				Calcium (Ca)	4.730	mg/L
				Carbonate (CO3)	0.500	mg/L
				Chloride (Cl)	0.430	mg/L
				Conductance (EC)	66.800	uS/cm
				Hardness	22.000	mg/L
				Hydroxide in Water	0.500	mg/L
				Magnesium (Mg)	2.410	mg/L
				Nitrate/Nitrite-N	0.006	mg/L
				Nitrate-N	0.006	mg/L
				Orthophosphate	0.001	mg/L
				pH in Water	6.200	pH
				Phosphorus, Dissolved	0.003	mg/L
				Phosphorus, Total	0.003	mg/L
				Potassium (K)	0.630	mg/L
				Silica, Reactive (as Si)	0.348	mg/L
				Sodium (Na)	1.900	mg/L
				Sulfate (SO4)	20.700	mg/L
				TDS (Calculated)	32.000	mg/L
				Total Carbon	5.100	mg/L
				Total Inorganic Carbon	0.700	mg/L

Appendix B Table B5. Results for constituents analyzed in water samples collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Date	Analytical Test	Value	
Stream P1	WCTP0101	WC-4				
			26-Jul-99			
				Total Kjeldahl Nitrogen	0.290	mg/L
				Total Organic Carbon	4.400	mg/L
				Total Suspended Solids	1.500	mg/L
				Turbidity	1.000	NTU
Stream P2	WCTP0201	WC-5				
			26-Jul-99			
				Alkalinity, Total (T Alk)	2.000	mg/L
				Ammonia-N	0.005	mg/L
				Balance	95.000	%
				Bicarbonate (HCO3)	2.000	mg/L
				Calcium (Ca)	2.970	mg/L
				Carbonate (CO3)	0.500	mg/L
				Chloride (Cl)	0.360	mg/L
				Conductance (EC)	50.400	uS/cm
				Hardness	15.000	mg/L
				Hydroxide in Water	0.500	mg/L
				Magnesium (Mg)	1.850	mg/L
				Nitrate/Nitrite-N	0.088	mg/L
				Nitrate-N	0.088	mg/L
				Orthophosphate	0.003	mg/L
				pH in Water	5.800	pH
				Phosphorus, Dissolved	0.001	mg/L
				Phosphorus, Total	0.002	mg/L
				Potassium (K)	0.360	mg/L
				Silica, Reactive (as Si)	1.330	mg/L
				Sodium (Na)	1.100	mg/L
				Sulfate (SO4)	15.800	mg/L
				TDS (Calculated)	24.000	mg/L
				Total Carbon	3.800	mg/L
				Total Inorganic Carbon	0.600	mg/L
				Total Kjeldahl Nitrogen	0.210	mg/L
				Total Organic Carbon	3.200	mg/L
				Total Suspended Solids	1.500	mg/L
				Turbidity	0.630	NTU

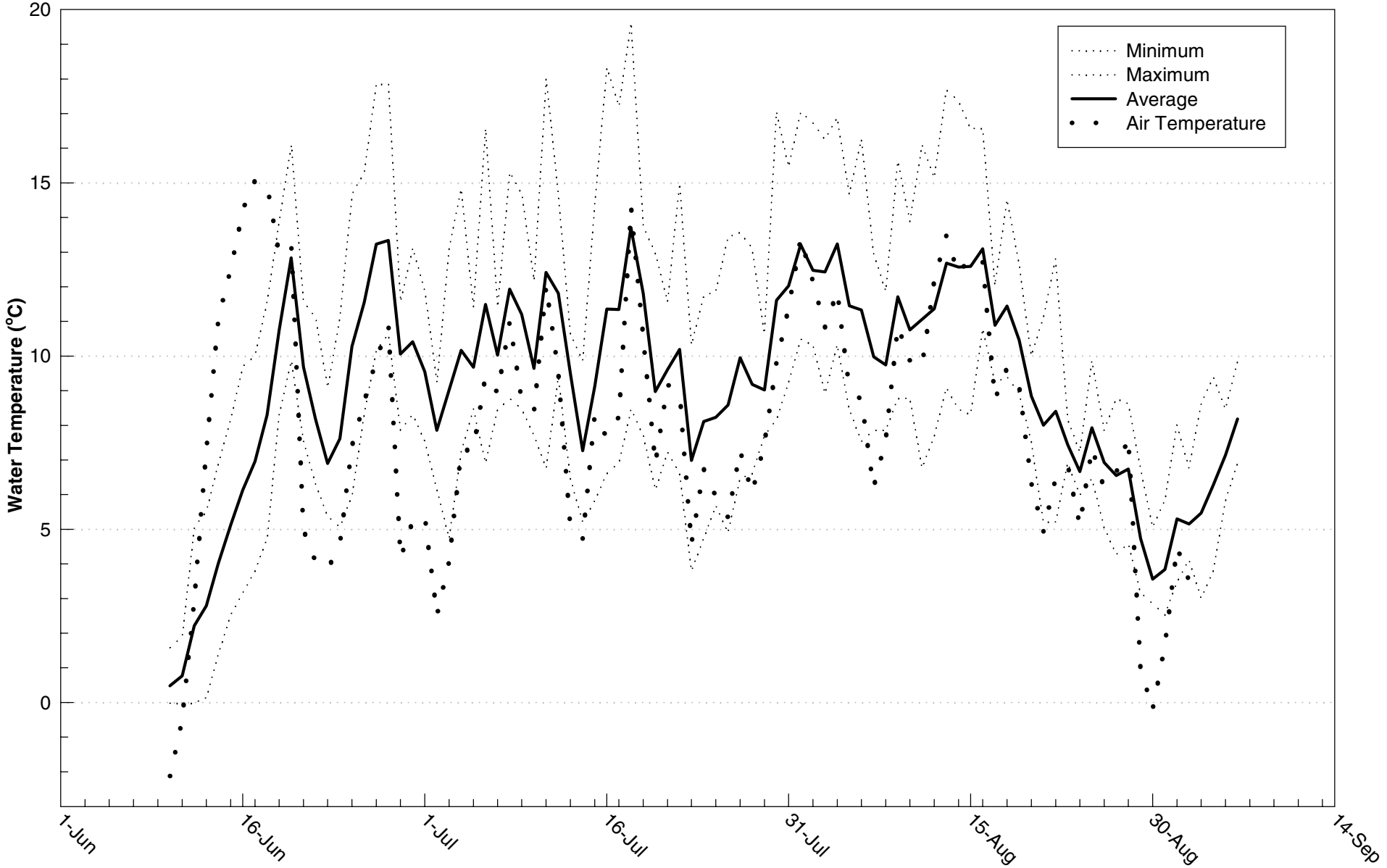

Figure B6 Daily water temperatures in Stream P1 from June to September 1999 (average daily air temperature provided for comparison).

APPENDIX C

NONVERTEBRATES

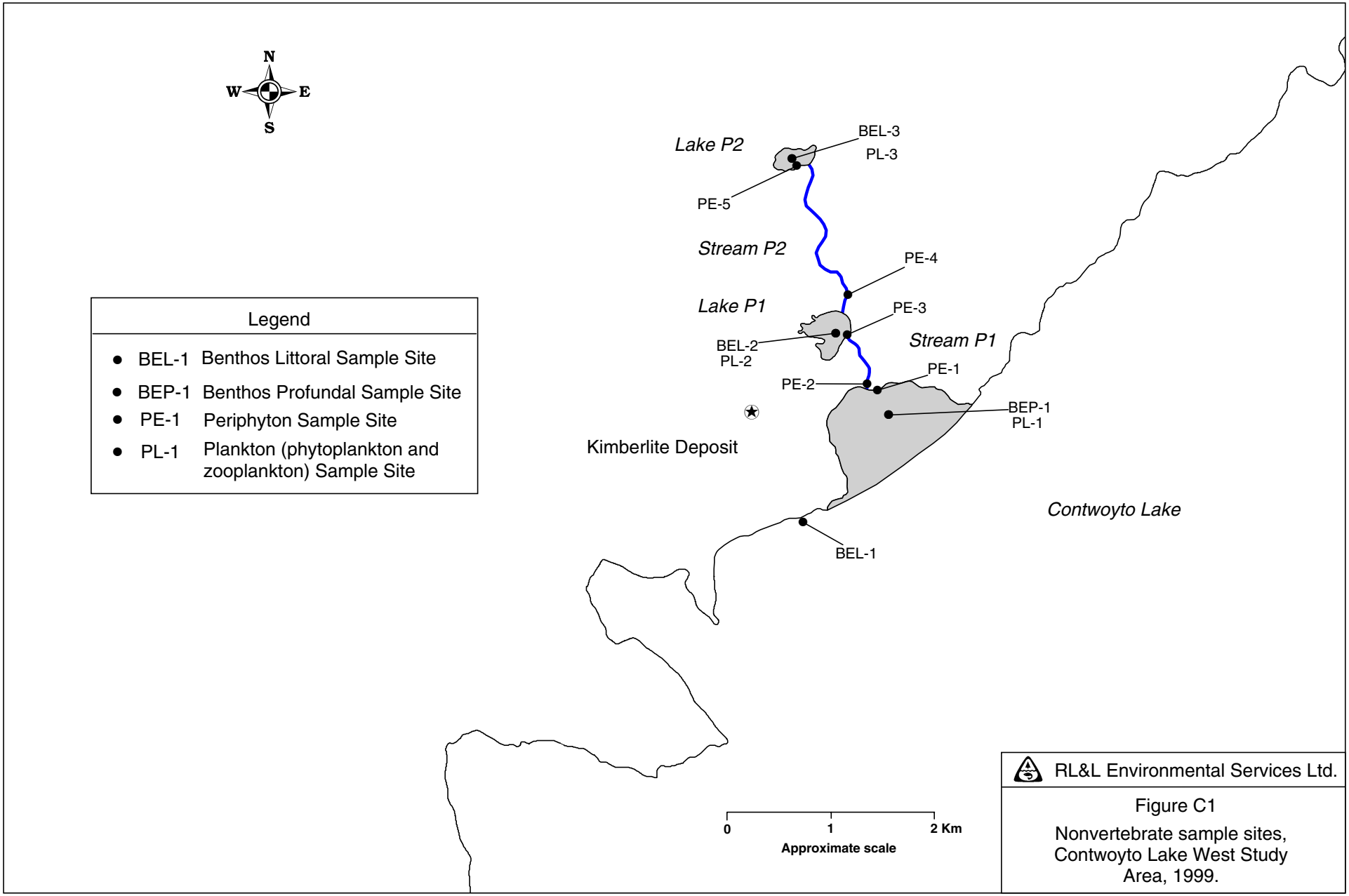

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Figure C1

Nonvertebrate sample sites, Contwoyto Lake West Study Area, 1999.

Appendix C Table C1. Periphyton sample parameters, chlorophyll *a* and ash free dry mass (AFDM) data collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Date	Area (cm^2)	Composite Number	Volume Filtered (mL)	Chlorophyll *a* (mg/m^2)	AFDM (mg/m^2)
Contwoyto Lake								
	PELCTW01	PE-1	25-Jul-99	20.0	5	5	2.79	17.60
Lake P1								
	PELP0101	PE-3	25-Jul-99	20.0	5	5	2.12	25.79
Lake P2								
	PELP0201	PE-5	25-Jul-99	20.0	5	5	0.00	10.07
Stream P1								
	PETP0101	PE-2	26-Jul-99	20.0	5	5	7.76	40.28
Stream P2								
	PETP0201	PE-4	26-Jul-99	20.0	5	5	1.44	18.68

Appendix C Table C2. Periphyton species and density data collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/cm^2)	Presence
Contwoyto Lake	PELCTW01	PE-1				
			BACILLARIOPHYTA			
				Achnanthes minutissima	3533	P
				Anabaena sp.		P
				Anacystis montana	2231	P
				Ankistrodesmus falcatus v. spiralis	558	P
				Aphanocapsa elachista v. planctonica	11900	P
				Arthrodesmus triangularis	186	P
				Bulbochaete sp.	1302	P
				Characium sp.		P
				Closterium spa		P
				Coeloastrum printzii		P
				Cosmarium capitulum v. groenlandicum		P
				Cosmarium septentrionale		P
				Cosmarium sp.	372	P
				Cosmarium speciosum		P
				Cosmarium subcrenulatum		P
				Cylindrocystis brebissonii	246	P
				Cymbella gracilis		P
				Desmonema wrangelii	43880	P
				Diatoma elongatum		P
				Dichothrix gypsophila	21196	P
				Dinobryon sertularia v.protuberans	6786	P
				Euastrum denticulatum		P
				Euastrum dubium v. maius		P
				Euastrum elegans		P
				Euastrum pectinatum		P
				Eunotia arcus	186	P
				Eunotia exigua		P
				Eunotia praerupta	369	P
				Frustulia vulgaris		P
				Gloeocystis schroeteri	4462	P
				Gomphosphaeria naegelianum		P
				Hyalotheca sp.	1116	P
				Kephyrion boreale	372	P
				Lyngbya contorta	2417	P
				Lyngbya sp.		P
				Melosira sp.		P
				Meridion circulare		P
				Mougeotia sp. a	930	P
				Mougeotia sp. b	1627	P
				Navicula sp.	615	P
				Nostoc commune		P
				Oocystis elliptica	1116	P
				Oocystis lacustris	9669	P
				Ophiocytium sp.		P

Appendix C Table C2. Periphyton species and density data collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/cm^2)	Presence
Contwoyto Lake	PELCTW01	PE-1				
			BACILLARIOPHYTA			
				Pediastrum boryanum v. ellesmerense		P
				Peridinium sp.		P
				Phacotus sp.	186	P
				Pinnularia sp.		P
				Pseudokephyrion angulosum	186	P
				Scenedesmus incrassatulus		P
				Scenedesmus quadricauda		P
				Schizothrix calcicola	443637	P
				Scopulonema minus	1673	P
				Sphaerozosma granulatum.	744	P
				Staurastrum sp.		P
				Synedra actinastroides	3533	P
				Synedra ulna		P
				Tabellaria fenestrata	744	P
				Tabellaria flocculosa	23117	P
				Total	589261	P
				Total Bacillariophyta	32097	P
				Total Chlorophyta	22514	P
				Total Chrysophyta	7716	P
				Total Cryptophyta	0	P
				Total Cyanophyta	526934	P
				Total Euglenophyta	0	P
				Total Pyrrophyta	0	P
				Trachelomonas sp.		P
				Unidentified statospore	372	P
				Xanthidium antilopaeum		P
				Zygnema sp.		P
Lake P1	PELP0101	PE-3				
			BACILLARIOPHYTA			
				Achnanthes flexella	996	P
				Achnanthes minutissima	72077	P
				Achnanthes sp.	4032	P
				Actinotaenium sp.		P
				Anabaena sp.	12097	P
				Anacystis cyanea		P
				Anacystis montana	66533	P
				Ankistrodesmus falcatus		P
				Aphanocapsa elachista v. planctonica	126099	P
				Arthrodesmus triangularis		P
				Bulbochaete sp.	1008	P
				Caloneis ventricosa v. truncatula		P
				Closterium spa		P
				Cosmarium granulatum		P

Appendix C Table C2. Periphyton species and density data collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/cm^2)	Presence
Lake P1	PELP0101	PE-3				
			BACILLARIOPHYTA			
				Cosmarium holmiense v. intermedium		P
				Cosmarium humile v. lacustre		P
				Cosmarium rectangulum		P
				Cosmarium sp.		P
				Cosmarium sp.	1494	P
				Cosmarium subcrenulatum		P
				Cylindrocystis brebissonii		P
				Cymbella gracilis	1008	P
				Cymbella sp.		P
				Dactylococcopsis linearis	6048	P
				Dinobryon sertularia v.protuberans	19153	P
				Elakatothrix sp.	1494	P
				Euastrum bidentatum	498	P
				Euastrum dubium v. maius	1008	P
				Euastrum elegans		P
				Eunotia maior	17137	P
				Eunotia praerupta	1494	P
				Eunotia praerupta v. bidens		P
				Eunotia triodon		P
				Fragilaria lapponica	13105	P
				Frustulia vulgaris	9073	P
				Gloeocystis schroeteri	1008	P
				Gomphonema sp.	69053	P
				Gomphosphaeria naegelianum	504036	P
				Gymnodinium uberrimum		P
				Kephyrion boreale		P
				Mougeotia sp. a		P
				Mougeotia sp. b	2016	P
				Nedium incurvum		P
				Nedium sp.		P
				Nitzschia angustata		P
				Nitzschia sp.	4032	P
				Oocystis elliptica		P
				Oocystis lacustris	36291	P
				Oscillatoria sp.		P
				Penium sp.		P
				Peridinium sp.		P
				Pinnularia sp.		P
				Pinnularia viridis		P
				Scenedesmus incrassatulus		P
				Schizothrix calcicola	820570	P
				Scopulonema minus	17137	P
				Scytonema figuratum	18428	P
				Sphaerozosma granulatum.	1992	P

Appendix C Table C2. Periphyton species and density data collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/cm^2)	Presence
Lake P1	PELP0101	PE-3				
			BACILLARIOPHYTA			
				Staurastrum borgeanum		P
				Staurastrum pachyrhynchum		P
				Staurastrum sp.		P
				Stauroneis phoenicenteron		P
				Stigonema mamillosum		P
				Surirella sp.		P
				Synedra sp	18145	P
				Tabellaria fenestrata	747	P
				Tabellaria flocculosa	160283	P
				Total	2017165	P
				Total Bacillariophyta	371182	P
				Total Chlorophyta	46809	P
				Total Chrysophyta	28226	P
				Total Cryptophyta	0	P
				Total Cyanophyta	1570948	P
				Total Euglenophyta	0	P
				Total Pyrrophyta	0	P
				Trachelomonas sp.		P
				Unidentified pennate diatom		P
				Unidentified statospore	9073	P
				Zygnema sp.		P
Lake P2	PELP0201	PE-5				
			BACILLARIOPHYTA			
				Achnanthes flexella		P
				Achnanthes minutissima	1302	P
				Agmenellum quadruplicatum		P
				Anabaena sp.	1859	P
				Anacystis dimidiata	744	P
				Anacystis montana	2231	P
				Ankistrodesmus falcatus v. spiralis		P
				Aphanocapsa elachista	23985	P
				Arthrodesmus incus f. minor	37	P
				Arthrodesmus triangularis v. inflatus		P
				Botryococcus sp.		P
				Bulbochaete sp.	372	P
				Closterium spa		P
				Coeloastrum printzii		P
				Cosmarium granulatum		P
				Cosmarium rectangulare		P
				Cosmarium septentrionale		P
				Cosmarium sp.	372	P
				Cosmarium subgranatum		P
				Crucigenia rectangularis		P

Appendix C Table C2. Periphyton species and density data collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/cm^2)	Presence
Lake P2	PELP0201	PE-5				
			BACILLARIOPHYTA			
				Cylindrocystis brebissonii	353	P
				Cymbella sp.	186	P
				Dactylococcopsis linearis		P
				Desmonema wrangelii	35885	P
				Dinobryon sertularia v.protuberans	13273	P
				Elakatothrix sp.	186	P
				Euastrum dubium v. maius		P
				Euastrum elegans		P
				Eunotia arcus	373	P
				Eunotia maior		P
				Eunotia praerupta	614	P
				Eunotia praerupta v. bidens		P
				Frustulia vulgaris	339	P
				Gloeocystis schroeteri		P
				Hyalotheca sp.	744	P
				Kephyrion boreale		P
				Melosira sp.	113	P
				Mougeotia sp. a		P
				Mougeotia sp. b	1952	P
				Nostoc commune		P
				Oocystis elliptica	930	P
				Oocystis lacustris	7251	P
				Peridinium sp.		P
				Pinnularia sp.		P
				Pseudokephyrion angulosum	372	P
				Scenedesmus incrassatulus		P
				Schizothrix calcicola	121043	P
				Scopulonema minus	7995	P
				Sphaerozosma granulatum.	1859	P
				Staurastrum borgeanum		P
				Staurastrum dejectum	186	P
				Staurastrum gladiosum		P
				Staurastrum sp.		P
				Stichogloea doederleinii		P
				Stigonema mamillosum	2975	P
				Synedra sp.	465	P
				Tabellaria fenestrata		P
				Tabellaria flocculosa	8042	P
				Total	248820.5	P
				Total Bacillariophyta	11434	P
				Total Chlorophyta	14242	P
				Total Chrysophyta	23964	P
				Total Cryptophyta	0	P
				Total Cyanophyta	196717	P

Appendix C Table C2. Periphyton species and density data collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/cm^2)	Presence
Lake P2	PELP0201	PE-5				
			BACILLARIOPHYTA			
				Total Euglenophyta	0	P
				Total Pyrrophyta	0	P
				Unidentified pennate diatom	1952	P
				Unidentified pennate diatom	2789	P
				Unidentified pennate diatom	186	P
				Unidentified statospore	10319	P
				Xanthidium smithii		P
				Zygnema sp.		P
Stream P1	PETP0101	PE-2				
			BACILLARIOPHYTA			
				Achnanthes flexella		P
				Achnanthes minutissima	18590	P
				Actinotaenium sp.	680	P
				Anacystis cyanea	125505	P
				Anacystis dimidiata		P
				Anacystis montana	141309	P
				Ankistrodesmus falcatus	1701	P
				Ankistrodesmus falcatus v. spiralis		P
				Aphanocapsa elachista	529910	P
				Arthrodesmus triangularis		P
				Bulbochaete sp.	1020	P
				Caloneis sp.	205921	P
				Characium sp.		P
				Closterium spa	255	P
				Closterium spb	228	P
				Cosmarium capitulum v. groenlandicum	2466	P
				Cosmarium granulatum		P
				Cosmarium rectangulum	680	P
				Cosmarium septentrionale		P
				Cosmarium sp.	1020	P
				Cosmarium subcrenulatum		P
				Cosmarium tetraopthalmum		P
				Cylindrocystis brebissonii		P
				Cymbella cuspidata		P
				Cymbella gracilis	1859	P
				Cymbella minuta		P
				Dactylococcopsis linearis		P
				Dichothrix gypsophila	92863	P
				Dinobryon sertularia v.protuberans	1859	P
				Elakatothrix sp.	2041	P
				Euastrum ansatum		P
				Euastrum bidentatum		P
				Euastrum denticulatum		P

Appendix C Table C2. Periphyton species and density data collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/cm^2)	Presence
Stream P1	PETP0101	PE-2				
			BACILLARIOPHYTA			
				Euastrum dubium v. maius	340	P
				Euastrum elegans	680	P
				Euastrum verrucosum		P
				Eunotia arcus		P
				Eunotia glacialis		P
				Eunotia maior		P
				Eunotia praerupta	7753	P
				Eunotia praerupta v. bidens	3741	P
				Fragilaria lapponica	3719	P
				Fragilaria sp.	2551	P
				Frustulia vulgaris	23558	P
				Geminella interrupta		P
				Gloeocystis schroeteri	27890	P
				Gomphonema sp.	1859	P
				Gomphosphaeria naegelianum	38434	P
				Hyalotheca sp.		P
				Kephyrion boreale	1859	P
				Melosira sp.	37187	P
				Mougeotia sp. a	1701	P
				Mougeotia sp. b	2211	P
				Netrium so.		P
				Oocystis elliptica	12402	P
				Oscillatoria tenuis		P
				Pediastrum boryanum v. ellesmerense	1360	P
				Penium sp.	3571	P
				Peridinium sp.		P
				Pinnularia sp.		P
				Scenedesmus denticulatis		P
				Scenedesmus incrassatulus	3719	P
				Scenedesmus quadricauda	7437	P
				Schizothrix calcicola	1121177	P
				Sphaerozosma granulatum.	340	P
				Staurastrum borgeanum	340	P
				Staurastrum furcigerum	340	P
				Staurastrum gladiosum		P
				Staurastrum sp.	680	P
				Staurastrum varians	340	P
				Stauroneis anceps		P
				Stauroneis phoenicenteron		P
				Stichogloea doederleinii	26031	P
				Stigonema mamillosum		P
				Surirella sp.		P
				Synedra ulna	46483	P
				Tabellaria fenestrata		P

Appendix C Table C2. Periphyton species and density data collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/cm^2)	Presence
Stream P1	PETP0101	PE-2				
			BACILLARIOPHYTA			
				Tabellaria flocculosa	167953	P
				Total	2680066	P
				Total Bacillariophyta	521174	P
				Total Chlorophyta	73442	P
				Total Chrysophyta	29749	P
				Total Cryptophyta	0	P
				Total Cyanophyta	2049198	P
				Total Euglenophyta	0	P
				Total Pyrrophyta	0	P
				Unidentified pennate diatom	11147	P
				Unidentified pennate diatom	1859	P
				Zygnema sp.		P
Stream P2	PETP0201	PE-4				
			BACILLARIOPHYTA			
				Achnanthes minutissima	109	P
				Achnanthes sp.	291	P
				Anacystis montana	655	P
				Ankistrodesmus falcatus		P
				Aphanocapsa elachista v. planctonica	764	P
				Characium sp.	36	P
				Closterium spa		P
				Closterium spb		P
				Cosmarium sp.		P
				Cosmarium subcrenulatum		P
				Cylindrocystis brebissonii	9	P
				Desmonema wrangelii	10331	P
				Dichothrix gypsophila	7603	P
				Dinobryon sertularia v.protuberans	91	P
				Euastrum dubium v. maius		P
				Eunotia glacialis	177	P
				Eunotia praerupta	76	P
				Eunotia triodon	18	P
				Frustulia vulgaris	146	P
				Geminella interrupta	827	P
				Gloeocystis schroeteri	91	P
				Hyalotheca sp.	36	P
				Kephyrion boreale	127	P
				Oocystis elliptica	236	P
				Oscillatoria tenuis	218	P
				Pseudokephyrion angulosum	23	P
				Schizothrix calcicola	3692	P
				Scopulonema minus	3674	P
				Sphaerozosma granulatum.		P

Appendix C Table C2. Periphyton species and density data collected from waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/cm^2)	Presence
Stream P2	PETP0201	PE-4				
			BACILLARIOPHYTA			
				Stichogloea doederleinii	200	P
				Stigonema mamillosum	2728	P
				Tabellaria fenestrata		P
				Tabellaria flocculosa	723	P
				Total	32894.5	P
				Total Bacillariophyta	1540	P
				Total Chlorophyta	1235	P
				Total Chrysophyta	441	P
				Total Cryptophyta	0	P
				Total Cyanophyta	29665	P
				Total Euglenophyta	0	P
				Total Pyrrophyta	0	P
				Unidentified pennate diatom	27	P
				Zygnema sp.		P

Appendix C Table C3. Phytoplankton sample parameters and chlorophyll *a* data collected from lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Date	Secchi Depth (m)	Depth Sampled (m)	Composite Number	Volume Filtered for Chlorophyll a Analysis (mL)	Chlorophyll a (mg/m^2)
Contwoyto Lake								
	PHLCTW01							
		PL-1	25-Jul-99	7.10	10.00	5	300	0.53
Lake P1								
	PHLP0101							
		PL-2	25-Jul-99	1.10	0.40	5	300	0.26
Lake P2								
	PHLP0201							
		PL-3	25-Jul-99	3.30	2.00	20	300	0.28

Appendix C Table C4. Phytoplankton species, density, and biovolume data collected from lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/mL)	Biovolume ($um^3 x 10^3$/mL)	Presence
Contwoyto Lake	PHLCTW01	PL-1					
			BACILLARIOPHYTA				
				Achnanthes flexella	0	0.000	P
				Achnanthes minutissima	17	3.679	
				Caloneis ventricosa	0	0.000	P
				Cyclotella glomerata	53	3.503	
				Cyclotella ocellata	36	48.218	
				Eunotia sp.	0	0.000	P
				Frustulia vulgaris	7	6.563	
				Melosira sp.	0	0.000	P
				Rhizosolenia longiseta	18	3.668	
				Synedra sp.	0	0.000	P
				Tabellaria floculosa	0	0.000	P
			CHLOROPHYTA				
				Ankistrodesmus convolutus	4	0.074	
				Ankistrodesmus falcatus	4	0.236	
				Ankistrodesmus falcatus v. spiralis	93	1.736	
				Arthrodesmus triangularis	4	2.457	
				Characium sp.	0	0.000	P
				Chlamydomonas sp. a	11	0.771	
				Coelastrum printzii	4	13.386	
				Cosmarium subcrenatum	0	0.000	P
				Crucigenia quadrata	0	0.000	P
				Elakatothrix gelatinosa	2	0.131	
				Hyalotheca sp.	0	0.000	P
				Kirchneriella sp.	7	0.101	
				Oocystis elliptica	11	8.895	
				Oocystis lacustris	4	2.387	
				Pediastrum simplex	0	0.000	P
				Sphaerocystis schroeteri	133	38.991	
				Sphaerozosma granulatum	7	4.789	
				Tetraedron arthrodesmiforme	21	0.769	
			CHRYSOPHYTA				
				Bitrichia longispina	0	0.000	P
				Chrysidastrum catenatum	28	14.506	
				Chrysochromulina parva	179	6.194	
				Chrysococcus sp.	227	18.392	
				Chrysoikos skujai	7	2.539	
				Chrysosphaerella rodhei	482	113.689	
				Chrysostephanosphaera globulifer	18	13.764	
				Dinobryon sertularia	0	0.000	P
				Dinobryon sertularia v.protuberans	18	28.411	
				Dinobryon sociale	69	89.973	
				Dinobryon tabellariae	7	16.906	

Appendix C Table C4. Phytoplankton species, density, and biovolume data collected from lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/mL)	Biovolume ($um^3 x 10^3$/mL)	Presence
Contwoyto Lake	PHLCTW01	PL-1					
			CHRYSOPHYTA				
				Ishtmochloron trispinatum	4	1.393	
				Kephyrion boreale	14	5.298	
				Mallomonas sp.	0	0.000	P
				Ochromonas sp. a	17	74.131	
				Ochromonas sp. b	4	0.916	
				Ochromonas stellaris	0	0.000	P
				Pseudokephyrion sp.	4	0.844	
				Stichogloea doederleinii	78	22.568	
				Synura sp.	7	4.402	
			CRYPTOPHYTA				
				Cryptomonas curvata	4	16.326	
				Cryptomonas ovata	0	0.000	P
				Cryptomonas reflexa	11	12.089	
				Katablepharis ovalis	57	11.139	
				Rhodomonas minuta	36	8.917	
			CYANOPHYTA				
				Anabaena sp.	0	0.000	P
				Anacystis montana	0	0.000	P
				Aphanocapsa elachista	796	2.772	
				Aphanothece clathrata	668	0.484	
				Dichotrix gypsophila	0	0.000	P
				Oscillatoria limnetica	71	0.784	
			PYRROPHYTA				
				Glenodinium sp.	28	35.558	
				Gymnodinium uberrimum	0	0.000	P
				Peridinium aciculiferum	12	106.187	
Lake P1	PHLP0101	PL-2					
			BACILLARIOPHYTA				
				Achnanthes flexella	0	0.000	P
				Achnanthes minutissima	9	3.362	
				Cocconeis sp.	0	0.000	P
				Cyclotella ocellata	2	1.692	
				Cyclotella sp.	0	0.000	P
				Cymbella minuta	0	0.000	P
				Diatoma elongatum	0	0.000	P
				Eunotia bidentula	0	0.000	P
				Eunotia exigua	1	0.342	
				Eunotia praerupta	2	1.295	
				Eunotia sp.	0	0.000	P
				Frustulia vulgaris	0	0.000	P
				Melosira sp.	4	0.871	
				Nitzschia sp. b	0	0.000	P

Appendix C Table C4. Phytoplankton species, density, and biovolume data collected from lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/mL)	Biovolume ($um^3 x 10^3$/mL)	Presence
Lake P1	PHLP0101	PL-2					
			BACILLARIOPHYTA				
				Pinnularia sp.	0	0.000	P
				Surirella sp.	0	0.000	P
				Synedra sp.	6	2.031	
				Tabellaria fenestrata	0	0.000	P
				Tabellaria floculosa	21	27.140	
			CHLOROPHYTA				
				Arthrodesmus triangularis	0	0.000	P
				Bulbochaete sp.	8	47.994	
				Chlamydomonas sp. a	3	0.807	
				Chlamydomonas sp. b	0	0.000	P
				Closterium sp. a	0	0.000	P
				Closterium sp. b	0	0.000	P
				Cosmarium phaseolus v. phaseolus	0	0.000	P
				Crucigenia quadrata	242	12.529	
				Crucigenia rectangularis	0	0.000	P
				Gonatozygon brebissonii	0	0.000	P
				Kirchneriella sp.	2	0.028	
				Oocystis elliptica	12	7.251	
				Oocystis lacustris	3	7.480	
				Oocystis pusilla	41	11.922	
				Pediastrum tetras	0	0.000	P
				Schroederia setigera	5	2.348	
				Sphaerocystis schroeteri	49	31.858	
				Sphaerozosma granulatum	3	1.463	
				Staurastrum sp. a	0	0.000	P
				Staurastrum sp. b	0	0.000	P
			CHRYSOPHYTA				
				Chromulina sp.	3	0.000	
				Chrysococcus sp.	0	0.144	
				Chrysosphaerella rodhei	77	26.529	
				Dinobryon sertularia v.protuberans	10	14.276	
				Ishtmochloron trispinatum	0	0.000	P
				Kephyrion boreale	2	0.304	
				Mallomonas sp.	0	0.000	P
				Ochromonas stellaris	1	3.581	
				Pseudokephyrion angulosum	0	0.000	P
				Stichogloea doederleinii	0	0.000	P
			CRYPTOPHYTA				
				Cryptomonas ovata	1843	1.843	
				Cryptomonas reflexa	4	9.389	
				Rhodomonas minuta	433	0.433	

Appendix C Table C4. Phytoplankton species, density, and biovolume data collected from lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/mL)	Biovolume ($um^3 x 10^3$/mL)	Presence
Lake P1	PHLP0101	PL-2					
			CYANOPHYTA				
				Agmenellum quadriplicatum	0	0.000	P
				Anabaena sp.	4	0.400	
				Anacystis montana	0	0.000	P
				Aphanocapsa elachista v. planctoni	0	0.000	P
				Dichotrix gypsophila	43	8.058	
				Gomphosphaeria naegelianum	0	0.000	P
				Lyngbya limnetica	7	0.041	
				Oscillatoria limnetica	32	0.150	
			PYRROPHYTA				
				Glenodinium sp.	5	4.254	
Lake P2	PHLP0201	PL-3					
			BACILLARIOPHYTA				
				Achnanthes minutissima	4	1.353	
				Caloneis ventricosa	0	0.000	P
				Cymbella minuta	0	0.000	P
				Cymbella sp.	0	0.000	P
				Diatoma elongatum	0	0.000	P
				Eunotia arcus	0	0.000	P
				Eunotia praerupta	0	0.000	P
				Frustulia vulgaris	1	0.544	
				Melosira sp.	0	0.000	P
				Navicula sp.	0	0.000	P
				Pinnularia sp.	0	0.000	P
				Synedra sp.	2	0.381	
				Tabellaria fenestrata	0	0.000	P
				Tabellaria floculosa	1	1.050	
			CHLOROPHYTA				
				Ankistrodesmus falcatus v. spiralis	0	0.000	P
				Characium sp.	11	2.844	
				Chlamydomonas sp. a	0	0.000	P
				Cosmarium granulatum	1	6.225	
				Cosmarium subcrenatum	1	2.192	
				Crucigenia quadrata	35	1.159	
				Elakatothrix gelatinosa	0	0.000	P
				Euastrum dubium v. maius	0	0.000	P
				Gloeocystis schroeteri	9	1.033	
				Kirchneriella sp.	2	0.008	
				Mougeotia sp.	0	0.000	P
				Oocystis elliptica	8	4.432	
				Oocystis lacustris	1	0.290	
				Oocystis pusilla	11	2.553	
				Scenedesmus incrassatulus	0	0.000	P

Appendix C Table C4. Phytoplankton species, density, and biovolume data collected from lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Taxonomic Group	Taxa	Density (cells/mL)	Biovolume ($um^3 x 10^3$/mL)	Presence
Lake P2	PHLP0201	PL-3					
			CHLOROPHYTA				
				Sphaerozosma granulatum	0	0.000	P
				Staurastrum sp. a	0	0.000	P
			CHRYSOPHYTA				
				Chromulina sp.	5	2.020	
				Chrysidastrum catenatum	3	1.345	
				Chrysococcus sp.	28	1.781	
				Chrysosphaerella rodhei	87	25.280	
				Dinobryon sertularia	0	0.000	P
				Dinobryon sertularia v.protuberans	8	14.557	
				Mallomonas sp.	7	8.494	
				Ochromonas sp. b	1	0.311	
				Stichogloea doederleinii	1	0.371	
			CRYPTOPHYTA				
				Cryptomonas ovata	1	1.488	
				Cryptomonas reflexa	12	16.200	
				Katablepharis ovalis	8	1.619	
				Rhodomonas minuta	20	4.382	
			CYANOPHYTA				
				Anabaena sp.	0	0.000	P
				Anacystis montana	0	0.000	P
				Aphanocapsa elachista v. planctoni	46	0.375	
				Lyngbya limnetica	112	0.663	
				Microcoleus vaginatus	6	0.278	
				Pseudanabaena sp.	7	0.190	
				Scopulina minus	6	0.522	
			PYRROPHYTA				
				Glenodinium sp.	4	5.088	

Appendix C Table C5. Zooplankton sample parameters, density, and biomass data collected from lakes in summer in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Sampling Date	Composite Number	Depth (m)	Secchi Depth (m)	Taxonomic Group	Taxa	Density (No./m^3)	Biomass (ug/m^3)
Contwoyto Lake	ZOLCTW01	PL-1								
			25-Jul-99	5	10.00	7.10				
							Calanoida			
								Calanoid copepodid	771	2214
								Calanoid nauplii	7091	779
								Leptodiaptomus sicilis	236	1833
							Cladocera			
								Bosmina longirostris	149	886
								Daphnia longiremis	24	153
								Daphnia middendorfiana	24	1532
								Holopedium gibberum	456	491650
							Cyclopoida			
								Cyclopoid copepodid	1368	3373
								Cyclopoid nauplii	3213	106
								Diacyclops bicuspidatus	779	7023
							Rotifera			
								Conochillus unicornis	7312	138
								Kellicotia longispina	9029	244
								Keratella cochlearis	13129	259
								Keratella quadrata	222	4
								Monostyla lunaris	55	2
								Polyarthra delichoptera	332	9

Appendix C Table C5. Zooplankton sample parameters, density, and biomass data collected from lakes in summer in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Sampling Date	Composite Number	Depth (m)	Secchi Depth (m)	Taxonomic Group	Taxa	Density (No./m^3)	Biomass (ug/m^3)
Lake P1	ZOLP0101	PL-2								
			25-Jul-99	5	0.80	1.10				
							Calanoida			
								Calanoid copepodid	58	166
								Leptodiaptomus sicilis	558	4334
							Cladocera			
								Daphnia longiremis	58	375
							Cyclopoida			
								Cyclopoid nauplii	3059	101
								Diacyclops bicuspidatus	212	1909
							Rotifera			
								Conochillus unicornis	3059	58
								Kellicotia longispina	3824	103
								Keratella cochlearis	1147	23
								Keratella quadrata	765	14
								Lepadella patella	1147	32
								Notholca aquminata	2295	100
Lake P2	ZOLP0201	PL-3								
			25-Jul-99	5	2.00	3.30				
							Calanoida			
								Calanoid copepodid	214	614
								Heterocope sp.	43	2890
								Leptodiaptomus sicilis	7308	56796
							Cladocera			
								Holopedium gibberum	43	46069

Appendix C Table C5. Zooplankton sample parameters, density, and biomass data collected from lakes in summer in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Map Label	Sampling Date	Composite Number	Depth (m)	Secchi Depth (m)	Taxonomic Group	Taxa	Density (No./m^3)	Biomass (ug/m^3)
Lake P2	ZOLP0201	PL-3								
			25-Jul-99	5	2.00	3.30				
							Cyclopoida			
								Cyclopoid copepodid	86	211
								Cyclopoid nauplii	36930	1221
								Diacyclops bicuspidatus	4658	42027
							Rotifera			
								Asplanchna spp.	420	54
								Kellicotia longispina	5875	159
								Keratella cochlearis	420	8
								Keratella quadrata	420	8
								Polyarthra delichoptera	3777	104

Appendix C Table C6. Benthic macroinvertebrate sample parameters, species, and density data collected from littoral and profundal zones of lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site	Map Label	Date	Depth (m)	Area (m^2)	Composite Number	Taxonomic Group		Total Number	Density (No/m^2)
Contwoyto Lake	BELLCTW01	BEL-1	25-Jul-99	3.00	0.023	3				
							Coelenterata			
							Hydridae			
								Hydra	1	43
							Copepoda			
							Calanoida			
									6	275
							Cyclopida			
									13	551
							Harpacticoida			
									8	348
							Diptera			
							Chironomidae			
							Orthocladiinae/Diamesinae		24	1058
							Tanypodinae		7	304
							Tanytarsini		20	855
							Chironomini		1	29
							Chironomidae pupae			
									8	333
							Hydracarina			
									2	87
							Mollusca			
							Pelecypoda			
							Sphaeriidae	*Sphaerium*	1	29
							Sphaeriidae		0	14
							Nematoda			
									13	565

Appendix C Table C6. Benthic macroinvertebrate sample parameters, species, and density data collected from littoral and profundal zones of lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site	Map Label	Date	Depth (m)	Area (m^2)	Composite Number	Taxonomic Group		Total Number	Density (No/m^2)
Contwoyto Lake	BELLCTW01	BEL-1	25-Jul-99	3.00	0.023	3				
							Oligochaeta			
							Lumbriculidae			
									1	29
							Naididae			
									0	14
							Tubificidae			
									1	43
							Ostracoda			
									1	29
							Trichoptera			
							Limnephilidae			
								Grensia	0	14
							Copepoda			
							Cyclopida			
									5	217
							Harpacticoida			
									8	348
							Diptera			
							Chironomidae			
							Orthocladiinae/Diamesinae		35	1522
							Chironomini		1	43
							Tanytarsini		44	1913
							Tanypodinae		5	217
							Chironomidae pupae			
									3	130
							Mollusca			
							Pelecypoda			
							Sphaeriidae		9	391

Appendix C Table C6. Benthic macroinvertebrate sample parameters, species, and density data collected from littoral and profundal zones of lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site	Map Label	Date	Depth (m)	Area (m^2)	Composite Number	Taxonomic Group	Total Number	Density (No/m^2)
Contwoyto Lake	BELLCTW01	BEL-1	25-Jul-99	3.00	0.023	3			
							Nematoda		
								10	435
							Oligochaeta		
							Naididae		
								4	174
							Ostracoda		
								8	348
Lake P1	BELLP0101	BEL-2	25-Jul-99	1.10	0.023	3			
							Copepoda		
							Cyclopida		
								1	43
							Harpacticoida		
								2	87
							Diptera		
							Ceratopogonidae		
							Ceratopogoninae	4	174
							Chironomidae		
							Tanytarsini	355	15435
							Tanypodinae	20	870
							Orthocladiinae/Diamesinae	61	2652
							Chironomini	3	130
							Chironomidae pupae		
								8	348
							Nematoda		
								4	174

Appendix C Table C6. Benthic macroinvertebrate sample parameters, species, and density data collected from littoral and profundal zones of lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site	Map Label	Date	Depth (m)	Area (m^2)	Composite Number	Taxonomic Group	Total Number	Density (No/m^2)
Lake P1	BELLP0101	BEL-2	25-Jul-99	1.10	0.023	3			
							Oligochaeta		
							Enchytraeidae		
								2	87
							Lumbriculidae		
								4	174
							Naididae		
								11	478
							Tubificidae		
								47	2043
							Ostracoda		
								4	174
Lake P2	BELLP0201	BEL-3	25-Jul-99	3.30	0.023	3			
							Copepoda		
							Calanoida		
								4	174
							Cyclopida		
								12	522
							Diptera		
							Chironomidae		
							Chironomini	2	87
							Orthocladiinae/Diamesinae	21	913
							Tanypodinae	12	522
							Tanytarsini	90	3913
							Chironomidae pupae		
								3	130
							Hydracarina		
								2	87

Appendix C Table C6. Benthic macroinvertebrate sample parameters, species, and density data collected from littoral and profundal zones of lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site	Map Label	Date	Depth (m)	Area (m^2)	Composite Number	Taxonomic Group		Total Number	Density (No/m^2)
Lake P2	BELLP0201	BEL-3	25-Jul-99	3.30	0.023	3				
							Hydracarina			
							Lebertiidae			
								Lebertia	1	43
							Microturbellaria			
							Mesostoma			
									3	130
							Mollusca			
							Pelecypoda			
							Sphaeriidae		9	391
							Nematoda			
									2	87
							Oligochaeta			
							Lumbriculidae			
									1	43
							Tubificidae			
									7	304
							Ostracoda			
									11	478

APPENDIX D

FISH

Appendix D Table D1. Fish species encountered in sampled waterbodies in the Contwoyto Lake West Study Area, 1999.

Family	Common Name	Scientific Name	Code
Cottidae			
	Slimy sculpin	*Cottus cognatus*	SLSC
Gadidae			
	Burbot	*Lota lota*	BURB
Gasterosteidae			
	Ninespine stickleback	*Pungitius pungitius*	NNST
Salmonidae			
	Arctic char	*Salvelinus alpinus*	ARCH
	Arctic grayling	*Thymallus arcticus*	ARGR
	Lake trout	*Salvelinus namaycush*	LKTR

Appendix D Table D2. Gill net sampling effort in lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Set Date	Set Time	Pull Date	Pull Time	Set Orientation	Minimum Depth (m)	Maximum Depth (m)	Dominant Substrate	Depth Position	Water Temperature (°C)
Contwoyto Lake											
	GNLCTW01										
		31-Jul-99	9:11	31-Jul-99	10:31	Perpendicular	1.5	4	Boulder	Bottom	10
		31-Jul-99	10:31	31-Jul-99	11:55	Perpendicular	1.5	4	Boulder	Bottom	10
		31-Jul-99	11:55	31-Jul-99	13:05	Perpendicular	1.5	4	Boulder	Bottom	10
		31-Jul-99	13:05	31-Jul-99	14:23	Perpendicular	1.5	4	Boulder	Bottom	10
		31-Jul-99	14:23	31-Jul-99	15:54	Perpendicular	1.5	4	Boulder	Bottom	10
		31-Jul-99	15:54	31-Jul-99	16:45	Perpendicular	1.5	4	Boulder	Bottom	10
		02-Sep-99	9:14	02-Sep-9	10:06	Perpendicular	1.5	3	Silt/Sand/Boulder	Bottom	6.5
		02-Sep-99	10:06	02-Sep-9	11:04	Perpendicular	1.5	3	Silt/Sand/Boulder	Bottom	6.5
		02-Sep-99	11:04	02-Sep-9	12:15	Perpendicular	1.5	3	Silt/Sand/Boulder	Bottom	6.5
		02-Sep-99	12:15	02-Sep-9	14:06	Perpendicular	1.5	3	Silt/Sand/Boulder	Bottom	6.5
		02-Sep-99	14:06	02-Sep-9	15:48	Perpendicular	1.5	3	Silt/Sand/Boulder	Bottom	6.5
	GNLCTW02										
		31-Jul-99	9:27	31-Jul-99	10:46	Perpendicular	2	4	Boulder	Bottom	10
		31-Jul-99	10:46	31-Jul-99	12:21	Perpendicular	2	4	Boulder	Bottom	10
		31-Jul-99	12:21	31-Jul-99	13:40	Perpendicular	2	4	Boulder	Bottom	10
		31-Jul-99	13:40	31-Jul-99	15:10	Perpendicular	2	4	Boulder	Bottom	10
		31-Jul-99	15:10	31-Jul-99	16:23	Perpendicular	2	4	Boulder	Bottom	10
	GNLCTW03										
		02-Sep-99	0:30	02-Sep-9	14:12	Perpendicular	2	5	Silt/Sand	Bottom	6.5
		02-Sep-99	9:43	02-Sep-9	10:20	Perpendicular	2	5	Silt/Sand	Bottom	6.5
		02-Sep-99	10:20	02-Sep-9	12:30	Perpendicular	2	5	Silt/Sand	Bottom	6.5
		02-Sep-99	14:12	02-Sep-9	16:20	Perpendicular	2	5	Silt/Sand	Bottom	6.5
	GNLCTW04										
		02-Sep-99	13:50	02-Sep-9	15:42	Perpendicular	2	5	Boulder	Bottom	6.5

Appendix D Table D2. Gill net sampling effort in lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Set Date	Set Time	Pull Date	Pull Time	Set Orientation	Minimum Depth (m)	Maximum Depth (m)	Dominant Substrate	Depth Position	Water Temperature (°C)
Lake P1											
	GNLP0101										
		30-Aug-9	11:40	30-Aug-	12:15	Perpendicular	0.8	1	Silt	Bottom	2.5
		30-Aug-9	12:15	30-Aug-	13:50	Perpendicular	0.8	1	Silt	Bottom	2.5
		30-Aug-9	13:50	30-Aug-	15:00	Perpendicular	0.8	1	Silt	Bottom	2.5
		30-Aug-9	15:00	31-Aug-	8:35	Perpendicular	0.8	1	Silt	Bottom	2.5
	GNLP0102										
		30-Aug-9	12:05	30-Aug-	13:30	Perpendicular	0.9	1.1	Boulder	Bottom	2.5
		30-Aug-9	13:30	30-Aug-	14:50	Perpendicular	0.9	1.1	Boulder	Bottom	2.5
		30-Aug-9	14:50	31-Aug-	8:20	Perpendicular	0.9	1.1	Boulder	Bottom	2.5
		31-Aug-9	8:20	31-Aug-	9:06	Perpendicular	0.9	1.1	Boulder	Bottom	2.5
Lake P2											
	GNLP0201										
		31-Aug-9	11:32	31-Aug-	13:27	Perpendicular	2.1	3.2	Silt	Bottom	4
		31-Aug-9	13:27	01-Sep-9	8:30	Perpendicular	2.1	3.2	Silt	Bottom	4
	GNLP0202										
		31-Aug-9	12:15	31-Aug-	13:50	Perpendicular	1.2	2.8	Boulder	Bottom	4
		31-Aug-9	13:50	01-Sep-9	8:48	Perpendicular	1.2	2.8	Boulder	Bottom	4

Appendix D Table D3. Numbers recorded and catch-per-unit-effort values (CPUE) for fish captured at gill net sites in lakes in the Contwoyto Lake West Study Area, 1999.

Season	Waterbody	Site Label	Time (h)	Effort ($100m^2$ •12h)	Arctic Char No.	Arctic Char CPUE	Lake Trout No.	Lake Trout CPUE
Summer								
	Contwoyto Lake							
		GNLCTW01	1.33	0.25				
		GNLCTW01	1.40	0.26			2	7.69
		GNLCTW01	1.17	0.22	1	4.60	2	9.20
		GNLCTW01	1.30	0.24			2	8.28
		GNLCTW01	1.52	0.28			1	3.54
		GNLCTW01	0.85	0.16				
		GNLCTW02	1.32	0.25			1	4.08
		GNLCTW02	1.58	0.29	1	3.41	2	6.81
		GNLCTW02	1.32	0.25				
		GNLCTW02	1.50	0.28	1	3.59	2	7.18
		GNLCTW02	1.22	0.23	1	4.41	2	8.82
Fall								
	Contwoyto Lake							
		GNLCTW01	0.87	0.16				
		GNLCTW01	0.97	0.18			2	11.10
		GNLCTW01	1.18	0.22			1	4.56
		GNLCTW01	1.85	0.34				
		GNLCTW01	1.70	0.32			1	3.17
		GNLCTW03	0.62	0.12				
		GNLCTW03	2.17	0.40			2	4.96
		GNLCTW03	13.70	2.55			2	0.79
		GNLCTW03	2.13	0.40				
		GNLCTW04	1.87	0.35			1	2.88
	Lake P1							
		GNLP0101	0.58	0.11				

Appendix D Table D3. Numbers recorded and catch-per-unit-effort values (CPUE) for fish captured at gill net sites in lakes in the Contwoyto Lake West Study Area, 1999.

Season	Waterbody	Site Label	Time (h)	Effort ($100m^2$ •12h)	Arctic Char		Lake Trout	
					No.	CPUE	No.	CPUE
Fall								
	Lake P1							
		GNLP0101	1.58	0.29				
		GNLP0101	1.17	0.22				
		GNLP0101	17.58	3.27	1	0.31		
		GNLP0102	1.42	0.26				
		GNLP0102	1.33	0.25				
		GNLP0102	17.50	3.25	1	0.31		
		GNLP0102	0.77	0.14				
	Lake P2							
		GNLP0201	1.92	0.36				
		GNLP0201	19.05	3.54				
		GNLP0202	1.58	0.29				
		GNLP0202	18.97	3.52				

Appendix D Table D4. Gee trap sampling effort in lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Set		Pull		Depth (m)	Water Temperature (°C)
		Date	Time	Date	Time		
Contwoyto Lake							
	GTLCTW01	31-Jul-99	9:44	31-Jul-99	17:35	1.10	10.0
	GTLCTW02	31-Jul-99	9:49	31-Jul-99	17:27	1.30	10.0
	GTLCTW03	31-Jul-99	9:53	31-Jul-99	17:21	1.20	10.0
	GTLCTW04	31-Jul-99	9:59	31-Jul-99	17:16	0.80	10.0
Lake P1							
	GTLP0101	30-Aug-99	9:35	31-Aug-99	9:18	0.35	3.5
	GTLP0102	30-Aug-99	9:45	31-Aug-99	9:14	0.35	3.5
	GTLP0103	30-Aug-99	9:50	31-Aug-99	9:12	0.40	3.5
	GTLP0104	30-Aug-99	10:00	31-Aug-99	9:09	0.30	3.5
Lake P2							
	GTLP0201	31-Aug-99	11:15	01-Sep-99	9:01	0.50	4.0
	GTLP0202	31-Aug-99	12:20	01-Sep-99	9:04	0.60	4.0
	GTLP0203	31-Aug-99	12:25	01-Sep-99	9:09	0.50	4.0
	GTLP0204	31-Aug-99	12:30	01-Sep-99	9:14	0.30	4.0

Appendix D Table D5. Number of fish recorded and catch-per-unit-effort (CPUE) values during backpack electrofishing in waterbodies in the Contwoyto Lake West Study Area, 1999.

Waterbody	Reach	Date	Effort (min)	Species	Captured	Observed	CPUE (No. fish/min)
Contwoyto Lake							
		13-Jun-99	4.25				
				Burbot	4		0.94
				Ninespine stickleback	4	2	1.41
				Slimy sculpin	1		0.24
		28-Jul-99	3.48				
				Arctic grayling	1		0.29
				Burbot	2		0.57
				Lake trout	1		0.29
				Ninespine stickleback	6	3	2.58
				Slimy sculpin	4	10	4.02
Lake P1							
		12-Jun-99	1.73				
				No fish			
Lake P2							
		11-Jun-99	6.57				
				No fish			
Stream P1							
	2	11-Jun-99	5.12				
				No fish			
	2	28-Jul-99	5.40				
				Ninespine stickleback	3	7	1.85
				Slimy sculpin	6	4	1.85
	3	12-Jun-99	5.85				
				No fish			
Stream P2							
	1	11-Jun-99	5.75				
				No fish			
	1	28-Aug-99	0.33				
				Arctic grayling	1		3.00
				Slimy sculpin	1	1	6.00
	2	11-Jun-99	5.35				
				No fish			
	2	28-Jul-99	3.40				
				Slimy sculpin	11	2	3.82

Appendix D Table D6. Life history data for fish recorded in waterbodies of the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Date	Species	Fork Length (mm)	Weight (g)	Sex	Maturity	Age	Age Structure	Capture Code	Tag No.
Contwoyto Lake											
	EFLCTW01										
		13-Jun-99									
			Burbot	495	1062					0	3304
			Burbot	430	506					0	3303
			Burbot	592	1394					0	3302
			Burbot	485	625					0	3301
			Ninespine stickleback	41						0	
			Ninespine stickleback	45						0	
			Ninespine stickleback	60						0	
			Ninespine stickleback	53						0	
			Slimy sculpin	91						0	
		28-Jul-99									
			Arctic grayling	203	70			2	Scale	0	3550
			Burbot	235	60					0	3548
			Burbot	166	30					0	
			Lake trout	121	15					0	
			Ninespine stickleback	39						0	
			Ninespine stickleback	39						0	
			Ninespine stickleback	51						0	
			Ninespine stickleback	39						0	
			Ninespine stickleback	37						0	
			Ninespine stickleback	36						0	
			Slimy sculpin	58						0	
			Slimy sculpin	36						0	
			Slimy sculpin	38						0	
			Slimy sculpin	43						0	
	GNLCTW01										
		31-Jul-99									
			Lake trout	450	776					0	3555
			Lake trout	480	1101					0	3556
		31-Jul-99									
			Arctic char	670	3500	Male	Mature			0	3561
			Lake trout	720	3500					0	3560
			Lake trout	565	1655					0	
		31-Jul-99									
			Lake trout	520	1720					0	3562
			Lake trout	115						0	
		31-Jul-99									
			Lake trout	795	5000					0	3563
		02-Sep-99									

Appendix D Table D6. Life history data for fish recorded in waterbodies of the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Date	Species	Fork Length (mm)	Weight (g)	Sex	Maturity	Age	Age Structure	Capture Code	Tag No.
Contwoyto Lake											
	GNLCTW01										
		02-Sep-99									
			Lake trout	655	3500	Male	Ripe			0	3586
			Lake trout	634	3750					0	3585
		02-Sep-99									
			Lake trout	653	3750	Male	Ripe			0	3589
		02-Sep-99									
			Lake trout	589		Male	Ripe			0	
	GNLCTW02										
		31-Jul-99									
			Arctic char	372	525					0	3557
			Lake trout	369	480					0	3559
			Lake trout	332	390					0	3558
		31-Jul-99									
			Arctic char	225	85	Male	Immature	3	Otolith	1	
			Lake trout	115	5	Unknown	Immature	1	Otolith	1	
		31-Jul-99									
			Arctic char	672	3250					0	3565
			Lake trout	381	620					0	3566
			Lake trout	635	3000					0	3564
	GNLCTW03										
		02-Sep-99									
			Lake trout	649	2700	Male	Ripe	23	Otolith	1	
			Lake trout	671	3250	Male	Ripe			0	3590
		02-Sep-99									
			Lake trout	705	4250					0	3588
			Lake trout	599	3500	Male	Ripe			0	3587
	GNLCTW04										
		02-Sep-99									
			Lake trout	658	4000	Female	Mature			0	
Lake P1											
	GNLP0101										
		30-Aug-99									
			Arctic char	187	68					0	
	GNLP0102										
		30-Aug-99									
			Arctic char	188	72	Unknown	Immature	2	Otolith	1	
	GTLP0101										
		30-Aug-99									
			Ninespine stickleback	63						0	

Appendix D Table D6. Life history data for fish recorded in waterbodies of the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Date	Species	Fork Length (mm)	Weight (g)	Sex	Maturity	Age	Age Structure	Capture Code	Tag No.
Lake P1											
	GTLP0101										
		30-Aug-99									
			Slimy sculpin	64						0	
			Slimy sculpin	51						0	
	GTLP0102										
		30-Aug-99									
			Ninespine stickleback	58						0	
	GTLP0103										
		30-Aug-99									
			Slimy sculpin	86	4					0	
			Slimy sculpin	80	4					0	
			Slimy sculpin	85	4					0	
	GTLP0104										
		30-Aug-99									
			Slimy sculpin	106	14					0	
Lake P2											
	GTLP0203										
		31-Aug-99									
			Slimy sculpin	67						0	
Stream P1											
	EFTP0102										
		28-Jul-99									
			Ninespine stickleback	44						0	
			Ninespine stickleback	36						0	
			Ninespine stickleback	44						0	
			Slimy sculpin	39						0	
			Slimy sculpin	48						0	
			Slimy sculpin	41						0	
			Slimy sculpin	44						0	
			Slimy sculpin	42						0	
			Slimy sculpin	50						0	
Stream P2											
	EFTP0201										
		28-Aug-99									
			Arctic grayling	113				1	Scale	0	
			Slimy sculpin	112						0	
	EFTP0202										
		28-Jul-99									
			Slimy sculpin	75						0	

Appendix D Table D6. Life history data for fish recorded in waterbodies of the Contwoyto Lake West Study Area, 1999.

Waterbody	Site Label	Date	Species	Fork Length (mm)	Weight (g)	Sex	Maturity	Age	Age Structure	Capture Code	Tag No.
Stream P2											
	EFTP0202										
		28-Jul-99									
			Slimy sculpin	86						0	
			Slimy sculpin	106						0	
			Slimy sculpin	87						0	
			Slimy sculpin	115						0	
			Slimy sculpin	109						0	
			Slimy sculpin	106						0	
			Slimy sculpin	118						0	
			Slimy sculpin	74						0	
			Slimy sculpin	103						0	
			Slimy sculpin	86						0	

Appendix D Table D7. Stomach contents for fish collected from lakes in the Contwoyto Lake West Study Area, 1999.

Waterbody	Date	Sampling Method	Species	Fork Length (mm)	Weight (g)	Stomach Fullness	Food Item	Food Item Value
Contwoyto Lake								
	31-Jul-99	Gill Net						
			Arctic char	225	85	15		
							Chironomid larvae	2
							Trichoptera larvae	3
							Zooplankton	10
			Lake trout	115	5	10		
							Oligochaetes	1
							Zooplankton	1
							Trichoptera larvae	1
							Parasite	2
							Chironomid larvae	5
	02-Sep-99	Gill Net						
			Lake trout	649	2700	1		
							Pelecypods	1
Lake P1								
	30-Aug-99	Gill Net						
			Arctic char	188	72	5		
							Zooplankton	5

Appendix D Table D8. Summary of sexual maturity for fish captured during fall spawning surveys in Contwoyto Lake, 1999.

Waterbody	Site Label	Species	Sexual Maturity	Count
Contwoyto Lake				
	GNLCTW01			
		Lake trout	Unknown (Adult)	1
		Lake trout	Ripe Male	3
	GNLCTW03			
		Lake trout	Ripe Male	3
		Lake trout	Unknown (Adult)	1
	GNLCTW04			
		Lake trout	Mature Female	1
Lake P1				
	GNLP0101			
		Arctic char	Unknown (Juvenile)	1
	GNLP0102			
		Arctic char	Unknown (Juvenile)	1

APPENDIX E

LAKE AND STREAM HABITAT CHARACTERISTICS

Appendix E Table E1. Shoreline lake habitat characteristics of Contwoyto Lake in the Contwoyto Lake West Study Area, 1999.

Waterbody	Zone	Shoreline Length (m)	Subsurface Slope	Substrate Type[1] (%)							Shoreline Habitat Types (%)			Shoreline Vegetation (%)		
				OM	SI	SA	GR	CO	BO	BE	Grass	Boulder	Bedrock	Grass	Sedge	Macrophyte
Contwoyto Lake																
	1	372.6	Low							100			100			
	2	435.7	Low				30	35	35		70		30	70		
	3	207.5	Low					50	50		100			70		
	4	353.1	Moderate					50	50		100			100		
	5	277.9	Low					50	50		50	50		100		
	6	579.2	Low					50	50		100			100		

[1] See Appendix A for definitions

Appendix E Table E2. Habitat characteristics of streams in the Contwoyto Lake West Study Area, 1999.

Waterbody	Reach	Sampling Date	Habitat Type	Wetted Width	Water Depth			Max. Depth	Water Velocity			Channel Type	Bank Type	Substrate Type (%)						
					.25	.50	.75		.25	.50	.75			OM	SI	SA	GR	CO	BO	BE
Stream P1																				
	1																			
		11-Jun-99																		
			Garden					0.25				Subsurface		10					90	
			Garden					0.3				Subsurface		10					90	
			Garden					0.33				Subsurface		10					90	
			Garden					0.39				Subsurface		10					90	
			Garden					0.43				Subsurface		10					90	
			Garden					0.54				Subsurface		10					90	
			Garden					0.55				Subsurface		10					90	
			Garden					0.56				Subsurface		10					90	
			Garden					0.64				Subsurface		10					90	
			Garden					0.21				Subsurface		10					90	
		28-Jul-99																		
			Garden					0.37				Subsurface		10					90	
			Garden					0.39				Subsurface		10					90	
			Garden					0.36				Subsurface		10					90	
	2																			
		11-Jun-99																		
			Riffle	1.16	0.25	0.3	0.63	0.63	0.26	0.9	0.08	Multiple	Defined						100	
			Riffle	1.46	0.07	0.23	0.3	0.33	0.1	1.01	0.29	Multiple	Defined						100	
			Riffle	2.14	0.23	0.18	0.16	0.3	0.28	0.84	0.65	Multiple	Defined					20	80	
			Run	1.78	0.1	0.13	0.1	0.14	0.13	0.25	0.15	Multiple	Defined			20	60	15	5	
			Run	1	0.17	0.3	0.15	0.3	0.12	0.5	0.04	Multiple	Defined			30	60	10		
			Pool	1.56	0.36	0.37	0.35	0.42	0.01	0.9	0.1	Multiple	Defined						100	
		28-Jul-99																		
			RFBG	1.26	0.27	0.28	0.18	0.29	0.1	0.22	0.005	Multiple	Defined						100	

Appendix E Table E2. Habitat characteristics of streams in the Contwoyto Lake West Study Area, 1999.

Waterbody	Reach	Sampling Date	Habitat Type	Wetted Width	Water Depth			Max. Depth	Water Velocity			Channel Type	Bank Type	Substrate Type (%)						
					.25	.50	.75		.25	.50	.75			OM	SI	SA	GR	CO	BO	BE
Stream P1																				
	2																			
			RFBG	1.97	0.04	0.1	0.07	0.1	0.47	0.02	0.16	Multiple	Defined						100	
			Run	1.21	0.16	0.21	0.16	0.22	0.26	0.17	0.13	Multiple	Defined						100	
	3																			
		12-Jun-99																		
			Riffle	5.12	0.13	0.2	0.17	0.2	0.46	0.45	0.59	Single	Defined		10		25	20	45	
			Riffle	13.96	0.18	0.08	0.21	0.33	0.07	0.1	0.005	Multiple	Ill-defined		10		25	25	40	
			Disperse	45				0.35				Multiple	Ill-defined	30	30		10		30	
			Riffle	13.98	0.37	0.25	0.21	0.38	0.24	0.005	0.005	Multiple	Ill-defined	10	10		20	25	35	
			Riffle	17.97	0.1	0.15	0.12	0.19	0.23	0.31	0.17	Multiple	Ill-defined	10	10			20	60	
			Run	7.47	0.24	0.17	0.2	0.25	0.12	0.14	0.03	Single	Ill-defined		5		50	30	15	
			Riffle	8.19	0.24	0.08	0.19	0.26	0.19	0.13	0.14	Multiple	Ill-defined				30	40	30	
		28-Jul-99																		
			Riffle	2	0.07	0.05	0.06	0.07	0.13	0.005	0.06	Multiple	Ill-defined						100	
			Riffle	1.98	0.13	0.17	0.08	0.18	0.32	0.005	0.005	Multiple	Ill-defined		5			5	90	
			Run	1.58	0.09	0.2	0.18	0.21	0.13	0.08	0.4	Multiple	Defined				50	20	30	
Stream P2																				
	1																			
		11-Jun-99																		
			Run	4.18	0.28	0.27	0.1	0.29	0.27	0.19	0	Multiple	Ill-defined	40	10	10	40			
			Run	3.77	0.24	0.32	0.14	0.34	0.13	0.33	0	Multiple	Ill-defined	45		15	40			
			Run	1.5	0.36	0.32	0.28	0.36	0.28	0.23	0.22	Multiple	Ill-defined			10	65	5	20	
			Run	2.12	0.49	0.28	0.15	0.47	0.36	0.09	0.005	Multiple	Ill-defined	10	10	65	15			
			Run	5.82	0.24	0.38	0.06	0.43	0.03	0.23	0	Single	Ill-defined			65	25		10	
			Run	4.21	0.48	0.6	0.44	0.6	0.12	0.22	0.05	Single	Ill-defined			30	10	10	50	
			Run	1.27	0.28	0.32	0.28	0.34	0.47	0.35	0.04	Multiple	Ill-defined			20	40	20	20	

Appendix E Table E2. Habitat characteristics of streams in the Contwoyto Lake West Study Area, 1999.

Waterbody	Reach	Sampling Date	Habitat Type	Wetted Width	Water Depth			Max. Depth	Water Velocity			Channel Type	Bank Type	Substrate Type (%)					
					.25	.50	.75		.25	.50	.75			OM	SI	SA	GR	CO	BO	BE
Stream P2																				
	1																			
		28-Jul-99																		
			Flat	1.99	0.26	0.45	0.12	0.45	0.15	0.11	0.005	Single	Defined		30		40		30	
	2																			
		11-Jun-99																		
			Riffle	1.79	0.16	0.1	0.13	0.22	0.31	0.41	0.49	Multiple	Defined	10			30		60	
			Riffle	1.85	0.16	0.19	0.22	0.27	0.17	0.61	0.26	Multiple	Defined			10	10	20	60	
			Riffle	1.65	0.14	0.2	0.18	0.21	0.53	0.47	0.51	Multiple	Defined			10	20	40	30	
			Riffle	1.82	0.32	0.23	0.22	0.32	0.14	0.22	0.21	Multiple	Defined				10	10	80	
			Riffle	1.64	0.14	0.21	0.16	0.21	0.48	0.26	0.24	Multiple	Defined			10	5	15	70	
			Riffle	1.24	0.14	0.18	0.13	0.18	0.83	1.05	0.31	Single	Defined					40	60	
		28-Jul-99																		
			Run	1.48	0.14	0.14	0.15	0.15	0.06	0.32	0.25	Single	Defined		50	20	20	10		
			Flat	1.37	0.05	0.25	0.23	0.24	0.005	0.13	0.2	Single	Defined		20		80			
			Run	1.53	0.19	0.18	0.14	0.17	0.08	0.14	0.28	Single	Defined		10	10	80			
			Run	1.32	0.05	0.13	0.08	0.16	0.005	0.34	0.23	Single	Defined		60		40			