APPENDIX 16

Environmental Baseline Report: Water Quality and Aquatic Biota

EAGLE GOLD PROJECT

Environmental Baseline Report:
Water Quality and Aquatic Biota

FINAL REPORT

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EXECUTIVE SUMMARY

Stantec was retained by Victoria Gold Corporation to prepare a baseline report on water, sediment, and aquatic biota of streams at the Eagle Gold Project (the Project), using methods consistent with environmental assessment standards under Yukon Territory and federal legislation. This report includes results of field studies conducted between 2007 and 2010 by Stantec (formerly Jacques Whitford AXYS) and historic data collected from 1976/77 (sediment only), and 1993 to 1996 (water, sediment, periphyton, benthic invertebrates) for the same area. Each component of the aquatic program is discussed in terms of background information, methods, quality assurance/quality control (QA/QC), and results.

Water, sediment, periphyton, and benthic invertebrates were collected from watercourses in four drainage basins (Haggart Creek, Dublin Gulch, Eagle Creek, and Lynx Creek) in the study area. Water samples were collected on 22 occasions from 18 sites between August 2007 and September 2010 to provide information on seasonal variability of water chemistry. Sediment samples were collected at eleven sites in September 2007, seven sites in September 2009, and eight sites in August 2010 to gather information relevant to toxicity and physical habitat for benthos, fish eggs, and juvenile fish. Periphyton and benthic invertebrates were gathered from eleven sites in 2007 to evaluate primary productivity (chlorophyll *a*), abundance and community diversity. Benthic invertebrates were also sampled at seven sites in 2009 and 2010.

Current and historic water quality data were compared to provide information on changes over time, given the area has been subject to intense placer mining activity. A baseline dataset useful for discrimination of potential future project effects from current conditions was created.

The streams were circumneutral to basic in pH. All sites, except those located in Dublin Gulch, had high acid buffering capacity, as indicated by high alkalinity, calcium, and hardness. Turbidity and total suspended solids levels tended to be low; exceptions were noted at one or two sites each in April 2008, June 2008, July 2010, and August 2010, and at most sites in May 2010. Nutrient levels tended to be low and suggestive of oligotrophic levels, with ammonia below detection limits in most samples, measurable amounts of nitrate, and low levels of phosphate and dissolved organic carbon.

Among metals, arsenic exceeded Canadian Council of Ministers of Environment (CCME) and British Columbia guidelines for protection of aquatic life in 100% of samples from Dublin Gulch, Eagle Pup, and Lynx Creek. For Haggart Creek, 28% of samples collected between 2007 and 2010 exceeded guidelines, including 64% of samples from site W29 below Platinum Creek and 62% of samples from W23 below Lynx Creek. Other metals occasionally exceeded guidelines; considering all sites, these included aluminum (36 times, 17%), cadmium (27 times, 13%), copper (16 times, 7%), iron (23 times, 11%), lead (9 times, 4%), and zinc (1 time, <1%). More than 90% of samples analyzed for cyanide (total and week acid dissociation) had levels below the analytical detection limit.

Seasonal trends were noted. Levels of pH, alkalinity, hardness, conductivity, TDS and nitrate tended to be lowest at most sites in May reflecting a lower influence of groundwater during high spring flows. Levels of TSS, aluminum, arsenic, cadmium, copper, iron, and lead tended to be highest at that time due to natural sediment transport mechanisms and the re-suspension of metals from sediments disturbed by placer mining over many years.

Four of the sites sampled in 1993 – 1996 were also sampled in 2007 – 2010. Results for the recent sampling programs were generally within the range observed for the 1990s for general chemistry, nutrients and organic matter, but with higher variability in the historic data. These parameters included pH, alkalinity, hardness, conductivity, sulphate, nitrate, dissolved ortho-phosphate, and total dissolved solids. Levels of total suspended solids and some metals, including aluminum, arsenic, copper, iron, and lead, were up to an order of magnitude higher in 1995 and 1996 than other years, and frequently exceeded CCME guidelines. Metal levels were highest at sites W8 and W10 in 1995 and 1996 and coincided with elevated total suspended solids at these sites.

Metals data for the fine (<63 µm) sediment fraction were similar to the water quality data in terms of high levels of arsenic at all sites and periodic guideline exceedances of sediment quality guidelines for cadmium, chromium, copper, lead, mercury, and zinc since 1976. Nickel concentrations exceeded guidelines at most sites on each sample date. Arsenic levels were higher than the CCME Probable Effects Level in all samples analyzed, and were highest at site W20 in 2007.

For periphyton, chlorophyll *a* levels suggest oligotrophic conditions in streams within the study area, as indicated by the water quality results. Highest richness, diversity, and evenness indices were recorded in Haggart Creek, suggesting better water quality than in Dublin Gulch, Eagle Pup, or Lynx Creek.

For benthic invertebrate communities, the lower richness, diversity, evenness, and pollution sensitive organisms (mayflies, stoneflies, caddisflies), combined with higher proportions of tolerant organisms (chironomids and lumbriculids) in the Eagle Creek system suggest that reduced habitat complexity and poor water and sediment quality discourage certain invertebrates from colonizing these sites. Given that water and sediment quality are similar in Eagle Creek and Dublin Gulch, this suggests that poor habitat, rather than toxic effects, influence the benthic communities in Eagle Creek. Higher invertebrate abundance in Dublin Gulch and Eagle Creek during some of the sampling years is likely due to the presence of smaller tolerant organisms and the absence of predatory fish in the upper reaches of these systems.

Metals levels in water and sediment, in addition to abundance and taxonomic composition of periphyton and benthic invertebrates are consistent with a mineralized area and reflect previous disturbance of substrates during placer mining.

ABBREVIATIONS AND ACRONYMS

%	percent
<	less than
>	greater than
µ	micro
µg/m2	micrograms per cubic metre
CCME	Canadian Council of Ministers of the Environment
CRM	certified reference materials
CV	coefficient of variation
CVAFS	cold vapour atomic fluorescence spectrometry
DFO	Fisheries and Oceans Canada
DO	dissolved oxygen
DOC	dissolved organic carbon
EEM	environmental effects monitoring
EPT	Ephemeroptera, Plecoptera and Trichoptera
HVAAS	hydride vapour atomic absorption spectrophotometry
ICP-AES	inductively coupled plasma atomic emission spectrophotometry
ICP-MS	inductively coupled plasma mass spectrophotometry
ICP-OES	inductively coupled plasma optical emission spectrophotometry
JW–AXYS	Jacques Whitford–AXYS
LEL	lowest effect level
mg/L	milligrams per litre
MMER	Metal Mining Effluent Regulations
MOE	Ministry of Environment
NRC	National Research Council
NTU	nephelometric turbidity unit
PEL	probable effect level
QA/QC	quality assurance/quality control
RPD…	relative percent difference
SD	standard deviation
SE	standard error of the mean
SQG	sediment quality guideline

TDS .... total dissolved solids

TKN .... Total Kjeldahl Nitrogen

TOC .... total organic carbon

TSS .... total suspended solids

WAD .... weak acid dissociable

WQG .... water quality guideline

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1 INTRODUCTION

This report presents background information, methods and results for the baseline aquatic studies (surface water, sediment, biota) conducted for Victoria Gold's Eagle Gold Project (the Project) proposed by Victoria Gold Corporation. The Eagle Gold Project is a proposed open pit gold mine within the Dublin Gulch watershed located 85 km northeast of the Village of Mayo, Yukon Territory.

Stantec was contracted by the Stratagold Corporation to begin environmental baseline studies in 2007. In 2009, Stratagold Corporation was acquired by Victoria Gold Corporation. During this time, the project name changed from Dublin Gulch to Eagle Gold and the local study area was updated to reflect any changes to the geographic extent of the proposed Eagle Gold Project.

This report includes results of field studies conducted between 2007 and 2010 by Stantec and historic data collected from 1976/1977 (for sediment only) and 1993 to 1996 for surface water, sediment, and biota. The 2007 to 2010 program collected information on current conditions in streams of the Project area using methods consistent with environmental assessment standards under Yukon and federal legislation. Water samples were collected between August 2007 and June 2008, between July and October 2009, and between March and September 2010 to provide information on seasonal variability. Sediment samples were collected in September 2007 and 2009 and August 2010. Periphyton were collected in August 2007. Benthic invertebrates were collected in September 2007, September 2009, and August 2010. Current and historic data were compared to provide information on temporal changes, given the area was subject to intense placer mining activity in the past. A baseline dataset useful for discriminating potential future project effects from current conditions and historical contamination was created.

Each component of the aquatic program is discussed in detail, with an introduction, overview of methods, Quality Assurance/Quality Control (QA/QC) procedures, results (including summary statistics for each watercourse), and discussion. All detailed methods, raw data and summary statistics for individual sites are reported in appendices.

2 STUDY AREA BOUNDARIES

This technical data report characterizes water quality and aquatic ecology in areas with the potential to be affected by the Project, as well as in nearby areas intended to be used as reference sites. The aquatic study area includes the Haggart Creek, Dublin Gulch, Eagle Creek, and Lynx Creek basins (Figure 2-1, see Section 9 Figures). Since 1976, 34 sites have been sampled within the study area. The Haggart, Dublin, and Eagle basins have the potential to be affected by the Project. Sites within these basins were selected upstream (reference) and downstream (exposed) of the proposed Project footprint where possible. Lynx Creek is a neighbouring basin unlikely to be affected by the Project, and not subject to placer mining in the past. Site names, locations, descriptions, rationale for selection, and number of dates sampled are summarized in Table 2-1. Site names, sites sampled in each of the water, sediment, periphyton and benthic invertebrate monitoring programs and historic site names are outlined in Table 2-2.

Table 2-1: Site Names, Locations, Type, Rationale for Selection and Number of Samples Collected in the Study Area

Drainage Basins – Sites	Location	Coordinates		Site Type	Rationale	Number of Samples			
		North	East			Water	Sediment	Periphyton	Benthic Invertebrates
Haggart Creek									
W2	Above Ironrust Creek	7102902.434	458442.1078	Reference	Above Project influence	10	2	1	1
W3	Lower Ironrust Creek	7102894.998	458173.7835	Reference	Above Project influence	10	1	1	1
W7	Above Fisher Gulch	7102607.989	458302.0849	Reference	Above Project influence	27	1	1	1
W11	Lower Fisher Gulch	7101793.623	457750.9435	Reference	Above Project influence	8		1	1
W22	Above Dublin Gulch	7101376.728	458318.9078	Reference	Above Project influence	25	4	1	3
W4	Below Dublin Gulch	7101222.661	458143.5501	Exposure	Below Project influence	46	4	2	2
W33	Lower Gill Gulch	7100246.838	458094.8672	Reference	Above Project influence	2 *			
W29	Below Eagle Creek	7099583	458225	Exposure	Below Project influence	11	2		2
W35	Lower 15 Pup	7097953.000	458100.000	Reference	Above Project influence	2			
W5	Above Lynx Creek	7095887.494	457814.7997	Exposure	Below Project influence	50	4	2	4
W23	Below Lynx Creek	7095682.491	457790.094	Exposure	Below Project influence	24	1	1	2
Dublin Gulch									
W20	Lower Bawn-Boy Gulch	7101961.381	461944.6726	Exposure	Above Project influence	10	2	1	1
W30	Lower Cascallen Gulch	7102209.058	461877.0589	Reference	Above Project influence	*	1		
W51	Below Bawn-Boy Gulch	7102039.734	461638.1497	Exposure	Above Project influence		1		
W31	Lower Olive Gulch	7101578.541	461223.466	Exposure	Below Project influence	*			
W8	Below Olive Gulch	7101619.462	461122.3858	Exposure	Below Project influence	13	2	1	1
W1	Above Stewart Gulch	7101545.36	460249.4257	Exposure	Below Project influence	51	3	2	4
W36	Upper Stewart Gulch	7101346.803	460485.8267	Exposure	Below Project influence		1		
W26	Lower Stewart Gulch	7101442.549	460330.9322	Exposure	Below Project influence	15	2	1	2

Drainage Basins – Sites	Location	Coordinates		Site Type	Rationale	Number of Samples			
		North	East			Water	Sediment	Periphyton	Benthic Invertebrates
W32	Lower Ann Gulch	7101210.698	459411.7036	Reference	Below Project influence	1*			
W21	Above Haggart Creek	7101261.107	458358.9936	Exposure	Below Project influence	22	3	1	3
W74	Inlet Pond Haggart Creek	7098330	458287	Exposure	Below Project influence		1		
W75	Outlet pond Haggart Creek	7098200	458312	Exposure	Below Project influence		1		
Eagle Creek									
W9	Lower Eagle Pup	7101052.411	459629.9615	Exposure	Below Project influence	27		2	2
W10	Lower Stuttle Gulch	7100840.729	459160.6433	Exposure	Below Project influence	13		1	1
W27	Eagle Creek	7100996.667	458235.4088	Exposure	Below Project influence	22	3		2
W34	Lower Platinum Gulch	7099629.222	458835.078	Exposure	Below Project influence	3			
W72	Inlet pond Eagle Creek	7099890	458361	Exposure	Below Project influence		1		
W73	Outlet pond Eagle Creek	7099730	458312	Exposure	Below Project influence		1		
Lynx Creek									
W62	Above Skate Creek	7101138.25	468945.8221	Reference	Separate basin		1		
W63	Below Skate Creek	7099598.001	467310.005	Reference	Separate basin		1		
W13	Above Ray Creek	7098295.001	464769.5287	Reference	Separate basin	5	1	1	1
W64	Below Ski Creek	7097774.075	462796.8628	Reference	Separate basin		1		
W6	Above Haggart Creek	7095964.417	458099.4169	Reference	Separate basin	29	1	2	2

NOTES:
* *in situ* readings when water levels were sufficient

Table 2-2: Sites Sampled and Historic Site Names in Aquatic Sampling Programs Conducted since 1976 at Eagle Gold

Drainage Basins – Sites	Water					Sediment						Periphyton		Benthic Invertebrates			
	1993 – 1995	1996	2007 – 2008	2009	2010	1976 – 1977	1993	1995	2007	2009	2010	1995	2007	1995	2007	2009	2010
Haggart Creek																	
W2	✓						S1	S1				P2		✓			
W3	✓					9065						P3		✓			
W7	✓	✓				9248						P7		✓			
W11	✓											P10		B10			
W22		W12a(96)	✓	✓	✓		S5	S5	✓	✓			✓		✓	✓	✓
W4	✓	✓	✓	✓	✓		S2	S2	✓		✓	P4	✓	✓	✓		
W33		✓		✓													
W29				✓	✓					✓	✓					✓	✓
W35		✓															
W5	✓	✓	✓	✓	✓		S3	S3	✓	✓		P5	✓	✓	✓	✓	✓
W23		W14	✓	✓	✓				✓				✓		✓		✓
Dublin Gulch																	
W20			✓	✓		9074			✓				✓				
W30				✓		9075											
W51						9385											
W31				✓													
W8	✓	✓					S4	S4				P8		✓			
W1	✓	✓	✓	✓	✓				✓	✓	✓	P1	✓	✓	✓	✓	✓
W36						9246											
W26	W12		✓	✓					✓	✓		P11		B11		✓	

Drainage Basins – Sites	Water					Sediment						Periphyton		Benthic Invertebrates			
	1993 – 1995	1996	2007 – 2008	2009	2010	1976 – 1977	1993	1995	2007	2009	2010	1995	2007	1995	2007	2009	2010
W32				✓	✓												
W21		W12(96)	✓	✓	✓	9251			✓	✓			✓		✓	✓	✓
W74											✓						
W75											✓						
Eagle Creek																	
W9	✓	✓			✓							P9	✓	✓	✓		
W10	✓	✓											✓		✓		
W27			✓		✓				✓	✓	✓					✓	✓
W34		✓			✓												
W72											✓						
W73											✓						
Lynx Creek																	
W62						9085											
W63						9164											
W13	✓	✓	✓						✓				✓		✓		
W64						9389											
W6	✓	✓	✓		✓				✓			P6	✓	✓	✓		

3 WATER QUALITY

Physical and chemical water quality parameters determine the physiological performance of individual aquatic organisms and influence characteristics at the population and community levels in terms of distribution, diversity, and density. Because freshwater systems are complex, adaptive, and dynamic, the completion of an extensive water quality monitoring program is essential to distinguish natural variations over time and space from human-induced environmental changes.

The water quality assessment was designed to provide data on general water chemistry, nutrient, organic carbon, cyanide, total suspended solids, and metal levels. These parameters are relevant to toxicity and habitat requirements for algae, benthos, and fish. The objectives of the study were:

- To obtain baseline data on water quality that can be used to assess potential changes related to construction, operation, closure, and post-closure stages of the Project.
- To identify parameters that may be present at elevated levels, and to use this information to propose site-specific water quality objectives, if needed.
- To provide baseline data that can be used to support future biological monitoring programs.

3.1 Methods

3.1.1 Review of Existing Literature

Water quality and aquatic biota are sensitive to mining activities and are vital in sustaining healthy aquatic ecosystems. Discharge of mine effluent to the receiving environment has potential for direct adverse effects on aquatic ecosystems through toxicity of metals, nutrient enrichment (elevated nitrate or ammonia from blasting residues), increased sulphate levels, changes in pH, and release of suspended sediments. Environmental effects of mine effluent discharge have been well documented and include excessive growth of periphyton resulting from nitrate or ammonia discharges, reduced abundance of periphyton and benthic invertebrates in areas close to discharge points, elimination of sensitive species, changes in community structure, and deformities of periphyton induced by metals (Aquamin 1996). Changes in periphyton and benthos productivity can have an effect on fish assemblages (abundance, size, bioaccumulation of metals in tissue), which can then affect birds, wildlife, and humans that consume fish.

Materials consulted to complete the baseline study of water quality in the Project area include:

- Hallam Knight Piésold 1996a
- Hallam Knight Piésold 1996b
- Jacques Whitford AXYS 2007
- Jacques Whitford AXYS 2008

3.1.2 Sampling Time and Locations

Baseline surface water quality within the study area (Figure 3-1) was assessed through three field studies conducted in the four main drainage basins, Haggart Creek, Dublin Gulch, Eagle Creek, and Lynx Creek, since 1993 (Table 3-1).

Between 1993 and 1995, the water quality monitoring program outlined in Table 3-2 was conducted by First Dynasty Mines Ltd. at 13 stream sites (Hallam Knight Piésold Ltd. 1996a). Samples were collected monthly from June to September in 1993, March and July in 1994, and May, July, August, September, and October in 1995. Samples were collected daily sampling from September 13 to 19, 1995 at four sites (W1, W4, W5, W7) to identify possible short-term variations in water quality during active placer mining within the Haggart Creek basin.

In 1996, First Dynasty Mines Ltd. conducted an additional survey at 15 sites within the study area in May through September (Table 3-3), which included one week of daily sampling in June to represent summer flow conditions at W1, W4, W5, and W7 (Hallam Knight Piésold Ltd. 1996b).

The 2007 through 2010 program outlined in Table 3-4 included collection of samples from 11 sites between August 2007 and June 2008 (JWA 2008). Most of the sites were sampled on eight dates to encompass seasonal variability and differences in flow conditions. Field studies were also conducted in 2009 between July and October at 12 sites and in 2010 between March and September at 12 sites (Table 3-4). Most of the sites were sampled on seven dates, to encompass seasonal variability and differences in flow conditions, although some sites (W26, W32, W34) could not be sampled on all dates due to low flows. *In situ* readings were also recorded from four smaller tributaries over this period when sufficient flows were present.

Table 3-1: Overview of Water Quality Sampling Program, 1993 to 2010

Drainage Basins – Sites	Location	Years Sampled							
		1993	1994	1995	1996	2007	2008	2009	2010
Haggart Creek									
W2	Above Ironrust Creek	✓	✓	✓					
W3	Lower Ironrust Creek	✓	✓	✓					
W7	Above Fisher Gulch	✓	✓	✓	✓				
W11	Lower Fisher Gulch	✓	✓	✓					
W22	Above Dublin Gulch				✓	✓	✓	✓	✓
W4	Below Dublin Gulch	✓	✓	✓	✓	✓	✓	✓	✓
W33	Lower Gill Gulch				✓			*	
W29	Below Eagle Creek							√	√
W35	Lower 15 Pup				✓				
W5	Above Lynx Creek	✓	✓	✓	✓	✓	✓	✓	✓
W23	Below Lynx Creek				✓	✓	✓	✓	✓
Dublin Gulch									
W20	Lower Bawn Boy Gulch					✓	✓	✓	
W30	Lower Cascallen Gulch							*	
W31	Lower Olive Gulch							*	
W8	Below Olive Gulch	✓	✓	✓	✓				
W1	Above Stewart Gulch	✓	✓	✓	✓	✓	✓	✓	✓
W26	Lower Stewart Gulch			✓		✓	✓	✓	
W32 *in situ*	Lower Ann Gulch							*	✓
W21	Above Haggart Creek				✓	✓	✓	✓	✓
Eagle Creek									
W9	Lower Eagle Pup	✓	✓	✓	✓			✓	✓
W10	Lower Stuttle Gulch	✓	✓	✓	✓				
W27	Eagle Creek					✓	✓	✓	✓
W34	Lower Platinum Gulch				✓				✓
Lynx Creek									
W13	Above Ray Creek			✓	✓	✓			
W6	Lower Lynx Creek	✓	✓	✓	✓	✓	✓	✓	✓

NOTE:
* *in situ* readings

Table 3-2: Stream Water Quality Sampling Program 1993 – 1995

Drainage Basins – Sites	1993				1994		1995											
	11-Jun	07-Jul	05-Aug	04-Sep	10-Mar	15-Jul	01-May	03-Jul	04-Jul	02-Aug	13-Sep	14-Sep	15-Sep	16-Sep	17-Sep	18-Sep	19-Sep	01-Oct
Haggart Creek																		
W2	✓	✓	✓	✓	✓	✓	✓		✓	✓								✓
W3	✓	✓	✓	✓	✓	✓	✓		✓	✓								✓
W7	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
W11	✓	✓	✓	✓	✓	✓			✓	✓								✓
W4	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
W5	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
Dublin Gulch																		
W8	✓	✓	✓	✓		✓		✓		✓								✓
W1	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓
W26								✓										
Eagle Creek																		
W9	✓	✓	✓	✓		✓	✓	✓		✓								✓
W10	✓	✓	✓	✓		✓	✓			✓								✓
Lynx Creek																		
W13										✓								
W6	✓	✓	✓	✓		✓		✓		✓								✓

Table 3-3: Stream Water Quality Sampling Program 1996

Drainage Basins –Sites	1996													
	20-May	21-May	23-May	24-May	22-Jun	23-Jun	24-Jun	25-Jun	26-Jun	27-Jun	13-Jul	22-Jul	13-Aug	20-Sep
Haggart Creek														
W7	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓
W22												✓	✓	✓
W4	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓
W33												✓	✓	
15 Pup												✓	✓	
W5	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓
W23												✓	✓	✓
Dublin Gulch														
W8				✓						✓		✓	✓	✓
W1	✓	✓	✓		✓	✓	✓	✓	✓	✓		✓	✓	✓
W21										✓				
Eagle Creek														
W9			✓							✓		✓	✓	✓
W10			✓							✓		✓	✓	✓
W34														✓
Lynx Creek														
W13											✓			
W6			✓							✓		✓	✓	✓

Table 3-4: Stream Water Quality Sampling Program, 2007 – 2010

Drainage Basins – Sites	2007						2008		2009							2010						
	14-Aug	29-Aug	11-Sep	25-Sep	19-Oct	20-Nov	25-Apr	9-June	18-20 Jul	6-Aug	20-Aug	01-02 Sep	16-Sep	05 -07 Oct	20-22 Oct	31-Mar	06-May	22-May	02-Jun	11-Jul	18-Aug	20-Sep
Haggart Creek																						
W22	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
W4	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓				✓	✓	✓	✓	✓	✓	✓
W33 *in situ*													✓									
W29										✓	✓		✓	✓	✓		✓	✓	✓	✓	✓	✓
W5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
W23	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Dublin Gulch																						
W20	✓	✓	✓					√	√	√	√		✓	✓	✓							
W30 *in situ*													✓									
W31 *in situ*													✓									
W1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
W26	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓							
W32													√				✓					
W21	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
Eagle Creek																						
W9									✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
W27	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
W34																	✓	✓				
Lynx Creek																						
W13	✓		✓		✓																	
W6	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓					✓	✓	✓	✓	✓	✓

3.1.3 Field Sampling Methods

Between 1993 and 1996, samples were collected in a set of five bottles at each site for analysis of general parameters, cyanide, mercury, and a broad range of total and dissolved metals. Samples were filtered and/or preserved in the field and shipped for analysis within 48 hours of collection to Analytical Services Laboratories Ltd., (ASL, now ALS Environmental) in Vancouver.

From 2007 to 2010, water samples were collected from midstream following the BC Freshwater Biological Sampling Manual (BC Ministry of Water, Land Air Protection 2003). Samples requiring filtration and/or preservation were dealt with as soon as possible after returning to shore. All samples and blanks were kept in coolers with ice packs until arrival at the laboratory (ALS Environmental, Vancouver BC). Chain of custody forms describing sampling times and analytical requirements were submitted to the analytical laboratory. *In situ* measurements of pH, temperature, conductivity, and dissolved oxygen were also on each sampling date. Detailed sampling methods for field preparation, water sample collection, preservation, and shipping are described in Appendix A5-1.

3.1.4 Laboratory Methods

Analysis of the 1993 to 1996 water samples were performed by ASL in accordance with *Standard Methods for the Examination of Water and Wastewater* published by the American Public Health Association, 1985 and 1989. Analysis consisted of physical parameters and anions such as pH, conductivity, sulphate, nutrients (including nitrogen and phosphorous species), total cyanide, selected total and dissolved metals, and total organic carbon.

Samples from 2007 to 2010 were analyzed for parameters listed in Appendix A, which include general parameters, nutrients, dissolved organic carbon (DOC), total and weak acid dissociable (WAD) cyanide, total and dissolved metals. Detection limits were suitable for comparison with water quality guidelines.

3.1.5 Data Analysis

Summary statistics were generated for all parameters at each site, as well as at sites pooled for each system over the whole monitoring period. These statistics included sample size, minimum and maximum values, median, mean, standard deviation, standard error, coefficient of variation, number of samples exceeding guidelines, and number of samples with values equal to or lower than the corresponding detection level. In addition, for each metal, the ratio (in percent) between dissolved and total concentrations was calculated as an indication of metal bioavailability.

For results below detection limit, a value of half the detection limit was used in the calculations. Detection limits used in 1993 through 1996 were consistent with laboratory practice at that time but, for several metals, were higher than used in the 2007 through 2009 program (e.g. 200 times higher for barium). In most cases, detection limits were well below Canadian Council of Ministers of Environment (CCME) and British Columbia approved and working guidelines for the protection of aquatic life, and had no bearing on the assessment of water quality in the study area. Parameters with detection limits approaching guidelines are summarized in Table 3-5. In addition, cadmium measurements below detection limits were considered to be within guidelines.

Table 3-5: Comparison of CCME and BC Water Quality Guidelines with Detection Limits for Parameters that had Detection Limits Approaching Guidelines

Parameter	Guideline (mg/L)		Detection Limit (mg/L)	
	CCME	BC	1993 – 1996	2007 – 2010
Cadmium	0.000017	0.00001 to 0.00006 varies with hardness	0.0002	0.000017
Cyanide	0.005[1]		0.001	0.005
Lead	0.001 to 0.007 varies with hardness	0.010 to 0.172 varies with hardness	0.001	0.00005
Mercury	0.000026	0.0001	0.00001	0.00005[2]
Selenium	0.001	0.002	0.0005	0.001
Silver	0.0001	0.0001 (hard ≤100) to 0.003 (hard >100)	0.0001	0.00001

NOTE:
1. Free cyanide
2. Mercury detection limit improved to 0.00001 mg/L in 2010

All results were compared to available criteria for protection of aquatic life specified in the *Canadian Water Quality Guidelines* (CCME 2007) and *British Columbia Approved and Working Water Quality Guidelines* (MOE 2006 and 2008; Nagpal, et al. 2006). These water quality guidelines (WQG) are listed in Table 3-6.

Table 3-6: Parameters Analyzed and Canadian (CCME) and British Columbia (Approved and Working) Water Quality Guidelines for Protection of Aquatic Life

Parameter	Water Quality Guideline Maximum (mg/L unless stated)	
	CCME	BC
Temperature, °C	NA	1°C change from optimum for fish species
Dissolved oxygen	minimum 5.5 – 9.5	minimum 5 to 9, depends on life stage
pH, units	6.5–9	6.5 – 9
Total Alkalinity	NA	site-specific
Turbidity, NTU	NA	8 NTU when background ≤ 8
Dissolved organic carbon (DOC)	NA	30-day median ± 20%
Total suspended solids (TSS)	NA	25 mg/L when background ≤ 250
Fluoride	NA	0.2 – 0.3
Chloride	NA	600
Sulphate	NA	100
Ammonia-N	varies with temp., pH	varies with temp., pH
Nitrate-N	2.9	200
Nitrite-N	0.197	0.06 – 0.6 for Cl- 2 to >10 mg/L
Cyanide, total	0.005 (free cyanide)	

Parameter	Water Quality Guideline Maximum (mg/L unless stated)	
	CCME	BC
Aluminum, total	0.1 (total), pH≥6.5	
Aluminum, dissolved		0.1 for pH ≥ 6.5
Antimony, total	NA	0.02
Arsenic, total	0.005	0.005
Barium, total	NA	5
Beryllium, total	NA	0.0053
Boron, total	NA	1.2
Cadmium, total	0.00001 to 0.00006[a]	0.00001 to 0.00006[a]
Calcium, dissolved		Up to 0.004 highly sensitive to acid inputs 0.004 to 0.008 moderately sensitive >0.008 low sensitivity
Chromium, total	0.0089 (Cr III)	0.0089 (Cr III)
Cobalt, total	NA	0.11
Copper, total	0.002 to 0.004[a]	0.004 to 0.019[a]
Iron, total	0.3	1.0b
Iron, dissolved	NA	0.35 [b]
Lead, total	0.001 to 0.007[a]	0.010 to 0.172[a]
Manganese, total	NA	0.8 to 2.5[a]
Mercury	0.000026	0.0001
Molybdenum, total	0.073	2
Nickel, total	0.025 to 0.15[a]	0.025 to 0.15[a]
Selenium, total	0.001	0.002 (considered max)
Silver, total	0.0001	0.0001 (hard≤100) and 0.003 (hard>100)
Titanium, total	NA	2
Uranium, total	NA	0.3
Vanadium, total	NA	0.006
Zinc, total	0.03	0.033 to 0.1[a]

NOTES:

[a] Varies with hardness, the range of metal values is presented for hardness of 20–180 mg/L

[b] Iron WQG updated by BC MOE in 2008

Additional parameters analyzed include: conductivity (field and lab), total hardness, total dissolved solids (TDS), chloride, phosphate (dissolved, ortho and total), total Kjeldahl Nitrogen, cyanide (weak acid diss.) bismuth, lithium, silicon, thallium, tin, magnesium, potassium, sodium, and the dissolved fraction for all listed metals.

Temporal trends were assessed for each site individually, and then differences among sites were evaluated. Temporal differences were assessed for historic data (1993 – 1996) and current data (2007 – 2010) for sites sampled in all years, such as sites W1, W4, W5, and W6.

Statistical analyses were carried out with Statgraphics Centurion XV, Version 15.2.00.

3.1.6 Quality Assurance/Quality Control

The Quality Assurance/Quality Control (QA/QC) program was designed to provide reliable monitoring data by minimizing sampling error, contamination, and erroneous results, and by quantifying any bias in the results. Values that exceeded the mean ±2 standard deviations for a given parameter in a given site were considered as outliers when they were associated with a manipulation or analytical problem (e.g. blank contamination, high hold time). These values were reported in the raw data appendix, but highlighted and excluded from summary statistic calculations.

Another important component of the QA/QC program was to assure data quality regarding precision, bias, adequate sample hold times, and detection limits. The examination of environmental data for potential artifacts due to contamination or reporting errors was thorough. Laboratory results and field notes were verified in relation to replicate and blank results, hold times and occurrence of unusual events. Levels of total and dissolved metals were compared to evaluate potential contamination during sample filtration in the field. Additional description of the field and laboratory QA/QC program is given in Appendix A5-2.

Field and Travel Blanks

Field and travel blanks were examined to determine whether there were detectable levels of any parameters. Most field and travel blank results were at or below detection limit, and values just above the detection limit were not considered to reflect contamination. Blank results are presented in Appendices A1-1 to A1-2. Results suggesting contamination are highlighted in these appendices.

Two of the eleven travel blanks had parameters that exceeded detection limits by more than five times over the 1993 to 1996 sample period. Total suspended solids (27 mg/L) and total aluminum (0.034 mg/L) exceeded detection limits by 27 and 7 times, respectively, and was indicative of contamination of the blank at the laboratory. The high total aluminum reading was not related to outliers among the sample results from that date. None of the travel or field blanks from 2007 – 2010 had levels above five times the detection limits.

Replicates

Laboratory results for field replicates were examined to determine if precision thresholds were exceeded. Field duplicates should have a difference of no more than 25% of their mean for parameters equal to or greater than five times the detection limit. Results for duplicate samples are presented in Appendix A1-3. Results for which the precision thresholds were exceeded are highlighted in this appendix.

Among the approximately 2,500 analyses performed in duplicate, less than 2% (40 analyses) showed results differing by more than 25% of the mean, when the replicate values were more than five times the detection limit. These variations included total suspended solids (4 times), total phosphate (3), nitrate (2), sulfate (1), TKN (1), total nitrogen (2), total aluminum (5), dissolved aluminum (3), total antimony (1), total (2) and dissolved (1) arsenic, total barium (1), total copper (1), total (2) and dissolved (1) iron, total lead (1), total magnesium (1), total (4) and dissolved (2) manganese, total silicon (1), and total uranium (1). Ten of these occurred in June 2010 at which time

ALS confirmed the laboratory results. Of these, WQG were exceeded for aluminum and arsenic in both replicates. There was no obvious reason to exclude either of the replicates so mean values were included in all further analysis (i.e., processed as per all other replicate samples).

Dissolved vs. Total Concentrations

Levels of total and dissolved metals were compared to evaluate potential contamination during sample filtration. Dissolved concentrations that exceeded the total concentrations by more than 25%, when both concentrations were at least five times the detection limit, were flagged as an indication of contamination. Where the metal concentration in the dissolved phase exceeded the total concentration by less than 10%, the higher values of the dissolved phase were attributed to random variations.

Dissolved levels exceeded the corresponding total levels four times between 1993 and 1996 with calcium (1), arsenic (2), and aluminum (1); and 19 times between 2007 and 2010 including molybdenum (1) and zinc (1) in 2007, manganese (1) and zinc (1) in 2009, and aluminum (1), arsenic (2), calcium (5), copper (1), magnesium (1), manganese (2), molybdenum (1), and silicon (1) in 2010.

Hold Time

All efforts were made to submit samples within applicable hold times, although with the remote location of the property, the 72 hour hold time for nitrite, nitrate, dissolved phosphate, and ortho-phosphate was typically exceeded by two to three days. As a consequence, some outliers observed could be related to long hold times; in general, ALS has not encountered anomalies in samples exceeding hold times (pers. comm. Natasha Markovic-Mirovic 2009).

3.2 Results

All raw data and summary statistics for water quality data (1993 to 2010) are documented in Appendices A2 and A3.

3.2.1 2007 to 2010 Program

3.2.1.1 General Chemistry

Circumneutral to basic conditions were reported at the monitored sites, with mean pH ranging from 7.5 to 8.3. All sites, except those located in Dublin Gulch, exhibited a high acid buffering capacity, as indicated by high mean alkalinity (>75 mg/L), calcium (>35 mg/L), and hardness (>130 mg/L), shown in Figure 3-2. Sites within the Dublin Gulch Creek watershed, with the exception of Stewart Gulch (W26), showed lower mean alkalinity (<55 mg/L) and softer water (<85 mg/L) than sites in Haggart, Lynx and Eagle systems. At site W20 (Bawn-Boy Gulch), a calcium concentration of 7.4 mg/L was measured in June 2008, indicating moderate sensitivity to acid inputs.

The range of conductivity measured at sites W1 (24 to 136 µS/cm) and W20 (54 to 73 µS/cm) tended to be much lower than at all other sites (51 to 464 µS/cm), as shown in Figure 3-2. Sites W1 and W20, both located within the upper Dublin Gulch watershed, were also distinct from the other drainage basins in their low sulphate (mean 12 and 5 mg/L, respectively) and total dissolved solids (TDS) concentrations (mean 69 and 47 mg/L, respectively). In the other drainage basins, mean concentrations averaged 44 to 63 mg/L for sulphate and 171 to 217 mg/L for TDS.

Turbidity tended to be low (<3 NTU) in all drainage basins for most of the year. Higher readings were occasionally observed in spring at a number of sites including April 2008 at site W27 (Eagle Pup, 53 NTU) and June 2008 at site W23 (downstream on Haggart Creek, 23 NTU). For these exceptions, concurrent high levels of TSS (58 and 154 mg/L, respectively) and guideline exceedances for copper and iron at W27 and total aluminum, cadmium, copper, iron, and lead at W23 suggest potential sediment re-suspension. April samples were collected from under the ice. In 2010, elevated readings (>10 NTU) were also observed on 06 May (W27, 102 NTU; W29, 19 NTU), 22 May (W5, 15 NTU; W6, 15 NTU; W21, 10 NTU; W23, 11 NTU; W27, 177 NTU; W29, 49 NTU), July (W27, 12 NTU), and Aug (W27, 85 NTU). These readings were generally associated with higher TSS loads and guideline exceedances for aluminum, arsenic, cadmium, copper, and lead. The high turbidity observed at W27 and W29 was traced to a seep in the Stuttle Creek valley. Erosion and sediment control measures were implemented in late August and turbidity readings returned to normal levels by September.

3.2.1.2 Nutrients and Organic Matter

Nutrient levels tended to be low. Ammonia concentrations were below detection limits in approximately 80% of samples analyzed. Nitrate and total nitrogen levels were consistently higher in Eagle Creek, intermediate in Lynx and Haggart Creeks, and lower in Dublin Gulch (Figure 3-2). No clear inter-site difference in Total Kjeldahl Nitrogen (TKN) levels was observed.

Phosphorus concentrations (ortho-phosphate and total dissolved phosphorus) were highest at W26 (Stewart Gulch), with one ortho-phosphate and one total phosphorus value in October 2007 ten times higher than the usually observed concentrations. These outliers were not compatible with the generally low trophic condition of the monitored streams, so are considered artifacts of sampling or analysis and excluded from summary statistics. Concentrations of ortho-phosphate, total dissolved phosphorus, and total phosphorus were generally lowest in Haggart Creek and below detection limits in 65% of samples.

Mean dissolved organic carbon (DOC) levels also tended to be low (<6 mg/L) at all sites other than W32 (Ann Gulch, 23 mg/L) and W34 (Platinum Gulch, 15 mg/L) where only one and two samples, respectively, were recorded from these ephemeral streams.

3.2.1.3 Metals and Cyanide

More than 90% of samples analyzed for cyanide (total and weak acid dissociation) had levels below the analytical detection limit.

Several metals showed levels consistently below analytical detection limits. These include:

- More than 75% of samples analyzed for beryllium, bismuth, boron, chromium, mercury (other than W32, only one sample), selenium, silver (other than W27, 73%; W32, only one sample; W34, one out of two samples), thallium, tin, titanium (W27, 73%), and vanadium at all sites.

- More than 50% of samples analyzed for total suspended solids (W27, 32%), cobalt (W22, 41%; W32, one sample), and cadmium (W13, 33%; W32, one sample) at all sites.

Total arsenic levels consistently exceeded CCME and BC guidelines for protection of aquatic life (0.005 mg/L) at most sites (Figure 3-3) as follows:

- All samples from sites W1, W20, W21, W26, W32 (Dublin Gulch watershed), W9, W27, W34 (Eagle Creek watershed), and W6, W13 (Lynx Creek watershed)
- Some samples (26 out 92) from Haggart Creek watershed (13 out of 21 at W23 downstream from Lynx Creek and 7 out of 11 from W29 downstream from Eagle Creek).
- No guideline exceedance for W22 (Haggart Creek upstream of Dublin Gulch).

Mean arsenic levels were approximately an order of magnitude higher in Dublin Gulch (0.060 mg/L) and Eagle Creek (0.063 mg/L) than in Haggart Creek (0.006 mg/L) and Lynx Creek (0.007 mg/L).

Other metals occasionally exceeded guidelines, with exceedances in April 2008 (W27), June 2008 (W23), 06 May 2010 (all sites), and 22 May 2010 (all sites) associated with freshet and high TSS levels. Levels higher than guidelines were noted for:

- Aluminum
- September 2007 (W6)
- April 2008 (W27)
- June 2008 (W20, W23)
- July 2009 (W26)
- September 2009 (W27)
- October 2009 (W23)
- 06 May 2010 (all sites except W21)
- 22 May 2010 (all sites)
- June 2010 (W1, W21, W27)
- July 2010 (W1, W27)
- August 2010 (W27).
- Cadmium
- August 2007 (W6)
- April 2008 (W1)
- June 2008 (W1, W23)
- August 2009 (W26)
- September 2009 (W27)

- 06 May 2010 (W4, W6, W9, W22, W23, W27, W29, W32)
- 22 May 2010 (all sites)
- June 2010 (W1)
- July 2010 (W1, W27)
- August 2010 (W27).
- Copper
- June 2008 (W23)
- 06 May 2010 (W4, W5, W6, W9, W23, W27, W29, W32)
- 22 May 2010 (W5, W6, W9, W23, W29)
- June 2010 (W1)
- August 2010 (W27).
- Iron
- April 2008 (W27)
- June 2008 (W23)
- March 2010 (W27)
- 06 May 2010 (W4, W5, W6, W22, W23, W27, W29, W32)
- 22 May 2010 (W1, W5, W6, W9, W21, W22, W23, W27, W29)
- June 2010 (W1)
- July 2010 (W27)
- August (W27).
- Lead
- June 2008 (W23)
- 06 May 2010 (W27, W32)
- 22 May 2010 (W1, W5, W21, W27, W29)
- June 2010 (W1).
- Zinc
- One sample at site W27 (August 2010).

3.2.2 Comparison of 2007-2010 Data versus Historical Data

Analytical results for 2007 – 2010 were generally within the range observed during the 1993 – 1996 monitoring program for general chemistry, nutrients, and organics; including pH, alkalinity, hardness, conductivity, sulphate, nitrate, dissolved ortho-phosphate, and total dissolved solids (Figure 3-4). Data variability was generally higher for the historical data than for the more recent data.

Total suspended solids and some metals, including aluminum, arsenic, copper, iron, and lead, were up to an order of magnitude higher in 1995 and 1996 than other years, exceeding CCME guidelines in many cases (Figure 3-5). The percentages of samples exceeding guidelines for aluminum, arsenic, cadmium, copper, iron, and lead are summarized in Table 3-7. Metal levels were highest at sites W8 in 1996 and W10 in 1995 and 1996 (Figure 3-6). Higher concentrations coincided with elevated total suspended solids at these sites.

Table 3-7: Percent of Samples Exceeding CCME Guidelines by Watershed in 1993/96

Parameter	Watershed			
	Haggart	Dublin	Eagle Pup	Lynx
Total Aluminum	19%	20%	40%	18%
Total Arsenic	23%	100%	94%	71%
Total Copper	8%	4%	22%	4%
Total Iron	14%	6%	28%	4%
Total Lead	6%	7%	14%	0%

Figures 3-4 through 3-6 provide a comparison of surface water between the two monitoring periods, highlight the years in which mean concentrations were unusually high, and show the sites contributing to these levels.

3.2.3 Seasonal Variability (1993 – 2010)

Seasonal variability of several parameters is shown in Figure 3-7. At most sites, levels of pH, alkalinity, hardness, conductivity, TDS, and nitrate tended to be lowest in May, at a time when high spring flows resulted in elevated TSS and the re-suspension of metals (aluminum, arsenic, cadmium, copper, iron, lead) from sediments disturbed by placer mining over many years. Sites W8 (upper Dublin) in July 1996 and W10 (lower Stewart Gulch) in May 1995 and 1996 had very high concentrations of TSS, aluminum, arsenic, cadmium, copper, iron, and lead. Placer mining is still active in the region and variable surface water quality over the years is likely related to the extent of mining in each drainage system.

Results of intensive sampling conducted over seven days in September 1995 and eight days in June 1996 suggest there is little short-term variability in routine water parameters (pH, alkalinity, hardness, sulphate, nitrate, and TDS). Variations in metal concentrations appeared to be related to TSS levels (Hallam Knight Piésold 1996a, b).

3.3 Water Quality Summary

Baseline studies conducted since 1993 indicated wide variability in general water chemistry among the monitored streams. Nutrient concentrations generally were low at all sites. A few parameters exceeded CCME and BC guidelines for protection of aquatic life: aluminum, arsenic, cadmium, copper, iron and lead. For all these parameters except arsenic, the observed exceedances occurred occasionally, most often during freshet. Total arsenic levels were consistently higher than the guideline year-round at all sites, except those in lower Lynx Creek and most Haggart Creek sites.

Metals levels in water are consistent with a mineralized area. Some elevated levels may reflect previous disturbance of substrates during placer mining, or elevated levels in groundwater.

4 SEDIMENT QUALITY

The sediment assessment was designed to provide data on pH and metal levels in the fine fraction of benthic sediments in watercourses in the study area. These parameters are relevant to toxicity and physical habitat requirements for benthos, fish eggs and juvenile fish. The objectives of the study were:

- To obtain baseline data on sediment quality that can be used to assess changes related to construction, operation, closure, and post-closure stages of the Project
- To identify sediment parameters that may be present at elevated levels, and to use this information to propose site-specific sediment quality objectives, if needed
- To provide baseline data that can be used to support future monitoring programs.

4.1 Methods

4.1.1 Review of Existing Literature

Sediment metal analysis is widely used as an indicator of environmental quality in baseline monitoring and environmental assessments. Streambed sediments serve as a repository for metals in both the particulate and dissolved fractions, often containing higher metal concentrations than are found in water. When sediment is disturbed, metals can be re-suspended into the water column. Metals that enter aquatic systems may cause acute or chronic toxicity in benthic invertebrates, plankton, and periphyton (e.g. biochemical and physiological changes; Hook and Fisher 2001; Grosell, et al., 2006; Wilding and Maltby 2006; Shaw, et al., 2006), which can lead to altered community structure, and effects on other organisms in the aquatic food chain.

Metals accumulate in sediments when metal particles are washed into water and settle onto the substrate, or when soluble metals become sorbed by sediment particles. The fate of these metals depends on local physical and chemical conditions in the sediment. Sediments act as either a source or a sink for metals, depending on redox potential, cation exchange capacity, particle size of sediments, and organic carbon content (Salomons, et al., 1987). Trace metals are present in sediments as discrete compounds or as ions held by cation-exchanging clays, bound to hydrated oxides of iron or manganese, or chelated by humic substances (Manahan 1984).

Particle size influences sediment quality and binding behaviour for metals and other contaminants. Fine (<63 μm) and coarse particles (>63 μm) differ in their mineralogical, morphological, physicochemical and mechanical properties (Salomons and Forstner 1984). Coarse sediments tend to be rounded and stack upon each other. Metals tend to be associated with the fine particle size (clays) as a result of the following characteristics of clay:

- Their diverse shapes and sizes
- Their tendency to aggregate and precipitate into the sediments as floc networks, which provides an open structure that binds metal ions in water
- Their electrical charge, so metals are attracted and bound more easily than to coarse, non-charged particles
- Their tendency to form aggregates from colloidal suspension, so they settle more quickly than particles in colloids.

In general, metals adsorb more readily to fines (Brook and Moore 1988), with the highest metal concentrations in the clay-sized particles. The exceptions are manganese and iron, which preferentially bind to coarse particles >300 µm. Characteristics such as water depth, pH, hardness, nutrient concentration, temperature, dissolved oxygen, and water circulation also affect the behaviour of metals in a stream (Mudroch and MacKnight 1991).

Metal-sediment interactions strongly influence the toxicity of metals in freshwater systems. Although there is some debate surrounding the sources and mechanisms of metal toxicity for benthic organisms (i.e., water vs. sediment) or absorption of dissolved metals vs. ingestion of particulate metals, the bioavailability and toxicity of metals can largely be determined by metal ion activity in sediment pore water (Carbonaro,, et al. 2005; Campbell, et al. 2006). Thus, chemical interactions that produce insoluble metal species reduce the potential for metal toxicity. For example, the natural presence of iron monosulphide (FeS) in lakes and streams lowers dissolved concentrations of Cu^{2+}, Cd^{2+}, Ni^{2+}, Pb^{2+}, Zn^{2+}, and Ag^{+} through formation of insoluble metal sulphides (Carbonaro, et al., 2005). The potential for metal toxicity also depends on levels of molecular oxygen, which oxidizes metal sulphides, thereby releasing metal ions back to the sediment pore water (Carbonaro, et al., 2005). Binding of metal ions to organic carbon also affects metal concentrations in pore water (Ankley, et al., 1996).

In the present assessment, metal concentrations in sediment were compared to BC working sediment quality guidelines (SQGs) (Nagpal, et al., 2006) and CCME Interim Sediment Quality Guidelines (ISQG) (CCME 2007), which are the same for most parameters, and to Probable Effect Levels (PEL). ISQG represent total metal concentrations below which adverse biological effects are not expected and are based on lowest effect levels (LELs), the chemical concentration below which adverse biological effects are expected to occur only rarely. PEL are concentrations above which adverse effects are likely to occur.

Materials consulted to complete the baseline study of sediment quality in the Project area include:

- Hallam Knight Piésold 1996a
- Jacques Whitford AXYS 2007
- Jacques Whitford AXYS 2008.

4.1.2 Sample Timing and Locations

Sites sampled for sediment were selected based on geological and hydrological characteristics relative to future mine activities. A total of 26 sites were sampled between 1976 and 2010: ten in Haggart Creek, eight in Dublin Gulch, three in Eagle Creek, and five in Lynx Creek systems.

Sample locations are shown in Figure 4-1 and summarized for the period from 1976 to 2010 in Table 4-1. The number of sites sampled in a given year varied. Samples were collected from 11 sites in the watershed by the Geological Survey of Canada in 1976 and 1977 and reanalyzed for a broad range of metals in 1989 and 1990 under the Canada Yukon Economic Development Program. First Dynasty Mines Ltd. collected six replicate samples from four sites on Haggart Creek and one site on Dublin Gulch in 1993 and 1995 (a Knight Piésold 1996). Jacques Whitford AXYS sampled 11 sites in the four systems in September 2007 (JWA 2008). The September 2009 and August 2010 programs focused on additional data from seven sites in the Haggart, Dublin and Eagle Creek systems considered most relevant to the preferred mine plan.

Table 4-1: Overview of Stream Sediment Sampling Program, 1976 – 2010

Drainage Basins – Sites	Location	Dates Sampled					
		1976 – 1977	July 1993	Aug 1995	Sep 2007	Sep 2009	Aug 2010
Haggart Creek							
W2	Above Ironrust Creek		✓	✓			
W3	Lower Ironrust Creek	✓					
W7	Above Fisher Gulch	✓					
W22	Above Dublin Gulch		✓	✓	✓	✓	
W4	Below Dublin Gulch		✓	✓	✓		✓
W29	Below Eagle Creek					✓	✓
W74	Inlet of pond						✓
W75	Outlet of pond						✓
W5	Above Lynx Creek		✓	✓	✓	✓	
W23	Below Lynx Creek				✓		
Dublin Gulch							
W20	Lower Bawn-Boy Gulch	✓			✓		
W30	Lower Cascallen Gulch	✓					
W51	Below Bawn-Boy	✓					
W8	Below Olive Gulch		✓	✓			
W1	Above Stewart Gulch				✓	✓	✓
W36	Upper Stewart Creek	✓					
W26	Lower Stewart Creek				✓	✓	
W21	Above Haggart Creek	✓			✓	✓	

Drainage Basins – Sites	Location	Dates Sampled					
		1976 – 1977	July 1993	Aug 1995	Sep 2007	Sep 2009	Aug 2010
Eagle Creek							
W27	Eagle Creek				✓	✓	✓
W72	Inlet of pond						✓
W73	Outlet of pond						✓
Lynx Creek							
W62	Above Skate Creek	✓					
W63	Below Skate Creek	✓					
W13	Above Ray Creek				✓		
W64	Below Ski Creek	✓					
W6	Lower Lynx Creek				✓		

4.1.3 Field Sampling Methods

Methods used to collect samples from 1976 – 1977 are not available, and some details of the 1993 and 1995 programs are not available, so it is not known if these programs sampled erosional or depositional habitat in the streams. In 1993 and 1995, six replicates were taken from each site, placed in paper bags, sealed, and allowed to dry in a cool dry place for several days before being shipped to Chemex Laboratories (1993) or Analytical Services Laboratory (1995) for analysis.

In 2007, 2009, and 2010 sampling methods were compatible with those described in the BC Freshwater Biological Sampling Manual (MWLAP 2003) and followed advice provided by Benoit Godin (Environmental Assessment and Contaminants Unit, Environment Canada) on methods used in the Yukon. Three replicates were collected from each site, with the first replicate located at a downstream position and the others located consecutively upstream to minimize substrate disturbance. Replicates were taken from erosional areas located less than 10 m apart. Fine sediment was collected using a variety of methods, depending on site conditions and water depth (2" lexan core tube, stainless steel trowel, glass jars, and gloved hands).

In situ water quality measurements (water temperature, specific conductivity, dissolved oxygen and pH) and water depth were recorded for each site. All containers were pre-labeled with date, site location, sample identification, sample type and replicate number. The containers were stored in a cooler with ice packs (at 4°C) and transported to ALS Environmental Laboratories (Vancouver, BC) for analysis. The fine fraction (<63 µm) was analyzed for pH and metals listed in Appendix B.

4.1.4 Laboratory Methods

Metal analyses in 1993 and 1995 were conducted on the <50 µm fraction using hydride vapour atomic absorption spectrophotometry (HVAAS) for antimony and either atomic absorption spectrophotometry (AAS) or atomic emission spectrophotometry (ICP-AES) for remaining metals.

The fine fraction (<63 µm) was analyzed in 2007, 2009, and 2010. Mercury was analyzed by cold vapour atomic fluorescence spectrophotometry (CVAFS) and the remaining metals by inductively coupled plasma mass spectrophotometry (ICP-MS) or optical emission spectrophotometry ICP-OES). Sediment parameters and detection limits used from 1976 through 2010 are listed in Table 4-2.

Table 4-2: Sediment Quality Parameters Measured and Detection Limits from 1976 – 2010

Parameter	Detection Limits (2007 – 2010)	Sampling Program					
		1976 – 1977	1993	1995	2007	2009	2010
pH	0.1				✓	✓	✓
Antimony, total	10		✓	✓	✓	✓	✓
Arsenic, total	5			✓	✓	✓	✓
Barium, total	1	✓			✓	✓	✓
Beryllium, total	0.5				✓	✓	✓
Bismuth, total			✓				
Cadmium, total	0.5			✓	✓	✓	✓
Chromium, total	2			✓	✓	✓	✓
Cobalt, total	2	✓			✓	✓	✓
Copper, total	1	✓	✓	✓	✓	✓	✓
Iron, total		✓					
Lead, total	30	✓	✓	✓	✓	✓	✓
Manganese, total		✓					
Mercury, total	0.005	✓	✓	✓	✓	✓	✓
Molybdenum, total	4	✓	✓	✓	✓	✓	✓
Nickel, total	5	✓		✓	✓	✓	✓
Selenium, total	2			✓	✓	✓	✓
Silver, total	2	✓	✓	✓	✓	✓	✓
Thallium, total	1				✓	✓	✓
Tin, total	5				✓	✓	✓
Tungsten, total		✓					
Uranium, total	0.05	✓					✓
Vanadium, total	2				✓	✓	✓
Zinc, total	1	✓	✓	✓	✓	✓	✓

4.1.5 Data Analysis

Data from 1993, 1995, 2007, 2009, and 2010 have been summarized as minimum, maximum, mean, median, standard deviation, and standard error for each site. Values less than the detection limit were treated as one-half the detection limit for statistical purposes (Appendix B2).

Results were compared with available CCME and BC SQG for protection of aquatic life (listed in Table 4-3). Two guideline levels were considered: the ISQG, which represent the concentration below which adverse biological effects are expected to occur only rarely, and Probable Effect Levels (PEL), which describe concentrations at which adverse effects are typically observed.

Table 4-3: Sediment Quality Guidelines for Protection of Aquatic Life (CCME) and BC Working Guidelines for Sediment (BCWSG)

Variable	CCME/BC SQG[a] (mg/kg dry weight)	
	ISQG	PEL
Arsenic, total	5.9	17
Cadmium, total	0.6	3.5
Chromium, total	37.3	90
Copper, total	35.7	197
Iron, total	21,200[b]	43,766[c]
Lead, total	35	91
Mercury, total	0.17	0.486
Nickel, total	16[b]	75[c]
Selenium, total	5[d]	–
Silver, total	0.5[e]	–
Zinc, total	123	315

NOTES:
ISQG = Interim Sediment Quality Guidelines
PEL = Probable Effect Level
[a] Guidelines are derived from CCME guidelines, except for iron, nickel, selenium and silver based on other jurisdictions
[b] Lowest Effect Level (LEL) – BCWSG
[c] Severe Effect Level – BCWSG
[d] BCWSG
[e] BCWSG, based on Ontario sediment quality guideline
SOURCE: Nagpal *et al.* 2006, CCME 2006 (interim sediment quality guidelines)

4.1.6 Quality Assurance/Quality Control

QA/QC protocols comprised standard procedures in the field to avoid sample contamination, examination of certified reference materials and laboratory duplicates, and assessment of the precision of field replicates.

4.1.6.1 Field Procedures

Quality assurance in the field included cleaning the equipment (plastic collection pan, spatulas) with de-ionized water between sites, rinsing thoroughly with ambient water between replicates, and wearing nitrile gloves (clean gloves at each site). The glass sampling jars were acid-washed and brought uncontaminated from the laboratory. Upon collection, samples were immediately placed in a clean cooler containing ice packs. Care was taken to not contaminate the inside of the jar or the cap.

Samples were kept in coolers or a clean refrigerator until they were sent to the laboratory for analysis (between one and eight day hold time).

4.1.6.2 Laboratory Procedures

Laboratory QA/QC procedures included use of certified reference materials (CRM) to assess recovery of metals in the analysis and use of analytical duplicates.

ALS Environmental provided results for analysis of CRM standard MESS-2 (marine sediment CRM for trace elements from National Research Council of Canada) for 2007, 2009 and 2010 data. ALS reported the analysis and certified values and calculated percent of target value. The laboratory analyses generally met the criterion of less than 20% difference in the value of metals found in the CRM samples compared to the target value as determined by the National Research Council (NRC).

Laboratory replicates from 2007, 2009 and 2010 were within 20% difference when parameter levels exceeded five times the detection limits.

4.1.6.3 Field Replicates

Replicate samples provide information about heterogeneity of the sediment within a site; the dispersion around the mean provides a measure of precision. Precision was assessed by calculating the coefficient of variation (CV) of each parameter at a site.

Precision for the three to five replicates per site was calculated to assess variability of samples collected in 2007, 2009, and 2010 using the formula:

CV = [standard deviation/mean]*100)

CV was not calculated for 1976/77 (no replicates) or 1993 and 1995 (unknown detection limits). The target for CV is no more than 20% of the mean when replicate samples collected at the same time and location are all at least five times the detection limit.

Of the 324 analyses for stream sediment (18 parameters times 18 sites) in 2007 and 2009 and 152 analyses (19 parameters times 8 sites) in 2010, 71 results (15%) had greater than 20% CV. A higher percentage was observed in 2009 (10%) and 2010 (35%) than in 2007 (3%). These precision analyses indicate generally good agreement among measurements at a given site for most parameters, along with higher variability for some parameters, reflecting the commonly observed heterogeneity of stream environments.

One field duplicate was collected from site W4 in 2007 and the relative percent difference (RPD) for each of the parameters was within 20%, with the exception of mercury (143%).

4.2 Results

The entire data set from 1976 to 2010 is presented in Appendix B1-1 through B1-6 (with summary statistics in Appendix B2-1 through B2-5). Variation in metal concentrations among years is shown in Figure 4-2. In general, no consistent pattern of distribution of metals by year could be delineated, suggesting that baseline metal concentrations in sediments are relatively stable within each site over time.

Significant variations in concentrations of some metals were observed among the four different systems (ANOVA, Tukey HSD, $p<0.05$), as shown in Figure 4-3. Sediment from Dublin Gulch had significantly higher levels of arsenic than sediment in Haggart Creek and significantly lower levels of copper than sediment in Haggart Creek and Eagle Creek. There were no significant differences in cadmium, lead, nickel, and zinc concentrations among systems.

Metal concentrations were typically lower in the Haggart and Lynx systems, with the exception of W62 (Lynx) in 1976/77 when elevated levels of copper, nickel, and zinc were recorded.

4.2.1 Comparison with Guidelines

Individual levels of antimony, barium, beryllium, bismuth, cobalt, iron, manganese, molybdenum, selenium, thallium, tin, tungsten, uranium, and vanadium did not exceed guidelines at any monitored site over the five study periods.

A number of metals exceeded guidelines at only a few sites:

- Cadmium exceeded ISQG in one replicate (W22 in 2009), but mean was below ISQG
- Chromium exceeded ISQG in all replicates at W1 in 2007 and one replicate each at W1 and W73 in 2010.
- Copper exceeded ISQG at W21 and W62 in 1976/77 and in all three replicates at W72 and W73 in 2010.
- Lead exceeded ISQG or PEL several times over the years:
- PEL at W21 and ISQG at W51 in 1976/77.
- ISQG in one replicate at W4 (mean below ISQG), two replicates at W5 (mean below ISQG) and five replicates at W8 (mean above ISQG) in 1993.
- ISQG in one replicate and PEL in one replicate at W8 in 1995 (mean above PEL), PEL in one replicate at W21 (mean above ISQG) and all replicates at W5 in 2009.
- ISQG in one replicate at W1 (mean below ISQG), three of five replicates at W29 (mean below ISQG), two replicates at W72 (mean above ISQG), one replicate at W74 (mean above ISQG), and all three replicates at W73 and W75 in 2010.
- Mercury exceeded ISQG in one replicate at each of W8 in 1995 and W4 in 2007; means remained below ISQG both years.
- Silver levels were below detection limits in 1995 (4 mg/kg), 2007, 2009 and 2010 (2 mg/kg); however, as detection limits were above the ISQG (0.5 mg/kg), it was not possible to determine whether guidelines were exceeded.
- Zinc exceeded ISQG at six sites and PEL at one site in 1976/77; ISQG in four replicates at W8 in 1993 (mean exceeded ISQG); ISQG in one replicate at W1 in 2007 and 2010 (mean below ISQG); ISQG in two replicates at W27 (mean below ISQG), and ISQG in one replicate at W73 (mean below ISQG) in 2010.

Nickel concentrations exceeded guidelines at most sites on each sample date. Nickel exceeded the ISQG in 70% of samples in 1976/77, 87% of samples in 1995, 91% of samples in 2007, 76% of samples in 2009, and 100% of samples in 2010, but was not analyzed in 1993. Mean nickel levels exceeded the ISQG at all sites except W20, W30, W1, and W26 in the Dublin system and W64 in the Lynx system.

As with surface water quality, arsenic concentrations in sediment were higher, relative to guidelines, than other metals. Arsenic levels were higher than the PEL in all samples analyzed, with highest concentrations generally measured in the Dublin Gulch watershed, specifically at W20 in 2007 and W8 in 1995. Arsenic exceeded the PEL in every replicate on each sample date in 1995, 2007, 2009, and 2010 (not analyzed in 1976/77 and 1993).

4.3 Sediment Summary

Metals levels in sediment of streams in the Project area are consistent with a mineralized area. Some elevated levels may reflect previous disturbance of substrates during placer mining or elevated levels in groundwater. Given the high background levels of these metals in sediments of the Project area, the ISQG (least effects levels for protection of aquatic life) for metals such as arsenic, copper, lead, nickel, and zinc will not be attainable in the region and site-specific objectives may be sought for the Project area.

The consequences for aquatic life of elevated concentrations of arsenic, copper, cadmium, lead, nickel, and zinc in sediments depend on bioavailability of these and other metals and on metal speciation. The effect of sediment metals on aquatic organisms is difficult to predict due to complex bio-physico-chemical interactions, for example with organic matter, other metals (iron and manganese complexes), hardness, and pH. To be bio-available, a metal must be present in a form that can be taken up by algal or invertebrate organisms, typically by surface adsorption of ions onto aquatic plants and animals (Smock 1983) or by ingestion. For adsorption to occur, metals must be available as non-bound forms (e.g. dissolved ions). Metals such as arsenic and mercury bind strongly to sediments, whereas others are weakly bound and are more readily released into the water (Branner et al., 1980). In addition to availability, metals must also have an affinity for adsorption onto biotic forms (Smock 1983), and this capacity varies greatly (e.g. low for manganese and high for chromium).

5 PERIPHYTON

The objectives of the periphyton monitoring program are to determine baseline conditions for:

- Primary productivity in streams (chlorophyll *a* standing crop), to compare to future levels in potentially affected streams
- Community diversity, to compare qualitatively to future communities in potentially affected streams.

5.1 Methods

5.1.1 Review of Existing Literature

Periphyton are algae that grow attached to substrates. They are the primary source of energy in third to sixth order streams (Stevenson 1996), so play a fundamental role in stream ecosystems. Algae convert inorganic carbon, nitrogen, and phosphorus into organic matter, making it available for secondary consumers such as benthic invertebrates. Branched or filamentous forms of periphyton can provide microhabitats for benthic invertebrates, where they provide stable refuge from predators or strong currents.

Periphyton are sensitive to changes in water chemistry and stream habitat. They have been used as indicators of water quality since the early 1900s because of known sensitivity to changes in nutrient, sediment (TSS) and metal levels, which makes them useful sentinels of changes related to mine operations. They also provide valuable links between water chemistry and the fish community.

Effects of metals on algae were summarized by St-Cyr et al., (1997) as part of the Aquatic Effects Technology Evaluation leading up to the Metal Mining Effluent Regulation and associated environmental effects monitoring (EEM) programs (Aquamin 1996, Environment Canada 2002). Effects range from chronic and acute toxicity, through physical deformities of diatoms.

Nutrient additions (eutrophication) can lead to excessive periphyton growth, with filamentous mats clogging or entangling invertebrates, depleting oxygen as they decompose, decreasing aesthetic values, decreasing the value of fish spawning habitat, and altering composition of the benthic invertebrate community (Horner, et al., 1983, Nordin 1985).

This section documents periphyton communities in streams within the proposed Project footprint and beyond, with potential to be affected by project activities or to provide reference sites. Both abundance (chlorophyll *a* or standing crop) and community diversity were assessed. Chlorophyll *a* is the predominant photosynthetic pigment found in all algae (Wetzel 2001), is an indicator of primary production in aquatic environments, and enables comparison among sites and systems.

Materials consulted to complete the baseline study of periphyton in the Project area include:

- Hallam Knight Piésold 1996a
- Jacques Whitford AXYS 2007.

5.1.2 Sample Timing and Locations

Two periphyton monitoring programs were completed at sites in the Haggart Creek, Dublin Gulch, Eagle Creek and Lynx Creek basins since 1995 (Figure 5-1). In 2007, periphyton samples were collected from 11 sites after peak flows subsided, between August 11 and August 20, and compared with historical data collected from 11 sites in August 1995 by First Dynasty Mines Ltd. (Hallam Knight Piésold 1996a). Sample sites and dates are summarized in Table 5-1.

Table 5-1: Periphyton Sample Timing and Locations in 1995 and 2007

Drainage Basins – Sites	Location	Dates Sampled	
		August 1995	11-20 Aug 2007
Haggart Creek System			
W2	Above Ironrust Creek	✓	
W3	Lower Ironrust Creek	✓	
W7	Below Ironrust Creek	✓	
W11	Lower Fisher Gulch	✓	
W22	Above Dublin Gulch		✓
W4	Below Dublin Gulch	✓	✓
W5	Above Lynx Creek	✓	✓
W23	Below Lynx Creek		✓
Dublin Gulch System			
W20	Lower Bawn-Boy Gulch		✓
W8	Below Olive Gulch	✓	
W1	Above Stewart Creek	✓	✓
W26	Lower Stewart Creek	✓	
W21	Above Haggart Creek		✓
Eagle Creek			
W9	Eagle Pup	✓	✓
W10	Lower Stuttle Gulch		✓
Lynx Creek			
W13	Above Ray Creek		✓
W6	Above Haggart Creek	✓	✓

5.1.3 Field and Laboratory

5.1.3.1 Field

In 1995, six replicates were collected from locations with similar depth and velocity at each of 11 sites. Samples were taken from 5.3 cm^2 areas of cobble-sized substrate at each site using a 50 mL Stockner sampler (modified syringe with attached toothbrush) and transferred to plastic 50 mL sample containers. Chlorophyll *a* samples were filtered through 0.45 mm cellulose acetate filters, buffered with $MgCO_3$, and stored frozen and protected from UV degradation prior to being submitted to ASL Ltd. for analysis. Samples for taxonomic analysis were preserved with Lugol's iodine solution and sent to Munro Environmental Consulting (North Vancouver, BC).

In 2007, five replicate periphyton samples were collected per site during the period of mid-summer maximum growth after peak scouring flows subsided. Methods and quality assurance measures used were compatible with those in the BC Freshwater Biological Sampling Manual (MWLAP 2003). Samples were collected from areas as similar as possible in flow and water depth within and among the sites. Field observations of habitat are listed in Appendix C.

The first replicate was located at a downstream position within the site and subsequent samples were located consecutively upstream no further than 5 m apart to minimize habitat variation. The following procedure was repeated for chlorophyll *a* and taxonomy samples. Each replicate sample was a composite of one to five rocks per site. Large, flat rocks representative of the area were selected. Each rock was placed in a collecting pan, a template was placed on it, and the area within the template (a disc) was scraped carefully with a toothbrush. The scraped area was rinsed with de-ionized water to wash off the periphyton. One to three discs was sampled per rock and the process was repeated for each rock. Thus, each replicate sample was a composite of the area scraped from up to three discs on up to five rocks. Details are listed in Appendix C.

The taxonomic samples were placed in 125 mL glass jars and preserved with Lugol's solution. Samples were stored in coolers, and then refrigerated until sent to Fraser Environmental Services (Surrey BC) for analysis.

The chlorophyll *a* samples were filtered through a 45 µm membrane filter with a Nalgene vacuum pump filtering apparatus in the field. The filtering apparatus was rinsed with de-ionized water after each sample was filtered to avoid contamination. Four to five drops of $MgCO_3$ were added to the filtering cup near the end of the filtration. The membrane was wrapped in aluminum foil and labeled with the sample identification, date, volume of sample filtered, and preservative used. Samples were placed in coolers in the field and stored in freezers until shipped to ALS Laboratory for analysis.

5.1.3.2 Laboratory Analysis – Chlorophyll

ALS Laboratory analyzed samples using fluorometry, following a modification of APHA method 10200H and USEPA method 445. Chlorophyll *a* results were reported as µg/L, and then converted to mg/m^2 for consistency. Data were converted to mg/m^2 based on the area of substrate scraped.

5.1.3.3 Laboratory Analysis – Taxonomy

In 1995, subsamples were settled in 2.5 ml settling chambers, then examined to identify species and estimate percent abundance of green, blue-green, and other common species. Diatoms were identified and assigned the relative abundance rankings of predominant, common, and present. No counts were done.

Fraser Environmental Services identified periphyton samples collected in 2007 following procedures outlined in their methods manual and described in Appendix C2. The volume of each sample was measured and a 25 mL sample randomly removed and settled in a chamber for approximately four hours. The entire chamber was then scanned at increasing powers of magnification to determine the species or genera present. For each sample, three diatom slides were prepared using either pyrolysis or acid digestion to clear the frustules. Slides were examined at increasing magnification and species/genera identified. Cells were counted in Utermohl-type settling chambers. At least ten random fields were counted, to a total count of at least 100 for the dominant species, and data were converted to cells/mL.

5.1.4 Data Analysis

Chlorophyll *a* data are summarized in Appendix C. Minimum, maximum, mean, median, standard deviation, and standard error (SE) were calculated from the five replicates for each site. Coefficient of variance (standard deviation/mean x 100) was calculated for chlorophyll data to assess variability, with a target CV of 20% or less.

Raw taxonomical data are presented in Appendix C as cells/cm^2 observed in each replicate (2007 data). For each species, the mean number of cells/cm^2, minimum, maximum, median, standard deviation (SD), and standard error (SE) were calculated for each site. Data were reported by taxonomic group and for the most abundant taxa at each site. The six groups are diatoms (Bacillariophyceae), green algae (Chlorophyta), blue-green algae (Cyanophyta), yellow-brown algae (Chrysophyta), dinoflagellates (Pyrrophyta), and red algae (Rhodophyta).

Community diversity of periphyton at each site was calculated using Simpson's Diversity Index (Environment Canada 2002):

$$D = 1 - \sum_{i=1}^{S} (p_i)^2$$

where:

pi is the proportion of the total average cell density (cells/cm^2) for each taxon *i*, and *S* is the total number of taxa.

Simpson's Evenness Index, E, was calculated as:

$$E = D/(1 - S^{-1})$$

The 1995 periphyton data (Hallam Knight Piésold 1996a) were summarized as relative abundance and number of taxa. Number of cells/cm^2 was not calculated. Percent abundance of green, blue-green, yellow-brown, and yellow-green algae species was estimated and diatom abundance was characterized as predominant (>25% abundance), common (5 to 25% abundance) or present, based on a semi-quantitative assessment.

5.1.5 QA/QC

QA/QC protocols included precautions for ensuring samples were protected from contamination and deterioration (consistency of sampling, correct use of equipment, detailed field notes, use of clean bottles). Bottles for taxonomy samples were labeled with indelible ink (sample site, replicate number, collection date, collector's name, and preservative). Care was taken to ensure sample bottles were kept in a cool, clean environment, either cooler or refrigerator, with minimal exposure to light.

Replicate samples (six in 1995 and five in 2007) were collected from the same general area at each site to detect heterogeneity within the environment, provide an estimate of the precision of the data, and provide a check on reproducibility of the sampling methods.

Standard protocols for chlorophyll *a* samples were followed to maintain sample quality prior to analysis. Fraser Environmental Services followed internal procedures for taxonomy: microscope calibration, counting procedures, Batch Quality Control procedures for precision and accuracy in taxonomic identifications, verification with an in-house reference collection, and external review. Appendix C4 contains a detailed summary of procedures and the results of five Batch Quality Control tests conducted to demonstrate accuracy in taxonomic identification (a comparison of analysis of the same samples by two in-house taxonomists). Percent similarity ranged from 75 to 94%.

5.2 Results

Physical and chemical conditions of the sampling sites are described in Section 2 (Water Quality).

5.2.1 Chlorophyll *a*

Chlorophyll *a* data were variable, even with collection of five replicates per site in 2007 and six replicates per site in 1995. For the 1995 data, CV ranged from 23 to 137%, exceeding the 20% target at all sites (Table 5-2), and was greater in headwaters and tributaries of Haggart and Dublin Gulch (W2, W3, W7, and W11) than in mainstem sites. For 2007, CV ranged from 42 to 188%, also exceeding the 20% target at each site. There were no obvious trends in variability. This high variability reflects well known heterogeneity of periphyton communities.

Table 5-2: Chlorophyll a (mg/m^2) in August Periphyton Samples from 1995 and 2007

Drainage Basin – Sites	Location	Chlorophyll *a* (mg/m^2)					
		1995			2007		
		Mean	SE	CV%	Mean	SE	CV%
Haggart							
W2	Upstream of Ironrust Creek	0.30	0.14	114	–	–	–
W3	Lower Ironrust Creek	0.18	0.10	137	–	–	–
W7	Downstream of Ironrust Creek	0.13	0.07	134	–	–	–
W11	Lower Fisher Gulch	0.50	0.24	118	–	–	–
W22	Upstream of Dublin Gulch	–	–	–	0.12	0.02	42
W4	Downstream of Dublin Gulch	0.04	0.02	92	0.35	0.21	137
W5	Upstream of Lynx Creek	0.12	0.03	69	0.25	0.12	108
W23	Downstream of Lynx Creek	–	–	–	0.57	0.39	135

Drainage Basin – Sites	Location	Chlorophyll *a* (mg/m²)					
		1995			2007		
		Mean	SE	CV%	Mean	SE	CV%
Dublin Gulch							
W20	Lower Bawn-Boy Gulch	–	–	–	0.21	0.04	43
W8	Upper Dublin Gulch below Olive Gulch	0.05	0.01	68	–	–	–
W1	Midway along Dublin Gulch	0.06	0.01	44	0.85	0.57	151
W26	Lower Stewart Creek	0.71	0.07	23	–	–	–
W21	Lower Dublin Gulch above Haggart Creek	–	–	–	0.19	0.10	116
Eagle Creek							
W9	Eagle Pup	0.26	0.09	85	1.12	0.94	188
W10	Lower Stuttle Gulch	–	–	–	0.02	0.00	50
Lynx Creek							
W13	Upper Lynx Creek	–	–	–	0.08	0.03	88
W6	Lower Lynx Creek	1.13	0.12	25	0.18	0.13	161

NOTE:
Mean of six samples in 1995 and five samples in 2007

In 2007, Haggart Creek chlorophyll *a* concentrations ranged from 0.12 to 0.57 mg/m^2 and increased with distance downstream from above Dublin Gulch (W22) to below Lynx Creek (W23) (Figure 5-2). In 1995, concentrations ranged from 0.04 to 0.50 mg/m^2 with no obvious trend in the data.

In Dublin Gulch, concentrations varied from 0.19 to 0.85 mg/m^2 in 2007 and from 0.05 to 0.71 mg/m^2 in 1995. In the Eagle Pup, chlorophyll *a* values ranged from 0.02 mg/m^2 at W10 (lower Stuttle Gulch) to 1.12 mg/m^2 at W9 (lower Eagle Pup) in 2007. In 1995, W9 had a concentration of 0.26 mg/m^2. There were no obvious trends in the chlorophyll a data within these basins.

Chlorophyll *a* levels in Lynx Creek ranged from 0.08 mg/m^2 at W13 in 2007 to 1.13 mg/m^2 at W6 in 1995. There were no obvious trends in the chlorophyll *a* data within Lynx Creek.

The lowest levels were recorded at W4, W8 and W1 in 1995, below known placer mining activity at that time, and at W10 in 2007; however, there is high variability at all sites. The range of chlorophyll *a* reported for streams in the Project area (0.02 to 1.13 mg/m^2) suggests oligotrophic conditions, as it is at the low range of values reported for streams in British Columbia. For example, maximum values of 35 and 45 mg/m^2 were reported in Fording River and lower Thompson River, respectively (Nordin 1985), and 100 mg/m^2 in Flathead River Basin (Sheehan, et al., 1980), which are considered productive inland streams. In contrast, maximum levels in less productive coastal streams included 13.6 mg/m^2 in Lynn Creek (North Vancouver; Nordin 1985), 1.9 mg/m^2 in Carnation Creek (Vancouver Island, Nordin 1985) and 4.7 mg/m^2 in Keough River (Vancouver Island, Perrin, et al., 1987).

5.2.2 Periphyton Communities

Periphyton abundance in samples collected in 2007 ranged from 151,000 to 2,680,000 cells/cm^2, with highest mean abundance in Dublin (1,670,000 cells/cm^2) and lowest in Eagle Creek (272,000 cells/cm^2) sites (Table 5-3; Figure 5-3). No cell count data were provided in the 1995 analyses.

Table 5-3 Mean Periphyton Abundance (Standard Error), Taxon Richness, Simpson's Diversity and Evenness in 1995 and 2007

Drainage Basin – Sites	Location	Abundance (cells/cm^2)	Taxon Richness		Simpson's Diversity	Evenness
		2007	1995	2007	2007	2007
Haggart Creek						
W2	Above Ironrust Creek	–	24	–	–	–
W3	Lower Ironrust Creek	–	16	–	–	–
W7	Below Ironrust Creek	–	31	–	–	–
W22	Above Dublin Gulch	1,010,000 (256,000)	-	68	0.73	0.74
W4	Below Dublin Gulch	341,000 (136,000)	22	67	0.63	0.64
W5	Above Lynx Creek	405,000 (271,000)	22	49	0.79	0.80
W23	Below Lynx Creek	1,530,000 (932,000)	–	56	0.54	0.55
Mean		**821,000**	**23**	**60**	**0.67**	**0.68**
Dublin Gulch						
W20	Lower Bawn-Boy Gulch	2,680,000 (401,000)	–	63	0.48	0.48
W8	Upper Dublin Gulch below Olive	–	14	–	–	–
W1	Midway along Dublin Gulch	1,030,000 (251,000)	17	50	0.52	0.53
W26	Lower Stewart Creek	–	21	–	–	–
W21	Above Haggart	1,290,000 (775,000)	–	57	0.79	0.80
Mean		**1,670,000**	**17**	**57**	**0.60**	**0.60**
Eagle Creek						
W9	Eagle Pup	301,000 (164,000)	10	37	0.73	0.75
W10	Lower Stuttle Gulch	243,000 (96,800)	–	50	0.44	0.45
Mean		**272,000**	**10**	**44**	**0.59**	**0.55**

Drainage Basin – Sites	Location	Abundance (cells/cm^2)	Taxon Richness		Simpson's Diversity	Evenness
		2007	1995	2007	2007	2007
Lynx Creek						
W13	Upper Lynx Creek	463,000 (130,000)	28	59	0.49	0.50
W6	lower Lynx Creek	151,000 (50,700)	47	52	0.69	0.70
Mean		**307,000**	**38**	**56**	**0.59**	**0.60**

Mean abundance ranged from:

- 341,000 to 1,530,000 cells/cm^2 in the Haggart system, greatest at sites W22, upstream of Dublin Gulch, and W23, downstream of Lynx Creek
- 1,030,000 to 2,680,000 cells/cm^2 in the Dublin system
- 243,000 to 301,000 cells/cm^2 in the Eagle Creek system
- 151,000 to 463,000 cells/cm^2 in Lynx Creek, low end of the range observed for all sites.

Taxon richness (number of taxa per site) varied from 37 to 68 species in 2007, with highest numbers reported for Haggart, above Dublin Gulch, and lowest numbers in Eagle Creek (Table 5-3, Figure 5-3). Estimates from 1995 indicated fewer taxa (10 to 47 species per site), although these estimates were made using different analytical methods, at a time of active placer mining. In 1995, mean richness was also lowest in Eagle Creek (10), and was highest in Lynx Creek (38); taxon richness in 1995 was typically less than half of estimates in 2007 for corresponding sites, with the exception of W6.

Species diversity ranged from 0.44 to 0.79 in the 2007 samples (Table 5-3, Figure 5-3); highest in Haggart and lowest in Eagle Creek and Lynx Creek. Evenness ranged from 0.48 in Bawn-Boy Gulch to 0.80 in Haggart Creek above Lynx Creek and in lower Dublin Gulch (Table 5-3, Figure 5-3).

Taxonomic composition in 1995 and 2007 is described in Appendices C5 and C6. The species reported are common in streams of western Canada (Stein and Borden 1979, Munro, et al.1985). Common and predominant species present in both years are summarized in Tables 5-4 and 5-5.

In Haggart Creek, diatoms and blue-green algae were the predominant taxa present at all sites in both 1995 and 2007. The following trends were reported:

- In 2007, a shift from predominantly diatoms (*Diatoma elongatum* with some *Achnanthes* spp.) with the blue-green *Homeothrix varians* common at W22 and W4, to higher proportions of *Homeothrix varians* and other blue-greens (*Chamaesiphon* spp., *Pseudoanabaena* spp.) further downstream of Dublin Gulch at W5 and W23
- In 1995, similar species of diatoms were common, with the blue-green *Phormidium* spp. and *P. autumnale* in place of *Homeothrix*; *Chamaesiphon* spp. were common at W23; the filamentous xanthophyte *Tribonema* sp. was predominant at site W11 (not sampled in 2007).

Table 5-4: Predominant and Common Periphyton Taxa in Samples Collected in 2007, Quantitative Assessment (mean of five samples)

Taxon		Abundance (% of total number)										
		Haggart				Dublin			Eagle/Stuttle		Lynx	
		W22	W4	W5	W23	W20	W1	W21	W9	W10	W13	W6
Bacillariophyta (diatoms)	*Achnanthes* sp	5		5								6
	Achnanthes minutissima	16	7	20								10
	Diatoma elongatum	46	58	11								
	Fragilaria sp.											
	Gomphonema angustatum/ parvulum						7					
Cyanophyta (blue-green algae)	*Chamaesiphon* spp				15					18	22	52
	Homeothrix varians	15	12	39	66	70	67	25	35	73	68	17
	Oscillatoria spp						10		37			
	Phormidium sp					16						
	Pseudanabaena spp.	5		7				44				
Chlorophyta (green algae)	*Ulothrix zonata*			5								
Chrysophyta (yellow-brown algae)	*Hydrurus foetidus*						10					

Table 5-5: Predominant and Common Periphyton Taxa in Samples Collected in 1995, Semi-Quantitative Assessment (mean of six samples)

Taxon		Abundance							
		Haggart				Dublin		Lynx	
		W2	W4	W7	W11	W1	W8	W6	W13
Bacillariophyta (diatoms)	*Achnanthes* spp	Common		Common	Common			Common	Common
	Cymbella spp.							Predominant	
	Diatoma elongatum	Common	Common	Common				Common	
	Fragilaria capucina							Common	
	Gomphonema angustatum/ parvulum		Common			Common	Common		Predominant
	Hannaea arcus	Common		Common		Common	Common		
	Meridion circulare								Common
	Navicula spp.				Common				
	Nitzschia spp.				Predominant				
	Synedra rumpens	Common	Common	Common				Common	Common
	Synedra ulna		Common	Common				Predominant	
Cyanophyta (blue-green algae)	*Chamaesiphon* spp		Predominant		Common		Predominant		
	Homeothrix varians								
	Oscillatoria spp								
	Phormidium autumnale	Predominant	Predominant	Common	Common	Common			Common
	Phormidium tenue	Common	Common	Predominant		Predominant	Predominant		
	Pseudanabaena spp.								

Taxon		Abundance							
		Haggart				Dublin		Lynx	
		W2	W4	W7	W11	W1	W8	W6	W13
Chlorophyta (green algae)	*Microspora loefgrennii*							Common	
	Mougeotia sp.				Common				
	Ulothrix zonata							Common	
Chrysophyta (yellow-brown algae)	*Hydrurus foetidus*					Predominant			Common
Xanthophyta (yellow-green algae)	*Tribonema* sp.				Predominant				

NOTE:
Predominant = >25%, common = 5 to 25% abundance

In Dublin Gulch, Eagle Creek and Stuttle Gulch, blue-green species were predominant:

- In 2007, the blue-green *Homeothrix varians* was predominant at all sites (W1, W9, W10, W20 and W21), with *Oscillatoria* sp. also predominant at W9 and *Pseudoanabaena* spp. also predominant at W21; the filamentous chrysophyte *Hydrurus foetidus* was common at W1
- In 1995, the blue-green *Phormidium tenue* was predominant in the Dublin Gulch samples (W1 and W8), with *Chamaesiphon incrustans* also predominant at W8; the chryosphyte *Hydrurus foetidus* was also predominant at W1.

In Lynx Creek, blue-green species were predominant in 2007 and diatoms were predominant in 1995 at sites W6 and W13:

- In 2007, the blue-greens *Homeothrix varians* and *Chamaesiphon* spp. were common or predominant
- In 1995, the diatoms *Synedra ulna* and *Cymbella* spp. were predominant at W13 and *Gomphonema angustatum* was predominant at W11, with several other diatoms, green algae and the chrysophyte *Hydrurus foetidus* common.

6 BENTHIC INVERTEBRATES

The objectives of the benthic invertebrates monitoring program are to:

- Characterize community diversity and abundance prior to project development so that changes due to project development, operation and closure can be evaluated.
- Assess variation relative to historic data.
- Provide supporting information for fisheries assessments.

6.1 Methods

6.1.1 Review of Existing Literature

Benthic invertebrates are commonly used for biomonitoring purposes. Their ubiquity and basically sedentary nature allow effective spatial analysis of the effects of contaminants and disturbance on a long-term basis through measurement of changes in density, community composition or ecosystem functioning. Benthic invertebrates are an important component of both flowing and standing water habitats, as they consume smaller animals and plants, aid in decomposition of organic material, and are an important source of food for fish and other animals.

The main advantages of using benthic invertebrates for biomonitoring are: 1) they are ubiquitous, so can be affected by perturbations in many aquatic habitats; 2) the many species involved offer a wide range of responses to environmental stresses; 3) they are relatively sedentary, which allows for the determination of the spatial changes caused by perturbations; and 4) they have long life cycles, so effects of perturbations over time can be observed (Rosenberg and Resh 1993, Barbour, et al., 1999).

This section documents benthic invertebrate communities collected in 1995, 2007, 2009, and 2010 in streams within the Project area and beyond, with potential to be affected by project activities or to provide reference sites.

Materials consulted to complete the baseline study of benthic invertebrates in the Project area include:

- Hallam Knight Piésold 1996a
- Jacques Whitford AXYS 2007.

6.1.2 Sample Timing and Locations

Current and historic monitoring sites within the study area are shown on Figure 6-1. The 2007 program was developed to provide comparison with historical benthic invertebrate sampling conducted in 1995 (Hallam Knight Piésold 1996a). Samples were collected during the late summer low flow period in August 1995 (11 sites), September 2007 (11 sites), September 2009 (7 sites), and August 2010 (7 sites) from riffle habitat (Table 6-1). Riffles were sampled to target the preferred habitat of the more sensitive benthic invertebrates.

Table 6-1: Benthic Invertebrate Sample Locations in the Haggart Creek, Dublin Gulch, Eagle Creek and Lynx Creek Basins, 1995, 2007, 2009, and 2010

Drainage Basins – Sites	Location	Dates Sampled			
		11 – 16 Aug 1995	11 – 20 Sept 2007	14 – 15 Sept 2009	18 – 19 Aug 2010
Haggart Creek					
W2	Above Ironrust Creek	✓			
W3	Lower Ironrust Creek	✓			
W7	Below Ironrust Creek	✓			
W11	Lower Fisher Gulch	✓			
W22	Above Dublin Gulch		✓	✓	✓
W4	Below Dublin Gulch	✓	✓		
W29	Below Eagle Creek			✓	✓
W5	Above Lynx Creek	✓	✓	✓	✓
W23	Below Lynx Creek		✓		✓
Dublin Gulch					
W20	Lower Bawn-Boy Gulch		✓		
W8	Below Olive Gulch	✓			
W1	Above Stewart Gulch	✓	✓	✓	✓
W26	Lower Stewart Gulch	✓		✓	
W21	Above Haggart Creek		✓	✓	✓

Drainage Basins – Sites	Location	Dates Sampled			
		11 – 16 Aug 1995	11 – 20 Sept 2007	14 – 15 Sept 2009	18 – 19 Aug 2010
Eagle Creek					
W9	Eagle Pup	✓	✓		
W10	Lower Stuttle Gulch		✓		
W27	Eagle Creek			✓	✓
Lynx Creek					
W13	Above Ray Creek		✓		
W6	Above Haggart Creek	✓	✓		

6.1.3 Field and Laboratory

Field Methods

In 1995, a Hess sampler (250 µm mesh; 0.096 m^2 sampling area) was used to collect three replicate samples at each site (Hallam Knight Piésold 1996a). The method was standardized by sampling to a substrate depth of 10 cm in riffle areas of similar depth, velocity and substrate. Samples were preserved in 10% formalin and Rose Bengal stain and shipped to Dr. Charles Low (Victoria, BC) for taxonomic analysis and enumeration.

In 2007, 2009, and 2010, invertebrates were collected using a Surber sampler (250 µm mesh size; 0.093 m^2 area). The sampler was positioned securely at a random location on the stream bottom, parallel to the water flow. Larger rocks were loosened from the substrate and rubbed to dislodge invertebrates. The remaining sediment was stirred to a 10 cm depth to float invertebrates and allow them to be washed by the current into the sampler. The sampler was then removed and the net rinsed with de-ionized water to wash any remaining organisms into the bottom of the net. The collected material was emptied into pre-labeled 250 mL plastic sample bottles and preserved with 10% buffered formalin. Five replicate samples at least 15 m apart were collected at each site, starting downstream and moving upstream to minimize substrate disruption and avoid potential sample contamination. A general description of the habitat (e.g. stream morphology, water depth), was recorded in the field notebook and is provided in Appendix D1. Samples were analyzed by Fraser Environmental Services (Surrey, BC).

Laboratory Methods

Laboratory analysis of the 1995 samples consisted of washing samples through a 180 µm mesh, separating macro-invertebrates from debris and identification to the lowest taxonomic level practical. Species were sorted into functional groups to provide percent composition of sensitive, facultative and tolerant organisms. The method analyzed the fraction retained by the 250 µm Hess Sampler.

Samples collected in 2007, 2009, and 2010 were rinsed and elutriated to remove formalin, sand and gravel. The sand and gravel was examined for trichopteran cases and molluscs before being discarded. Samples were sieved and fractionated with a 1 mm and a 500 µm sieve to remove smaller debris and organisms. The fractions were labeled and stored in two separate plastic jars. Each sample fraction was examined to determine total numbers and assess the need for sub-sampling, following current practices outlined in the BC Freshwater Biological Sampling Manual (MWLAP 2003). The method analyzed invertebrates retained by the 500 µm lab sieve. Invertebrates were identified to the lowest practical level (genus for most insects including chironomids, family or order for other organisms, species or phylum in some cases). Detailed taxonomic references and methods, including QA/QC, used in 2007, 2009, and 2010 are provided in Appendices D2.

Taxonomic data for samples collected in 1995, 2007, 2009, and 2010 are listed in Appendices D3 through D6, respectively.

6.1.4 Data Analysis

To facilitate data analysis and presentation, the various life stages (i.e., adult, larval, and pupal) of individual taxa were combined. For comparison and discussion purposes, lower taxonomic levels were often combined into higher levels (usually family).

Density (number of individuals per unit area), an indicator of habitat availability and fish food abundance, and summary statistics including minimum, maximum, median, standard deviation, and standard error for each taxon were calculated for each site. Data were reported as organisms/m^2, with appropriate conversions of the data.

Community diversity, D, of benthic invertebrates at each site was calculated using Simpson's Diversity Index (Environment Canada 2002). This index is a measure of community structure defined by the relationship between the number of distinct taxa and their relative abundances:

$$D = 1 - \sum_{i=1}^{S} (p_i)^2$$

where:

p_i is the proportion of the i^{th} taxon at the station and S is the total number of taxa at the station.

Simpson's Evenness Index, E, was calculated as:

$$E = D/(1 - S^{-1})$$

The Ephemeroptera, Plecoptera, and Trichoptera (EPT) index, an estimate of taxon richness among the three insect orders commonly considered sensitive to pollution (mayflies, stoneflies, caddisflies), was calculated for each site.

6.1.5 QA/QC

In 2007, 2009, and 2010, field and analytical QA/QC measures were based on the Freshwater Biological Sampling Manual (MWLAP 2003) and Fraser Environmental Services internal QA/QC procedures. The procedures ensured that all personnel were adequately trained, sampling methods were consistent, samples were correctly collected, labeled and preserved, equipment was properly cleaned, detailed field notes were kept, chain-of-custody forms were used, and safe shipping and storage methods were followed.

Sorting efficiency was assessed, with 90% efficiency considered acceptable. Samples were split when the number of individuals per sample was high. Splitting efficiency was calculated. A minimum of 300 organisms was counted.

6.2 Results

6.2.1 Abundance

Across all sampling years, benthic invertebrate abundance was generally lowest in the Haggart Creek system and highest at sites in Dublin Gulch and Eagle Creek (Table 6-2; Figure 6-2). Benthic invertebrate samples were not collected from the Lynx system in 2009 or 2010. Trends in mean abundance are as follows:

- In 1995, 2,200 organisms/m^2 (W5, Haggart) to 20,000 organisms/m^2 (W1, Dublin); generally higher than levels recorded in subsequent years.
- In 2007, 1,700 organisms/m^2 (W5, Haggart) to 9,900 organisms/m^2 (W9, Eagle).
- In 2009, 3,100 organisms/m^2 (W22, Haggart) to 8,100 organisms/m^2 (W1, Dublin), again generally lower in the Haggart system.
- In 2010, (970 organisms/m^2 to 3,900 organisms/m^2, similar spatial trend to 2009, but with lower abundance at all sites compared to previous years

Table 6-2: Benthic Invertebrate Abundance in Area Streams

Drainage Basins – Sites	Location	Abundance (organisms/m²)			
		1995	2007	2009	2010
Haggart Creek					
W2	Above Ironrust Creek	8,000	–	–	–
W3	Lower Ironrust Creek	2,400	–	–	–
W7	Below Ironrust Creek	12,100	–	–	–
W11	Lower Fisher Gulch	7,200	–	–	–
W22	Above Dublin Gulch	–	2,100	3,138	1,832
W4	Below Dublin Gulch	2,700	2,100	–	–
W5	Above Lynx Creek	2,200	1,700	5,518	968
W23	Below Lynx Creek	–	2,400	–	2,219
W29	Below Eagle Creek	–	–	3,171	1,888

Drainage Basins – Sites	Location	Abundance (organisms/m²)			
		1995	2007	2009	2010
Dublin Gulch					
W8	Below Olive Gulch	9,900	–	–	–
W1	Above Stewart Gulch	20,000	4,800	8,087	3,916
W26	Lower Stewart Gulch	19,000	–	4,461	–
W21	Above Haggart Creek	–	4,900	6,826	3,492
Eagle Creek					
W9	Eagle Pup	10,300	9,900	–	–
W10	Lower Stuttle Gulch	–	4,500	–	–
W27	Lower Eagle Creek	–	–	5,374	1,890
Lynx Creek					
W13	Above Ray Creek	–	5,400	–	–
W6	Above Haggart Creek	9,100	3,700	–	–

6.2.2 Richness

Richness, the number of taxa per site (at the family level), generally was consistent at a given site over the years sampled, and tended to be highest at sites in the Haggart system. Richness ranged from 11 to 29 in 1995, 16 to 27 in 2007, 22 to 25 in 2009, and 19 to 27 in 2010 (Table 6-3; Figure 6-2). In 1995 and 2007, richness was highest at sites in the Haggart Creek system and lowest at sites in the Dublin Gulch and Eagle Creek systems. In 2009 and 2010, richness was more similar in the Haggart and Dublin Gulch systems. At a given site, richness was similar over the years, except for W26 (Dublin), where richness increased from 11 taxa in 1995 to 25 taxa in 2009.

Table 6-3: Benthic Invertebrate Richness in Area Streams

Drainage Basins – Sites	Location	Richness			
		1995	2007	2009	2010
Haggart Creek					
W2	Above Ironrust Creek	29	–	–	–
W3	Lower Ironrust Creek	20	–	–	–
W7	Below Ironrust Creek	24	–	–	–
W11	Lower Fisher Gulch	15	–	–	–
W22	Above Dublin Gulch	–	22	25	25
W4	Below Dublin Gulch	26	27	–	–
W5	Above Lynx Creek	23	21	25	23

Drainage Basins – Sites	Location	Richness			
		1995	2007	2009	2010
W23	Below Lynx Creek	–	25	–	23
W29	Below Eagle Creek	–	–	25	25
Dublin Gulch					
W8	Below Olive Gulch	16	–	–	–
W1	Above Stewart Gulch	26	19	23	24
W26	Lower Stewart Gulch	11	–	25	–
W21	Above Haggart Creek	–	22	22	27
Eagle Creek					
W9	Eagle Pup	15	16	–	–
W10	Lower Stuttle Gulch	–	16	–	–
W27	Lower Eagle Creek	–	–	22	19
Lynx Creek					
W13	Above Ray Creek	–	23	–	–
W6	Above Haggart Creek	24	22	–	–

6.2.3 Diversity

Similar to the trend for taxon richness, diversity generally was consistent at a given site over the years sampled, and tended to be highest in the Haggart and Lynx systems. In 1995, diversity ranged from 0.21 to 0.85, lowest at W9 and W26, within the Dublin Gulch and Eagle Creek systems (Table 6-4; Figure 6-2). In 2007, diversity ranged from 0.64 to 0.85, with the highest values recorded in the Haggart Creek system (W4, W5) and lowest values in Dublin Gulch (W21), Eagle Creek (W9, W10), and Lynx Creek (W6) systems. In 2009 diversity ranged from 0.70 (W27) in the Eagle Creek system to 0.85 in the Dublin Gulch (W21) and Haggart Creek (W22) systems; diversity was similar in Haggart Creek and Dublin Gulch. Values recorded in 2010 followed a similar trend to 1995 and 2007, with generally higher diversity in the Haggart Creek system than Dublin Gulch or Eagle Creek, ranging from 0.51 in Eagle Creek (W27) to 0.87 in the Haggart Creek system (W23).

Table 6-4: Benthic Invertebrate Diversity in Area Streams

Drainage Basins – Sites	Location	Simpson's Diversity Index			
		1995	2007	2009	2010
Haggart Creek					
W2	Above Ironrust Creek	0.83	–	–	–
W3	Lower Ironrust Creek	0.78	–	–	–
W7	Below Ironrust Creek	0.8	–	–	–
W11	Lower Fisher Gulch	0.78	–	–	–
W22	Above Dublin Gulch	–	0.81	0.85	0.71
W4	Below Dublin Gulch	0.85	0.85	–	–
W5	Above Lynx Creek	0.76	0.85	0.78	0.86
W23	Below Lynx Creek	–	0.84	–	0.87
W29	Below Eagle Creek	–	–	0.74	0.57
Dublin Gulch					
W8	Below Olive Gulch	0.71	–	–	–
W1	Above Stewart Gulch	0.71	0.81	0.83	0.73
W26	Lower Stewart Gulch	0.35	–	0.76	–
W21	Above Haggart Creek	–	0.64	0.85	0.7
Eagle Creek					
W9	Eagle Pup	0.21	0.72	–	–
W10	Lower Stuttle Gulch	–	0.67	–	–
W27	Lower Eagle Creek	–	–	0.7	0.51
Lynx Creek					
W13	Above Ray Creek	–	0.8	–	–
W6	Above Haggart Creek	0.83	0.68	–	–

6.2.4 Evenness

Evenness tended to be higher at sites in the Haggart Creek system than at other sites and to be generally comparable from year to year (Table 6-5; Figure 6-3). In 1995, evenness values ranged from 0.23 (W9, Eagle Creek) to 0.88 (W4, Haggart Creek). In 2007, it ranged from 0.67 (W21, Dublin Gulch) to 0.89 (W5, Haggart Creek), with a particularly high value in Eagle Creek compared to 1995 data. In 2009, evenness ranged from 0.74 (W27, Eagle Creek) to 0.89 (W21, Dublin Gulch), and in 2010, it ranged from 0.54 (W27, Eagle Creek) to 0.94 (W23, Haggart Creek).

Table 6-5: Benthic Invertebrate Evenness in Area Streams

Drainage Basins – Sites	Location	Evenness			
		1995	2007	2009	2010
Haggart Creek					
W2	Above Ironrust Creek	0.86	–	–	–
W3	Lower Ironrust Creek	0.82	–	–	–
W7	Below Ironrust Creek	0.84	–	–	–
W11	Lower Fisher Gulch	0.83	–	–	–
W22	Above Dublin Gulch	–	0.85	0.88	0.74
W4	Below Dublin Gulch	0.88	0.88	–	–
W5	Above Lynx Creek	0.80	0.89	0.81	0.89
W23	Below Lynx Creek	–	0.87	–	0.91
W29	Below Eagle Creek	–	–	0.77	0.59
Dublin Gulch					
W8	Below Olive Gulch	0.76	–	–	–
W1	Above Stewart Gulch	0.74	0.86	0.87	0.76
W26	Lower Stewart Gulch	0.38	–	0.79	–
W21	Above Haggart Creek	–	0.67	0.89	0.72
Eagle Creek					
W9	Eagle Pup	0.23	0.77	–	–
W10	Lower Stuttle Gulch	–	0.71	–	–
W27	Lower Eagle Creek	–	–	0.74	0.54
Lynx Creek					
W13	Above Ray Creek	–	0.83	–	–
W6	Above Haggart Creek	0.87	0.72	–	–

6.2.5 EPT

The EPT index is the number of taxa collectively belonging to the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). EPT organisms are considered sensitive to sediment and organic matter inputs (pollution-sensitive), preferring well-oxygenated flowing waters with cobble and boulder substrate. The EPT index values were similar from one year to the next at a given site. EPT values ranged from 7 to 20 taxa, and tended to be higher at sites in the Haggart and Dublin systems than in the Eagle and Lynx systems (Table 6-6; Figure 6-3):

- In 1995, values ranged from 7 (W9 in Eagle system and W26 in Dublin system) to 18 (W2 and W4 in Haggart Creek), with low EPT also recorded in two tributaries of Haggart Creek (W3 in Ironrust Creek and W11 in Fisher Gulch).
- In 2007, values ranged from 6 (W10 in Eagle system) to 17 (W5 in Haggart system. Values were generally highest at sites in Haggart Creek (W4, W5, W23) and lowest in Eagle Creek (W9, W10) and Dublin Gulch (W21) systems.
- In 2009, values ranged from 12 (W26) to 20 (W1), both in the Dublin Gulch system.
- In 2010, values ranged from 12 (W27 in Eagle system) to 20 (W1 in Dublin system).

Table 6-6: Benthic Invertebrate EPT in Area Streams

Drainage Basins – Sites	Location	Evenness			
		1995	2007	2009	2010
Haggart Creek					
W2	Above Ironrust Creek	18	–	–	–
W3	Lower Ironrust Creek	8	–	–	–
W7	Below Ironrust Creek	16	–	–	–
W11	Lower Fisher Gulch	7	–	–	–
W22	Above Dublin Gulch	–	13	16	16
W4	Below Dublin Gulch	18	15	–	–
W5	Above Lynx Creek	16	17	18	19
W23	Below Lynx Creek	–	15	–	19
W29	Below Eagle Creek	–	–	17	16
Dublin Gulch					
W8	Below Olive Gulch	11	–	–	–
W1	Above Stewart Gulch	14	14	20	20
W26	Lower Stewart Gulch	7	–	12	–
W21	Above Haggart Creek	–	11	16	19
Eagle Creek					
W9	Eagle Pup	7	10	–	–
W10	Lower Stuttle Gulch	–	6	–	–
W27	Lower Eagle Creek	–	–	13	12
Lynx Creek					
W13	Above Ray Creek	–	13	–	–
W6	Above Haggart Creek	14	14	–	–

6.2.6 Taxonomic Composition

6.2.6.1 Haggart Creek

Sites in the Haggart system generally had the lowest abundance and some of the highest richness, diversity, evenness, and EPT values. Mean proportions of Ephemeroptera (22 to 30%), Trichoptera (1 to 5%), and Oligochaeta (22 to 31%) were similar across all sampling years (Table 6-7). However, the mean proportions of Plecoptera and Chironomidae varied substantially between years, with a range of 14 to 40% for Plecoptera, and 6 to 23% for Chironomidae.

In 1995, oligochaetes, chironomids or midges (Chironomidae), mayflies (Ephemeroptera) and stoneflies (Plecoptera) were the most abundant taxa:

- At upper sites (W2, W7), lumbriculid oligochaetes, chironomids (*Cricotopus* sp.) and mayflies (*Cinygmula* sp., *Ephemerella doddi, Baetis* sp. and *Epeorus* sp.) were the predominant taxa.
- At lower sites (W4 and W5), composition was similar, with larger numbers of stoneflies (*Capnia* sp. and *Zapada* sp.) and fewer lumbriculid oligochaetes).
- Ironrust Creek (W3) and Fisher Gulch (W11) had lower richness, diversity, and EPT taxa than the other sites in the Haggart basin. Lumbriculids, chironomids, stoneflies and mayflies were predominant at these sites as well; however, there were fewer species of mayflies, stoneflies and caddisflies (EPT) reported.

Table 6-7: Proportions of the Most Common Benthic Invertebrate Taxa at Sites in the Study Area

Drainage Basins – Sites	Ephemeroptera				Plecoptera				Trichoptera				Chironomidae				Oligochaeta			
	1995	2007	2009	2010	1995	2007	2009	2010	1995	2007	2009	2010	1995	2007	2009	2010	1995	2007	2009	2010
Haggart Creek																				
W2	37	–	–	–	10	–	–	–	4	–	–	–	15	–	–	–	23	–	–	–
W3	9	–	–	–	17	–	–	–	0	–	–	–	22	–	–	–	48	–	–	–
W7	18	–	–	–	4	–	–	–	1	–	–	–	30	–	–	–	40	–	–	–
W11	26	–	–	–	39	–	–	–	0	–	–	–	11	–	–	–	19	–	–	–
W22	–	16	25	16	–	23	32	10	–	3	2	10	–	6	5	2	–	38	30	50
W4	22	16	–	–	37	26	–	–	1	3	–	–	19	14	–	–	14	31	–	–
W5	22	29	23	48	23	30	62	23	0	2	62	3	41	27	9	12	2	4	2	3
W23	–	37	–	41	–	15	–	14	–	4	–	4	–	23	–	22	–	14	–	6
W29	–	–	18	17	–	–	24	6	–	–	1	3	–	–	3	3	–	–	47	64
Mean	**22**	**25**	**22**	**30**	**22**	**24**	**40**	**14**	**1**	**3**	**1**	**5**	**23**	**18**	**6**	**10**	**24**	**22**	**26**	**31**
Dublin Gulch																				
W8	48	–	–	–	8	–	–	–	0	–	–	–	34	–	–	–	7	–	–	–
W1	22	17	14	16	9	30	39	22	0	1	0.4	2	48	15	31	9	16	33	12	47
W26	8	–	6	–	3	–	17	–	0	–	0.05	–	80	–	19	–	9	–	41	–
W21	–	23	33	31	–	8	45	5	–	3	2	4	–	3	5	3	–	57	11	50
Mean	**26**	**20**	**18**	**24**	**7**	**19**	**34**	**14**	**0**	**2**	**1**	**3**	**54**	**9**	**18**	**6**	**11**	**45**	**21**	**49**

Drainage Basins – Sites	Ephemeroptera				Plecoptera				Trichoptera				Chironomidae				Oligochaeta			
	1995	2007	2009	2010	1995	2007	2009	2010	1995	2007	2009	2010	1995	2007	2009	2010	1995	2007	2009	2010
Eagle Creek																				
W9	0	4	–	–	1	29	–	–	0	0	–	–	88	21	–	–	9	45	–	–
W10	–	3	–	–	–	64	–	–	–	0	–	–	–	17	–	–	–	11	–	–
W27	–	–	5	1	–	–	57	10	–	–	1	3	–	–	25	69	–	–	5	1
Mean	**0**	**4**	**5**	**1**	**1**	**47**	**57**	**10**	**0**	**0**	**1**	**3**	**88**	**19**	**25**	**69**	**9**	**28**	**5**	**1**
Lynx Creek																				
W13	–	7	–	–	–	34	–	–	–	3	–	–	–	23	–	–	–	20	–	–
W6	28	20	–	–	26	16	–	–	0	1	–	–	27	8	–	–	11	52	–	–
Mean	**28**	**14**	**–**	**–**	**26**	**25**	**–**	**–**	**0**	**2**	**–**	**–**	**27**	**16**	**–**	**–**	**11**	**36**	**–**	**–**

In 2007, the predominant taxa were similar to 1995:

- At the upper site (W22), lumbriculid oligochaetes were predominant, followed by stoneflies (*Zapada* sp. and *Taenionema* sp.) and mayflies (*Cinygmula* sp*., Epeorus* sp.).
- At the lower sites (W5 and W23), mayflies (*Drunella doddsii*, *Cinygmula* sp., *Epeorus* sp.), stoneflies (Capnidae, *Zapada* sp., *Suwallia* sp*.),* and chironomids (*Cricotipus* sp*., Eukiefferiella* sp*.*) were predominant.
- W4, just below Dublin Gulch, more closely resembled the upper sites with lumbriculids most abundant, followed by stoneflies and mayflies.

In 2009, the predominant taxa were Ephemeroptera (mayflies), Plecoptera (stoneflies), and oligochaetes, accounting for approximately 88% of the total:

- At the upper site (W22), stoneflies (Capnidae, *Zapada* sp., *Suwallia* sp.) were predominant, followed by lumbriculid oligochaetes, and mayflies (*Baetis* sp., Ephemerellidae, Heptageniidae).
- At the lower site (W5), stoneflies (Capniidae, *Zapada* sp., *Taenionema* sp., *Suwallia* sp.) were predominant, followed by mayflies (*Baetis* sp., Heptageniidae, Ephemerellidae). At W29, olichogaetes were dominant, followed by stoneflies and mayflies.

In 2010, the predominant taxa were Oligochaetes and mayflies, followed by stoneflies and chironomids.

- At the upper site (W22), lumbriculide oligochaetes were predominant.
- At the lower sites (W5 and W23), mayflies (*Drunella doddsi*, Heptageniidae, *Accentrella* sp.) were predominant, and oligochaetes made up a relatively small proportion of the taxa.

6.2.6.2 Dublin Gulch

Sites in the Dublin basin generally had higher abundance and slightly lower richness, diversity, evenness and EPT taxa than at sites in the Haggart Creek system. Proportions of mayflies (18 to 26%) were similar to Haggart but proportions of stoneflies (7 to 34%) were generally lower. Lower stonefly proportions in the Dublin system were accompanied by higher proportions of chironomids in 1995 and lumbriculid oligochaetes in 2007 and 2010.

- In 1995, chironomids (*Synorthocladius* sp., *Diamesa* sp.) and mayflies (*Cingymula* sp, *Ephemerella* sp., *Epeorus* sp. and *Ameletus* sp.) were the most abundant taxa.
- In 2007, lumbriculid oligochaetes and stoneflies (*Zapada* sp., *Sweltsa* sp. and *Alloperla* fraternal) were predominant.
- In 2009, stoneflies (Capnidae, *Zapada* sp., *Suwallia* sp.) were predominant at W1 (upper) and W21 (lower Dublin Gulch). Oligochaetes were predominant at W26, a tributary to Dublin Gulch.
- In 2010, oligochaetes were the predominant taxa at both W21 and W1. Mayflies were also abundant at W21 (*Baetis* sp., Heptageniidae, Ephemerellidae), and stoneflies (Capnidae, *Zapada* sp., *Suwallia* sp.) were abundant at W1. W26 was not sampled in 2010.

6.2.6.3 Eagle Creek

Relatively high abundance and lower richness, diversity, evenness, and EPT were characteristic of sites in Eagle Creek (W9, W10, W27). Mayflies and caddisflies were generally absent. Diversity was low in 1995 with chironomids (88%) accounting for most of the organisms identified at W9.

- In 1995, Orthocladiinae chironomids (*Cricotopus* sp., and *Synorthocladius* sp.) were most abundant.
- In 2007, stoneflies (*Zapada* sp., *Nemoura* sp. and Capniidae), chironomids (*Diamesa* sp.), and lumbriculid oligochaetes were most abundant.
- In 2009, stoneflies (Capniidae, *Zapada* sp,) were predominant, followed by chironomids.
- In 2010, chironomids were again predominant.

6.2.6.4 Lynx Creek

Abundance and index values were intermediate at W13 and W6 in Lynx Creek compared to the other systems. Benthic invertebrates were only collected from this system in 1995 and 2007.

- In 1995, mayflies (*Cinygmula* sp., *Baetis* sp., *Ephemerella* sp.), stoneflies (*Capnia* sp., *Zapada* sp.), and chironomids (*Cricotopus* sp., *Eukiefferiella* sp., *Cardiocladius* sp.) were equally abundant at W6.
- In 2007, lumbriculid oligochaetes (52%) were predominant, while mayflies (*Cinygmula* sp., *Epeorus* sp.), and stoneflies (*Zapada* sp., *Suwallia* sp.) remained abundant. At W13, stoneflies (*Zapada* sp.), chironomids (*Cricotopus* sp.) and lumbriculid oligochaetes were predominant.

6.3 Benthic Invertebrate Summary

Relatively low richness, diversity, evenness, and EPT combined with higher proportions of tolerant groups (chironomids and oligochaetes) in the more recent samples (2007, 2009, 2010) from the Eagle Creek system indicate that reduced habitat complexity and/or poor water and sediment quality may be preventing many sensitive organisms (mayflies, stoneflies, and caddisflies) from colonizing these sites. Although arsenic concentrations in water and sediment were much higher in Eagle Creek than in Haggart and Lynx (summarized in Table 6-8), concentrations were similar to those observed in Dublin Gulch which did not exhibit low richness, diversity, evenness, and EPT. The results suggest that poor habitat (e.g. more homogenous substrate, more spates) is more likely responsible for the lower biotic indices than toxic effects.

Increased invertebrate abundance in Dublin Gulch and Eagle Creek systems during some of the sampling years is likely due to the presence of smaller tolerant organisms and the absence of predatory fish in the upper reaches of these systems.

Table 6-8: Mean Arsenic Concentrations in Water and Sediment from Haggart Creek, Dublin Gulch, Eagle Creek, and Lynx Creek (2007 to 2010)

System	Water (mg/L)	Sediment (mg/kg)
Haggart Creek	0.0056	104
Dublin Gulch	0.0596	296
Eagle Creek	0.0630	205
Lynx Creek	0.0070	102

7 CLOSURE

Stantec has prepared this report for the sole benefit of Victoria Gold for the purpose of documenting baseline conditions in anticipation of an environmental assessment under the Yukon Territory *Environmental and Socio-Economic Assessment Act*. The report may not be relied upon by any other person or entity, other than for its intended purposes, without the express written consent of Stantec and Victoria Gold. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties.

The information provided in this report was compiled from existing documents and data provided by Victoria Gold, field data compiled by Stantec (formerly Jacques Whitford AXYS Ltd.), and by applying currently accepted industry standard mitigation and prevention principles. This report represents the best professional judgment of our personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

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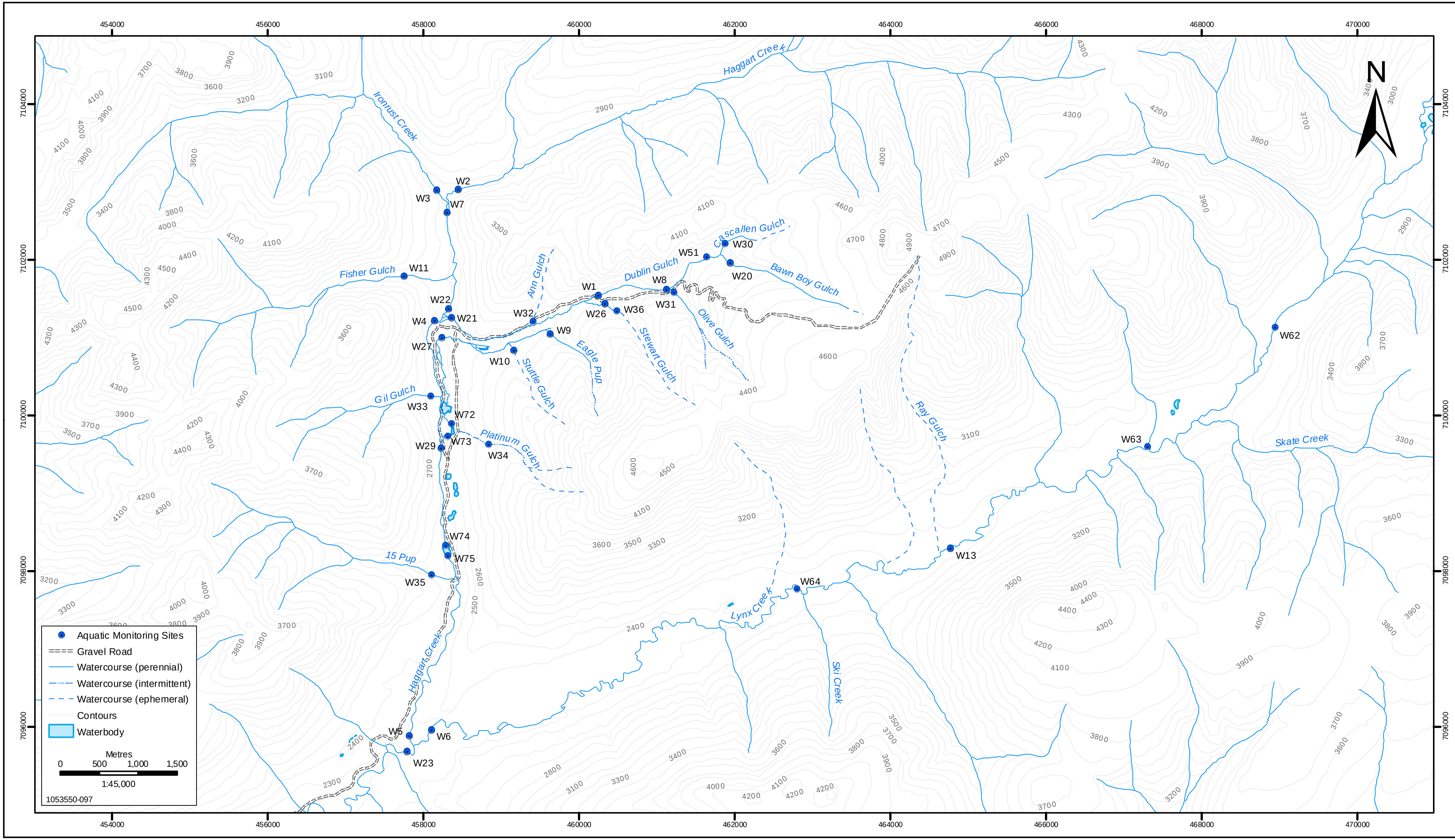
9 FIGURES

Please see the following pages.



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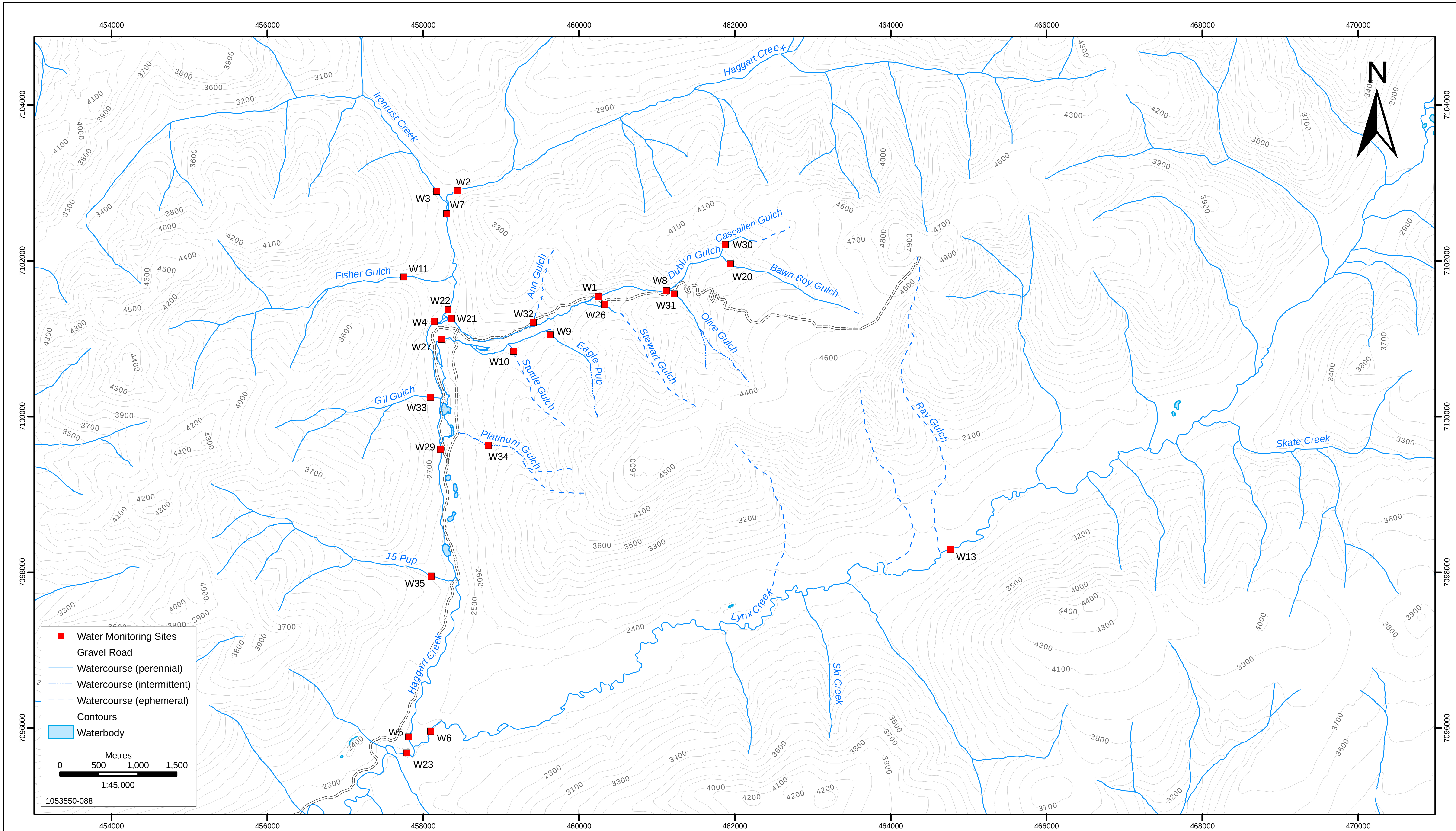

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Figure 3-2: Minimum, Average and Maximum Levels of Several Water Quality Parameters in 2007 – 2010

Black symbols: Dublin Gulch and tributaries; red symbols: Haggart Creek; green symbols: Dublin Gulch; blue symbols: Eagle Creek; black symbols: Lynx Creek; red lines: CCME Guidelines

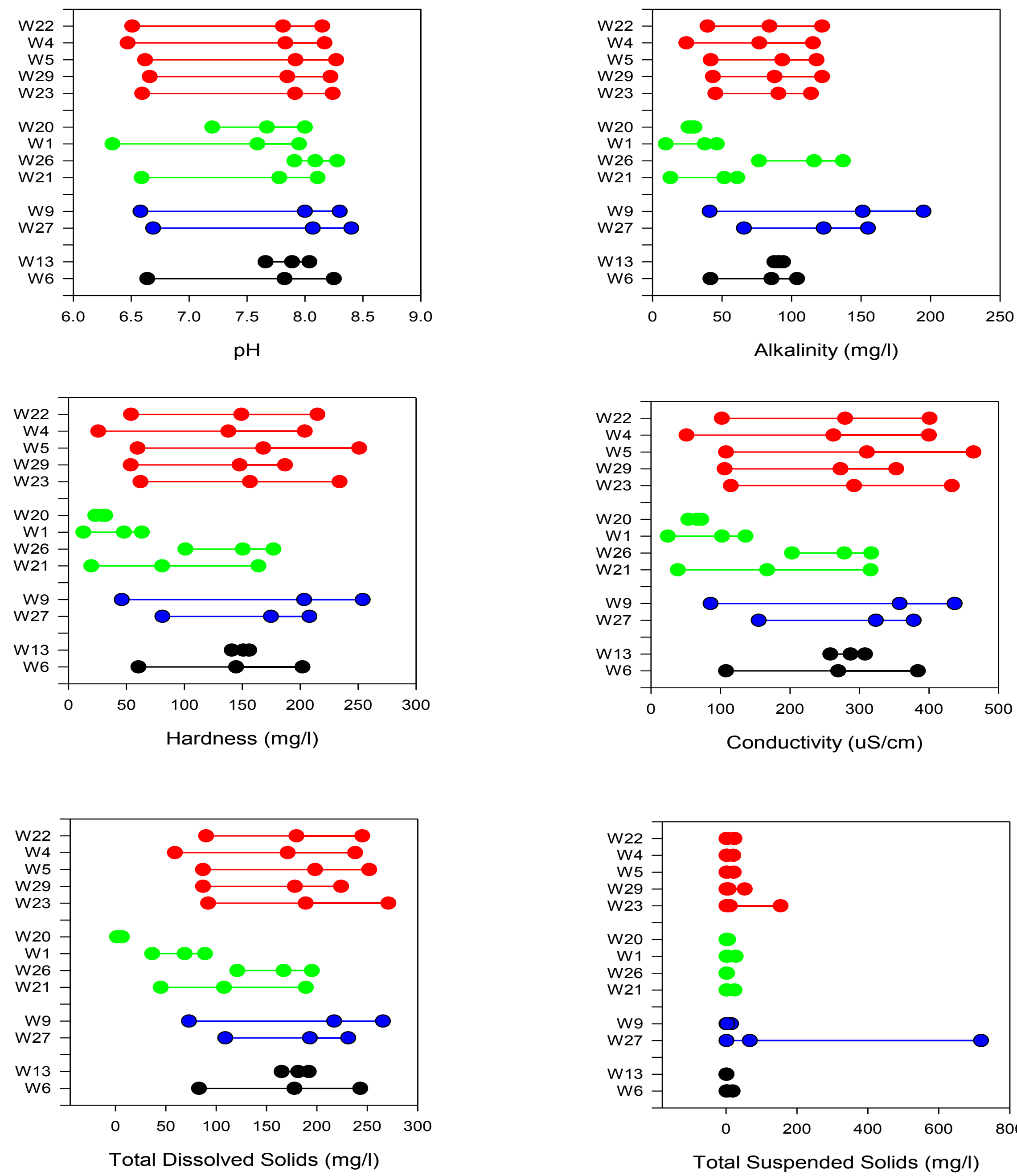


Figure 3-2: ***Continued*. Minimum, Average and Maximum Levels of Several Water Quality Parameters in 2007 – 2010**

Black symbols: Dublin Gulch and tributaries; red symbols: Haggart Creek; green symbols: Dublin Gulch; blue symbols: Eagle Creek; black symbols: Lynx Creek; red lines: CCME Guidelines

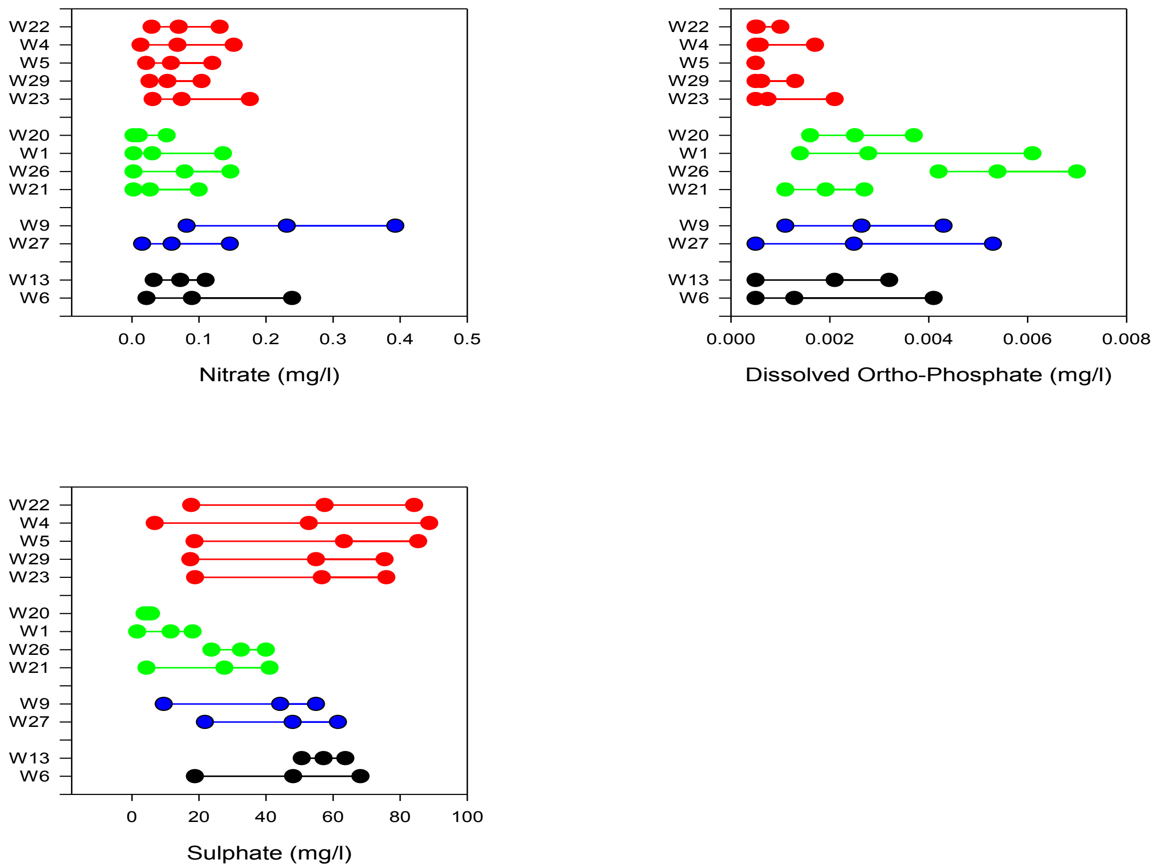


Figure 3-3: Minimum, Average and Maximum Levels of Metals in 2007 – 2010
Black symbols: Dublin Gulch and tributaries; red symbols: Haggart Creek; green symbols: Dublin Gulch; blue symbols: Eagle Creek; black symbols: Lynx Creek; red lines: CCME Guidelines

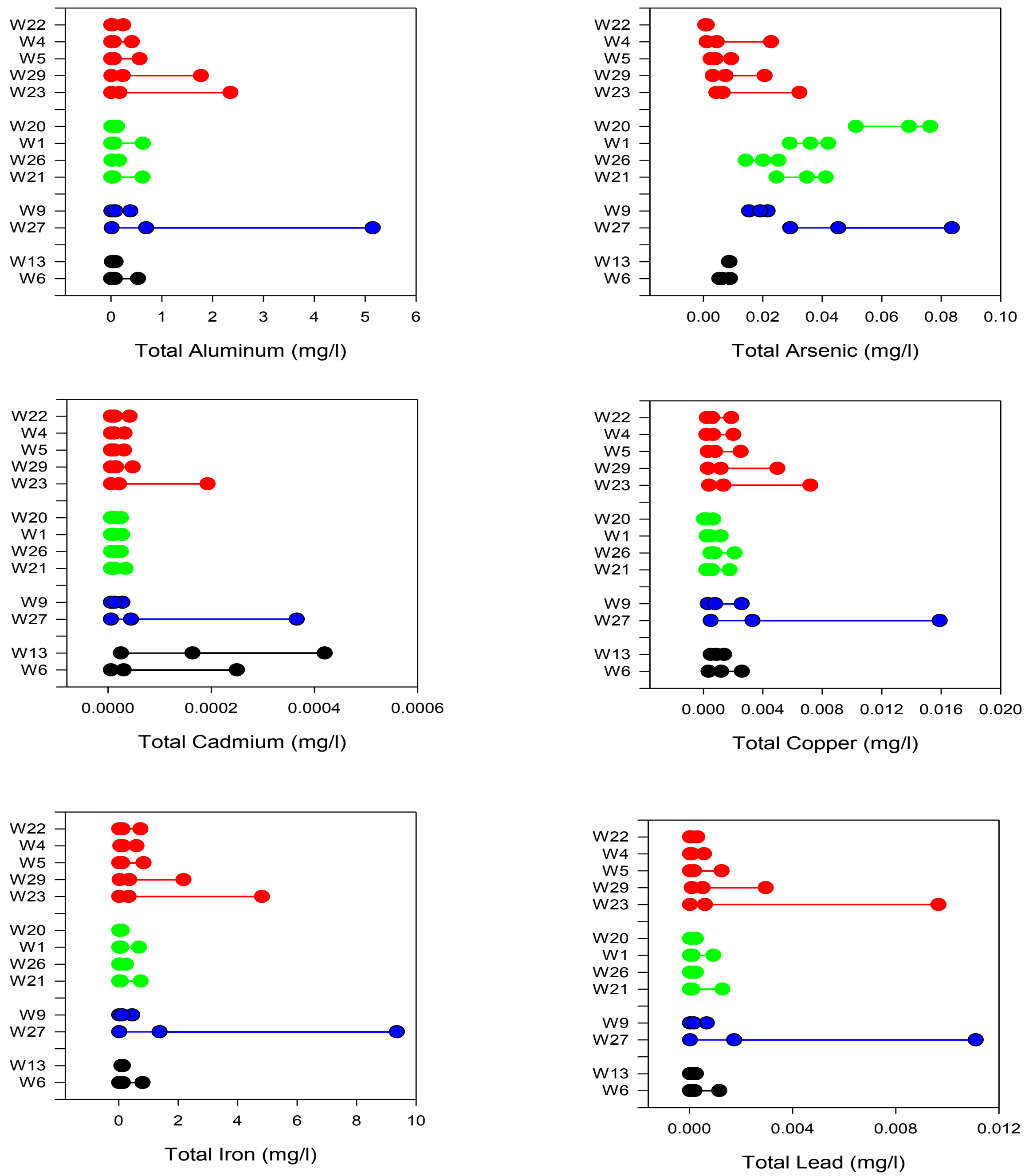


Figure 3-4: Range of Values (Minimum, Average, Maximum) of General Water Quality Parameters for Four Sites Monitored in 2007/10 and in 1993/96 (historic)

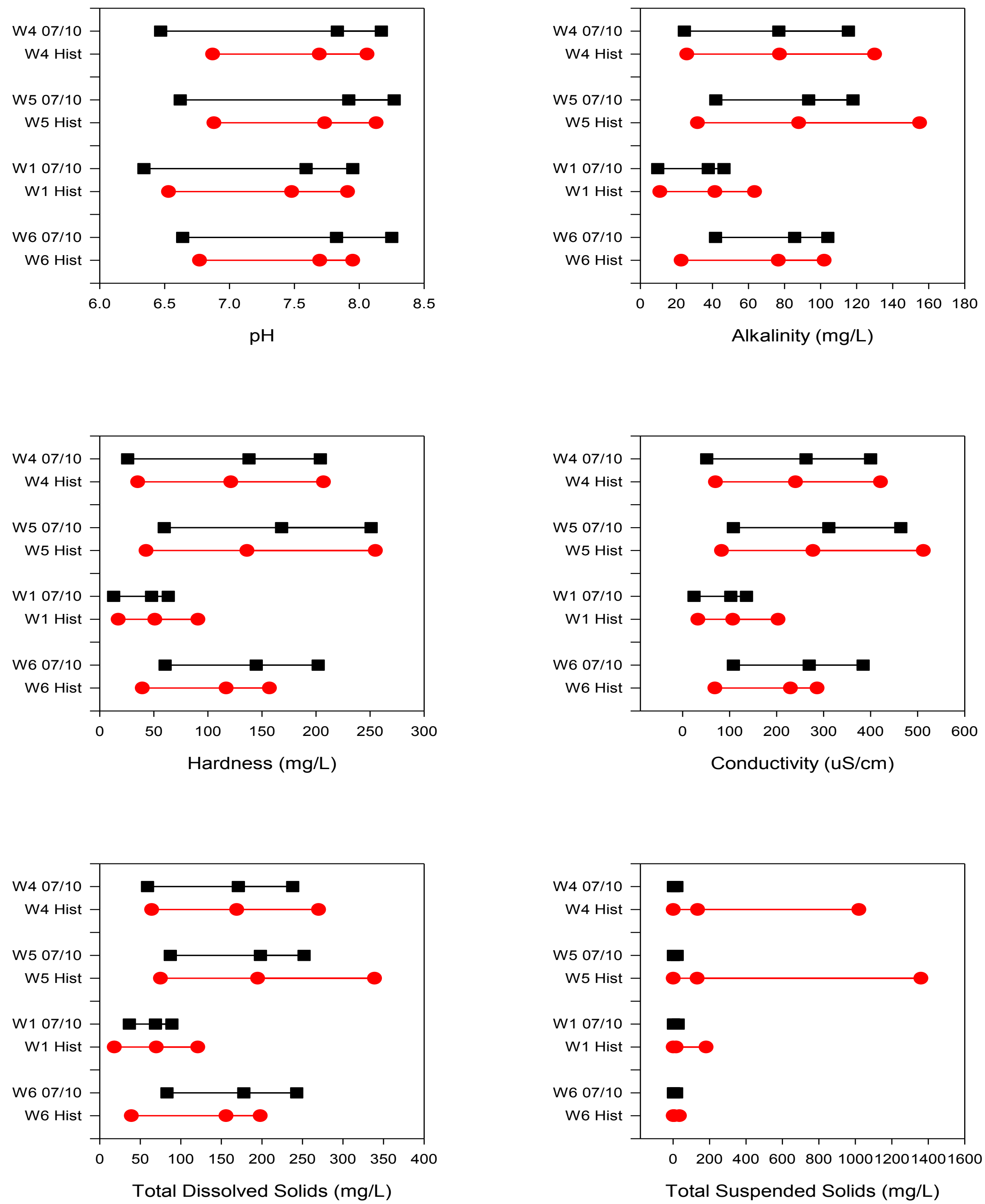


Figure 3-4: *Continued.* Range of Values (Minimum, Average, Maximum) of General Water Quality Parameters for Four Sites Monitored in 2007/10 and in 1993/96 (historic)

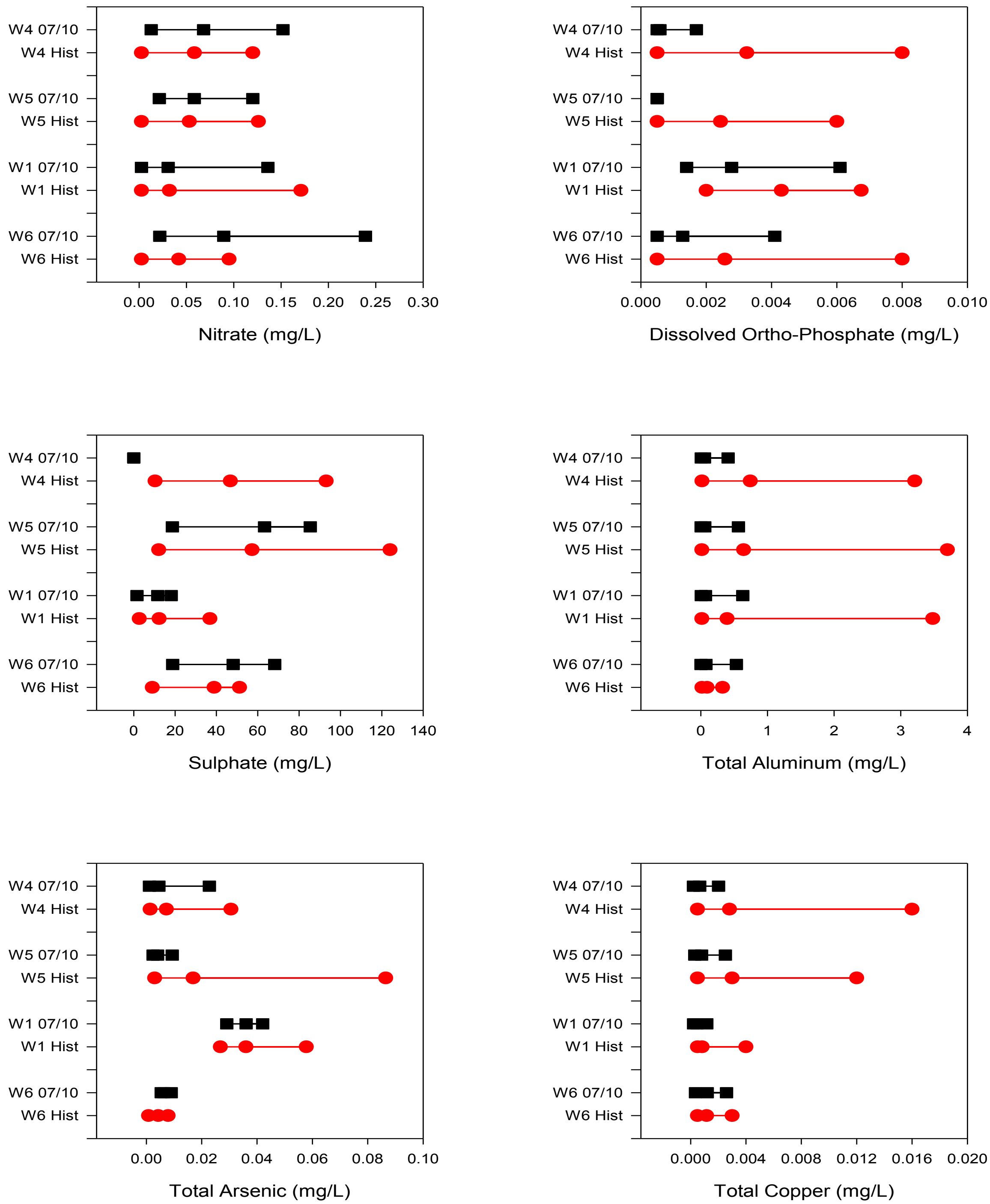
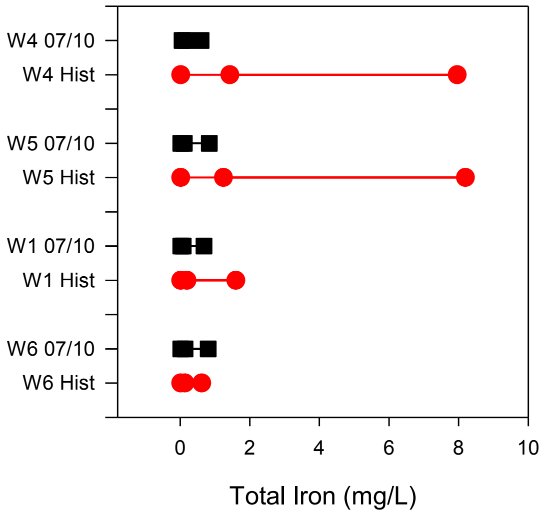


Figure 3-4: ***Continued.*** **Range of Values (Minimum, Average, Maximum) of General Water Quality Parameters for Four Sites Monitored in 2007/10 and in 1993/96 (historic)**



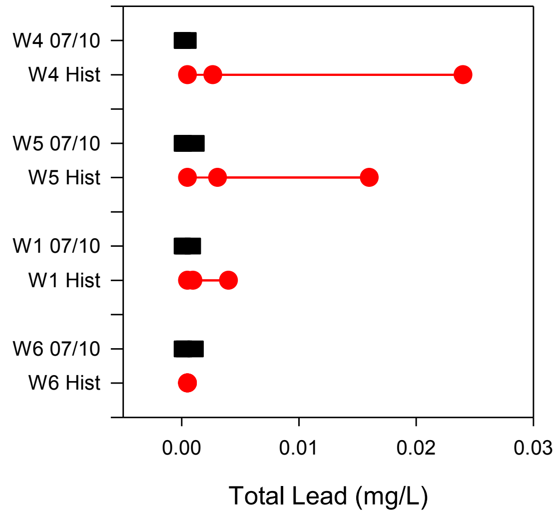


Figure 3-5: Annual Mean Values and Standard Error of Water Quality Parameters for Sites (all sites together) in Haggart (Black), Dublin (Red), Eagle (Green), and Lynx (Yellow) Watersheds. Red line is CCME guideline

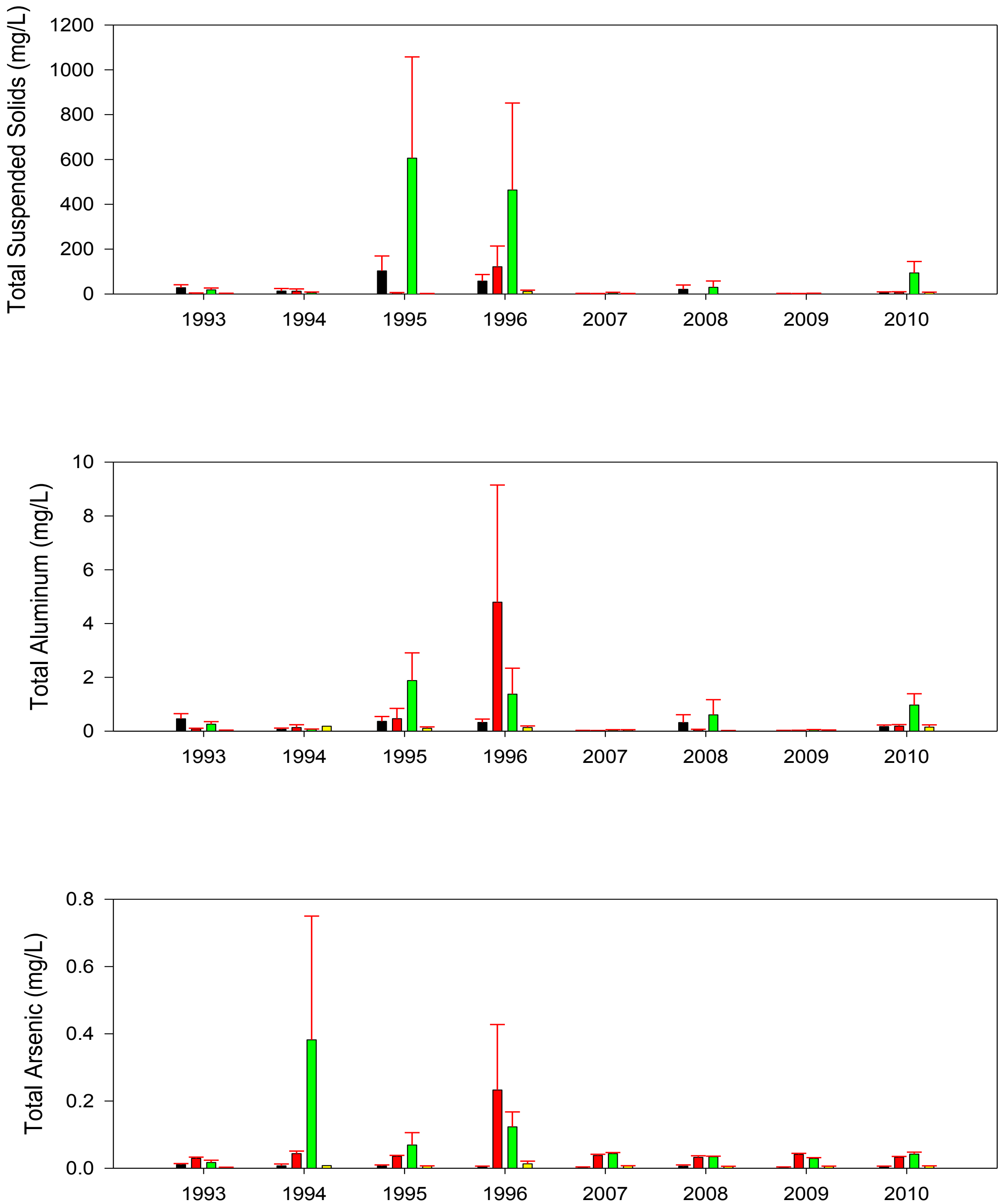
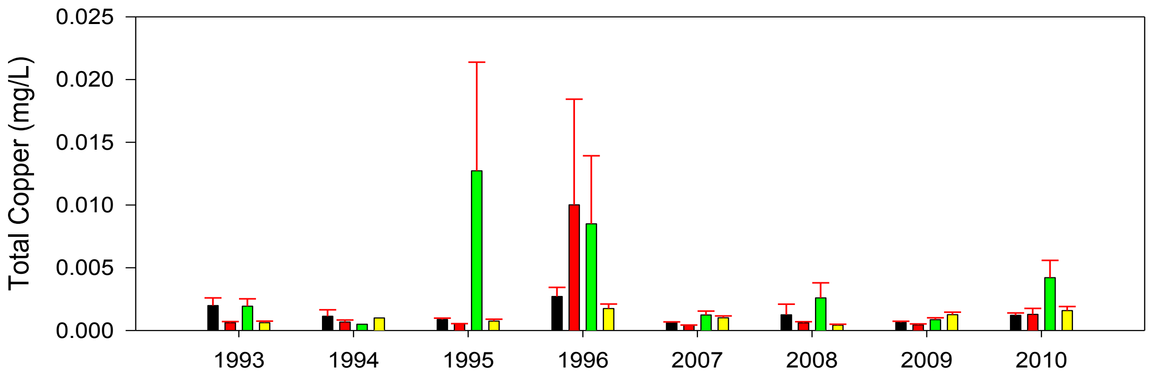
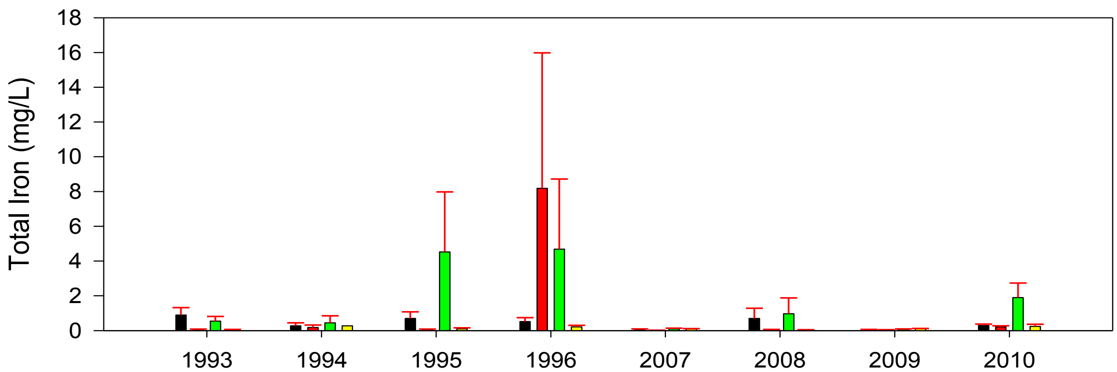


Figure 3-5: ***Continued.*** **Annual Mean Values and Standard Error of Water Quality Parameters for Sites (all sites together) in Haggart (Black), Dublin (Red), Eagle (Green), and Lynx (Yellow) Watersheds. Red line is CCME guideline**





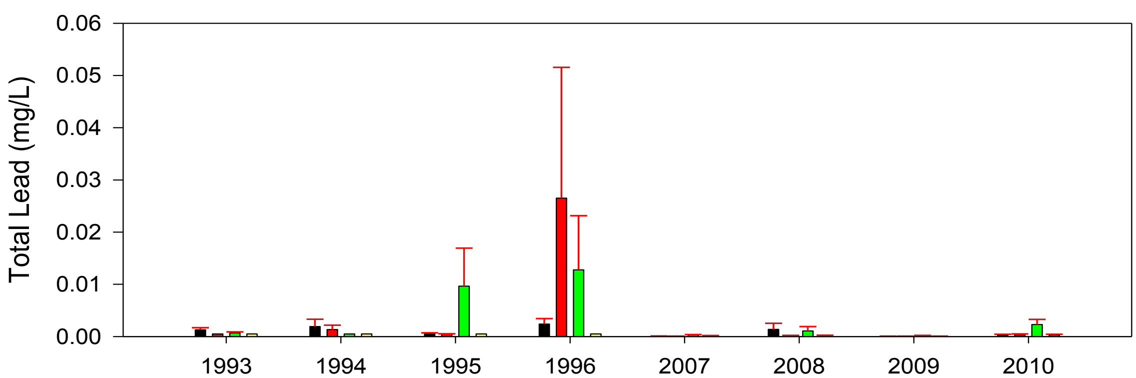
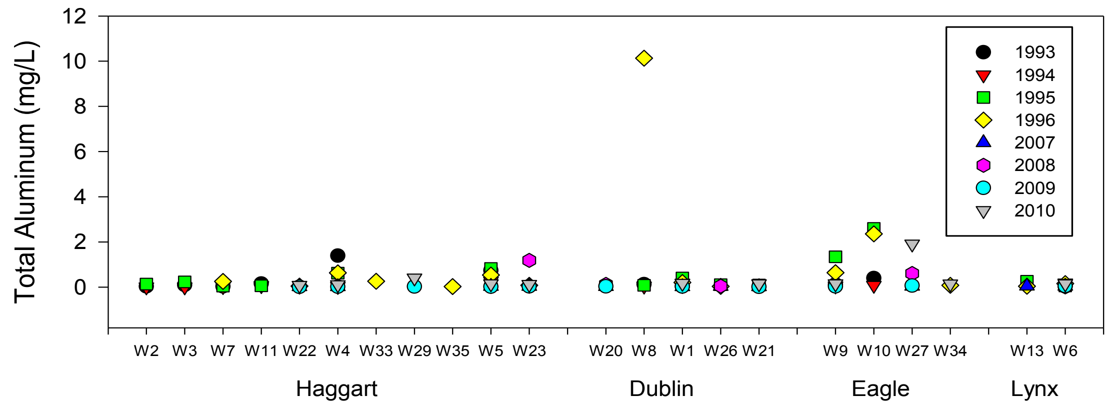
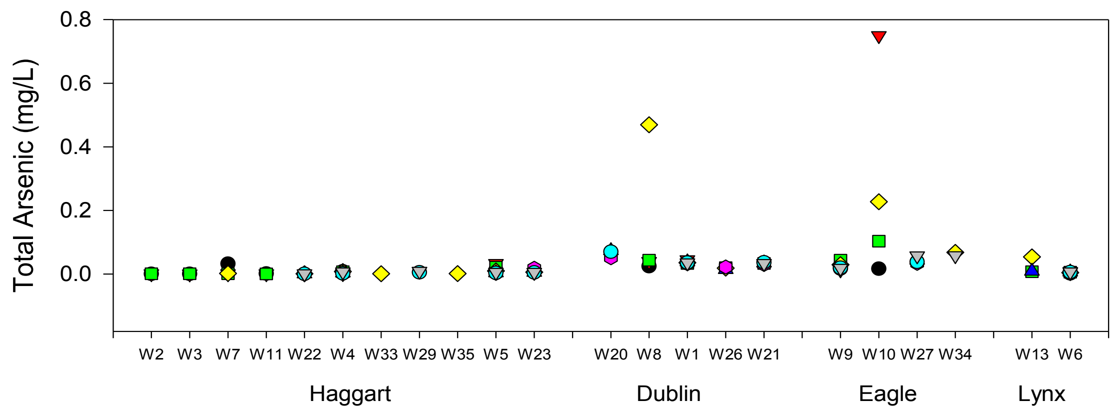


Figure 3-6: Mean Annual Levels of Metals at Sites in Haggart, Dublin, Eagle, and Lynx Watersheds since 1993





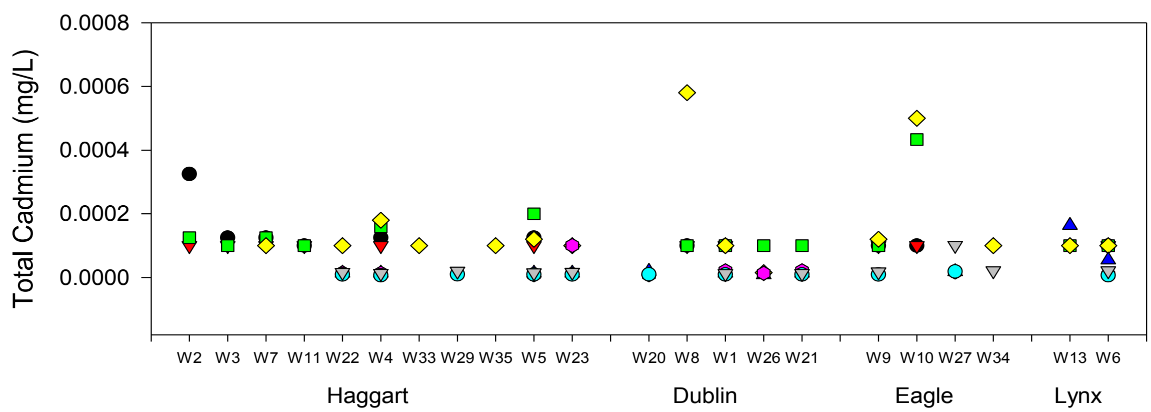


Figure 3-6: ***Continued.*** **Mean Annual Levels of Metals at Sites in Haggart, Dublin, Eagle, and Lynx Watersheds since 1993**

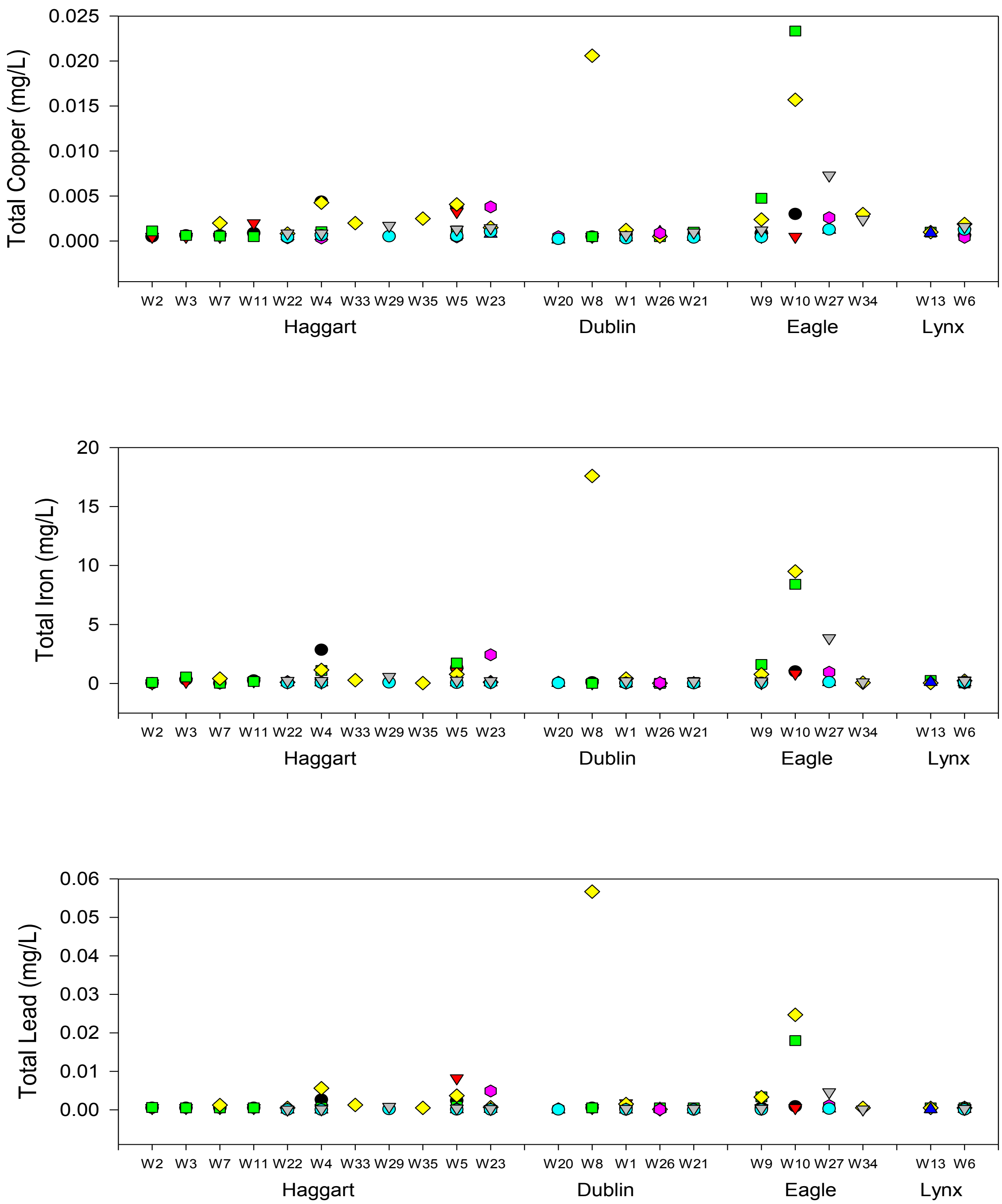


Figure 3-7: Temporal Variations in Surface Water Parameters in the Monitored Sites from 1993 – 2010

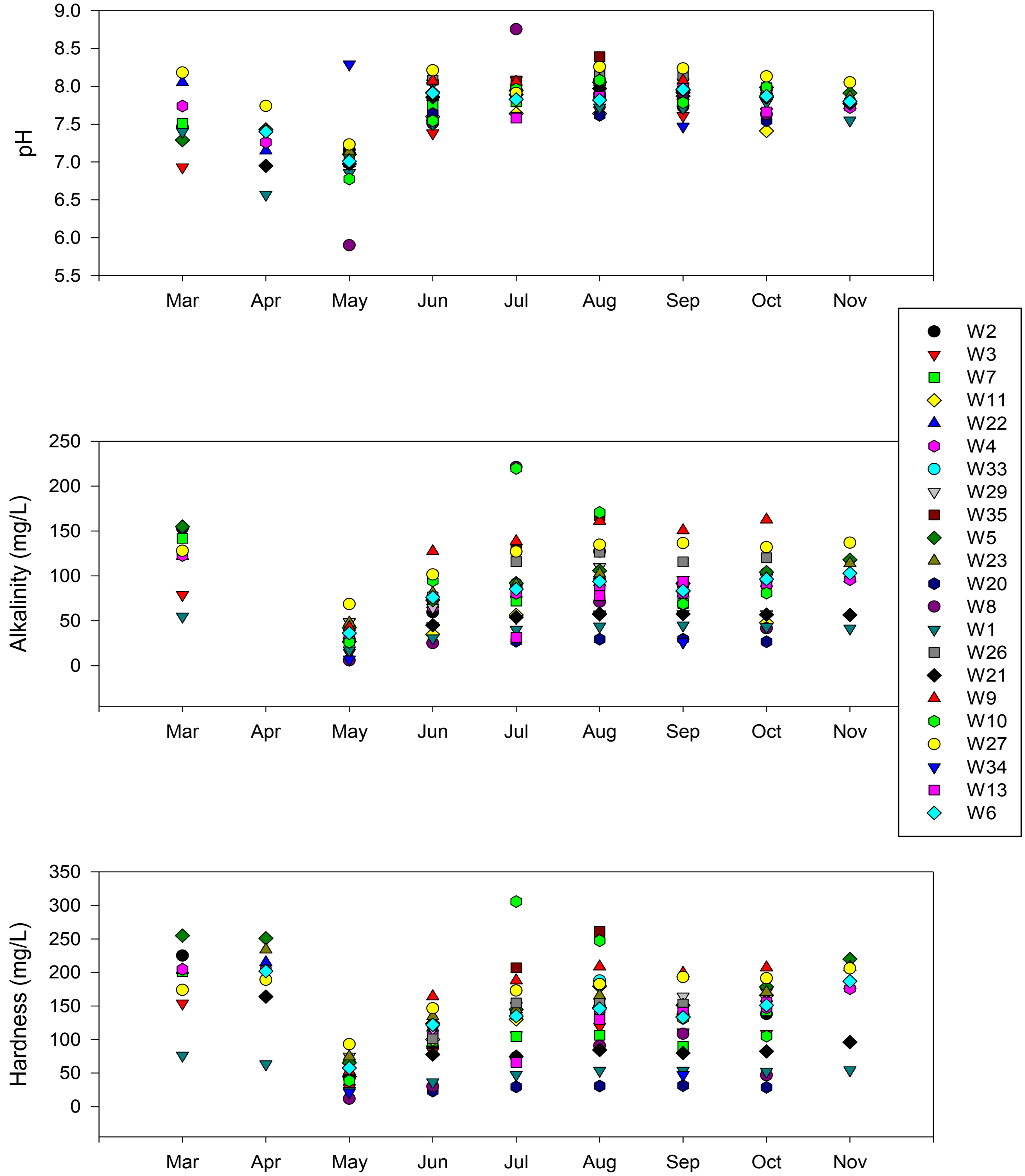
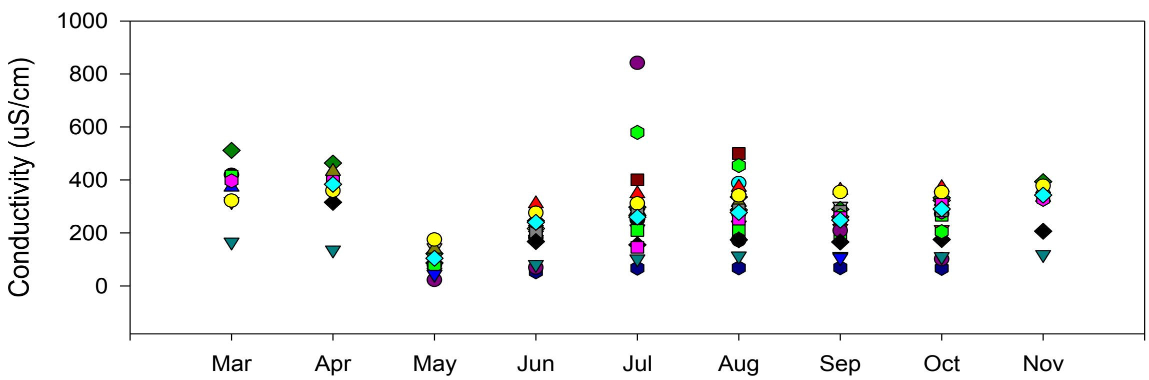
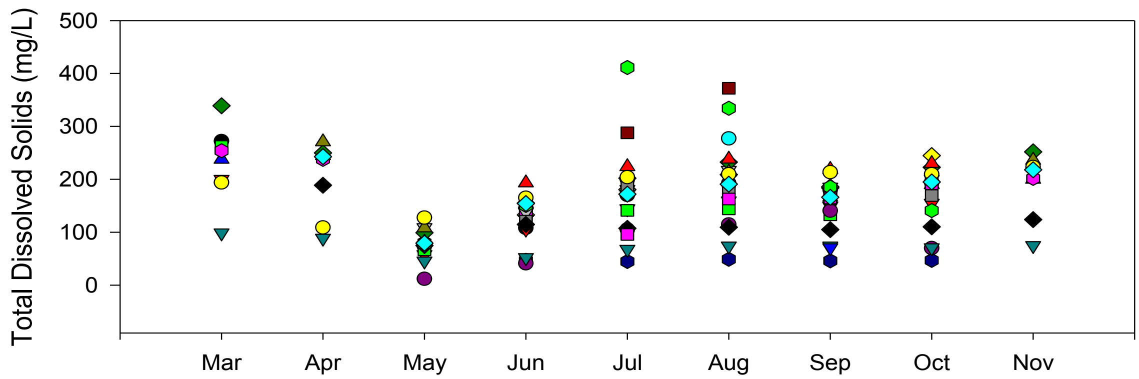


Figure 3-7: ***Continued.*** **Temporal Variations in Surface Water Parameters in the Monitored Sites from 1993 – 2010**





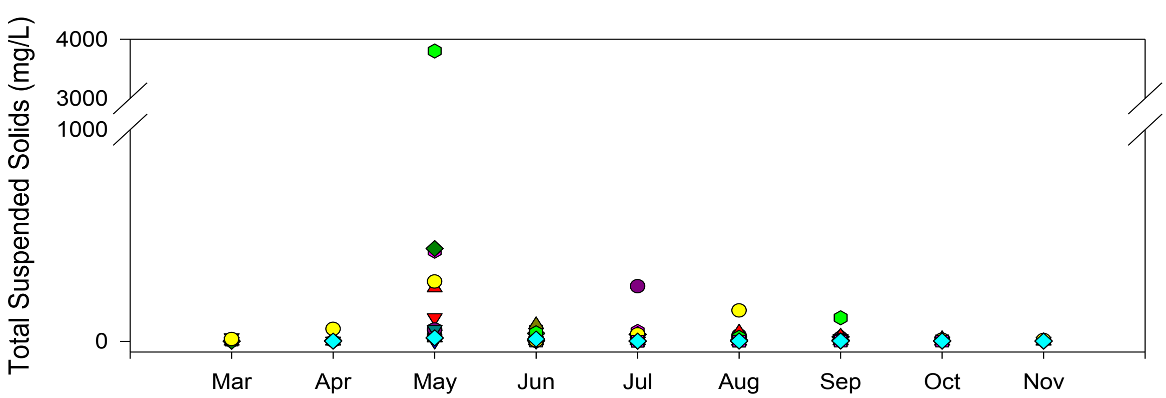
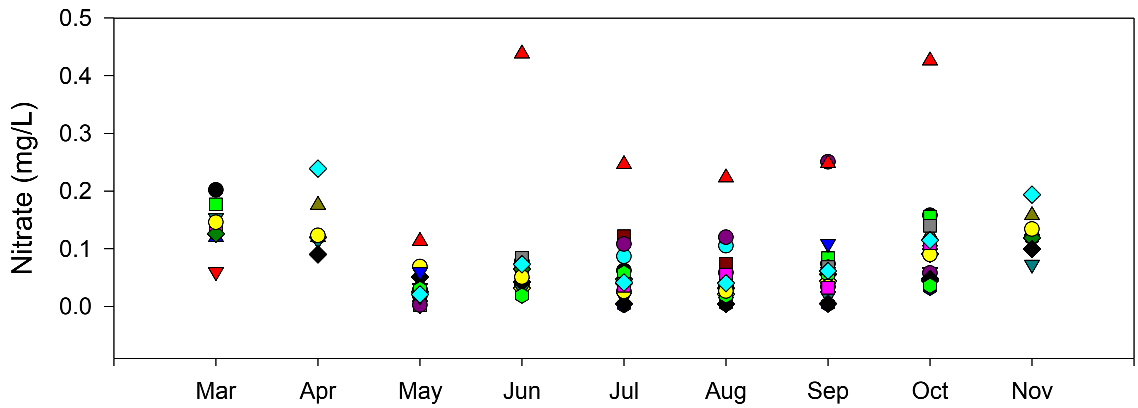


Figure 3-7: ***Continued.*** **Temporal Variations in Surface Water Parameters in the Monitored Sites from 1993 – 2010**



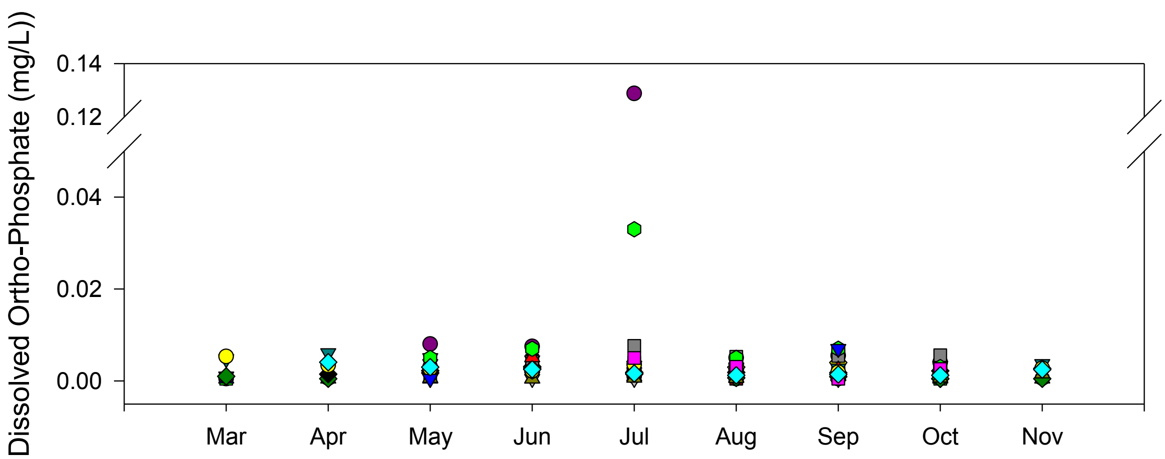


Figure 3-7: ***Continued.*** **Temporal Variations in Surface Water Parameters in the Monitored Sites from 1993 – 2010**

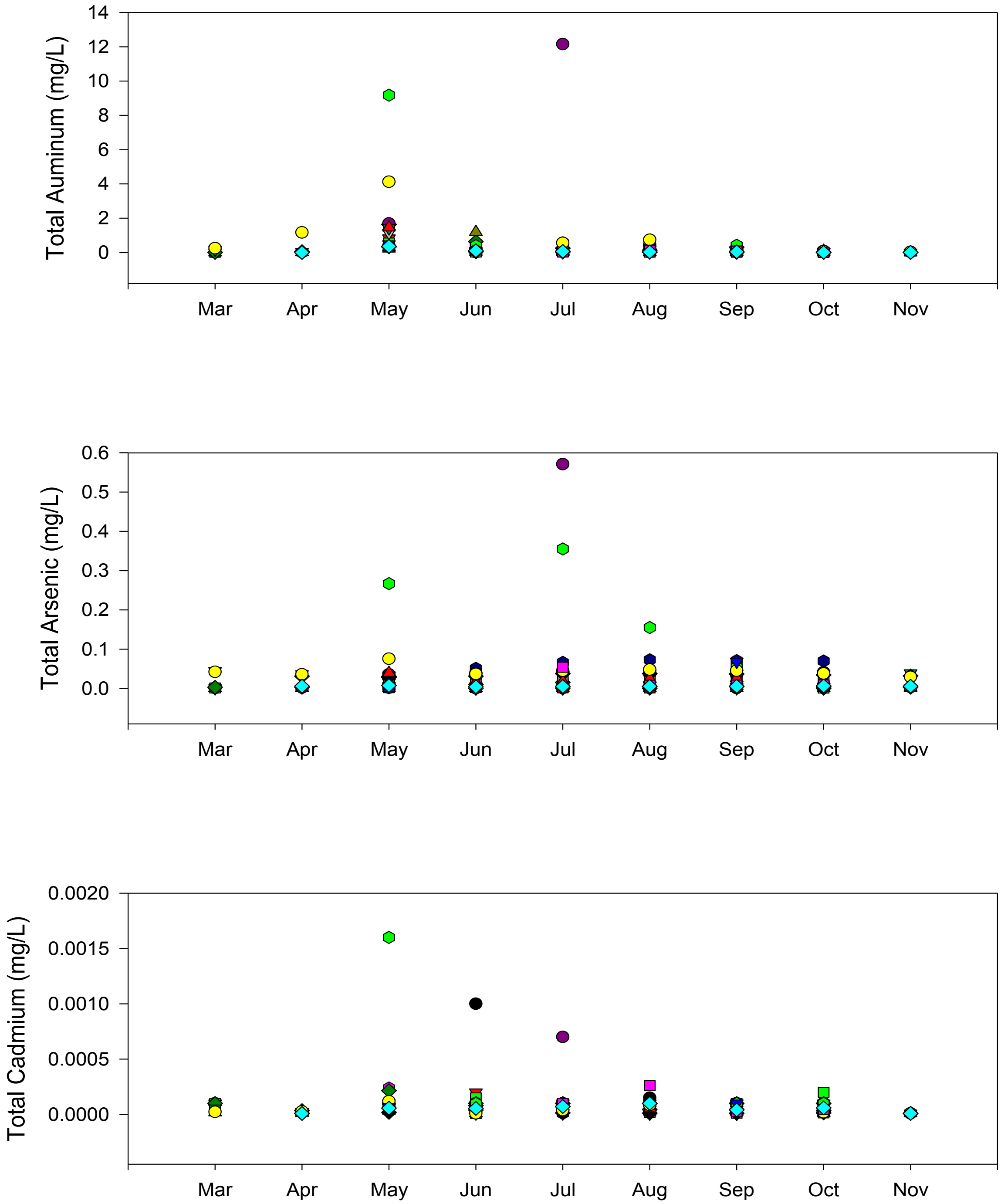
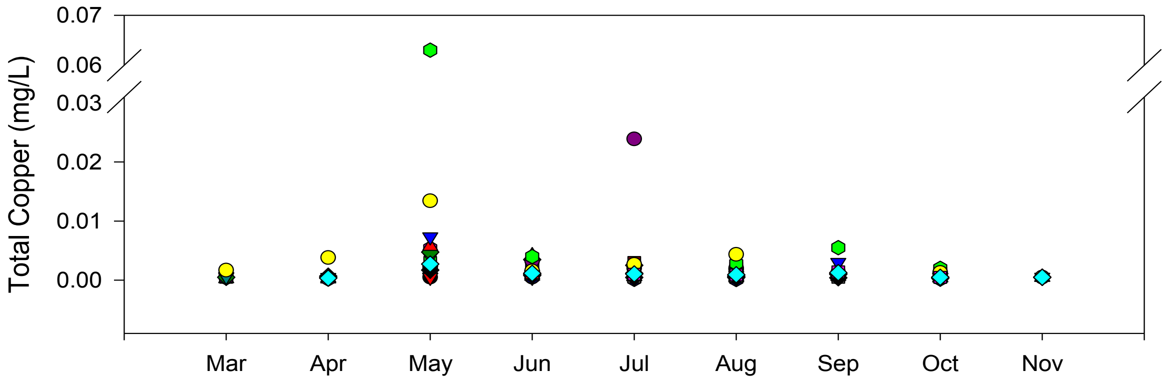
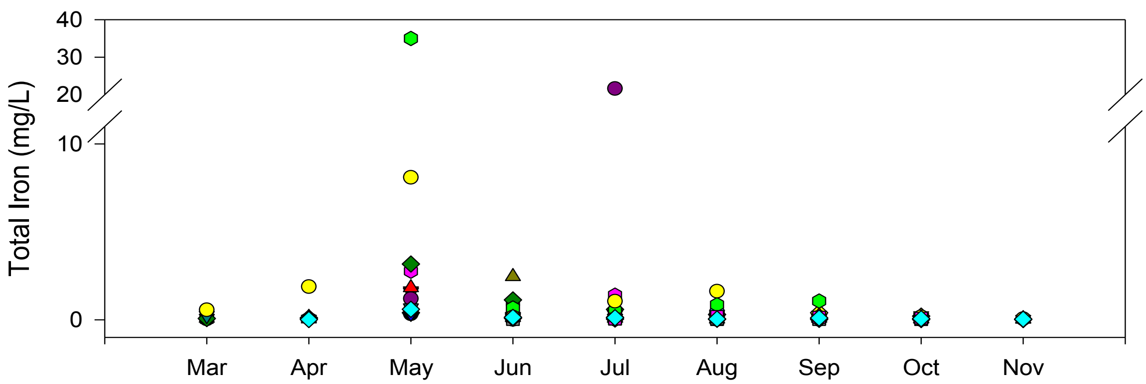
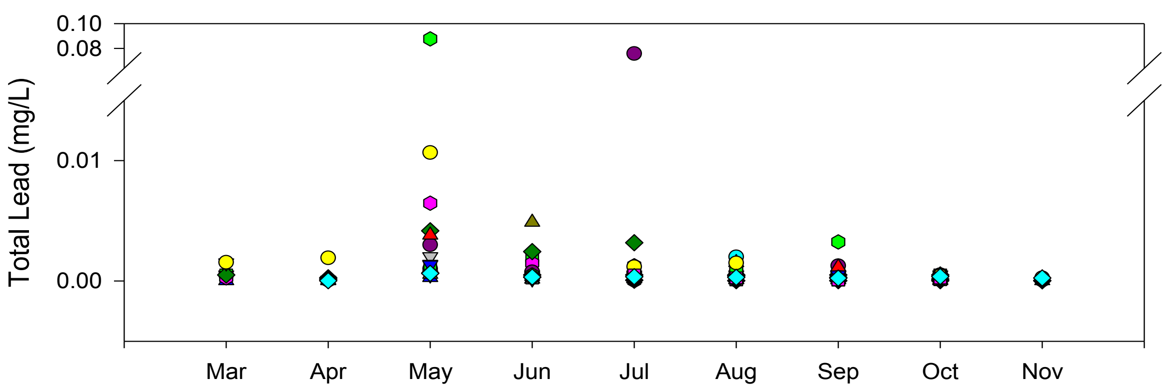
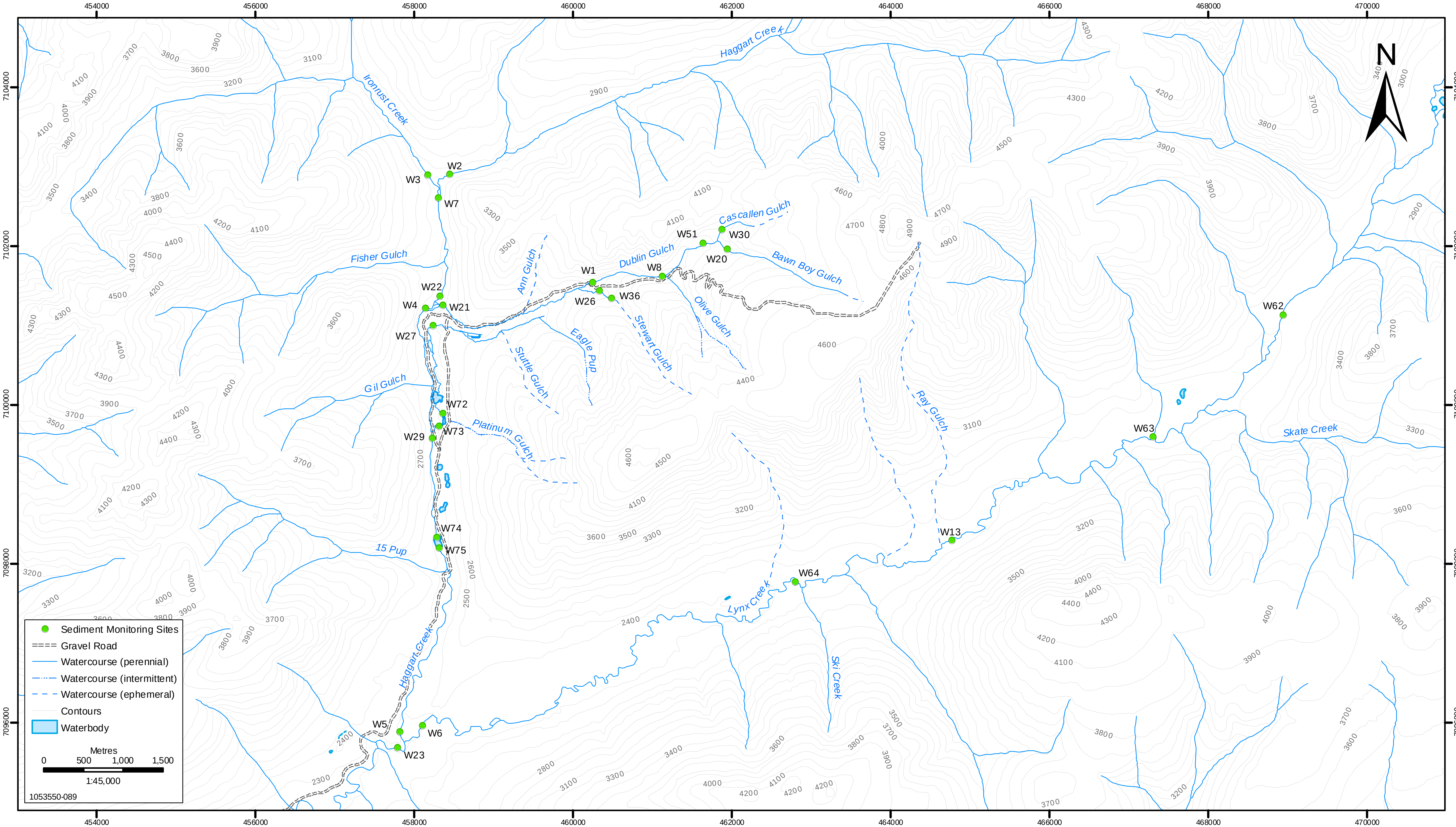


Figure 3-7: ***Continued.*** **Temporal Variations in Surface Water Parameters in the Monitored Sites from 1993 – 2010**









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EAGLE GOLD PROJECT
YUKON TERRITORY

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DATUM	CHECKED BY
NAD 83	RS
DATE	FIGURE NO.
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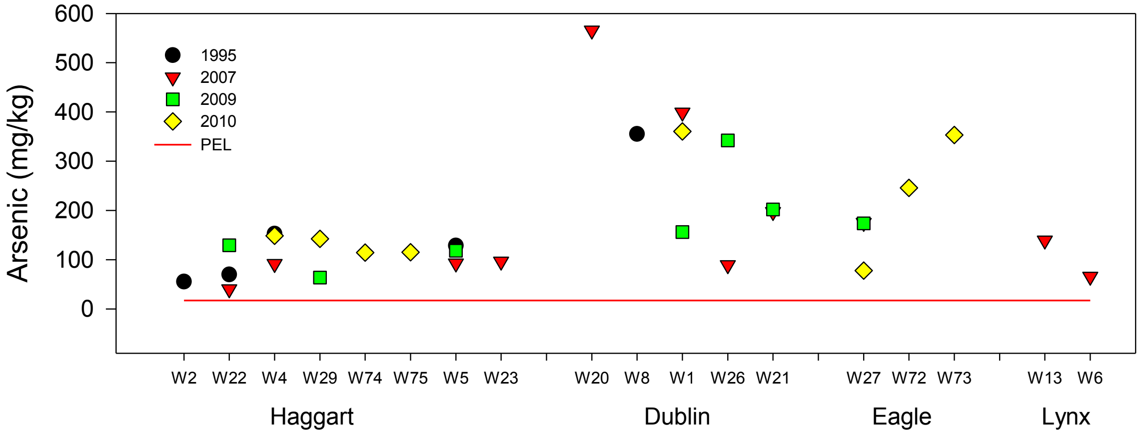
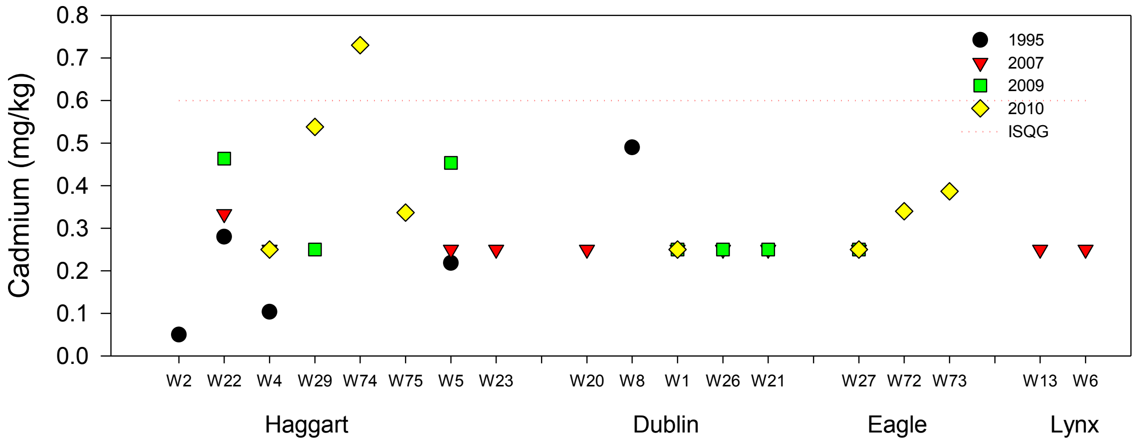
Figure 4-2: Mean Metal Levels at Sites in Haggart, Dublin, Eagle, and Lynx since 1976





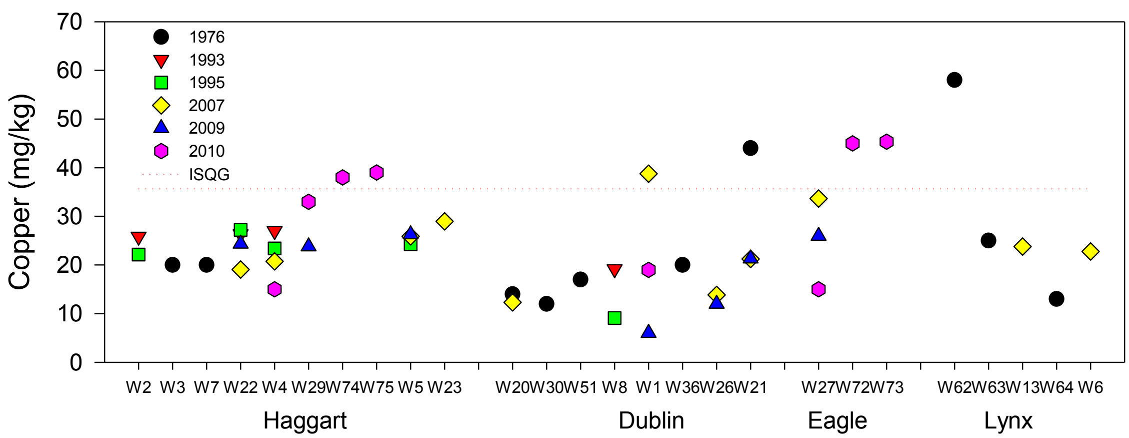


Figure 4-2: ***Continued.*** **Mean Metal Levels at Sites in Haggart, Dublin, Eagle, and Lynx since 1976**

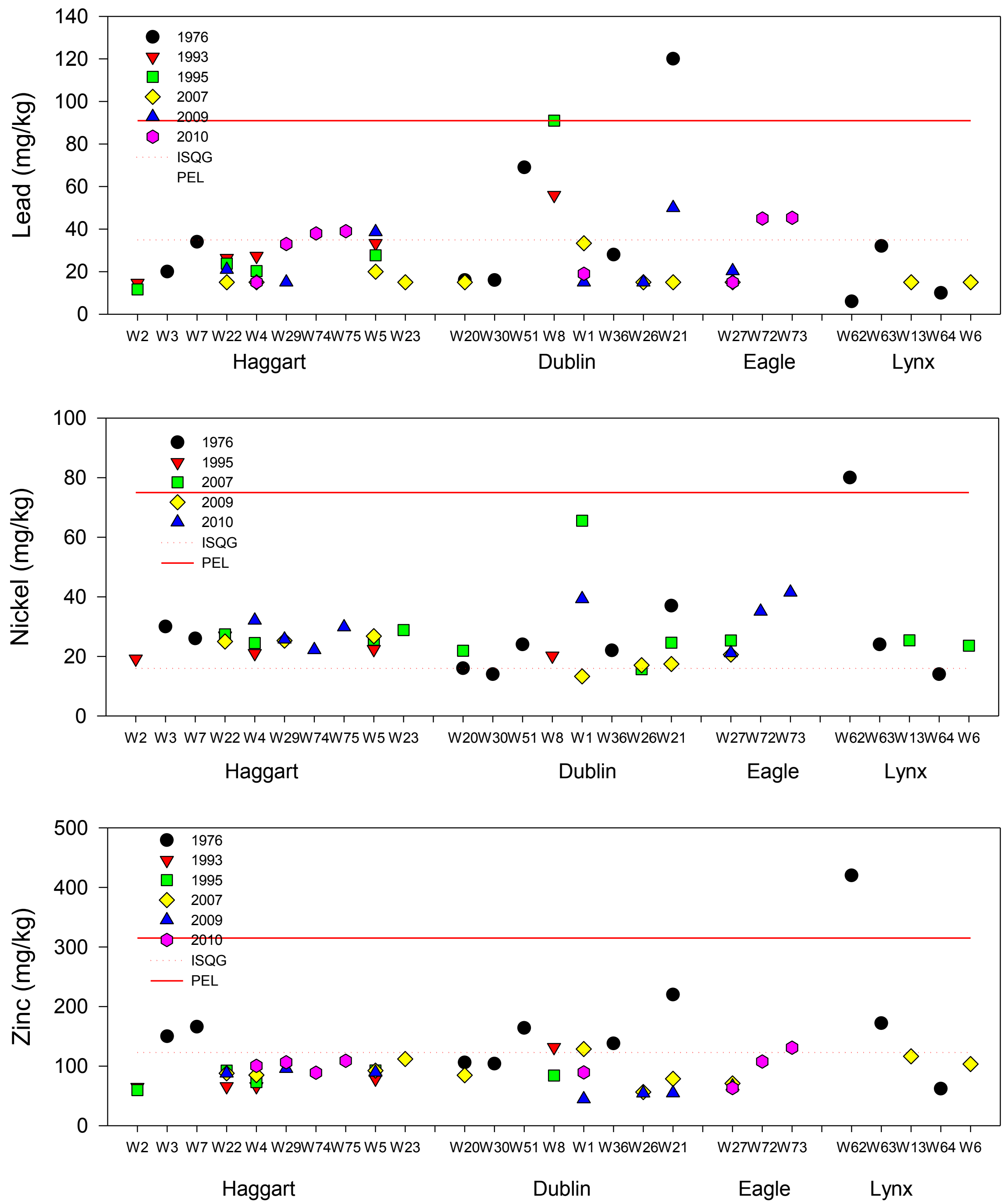
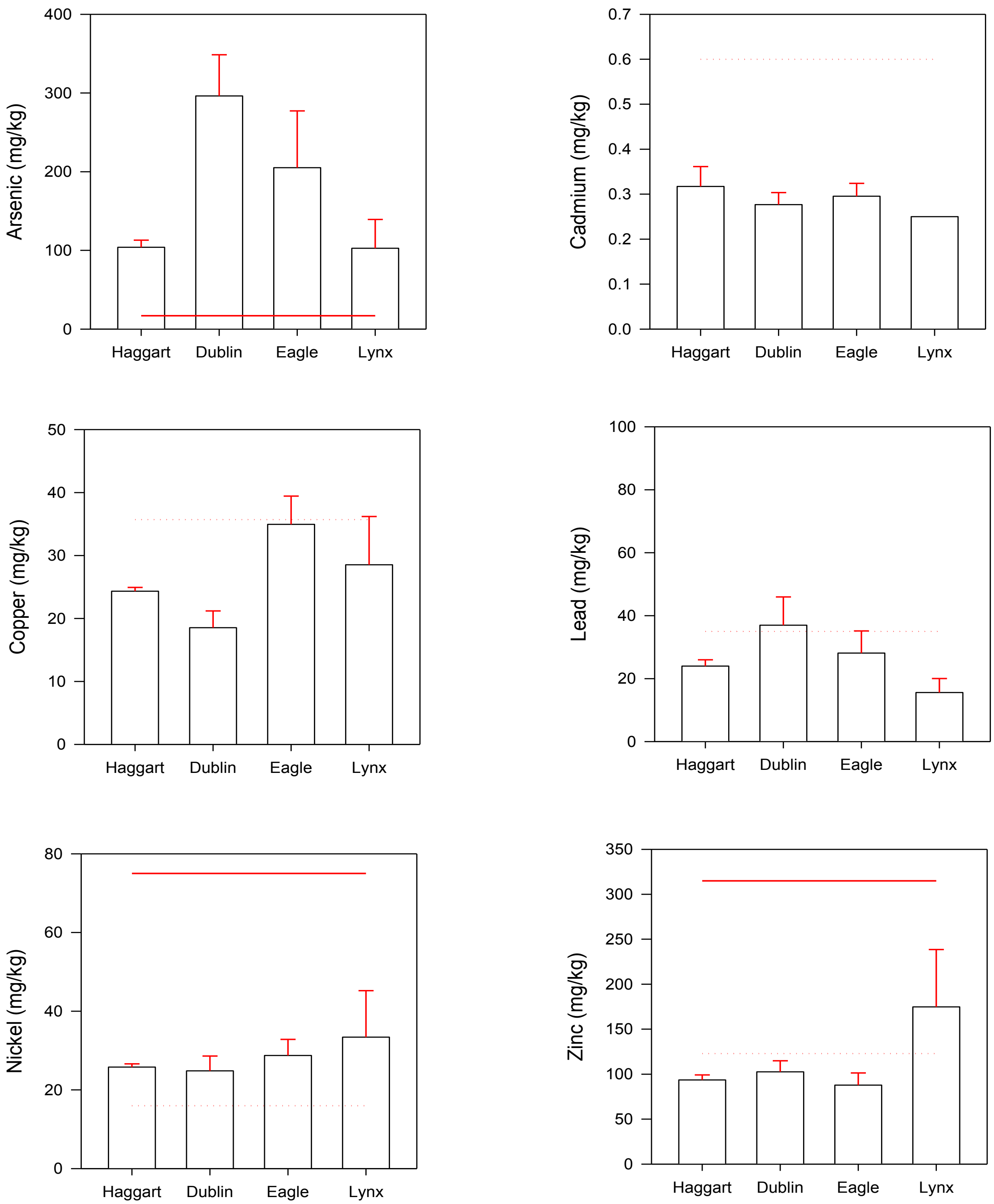
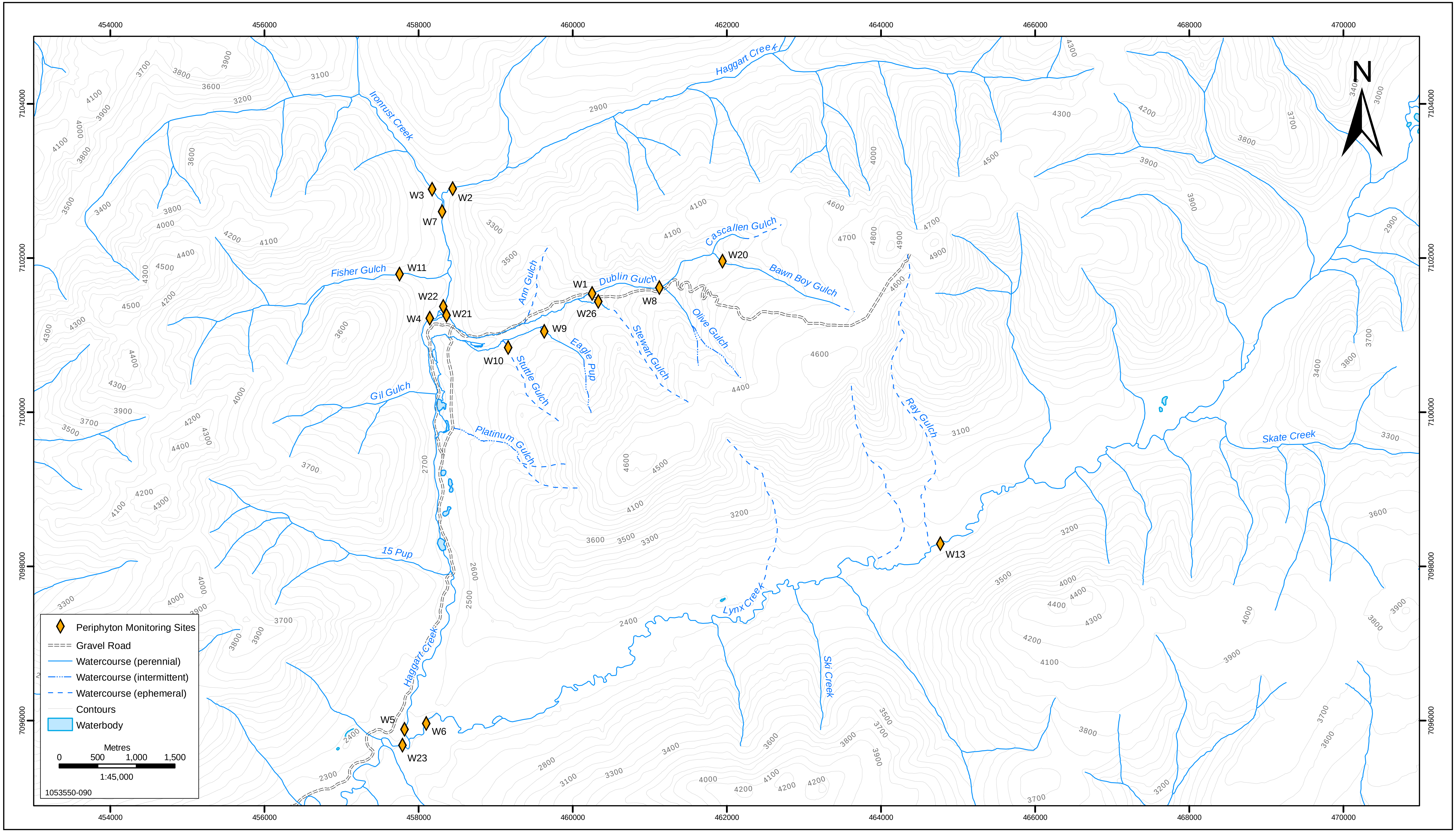


Figure 4-3: Mean Metal Levels (and standard error) in Haggart, Dublin, Eagle, and Lynx Basins since 1976 (solid line is PEL, dotted line is ISQG)





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DATE 28-Oct-09	FIGURE NO. 5-1

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Figure 5-2: Chlorophyll a (mg/m^2) at Sites in the Study area from 1995 and 2007 (mean ± standard error)

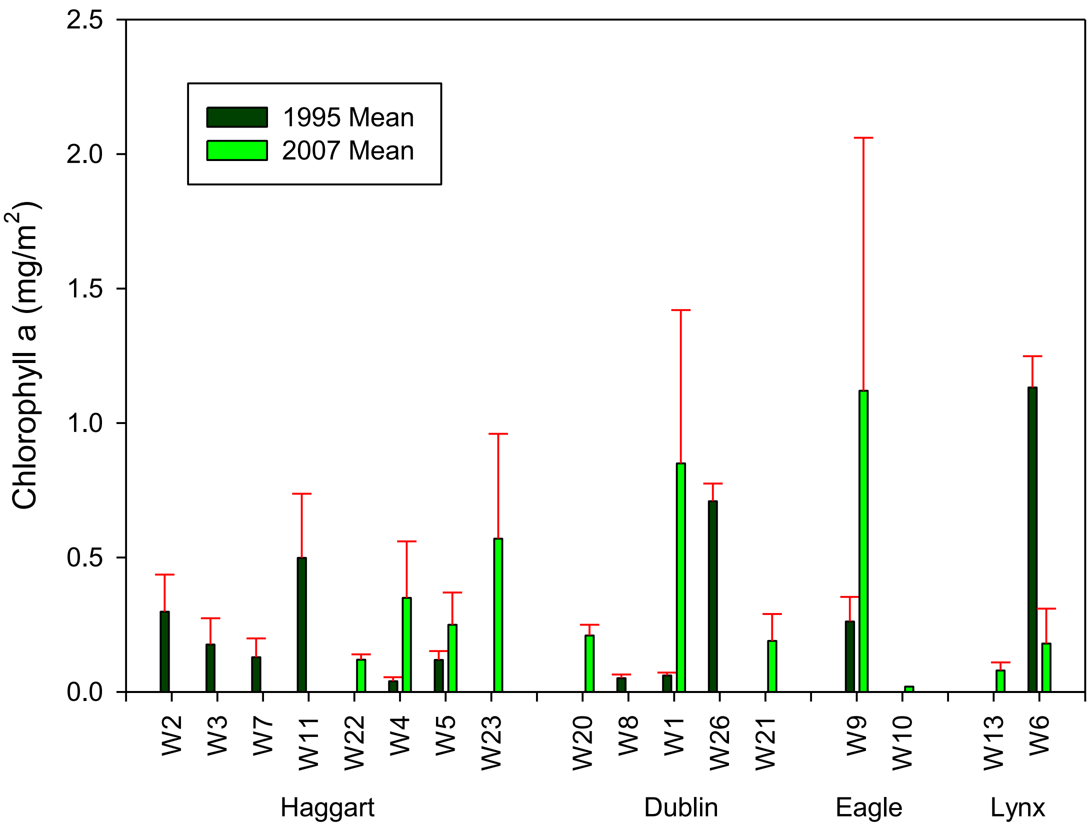
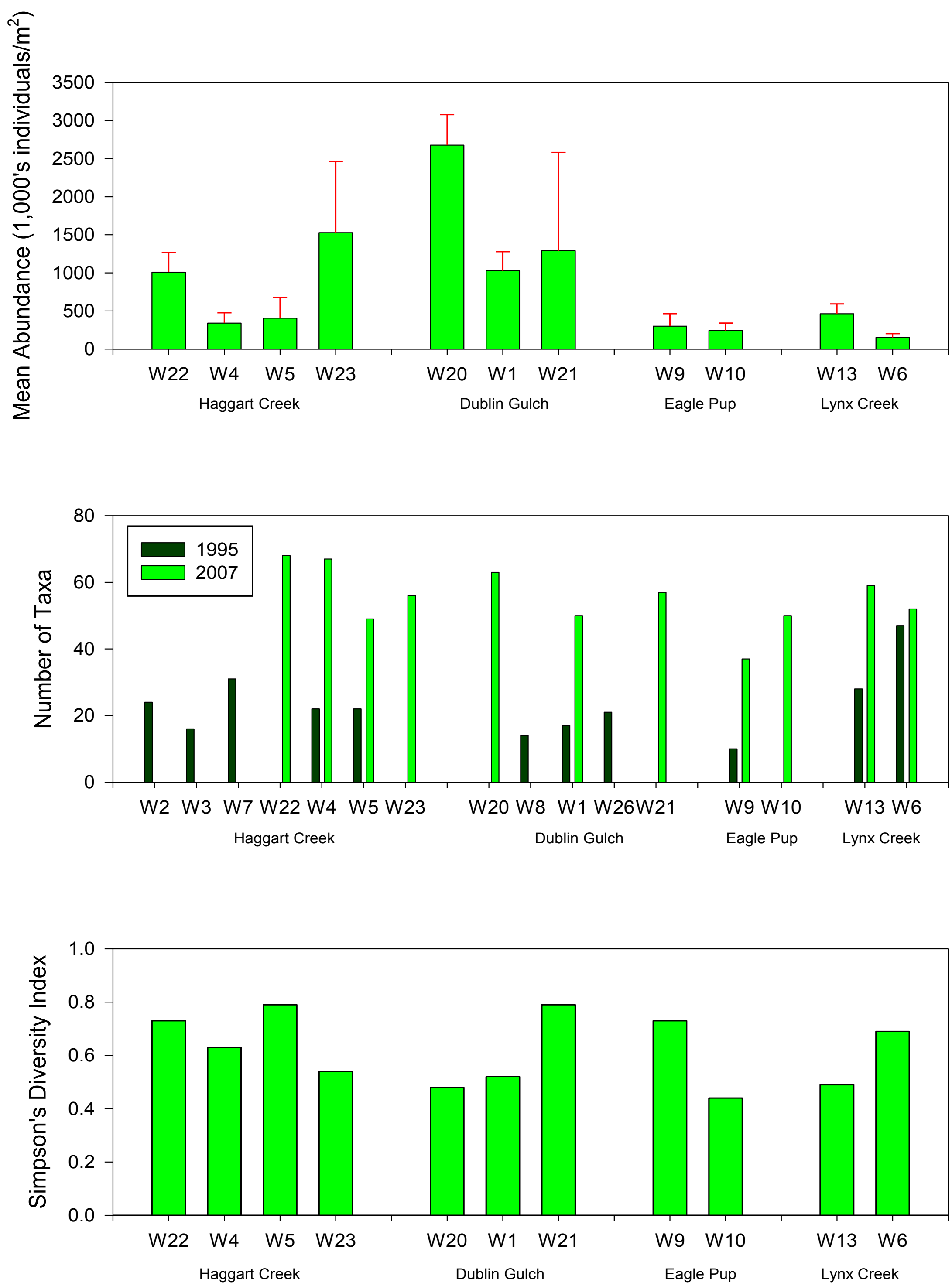
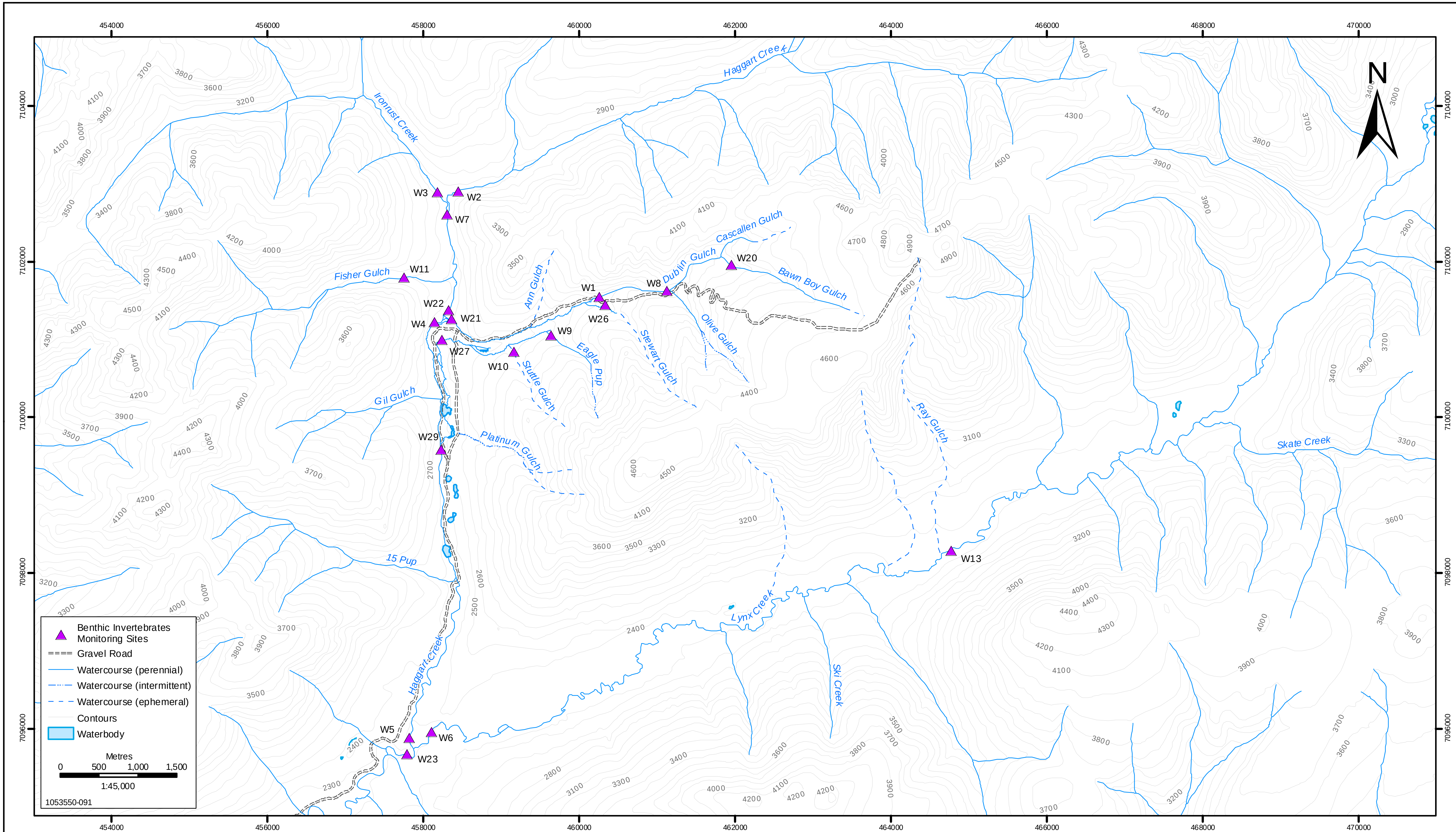


Figure 5-3: Characteristics of Periphyton Communities in the Project Area (mean ± standard error)





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NAD 83	RS
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Figure 6-2: Abundance, Richness and Diversity of Benthic Invertebrates at Sites in the Study Area (mean ± standard error)

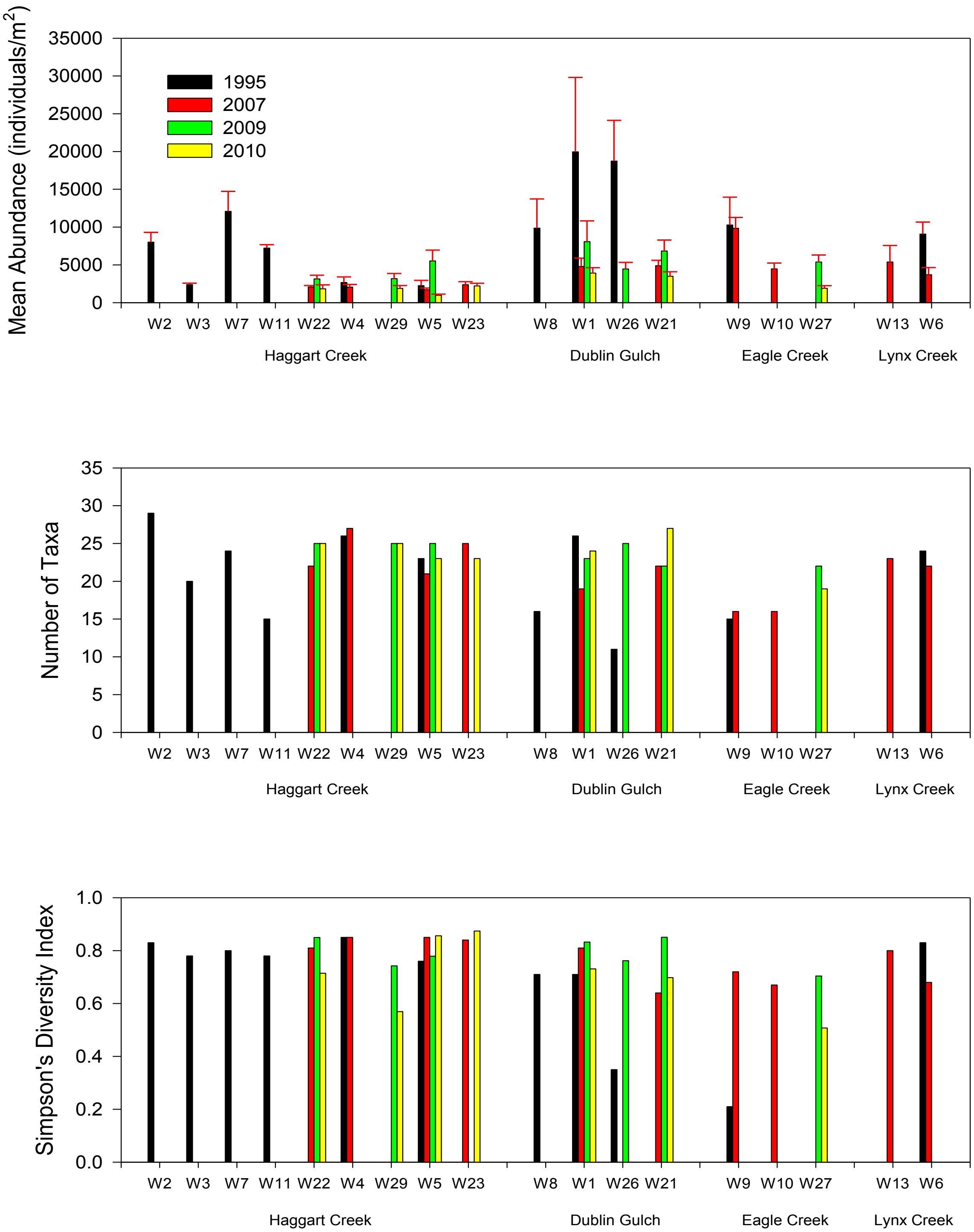
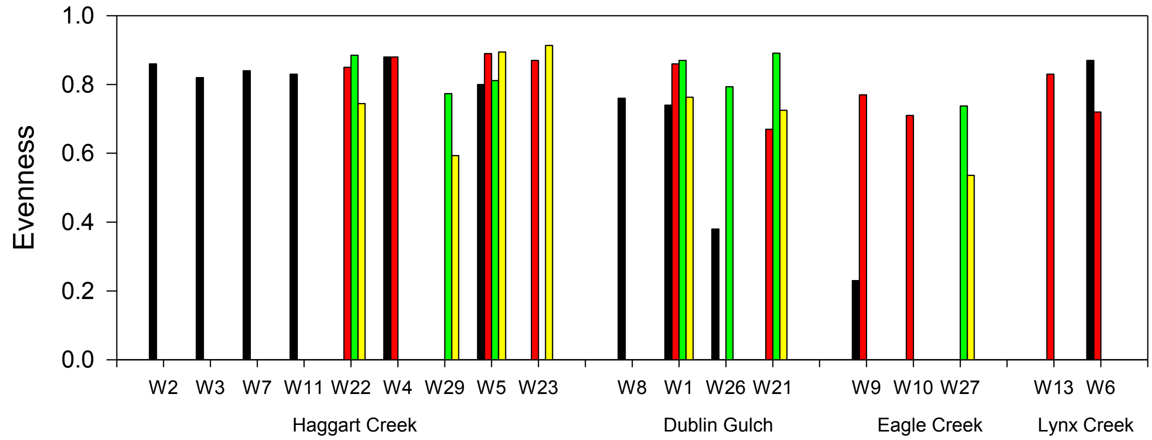
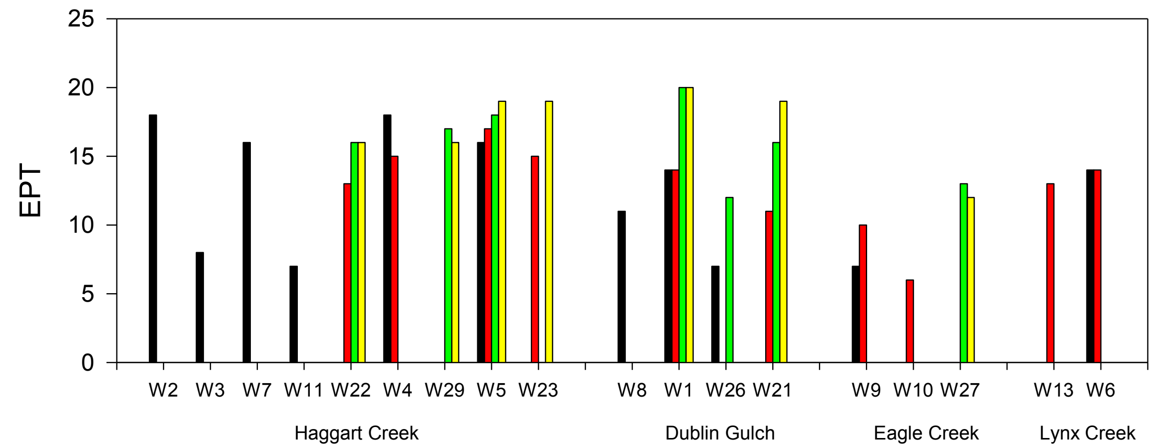


Figure 6-3: Evenness and EPT of Benthic Invertebrates at Sites in the Study Area





APPENDIX A

Water Quality

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APPENDIX A – Water Quality
APPENDIX A1: QA/QC – Travel Blanks 1993-1996

Travel Blanks for the 1993-1996 Surface Water Monitoring Program

Station	Travel Blank	Travel Blank	Travel Blank	Travel Blank	Travel Blank	Travel Blank	Travel Blank	Travel Blank	Travel Blank	Travel Blank	Travel Blank
Date	**1-May-95**	**3-Jul-95**	**2-Aug-95**	**1-Oct-95**	**23-May-96**	**23-Jun-96**	**27-Jun-96**	**22-Jul-96**	**13-Aug-96**	**13-Aug-96**	**20-Sep-96**
ASL W.O. #	**E9182**	**F1804**	**F2680**	**F4350**	**G1428**	**G2418**	**G2599**	**G3408**	**G4188**	**G4188**	**G5423**
Sample Type	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water
QA/QC	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
pH	**5.67**	**5.85**	**6.02**	**5.89**	**5.81**	**6.24**		**5.75**	**5.79**	**5.89**	**5.9**
Electrical Conductivity, µmho/cm	1.7	2.2	1.1	1.2	<1.0	1.2		1	1	<1.0	1.5
Total Dissolved Solids, mg/l	2	<1	<1	<1	<1	<1		<1	<1	<1	<1
Total Suspended Solids, mg/l	27	<1	<1	<1	1	<1		<1	<1	1	<1
Hardness, $CaCO_3$ **mg/l**	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05		<0.05	<0.05	<0.05	<0.05
Turbidity, NTU	<0.10	<0.10	0.4	<0.10	0.1	0.1		<0.1	<0.1	<0.1	<0.1
Alkalinity, $CaCO_3$ **mg/l**	2.8	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0
Chloride, mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		<0.5	<0.5	<0.5	<0.5
Fluoride, mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02		<0.02	<0.02	<0.02	<0.02
Sulphate (SO_4)**, mg/l**	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0
Ammonia Nitrogen (NH_4)**, mg/l**	0.025	<0.005	<0.005	<0.005	<0.005	<0.005		<0.005	<0.005	<0.005	<0.005
Nitrate Nitrogen (NO_3)**, mg/l**	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005		<0.005	<0.005	<0.005	<0.005
Nitrite Nitrogen (NO_2)**, mg/l**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		<0.001	<0.001	<0.001	<0.001
Dissolved ortho-Phosphate, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		0.002	<0.001	<0.001	0.002
Total Dissolved Phosphate, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	0.003		0.002	<0.001	<0.001	0.002
Total Phosphorus, mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		0.002	<0.001	<0.001	0.002
Total Cyanide (CN^-)**, mg/l**	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Aluminum (total), mg/l	0.005	**0.007**	**0.034**	**0.007**	<0.005	<0.005	<0.005	<0.005	<0.005	**0.008**	<0.005
Antimony (total), mg/l	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Arsenic (total), mg/l	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.0001	<0.0001	<0.0001	<0.0001
Barium (total), mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Beryllium (total), mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth (total), mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Boron (total), mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Cadmium (total), mg/l	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Calcium (total), mg/l	<0.050	<0.050	0.1	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.056	<0.050
Chromium (total), mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt (total), mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Copper (total), mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (total), mg/l	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (total), mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Magnesium (total), mg/l	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Manganese (total), mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Mercury (total), mg/l	<0.00001	<0.00001	<0.00001	<0.00001	0.00006	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Molybdenum (total), mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel (total), mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Selenium (total), mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0007	<0.0005	<0.0005	<0.0005	0.0005
Silicon (total), mg/l	<0.050	0.071	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

APPENDIX A – Water Quality
APPENDIX A1: QA/QC – Travel Blanks 1993-1996

Station	**Travel Blank**	**Travel Blank**	**Travel Blank**	**Travel Blank**	**Travel Blank**	**Travel Blank**	**Travel Blank**	**Travel Blank**	**Travel Blank**	**Travel Blank**	**Travel Blank**
Date	**1-May-95**	**3-Jul-95**	**2-Aug-95**	**1-Oct-95**	**23-May-96**	**23-Jun-96**	**27-Jun-96**	**22-Jul-96**	**13-Aug-96**	**13-Aug-96**	**20-Sep-96**
ASL W.O. #	**E9182**	**F1804**	**F2680**	**F4350**	**G1428**	**G2418**	**G2599**	**G3408**	**G4188**	**G4188**	**G5423**
Sample Type	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water	deionized water
QA/QC	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Silver (total), mg/l	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Strontium (total), mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.002
Titanium (total), mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (total), mg/l	0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Vanadium (total), mg/l	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Zinc (total), mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Aluminum (dissolved), mg/l	<0.005	0.008	<0.005	0.008						0.009	
Antimony (dissolved), mg/l	<0.0001	<0.0001	<0.0001	<0.0001						<0.0001	
Arsenic (dissolved), mg/l	<0.0001	<0.0001	<0.0001	<0.0001						<0.0001	
Barium (dissolved), mg/l	<0.010	<0.010	<0.010	<0.010						<0.010	
Beryllium (dissolved), mg/l	<0.005	<0.005	<0.005	<0.005						<0.005	
Bismuth (dissolved), mg/l	<0.10	<0.10	<0.10	<0.10						<0.10	
Boron (dissolved), mg/l	<0.10	<0.10	<0.10	<0.10						<0.10	
Cadmium (dissolved), mg/l	<0.0002	<0.0002	<0.0002	<0.0002						<0.0002	
Calcium (dissolved), mg/l	<0.050	<0.050	<0.050	<0.050						<0.050	
Chromium (dissolved), mg/l	<0.001	<0.001	<0.001	<0.001						<0.001	
Cobalt (dissolved), mg/l	<0.001	<0.001	<0.001	<0.001						<0.001	
Copper (dissolved), mg/l	<0.001	<0.001	<0.001	<0.001						<0.001	
Iron (dissolved), mg/l	<0.030	<0.030	<0.030	<0.030						<0.030	
Lead (dissolved), mg/l	<0.001	<0.001	<0.001	<0.001						<0.001	
Magnesium (dissolved), mg/l	<0.050	<0.050	<0.050	<0.050						<0.050	
Manganese (dissolved), mg/l	<0.005	<0.005	<0.005	<0.005						<0.005	
Molybdenum (dissolved), mg/l	<0.001	<0.001	<0.001	<0.001						<0.001	
Nickel (dissolved), mg/l	<0.001	<0.001	<0.001	<0.001						<0.001	
Potassium (dissolved), mg/l	<0.01	<0.01	<0.01	<0.01						<0.01	
Selenium (dissolved), mg/l	<0.0005	<0.0005	<0.0005	<0.0005						<0.0005	
Silicon (dissolved), mg/l	<0.050	0.067	<0.050	<0.050						<0.050	
Silver (dissolved), mg/l	<0.0001	<0.0001	<0.0001	<0.0001						<0.0001	
Sodium (dissolved), mg/l	<0.01	<0.01	<0.01	<0.01						<0.01	
Strontium (dissolved), mg/l	<0.001	<0.001	<0.001	<0.001						<0.001	
Titanium (dissolved), mg/l	<0.010	<0.010	<0.010	<0.010						<0.010	
Uranium (dissolved), mg/l	0.00001	<0.00001	<0.00001	<0.00001						<0.00001	
Vanadium (dissolved), mg/l	<0.030	<0.030	<0.030	<0.030						<0.030	
Zinc (dissolved), mg/l	<0.005	<0.005	<0.005	<0.005						<0.005	
Total Organic Carbon, mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5		0.6	0.8	0.6	<0.5

APPENDIX A – Water Quality
APPENDIX A1: QA/QC – Travel Blanks 2007-2008

Travel Blanks for the 2007-2008 Surface Water Monitoring Program

	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK
Date Sampled	19-NOV-07	12-AUG-07	29-AUG-07	12-SEP-07	26-SEP-07	20-OCT-07	26-APR-08
Physical Tests							
Hardness (as CaCO3)	-	<0.50	<0.50	-	<0.70	-	<0.50
Conductivity	<2.0	<2.0	<2.0	<2.0	9.9	-	6.1
pH	5.83	5.63	5.61	5.59	5.68	-	5.48
Total Dissolved Solids	<10	<10		<10	<10	-	<10
Total Suspended Solids	<3.0	<3.0	3.1	<3.0	<3.0	-	<3.0
Turbidity	<0.10	<0.10	<0.10	<0.10	0.35	-	<0.10
Anions and Nutrients							
Ammonia as N	<0.0050	<0.0050	<0.020	<0.0050	<0.0050	<0.020	<0.0050
Alkalinity, Total (as CaCO3)	<2.0	<2.0		<2.0		-	
Chloride (Cl)	<0.50	<0.50	<0.50	<0.50		-	
Fluoride (F)	<0.020	<0.020	<0.020	<0.020		-	
Sulfate (SO4)	<0.50	<0.50	<0.50	<0.50		-	
Nitrate (as N)	<0.0050	<0.0050	<0.0050	<0.0050		-	<0.0050
Nitrite (as N)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010
Total Kjeldahl Nitrogen	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-
Ortho Phosphate as P	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010
Total Dissolved Phosphate As P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	-	<0.0020
Total Phosphate as P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	-	<0.0020
Cyanides							
Cyanide, Weak Acid Diss	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-
Cyanide, Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-
Total Metals							
Aluminum (Al)-Total	<0.0050	<0.0010	<0.0010	<0.0050	<0.0050	-	<0.0010
Antimony (Sb)-Total	<0.00050	<0.00010	<0.00010	<0.00010	<0.00050	-	<0.00010
Arsenic (As)-Total	<0.00050	<0.00010	<0.00010	<0.00010	<0.00050	-	<0.00010
Barium (Ba)-Total	<0.020	<0.000050	<0.000050	<0.000050	<0.020	-	<0.000050
Beryllium (Be)-Total	<0.0010	<0.00050	<0.00050	<0.00050	<0.0010	-	<0.00050
Bismuth (Bi)-Total		<0.00050	<0.00050	<0.00050			<0.00050
Boron (B)-Total	<0.10	<0.010	<0.010	<0.010	<0.10	-	<0.010
Cadmium (Cd)-Total	<0.000017	<0.000017	<0.000050	<0.000050	<0.000017	-	<0.000017
Calcium (Ca)-Total	<0.10	<0.050	<0.050	<0.050	<0.10	-	<0.050
Chromium (Cr)-Total	<0.0010	<0.00050	<0.00050	<0.00050	<0.0010	-	<0.00050
Cobalt (Co)-Total	<0.00030	<0.00010	<0.00010	<0.00010	<0.00030	-	<0.00010
Copper (Cu)-Total	<0.0010	<0.00010	<0.00010	<0.00010	<0.0010	-	<0.00010
Iron (Fe)-Total	<0.030	<0.030	<0.030	<0.030	<0.030	-	<0.030
Lead (Pb)-Total	<0.00050	<0.000050	<0.000050	<0.000050	<0.00050	-	<0.000050
Lithium (Li)-Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050
Magnesium (Mg)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	-	<0.10
Manganese (Mn)-Total	<0.00030	<0.000050	<0.000050	<0.000050	<0.00030	-	<0.000050
Mercury (Hg)-Total	<0.000020				<0.000020	-	
Molybdenum (Mo)-Total	<0.0010	<0.000050	<0.000050	<0.000050	<0.0010	-	<0.000050
Nickel (Ni)-Total	<0.0010	<0.00050	<0.00050	<0.00050	<0.0010	-	<0.00050
Potassium (K)-Total		<0.30	<0.30	<0.30			<0.30
Potassium (K)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0
Selenium (Se)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010
Silicon (Si)-Total		<0.050	<0.050	<0.050			<0.050
Silver (Ag)-Total	<0.000020	<0.000010	<0.000010	<0.000010	<0.000020	-	<0.000010
Sodium (Na)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	-	<2.0
Strontium (Sr)-Total		<0.00010	<0.00010	<0.00010			<0.00010
Thallium (Tl)-Total	<0.00020	<0.00010	<0.00010	<0.00010	<0.00020	-	<0.00010

APPENDIX A – Water Quality
APPENDIX A1: QA/QC – Travel Blanks 2007-2008

	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK
Date Sampled	19-NOV-07	12-AUG-07	29-AUG-07	12-SEP-07	26-SEP-07	20-OCT-07	26-APR-08
Tin (Sn)-Total	<0.00050	<0.00010	<0.00010	<0.00010	<0.00050	-	<0.00010
Titanium (Ti)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	-	<0.010
Uranium (U)-Total	<0.00020	<0.000010	<0.000010	<0.000010	<0.00020	-	<0.000010
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.030	-	<0.0010
Zinc (Zn)-Total	<0.0050	<0.0010	<0.0010	<0.0010	<0.0050	-	<0.0010
Dissolved Metals							
Aluminum (Al)-Dissolved	-	-	-	-	-	-	-
Antimony (Sb)-Dissolved	-	-	-	-	-	-	-
Arsenic (As)-Dissolved	-	-	-	-	-	-	-
Barium (Ba)-Dissolved	-	-	-	-	-	-	-
Beryllium (Be)-Dissolved	-	-	-	-	-	-	-
Bismuth (Bi)-Total		-	-	-			-
Boron (B)-Dissolved	-	-	-	-	-	-	-
Cadmium (Cd)-Dissolved	-	-	-	-	-	-	-
Calcium (Ca)-Dissolved	-	-	-	-	-	-	-
Chromium (Cr)-Dissolved	-	-	-	-	-	-	-
Cobalt (Co)-Dissolved	-	-	-	-	-	-	-
Copper (Cu)-Dissolved	-	-	-	-	-	-	-
Iron (Fe)-Dissolved	-	-	-	-	-	-	-
Lead (Pb)-Dissolved	-	-	-	-	-	-	-
Lithium (Li)-Dissolved	-	-	-	-	-	-	-
Magnesium (Mg)-Dissolved	-	-	-	-	-	-	-
Manganese (Mn)-Dissolved	-	-	-	-	-	-	-
Mercury (Hg)-Dissolved	-				-	-	
Molybdenum (Mo)-Dissolved	-	-	-	-	-	-	-
Nickel (Ni)-Dissolved	-	-	-	-	-	-	-
Phosphorus (P)-Total		-	-	-			-
Potassium (K)-Dissolved	-	-	-	-	-	-	-
Selenium (Se)-Dissolved	-	-	-	-	-	-	-
Silicon (Si)-Total		-	-	-			-
Silver (Ag)-Dissolved	-	-	-	-	-	-	-
Sodium (Na)-Dissolved	-	-	-	-	-	-	-
Strontium (Sr)-Total		-	-	-			-
Thallium (Tl)-Dissolved	-	-	-	-	-	-	-
Tin (Sn)-Dissolved	-	-	-	-	-	-	-
Titanium (Ti)-Dissolved	-	-	-	-	-	-	-
Uranium (U)-Dissolved	-	-	-	-	-	-	-
Vanadium (V)-Dissolved	-	-	-	-	-	-	-
Zinc (Zn)-Dissolved	-	-	-	-	-	-	-
Organic Parameters							
Total Organic Carbon	<0.50	<0.50	<0.50	<0.50	<0.50	-	-
XNo class							
Dissolved Organic Carbon							
Detectable values							

APPENDIX A – Water Quality
APPENDIX A1: QA/QC – Travel Blanks 2009

Travel Blanks for the 2009 Surface Water Monitoring Program

	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK
Date Sampled	20-Jul-09	06-AUG-09	20-AUG-09	01 Sep 2009	16-Sep-09	7-Oct-09	20-Oct-09
Physical Tests							
Conductivity	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Hardness (as CaCO3)	<1.0	-	<1.0	<1.0	<1.0	<1.0	<1.0
pH	5.65	5.57	5.60	5.59	5.65	5.53	5.48
Total Suspended Solids	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	<10	<10	<10	<10	<10	<10	<10
Turbidity	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Ammonia as N	<0.0050	<0.0050	<0.020	<0.0050	<0.020	<0.0050	<0.020
Bromide (Br)		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride (Fl)		<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Nitrate (as N)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0060
Nitrite (as N)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	0.059	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Nitrogen	<0.060	<0.060	<0.050	<0.060	<0.060	<0.060	0.184
Ortho Phosphate as P	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Dissolved Phosphate As P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total Phosphate as P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Sulfate (SO4)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cyanides							
Cyanide, Weak Acid Diss	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050
Cyanide, Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	<0.0050
Organic/Inorganic Carbon							
Dissolved Organic Carbon	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Metals							
Aluminum (Al)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Antimony (Sb)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000050
Calcium (Ca)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chromium (Cr)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Iron (Fe)-Total	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)-Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese (Mn)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Mercury (Hg)-Total	<0.000050	<0.000050	<0.000020	<0.000050		<0.000050	<0.000050
Molybdenum (Mo)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus (P)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

APPENDIX A – Water Quality
APPENDIX A1: QA/QC – Travel Blanks 2009

	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK
Date Sampled	20-Jul-09	06-AUG-09	20-AUG-09	01 Sep 2009	16-Sep-09	7-Oct-09	20-Oct-09
Silicon (Si)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silver (Ag)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium (Sr)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Metals							
Aluminum (Al)-Dissolved	-	-	-	-	-	-	-
Antimony (Sb)-Dissolved	-	-	-	-	-	-	-
Arsenic (As)-Dissolved	-	-	-	-	-	-	-
Barium (Ba)-Dissolved	-	-	-	-	-	-	-
Beryllium (Be)-Dissolved	-	-	-	-	-	-	-
Bismuth (Bi)-Dissolved	-	-	-	-	-	-	-
Boron (B)-Dissolved	-	-	-	-	-	-	-
Cadmium (Cd)-Dissolved	-	-	-	-	-	-	-
Calcium (Ca)-Dissolved	-	-	-	-	-	-	-
Chromium (Cr)-Dissolved	-	-	-	-	-	-	-
Cobalt (Co)-Dissolved	-	-	-	-	-	-	-
Copper (Cu)-Dissolved	-	-	-	-	-	-	-
Iron (Fe)-Dissolved	-	-	-	-	-	-	-
Lead (Pb)-Dissolved	-	-	-	-	-	-	-
Lithium (Li)-Dissolved	-	-	-	-	-	-	-
Magnesium (Mg)-Dissolved	-	-	-	-	-	-	-
Manganese (Mn)-Dissolved	-	-	-	-	-	-	-
Mercury (Hg)-Dissolved	-	-	-	-		-	-
Molybdenum (Mo)-Dissolved	-	-	-	-	-	-	-
Nickel (Ni)-Dissolved	-	-	-	-	-	-	-
Phosphorus (P)-Dissolved	-	-	-	-	-	-	-
Potassium (K)-Dissolved	-	-	-	-	-	-	-
Selenium (Se)-Dissolved	-	-	-	-	-	-	-
Silicon (Si)-Dissolved	-	-	-	-	-	-	-
Silver (Ag)-Dissolved	-	-	-	-	-	-	-
Sodium (Na)-Dissolved	-	-	-	-	-	-	-
Strontium (Sr)-Dissolved	-	-	-	-	-	-	-
Thallium (Tl)-Dissolved	-	-	-	-	-	-	-
Tin (Sn)-Dissolved	-	-	-	-	-	-	-
Titanium (Ti)-Dissolved	-	-	-	-	-	-	-
Uranium (U)-Dissolved	-	-	-	-	-	-	-
Vanadium (V)-Dissolved	-	-	-	-	-	-	-
Zinc (Zn)-Dissolved	-	-	-	-	-	-	-
Detectable values							

Travel Blanks for the 2010 Surface Water Monitoring Program

	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	Filter Blanks	Filter Blanks
Date Sampled	31-MAR-10	06-MAY-10	22-MAY-10	02-JUN-10	11-JUL-10	18-AUG-10	16-SEP-10	16-SEP-10	16-SEP-10
Physical Tests									
Conductivity	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-
Hardness (as CaCO3)	<1.0	<1.0	<1.0	<1.0	-	<0.50	<0.50	<0.50	<0.50
pH	5.44	5.63	5.65	5.67	5.68	5.63	5.84	-	-
Total Suspended Solids	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	-	-
Total Dissolved Solids	<10	<10	<10	<10	<10	<10	<10	-	-
Turbidity	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
Anions and Nutrients									
Alkalinity, Total (as CaCO3)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-
Ammonia as N	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-
Bromide (Br)	<0.050	<0.050		<0.050	<0.050	<0.050	<0.050	-	-
Chloride (Cl)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	-
Fluoride (Fl)	<0.020	<0.020		<0.020	<0.020	<0.020	<0.020	-	-
Nitrate (as N)	0.0091	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-
Nitrite (as N)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Total Kjeldahl Nitrogen	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	-
Total Nitrogen	<0.060	<0.060	<0.060	<0.060	<0.060	<0.0025	<0.0025	-	-
Ortho Phosphate as P	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Total Dissolved Phosphate As P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	-	-
Total Phosphate as P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	-	-
Sulfate (SO4)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	-	-
Cyanides									
Cyanide, Weak Acid Diss	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-
Cyanide, Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-
Organic/Inorganic Carbon									
Dissolved Organic Carbon	<0.50	<0.50	<0.50	-	<0.50	<0.50	0.56	-	-
Total Organic Carbon				<0.20					
Total Metals									
Aluminum (Al)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Antimony (Sb)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Arsenic (As)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Barium (Ba)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	-	-
Bismuth (Bi)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	-	-
Boron (B)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Cadmium (Cd)-Total	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	-	-
Calcium (Ca)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	-
Chromium (Cr)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	-	-
Cobalt (Co)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Copper (Cu)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Iron (Fe)-Total	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	-	-
Lead (Pb)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-
Lithium (Li)-Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-
Magnesium (Mg)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	-	-
Manganese (Mn)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-
Mercury (Hg)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	-	-
Molybdenum (Mo)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	-	-
Nickel (Ni)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	-	-
Phosphorus (P)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	-	-
Potassium (K)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-
Selenium (Se)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Silicon (Si)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	-	-

	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK	Filter Blanks	Filter Blanks
Date Sampled	31-MAR-10	06-MAY-10	22-MAY-10	02-JUN-10	11-JUL-10	18-AUG-10	16-SEP-10	16-SEP-10	16-SEP-10
Silver (Ag)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	-
Sodium (Na)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	-	-
Strontium (Sr)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Thallium (Tl)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Tin (Sn)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Titanium (Ti)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	-	-
Uranium (U)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	-	-
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Zinc (Zn)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Dissolved Metals									
Aluminum (Al)-Dissolved	-	-	-	-	-	-	-	<0.0010	<0.0010
Antimony (Sb)-Dissolved	-	-	-	-	-	-	-	<0.00010	<0.00010
Arsenic (As)-Dissolved	-	-	-	-	-	-	-	<0.00010	<0.00010
Barium (Ba)-Dissolved	-	-	-	-	-	-	-	<0.000050	<0.000050
Beryllium (Be)-Dissolved	-	-	-	-	-	-	-	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	-	-	-	-	-	-	-	<0.00050	<0.00050
Boron (B)-Dissolved	-	-	-	-	-	-	-	<0.010	<0.010
Cadmium (Cd)-Dissolved	-	-	-	-	-	-	-	<0.000017	<0.000017
Calcium (Ca)-Dissolved	-	-	-	-	-	-	-	<0.050	<0.050
Chromium (Cr)-Dissolved	-	-	-	-	-	-	-	<0.00050	<0.00050
Cobalt (Co)-Dissolved	-	-	-	-	-	-	-	<0.00010	<0.00010
Copper (Cu)-Dissolved	-	-	-	-	-	-	-	<0.00010	<0.00010
Iron (Fe)-Dissolved	-	-	-	-	-	-	-	<0.030	<0.030
Lead (Pb)-Dissolved	-	-	-	-	-	-	-	<0.000050	<0.000050
Lithium (Li)-Dissolved	-	-	-	-	-	-	-	<0.0050	<0.0050
Magnesium (Mg)-Dissolved	-	-	-	-	-	-	-	<0.10	<0.10
Manganese (Mn)-Dissolved	-	-	-	-	-	-	-	<0.000050	<0.000050
Mercury (Hg)-Dissolved	-	-	-	-	-	-	-	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	-	-	-	-	-	-	-	<0.000050	<0.000050
Nickel (Ni)-Dissolved	-	-	-	-	-	-	-	<0.00050	<0.00050
Phosphorus (P)-Dissolved	-	-	-	-	-	-	-	<0.30	<0.30
Potassium (K)-Dissolved	-	-	-	-	-	-	-	<2.0	<2.0
Selenium (Se)-Dissolved	-	-	-	-	-	-	-	<0.0010	<0.0010
Silicon (Si)-Dissolved	-	-	-	-	-	-	-	<0.050	<0.050
Silver (Ag)-Dissolved	-	-	-	-	-	-	-	<0.000010	<0.000010
Sodium (Na)-Dissolved	-	-	-	-	-	-	-	<2.0	<2.0
Strontium (Sr)-Dissolved	-	-	-	-	-	-	-	<0.00010	0.00017
Thallium (Tl)-Dissolved	-	-	-	-	-	-	-	<0.00010	<0.00010
Tin (Sn)-Dissolved	-	-	-	-	-	-	-	<0.00010	<0.00010
Titanium (Ti)-Dissolved	-	-	-	-	-	-	-	<0.010	<0.010
Uranium (U)-Dissolved	-	-	-	-	-	-	-	<0.000010	<0.000010
Vanadium (V)-Dissolved	-	-	-	-	-	-	-	<0.0010	<0.0010
Zinc (Zn)-Dissolved	-	-	-	-	-	-	-	<0.0010	<0.0010
Detectable values									

APPENDIX A – Water Quality
APPENDIX A1: QA/QC – Field Blanks 2007-2008

Field Blanks for the 2007-2008 Surface Water Monitoring Program

Parameter	Unit	15-AUG-07	29-AUG-07	12-SEP-07	20-Oct-07	19-NOV-07	26-APR-08	10-JUN-08
pH	–		5.59	5.57	5.49	5.68	-	-
Conductivity	µmho/cm		<2.0	<2.0	<2.0	<2.0	-	-
Total Dissolved Solids	mg/L		-	<10	<10	<10	-	-
Total Suspended Solids	mg/L		<3.0	<3.0	<3.0	<3.0	-	-
Hardness, $CaCO_2$	mg/L	<0.50	<0.50	<0.50	<0.70	<0.70	-	<0.70
Turbidity	NTU		<0.10	<0.10	<0.10	<0.10	-	-
Anions								
Alkalinity, $CaCO_2$	mg/L			<2.0	<2.0	<2.0	-	-
Chloride	mg/L		<0.50	<0.50	<0.50	<0.50	-	-
Fluroide	mg/L		<0.020	<0.020	<0.020	<0.020	-	-
Sulphate (SO_2)	mg/L		<0.50	<0.50	<0.50	<0.50	-	-
Bromide (Br)	mg/L				-	-	-	-
Nutrients								
Ammonia Nitrogen (NH_4)	mg/L	<0.020	<0.020	<0.0050	0.0061	<0.0050	-	-
Nitrate Nitrogen (NO_3)	mg/L		<0.0050	<0.0050	<0.0050	<0.0050	-	-
Nitrite Nitrogen (NO_2)	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	-	-
Nitrate and Nitrite as N	mg/L					-	-	-
Dissolved ortho-Phosphate	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	-	-
Total Dissolved Phosphorus	mg/L		<0.0020	<0.0020	<0.0020	<0.0020	-	-
Total Phosphorus	mg/L		<0.0020	<0.0020	<0.0020	<0.0020	-	-
Total Kjeldahl Nitrogen	mg/L		<0.050	<0.050	<0.050	<0.050	-	-
Cyanide								
Total Cyanide (CN-)	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-
Cyanide, Weak Acid Diss	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	-	-
Total Metals								
Aluminum, total	mg/L	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050	<0.0010	<0.0050
Antimony, total	mg/L	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00010	<0.00050
Arsenic, total	mg/L	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00010	<0.00050
Barium, total	mg/L	<0.000050	<0.000080	<0.000050	<0.020	<0.020	<0.000050	<0.020
Beryllium, total	mg/L	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.00050	<0.0010
Bismuth, total	mg/L	<0.00050	<0.00050	<0.00050		-	<0.00050	
Boron, total	mg/L	<0.010	<0.010	<0.010	<0.10	<0.10	<0.010	<0.10
Cadmium, total	mg/L	<0.000017	<0.000050	<0.000050	<0.000017	<0.000017	<0.000017	<0.000017
Calcium, total	mg/L	<0.050	<0.050	<0.050	<0.10	<0.10	<0.050	<0.10
Chromium, total	mg/L	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.00050	<0.0010
Cobalt, total	mg/L	<0.00010	<0.00010	<0.00010	<0.00030	<0.00030	<0.00010	<0.00030
Copper, total	mg/L	<0.00010	<0.00010	<0.00010	<0.0010	<0.0010	<0.00010	<0.0010
Iron, total	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead, total	mg/L	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.000050	<0.00050
Lithium, total	mg/L	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium, toal	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese, total	mg/L	<0.000050	<0.000050	<0.000050	<0.00030	<0.00030	<0.000050	<0.00030
Mercury, total	mg/L				<0.000050	<0.000020		<0.000020
Molybdenum, total	mg/L	<0.000050	<0.000050	<0.000050	<0.0010	<0.0010	<0.000050	<0.0010
Nickel, total	mg/L	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.00050	<0.0010
Phosphorus, total	mg/L	<0.30	<0.30	<0.30		-	<0.30	
Potassium, total	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium, total	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

APPENDIX A – Water Quality
APPENDIX A1: QA/QC – Field Blanks 2007-2008

Parameter	Unit	15-AUG-07	29-AUG-07	12-SEP-07	20-Oct-07	19-NOV-07	26-APR-08	10-JUN-08
Silicon, total	mg/L	<0.050	<0.050	<0.050		-	<0.050	
Silver , total	mg/L	<0.000010	<0.000010	<0.000010	<0.000020	<0.000020	<0.000010	<0.000020
Sodium, total	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium, total	mg/L	<0.00010	<0.00010	<0.00010		-	<0.00010	
Thallium, total	mg/L	<0.00010	<0.00010	<0.00010	<0.00020	<0.00020	<0.00010	<0.00020
Tin, total	mg/L	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00010	<0.00050
Titanium, total	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium, total	mg/L	<0.000010	<0.000010	<0.000010	<0.00020	<0.00020	<0.000010	<0.00020
Vanadium, total	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc, total	mg/L	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050	<0.0010	<0.0050
Dissolved Metals								
Aluminum, diss.	mg/L	-	-	-	-	-	-	-
Antimony, diss.	mg/L	-	-	-	-	-	-	-
Arsenic, diss.	mg/L	-	-	-	-	-	-	-
Barium, diss.	mg/L	-	-	-	-	-	-	-
Beryllium, diss.	mg/L	-	-	-	-	-	-	-
Bismuth, diss.	mg/L	-	-	-	-	-	-	-
Boron, diss.	mg/L	-	-	-	-	-	-	-
Cadmium, diss.	mg/L	-	-	-	-	-	-	-
Calcium, diss.	mg/L	-	-	-	-	-	-	-
Chromium, diss.	mg/L	-	-	-	-	-	-	-
Cobalt, diss.	mg/L	-	-	-	-	-	-	-
Copper, diss.	mg/L	-	-	-	-	-	-	-
Iron, diss.	mg/L	-	-	-	-	-	-	-
Lead, diss.	mg/L	-	-	-	-	-	-	-
Lithium, diss.	mg/L	-	-	-	-	-	-	-
Magnesium, diss.	mg/L	-	-	-	-	-	-	-
Manganese, diss.	mg/L	-	-	-	-	-	-	-
Mercury (Hg)-Dissolved	mg/L	-	-	-	-	-	-	-
Molybdenum, diss.	mg/L	-	-	-	-	-	-	-
Nickel, diss.	mg/L	-	-	-	-	-	-	-
Phosphorus, diss.	mg/L	-	-	-	-	-	-	-
Potassium, diss.	mg/L	-	-	-	-	-	-	-
Selenium, diss.	mg/L	-	-	-	-	-	-	-
Silicon, diss.	mg/L	-	-	-	-	-	-	-
Silver, diss.	mg/L	-	-	-	-	-	-	-
Sodium, diss.	mg/L	-	-	-	-	-	-	-
Strontium, diss.	mg/L	-	-	-	-	-	-	-
Thallium, diss.	mg/L	-	-	-	-	-	-	-
Tin, diss.	mg/L	-	-	-	-	-	-	-
Titanium, diss.	mg/L	-	-	-	-	-	-	-
Uranium, diss.	mg/L	-	-	-	-	-	-	-
Vanadium, diss.	mg/L	-	-	-	-	-	-	-
Zinc, diss.	mg/L	-	-	-	-	-	-	-
Organic Parameters								
Total Organic Carbon	mg/L	-	-	-	-	-	<0.50	<0.50
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	-
Detectable values								

APPENDIX A – Water Quality
APPENDIX A1-2: QA/QC – Field Blanks 2009

Field Blanks for the 2009 Surface Water Monitoring Program

	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
Date Sampled	06-AUG-09	02-SEP-09	16 Sep 2009	07-OCT-09	20-Oct-09
Physical Tests					
Conductivity	<2.0	<2.0	<2.0	<2.0	<2.0
Hardness (as $CaCO_3$)	<1.0	<1.0	<1.0	<1.0	<1.0
pH	5.83	5.61	5.73	5.59	5.53
Total Suspended Solids	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	<10	<10	<10	<10	<10
Turbidity	<0.10	<0.10	<0.10	<0.10	<0.10
Anions and Nutrients					
Alkalinity, Total (as $CaCO_3$)	<2.0	<2.0	<2.0	<2.0	<2.0
Ammonia as N	<0.0050	<0.0050	<0.020	<0.0050	<0.020
Bromide (Br)	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	<0.020	<0.020	<0.020	<0.020	<0.020
Nitrate (as N)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	<0.050	<0.050	<0.050	<0.050	<0.050
Total Nitrogen	<0.060	<0.060	<0.060	<0.060	<0.060
Ortho Phosphate as P	<0.0010	-	<0.0010	-	<0.0010
Total Dissolved Phosphate As P	<0.0020	-	<0.0020	-	<0.0020
Total Phosphate as P	<0.0020	-	<0.0020	-	<0.0020
Sulfate (SO_4)	<0.50	<0.50	<0.50	<0.50	<0.50
Cyanides					
Cyanide, Weak Acid Diss	<0.0050	-	<0.0050	-	<0.0050
Cyanide, Total	<0.0050	-	<0.0050	-	<0.0050
Organic/Inorganic Carbon					
Dissolved Organic Carbon	<0.50	<0.50	<0.50	<0.50	<0.50
Total Metals					
Aluminum (Al)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Antimony (Sb)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Total	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	<0.000017	<0.000017	<0.000017	<0.000017	<0.000050
Calcium (Ca)-Total	<0.050	<0.050	<0.050	<0.050	<0.050
Chromium (Cr)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Iron (Fe)-Total	<0.030	<0.030	<0.030	<0.030	<0.030

APPENDIX A – Water Quality
APPENDIX A1-2: QA/QC – Field Blanks 2009

	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
Date Sampled	06-AUG-09	02-SEP-09	16 Sep 2009	07-OCT-09	20-Oct-09
Lead (Pb)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)-Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese (Mn)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Mercury (Hg)-Total	<0.000050	<0.000050		<0.000050	<0.000050
Molybdenum (Mo)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus (P)-Total	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)-Total	<0.050	<0.050	<0.050	<0.050	<0.050
Silver (Ag)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Total	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium (Sr)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Metals					
Aluminum (Al)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Antimony (Sb)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	<0.000017	<0.000017	<0.000050
Calcium (Ca)-Dissolved	<0.050	<0.050	<0.050	<0.050	<0.050
Chromium (Cr)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Iron (Fe)-Dissolved	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Dissolved	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese (Mn)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Mercury (Hg)-Dissolved	<0.000050	<0.000050		<0.000050	<0.000050
Molybdenum (Mo)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30	<0.30

APPENDIX A – Water Quality
APPENDIX A1-2: QA/QC – Field Blanks 2009

	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
Date Sampled	06-AUG-09	02-SEP-09	16 Sep 2009	07-OCT-09	20-Oct-09
Potassium (K)-Dissolved	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)-Dissolved	<0.050	<0.050	<0.050	<0.050	<0.050
Silver (Ag)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)-Dissolved	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium (Sr)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Detectable values					

Field Blanks for the 2010 Surface Water Monitoring Program

	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
Date Sampled	31-MAR-10	06-MAY-10	02-JUN-10	11-JUL-10	18-AUG-10	16-SEP-10
Physical Tests						
Conductivity	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Hardness (as $CaCO_3$)	<1.0	<1.0	<1.0	<0.50	<0.50	<0.50
pH	5.65	5.81	5.90	5.71	6.17	5.67
Total Suspended Solids	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Total Dissolved Solids	<10	<10	<10	<10	<10	<10
Turbidity	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anions and Nutrients						
Alkalinity, Total (as $CaCO_3$)	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Ammonia as N	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Bromide (Br)	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Fluoride (F)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
Nitrate (as N)	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrite (as N)	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Kjeldahl Nitrogen	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Total Nitrogen	<0.050	<0.060	<0.060	<0.060	<0.0025	<0.0025
Ortho Phosphate as P	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total Dissolved Phosphate As P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total Phosphate as P	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Sulfate (SO_4)	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cyanides						
Cyanide, Weak Acid Diss	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Cyanide, Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Organic/Inorganic Carbon						
Dissolved Organic Carbon	<0.50	<0.50	<0.20	<0.50	<0.50	<0.50
Total Metals						
Aluminum (Al)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Antimony (Sb)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Beryllium (Be)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)-Total	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017	<0.000017
Calcium (Ca)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chromium (Cr)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Iron (Fe)-Total	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)-Total	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Total	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese (Mn)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Mercury (Hg)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010
Molybdenum (Mo)-Total	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)-Total	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Phosphorus (P)-Total	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Selenium (Se)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)-Total	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Silver (Ag)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010

	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK	FIELD BLANK
Date Sampled	31-MAR-10	06-MAY-10	02-JUN-10	11-JUL-10	18-AUG-10	16-SEP-10
Sodium (Na)-Total	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium (Sr)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)-Total	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Total	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Total	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)-Total	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Dissolved Metals						
Aluminum (Al)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Antimony (Sb)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Arsenic (As)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Barium (Ba)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	-	-
Beryllium (Be)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	-	-
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	-	-
Boron (B)-Dissolved	<0.010	<0.010	<0.010	<0.010	-	-
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	<0.000017	<0.000017	-	-
Calcium (Ca)-Dissolved	<0.050	<0.050	<0.050	<0.050	-	-
Chromium (Cr)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	-	-
Cobalt (Co)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Copper (Cu)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Iron (Fe)-Dissolved	<0.030	<0.030	<0.030	<0.030	-	-
Lead (Pb)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	-	-
Lithium (Li)-Dissolved	<0.0050	<0.0050	<0.0050	<0.0050	-	-
Magnesium (Mg)-Dissolved	<0.10	<0.10	<0.10	<0.10	-	-
Manganese (Mn)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	-	-
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	-	-
Molybdenum (Mo)-Dissolved	<0.000050	<0.000050	<0.000050	<0.000050	-	-
Nickel (Ni)-Dissolved	<0.00050	<0.00050	<0.00050	<0.00050	-	-
Phosphorus (P)-Dissolved	<0.30	<0.30	<0.30	<0.30	-	-
Potassium (K)-Dissolved	<2.0	<2.0	<2.0	<2.0	-	-
Selenium (Se)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Silicon (Si)-Dissolved	<0.050	<0.050	<0.050	<0.050	-	-
Silver (Ag)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	-	-
Sodium (Na)-Dissolved	<2.0	<2.0	<2.0	<2.0	-	-
Strontium (Sr)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Thallium (Tl)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Tin (Sn)-Dissolved	<0.00010	<0.00010	<0.00010	<0.00010	-	-
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	<0.010	-	-
Uranium (U)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	-	-
Vanadium (V)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Zinc (Zn)-Dissolved	<0.0010	<0.0010	<0.0010	<0.0010	-	-
Detectable values						

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2007-2008

Laboratory Replicates for the 2007-2008 Surface Water Monitoring Program

RPD is Relative Percent Difference (Difference / Mean expressed as a percent). Used for results which are >10x detection limit

Diff is the difference between the replicate values in concentration units. Used where replicate 1 value is <10x detection limit.

18-Dec-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Total Metals							
Aluminum (Al)-Total	0.0070	0.0081	mg/L	-	-	0.0011	0.02
Antimony (Sb)-Total	0.00113	0.00115	mg/L	-	-	0.00003	0.002
Arsenic (As)-Total	0.0388	0.0396	mg/L	2.1	20	-	-
Barium (Ba)-Total	0.033	0.034	mg/L	-	-	0.001	0.08
Beryllium (Be)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Boron (B)-Total	<0.10	<0.10	mg/L	N/A	20	-	-
Cadmium (Cd)-Total	<0.000017	<0.000010	mg/L	N/A	20	-	-
Calcium (Ca)-Total	16.0	15.9	mg/L	0.52	20	-	-
Chromium (Cr)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Cobalt (Co)-Total	<0.00030	<0.00030	mg/L	N/A	20	-	-
Copper (Cu)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Iron (Fe)-Total	<0.030	<0.030	mg/L	N/A	20	-	-
Lead (Pb)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Lithium (Li)-Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
Magnesium (Mg)-Total	3.99	4.00	mg/L	0.10	20	-	-
Manganese (Mn)-Total	<0.00030	<0.00030	mg/L	N/A	20	-	-
Mercury (Hg)-Total	<0.000020	<0.000020	mg/L	N/A	20	-	-
Molybdenum (Mo)-Total	0.0017	0.0018	mg/L	-	-	0.0001	0.004
Nickel (Ni)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Silver (Ag)-Total	<0.000020	<0.000020	mg/L	N/A	20	-	-
Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
Thallium (Tl)-Total	<0.00020	<0.00020	mg/L	N/A	20	-	-
Tin (Sn)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
Uranium (U)-Total	0.00034	0.00029	mg/L	-	-	0.00004	0.0008
Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Zinc (Zn)-Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
Dissolved Metals							
Aluminum (Al)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-
Antimony (Sb)-Dissolved	0.00111	0.00110	mg/L	-	-	0.00001	0.002
Arsenic (As)-Dissolved	0.0357	0.0356	mg/L	0.14	20	-	-
Barium (Ba)-Dissolved	0.042	0.042	mg/L	-	-	0.000	0.08
Beryllium (Be)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Boron (B)-Dissolved	<0.10	<0.10	mg/L	N/A	20	-	-
Cadmium (Cd)-Dissolved	<0.000017	0.000014	mg/L	-	-	0.000003	0.00004
Calcium (Ca)-Dissolved	15.3	15.4	mg/L	0.33	20	-	-
Chromium (Cr)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Cobalt (Co)-Dissolved	<0.00030	<0.00030	mg/L	N/A	20	-	-
Copper (Cu)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Iron (Fe)-Dissolved	<0.030	<0.030	mg/L	N/A	20	-	-
Lead (Pb)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Lithium (Li)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-
Magnesium (Mg)-Dissolved	3.92	3.98	mg/L	1.3	20	-	-

16-Aug-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Total Metals							
Aluminum (Al)-Total	0.0127	0.0139	mg/L	8.5	20	-	-
Antimony (Sb)-Total	0.00024	0.00024	mg/L	-	-	0.00000	0.0004
Arsenic (As)-Total	0.00072	0.00075	mg/L	-	-	0.00002	0.0004
Barium (Ba)-Total	0.0329	0.0334	mg/L	1.6	20	-	-
Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
Cadmium (Cd)-Total	<0.000017	<0.000017	mg/L	N/A	20	-	-
Calcium (Ca)-Total	36.9	36.3	mg/L	1.6	20	-	-
Chromium (Cr)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Cobalt (Co)-Total	0.00012	0.00012	mg/L	-	-	0.00000	0.0004
Copper (Cu)-Total	0.00046	0.00054	mg/L	-	-	0.00007	0.0004
Iron (Fe)-Total	0.079	0.078	mg/L	-	-	0.001	0.12
Lead (Pb)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
Lithium (Li)-Total	0.0052	0.0054	mg/L	-	-	0.0001	0.02
Magnesium (Mg)-Total	12.4	12.3	mg/L	0.55	20	-	-
Manganese (Mn)-Total	0.0442	0.0454	mg/L	2.6	20	-	-
Molybdenum (Mo)-Total	0.000064	0.000060	mg/L	-	-	0.000004	0.0002
Nickel (Ni)-Total	0.00078	0.00083	mg/L	-	-	0.00006	0.002
Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-
Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Silicon (Si)-Total	3.42	3.37	mg/L	1.7	20	-	-
Silver (Ag)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-
Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
Strontium (Sr)-Total	0.170	0.172	mg/L	0.88	20	-	-
Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
Uranium (U)-Total	0.000683	0.000733	mg/L	7.2	20	-	-
Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Zinc (Zn)-Total	0.0010	0.0013	mg/L	-	-	0.0003	0.004
Dissolved Metals							
Aluminum (Al)-Dissolved	0.0122	0.0121	mg/L	0.64	20	-	-
Antimony (Sb)-Dissolved	0.00063	0.00064	mg/L	-	-	0.00001	0.0004
Arsenic (As)-Dissolved	0.0747	0.0752	mg/L	0.79	20	-	-
Barium (Ba)-Dissolved	0.0260	0.0261	mg/L	0.13	20	-	-
Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Boron (B)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	mg/L	N/A	20	-	-
Calcium (Ca)-Dissolved	9.23	9.60	mg/L	3.9	20	-	-
Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Cobalt (Co)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Copper (Cu)-Dissolved	0.00013	0.00017	mg/L	-	-	0.00004	0.0004

30-Aug-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Anions and Nutrients							
Ammonia as N	0.023	0.214	mg/L	7.6	20	-	-
Dissolved Metals							
Calcium (Ca)-	43.9	44.5	mg/L	1.4	20	-	-
Iron (Fe)-Diss	0.038	0.049	mg/L	-	-	0.012	0.12
Magnesium (M	10.1	10.2	mg/L	0.87	20	-	-
Phosphorus (I	<0.30	<0.30	mg/L	N/A	20	-	-
Potassium (K)	<2.0	<2.0	mg/L	N/A	20	-	-
Silicon (Si)-Di	3.76	3.80	mg/L	1.1	20	-	-
Sodium (Na)-I	<2.0	<2.0	mg/L	N/A	20	-	-
Titanium (Ti)-I	<0.010	<0.010	mg/L	N/A	20	-	-
Anions and Nutrients							
Total Dissolve	<0.0020	<0.0020	mg/L	N/A	20	-	-
Total Phospha	<0.0020	0.0022	mg/L	N/A	20	-	-
Physical Tests							
Total Suspend	<3.0	<3.0	mg/L	N/A	25	-	-
Anions and Nutrients							
Ammonia as N	<0.020	<0.020	mg/L	N/A	20	-	-
Ortho Phosph	<0.0010	<0.0010	mg/L	N/A	20	-	-
Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-
Fluoride (F)	0.077	0.077	mg/L	-	-	0.000	0.08
Sulfate (SO4)	12.7	12.6	mg/L	0.17	20	-	-
Nitrate (as N)	<0.0050	<0.0050	mg/L	N/A	20	-	-
Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-
Physical Tests							
Conductivity	269	272	uS/cm	1.1	20	-	-
pH	8.23	8.28	pH	0.58	20	-	-
Turbidity	0.51	0.47	NTU	-	-	0.040	0.4
Anions and Nutrients							
Total Dissolve	<0.0020	<0.0020	mg/L	N/A	20	-	-
Total Phospha	<0.0020	<0.0020	mg/L	N/A	20	-	-
Cyanides							
Cyanide, Wea	<0.0050	<0.0050	mg/L	N/A	20	-	-
Cyanide, Tota	<0.0050	<0.0050	mg/L	N/A	20	-	-

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2007-2008

18-Dec-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	16-Aug-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	30-Aug-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Manganese (Mn)-Dissolved	<0.00030	<0.00030	mg/L	N/A	20	-	-	Iron (Fe)-Dissolved	<0.030	<0.030	mg/L	N/A	20	-	-								
Mercury (Hg)-Dissolved	<0.000020	<0.000020	mg/L	N/A	20	-	-	Lead (Pb)-Dissolved	<0.000050	<0.000050	mg/L	N/A	20	-	-								
Molybdenum (Mo)-Dissolved	0.0018	0.0018	mg/L	-	-	0.0000	0.004	Lithium (Li)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-								
Nickel (Ni)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Magnesium (Mg)-Dissolved	1.50	1.54	mg/L	2.4	20	-	-								
Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-	Manganese (Mn)-Dissolved	0.00127	0.00124	mg/L	1.7	20	-	-								
Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Molybdenum (Mo)-Dissolved	0.00106	0.00101	mg/L	4.4	20	-	-								
Silver (Ag)-Dissolved	<0.000020	<0.000020	mg/L	N/A	20	-	-	Nickel (Ni)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-								
Sodium (Na)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-	Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L	N/A	20	-	-								
Thallium (Tl)-Dissolved	<0.00020	<0.00020	mg/L	N/A	20	-	-	Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-								
Tin (Sn)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-								
Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-	Silicon (Si)-Dissolved	5.65	5.85	mg/L	3.5	20	-	-								
Uranium (U)-Dissolved	0.00048	0.00048	mg/L	-	-	0.00000	0.0008	Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-								
Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Sodium (Na)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-								
Zinc (Zn)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-	Strontium (Sr)-Dissolved	0.0532	0.0541	mg/L	1.7	20	-	-								
Anions and Nutrients								Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-								
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-	-	Tin (Sn)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-								
Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-	-	Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-								
Total Kjeldahl Nitrogen	<0.050	<0.050	mg/L	N/A	20	-	-	Uranium (U)-Dissolved	0.000334	0.000337	mg/L	0.96	20	-	-								
Cyanides								Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-								
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-	Zinc (Zn)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-								
Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-	**Cyanides**															
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-								
Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-	Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-								
Anions and Nutrients								**Physical Tests**															
Ortho Phosphate as P	<0.0010	<0.0010	mg/L	N/A	20	-	-	Total Dissolved Solids	168	166	mg/L	1.5	20	-	-								
Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-	-	Total Suspended Solids	<3.0	<3.0	mg/L	N/A	25	-	-								
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-	-	**Anions and Nutrients**															
Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-	-	Nitrate (as N)	0.0457	0.0462	mg/L	-	-	0.0005	0.02								
Organic Parameters								Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-								
Dissolved Organic Carbon	<0.50	<0.50	mg/L	N/A	20	-	-	Total Kjeldahl Nitrogen	<0.050	<0.050	mg/L	N/A	20	-	-								
								Alkalinity, Total (as CaCO3)	89.0	84.2	mg/L	5.4	20	-	-								
								Organic Parameters															
								Dissolved Organic Carbon	2.35	2.37	mg/L	-	-	0.02	2								

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2007-2008

13-Sep-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Physical Tests							
Conductivity	291	292	uS/cm	0.34	20	-	-
pH	7.21	7.60	pH	5.3	-	-	-
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	81.3	78.1	mg/L	4.0	20	-	-
Organic Parameters							
Dissolved Organic Carbon	1.73	1.70	mg/L	-	-	0.03	2
Anions and Nutrients							
Total Dissolved Phosphate As P	0.0057	0.0081	mg/L	-	-	0.0024	0.008
Total Phosphate as P	0.0068	0.0070	mg/L	-	0.0002	0.008	
Ammonia as N	<0.0050	<0.0050	mg/L	N/A	-	-	
Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-
Fluoride (F)	0.142	0.141	mg/L	-	-	0.001	0.08
Sulfate (SO4)	54.6	54.6	mg/L	0.073	-	-	-
Nitrate (as N)	0.0309	0.0311	mg/L	-	0.0002	0.02	
Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-
Ortho Phosphate as P	0.0017	0.0015	mg/L	-	0.0002	0.004	

27-Sep-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Physical Tests							
Total Dissolved Solids	182	182	mg/L	0.0	20	-	-
Anions and Nutrients							
Total Dissolved Phosphate As P	0.0027	0.0032	mg/L	-	-	0.0005	0.008
Total Phosphate as P	0.0051	0.0037	mg/L	-	-	0.0014	0.008
Organic Parameters							
Dissolved Organic Carbon	4.51	4.49	mg/L	-	-	0.02	2
Physical Tests							
Turbidity	1.11	1.01	NTU	9.4	39	-	-
Anions and Nutrients							
Total Kjeldahl Nitrogen	0.072	0.075	mg/L	-	-	0.003	0.2
Cyanides							
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
Cyanide, Total	<0.0050	0.0053	mg/L	N/A	20	-	-
Anions and Nutrients							
Ortho Phosphate as P	0.0016	0.0016	mg/L	-	-	0.0000	0.004
Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-	-
Physical Tests							
Conductivity	108	108	uS/cm	0.19	20	-	-
pH	7.95	7.94	pH	0.18	20	-	-
Cyanides							
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-

22-Oct-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit
Dissolved Metals					
Aluminum (Al)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20
Antimony (Sb)-Dissolved	0.00130	0.00131	mg/L	-	-
Arsenic (As)-Dissolved	0.0338	0.0338	mg/L	0.050	20
Barium (Ba)-Dissolved	0.049	0.049	mg/L	-	-
Beryllium (Be)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20
Boron (B)-Dissolved	<0.10	<0.10	mg/L	N/A	20
Cadmium (Cd)-Dissolved	<0.000017	0.000011	mg/L	-	-
Calcium (Ca)-Dissolved	21.4	21.4	mg/L	0.24	20
Chromium (Cr)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20
Cobalt (Co)-Dissolved	<0.00030	<0.00030	mg/L	N/A	20
Copper (Cu)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20
Iron (Fe)-Dissolved	0.034	<0.030	mg/L	N/A	20
Lead (Pb)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20
Lithium (Li)-Dissolved	0.0083	0.0081	mg/L	-	-
Magnesium (Mg)-Dissolved	7.00	7.16	mg/L	2.2	20
Manganese (Mn)-Dissolved	0.00427	0.00421	mg/L	1.5	20
Mercury (Hg)-Dissolved	<0.000050	<0.000050	mg/L	N/A	26
Molybdenum (Mo)-Dissolved	0.0015	0.0014	mg/L	-	-
Nickel (Ni)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20
Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20
Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20
Silver (Ag)-Dissolved	<0.000020	<0.000020	mg/L	N/A	20
Sodium (Na)-Dissolved	2.0	<2.0	mg/L	N/A	20
Thallium (Tl)-Dissolved	<0.00020	<0.00020	mg/L	N/A	20
Tin (Sn)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20
Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20
Uranium (U)-Dissolved	0.00075	0.00074	mg/L	-	-
Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20
Zinc (Zn)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20
Total Metals					
Aluminum (Al)-Total	0.0137	0.0137	mg/L	-	-
Antimony (Sb)-Total	<0.00050	<0.00050	mg/L	N/A	20
Arsenic (As)-Total	0.00600	0.00601	mg/L	0.060	20
Barium (Ba)-Total	0.054	0.053	mg/L	-	-
Beryllium (Be)-Total	<0.0010	<0.0010	mg/L	N/A	20
Boron (B)-Total	<0.10	<0.10	mg/L	N/A	20
Cadmium (Cd)-Total	0.000019	0.000022	mg/L	-	-
Calcium (Ca)-Total	53.7	54.0	mg/L	0.58	20
Chromium (Cr)-Total	<0.0010	<0.0010	mg/L	N/A	20
Cobalt (Co)-Total	<0.00030	<0.00030	mg/L	N/A	20
Copper (Cu)-Total	<0.0010	<0.0010	mg/L	N/A	20
Iron (Fe)-Total	0.038	0.035	mg/L	-	-
Lead (Pb)-Total	<0.00050	<0.00050	mg/L	N/A	20
Lithium (Li)-Total	<0.0050	<0.0050	mg/L	N/A	20
Magnesium (Mg)-Total	8.04	7.81	mg/L	2.9	20

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2007-2008

13-Sep-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	27-Sep-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	22-Oct-07	Replicate 1	Replicate 2	Units	RPD	RPD Limit
																Manganese (Mn)-Total	0.00936	0.00931	mg/L	0.54	20
																Mercury (Hg)-Total	<0.000050	<0.000050	mg/L	N/A	26
																Molybdenum (Mo)-Total	<0.0010	<0.0010	mg/L	N/A	20
																Nickel (Ni)-Total	<0.0010	<0.0010	mg/L	N/A	20
																Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20
																Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20
																Silver (Ag)-Total	<0.000020	<0.000020	mg/L	N/A	20
																Sodium (Na)-Total	2.1	<2.0	mg/L	N/A	20
																Thallium (Tl)-Total	<0.00020	<0.00020	mg/L	N/A	20
																Tin (Sn)-Total	<0.00050	<0.00050	mg/L	N/A	20
																Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20
																Uranium (U)-Total	0.00079	0.00078	mg/L	-	-
																Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20
																L569022-8	Water	WG679959-5	Zinc (Zn)-T	<0.0050	<0.0050
																Anions and Nutrients					
																Total Dissolved Phosphate As P	0.0029	0.0021	mg/L	-	-
																Total Phosphate as P	0.0030	0.0030	mg/L	-	-
																Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20
																Fluoride (F)	<0.020	<0.020	mg/L	N/A	20
																Sulfate (SO4)	<0.50	<0.50	mg/L	N/A	20
																Nitrate (as N)	<0.0050	<0.0050	mg/L	N/A	20
																Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20
																Total Kjeldahl Nitrogen	0.058	0.058	mg/L	-	-
																Alkalinity, Total (as CaCO3)	55.0	56.1	mg/L	1.9	20
																Organic Parameters					
																Dissolved Organic Carbon	1.51	1.50	mg/L	-	-
																Physical Tests					
																Conductivity	178	178	uS/cm	0.056	20
																pH	8.01	8.01	pH	0.0069	20
																Total Dissolved Solids	183	174	mg/L	4.8	20
																Total Suspended Solids	3.5	3.0	mg/L	-	-
																Cyanides					
																Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20
																Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2007-2008

Diff	Diff Limit	28-Apr-08	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	13-Jun-08	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
		Dissolved Metals								**Anions and Nutrients**							
-	-	Aluminum (Al)-Dissolved	0.0019	0.0019	mg/L	-	-	0.0000	0.004	Bromide (Br)	<0.050	<0.050	mg/L	N/A	20	-	-
0.00002	0.002	Antimony (Sb)-Dissolved	0.00028	0.00027	mg/L	-	-	0.00001	0.0004	Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-
-	-	Arsenic (As)-Dissolved	0.00577	0.00570	mg/L	1.2	20	-	-	Fluoride (F)	0.071	0.071	mg/L	-	-	0.001	0.08
0.000	0.08	Barium (Ba)-Dissolved	0.0514	0.0511	mg/L	0.72	20	-	-	Sulfate (SO4)	9.49	9.49	mg/L	0.083	20	-	-
-	-	Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	**Cyanides**							
-	-	Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
0.000002	0.00004	Boron (B)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-	Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
-	-	Cadmium (Cd)-Dissolved	<0.000017	<0.000017	mg/L	N/A	20	-	-	**Dissolved Metals**							
-	-	Calcium (Ca)-Dissolved	64.0	63.3	mg/L	1.1	20	-	-	Aluminum (Al)-Dissolved	0.0227	0.0226	mg/L	-	-	0.0000	0.02
-	-	Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Antimony (Sb)-Dissolved	0.00106	0.00105	mg/L	-	-	0.00001	0.002
-	-	Cobalt (Co)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-	Arsenic (As)-Dissolved	0.0278	0.0279	mg/L	0.49	20	-	-
-	-	Copper (Cu)-Dissolved	0.00037	0.00037	mg/L	-	-	0.00000	0.0004	Barium (Ba)-Dissolved	0.035	0.034	mg/L	-	-	0.000	0.08
-	-	Iron (Fe)-Dissolved	<0.030	<0.030	mg/L	N/A	20	-	-	Beryllium (Be)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
0.0003	0.02	Lead (Pb)-Dissolved	<0.000050	<0.000050	mg/L	N/A	20	-	-	Boron (B)-Dissolved	<0.10	<0.10	mg/L	N/A	20	-	-
-	-	Lithium (Li)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-	Cadmium (Cd)-Dissolved	<0.000017	<0.000010	mg/L	N/A	20	-	-
-	-	Magnesium (Mg)-Dissolved	10.3	10.1	mg/L	1.6	20	-	-	Calcium (Ca)-Dissolved	11.0	10.7	mg/L	2.1	20	-	-
-	-	Manganese (Mn)-Dissolved	0.0138	0.0134	mg/L	3.0	20	-	-	Chromium (Cr)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
0.0000	0.004	Molybdenum (Mo)-Dissolved	0.000736	0.000726	mg/L	1.3	20	-	-	Cobalt (Co)-Dissolved	<0.00030	<0.00030	mg/L	N/A	20	-	-
-	-	Nickel (Ni)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Copper (Cu)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
-	-	Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L	N/A	20	-	-	Iron (Fe)-Dissolved	<0.030	<0.030	mg/L	N/A	20	-	-
-	-	Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-	Lead (Pb)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
-	-	Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Lithium (Li)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-
-	-	Silicon (Si)-Dissolved	4.60	4.50	mg/L	2.2	20	-	-	Magnesium (Mg)-Dissolved	2.60	2.56	mg/L	1.4	20	-	-
-	-	Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-	Manganese (Mn)-Dissolved	0.00030	0.00042	mg/L	-	-	0.00012	0.0012
-	-	Sodium (Na)-Dissolved	2.3	2.1	mg/L	-	-	0.1	8	Mercury (Hg)-Dissolved	<0.000020	<0.000020	mg/L	N/A	20	-	-
-	-	Strontium (Sr)-Dissolved	0.207	0.208	mg/L	0.30	20	-	-	Molybdenum (Mo)-Dissolved	0.0017	0.0017	mg/L	-	-	0.0000	0.004
0.00001	0.0008	Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-	Nickel (Ni)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
-	-	Tin (Sn)-Dissolved	0.00033	0.00028	mg/L	-	-	0.00005	0.0004	Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-
-	-	Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-	Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
		Uranium (U)-Dissolved	0.000967	0.000942	mg/L	2.6	20	-	-	Silver (Ag)-Dissolved	<0.000020	<0.000020	mg/L	N/A	20	-	-
0.0000	0.02	Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Sodium (Na)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-
-	-	Zinc (Zn)-Dissolved	0.0012	0.0012	mg/L	-	-	0.0000	0.004	Thallium (Tl)-Dissolved	<0.00020	<0.00020	mg/L	N/A	20	-	-
-	-	**Total Metals**								Tin (Sn)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
0.001	0.08	Aluminum (Al)-Total	1.17	1.20	mg/L	2.3	20	-	-	Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
-	-	Antimony (Sb)-Total	0.00478	0.00495	mg/L	3.4				Uranium (U)-Dissolved	0.00031	0.00030	mg/L	-	-	0.00001	0.0008
-	-	Arsenic (As)-Total	0.0359	0.0363	mg/L	0.90	L642195-6	Water	WG789338-	Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
0.000003	0.00004	Barium (Ba)-Total	0.0653	0.0658	mg/L	0.74	20	-	-	Zinc (Zn)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-
-	-	Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-	**Physical Tests**							
-	-	Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	Mercury (H	<0.000020	<0.000020	Conductivity	203	204	uS/cm	0.49	20	-	-
-	-	Boron (B)-Total	<0.010	<0.010	mg/L	N/A				pH	8.08	8.09	pH	0.18	20	-	-
-	-	Cadmium (Cd)-Total	0.000026	0.000029	mg/L	-	-	0.000003	0.000068	**Anions and Nutrients**							
0.003	0.12	Calcium (Ca)-Total	41.3	41.0	mg/L	0.92	20	-	-	Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-	-
-	-	Chromium (Cr)-Total	0.00163	0.00166	mg/L	-	-	0.00004	0.002	Total Dissolved Phosphate As P	0.0046	0.0039	mg/L	-	-	0.0006	0.008
-	-	Cobalt (Co)-Total	0.00078	0.00081	mg/L	-	-	0.00002	0.0004	Total Phosphate as P	0.0035	0.0038	mg/L	-	-	0.0003	0.008
-	-	Copper (Cu)-Total	0.00379	0.00424	mg/L	11	20	-	-	**Anions and Nutrients**							

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2007-2008

Diff	Diff Limit	28-Apr-08	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	13-Jun-08	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
-	-	Iron (Fe)-Total	1.88	2.08	mg/L	11	20	-	-	Total Kjeldahl Nitrogen	0.095	0.129	mg/L	-	-	0.034	0.2
-	-	Lead (Pb)-Total	0.00191	0.00200	mg/L	4.8	20	-	-								
-	-	Lithium (Li)-Total	0.0129	0.0128	mg/L	-	-	0.0000	0.02								
-	-	Magnesium (Mg)-Total	21.6	21.4	mg/L	0.87	20	-	-								
-	-	Manganese (Mn)-Total	0.0316	0.0322	mg/L	1.9	20	-	-								
-	-	Molybdenum (Mo)-Total	0.00110	0.00113	mg/L	2.9	20	-	-								
-	-	Nickel (Ni)-Total	0.00228	0.00237	mg/L	-	-	0.00008	0.002								
-	-	Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-								
-	-	Potassium (K)-Total	2.4	2.4	mg/L	-	-	0.1	8								
-	-	Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-								
-	-	Silicon (Si)-Total	6.02	6.25	mg/L	3.8	20	-	-								
0.00001	0.0008	Silver (Ag)-Total	0.000020	0.000024	mg/L	-	-	0.000004	0.00004								
-	-	Sodium (Na)-Total	2.6	2.5	mg/L	-	-	0.1	8								
mg/L	N/A	Strontium (Sr)-Total	0.242	0.239	mg/L	1.1	20	-	-								
		Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-								
0.0008	0.008	Tin (Sn)-Total	0.00025	0.00013	mg/L	-	-	0.00011	0.0004								
0.0000	0.008	Titanium (Ti)-Total	0.030	0.037	mg/L	-	-	0.007	0.04								
-	-	Uranium (U)-Total	0.00442	0.00442	mg/L	0.11	20	-	-								
-	-	Vanadium (V)-Total	0.0019	0.0019	mg/L	-	-	0.0000	0.004								
-	-	Zinc (Zn)-Total	0.0055	0.0062	mg/L	-	-	0.0007	0.004								
-	-	Mercury (Hg)-Total	<0.000050	<0.000050	mg/L	N/A	26	-	-								
-	-	**Cyanide**															
0.000	0.2	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-								
-	-	Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-								
		Physical Tests															
0.01	2	Turbidity	1.62	1.66	NTU	2.4	39	-	-								
		Total Kjeldahl Nitrogen	<0.050	<0.050	mg/L	N/A	20	-	-								
-	-	**Anions and Nutrients**															
-	-	Total Dissolved Phosphate As P	0.0029	0.0029	mg/L	-	-	0.0000	0.008								
-	-	Total Phosphate as P	0.0043	0.0045	mg/L	-	-	0.0003	0.008								
0.5	12	Ortho Phosphate as P	0.0061	0.0065	mg/L	-	-	0.0004	0.004								
-	-																
-	-																

Laboratory Replicates for the 2009 Surface Water Monitoring Program

RPD is Relative Percent Difference (Difference / Mean expressed as a percent). Used for results which are >10x detection limit

Diff is the difference between the replicate values in concentration units. Used where replicate 1 value is <10x detection limit.

15 July 2009	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Anions and Nutrients							
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Cyanides							
Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
Anions and Nutrients							
Total Kjeldahl Nitrogen	<0.050	<0.050	mg/L	N/A	20	-	-
Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-
Nitrate (as N)	0.0400	0.0397	mg/L	-	-	0.0003	0.02
Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-
Sulfate (SO4)	64.2	64.1	mg/L	0.17	20	-	-
Ortho Phosphate as P	0.0037	0.0033	mg/L	-	-	0.0004	0.004
Dissolved Metals							
Aluminum (Al)-Dissolved	0.0075	0.0073	mg/L	-	-	0.0001	0.004
Antimony (Sb)-Dissolved	0.00106	0.00104	mg/L	1.1	20	-	-
Arsenic (As)-Dissolved	0.0357	0.0361	mg/L	1.1	20	-	-
Barium (Ba)-Dissolved	0.0378	0.0383	mg/L	1.2	20	-	-
Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Boron (B)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	mg/L	N/A	20	-	-
Calcium (Ca)-Dissolved	13.6	13.6	mg/L	0.26	20	-	-
Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Cobalt (Co)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Copper (Cu)-Dissolved	0.00029	0.00028	mg/L	-	-	0.00002	0.0004
Iron (Fe)-Dissolved	<0.030	<0.030	mg/L	N/A	20	-	-
Lead (Pb)-Dissolved	<0.000050	<0.000050	mg/L	N/A	20	-	-
Lithium (Li)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-
Magnesium (Mg)-Dissolved	3.28	3.28	mg/L	0.013	20	-	-
Manganese (Mn)-Dissolved	0.000064	<0.000050	mg/L	N/A	20	-	-
Molybdenum (Mo)-Dissolved	0.00185	0.00186	mg/L	0.58	20	-	-
Nickel (Ni)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L	N/A	20	-	-
Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-
Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Silicon (Si)-Dissolved	5.84	5.83	mg/L	0.22	20	-	-
Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-
Sodium (Na)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-
Strontium (Sr)-Dissolved	0.0789	0.0804	mg/L	1.9	20	-	-
Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Tin (Sn)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Uranium (U)-Dissolved	0.000376	0.000371	mg/L	1.3	20	-	-
Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Zinc (Zn)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-

06 Aug 2009	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Physical Tests							
Total Suspended Solids	<3.0	<3.0	mg/L	N/A	25	-	-
Total Dissolved Solids	78	77	mg/L	-	-	1	40
Anions and Nutrients							
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Cyanides							
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
Anions and Nutrients							
Alkalinity, Total (as $CaCO_3$)	114	116	mg/L	1.6	20	-	-
Total Metals							
Mercury (Hg)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
Anions and Nutrients							
Bromide (Br)	<0.050	<0.050	mg/L	N/A	20	-	-
Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-
Fluoride (F)	0.089	0.090	mg/L	-	-	0.001	0.08
Nitrate (as N)	0.0093	0.0093	mg/L	-	-	0.0000	0.02
Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-
Total Kjeldahl Nitrogen	0.101	0.104	mg/L	-	-	0.003	0.2
Sulfate (SO_4)	38.7	38.7	mg/L	0.025	20	-	-
Physical Tests							
Turbidity	0.33	0.32	NTU	-	-	0.010	0.4
Anions and Nutrients							
Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-	-
Organic / Inorganic Carbon							
Dissolved Organic Carbon	1.64	1.67	mg/L	-	-	0.03	2
Anions and Nutrients							
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Total Metals							
Mercury (Hg)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
Anions and Nutrients							
Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-	-
Cyanides							
Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-

20-Aug-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Physical Tests							
Conductivity	67.3	68.9	uS/cm	2.3	20	-	-
pH	7.20	7.46	pH	3.5	20	-	-
Turbidity	0.60	0.61	NTU	-	-	0.010	0.4
Cyanides							
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
Total Metals							
Aluminum (Al)-Total	0.0450	0.0452	mg/L	0.33	20	-	-
Antimony (Sb)-Total	0.00117	0.00112	mg/L	3.9	20	-	-
Arsenic (As)-Total	0.0354	0.0348	mg/L	1.7	20	-	-
Barium (Ba)-Total	0.0415	0.0408	mg/L	1.5	20	-	-
Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
Cadmium (Cd)-Total	<0.000017	<0.000017	mg/L	N/A	20	-	-
Calcium (Ca)-Total	14.0	14.5	mg/L	2.9	20	-	-
Chromium (Cr)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Cobalt (Co)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
Copper (Cu)-Total	0.00036	0.00036	mg/L	-	-	0.00000	0.0004
Iron (Fe)-Total	0.059	0.064	mg/L	-	-	0.006	0.12
Lead (Pb)-Total	0.000080	0.000085	mg/L	-	-	0.000005	0.0002
Lithium (Li)-Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
Magnesium (Mg)-Total	3.44	3.51	mg/L	2.1	20	-	-
Manganese (Mn)-Total	0.00222	0.00218	mg/L	1.9	20	-	-
Molybdenum (Mo)-Total	0.00197	0.00191	mg/L	3.2	20	-	-
Nickel (Ni)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-
Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Silicon (Si)-Total	5.65	5.85	mg/L	3.4	20	-	-
Silver (Ag)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-
Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
Strontium (Sr)-Total	0.0805	0.0790	mg/L	1.8	20	-	-
Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
Uranium (U)-Total	0.000411	0.000414	mg/L	0.87	20	-	-
Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Zinc (Zn)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Anions and Nutrients							
Alkalinity, Total (as $CaCO_3$)	137	135	mg/L	2.1	20	-	-
Physical Tests							
Total Suspended Solids	<3.0	<3.0	mg/L	N/A	25	-	-
Total Dissolved Solids	267	261	mg/L	2.1	20	-	-

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2009

15 July 2009	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	117	119	mg/L	2.1	20	-	-
Total Metals							
Mercury (Hg)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
Physical Tests							
Turbidity	1.37	1.43	NTU	4.3	39	-	-
Total Metals							
Aluminum (Al)-Total	0.160	0.140	mg/L	13	20	-	-
Antimony (Sb)-Total	0.00091	0.00088	mg/L	-	-	0.00003	0.0004
Arsenic (As)-Total	0.0225	0.0221	mg/L	1.7	20	-	-
Barium (Ba)-Total	0.0823	0.0811	mg/L	1.4	20	-	-
Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
Cadmium (Cd)-Total	0.000019	0.000018	mg/L	-	-	0.000001	0.000068
Calcium (Ca)-Total	38.2	38.3	mg/L	0.18	20	-	-
Chromium (Cr)-Total	0.00056	<0.00050	mg/L	N/A	20	-	-
Cobalt (Co)-Total	0.00014	0.00011	mg/L	-	-	0.00003	0.0004
Copper (Cu)-Total	<0.0012	<0.0012	mg/L	N/A	20	-	-
Iron (Fe)-Total	0.242	0.263	mg/L	-	-	0.021	0.12
Lead (Pb)-Total	0.000224	0.000202	mg/L	-	-	0.000022	0.0002
Lithium (Li)-Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
Magnesium (Mg)-Total	17.2	17.2	mg/L	0.31	20	-	-
Manganese (Mn)-Total	0.00544	0.00485	mg/L	12	20	-	-
Molybdenum (Mo)-Total	0.00363	0.00357	mg/L	1.6	20	-	-
Nickel (Ni)-Total	0.00063	0.00062	mg/L	-	-	0.00001	0.002
Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-
Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Silicon (Si)-Total	5.20	5.23	mg/L	0.55	20	-	-
Silver (Ag)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-
Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
Strontium (Sr)-Total	0.345	0.343	mg/L	0.39	20	-	-
Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
Titanium (Ti)-Total	0.011	0.011	mg/L	-	-	0.000	0.04
Uranium (U)-Total	0.00509	0.00503	mg/L	1.1	20	-	-
Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Zinc (Zn)-Total	<0.0030	<0.0030	mg/L	N/A	20	-	-
Anions and Nutrients							
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Dissolved Metals							
Aluminum (Al)-Dissolved	0.0052	0.0054	mg/L	-	-	0.0002	0.004
Antimony (Sb)-Dissolved	0.00070	0.00069	mg/L	-	-	0.00001	0.0004
Arsenic (As)-Dissolved	0.00454	0.00463	mg/L	2.0	20	-	-
Barium (Ba)-Dissolved	0.0521	0.0520	mg/L	0.13	20	-	-
Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-

06 Aug 2009	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit

20-Aug-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Anions and Nutrients							
Bromide (Br)	<0.050	<0.050	mg/L	N/A	20	-	-
Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-
Fluoride (F)	0.099	0.098	mg/L	-	-	0.001	0.08
Nitrate (as N)	0.0064	0.0063	mg/L	-	-	0.0001	0.02
Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-
Total Nitrogen	<0.050	<0.050	mg/L	N/A	20	-	-
Total Dissolved Phosphate As	<0.0020	<0.0020	mg/L	N/A	20	-	-
Sulfate (SO4)	36.5	36.6	mg/L	0.10	20	-	-
Total Metals							
Mercury (Hg)-Total	<0.000020	<0.000020	mg/L	N/A	20	-	-
Aluminum (Al)-Total	0.0055	0.0053	mg/L	-	-	0.0002	0.004
Antimony (Sb)-Total	0.00026	0.00024	mg/L	-	-	0.00001	0.0004
Arsenic (As)-Total	0.00090	0.00101	mg/L	-	-	0.00011	0.0004
Barium (Ba)-Total	0.0383	0.0372	mg/L	2.9	20	-	-
Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
Cadmium (Cd)-Total	<0.000017	<0.000017	mg/L	N/A	20	-	-
Calcium (Ca)-Total	41.4	42.6	mg/L	2.8	20	-	-
Chromium (Cr)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
Cobalt (Co)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
Copper (Cu)-Total	0.00025	0.00025	mg/L	-	-	0.00000	0.0004
Iron (Fe)-Total	<0.030	<0.030	mg/L	N/A	20	-	-
Lead (Pb)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
Lithium (Li)-Total	0.0070	0.0066	mg/L	-	-	0.0005	0.02
Magnesium (Mg)-Total	15.8	16.1	mg/L	2.3	20	-	-
Manganese (Mn)-Total	0.0173	0.0171	mg/L	0.93	20	-	-
Molybdenum (Mo)-Total	0.000074	0.000055	mg/L	-	-	0.000019	0.0002
Nickel (Ni)-Total	0.00063	0.00062	mg/L	-	-	0.00002	0.002
Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-
Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Silicon (Si)-Total	3.99	4.04	mg/L	1.3	20	-	-
Silver (Ag)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-
Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
Strontium (Sr)-Total	0.207	0.200	mg/L	3.8	20	-	-
Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
Uranium (U)-Total	0.000967	0.000912	mg/L	5.9	20	-	-
Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Zinc (Zn)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
Anions and Nutrients							
Ortho Phosphate as P	0.0010	0.0012	mg/L	-	-	0.0002	0.004
Dissolved Metals							
Aluminum (Al)-Dissolved	0.0062	0.0059	mg/L	-	-	0.0004	0.004
Antimony (Sb)-Dissolved	0.00093	0.00101	mg/L	-	-	0.00007	0.0004
Arsenic (As)-Dissolved	0.00345	0.00362	mg/L	4.8	20	-	-
Barium (Ba)-Dissolved	0.0378	0.0394	mg/L	4.2	20	-	-

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2009

15 July 2009	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Boron (B)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	mg/L	N/A	20	-	-
Calcium (Ca)-Dissolved	49.0	49.5	mg/L	0.99	20	-	-
Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Cobalt (Co)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Copper (Cu)-Dissolved	0.00065	0.00065	mg/L	-	-	0.00000	0.0004
Iron (Fe)-Dissolved	0.033	0.032	mg/L	-	-	0.001	0.12
Lead (Pb)-Dissolved	<0.000050	<0.000050	mg/L	N/A	20	-	-
Lithium (Li)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-
Magnesium (Mg)-Dissolved	12.7	12.6	mg/L	0.40	20	-	-
Manganese (Mn)-Dissolved	0.0172	0.0171	mg/L	0.49	20	-	-
Mercury (Hg)-Dissolved	<0.000050	<0.000050	mg/L	N/A	20	-	-
Molybdenum (Mo)-Dissolved	0.000548	0.000559	mg/L	1.9	20	-	-
Nickel (Ni)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L	N/A	20	-	-
Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-
Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Silicon (Si)-Dissolved	4.04	4.04	mg/L	0.0092	20	-	-
Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-
Sodium (Na)-Dissolved	2.1	2.0	mg/L	-	-	0.0	8
Strontium (Sr)-Dissolved	0.243	0.243	mg/L	0.25	20	-	-
Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Tin (Sn)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Uranium (U)-Dissolved	0.000975	0.000976	mg/L	0.13	20	-	-
Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Zinc (Zn)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Physical Tests							
Conductivity	353	354	uS/cm	0.28	20	-	-
pH	8.11	8.11	pH	0.099	20	-	-
Organic / Inorganic Carbon							
Dissolved Organic Carbon	2.19	2.12	mg/L	-	-	0.07	2
Total Metals							
Mercury (Hg)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
Anions and Nutrients							
Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-
Nitrate (as N)	<0.0050	<0.0050	mg/L	N/A	20	-	-
Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Sulfate (SO4)	<0.50	<0.50	mg/L	N/A	20	-	-
Cyanides							
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-

06 Aug 2009	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit

20-Aug-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Boron (B)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	mg/L	N/A	20	-	-
Calcium (Ca)-Dissolved	43.7	44.3	mg/L	1.3	20	-	-
Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Cobalt (Co)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Copper (Cu)-Dissolved	0.00051	0.00054	mg/L	-	-	0.00003	0.0004
Iron (Fe)-Dissolved	<0.030	<0.030	mg/L	N/A	20	-	-
Lead (Pb)-Dissolved	0.000122	0.000128	mg/L	-	-	0.000007	0.0002
Lithium (Li)-Dissolved	0.0066	0.0071	mg/L	-	-	0.0005	0.02
Magnesium (Mg)-Dissolved	16.8	16.8	mg/L	0.056	20	-	-
Manganese (Mn)-Dissolved	0.0270	0.0281	mg/L	4.3	20	-	-
Mercury (Hg)-Dissolved	<0.000020	<0.000020	mg/L	N/A	20	-	-
Molybdenum (Mo)-Dissolved	0.000181	0.000190	mg/L	-	-	0.000009	0.0002
Nickel (Ni)-Dissolved	0.00074	0.00078	mg/L	-	-	0.00005	0.002
Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L	N/A	20	-	-
Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-
Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Silicon (Si)-Dissolved	4.01	3.99	mg/L	0.35	20	-	-
Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-
Sodium (Na)-Dissolved	2.0	2.0	mg/L	-	-	0.0	8
Strontium (Sr)-Dissolved	0.204	0.212	mg/L	3.9	20	-	-
Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Tin (Sn)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Uranium (U)-Dissolved	0.00122	0.00127	mg/L	3.7	20	-	-
Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Zinc (Zn)-Dissolved	0.0019	0.0019	mg/L	-	-	0.0001	0.004
Anions and Nutrients							
Ammonia as N	<0.020	<0.020	mg/L	N/A	20	-	-
Total Nitrogen	0.320	0.320	mg/L	-	-	0.000	0.2
Cyanides							
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
Total Metals							
Mercury (Hg)-Total	<0.000020	<0.000020	mg/L	N/A	20	-	-
Anions and Nutrients							
Total Kjeldahl Nitrogen	<0.050	<0.050	mg/L	N/A	20	-	-
Cyanides							
Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2009

01-Sep-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Physical Tests							
Turbidity	0.32	0.32	NTU	-	-	0.010	0.4
Cyanides							
Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
Total Metals							
Mercury (Hg)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
Anions and Nutrients							
Alkalinity, Total (as CaCO3)	40.1	40.0	mg/L	0.38	20	-	-
Ortho Phosphate as P	0.0030	0.0026	mg/L	-	-	0.0004	0.004
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Total Phosphate as P	0.0023	0.0024	mg/L	-	-	0.0001	0.008
Dissolved Metals							
Aluminum (Al)-Dissolved	0.0090	0.0086	mg/L	-	-	0.0005	0.004
Antimony (Sb)-Dissolved	0.00112	0.00116	mg/L	3.6	20	-	-
Arsenic (As)-Dissolved	0.0366	0.0375	mg/L	2.5	20	-	-
Barium (Ba)-Dissolved	0.0388	0.0397	mg/L	2.4	20	-	-
Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Boron (B)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	mg/L	N/A	20	-	-
Calcium (Ca)-Dissolved	14.0	14.0	mg/L	0.23	20	-	-
Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Cobalt (Co)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Copper (Cu)-Dissolved	0.00025	0.00026	mg/L	-	-	0.00001	0.0004
Iron (Fe)-Dissolved	<0.030	<0.030	mg/L	N/A	20	-	-
Lead (Pb)-Dissolved	<0.000050	<0.000050	mg/L	N/A	20	-	-
Lithium (Li)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-
Magnesium (Mg)-Dissolved	3.18	3.19	mg/L	0.13	20	-	-
Manganese (Mn)-Dissolved	0.000243	0.000251	mg/L	-	-	0.000007	0.0002
Mercury (Hg)-Dissolved	<0.000050	<0.000050	mg/L	N/A	20	-	-
Molybdenum (Mo)-Dissolved	0.00198	0.00206	mg/L	3.9	20	-	-
Nickel (Ni)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L	N/A	20	-	-
Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-
Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Silicon (Si)-Dissolved	5.72	5.77	mg/L	0.86	20	-	-
Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-
Sodium (Na)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-
Strontium (Sr)-Dissolved	0.0746	0.0775	mg/L	3.8	20	-	-
Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Tin (Sn)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Uranium (U)-Dissolved	0.000390	0.000389	mg/L	0.27	20	-	-
Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Zinc (Zn)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-

16-Sep-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Anions and Nutrients							
Total Kjeldahl Nitrogen	0.053	0.059	mg/L	-	-	0.005	0.2
Alkalinity, Total (as $CaCO_3$)	95.4	96.9	mg/L	1.5	20	-	-
Ortho Phosphate as P	<0.0010	<0.0010	mg/L	N/A	20	-	-
Cyanides							
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
Anions and Nutrients							
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-	-
Physical Tests							
Conductivity	<2.0	<2.0	uS/cm	N/A	20	-	-
Anions and Nutrients							
Bromide (Br)	<0.050	<0.050	mg/L	N/A	20	-	-
Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-
Fluoride (F)	<0.020	<0.020	mg/L	N/A	20	-	-
Nitrate (as N)	<0.0050	<0.0050	mg/L	N/A	20	-	-
Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-
Sulfate (SO_4)	<0.50	<0.50	mg/L	N/A	20	-	-
Cyanides							
Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
Organic / Inorganic Carbon							
Dissolved Organic Carbon	3.33	3.37	mg/L	-	-	0.04	2

05-Oct-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff
Anions and Nutrients						
Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-
Cyanides						
Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-
Anions and Nutrients						
Total Dissolved Phosphate As P	0.0032	0.0031	mg/L	-	-	0.0002
Total Phosphate as P	0.0043	0.0069	mg/L	-	-	0.0026
Organic / Inorganic Carbon						
Dissolved Organic Carbon	2.15	2.04	mg/L	-	-	0.11
Anions and Nutrients						
Total Kjeldahl Nitrogen	<0.050	<0.050	mg/L	N/A	20	-
Alkalinity, Total (as $CaCO_3$)	<2.0	<2.0	mg/L	N/A	20	-
Bromide (Br)	<0.050	<0.050	mg/L	N/A	20	-
Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-
Fluoride (F)	0.069	0.068	mg/L	-	-	0.001
Nitrate (as N)	0.117	0.118	mg/L	0.26	20	-
Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-
Total Phosphate as P	0.0024	0.0022	mg/L	-	-	0.0002
Sulfate (SO_4)	57.9	57.9	mg/L	0.027	20	-

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2009

01-Sep-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	16-Sep-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	05-Oct-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff
Physical Tests																						
pH	7.57	7.75	pH	2.4	20	-	-															
Organic / Inorganic Carbon																						
Dissolved Organic Carbon	4.42	4.34	mg/L	-	-	0.08	2															
Cyanides																						
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-															
Total Metals																						
Aluminum (Al)-Total	0.0179	0.0168	mg/L	6.0	20	-	-															
Antimony (Sb)-Total	0.00151	0.00144	mg/L	4.6	20	-	-															
Arsenic (As)-Total	0.0378	0.0370	mg/L	2.2	20	-	-															
Barium (Ba)-Total	0.0438	0.0422	mg/L	3.7	20	-	-															
Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-															
Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-															
Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-															
Cadmium (Cd)-Total	<0.000017	<0.000017	mg/L	N/A	20	-	-															
Calcium (Ca)-Total	20.4	20.4	mg/L	0.086	20	-	-															
Chromium (Cr)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-															
Cobalt (Co)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-															
Copper (Cu)-Total	0.00044	0.00043	mg/L	-	-	0.00000	0.0004															
Iron (Fe)-Total	<0.030	<0.030	mg/L	N/A	20	-	-															
Lead (Pb)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-															
Lithium (Li)-Total	0.0073	0.0074	mg/L	-	-	0.0001	0.02															
Magnesium (Mg)-Total	6.55	6.59	mg/L	0.50	20	-	-															
Manganese (Mn)-Total	0.00191	0.00181	mg/L	5.1	20	-	-															
Molybdenum (Mo)-Total	0.00174	0.00170	mg/L	2.1	20	-	-															
Nickel (Ni)-Total	0.00052	<0.00050	mg/L	N/A	20	-	-															
Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-															
Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-															
Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-															
Silicon (Si)-Total	5.91	5.92	mg/L	0.22	20	-	-															
Silver (Ag)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-															
Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-															
Strontium (Sr)-Total	0.117	0.114	mg/L	2.2	20	-	-															
Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-															
Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-															
Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-	-															
Uranium (U)-Total	0.000631	0.000610	mg/L	3.4	20	-	-															
Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-															
Zinc (Zn)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-															
Physical Tests																						
Conductivity	326	328	uS/cm	0.61	20	-	-															
Anions and Nutrients																						
Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-	-															
Cyanides																						
Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-															

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2009

01-Sep-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	16-Sep-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	05-Oct-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff
Anions and Nutrients																						
Total Kjeldahl Nitrogen	0.154	0.140	mg/L	-	-	0.014	0.2															
Total Metals																						
Aluminum (Al)-Total	0.0459	0.0428	mg/L	6.9	20	-	-															
Antimony (Sb)-Total	0.00056	0.00054	mg/L	-	-	0.00002	0.0004															
Arsenic (As)-Total	0.00489	0.00496	mg/L	1.4	20	-	-															
Barium (Ba)-Total	0.0402	0.0400	mg/L	0.53	20	-	-															
Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-															
Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-															
Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-															
Cadmium (Cd)-Total	<0.000017	<0.000017	mg/L	N/A	20	-	-															
Calcium (Ca)-Total	39.5	39.6	mg/L	0.27	20	-	-															
Chromium (Cr)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-															
Cobalt (Co)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-															
Copper (Cu)-Total	0.00132	0.00136	mg/L	2.9	20	-	-															
Iron (Fe)-Total	0.115	0.105	mg/L	-	-	0.010	0.12															
Lead (Pb)-Total	0.000093	0.000096	mg/L	-	-	0.000003	0.0002															
Lithium (Li)-Total	<0.0050	<0.0050	mg/L	N/A	20	-	-															
Magnesium (Mg)-Total	8.84	8.95	mg/L	1.3	20	-	-															
Manganese (Mn)-Total	0.0212	0.0214	mg/L	1.0	20	-	-															
Molybdenum (Mo)-Total	0.000532	0.000565	mg/L	6.0	20	-	-															
Nickel (Ni)-Total	0.00101	0.00104	mg/L	-	-	0.00003	0.002															
Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-															
Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-															
Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-															
Silicon (Si)-Total	3.91	3.95	mg/L	0.99	20	-	-															
Silver (Ag)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-															
Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-															
Strontium (Sr)-Total	0.174	0.175	mg/L	0.077	20	-	-															
Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-															
Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-															
Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-	-															
Uranium (U)-Total	0.000660	0.000648	mg/L	1.7	20	-	-															
Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-															
Zinc (Zn)-Total	0.0013	0.0025	mg/L	-	-	0.0012	0.004															
Anions and Nutrients																						
Bromide (Br)	<0.050	<0.050	mg/L	N/A	20	-	-															
Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-															
Fluoride (F)	<0.020	<0.020	mg/L	N/A	20	-	-															
Nitrate (as N)	<0.0050	<0.0050	mg/L	N/A	20	-	-															
Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-															
Total Dissolved Phosphate As P	<0.0020	<0.0020	mg/L	N/A	20	-	-															
Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-	-															
Sulfate (SO4)	<0.50	<0.50	mg/L	N/A	20	-	-															

Diff Limit	20-Oct-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
	Cyanides							
-	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
	Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
-	**Total Metals**							
-	Aluminum (Al)-Total	<0.010	0.0111	mg/L	-	-	0.0011	0.004
	Antimony (Sb)-Total	0.00022	0.00022	mg/L	-	-	0.00000	0.0004
	Arsenic (As)-Total	0.00066	0.00069	mg/L	-	-	0.00003	0.0004
0.008	Barium (Ba)-Total	0.0315	0.0328	mg/L	4.1	20	-	-
0.008	Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
	Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
	Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
2	Cadmium (Cd)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
	Calcium (Ca)-Total	38.7	39.6	mg/L	2.2	20	-	-
	Chromium (Cr)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
-	Cobalt (Co)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
-	Copper (Cu)-Total	<0.00060	<0.00050	mg/L	N/A	20	-	-
-	Iron (Fe)-Total	0.058	0.041	mg/L	-	-	0.017	0.12
-	Lead (Pb)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
0.08	Lithium (Li)-Total	0.0053	0.0058	mg/L	-	-	0.0005	0.02
-	Magnesium (Mg)-Total	13.3	13.7	mg/L	3.2	20	-	-
-	Manganese (Mn)-Total	0.0181	0.0186	mg/L	2.8	20	-	-
-	Molybdenum (Mo)-Total	0.000120	0.000075	mg/L	-	-	0.000045	0.0002
0.008	Nickel (Ni)-Total	0.00087	0.00066	mg/L	-	-	0.00021	0.002
-	Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-
	Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
	Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
	Silicon (Si)-Total	3.48	3.58	mg/L	2.7	20	-	-
	Silver (Ag)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-
	Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
	Strontium (Sr)-Total	0.178	0.188	mg/L	5.5	20	-	-
	Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
	Tin (Sn)-Total	<0.00020	<0.00020	mg/L	N/A	20	-	-
	Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
	Uranium (U)-Total	0.000876	0.000912	mg/L	4.0	20	-	-
	Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
	Zinc (Zn)-Total	0.0014	0.0014	mg/L	-	-	0.0000	0.004
	Anions and Nutrients							
	Ortho Phosphate as P	0.0031	0.0041	mg/L	-	-	0.0010	0.004
	Alkalinity, Total (as CaCO3)	682	672	mg/L	1.5	20	-	-
	Total Metals							
	Mercury (Hg)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
	Anions and Nutrients							
	Total Dissolved Phosphate As P	0.0041	0.0043	mg/L	-	-	0.0002	0.008
	Total Phosphate as P	0.0067	0.0062	mg/L	-	-	0.0004	0.008

APPENDIX A – Water Quality
APPENDIX A1-3: QA/QC – Laboratory Replicates 2009

Diff Limit	20-Oct-09	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
	Cyanides							
	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
	Anions and Nutrients							
	Total Kjeldahl Nitrogen	0.058	0.051	mg/L	-	-	0.008	0.2
	Bromide (Br)	<0.050	<0.050	mg/L	N/A	20	-	-
	Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-
	Fluoride (F)	0.078	0.075	mg/L	-	-	0.004	0.08
	Nitrate (as N)	0.147	0.149	mg/L	1.2	20	-	-
	Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-
	Sulfate (SO4)	67.7	67.7	mg/L	0.034	20	-	-
	Physical Tests							
	Total Suspended Solids	<3.0	<3.0	mg/L	N/A	20	-	-
	Total Dissolved Solids	<10	<10	mg/L	N/A	20	-	-
	Anions and Nutrients							
	Ortho Phosphate as P	<0.0010	<0.0010	mg/L	N/A	20	-	-
	Physical Tests							
	pH	5.48	5.44	pH	0.73	20	-	-
	Organic / Inorganic Carbon							
	Dissolved Organic Carbon	<0.50	<0.50	mg/L	N/A	20	-	-
	Anions and Nutrients							
	Ammonia as N	<0.020	<0.020	mg/L	N/A	20	-	-
	Physical Tests							
	Turbidity	0.66	0.67	NTU	-	-	0.010	0.4
	Cyanides							
	Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-

Laboratory Replicates for the 2010 Surface Water Monitoring Program

RPD is Relative Percent Difference (Difference / Mean expressed as a percent). Used for results which are >10x detection limit

Diff is the difference between the replicate values in concentration units. Used where replicate 1 value is <10x detection limit.

31-MAR-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	06-MAY-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff
Anions and Nutrients								**Physical Tests**						
Ortho Phosphate as P	0.0046	0.0048	mg/L	-	-	0.0002	0.004	Alkalinity, Total (as CaCO3)	29.9	29.9	mg/L	0.037	20	-
Total Dissolved Phosphate As	0.0053	0.0052	mg/L	-	-	0.0001	0.008	Total Dissolved Phosphate A	0.0067	0.0074	mg/L	-	-	0.0007
Total Phosphate as P	0.0057	0.0060	mg/L	-	-	0.0003	0.008	Total Phosphate as P	0.0083	0.0086	mg/L	-	-	0.0003
Cyanide, Total	<0.0050	<0.0020	mg/L	N/A	20	-	-	Cyanide, Weak Acid Diss	<0.0050	<0.0020	mg/L	N/A	20	-
								Cyanide, Total	<0.0050	<0.0020	mg/L	N/A	20	-
Aluminum (Al)-Dissolved	0.0026	0.0032	mg/L	-	-	0.0006	0.004							
Antimony (Sb)-Dissolved	0.00103	0.00100	mg/L	2.9	20	-	-	Turbidity	19.1	18.7	NTU	2.1	39	-
Arsenic (As)-Dissolved	0.0296	0.0291	mg/L	1.8	20	-	-							
Barium (Ba)-Dissolved	0.0458	0.0462	mg/L	0.90	20	-	-							
Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Aluminum (Al)-Dissolved	0.0515	0.0519	mg/L	0.79	20	-
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Antimony (Sb)-Dissolved	0.00060	0.00060	mg/L	-	-	0.00000
Boron (B)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-	Arsenic (As)-Dissolved	0.00423	0.00427	mg/L	0.80	20	-
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	mg/L	N/A	20	-	-	Barium (Ba)-Dissolved	0.0279	0.0287	mg/L	2.8	20	-
Calcium (Ca)-Dissolved	17.3	17.3	mg/L	0.39	20	-	-	Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-
Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-
Cobalt (Co)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-	Boron (B)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-
Copper (Cu)-Dissolved	0.00019	0.00021	mg/L	-	-	0.00002	0.0004	Cadmium (Cd)-Dissolved	0.000026	0.000024	mg/L	-	-	0.000002
Iron (Fe)-Dissolved	<0.030	<0.030	mg/L	N/A	20	-	-	Calcium (Ca)-Dissolved	23.2	23.0	mg/L	1.1	20	-
Lead (Pb)-Dissolved	<0.000050	<0.000050	mg/L	N/A	20	-	-	Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-
Lithium (Li)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-	Cobalt (Co)-Dissolved	0.00022	0.00022	mg/L	-	-	0.00000
Magnesium (Mg)-Dissolved	4.56	4.54	mg/L	0.54	20	-	-	Copper (Cu)-Dissolved	0.00183	0.00186	mg/L	1.2	20	-
Manganese (Mn)-Dissolved	0.000111	0.000102	mg/L	-	-	0.000009	0.0002	Iron (Fe)-Dissolved	0.141	0.136	mg/L	-	-	0.005

31-MAR-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	06-MAY-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff
Mercury (Hg)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-	Lead (Pb)-Dissolved	0.000132	0.000121	mg/L	-	-	0.000011
Molybdenum (Mo)-Dissolved	0.00213	0.00214	mg/L	0.65	20	-	-	Lithium (Li)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-
Nickel (Ni)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Magnesium (Mg)-Dissolved	9.17	9.01	mg/L	1.7	20	-
Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L	N/A	20	-	-	Manganese (Mn)-Dissolved	0.0373	0.0376	mg/L	0.99	20	-
Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-	Mercury (Hg)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-
Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Molybdenum (Mo)-Dissolved	0.000145	0.000158	mg/L	-	-	0.000013
Silicon (Si)-Dissolved	6.00	5.95	mg/L	0.90	20	-	-	Nickel (Ni)-Dissolved	0.00229	0.00230	mg/L	-	-	0.00001
Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-	Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L	N/A	20	-
Sodium (Na)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-	Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-
Strontium (Sr)-Dissolved	0.0882	0.0878	mg/L	0.47	20	-	-	Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-
Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-	Silicon (Si)-Dissolved	2.84	2.80	mg/L	1.4	20	-
Tin (Sn)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-	Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-
Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-	Sodium (Na)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-
Uranium (U)-Dissolved	0.000550	0.000560	mg/L	1.8	20	-	-	Strontium (Sr)-Dissolved	0.108	0.110	mg/L	1.9	20	-
Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-
Zinc (Zn)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Tin (Sn)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-
								Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-
								Uranium (U)-Dissolved	0.000670	0.000703	mg/L	4.9	20	-
Dissolved Organic Carbon	1.09	1.08	mg/L	0.92	20	-	-	Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-
								Zinc (Zn)-Dissolved	0.0026	0.0025	mg/L	-	-	0.0001
Total Suspended Solids	<3.0	<3.0	mg/L	N/A	20	-	-							
Total Dissolved Solids	<10	<10	mg/L	N/A	20	-	-	Conductivity	201	201	uS/cm	0.0	20	-
								pH	7.75	7.82	pH	0.97	20	-
Total Kjeldahl Nitrogen	<0.050	<0.050	mg/L	N/A	17	-	-							
								Aluminum (Al)-Total	0.230	0.225	mg/L	2.2	20	-
								Antimony (Sb)-Total	0.00064	0.00066	mg/L	-	-	0.00002
Mercury (Hg)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-	Arsenic (As)-Total	0.00460	0.00461	mg/L	0.22	20	-

31-MAR-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	06-MAY-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff
								Barium (Ba)-Total	0.0314	0.0317	mg/L	0.93	20	-
								Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-
								Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-
								Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-
								Cadmium (Cd)-Total	0.000027	0.000027	mg/L	-	-	0.000000
								Calcium (Ca)-Total	25.1	25.3	mg/L	0.80	20	-
								Chromium (Cr)-Total	<0.00050	<0.00050	mg/L	N/A	20	-
								Cobalt (Co)-Total	0.00034	0.00034	mg/L	-	-	0.00000
								Copper (Cu)-Total	0.00244	0.00265	mg/L	8.4	20	-
								Iron (Fe)-Total	0.403	0.403	mg/L	0.12	20	-
								Lead (Pb)-Total	0.000432	0.000438	mg/L	-	-	0.000006
								Lithium (Li)-Total	<0.0050	0.0051	mg/L	N/A	20	-
								Magnesium (Mg)-Total	10.3	10.4	mg/L	0.97	20	-
								Manganese (Mn)-Total	0.0629	0.0640	mg/L	1.8	20	-
								Molybdenum (Mo)-Total	0.000146	0.000154	mg/L	-	-	0.000007
								Nickel (Ni)-Total	0.00287	0.00295	mg/L	-	-	0.00008
								Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-
								Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-
								Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-
								Silicon (Si)-Total	3.09	3.14	mg/L	1.6	20	-
								Silver (Ag)-Total	0.000010	<0.000010	mg/L	N/A	20	-
								Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-
								Strontium (Sr)-Total	0.133	0.132	mg/L	1.1	20	-
								Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-
								Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-
								Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-
								Uranium (U)-Total	0.000790	0.000804	mg/L	1.8	20	-
								Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-
								Zinc (Zn)-Total	0.0037	0.0036	mg/L	-	-	0.0001

31-MAR-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	06-MAY-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff
								Bromide (Br)	<0.050	<0.050	mg/L	N/A	20	-
								Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-
								Fluoride (F)	0.069	0.070	mg/L	-	-	0.001
								Nitrate (as N)	0.0415	0.0399	mg/L	-	-	0.0016
								Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-
								Sulfate (SO4)	30.2	30.2	mg/L	0.021	20	-
								Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-
								Total Kjeldahl Nitrogen	<0.050	<0.050	mg/L	N/A	17	-
								Total Dissolved Phosphate A	<0.0020	<0.0020	mg/L	N/A	20	-
								Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-
								Total Suspended Solids	<3.0	<3.0	mg/L	N/A	20	-
								Total Dissolved Solids	<10	<10	mg/L	N/A	20	-
								Total Nitrogen	<0.050	<0.050	mg/L	N/A	20	-

31-MAR-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	06-MAY-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff

Laboratory Replicates f

RPD is Relative Percent Differ

Diff is the difference between

31-MAR-10	Diff Limit	22-MAY-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	02-JUN-10	Replicate 1
Anions and Nutrients		**Physical Tests**								**Physical Tests**	
Ortho Phosphate as P	-	Turbidity	7.74	7.65	NTU	1.2	39	-	-	Ammonia as N	<0.0050
Total Dissolved Phosphate As	0.008									Bromide (Br)	<0.050
Total Phosphate as P	0.008									Chloride (Cl)	<0.50
		Ortho Phosphate as P	0.0025	0.0023	mg/L	-	-	0.0001	0.004	Fluoride (F)	0.054
										Nitrate (as N)	0.0648
Cyanide, Total	-									Nitrite (as N)	<0.0010
	-	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-	Total Dissolved Phosphate As P	<0.0020
										Total Phosphate as P	0.0030
Aluminum (Al)-Dissolved										Sulfate (SO4)	38.9
Antimony (Sb)-Dissolved	-	Conductivity	38.8	38.5	uS/cm	0.78	10	-	-		
Arsenic (As)-Dissolved		pH	6.59	6.44	pH	2.3	20	-	-		
Barium (Ba)-Dissolved										Cyanide, Weak Acid Diss	<0.0050
Beryllium (Be)-Dissolved	-										
Bismuth (Bi)-Dissolved	0.0004	Alkalinity, Total (as CaCO3)	12.9	12.8	mg/L	0.22	20	-	-		
Boron (B)-Dissolved	-									Total Suspended Solids	<3.0
Cadmium (Cd)-Dissolved	-									Total Dissolved Solids	52
Calcium (Ca)-Dissolved	-	Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-	Turbidity	1.52
Chromium (Cr)-Dissolved	-	Cyanide, Total	0.0054	0.0054	mg/L	-	-	0.0001	0.02		
Cobalt (Co)-Dissolved	-										
Copper (Cu)-Dissolved	0.000068									Cyanide, Weak Acid Diss	<0.0050
Iron (Fe)-Dissolved	-	Dissolved Organic Carbon	10.8	10.7	mg/L	0.19	20	-	-		
Lead (Pb)-Dissolved	-										
Lithium (Li)-Dissolved	0.0004									Aluminum (Al)-Total	0.0489
Magnesium (Mg)-Dissolved	-	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-	Antimony (Sb)-Total	0.00054
Manganese (Mn)-Dissolved	0.12									Arsenic (As)-Total	0.0167

31-MAR-10	Diff Limit	22-MAY-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	02-JUN-10	Replicate 1
Mercury (Hg)-Dissolved	0.0002									Barium (Ba)-Total	0.0705
Molybdenum (Mo)-Dissolved	-	Mercury (Hg)-Total	<0.000010	0.000018	mg/L	N/A	20	-	-	Beryllium (Be)-Total	<0.00050
Nickel (Ni)-Dissolved	-	Mercury (Hg)-Total	<0.000010	0.000012	mg/L	N/A	20	-	-	Bismuth (Bi)-Total	<0.00050
Phosphorus (P)-Dissolved	-									Boron (B)-Total	<0.010
Potassium (K)-Dissolved	-									Cadmium (Cd)-Total	<0.000017
Selenium (Se)-Dissolved	0.0002	Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-	-	Calcium (Ca)-Total	38.2
Silicon (Si)-Dissolved	0.002	Total Dissolved Phosphate As	0.0054	0.0054	mg/L	-	-	0.0000	0.008	Chromium (Cr)-Total	<0.00050
Silver (Ag)-Dissolved	-	Total Phosphate as P	0.0187	0.0187	mg/L	-	-	0.0000	0.008	Cobalt (Co)-Total	<0.00010
Sodium (Na)-Dissolved	-	Total Kjeldahl Nitrogen	0.234	0.224	mg/L	-	-	0.011	0.2	Copper (Cu)-Total	0.00077
Strontium (Sr)-Dissolved	-									Iron (Fe)-Total	0.075
Thallium (Tl)-Dissolved	-									Lead (Pb)-Total	0.000141
Tin (Sn)-Dissolved	-	Aluminum (Al)-Total	0.533	0.553	mg/L	3.6	20	-	-	Lithium (Li)-Total	0.0082
Titanium (Ti)-Dissolved	-	Antimony (Sb)-Total	0.00066	0.00061	mg/L	-	-	0.00004	0.0004	Magnesium (Mg)-Total	22.3
Uranium (U)-Dissolved	-	Arsenic (As)-Total	0.00896	0.00856	mg/L	4.6	20	-	-	Manganese (Mn)-Total	0.00144
Vanadium (V)-Dissolved	-	Barium (Ba)-Total	0.0237	0.0236	mg/L	0.17	20	-	-	Molybdenum (Mo)-Total	0.00175
Zinc (Zn)-Dissolved	-	Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-	Nickel (Ni)-Total	<0.00050
	-	Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-	Phosphorus (P)-Total	<0.30
	-	Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-	Potassium (K)-Total	<2.0
Dissolved Organic Carbon	-	Cadmium (Cd)-Total	0.000029	0.000028	mg/L	-	-	0.000001	0.000068	Selenium (Se)-Total	<0.0010
	0.004	Calcium (Ca)-Total	15.8	16.2	mg/L	2.7	20	-	-	Silicon (Si)-Total	3.66
		Chromium (Cr)-Total	0.00086	0.00079	mg/L	-	-	0.00006	0.002	Silver (Ag)-Total	<0.000010
Total Suspended Solids		Cobalt (Co)-Total	0.00048	0.00041	mg/L	-	-	0.00007	0.0004	Sodium (Na)-Total	2.6
Total Dissolved Solids	-	Copper (Cu)-Total	0.00259	0.00293	mg/L	12	20	-	-	Strontium (Sr)-Total	0.291
	-	Iron (Fe)-Total	0.806	0.704	mg/L	14	20	-	-	Thallium (Tl)-Total	<0.00010
		Lead (Pb)-Total	0.00116	0.00113	mg/L	2.5	20	-	-	Tin (Sn)-Total	<0.00010
Total Kjeldahl Nitrogen		Lithium (Li)-Total	<0.0050	<0.0050	mg/L	N/A	20	-	-	Titanium (Ti)-Total	<0.010
	-	Magnesium (Mg)-Total	5.12	5.25	mg/L	2.5	20	-	-	Uranium (U)-Total	0.0111
	0.0004	Manganese (Mn)-Total	0.0462	0.0472	mg/L	2.0	20	-	-	Vanadium (V)-Total	<0.0010
Mercury (Hg)-Total	-	Molybdenum (Mo)-Total	0.000193	0.000186	mg/L	-	-	0.000007	0.0002	Zinc (Zn)-Total	<0.0010

31-MAR-10	Diff Limit	22-MAY-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	02-JUN-10	Replicate 1
	-	Nickel (Ni)-Total	0.00207	0.00203	mg/L	-	-	0.00004	0.002		
	-	Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-		
	-	Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-	Aluminum (Al)-Dissolved	0.0032
	-	Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-	Antimony (Sb)-Dissolved	0.00495
	0.000068	Silicon (Si)-Total	2.64	2.57	mg/L	2.9	20	-	-	Arsenic (As)-Dissolved	0.0447
	-	Silver (Ag)-Total	0.000014	0.000013	mg/L	-	-	0.000001	0.00004	Barium (Ba)-Dissolved	0.0462
	-	Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-	Beryllium (Be)-Dissolved	<0.00050
	0.0004	Strontium (Sr)-Total	0.0912	0.0947	mg/L	3.8	20	-	-	Bismuth (Bi)-Dissolved	<0.00050
	-	Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-	Boron (B)-Dissolved	<0.010
	-	Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-	Cadmium (Cd)-Dissolved	<0.000017
	0.0002	Titanium (Ti)-Total	0.017	0.014	mg/L	-	-	0.003	0.04	Calcium (Ca)-Dissolved	30.4
	-	Uranium (U)-Total	0.000402	0.000409	mg/L	1.8	20	-	-	Chromium (Cr)-Dissolved	<0.00050
	-	Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-	Cobalt (Co)-Dissolved	<0.00010
	-	Zinc (Zn)-Total	0.0040	0.0040	mg/L	-	-	0.0000	0.004	Copper (Cu)-Dissolved	0.00131
	0.0002									Iron (Fe)-Dissolved	<0.030
	0.002									Lead (Pb)-Dissolved	0.000060
	-	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-	Lithium (Li)-Dissolved	0.0097
	-									Magnesium (Mg)-Dissolved	16.4
	-									Manganese (Mn)-Dissolved	0.00477
	-	Total Suspended Solids	<3.0	<3.0	mg/L	N/A	20	-	-	Mercury (Hg)-Dissolved	<0.000010
	-	Total Dissolved Solids	<10	<10	mg/L	N/A	20	-	-	Molybdenum (Mo)-Dissolved	0.00104
	-									Nickel (Ni)-Dissolved	0.00062
	-									Phosphorus (P)-Dissolved	<0.30
	-	Total Dissolved Phosphate As	<0.0020	<0.0020	mg/L	N/A	20	-	-	Potassium (K)-Dissolved	<2.0
	-	Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-	-	Selenium (Se)-Dissolved	<0.0010
	-									Silicon (Si)-Dissolved	4.77
	-									Silver (Ag)-Dissolved	<0.000010
	-									Sodium (Na)-Dissolved	<2.0
	0.004									Strontium (Sr)-Dissolved	0.187

31-MAR-10	Diff Limit	22-MAY-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	02-JUN-10	Replicate 1
										Thallium (Tl)-Dissolved	<0.00010
										Tin (Sn)-Dissolved	<0.00010
	-									Titanium (Ti)-Dissolved	<0.010
	-									Uranium (U)-Dissolved	0.00194
	0.08									Vanadium (V)-Dissolved	<0.0010
	0.02									Zinc (Zn)-Dissolved	<0.0010
	-										
	-										
	-									Aluminum (Al)-Total	0.0652
	-									Antimony (Sb)-Total	0.00035
	-									Arsenic (As)-Total	0.00394
	-									Barium (Ba)-Total	0.0277
										Beryllium (Be)-Total	<0.00050
										Bismuth (Bi)-Total	<0.00050
	-									Boron (B)-Total	<0.010
	-									Cadmium (Cd)-Total	<0.000017
										Calcium (Ca)-Total	25.5
										Chromium (Cr)-Total	<0.00050
	-									Cobalt (Co)-Total	0.00013
										Copper (Cu)-Total	0.00102
										Iron (Fe)-Total	0.136
										Lead (Pb)-Total	0.000151
										Lithium (Li)-Total	<0.0050
										Magnesium (Mg)-Total	8.18
										Manganese (Mn)-Total	0.0187
										Molybdenum (Mo)-Total	0.000236
										Nickel (Ni)-Total	0.00095
										Phosphorus (P)-Total	<0.30
										Potassium (K)-Total	<2.0

31-MAR-10	Diff Limit	22-MAY-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	02-JUN-10	Replicate 1
										Selenium (Se)-Total	<0.0010
										Silicon (Si)-Total	3.09
										Silver (Ag)-Total	<0.000010
										Sodium (Na)-Total	<2.0
										Strontium (Sr)-Total	0.133
										Thallium (Tl)-Total	<0.00010
										Tin (Sn)-Total	<0.00010
										Titanium (Ti)-Total	<0.010
										Uranium (U)-Total	0.000549
										Vanadium (V)-Total	<0.0010
										Zinc (Zn)-Total	0.0014
										Mercury (Hg)-Total	<0.000010
										Conductivity	233
										pH	8.12
										Turbidity	0.69
										Total Dissolved Phosphate As P	0.0023
										Total Phosphate as P	0.0047
										Cyanide, Weak Acid Diss	<0.0050

Laboratory Replicates f

RPD is Relative Percent Differ

Diff is the difference between

31-MAR-10	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	11-JUL-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Anions and Nutrients							Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-	-
Ortho Phosphate as P	<0.0050	mg/L	N/A	20	-	-								
Total Dissolved Phosphate As	<0.050	mg/L	N/A	20	-	-								
Total Phosphate as P	<0.50	mg/L	N/A	20	-	-	Aluminum (Al)-Dissolved	0.0093	0.0090	mg/L	-	-	0.0003	0.004
	0.055	mg/L	-	-	0.001	0.08	Antimony (Sb)-Dissolved	0.00101	0.00104	mg/L	3.4	20	-	-
	0.0645	mg/L	0.46	20	-	-	Arsenic (As)-Dissolved	0.0420	0.0417	mg/L	0.72	20	-	-
Cyanide, Total	<0.0010	mg/L	N/A	20	-	-	Barium (Ba)-Dissolved	0.0361	0.0362	mg/L	0.17	20	-	-
	<0.0020	mg/L	N/A	20	-	-	Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
	0.0022	mg/L	-	-	0.0007	0.008	Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Aluminum (Al)-Dissolved	38.9	mg/L	0.14	20	-	-	Boron (B)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Antimony (Sb)-Dissolved							Cadmium (Cd)-Dissolved	<0.000017	<0.000017	mg/L	N/A	20	-	-
Arsenic (As)-Dissolved							Calcium (Ca)-Dissolved	12.7	12.7	mg/L	0.10	20	-	-
Barium (Ba)-Dissolved	<0.0050	mg/L	N/A	20	-	-	Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Beryllium (Be)-Dissolved							Cobalt (Co)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Bismuth (Bi)-Dissolved							Copper (Cu)-Dissolved	0.00037	0.00037	mg/L	-	-	0.00000	0.0004
Boron (B)-Dissolved	<3.0	mg/L	N/A	20	-	-	Iron (Fe)-Dissolved	<0.030	<0.030	mg/L	N/A	20	-	-
Cadmium (Cd)-Dissolved	52	mg/L	-	-	1	40	Lead (Pb)-Dissolved	<0.000050	<0.000050	mg/L	N/A	20	-	-
Calcium (Ca)-Dissolved	1.62	NTU	6.4	39	-	-	Lithium (Li)-Dissolved	<0.0050	<0.0050	mg/L	N/A	20	-	-
Chromium (Cr)-Dissolved							Magnesium (Mg)-Dissolved	2.78	2.78	mg/L	0.038	20	-	-
Cobalt (Co)-Dissolved							Manganese (Mn)-Dissolved	0.000296	0.000295	mg/L	-	-	0.000000	0.0002
Copper (Cu)-Dissolved	<0.0050	mg/L	N/A	20	-	-	Mercury (Hg)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-
Iron (Fe)-Dissolved							Molybdenum (Mo)-Dissolved	0.00193	0.00186	mg/L	3.8	20	-	-
Lead (Pb)-Dissolved							Nickel (Ni)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-
Lithium (Li)-Dissolved	0.0517	mg/L	5.6	20	-	-	Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L	N/A	20	-	-
Magnesium (Mg)-Dissolved	0.00055	mg/L	-	-	0.00001	0.0004	Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-
Manganese (Mn)-Dissolved	0.0169	mg/L	0.80	20	-	-	Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-

31-MAR-10	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	11-JUL-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
Mercury (Hg)-Dissolved	0.0706	mg/L	0.20	20	-	-	Silicon (Si)-Dissolved	6.00	6.06	mg/L	0.96	20	-	-
Molybdenum (Mo)-Dissolved	<0.00050	mg/L	N/A	20	-	-	Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-
Nickel (Ni)-Dissolved	<0.00050	mg/L	N/A	20	-	-	Sodium (Na)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-
Phosphorus (P)-Dissolved	<0.010	mg/L	N/A	20	-	-	Strontium (Sr)-Dissolved	0.0692	0.0688	mg/L	0.66	20	-	-
Potassium (K)-Dissolved	<0.000017	mg/L	N/A	20	-	-	Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Selenium (Se)-Dissolved	38.4	mg/L	0.31	20	-	-	Tin (Sn)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-
Silicon (Si)-Dissolved	<0.00050	mg/L	N/A	20	-	-	Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-
Silver (Ag)-Dissolved	<0.00010	mg/L	N/A	20	-	-	Uranium (U)-Dissolved	0.000317	0.000308	mg/L	2.9	20	-	-
Sodium (Na)-Dissolved	0.00077	mg/L	-	-	0.00000	0.0004	Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Strontium (Sr)-Dissolved	0.078	mg/L	-	-	0.003	0.12	Zinc (Zn)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-
Thallium (Tl)-Dissolved	0.000142	mg/L	-	-	0.000001	0.0002								
Tin (Sn)-Dissolved	0.0091	mg/L	-	-	0.0009	0.02								
Titanium (Ti)-Dissolved	22.2	mg/L	0.22	20	-	-	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
Uranium (U)-Dissolved	0.00140	mg/L	3.0	20	-	-	Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
Vanadium (V)-Dissolved	0.00163	mg/L	6.7	20	-	-								
Zinc (Zn)-Dissolved	<0.00050	mg/L	N/A	20	-	-								
	<0.30	mg/L	N/A	20	-	-	Mercury (Hg)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-
	<2.0	mg/L	N/A	20	-	-								
Dissolved Organic Carbon	<0.0010	mg/L	N/A	20	-	-								
	3.65	mg/L	0.28	20	-	-	Total Dissolved Phosphate A	<0.0020	<0.0020	mg/L	N/A	20	-	-
	<0.000010	mg/L	N/A	20	-	-	Total Phosphate as P	0.0032	<0.0020	mg/L	N/A	20	-	-
Total Suspended Solids	2.6	mg/L	-	-	0.0	8								
Total Dissolved Solids	0.297	mg/L	2.0	20	-	-								
	<0.00010	mg/L	N/A	20	-	-	Turbidity	0.52	0.54	NTU	-	-	0.020	0.4
	<0.00010	mg/L	N/A	20	-	-	Total Suspended Solids	<3.0	<3.0	mg/L	N/A	20	-	-
Total Kjeldahl Nitrogen	<0.010	mg/L	N/A	20	-	-	Total Dissolved Solids	190	191	mg/L	0.26	20	-	-
	0.0110	mg/L	0.86	20	-	-								
	<0.0010	mg/L	N/A	20	-	-								
Mercury (Hg)-Total	<0.0010	mg/L	N/A	20	-	-	Alkalinity, Total (as CaCO3)	93.0	91.1	mg/L	2.1	20	-	-

31-MAR-10	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	11-JUL-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
	0.0034	mg/L	-	-	0.0002	0.004	Aluminum (Al)-Total	0.0342	0.0331	mg/L	3.4	20	-	-
	0.00489	mg/L	1.4	20	-	-	Antimony (Sb)-Total	0.00062	0.00059	mg/L	-	-	0.00003	0.0004
	0.0449	mg/L	0.66	20	-	-	Arsenic (As)-Total	0.00543	0.00506	mg/L	7.0	20	-	-
	0.0461	mg/L	0.15	20	-	-	Barium (Ba)-Total	0.0454	0.0447	mg/L	1.6	20	-	-
	<0.00050	mg/L	N/A	20	-	-	Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
	<0.00050	mg/L	N/A	20	-	-	Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
	<0.010	mg/L	N/A	20	-	-	Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
	<0.000017	mg/L	N/A	20	-	-	Cadmium (Cd)-Total	<0.000017	<0.000017	mg/L	N/A	20	-	-
	30.0	mg/L	1.4	20	-	-	Calcium (Ca)-Total	42.9	42.2	mg/L	1.6	20	-	-
	<0.00050	mg/L	N/A	20	-	-	Chromium (Cr)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
	<0.00010	mg/L	N/A	20	-	-	Cobalt (Co)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
	0.00133	mg/L	1.7	20	-	-	Copper (Cu)-Total	0.00091	0.00093	mg/L	-	-	0.00003	0.0004
	<0.030	mg/L	N/A	20	-	-	Iron (Fe)-Total	0.072	0.071	mg/L	-	-	0.001	0.12
	0.000069	mg/L	-	-	0.000009	0.0002	Lead (Pb)-Total	0.000068	0.000059	mg/L	-	-	0.000009	0.0002
	0.0102	mg/L	-	-	0.0005	0.02	Lithium (Li)-Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
	16.3	mg/L	0.78	20	-	-	Magnesium (Mg)-Total	10.6	10.4	mg/L	2.1	20	-	-
	0.00484	mg/L	1.5	20	-	-	Manganese (Mn)-Total	0.0156	0.0155	mg/L	0.78	20	-	-
	<0.000010	mg/L	N/A	20	-	-	Molybdenum (Mo)-Total	0.000518	0.000530	mg/L	2.4	20	-	-
	0.00106	mg/L	1.8	20	-	-	Nickel (Ni)-Total	0.00050	0.00052	mg/L	-	-	0.00002	0.002
	0.00056	mg/L	-	-	0.00005	0.002	Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-
	<0.30	mg/L	N/A	20	-	-	Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
	<2.0	mg/L	N/A	20	-	-	Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
	<0.0010	mg/L	N/A	20	-	-	Silicon (Si)-Total	4.17	4.07	mg/L	2.3	20	-	-
	4.73	mg/L	0.76	20	-	-	Silver (Ag)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-
	<0.000010	mg/L	N/A	20	-	-	Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
	<2.0	mg/L	N/A	20	-	-	Strontium (Sr)-Total	0.198	0.193	mg/L	2.7	20	-	-
	0.187	mg/L	0.027	20	-	-	Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-

31-MAR-10	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	11-JUL-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
	<0.00010	mg/L	N/A	20	-	-	Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
	<0.00010	mg/L	N/A	20	-	-	Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
	<0.010	mg/L	N/A	20	-	-	Uranium (U)-Total	0.000911	0.000851	mg/L	6.8	20	-	-
	0.00194	mg/L	0.17	20	-	-	Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
	<0.0010	mg/L	N/A	20	-	-	Zinc (Zn)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
	0.0012	mg/L	N/A	20	-	-								
							Ammonia as N	<0.0050	<0.0050	mg/L	N/A	20	-	-
	0.0630	mg/L	3.5	20	-	-								
	0.00033	mg/L	-	-	0.00001	0.0004								
	0.00396	mg/L	0.59	20	-	-	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
	0.0269	mg/L	2.7	20	-	-								
	<0.00050	mg/L	N/A	20	-	-								
	<0.00050	mg/L	N/A	20	-	-	Ortho Phosphate as P	<0.0010	<0.0010	mg/L	N/A	20	-	-
	<0.010	mg/L	N/A	20	-	-	Bromide (Br)	<0.050	<0.050	mg/L	N/A	20	-	-
	<0.000017	mg/L	N/A	20	-	-	Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-
	25.8	mg/L	1.0	20	-	-	Fluoride (F)	<0.020	<0.020	mg/L	N/A	20	-	-
	<0.00050	mg/L	N/A	20	-	-	Nitrate (as N)	<0.0050	<0.0050	mg/L	N/A	20	-	-
	0.00012	mg/L	-	-	0.00001	0.0004	Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-
	0.00111	mg/L	8.8	20	-	-	Sulfate (SO4)	<0.50	<0.50	mg/L	N/A	20	-	-
	0.137	mg/L	-	-	0.001	0.12	Total Kjeldahl Nitrogen	<0.050	<0.050	mg/L	N/A	20	-	-
	0.000155	mg/L	-	-	0.000004	0.0002								
	<0.0050	mg/L	N/A	20	-	-								
	8.28	mg/L	1.3	20	-	-	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L	N/A	20	-	-
	0.0183	mg/L	2.1	20	-	-	Cyanide, Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
	0.000238	mg/L	-	-	0.000002	0.0002								
	0.00090	mg/L	-	-	0.00005	0.002								
	<0.30	mg/L	N/A	20	-	-	Aluminum (Al)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
	<2.0	mg/L	N/A	20	-	-	Antimony (Sb)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-

31-MAR-10	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	11-JUL-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
	<0.0010	mg/L	N/A	20	-	-	Arsenic (As)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
	3.13	mg/L	1.3	20	-	-	Barium (Ba)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
	<0.000010	mg/L	N/A	20	-	-	Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
	<2.0	mg/L	N/A	20	-	-	Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
	0.129	mg/L	3.7	20	-	-	Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
	<0.00010	mg/L	N/A	20	-	-	Cadmium (Cd)-Total	<0.000017	<0.000017	mg/L	N/A	20	-	-
	<0.00010	mg/L	N/A	20	-	-	Calcium (Ca)-Total	<0.050	<0.050	mg/L	N/A	20	-	-
	<0.010	mg/L	N/A	20	-	-	Chromium (Cr)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
	0.000544	mg/L	1.1	20	-	-	Cobalt (Co)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
	<0.0010	mg/L	N/A	20	-	-	Copper (Cu)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
	0.0017	mg/L	-	-	0.0003	0.004	Iron (Fe)-Total	<0.030	<0.030	mg/L	N/A	20	-	-
	<0.000010	mg/L	N/A	20	-	-	Lead (Pb)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
							Lithium (Li)-Total	<0.0050	<0.0050	mg/L	N/A	20	-	-
							Magnesium (Mg)-Total	<0.10	<0.10	mg/L	N/A	20	-	-
	232	uS/cm	0.43	10	-	-	Manganese (Mn)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
	8.11	pH	0.021	20	-	-	Mercury (Hg)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-
	0.67	NTU	-	-	0.020	0.4	Molybdenum (Mo)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-
							Nickel (Ni)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-
							Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-
	0.0026	mg/L	-	-	0.0003	0.008	Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
	0.0037	mg/L	-	-	0.0010	0.008	Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
							Silicon (Si)-Total	<0.050	<0.050	mg/L	N/A	20	-	-
							Silver (Ag)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-
	<0.0050	mg/L	N/A	20	-	-	Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-
							Strontium (Sr)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
							Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
							Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-
							Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-	-
							Uranium (U)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-

31-MAR-10	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	11-JUL-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit
							Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-
							Zinc (Zn)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-

Laboratory Replicates f

RPD is Relative Percent Differ

Diff is the difference between

31-MAR-10	18-AUG-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	16-SEP-10	Replicate 1	Replicate 2	Units
Anions and Nutrients	Ortho Phosphate as P	0.0022	0.0021	mg/L	-	-	0.0001	0.004				
Ortho Phosphate as P									Alkalinity, Total (as CaCO3)	106	105	mg/L
Total Dissolved Phosphate As									Ammonia as N	<0.0050	<0.0050	mg/L
Total Phosphate as P	Cyanide, Total	<0.0050	<0.0020	mg/L	N/A	20	-	-	Bromide (Br)	<0.050	<0.050	mg/L
									Chloride (Cl)	<0.50	<0.50	mg/L
									Fluoride (F)	<0.020	<0.020	mg/L
Cyanide, Total	Aluminum (Al)-Dissolved	0.0055	0.0057	mg/L	-	-	0.0001	0.004	Nitrate (as N)	<0.0050	<0.0050	mg/L
	Antimony (Sb)-Dissolved	0.00134	0.00135	mg/L	0.52	20	-	-	Nitrite (as N)	<0.0010	<0.0010	mg/L
	Arsenic (As)-Dissolved	0.0375	0.0373	mg/L	0.50	20	-	-	Total Kjeldahl Nitrogen	0.069	0.058	mg/L
Aluminum (Al)-Dissolved	Barium (Ba)-Dissolved	0.0438	0.0436	mg/L	0.45	20	-	-	Ortho Phosphate as P	0.0016	0.0016	mg/L
Antimony (Sb)-Dissolved	Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Total Dissolved Phosphate As	0.0021	<0.0020	mg/L
Arsenic (As)-Dissolved	Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Total Phosphate as P	0.0022	0.0024	mg/L
Barium (Ba)-Dissolved	Boron (B)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-	Sulfate (SO4)	<0.50	<0.50	mg/L
Beryllium (Be)-Dissolved	Cadmium (Cd)-Dissolved	<0.000017	<0.000017	mg/L	N/A	20	-	-				
Bismuth (Bi)-Dissolved	Calcium (Ca)-Dissolved	20.7	20.8	mg/L	0.13	20	-	-				
Boron (B)-Dissolved	Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L
Cadmium (Cd)-Dissolved	Cobalt (Co)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-	Cyanide, Total	<0.0050	<0.0050	mg/L
Calcium (Ca)-Dissolved	Copper (Cu)-Dissolved	0.00035	0.00036	mg/L	-	-	0.00001	0.0004				
Chromium (Cr)-Dissolved	Iron (Fe)-Dissolved	<0.030	<0.030	mg/L	N/A	20	-	-				
Cobalt (Co)-Dissolved	Lead (Pb)-Dissolved	<0.000050	<0.000050	mg/L	N/A	20	-	-	Aluminum (Al)-Total	0.0219	0.0220	mg/L
Copper (Cu)-Dissolved	Lithium (Li)-Dissolved	0.0071	0.0073	mg/L	-	-	0.0003	0.02	Antimony (Sb)-Total	0.00132	0.00134	mg/L
Iron (Fe)-Dissolved	Magnesium (Mg)-Dissolved	6.38	6.35	mg/L	0.52	20	-	-	Arsenic (As)-Total	0.0383	0.0380	mg/L
Lead (Pb)-Dissolved	Manganese (Mn)-Dissolved	0.00193	0.00193	mg/L	0.0093	20	-	-	Barium (Ba)-Total	0.0492	0.0495	mg/L
Lithium (Li)-Dissolved	Molybdenum (Mo)-Dissolved	0.00167	0.00165	mg/L	1.6	20	-	-	Beryllium (Be)-Total	<0.00050	<0.00050	mg/L
Magnesium (Mg)-Dissolved	Nickel (Ni)-Dissolved	<0.00050	<0.00050	mg/L	N/A	20	-	-	Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L
Manganese (Mn)-Dissolved	Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L	N/A	20	-	-	Boron (B)-Total	<0.010	<0.010	mg/L

31-MAR-10	18-AUG-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	16-SEP-10	Replicate 1	Replicate 2	Units
Mercury (Hg)-Dissolved	Potassium (K)-Dissolved	<2.0	<2.0	mg/L	N/A	20	-	-	Cadmium (Cd)-Total	<0.000017	<0.000017	mg/L
Molybdenum (Mo)-Dissolved	Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Calcium (Ca)-Total	21.2	21.4	mg/L
Nickel (Ni)-Dissolved	Silicon (Si)-Dissolved	6.01	6.01	mg/L	0.025	20	-	-	Chromium (Cr)-Total	<0.00050	<0.00050	mg/L
Phosphorus (P)-Dissolved	Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L	N/A	20	-	-	Cobalt (Co)-Total	<0.00010	<0.00010	mg/L
Potassium (K)-Dissolved	Sodium (Na)-Dissolved	2.0	<2.0	mg/L	N/A	20	-	-	Copper (Cu)-Total	<0.00050	<0.00050	mg/L
Selenium (Se)-Dissolved	Strontium (Sr)-Dissolved	0.109	0.110	mg/L	1.1	20	-	-	Iron (Fe)-Total	0.040	0.036	mg/L
Silicon (Si)-Dissolved	Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-	Lead (Pb)-Total	0.000061	0.000163	mg/L
Silver (Ag)-Dissolved	Tin (Sn)-Dissolved	<0.00010	<0.00010	mg/L	N/A	20	-	-	Lithium (Li)-Total	0.0077	0.0075	mg/L
Sodium (Na)-Dissolved	Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L	N/A	20	-	-	Magnesium (Mg)-Total	6.93	6.99	mg/L
Strontium (Sr)-Dissolved	Uranium (U)-Dissolved	0.000576	0.000574	mg/L	0.41	20	-	-	Manganese (Mn)-Total	0.00434	0.00428	mg/L
Thallium (Tl)-Dissolved	Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Mercury (Hg)-Total	<0.000010	<0.000010	mg/L
Tin (Sn)-Dissolved	Zinc (Zn)-Dissolved	<0.0010	<0.0010	mg/L	N/A	20	-	-	Molybdenum (Mo)-Total	0.00187	0.00186	mg/L
Titanium (Ti)-Dissolved									Nickel (Ni)-Total	0.00052	0.00055	mg/L
Uranium (U)-Dissolved									Phosphorus (P)-Total	<0.30	<0.30	mg/L
Vanadium (V)-Dissolved	Mercury (Hg)-Total	<0.000050	<0.000050	mg/L	N/A	20	-	-	Potassium (K)-Total	<2.0	<2.0	mg/L
Zinc (Zn)-Dissolved									Selenium (Se)-Total	<0.0010	<0.0010	mg/L
									Silicon (Si)-Total	5.99	6.05	mg/L
	Total Dissolved Phosphate As	<0.0020	<0.0020	mg/L	N/A	20	-	-	Silver (Ag)-Total	<0.000010	<0.000010	mg/L
Dissolved Organic Carbon	Total Phosphate as P	<0.0020	<0.0020	mg/L	N/A	20	-	-	Sodium (Na)-Total	<2.0	<2.0	mg/L
									Strontium (Sr)-Total	0.123	0.123	mg/L
									Thallium (Tl)-Total	<0.00010	<0.00010	mg/L
Total Suspended Solids	Aluminum (Al)-Total	0.0120	0.0124	mg/L	3.5	20	-	-	Tin (Sn)-Total	<0.00010	<0.00010	mg/L
Total Dissolved Solids	Antimony (Sb)-Total	0.00077	0.00077	mg/L	-	-	0.00000	0.0004	Titanium (Ti)-Total	<0.010	<0.010	mg/L
	Arsenic (As)-Total	0.00474	0.00484	mg/L	2.0	20	-	-	Uranium (U)-Total	0.000795	0.000779	mg/L
	Barium (Ba)-Total	0.0403	0.0408	mg/L	1.1	20	-	-	Vanadium (V)-Total	<0.0010	<0.0010	mg/L
Total Kjeldahl Nitrogen	Beryllium (Be)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-	Zinc (Zn)-Total	0.0010	0.0023	mg/L
	Bismuth (Bi)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-				
	Boron (B)-Total	<0.010	<0.010	mg/L	N/A	20	-	-				
Mercury (Hg)-Total	Cadmium (Cd)-Total	<0.000017	<0.000017	mg/L	N/A	20	-	-	Aluminum (Al)-Dissolved	0.0058	0.0056	mg/L

31-MAR-10	18-AUG-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	16-SEP-10	Replicate 1	Replicate 2	Units
	Calcium (Ca)-Total	43.3	44.3	mg/L	2.2	20	-	-	Antimony (Sb)-Dissolved	0.00023	0.00022	mg/L
	Chromium (Cr)-Total	<0.00050	<0.00050	mg/L	N/A	20	-	-	Arsenic (As)-Dissolved	0.00071	0.00070	mg/L
	Cobalt (Co)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-	Barium (Ba)-Dissolved	0.0350	0.0345	mg/L
	Copper (Cu)-Total	0.00059	0.00065	mg/L	-	-	0.00005	0.0004	Beryllium (Be)-Dissolved	<0.00050	<0.00050	mg/L
	Iron (Fe)-Total	0.047	0.046	mg/L	-	-	0.001	0.12	Bismuth (Bi)-Dissolved	<0.00050	<0.00050	mg/L
	Lead (Pb)-Total	0.000134	0.000143	mg/L	-	-	0.000009	0.0002	Boron (B)-Dissolved	<0.010	<0.010	mg/L
	Lithium (Li)-Total	0.0076	0.0077	mg/L	-	-	0.0000	0.02	Cadmium (Cd)-Dissolved	<0.000017	<0.000017	mg/L
	Magnesium (Mg)-Total	15.4	15.7	mg/L	1.8	20	-	-	Calcium (Ca)-Dissolved	43.4	43.2	mg/L
	Manganese (Mn)-Total	0.0308	0.0309	mg/L	0.30	20	-	-	Chromium (Cr)-Dissolved	<0.00050	<0.00050	mg/L
	Molybdenum (Mo)-Total	0.000288	0.000268	mg/L	-	-	0.000020	0.0002	Cobalt (Co)-Dissolved	0.00012	0.00011	mg/L
	Nickel (Ni)-Total	0.00075	0.00082	mg/L	-	-	0.00007	0.002	Copper (Cu)-Dissolved	0.00039	0.00041	mg/L
	Phosphorus (P)-Total	<0.30	<0.30	mg/L	N/A	20	-	-	Iron (Fe)-Dissolved	0.038	0.039	mg/L
	Potassium (K)-Total	<2.0	<2.0	mg/L	N/A	20	-	-	Lead (Pb)-Dissolved	<0.000050	<0.000050	mg/L
	Selenium (Se)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-	Lithium (Li)-Dissolved	0.0056	0.0057	mg/L
	Silicon (Si)-Total	3.95	4.01	mg/L	1.6	20	-	-	Magnesium (Mg)-Dissolved	14.9	15.0	mg/L
	Silver (Ag)-Total	<0.000010	<0.000010	mg/L	N/A	20	-	-	Manganese (Mn)-Dissolved	0.0439	0.0431	mg/L
	Sodium (Na)-Total	<2.0	<2.0	mg/L	N/A	20	-	-	Mercury (Hg)-Dissolved	<0.000010	<0.000010	mg/L
	Strontium (Sr)-Total	0.232	0.234	mg/L	0.96	20	-	-	Molybdenum (Mo)-Dissolved	0.000052	0.000067	mg/L
	Thallium (Tl)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-	Nickel (Ni)-Dissolved	0.00101	0.00098	mg/L
	Tin (Sn)-Total	<0.00010	<0.00010	mg/L	N/A	20	-	-	Phosphorus (P)-Dissolved	<0.30	<0.30	mg/L
	Titanium (Ti)-Total	<0.010	<0.010	mg/L	N/A	20	-	-	Potassium (K)-Dissolved	<2.0	<2.0	mg/L
	Uranium (U)-Total	0.00108	0.00110	mg/L	1.4	20	-	-	Selenium (Se)-Dissolved	<0.0010	<0.0010	mg/L
	Vanadium (V)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-	Silicon (Si)-Dissolved	3.91	3.92	mg/L
	Zinc (Zn)-Total	<0.0010	<0.0010	mg/L	N/A	20	-	-	Silver (Ag)-Dissolved	<0.000010	<0.000010	mg/L
									Sodium (Na)-Dissolved	<2.0	<2.0	mg/L
									Strontium (Sr)-Dissolved	0.193	0.192	mg/L
	Total Suspended Solids	<3.0	<3.0	mg/L	N/A	20	-	-	Thallium (Tl)-Dissolved	<0.00010	<0.00010	mg/L
	Total Dissolved Solids	216	211	mg/L	2.1	20	-	-	Tin (Sn)-Dissolved	<0.00010	<0.00010	mg/L
									Titanium (Ti)-Dissolved	<0.010	<0.010	mg/L

31-MAR-10	18-AUG-10	Replicate 1	Replicate 2	Units	RPD	RPD Limit	Diff	Diff Limit	16-SEP-10	Replicate 1	Replicate 2	Units
									Uranium (U)-Dissolved	0.000848	0.000828	mg/L
	Alkalinity, Total (as CaCO3)	102	103	mg/L	1.1	20	-	-	Vanadium (V)-Dissolved	<0.0010	<0.0010	mg/L
									Zinc (Zn)-Dissolved	0.0012	0.0012	mg/L
	Turbidity	<0.10	<0.10	NTU	N/A	39	-	-				
									Cyanide, Weak Acid Diss	<0.0050	<0.0050	mg/L
	Bromide (Br)	<0.050	<0.050	mg/L	N/A	20	-	-				
	Chloride (Cl)	<0.50	<0.50	mg/L	N/A	20	-	-				
	Fluoride (F)	<0.020	<0.020	mg/L	N/A	20	-	-				
	Nitrate (as N)	<0.0050	<0.0050	mg/L	N/A	20	-	-				
	Nitrite (as N)	<0.0010	<0.0010	mg/L	N/A	20	-	-				
	Total Dissolved Phosphate As	<0.0020	<0.0020	mg/L	N/A	20	-	-				
	Sulfate (SO4)	<0.50	<0.50	mg/L	N/A	20	-	-				

Laboratory Replicates f

RPD is Relative Percent Differ

Diff is the difference between

31-MAR-10	RPD	RPD Limit	Diff	Diff Limit
Anions and Nutrients				
Ortho Phosphate as P	0.36	20	-	-
Total Dissolved Phosphate As	N/A	20	-	-
Total Phosphate as P	N/A	20	-	-
	N/A	20	-	-
	N/A	20	-	-
Cyanide, Total	N/A	20	-	-
	N/A	20	-	-
	-	-	0.011	0.2
Aluminum (Al)-Dissolved	-	-	0.0000	0.004
Antimony (Sb)-Dissolved	N/A	20	-	-
Arsenic (As)-Dissolved	-	-	0.0001	0.008
Barium (Ba)-Dissolved	N/A	20	-	-
Beryllium (Be)-Dissolved				
Bismuth (Bi)-Dissolved				
Boron (B)-Dissolved	N/A	20	-	-
Cadmium (Cd)-Dissolved	N/A	20	-	-
Calcium (Ca)-Dissolved				
Chromium (Cr)-Dissolved				
Cobalt (Co)-Dissolved	0.59	20	-	-
Copper (Cu)-Dissolved	1.6	20	-	-
Iron (Fe)-Dissolved	0.85	20	-	-
Lead (Pb)-Dissolved	0.46	20	-	-
Lithium (Li)-Dissolved	N/A	20	-	-
Magnesium (Mg)-Dissolved	N/A	20	-	-
Manganese (Mn)-Dissolved	N/A	20	-	-

31-MAR-10	RPD	RPD Limit	Diff	Diff Limit
Mercury (Hg)-Dissolved	N/A	20	-	-
Molybdenum (Mo)-Dissolved	1.2	20	-	-
Nickel (Ni)-Dissolved	N/A	20	-	-
Phosphorus (P)-Dissolved	N/A	20	-	-
Potassium (K)-Dissolved	N/A	20	-	-
Selenium (Se)-Dissolved	-	-	0.004	0.12
Silicon (Si)-Dissolved	-	-	0.000102	0.0002
Silver (Ag)-Dissolved	-	-	0.0001	0.02
Sodium (Na)-Dissolved	0.93	20	-	-
Strontium (Sr)-Dissolved	1.3	20	-	-
Thallium (Tl)-Dissolved	N/A	20	-	-
Tin (Sn)-Dissolved	0.065	20	-	-
Titanium (Ti)-Dissolved	-	-	0.00003	0.002
Uranium (U)-Dissolved	N/A	20	-	-
Vanadium (V)-Dissolved	N/A	20	-	-
Zinc (Zn)-Dissolved	N/A	20	-	-
	1.0	20	-	-
	N/A	20	-	-
Dissolved Organic Carbon	N/A	20	-	-
	0.033	20	-	-
	N/A	20	-	-
Total Suspended Solids	N/A	20	-	-
Total Dissolved Solids	N/A	20	-	-
	2.1	20	-	-
	N/A	20	-	-
Total Kjeldahl Nitrogen	-	-	0.0013	0.004
Mercury (Hg)-Total	-	-	0.0001	0.004

31-MAR-10	RPD	RPD Limit	Diff	Diff Limit
	-	-	0.00000	0.0004
	-	-	0.00001	0.0004
	1.5	20	-	-
	N/A	20	-	-
	N/A	20	-	-
	N/A	20	-	-
	N/A	20	-	-
	0.46	20	-	-
	N/A	20	-	-
	-	-	0.00000	0.0004
	-	-	0.00002	0.0004
	-	-	0.001	0.12
	N/A	20	-	-
	-	-	0.0001	0.02
	0.58	20	-	-
	1.8	20	-	-
	N/A	20	-	-
	-	-	0.000015	0.0002
	-	-	0.00004	0.002
	N/A	20	-	-
	N/A	20	-	-
	N/A	20	-	-
	0.19	20	-	-
	N/A	20	-	-
	N/A	20	-	-
	0.90	20	-	-
	N/A	20	-	-
	N/A	20	-	-
	N/A	20	-	-

31-MAR-10	RPD	RPD Limit	Diff	Diff Limit
	2.3	20	-	-
	N/A	20	-	-
	-	-	0.0000	0.004
	N/A	20	-	-

APPENDIX A – Water Quality

APPENDIX A1-4: QA/QC – Field Replicates 1993-1996

Field Replicates for the 1993-1996 Surface Water Monitoring Program

Station	W6	W6 (Rep)	RPD	W1	W1 (Rep)		W5	W5 (Rep)		W11	W11 (Rep)		W7	W7 (Rep)		W1	W1 (Rep)	
Date	11-Jun-93	11-Jun-93		3-Jul-95	3-Jul-95		2-Aug-95	2-Aug-95		1-Oct-95	1-Oct-95		20-Jun-96	20-Jun-96		21-Jun-96	21-Jun-96	
pH	7.65	7.67	0	7.53	7.6	1	8.03	8.04	0	7.41	7.43	0				7.26	7.27	0
Electrical Conductivity, µmho/cm	212	213	0	100	99	1	337	337	0	323	317	2				90.8	91.3	1
Total Dissolved Solids, mg/l	131	130	1	65	65	0	239	240	0	245	245	0				59	58	2
Total Suspended Solids, mg/l	6	4	40	0.5	0.5	0	7	8	13	3	2	40				6	4	40
Hardness, $CaCO_3$ mg/l	103	103	0	48.3	48	1	174	175	1	166	159	4	94.6	94.9	0	41.5	41.2	1
Turbidity, NTU	0.64	0.54	17	0.16	0.24	40	8.71	10.5	19	1.12	1.14	2				3.4	3.1	9
Alkalinity, $CaCO_3$ mg/l	66.7	65.1	2	38.4	38.5	0	106	109	3	47.8	48	0				35.1	35.4	1
Chloride, mg/l	0.8	0.25	105	0.25	0.25	0	0.5	0.6	18	0.6	0.9	40	0.25	0.25	0	0.5	0.25	67
Fluoride, mg/l	0.08	0.08	0	0.06	0.07	15	0.13	0.13	0	0.16	0.16	0	0.06	0.06	0	0.08	0.08	0
Sulphate (SO_4), mg/l	38.1	38.8	2	9.9	9.8	1	69.1	67.3	3	110	112	2	35.4	34.6	2	9.7	9.7	0
Ammonia Nitrogen (NH_4), mg/l	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.01	120	0.0025	0.0025	0	0.01	0.005	67	0.006	0.0025	82
Nitrate Nitrogen (NO_3), mg/l	0.052	0.048	8	0.014	0.015	7	0.042	0.043	2	0.045	0.047	4				0.053	0.049	8
Nitrite Nitrogen (NO_2), mg/l	0.0005	0.0005	0	0.001	0.001	0	0.003	0.002	40	0.001	0.001	0				0.0005	0.0005	0
Dissolved ortho-Phosphate, mg/l	0.005	0.004	22	0.004	0.003	29	0.0005	0.001	67	0.0005	0.0005	0	0.043	0.044	2	0.011	0.01	10
Total Dissolved Phosphate, mg/l	0.005	0.005	0	0.004	0.003	29	0.002	0.003	40	0.002	0.002	0				0.011	0.011	0
Total Phosphorus, mg/l	0.011	0.008	32	0.028	0.025	11	0.015	0.014	7	0.003	0.003	0	0.145	0.116	22	0.019	0.02	5
Total Cyanide (CN-), mg/l	0.001	0.0005	67	0.002	0.002	0	0.002	0.002	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Aluminum (total), mg/l	0.045	0.01	127	0.086	0.097	12	0.11	0.107	3	0.025	0.035	33	0.635	0.602	5	0.044	0.045	2
Antimony (total), mg/l	0.0004	0.0004	0	0.0008	0.0009	12	0.0016	0.0015	6	0.0002	0.0003	40	0.0004	0.0004	0	0.0012	0.0012	0
Arsenic (total), mg/l	0.0049	0.0044	11	0.0332	0.0316	5	0.0051	0.0047	8	0.0007	0.0007	0	0.0031	0.0031	0	0.029	0.0292	1
Barium (total), mg/l	0.035	0.035	0	0.042	0.042	0	0.043	0.043	0	0.029	0.029	0	0.034	0.034	0	0.03	0.028	7
Beryllium (total), mg/l	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0
Bismuth (total), mg/l	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0
Boron (total), mg/l	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0
Cadmium (total), mg/l	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0
Calcium (total), mg/l	33	33.3	1	13.6	13.4	1	42.7	43.4	2	43.9	44.8	2	27.5	27.3	1	11.1	10.8	3
Chromium (total), mg/l	0.004	0.0005	156	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Cobalt (total), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.001	0.0005	67	0.001	0.001	0	0.0005	0.0005	0
Copper (total), mg/l	0.001	0.001	0	0.0005	0.0005	0	0.001	0.002	67	0.0005	0.0005	0	0.004	0.004	0	0.0005	0.0005	0
Iron (total), mg/l	0.083	0.042	66	0.015	0.015	0	0.112	0.098	13	0.208	0.223	7	1.1	1.04	6	0.05	0.052	4
Lead (total), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.002	0.002	0	0.0005	0.0005	0	0.004	0.003	29	0.0005	0.0005	0
Magnesium (total), mg/l	5.16	5.26	2	3.67	3.62	1	16.5	16.7	1	12.9	13	1	7.13	7.06	1	3.48	3.39	3
Manganese (total), mg/l	0.005	0.0025	67	0.0025	0.0025	0	0.038	0.038	0	0.257	0.262	2	0.066	0.068	3	0.0025	0.0025	0
Mercury (total), mg/l	0.000005	0.000005	0	0.000005	0.000005	0	0.000005	0.000005	0	0.000005	0.000005	0	0.00001	0.000005	67	0.000005	0.000005	0
Molybdenum (total), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.002	0.002	0
Nickel (total), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.002	0.003	40	0.003	0.003	0	0.0005	0.0005	0
Selenium (total), mg/l	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0
Silicon (total), mg/l	3.64	3.68	1	5.42	5.34	1	3.86	3.9	1	4.52	4.56	1	2.91	2.74	6	4.54	4.45	2
Silver (total), mg/l	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0
Strontium (total), mg/l	0.134	0.134	0	0.078	0.077	1	0.234	0.238	2	0.158	0.16	1	0.144	0.143	1	0.071	0.07	1
Titanium (total), mg/l				0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0
Uranium (total), mg/l	0.00026	0.00022	17	0.0003	0.00029	3	0.00161	0.00162	1	0.00025	0.00024	4	0.00067	0.00068	1	0.00031	0.00033	6
Vanadium (total), mg/l	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0
Zinc (total), mg/l	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0
Aluminum (dissolved), mg/l	0.01	0.01	0	0.039	0.094	83	0.028	0.03	7	0.134	0.049	93	0.033	0.034	3	0.032	0.034	6
Antimony (dissolved), mg/l	0.0003	0.0003	0	0.001	0.0009	11	0.0014	0.0014	0	0.0002	0.0002	0	0.0004	0.0004	0	0.0012	0.0012	0

APPENDIX A – Water Quality
APPENDIX A1-4: QA/QC – Field Replicates 1993-1996

Station	W6	W6 (Rep)	RPD	W1	W1 (Rep)		W5	W5 (Rep)		W11	W11 (Rep)		W7	W7 (Rep)		W1	W1 (Rep)	
Date	11-Jun-93	11-Jun-93		3-Jul-95	3-Jul-95		2-Aug-95	2-Aug-95		1-Oct-95	1-Oct-95		20-Jun-96	20-Jun-96		21-Jun-96	21-Jun-96	
Arsenic (dissolved), mg/l	0.0045	0.0043	5	0.0317	0.0311	2	0.0042	0.004	5	0.0009	0.0007	25	0.0012	0.0011	9	0.0266	0.0264	1
Barium (dissolved), mg/l	0.035	0.035	0	0.042	0.044	5	0.041	0.041	0	0.032	0.028	13	0.025	0.025	0	0.035	0.034	3
Beryllium (dissolved), mg/l	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0
Bismuth (dissolved), mg/l	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0
Boron (dissolved), mg/l	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0
Cadmium (dissolved), mg/l	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0
Calcium (dissolved), mg/l	32.9	32.8	0	13.4	13.3	1	42.6	42.8	0	45.2	43.1	5	26.7	26.8	0	11.1	11	1
Chromium (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Cobalt (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Copper (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.001	0.001	0	0.0005	0.0005	0	0.001	0.001	0	0.0005	0.0005	0
Iron (dissolved), mg/l	0.03	0.03	0	0.015	0.015	0	0.015	0.015	0	0.283	0.158	57	0.049	0.044	11	0.015	0.015	0
Lead (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Magnesium (dissolved), mg/l	5.12	5.16	1	3.61	3.58	1	16.4	16.5	1	13	12.6	3	6.81	6.81	0	3.35	3.35	0
Manganese (dissolved), mg/l	0.005	0.0025	67	0.0025	0.0025	0	0.032	0.033	3	0.268	0.253	6	0.013	0.013	0	0.0025	0.0025	0
Molybdenum (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.002	0.002	0
Nickel (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.001	0.001	0	0.0005	0.0005	0	0.0005	0.0005	0
Potassium (dissolved), mg/l	0.9	0.89	1	0.69	0.69	0	1.9	1.94	2	0.75	0.75	0	0.68	0.67	1	0.73	0.74	1
Selenium (dissolved), mg/l	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0
Silicon (dissolved), mg/l	3.62	3.62	0	5.33	5.33	0	3.78	3.77	0	4.55	4.45	2	2.38	2.38	0	4.29	4.26	1
Silver (dissolved), mg/l	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0
Sodium (dissolved), mg/l	1.26	1.25	1	1.65	1.67	1	2.33	2.38	2	1.83	1.82	1	1.32	1.37	4	1.32	1.33	1
Strontium (dissolved), mg/l	0.134	0.132	2	0.076	0.076	0	0.233	0.234	0	0.161	0.153	5	0.14	0.139	1	0.07	0.07	0
Titanium (dissolved), mg/l				0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0
Uranium (dissolved), mg/l	0.00022	0.00022	0	0.00029	0.00029	0	0.00156	0.0016	3	0.00024	0.00024	0	0.00059	0.00059	0	0.00046	0.00045	2
Vanadium (dissolved), mg/l	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0
Zinc (dissolved), mg/l	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.035	0.007	133	0.0025	0.0025	0	0.0025	0.0025	0
Total Organic Carbon, mg/l				1.6	1.6	0	2.3	2.2	4	2.9	2.8	4	5.6	5.7	2	5.2	4.9	6

Field Replicates for the 1993-1996 Sur

Station	W4	W4 (Rep)		W5	W5 (Rep)		W7	W7 (Rep)		W1	W1 (Rep)		W4	W4 (Rep)		W5	W5 (Rep)	
Date	22-Jun-96	22-Jun-96		23-Jun-96	23-Jun-96		24-Jun-96	24-Jun-96		25-Jun-96	25-Jun-96		26-Jun-96	26-Jun-96		27-Jun-96	27-Jun-96	
pH	7.76	7.7	1	7.79	7.81	0	7.69	7.65	1	7.58	7.51	1	7.68	7.69	0	7.76	7.81	1
Electrical Conductivity, µmho/cm	224	223	0	259	258	0	222	221	0	103	102	1	229	229	0	286	286	0
Total Dissolved Solids, mg/l	152	155	2	182	178	2	152	154	1	63	63	0	157	155	1	199	192	4
Total Suspended Solids, mg/l	168	55	101	27	35	26	53	41	26	3	3	0	66	75	13	19	23	19
Hardness, $CaCO_3$ mg/l	107	113	5	127	127	0	108	110	2	47.3	48	1	110	105	5	137	136	1
Turbidity, NTU	92.8	78.5	17	20.8	19.8	5	11.8	9.6	21	0.9	1	11	36.6	38.6	5	12.2	12.5	2
Alkalinity, $CaCO_3$ mg/l	68.4	67.1	2	76.4	75.6	1	73.1	73.9	1	39.8	38.7	3	70.3	68.6	2	86	83.4	3
Chloride, mg/l	0.8	0.8	0	0.7	0.5	33	0.25	0.25	0	0.25	0.25	0	0.25	0.25	0	0.25	0.25	0
Fluoride, mg/l	0.08	0.08	0	0.08	0.09	12	0.11	0.1	10	0.08	0.1	22	0.12	0.11	9	0.13	0.13	0
Sulphate (SO_4), mg/l	41.1	41.1	0	53.9	50.4	7	37.7	37.6	0	10.4	10.5	1	44.9	45.2	1	60.6	57.2	6
Ammonia Nitrogen (NH_4), mg/l	0.009	0.008	12	0.0025	0.009	113	0.0025	0.02	156	0.0025	0.0025	0	0.0025	0.0025	0	0.011	0.011	0
Nitrate Nitrogen (NO_3), mg/l	0.044	0.079	57	0.075	0.076	1	0.099	0.09	10	0.045	0.041	9	0.076	0.076	0	0.079	0.084	6
Nitrite Nitrogen (NO_2), mg/l	0.001	0.002	67	0.0005	0.0005	0	0.0005	0.001	67	0.001	0.001	0	0.001	0.001	0	0.003	0.001	100
Dissolved ortho-Phosphate, mg/l	0.001	0.003	100	0.003	0.002	40	0.001	0.002	67	0.005	0.005	0	0.0005	0.003	143	0.004	0.003	29
Total Dissolved Phosphate, mg/l	0.002	0.003	40	0.004	0.004	0	0.002	0.003	40	0.008	0.007	13	0.004	0.003	29	0.004	0.004	0
Total Phosphorus, mg/l	0.21	0.192	9	0.051	0.052	2	0.04	0.036	11	0.009	0.009	0	0.106	0.137	26	0.035	0.037	6
Total Cyanide (CN-), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Aluminum (total), mg/l	0.653	0.683	4	0.272	0.277	2	0.24	0.215	11	0.065	0.051	24	0.397	0.391	2	0.215	0.208	3
Antimony (total), mg/l	0.0007	0.0007	0	0.0009	0.0009	0	0.0003	0.0003	0	0.0013	0.0013	0	0.0005	0.0005	0	0.0011	0.001	10
Arsenic (total), mg/l	0.0061	0.0059	3	0.0052	0.0052	0	0.0018	0.0014	25	0.0222	0.0265	18	0.004	0.0039	3	0.0052	0.0048	8
Barium (total), mg/l	0.049	0.053	8	0.044	0.044	0	0.035	0.031	12	0.045	0.045	0	0.045	0.043	5	0.046	0.043	7
Beryllium (total), mg/l	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0
Bismuth (total), mg/l	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0
Boron (total), mg/l	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0
Cadmium (total), mg/l	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0
Calcium (total), mg/l	27.4	28.7	5	31.4	30	5	30.4	30.7	1	12.9	12.6	2	28.8	28.2	2	35.1	34.7	1
Chromium (total), mg/l	0.002	0.002	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Cobalt (total), mg/l	0.002	0.002	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Copper (total), mg/l	0.006	0.006	0	0.002	0.002	0	0.002	0.002	0	0.0005	0.0005	0	0.002	0.002	0	0.002	0.002	0
Iron (total), mg/l	1.71	1.85	8	0.457	0.415	10	0.491	0.315	44	0.041	0.041	0	0.496	0.477	4	0.274	0.242	12
Lead (total), mg/l	0.005	0.005	0	0.001	0.001	0	0.001	0.0005	67	0.0005	0.0005	0	0.002	0.002	0	0.0005	0.0005	0
Magnesium (total), mg/l	9.3	9.73	5	11.5	11.1	4	7.76	7.79	0	3.93	3.93	0	10	9.89	1	13.4	13.4	0
Manganese (total), mg/l	0.128	0.134	5	0.056	0.053	6	0.033	0.025	28	0.0025	0.0025	0	0.077	0.073	5	0.044	0.042	5
Mercury (total), mg/l	0.000005	0.000005	0	0.000005	0.000005	0	0.000005	0.000005	0	0.000005	0.000005	0	0.000005	0.000005	0	0.000005	0.000005	0
Molybdenum (total), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.002	0.002	0	0.0005	0.0005	0	0.0005	0.0005	0
Nickel (total), mg/l	0.004	0.004	0	0.001	0.001	0	0.002	0.001	67	0.0005	0.0005	0	0.002	0.002	0	0.002	0.002	0
Selenium (total), mg/l	0.0006	0.00025	82	0.0005	0.00025	67	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0
Silicon (total), mg/l	3.47	3.65	5	3.25	3.14	3	2.69	2.64	2	4.63	4.65	0	3.13	3.08	2	3.31	3.29	1
Silver (total), mg/l	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0
Strontium (total), mg/l	0.144	0.15	4	0.163	0.161	1	0.16	0.162	1	0.079	0.079	0	0.149	0.146	2	0.184	0.184	0
Titanium (total), mg/l	0.018	0.026	36	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0
Uranium (total), mg/l	0.00087	0.00093	7	0.00104	0.00101	3	0.00076	0.00075	1	0.00044	0.00044	0	0.00068	0.00068	0	0.00103	0.00104	1
Vanadium (total), mg/l	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0
Zinc (total), mg/l	0.007	0.008	13	0.006	0.0025	82	0.0025	0.0025	0	0.008	0.0025	105	0.0025	0.0025	0	0.0025	0.0025	0
Aluminum (dissolved), mg/l	0.027	0.041	41	0.025	0.027	8	0.021	0.022	5	0.021	0.02	5	0.013	0.015	14	0.01	0.01	0
Antimony (dissolved), mg/l	0.0005	0.0005	0	0.0009	0.001	11	0.0003	0.0004	29	0.0013	0.0013	0	0.0004	0.0004	0	0.001	0.001	0

APPENDIX A – Water Quality

APPENDIX A1-4: QA/QC – Field Replicates 1993-1996

Station	W4	W4 (Rep)		W5	W5 (Rep)		W7	W7 (Rep)		W1	W1 (Rep)		W4	W4 (Rep)		W5	W5 (Rep)	
Date	22-Jun-96	22-Jun-96		23-Jun-96	23-Jun-96		24-Jun-96	24-Jun-96		25-Jun-96	25-Jun-96		26-Jun-96	26-Jun-96		27-Jun-96	27-Jun-96	
Arsenic (dissolved), mg/l	0.0019	0.002	5	0.0033	0.0035	6	0.0008	0.0008	0	0.0254	0.0255	0	0.0014	0.0014	0	0.0031	0.003	3
Barium (dissolved), mg/l	0.031	0.033	6	0.038	0.038	0	0.027	0.027	0	0.037	0.045	20	0.033	0.031	6	0.038	0.038	0
Beryllium (dissolved), mg/l	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0
Bismuth (dissolved), mg/l	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0
Boron (dissolved), mg/l	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0	0.05	0.05	0
Cadmium (dissolved), mg/l	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0	0.0001	0.0001	0
Calcium (dissolved), mg/l	27.5	29	5	31.5	31.6	0	30.3	31.1	3	12.5	12.7	2	28.1	26.7	5	33.7	33.4	1
Chromium (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Cobalt (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Copper (dissolved), mg/l	0.0005	0.001	67	0.001	0.001	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.001	0.001	0
Iron (dissolved), mg/l	0.067	0.097	37	0.055	0.051	8	0.015	0.015	0	0.015	0.015	0	0.041	0.034	19	0.015	0.015	0
Lead (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Magnesium (dissolved), mg/l	9.38	9.77	4	11.7	11.7	0	7.73	7.83	1	3.89	3.94	1	9.65	9.32	3	12.9	12.7	2
Manganese (dissolved), mg/l	0.053	0.056	6	0.038	0.039	3	0.01	0.011	10	0.0025	0.0025	0	0.021	0.016	27	0.023	0.022	4
Molybdenum (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.002	0.002	0	0.0005	0.0005	0	0.0005	0.0005	0
Nickel (dissolved), mg/l	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.001	0.001	0	0.001	0.001	0
Potassium (dissolved), mg/l	0.81	0.81	0	1.01	1.02	1	0.72	0.73	1	0.76	0.77	1	0.88	0.85	3	1.14	1.21	6
Selenium (dissolved), mg/l	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0
Silicon (dissolved), mg/l	2.91	3.06	5	3.09	3.09	0	2.53	2.56	1	4.61	4.62	0	2.9	2.84	2	3.03	3	1
Silver (dissolved), mg/l	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0
Sodium (dissolved), mg/l	1.48	1.46	1	1.71	1.69	1	1.54	1.53	1	1.38	1.42	3	1.37	1.39	1	1.83	1.77	3
Strontium (dissolved), mg/l	0.145	0.152	5	0.163	0.166	2	0.16	0.163	2	0.078	0.08	3	0.144	0.139	4	0.177	0.175	1
Titanium (dissolved), mg/l	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0
Uranium (dissolved), mg/l	0.0007	0.0007	0	0.001	0.00099	1	0.00072	0.00072	0	0.00043	0.00044	2	0.00061	0.00061	0	0.001	0.001	0
Vanadium (dissolved), mg/l	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0	0.015	0.015	0
Zinc (dissolved), mg/l	0.0025	0.0025	0	0.008	0.006	29	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0
Total Organic Carbon, mg/l	4.9	5.1	4	5	4.8	4	4.1	4.4	7	4.4	4.3	2	3.7	3.9	5	4.1	3.4	19

APPENDIX A – Water Quality
APPENDIX A1-4: QA/QC – Field Replicates 2007-2008

Field Replicates for the 2007-2008 Surface Water Monitoring Program

Date Sampled	W-5 HAGGART CK U/S			W-21 DUBLIN GULCH U/S HAGGART CK			W-26 STEWARD GULCH			W-27 EAGLE PUP + SUTTLE			W-1 DUBLIN MIDWAY			W-23 HAGGART CR D/S LYNX		
	21-NOV-07	21-NOV-07		15-AUG-07	15-AUG-07		29-AUG-07	29-AUG-07		11-SEP-07	12-SEP-07		26-SEP-07	26-SEP-07		25-APR-08	25-APR-08	
	Repl. 1	Repl. 2	RPD	Repl. 1	Repl. 2	RPD	Repl. 1	Repl. 2	RPD	Repl. 1	Repl. 2	RPD	Repl. 1	Repl. 2	RPD	Repl. 1	Repl. 2	RPD
Physical Tests																		
Hardness (as CaCO3)	220	213	1.6%	81.7	79.4	1.4%	142	143	0.4%	208	205	0.7%	48.7	47.3	1.5%	227	234	1.5%
Conductivity	394	390	0.5%	168	168	0.0%	269	274	0.9%	364	362	0.3%	112	108	1.8%	432	433	0.1%
pH	7.91	7.92	0.1%	8.07	8.07	0.0%	8.23	8.24	0.1%	8.13	7.98	0.9%	8.04	7.95	0.6%	7.66	7.43	1.5%
Total Dissolved Solids	252	249	0.6%	102	106	1.9%				224	216	1.8%	76.0	68.0	5.6%	295	271	4.2%
Total Suspended Solids	<3.0	<3.0	0.0%	<3.0	<3.0	0.0%	<3.0	<3.0	0.0%	<3.0	<3.0	0.0%	4.0	<3.0		<3.0	<3.0	0.0%
Turbidity	0.59	0.57	1.7%	0.62	0.72	7.5%	0.66	0.51	12.8%	0.55	0.62	6.0%	0.66	0.24	46.7%	1.45	1.28	6.2%
Anions and Nutrients																		
Ammonia as N	0.0063	0.0052	9.6%	<0.020	<0.020	0.0%	<0.020	<0.020	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%
Alkalinity, Total (as CaCO3)	118	119	0.4%	57.1	56.4	0.6%				137	149	4.2%						
Bromide (Br)				<0.050	<0.050	0.0%						0.0%						
Chloride (Cl)	<0.50	<0.50	0.0%	<0.50	<0.50	0.0%	<0.50	<0.50	0.0%	<0.50	<0.50	0.0%						
Fluoride (F)	0.091	0.094	1.6%	0.082	0.085	1.8%	0.137	0.137	0.0%	0.142	0.142	0.0%						
Sulfate (SO4)	85.3	85.3	0.0%	26.7	26.9	0.4%	29.5	29.5	0.0%	54.6	54.6	0.0%						
Nitrate (as N)	0.119	0.119	0.0%	<0.0050	<0.0050	0.0%	0.0547	0.0542	0.5%	0.0304	0.0309	0.8%				0.176	0.176	0.0%
Nitrite (as N)	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%
Total Kjeldahl Nitrogen	<0.050	<0.050	0.0%	0.076	0.093	10.1%	0.086	0.084	1.2%	0.069	0.073	2.8%	0.058	<0.050		0.058	<0.050	
Ortho Phosphate as P	<0.0010	<0.0010	0.0%	0.0022	0.0021	2.3%	0.0050	0.0045	5.3%	0.0016	0.0017	3.0%	0.0026	0.0024	4.0%	0.0016	0.0021	13.5%
Total Dissolved Phosphate As P	<0.0020	<0.0020	0.0%	0.0040	0.0029	15.9%	0.0054	0.0054	0.0%	0.0021	0.0029	16.0%	0.0042	0.0040	2.4%	0.0023	0.0029	11.5%
Total Phosphate as P	<0.0020	<0.0020	0.0%	0.0050	0.0041	9.9%	0.0067	0.0070	2.2%	0.0038	0.0047	10.6%	0.0043	0.0044	1.1%	0.0044	0.0043	1.1%
Cyanides																		
Cyanide, Weak Acid Diss	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%
Cyanide, Total	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%
Total Metals																		
Aluminum (Al)-Total	0.0073	0.0061	9.0%	0.0165	0.0158	2.2%	0.0256	0.0261	1.0%	0.0563	0.0201	47.4%	0.0199	0.0180	5.0%	0.0212	0.0188	6.0%
Antimony (Sb)-Total	0.00063	0.00061	1.6%	0.00138	0.00141	1.1%	0.00090	0.00089	0.6%	0.00496	0.00509	1.3%	0.00107	0.00106	0.5%	0.00046	0.00044	2.2%
Arsenic (As)-Total	0.00285	0.00275	1.8%	0.0352	0.0347	0.7%	0.0191	0.0190	0.3%	0.0470	0.0485	1.6%	0.0391	0.0375	2.1%	0.00454	0.00438	1.8%
Barium (Ba)-Total	0.035	0.038	4.1%	0.0436	0.0437	0.1%	0.0529	0.0521	0.8%	0.0622	0.0636	1.1%	0.041	0.041	0.0%	0.0504	0.0495	0.9%
Beryllium (Be)-Total	<0.0010	<0.0010	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.0010	<0.0010	0.0%	<0.00050	<0.00050	0.0%
Bismuth (Bi)-Total				<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%			0.0%	<0.00050	<0.00050	0.0%
Boron (B)-Total	<0.10	<0.10	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.10	<0.10	0.0%	<0.010	<0.010	0.0%
Cadmium (Cd)-Total	0.000017	<0.000017	0.0%	<0.000017	<0.000017	0.0%	<0.000050	<0.000050	0.0%	<0.000050	<0.000050	0.0%	<0.000017	<0.000017	0.0%	<0.000017	<0.000017	0.0%
Calcium (Ca)-Total	54.2	54.3	0.1%	20.0	19.8	0.5%	33.4	33.2	0.3%	43.0	42.9	0.1%	14.7	14.7	0.0%	61.3	61.9	0.5%
Chromium (Cr)-Total	<0.0010	<0.0010	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.0010	<0.0010	0.0%	<0.00050	<0.00050	0.0%
Cobalt (Co)-Total	<0.00030	<0.00030	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00030	<0.00030	0.0%	<0.00010	<0.00010	0.0%
Copper (Cu)-Total	<0.0010	<0.0010	0.0%	0.00041	0.00039	2.5%	0.00052	0.00077	19.4%	0.00087	0.00091	2.2%	<0.0010	<0.0010	0.0%	0.0004	0.00038	2.6%
Iron (Fe)-Total	0.038	0.039	1.3%	0.035	<0.030	0.0%	<0.030	<0.030	0.0%	0.226	0.032	75.2%	<0.030	<0.030	0.0%	0.051	0.05	1.0%
Lead (Pb)-Total	<0.00050	<0.00050	0.0%	<0.000050	<0.000050	0.0%	<0.000050	0.000074		0.000087	0.000084	1.8%	<0.00050	<0.00050	0.0%	0.000093	0.000087	3.3%
Lithium (Li)-Total	0.0072	0.0074	1.4%	0.0076	0.0075	0.7%	<0.0050	<0.0050	0.0%	0.0103	0.0105	1.0%	<0.0050	<0.0050	0.0%	0.0051	<0.0050	0.0%
Magnesium (Mg)-Total	19.9	20	0.3%	6.75	6.65	0.7%	15.1	15.0	0.3%	24.4	24.3	0.2%	3.33	3.29	0.6%	18.7	18.9	0.5%
Manganese (Mn)-Total	0.0709	0.0687	1.6%	0.00411	0.00409	0.2%	0.000705	0.000654	3.8%	0.00561	0.00533	2.6%	0.00073	0.00072	0.7%	0.0387	0.0376	1.4%
Mercury (Hg)-Total	<0.000020	<0.000020	0.0%			0.0%							<0.000020	<0.000020	0.0%			0.0%
Molybdenum (Mo)-Total	<0.0010	<0.0010	0.0%	0.00164	0.00163	0.3%	0.00345	0.00340	0.7%	0.000887	0.000886	0.1%	0.0019	0.0018	2.7%	0.000364	0.000398	4.5%
Nickel (Ni)-Total	0.0011	0.0011	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	0.00051	0.00051	0.0%	<0.0010	<0.0010	0.0%	<0.00050	<0.00050	0.0%
Phosphorus (P)-Total				<0.30	<0.30	0.0%	<0.30	<0.30	0.0%	<0.30	<0.30	0.0%			0.0%	<0.30	<0.30	0.0%
Potassium (K)-Total	<2.0	<2.0	0.0%	<2.0	<2.0	0.0%	<2.0	<2.0	0.0%	2.3	2.2	2.2%	<2.0	<2.0	0.0%	<2.0	<2.0	0.0%

APPENDIX A – Water Quality

APPENDIX A1-4: QA/QC – Field Replicates 2007-2008

	W-5 HAGGART CK U/S			W-21 DUBLIN GULCH U/S HAGGART CK			W-26 STEWARD GULCH			W-27 EAGLE PUP + SUTTLE			W-1 DUBLIN MIDWAY			W-23 HAGGART CR D/S LYNX		
Date Sampled	21-NOV-07	21-NOV-07		15-AUG-07	15-AUG-07		29-AUG-07	29-AUG-07		11-SEP-07	12-SEP-07		26-SEP-07	26-SEP-07		25-APR-08	25-APR-08	
	Repl. 1	Repl. 2	RPD	Repl. 1	Repl. 2	RPD	Repl. 1	Repl. 2	RPD	Repl. 1	Repl. 2	RPD	Repl. 1	Repl. 2	RPD	Repl. 1	Repl. 2	RPD
Selenium (Se)-Total	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%
Silicon (Si)-Total				5.13	5.09	0.4%	4.59	4.56	0.3%	5.22	5.15	0.7%			0.0%	4.38	4.38	0.0%
Silver (Ag)-Total	<0.000020	<0.000020	0.0%	<0.000010	<0.000010	0.0%	<0.000010	<0.000010	0.0%	<0.000010	<0.000010	0.0%	<0.000020	<0.000020	0.0%	<0.000010	<0.000010	0.0%
Sodium (Na)-Total	2.1	2.1	0.0%	<2.0	<2.0	0.0%	<2.0	<2.0	0.0%	3.1	3.0	1.6%	<2.0	<2.0	0.0%	2.3	2.4	2.1%
Strontium (Sr)-Total				0.114	0.114	0.0%	0.237	0.236	0.2%	0.262	0.263	0.2%			0.0%	0.251	0.245	1.2%
Thallium (Tl)-Total	<0.00020	<0.00020	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00020	<0.00020	0.0%	<0.00010	<0.00010	0.0%
Tin (Sn)-Total	<0.00050	<0.00050	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00050	<0.00050	0.0%	0.00015	0.00026	26.8%
Titanium (Ti)-Total	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%
Uranium (U)-Total	0.00174	0.0017	1.2%	0.000774	0.000761	0.8%	0.00434	0.00430	0.5%	0.00363	0.00381	2.4%	0.00046	0.00046	0.0%	0.00171	0.00169	0.6%
Vanadium (V)-Total	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.030	<0.030	0.0%	<0.0010	<0.0010	0.0%
Zinc (Zn)-Total	0.023	0.0206	5.5%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0050	<0.0050	0.0%	0.0012	0.0012	0.0%
Dissolved Metals																		
Aluminum (Al)-Dissolved	<0.0050	<0.0050	0.0%	0.0068	0.0069	0.7%	0.0110	0.0109	0.5%	0.0016	0.0044	46.7%	0.0057	0.0055	1.8%	0.002	0.0018	5.3%
Antimony (Sb)-Dissolved	0.00062	0.00061	0.8%	0.00137	0.00138	0.4%	0.00090	0.00090	0.0%	0.00514	0.00525	1.1%	0.00104	0.00102	1.0%	0.00045	0.00043	2.3%
Arsenic (As)-Dissolved	0.00261	0.0026	0.2%	0.0348	0.0349	0.1%	0.0183	0.0184	0.3%	0.0481	0.0476	0.5%	0.0357	0.0355	0.3%	0.004	0.00399	0.1%
Barium (Ba)-Dissolved	0.041	0.04	1.2%	0.0431	0.0433	0.2%	0.0511	0.0518	0.7%	0.0624	0.0636	1.0%	0.039	0.038	1.3%	0.0495	0.0489	0.6%
Beryllium (Be)-Dissolved	<0.0010	<0.0010	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.0010	<0.0010	0.0%	<0.00050	<0.00050	0.0%
Bismuth (Bi)-Total				<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%			0.0%	<0.00050	<0.00050	0.0%
Boron (B)-Dissolved	<0.10	<0.10	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.10	<0.10	0.0%	<0.010	<0.010	0.0%
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	0.0%	<0.000017	<0.000017	0.0%	<0.000050	<0.000050	0.0%	<0.000050	<0.000050	0.0%	<0.000017	<0.000017	0.0%	<0.000017	<0.000017	0.0%
Calcium (Ca)-Dissolved	54.5	53	1.4%	21.1	20.5	1.4%	32.6	32.8	0.3%	43.1	42.4	0.8%	14.2	13.8	1.4%	61.1	62.2	0.9%
Chromium (Cr)-Dissolved	<0.0010	<0.0010	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.0010	<0.0010	0.0%	<0.00050	<0.00050	0.0%
Cobalt (Co)-Dissolved	<0.00030	<0.00030	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00030	<0.00030	0.0%	<0.00010	<0.00010	0.0%
Copper (Cu)-Dissolved	<0.0010	<0.0010	0.0%	0.00038	0.00042	5.0%	0.00048	0.00051	3.0%	0.00080	0.00109	15.3%	<0.0010	<0.0010	0.0%	0.00034	0.00031	4.6%
Iron (Fe)-Dissolved	<0.030	<0.030	0.0%	<0.030	<0.030	0.0%	<0.030	<0.030	0.0%	<0.030	<0.030	0.0%	<0.030	<0.030	0.0%	<0.030	<0.030	0.0%
Lead (Pb)-Dissolved	<0.00050	<0.00050	0.0%	<0.000050	<0.000050	0.0%	<0.000050	<0.000050	0.0%	<0.000050	<0.000050	0.0%	<0.00050	<0.00050	0.0%	<0.000050	<0.000050	0.0%
Lithium (Li)-Dissolved	0.0075	0.0073	1.4%	0.0075	0.0075	0.0%	<0.0050	<0.0050	0.0%	0.0106	0.0106	0.0%	<0.0050	<0.0050	0.0%	<0.0050	<0.0050	0.0%
Magnesium (Mg)-Dissolved	20.3	19.6	1.8%	7.07	6.87	1.4%	14.8	14.9	0.3%	24.5	24.1	0.8%	3.21	3.10	1.7%	18.2	19	2.2%
Manganese (Mn)-Dissolved	0.0706	0.0679	1.9%	0.00350	0.00350	0.0%	0.000225	0.000220	1.1%	0.00388	0.00390	0.3%	<0.00030	0.00032		0.0356	0.0342	2.0%
Mercury (Hg)-Dissolved	<0.000020	<0.000020	0.0%			0.0%							<0.000020	<0.000020	0.0%			
Molybdenum (Mo)-Dissolved	<0.0010	<0.0010	0.0%	0.00162	0.00157	1.6%	0.00346	0.00351	0.7%	0.000905	0.000968	3.4%	0.0018	0.0019	2.7%	0.000395	0.000385	1.3%
Nickel (Ni)-Dissolved	0.0012	0.0011	4.3%	<0.00050	<0.00050	0.0%	<0.00050	<0.00050	0.0%	<0.00050	0.00080		<0.0010	<0.0010	0.0%	<0.00050	<0.00050	0.0%
Phosphorus (P)-Total				<0.30	<0.30	0.0%	<0.30	<0.30	0.0%	<0.30	<0.30	0.0%			0.0%	<0.30	<0.30	0.0%
Potassium (K)-Dissolved	<2.0	<2.0	0.0%	<2.0	<2.0	0.0%	<2.0	<2.0	0.0%	2.3	2.2	2.2%	<2.0	<2.0	0.0%	<2.0	<2.0	0.0%
Selenium (Se)-Dissolved	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%
Silicon (Si)-Total				5.36	5.17	1.8%	4.48	4.46	0.2%	5.17	5.06	1.1%			0.0%	4.23	4.47	2.8%
Silver (Ag)-Dissolved	<0.000020	<0.000020	0.0%	<0.000010	<0.000010	0.0%	<0.000010	<0.000010	0.0%	<0.000010	<0.000010	0.0%	<0.000020	<0.000020	0.0%	<0.000010	<0.000010	0.0%
Sodium (Na)-Dissolved	2.2	2.1	2.3%	<2.0	<2.0	0.0%	<2.0	<2.0	0.0%	3.1	3.0	1.6%	<2.0	<2.0	0.0%	2.2	2.4	4.3%
Strontium (Sr)-Total				0.112	0.112	0.0%	0.234	0.237	0.6%	0.264	0.271	1.3%			0.0%	0.247	0.244	0.6%
Thallium (Tl)-Dissolved	<0.00020	<0.00020	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00020	<0.00020	0.0%	<0.00010	<0.00010	0.0%
Tin (Sn)-Dissolved	<0.00050	<0.00050	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00010	<0.00010	0.0%	<0.00050	<0.00050	0.0%	<0.00010	0.00022	
Titanium (Ti)-Dissolved	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%	<0.010	<0.010	0.0%
Uranium (U)-Dissolved	0.00172	0.00169	0.9%	0.000732	0.000758	1.7%	0.00429	0.00428	0.1%	0.00379	0.00391	1.6%	0.00045	0.00045	0.0%	0.00171	0.00169	0.6%
Vanadium (V)-Dissolved	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.030	<0.030	0.0%	<0.0010	<0.0010	0.0%
Zinc (Zn)-Dissolved	0.0055	<0.0050	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0010	<0.0010	0.0%	<0.0050	<0.0050	0.0%	0.0028	0.0017	24.4%
Organic Parameters																		
Total Organic Carbon	1.5	1.6	3.2%	1.92	1.92	0.0%	2.98	3.12	2.3%	1.96	1.99	0.8%	1.63	1.65	0.6%	-	-	
Dissolved Organic Carbon																1.64	1.63	0.3%

APPENDIX A – Water Quality
APPENDIX A1-4: QA/QC – Field Replicates 2009

Field Replicates for the 2009 Surface Water Monitoring Program

	W-23			W-9			W22			W-23			W-29		
Date Sampled	20 July 2009			20-Aug-09			16-Sep-09			7-Oct-09			20-Oct-09		
	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD
Conductivity	325	328	0	425	425.5	0	279	278	1	302	301	1	318	320	1
Hardness (as $CaCO_3$)	175	174	0	251	251	0	151	149.5	2	158	156	3	181	182	1
pH	8.01	8.06	0	8.19	8.19	0	7.88	7.91	1	7.76	7.82	1	7.85	7.90	1
Total Suspended Solids	1.5	1.5	0	1.5	1.5	0	1.5	1.5	0	1.5	1.5	0	5.0	3.3	108
Total Dissolved Solids	210	216	1	264	265.5	1	167	168.5	2	189	191	2	211	207	4
Turbidity	1.28	1.24	2	0.52	0.565	8	0.36	0.345	9	0.54	0.59	17	1.26	1.32	8
Anions and Nutrients															
Alkalinity, Total (as $CaCO_3$)	101	99.3	1	191	191	0	82	83.45	3	98.8	96.4	5	94.6	97.8	7
Ammonia as N	0.0025	0.0025	0	0.01	0.01	0	0.01	0.017	82	0.0025	0.0025	0	0.01	0.0155	71
Bromide (Br)				0.025	0.025	0	0.025	0.025	0	0.025	0.025	0	0.025	0.025	0
Chloride (Cl)	0.25	0.25	0	0.25	0.25	0	0.25	0.25	0	0.25	0.25	0	0.25	0.25	0
Fluoride (Fl)				0.173	0.172	1	0.089	0.089	0	0.069	0.069	1	0.083	0.083	0
Nitrate (as N)	0.0402	0.0384	2	0.21	0.2125	1	0.0758	0.07775	5	0.117	0.118	2	0.104	0.104	0
Nitrite (as N)	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0
Total Kjeldahl Nitrogen	0.124	0.095	13	0.069	0.073	5	0.052	0.056	14	0.140	0.121	32	0.080	0.069	32
Total Nitrogen	0.164	0.133	10	0.32	0.32	0	0.128	0.1335	8	0.257	0.239	16	0.030	0.096	138
Ortho Phosphate as P	0.0005	0.0005	0	0.0027	0.00285	5	0.0005	0.0005	0	0.0005	0.0005	0	0.0014	0.0010	95
Total Dissolved Phosphate As P	0.001	0.001	0	0.001	0.001	0	0.001	0.001	0	0.001	0.001	0	0.001	0.001	0
Total Phosphate as P	0.001	0.001	0	0.0022	0.00255	14	0.001	0.001	0	0.0024	0.0022	18	0.0027	0.0024	25
Sulfate (SO4)	68.1	68.1	0	55	54.95	0	59	59.35	1	57.9	57.9	0	67.1	67.1	0
Cyanides															
Cyanide, Weak Acid Diss	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	-			0.0025	0.0025	0
Cyanide, Total	0.0025	0.0025	0	0.0025	0.0025	0	0.0025	0.0025	0	-			0.0025	0.0025	0
Organic/Inorganic Carbon															
Dissolved Organic Carbon	2.7	2.63	1	1.88	1.95	4	3.33	3.33	0	3.04	3.02	2	1.40	1.43	4
Total Metals															
Aluminum (Al)-Total	0.0214	0.0556	44	0.012	0.01225	2	0.0134	0.0133	2	-			0.0420	0.0316	66
Antimony (Sb)-Total	0.00066	0.00072	4	0.00059	0.000625	6	0.00025	0.00024	8	-			0.00069	0.00069	1
Arsenic (As)-Total	0.00477	0.0048	0	0.0191	0.0195	2	0.00071	0.000735	7	-			0.00418	0.00418	0
Barium (Ba)-Total	0.0523	0.0559	3	0.076	0.07755	2	0.0313	0.031	2	-			0.0368	0.0361	4
Beryllium (Be)-Total	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	-			0.00025	0.00025	0

APPENDIX A – Water Quality
APPENDIX A1-4: QA/QC – Field Replicates 2009

	W-23			W-9			W22			W-23			W-29		
Date Sampled	20 July 2009			20-Aug-09			16-Sep-09			7-Oct-09			20-Oct-09		
	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD
Bismuth (Bi)-Total	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	-			0.00025	0.00025	0
Boron (B)-Total	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	-			0.005	0.005	0
Cadmium (Cd)-Total	0.0000085	0.0000085	0	0.0000057	5.7E-06	0	5.7E-06	5.7E-06	0	-			0.000025	0.000025	0
Calcium (Ca)-Total	48.9	49.1	0	45.8	45.8	0	39.1	39.05	0	-			43.4	43.1	1
Chromium (Cr)-Total	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	-			0.00025	0.00025	0
Cobalt (Co)-Total	0.00005	0.00005	0	0.00005	0.00005	0	0.0001	0.0001	0	-			0.00005	0.00005	0
Copper (Cu)-Total	<0.00080	0.0005	0	0.00039	0.00041	5	0.00059	0.00061	7	-			0.0003	0.0003	0
Iron (Fe)-Total	0.066	0.08	10	0.015	0.015	0	0.064	0.0625	5	-			0.114	0.093	45
Lead (Pb)-Total	0.000025	0.000025	0	0.000058	6.75E-05	14	0.000025	0.000025	0	-			0.000360	0.000250	89
Lithium (Li)-Total	0.0025	0.0025	0	0.0108	0.01065	1	0.0051	0.00515	2	-			0.0065	0.0065	2
Magnesium (Mg)-Total	12.8	12.7	0	32.5	32.75	1	12.7	12.65	1	-			15.3	15.3	1
Manganese (Mn)-Total	0.0186	0.0204	5	0.000636	0.000673	5	0.0253	0.02515	1	-			0.0302	0.0285	12
Mercury (Hg)-Total	0.000025	0.000025	0	0.00001	0.00001	0				-			0.000025	0.0000	0
Molybdenum (Mo)-Total	0.000552	0.000635	7	0.00097	0.001005	3	0.000061	0.000065	12	-			0.000228	0.000244	13
Nickel (Ni)-Total	0.00053	0.00064	9	0.00025	0.00025	0	0.00092	0.000915	1	-			0.00084	0.00079	13
Phosphorus (P)-Total	0.15	0.15	0	0.15	0.15	0	0.15	0.15	0	-			0.15	0.15	0
Potassium (K)-Total	1	1	0	1	1	0	1	1	0	-			1	1	0
Selenium (Se)-Total	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	-			0.0005	0.0005	0
Silicon (Si)-Total	4.09	4.11	0	4	4	0	3.78	3.765	1	-			3.83	3.83	0
Silver (Ag)-Total	0.000005	0.000005	0	0.000005	0.000005	0	0.000005	0.000005	0	-			0.000005	0.000005	0
Sodium (Na)-Total	2	2.1	2	2.9	2.95	2	1	1	0	-			1	1	0
Strontium (Sr)-Total	0.247	0.273	5	0.35	0.3465	1	0.162	0.161	1	-			0.193	0.195	2
Thallium (Tl)-Total	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	-			0.00005	0.00005	0
Tin (Sn)-Total	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	-			0.00005	0.00005	0
Titanium (Ti)-Total	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	-			0.005	0.005	0
Uranium (U)-Total	0.000987	0.00106	4	0.00972	0.009845	1	0.000707	0.000693	4	-			0.00130	0.00132	3
Vanadium (V)-Total	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	0	-			0.0005	0.0005	0
Zinc (Zn)-Total	0.0005	0.0015	50	0.0005	0.0005	0	0.0033	0.0023	87	-			0.0019	0.0018	17
Dissolved Metals															
Aluminum (Al)-Dissolved	0.0052	0.0057	5	0.0035	0.00335	4	0.0108	0.0109	2	0.0074	0.0073	3	0.0028	0.0027	11
Antimony (Sb)-Dissolved	0.0007	0.00069	1	0.00061	0.00059	3	0.00024	0.000245	4	0.00048	0.00047	4	0.00068	0.00068	1
Arsenic (As)-Dissolved	0.00454	0.00453	0	0.0195	0.01915	2	0.00073	0.00072	3	0.00450	0.00450	0	0.00385	0.00386	0
Barium (Ba)-Dissolved	0.0521	0.0503	2	0.079	0.07725	2	0.0309	0.0312	2	0.0392	0.0385	4	0.0353	0.0354	1

APPENDIX A – Water Quality
APPENDIX A1-4: QA/QC – Field Replicates 2009

	W-23			W-9			W22			W-23			W-29		
Date Sampled	20 July 2009			20-Aug-09			16-Sep-09			7-Oct-09			20-Oct-09		
	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD
Beryllium (Be)-Dissolved	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0
Bismuth (Bi)-Dissolved	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0
Boron (B)-Dissolved	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0	0.005	0.005	0
Cadmium (Cd)-Dissolved	0.0000085	0.0000085	0	0.0000057	5.7E-06	0	5.7E-06	5.7E-06	0	0.0000057	5.7E-06	0	0.000025	0.000025	0
Calcium (Ca)-Dissolved	49	48.9	0	46.3	46.25	0	39.4	39.05	2	45.7	45.0	3	46.2	46.3	0
Chromium (Cr)-Dissolved	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0	0.00025	0.00025	0
Cobalt (Co)-Dissolved	0.00005	0.00005	0	0.00005	0.00005	0	0.0001	0.000105	10	0.00005	0.00005	0	0.00005	0.00005	0
Copper (Cu)-Dissolved	0.00065	0.00067	2	0.00036	0.000325	11	0.00058	0.000585	2	0.00060	0.00060	0	0.00032	0.00033	6
Iron (Fe)-Dissolved	0.033	0.034	1	0.015	0.015	0	0.046	0.0455	2	0.015	0.015	0	0.015	0.015	0
Lead (Pb)-Dissolved	0.000025	0.000025	0	0.000025	0.000025	0	0.000025	0.000025	0	0.000025	0.000025	0	0.000025	0.000025	0
Lithium (Li)-Dissolved	0.0025	0.0025	0	0.011	0.01075	2	0.0025	0.00385	70	0.0025	0.0025	0	0.0063	0.0061	7
Magnesium (Mg)-Dissolved	12.7	12.6	0	32.8	32.85	0	12.8	12.7	2	10.5	10.5	0	15.8	15.9	1
Manganese (Mn)-Dissolved	0.0172	0.0167	1	0.00015	0.00013	15	0.0248	0.02465	1	0.0208	0.0208	0	0.0232	0.0233	0
Mercury (Hg)-Dissolved	0.000025	0.000025	0	0.00001	0.00001	0			9	0.000025	0.000025	0	0.000025	0.0000	0
Molybdenum (Mo)-Dissolved	0.000548	0.000555	1	0.00103	0.001011	2	0.000061	5.85E-05	4	0.000539	0.000535	2	0.000205	0.000208	2
Nickel (Ni)-Dissolved	0.00025	0.00025	0	0.00025	0.00025	0	0.00094	0.00096	0	0.00059	0.00042	81	0.00060	0.00058	7
Phosphorus (P)-Dissolved	0.15	0.15	0	0.15	0.15	0	0.15	0.15	0	0.15	0.15	0	0.15	0.15	0
Potassium (K)-Dissolved	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0
Selenium (Se)-Dissolved	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	2	0.0005	0.0005	0	0.0005	0.0005	0
Silicon (Si)-Dissolved	4.04	4.04	0	3.95	3.965	0	3.81	3.78	0	4.02	4.01	0	4.01	4.03	1
Silver (Ag)-Dissolved	0.000005	0.000005	0	0.000005	0.000005	0	0.000005	0.000005	0	0.000005	0.000005	0	0.000005	0.000005	0
Sodium (Na)-Dissolved	2.1	2.1	0	2.9	2.95	2	1	1	0	1	1	0	1	1	0
Strontium (Sr)-Dissolved	0.243	0.243	0	0.364	0.3475	5	0.161	0.161	0	0.159	0.166	8	0.187	0.190	3
Thallium (Tl)-Dissolved	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0
Tin (Sn)-Dissolved	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0	0.00005	0.00005	0
Titanium (Ti)-Dissolved	0.005	0.005	0	0.005	0.005	0	0.005	0.005	2	0.005	0.005	0	0.005	0.005	0
Uranium (U)-Dissolved	0.000975	0.000983	0	0.0102	0.00993	3	0.000708	0.000702	0	0.000865	0.000847	4	0.00128	0.00130	2
Vanadium (V)-Dissolved	0.0005	0.0005	0	0.0005	0.0005	0	0.0005	0.0005	15	0.0005	0.0005	0	0.0005	0.0005	0
Zinc (Zn)-Dissolved	0.0005	0.0005	0	0.0005	0.0005	0	0.0012	0.0013		0.0011	0.0011	10	0.0005	0.0005	0

Field Replicates for the 2010 Surface Water Monitoring Program

	W4			W1			W1			W23			W1		
Date Sampled	31-MAR-10			06-MAY-10			22-MAY-10			22-MAY-10			02-JUN-10		
	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD
Conductivity	372	372	0	78.2	79.3	1	23.8	24.7	-4	115	115	0	94.0	72.9	25
Hardness (as $CaCO_3$)	203	202	0	41.6	40.5	3	12.2	13.6	-11	59.4	65.0	-9	32.9	32.4	2
pH	8.05	8.05	0	7.41	7.31	1	6.31	6.37	-1	6.63	6.56	1	7.90	7.82	1
Total Suspended Solids	<3.0	<3.0	0	<3.0	<3.0	0	28.0	27.0	4	20.0	31.0	-43	3.5	<3.0	0
Total Dissolved Solids	238	238	0	77	77	0	34	39	-14	94	90	4	47	52	-10
Turbidity	0.71	0.70	1	0.45	0.42	7	7.74	7.60	2	10.7	11.0	-3	1.49	1.52	-2
Anions and Nutrients															
Alkalinity, Total (as $CaCO_3$)	116	115	1	29.9	30.3	1	9.1	10.1	-10	45.7	44.8	2	27.7	27.0	3
Ammonia as N	0.0052	0.0053	-2	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Bromide (Br)	<0.050	<0.050	0	<0.050	<0.050	0							<0.050	<0.050	0
Chloride (Cl)	<0.50	<0.50	0	<0.50	<0.50	0	<0.50	<0.50	0	<0.50	<0.50	0	<0.50	<0.50	0
Fluoride (Fl)	0.116	0.116	0	0.074	0.071	4							0.053	0.053	0
Nitrate (as N)	0.152	0.152	0	0.0470	0.0456	3	0.0081	0.0082	-1	0.0312	0.0309	1	0.0275	0.0289	-5
Nitrite (as N)	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Total Kjeldahl Nitrogen	0.062	0.025	85	0.557	0.312	56	0.277	0.256	8	0.265	0.295	-11	0.113	0.095	17
Total Nitrogen	0.160	0.150	6	0.604	0.358	51	0.286	0.264	8	0.296	0.326	-10	0.141	0.124	13
Ortho Phosphate as P	0.0010	0.0005	67	<0.0010	0.0024	0	0.0025	0.0023	8	0.0011	<0.0010	0	0.0029	0.0028	4
Total Dissolved Phosphate As P	<0.0020	<0.0020	0	0.0067	0.0073	9	0.0105	0.0107	-2	0.0059	0.0069	-16	0.0030	0.0040	-29
Total Phosphate as P	<0.0020	<0.0020	0	0.0083	0.0085	2	0.0374	0.096	-88	0.0206	0.0246	-18	0.0067	0.0095	-35
Sulfate (SO4)	88.7	88.7	0	8.91	8.80	1	1.56	1.58	-1	18.8	18.9	-1	6.16	6.14	0
Cyanides															
Cyanide, Weak Acid Diss	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Cyanide, Total	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0	0.0052	<0.0050	0
Organic/Inorganic Carbon															
Dissolved Organic Carbon	0.80	1.09	-31	9.32	9.32	0	10.3	10.3	0	11.2	11.1	1	4.59	4.03	13
Total Metals															
Aluminum (Al)-Total	0.0089	0.0102	-14	0.130	0.0844	43	0.693	0.565	20	0.385	0.487	-23	2.35	0.164	174
Antimony (Sb)-Total	0.00027	0.00027	0	0.00113	0.00111	2	0.00069	0.00062	11	0.00051	0.00056	-9	0.00159	0.00104	42
Arsenic (As)-Total	0.00135	0.00129	5	0.0288	0.0293	2	0.0317	0.0290	9	0.00700	0.00766	-9	0.0737	0.0351	71
Barium (Ba)-Total	0.0419	0.0417	0	0.0356	0.0353	1	0.0234	0.0212	10	0.0249	0.0272	-9	0.0735	0.0323	78
Beryllium (Be)-Total	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)-Total	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)-Total	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)-Total	<0.000017	<0.000017	0	<0.000017	<0.000017	0	0.000032	0.000023	33	0.000033	0.000034	-3	0.000065	<0.000017	0
Calcium (Ca)-Total	46.4	46.9	-1	11.1	10.9	2	3.77	4.26	-12	16.7	19.3	-14	9.99	9.54	5
Chromium (Cr)-Total	<0.00050	<0.00050	0	<0.00050	<0.00050	0	0.00122	0.00090	30	0.00071	0.00086	-19	0.00564	<0.00050	0
Cobalt (Co)-Total	0.00015	0.00017	-13	<0.00010	<0.00010	0	0.00044	0.00029	41	0.00034	0.00040	-16	0.00207	0.00012	178
Copper (Cu)-Total	0.00028	0.00025	11	0.00100	0.00108	8	0.00120	0.00113	6	0.00249	0.00265	-6	0.00425	0.00093	128
Iron (Fe)-Total	0.089	0.093	-4	0.150	0.084	56	0.752	0.619	19	0.583	0.750	-25	3.97	0.215	179
Lead (Pb)-Total	<0.000050	<0.000050	0	0.000150	0.000062	83	0.00113	0.000733	43	0.000748	0.000873	-15	0.00403	0.000248	177
Lithium (Li)-Total	0.0082	0.0077	6	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0	0.0052	<0.0050	0
Magnesium (Mg)-Total	20.0	20.2	-1	2.81	2.78	1	0.84	0.88	-5	4.07	4.50	-10	3.04	2.17	33
Manganese (Mn)-Total	0.0451	0.0430	5	0.00301	0.00119	87	0.0267	0.0180	39	0.0314	0.0353	-12	0.101	0.00596	178
Mercury (Hg)-Total	<0.000010	<0.000010	0	0.000011	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)-Total	0.000098	0.000091	7	0.00163	0.00172	5	0.000767	0.000745	3	0.000316	0.000330	-4	0.00186	0.00171	8
Nickel (Ni)-Total	0.00122	0.00123	-1	0.00103	0.00117	13	0.00159	0.00121	27	0.00178	0.00194	-9	0.00606	0.00073	157
Phosphorus (P)-Total	<0.30	<0.30	0	<0.30	<0.30	0	<0.30	<0.30	0	<0.30	<0.30	0	<0.30	<0.30	0
Potassium (K)-Total	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Selenium (Se)-Total	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)-Total	4.18	4.22	-1	4.73	4.67	1	2.41	2.48	-3	2.43	2.82	-15	8.25	4.91	51

	W4			W1			W1			W23			W1		
Date Sampled	31-MAR-10			06-MAY-10			22-MAY-10			22-MAY-10			02-JUN-10		
	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD
Silver (Ag)-Total	<0.000010	<0.000010	0	<0.000010	0.000019	0	0.000021	0.000012	55	<0.000010	0.000012	0	0.000027	<0.000010	0
Sodium (Na)-Total	2.2	2.2	0	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Strontium (Sr)-Total	0.237	0.236	0	0.0578	0.0571	1	0.0251	0.0249	1	0.0911	0.0972	-6	0.0580	0.0546	6
Thallium (Tl)-Total	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)-Total	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0	0.00013	<0.00010	0
Titanium (Ti)-Total	<0.010	<0.010	0	<0.010	<0.010	0	0.027	0.018	40	0.012	0.016	-29	0.166	<0.010	0
Uranium (U)-Total	0.00146	0.00143	2	0.000554	0.000486	13	0.000732	0.000661	10	0.000311	0.000324	-4	0.00141	0.000474	99
Vanadium (V)-Total	<0.0010	<0.0010	0	<0.0010	<0.0010	0	0.0014	<0.0010	0	<0.0010	<0.0010	0	0.0068	<0.0010	0
Zinc (Zn)-Total	0.0029	0.0028	4	0.0014	0.0013	7	0.0045	0.0034	28	0.0048	0.0049	-2	0.0144	0.0024	143
Dissolved Metals															
Aluminum (Al)-Dissolved	0.0016	0.0017	-6	0.0608	0.0633	4	0.162	0.168	-4	0.0667	0.0664	0	0.0337	0.0325	4
Antimony (Sb)-Dissolved	0.00025	0.00026	-4	0.00106	0.00109	3	0.00040	0.00039	3	0.00040	0.00041	-2	0.00097	0.00097	0
Arsenic (As)-Dissolved	0.00112	0.00110	2	0.0290	0.0285	2	0.0191	0.0194	-2	0.00403	0.00395	2	0.0316	0.0319	-1
Barium (Ba)-Dissolved	0.0405	0.0399	1	0.0334	0.0333	0	0.0151	0.0155	-3	0.0205	0.0205	0	0.0284	0.0286	-1
Beryllium (Be)-Dissolved	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)-Dissolved	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	0	<0.000017	<0.000017	0	<0.000017	<0.000017	0	<0.000017	0.000018	0	<0.000017	<0.000017	0
Calcium (Ca)-Dissolved	47.8	47.6	0	11.8	11.4	3	3.68	4.15	-12	17.1	18.9	-10	9.51	9.67	-2
Chromium (Cr)-Dissolved	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)-Dissolved	0.00013	0.00012	8	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Copper (Cu)-Dissolved	0.00021	0.00019	10	0.00082	0.00088	7	0.00078	0.00070	11	0.00193	0.00174	10	0.00051	0.00055	-8
Iron (Fe)-Dissolved	<0.030	<0.030	0	0.066	0.065	2	0.085	0.099	-15	0.122	0.129	-6	<0.030	<0.030	0
Lead (Pb)-Dissolved	<0.000050	<0.000050	0	<0.000050	<0.000050	0	0.000061	0.000061	0	0.000109	0.000104	5	<0.000050	<0.000050	0
Lithium (Li)-Dissolved	0.0079	0.0076	4	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Magnesium (Mg)-Dissolved	20.3	20.2	0	2.97	2.92	2	0.72	0.79	-9	4.03	4.31	-7	2.10	2.13	-1
Manganese (Mn)-Dissolved	0.0375	0.0367	2	0.000617	0.000605	2	0.000460	0.000411	11	0.00261	0.00194	29	0.000498	0.000516	-4
Mercury (Hg)-Dissolved	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Molybdenum (Mo)-Dissolved	0.000092	0.000096	-4	0.00148	0.00149	1	0.000587	0.000586	0	0.000311	0.000317	-2	0.00153	0.00157	-3
Nickel (Ni)-Dissolved	0.00121	0.00123	-2	0.00081	0.00101	22	0.00060	0.00056	7	0.00126	0.00113	11	<0.00050	<0.00050	0
Phosphorus (P)-Dissolved	<0.30	<0.30	0	<0.30	<0.30	0	<0.30	<0.30	0	<0.30	<0.30	0	<0.30	<0.30	0
Potassium (K)-Dissolved	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Selenium (Se)-Dissolved	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)-Dissolved	4.25	4.22	1	4.93	4.83	2	1.79	1.98	-10	2.05	2.22	-8	4.73	4.78	-1
Silver (Ag)-Dissolved	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)-Dissolved	2.2	2.2	0	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Strontium (Sr)-Dissolved	0.227	0.223	2	0.0538	0.0536	0	0.0220	0.0225	-2	0.0888	0.0883	1	0.0501	0.0504	-1
Thallium (Tl)-Dissolved	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)-Dissolved	<0.00010	<0.00010	0	0.00012	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)-Dissolved	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)-Dissolved	0.00140	0.00142	-1	0.000462	0.000453	2	0.000437	0.000439	0	0.000269	0.000271	-1	0.000355	0.000359	-1
Vanadium (V)-Dissolved	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)-Dissolved	0.0026	0.0023	12	0.0010	0.0019	62	0.0013	0.0015	-14	0.0029	0.0013	76	0.0022	0.0024	-9

Field Replicates for the 2010 Sur

	W22			W1			W22		
Date Sampled	11-JUL-10			18-AUG-10			16-SEP-10		
	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD
Conductivity	265	271	-2	106	105	1	307	309	-1
Hardness (as $CaCO_3$)	142	151	-6	51.1	50.4	1	169	170	-1
pH	8.01	7.97	1	7.76	7.98	-3	8.09	8.11	0
Total Suspended Solids	<3.0	<3.0	0	3.8	<3.0	0	<3.0	<3.0	0
Total Dissolved Solids	186	185	1	72	76	-5	197	197	0
Turbidity	0.47	0.39	19	0.55	0.45	20	0.34	0.42	-21
Anions and Nutrients									
Alkalinity, Total (as $CaCO_3$)	83.1	86.5	-4	41.9	41.7	0	95.6	94.2	1
Ammonia as N	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Bromide (Br)	<0.050	<0.050	0	<0.050	<0.050	0	<0.050	<0.050	0
Chloride (Cl)	<0.50	<0.50	0	<0.50	<0.50	0	<0.50	<0.50	0
Fluoride (Fl)	0.066	0.068	-3	0.068	0.066	3	0.087	0.043	68
Nitrate (as N)	0.0610	0.0469	26	0.0115	0.0093	21	0.0806	0.0423	62
Nitrite (as N)	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Total Kjeldahl Nitrogen	<0.050	<0.050	0	<0.050	<0.050	0	0.099	0.079	22
Total Nitrogen	0.061	<0.060	0	0.0115	0.0093	21	0.180	0.121	39
Ortho Phosphate as P	<0.0010	<0.0010	0	0.0022	0.0023	-4	<0.0010	<0.0010	0
Total Dissolved Phosphate As P	<0.0020	0.0023	0	0.0023	0.0020	14	<0.0020	<0.0020	0
Total Phosphate as P	<0.0020	<0.0020	0	0.0046	0.0046	0	<0.0020	<0.0020	0
Sulfate (SO4)	55.6	56.3	-1	10.9	10.7	2	66.4	35.5	61
Cyanides									
Cyanide, Weak Acid Diss	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Cyanide, Total	<0.0050	<0.0050	0	<0.0050	<0.0050	0	<0.0050	<0.0050	0
Organic/Inorganic Carbon									
Dissolved Organic Carbon	1.90	2.22	-16	1.83	1.88	-3	2.18	2.20	-1
Total Metals									
Aluminum (Al)-Total	0.0175	0.0156	11	0.0300	0.0324	-8	0.0112	0.0098	13
Antimony (Sb)-Total	0.00023	0.00024	-4	0.00112	0.00113	-1	0.00022	0.00023	-4
Arsenic (As)-Total	0.00071	0.00095	-29	0.0405	0.0405	0	0.00075	0.00078	-4
Barium (Ba)-Total	0.0348	0.0367	-5	0.0420	0.0429	-2	0.0344	0.0363	-5
Beryllium (Be)-Total	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)-Total	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)-Total	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)-Total	<0.000017	<0.000017	0	<0.000017	<0.000017	0	<0.000017	<0.000017	0
Calcium (Ca)-Total	35.4	38.0	-7	15.0	14.6	3	41.7	43.6	-4
Chromium (Cr)-Total	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)-Total	0.00010	0.00019	-62	<0.00010	<0.00010	0	0.00012	0.00014	-15
Copper (Cu)-Total	0.00055	<0.00060	0	0.00037	0.00034	8	<0.00050	<0.00050	0
Iron (Fe)-Total	0.089	0.174	-65	<0.030	0.034	0	0.064	0.073	-13
Lead (Pb)-Total	<0.000050	<0.000050	0	0.000054	0.000053	2	<0.000050	<0.000050	0
Lithium (Li)-Total	0.0051	0.0053	-4	<0.0050	<0.0050	0	0.0057	0.0056	2
Magnesium (Mg)-Total	11.8	12.8	-8	3.22	3.16	2	14.5	15.2	-5
Manganese (Mn)-Total	0.0361	0.0896	-85	0.00129	0.00149	-14	0.0471	0.0577	-20
Mercury (Hg)-Total	<0.000010	<0.000010	0	<0.000050	<0.000050	0	<0.000010	<0.000010	0
Molybdenum (Mo)-Total	0.000063	0.000095	-41	0.00217	0.00213	2	0.000077	0.000072	7
Nickel (Ni)-Total	0.00080	0.00098	-20	<0.00050	<0.00050	0	0.00110	0.00105	5
Phosphorus (P)-Total	<0.30	<0.30	0	<0.30	<0.30	0	<0.30	<0.30	0
Potassium (K)-Total	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Selenium (Se)-Total	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)-Total	3.67	3.85	-5	5.82	5.73	2	3.80	3.98	-5

	W22			W1			W22		
Date Sampled	11-JUL-10			18-AUG-10			16-SEP-10		
	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD	Rep 1	Rep 2	RPD
Silver (Ag)-Total	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)-Total	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Strontium (Sr)-Total	0.180	0.189	-5	0.0839	0.0843	0	0.195	0.210	-7
Thallium (Tl)-Total	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)-Total	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)-Total	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)-Total	0.000761	0.000797	-5	0.000408	0.000404	1	0.000883	0.000903	-2
Vanadium (V)-Total	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)-Total	0.0013	0.0012	8	<0.0010	0.0011	0	0.0023	0.0019	19
Dissolved Metals									
Aluminum (Al)-Dissolved	0.0090	0.0086	5	0.0059	0.0061	-3	0.0055	0.0058	-5
Antimony (Sb)-Dissolved	0.00023	0.00022	4	0.00106	0.00107	-1	0.00022	0.00023	-4
Arsenic (As)-Dissolved	0.00068	0.00090	-28	0.0393	0.0397	-1	0.00072	0.00071	1
Barium (Ba)-Dissolved	0.0330	0.0337	-2	0.0391	0.0408	-4	0.0338	0.0350	-3
Beryllium (Be)-Dissolved	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Bismuth (Bi)-Dissolved	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Boron (B)-Dissolved	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Cadmium (Cd)-Dissolved	<0.000017	<0.000017	0	<0.000017	<0.000017	0	<0.000017	<0.000017	0
Calcium (Ca)-Dissolved	36.7	38.7	-5	15.1	14.9	1	43.2	43.4	0
Chromium (Cr)-Dissolved	<0.00050	<0.00050	0	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Cobalt (Co)-Dissolved	<0.00010	0.00015	0	<0.00010	<0.00010	0	0.00010	0.00012	-18
Copper (Cu)-Dissolved	0.00046	0.00045	2	0.00024	0.00024	0	0.00038	0.00039	-3
Iron (Fe)-Dissolved	0.042	0.107	-87	<0.030	<0.030	0	0.036	0.038	-5
Lead (Pb)-Dissolved	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium (Li)-Dissolved	<0.0050	0.0053	0	<0.0050	<0.0050	0	0.0059	0.0056	5
Magnesium (Mg)-Dissolved	12.3	13.1	-6	3.25	3.21	1	14.8	14.9	-1
Manganese (Mn)-Dissolved	0.0288	0.0726	-86	0.000146	0.000142	3	0.0417	0.0439	-5
Mercury (Hg)-Dissolved	<0.000010	<0.000010	0	<0.000050	<0.000050	0	<0.000010	<0.000010	0
Molybdenum (Mo)-Dissolved	0.000063	0.000075	-17	0.00192	0.00196	-2	0.000062	0.000052	18
Nickel (Ni)-Dissolved	0.00062	0.00084	-30	<0.00050	<0.00050	0	0.00108	0.00101	7
Phosphorus (P)-Dissolved	<0.30	<0.30	0	<0.30	<0.30	0	<0.30	<0.30	0
Potassium (K)-Dissolved	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Selenium (Se)-Dissolved	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Silicon (Si)-Dissolved	3.82	3.95	-3	5.88	5.86	0	3.85	3.91	-2
Silver (Ag)-Dissolved	<0.000010	<0.000010	0	<0.000010	<0.000010	0	<0.000010	<0.000010	0
Sodium (Na)-Dissolved	<2.0	<2.0	0	<2.0	<2.0	0	<2.0	<2.0	0
Strontium (Sr)-Dissolved	0.173	0.177	-2	0.0751	0.0777	-3	0.190	0.193	-2
Thallium (Tl)-Dissolved	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Tin (Sn)-Dissolved	<0.00010	<0.00010	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Titanium (Ti)-Dissolved	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Uranium (U)-Dissolved	0.000651	0.000670	-3	0.000385	0.000390	-1	0.000846	0.000848	0
Vanadium (V)-Dissolved	<0.0010	<0.0010	0	<0.0010	<0.0010	0	<0.0010	<0.0010	0
Zinc (Zn)-Dissolved	<0.0010	<0.0010	0	<0.0010	<0.0010	0	0.0012	0.0012	0

APPENDIX B

Sediment Quality

Table of Contents

Appendix B – Sediment

Appendix B1-1: Raw Data 1976-77

1976-77 (ppm)	Site									
	W3	W7	W20	W21	W30	W36	W51	W62	W63	W64
Zn	150	166	106	220	104	138	164	420	172	62
Cu	20	20	14	44	12	20	17	58	25	13
Pb	20	34	16	120	16	28	69	6	32	10
Ni	30	26	16	37	14	22	24	80	24	14
Co	20	10	12	16	12	6	12	42	14	7
Ag	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Mn	1860	420	980	315	740	400	580	820	650	360
Mo	<2	<2	<2	6	<2	4	2	8	2	<2
Fe	2.9	2.3	2	4.1	1.9	2.5	2.7	5.7	2.5	1.6
Hg	ns	ns	ns	ns	ns	ns	ns	ns	ns	ns
U	3.9	8.3	19.4	5.8	18.6	13.6	19.2	3	3.6	3.4
W	<4	40	250	250	250	60	50	<4	4	20
Ba	840	960	960	1060	880	1020	1040	860	1100	680

Appendix B – Sediment
Appendix B1-2: Raw Data 1993

W2						
(ppm)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Ag	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bi	156	78	152	128	130	124
Cu	28	26	24	25	25	27
Hg	<1	<1	<1	<1	<1	<1
Mo	<1	1	<1	<1	<1	<1
Pb	14	20	12	8	16	18
Sb	<2	2	2	<2	2	2
Zn	62	66	62	64	66	68

Appendix B – Sediment
Appendix B1-2: Raw Data 1993

W4						
(ppm)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Ag	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Bi	62	120	286	80	90	158
Cu	24	26	33	26	26	27
Hg	<1	<1	<1	<1	<1	<1
Mo	<1	<1	1	<1	1	1
Pb	18	26	36	32	26	26
Sb	4	4	12	4	4	4
Zn	58	68	72	64	64	70

Appendix B – Sediment
Appendix B1-2: Raw Data 1993

W5						
(ppm)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Ag	<0.2	<0.2	0.4	<0.2	<0.2	0.2
Bi	148	144	158	146	144	144
Cu	24	24	26	27	25	25
Hg	<1	<1	<1	<1	<1	<1
Mo	<1	<1	<1	<1	<1	<1
Pb	30	32	34	36	36	32
Sb	6	4	10	8	8	12
Zn	76	80	84	80	76	76

Appendix B – Sediment
Appendix B1-2: Raw Data 1993

W8						
(ppm)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Ag	0.2	<0.2	0.4	<0.2	0.2	<0.2
Bi	470	370	454	374	590	422
Cu	19	18	19	19	20	20
Hg	<1	<1	<1	<1	<1	<1
Mo	6	3	6	6	7	3
Pb	60	46	68	60	68	34
Sb	12	12	16	16	14	6
Zn	128	124	152	120	154	112

Appendix B – Sediment
Appendix B1-2: Raw Data 1993

W22						
(ppm)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Ag	<0.2	0.2	<0.2	<0.2	<0.2	<0.2
Bi	44	54	46	44	34	30
Cu	25	28	27	25	28	25
Hg	<1	<1	<1	<1	<1	<1
Mo	<1	1	<1	<1	<1	1
Pb	26	28	28	28	28	20
Sb	2	4	4	6	4	4
Zn	64	72	68	62	68	62

Appendix B – Sediment
Appendix B1-3: Raw Data 1995

W2						
(ppm)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Ag	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
As	49.8	53.4	51.5	53.9	62.3	60.8
Cd	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Co	12.3	10.3	11.3	12.5	10.2	12.9
Cr	11.8	14.1	6.6	15.1	11.2	8.1
Cu	18.9	27.6	11.9	24.7	23.9	25.8
Hg	0.024	0.033	0.014	0.033	0.024	0.026
Mo	<8.0	<8.0	<4.0	<8.0	<8.0	<8.0
Ni	17.6	18.4	17.8	22.7	18.2	20.5
Pb	12.3	13.2	10.5	12.2	10.7	11
Sb	2.95	3.18	2.75	2.63	3.67	3.51
Se	0.22	0.15	0.18	0.19	0.16	0.15
Zn	54.5	57.6	55.2	59.2	62	69.1

Appendix B – Sediment
Appendix B1-3: Raw Data 1995

W4						
(ppm)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Ag	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0
As	197	75.4	145	220	101	178
Cd	0.18	<0.1	0.16	0.13	<0.1	<0.1
Co	13.6	5.8	13	10.1	10.6	11.6
Cr	14.1	6.6	15.1	11.2	8.1	12.5
Cu	27.6	11.9	24.7	23.9	25.8	26.4
Hg	0.033	0.014	0.033	0.024	0.026	0.02
Mo	<8.0	<4.0	<8.0	<8.0	<8.0	<8.0
Ni	26.2	10.5	25.7	22.2	18.5	23
Pb	31.1	9	25.3	17.4	19.4	19.6
Sb	10.7	3.81	8.6	7.65	10.7	9.45
Se	0.23	<0.1	0.22	0.2	0.23	0.19
Zn	90.2	37.5	89	82	73.1	66.7

Appendix B – Sediment
Appendix B1-3: Raw Data 1995

W5						
(ppm)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Ag	<4.0	<4.0	<4.0	<4.0	<2.0	<4.0
As	142	127	113	138	135	116
Cd	0.17	0.15	0.19	0.23	0.39	0.18
Co	10.1	10.6	11.6	13	14.2	9.4
Cr	19.4	19.8	18.6	19.4	19.3	15.2
Cu	23.6	23.4	23.9	25	26.9	22.9
Hg	0.024	0.032	0.025	0.027	0.031	0.022
Mo	<8.0	<8.0	<8.0	<8.0	<8.0	<8.0
Ni	24.2	21.6	19.7	25.5	25.2	18
Pb	27.6	27.7	28.4	29.7	29.7	23.1
Sb	15.6	40.5	20.1	21.2	15	17.3
Se	0.24	0.32	0.27	0.28	0.3	0.21
Zn	97.5	91.1	86.1	102	97.8	81.2

Appendix B – Sediment
Appendix B1-3: Raw Data 1995

W8						
(ppm)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Ag	<4.0	<4.0	<2.0	<2.0	<2.0	<2.0
As	337	565	331	317	333	249
Cd	0.43	0.96	0.38	0.27	0.39	0.51
Co	9.1	8	9.9	9.9	8.8	9
Cr	12.5	10.8	13.4	12.8	14.5	10.5
Cu	9.2	12.4	6.6	7	10.4	8.9
Hg	0.012	0.82	0.005	<0.005	0.006	0.005
Mo	<8.0	<8.0	<4.0	<4.0	<4.0	5.2
Ni	15.7	13.9	17.1	41.6	19.4	13.4
Pb	25.1	420	36.2	18.2	20.5	26
Sb	16.9	22.4	20.2	18.2	12.1	9.45
Se	0.18	0.28	0.19	0.19	0.2	0.21
Zn	95.9	79.9	68.3	71.2	82.9	107

Appendix B – Sediment
Appendix B1-3: Raw Data 1995

W22						
(ppm)	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6
Ag	<10.0	<4.0	<4.0	<4.0	<4.0	<4.0
As	94.2	58.4	68	75.2	65.6	58.4
Cd	0.36	0.27	0.3	0.32	0.25	0.18
Co	16	15.1	14.2	19.6	16	13.7
Cr	15	11	11.5	14.6	15.7	9.5
Cu	34.5	22.3	27.4	30	27.1	21.9
Hg	0.093	0.035	0.068	0.041	0.037	0.025
Mo	<20	<8.0	<8.0	<8.0	<8.0	<8.0
Ni	30	24.4	24.6	30.5	28.4	23.8
Pb	31.8	20.2	26.8	26.8	20.9	16.1
Sb	18.1	9.6	10.2	7.82	7.61	4.84
Se	0.44	0.25	0.28	0.33	0.28	0.2
Zn	111	77.7	97	97.3	96.5	75.5

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID Physical Tests	Detection Limits	W-1 S.1	W-1 S.2	W-1 S.3
pH	0.1	6.92	6.61	6.80
Metals (mg/kg)				
Antimony (Sb)	10	<10	10	10
Arsenic (As)	5	378	412	407
Barium (Ba)	1	253	259	257
Beryllium (Be)	0.5	0.91	0.94	0.93
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	61.0	58.3	56.3
Cobalt (Co)	2	17.1	16.9	16.6
Copper (Cu)	1	39.4	38.5	38.4
Lead (Pb)	30	32	34	34
Mercury (Hg)	0.005	0.0721	0.0771	0.0727
Molybdenum (Mo)	4	4.0	4.1	<4.0
Nickel (Ni)	5	67.7	64.5	64.4
Selenium (Se)	2	<3.0	<3.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	62.6	62.7	61.6
Zinc (Zn)	1	127	130	129

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID / Physical Tests	Detection Limits	W-4 S.1	W-4 S.2	W-4 S.3	W-4 S.3 DUP
pH	0.1	7.74	7.45	7.59	7.67
Metals (mg/kg)					
Antimony (Sb)	10	<10	<10	<10	<10
Arsenic (As)	5	88.9	108	79.9	75.2
Barium (Ba)	1	172	185	174	175
Beryllium (Be)	0.5	<0.50	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	2	17.3	20.4	18.3	16.2
Cobalt (Co)	2	10.4	12.2	11.4	11.0
Copper (Cu)	1	20.1	22.7	20.1	18.8
Lead (Pb)	30	<30	<30	<30	<30
Mercury (Hg)	0.005	0.0650	0.0686	0.0621	0.373
Molybdenum (Mo)	4	<4.0	<4.0	<4.0	<4.0
Nickel (Ni)	5	23.4	27.0	23.9	22.2
Selenium (Se)	2	<2.0	<2.0	<2.0	<3.0
Silver (Ag)	2	<2.0	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0	<5.0
Vanadium (V)	2	29.8	31.7	29.4	29.5
Zinc (Zn)	1	80.4	94.8	83.9	75.2

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID / Physical Tests	Detection Limits	W-5 S.1	W-5 S.2	W-5 S.3
pH	0.1	7.71	7.61	7.82
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	91.2	94.9	91.9
Barium (Ba)	1	176	174	190
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	19.0	18.6	20.6
Cobalt (Co)	2	11.6	11.0	11.8
Copper (Cu)	1	26.2	24.2	27.2
Lead (Pb)	30	30	<30	<30
Mercury (Hg)	0.005	0.0659	0.0810	0.0655
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	25.5	24.4	26.8
Selenium (Se)	2	<3.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	29.4	29.4	31.9
Zinc (Zn)	1	92.8	89.3	95.2

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID Physical Tests	Detection Limits	W-6 S.1	W-6 S.2	W-6 S.3
pH	0.1	7.26	7.28	7.39
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	69.6	65.0	63.2
Barium (Ba)	1	193	196	193
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	20.2	20.1	20.2
Cobalt (Co)	2	10.2	10.3	9.8
Copper (Cu)	1	22.4	23.2	22.7
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.0388	0.0377	0.0399
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	23.5	23.9	23.3
Selenium (Se)	2	<2.0	<2.0	<3.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	33.7	33.3	33.3
Zinc (Zn)	1	105	104	101

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID	Detection Limits	W-13 S.1	W-13 S.2	W-13 S.3
Physical Tests				
pH	0.1	7.45	7.28	7.38
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	134	148	136
Barium (Ba)	1	237	230	216
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	23.2	23.6	22.7
Cobalt (Co)	2	10.9	11.2	10.7
Copper (Cu)	1	23.9	24.8	22.7
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.0467	0.0795	0.0380
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	25.1	26.1	24.9
Selenium (Se)	2	<2.0	<4.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	38.5	38.8	36.5
Zinc (Zn)	1	116	121	112

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID Physical Tests	Detection Limits	W-20 S.1	W-20 S.2	W-20 S.3
pH	0.1	7.08	7.03	6.97
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	608	561	528
Barium (Ba)	1	231	209	216
Beryllium (Be)	0.5	1.30	1.26	1.12
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	23.4	20.4	21.3
Cobalt (Co)	2	9.2	7.9	8.0
Copper (Cu)	1	13.0	12.0	11.9
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.0702	0.0703	0.0638
Molybdenum (Mo)	4	7.3	6.3	5.5
Nickel (Ni)	5	24.2	21.3	20.1
Selenium (Se)	2	<2.0	<3.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	37.1	35.2	36.5
Zinc (Zn)	1	99.8	77.0	77.1

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID Physical Tests	Detection Limits	W-21 S.1	W-21 S.2	W-21 S.3
pH	0.1	7.26	6.91	7.11
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	201	180	211
Barium (Ba)	1	194	172	190
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	25.9	25.1	26.2
Cobalt (Co)	2	8.9	8.7	9.4
Copper (Cu)	1	20.7	20.4	22.6
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.0467	0.0400	0.0439
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	24.5	23.8	25.4
Selenium (Se)	2	<2.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	39.6	37.8	39.5
Zinc (Zn)	1	80.4	73.4	82.2

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID Physical Tests	Detection Limits	W-22 S.1	W-22 S.2	W-22 S.3
pH	0.1	6.88	7.05	7.22
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	34.6	54.9	30.7
Barium (Ba)	1	198	219	214
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	0.50	<0.50	<0.50
Chromium (Cr)	2	16.4	16.6	17.3
Cobalt (Co)	2	14.1	13.6	14.7
Copper (Cu)	1	18.0	20.1	19.1
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.111	0.122	0.0674
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	26.4	25.8	30.0
Selenium (Se)	2	<2.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	28.4	32.2	31.3
Zinc (Zn)	1	87.9	87.0	89.0

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID Physical Tests	Detection Limits	W-23 S.1	W-23 S.2	W-23 S.3
pH	0.1	7.78	7.78	7.75
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	92.7	96.4	100
Barium (Ba)	1	213	221	223
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	22.3	23.3	23.5
Cobalt (Co)	2	12.2	12.8	13.0
Copper (Cu)	1	28.2	29.2	29.5
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.0569	0.0572	0.0580
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	27.9	29.3	29.3
Selenium (Se)	2	<2.0	<3.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	34.7	36.2	37.1
Zinc (Zn)	1	109	114	113

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID / Physical Tests	Detection Limits	W-26 S.1	W-26 S.2	W-26 S.3
pH	0.1	6.31	6.54	6.62
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	85.8	94.5	86.9
Barium (Ba)	1	141	146	141
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	19.5	20.2	20.7
Cobalt (Co)	2	6.3	6.4	6.2
Copper (Cu)	1	13.7	14.7	13.1
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.0372	0.0463	0.0881
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	15.8	16.0	15.2
Selenium (Se)	2	<2.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	32.6	34.3	35.1
Zinc (Zn)	1	56.3	57.1	55.9

Appendix B – Sediment
Appendix B1-4: Raw Data 2007

Sample ID Physical Tests	Detection Limits	W-27 S.1	W-27 S.2	W-27 S.3
pH	0.1	8.19	8.02	7.90
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	166	179	180
Barium (Ba)	1	118	121	129
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	12.9	13.1	13.1
Cobalt (Co)	2	12.2	12.0	12.0
Copper (Cu)	1	33.6	33.5	33.9
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.0510	0.0556	0.0556
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	25.4	25.5	25.1
Selenium (Se)	2	<3.0	<3.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	24.8	24.7	24.7
Zinc (Zn)	1	71.1	71.8	70.1

Appendix B – Sediment
Appendix B1-5: Raw Data 2009

Sample ID Physical Tests	Detection Limits	W-1 S.1	W-1 S.2	W-1 S.3
Physical Tests				
pH	0.1	7.15	7.58	7.52
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	166	139	163
Barium (Ba)	1	78.1	48.8	63.2
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	7.6	5.6	8.7
Cobalt (Co)	2	6.4	3.9	6.7
Copper (Cu)	1	7.5	3.5	7.0
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.0161	0.0058	0.0155
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	16.0	9.6	14.2
Selenium (Se)	2	<2.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	10.7	7.9	10.9
Zinc (Zn)	1	77.2	21.8	34.9

Appendix B – Sediment
Appendix B1-5: Raw Data 2009

Sample ID / Physical Tests	Detection Limits	W-5 S.1	W-5 S.2	W-5 S.3
Physical Tests				
pH	0.1	7.66	7.83	7.85
Metals (mg/kg)				
Antimony (Sb)	10	10	11	17
Arsenic (As)	5	129	116	110
Barium (Ba)	1	69.5	103	120
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	0.54	0.57
Chromium (Cr)	2	16.7	22.0	21.1
Cobalt (Co)	2	10.6	12.2	12.1
Copper (Cu)	1	24.4	28.1	26.3
Lead (Pb)	30	43	37	36
Mercury (Hg)	0.005	0.0218	0.0334	0.0366
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	25.7	27.3	27.3
Selenium (Se)	2	<2.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	13.3	20.4	19.0
Zinc (Zn)	1	81.7	96.8	89.8

Appendix B – Sediment
Appendix B1-5: Raw Data 2009

Sample ID / Physical Tests	Detection Limits	W-21 S.1	W-21 S.2	W-21 S.3
Physical Tests				
pH	0.1	7.73	7.43	7.82
Metals (mg/kg)				
Antimony (Sb)	10	<10	11	<10
Arsenic (As)	5	197	224	185
Barium (Ba)	1	87.2	65.6	66.5
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	11.4	10.6	10.9
Cobalt (Co)	2	9.1	8.3	7.1
Copper (Cu)	1	31.2	17.8	14.9
Lead (Pb)	30	<30	<30	120
Mercury (Hg)	0.005	0.0090	0.0167	0.0300
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	17.7	17.3	17.3
Selenium (Se)	2	<2.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	14.1	13.3	13.0
Zinc (Zn)	1	52.3	57.2	54.5

Appendix B – Sediment
Appendix B1-5: Raw Data 2009

Sample ID / Physical Tests	Detection Limits	W-22 S.1	W-22 S.2	W-22 S.3
Physical Tests				
pH	0.1	7.24	6.88	7.24
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	62.6	104	221
Barium (Ba)	1	138	87.9	92.4
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	0.52	<0.50	0.62
Chromium (Cr)	2	16.3	10.1	10.4
Cobalt (Co)	2	15.6	11.3	12.0
Copper (Cu)	1	24.6	25.3	23.1
Lead (Pb)	30	<30	<30	33
Mercury (Hg)	0.005	0.0531	0.0383	0.0410
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	27.6	23.9	23.5
Selenium (Se)	2	<2.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	18.8	13.6	12.5
Zinc (Zn)	1	91.3	87.0	85.5

Appendix B – Sediment
Appendix B1-5: Raw Data 2009

Sample ID / Physical Tests	Detection Limits	W-26 S.1	W-26 S.2	W-26 S.3
Physical Tests				
pH	0.1	7.83	7.72	7.75
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	547	200	279
Barium (Ba)	1	86.1	98.4	74.8
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	11.8	15.1	13.3
Cobalt (Co)	2	6.9	7.9	7.6
Copper (Cu)	1	10.7	12.3	13.0
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.0105	0.0131	0.0096
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	16.0	17.5	17.6
Selenium (Se)	2	<2.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	15.2	20.5	18.2
Zinc (Zn)	1	47.8	50.1	65.2

Appendix B – Sediment
Appendix B1-5: Raw Data 2009

Sample ID	Detection Limits	W-27 S.1	W-27 S.2	W-27 S.3
Physical Tests				
Physical Tests				
pH	0.1	8.44	8.34	7.95
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	194	177	150
Barium (Ba)	1	62.8	89.8	44.3
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	12.8	13.4	9.0
Cobalt (Co)	2	10.3	10.4	7.0
Copper (Cu)	1	28.0	28.5	21.4
Lead (Pb)	30	31	<30	<30
Mercury (Hg)	0.005	0.0255	0.0405	0.0112
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	23.6	22.2	16.0
Selenium (Se)	2	<2.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	15.6	16.4	11.7
Zinc (Zn)	1	72.9	70.5	55.1

Appendix B – Sediment
Appendix B1-5: Raw Data 2009

Sample ID / Physical Tests	Detection Limits	W-29 S.1	W-29 S.2	W-29 S.3
Physical Tests				
pH	0.1	7.76	7.57	7.50
Metals (mg/kg)				
Antimony (Sb)	10	11	10	12
Arsenic (As)	5	54.9	77.9	57.9
Barium (Ba)	1	41.9	60.9	73.6
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50
Chromium (Cr)	2	20.4	13.4	14.9
Cobalt (Co)	2	11.9	12.9	11.9
Copper (Cu)	1	22.6	24.8	24.0
Lead (Pb)	30	<30	<30	<30
Mercury (Hg)	0.005	0.0157	0.0216	0.0255
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	25.9	24.6	25.3
Selenium (Se)	2	<2.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Vanadium (V)	2	12.4	10.7	12.5
Zinc (Zn)	1	93.8	100	93.0

Appendix B – Sediment
Appendix B1-6: Raw Data 2010

Sample ID / Physical Tests	Detection Limits	W1-1	W1-2	W1-3	W1-4	W1-5
Physical Tests						
pH	0.1	7.49	7.30	7.06	7.14	7.56
Metals (mg/kg)						
Antimony (Sb)	10	<10	<10	13	10	<10
Arsenic (As)	5	378	346	474	403	201
Barium (Ba)	1	196	153	251	174	77.3
Beryllium (Be)	0.5	0.91	0.76	1.22	0.86	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	2	34.9	24.1	42.8	28.4	10.8
Cobalt (Co)	2	12.5	12.8	18.7	15.7	6.4
Copper (Cu)	1	20.8	15.8	23.6	17.5	7.6
Lead (Pb)	30	<30	<30	35	<30	<30
Mercury (Hg)	0.005	0.0388	0.0238	0.0465	0.0222	0.0122
Molybdenum (Mo)	4	<4.0	4.2	5.3	4.5	<4.0
Nickel (Ni)	5	44.2	34.9	55.5	45.3	16.4
Selenium (Se)	2 - 4	<2.6	<2.0	<4.0	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0	<5.0	<5.0
Uranium (U)	0.05	4.97	4.84	6.56	5.44	2.37
Vanadium (V)	2	37.3	28.3	46.2	31.1	13.0
Zinc (Zn)	1	100	88.0	126	96.2	37.1

Appendix B – Sediment
Appendix B1-6: Raw Data 2010

Sample ID / Physical Tests	Detection Limits	W4-1	W4-2	W4-3	W4-4	W4-5
Physical Tests						
pH	0.1	7.47	7.55	7.31	7.50	7.44
Metals (mg/kg)						
Antimony (Sb)	10	<10	<10	<10	<10	<10
Arsenic (As)	5	142	132	165	153	151
Barium (Ba)	1	136	143	159	129	136
Beryllium (Be)	0.5	<0.50	<0.50	0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	2	14.3	16.5	18.1	16.0	17.2
Cobalt (Co)	2	18.7	16.7	18.0	15.4	16.5
Copper (Cu)	1	23.6	25.2	28.3	23.0	27.3
Lead (Pb)	30	<30	<30	<30	<30	<30
Mercury (Hg)	0.005	0.0401	0.0497	0.0620	<0.0050	0.0385
Molybdenum (Mo)	4	<4.0	<4.0	<4.0	<4.0	<4.0
Nickel (Ni)	5	33.1	30.6	35.2	29.7	31.8
Selenium (Se)	2.2 - 3	<2.3	<3.0	<2.3	<3.0	<2.2
Silver (Ag)	2	<2.0	<2.0	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0	<5.0	<5.0
Uranium (U)	0.05	1.41	1.66	2.24	1.54	1.49
Vanadium (V)	2	17.9	21.7	24.3	22.1	21.6
Zinc (Zn)	1	104	101	107	93.1	96.4

Appendix B – Sediment
Appendix B1-6: Raw Data 2010

Sample ID / Physical Tests	Detection Limits	W27-1	W27-2	W27-3	W27-4	W27-5
Physical Tests						
pH	0.1	8.55	8.58	8.54	8.48	8.70
Metals (mg/kg)						
Antimony (Sb)	10	<10	<10	<10	<10	<10
Arsenic (As)	5	58.6	77.2	79.0	62.6	112
Barium (Ba)	1	251	301	189	315	174
Beryllium (Be)	0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	2	16.1	17.8	15.6	19.5	14.3
Cobalt (Co)	2	7.3	8.6	7.9	8.7	8.3
Copper (Cu)	1	21.8	28.9	22.9	28.2	21.0
Lead (Pb)	30	<30	<30	<30	<30	<30
Mercury (Hg)	0.005	0.0261	0.0295	0.0258	0.0302	0.0193
Molybdenum (Mo)	4	<4.0	<4.0	<4.0	<4.0	<4.0
Nickel (Ni)	5	19.3	23.0	20.6	23.6	19.2
Selenium (Se)	2 - 2.8	<2.1	<2.2	<2.0	<2.2	<2.8
Silver (Ag)	2	<2.0	<2.0	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0	<5.0	<5.0
Uranium (U)	0.05	0.679	0.891	0.659	0.784	0.794
Vanadium (V)	2	24.8	30.3	24.7	32.0	20.7
Zinc (Zn)	1	58.8	68.7	62.4	69.6	56.5

Appendix B – Sediment
Appendix B1-6: Raw Data 2010

Sample ID / Physical Tests	Detection Limits	W29-1	W29-2	W29-3	W29-4	W29-5
Physical Tests						
pH	0.1	7.29	7.50	7.72	7.90	7.70
Metals (mg/kg)						
Antimony (Sb)	10	15	<10	12	<10	11
Arsenic (As)	5	185	80.6	168	179	99.5
Barium (Ba)	1	70.7	46.1	94.9	57.4	56.8
Beryllium (Be)	0.5	<0.50	<0.50	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	<0.50	0.80	1.14
Chromium (Cr)	2	13.1	10.5	17.1	10.1	14.5
Cobalt (Co)	2	15.2	11.6	13.2	9.8	13.2
Copper (Cu)	1	25.3	20.4	27.0	21.2	24.9
Lead (Pb)	30	45	<30	49	<30	41
Mercury (Hg)	0.005	0.0358	0.0278	0.0563	0.0171	0.0271
Molybdenum (Mo)	4	<4.0	<4.0	<4.0	<4.0	<4.0
Nickel (Ni)	5	32.1	24.8	27.4	20.3	24.1
Selenium (Se)	2	<4.0	<2.5	<3.1	<2.0	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0	<5.0	<5.0
Uranium (U)	0.05	1.27	0.935	1.47	0.760	1.04
Vanadium (V)	2	15.6	11.2	19.6	12.4	14.4
Zinc (Zn)	1	96.6	127	125	78.0	105

Appendix B – Sediment
Appendix B1-6: Raw Data 2010

Sample ID Physical Tests	Detection Limits	W72-1	W72-2	W72-3
Physical Tests				
pH	0.1	7.65	8.15	7.32
Metals (mg/kg)				
Antimony (Sb)	10	15	11	19
Arsenic (As)	5	252	220	266
Barium (Ba)	1	159	156	156
Beryllium (Be)	0.5	0.62	<0.50	0.75
Cadmium (Cd)	0.5	<0.50	<0.50	0.52
Chromium (Cr)	2	26.4	20.5	28.4
Cobalt (Co)	2	17.0	13.4	16.4
Copper (Cu)	1	45.2	38.7	52.9
Lead (Pb)	30	49	33	53
Mercury (Hg)	0.005	0.0653	0.0570	0.0724
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	37.9	29.4	38.0
Selenium (Se)	2 - 3.1	<2.0	<2.0	<3.1
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Uranium (U)	0.05	2.99	1.43	2.91
Vanadium (V)	2	31.4	26.0	31.5
Zinc (Zn)	1	113	89.2	121

Appendix B – Sediment
Appendix B1-6: Raw Data 20100

Sample ID Physical Tests	Detection Limits	W73-1	W73-2	W73-3
Physical Tests				
pH	0.1	7.56	7.25	7.13
Metals (mg/kg)				
Antimony (Sb)	10	15	14	14
Arsenic (As)	5	517	313	229
Barium (Ba)	1	290	186	132
Beryllium (Be)	0.5	1.16	0.78	0.60
Cadmium (Cd)	0.5	<0.50	<0.50	0.66
Chromium (Cr)	2	44.5	32.4	24.8
Cobalt (Co)	2	21.9	16.6	12.9
Copper (Cu)	1	50.9	44.7	39.1
Lead (Pb)	30	52	44	40
Mercury (Hg)	0.005	0.0662	0.0546	0.0458
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	53.1	39.5	31.9
Selenium (Se)	2	0.50	<2.6	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Uranium (U)	0.05	3.97	2.52	2.25
Vanadium (V)	2	54.6	37.5	28.1
Zinc (Zn)	1	160	123	110

Appendix B – Sediment
Appendix B1-6: Raw Data 2010

Sample ID / Physical Tests	Detection Limits	W74-1	W74-2	W74-3
Physical Tests				
pH	0.1	7.64	7.57	7.68
Metals (mg/kg)				
Antimony (Sb)	10	<10	<10	<10
Arsenic (As)	5	105	134	104
Barium (Ba)	1	45.6	66.3	61.9
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	0.84	1.10	<0.50
Chromium (Cr)	2	9.2	13.6	12.5
Cobalt (Co)	2	9.9	11.5	13.3
Copper (Cu)	1	19.7	27.4	23.6
Lead (Pb)	30	<30	35	64
Mercury (Hg)	0.005	0.0156	0.0319	0.0607
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	18.0	21.5	27.0
Selenium (Se)	2	<2.0	<2.0	<2.8
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Uranium (U)	0.05	1.01	1.12	1.11
Vanadium (V)	2	10.8	15.2	12.1
Zinc (Zn)	1	66.5	107	93.4

Appendix B – Sediment
Appendix B1-6: Raw Data 2010

Sample ID / Physical Tests	Detection Limits	W75-1	W75-2	W75-3
Physical Tests				
pH	0.1	7.41	7.11	7.52
Metals (mg/kg)				
Antimony (Sb)	10	<10	12	<10
Arsenic (As)	5	129	106	110
Barium (Ba)	1	166	161	165
Beryllium (Be)	0.5	<0.50	<0.50	<0.50
Cadmium (Cd)	0.5	<0.50	<0.50	0.51
Chromium (Cr)	2	22.0	20.7	21.5
Cobalt (Co)	2	14.2	13.2	14.0
Copper (Cu)	1	29.0	26.1	27.8
Lead (Pb)	30	39	39	39
Mercury (Hg)	0.005	0.0653	0.0565	0.0643
Molybdenum (Mo)	4	<4.0	<4.0	<4.0
Nickel (Ni)	5	30.6	28.8	30.1
Selenium (Se)	2 - 2.6	<2.6	<2.2	<2.0
Silver (Ag)	2	<2.0	<2.0	<2.0
Thallium (Tl)	1	<1.0	<1.0	<1.0
Tin (Sn)	5	<5.0	<5.0	<5.0
Uranium (U)	0.05	2.17	1.67	1.99
Vanadium (V)	2	28.0	26.7	27.2
Zinc (Zn)	1	110	106	111

Appendix B – Sediment
Appendix B2-1: Summary Statistics 1993

W2	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
Ag	0.5[e]	-	6	0.1	0.1	0.1	0.1	0.0	0.0	0
Bi			6	78.0	156.0	128.0	129.0	27.9	11.4	22
Cu	35.7	197	6	24.0	28.0	25.8	25.5	1.5	0.6	6
Hg	0.17	0.486	6	0.5	0.5	0.5	0.5	0.0	0.0	0
Mo			6	0.5	1.0	0.6	0.5	0.2	0.1	35
Pb	35	91	6	8.0	20.0	14.7	15.0	4.3	1.8	29
Sb			6	1.0	2.0	1.7	2.0	0.5	0.2	31
Zn	123	315	6	62.0	68.0	64.7	65.0	2.4	1.0	4

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-1: Summary Statistics 1993

W4	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
Ag	0.5[e]	-	6	0.1	0.1	0.1	0.1	0.0	0.0	0
Bi			6	62.0	286.0	132.7	105.0	82.3	33.6	62
Cu	35.7	197	6	24.0	33.0	27.0	26.0	3.1	1.3	11
Hg	0.17	0.486	6	0.5	0.5	0.5	0.5	0.0	0.0	0
Mo			6	0.5	1.0	0.8	0.8	0.3	0.1	37
Pb	35	91	6	18.0	36.0	27.3	26.0	6.2	2.5	23
Sb			6	4.0	12.0	5.3	4.0	3.3	1.3	61
Zn	123	315	6	58.0	72.0	66.0	66.0	5.1	2.1	8

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-1: Summary Statistics 1993

W5	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
Ag	0.5[e]	-	6	0.1	0.4	0.2	0.1	0.1	0.0	73
Bi			6	144.0	158.0	147.3	145.0	5.5	2.2	4
Cu	35.7	197	6	24.0	27.0	25.2	25.0	1.2	0.5	5
Hg	0.17	0.486	6	0.5	0.5	0.5	0.5	0.0	0.0	0
Mo			6	0.5	0.5	0.5	0.5	0.0	0.0	0
Pb	35	91	6	30.0	36.0	33.3	33.0	2.4	1.0	7
Sb			6	4.0	12.0	8.0	8.0	2.8	1.2	35
Zn	123	315	6	76.0	84.0	78.7	78.0	3.3	1.3	4

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-1: Summary Statistics 1993

W8	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
Ag	0.5[e]	-	6	0.1	0.4	0.2	0.2	0.1	0.0	64
Bi			6	370.0	590.0	446.7	438.0	81.1	33.1	18
Cu	35.7	197	6	18.0	20.0	19.2	19.0	0.8	0.3	4
Hg	0.17	0.486	6	0.5	0.5	0.5	0.5	0.0	0.0	0
Mo			6	3.0	7.0	5.2	6.0	1.7	0.7	33
Pb	35	91	6	34.0	68.0	56.0	60.0	13.4	5.5	24
Sb			6	6.0	16.0	12.7	13.0	3.7	1.5	29
Zn	123	315	6	112.0	154.0	131.7	126.0	17.4	7.1	13

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-1: Summary Statistics 1993

W22	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
Ag	0.5[e]	-	6	0.1	0.2	0.1	0.1	0.0	0.0	35
Bi			6	30.0	54.0	42.0	44.0	8.7	3.5	21
Cu	35.7	197	6	25.0	28.0	26.3	26.0	1.5	0.6	6
Hg	0.17	0.486	6	0.5	0.5	0.5	0.5	0.0	0.0	0
Mo			6	0.5	1.0	0.7	0.5	0.3	0.1	39
Pb	35	91	6	20.0	28.0	26.3	28.0	3.2	1.3	12
Sb			6	2.0	6.0	4.0	4.0	1.3	0.5	32
Zn	123	315	6	62.0	72.0	66.0	66.0	4.0	1.6	6

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment

Appendix B2-2: Summary Statistics 1995

W2	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
Ag	0.5[e]	-	6	2	2	2.00	2	0.00	0.00	0
As	5.9	17	6	49.8	62.3	55.28	53.65	5.09	2.08	9
Cd	0.6	3.5	6	0.05	0.05	0.05	0.05	0.00	0.00	0
Co			6	10.2	12.9	11.58	11.8	1.16	0.47	10
Cr	37.3	90	6	6.6	15.1	11.15	11.5	3.31	1.35	30
Cu	35.7	197	6	11.9	27.6	22.13	24.3	5.80	2.37	26
Hg	0.17	0.486	6	0.014	0.033	0.03	0.025	0.01	0.00	28
Mo			6	2	4	3.67	4	0.82	0.33	22
Ni	16[b]	75[c]	6	17.6	22.7	19.20	18.3	2.00	0.82	10
Pb	35	91	6	10.5	13.2	11.65	11.6	1.07	0.44	9
Sb			6	2.63	3.67	3.12	3.065	0.42	0.17	13
Se	5[d]	-	6	0.15	0.22	0.18	0.17	0.03	0.01	16
Zn	123	315	6	54.5	69.1	59.60	58.4	5.40	2.20	9

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-2: Summary Statistics 1995

W4	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
Ag	0.5[e]	-	6	2	2	2.00	2	0.00	0.00	0
As	5.9	17	6	75.4	220	152.73	161.5	56.28	22.98	37
Cd	0.6	3.5	6	0.05	0.18	0.10	0.09	0.06	0.02	59
Co			6	5.8	13.6	10.78	11.1	2.79	1.14	26
Cr	37.3	90	6	6.6	15.1	11.27	11.85	3.35	1.37	30
Cu	35.7	197	6	11.9	27.6	23.38	25.25	5.77	2.36	25
Hg	0.17	0.486	6	0.014	0.033	0.03	0.025	0.01	0.00	30
Mo			6	2	4	3.67	4	0.82	0.33	22
Ni	16[b]	75[c]	6	10.5	26.2	21.02	22.6	5.85	2.39	28
Pb	35	91	6	9	31.1	20.30	19.5	7.47	3.05	37
Sb			6	3.81	10.7	8.49	9.025	2.58	1.05	30
Se	5[d]	-	6	0.05	0.23	0.19	0.21	0.07	0.03	37
Zn	123	315	6	37.5	90.2	73.08	77.55	19.66	8.03	27

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment

Appendix B2-2: Summary Statistics 1995

W5	SQG		Summary Statistics								
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
Ag	0.5[e]	-	6	1	2	1.83	2	0.41	0.17	22
As	5.9	17	6	113	142	128.50	131	11.95	4.88	9
Cd	0.6	3.5	6	0.15	0.39	0.22	0.185	0.09	0.04	40
Co			6	9.4	14.2	11.48	11.1	1.83	0.75	16
Cr	37.3	90	6	15.2	19.8	18.62	19.35	1.72	0.70	9
Cu	35.7	197	6	22.9	26.9	24.28	23.75	1.46	0.60	6
Hg	0.17	0.486	6	0.022	0.032	0.03	0.026	0.00	0.00	15
Mo			6	4	4	4.00	4	0.00	0.00	0
Ni	16[b]	75[c]	6	18	25.5	22.37	22.9	3.10	1.26	14
Pb	35	91	6	23.1	29.7	27.70	28.05	2.44	0.99	9
Sb			6	15	40.5	21.62	18.7	9.57	3.91	44
Se	5[d]	-	6	0.21	0.32	0.27	0.275	0.04	0.02	15
Zn	123	315	6	81.2	102	92.62	94.3	7.92	3.23	9

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-2: Summary Statistics 1995

W8	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
Ag	0.5[e]	-	6	1	2	1.33	1	0.52	0.21	39
As	5.9	17	6	249	565	355.33	332	107.85	44.03	30
Cd	0.6	3.5	6	0.27	0.96	0.49	0.41	0.24	0.10	50
Co			6	8	9.9	9.12	9.05	0.72	0.29	8
Cr	37.3	90	6	10.5	14.5	12.42	12.65	1.53	0.63	12
Cu	35.7	197	6	6.6	12.4	9.08	9.05	2.16	0.88	24
Hg	0.17	0.486	6	0.0025	0.82	0.14	0.0055	0.33	0.14	234
Mo			6	2	5.2	3.20	3	1.39	0.57	43
Ni	16[b]	75[c]	6	13.4	41.6	20.18	16.4	10.72	4.38	53
Pb	35	91	6	18.2	420	91.00	25.55	161.30	65.85	177
Sb			6	9.45	22.4	16.54	17.55	4.91	2.01	30
Se	5[d]	-	6	0.18	0.28	0.21	0.195	0.04	0.01	18
Zn	123	315	6	68.3	107	84.20	81.4	14.82	6.05	18

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-2: Summary Statistics 1995

W22	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
Ag	0.5[e]	-	6	2	5	2.50	2	1.22	0.50	49
As	5.9	17	6	58.4	94.2	69.97	66.8	13.45	5.49	19
Cd	0.6	3.5	6	0.18	0.36	0.28	0.285	0.06	0.03	22
Co			6	13.7	19.6	15.77	15.55	2.10	0.86	13
Cr	37.3	90	6	9.5	15.7	12.88	13.05	2.54	1.04	20
Cu	35.7	197	6	21.9	34.5	27.20	27.25	4.76	1.94	17
Hg	0.17	0.486	6	0.025	0.093	0.05	0.039	0.03	0.01	51
Mo			6	4	10	5.00	4	2.45	1.00	49
Ni	16[b]	75[c]	6	23.8	30.5	26.95	26.5	3.03	1.24	11
Pb	35	91	6	16.1	31.8	23.77	23.85	5.70	2.33	24
Sb			6	4.84	18.1	9.70	8.71	4.52	1.85	47
Se	5[d]	-	6	0.2	0.44	0.30	0.28	0.08	0.03	28
Zn	123	315	6	75.5	111	92.50	96.75	13.49	5.51	15

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

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b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W1	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	6.61	6.92	6.78	6.80	0.16	0.09	2
Metals (mg/kg)										
Antimony (Sb)			3	5.00	10.00	8.33	10.00	2.89	1.67	-
Arsenic (As)	5.9	17	3	378.00	412.00	399.00	407.00	18.36	10.60	5
Barium (Ba)			3	253.00	259.00	256.33	257.00	3.06	1.76	1
Beryllium (Be)			3	0.91	0.94	0.93	0.93	0.02	0.01	-
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	-
Chromium (Cr)	37	90	3	56.30	61.00	58.53	58.30	2.36	1.36	4
Cobalt (Co)			3	16.60	17.10	16.87	16.90	0.25	0.15	1
Copper (Cu)	36	197	3	38.40	39.40	38.77	38.50	0.55	0.32	1
Lead (Pb)	35	91	3	32.00	34.00	33.33	34.00	1.15	0.67	-
Mercury (Hg)	0.2	0.49	3	0.07	0.08	0.07	0.07	0.00	0.00	4
Molybdenum (Mo)			3	2.00	4.10	3.37	4.00	1.18	0.68	-
Nickel (Ni)	16[b]	75[c]	3	64.40	67.70	65.53	64.50	1.88	1.08	3
Selenium (Se)	5[d]	-	3	1.00	1.50	1.33	1.50	0.29	0.17	-
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Vanadium (V)			3	61.60	62.70	62.30	62.60	0.61	0.35	1
Zinc (Zn)	123	315	3	127.00	130.00	128.67	129.00	1.53	0.88	1

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W4	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.45	7.74	7.61	7.63	0.15	0.08	2
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	-
Arsenic (As)	5.9	17	3	77.55	108.00	91.48	88.90	15.39	8.88	17
Barium (Ba)			3	172.00	185.00	177.17	174.50	6.90	3.98	4
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	-
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	-
Chromium (Cr)	37	90	3	17.25	20.40	18.32	17.30	1.80	1.04	10
Cobalt (Co)			3	10.40	12.20	11.27	11.20	0.90	0.52	8
Copper (Cu)	36	197	3	19.45	22.70	20.75	20.10	1.72	0.99	8
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	-
Mercury (Hg)	0.2	0.49	3	0.07	0.22	0.12	0.07	0.09	0.05	74
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	-
Nickel (Ni)	16[b]	75[c]	3	23.05	27.00	24.48	23.40	2.19	1.26	-
Selenium (Se)	5[d]	-	3	1.00	1.25	1.08	1.00	0.14	0.08	-
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	-
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	-
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	-
Vanadium (V)			3	29.45	31.70	30.32	29.80	1.21	0.70	4
Zinc (Zn)	123	315	3	79.55	94.80	84.92	80.40	8.57	4.95	10

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

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b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W5	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.61	7.82	7.71	7.71	0.11	0.06	1
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	-
Arsenic (As)	5.9	17	3	91.20	94.90	92.67	91.90	1.97	1.13	2
Barium (Ba)			3	174.00	190.00	180.00	176.00	8.72	5.03	5
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	-
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	-
Chromium (Cr)	37	90	3	18.60	20.60	19.40	19.00	1.06	0.61	5
Cobalt (Co)			3	11.00	11.80	11.47	11.60	0.42	0.24	4
Copper (Cu)	36	197	3	24.20	27.20	25.87	26.20	1.53	0.88	6
Lead (Pb)	35	91	3	15.00	30.00	20.00	15.00	8.66	5.00	-
Mercury (Hg)	0.2	0.49	3	0.07	0.08	0.07	0.07	0.01	0.01	12
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	-
Nickel (Ni)	16[b]	75[c]	3	24.40	26.80	25.57	25.50	1.20	0.69	-
Selenium (Se)	5[d]	-	3	1.00	1.50	1.17	1.00	0.29	0.17	-
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	-
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	-
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	-
Vanadium (V)			3	29.40	31.90	30.23	29.40	1.44	0.83	5
Zinc (Zn)	123	315	3	89.30	95.20	92.43	92.80	2.97	1.71	3

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W6	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.26	7.39	7.31	7.28	0.07	0.04	1
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	-
Arsenic (As)	5.9	17	3	63.20	69.60	65.93	65.00	3.30	1.91	5
Barium (Ba)			3	193.00	196.00	194.00	193.00	1.73	1.00	1
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	-
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	-
Chromium (Cr)	37	90	3	20.10	20.20	20.17	20.20	0.06	0.03	0
Cobalt (Co)			3	9.80	10.30	10.10	10.20	0.26	0.15	-
Copper (Cu)	36	197	3	22.40	23.20	22.77	22.70	0.40	0.23	2
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	-
Mercury (Hg)	0.2	0.49	3	0.04	0.04	0.04	0.04	0.00	0.00	3
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	-
Nickel (Ni)	16[b]	75[c]	3	23.30	23.90	23.57	23.50	0.31	0.18	-
Selenium (Se)	5[d]	-	3	1.00	1.50	1.17	1.00	0.29	0.17	-
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	-
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	-
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	-
Vanadium (V)			3	33.30	33.70	33.43	33.30	0.23	0.13	1
Zinc (Zn)	123	315	3	101.00	105.00	103.33	104.00	2.08	1.20	2

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W13	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.28	7.45	7.37	7.38	0.09	0.05	1
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	-
Arsenic (As)	5.9	17	3	134.00	148.00	139.33	136.00	7.57	4.37	5
Barium (Ba)			3	216.00	237.00	227.67	230.00	10.69	6.17	5
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	-
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	-
Chromium (Cr)	37	90	3	22.70	23.60	23.17	23.20	0.45	0.26	2
Cobalt (Co)			3	10.70	11.20	10.93	10.90	0.25	0.15	2
Copper (Cu)	36	197	3	22.70	24.80	23.80	23.90	1.05	0.61	4
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	-
Mercury (Hg)	0.2	0.49	3	0.04	0.08	0.05	0.05	0.02	0.01	40
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	-
Nickel (Ni)	16[b]	75[c]	3	24.90	26.10	25.37	25.10	0.64	0.37	-
Selenium (Se)	5[d]	-	3	1.00	2.00	1.33	1.00	0.58	0.33	-
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	-
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	-
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	-
Vanadium (V)			3	36.50	38.80	37.93	38.50	1.25	0.72	3
Zinc (Zn)	123	315	3	112.00	121.00	116.33	116.00	4.51	2.60	4

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W20	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	6.97	7.08	7.03	7.03	0.06	0.03	1
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	-
Arsenic (As)	5.9	17	3	528.00	608.00	565.67	561.00	40.20	23.21	7
Barium (Ba)			3	209.00	231.00	218.67	216.00	11.24	6.49	5
Beryllium (Be)			3	1.12	1.30	1.23	1.26	0.09	0.05	-
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	-
Chromium (Cr)	37	90	3	20.40	23.40	21.70	21.30	1.54	0.89	7
Cobalt (Co)			3	7.90	9.20	8.37	8.00	0.72	0.42	-
Copper (Cu)	36	197	3	11.90	13.00	12.30	12.00	0.61	0.35	5
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	-
Mercury (Hg)	0.2	0.49	3	0.06	0.07	0.07	0.07	0.00	0.00	5
Molybdenum (Mo)			3	5.50	7.30	6.37	6.30	0.90	0.52	-
Nickel (Ni)	16[b]	75[c]	3	20.10	24.20	21.87	21.30	2.11	1.22	-
Selenium (Se)	5[d]	-	3	1.00	1.50	1.17	1.00	0.29	0.17	-
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	-
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	-
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	-
Vanadium (V)			3	35.20	37.10	36.27	36.50	0.97	0.56	3
Zinc (Zn)	123	315	3	77.00	99.80	84.63	77.10	13.13	7.58	16

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W21	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	6.91	7.26	7.09	7.11	0.18	0.10	2
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	-
Arsenic (As)	5.9	17	3	180.00	211.00	197.33	201.00	15.82	9.13	8
Barium (Ba)			3	172.00	194.00	185.33	190.00	11.72	6.77	6
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	-
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	-
Chromium (Cr)	37	90	3	25.10	26.20	25.73	25.90	0.57	0.33	2
Cobalt (Co)			3	8.70	9.40	9.00	8.90	0.36	0.21	-
Copper (Cu)	36	197	3	20.40	22.60	21.23	20.70	1.19	0.69	6
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	-
Mercury (Hg)	0.2	0.49	3	0.04	0.05	0.04	0.04	0.00	0.00	8
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	-
Nickel (Ni)	16[b]	75[c]	3	23.80	25.40	24.57	24.50	0.80	0.46	-
Selenium (Se)	5[d]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	-
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	-
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	-
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	-
Vanadium (V)			3	37.80	39.60	38.97	39.50	1.01	0.58	3
Zinc (Zn)	123	315	3	73.40	82.20	78.67	80.40	4.65	2.68	6

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W22	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	6.88	7.22	7.05	7.05	0.17	0.10	2
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	-
Arsenic (As)	5.9	17	3	30.70	54.90	40.07	34.60	12.99	7.50	32
Barium (Ba)			3	198.00	219.00	210.33	214.00	10.97	6.33	5
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	-
Cadmium (Cd)	0.6	3.5	3	0.25	0.50	0.33	0.25	0.14	0.08	-
Chromium (Cr)	37	90	3	16.40	17.30	16.77	16.60	0.47	0.27	3
Cobalt (Co)			3	13.60	14.70	14.13	14.10	0.55	0.32	4
Copper (Cu)	36	197	3	18.00	20.10	19.07	19.10	1.05	0.61	6
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	-
Mercury (Hg)	0.2	0.49	3	0.07	0.12	0.10	0.11	0.03	0.02	29
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	-
Nickel (Ni)	16[b]	75[c]	3	25.80	30.00	27.40	26.40	2.27	1.31	8
Selenium (Se)	5[d]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	-
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	-
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	-
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	-
Vanadium (V)			3	28.40	32.20	30.63	31.30	1.99	1.15	6
Zinc (Zn)	123	315	3	87.00	89.00	87.97	87.90	1.00	0.58	1

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W23	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.75	7.78	7.77	7.78	0.02	0.01	0
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	-
Arsenic (As)	5.9	17	3	92.70	100.00	96.37	96.40	3.65	2.11	4
Barium (Ba)			3	213.00	223.00	219.00	221.00	5.29	3.06	2
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	-
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	-
Chromium (Cr)	37	90	3	22.30	23.50	23.03	23.30	0.64	0.37	3
Cobalt (Co)			3	12.20	13.00	12.67	12.80	0.42	0.24	3
Copper (Cu)	36	197	3	28.20	29.50	28.97	29.20	0.68	0.39	2
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	-
Mercury (Hg)	0.2	0.49	3	0.06	0.06	0.06	0.06	0.00	0.00	1
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	-
Nickel (Ni)	16[b]	75[c]	3	27.90	29.30	28.83	29.30	0.81	0.47	3
Selenium (Se)	5[d]	-	3	1.00	1.50	1.17	1.00	0.29	0.17	-
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	-
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	-
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	-
Vanadium (V)			3	34.70	37.10	36.00	36.20	1.21	0.70	3
Zinc (Zn)	123	315	3	109.00	114.00	112.00	113.00	2.65	1.53	2

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W26	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	6.31	6.62	6.49	6.54	0.16	0.09	2
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	0
Arsenic (As)	5.9	17	3	85.80	94.50	89.07	86.90	4.74	2.74	5
Barium (Ba)			3	141.00	146.00	142.67	141.00	2.89	1.67	2
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	0
Chromium (Cr)	37	90	3	19.50	20.70	20.13	20.20	0.60	0.35	3
Cobalt (Co)			3	6.20	6.40	6.30	6.30	0.10	0.06	2
Copper (Cu)	36	197	3	13.10	14.70	13.83	13.70	0.81	0.47	6
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	0
Mercury (Hg)	0.2	0.49	3	0.04	0.09	0.06	0.05	0.03	0.02	47
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	15.20	16.00	15.67	15.80	0.42	0.24	3
Selenium (Se)	5[d]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Vanadium (V)			3	32.60	35.10	34.00	34.30	1.28	0.74	4
Zinc (Zn)	123	315	3	55.90	57.10	56.43	56.30	0.61	0.35	1

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B – Sediment
Appendix B2-3: Summary Statistics 2007

W27	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.90	8.19	8.04	8.02	0.15	0.08	2
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	0
Arsenic (As)	5.9	17	3	166.00	180.00	175.00	179.00	7.81	4.51	4
Barium (Ba)			3	118.00	129.00	122.67	121.00	5.69	3.28	5
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	0
Chromium (Cr)	37	90	3	12.90	13.10	13.03	13.10	0.12	0.07	1
Cobalt (Co)			3	12.00	12.20	12.07	12.00	0.12	0.07	1
Copper (Cu)	36	197	3	33.50	33.90	33.67	33.60	0.21	0.12	1
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	0
Mercury (Hg)	0.2	0.49	3	0.05	0.06	0.05	0.06	0.00	0.00	5
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	25.10	25.50	25.33	25.40	0.21	0.12	1
Selenium (Se)	5[d]	-	3	1.00	1.50	1.33	1.50	0.29	0.17	22
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Vanadium (V)			3	24.70	24.80	24.73	24.70	0.06	0.03	0
Zinc (Zn)	123	315	3	70.10	71.80	71.00	71.10	0.85	0.49	1

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-4: Summary Statistics 2009

W1	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.15	7.58	7.42	7.52	0.23	0.13	3
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	0
Arsenic (As)	5.9	17	3	139.00	166.00	156.00	163.00	14.80	8.54	9
Barium (Ba)			3	48.80	78.10	63.37	63.20	14.65	8.46	23
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	0
Chromium (Cr)	37	90	3	5.60	8.70	7.30	7.60	1.57	0.91	22
Cobalt (Co)			3	3.90	6.70	5.67	6.40	1.54	0.89	27
Copper (Cu)	36	197	3	3.50	7.50	6.00	7.00	2.18	1.26	36
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	0
Mercury (Hg)	0.2	0.49	3	0.01	0.02	0.01	0.02	0.01	0.00	46
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	9.60	16.00	13.27	14.20	3.30	1.91	25
Selenium (Se)	5[d]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Vanadium (V)			3	7.90	10.90	9.83	10.70	1.68	0.97	17
Zinc (Zn)	123	315	3	21.80	77.20	44.63	34.90	28.95	16.72	65

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-4: Summary Statistics 2009

W5	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.66	7.85	7.78	7.83	0.10	0.06	1
Metals (mg/kg)										
Antimony (Sb)			3	10.00	17.00	12.67	11.00	3.79	2.19	30
Arsenic (As)	5.9	17	3	110.00	129.00	118.33	116.00	9.71	5.61	8
Barium (Ba)			3	69.50	120.00	97.50	103.00	25.70	14.84	26
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	0.57	0.45	0.54	0.18	0.10	39
Chromium (Cr)	37	90	3	16.70	22.00	19.93	21.10	2.84	1.64	14
Cobalt (Co)			3	10.60	12.20	11.63	12.10	0.90	0.52	8
Copper (Cu)	36	197	3	24.40	28.10	26.27	26.30	1.85	1.07	7
Lead (Pb)	35	91	3	36.00	43.00	38.67	37.00	3.79	2.19	10
Mercury (Hg)	0.2	0.49	3	0.02	0.04	0.03	0.03	0.01	0.00	25
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	25.70	27.30	26.77	27.30	0.92	0.53	3
Selenium (Se)	5[d]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Vanadium (V)			3	13.30	20.40	17.57	19.00	3.76	2.17	21
Zinc (Zn)	123	315	3	81.70	96.80	89.43	89.80	7.56	4.36	8

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-4: Summary Statistics 2009

W21	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.43	7.82	7.66	7.73	0.20	0.12	3
Metals (mg/kg)										
Antimony (Sb)			3	5.00	11.00	7.00	5.00	3.46	2.00	49
Arsenic (As)	5.9	17	3	185.00	224.00	202.00	197.00	19.97	11.53	10
Barium (Ba)			3	65.60	87.20	73.10	66.50	12.22	7.05	17
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	0
Chromium (Cr)	37	90	3	10.60	11.40	10.97	10.90	0.40	0.23	4
Cobalt (Co)			3	7.10	9.10	8.17	8.30	1.01	0.58	12
Copper (Cu)	36	197	3	14.90	31.20	21.30	17.80	8.70	5.02	41
Lead (Pb)	35	91	3	15.00	120.00	50.00	15.00	60.62	35.00	121
Mercury (Hg)	0.2	0.49	3	0.01	0.03	0.02	0.02	0.01	0.01	57
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	17.30	17.70	17.43	17.30	0.23	0.13	1
Selenium (Se)	5[d]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Vanadium (V)			3	13.00	14.10	13.47	13.30	0.57	0.33	4
Zinc (Zn)	123	315	3	52.30	57.20	54.67	54.50	2.45	1.42	4

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-4: Summary Statistics 2009

W22	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	6.88	7.24	7.12	7.24	0.21	0.12	3
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	0
Arsenic (As)	5.9	17	3	62.60	221.00	129.20	104.00	82.15	47.43	64
Barium (Ba)			3	87.90	138.00	106.10	92.40	27.72	16.00	26
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	0.62	0.46	0.52	0.19	0.11	41
Chromium (Cr)	37.3	90	3	10.10	16.30	12.27	10.40	3.50	2.02	29
Cobalt (Co)			3	11.30	15.60	12.97	12.00	2.31	1.33	18
Copper (Cu)	35.7	197	3	23.10	25.30	24.33	24.60	1.12	0.65	5
Lead (Pb)	35	91	3	15.00	33.00	21.00	15.00	10.39	6.00	49
Mercury (Hg)	0.17	0.486	3	0.04	0.05	0.04	0.04	0.01	0.00	18
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	23.50	27.60	25.00	23.90	2.26	1.31	9
Selenium (Se)	5[d]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Vanadium (V)			3	12.50	18.80	14.97	13.60	3.37	1.94	22
Zinc (Zn)	123	315	3	85.50	91.30	87.93	87.00	3.01	1.74	3

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-4: Summary Statistics 2009

W26	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.72	7.83	7.77	7.75	0.06	0.03	1
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	0
Arsenic (As)	5.9	17	3	200.00	547.00	342.00	279.00	181.88	105.01	53
Barium (Ba)			3	74.80	98.40	86.43	86.10	11.80	6.81	14
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	0
Chromium (Cr)	37	90	3	11.80	15.10	13.40	13.30	1.65	0.95	12
Cobalt (Co)			3	6.90	7.90	7.47	7.60	0.51	0.30	7
Copper (Cu)	36	197	3	10.70	13.00	12.00	12.30	1.18	0.68	10
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	0
Mercury (Hg)	0.2	0.49	3	0.01	0.01	0.01	0.01	0.00	0.00	16
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	16.00	17.60	17.03	17.50	0.90	0.52	5
Selenium (Se)	5[d]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Vanadium (V)			3	15.20	20.50	17.97	18.20	2.66	1.53	15
Zinc (Zn)	123	315	3	47.80	65.20	54.37	50.10	9.45	5.46	17

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-4: Summary Statistics 2009

W27	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.95	8.44	8.24	8.34	0.26	0.15	3
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	0
Arsenic (As)	5.9	17	3	150.00	194.00	173.67	177.00	22.19	12.81	13
Barium (Ba)			3	44.30	89.80	65.63	62.80	22.88	13.21	35
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	0
Chromium (Cr)	37	90	3	9.00	13.40	11.73	12.80	2.39	1.38	20
Cobalt (Co)			3	7.00	10.40	9.23	10.30	1.93	1.12	21
Copper (Cu)	36	197	3	21.40	28.50	25.97	28.00	3.96	2.29	15
Lead (Pb)	35	91	3	15.00	31.00	20.33	15.00	9.24	5.33	45
Mercury (Hg)	0.2	0.49	3	0.01	0.04	0.03	0.03	0.01	0.01	57
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	16.00	23.60	20.60	22.20	4.04	2.34	20
Selenium (Se)	5[d]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Vanadium (V)			3	11.70	16.40	14.57	15.60	2.51	1.45	17
Zinc (Zn)	123	315	3	55.10	72.90	66.17	70.50	9.66	5.58	15

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-4: Summary Statistics 2009

W29	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.50	7.76	7.61	7.57	0.13	0.08	2
Metals (mg/kg)										
Antimony (Sb)			3	10.00	12.00	11.00	11.00	1.00	0.58	9
Arsenic (As)	5.9	17	3	54.90	77.90	63.57	57.90	12.50	7.22	20
Barium (Ba)			3	41.90	73.60	58.80	60.90	15.95	9.21	27
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	0.25	0.25	0.25	0.00	0.00	0
Chromium (Cr)	37	90	3	13.40	20.40	16.23	14.90	3.69	2.13	23
Cobalt (Co)			3	11.90	12.90	12.23	11.90	0.58	0.33	5
Copper (Cu)	36	197	3	22.60	24.80	23.80	24.00	1.11	0.64	5
Lead (Pb)	35	91	3	15.00	15.00	15.00	15.00	0.00	0.00	0
Mercury (Hg)	0.2	0.49	3	0.02	0.03	0.02	0.02	0.00	0.00	24
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	24.60	25.90	25.27	25.30	0.65	0.38	3
Selenium (Se)	5[d]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Vanadium (V)			3	10.70	12.50	11.87	12.40	1.01	0.58	9
Zinc (Zn)	123	315	3	93.00	100.00	95.60	93.80	3.83	2.21	4

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment

Appendix B2-5: Summary Statistics 2010

W1	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			5	7.06	7.56	7.31	7.30	0.22	0.10	0
Metals (mg/kg)										
Antimony (Sb)			5	5.00	13.00	7.60	5.00	3.71	1.66	49
Arsenic (As)	5.9	17	5	201.00	474.00	360.40	378.00	100.80	45.08	28
Barium (Ba)			5	77.30	251.00	170.26	174.00	63.51	28.40	37
Beryllium (Be)			5	0.25	1.22	0.80	0.86	0.35	0.16	44
Cadmium (Cd)	0.6	3.5	5	0.25	0.25	0.25	0.25	0.00	0.00	0
Chromium (Cr)	37.3	90	5	10.80	42.80	28.20	28.40	12.02	5.37	43
Cobalt (Co)			5	6.40	18.70	13.22	12.80	4.57	2.04	35
Copper (Cu)	35.7	197	5	7.60	23.60	17.06	17.50	6.08	2.72	36
Lead (Pb)	35	91	5	15.00	35.00	19.00	15.00	8.94	4.00	47
Mercury (Hg)	0.17	0.486	5	0.01	0.05	0.03	0.02	0.01	0.01	48
Molybdenum (Mo)			5	2.00	5.30	3.60	4.20	1.51	0.68	42
Nickel (Ni)	16[b]	75[c]	5	16.40	55.50	39.26	44.20	14.72	6.58	37
Selenium (Se)	5[d]	-	5	1.00	2.00	1.26	1.00	0.43	0.19	34
Silver (Ag)	0.5[e]	-	5	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			5	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			5	2.50	2.50	2.50	2.50	0.00	0.00	0
Uranium (U)			5	2.37	6.56	4.84	4.97	1.54	0.69	32
Vanadium (V)			5	13.00	46.20	31.18	31.10	12.27	5.49	39
Zinc (Zn)	123	315	5	37.10	126.00	89.46	96.20	32.54	14.55	36

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-5: Summary Statistics 2010

W4	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			5	7.31	7.55	7.45	7.47	0.09	0.04	0
Metals (mg/kg)										
Antimony (Sb)			5	5.00	5.00	5.00	5.00	0.00	0.00	0
Arsenic (As)	5.9	17	5	132.00	165.00	148.60	151.00	12.38	5.54	8
Barium (Ba)			5	129.00	159.00	140.60	136.00	11.41	5.10	8
Beryllium (Be)			5	0.25	0.50	0.30	0.25	0.11	0.05	37
Cadmium (Cd)	0.6	3.5	5	0.25	0.25	0.25	0.25	0.00	0.00	0
Chromium (Cr)	37.3	90	5	14.30	18.10	16.42	16.50	1.42	0.64	9
Cobalt (Co)			5	15.40	18.70	17.06	16.70	1.30	0.58	8
Copper (Cu)	35.7	197	5	23.00	28.30	25.48	25.20	2.29	1.03	9
Lead (Pb)	35	91	5	15.00	15.00	15.00	15.00	0.00	0.00	0
Mercury (Hg)	0.17	0.486	5	0.00	0.06	0.04	0.04	0.02	0.01	58
Molybdenum (Mo)			5	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	5	29.70	35.20	32.08	31.80	2.16	0.97	7
Selenium (Se)	5[d]	-	5	1.10	1.50	1.28	1.15	0.20	0.09	16
Silver (Ag)	0.5[e]	-	5	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			5	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			5	2.50	2.50	2.50	2.50	0.00	0.00	0
Uranium (U)			5	1.41	2.24	1.67	1.54	0.33	0.15	20
Vanadium (V)			5	17.90	24.30	21.52	21.70	2.30	1.03	11
Zinc (Zn)	123	315	5	93.10	107.00	100.30	101.00	5.62	2.51	6

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-5: Summary Statistics 2010

W27	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			5	8.48	8.70	8.57	8.55	0.08	0.04	0
Metals (mg/kg)										
Antimony (Sb)			5	5.00	5.00	5.00	5.00	0.00	0.00	0
Arsenic (As)	5.9	17	5	58.60	112.00	77.88	77.20	21.04	9.41	27
Barium (Ba)			5	174.00	315.00	246.00	251.00	63.73	28.50	26
Beryllium (Be)			5	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	5	0.25	0.25	0.25	0.25	0.00	0.00	0
Chromium (Cr)	37.3	90	5	14.30	19.50	16.66	16.10	2.02	0.90	12
Cobalt (Co)			5	7.30	8.70	8.16	8.30	0.57	0.26	7
Copper (Cu)	35.7	197	5	21.00	28.90	24.56	22.90	3.71	1.66	15
Lead (Pb)	35	91	5	15.00	15.00	15.00	15.00	0.00	0.00	0
Mercury (Hg)	0.17	0.486	5	0.02	0.03	0.03	0.03	0.00	0.00	17
Molybdenum (Mo)			5	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	5	19.20	23.60	21.14	20.60	2.06	0.92	10
Selenium (Se)	5[d]	-	5	1.00	1.40	1.13	1.10	0.16	0.07	14
Silver (Ag)	0.5[e]	-	5	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			5	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			5	2.50	2.50	2.50	2.50	0.00	0.00	0
Uranium (U)			5	0.66	0.89	0.76	0.78	0.09	0.04	12
Vanadium (V)			5	20.70	32.00	26.50	24.80	4.60	2.05	17
Zinc (Zn)	123	315	5	56.50	69.60	63.20	62.40	5.83	2.61	9

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment

Appendix B2-5: Summary Statistics 2010

W29	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			5	7.29	7.90	7.62	7.70	0.23	0.10	0
Metals (mg/kg)										
Antimony (Sb)			5	5.00	15.00	9.60	11.00	4.45	1.99	46
Arsenic (As)	5.9	17	5	80.60	185.00	142.42	168.00	48.66	21.76	34
Barium (Ba)			5	46.10	94.90	65.18	57.40	18.77	8.39	29
Beryllium (Be)			5	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	5	0.25	1.14	0.54	0.25	0.41	0.18	77
Chromium (Cr)	37.3	90	5	10.10	17.10	13.06	13.10	2.90	1.30	22
Cobalt (Co)			5	9.80	15.20	12.60	13.20	2.02	0.90	16
Copper (Cu)	35.7	197	5	20.40	27.00	23.76	24.90	2.83	1.27	12
Lead (Pb)	35	91	5	15.00	49.00	33.00	41.00	16.67	7.46	51
Mercury (Hg)	0.17	0.486	5	0.02	0.06	0.03	0.03	0.01	0.01	45
Molybdenum (Mo)			5	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	5	20.30	32.10	25.74	24.80	4.37	1.95	17
Selenium (Se)	5[d]	-	5	1.00	2.00	1.36	1.25	0.42	0.19	31
Silver (Ag)	0.5[e]	-	5	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			5	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			5	2.50	2.50	2.50	2.50	0.00	0.00	0
Uranium (U)			5	0.76	1.47	1.10	1.04	0.28	0.12	26
Vanadium (V)			5	11.20	19.60	14.64	14.40	3.26	1.46	22
Zinc (Zn)	123	315	5	78.00	127.00	106.32	105.00	20.46	9.15	19

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-5: Summary Statistics 2010

W72	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.32	8.15	7.71	7.65	0.42	0.24	5
Metals (mg/kg)										
Antimony (Sb)			3	11.00	19.00	15.00	15.00	4.00	2.31	27
Arsenic (As)	5.9	17	3	220.00	266.00	246.00	252.00	23.58	13.61	10
Barium (Ba)			3	156.00	159.00	157.00	156.00	1.73	1.00	1
Beryllium (Be)			3	0.25	0.75	0.54	0.62	0.26	0.15	48
Cadmium (Cd)	0.6	3.5	3	0.25	0.52	0.34	0.25	0.16	0.09	46
Chromium (Cr)	37.3	90	3	20.50	28.40	25.10	26.40	4.11	2.37	16
Cobalt (Co)			3	13.40	17.00	15.60	16.40	1.93	1.11	12
Copper (Cu)	35.7	197	3	38.70	52.90	45.60	45.20	7.11	4.10	16
Lead (Pb)	35	91	3	33.00	53.00	45.00	49.00	10.58	6.11	24
Mercury (Hg)	0.17	0.486	3	0.06	0.07	0.06	0.07	0.01	0.00	12
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	29.40	38.00	35.10	37.90	4.94	2.85	14
Selenium (Se)	5[d]	-	3	1.00	1.55	1.18	1.00	0.32	0.18	27
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Uranium (U)			3	1.43	2.99	2.44	2.91	0.88	0.51	36
Vanadium (V)			3	26.00	31.50	29.63	31.40	3.15	1.82	11
Zinc (Zn)	123	315	3	89.20	121.00	107.73	113.00	16.54	9.55	15

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment
Appendix B2-5: Summary Statistics 2010

W73	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.13	7.56	7.31	7.25	0.22	0.13	3
Metals (mg/kg)										
Antimony (Sb)			3	14.00	15.00	14.33	14.00	0.58	0.33	4
Arsenic (As)	5.9	17	3	229.00	517.00	353.00	313.00	148.11	85.51	42
Barium (Ba)			3	132.00	290.00	202.67	186.00	80.31	46.37	40
Beryllium (Be)			3	0.60	1.16	0.85	0.78	0.29	0.17	34
Cadmium (Cd)	0.6	3.5	3	0.25	0.66	0.39	0.25	0.24	0.14	61
Chromium (Cr)	37.3	90	3	24.80	44.50	33.90	32.40	9.94	5.74	29
Cobalt (Co)			3	12.90	21.90	17.13	16.60	4.52	2.61	26
Copper (Cu)	35.7	197	3	39.10	50.90	44.90	44.70	5.90	3.41	13
Lead (Pb)	35	91	3	40.00	52.00	45.33	44.00	6.11	3.53	13
Mercury (Hg)	0.17	0.486	3	0.05	0.07	0.06	0.05	0.01	0.01	28
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	31.90	53.10	41.50	39.50	10.74	6.20	26
Selenium (Se)	5[d]	-	3	0.50	1.30	0.93	1.00	0.40	0.23	43
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Uranium (U)			3	2.25	3.97	2.91	2.52	0.93	0.53	32
Vanadium (V)			3	28.10	54.60	40.07	37.50	13.44	7.76	34
Zinc (Zn)	123	315	3	110.00	160.00	131.00	123.00	25.94	14.98	20

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment

Appendix B2-5: Summary Statistics 2010

W74	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.57	7.68	7.63	7.64	0.06	0.03	1
Metals (mg/kg)										
Antimony (Sb)			3	5.00	5.00	5.00	5.00	0.00	0.00	0
Arsenic (As)	5.9	17	3	104.00	134.00	114.33	105.00	17.04	9.84	15
Barium (Ba)			3	45.60	66.30	57.93	61.90	10.91	6.30	19
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	1.10	0.73	0.84	0.44	0.25	60
Chromium (Cr)	37.3	90	3	9.20	13.60	11.77	12.50	2.29	1.32	19
Cobalt (Co)			3	9.90	13.30	11.57	11.50	1.70	0.98	15
Copper (Cu)	35.7	197	3	19.70	27.40	23.57	23.60	3.85	2.22	16
Lead (Pb)	35	91	3	15.00	64.00	38.00	35.00	24.64	14.22	65
Mercury (Hg)	0.17	0.486	3	0.02	0.06	0.04	0.03	0.02	0.01	63
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	18.00	27.00	22.17	21.50	4.54	2.62	20
Selenium (Se)	5[d]	-	3	1.00	1.40	1.13	1.00	0.23	0.13	20
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Uranium (U)			3	1.01	1.12	1.08	1.11	0.06	0.04	6
Vanadium (V)			3	10.80	15.20	12.70	12.10	2.26	1.31	18
Zinc (Zn)	123	315	3	66.50	107.00	88.97	93.40	20.61	11.90	23

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

Appendix B - Sediment

Appendix B2-5: Summary Statistics 2010

W75	SQG		Summary Statistics							
(ppm)	LEL	PEL	n	min	max	mean	med	sd	se	cv
pH			3	7.11	7.52	7.35	7.41	0.21	0.12	3
Metals (mg/kg)										
Antimony (Sb)			3	5.00	12.00	7.33	5.00	4.04	2.33	55
Arsenic (As)	5.9	17	3	106.00	129.00	115.00	110.00	12.29	7.09	11
Barium (Ba)			3	161.00	166.00	164.00	165.00	2.65	1.53	2
Beryllium (Be)			3	0.25	0.25	0.25	0.25	0.00	0.00	0
Cadmium (Cd)	0.6	3.5	3	0.25	0.51	0.34	0.25	0.15	0.09	45
Chromium (Cr)	37.3	90	3	20.70	22.00	21.40	21.50	0.66	0.38	3
Cobalt (Co)			3	13.20	14.20	13.80	14.00	0.53	0.31	4
Copper (Cu)	35.7	197	3	26.10	29.00	27.63	27.80	1.46	0.84	5
Lead (Pb)	35	91	3	39.00	39.00	39.00	39.00	0.00	0.00	0
Mercury (Hg)	0.17	0.486	3	0.06	0.07	0.06	0.06	0.00	0.00	8
Molybdenum (Mo)			3	2.00	2.00	2.00	2.00	0.00	0.00	0
Nickel (Ni)	16[b]	75[c]	3	28.80	30.60	29.83	30.10	0.93	0.54	3
Selenium (Se)	5[d]	-	3	1.00	1.30	1.13	1.10	0.15	0.09	13
Silver (Ag)	0.5[e]	-	3	1.00	1.00	1.00	1.00	0.00	0.00	0
Thallium (Tl)			3	0.50	0.50	0.50	0.50	0.00	0.00	0
Tin (Sn)			3	2.50	2.50	2.50	2.50	0.00	0.00	0
Uranium (U)			3	1.67	2.17	1.94	1.99	0.25	0.15	13
Vanadium (V)			3	26.70	28.00	27.30	27.20	0.66	0.38	2
Zinc (Zn)	123	315	3	106.00	111.00	109.00	110.00	2.65	1.53	2

NOTES:

ISQG = Interim Sediment Quality Guidelines

PEL = Probable Effect Level

a BCWSG are derived from CCME Guidelines, except guidelines for iron, nickel, selenium and silver based on other jurisdictions

b Lowest Effect Level (LEL) - BCWSG

c Severe Effect Level- BCWSG

d BCWSG

e BCWSG, based on Ontario sediment quality guideline

SOURCE: Nagpal et al. 2006, CCME 2006 (interim sediment quality guidelines)

APPENDIX C

Periphyton

Table of Contents

Appendix C – Periphyton

Appendix C1: Sample Summary

Site	Date	Replicate	Number of Disks	Area Sampled per Replicate	Comments
W1	20-Aug-07	1	6	48.2	cobble size rocks, thin cover of green brown algae
		2	6	48.2	
		3	6	48.2	
		4	6	48.2	
		5	6	48.2	
W4	15-Aug-07	1	6	48.2	cobble size rocks, little to no algae visible
		2	6	48.2	
		3	6	48.2	
		4	6	48.2	
		5	6	48.2	
W5	13-Aug-07	1	6	48.2	cobble size rocks, little to thin cover of green brown algae
		2	6	48.2	
		3	6	48.2	
		4	6	48.2	
		5	6	48.2	
W6	14-Aug-07	1	6	48.2	cobble size rocks, little to no algae visible
		2	6	48.2	
		3	6	48.2	
		4	6	48.2	
		5	6	48.2	
W9	18-Aug-07	1	6	48.2	cobble size rocks, little to thin cover of green brown algae
		2	6	48.2	
		3	6	48.2	
		4	6	48.2	
		5	6	48.2	
W10	18-Aug-07	1	6	48.2	cobble size rocks, little to thin cover of green brown algae
		2	6	48.2	
		3	6	48.2	
		4	6	48.2	
		5	6	48.2	
W13	12-Aug-07	1	6	48.2	
		2	8	64.3	
		3	8	64.3	
		4	8	64.3	
		5	6	48.2	
W20	20-Aug-07	1	6	48.2	cobble and boulder size rocks, little to thin cover of green brown algae
		2	6	48.2	
		3	6	48.2	
		4	4	32.2	
		5	6	48.2	

Appendix C – Periphyton
Appendix C1: Sample Summary

Site	Date	Replicate	Number of Disks	Area Sampled per Replicate	Comments
W21	16-Aug-07	1	6	48.2	cobble size rocks, little to thin cover of green brown algae
		2	6	48.2	
		3	6	48.2	
		4	6	48.2	
		5	6	48.2	
W22	15-Aug-07	1	6	48.2	cobble size rocks, little to thin cover of green brown algae
		2	6	48.2	
		3	6	48.2	
		4	6	48.2	
		5	6	48.2	
W23	11-Aug-07	1	6	48.2	cobble sized rocks, little to matted green algae on rocks
		2	8	64.3	
		3	10	80.4	
		4	6	48.2	
		5	?	?	

Note:

1. Two disks per rock
2. Area based on 8.04 cm^2 per disk

FRASER ENVIRONMENTAL SERVICES

METHODS MANUAL
JANUARY 1994

By Linde Looy, R.P.Bio.

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FRASER ENVIRONMENTAL SERVICES

METHODS MANUAL

Details of the analytical methods used by Fraser Environmental Services are described here. Our firm employs similar standard techniques to ensure consistency over time. The QA/QC procedures employed can be found in the QA/QC Manual.

Phytoplankton Identification and Enumeration

Scope :

This method describes the identification and enumeration of phytoplankton.

Summary :

The sample is settled overnight and the slide is examined. Using the appropriate keys and procedures, phytoplankton can then be identified and subsequently enumerated.

Apparatus :

1. Utermohl-type settling chambers
2. Inverted microscope
3. Compound microscope
4. Appropriate taxonomic keys

Reagents :

1. Lugol's Solution : prepared as outlined in **Standard Methods for the Examination of Water and Wastewater.**

Procedure :

1. Calibrate the microscope using stage and ocular micrometers (see Section 1, page 8 for procedure).
2. Confirm that the sample is appropriately preserved.
3. Settle out an appropriate sample volume randomly removed depending on the density of organisms (usually 100 mL) for approximately 24 hours. Use smaller or diluted volumes for densely populated samples or concentrate sparsely populated samples by centrifugation or by sedimentation.
4. Scan the entire slide at increasing powers of magnification to determine which species/genera are present. Identify the organisms observed to the requested level if possible.
5. Once the identifications are made, do the counts. Count at least 10 random fields,

continue counting until you get a total count of at least 100 for the dominant species. Statistical tests for randomness will be performed.

6. Enumerate the data by a total cell count (cells/mL). Calculate the per mL total for each species or genera by multiplying the actual count by the factor F as defined below :

$$F = \frac{\underline{A / r^2 \pi N}}{V}$$

where A= the area of the settling chamber
r= the radius of the field
N= the number of fields counted
V= the volume settled

Taxonomic Keys :

1. Bourrelly, P. (1966)
2. Cleve-Euler, A. (1951)
3. Cleve-Euler, A. (1968)
4. Contant, H. (1978)
5. Dodd, J. (1947)
6. Germain, H. (1981)
7. Hustedt, F. (1930)
8. Hustedt, F. (1985)
9. Patrick, R. (1966)
10. Patrick, R. (1975)
11. Pennak, R. (1953)
12. Prescott, G. (1978)
13. Prescott, G. (1982)
14. Stein, J. (1975)
15. Ward, H.B. (1959)
16. Webber, C. (1966)

Note : Other taxonomic keys may be used but they will be cited in the data summary.

<u>References :</u>

Bold, Harold C., and Wynne, Michael J. 1978. **Introduction to the Algae : Structure and Reproduction**.

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Wetzel, R.G. 1983. **Limnology: Second edition**.

Periphyton Identification and Enumeration

Scope :

This method describes the identification and enumeration of periphyton.

Summary :

The sample is settled for at least two hours and the slide is examined. The minimum settling time is dependent on the volume of the chamber used. Using the appropriate keys and procedures, periphyton can then be identified and subsequently enumerated.

Apparatus :

1. Utermohl-type settling chambers
2. Inverted microscope
3. Compound microscope
4. Appropriate taxonomic keys

Reagents :

1. Lugol's Solution : prepared as outlined in **Standard Methods for the Examination of Water and Wastewater.**
2. Hyrax mounting medium (or other medium with similar optical properties).

Procedure :

1. Calibrate the microscope using stage and ocular micrometers (see Section 1, page 8 for procedure).
2. Confirm that the sample is appropriately preserved. Measure and record the total volume of the sample.
3. Settle out an appropriate sample volume randomly removed, depending on the density of organisms (usually 25 mL) for approximately 4 hours. Use smaller or diluted volumes for densely populated samples or concentrate sparsely populated samples by centrifugation or by sedimentation.
4. Scan the entire slide at increasing powers of magnification to determine which species/genera are present. Identify the organisms observed to the requested level if possible.
5. Prepare three diatom slides using either pyrolysis or acid digestion to clear the frustules. See Standard Methods for the Examination of Water and Wastewater for further details of these procedures.
6. Examine the three diatom slides at increasing powers of magnification. Identify the organisms observed to the requested level if possible. Work on one slide and use the other two slides for confirmation.

7. Once the identifications are made, do the counts. From the settling chambers count at least 10 random fields, continue counting until you get a total count of at least 100 for the dominant species. Statistical tests for randomness will be performed.
8. Enumerate the data by a total cell count (cells/mL). Calculate the per mL total for each species or genera by multiplying the actual count by the factor F as defined below :

$$F = \frac{A / r^2 \pi N}{V}$$

where A= the area of the settling chamber
r= the radius of the field
N= the number of fields counted
V= the volume settled

The cells per total sample can then be determined by multiplying by the total sample volume. Then divide by the area sampled to get cells per cm^2. In other words the count can be multiplied by factor P as defined below to get cells per cm^2 :

$$P = \frac{FD\,V_t}{A_s}$$

where F = the factor defined previously
D = the dilution
V_t = the total sample volume
A_s = the area sampled (cm^2)

Taxonomic keys:

1. Cleve-Euler, A. (1951)
2. Cleve-Euler, A. (1968)
3. Contant, H. (1978)
4. Dodd, J. (1947)
5. Geitler, L. (1932)
6. Germain, H. (1981)
7. Huber-Pestalozzi, G. (1938, 1941, 1961,1955, 1972 & 1983)
8. Hustedt, F. (1930)
9. Hustedt, F. (1985)
10. Komarek, J. and K. Anagnostidis. (1999)
11. Patrick, R. (1966)
12. Patrick, R. (1975)
13. Pennak, R. (1953)
14. Prescott, G. (1978)
15. Prescott, G. (1982)
16. Stein, J. (1975)
17. Ward, H.B and C. G. Whipple. (1959)
18. Webber, C. (1966)

Note : Other taxonomic keys may be used but they will be cited in the data summary.

References:

Bold, Harold C., and Wynne, Michael J. 1978. **Introduction to the Algae : Structure and Reproduction**.

Clesceri, L.S., Greenberg, A.E. and Trussell, R.R. (eds). 1989. **Standard Methods for the Examination of Water and Wastewater. 17th edition**. APHA - AWWA - WPCF.

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Zooplankton Identification and Enumeration

Scope :

This method describes the identification and enumeration of zooplankton.

Summary :

The sample is settled and the slide is examined. Using the appropriate keys and procedures, zooplankton can then be identified and subsequently enumerated.

Apparatus :

1. Sedgwick-Rafters
2. Inverted microscope
3. Compound microscope
4. Stereoscopic microscope
5. Appropriate taxonomic keys

Reagents :

1. Preservative such as 70% ethanol or 10% buffered formalin
2. 0.04% rose bengal stain

Procedure :

1. Confirm that the sample is appropriately preserved. Measure and record the total volume of the sample.
2. Examine an appropriate sample volume depending on the density of organisms (usually 50 mL) in a petri dish. Use smaller or diluted volumes for densely populated samples or concentrate sparsely populated samples by centrifugation or by sedimentation.
3. Scan the entire dish at increasing powers of magnification to determine which species/genera are present. Identify the organisms observed to the requested level if possible.
4. Once the identifications are made, do the counts. Settle out a 1mL aliquot of a well mixed subsample in a Sedgwick-Rafter, allow to settle for at least 15 minutes.Count the entire cell using a strip counting method. Count at least 3 of the 1mL aliquots, continue counting until you get a total count of at least 200 zooplankton organisms.
5. Enumerate the data by calculating the total number of organisms per sample for each species or genera. Take an average count for each species or genera from all the aliquots counted. This gives you an organisms per mL count. Now the volume can then be multiplied in to give you a count of organisms per total sample. The counts may be expressed as a number/unit volume or a number/unit area, depending on the instructions in the requisition.

Taxonomic Keys :

1. Brandlova, J. et. al (1972)
2. Brooks, J.L. (1957)
3. Comita, G.W. et. al (1976)
4. Deevey, E.S. et. al (1971)
5. Edmondson, W.T. et. al (1982)
6. Fulton, J. (1968)
7. Green, J.D. et. al (1982)
8. Pennak, R.W. (1953)
9. Pinel-Alloul, B. et. al (1988)
10. Pontin, R.M. (1978)
11. Ruttner-Kolisko, A. (1974)
12. Smith, D.L. (1977)
13. Ward, H.B. et. al (1959)

Note : Other taxonomic keys may be used but they will be cited in the data summary.

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Benthic Invertebrate Identification and Enumeration

Scope :

This method describes the identification and enumeration of benthic invertebrates.

Summary :

The sample is fractioned into various sizes. Invertebrates are removed, sorted, identified and enumerated using appropriate procedures and taxonomic keys.

Apparatus :

1. Nested screens of various sizes 1 - .001 mm
2. Dissecting microscope
3. Subsampling equipment (splitter, Stemple pipette, or gridded petri dish)
4. Compound microscope equipped with phase contrast

Reagents :

1. ethanol
2. mounting media (CMCP, Euparol)
3. KOH

Procedure :

1. Wash and decant animals and detritus from sediments and preservative.
2. Sieve through nested screens. Size classes are similar to Cummins et al. 1973.
3. Microscope sort for benthic invertebrates. Remove from detritus. Identify individuals to appropriate taxa.
4. Identified taxa will be sorted in 70% ethanol in glass vials.
5. If a sample unit contains a very large number of individuals in a given taxon, it may be necessary to subsample to obtain an estimate because the time required to count is prohibitive (Merrit and Cummins 1984). If subsampling is required, size fraction and subsample volumes will be based on the nature of the sample, especially the density of benthic invertebrates. For example, size fractions will be made up to a constant volume (500-1000 mL) and 1 - 3 subsamples (40 mL) will be randomly removed (Merritt and Cummins 1984). Statistical tests for randomness will be performed according to Elliot (1977). Subsamples will be identified as in procedure 3.
6. If permanent microscope slides are required to be made in order to identify benthic invertebrates to a particular level, the following two procedures will be used : a) direct slide mounting from water or ethanol if CMC or Euparol is used, or b) the clearing of opaque tissues by heating in 5-10% KOH solution until transparent, then transfer to distilled water and 95% ethanol 1 minute, then use mounting media.

Taxonomic Keys :

1. Clarke, A.H. (1973)
2. Curtis (1967)
3. Brinkhurst (1971)
4. Burch, J.B. (1972)
5. Burch, J.B. (1973)
6. Edmunds et al. (1978)
7. Ferris et al. (1973)
8. Forrest, H. (1963)
9. Johannsen (1934)
10. Kenk, R. (1972)
11. Klemm, D.J. (1972)
12. McAlpine et al. (1981)
13. Merritt and Cummins (1984)
14. Nimmo and Scudder (1978)
15. Pennak (1989)
16. Richards (1968)
17. Usinger (1963)
18. Wiggins (1977)
19. Scudder et al. (1976)

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Appendix C – Periphyton
Appendix C3: Chlorophylla 1995

1995	Chlorophyll a (µg/cm²)												
Site	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	count	min	max	mean	med	sd	se
W1	0.073	0.026	0.059	0.037	0.1	0.069	6	0.026	0.1	0.061	0.064	0.027	0.011
W2	0.208	0.399	0.035	0.937	0.108	0.098	6	0.035	0.937	0.298	0.158	0.338	0.138
W3	0.66	0.033	0.055	0.147	0.098	0.061	6	0.033	0.66	0.176	0.08	0.241	0.098
W4	0.008	0.01	0.012	0.049	0.098	0.061	6	0.008	0.098	0.04	0.031	0.036	0.015
W5	0.183	0.039	0.234	0.143	0.029	0.086	6	0.029	0.234	0.119	0.115	0.082	0.033
W6	1.222	1.267	1.418	1.322	0.866	0.697	6	0.697	1.418	1.132	1.245	0.284	0.116
W7	0.01	0.169	0.045	0.462	0.053	0.033	6	0.01	0.462	0.129	0.049	0.172	0.07
W8	0.092	0.01	0.029	0.061	0.026	0.088	6	0.01	0.092	0.051	0.045	0.034	0.014
W9	0.12	0.251	0.642	0.065	0.397	0.098	6	0.065	0.642	0.262	0.186	0.223	0.091
W11	1.167	1.308	0.096	0.34	0.022	0.053	6	0.022	1.308	0.498	0.218	0.586	0.239
W12	0.454	0.692	0.678	0.949	0.684	0.798	6	0.454	0.949	0.709	0.688	0.163	0.066

Appendix C – Periphyton
Appendix C3: Chlorophylla 2007

2007	Parameter	Chlorophylla												
		1	2	3	4	5	n	min	max	mean	median	sd	se	cv
W1	Chlorophyll a (µg)	7.93	5.58	75.7	9.55	4.17	5	4.17	75.7	20.59	7.93	30.9	13.8	
8/20/2007	Area Scraped (cm²)	24.12	24.12	24.12	24.12	24.12								
	Chlorophyll a (mg/m²)	0.33	0.23	3.14	0.4	0.17	5	0.17	3.14	0.85	0.33	1.28	0.57	151
W4	Chlorophyll a (µg)	0.35	8.41	28.2	0.36	5.35	5	0.35	28.2	8.534	5.35	11.5	5.15	
8/15/2007	Area Scraped (cm²)	24.12	24.12	24.12	24.12	24.12								
	Chlorophyll a (mg/m²)	0.01	0.35	1.17	0.01	0.22	5	0.01	1.17	0.35	0.22	0.48	0.21	137
W5	Chlorophyll a (µg)	2.77	3.15	6.77	17	0.5	5	0.5	17	6.038	3.15	6.53	2.92	
8/13/2007	Area Scraped (cm²)	24.12	24.12	24.12	24.12	24.12								
	Chlorophyll a (mg/m²)	0.11	0.13	0.28	0.7	0.02	5	0.02	0.7	0.25	0.13	0.27	0.12	108
W6	Chlorophyll a (µg)	0.84	1.7	1.62	0.64	16.7	5	0.64	16.7	4.3	1.62	6.95	3.11	
8/14/2007	Area Scraped (cm²)	24.12	24.12	24.12	24.12	24.12								
	Chlorophyll a (mg/m²)	0.03	0.07	0.07	0.03	0.69	5	0.03	0.69	0.18	0.07	0.29	0.13	161
W9	Chlorophyll a (µg)	118	4.04	5.63	5.9	1.72	5	1.72	118	27.06	5.63	50.9	22.7	
8/18/2007	Area Scraped (cm²)	24.12	24.12	24.12	24.12	24.12								
	Chlorophyll a (mg/m²)	4.89	0.17	0.23	0.24	0.07	5	0.07	4.89	1.12	0.23	2.11	0.94	188
W10	Chlorophyll a (µg)	0.34	0.58	0.07	0.79	0.43	5	0.07	0.79	0.442	0.43	0.27	0.12	
8/18/2007	Area Scraped (cm²)	24.12	24.12	24.12	24.12	24.12								
	Chlorophyll a (mg/m²)	0.01	0.02	0	0.03	0.02	5	0	0.03	0.02	0.02	0.01	0	50
W13	Chlorophyll a (µg)	0.92	2.16	1.43	1.23	5.02	5	0.92	5.02	2.152	1.43	1.67	0.75	
8/12/2007	Area Scraped (cm²)	24.12	32.16	32.16	32.16	24.12								
	Chlorophyll a (mg/m²)	0.04	0.07	0.04	0.04	0.21	5	0.04	0.21	0.08	0.04	0.07	0.03	88
W20	Chlorophyll a (µg)	7.48	2.32	6.8	3.05	3.68	5	2.32	7.48	4.666	3.68	2.32	1.04	
8/20/2007	Area Scraped (cm²)	24.12	24.12	24.12	16.08	24.12								
	Chlorophyll a (mg/m²)	0.31	0.1	0.28	0.19	0.15	5	0.1	0.31	0.21	0.19	0.09	0.04	43
W21	Chlorophyll a (µg)	8.2	1.94	0.48	12.3	0.18	5	0.18	12.3	4.62	1.94	5.38	2.41	
8/16/2007	Area Scraped (cm²)	24.12	24.12	24.12	24.12	24.12								
	Chlorophyll a (mg/m²)	0.34	0.08	0.02	0.51	0.01	5	0.01	0.51	0.19	0.08	0.22	0.1	116
W22	Chlorophyll a (µg)	3.31	2.37	4.39	1.47	2.66	5	1.47	4.39	2.84	2.66	1.09	0.49	
8/15/2007	Area Scraped (cm²)	24.12	24.12	24.12	24.12	24.12								
	Chlorophyll a (mg/m²)	0.14	0.1	0.18	0.06	0.11	5	0.06	0.18	0.12	0.11	0.05	0.02	42
W23	Chlorophyll a (µg)	12.7	1.91	0.84	40.4	0.97	5	0.84	40.4	11.36	1.91	17	7.59	
8/11/2007	Area Scraped (cm²)	24.12	32.16	40.2	24.12									
	Chlorophyll a (mg/m²)	0.53	0.06	0.02	1.67		4	0.02	1.67	0.57	0.29	0.77	0.39	135

FRASER ENVIRONMENTAL SERVICES

QUALITY ASSURANCE PROGRAM

MARCH 1994

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FRASER ENVIRONMENTAL SERVICES

QUALITY ASSURANCE PROGRAM – MARCH 1994

INTRODUCTION

Fraser Environmental Services (FES) is a company based on professional staff with a commitment to supply quality data in a timely manner. To this end we are committed to consistent delivery of accurate results. This is a formidable task especially in the area of taxonomic identification and enumeration, the following manual addresses our efforts. Linde Looy, the firm's principle biologist, is responsible for developing, implementing and monitoring the QA/QC data produced by FES.

INTERNAL QA/QC

An integral part of taxonomic identification and enumeration is the equipment, specifically the microscope. The following is a description of the procedures FES employs to ensure the proper use of the microscope.

Microscope Calibration Routines

Microscope Calibration Procedure

Each microscope may vary therefore each microscope is calibrated carefully. The inverted and compound microscopes are calibrated as follows:

1. Place an ocular micrometer in one eyepiece.
2. Place a stage micrometer with a standardized and accurately ruled scale on a glass slide on the stage.
3. The ocular and stage micrometers are then made parallel and superimposed in part and the line at the left edge of the ocular micrometer is lined up with the zero mark on the stage micrometer scale.
4. The actual distance between divisions of the ocular micrometer are then measured on the stage micrometer scale.
5. The length of field and the distance between divisions are then measured.

Note : This calibration is done on each microscope at each power of magnification by each analyst. Inter-pupilary differences may affect the calibrations of different analysts, especially at higher powers.

Procedure For Establishing Kohler Illumination (from WCB laboratory services)

Kohler illumination must be established on all microscopes requiring it on a daily basis.

1. Select substage aperature diaphragm.

2. Focus on a slide-coverslip preparation using the 10x magnification objective.
3. Close the field diaphragm and then focus the field diaphragm image in the field of view by racking the substage condenser up or down.
4. Center the focused field diaphragm image by adjusting centering screws.
5. Open up the field diaphragm close to the edge of the field of view, fine focus, readjust centering if necessary, and then open to just beyond the field of view.
6. Insert the Bertrand lens or centering telescope.
7. Focus an image of the lamp filament in the objective back focal plane by moving the lamp bulb fixture along the axis relative to the lamp condenser. Open substage diaphragm if necessary.
8. Center the lamp filament image by lateral movement of the lamp bulb. Rotation in its mount may suffice if there are no centering screws. Close substage diaphragm if it was opened.
9. Remove the Bertrand lens or centering telescope. Kohler illumination is now established.

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Counting Procedures

To demonstrate that FES is following uniform counting procedures and that consistent sample concentration and subsampling techniques are employed the following sample data has been examined to show statistical randomness for all sample types. First we will supply sample data for sample types routinely received (zooplankton and phytoplankton) and then we will show the statistical treatment of the data.

Sample A – 1 (930293)
Zooplankton
Total Sample Volume = 162 mL

DOMINANTS :		# organisms / total sample
Phylum : Rotifera		
Keratella cochlearis		4,320.0
Keratella quadrata		6,750.0
NON-DOMINANTS :		
Order : Cladocera		
Daphnia pulex		270.0
Subclass : Copepoda		
Diacyclops bicuspidatus thomasi	adult	Present
Diacyclops bicuspidatus thomasi	copepodid	108.0
Diaptomus	adult	Present
Nauplii		12,852.0
Order : Diptera		
UID larvae		Present
Subclass : Ostracoda		
UID Podocopa		Present
Phylum : Rotifera		
Brachionus		Present
Polyarthra vulgaris		1,512.0

UID = unidentified

Analyst : Linde Looy

Sample A – 2 (930293)
Zooplankton
Total Sample Volume = 162 mL

DOMINANTS :		# organisms / total sample
Phylum : Rotifera		
Keratella cochlearis		3,942.0
Keratella quadrata		5,994.0
NON-DOMINANTS :		
Order : Cladocera		
Ceriodaphnia		270.0
Daphnia pulex		324.0
Pleuroxus		Present
Subclass : Copepoda		
Diacyclops bicuspidatus thomasi	adult	Present
Diacyclops bicuspidatus thomasi	copepodid	108.0
Diaptomus	adult	Present
Nauplii		12,528.0
Order : Diptera		
UID larvae		Present
Phylum : Rotifera		
Polyarthra vulgaris		2,538.0

UID = unidentified

Analyst : Linde Looy

COUNT# - A-1 :

Name	#1	#2	#3	Avg.#/mL	Total orgs/sample
Copepod Nauplii	81	79	78	79.3	12,852.0
Keratella quadrata	44	38	43	41.7	6,750.0
Keratella cochlearis	26	27	27	26.7	4,320.0
Polyarthra vulgaris	8	9	11	9.3	1,512.0
Diacyclops bicus. thomasi a	0	0	0	0	Present
Diacyclops bicus. thomasi c	0	1	1	0.7	108.0
Daphnia pulex	1	2	2	1.7	270.0
Brachionus sp.	0	0	0	0	Present
Diaptomus	0	0	0	0	Present
Ostracod	0	0	0	0	Present
Diptera larvae	0	0	0	0	Present

COUNT# - A-2 :

Name	#1	#2	#3	Avg.#/mL	Total orgs/sample
Copepod Nauplii	81	75	76	77.3	12,528.0
Keratella quadrata	33	41	37	37.0	5,994.0
Keratella cochlearis	24	27	22	24.3	3,942.0
Polyarthra vulgaris	20	15	12	15.7	2,538.0
Diacyclops bicus. thomasi a	0	0	0	0	Present
Diacyclops bicus. thomasi c	2	0	0	0.7	108.0
Daphnia pulex	3	3	0	2.0	324.0
Pleuroxus sp.	0	0	0	0	Present
Ceriodaphnia	3	0	2	1.7	270.0
Diptera larvae	0	0	0	0	Present

Agreement with a Poisson series is the accepted test for randomness. No tests can prove randomness, and agreement with a Poisson series simply means that the hypothesis of randomness is not disproved (Elliott, 1977).

X^2 (chi squared) test (variance to mean ratio) for agreement with a Poisson series; n<31

$$X^2 = \frac{s^2\,(n-1)}{X}$$

For above data for COUNT #1 :

Copepod Nauplii : $X^2 = 0.06$
Keratella quadrata : $X^2 = 0.50$
Keratella cochlearis : $X^2 = 0.03$
Polyarthra vulgaris : $X^2 = 0.50$

Since all these X^2 values are <1, the hypothesis of randomness is not disproved at 95% probability level (P>0.05). We consider this evidence that the subsampling and counting techniques that FES employs for zooplankton are random.

Sample B (920034)
Phytoplankton

DOMINANTS :	# cells / mL
Order : Centrales	
Melosira italica	252.0
NON-DOMINANTS :	
Order : Centrales	
Rhizosolenia longiseta	14.0
Cyclotella glomerata	Present
Coscinodiscus sp.	Present
Order : Ochromonadales	
Dinobryon sp.	Present
Order : Pennales	
Fragilaria sp.	Present
Navicula sp.	Present
Order : Dinokontae	
Peridinium inconspicuum	Present
Order : Chlorococcales	
Crucigenia rectangularis	Present
Elakatothrix gelatinosa	Present
Order : Rhizochrysidales	
Diceras phaseolus	Present
Order : Cryptomonadales	
Cryptomonas ovata	Present
Chroomonas acuta	2.8
Order : Zygnematales	
Xanthidium sp.	Present

Analyst : Linde Looy

COUNT #1 - B

Name	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	cells/mL
M. italica	12	11	7	10	6	12	6	6	8	16	Present
R. longiseta		1	1	1			1	1			14.0
C. acuta								1			2.8
P. inconspicuum											Present
E. gelatinosa											Present
Xanthidium											Present
D. phaseolus											Present
Fragilaria											Present
Navicula											Present
C. ovata											Present
Dinobryon											Present
C. rectangularis											Present
C. glomerata											Present
Coscinodiscus											Present

Agreement with a Poisson series is the accepted test for randomness. No tests can prove randomness, and agreement with a Poisson series simply means that the hypothesis of randomness is not disproved (Elliott, 1977).

X^2 (chi squared) test (variance to mean ratio) for agreement with a Poisson series; n<31

$$X^2 = \frac{s^2\,(n-1)}{X}$$

For above data for COUNT #1 – B :

Melosira italica : $X^2 = 10.89$

Since this X^2 value is $2 < X^2 < 18$, the hypothesis of randomness is not disproved at 95% probability level (P>0.05). We consider this evidence that the subsampling and counting techniques that FES employs for phytoplankton are random.

FOR COMPARISON OF TWO SAMPLES :

Because of the nature of the data being compared, we have used a % Similarity test. This treatment allows comparison of data both quantitatively and qualitatively.

% SIMILARITY

Name	COUNT #1 : % Composition	COUNT #2 : % Composition	% Similarity
Copepod Nauplii	49.8	48.7	48.7
Keratella quadrata	26.2	23.3	23.3
Keratella cochlearis	16.7	15.3	15.3
Polyarthra vulgaris	5.9	9.9	5.9
Diacyclops bicus. thomasi a	<0.2	<0.2	<0.2
Diacyclops bicus. thomasi c	0.4	0.4	0.4
Daphnia pulex	1.0	1.3	1.0
Brachionus sp.	<0.2	-	<0.2
Diaptomus a	<0.2	-	<0.2
Ostracod	<0.2	-	<0.2
Diptera larvae	<0.2	<0.2	<0.2
Pleuroxus sp.	-	<0.2	<0.2
Ceriodaphnia	-	1.1	<0.2
TOTAL			**94.6%**

References :

Elliott, J.M. 1977. **Some Methods for the Statistical Analysis of Samples of Benthic Invertebrates.**

EXTERNAL VERIFICATION :

Wherever possible, and as funds are available, Fraser Environmental Services will send out samples and specimens for external verification by experts. Part of this process includes compiling a list of experts for different groups of organisms. Verified specimens will be incorporated into Fraser Environmental Services' Reference Collection.

REFERENCE COLLECTION (IN-HOUSE) :

Fraser Environmental Services is in the on-going process of building an in-house Reference Collection. Specimens that have been verified by an expert will be identified within the collection. As funds become available we intend to have the entire collection verified externally.

VOUCHER COLLECTION (BC MINISTRY OF ENVIRONMENT) :

Samples or specimens that are to go into the Ministry collection or their Reference Collection will be processed at Fraser Environmental Services according to the Ministry's protocols.

CONCLUSIONS :

Performance Monitoring / 'Batch Quality Control' Procedures

a) Fraser Environmental Services can demonstrate that for the compound and compound inverted microscope's ocular and objective lenses, calibration procedures are followed.
b) Fraser Environmental Services has demonstrated that consistent sample concentration and subsampling techniques are employed for phytoplankton and zooplankton identifications by demonstrating that counts for repeated concentrations or subsamples from the same sample agree with a Poisson distribution.
c) Fraser Environmental Services has demonstrated that uniform counting procedures are followed for phytoplankton and zooplankton by showing statistical randomness.
d) Fraser Environmental Services can demonstrate that the taxonomic level identifications are constant throughout each study through 'Batch Quality Control' procedures and verification with reference collections.
e) Two 'Batch Quality Control' procedures are in place within analytical runs to monitor and verify precision and accuracy. Precision may be monitored by duplicate controls, i.e. the same taxonomist may analyze one sample in duplicate for 1 in every 10 samples (the analysis of blind duplicates may be incorporated here). Accuracy will be monitored by in-house confirmations, i.e. another taxonomist will analyze the sample in at least 1 in every 10 samples.
f) Difficult, typical or dominant specimens are stored in a reference collection for confirmation by another expert agency (especially for zooplankton and benthic invertebrates). Organisms verified from the laboratory collection will be identified in the data summary. Fraser Environmental Services is in the on-going process of building a reference collection for validation, as well we will use experts wherever possible for verification. The use of video will be investigated for voucher information especially for phytoplankton and periphyton. Further, all FES personnel are actively participating in a taxonomists' working group.

Control Criteria/Limits

In order for the batch of samples to be qualitatively acceptable for either Phytoplankton/Zooplankton/Periphyton and Invertebrate identifications, the dominant organisms must be correctly verified against verified reference collection(s) for the internal accuracy control.

In order for the batch of samples to be quantitatively acceptable duplicate analyses of subsamples, the relative standard difference should not exceed + or – 30% between the correctly identified individual taxa for internal precision control, in other words, the %Similarity must be at least %70.0.

It is understood the Ministry will monitor the data produced by Fraser Environmental Services. In order to control and monitor the operation of the firm's internal batch quality control procedures, blind duplicates and verified control reference samples will be inserted randomly into the sampling sequences on an as needed basis. Further the quality of the taxonomic results produced by Fraser Environmental Services for samples submitted from a particular Ministry Region(s) will be judged acceptable on the basis of the results for both the internal and external blind verified reference and duplicate samples.

It is understood that the Ministry may submit external blind reference samples for the purposes of evaluating laboratory performance. For external accuracy control, individual taxonomic identifications will be 'flagged' if the reference organisms are incorrectly identified at a specific taxonomic level. Four consecutive identifications of a particular organism(s) at a specific taxonomic level can be considered an audit. If a reference organism(s) is 'flagged' in excess of two times within an audit, it constitutes an audit failure. If a taxa is 'flagged' in excess of two consecutive audits, the Ministry reserves the right that it be credited the full cost of the specific taxa during the stated audit period, and the Ministry may terminate the contract for the identification of that specific aquatic community.

Remedies

Should the 'Control Criteria' not be met, i.e. should the precision or accuracy be greater than + or – 30% or should a dominant not be correctly verified against verified reference collection(s) for the internal accuracy control, the misidentifications will be resolved by applying the proper name or by re-identifying the problematic family. The batch will be reanalysed. All taxonomists will be informed of the proper identification.

Laboratory QA/QC

Linde Looy will be responsible for the delivery of the laboratory QA/QC.

Staff Training and Re-Training Programs

Fraser Environmental Services is dedicated to maintaining a high standard of quality. This is especially important in our area of expertise, taxonomic identifications, where the quality of work depends entirely on the abilities of the biologists. Therefore all the analysts working on taxonomic identifications have university degrees and continue to keep abreast of their areas by attending conferences, keeping up with the literature and maintaining memberships in associations and societies that are specific to their fields. Further, we maintain contacts with other taxonomists and Ms. Looy is developing a forum for taxonomists to share information (something like the WCMUC). Early responses from some colleagues seem promising.

Appendix C – Periphyton
Appendix C4-2: QAQC

Prepared by FRASER ENVIRONMENTAL SERVICES
Prepared for Stantec / Jacques Whitford AXYS Ltd.

Periphyton Taxa and Abundance
Project Name and Number : Dublin Gulch - 1028268.13

FES Sample Number '070591
Site Name W1
Replicate Number 2
Collection Date 8/20/2007
Area Sampled (cm^2) 24.12

	FES Sample Number	070591		070591		
	Taxonomist	Cris Baldazzi		Linde Looy		
	units	cells/cm^2	% comp	cells/cm^2	% comp	% Similarity
Phylum / Order	Genera and Species					
Bacillariophycae						
Pennales	*Achnanthes lanceolata*	156.4	<0.1			
	Achnanthes minutissima	605.8	0.1	2,358.6	0.5	
	Achnanthes spp.	2,120.3	0.5	1,179.3	0.2	0.6
	Caloneis spp.	<39.1	<0.1	<1,179.3	<0.1	
	Ceratoneis arcus	19,815.2	4.4	23,586.0	5.0	4.4
	Cocconeis placentula	<39.1	<0.1	<1,179.3	<0.1	
	Cymbella cesatii	<39.1	<0.1			
	Cymbella cistula	156.4	<0.1			
	Cymbella minuta	<39.1	<0.1	<1,179.3	<0.1	
	Cymbella sinuata	78.2	<0.1			
	Cymbella spp.			1,179.3	0.2	
	Diatoma heimale var. mesodon	3,029.0	0.7			
	Diatoma heimale			3,537.9	0.7	0.7
	Diploneis sp.	<39.1	<0.1			
	Fragilaria vaucheriae	1,514.5	0.3			
	Fragilaria spp.	2,120.3	0.5	4,717.2	1.0	0.8
	Gomphonema angustatum/parvulum	27,974.4	6.3			
	Gomphonema spp.	12,821.6	2.9	25,944.6	5.5	5.5
	Meridion circulare	625.6	0.1	1,179.3	0.2	0.1
	Navicula cryptonella	703.8	0.2			
	Navicula radiosa	<39.1	<0.1			
	Navicula spp.	<39.1	<0.1	2,358.6	0.5	0.2
	Nitzschia spp.	234.6	0.1	<1,179.3	<0.1	
	Pinnularia spp.	39.1	<0.1	<1,179.3	<0.1	
	Stauroneis spp.	<39.1	<0.1			
	Surirella angusta	<39.1	<0.1			

Appendix C – Periphyton
Appendix C4-2: QAQC

	FES Sample Number	070591		070591		
	Taxonomist	**Cris Baldazzi**		**Linde Looy**		
	units	cells/cm^2	% comp	cells/cm^2	% comp	% Similarity
	Synedra cf. filiformis	2,423.2	0.5			
	Synedra spp.			<1,179.3	<0.1	
	UID	<39.1	<0.1	2,358.6	0.5	0.1
	UID deformed diatoms	605.8	0.1			
Chlorophyta						
Zygnematales	*Cosmarium spp.*	<39.1	<0.1			
Chrysophyta						
Chromulinales	*Chrysococcus sp.*	20,980.8	4.7			
	Chrysococcus sp. ?			<1,179.3	<0.1	
	Hydrurus foetidus	179,502.4	40.1	188,688.0	39.6	39.6
Chrysophyta	UID unicellular	302.9	0.1			
Cyanophyta						
Oscillatoriales	*Lyngbya limnetica/Homeothrix varians*			218,170.5	45.8	
	Homoeothrix varians	159,687.2	35.7			35.7
	Oscillatoria sp. ?			<1,179.3	<0.1	
	Phormidium sp. ?	<39.1	<0.1			
	Pseudanabaena sp.	6,058.0	1.4	<1,179.3	<0.1	
	UID Oscillatoriales	3,284.4	0.7			
Unidentified	UID unicellular	2,331.2	0.5	<1,179.3	<0.1	
	TOTAL :	**447,171.1**	**99.9%**	**476,437.2**	**99.9%**	**87.7%**

UID = unidentified

cf. = (confertim = close together) = possibly for species

? = possibly for genus

Appendix C – Perphyton
Appendix C4-3: QAQC

Prepared by FRASER ENVIRONMENTAL SERVICES
Prepared for Stantec / Jacques Whitford AXYS Ltd.

Periphyton Taxa and Abundance
Project Name and Number : Dublin Gulch - 1028268.13

FES Sample Number	070599
Site Name	W4
Replicate Number	5
Collection Date	15-Aug-07
Area Sampled (cm^2)	24.12

	FES Sample Number	**070599**		**070599**		
	Taxonomist	**Cris Baldazzi**		**Linde Looy**		
	units	cells/cm^2	% comp	cells/cm^2	% comp	% Similarity
Phylum / Order	Genera and Species					
Bacillariophycae						
Pennales	*Achnanthes flexella*	103.6	<0.1	707.6	0.2	
	Achnanthes minutissima	15,460.0	5.9	16,982.4	5.4	5.4
	Achnanthes spp.	5,411.0	2.1	1,415.2	0.5	0.7
	Amphipleura pellucida	<25.9	<0.1	<707.6	<0.1	
	Ceratoneis arcus	5,223.4	2.0	6,368.4	2.0	2.0
	Cocconeis placentula	25.9	<0.1	707.6	0.2	
	Cymbella cistula	310.8	0.1			
	Cymbella minuta	362.6	0.1	707.6	0.2	0.1
	Cymbella sinuata	103.6	<0.1			
	Cymbella spp.	103.6	<0.1	707.6	0.2	0.2
	Denticula sp. ?	<25.9	<0.1			
	Diatoma elongatum	146,097.0	56.1	198,128.0	63.2	56.1
	Diatoma heimale var. mesodon	103.6	<0.1			
	Diatoma heimale			2,122.8	0.7	
	Diatoma sp.	<25.9	<0.1			
	Diploneis sp.	<25.9	<25.9			
	Epithemia sorex		<0.1			
	Eunotia spp.	<25.9	<0.1	<707.6	<0.1	
	Fragilaria capucina	<25.9	<0.1			
	Fragilaria vaucheriae	2,611.7	1.0			
	Fragilaria spp.	2,611.7	1.0	1,415.2	0.5	0.5
	Frustulia rhomboides	<25.9	<0.1			
	Gomphonema angustatum/parvulum	602.7	0.2			
	Gomphonema spp.	3,214.4	1.2	4,245.6	1.4	1.4
	Meridion circulare	51.8	<0.1			
	Navicula cryptonella	207.2	0.1			
	Navicula radiosa	<25.9	<0.1			
	Navicula spp.	51.8	<0.1	707.6	0.2	0.1
	Neidium spp.	<25.9	<0.1			
	Nitzschia dissipata	<25.9	<0.1			
	Nitzschia palea	200.9	0.1			
	Nitzschia spp.	401.8	0.2	<707.6	<0.1	

Appendix C – Perphyton
Appendix C4-3: QAQC

	FES Sample Number	070599		070599		
	Taxonomist	Cris Baldazzi		Linde Looy		
	units	cells/cm^2	% comp	cells/cm^2	% comp	% Similarity
	Pinnularia spp.	<25.9	<0.1			
	Stauroneis spp.	<25.9	<0.1			
	Surirella angusta	<25.9	<0.1			
	Synedra cf. filiformis	9,276.0	3.6			
	Synedra ulna	803.6	0.3	5,660.8	1.8	0.3
	Synedra spp.	51.8	<0.1	2,122.8	0.7	
	UID			707.6	0.2	0.2
Chlorophyta						
Chaetophorales	UID Chaetophorales	<25.9	<0.1			
Ulothricales	*Ulothrix zonata*	621.6	0.2	<707.6	<0.1	
Zygnematales	*Closterium spp.*	<25.9	<0.1			
Chlorophyta	UID filamentous	155.4	0.1			
	UID unicellular	51.8	<0.1			
Chrysophyta	UID cyst	803.6	0.3			
	UID unicellular	5,411.0	2.1			
Cyanophyta						
Chamaesiphonales	*Chamaesiphon spp.*	200.9	0.1			
	Clastidium setigerum	10,049.0	3.9			
Nostocales	*Anabaena / Nostoc spp.*	<25.9	<0.1			
Oscillatoriales	*Lyngbya limnetica / Homeothrix varians*			49,532.0	15.8	15.8
	Homoeothrix varians	44,599.8	17.1			
	Oscillatoria sp. ?			<707.6	<0.1	
	Pseudanabaena catenata	414.4	0.2			
	Pseudanabaena sp.	310.8	0.1			
	Peudanabaena sp. ?			<707.6	<0.1	
	Spirulina sp.	621.6	0.2	<707.6	<0.1	
	UID Oscillatoriales	1,295.0	0.5			
Unidentified	UID colonial			11,321.6	3.6	
	UID filamentous			5,660.8	1.8	
	UID flagellate	200.9	0.1			
	UID unicellular	2,319.0	0.9	4,245.6	1.4	0.9
	TOTAL :	**260,445.3**	**99.8 %**	**313,466.8**	**100.0%**	**83.7%**

UID = unidentified

cf. = (confertim = close together) = possibly for species

? = possibly for genus

Appendix C – Periphyton
Appendix C4-4: QAQC

Prepared by FRASER ENVIRONMENTAL SERVICES
Prepared for Stantec / Jacques Whitford AXYS Ltd.

Periphyton Taxa and Abundance
Project Name and Number : Dublin Gulch - 1028268.13

FES Sample Number	070613
Site Name	W9
Replicate Number	4
Collection Date	18-Aug-07
Area Sampled (cm^2)	24.12

	FES Sample Number	070613		070613		
	Taxonomist	Cris Baldazzi		Linde Looy		
	units	$cells/cm^2$	% comp	$cells/cm^2$	% comp	% Similarity
Order	Genera and Species					
Bacillariophycae						
Pennales	*Achnanthes lanceolata*	16.2	<0.1			
	Achnanthes minutissima	376.2	2.2	2,122.8	5.4	
	Achnanthes spp.	752.4	4.4	1,415.2	3.6	6.6
	Ceratoneis arcus	162.0	0.9	<707.6	<0.1	
	Cymbella cistula	<8.1	<0.1			
	Cymbella sinuata	64.8	0.4			
	Cymbella spp.	<8.1	<0.1	707.6	1.8	0.4
	Fragilaria vaucheriae	48.6	0.3			
	Fragilaria spp.	97.2	0.6	1,415.2	3.6	0.9
	Gomphonema angustatum/parvulum	1,442.1	8.4			
	Gomphonema spp.	188.1	1.1	2,830.4	7.1	7.1
	Meridion circulare	324.0	1.9	<707.6	<0.1	
	Navicula cryptonella	<8.1	<0.1			
	Navicula spp.	8.1	<0.1	<707.6	<0.1	
	Pinnularia spp.	<8.1	<0.1			
	Stauroneis spp.	<8.1	<0.1			
	Surirella angusta	<8.1	<0.1			
	Synedra cf. filiformis	8.1	<0.1			
	Synedra spp.			<707.6	<0.1	
	UID			707.6	1.8	
	UID deformed diatoms	<8.1	<0.1			
Chrysophyta						
Chromulinales	*Hydrurus foetidus*	64.8	0.4	3,538.0	8.9	0.4
Ochromonadales	*Dinobryon spp.*	16.2	<0.1	<707.6	<0.1	
	Pseudokephyrion sp.	<8.1	<0.1			
Chrysophyta	UID colonial	<8.1	<0.1			
	UID unicellular	10,375.9	60.7			

	FES Sample Number	070613		070613		
	Taxonomist	Cris Baldazzi		Linde Looy		
	units	cells/cm^2	% comp	cells/cm^2	% comp	% Similarity
Cyanophyta						
Chamaesiphonales	*Chamaesiphon spp.*	125.4	0.7			
Chroococcales	*Anacystis sp.*			<707.6	<0.1	
	UID Chroococcales	188.1	1.1			
Oscillatoriales	*Lyngbya limnetica/Homeothrix varians*			8,491.2	21.4	
	Homoeothrix varians	2,194.5	12.8			12.8
	Oscillatoria spp.	567.0	3.3			
	Oscillatoria sp. ?			<707.6	<0.1	
Unidentified	UID filamentous			<707.6	<0.1	
	UID flagellates			<707.6	<0.1	
	UID unicellular	62.7	0.4	18,397.6	46.4	46.4
	TOTAL :	**17,082.4**	**99.6%**	**39,625.6**	**100.0%**	**74.6%**

UID = unidentified

cf. = (confertim = close together) = possibly for species

? = possibly for genus

Appendix C – Peripyton
Appendix C4-5: QAQC

Prepared by FRASER ENVIRONMENTAL SERVICES
Prepared for Stantec / Jacques Whitford AXYS Ltd.

Periphyton Taxa and Abundance
Project Name and Number : Dublin Gulch - 1028268.13

FES Sample Number	070623
Site Name	W13
Replicate Number	4
Collection Date	12-Aug-07
Area Sampled (cm^2)	32.16

	FES Sample Number	**070623**		**070623**		
	Taxonomist	**Cris Baldazzi**		**Linde Looy**		
	units	$cells/cm^2$	% comp	$cells/cm^2$	% comp	% Similarity
Order	Genera and Species					
Bacillariophycae						
Pennales	Achnanthes lanceolata	186.6	<0.1			
	Achnanthes minutissima	21,892.9	4.0	18,397.6	5.3	4.0
	Achnanthes spp.	1,435.6	0.3	4,245.6	1.2	0.3
	Amphora sp.	<12.0	<0.1			
	Ceratoneis arcus	192.0	<0.1	707.6	0.2	
	Cocconeis placentula	24.0	<0.1	707.6	0.2	
	Cymbella minuta	373.2	<0.1	<707.6	<0.1	
	Cymbella spp.	12.0	<0.1	<707.6	<0.1	
	Diatoma heimale var. mesodon	216.0	<0.1			
	Diatoma heimale			<707.6	<0.1	
	Diploneis elliptica	<12.0	<0.1			
	Diploneis sp.			<707.6	<0.1	
	Fragilaria capucina	<12.0	<0.1			
	Fragilaria vaucheriae	1,306.2	0.2			
	Fragilaria spp.	1,679.4	0.3	<707.6	<0.1	
	Gomphonema angustatum/parvulum	3,947.9	0.7			
	Gomphonema spp.	1,794.5	0.3	5,660.8	1.6	1.0
	Meridion circulare	192.0	<0.1	<707.6	<0.1	
	Navicula cryptocephala	24.0	<0.1			
	Navicula cryptonella	24.0	<0.1			
	Navicula radiosa	<12.0	<0.1			
	Navicula rhyconcephala	<12.0	<0.1			
	Navicula spp.	<12.0	<0.1	707.6	0.2	
	Nitzschia dissipata	24.0	<0.1			
	Nitzschia spp.	653.1	0.1	707.6	0.2	0.1
	Pinnularia spp.	24.0	<0.1			
	Stauroneis spp.	<12.0	<0.1	<707.6	<0.1	

Appendix C – Peripyton
Appendix C4-5: QAQC

	FES Sample Number	070623		070623		
	Taxonomist	Cris Baldazzi		Linde Looy		
	units	cells/cm^2	% comp	cells/cm^2	% comp	% Similarity
	Surirella angusta	<12.0	<0.1			
	Synedra cf. filiformis	279.9	0.1			
	Synedra ulna	<12.0	<0.1	<707.6	<0.1	
	Synedra spp.	<12.0	<0.1	<707.6	<0.1	
	UID	24.0	<0.1			
Chlorophyta						
Ulothricales	*Microspora sp.*	<12.0	<0.1			
	Ulothrix zonata	168.0	<0.1	<707.6	<0.1	
	Ulothrix spp.	312.0	0.1			
Chrysophyta						
Chromulinales	*Chromulina sp. ?*	373.2	0.1			
Ochromonadales	*Dinobryon spp.*	<12.0	<0.1			
Chrysophyta	UID unicellular	4,306.8	0.8	<707.6	<0.1	
Cyanophyta						
Chamaesiphonales	*Chamaesiphon spp.*	145,713.4	26.9	84,912.0	24.7	24.7
	Clastidium setigerum	93.3	<0.1			
Oscillatoriales	*Lyngbya limnetica/Homeothrix varians*			219,356.0	63.8	
	Homoeothrix varians	340,955.0	62.9			62.9
	Oscillatoria spp.	<12.0	<0.1			
	Oscillatoria sp. ?			4,245.6	1.2	1.2
	UID Oscillatoriales	14,356.0	2.7			
Rhodophyta						
Nemalionales	*Audouinella sp.*	1,008.0	0.2			
Unidentified	UID filamentous			<707.6	<0.1	
	UID unicellular	93.3	<0.1	4,245.6	1.2	
	TOTAL :	**541,684.3**	**99.8%**	**343,893.6**	**99.8%**	**94.2%**

UID = unidentified

cf. = (confertim = close together) = possibly for species

? = possibly for genus

Appendix C - Periphyton
Appendix C4-6: QAQC

Prepared by FRASER ENVIRONMENTAL SERVICES
Prepared for Stantec / Jacques Whitford AXYS Ltd.

Periphyton Taxa and Abundance
Project Name and Number : Dublin Gulch - 1028268.13

FES Sample Number	070641
Site Name	W23
Replicate Number	2
Collection Date	11-Aug-07
Area Sampled (cm^2)	32.16

	FES Sample Number	070641		070641		
	Taxonomist	Cris Baldazzi		Linde Looy		
	units	cells/cm^2	% comp	cells/cm^2	% comp	% Simalrity
Order	Genera and Species					
Bacillariophycae						
Pennales	*Achnanthes minutissima*	10.2	<0.1	42.6	<0.1	
	Achnanthes spp.	5.1	<0.1	14.2	<0.1	
	Ceratoneis arcus	15.3	<0.1	14.2	<0.1	
	Cocconeis placentula	15.3	<0.1	<14.2	<0.1	
	Cymbella cistula	<5.1	<0.1			
	Cymbella minuta	15.3	<0.1	14.2	<0.1	
	Cymbella sinuata	10.2	<0.1			
	Cymbella spp.	<5.1	<0.1	42.6	<0.1	
	Diatoma elongatum	10.2	<0.1	<14.2	<0.1	
	Diatoma heimale var. mesodon	<5.1	<0.1			
	Fragilaria vaucheriae	20.4	<0.1			
	Fragilaria spp.	10.2	<0.1	42.6	<0.1	
	Gomphonema angustatum/parvulum	40.8	<0.1			
	Gomphonema spp.	35.7	<0.1	28.4	<0.1	
	Navicula cryptocephala	10.2	<0.1			
	Navicula spp.	15.3	<0.1	14.2	<0.1	
	Nitzschia spp.	5.1	<0.1	<14.2	<0.1	
	Pinnularia spp.	<5.1	<0.1			
	Synedra cf. filiformis	5.1	<0.1			
	Synedra spp.			<14.2	<0.1	
Chlorophyta						
Ulothricales	*Ulothrix zonata*	122.4	0.1	170.4	0.2	0.1
	Ulothrix spp.	<5.1	<0.1			
	Ulothrix sp. ?			<14.2	<0.1	
Chlorophyta	UID filamentous	<5.1	<0.1			
Cyanophyta						
Chamaesiphonales	*Chamaesiphon spp.*	916.8	1.0	1,562.0	1.8	1.0

Appendix C - Periphyton
Appendix C4-6: QAQC

	FES Sample Number	070641		070641		
	Taxonomist	Cris Baldazzi		Linde Looy		
	units	cells/cm^2	% comp	cells/cm^2	% comp	% Simalrity
Oscillatoriales	*Lyngbya limnetica/Homeothrix varians*			19,880.0	23.2	
	Homoeothrix varians	16,808.0	17.4			17.4
	Oscillatoria spp.	78,233.6	81.2	63,900.0	74.5	74.5
	UID Oscillatoriales	61.2	0.2			
Unidentified	UID colonial	15.3	<0.1			
	UID filamentous			<14.2	<0.1	
	UID unicellular			<14.2	<0.1	
	TOTAL :	**96,381.7**	**99.8%**	**85,725.4**	**99.7%**	**93.0%**

UID = unidentified

cf. = (confertim = close together) = possibly for species

? = possibly for genus

APPENDIX XII

Periphyton Results

FIRST DYNASTY MINES LTD.
DUBLIN GULCH PROJECT

PERIPHYTON SPECIES COMPOSITION
SITE P1, AUGUST 1995

	REPLICATES					
	P1A	P1B	P1C	P1D	P1E	P1F
Blue-green Algae (Cyanophyceae)						
Phormidium autumnale	1%	5%	1%	65%	10%	1%
Phormidium tenue	40%	35%	50%	25%	25%	35%
Chrysophyceae						
Hydrurus foetidus	40%	25%	40%		50%	50%
Diatoms (Bacillariophyceae)	19%	35%	9%	10%	15%	14%
Achnanthes spp	+	+	+	+	+	+
Cocconeis placentula (dead)	+	+	+	+	+	+
Cymbella spp.	++	+	+	+		+
Cymbella minuta	+	+	+	+	+	
Diatoma hiemale v mesodon	+	+	+			+
Fragilaria construens	+					
Gomphonema spp	+	+	+			+
Gomphonema angustatum	++	+++	+++	+	++	+++
Gomphonema brebissonii	+					
Hannaea arcus	+++	++	++	+	++	++
Meridion circulare (dead)	+	+	+	+		+
Navicula spp	+				+	+
Nitzschia spp				+		
Synedra rumpens				++	+	+

Key to Abundance:

+++ Dominant

++ Common

\+ Present

	P1A	P1B	P1C	P1D	P1E	P1F
# of Blue-greens	2	2	2	2	2	2
# of Chrysophytes	1	1	1	0	1	1
# of Diatoms	12	9	9	9	7	10
Total Species	15	12	12	11	10	13

SITE P2, 1995

	REPLICATES					
	P2A	P2B	P2C	P2D	P2E	P2F
Blue-green Algae (Cyanophyceae)						
Chamaesiphon incrustans	+		5%	1%	1%	
Merismopedia sp		+	+			
Phormidium autumnale	95%	95%	5%	95%	95%	10%
Phormidium tenue			85%		+	+
Chrysophyceae						
Hydrurus foetidus				+		
Diatoms (Bacillariophyceae)	5%	5%	5%	4%	4%	90%
Achnanthes spp.	++	++	++	+++	+++	+++
Amphora ovalis		+				
Cocconeis placentula		+	+		+	
Cymbella spp		+	+	+	+	+
Cymbella cistula	+	+				
Cymbella minuta	+	+	+	+	+	+
Cymbella sinuata			+			+
Denticula elegans						+
Diatoma tenue	++	+	+	++	++	++
Didymosphenia geminata					+	
Diploneis sp						+
Gomphonema spp			+	+	+	+
Hannaea arcus	+++	++	+	++	+++	++
Meridion circulare	+	+			+	
Navicula spp.	+	+	+	+	+	+
Stauroneis sp.						+
Synedra radians						+
Synedra rumpens	++	+	++	++	++	+++
Synedra ulna	+	+	+			+++

Key to Abundance.

+++ Dominant

++ Common

\+ Present

	P2A	P2B	P2C	P2D	P2E	P2F
# of Blue-greens	2	2	4	2	3	1
# of Chrysophytes	0	0	0	1	0	0
# of Diatoms	9	12	11	8	11	14
Total Species	11	14	15	11	14	15

SITE P3

	REPLICATES					
	P3A	P3B	P3C	P3D	P3E	P3F
Blue-green Algae (Cyanophyceae)						
Chamaesiphon incrustans		+				
Phormidium autumnale	+	+		+	+	+
Phormidium tenue		+				
Green Algae (Chlorophyceae)						
Closterium sp.	+		+	+	+	
Diatoms (Bacillariophyceae)	>99%	>99%	>99%	>99%	>99%	>99%
Achnanthes spp	++	++	++	+	++	+
Cocconeis placentula						
Cymbella spp		+	+	+	+	
Cymbella minuta		+	+	+	+	
Diatoma hiemale v mesodon						+
Diatoma tenue		+		+		+
Fragilaria construens						
Gomphonema spp.	+	+	+	+	+	++
Gomphonema angustatum	+	++	+	+	+	++
Hannaea arcus	++	++		+	+	+
Navicula spp.	+	+	+	+	+	+
Nitzschia spp						
Synedra radians	+			+		
Synedra rumpens	++	++	+	++	++	++
Synedra ulna	+++	+++	+++	+++	+++	+++

Key to Abundance

+++ Dominant

++ Common

+ Present

# of Blue-greens	1	3	0	1	1	1
# of Greens	1	0	1	1	1	0
# of Diatoms	8	10	8	11	9	8
Total Species	10	13	9	13	11	9

DUBLIN GULCH PERIPHYTON
SITE P4, 1995

	REPLICATES					
	P4A	P4B	P4C	P4D	P4E	P4F
Blue-green Algae (Cyanophyceae)						
Chamaesiphon incrustans	40%	25%		90%	5%	+
Phormidium autumnale	40%	+	90%		5%	75%
Phormidium tenue	10%	5%		+	5%	
Green Algae (Chlorophyceae)						
Closterium sp.			+		+	+
Cosmarium sp					+	+
Mougeotia sp.		+				
Stigeoclonium sp		+	+			
Ulothrix tenerrima						+
Diatoms (Bacillariophyceae)	10%	70%	10%	10%	85%	25%
Achnanthes spp.	+	++	+	+	+	+
Cocconeis placentula				+		
Cymbella spp		+			+	+
Cymbella minuta	+	+	+		+	+
Denticula elegans		+				
Diatoma tenue		+	+	+	+	+++
Didymosphenia geminata	+				++	++
Gomphonema spp	+	++	+	+	+	
Gomphonema angustatum	++	+++	+		++	
Hannaea arcus		+	+	+	++	
Meridion circulare					+	+
Navicula spp.		+	+			+
Pinnularia sp	+					
Synedra rumpens		++	++	+	++	+++
Synedra ulna	+	++		+	+++	++

Key to Abundance

+++ Dominant

++ Common

\+ Present

	P4A	P4B	P4C	P4D	P4E	P4F
# of Blue-greens	3	3	1	2	3	2
# of Greens	0	2	2	0	2	3
# of Diatoms	7	11	8	7	11	9
Total Species	10	16	11	9	16	14

DUBLIN GULCH PERIPHYTON
SITE P5, 1995

	REPLICATES					
	P5A	P5B	P5C	P5D	P5E	P5F
Blue-green Algae (Cyanophyceae)						
Phormidium autumnale	+		+	+		+
Phormidium tenue		1%	5%		5%	10%
Green Algae (Chlorophyceae)						
Microspora loefgrenii				+		
Mougeotia sp	10%	10%	10%	5%	10%	1%
Stigeoclonium sp		+			+	
Ulothrix tenerrima		+				
Ulothrix zonata		+			1%	
Chrysophyceae						
Dinobryon cylindricum	+					
Diatoms (Bacillariophyceae)	90%	89%	85%	95%	80%	89%
Achnanthes spp	++	++	+	++	+	+
Cymbella spp	+	+	+	+	+	+
Cymbella minuta	+	+	+			+
Diatoma tenue	++	+++	++	++	+++	++
Didymosphenia geminata	+		+		+	+
Gomphonema spp				+		
Gomphonema angustatum			+			+
Hannaea arcus	+			+		
Meridion circulare	+					
Navicula spp	+	+	+		+	+
Nitzschia spp.		+			+	+
Pinnularia sp		+				
Synedra rumpens	++	++	++	++	++	++
Synedra ulna	+	++	+	+	++	+

Key to Abundance

+++ Dominant
++ Common
+ Present

	P5A	P5B	P5C	P5D	P5E	P5F
# of Blue-greens	1	1	2	1	1	2
# of Greens	1	4	1	2	3	1
# of Chrysophytes	1	0	0	0	0	0
# of Diatoms	10	9	9	7	8	10
Total Species	13	14	12	10	12	13

DUBLIN GULCH PERIPHYTON
SITE P6, 1995

	REPLICATES					
	P6A	P6B	P6C	P6D	P6E	P6F
Blue-green Algae (Cyanophyceae)						
Chamaesiphon incrustans	+		1%			+
Merismopedia sp	1%	+	+	+	+	+
Phormidium autumnale	+	+	+		+	+
Phormidium tenue			+		+	+
Green Algae (Chlorophyceae)						
Closterium sp.	+		+	+	+	+
Cosmarium sp		+				
Microspora loefgrenii					75%	+
Mougeotia sp.			+			+
Oedogonium sp.		+	+			+
Spirogyra sp					+	
Ulothrix tenerrima		5%	+			
Ulothrix tenuissima	+	+	+	1%		+
Ulothrix zonata		5%	1%	5%		5%
unidentified palmelloid green			+			
Chrysophyceae						
Hydrurus foetidus					1%	+
Xanthophyceae						
Tribonema sp				+	+	
Red Algae (Rhodophyceae)						
Audouinella violacea				+	+	
Diatoms (Bacillariophyceae)	99%	90%	98%	94%	24%	95%
Achnanthes spp	+++	+++	++	++	++	++
Amphora ovalis			+			
Caloneis sp				+		
Cocconeis placentula	+	+	+	+	+	
Cymatopleura sp	+	+	+	+		+
Cymbella spp	++	++	++	+	+	++
Cymbella cf *affinis*	++	++	++	+	+	++
Cymbella cistula	++	++	++	++	+	++
Cymbella minuta	+	+	+	+	+	+

DUBLIN GULCH PERIPHYTON

SITE P6, 1995

	REPLICATES					
	P6a	P6b	P6c	P6d	P6e	P6f
Diatoms (Bacillariophyceae)						
Diatoma hiemale v mesodon	+	+	+	+	+	+
Diatoma tenue	+++	+++	+	++	++	++
Didymosphenia geminata	+	+	+	+	+	+
Epithemia turgida			+			
Fragilaria capucina	++	++	++	+	++	++
Fragilaria construens					+	
Fragilaria crotonensis	+			+		
Gomphonema spp	+	+	+	+	+	+
Gomphonema angustatum			++	+	+	+
Gomphonema brebissonii					+	
Hannaea arcus	+	+	+	+	++	+
Meridion circulare	+	+	+		+	+
Navicula spp	+	+		+	+	
Nitzschia spp		+			+	+
Pinnularia sp				+	+	+
Rhopalodia gibba				+		
Stauroneis sp						+
Surirella sp.		+				
Synedra radians		+			+	
Synedra rumpens	++	++	++	++	++	++
Synedra ulna	+++	+++	+++	+++	+++	+++
Tabellaria flocculosa		+				

Key to Abundance:

+++ Dominant

++ Common

\+ Present

# of Blue-greens	4	2	4	1	3	4
# of Greens	2	5	7	3	3	6
# of Chrysophytes	0	0	0	0	1	1
# of Xanthophytes	0	0	0	1	1	0
# of Reds	0	0	0	1	1	0
# of Diatoms	18	21	19	21	22	19
Total Species	24	28	30	27	31	30

DUBLIN GULCH PERIPHYTON
SITE P7, 1995

	REPLICATES					
	P7A	P7B	P7C	P7D	P7E	P7F
Blue-green Algae (Cyanophyceae)						
Merismopedia sp.				+	+	+
Phormidium autumnale	+		+	+	25%	
Phormidium tenue				90%	65%	
Green Algae (Chlorophyceae)						
Closterium sp			+			
Geminella sp	1%	1%				
Mougeotia sp.	10%	+	1%			+
Ulothrix tenerrima					+	
Ulothrix zonata				+		
Diatoms (Bacillariophyceae)	89%	99%	99%	10%	10%	>99%
Achnanthes spp	++	++	++	++	++	++
Amphora ovalis						+
Cocconeis placentula		+	+		+	+
Cymbella spp	+	+	+	+	+	+
Cymbella minuta	+		+			+
Cymbella sinuata						+
Denticula elegans			+		+	+
Diatoma hiemale v mesodon	+			+		
Diatoma tenue	++	++	+	++	++	++
Didymosphenia geminata		+	+			+
Diploneis sp			+			
Fragilaria capucina	+		+	+	+	
Gomphonema spp	+			+		
Gomphonema angustatum	+	+	+	+	+	+
Hannaea arcus	+++	++	++	++	+	+
Meridion circulare				+	+	+
Navicula spp		+	+	+	+	+
Nitzschia spp		+	+	+		+
Pinnularia sp			+		+	+
Surirella sp.						+
Synedra radians		+	+			
Synedra rumpens		++	++	++	++	++
Synedra ulna	+	++	+	+	+	++

Key to Abundance

+++ Dominant

++ Common

+ Present

# of Blue-greens	2	2	2	2	2	2
# of Chrysophytes	1	1	1	0	1	1
# of Diatoms	12	9	9	9	7	10
Total Species	15	12	12	11	10	13

DUBLIN GULCH PERIPHYTON
SITE P8, 1995

	REPLICATES					
	P8A	P8B	P8C	P8D	P8E	P8F
Blue-green Algae (Cyanophyceae)						
Chamaesiphon incrustans	40%	40%	40%	50%	20%	20%
Phormidium tenue	20%	20%	20%	25%	40%	40%
Diatoms (Bacillariophyceae)	40%	40%	40%	25%	40%	40%
Achnanthes spp.	+	+	+	+	+	+
Cocconeis placentula (dead)		+	+		+	+
Cymbella spp.		+			+	
Diatoma hiemale v. mesodon			+		+	
Fragilaria construens			+			
Gomphonema spp		+	+		+	
Gomphonema angustatum	+	++	+++	++	+	++
Hannaea arcus	++	++	++	+++	+++	++
Meridion circulare	+	+	++		+	+
Navicula spp.	+	+		+	+	+
Pinnularia sp			+	+		
Synedra rumpens	+	+		+	+	+

Key to Abundance:

+++ Dominant

++ Common

\+ Present

# of Blue-greens	2	2	2	2	2	2
# of Diatoms	6	9	9	6	10	7
Total Species	8	11	11	8	12	9

DUBLIN GULCH PERIPHYTON
SITE P9, 1995

	REPLICATES					
	P9A	P9B	P9C	P9D	P9E	P9F
Blue-green Algae (Cyanophyceae)						
Phormidium autumnale	50%	90%	75%	75%	75%	90%
Phormidium tenue		+		+		
Diatoms (Bacillariophyceae)	50%	10%	25%	25%	25%	10%
Achnanthes spp.				+		
Cymbella spp	++	+				+
Gomphonema angustatum	+	++	++	++	++	++
Meridion circulare	+++		+	+	+	+
Navicula spp	+	+			+	+
Surirella sp			+	+		+
Synedra radians	+			+		
Synedra rumpens				+		

Key to Abundance.

+++ Dominant

++ Common

+ Present

# of Blue-greens	1	2	1	2	1	1
# of Diatoms	5	3	3	6	3	5
Total Species	6	5	4	8	4	6

DUBLIN GULCH PERIPHYTON
SITE P11, 1995

	REPLICATES					
	P11A	P11B	P11C	P11D	P11E	P11F
Blue-green Algae (Cyanophyceae)						
Chamaesiphon incrustans				25%		
Phormidium autumnale					75%	+
Green Algae (Chlorophyceae)						
Closterium sp	5%	+				5%
Mougeotia sp	40%	20%				25%
Rhizoclonium sp. (poor shape)	+					+
Xanthophyceae						
Tribonema sp	40%	75%	10%	10%		50%
Diatoms (Bacillariophyceae)	15%	5%	90%	65%	25%	20%
Achnanthes spp.		+	+	++		+++
Cymbella spp	++	+		+		+
Diatoma hiemale v mesodon					+	+
Diatoma tenue					+	
Gomphonema spp	+	+	+	+		++
Gomphonema angustatum				+	++	
Meridion circulare		+	+		+	+
Navicula spp	++		++	+	+	++
Nitzschia spp	+++	++	++	++		+++
Pinnularia sp	+	+	+	+		+
Rhoicosphenia curvata			+			
Surirella sp	+		+		+	
Synedra radians	+				+	
Synedra rumpens				+		
Synedra ulna			+	+		

Key to Abundance.

+++ Dominant

++ Common

\+ Present

# of Blue-greens	0	0	0	1	1	1
# of Greens	3	2	0	0	0	3
# of Xanthophytes	1	1	1	1	0	1
# of Diatoms	7	6	8	9	7	8
Total Species	11	9	9	11	8	13

DUBLIN GULCH PERIPHYTON
SITE P13, 1995

	REPLICATES					
	P13A	**P13B**	**P13C**	**P13D**	**P13E**	**P13F**
Blue-green Algae (Cyanophyceae)						
Chamaesiphon incrustans		+	5%	10%		
Merismopedia sp	+					
Phormidium autumnale	1%	+	85%	+	+	1%
Phormidium tenue	5%	20%	1%	+	1%	1%
Green Algae (Chlorophyceae)						
Closterium sp.			+	+		
Cosmarium sp			+			+
Microspora loefgrenii			+			
Chrysophyceae						
Hydrurus foetidus		20%	2%	10%	90%	
Xanthophyceae						
Tribonema sp	+		+	+		+
Diatoms (Bacillariophyceae)	94%	60%	7%	80%	9%	98%
Achnanthes spp	++	++	++	++	++	+++
Amphora ovalis	+					+
Cymbella spp	++	+	+		+	+
Cymbella affinis	+	+	+	+		+
Cymbella cistula			+			
Cymbella minuta	+	+	++	+		+
Cymbella sinuata				+		
Diatoma hiemale v mesodon					+	
Fragilaria crotonensis						+
Gomphonema spp	+++	++	++	++	+	+
Gomphonema angustatum	+++	+++	+++	+++	+++	++
Gomphonema brebissonii				+		
Hannaea arcus				+		
Meridion circulare	++	++	+	+	+	++
Navicula spp	+	+	+	+		+
Surirella sp.	+			+		+
Synedra radians	+				+	+
Synedra rumpens	+++	+++	++	++	++	+++
Synedra ulna	+	+	+	+	+	+

Key to Abundance

+++ Dominant

++ Common

+ Present

# of Blue-greens	3	3	3	3	2	2
# of Greens	0	0	3	1	0	1
# of Chrysophytes	0	1	1	1	1	0
# of Xanthophytes	1	0	1	1	0	1
# of Diatoms	13	10	11	13	9	14
Total Species	17	14	19	19	12	18

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name	W1	Genera and Species	Replicate Number and Area Sampled (cm²)											
Date	8/20/2007													
Phylum	Order		1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	Cyclotella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Pennales	Achnanthes flexella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Achnanthes lanceolata	27.1	156.4	143.2	56.8	108.6	5	27.1	156.4	98.4	108.6	55.4	24.8
		Achnanthes minutissima	1,262.4	605.8	1,664.4	1,760.0	420.8	5	420.8	1760.0	1142.7	1262.4	607.7	271.7
		Achnanthes spp.	841.6	2,120.3	1,109.6	660.0	841.6	5	660.0	2120.3	1114.6	841.6	584.6	261.5
		Achnanthes sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphipleura pellucida						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora ovalis	<27.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora sp.			<35.8			1	0.0	0.0	0.0	0.0	0.0	0.0
		Anomoeoneis vitrea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.	<27.1	<39.1	<35.8			3	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis sp. ?			<35.8			1	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	20,245.0	19,815.2	27,752.4	11,852.4	2,524.8	5	2524.8	27752.4	16438.0	19815.2	9598.4	4292.5
		Cocconeis pediculus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula	<27.1	<39.1	35.8	28.4	<54.3	5	0.0	35.8	12.8	0.0	17.8	7.9
		Cymatopleura sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii		<39.1				1	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cistula		156.4	<35.8	<28.4		3	0.0	156.4	31.3	0.0	69.9	31.3
		Cymbella cuspidata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	162.6	<39.1	644.4	113.6	<54.3	5	0.0	644.4	184.1	113.6	267.0	119.4
		Cymbella sinuata	108.4	78.2	143.2	56.8	<54.3	5	0.0	143.2	77.3	78.2	54.1	24.2
		Cymbella spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma heimale var. mesodon	2,524.8	3,029.0	4,715.8	2,860.0	1,472.8	5	1472.8	4715.8	2920.5	2860.0	1171.6	524.0
		Diatoma heimale			<35.8	<28.4	<54.3	3	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.			<35.8			1	0.0	0.0	0.0	0.0	0.0	0.0
		Didymosphenia geminata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis elliptica						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis oblongella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.		<39.1		<28.4	<54.3	3	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria construens						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria montana	<27.1					1	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W1 8/20/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm^2)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Fragilaria vaucheriae	1,262.4	1,514.5	832.2	1,540.0	<54.3	5	832.2	1540.0	1287.3	1388.5	328.2	146.8
		Fragilaria spp.	1,472.8	2,120.3	832.2	440.0	108.6	5	108.6	2120.3	994.8	832.2	808.5	361.6
		Frustulia rhomboides						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema acuminatum	<27.1			<28.4		2	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	92,317.2	27,974.4	85,392.0	93,972.6	63,974.2	5	27974.4	93972.6	72726.1	85392.0	27726.2	12399.5
		Gomphonema subclavatum	<27.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		*Gomphonema spp.**	18,625.4	12,821.6	22,415.4	16,085.4	14,576.4	5	12821.6	22415.4	16904.8	16085.4	3744.7	1674.7
		Meridion circulare	216.8	625.6	716.0	170.4	325.8	5	170.4	716.0	410.9	325.8	245.9	110.0
		Navicula aurora						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala			71.6	<28.4	<54.3	3	0.0	71.6	14.3	0.0	32.0	14.3
		Navicula cryptonella	108.4	703.8	429.6	511.2	162.9	5	108.4	703.8	383.2	429.6	247.7	110.8
		Navicula lanceolata	<27.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa		<39.1	<35.8	<28.4	<54.3	4	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula rhyconcephala						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula salinarum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.		<39.1			<54.3	2	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp.				<28.4		1	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia dissipata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia filiformis			<35.8			1	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia spp.		234.6	214.8	170.4	54.3	4	0.0	234.6	134.8	170.4	102.8	46.0
		Pinnularia spp.	<27.1	39.1	<35.8	<28.4	<54.3	5	0.0	39.1	7.8	0.0	17.5	7.8
		Rhopalodia gibba						0	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.		<39.1	<35.8	<28.4		3	0.0	0.0	0.0	0.0	0.0	0.0
		Stenopterobia sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta	<27.1	<39.1		<28.4	<54.3	4	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra acus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	54.2	2,423.2	2,774.0	660.0	631.2	5	54.2	2774.0	1308.5	660.0	1208.6	540.5
		Synedra incisa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra ulna	<27.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria fenestrata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa						0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyta	Chlorococcales	*Characium sp.*					<54.3	1	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name	W1	Genera and Species	Replicate Number and Area Sampled (cm^2)											
Date	8/20/2007													
Phylum	Order		1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Sphaerocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	*Oedogonium spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	*Geminella sp. ?*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Microspora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Zygnematales	*Closterium spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.		<39.1				1	0.0	0.0	0.0	0.0	0.0	0.0
		Cylindrocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp	<27.1					1	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	*Chromulina sp. ?*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp.		20,980.8	277.4	2,539.8	210.4	4	0.0	20980.8	4801.7	277.4	9103.4	4071.1
		Chrysococcus sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus	103,654.4	179,502.4	109,942.2	94,819.2	38,060.6	5	38060.6	179502.4	105195.8	103654.4	50401.3	22540.2
	Ochromonadales	*Dinobryon spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hyalobryon sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	*Tribonema spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tribonema sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	*Chamaesiphon spp.*	1,619.6		1,664.4	14,392.2	11,337.2	4	0.0	14392.2	5802.7	1664.4	6570.9	2938.6
		Clastidium setigerum						0	0.0	0.0	0.0	0.0	0.0	0.0
	Chroococcales	*Aphanocapsa spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Aphanothece spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Merismopedia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	*Anabaena spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Anabaena / Nostoc spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Calothrix sp.?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tolypothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oscillatoriales	*Lyngbya spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Homoeothrix varians	769,310.0	159,687.2	834,706.8	1,329,162.0	361,170.8	5	159687.2	1329162.0	690807.4	769310.0	454179.3	203115.1
		Homoeothrix sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.				<28.4		1	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.			508,082.4			1	0.0	508082.4	101616.5	0.0	227221.4	101616.5
		Oscillatoria sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Phormidium sp. ?		<39.1				1	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena catenata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena sp.	4,418.4	6,058.0	3,328.8	3,080.0	543.0	5	543.0	6058.0	3485.6	3328.8	2020.9	903.8
		Schizothrix sp. ?			<35.8			1	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrrophyta	Dinokontae	*Peridinium / Glenodinium sp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	*Audouinella sp.*						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm^2)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	Cyclotella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Pennales	Achnanthes flexella	47.2	190.8	274.2	7.0	103.6	5	7.0	274.2	124.6	103.6	108.4	48.5
		Achnanthes lanceolata	94.4	95.4				2	0.0	95.4	38.0	0.0	52.0	23.2
		Achnanthes minutissima	6,330.6	39,849.6	58,561.7	1,300.8	15,460.0	5	1300.8	58561.7	24300.5	15460.0	24216.0	10829.7
		Achnanthes spp.	4,923.8	37,003.2	29,961.8	271.0	5,411.0	5	271.0	37003.2	15514.2	5411.0	16711.5	7473.6
		Achnanthes sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphipleura pellucida	<23.6				<25.9	2	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora ovalis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora sp.			<45.7			1	0.0	0.0	0.0	0.0	0.0	0.0
		Anomoeoneis vitrea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.		47.7				1	0.0	47.7	9.5	0.0	21.3	9.5
		Caloneis sp. ?				<7.0		1	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	1,462.4	5,916.8	4,600.7	56.0	5,223.4	5	56.0	5916.8	3451.9	4600.7	2550.7	1140.7
		Cocconeis pediculus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula	23.6	95.4	45.7	<7.0	25.9	5	0.0	95.4	38.1	25.9	35.9	16.0
		Cymatopleura sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cistula	47.2	477.0	822.6	28.0	310.8	5	28.0	822.6	337.1	310.8	330.0	147.6
		Cymbella cuspidata			<45.7			1	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	141.6	763.2	1,415.6	<7.0	362.6	5	0.0	1415.6	536.6	362.6	569.7	254.8
		Cymbella sinuata	23.6	190.8	274.2	28.0	103.6	5	23.6	274.2	124.0	103.6	108.1	48.3
		Cymbella spp.	<23.6	572.4	457.0	<7.0	103.6	5	0.0	572.4	226.6	103.6	269.5	120.5
		Denticula sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?					<25.9	1	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum	29,542.8	418,420.8	405,846.2	2,005.4	146,097.0	5	2005.4	418420.8	200382.4	146097.0	200775.1	89789.4
		Diatoma heimale var. mesodon	94.4	286.2	274.2		103.6	4	0.0	286.2	151.7	103.6	124.2	55.5
		Diatoma heimale						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.			<45.7		<25.9	2	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Didymosphenia geminata		<47.7	45.7			2	0.0	45.7	9.1	0.0	20.4	9.1
		Diploneis elliptica		<47.7				1	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis oblongella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.					<25.9	1	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.	<23.6					1	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.	<23.6		<45.7		<25.9	3	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina					<25.9	1	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria construens						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria montana	<23.6	<47.7	<45.7			3	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria vaucheriae	1,096.8	4,807.4	4,246.8	42.0	2,611.7	5	42.0	4807.4	2560.9	2611.7	2023.6	905.0
		Fragilaria spp.	914.0	4,067.8	1,061.7	28.0	2,611.7	5	28.0	4067.8	1736.6	1061.7	1600.9	716.0
		Frustulia rhomboides					<25.9	1	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Gomphonema acuminatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	2,376.4	5,177.2	3,185.1	98.0	602.7	5	98.0	5177.2	2287.9	2376.4	2049.2	916.4
		Gomphonema subclavatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema spp.*	731.2	6,656.4	1,769.5	271.0	3,214.4	5	271.0	6656.4	2528.5	1769.5	2569.7	1149.2
		Meridion circulare	23.6	477.0	182.8	<7.0	51.8	5	0.0	477.0	147.0	51.8	197.5	88.3
		Navicula aurora						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptonella	94.4	667.8	365.6		207.2	4	0.0	667.8	267.0	207.2	262.2	117.3
		Navicula lanceolata	<23.6					1	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa		95.4	45.7		<25.9	3	0.0	95.4	28.2	0.0	42.4	19.0
		Navicula rhyconcephala						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula salinarum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.	47.2	1,479.2	1,061.7	<7.0	51.8	5	0.0	1479.2	528.0	51.8	694.0	310.3
		Neidium spp.		95.4	<45.7		<25.9	3	0.0	95.4	19.1	0.0	42.7	19.1
		Neidium spp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia dissipata	47.2				<25.9	2	0.0	47.2	9.4	0.0	21.1	9.4
		Nitzschia filiformis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea	94.4	4,437.6	2,123.4	7.0	200.9	5	7.0	4437.6	1372.7	200.9	1925.5	861.1
		Nitzschia spp.	47.2	1,109.4	1,061.7	42.0	401.8	5	42.0	1109.4	532.4	401.8	525.8	235.2
		Pinnularia spp.	<23.6	286.2	91.4	<7.0	<25.9	5	0.0	286.2	75.5	0.0	124.2	55.6
		Rhopalodia gibba			<45.7			1	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.		<47.7	<45.7		<25.9	3	0.0	0.0	0.0	0.0	0.0	0.0
		Stenopterobia sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta	<23.6		<45.7		<25.9	3	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella spp.		<47.7				1	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra acus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	1,462.4	21,348.0	19,066.6	325.2	9,276.0	5	325.2	21348.0	10295.6	9276.0	9715.4	4344.9
		Synedra incisa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra ulna	236.0	1,479.2	3,185.1	7.0	803.6	5	7.0	3185.1	1142.2	803.6	1275.9	570.6
		Synedra spp.	94.4	1,109.4	353.9		51.8	4	0.0	1109.4	321.9	94.4	460.8	206.1
		Tabellaria fenestrata		<47.7	<45.7			2	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa	<23.6		<45.7			2	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyta	Chlorococcales	Characium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.			<45.7			1	0.0	0.0	0.0	0.0	0.0	0.0
		Sphaerocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	Oedogonium spp.	<23.6					1	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	Geminella sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Microspora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata	<23.6	477.0	3,930.2	14.0	621.6	5	0.0	3930.2	1008.6	477.0	1656.4	740.8
		Ulothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Zygnematales	Closterium spp.		<47.7	<45.7		<25.9	3	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.			<45.7			1	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm^2)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Cylindrocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp		<47.7				1	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	*Chromulina sp. ?*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ochromonadales	*Dinobryon spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hyalobryon sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	*Tribonema spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tribonema sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	*Chamaesiphon spp.*	13,364.6	2,958.4	10,895.2	1,251.6	200.9	5	200.9	13364.6	5734.1	2958.4	5984.9	2676.5
		Clastidium setigerum	10,551.0	2,218.8	5,447.6	11,681.6	10,049.0	5	2218.8	11681.6	7989.6	10049.0	4006.1	1791.6
	Chroococcales	*Aphanocapsa spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Aphanothece spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Merismopedia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	*Anabaena spp.*		<47.7				1	0.0	0.0	0.0	0.0	0.0	0.0
		Anabaena / Nostoc spp.		<47.7			<25.9	2	0.0	0.0	0.0	0.0	0.0	0.0
		Calothrix sp.?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tolypothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oscillatoriales	*Lyngbya spp.*	<23.6					1	0.0	0.0	0.0	0.0	0.0	0.0
		Homoeothrix varians	33,635.2	54,360.6	71,487.8	4,281.8	44,599.8	5	4281.8	71487.8	41673.0	44599.8	25105.6	11227.6
		Homoeothrix sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria sp. ?	<23.6	<47.7	1,919.4			3	0.0	1919.4	383.9	0.0	858.4	383.9
		Phormidium sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena catenata	1,274.4	44,745.8	15,925.5	140.0	414.4	5	140.0	44745.8	12500.0	1274.4	19211.8	8591.8
		Pseudanabaena sp.	896.8	9,614.8		154.0	310.8	4	0.0	9614.8	2195.3	310.8	4161.5	1861.1
		Schizothrix sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.	<23.6		<45.7		621.6	3	0.0	621.6	124.3	0.0	278.0	124.3
Pyrrophyta	Dinokontae	*Peridinium / Glenodinium sp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	*Audouinella sp.*	<23.6					1	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name	W4	Genera and Species	Replicate Number and Area Sampled (cm^2)											
Date	8/15/2007													
Phylum	Order		1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	Cyclotella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Pennales	Achnanthes flexella	<15.6	256.8	9.2	<7.2	<88.0	5	0.0	256.8	53.2	0.0	113.9	50.9
		Achnanthes lanceolata		<42.8		<7.2		2	0.0	0.0	0.0	0.0	0.0	0.0
		Achnanthes minutissima	25,174.8	98,244.3	11,782.0	1,450.8	262,560.0	5	1450.8	262560.0	79842.4	25174.8	108961.4	48729.0
		Achnanthes spp.	3,263.4	25,518.0	1,096.0	223.2	68,265.6	5	223.2	68265.6	19673.2	3263.4	29103.6	13015.5
		Achnanthes sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphipleura pellucida	<15.6	42.8	18.4		528.0	4	0.0	528.0	117.8	18.4	230.0	102.8
		Amphora ovalis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora sp.					<88.0	1	0.0	0.0	0.0	0.0	0.0	0.0
		Anomoeoneis vitrea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.		<42.8				1	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis sp. ?			<9.2		<88.0	2	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	2,908.8	12,759.0	3,014.0	201.6	36,758.4	5	201.6	36758.4	11128.4	3014.0	15102.6	6754.1
		Cocconeis pediculus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula	15.6	<42.8			<88.0	3	0.0	15.6	3.1	0.0	7.0	3.1
		Cymatopleura sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii		<42.8	<9.2			2	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cistula	62.4	428.0	55.2	<7.2	880.0	5	0.0	880.0	285.1	62.4	373.5	167.0
		Cymbella cuspidata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	156.0	1,326.4	73.6	<7.2	528.0	5	0.0	1326.4	416.8	156.0	547.6	244.9
		Cymbella sinuata	93.6	331.6	36.8	<7.2	528.0	5	0.0	528.0	198.0	93.6	225.2	100.7
		Cymbella spp.	<15.6	342.4	18.4		<88.0	4	0.0	342.4	72.2	0.0	151.3	67.7
		Denticula sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum	22,377.6	14,034.9	12,056.0	446.4	170,664.0	5	446.4	170664.0	43915.8	14034.9	71285.5	31879.9
		Diatoma heimale var. mesodon	15.6	42.8			88.0	3	0.0	88.0	29.3	15.6	37.2	16.6
		Diatoma heimale						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Didymosphenia geminata		<42.8	<9.2	<7.2	88.0	4	0.0	88.0	17.6	0.0	39.4	17.6
		Diploneis elliptica		<42.8				1	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis oblongella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria construens						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria montana						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria vaucheriae	848.4	663.2	284.8	28.8	5,458.4	5	28.8	5458.4	1456.7	663.2	2259.7	1010.6
		Fragilaria spp.	484.8	994.8	356.0	7.2	1,364.6	5	7.2	1364.6	641.5	484.8	537.6	240.4
		Frustulia rhomboides						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Gomphonema acuminatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	363.6	1,989.6	356.0	28.8	3,411.5	5	28.8	3411.5	1229.9	363.6	1439.9	643.9
		Gomphonema subclavatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema spp.*	2,181.6	2,984.4	1,780.0	558.0	44,635.2	5	558.0	44635.2	10427.8	2181.6	19142.5	8560.8
		Meridion circulare		<42.8			<88.0	2	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula aurora						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala		<42.8	<9.2		<88.0	3	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptonella	62.4	256.8		<7.2	176.0	4	0.0	256.8	99.0	62.4	113.8	50.9
		Navicula lanceolata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa	<15.6	<42.8	<9.2		<88.0	4	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula rhyconcephala						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula salinarum	<15.6	<42.8				2	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.	62.4	342.4	18.4	<7.2	528.0	5	0.0	528.0	190.2	62.4	234.1	104.7
		Neidium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia dissipata					<88.0	1	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia filiformis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea	93.6	2,321.2	73.6	<7.2	880.0	5	0.0	2321.2	673.7	93.6	988.3	442.0
		Nitzschia spp.	62.4	1,989.6	36.8		704.0	4	0.0	1989.6	558.6	62.4	851.4	380.8
		Pinnularia spp.					<88.0	1	0.0	0.0	0.0	0.0	0.0	0.0
		Rhopalodia gibba						0	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.	<15.6	<42.8		<7.2		3	0.0	0.0	0.0	0.0	0.0	0.0
		Stenopterobia sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta						0	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella spp.					<88.0	1	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra acus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	6,060.6	19,138.5	1,281.6	57.6	39,384.0	5	57.6	39384.0	13184.5	6060.6	16481.9	7370.9
		Synedra incisa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra ulna	1,575.6	1,658.0	854.4	100.8	12,281.4	5	100.8	12281.4	3294.0	1575.6	5063.4	2264.4
		Synedra spp.	121.2	171.2	142.4	<7.2	<88.0	5	0.0	171.2	87.0	121.2	81.3	36.4
		Tabellaria fenestrata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa						0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyta	Chlorococcales	Characium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Sphaerocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	Oedogonium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	Geminella sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Microspora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata	1,216.8	<42.8	588.8	<7.2	95,522.0	5	0.0	95522.0	19465.5	588.8	42519.8	19015.5
		Ulothrix spp.					4,750.0	1	0.0	4750.0	950.0	0.0	2124.3	950.0
	Zygnematales	Closterium spp.					<88.0	1	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Cylindrocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp						0	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	*Chromulina sp. ?*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ochromonadales	*Dinobryon spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hyalobryon sp.		<42.8				1	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	*Tribonema spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tribonema sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	*Chamaesiphon spp.*			1,370.0	30,916.8		2	0.0	30916.8	6457.4	0.0	13686.1	6120.6
		Clastidium setigerum	3,729.6		6,028.0	5,367.7	5,458.4	4	0.0	6028.0	4116.7	5367.7	2455.4	1098.1
	Chroococcales	*Aphanocapsa spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Aphanothece spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Merismopedia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	*Anabaena spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Anabaena / Nostoc spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Calothrix sp.?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tolypothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oscillatoriales	*Lyngbya spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Homoeothrix varians	17,937.6	15,253.6	43,840.0	29,843.3	685,281.6	5	15253.6	685281.6	158431.2	29843.3	294735.3	131809.6
		Homoeothrix sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Phormidium sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena catenata		96,968.4	284.8		10,234.5	3	0.0	96968.4	21497.5	284.8	42417.5	18969.7
		Pseudanabaena sp.	249.6	7,626.8	498.4		25,245.1	4	0.0	25245.1	6724.0	498.4	10836.7	4846.3
		Schizothrix sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.	218.4		220.8			2	0.0	220.8	87.8	0.0	120.3	53.8
Pyrrophyta	Dinokontae	*Peridinium / Glenodinium sp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	*Audouinella sp.*			<9.2	<7.2		2	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	Cyclotella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Pennales	Achnanthes flexella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Achnanthes lanceolata		<7.1	<5.7	9.0	637.6	4	0.0	637.6	129.3	0.0	284.2	127.1
		Achnanthes minutissima	12,307.4	990.0	220.0	207.0	61,345.0	5	207.0	61345.0	15013.9	990.0	26403.9	11808.2
		Achnanthes spp.	3,546.2	825.0	528.0	276.0	41,714.6	5	276.0	41714.6	9378.0	825.0	18124.5	8105.5
		Achnanthes sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphipleura pellucida	<7.0				<41.1	2	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora ovalis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora sp.					<41.1	1	0.0	0.0	0.0	0.0	0.0	0.0
		Anomoeoneis vitrea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.					<41.1	1	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis sp. ?					<41.1	1	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	56.0	99.4	22.8	138.0	43.2	5	22.8	138.0	71.9	56.0	46.4	20.8
		Cocconeis pediculus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula	126.0	56.8	125.4	18.0	328.8	5	18.0	328.8	131.0	125.4	119.8	53.6
		Cymatopleura sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cistula	<7.0		<5.7	<4.5	<41.1	4	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cuspidata					<41.1	1	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	98.0	28.4	<5.7	18.0	2,231.6	5	0.0	2231.6	475.2	28.4	982.6	439.4
		Cymbella sinuata	542.0	4,232.0	396.0	341.5	2,550.4	5	341.5	4232.0	1612.4	542.0	1730.8	774.0
		Cymbella spp.	28.0		<5.7	<4.5	82.2	4	0.0	82.2	22.0	0.0	35.7	16.0
		Denticula sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum	84.0					1	0.0	84.0	16.8	0.0	37.6	16.8
		Diatoma heimale var. mesodon	56.0	7.1	<5.7	63.0	904.2	5	0.0	904.2	206.1	56.0	391.3	175.0
		Diatoma heimale						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Didymosphenia geminata	<7.0					1	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis elliptica						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis oblongella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.					<41.1	1	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria construens						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria montana						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria vaucheriae	1,517.6	110.0	44.8	103.5	4,463.2	5	44.8	4463.2	1247.8	110.0	1901.5	850.4
		Fragilaria spp.	271.0	550.0	11.4	276.0	4,144.4	5	11.4	4144.4	1050.6	276.0	1740.0	778.1
		Frustulia rhomboides						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm^2)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Gomphonema acuminatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	2,920.4	2,116.0	616.0	724.5	7,651.2	5	616.0	7651.2	2805.6	2116.0	2876.4	1286.3
		Gomphonema subclavatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema spp.*	7,301.0	7,194.4	1,693.0	1,483.5	4,782.0	5	1483.5	7301.0	4490.8	4782.0	2835.6	1268.1
		Meridion circulare	28.0	28.8	5.7	18.0	739.8	5	5.7	739.8	164.1	28.0	322.0	144.0
		Navicula aurora					<41.1	1	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptonella			<5.7	4.5		2	0.0	4.5	0.9	0.0	2.0	0.9
		Navicula lanceolata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa	<7.0	<7.1	<5.7		82.2	4	0.0	82.2	16.4	0.0	36.8	16.4
		Navicula rhyconcephala					164.4	1	0.0	164.4	32.9	0.0	73.5	32.9
		Navicula salinarum		<7.1	<5.7			2	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.	7.0	71.0	<5.7	<4.5	3,506.8	5	0.0	3506.8	717.0	7.0	1559.9	697.6
		Neidium spp.				<4.5		1	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis					41.1	1	0.0	41.1	8.2	0.0	18.4	8.2
		Nitzschia dissipata				<4.5	1,912.8	2	0.0	1912.8	382.6	0.0	855.4	382.6
		Nitzschia filiformis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea	28.0	14.2		<4.5	318.8	4	0.0	318.8	72.2	14.2	138.3	61.9
		Nitzschia spp.	42.0	99.4	<5.7	18.0	6,694.8	5	0.0	6694.8	1370.8	42.0	2976.4	1331.1
		Pinnularia spp.	<7.0	<7.1			246.6	3	0.0	246.6	49.3	0.0	110.3	49.3
		Rhopalodia gibba						0	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Stenopterobia sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta					<41.1	1	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella spp.					<41.1	1	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra acus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	84.0	85.2	<5.7	45.0	2,550.4	5	0.0	2550.4	552.9	84.0	1117.2	499.6
		Synedra incisa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra ulna	14.0			<4.5	41.1	3	0.0	41.1	11.0	0.0	17.9	8.0
		Synedra spp.	14.0			<4.5		2	0.0	14.0	2.8	0.0	6.3	2.8
		Tabellaria fenestrata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa					<41.1	1	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyta	Chlorococcales	Characium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Sphaerocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	Oedogonium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	Geminella sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Microspora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata	112.0	113.6	79.8	552.0	9,453.0	5	79.8	9453.0	2062.1	113.6	4136.3	1849.8
		Ulothrix spp.	<7,0	<7.1		27.0	4,767.6	4	0.0	4767.6	958.9	0.0	2129.1	952.2
	Zygnematales	Closterium spp.	<7.0	<7.1	<5.7	<4.5	<41.1	5	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name	W4	Genera and Species	Replicate Number and Area Sampled (cm²)											
Date	8/15/2007													
Phylum	Order		1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Cylindrocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp						0	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	Chromulina sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus	162.6	1,320.0	<5.7	27.0	637.6	5	0.0	1320.0	429.4	162.6	559.9	250.4
	Ochromonadales	Dinobryon spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hyalobryon sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	Tribonema spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tribonema sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	Chamaesiphon spp.	66,334.8	9,310.4	87,358.8	121,470.6	105,513.4	5	9310.4	121470.6	77997.6	87358.8	43556.3	19479.0
		Clastidium setigerum	5,423.6	220.0	677.2		4,907.6	4	0.0	5423.6	2245.7	677.2	2682.9	1199.8
	Chroococcales	Aphanocapsa spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Aphanothece spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Merismopedia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	Anabaena spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Anabaena / Nostoc spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Calothrix sp.?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tolypothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oscillatoriales	Lyngbya spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Homoeothrix varians	62,580.0	3,630.0	4,488.0	2,967.0	57,702.8	5	2967.0	62580.0	26273.6	4488.0	30969.7	13850.1
		Homoeothrix sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Phormidium sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena catenata					246.6	1	0.0	246.6	49.3	0.0	110.3	49.3
		Pseudanabaena sp.			<5.7		3,041.4	2	0.0	3041.4	608.3	0.0	1360.2	608.3
		Schizothrix sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.		<7.1				1	0.0	0.0	0.0	0.0	0.0	0.0
Pyrrophyta	Dinokontae	Peridinium / Glenodinium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	Audouinella sp.	392.0	42.6			515.4	3	0.0	515.4	190.0	42.6	245.3	109.7

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name	W4		Replicate Number and Area Sampled (cm^2)											
Date	8/15/2007	Genera and Species												
Phylum	Order		1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	Cyclotella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Pennales	Achnanthes flexella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Achnanthes lanceolata	169.6		<8.2	16.2	20.4	4	0.0	169.6	41.2	16.2	72.4	32.4
		Achnanthes minutissima	1,970.4	1,132.0	638.0	376.2	78.6	5	78.6	1970.4	839.0	638.0	741.4	331.6
		Achnanthes spp.	1,313.6	116.8	446.6	752.4	157.2	5	116.8	1313.6	557.3	446.6	494.1	221.0
		Achnanthes sp. ?	60,657.6		63.8			2	0.0	60657.6	12144.3	0.0	27119.8	12128.3
		Amphipleura pellucida						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora ovalis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Anomoeoneis vitrea	<42.4					1	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	1,970.4	759.2	<8.2	162.0	235.8	5	0.0	1970.4	625.5	235.8	803.8	359.5
		Cocconeis pediculus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymatopleura sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cistula				<8.1		1	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cuspidata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	339.2	<29.2	8.2		5.1	4	0.0	339.2	70.5	5.1	150.2	67.2
		Cymbella sinuata	254.4	<29.2	32.8	64.8	20.4	5	0.0	254.4	74.5	32.8	103.3	46.2
		Cymbella spp.				<8.1		1	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma heimale var. mesodon	169.6					1	0.0	169.6	33.9	0.0	75.8	33.9
		Diatoma heimale						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Didymosphenia geminata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis elliptica						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis oblongella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.		<29.2				1	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria construens						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria montana						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria vaucheriae	2,955.6	175.2		48.6	39.3	4	0.0	2955.6	643.7	48.6	1294.0	578.7
		Fragilaria spp.	656.8	<29.2	32.8	97.2	78.6	5	0.0	656.8	173.1	78.6	273.1	122.1
		Frustulia rhomboides						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Gomphonema acuminatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	12,479.2	67,074.7	24,294.6	1,442.1	2,572.1	5	1442.1	67074.7	21572.5	12479.2	27049.9	12097.1
		Gomphonema subclavatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema spp.*	2,955.6	5,226.6	736.2	188.1	157.2	5	157.2	5226.6	1852.7	736.2	2207.5	987.2
		Meridion circulare	1,642.0	175.2	574.2	324.0	510.9	5	175.2	1642.0	645.3	510.9	579.0	258.9
		Navicula aurora						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala			<8.2			1	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptonella	1,912.8	<29.2		<8.1		3	0.0	1912.8	382.6	0.0	855.4	382.6
		Navicula lanceolata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula rhyconcephala						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula salinarum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.	1,313.6	116.8	63.8	8.1	39.3	5	8.1	1313.6	308.3	63.8	563.4	251.9
		Neidium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia dissipata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia filiformis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia spp.	169.6				10.2	2	0.0	169.6	36.0	0.0	74.8	33.5
		Pinnularia spp.				<8.1		1	0.0	0.0	0.0	0.0	0.0	0.0
		Rhopalodia gibba						0	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.			<8.2	<8.1		2	0.0	0.0	0.0	0.0	0.0	0.0
		Stenopterobia sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta	<42.4			<8.1		2	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra acus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	656.8		<8.2	8.1	5.1	4	0.0	656.8	134.0	5.1	292.3	130.7
		Synedra incisa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra ulna						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra spp.	42.4					1	0.0	42.4	8.5	0.0	19.0	8.5
		Tabellaria fenestrata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa		<29.2				1	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyta	Chlorococcales	Characium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.	<42.4	<29.2	<8.2			3	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Sphaerocystis sp.			<8.2			1	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	Oedogonium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	Geminella sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Microspora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Zygnematales	Closterium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm^2)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Cylindrocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp						0	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	*Chromulina sp. ?*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus	1,526.4	58,363.7	510.4	64.8	10.2	5	10.2	58363.7	12095.1	510.4	25872.1	11570.3
	Ochromonadales	*Dinobryon spp.*	848.0	1,401.6	278.8	16.2	<5.1	5	0.0	1401.6	508.9	278.8	605.5	270.8
		Hyalobryon sp.		<29.2				1	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.		<29.2		<8.1		2	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	*Tribonema spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tribonema sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	*Chamaesiphon spp.*	48,020.6	121,954.0	2,169.2	125.4	353.7	5	125.4	121954.0	34524.6	2169.2	52971.4	23689.5
		Clastidium setigerum						0	0.0	0.0	0.0	0.0	0.0	0.0
	Chroococcales	*Aphanocapsa spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Aphanothece spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Merismopedia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	*Anabaena spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Anabaena / Nostoc spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Calothrix sp.?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tolypothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oscillatoriales	*Lyngbya spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Homoeothrix varians	5,172.8	503,495.8	8,549.2	2,194.5		4	0.0	503495.8	103882.5	5172.8	223413.8	99913.7
		Homoeothrix sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.	487,017.2	<29.2	63,313.2	567.0	<5.1	5	0.0	487017.2	110179.5	567.0	212424.7	94999.2
		Oscillatoria sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Phormidium sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena catenata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Schizothrix sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrrophyta	Dinokontae	*Peridinium / Glenodinium sp.*			<8.2			1	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	*Audouinella sp.*						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	Cyclotella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Pennales	Achnanthes flexella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Achnanthes lanceolata	14.4	19.0	20.2	1,273.0	232.8	5	14.4	1273.0	311.9	20.2	545.3	243.9
		Achnanthes minutissima	167.4	1,975.4	2,420.8	1,546.2	6,717.0	5	167.4	6717.0	2565.4	1975.4	2469.5	1104.4
		Achnanthes spp.	223.2	293.2	1,815.6	1,288.5	2,239.0	5	223.2	2239.0	1171.9	1288.5	899.8	402.4
		Achnanthes sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphipleura pellucida						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora ovalis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Anomoeoneis vitrea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa					<15.0	1	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.		<9.5	10.1	8.6	30.0	4	0.0	30.0	9.7	8.6	12.3	5.5
		Caloneis sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	<7.2		<10.1		<15.0	3	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis pediculus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula		<9.5				1	0.0	0.0	0.0	0.0	0.0	0.0
		Cymatopleura sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cistula	<7.2	<9.5	10.1	<8.6		4	0.0	10.1	2.0	0.0	4.5	2.0
		Cymbella cuspidata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	28.8	<9.5	40.4	17.2	30.0	5	0.0	40.4	23.3	28.8	15.4	6.9
		Cymbella sinuata	144.0	219.9	471.6	737.0	2,095.2	5	144.0	2095.2	733.5	471.6	795.9	356.0
		Cymbella spp.	7.2	9.5	20.2	8.6		4	0.0	20.2	9.1	8.6	7.2	3.2
		Denticula sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma heimale var. mesodon						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma heimale						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Didymosphenia geminata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis elliptica	<7.2		<10.1		<15.0	3	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis oblongella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.				<8.6		1	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.				<8.6		1	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria construens						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria montana						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria vaucheriae	167.4	1,319.4	235.8	1,005.0	3,375.6	5	167.4	3375.6	1220.6	1005.0	1301.9	582.2
		Fragilaria spp.	14.4	<9.5	20.2	268.0	465.6	5	0.0	465.6	153.6	20.2	206.9	92.5
		Frustulia rhomboides						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Gomphonema acuminatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	28.8	38.0	40.4	34.4	60.0	5	28.8	60.0	40.3	38.0	11.8	5.3
		Gomphonema subclavatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema spp.*	14.4	<9.5	40.4	51.6	232.8	5	0.0	232.8	67.8	40.4	94.5	42.2
		Meridion circulare	781.2	5,079.6	80.8	86.0	150.0	5	80.8	5079.6	1235.5	150.0	2168.9	970.0
		Navicula aurora						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala	230.4	247.0	242.4	51.6	90.0	5	51.6	247.0	172.3	230.4	93.8	42.0
		Navicula cryptonella	28.8	<9.5	60.6	34.4		4	0.0	60.6	24.8	28.8	25.6	11.4
		Navicula lanceolata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula rhyconcephala						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula salinarum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.	167.4	146.6	786.0	603.0	4,539.6	5	146.6	4539.6	1248.5	603.0	1860.4	832.0
		Neidium spp.		<9.5	<10.1	<8.6	<15.0	4	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia dissipata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia filiformis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia spp.	223.2	219.9	3,631.2	1,803.9	4,030.2	5	219.9	4030.2	1981.7	1803.9	1812.8	810.7
		Pinnularia spp.	7.2	<9.5	80.8	51.6	30.0	5	0.0	80.8	33.9	30.0	33.1	14.8
		Rhopalodia gibba	<7.2		<10.1	<8.6	<15.0	4	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.			<10.1			1	0.0	0.0	0.0	0.0	0.0	0.0
		Stenopterobia sp. ?			<10.1			1	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta	<7.2		<10.1	8.6	30.0	4	0.0	30.0	7.7	0.0	13.0	5.8
		Surirella spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra acus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	3,220.5	6,772.8	6,052.0	9,534.9	9,403.8	5	3220.5	9534.9	6996.8	6772.8	2619.1	1171.3
		Synedra incisa	<7.2			17.2		2	0.0	17.2	3.4	0.0	7.7	3.4
		Synedra ulna	7.2	9.5	10.1	<8.6	<15.0	5	0.0	10.1	5.4	7.2	5.0	2.2
		Synedra spp.	14.4	38.0	20.2	51.6	<15.0	5	0.0	51.6	24.8	20.2	20.2	9.0
		Tabellaria fenestrata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa						0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyta	Chlorococcales	Characium sp.				<8.6		1	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.				<8.6		1	0.0	0.0	0.0	0.0	0.0	0.0
		Sphaerocystis sp.			<10.1			1	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	Oedogonium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	Geminella sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Microspora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Zygnematales	Closterium spp.			<10.1			1	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Cylindrocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp						0	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	Chromulina sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp. ?			<10.1			1	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ochromonadales	Dinobryon spp.	28.8	9.5	20.2	17.2	60.0	5	9.5	60.0	27.1	20.2	19.6	8.8
		Hyalobryon sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	Tribonema spp.	288.0	171.0	525.2	<8.6	<15.0	5	0.0	525.2	196.8	171.0	220.4	98.6
		Tribonema sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	Chamaesiphon spp.	11,593.8	59,826.4	9,985.8	71,640.6	65,378.8	5	9985.8	71640.6	43685.1	59826.4	30323.9	13561.3
		Clastidium setigerum	7,299.8	9,877.0				2	0.0	9877.0	3435.4	0.0	4791.5	2142.8
	Chroococcales	Aphanocapsa spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Aphanothece spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Merismopedia spp.				<8.6		1	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	Anabaena spp.	<7.2		242.4			2	0.0	242.4	48.5	0.0	108.4	48.5
		Anabaena / Nostoc spp.	<7.2		<10.1	<8.6		3	0.0	0.0	0.0	0.0	0.0	0.0
		Calothrix sp.?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tolypothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oscillatoriales	Lyngbya spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Homoeothrix varians	40,148.9	513,039.6	58,704.4	186,574.8	85,529.8	5	40148.9	513039.6	176799.5	85529.8	196279.7	87779.0
		Homoeothrix sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.	<7.2					1	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Phormidium sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena catenata	<7.2			240.8	2,444.4	3	0.0	2444.4	537.0	0.0	1071.3	479.1
		Pseudanabaena sp.			585.8			1	0.0	585.8	117.2	0.0	262.0	117.2
		Schizothrix sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrrophyta	Dinokontae	Peridinium / Glenodinium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	Audouinella sp.			<10.1			1	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	Cyclotella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Pennales	Achnanthes flexella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Achnanthes lanceolata	<8.6	30.0	98.0	186.6		4	0.0	186.6	62.9	30.0	79.9	35.7
		Achnanthes minutissima	210.0	22,761.3	7,923.3	21,892.9	3,357.9	5	210.0	22761.3	11229.1	7923.3	10500.2	4695.8
		Achnanthes spp.	140.0	2,231.5	2,263.8	1,435.6	1,549.8	5	140.0	2263.8	1524.1	1549.8	861.9	385.5
		Achnanthes sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphipleura pellucida						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora ovalis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora sp.				<12.0		1	0.0	0.0	0.0	0.0	0.0	0.0
		Anomoeoneis vitrea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.	<8.6	<15.0				2	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	<8.6	4,016.7	75.6	192.0	199.8	5	0.0	4016.7	896.8	192.0	1746.1	780.9
		Cocconeis pediculus	<8.6					1	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula	<8.6	30.0	25.2	24.0	<33.3	5	0.0	30.0	15.8	24.0	14.6	6.5
		Cymatopleura sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cistula					<33.3	1	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cuspidata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	51.6	1,276.0	2,646.0	373.2	865.8	5	51.6	2646.0	1042.5	865.8	1010.8	452.0
		Cymbella sinuata	17.2	30.0	75.6		<33.3	4	0.0	75.6	24.6	17.2	31.2	14.0
		Cymbella spp.		15.0	12.6	12.0	<33.3	4	0.0	15.0	7.9	12.0	7.3	3.3
		Denticula sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma heimale var. mesodon	34.4	4,463.0	25.2	216.0	199.8	5	25.2	4463.0	987.7	199.8	1944.8	869.7
		Diatoma heimale						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Didymosphenia geminata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis elliptica		<15.0		<12.0	<33.3	3	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis oblongella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.	<8.6					1	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex					<33.3	1	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.		<15.0	<12.6			2	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina				<12.0		1	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria construens						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria montana						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria vaucheriae	<8.6	1,392.0	784.0	1,306.2	774.9	5	0.0	1392.0	851.4	784.0	555.5	248.4
		Fragilaria spp.	34.4	3,124.1	392.0	1,679.4	1,808.1	5	34.4	3124.1	1407.6	1679.4	1234.7	552.2
		Frustulia rhomboides						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name	W4	Genera and Species	Replicate Number and Area Sampled (cm²)											
Date	8/15/2007													
Phylum	Order		1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Gomphonema acuminatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	1,750.0	22,761.3	10,941.7	3,947.9	4,649.4	5	1750.0	22761.3	8810.1	4649.4	8514.4	3807.7
		Gomphonema subclavatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema spp.*	350.0	3,570.4	2,641.1	1,794.5	1,033.2	5	350.0	3570.4	1877.8	1794.5	1274.9	570.2
		Meridion circulare	34.4	2,436.0	100.8	192.0	133.2	5	34.4	2436.0	579.3	133.2	1039.5	464.9
		Navicula aurora						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala	8.6	120.0	25.2	24.0	266.4	5	8.6	266.4	88.8	25.2	108.6	48.6
		Navicula cryptonella			<12.6	24.0	<33.3	3	0.0	24.0	4.8	0.0	10.7	4.8
		Navicula lanceolata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula			<12.6			1	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa	<8.6	15.0	<12.6	<12.0	33.3	5	0.0	33.3	9.7	0.0	14.7	6.6
		Navicula rhyconcephala	<8.6	<15.0	<12.6	<12.0	<33.3	5	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula salinarum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.	<8.6	348.0	25.2	<12.0	333.0	5	0.0	348.0	141.2	25.2	182.3	81.5
		Neidium spp.	<8.6				<33.3	2	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp. ?		<15.0				1	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis					66.6	1	0.0	66.6	13.3	0.0	29.8	13.3
		Nitzschia dissipata		<15.0		24.0		2	0.0	24.0	4.8	0.0	10.7	4.8
		Nitzschia filiformis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea	17.2				199.8	2	0.0	199.8	43.4	0.0	87.7	39.2
		Nitzschia spp.	350.0	2,677.8	294.0	653.1	2,324.7	5	294.0	2677.8	1259.9	653.1	1148.2	513.5
		Pinnularia spp.	8.6	60.0		24.0	<33.3	4	0.0	60.0	18.5	8.6	25.2	11.3
		Rhopalodia gibba						0	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.	<8.6	<15.0		<12.0	<33.3	4	0.0	0.0	0.0	0.0	0.0	0.0
		Stenopterobia sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta	<8.6	<15.0		<12.0	<33.3	4	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra acus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	34.4	812.0	25.2	279.9	1,291.5	5	25.2	1291.5	488.6	279.9	550.9	246.4
		Synedra incisa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra ulna	<8.6	15.0	<12.6	<12.0	<33.3	5	0.0	15.0	3.0	0.0	6.7	3.0
		Synedra spp.		30.0		<12.0		2	0.0	30.0	6.0	0.0	13.4	6.0
		Tabellaria fenestrata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa			<12.6			1	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyta	Chlorococcales	Characium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.					<33.3	1	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Sphaerocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	Oedogonium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	Geminella sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Microspora sp.				<12.0		1	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata	464.4	1,710.0	1,234.8	168.0	9,923.4	5	168.0	9923.4	2700.1	1234.8	4083.9	1826.4
		Ulothrix spp.	636.4	1,260.0	579.6	312.0	2,997.0	5	312.0	2997.0	1157.0	636.4	1085.7	485.5
	Zygnematales	Closterium spp.		<15.0			<33.3	2	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Cylindrocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp						0	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	*Chromulina sp. ?*		46,547.2	686.0	373.2	2,841.3	4	0.0	46547.2	10089.5	686.0	20410.4	9127.8
		Chrysococcus sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus	<8.6	30.0	<12.6		<33.3	4	0.0	30.0	6.0	0.0	13.4	6.0
	Ochromonadales	*Dinobryon spp.*	8.6	30.0	50.4	<12.0	66.6	5	0.0	66.6	31.1	30.0	27.9	12.5
		Hyalobryon sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	*Tribonema spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tribonema sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	*Chamaesiphon spp.*	3,607.8	70,515.4	68,668.6	145,713.4	214,660.8	5	3607.8	214660.8	100633.2	70515.4	81205.4	36316.2
		Clastidium setigerum	70.0	348.0	98.0	93.3		4	0.0	348.0	121.9	93.3	132.3	59.2
	Chroococcales	*Aphanocapsa spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Aphanothece spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Merismopedia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	*Anabaena spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Anabaena / Nostoc spp.	<8.6					1	0.0	0.0	0.0	0.0	0.0	0.0
		Calothrix sp.?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tolypothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oscillatoriales	*Lyngbya spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Homoeothrix varians	4,970.0	301,698.8	359,189.6	340,955.0	562,490.8	5	4970.0	562490.8	313860.8	340955.0	200104.4	89489.4
		Homoeothrix sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.	<8.6	105.0	907.2	<12.0		4	0.0	907.2	202.4	0.0	396.6	177.4
		Oscillatoria sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Phormidium sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena catenata					<33.3	1	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena sp.					399.6	1	0.0	399.6	79.9	0.0	178.7	79.9
		Schizothrix sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrrophyta	Dinokontae	*Peridinium / Glenodinium sp.*			<12.6			1	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	*Audouinella sp.*	<8.6	480.0	1,612.8	1,008.0	8,658.0	5	0.0	8658.0	2351.8	1008.0	3576.1	1599.3

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	Cyclotella sp.		<51.0				1	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.	<112.1	<51.0	<79.8	<106.1	88.0	5	0.0	88.0	17.6	0.0	0.0	0.0
	Pennales	Achnanthes flexella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Achnanthes lanceolata	2,606.4	790.6	618.5	822.6	2,388.4	5	618.5	2606.4	1445.3	822.6	966.6	432.3
		Achnanthes minutissima	7,819.2	3,162.4	4,329.5	5,758.2	5,800.4	5	3162.4	7819.2	5373.9	5758.2	1752.9	783.9
		Achnanthes spp.	7,819.2	1,976.5	3,711.0	2,467.8	2,047.2	5	1976.5	7819.2	3604.3	2467.8	2456.8	1098.7
		Achnanthes sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphipleura pellucida						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora ovalis	<112.1	<51.0		<106.1	<44.0	4	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora sp.	<112.1		<79.8		44.0	3	0.0	44.0	8.8	0.0	19.7	8.8
		Anomoeoneis vitrea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa	<112.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.	672.6	<51.0	79.8	212.2	88.0	5	0.0	672.6	210.5	88.0	269.2	120.4
		Caloneis sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	30,089.7	50,206.2	111,869.4	72,804.2	32,820.0	5	30089.7	111869.4	59557.9	50206.2	33847.8	15137.2
		Cocconeis pediculus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula	448.4	<51.0	159.6	106.1	176.0	5	0.0	448.4	178.0	159.6	166.1	74.3
		Cymatopleura sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii	112.1				<44.0	2	0.0	112.1	22.4	0.0	50.1	22.4
		Cymbella cistula	896.8	102.0	798.0	848.8	352.0	5	102.0	896.8	599.5	798.0	353.1	157.9
		Cymbella cuspidata	<112.1				<44.0	2	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	3,475.2	2,767.1	6,185.0	4,935.6	2,388.4	5	2388.4	6185.0	3950.3	3475.2	1583.5	708.2
		Cymbella sinuata	224.2	<51.0	<79.8	<106.1		4	0.0	224.2	44.8	0.0	100.3	44.8
		Cymbella spp.	<112.1	102.0	159.6	106.1		4	0.0	159.6	73.5	102.0	70.9	31.7
		Denticula sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma heimale var. mesodon	11,294.4	7,115.4	14,225.5	20,565.0	7,847.6	5	7115.4	20565.0	12209.6	11294.4	5470.2	2446.3
		Diatoma heimale					<44.0	1	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.	<112.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.	224.2	51.0	159.6		88.0	4	0.0	224.2	104.6	88.0	88.6	39.6
		Didymosphenia geminata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis elliptica	112.1	<51.0	<79.8	<106.1	<44.0	5	0.0	112.1	22.4	0.0	0.0	0.0
		Diploneis oblongella				<106.1		1	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.	<112.1	<51.0	<79.8			3	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.	<112.1			<106.1	<44.0	3	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina	<112.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria construens	448.4				341.2	2	0.0	448.4	157.9	0.0	219.5	98.2
		Fragilaria montana			<79.8			1	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria vaucheriae	16,716.5	1,581.2	1,855.5	5,758.2	4,435.6	5	1581.2	16716.5	6069.4	4435.6	6205.4	2775.1
		Fragilaria spp.	33,433.0	1,581.2	4,329.5	6,580.8	4,435.6	5	1581.2	33433.0	10072.0	4435.6	13179.2	5893.9
		Frustulia rhomboides						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema acuminatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	6,081.6	408.0	2,234.4	4,935.6	2,047.2	5	408.0	6081.6	3141.4	2234.4	2310.6	1033.3
		Gomphonema subclavatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema spp.*	4,344.0	612.0	1,276.8	2,467.8	682.4	5	612.0	4344.0	1876.6	1276.8	1567.1	700.8
		Meridion circulare	6,081.6	918.0	2,553.6	6,580.8	3,412.0	5	918.0	6580.8	3909.2	3412.0	2392.1	1069.8

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Navicula aurora						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala	9,556.8	1,632.0	4,149.6	4,244.0	5,118.0	5	1632.0	9556.8	4940.1	4244.0	2889.6	1292.3
		Navicula cryptonella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula lanceolata	<112.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula					<44.0	1	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa	448.4	204.0		<106.1	88.0	4	0.0	448.4	148.1	88.0	187.6	83.9
		Navicula rhyconcephala						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula salinarum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.	5,212.8	790.6	1,855.5	3,290.4	1,706.0	5	790.6	5212.8	2571.1	1855.5	1726.7	772.2
		Neidium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia dissipata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia filiformis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia spp.	8,688.0	1,185.9	6,803.5	4,935.6	2,047.2	5	1185.9	8688.0	4732.0	4935.6	3153.0	1410.1
		Pinnularia spp.	672.6	102.0	<79.8	424.4	176.0	5	0.0	672.6	275.0	176.0	271.9	121.6
		Rhopalodia gibba						0	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Stenopterobia sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta	<112.1	<51.0		106.1	<44.0	4	0.0	106.1	21.2	0.0	47.4	21.2
		Surirella spp.			<79.8			1	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra acus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	12,163.2	9,882.5	12,370.0	18,097.2	19,692.0	5	9882.5	19692.0	14441.0	12370.0	4218.9	1886.8
		Synedra incisa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra ulna	<112.1	<51.0	<79.8	<106.1	<44.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra spp.				<106.1	<44.0	2	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria fenestrata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa				212.2		1	0.0	212.2	42.4	0.0	94.9	42.4
Chlorophyta	Chlorococcales	*Characium sp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Sphaerocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	*Oedogonium spp.*	<112.1		<79.8			2	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	*Geminella sp. ?*	672.6				176.0	2	0.0	672.6	169.7	0.0	291.3	130.3
		Microspora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Zygnematales	*Closterium spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.	<112.1			<106.1	<44.0	3	0.0	0.0	0.0	0.0	0.0	0.0
		Cylindrocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp						0	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	*Chromulina sp. ?*				<106.1	682.4	2	0.0	682.4	136.5	0.0	305.2	136.5
		Chrysococcus sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ochromonadales	*Dinobryon spp.*			<79.8			1	0.0	0.0	0.0	0.0	0.0	0.0
		Hyalobryon sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	*Tribonema spp.*		408.0	<79.8	636.6		3	0.0	636.6	208.9	0.0	297.3	132.9

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Tribonema sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	*Chamaesiphon spp.*	66,866.0	73,027.2	90,447.6	145,608.4	136,531.2	5	66866.0	145608.4	102496.1	90447.6	36401.0	16279.0
		Clastidium setigerum						0	0.0	0.0	0.0	0.0	0.0	0.0
	Chroococcales	*Aphanocapsa spp.*	20,851.2					1	0.0	20851.2	4170.2	0.0	9324.9	4170.2
		Aphanothece spp.	31,276.8					1	0.0	31276.8	6255.4	0.0	13987.4	6255.4
		Merismopedia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	*Anabaena spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Anabaena / Nostoc spp.	6,501.8	<51.0		1,697.6	2,992.0	4	0.0	6501.8	2238.3	1697.6	2695.3	1205.4
		Calothrix sp.?					308.0	1	0.0	308.0	61.6	0.0	137.7	61.6
		Tolypothrix spp.					352.0	1	0.0	352.0	70.4	0.0	157.4	70.4
	Oscillatoriales	*Lyngbya spp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Homoeothrix varians	2,273,444.0	1,281,018.8	1,180,579.2	3,146,407.7	1,546,478.4	5	1180579.2	3146407.7	1885585.6	1546478.4	824262.6	368621.4
		Homoeothrix sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.	60,816.0	13,835.5	261,822.0	28,791.0	95,834.4	5	13835.5	261822.0	92219.8	60816.0	99914.3	44683.0
		Oscillatoria sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Phormidium sp. ?	55,603.2	485,326.6	587,909.4	683,726.4	282,252.0	5	55603.2	683726.4	418963.5	485326.6	251876.4	112642.6
		Pseudanabaena catenata	20,851.2	1,185.9	7,422.0		5,800.4	4	0.0	20851.2	7051.9	5800.4	8310.6	3716.6
		Pseudanabaena sp.	50,390.4	5,534.2	14,844.0	18,097.2	6,824.0	5	5534.2	50390.4	19138.0	14844.0	18254.7	8163.7
		Schizothrix sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
Pyrrophyta	Dinokontae	*Peridinium / Glenodinium sp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	*Audouinella sp.*						0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name / Date / Phylum	W4 / 8/15/2007 / Order	Genera and Species	Replicate Number and Area Sampled (cm²) 1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	Cyclotella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.	<162.5	<31.0		<94.6		3	0.0	0.0	0.0	0.0	0.0	0.0
	Pennales	Achnanthes flexella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Achnanthes lanceolata	2,518.6	720.6	191.4	5,866.4	<3.1	5	0.0	5866.4	1859.4	720.6	2450.9	1096.1
		Achnanthes minutissima	18,889.5	1,921.6	1,148.4	10,266.2	12.4	5	12.4	18889.5	6447.6	1921.6	8052.3	3601.1
		Achnanthes spp.	10,074.4	1,201.0	382.8	8,799.6	18.6	5	18.6	10074.4	4095.3	1201.0	4915.8	2198.4
		Achnanthes sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphipleura pellucida						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora ovalis	162.5	31.0	12.3			3	0.0	162.5	41.2	12.3	69.0	30.9
		Amphora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Anomoeoneis vitrea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.	975.0	372.0	73.8	1,892.0		4	0.0	1892.0	662.6	372.0	787.3	352.1
		Caloneis sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	135,696.4	29,577.6	7,730.1	101,588.4	49.6	5	49.6	135696.4	54928.4	29577.6	60379.3	27002.5
		Cocconeis pediculus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula	1,300.0	186.0	98.4	1,135.2	<3.1	5	0.0	1300.0	543.9	186.0	621.2	277.8
		Cymatopleura sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis	<162.5					1	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii	<162.5	<31.0		<94.6		3	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cistula	92,079.7	4,323.6	478.5	28,219.0	3.1	5	3.1	92079.7	25020.8	4323.6	39254.6	17555.2
		Cymbella cuspidata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	10,074.4	960.8	49.2	2,270.4	<3.1	5	0.0	10074.4	2671.0	960.8	4239.8	1896.1
		Cymbella sinuata	975.0	62.0	98.4	1,135.2	6.2	5	6.2	1135.2	455.4	98.4	551.4	246.6
		Cymbella spp.		186.0	24.6	756.8		3	0.0	756.8	193.5	24.6	324.3	145.0
		Denticula sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma heimale var. mesodon	42,816.2	6,245.2	1,722.6	30,798.6	6.2	5	6.2	42816.2	16317.8	6245.2	19315.8	8638.3
		Diatoma heimale						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Didymosphenia geminata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis elliptica	<162.5	<31.0	<12.3	<94.6		4	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis oblongella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.				<94.6		1	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina	<162.5					1	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria construens			<12.3			1	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria montana				<94.6		1	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria vaucheriae	3,777.9	480.4	287.1	2,933.2		4	0.0	3777.9	1495.7	480.4	1732.3	774.7
		Fragilaria spp.	15,111.6	1,201.0	382.8	353,450.6	3.1	5	3.1	353450.6	74029.8	1201.0	156329.1	69912.5
		Frustulia rhomboides		<31.0				1	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name	W4	Genera and Species	Replicate Number and Area Sampled (cm^2)											
Date	8/15/2007													
Phylum	Order		1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Gomphonema acuminatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	34,001.1	14,788.8	3,312.9	17,599.2	86.8	5	86.8	34001.1	13957.8	14788.8	13429.5	6005.8
		Gomphonema subclavatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema spp.*	13,852.3	4,621.5	1,472.4	8,799.6	49.6	5	49.6	13852.3	5759.1	4621.5	5635.0	2520.0
		Meridion circulare	26,445.3	1,441.2	478.5	16,132.6	18.6	5	18.6	26445.3	8903.2	1441.2	11891.0	5317.8
		Navicula aurora						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala	28,963.9	3,603.0	1,052.7	27,865.4	3.1	5	3.1	28963.9	12297.6	3603.0	14776.0	6608.0
		Navicula cryptonella						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula lanceolata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa	162.5	<31.0		<94.6	<3.1	4	0.0	162.5	32.5	0.0	72.7	32.5
		Navicula rhyconcephala						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula salinarum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.	12,593.0	3,843.2	191.4	20,532.4		4	0.0	20532.4	7432.0	3843.2	8927.4	3992.5
		Neidium spp.				<94.6		1	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia dissipata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia filiformis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia spp.	7,555.8	3,843.2	765.6	19,065.8	6.2	5	6.2	19065.8	6247.3	3843.2	7759.0	3469.9
		Pinnularia spp.	1,625.0	124.0	73.8	2,270.4		4	0.0	2270.4	818.6	124.0	1056.6	472.5
		Rhopalodia gibba		<31.0				1	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.	<162.5	<31.0	<12.3	94.6		4	0.0	94.6	18.9	0.0	42.3	18.9
		Stenopterobia sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta	650.0	<31.0	24.6	1,135.2		4	0.0	1135.2	362.0	24.6	514.0	229.9
		Surirella spp.	<162.5	93.0	12.3	378.4		4	0.0	378.4	96.7	12.3	162.2	72.5
		Synedra acus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	96,926.0	6,005.0	2,201.1	30,798.6	6.2	5	6.2	96926.0	27187.4	6005.0	40891.1	18287.1
		Synedra incisa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra ulna	162.5	124.0	<12.3	<94.6		4	0.0	162.5	57.3	0.0	79.6	35.6
		Synedra spp.	<162.5	<31.0	<12.3			3	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria fenestrata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa						0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyta	Chlorococcales	Characium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.	<162.5					1	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Sphaerocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	Oedogonium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	Geminella sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Microspora sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata		310.0				1	0.0	310.0	62.0	0.0	138.6	62.0
		Ulothrix spp.	<162.5	434.0				2	0.0	434.0	86.8	0.0	194.1	86.8
	Zygnematales	Closterium spp.			<12.3			1	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.		<31.0		<94.6		2	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm^2)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Cylindrocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp		<31.0				1	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	Chromulina sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus	325.0					1	0.0	325.0	65.0	0.0	145.3	65.0
	Ochromonadales	Dinobryon spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hyalobryon sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	Tribonema spp.	<162.5	<31.0	110.7	1,892.0		4	0.0	1892.0	400.5	0.0	835.1	373.5
		Tribonema sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	Chamaesiphon spp.	184,159.4	9,243.0	23,926.5	26,398.8	4,600.0	5	4600.0	184159.4	49665.5	23926.5	75758.4	33880.2
		Clastidium setigerum						0	0.0	0.0	0.0	0.0	0.0	0.0
	Chroococcales	Aphanocapsa spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Aphanothece spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Merismopedia spp.	<162.5					1	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	Anabaena spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Anabaena / Nostoc spp.	12,025.0	19,936.6	541.2	4,540.8		4	0.0	19936.6	7408.7	4540.8	8493.2	3798.3
		Calothrix sp.?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tolypothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oscillatoriales	Lyngbya spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Homoeothrix varians	1,308,501.0	91,505.7	103,436.1	19,065.8	76,912.0	5	19065.8	1308501.0	319884.1	91505.7	553601.1	247578.0
		Homoeothrix sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.	198,698.3	2,418.0	<12.3	10,216.8		4	0.0	198698.3	42266.6	2418.0	87548.4	39152.8
		Oscillatoria sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Phormidium sp. ?	127,189.3	1,674.0	19,141.2		<3.1	4	0.0	127189.3	29600.9	1674.0	55148.1	24663.0
		Pseudanabaena catenata	402,242.9	57,306.6	6,625.8	30,798.6		4	0.0	402242.9	99394.8	30798.6	170791.7	76380.4
		Pseudanabaena sp.	1,415,119.6	131,250.6	25,398.9	778,844.4	105.4	5	105.4	1415119.6	470143.8	131250.6	616818.1	275849.4
		Schizothrix sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.		1,201.0				1	0.0	1201.0	240.2	0.0	537.1	240.2
Pyrrophyta	Dinokontae	Peridinium / Glenodinium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	Audouinella sp.	<162.5	<31.0				2	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	*Cyclotella sp.*						0	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Pennales	*Achnanthes flexella*	3,634.8	1,122.4	222.0	1,036.8	744.0	5	222.0	3634.8	1352.0	1036.8	1323.8	592.0
		Achnanthes lanceolata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Achnanthes minutissima	156,190.4	209,461.8	130,295.6	190,668.4	108,139.2	5	108139.2	209461.8	158951.1	156190.4	41737.1	18665.4
		Achnanthes spp.	53,617.6	43,188.0	64,043.6	61,838.4	38,819.2	5	38819.2	64043.6	52301.4	53617.6	11128.7	4976.9
		Achnanthes sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Amphipleura pellucida		<36.2	<36.2	<43.2	<46.5	4	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora ovalis	<39.1	<36.2	<36.2	<43.2	<46.5	5	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora sp.	<39.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		Anomoeoneis vitrea						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.	156.4	144.8	37.0	43.2	93.0	5	37.0	156.4	94.9	93.0	55.5	24.8
		Caloneis sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	5,149.3	4,209.0	2,869.0	1,674.0	6,845.7	5	1674.0	6845.7	4149.4	4209.0	2002.5	895.6
		Cocconeis pediculus						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula	39.1	144.8	74.0	172.8	186.0	5	39.1	186.0	123.3	144.8	64.0	28.6
		Cymatopleura sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii		<36.2	<36.2	<43.2		3	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cistula	78.2	36.2	37.0	43.2	93.0	5	36.2	93.0	57.5	43.2	26.3	11.8
		Cymbella cuspidata		<36.2		<43.2	<46.5	3	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	3,029.0	2,525.4	2,008.3	2,008.8	3,242.7	5	2008.3	3242.7	2562.8	2525.4	569.1	254.5
		Cymbella sinuata	605.8	841.8	860.7	259.2	279.0	5	259.2	860.7	569.3	605.8	291.9	130.6
		Cymbella spp.	312.8	362.0	296.0	432.0	279.0	5	279.0	432.0	336.4	312.8	61.8	27.6
		Denticula sp.		<36.2				1	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum	170,177.6	209,461.8	181,088.8	1,494,442.8	285,598.4	5	170177.6	1494442.8	468153.9	209461.8	575480.9	257362.9
		Diatoma heimale var. mesodon	156.4	36.2	74.0	<43.2	93.0	5	0.0	156.4	71.9	74.0	59.2	26.5
		Diatoma heimale						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.			<36.2			1	0.0	0.0	0.0	0.0	0.0	0.0
		Didymosphenia geminata		<36.2		<43.2		2	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis elliptica	<39.1	<36.2		<43.2		3	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis oblongella	<39.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.				<43.2	<46.5	2	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex						0	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.		<36.2				1	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.	<39.1	<36.2	<36.2	<43.2	<46.5	5	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina	156.4	181.0	<36.2		<46.5	4	0.0	181.0	67.5	0.0	92.8	41.5
		Fragilaria construens	78.2		74.0	<43.2		3	0.0	78.2	30.4	0.0	41.7	18.7
		Fragilaria montana						0	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria vaucheriae	5,828.0	3,239.1	3,312.6	3,682.8	7,206.0	5	3239.1	7206.0	4653.7	3682.8	1777.3	794.8
		Fragilaria spp.	18,649.6	9,717.3	12,146.2	4,687.2	7,926.6	5	4687.2	18649.6	10625.4	9717.3	5245.7	2346.0
		Frustulia rhomboides		<36.2				1	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Gomphonema acuminatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	9,324.8	7,557.9	8,833.6	5,356.8	11,529.6	5	5356.8	11529.6	8520.5	8833.6	2276.8	1018.2
		Gomphonema subclavatum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema spp.*	5,828.0	6,478.2	7,729.4	4,017.6	3,603.0	5	3603.0	7729.4	5531.2	5828.0	1719.4	769.0
		Meridion circulare	156.4	<36.2	37.0	43.2	46.5	5	0.0	156.4	56.6	43.2	58.8	26.3
		Navicula aurora						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala	234.6	724.0	222.0	432.0	186.0	5	186.0	724.0	359.7	234.6	225.1	100.7
		Navicula cryptonella				86.4		1	0.0	86.4	17.3	0.0	38.6	17.3
		Navicula lanceolata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa	156.4	144.8	<36.2	86.4	93.0	5	0.0	156.4	96.1	93.0	61.9	27.7
		Navicula rhyconcephala						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula salinarum						0	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.	1,514.5	2,244.8	1,434.5	3,348.0	2,161.8	5	1434.5	3348.0	2140.7	2161.8	768.1	343.5
		Neidium spp.			<36.2	<43.2		2	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia dissipata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia filiformis						0	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea	3,331.9	5,612.0	2,295.2	2,343.6	6,485.4	5	2295.2	6485.4	4013.6	3331.9	1928.2	862.3
		Nitzschia spp.	156.4	841.8	573.8	1,339.2	1,080.9	5	156.4	1339.2	798.4	841.8	457.4	204.5
		Pinnularia spp.	156.4	144.8	<36.2	172.8	186.0	5	0.0	186.0	132.0	156.4	75.4	33.7
		Rhopalodia gibba		<36.2		<43.2		2	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.	39.1	<36.2	<36.2	<43.2	<46.5	5	0.0	39.1	7.8	0.0	17.5	7.8
		Stenopterobia sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta	<39.1	<36.2	37.0	<43.2	<46.5	5	0.0	37.0	7.4	0.0	16.5	7.4
		Surirella spp.	<39.1				<46.5	2	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra acus		<36.2				1	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	41,961.6	28,072.2	18,771.4	27,054.3	27,728.0	5	18771.4	41961.6	28717.5	27728.0	8344.1	3731.6
		Synedra incisa						0	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra ulna	1,564.0	1,592.8	740.0	345.6	2,325.0	5	345.6	2325.0	1313.5	1564.0	779.4	348.5
		Synedra spp.	860.2	1,683.6	1,147.6	345.6	1,080.9	5	345.6	1683.6	1023.6	1080.9	484.9	216.9
		Tabellaria fenestrata						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa		<36.2	<36.2	<43.2	<46.5	4	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyta	Chlorococcales	Characium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Sphaerocystis sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	Oedogonium spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	Geminella sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Microspora sp.	<39.1	<36.2			<46.5	3	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata	<39.1	1,954.8	518.0	<43.2	930.0	5	0.0	1954.8	680.6	518.0	812.2	363.2
		Ulothrix spp.	<39.1		222.0	86.4	93.0	4	0.0	222.0	80.3	86.4	91.1	40.7
	Zygnematales	Closterium spp.	<39.1		<36.2	<43.2		3	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.		<36.2	<36.2			2	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name	W4	Genera and Species	Replicate Number and Area Sampled (cm^2)											
Date	8/15/2007													
Phylum	Order		1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Cylindrocystis sp.	<39.1					1	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp						0	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	Chromulina sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus						0	0.0	0.0	0.0	0.0	0.0	0.0
	Ochromonadales	Dinobryon spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hyalobryon sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	Tribonema spp.			<36.2	<43.2		2	0.0	0.0	0.0	0.0	0.0	0.0
		Tribonema sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	Chamaesiphon spp.			860.7	669.6	3,603.0	3	0.0	3603.0	1026.7	669.6	1491.7	667.1
		Clastidium setigerum	16,318.4	17,275.2	41,959.6	36,072.4	15,250.4	5	15250.4	41959.6	25375.2	17275.2	12645.4	5655.2
	Chroococcales	Aphanocapsa spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Aphanothece spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Merismopedia spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	Anabaena spp.		<36.2				1	0.0	0.0	0.0	0.0	0.0	0.0
		Anabaena / Nostoc spp.				<43.2		1	0.0	0.0	0.0	0.0	0.0	0.0
		Calothrix sp.?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Tolypothrix spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
	Oscillatoriales	Lyngbya spp.	92,990.3	868.6	592.0	1,036.8	4,278.0	5	592.0	92990.3	19953.1	1036.8	40856.6	18271.6
		Homoeothrix varians	132,878.4	138,201.6	146,858.6	168,767.3	163,595.2	5	132878.4	168767.3	150060.2	146858.6	15646.4	6997.3
		Homoeothrix sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.					<46.5	1	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.						0	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Phormidium sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena catenata	148,031.2	36,709.8	17,787.8	9,374.4	36,030.0	5	9374.4	148031.2	49586.6	36030.0	56278.6	25168.5
		Pseudanabaena sp.	15,145.0	7,557.9			<46.5	3	0.0	15145.0	4540.6	0.0	6771.4	3028.3
		Schizothrix sp. ?						0	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.		941.2	444.0		1,209.0	3	0.0	1209.0	518.8	444.0	547.4	244.8
Pyrrophyta	Dinokontae	Peridinium / Glenodinium sp.						0	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	Audouinella sp.			<36.2		<46.5	2	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
Bacillariophycae	Centrales	Cyclotella sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Melosira sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
	Pennales	Achnanthes flexella	130.0	0.0	0.0	<82.3	0.0	5	0.0	130.0	26.0	0.0	58.1	26.0
		Achnanthes lanceolata	0.0	0.0	0.0	329.2	<2.0	5	0.0	329.2	65.8	0.0	147.2	65.8
		Achnanthes minutissima	151,203.0	10.2	112.0	134,959.0	61.6	5	10.2	151203.0	57269.2	112.0	78545.4	35126.6
		Achnanthes spp.	15,508.0	5.1	32.0	17,176.6	77.0	5	5.1	17176.6	6559.7	77.0	8949.7	4002.4
		Achnanthes sp. ?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Amphipleura pellucida	<65.0	0.0	0.0	<82.3	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora ovalis	<65.0	0.0	0.0	<82.3	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Amphora sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Anomoeoneis vitrea	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis ventricosa	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Caloneis spp.	0.0	0.0	0.0	<82.3	0.0	5	0.0	130.0	26.0	0.0	58.1	26.0
		Caloneis sp. ?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Ceratoneis arcus	17,446.5	15.3	12.0	34,353.2	446.6	5	12.0	34353.2	10454.7	446.6	15315.2	6849.1
		Cocconeis pediculus	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Cocconeis placentula	390.0	15.3	2.0	493.8	16.0	5	2.0	493.8	183.4	16.0	238.9	106.8
		Cymatopleura sp.	0.0	0.0	0.0	0.0	<2.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella affinis	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cesatii	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella cistula	260.0	<5.1		329.2	<2.0	5	0.0	329.2	117.8	0.0	163.2	73.0
		Cymbella cuspidata	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Cymbella minuta	5,541.8	15.3	16.0	2,550.8	72.0	5	15.3	5541.8	1639.2	72.0	2438.7	1090.6
		Cymbella sinuata	650.0	10.2	24.0	1,275.4	107.8	5	10.2	1275.4	413.5	107.8	549.2	245.6
		Cymbella spp.	260.0	<5.1	0.0	<82.3	<2.0	5	0.0	260.0	52.0	0.0	116.3	52.0
		Denticula sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Denticula sp. ?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma elongatum	124,064.0	10.2	16.0	80,975.4	277.2	5	10.2	124064.0	41068.6	277.2	58128.8	25996.0
		Diatoma heimale var. mesodon	260.0	<5.1	0.0	493.8	2.0	5	0.0	493.8	151.2	2.0	222.0	99.3
		Diatoma heimale	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Diatoma sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Diatomella sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Didymosphenia geminata	130.0	0.0	0.0	329.2	0.0	5	0.0	329.2	91.8	0.0	144.1	64.5
		Diploneis elliptica	0.0	0.0	0.0	<82.3	<2.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis oblongella	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Diploneis sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sorex	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Epithemia sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Eunotia spp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria capucina	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria construens	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria montana	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Fragilaria vaucheriae	7,053.2	20.4	8.0	8,290.1	20.0	5	8.0	8290.1	3078.3	20.4	4215.8	1885.4
		Fragilaria spp.	4,030.4	10.2	0.0	3,188.5	20.0	5	0.0	4030.4	1449.8	20.0	1993.8	891.7
		Frustulia rhomboides	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name	W4	Genera and Species	Replicate Number and Area Sampled (cm²)											
Date	8/15/2007													
Phylum	Order		1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Gomphonema acuminatum	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema angustatum/parvulum	8,564.6	40.8	183.6	6,377.0	592.0	5	40.8	8564.6	3151.6	592.0	4023.1	1799.2
		Gomphonema subclavatum	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Gomphonema spp.*	4,534.2	35.7	336.6	7,014.7	651.2	5	35.7	7014.7	2514.5	651.2	3110.1	1390.9
		Meridion circulare	65.0	0.0	0.0	82.3	8.0	5	0.0	82.3	31.1	8.0	39.5	17.7
		Navicula aurora	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula cryptocephala	650.0	10.2	<2.0	658.4	<2.0	5	0.0	658.4	263.7	10.2	356.5	159.4
		Navicula cryptonella	130.0	0.0	0.0	164.6	<2.0	5	0.0	164.6	58.9	0.0	81.6	36.5
		Navicula lanceolata	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula pupula	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula radiosa	130.0	0.0	0.0	82.3	<2.0	5	0.0	130.0	42.5	0.0	60.5	27.1
		Navicula rhyconcephala	<65.0	0.0	0.0	<82.3	<2.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula salinarum	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Navicula spp.	3,526.6	15.3	<2.0	1,275.4	4.0	5	0.0	3526.6	964.3	15.3	1534.2	686.1
		Neidium spp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Neidium spp. ?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia acicularis	130.0	0.0	0.0	0.0	0.0	5	0.0	130.0	26.0	0.0	58.1	26.0
		Nitzschia dissipata	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia filiformis	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Nitzschia palea	130.0	0.0	0.0	493.8	8.0	5	0.0	493.8	126.4	8.0	212.7	95.1
		Nitzschia spp.	5,038.0	5.1	2.0	3,826.2	46.2	5	2.0	5038.0	1783.5	46.2	2455.6	1098.2
		Pinnularia spp.	<65.0	<5.1	0.0	<82.3	<2.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Rhopalodia gibba	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Stauroneis spp.	<65.0	0.0	0.0	<82.3	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Stenopterobia sp. ?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella angusta	<65.0	0.0	0.0	<82.3	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Surirella spp.	0.0	0.0	0.0	<82.3	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra acus	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra cf. filiformis	13,602.6	5.1	8.0	14,667.1	61.6	5	5.1	14667.1	5668.9	61.6	7737.5	3460.3
		Synedra incisa	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Synedra ulna	21,323.5	0.0	0.0	10,205.2	104.0	5	0.0	21323.5	6326.5	104.0	9470.0	4235.1
		Synedra spp.	2,015.2	0.0	0.0	1,275.4	0.0	5	0.0	2015.2	658.1	0.0	938.4	419.6
		Tabellaria fenestrata	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Tabellaria flocculosa	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
Chlorophyta	Chlorococcales	Characium sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Oocystis spp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Selanastrum sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Sphaerocystis sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
	Oedogoniales	Oedogonium spp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
	Ulothricales	Geminella sp. ?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Microspora sp.	0.0	0.0	0.0	<82.3	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Ulothrix zonata	57,937.0	122.4	24.0	284,099.6	84.0	5	24.0	284099.6	68453.4	122.4	123125.9	55063.6
		Ulothrix spp.	13,098.8	<5.1	0.0	15,143.2	60.0	5	0.0	15143.2	5660.4	60.0	7757.2	3469.1
	Zygnematales	Closterium spp.	<65.0	0.0	0.0	<82.3	<2.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Cosmarium spp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0

Appendix C – Periphyton
Appendix C6: Raw Data 2007

Site Name Date Phylum	W4 8/15/2007 Order	Genera and Species	Replicate Number and Area Sampled (cm²)											
			1 (24.12)	2 (24.12)	3 (24.12)	4 (24.12)	5 (24.12)	n	min	max	avg	med	sd	se
		Cylindrocystis sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Mougeotia spp	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
Chrysophyta	Chromulinales	Chromulina sp. ?	0.0	0.0	0.0	0.0	5,209.6	5	0.0	5209.6	1041.9	0.0	2329.8	1041.9
		Chrysococcus sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Chrysococcus sp. ?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrurus foetidus	<65.0	0.0	0.0	0.0	128.0	5	0.0	128.0	25.6	0.0	57.2	25.6
	Ochromonadales	Dinobryon spp.	0.0	0.0	<2.0	0.0	<2.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Hyalobryon sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudokephyrion sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
	Tribonematales	Tribonema spp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Tribonema sp. ?	<65.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
Cyanophyta	Chamaesiphonales	Chamaesiphon spp.	701,737.0	916.8	2,356.0	463,768.2	1,539.2	5	916.8	701737.0	234063.4	2356.0	329240.1	147240.6
		Clastidium setigerum	93,048.0	0.0	153.0	53,983.6	0.0	5	0.0	93048.0	29436.9	153.0	42542.7	19025.7
	Chroococcales	Aphanocapsa spp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Aphanothece spp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Merismopedia spp.	0.0	0.0	0.0	0.0	<2.0	5	0.0	0.0	0.0	0.0	0.0	0.0
	Nostocales	Anabaena spp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Anabaena / Nostoc spp.	<65.0	0.0	0.0	0.0	<2.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Calothrix sp.?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Tolypothrix spp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
	Oscillatoriales	Lyngbya spp.	12,091.2	0.0	0.0	0.0	0.0	5	0.0	12091.2	2418.2	0.0	5407.3	2418.2
		Homoeothrix varians	3,047,322.0	16,808.0	1,774.8	1,963,040.0	8,761.6	5	1774.8	3047322.0	1007541.3	16808.0	1419891.1	634994.6
		Homoeothrix sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Hydrocoleum sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Oscillatoria spp.	0.0	78,233.6	<2.0	1,646.0	<2.0	5	0.0	78233.6	15975.9	0.0	34810.4	15567.7
		Oscillatoria sp. ?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Phormidium sp. ?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Pseudanabaena catenata	10,579.8	0.0	0.0	29,971.9	248.0	5	0.0	29971.9	8159.9	248.0	13013.3	5819.7
		Pseudanabaena sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Schizothrix sp. ?	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
		Spirulina sp.	0.0	0.0	0.0	<82.3	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
Pyrrophyta	Dinokontae	Peridinium / Glenodinium sp.	0.0	0.0	0.0	0.0	0.0	5	0.0	0.0	0.0	0.0	0.0	0.0
Rhodophyta	Nemalionales	Audouinella sp.	49,372.4	0.0	0.0	9,876.0	0.0	5	0.0	49372.4	11849.7	0.0	21407.3	9573.6

APPENDIX D

Benthic Invertebrates

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APPENDIX D – BENTHIC INVERTEBRATES

Appendix D1: Site Characteristics

2007 Benthic Invertebrate Sampling Site Characteristics

Site	Date	Location	N	Comments
W22	15 Aug 2007	Upstream of Dublin Gulch	5	Water depth 5 to 10 cm Substrate predominantly cobble, gravel and fines
W4	15 Aug 2007	Downstream of Dublin Gulch	5	Water depth 5 to 10 cm Substrate predominantly cobble, gravel and fines
W5	12 Aug 2007	Upstream of Lynx Creek	5	Water depth 5 to 10 cm Substrate predominantly cobble and gravel with some fines
W23	11 Aug 2007	Downstream of Lynx Creek	5	Water depth 5 to 10 cm Substrate predominantly cobble, gravel and fines
W20	20 Aug 2007	Lower Bawn Boy Gulch	5	Large boulders, few riffles, fast water No samples taken
W1	20 Aug 2007	Midway along Dublin Gulch	5	Water depth 5 to 10 cm Substrate included boulder, cobble, gravel and fines
W21	16 Aug 2007	Lower Dublin Gulch	5	Water depth 5 to 10 cm Substrate included boulder, cobble, gravel and fines
W9	18 Aug 2007	Lower Eagle Pup	5	Water depth 5 to 10 cm Substrate predominantly cobble, gravel and fines
W10	18 Aug 2007	Lower Stuttle Gulch	5	Very low water levels (under 5 cm) Substrate predominantly cobble, gravel and fines
W13	12 Aug 2007	Upper Lynx Creek	5	Water depth 10 to 20 cm Substrate predominantly cobble and gravel with some boulders and fines
W6	13 Aug 2007	Lower Lynx Creek	5	Water depth 5 to 10 cm Substrate predominantly cobble and gravel with some fines

2009 Benthic Invertebrate Sampling Site Characteristics

Site	Date	Location	N	Comments
W22	14 Sep 2009	Upstream of Dublin Gulch	5	Water depth 10 to 20 cm Substrate predominantly cobble, gravel and fines
W26	14 Sep 2009	Stewart Gulch	5	Water depth 5 to 10 cm Substrate predominantly cobble, gravel and fines
W5	14 Sep 2009	Upstream of Lynx Creek	5	Water depth 10 to 20 cm Substrate predominantly cobble and gravel with some fines
W1	14 Sep 2009	Midway along Dublin Gulch	5	Water depth 5 to 15 cm Substrate included boulder, cobble, gravel and fines
W21	14 Sep 2009	Lower Dublin Gulch	5	Water depth 5 to 15 cm Substrate included boulder, cobble, gravel and fines
W27	14 Sep 2009	Eagle Creek	5	Water depth 5 to 10 cm Substrate predominantly gravel and fines
W29	14 Sep 2009	Downstream of Platinum Gulch	5	Water depth 10 to 20 cm Substrate predominantly cobble, gravel and fines

2010 Benthic Invertebrate Sampling Site Characteristics

Site	Date	Location	N	Comments
W22	18 Aug 2010	upstream of Dublin Gulch	5	Water depth 15 to 25 cm Substrate predominantly cobble, gravel and fines
W29	18 Aug 2010	downstream of Platinum Gulch	5	Water depth 15 to 25 cm Substrate predominantly cobble, gravel and fines
W5	18 Aug 2010	upstream of Lynx Creek	5	Water depth 15 to 25 cm Substrate predominantly cobble and gravel with some fines
W23	18 Aug 2010	downstream of Lynx Creek	5	Water depth 15 to 25 cm Substrate predominantly cobble, gravel and fines
W27	18 Aug 2010	Eagle Creek	5	Water depth 5 to 10 cm Substrate predominantly gravel and fines
W1	18 Aug 2010	midway along Dublin Gulch	5	Water depth 10 to 20 cm Substrate included boulder, cobble, gravel and fines
W21	18 Aug 2010	lower Dublin Gulch	5	Water depth 10 to 20 cm Substrate included boulder, cobble, gravel and fines

Dublin Gulch Benthic Invertebrate Methods – Cordillera Consulting Sue Salter, Summerland,BC

The benthic invertebrate samples collected by Jacques-Whitford Axys were received by Cordillera Consulting in the fall of 2007 for processing. A hold work order was placed on the project and the samples were stored by Cordillera Consulting until the summer of 2009 when the work was given the go ahead to proceed.

The samples were rinsed and elutriated to remove formalin and sand and gravel. The sand and gravel was examined for trichopterans cases and molluscs before being discarded. The samples were sieved and fractionated with a 1 mm and a 500 micron sieve to remove smaller debris and organisms. The two fractions were labelled and stored in two separate plastic jars.

Each sample fraction was examined to determine total numbers and need for subsampling. Most of the samples in this project were sorted in their entirety except for 9 samples. Those fractions were subsampled using an area method within an 8 inch sieve. The sample was evenly distributed within an 8 inch sieve by immersing into a basin of water and stirring the sample 10 times in figure 8's. The sample then settles evenly as the sieve is raised through the water column. A quarter size template is positioned over the sieve to mark off one quarter. The subsample is removed completely and then sorted. A minimum number of 300 was used as a guideline for the sorting process.

The subsample sizes and numbers counted are as follows:

Sample Name		Subsample	# organisms
W9-1	Fine	1/4	254
	Course	all	80
W9-2	Fine	1/4	295
	Course	all	59
W9-3	Fine	1/4	240
	Course	all	44
W9-4	Fine	1/4	183
	Course	all	27
W9-5	Fine	1/2	232
	Course	all	27
W10-3	Fine	1/2	235
	Course	all	25
W10-4	Fine	1/2	348
	Course	all	82
W13-4	Fine	1/4	183
	Course	1/5	106
W21-4	Fine	1/2	260
	Course	all	144

Sorting efficiency was measured by resorting 5 of the samples (10 %). The sorting efficiency was 90% or greater in the five resorted samples.

The invertebrates were stored in vials with 80% ethanol as preservative. The taxonomist identified the invertebrates using the following texts:

Clifford, Hugh F. 1991. Aquatic Invertebrates of Alberta. University of Alberta Press Edmonton, Alberta.

Epler, John. 2001 The Larval Chironomids of North and South Carolina. http://home.earthlink.net/~johnepler/

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Jacobus, Luke and Pat Randolph. 2005. Northwest Ephemeroptera Nymphs. Manual from Northwest Biological Assessment Working Group. Moscow Idaho 2005. Not Published.

Kathman,R.D., R.O. Brinkhurst. 1999. Guide to the Freshwater Oligochaetes of North America. Aquatic Resources Center, College Grove, Tennessee.

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Westfall, Minter J. Jr. and May, Michael L. 1996. Damselflies of North America. Scientific Publishers, Gainesville, FL.

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Oliver, Donald R. and Mary E. Roussel. 1983. The Insects and Arachnids of Canada Part 11. The Genera of larval midges of Canada. Biosystematics Research Institute. Ottawa, Ontario. Research Branch, Agriculture Canada. Publication 1746.

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Thorpe, J. H. and A. P. Covich [Eds.] 1991. Ecology and classification of North American freshwater invertebrates. Academic Press, San Diego.

Weiderholm, Torgny (Ed.) 1983. The larvae of Chironomidae (Diptera) of the Holartic region. Entomologica Scaninavica. Supplement No. 19.

http://albertson.edu/campus/community/museum/CorbiculaceaOfNorthAmerica-GLMackie/Sphaeriidae/SphaeriidaeIndex.htm

http://albertson.edu/campus/community/museum/CorbiculaceaOfNorthAmerica-GLMackie/CorbiculaceaIndex.htm

A reference collection has been complied of all taxa identified in the project.

1995	W1a	W1b	W1c	W2a	W2b	W2c	W3a	W3b	W3c	W4a	W4b	W4c	W5a	W5b	W5c	W6a	W6b
Order : Ephemeroptera		48	8		8											1	1
Family : Ameletidae																	
Ameletus sp.	2	50	4	4	4	3	1		8		4		4				
Family : Baetidae																	
Baetis intercalaris													11	3	3	1	
Baetis sp.	2	50	8	13	11	24	1		4	12	15	8	60	10	36	8	36
Family : Ephemerellidae																	
Ephemerella sp	27	192	40	20	1	48	1		5	2							44
Ephemerella coloradensis	2		2								1					2	
Ephemerella doddsi					10	17				7	16	9			1	11	11
Ephemerella grandis													1				
Family : Heptageniidae																	
Cinygmula sp.	102	405	289	106	287	213	5	9	20	13	24	17	4	4	2	135	196
Epeorus albertae	11	63	21	14	46	30		4	1	9	25	9			1	11	11
Rhithrogena sp.					4	1				1		1					
Order : Plecoptera	35	240	80	44	56	109	3	23	6	5	19	4	170	26	39	40	168
Family : Nemouridae																	
Zapada sp.	3	23	8	6	10	21		3	1	2	21	2	10		1	2	28
Family : Perlodidae																	
Isoperla sp.	7					3					9						
Megarcys sp.		1	2		1					1	2	1	1				1
Skwala sp.															1		
Family : Chloroperlidae																	
Sweltsa sp.	19	3	4	9	10	9	10	2	14	3	1		1			21	12
Utaperla sp.						9						1					
Family : Capniidae																	
Capnia sp.	24	144	268	48	20	24	1	30	59	43	146	34	50	35	32	126	296
Family : Taeniopterygidae																	
Podmosta sp.																	
Taenionema sp.	1				25	26				9	7	6	14	1	1	8	4
Order : Trichoptera		32														1	
Family : Rhyacophilidae																	
Rhyacophila (acropedes)(short)			1	2	3	11					2	2	1				
Rhyacophila vagrita (No)				2	2	3					1						
Rhyacophila (vao)(long br)				1		1					1						
Family : Glossosomatidae																	
Glossosoma sp.			4	11	17	30										1	
Family : Limniphilidae															1		
Ecclisomyia sp.																	
Order : Diptera																	
Family : Chironomidae	1	1		1	4	5	6	5			9	3	1		3	5	1
Subfamily : Chironominae																	
Subfamily : Orthocladiinae	40	1410	540	48	32	32	4	12	2	4	10	7	36	13	11	45	50
Cardiocladius sp.		7	39	4				1		1	1		10	2		5	65
Corynoneura sp.										1	1					1	4
Cricotopus sp.	8	67	28	47	56	105	53	18	5	13	44	22	84	37	40	29	140
Eukiefferiella sp.	17	16	8		4		13	5		2	11	3	9	6	2	25	52
Euryhapsis sp.		1										1					
Synorthocladius sp.		257	100	12	4	4	1		1	1	1				1		
Thiennemaniella sp.		48	8		4	5	1	5	1	4	4	2	4	1	2	4	4
Subfamily : Tanypodinae																	
Thiennemanimyia sp.	1													1			
Subfamily : Tanytarsini																	
Micropsectra sp.																	
Subfamily : Diamesinae																	

1995	W1a	W1b	W1c	W2a	W2b	W2c	W3a	W3b	W3c	W4a	W4b	W4c	W5a	W5b	W5c	W6a	W6b
Diamesa sp.	26	114	16				14	11	2	2	6	6	5			21	32
Family : Culcidae																1	
Family : Deuterophlebidae																	
Deuterophlebia sp.				1													
Family : Dolichopodidae											1						
Family : Ceratopogonidae																	
Palpomyia sp.	2	96	12	11	8	53	1			8	1	1	15	2			1
Culicoides sp.											1						
Family : Empididae																	
Chelifera sp.	1		1	2		9					1	1	4	3	2		
Clinocera sp.																	
Weidemannia sp.		1		17	18	17			1	1		1				1	
Family :Ephydridae																	
Notophila sp.																	
Family : Simuliidae																	
Simulium sp.																	
Prosimulium sp.								3									
Family : Psychodidae																	
Pericoma sp.				5	4												12
Family : Muscidae																	
Limnophora sp.	1	6									1						
Family : Tipulidae					1												
Dicranota sp.	2	19	16			4		1	1				2	1			8
Hexatoma sp.	2				1												
Osmosia sp.																	
Tipula sp.							1										
Order : Collembola																	
Hypogastrura sp.						1	1				1						
Isotomurus sp.	1			4				2	1	6	1	1					
Order : Copepoda																	
Calanoida									1								
Harpacticoida	3	16		12	4	27				1	4		8	2	4	24	16
Order : Ostracoda																	
Candona sp.																	
Cypria sp.				8													
Oligochaeta																	
Family : Enchytraeidae		16	4	1			6	1	20	10	8	5		2	1	4	
Family : Haplotaxidae																	
Haplotaxis gordioides																	
Family : Tubificidae	1				4	13	10	22	8	15	4	14		2	2	48	37
Family : Lumbriculidae	164	613	122	130	144	241	139	70	57	18	15	21	4	2		66	13
Kincaidiana hexatheca																1	
Phylum : Platyhelminthes																	
Turbellaria	1	3		4			1	2	5	2	1	1					
Phylum : Nemata	4	86	12	13	4	5		1	6	1	2	2	12	1	3	8	33
Phylum : Arachnidia	2		5	8		5				1		3		4	7	4	37
Family : Sperchonidae																	
Sperchon sp.		1	4	5	5					2	1		1		1		
Family : Dermoglyphidae																	
Neumannia sp.														5	4		
Family : Torrenticolidae																	
Torrenticola sp.	2		8			5					1			1			
TOTAL																	

1995	W6c	W7a	W7b	W7c	W8a	W8b	W8c	W9a	W9b	W9c	W11a	W11b	W11c	W12a	W12b	W12c
Order : Ephemeroptera	2															
Family : Ameletidae			8													
Ameletus sp.				4	20	118	21				135	58	34	20	81	9
Family : Baetidae																
Baetis intercalaris						2										
Baetis sp.	75	50	53	30	37	9	5			2	4	8	8	1	22	5
Family : Ephemerellidae																
Ephemerella sp	16	3	20	12												
Ephemerella coloradensis		1	1													
Ephemerella doddsi	24	60	57	52							1					
Ephemerella grandis																
Family : Heptageniidae																
Cinygmula sp.	123	25	111	110	461	75	82	4	4		69	137	82	58	128	35
Epeorus albertae	24	9	20	20	428	72	35	2						7	36	7
Rhithrogena sp.																
Order : Plecoptera	92	106	140	48		32	1	28	52	45	148	425	240	144	418	38
Family : Nemouridae																
Zapada sp.	27															
Family : Perlodidae																
Isoperla sp.	4		13				2	2								
Megarcys sp.	4	2	2	1	11		3					1	2			
Skwala sp.																
Family : Chloroperlidae																
Sweltsa sp.	11			5	99	13	31	2				1				
Utaperla sp.			1	4												
Family : Capniidae																
Capnia sp.	125	25	37	32	11	16	8	6	4	8	343	261	203	81	73	7
Family : Taeniopterygidae																
Podmosta sp.								3	1	12					3	
Taenionema sp.	15		17	1	40											
Order : Trichoptera															16	
Family : Rhyacophilidae																
Rhyacophila (acropedes)(short)		7	10	2												
Rhyacophila vagrita (No)			1													
Rhyacophila (vao)(long br)																
Family : Glossosomatidae																
Glossosoma sp.		1	7	10												
Family : Limniphilidae																
Ecclisomyia sp.					1	2										
Order : Diptera																
Family : Chironomidae	6	8	1	4	2		2	2	7	27	3	8	16	12	17	3
Subfamily : Chironominae																
Subfamily : Orthocladiinae	66	99	165	52	104	720	8	148	1264	863	61	4	24	1550	1650	540
Cardiocladius sp.	27		4		5	10	2			2				8		
Corynoneura sp.	2															
Cricotopus sp.	83	227	216	121	33	20	1	16	43	78	4	10	4	218	139	6
Eukiefferiella sp.	42	48	8	30	24	17	1	6	6	2					11	4
Euryhapsis sp.									3	9				7	3	1
Synorthocladius sp.			1	2	1		2	20	65	4			4	21	24	
Thiennemaniella sp.		24	34	8							4	9		8		
Subfamily : Tanypodinae																
Thiennemanimyia sp.																
Subfamily : Tanytarsini																
Micropsectra sp.				2							3					
Subfamily : Diamesinae																

1995	W6c	W7a	W7b	W7c	W8a	W8b	W8c	W9a	W9b	W9c	W11a	W11b	W11c	W12a	W12b	W12c
Diamesa sp.	17	8	8	4	2	9	2	12	7	69	7	10	76	20	27	101
Family : Culcidae																
Family : Deuterophlebidae																
Deuterophlebia sp.																
Family : Dolichopodidae																
Family : Ceratopogonidae																
Palpomyia sp.				42								24	9			
Culicoides sp.				2	1					1	1					1
Family : Empididae																
Chelifera sp.		56	16	3	10		1		8	10						
Clinocera sp.		1	1		2											
Weidemannia sp.	1		2	10	25											
Family :Ephydridae																
Notophila sp.			3													
Family : Simuliidae	5															
Simulium sp.			10							7		1				
Prosimulium sp.	5		1									8	1			2
Family : Psychodidae																
Pericoma sp.	3		2	2					1			1				
Family : Muscidae																
Limnophora sp.																
Family : Tipulidae																
Dicranota sp.	2		1	4							23	12	12			
Hexatoma sp.				1			1									
Osmosia sp.									1	1						
Tipula sp.																
Order : Collembola																
Hypogastrura sp.																
Isotomurus sp.																
Order : Copepoda																
Calanoida																
Harpacticoida	23															
Order : Ostracoda																
Candona sp.	2															
Cypria sp.																
Oligochaeta																
Family : Enchytraeidae	2	48	101	5												
Family : Haplotaxidae																
Haplotaxis gordioides		1		2												
Family : Tubificidae	60	16	149	53	51			3	8	21	1	23	22		113	10
Family : Lumbriculidae	68	302	567	148	113	7	31	75	66	95	112	72	176	1	274	92
Kincaidiana hexatheca	1															
Phylum : Platyhelminthes																
Turbellaria																
Phylum : Nemata	3															
Phylum : Arachnidia	2	8	12	20	32		3	2			12	4	4		1	4
Family : Sperchonidae																
Sperchon sp.		16		4	1		4									
Family : Dermoglyphidae																
Neumannia sp.	1			2												
Family : Torrenticolidae																
Torrenticola sp.																
TOTAL																

1995	1	2	3	4	5	6	7	8	9	11	13
Order : Ephemeroptera											
Family : Ameletidae	1	1	1	1	1		1	1		1	1
Family : Baetidae	1	1	1	1	1	1	1	1	1	1	1
Family : Ephemerellidae	1	1	1	1	1	1	1			1	
Family : Heptageniidae	1	1	1	1	1	1	1	1	1	1	1
Order : Plecoptera											
Family : Nemouridae	1	1	1	1	1	1					
Family : Perlodidae	1	1		1	1	1	1	1	1	1	
Family : Chloroperlidae	1	1	1	1	1	1	1	1	1	1	
Family : Capniidae	1	1	1	1	1	1	1	1	1	1	1
Family : Taeniopterygidae	1	1		1	1	1	1	1	1		1
Order : Trichoptera											
Family : Rhyacophilidae	1	1		1	1		1				
Family : Glossosomatidae	1	1				1	1				
Family : Limniphilidae					1			1		1	1
Order : Diptera											
Family : Chironomidae	1	1	1	1	1	1	1	1	1	1	1
Family :Ephydridae							1				
Family :Muscidae	1			1							
Family : Ceratopogonidae	1	1	1	1	1	1	1	1	1	1	1
Family : Empididae	1	1	1	1	1	1	1	1	1		
Family : Simuliidae			1			1	1		1	1	1
Family : Psychodidae		1				1	1		1	1	
Family : Tipulidae	1	1	1		1	1	1	1	1	1	
Order : Colembola	1	1	1	1							
Family : Isotomidae	1	1	1	1							
Family : Hypogastruridae		1	1	1							
Subclass : Copepoda	1	1	1	1	1	1					
Suborder : Hydracarina	1	1		1	1	1	1	1	1	1	1
Phylum : Platyhelminthes	1	1	1	1							
SubClass : Oligochaeta											
Family : Lumbriculidae	1	1	1	1	1	1	1	1	1	1	1
Family : Tubificidae	1	1	1	1	1	1	1	1	1	1	1
Family : Enchytraeidae	1	1	1	1	1	1	1				
Family : Haplotaxidae							1				
Phylum : Nemata	1	1	1	1	1	1					
TOTAL	**25**	**26**	**21**	**24**	**21**	**21**	**22**	**15**	**15**	**16**	**12**

1995	W1a	W1b	W1c	W2a	W2b	W2c	W3a	W3b	W3c	W4a	W4b	W4c
Family : Ameletidae	2	50	4	4	4	3	1		8		4	
Family : Baetidae	2	50	8	13	11	24	1	0	4	12	15	8
Family : Ephemerellidae	29	192	42	20	11	65	1	0	5	9	17	9
Family : Heptageniidae	113	468	310	120	337	244	5	13	21	23	49	27
Family : Nemouridae	3	23	8	6	10	21		3	1	2	21	2
Family : Perlodidae	7	1	2	0	1	3	0	0	0	1	11	1
Family : Chloroperlidae	19	3	4	9	10	18	10	2	14	3	1	1
Family : Capniidae	24	144	268	48	20	24	1	30	59	43	146	34
Family : Taeniopterygidae	1	0	0	0	25	26	0	0	0	9	7	6
Family : Rhyacophilidae	0	0	1	5	5	15	0	0	0	0	4	2
Family : Glossosomatidae			4	11	17	30						
Family : Limniphilidae												
Family : Chironomidae	92	1920	739	111	100	146	86	52	11	28	78	41
Family : Culcidae												
Family : Deuterophlebidae				1								
Family : Dolichopodidae											1	
Family : Ceratopogonidae	2	96	12	11	8	53	1	0	0	8	2	1
Family : Empididae	1	1	1	19	18	26	0	0	1	1	1	2
Family :Ephydridae												
Family : Simuliidae	0	0	0	0	0	0	0	3	0	0	0	0
Family : Psychodidae				5	4							
Family : Muscidae	1	6									1	
Family : Tipulidae	4	19	16	0	2	4	1	1	1	0	0	0
Family : Hypogastruridae						1	1				1	

Family : Isotomidae	1			4				2	1	6	1	1
Order : Calanoida									1			
Order : Harpacticoida	3	16		12	4	27				1	4	
Family : Candonidae												
Family : Cypridae				8								
Family : Enchytraeidae		16	4	1			6	1	20	10	8	5
Family : Haplotaxidae												
Family : Tubificidae	1				4	13	10	22	8	15	4	14
Family : Lumbriculidae	164	613	122	130	144	241	139	70	57	18	15	21
Phylum : Platyhelminthes	1	3		4			1	2	5	2	1	1
Phylum : Nemata	4	86	12	13	4	5		1	6	1	2	2
Phylum : Arachnidia	2		5	8		5				1		3
Family : Sperchonidae		1	4	5	5					2	1	
Family : Dermoglyphidae												
Family : Torrenticolidae	2		8			5					1	
TOTAL												

1995	W5a	W5b	W5c	W6a	W6b	W6c	W7a	W7b	W7c	W8a	W8b	W8c
Family : Ameletidae	4								4	20	118	21
Family : Baetidae	71	13	39	9	36	75	50	53	30	37	11	5
Family : Ephemerellidae	1	0	1	13	55	40	64	78	64	0	0	0
Family : Heptageniidae	4	4	3	146	207	147	34	131	130	889	147	117
Family : Nemouridae	10		1	2	28	27						
Family : Perlodidae	1	0	1	0	1	8	2	15	1	11	0	5
Family : Chloroperlidae	1	0	0	21	12	11	0	1	9	99	13	31
Family : Capniidae	50	35	32	126	296	125	25	37	32	11	16	8
Family : Taeniopterygidae	14	1	1	8	4	15	0	17	1	40	0	0
Family : Rhyacophilidae	1	0	0	0	0	0	7	11	2	0	0	0
Family : Glossosomatidae				1			1	7	10			
Family : Limniphilidae										1	2	
Family : Chironomidae	148	60	56	130	347	237	406	436	219	169	776	16
Family : Culcidae				1								
Family : Deuterophlebidae												
Family : Dolichopodidae												
Family : Ceratopogonidae	15	2	0	0	1	0	0	0	44	1	0	0
Family : Empididae	4	3	2	1	0	1	57	19	13	37	0	1
Family :Ephydridae								3				
Family : Simuliidae	0	0	0	0	0	10	0	11	0	0	0	0
Family : Psychodidae					12	3		2	2			
Family : Muscidae												
Family : Tipulidae	2	1	0	0	8	2	0	1	5	0	0	1
Family : Hypogastruridae												

Family : Isotomidae												
Order : Calanoida												
Order : Harpacticoida	8	2	4	24	16	23						
Family : Candonidae						2						
Family : Cypridae												
Family : Enchytraeidae		2	1	4		2	48	101	5			
Family : Haplotaxidae							1		2			
Family : Tubificidae		2	2	48	37	60	16	149	53	51		
Family : Lumbriculidae	4	2		67	13	69	302	567	148	113	7	31
Phylum : Platyhelminthes												
Phylum : Nemata	12	1	3	8	33	3						
Phylum : Arachnidia		4	7	4	37	2	8	12	20	32		3
Family : Sperchonidae	1		1				16		4	1		4
Family : Dermoglyphidae		5	4			1			2			
Family : Torrenticolidae		1										
TOTAL												

1995	W9a	W9b	W9c	W11a	W11b	W11c	W12a	W12b	W12c
Family : Ameletidae				135	58	34	20	81	9
Family : Baetidae	0	0	2	4	8	8	1	22	5
Family : Ephemerellidae	0	0	0	1	0	0	0	0	0
Family : Heptageniidae	6	4	0	69	137	82	65	164	42
Family : Nemouridae									
Family : Perlodidae	2	0	0	0	1	2	0	0	0
Family : Chloroperlidae	2	0	0	0	1	0	0	0	0
Family : Capniidae	6	4	8	343	261	203	81	73	7
Family : Taeniopterygidae	3	1	12	0	0	0	0	3	0
Family : Rhyacophilidae	0	0	0	0	0	0	0	0	0
Family : Glossosomatidae									
Family : Limniphilidae									
Family : Chironomidae	202	1388	1027	79	33	108	1832	1854	652
Family : Culcidae									
Family : Deuterophlebidae									
Family : Dolichopodidae									
Family : Ceratopogonidae	0	0	1	1	24	9	0	0	1
Family : Empididae	0	8	10	0	0	0	0	0	0
Family :Ephydridae									
Family : Simuliidae	0	0	7	0	9	1	0	0	2
Family : Psychodidae		1			1				
Family : Muscidae									
Family : Tipulidae	0	1	1	23	12	12	0	0	0
Family : Hypogastruridae									

Family : Isotomidae									
Order : Calanoida									
Order : Harpacticoida									
Family : Candonidae									
Family : Cypridae									
Family : Enchytraeidae									
Family : Haplotaxidae									
Family : Tubificidae	3	8	21	1	23	22		113	10
Family : Lumbriculidae	75	66	95	112	72	176	1	274	92
Phylum : Platyhelminthes									
Phylum : Nemata									
Phylum : Arachnidia	2			12	4	4		1	4
Family : Sperchonidae									
Family : Dermoglyphidae									
Family : Torrenticolidae									
TOTAL									

1995	W1a	W1b	W1c	n	min	max	avg	med	sd	se
Family : Ameletidae	2	50	4	3	2	50	18.7	4	27.2	15.7
Family : Baetidae	2	50	8	3	2	50	20.0	8	26.2	15.1
Family : Ephemerellidae	29	192	42	3	29	192	87.7	42	90.6	52.3
Family : Heptageniidae	113	468	310	3	113	468	297.0	310	177.9	102.7
Family : Nemouridae	3	23	8	3	3	23	11.3	8	10.4	6.0
Family : Perlodidae	7	1	2	3	1	7	3.3	2	3.2	1.9
Family : Chloroperlidae	19	3	4	3	3	19	8.7	4	9.0	5.2
Family : Capniidae	24	144	268	3	24	268	145.3	144	122.0	70.4
Family : Taeniopterygidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Rhyacophilidae	0	0	1	3	0	1	0.3	0	0.6	0.3
Family : Glossosomatidae	0	0	4	3	0	4	1.3	0	2.3	1.3
Family : Limniphilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chironomidae	92	1920	739	3	92	1920	917.0	739	926.9	535.2
Family : Culcidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Deuterophlebidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dolichopodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Ceratopogonidae	2	96	12	3	2	96	36.7	12	51.6	29.8
Family : Empididae	1	1	1	3	1	1	1.0	1	0.0	0.0
Family :Ephydridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Simuliidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Psychodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Muscidae	1	6	0	3	0	6	2.3	1	3.2	1.9
Family : Tipulidae	4	19	16	3	4	19	13.0	16	7.9	4.6
Family : Hypogastruridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Isotomidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Order : Calanoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Harpacticoida	3	16	0	3	0	16	6.3	3	8.5	4.9
Family : Candonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Cypridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Enchytraeidae	0	16	4	3	0	16	6.7	4	8.3	4.8
Family : Haplotaxidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tubificidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Lumbriculidae	164	613	122	3	122	613	299.7	164	272.2	157.1
Phylum : Platyhelminthes	1	3	0	3	0	3	1.3	1	1.5	0.9
Phylum : Nemata	4	86	12	3	4	86	34.0	12	45.2	26.1
Phylum : Arachnidia	2	0	5	3	0	5	2.3	2	2.5	1.5
Family : Sperchonidae	0	1	4	3	0	4	1.7	1	2.1	1.2
Family : Dermoglyphidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Torrenticolidae	2	0	8	3	0	8	3.3	2	4.2	2.4
Summary	**478**	**3708**	**1574**	**3**	**478**	**3708**	**1920.0**	**1574**	**1642.6**	**948.3**

1995	W2a	W2b	W2c	n	min	max	avg	med	sd	se
Family : Ameletidae	4	4	3	3	3	4	3.7	4	0.6	0.3
Family : Baetidae	13	11	24	3	11	24	16.0	13	7.0	4.0
Family : Ephemerellidae	20	11	65	3	11	65	32.0	20	28.9	16.7
Family : Heptageniidae	120	337	244	3	120	337	233.7	244	108.9	62.9
Family : Nemouridae	6	10	21	3	6	21	12.3	10	7.8	4.5
Family : Perlodidae	0	1	3	3	0	3	1.3	1	1.5	0.9
Family : Chloroperlidae	9	10	18	3	9	18	12.3	10	4.9	2.8
Family : Capniidae	48	20	24	3	20	48	30.7	24	15.1	8.7
Family : Taeniopterygidae	0	25	26	3	0	26	17.0	25	14.7	8.5
Family : Rhyacophilidae	5	5	15	3	5	15	8.3	5	5.8	3.3
Family : Glossosomatidae	11	17	30	3	11	30	19.3	17	9.7	5.6
Family : Limniphilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chironomidae	111	100	146	3	100	146	119.0	111	24.0	13.9
Family : Culcidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Deuterophlebidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Dolichopodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Ceratopogonidae	11	8	53	3	8	53	24.0	11	25.2	14.5
Family : Empididae	19	18	26	3	18	26	21.0	19	4.4	2.5
Family :Ephydridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Simuliidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Psychodidae	5	4	0	3	0	5	3.0	4	2.6	1.5
Family : Muscidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tipulidae	0	2	4	3	0	4	2.0	2	2.0	1.2
Family : Hypogastruridae	0	0	1	3	0	1	0.3	0	0.6	0.3
Family : Isotomidae	4	0	0	3	0	4	1.3	0	2.3	1.3
Order : Calanoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Harpacticoida	12	4	27	3	4	27	14.3	12	11.7	6.7
Family : Candonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Cypridae	8	0	0	3	0	8	2.7	0	4.6	2.7
Family : Enchytraeidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Haplotaxidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tubificidae	0	4	13	3	0	13	5.7	4	6.7	3.8
Family : Lumbriculidae	130	144	241	3	130	241	171.7	144	60.5	34.9
Phylum : Platyhelminthes	4	0	0	3	0	4	1.3	0	2.3	1.3
Phylum : Nemata	13	4	5	3	4	13	7.3	5	4.9	2.8
Phylum : Arachnidia	8	0	5	3	0	8	4.3	5	4.0	2.3
Family : Sperchonidae	5	5	0	3	0	5	3.3	5	2.9	1.7
Family : Dermoglyphidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Torrenticolidae	0	0	5	3	0	5	1.7	0	2.9	1.7
Summary	**568**	**744**	**999**	**3**	**568**	**999**	**770.3**	**744**	**216.7**	**125.1**

1995	W3a	W3b	W3c	n	min	max	avg	med	sd	se
Family : Ameletidae	1	0	8	3	0	8	3.0	1	4.4	2.5
Family : Baetidae	1	0	4	3	0	4	1.7	1	2.1	1.2
Family : Ephemerellidae	1	0	5	3	0	5	2.0	1	2.6	1.5
Family : Heptageniidae	5	13	21	3	5	21	13.0	13	8.0	4.6
Family : Nemouridae	0	3	1	3	0	3	1.3	1	1.5	0.9
Family : Perlodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chloroperlidae	10	2	14	3	2	14	8.7	10	6.1	3.5
Family : Capniidae	1	30	59	3	1	59	30.0	30	29.0	16.7
Family : Taeniopterygidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Rhyacophilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Glossosomatidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Limniphilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chironomidae	86	52	11	3	11	86	49.7	52	37.6	21.7
Family : Culcidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Deuterophlebidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dolichopodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Ceratopogonidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Empididae	0	0	1	3	0	1	0.3	0	0.6	0.3
Family :Ephydridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Simuliidae	0	3	0	3	0	3	1.0	0	1.7	1.0
Family : Psychodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Muscidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tipulidae	1	1	1	3	1	1	1.0	1	0.0	0.0
Family : Hypogastruridae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Isotomidae	0	2	1	3	0	2	1.0	1	1.0	0.6
Order : Calanoida	0	0	1	3	0	1	0.3	0	0.6	0.3
Order : Harpacticoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Candonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Cypridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Enchytraeidae	6	1	20	3	1	20	9.0	6	9.8	5.7
Family : Haplotaxidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tubificidae	10	22	8	3	8	22	13.3	10	7.6	4.4
Family : Lumbriculidae	139	70	57	3	57	139	88.7	70	44.1	25.4
Phylum : Platyhelminthes	1	2	5	3	1	5	2.7	2	2.1	1.2
Phylum : Nemata	0	1	6	3	0	6	2.3	1	3.2	1.9
Phylum : Arachnidia	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Sperchonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dermoglyphidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Torrenticolidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Summary	**264**	**202**	**223**	**3**	**202**	**264**	**229.7**	**223**	**31.5**	**18.2**

1995	W4a	W4b	W4c	n	min	max	avg	med	sd	se
Family : Ameletidae	0	4	0	3	0	4	1.3	0	2.3	1.3
Family : Baetidae	12	15	8	3	8	15	11.7	12	3.5	2.0
Family : Ephemerellidae	9	17	9	3	9	17	11.7	9	4.6	2.7
Family : Heptageniidae	23	49	27	3	23	49	33.0	27	14.0	8.1
Family : Nemouridae	2	21	2	3	2	21	8.3	2	11.0	6.3
Family : Perlodidae	1	11	1	3	1	11	4.3	1	5.8	3.3
Family : Chloroperlidae	3	1	1	3	1	3	1.7	1	1.2	0.7
Family : Capniidae	43	146	34	3	34	146	74.3	43	62.2	35.9
Family : Taeniopterygidae	9	7	6	3	6	9	7.3	7	1.5	0.9
Family : Rhyacophilidae	0	4	2	3	0	4	2.0	2	2.0	1.2
Family : Glossosomatidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Limniphilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chironomidae	28	78	41	3	28	78	49.0	41	25.9	15.0
Family : Culcidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Deuterophlebidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dolichopodidae	0	1	0	3	0	1	0.3	0	0.6	0.3
Family : Ceratopogonidae	8	2	1	3	1	8	3.7	2	3.8	2.2
Family : Empididae	1	1	2	3	1	2	1.3	1	0.6	0.3
Family :Ephydridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Simuliidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Psychodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Muscidae	0	1	0	3	0	1	0.3	0	0.6	0.3
Family : Tipulidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Hypogastruridae	0	1	0	3	0	1	0.3	0	0.6	0.3
Family : Isotomidae	6	1	1	3	1	6	2.7	1	2.9	1.7
Order : Calanoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Harpacticoida	1	4	0	3	0	4	1.7	1	2.1	1.2
Family : Candonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Cypridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Enchytraeidae	10	8	5	3	5	10	7.7	8	2.5	1.5
Family : Haplotaxidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tubificidae	15	4	14	3	4	15	11.0	14	6.1	3.5
Family : Lumbriculidae	18	15	21	3	15	21	18.0	18	3.0	1.7
Phylum : Platyhelminthes	2	1	1	3	1	2	1.3	1	0.6	0.3
Phylum : Nemata	1	2	2	3	1	2	1.7	2	0.6	0.3
Phylum : Arachnidia	1	0	3	3	0	3	1.3	1	1.5	0.9
Family : Sperchonidae	2	1	0	3	0	2	1.0	1	1.0	0.6
Family : Dermoglyphidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Torrenticolidae	0	1	0	3	0	1	0.3	0	0.6	0.3
Summary	**195**	**396**	**181**	**3**	**181**	**396**	**257.3**	**195**	**120.3**	**69.5**

1995	W5a	W5b	W5c	n	min	max	avg	med	sd	se
Family : Ameletidae	4	0	0	3	0	4	1.3	0	2.3	1.3
Family : Baetidae	71	13	39	3	13	71	41.0	39	29.1	16.8
Family : Ephemerellidae	1	0	1	3	0	1	0.7	1	0.6	0.3
Family : Heptageniidae	4	4	3	3	3	4	3.7	4	0.6	0.3
Family : Nemouridae	10	0	1	3	0	10	3.7	1	5.5	3.2
Family : Perlodidae	1	0	1	3	0	1	0.7	1	0.6	0.3
Family : Chloroperlidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Capniidae	50	35	32	3	32	50	39.0	35	9.6	5.6
Family : Taeniopterygidae	14	1	1	3	1	14	5.3	1	7.5	4.3
Family : Rhyacophilidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Glossosomatidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Limniphilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chironomidae	148	60	56	3	56	148	88.0	60	52.0	30.0
Family : Culcidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Deuterophlebidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dolichopodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Ceratopogonidae	15	2	0	3	0	15	5.7	2	8.1	4.7
Family : Empididae	4	3	2	3	2	4	3.0	3	1.0	0.6
Family :Ephydridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Simuliidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Psychodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Muscidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tipulidae	2	1	0	3	0	2	1.0	1	1.0	0.6
Family : Hypogastruridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Isotomidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Calanoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Harpacticoida	8	2	4	3	2	8	4.7	4	3.1	1.8
Family : Candonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Cypridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Enchytraeidae	0	2	1	3	0	2	1.0	1	1.0	0.6
Family : Haplotaxidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tubificidae	0	2	2	3	0	2	1.3	2	1.2	0.7
Family : Lumbriculidae	4	2	0	3	0	4	2.0	2	2.0	1.2
Phylum : Platyhelminthes	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Nemata	12	1	3	3	1	12	5.3	3	5.9	3.4
Phylum : Arachnidia	0	4	7	3	0	7	3.7	4	3.5	2.0
Family : Sperchonidae	1	0	1	3	0	1	0.7	1	0.6	0.3
Family : Dermoglyphidae	0	5	4	3	0	5	3.0	4	2.6	1.5
Family : Torrenticolidae	0	1	0	3	0	1	0.3	0	0.6	0.3
Summary	**351**	**138**	**158**	**3**	**138**	**351**	**215.7**	**158**	**117.6**	**67.9**

1995	W6a	W6b	W6c	n	min	max	avg	med	sd	se
Family : Ameletidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Baetidae	9	36	75	3	9	75	40.0	36	33.2	19.2
Family : Ephemerellidae	13	55	40	3	13	55	36.0	40	21.3	12.3
Family : Heptageniidae	146	207	147	3	146	207	166.7	147	34.9	20.2
Family : Nemouridae	2	28	27	3	2	28	19.0	27	14.7	8.5
Family : Perlodidae	0	1	8	3	0	8	3.0	1	4.4	2.5
Family : Chloroperlidae	21	12	11	3	11	21	14.7	12	5.5	3.2
Family : Capniidae	126	296	125	3	125	296	182.3	126	98.4	56.8
Family : Taeniopterygidae	8	4	15	3	4	15	9.0	8	5.6	3.2
Family : Rhyacophilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Glossosomatidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Limniphilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chironomidae	130	347	237	3	130	347	238.0	237	108.5	62.6
Family : Culcidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Deuterophlebidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dolichopodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Ceratopogonidae	0	1	0	3	0	1	0.3	0	0.6	0.3
Family : Empididae	1	0	1	3	0	1	0.7	1	0.6	0.3
Family :Ephydridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Simuliidae	0	0	10	3	0	10	3.3	0	5.8	3.3
Family : Psychodidae	0	12	3	3	0	12	5.0	3	6.2	3.6
Family : Muscidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tipulidae	0	8	2	3	0	8	3.3	2	4.2	2.4
Family : Hypogastruridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Isotomidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Calanoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Harpacticoida	24	16	23	3	16	24	21.0	23	4.4	2.5
Family : Candonidae	0	0	2	3	0	2	0.7	0	1.2	0.7
Family : Cypridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Enchytraeidae	4	0	2	3	0	4	2.0	2	2.0	1.2
Family : Haplotaxidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tubificidae	48	37	60	3	37	60	48.3	48	11.5	6.6
Family : Lumbriculidae	67	13	69	3	13	69	49.7	67	31.8	18.3
Phylum : Platyhelminthes	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Nemata	8	33	3	3	3	33	14.7	8	16.1	9.3
Phylum : Arachnidia	4	37	2	3	2	37	14.3	4	19.7	11.3
Family : Sperchonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dermoglyphidae	0	0	1	3	0	1	0.3	0	0.6	0.3
Family : Torrenticolidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Summary	**613**	**1143**	**863**	**3**	**613**	**1143**	**873.0**	**863**	**265.1**	**153.1**

1995	W7a	W7b	W7c	n	min	max	avg	med	sd	se
Family : Ameletidae	0	0	4	3	0	4	1.3	0	2.3	1.3
Family : Baetidae	50	53	30	3	30	53	44.3	50	12.5	7.2
Family : Ephemerellidae	64	78	64	3	64	78	68.7	64	8.1	4.7
Family : Heptageniidae	34	131	130	3	34	131	98.3	130	55.7	32.2
Family : Nemouridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Perlodidae	2	15	1	3	1	15	6.0	2	7.8	4.5
Family : Chloroperlidae	0	1	9	3	0	9	3.3	1	4.9	2.8
Family : Capniidae	25	37	32	3	25	37	31.3	32	6.0	3.5
Family : Taeniopterygidae	0	17	1	3	0	17	6.0	1	9.5	5.5
Family : Rhyacophilidae	7	11	2	3	2	11	6.7	7	4.5	2.6
Family : Glossosomatidae	1	7	10	3	1	10	6.0	7	4.6	2.6
Family : Limniphilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chironomidae	406	436	219	3	219	436	353.7	406	117.6	67.9
Family : Culcidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Deuterophlebidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dolichopodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Ceratopogonidae	0	0	44	3	0	44	14.7	0	25.4	14.7
Family : Empididae	57	19	13	3	13	57	29.7	19	23.9	13.8
Family :Ephydridae	0	3	0	3	0	3	1.0	0	1.7	1.0
Family : Simuliidae	0	11	0	3	0	11	3.7	0	6.4	3.7
Family : Psychodidae	0	2	2	3	0	2	1.3	2	1.2	0.7
Family : Muscidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tipulidae	0	1	5	3	0	5	2.0	1	2.6	1.5
Family : Hypogastruridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Isotomidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Calanoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Harpacticoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Candonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Cypridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Enchytraeidae	48	101	5	3	5	101	51.3	48	48.1	27.8
Family : Haplotaxidae	1	0	2	3	0	2	1.0	1	1.0	0.6
Family : Tubificidae	16	149	53	3	16	149	72.7	53	68.6	39.6
Family : Lumbriculidae	302	567	148	3	148	567	339.0	302	211.9	122.4
Phylum : Platyhelminthes	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Nemata	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Arachnidia	8	12	20	3	8	20	13.3	12	6.1	3.5
Family : Sperchonidae	16	0	4	3	0	16	6.7	4	8.3	4.8
Family : Dermoglyphidae	0	0	2	3	0	2	0.7	0	1.2	0.7
Family : Torrenticolidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Summary	**1037**	**1651**	**800**	**3**	**800**	**1651**	**1162.7**	**1037**	**439.2**	**253.6**

1995	W8a	W8b	W8c	n	min	max	avg	med	sd	se
Family : Ameletidae	20	118	21	3	20	118	53.0	21	56.3	32.5
Family : Baetidae	37	11	5	3	5	37	17.7	11	17.0	9.8
Family : Ephemerellidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Heptageniidae	889	147	117	3	117	889	384.3	147	437.3	252.5
Family : Nemouridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Perlodidae	11	0	5	3	0	11	5.3	5	5.5	3.2
Family : Chloroperlidae	99	13	31	3	13	99	47.7	31	45.4	26.2
Family : Capniidae	11	16	8	3	8	16	11.7	11	4.0	2.3
Family : Taeniopterygidae	40	0	0	3	0	40	13.3	0	23.1	13.3
Family : Rhyacophilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Glossosomatidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Limniphilidae	1	2	0	3	0	2	1.0	1	1.0	0.6
Family : Chironomidae	169	776	16	3	16	776	320.3	169	402.0	232.1
Family : Culcidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Deuterophlebidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dolichopodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Ceratopogonidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Empididae	37	0	1	3	0	37	12.7	1	21.1	12.2
Family :Ephydridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Simuliidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Psychodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Muscidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tipulidae	0	0	1	3	0	1	0.3	0	0.6	0.3
Family : Hypogastruridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Isotomidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Calanoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Harpacticoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Candonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Cypridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Enchytraeidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Haplotaxidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tubificidae	51	0	0	3	0	51	17.0	0	29.4	17.0
Family : Lumbriculidae	113	7	31	3	7	113	50.3	31	55.6	32.1
Phylum : Platyhelminthes	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Nemata	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Arachnidia	32	0	3	3	0	32	11.7	3	17.7	10.2
Family : Sperchonidae	1	0	4	3	0	4	1.7	1	2.1	1.2
Family : Dermoglyphidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Torrenticolidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Summary	**1512**	**1090**	**243**	**3**	**243**	**1512**	**948.3**	**1090**	**646.3**	**373.1**

1995	W9a	W9b	W9c	n	min	max	avg	med	sd	se
Family : Ameletidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Baetidae	0	0	2	3	0	2	0.7	0	1.2	0.7
Family : Ephemerellidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Heptageniidae	6	4	0	3	0	6	3.3	4	3.1	1.8
Family : Nemouridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Perlodidae	2	0	0	3	0	2	0.7	0	1.2	0.7
Family : Chloroperlidae	2	0	0	3	0	2	0.7	0	1.2	0.7
Family : Capniidae	6	4	8	3	4	8	6.0	6	2.0	1.2
Family : Taeniopterygidae	3	1	12	3	1	12	5.3	3	5.9	3.4
Family : Rhyacophilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Glossosomatidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Limniphilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chironomidae	202	1388	1027	3	202	1388	872.3	1027	607.9	351.0
Family : Culcidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Deuterophlebidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dolichopodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Ceratopogonidae	0	0	1	3	0	1	0.3	0	0.6	0.3
Family : Empididae	0	8	10	3	0	10	6.0	8	5.3	3.1
Family :Ephydridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Simuliidae	0	0	7	3	0	7	2.3	0	4.0	2.3
Family : Psychodidae	0	1	0	3	0	1	0.3	0	0.6	0.3
Family : Muscidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tipulidae	0	1	1	3	0	1	0.7	1	0.6	0.3
Family : Hypogastruridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Isotomidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Calanoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Harpacticoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Candonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Cypridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Enchytraeidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Haplotaxidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tubificidae	3	8	21	3	3	21	10.7	8	9.3	5.4
Family : Lumbriculidae	75	66	95	3	66	95	78.7	75	14.8	8.6
Phylum : Platyhelminthes	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Nemata	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Arachnidia	2	0	0	3	0	2	0.7	0	1.2	0.7
Family : Sperchonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dermoglyphidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Torrenticolidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Summary	**301**	**1481**	**1184**	**3**	**301**	**1481**	**988.7**	**1184**	**613.8**	**354.4**

1995	W11a	W11b	W11c	n	min	max	avg	med	sd	se
Family : Ameletidae	135	58	34	3	34	135	75.7	58	52.8	30.5
Family : Baetidae	4	8	8	3	4	8	6.7	8	2.3	1.3
Family : Ephemerellidae	1	0	0	3	0	1	0.3	0	0.6	0.3
Family : Heptageniidae	69	137	82	3	69	137	96.0	82	36.1	20.8
Family : Nemouridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Perlodidae	0	1	2	3	0	2	1.0	1	1.0	0.6
Family : Chloroperlidae	0	1	0	3	0	1	0.3	0	0.6	0.3
Family : Capniidae	343	261	203	3	203	343	269.0	261	70.3	40.6
Family : Taeniopterygidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Rhyacophilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Glossosomatidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Limniphilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chironomidae	79	33	108	3	33	108	73.3	79	37.8	21.8
Family : Culcidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Deuterophlebidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dolichopodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Ceratopogonidae	1	24	9	3	1	24	11.3	9	11.7	6.7
Family : Empididae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family :Ephydridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Simuliidae	0	9	1	3	0	9	3.3	1	4.9	2.8
Family : Psychodidae	0	1	0	3	0	1	0.3	0	0.6	0.3
Family : Muscidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tipulidae	23	12	12	3	12	23	15.7	12	6.4	3.7
Family : Hypogastruridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Isotomidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Calanoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Harpacticoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Candonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Cypridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Enchytraeidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Haplotaxidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tubificidae	1	23	22	3	1	23	15.3	22	12.4	7.2
Family : Lumbriculidae	112	72	176	3	72	176	120.0	112	52.5	30.3
Phylum : Platyhelminthes	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Nemata	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Arachnidia	12	4	4	3	4	12	6.7	4	4.6	2.7
Family : Sperchonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dermoglyphidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Torrenticolidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Summary	**780**	**644**	**661**	**3**	**644**	**780**	**695.0**	**661**	**74.1**	**42.8**

1995	W26a	W26b	W26c	n	min	max	avg	med	sd	se
Family : Ameletidae	20	81	9	3	9	81	36.7	20	38.8	22.4
Family : Baetidae	1	22	5	3	1	22	9.3	5	11.2	6.4
Family : Ephemerellidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Heptageniidae	65	164	42	3	42	164	90.3	65	64.8	37.4
Family : Nemouridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Perlodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chloroperlidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Capniidae	81	73	7	3	7	81	53.7	73	40.6	23.4
Family : Taeniopterygidae	0	3	0	3	0	3	1.0	0	1.7	1.0
Family : Rhyacophilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Glossosomatidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Limniphilidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Chironomidae	1832	1854	652	3	652	1854	1446.0	1832	687.7	397.1
Family : Culcidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Deuterophlebidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dolichopodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Ceratopogonidae	0	0	1	3	0	1	0.3	0	0.6	0.3
Family : Empididae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family :Ephydridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Simuliidae	0	0	2	3	0	2	0.7	0	1.2	0.7
Family : Psychodidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Muscidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tipulidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Hypogastruridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Isotomidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Calanoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Order : Harpacticoida	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Candonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Cypridae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Enchytraeidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Haplotaxidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Tubificidae	0	113	10	3	0	113	41.0	10	62.6	36.1
Family : Lumbriculidae	1	274	92	3	1	274	122.3	92	139.0	80.3
Phylum : Platyhelminthes	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Nemata	0	0	0	3	0	0	0.0	0	0.0	0.0
Phylum : Arachnidia	0	1	4	3	0	4	1.7	1	2.1	1.2
Family : Sperchonidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Dermoglyphidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Family : Torrenticolidae	0	0	0	3	0	0	0.0	0	0.0	0.0
Summary	**2000**	**2585**	**824**	**3**	**824**	**2585**	**1803.0**	**2000**	**896.9**	**517.8**

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Table 7.1
Benthic Invertebrate Samples

Sensitive organisms	B1a	B1b	B1c	B2a	B2b	B2c	B3a	B3b	B3c	B4a	B4b	B4c	B5a	B5b	B5c	B6a	B6b	B6c
Ephemeroptera unid J/D		48	8		8											1	1	2
Ameletus sp	2	50	4	4	4	3	1		8		4		4					
Baetis intercalaris													11	3	3	1		
Baetis sp	2	50	8	13	11	24	1		4	12	15	8	60	10	36	8	36	75
Cinygmula sp	102	405	289	106	287	213	5	9	20	13	24	17	4	4	2	135	196	123
Ephemerella sp	27	192	40	20	1	48	1		5	2							44	16
Ephemerella coloradensis	2		2								1					2		
Ephemerella doddsi					10	17				7	16	9	16	2	1	13	13	4
Ephemerella grandis													1					
Epeorus albertae	11	63	21	14	46	30		4	1	9	25	9			1	11	11	24
Rhithrogena sp					4	1				1		1						
Plecoptera Unid J/d	35	240	80	44	56	109	3	23	6	5	19	4	170	26	39	40	168	92
Capnia sp	24	144	268	48	20	24	1	30	59	43	146	34	50	35	32	126	296	125
Isoperla sp	7					3					9							4
Megarcys sp		1	2		1					1	2	1	1				1	4
Podmosta sp																		
Setvena sp																		
Skwala curvata															1			
Sweltsa sp	19	3	4	9	10	9	10	2	14	3	1		1			21	12	11
Taenionema sp	1				25	26				9	7	6	14	1	1	8	4	15
Utaperla sp						9						1						
Zapada sp	3	23	8	6	10	21		3	1	2	21	2	10		1	2	28	27
Trichoptera Unid J/D		32														1		
Glossosomatidae																		
Glossosoma sp			4	11	17	30										1		
Limnephilidae unid J/D															1			
Ecclisomyia sp																		
Onocosmoecus sp																		
Rhyacophilidae																		
Rhyacophila (acropedes)(Short)			1	2	3	11					2	2	1					
Rhyacophila vagrita(No)				2	2	3					1							
Rhyacophila (vao) (Long br)				1		1					1							
Facultative organisms																		
Diptera Unid L						2											4	
Diptera unid A						1					1			1				1
Ceratopogonidae																		
Culicoides sp											1							
Palpomyia sp	2	96	12	11	8	53	1			8	1	1	15	2			1	
Chironomidae adults											1	2	1					1
Chironomidae pupae	1	1		1	4	5	6	5			8	1			3	5	1	6
S.F. Chironominae unid J/D																		
S.F. Diamesinae																		
Diamesa sp	26	114	16				14	11	2	2	6	6	5			21	32	17
S.F. Orthocladiinae Unid J/D	40	1410	540	48	32	32	4	12	2	4	10	7	36	13	11	45	50	66
Cardiocladius sp		7	39	4				1		1	1		10	2		5	65	27
Corynoneura sp										1	1					1	4	2
Cricotopus sp	8	67	28	47	56	105	53	18	5	13	44	22	84	37	40	29	140	83
Eukiefferiella sp	17	16	8		4		13	5		2	11	3	9	6	2	25	52	42
Euryhapsis sp		1										1						
Synorthocladius sp		257	100	12	4	4	1		1	1	1				1			
Thienemanniella sp		48	8		4	5	1	5	1	4	4	2	4	1	2	4	4	
S.F. Tanypodinae																		
Thienemannimyia sp	1													1				
S.F. Tanytarsini	3	32	16	12	8	5		1			1					16	20	69
Micropsectra sp																		
Culicidae Unid A																1		
Deuterophlebiidae																		
Deuterophlebia sp				1														
Dolichopodidae																		
(Dolichopus sp?)											1							
Empididae																		

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Table 7.1
Benthic Invertebrate Samples

Facultative Organisms (contd.)	B1a	B1b	B1c	B2a	B2b	B2c	B3a	B3b	B3c	B4a	B4b	B4c	B5a	B5b	B5c	B6a	B6b	B6c
Chelifera	1		1	2		9					1	1	4	3	2			
Clinocera sp																		
Weidemannia sp		1		17	18	17			1	1		1				1		1
Ephydridae																		
Notophila sp																		
Psychodidae																		
Pericoma sp				5	4												12	3
Muscidae																		
Limnophora sp	1	6									1							
Simuliidae unid J/D																		
Prosimulium sp L								3										
Prosimulium sp P																		5
Simulium sp L																		1
(Syrphidae ? P)																		
Tipulidae					1													
Dicranota sp	2	19	16			4		1	1				2	1			8	2
Hexatoma sp	2				1													
Ormosia sp																		
Tipula sp							1											
Collembola																		
Hypogastrura sp						1	1				1							
Isotomurus sp	1			4				2	1	6	1	1						
Copepoda																		
Calanoida									1									
Harpacticoida	3	16		12	4	27				1	4		8	2	4	24	16	23
Hydracarina Unid J/D	2		5	8		5				1		3		4	7	4	37	2
Kawamuracarus sp																		
Neumannia sp														5	4			1
Sperchon sp		1	4	5	5					2	1		1		1			
Torrenticola sp	2		8			5					1			1				
Wandesia sp																		
Ostracoda Unid																		
Candona sp																		2
Cypria sp				8														
Tardigrada																		
Turbellaria	1	3		4			1	2	5	2	1	1						
Oligochaeta, Naididae																		
Chaetogaster sp																		
Nais sp																		
Nematoda	4	66	12	13	4	5		1	6	1	2	2	12	1	3	8	33	3
Fish Unid J (Cottidae?)																		
Tolerant Organisms																		
Oligochaeta																		
Enchytraeidae		16	4	1			6	1	20	10	8	5		2	1	4		2
Haplotaxidae																		
Haplotaxis gordioides																		
Tubificidae	1				4	13	10	22	8	15	4	14		2	2	48	37	60
Lumbriculidae	164	613	122	130	144	241	139	70	57	18	15	21	4	2		66	13	68
Kincaidiana hexatheca																1		1
Terrestrial																		
Mollusca																		
Helicidae																		
Limacidae																		
Pupillidae																		
Aphididae								1	5	1								
Cicadellidae																		
Coleoptera A					1													
Hydrovatus sp L										1								
Hemiptera																		
Hymenoptera																		
Hymenoptera sp								1	1	1	3							
Formicidae											1							
Thysanoptera				4														

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Table 7.1
Benthic Invertebrate Samples

Sensitive organisms	B7a	B7b	B7c	B8a	B8b	B8c	B9a	B9b	B9c	B11a	B11b	B11c	B13a	B13b	B13c
Ephemeroptera unid J/D		8													
Ameletus sp			4	20	118	21				135	58	34	20	81	9
Baetis intercalaris					2										
Baetis sp	50	53	30	37	9	5			2	4	8	8	1	22	5
Cinygmula sp	·25	111	110	461	75	82	4	4		69	137	82	58	128	35
Ephemerella sp	3	20	12												
Ephemerella coloradensis	1	1													
Ephemerella doddsi	60	57	52							1					
Ephemerella grandis															
Epeorus albertae	9	20	20	428	72	35	2						7	36	7
Rhithrogena sp															
Plecoptera Unid J/d	106	140	48		32	1	28	52	45	148	425	240	144	418	38
Capnia sp	25	37	32	11	16	8	6	4	8	343	261	203	81	73	7
Isoperla sp		13				2	2								
Megarcys sp	2	2	1	11		3					1	2			
Podmosta sp							3	1	12					3	
Setvena sp															
Skwala curvata															
Sweltsa sp			5	99	13	31	2				1				
Taenionema sp		17	1	40											
Utaperla sp		1	4												
Zapada sp															
Trichoptera Unid J/D														16	
Glossosomatidae															
Glossosoma sp	1	7	10												
Limnephilidae unid J/D				40		3				4					
Ecclisomyia sp				1	2										1
Onocosmoecus sp															
Rhyacophilidae															
Rhyacophila (acropedes)(Short)	7	10	2												
Rhyacophila vagrita(No)		1													
Rhyacophila (vao) (Long br)															
Facultative organisms															
Diptera Unid L										2	5	1	1		
Diptera unid A			1	1										1	
Ceratopogonidae															
Culicoides sp														27	
Palpomyia sp			42								24	9			
Chironomidae adults			2	1					1	1					1
Chironomidae pupae	8	1	2	1		2	2	7	26	2	8	16	12	17	2
S.F. Chironominae unid J/D															
S.F. Diamesinae															
Diamesa sp	8	8	4	2	9	2	12	7	69	7	10	76	20	27	101
S.F. Orthocladiinae Unid J/D	99	165	52	104	720	8	148	1264	663	61	4	24	1550	1650	540
Cardiocladius sp		4		5	10	2			2				8		
Corynoneura sp															
Cricotopus sp	227	216	121	33	20	1	16	43	78	4	10	4	218	139	6
Eukiefferiella sp	48	8	30	24	17	1	6	6	2					11	4
Euryhapsis sp								3	9				7	3	1
Synorthocladius sp		1	2	1		2	20	65	4			4	21	24	
Thienemanniella sp	24	34	8							4	9		8		
S.F. Tanypodinae															
Thienemannimyia sp															
S.F. Tanytarsini	64	140	36	10	36	1	6							48	16
Micropsectra sp			2										3		
Culicidae Unid A															
Deuterophlebiidae															
Deuterophlebia sp															
Dolichopodidae															
(Dolichopus sp?)															
Empididae															

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Table 7.1
Benthic Invertebrate Samples

Facultative Organisms (contd.)	B7a	B7b	B7c	B8a	B8b	B8c	B9a	B9b	B9c	B11a	B11b	B11c	B13a	B13b	B13c
Chelifera	56	16	3	10		1		8	10						
Clinocera sp	1	1		2											
Weidemannia sp		2	10	25											
Ephydridae															
Notophila sp		3													
Psychodidae															
Pericoma sp		2	2					1			1				
Muscidae															
Limnophora sp															
Simuliidae unid J/D															
Prosimulium sp L											8	1			2
Prosimulium sp P		1													
Simulium sp L		10							7		1				
(Syrphidae ? P)								1	1						
Tipulidae															
Dicranota sp		1	4							23	12	12			
Hexatoma sp			1			1									
Ormosia sp								1	1						
Tipula sp															
Collembola															
Hypogastrura sp															
Isotomurus sp															
Copepoda															
Calanoida															
Harpacticoida															
Hydracarina Unid J/D	8	12	20	32		3	2			12	4	4		1	4
Kawamuracarus sp															
Neumannia sp			2												
Sperchon sp	16		4	1		4									
Torrenticola sp															
Wandesia sp															
Ostracoda Unid															
Candona sp															
Cypria sp															
Tardigrada															
Turbellaria															
Oligochaeta, Naididae															
Chaetogaster sp															
Nais sp															
Nematoda															
Fish Unid J (Cottidae?)															
Tolerant Organisms															
Oligochaeta															
Enchytraeidae	48	101	5												
Haplotaxidae															
Haplotaxis gordioides	1		2												
Tubificidae	16	149	53	51			3	8	21	1	23	22		113	10
Lumbriculidae	302	567	146	113	7	31	75	65	95	112	72	176	1	274	92
Kincaidiana hexatheca															
Terrestrial															
Mollusca															
Helicidae															
Limacidae									1				1	2	
Pupillidae															
Aphididae															
Cicadellidae															
Coleoptera A															
Hydrovatus sp L															
Hemiptera															
Hymenoptera															
Hymenoptera sp												1			
Formicidae															
Thysanoptera								1		1	14	8			1

Appendix D – Benthic Invertebrates

Appendix D4: 2007 Fraser Environmental
Benthic Invertebrate Taxa / Abundance

	Stage	W1-1	W1-2	W1-3	W1-4	W1-5	W4-1	W4-2	W4-3	W4-4	W4-5
Order : Ephemeroptera		0	0	0	0	0	0	0	0	0	0
Family : Ameletidae		0	0	0	0	0	0	0	0	0	0
Ameletus sp.		25	0	3	44	10	0	5	11	10	0
Family : Baetidae		0	0	0	0	0	0	0	0	0	0
Baetis sp.	nymph	3	0	4	0	2	0	1	0	0	1
Acentrella sp.	nymph	0	0	0	0	0	0	0	0	0	0
Family : Ephemerellidae	juv	3	0	0	0	0	0	4	1	0	5
Drunella doddsii	nymph	0	0	0	0	0	0	0	0	0	0
Drunella coloradensis	nymph	1	2	0	0	1	0	0	0	0	0
Family : Heptageniidae	juv	125	0	7	0	21	0	0	0	0	0
Cinygmula sp.	nymph	33	8	13	14	27	12	6	13	16	15
Epeorus sp.	nymph	4	1	3	0	5	11	21	10	4	10
Rhithrogena sp.	nymph	1	4	15	3	6	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Plecoptera	juv	0	0	0	0	0	0	0	0	0	0
Family : Nemouridae		0	0	0	0	0	0	0	0	0	0
Zapada sp.		58	43	63	24	59	2	3	18	10	11
Nemoura sp.											
Family : Perlodidae		0	2	2	0	0	0	0	0	0	0
Megarcys sp.		1	0	6	1	0	1	0	0	0	0
Skwala sp.											
Family : Chloroperlidae		20	6	16	9	8	0	21	7	9	8
Sweltsa sp.		45	49	11	15	24	8	2	0	8	6
Suwallia sp.											
Alloperla fraterna		57	30	9	8	22	10	0	0	5	8
Family : Capniidae		35	8	16	11	13	6	8	15	3	6
Family : Leutridae		3	0	2	0	0	2	3	9	1	0
Family : Taeniopterygidae							0	0	0	3	0
Taenionema sp.	larvae						11	3	0	0	41
		0	0	0	0	0	0	0	0	0	0
Order : Coleoptera		0	0	0	0	0	0	0	0	0	0
Family : Hydrophilidae	larvae									1	0
		0	0	0	0	0	0	0	0	0	0
Order : Trichoptera	larvae	0	0	0	0	0	0	0	0	0	0
Family : Rhyacophilidae	larvae		0	0	0	0	0	0	0	0	0
Rhyacophila sp.	larvae		3	4	1	5	1	0	11	1	10
Family : Apatniidae					0	2	0	0	0	0	0
Apatnia sp.	larvae				0	0	0	0	0	1	0
Family : Glossosomatidae									0	0	0
Glossosoma sp.	larvae								3	0	1
Family : Limniphilidae											
Dicosmoecus sp.	larvae										
		0	0	0	0	0	0	0	0	0	0
Order : Hemiptera		0	0	0	0	0	0	0	0	1	0
		0	0	0	0	0	0	0	0	0	0
Order : Diptera	pupa	1	0	0	0	1	0	0	0	0	0
Family : Chironomidae		0	0	0	0	0	0	0	0	0	0
Subfamily : Chironominae	pupa	0	0	0	0	0	0	0	0	0	3
Subfamily : Orthocladiinae	larvae	0	0	0	2	0	0	0	0	0	0
Cricotopus/Orthocladius sp.	larvae		6	3	0	11	0	18	54	19	3
Chaetocladius sp.?	larvae										
Eukiefferiella sp.	larvae	7	0	0	27	13	0	0	0	0	4
Diplocladius sp.	larvae										
Pseudosmittia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Psectrocladius sp.	larvae							3	10	0	0
Rheocricotopus sp.	larvae	6	0	0	0	0	0	0	0	0	0
Synorthocladius sp.	larvae										
Thiennemanimyia sp.	larvae										
Tvetenia sp.	larvae	0	0	0	0	7	5	0	0	0	0

Appendix D – Benthic Invertebrates
Appendix D4: 2007 Fraser Environmental
Benthic Invertebrate Taxa / Abundance

	Stage	W1-1	W1-2	W1-3	W1-4	W1-5	W4-1	W4-2	W4-3	W4-4	W4-5
Subfamily : Diamesinae	larvae	0	0	0	0	0	0	0	0	0	0
Diamesa sp.	larvae	105	37	14	0	21	0	0	12	2	0
Pagastia sp.	larvae	25	8	40	4	0	0	0	0	0	2
Pseudodiamesa sp.	larvae										
Family :Ephrididae	larvae										
Family : Ceratopogonidae	larvae	0	0	0	0	0	0	0	0	0	0
Bezzia/Palpomyia sp.	larvae	0	0	0	0	0	0	0	2	2	0
Culicoides sp.	larvae									1	0
Family : Empididae	larvae	0	0	0	0	0	0	0	0	0	0
Chelifera/Metachela sp.	larvae		1	0	0	0	0	0	16	3	1
Clinocera sp.	larvae	0	0	0	0	0	0	0	2	0	0
Oreogeton sp.	larvae	28	10	4	3	4	4	8	5	6	8
Family : Simuliidae	pupa	0	0	0	0	0	0	0	0	0	1
Simulium sp.	larvae	0	0	0	0	0	0	0	0	0	0
Prosimulium sp.	larvae										
Twinnia sp.	larvae										
Family : Psychodidae		0	0	0	0	0	0	0	0	0	0
Pericoma sp.	larvae	5	0	0	0	0	1	0	0	0	0
Family : Tipulidae		0	0	0	0	0	0	0	0	0	0
Dicranota sp.	larvae	1	0	0	0	0	0	0	0	0	0
Hexatoma sp.	larvae										
Tipula sp.	larvae				0	1	0	0	0	0	0
Rhabdomastix sp.	larvae								5	0	0
Limnophila sp.	larvae										
		0	0	0	0	0	0	0	0	0	0
Order : Colembola		0	0	0	0	0	0	0	0	0	0
Family : Sminthuridae		1	0	0	7	0	0	6	7	0	2
Family : Poduridae		0	0	0	0	0	0	1	0	0	0
		0	0	0	0	0	0	0	0	0	0
Phylum : Mollusca		0	0	0	0	0	0	0	0	0	0
Class : Gastropoda		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Oligochaeta		0	0	0	0	0	0	0	0	0	0
Family : Lumbriculidae		226	88	256	148	15	27	112	70	51	33
Family : Planaridae											0
Polycelis coronata											1
		0	0	0	0	0	0	0	0	0	0
Phylum : Nemata		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Class : Crustacea		0	0	0	0	0	0	0	0	0	0
Subclass : Amphipoda		0	0	0	0	0	0	0	0	0	0
Hyalella sp.		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Phylum : Arachnidia		0	0	0	0	0	0	0	0	0	0
Order : Prostigmata		0	0	0	0	0	0	1	0	0	0
Family : Sperchonidae		0	0	0	0	0	0	0	0	0	0
Sperchon sp.		10	0	1	0	1	0	2	7	0	1
Family : Mideopsidae		0	0	0	0	0	0	0	0	0	0
Mideopsis sp.		1	0	0	0	0	0	0	0	0	0
Family : Lebertiidae							0	0	0	0	0
Lebertia sp.							1	0	3	0	0
		0	0	0	0	0	0	0	0	0	0
TOTAL		830	306	492	321	279	102	228	291	157	181

	Stage	W5-1	W5-2	W5-3	W5-4	W5-5	W6-1	W6-2	W6-3	W6-4	W6-5
Order : Ephemeroptera		0	0	0	0	0	0	0	0	0	0
Family : Ameletidae		0	0	0	0	0	0	0	0	0	0
Ameletus sp.		5	0	0	2	3	0	1	1	0	0
Family : Baetidae		0	0	0	0	0	0	0	0	0	0
Baetis sp.	nymph	0	1	0	0	0	0	0	0	1	0
Acentrella sp.	nymph	0	1	0	0	1	0	0	0	0	0
Family : Ephemerellidae	juv	0	0	0	4	5	6	3	7	6	6
Drunella doddsii	nymph	13	20	3	1	0	0	0	0	0	0
Drunella coloradensis	nymph	0	0	0	1	1	3	0	9	2	2
Family : Heptageniidae	juv	0	4	0	0	0	0	0	0	0	0
Cinygmula sp.	nymph	14	15	12	10	34	37	13	28	13	36
Epeorus sp.	nymph	23	18	3	8	25	36	4	54	30	50
Rhithrogena sp.	nymph	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Plecoptera	juv	0	0	0	0	0	0	0	0	0	0
Family : Nemouridae		0	0	0	0	0	0	0	0	0	0
Zapada sp.		12	3	5	4	32	24	8	17	10	10
Nemoura sp.											
Family : Perlodidae		0	0	0	0	0	0	0	0	0	0
Megarcys sp.		0	0	0	0	0	1	1	0	2	0
Skwala sp.								1		0	0
Family : Chloroperlidae		2	7	0	0	0	16	0	0	14	0
Sweltsa sp.		0	0	3	0	4	0	1	4	9	3
Suwallia sp.		5	11	3	10	10	13	4	11	12	13
Alloperla fraterna		0	0	0	0	0	0	0	0	0	0
Family : Capniidae		18	20	13	33	21	9	4	20	13	7
Family : Leutridae		4	0	0	0	0	0	0	0	0	0
Family : Taeniopterygidae		0	0	0	0	0	0	0	0	0	0
Taenionema sp.	larvae	3	9	0	2	0	0	3	11	6	23
		0	0	0	0	0	0	0	0	0	0
Order : Coleoptera		0	0	0	0	0	0	0	0	0	0
Family : Hydrophilidae	larvae	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Trichoptera	larvae	0	0	0	0	0	0	0	0	0	0
Family : Rhyacophilidae	larvae	0	0	0	0	0	0	0	0	0	0
Rhyacophila sp.	larvae	4	2	2	2	2	3	1	1	2	1
Family : Apatniidae		0	0	0	0	0	0	0	0	0	0
Apatnia sp.	larvae	0	1	0	0	0	0	0	0	0	0
Family : Glossosomatidae		0	0	0	0	0	0	0	0	0	0
Glossosoma sp.	larvae	0	1	0	0	0	2	0	4	1	5
Family : Limniphilidae				0	0	0	0	0	0	0	0
Dicosmoecus sp.	larvae			1	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Hemiptera		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Diptera	pupa	0	0	0	0	0	1	5	0	0	0
Family : Chironomidae		0	0	0	0	0	0	0	0	0	0
Subfamily : Chironominae	pupa	0	0	0	0	0	0	0	0	0	0
Subfamily : Orthocladiinae	larvae	0	0	0	0	0	3	0	0	0	0
Cricotopus/Orthocladius sp.	larvae	6	0	108	0	57	0	2	5	4	3
Chaetocladius sp.?	larvae										
Eukiefferiella sp.	larvae	9	0	0	0	0	0	0	0	0	0
Diplocladius sp.	larvae										
Pseudosmittia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Psectrocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0
Rheocricotopus sp.	larvae	0	0	0	0	0	0	1	0	0	0
Synorthocladius sp.	larvae						1	0	0	0	0
Thiennemanimyia sp.	larvae										
Tvetenia sp.	larvae	15	10	0	0	0	19	1	46	20	19

Appendix D – Benthic Invertebrates
Appendix D4: 2007 Fraser Environmental
Benthic Invertebrate Taxa / Abundance

	Stage	W5-1	W5-2	W5-3	W5-4	W5-5	W6-1	W6-2	W6-3	W6-4	W6-5
Subfamily : Diamesinae	larvae	0	0	0	0	0	0	0	0	0	0
Diamesa sp.	larvae	0	0	0	0	0	0	0	0	0	0
Pagastia sp.	larvae	5	4	0	0	0	0	1	0	1	0
Pseudodiamesa sp.	larvae										
Family :Ephrididae	larvae										
Family : Ceratopogonidae	larvae	0	0	0	0	0	0	0	0	0	0
Bezzia/Palpomyia sp.	larvae	0	1	7	0	0	3	1	0	0	0
Culicoides sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Empididae	larvae	0	0	0	0	0	0	0	0	0	0
Chelifera/Metachela sp.	larvae	0	0	4	1	0	2	0	1	0	0
Clinocera sp.	larvae	0	0	0	0	0	0	0	0	1	0
Oreogeton sp.	larvae	12	2	3	2	3	4	2	1	12	2
Family : Simuliidae	pupa	1	0	0	0	1	0	0	0	0	0
Simulium sp.	larvae	0	0	0	0	1	0	0	0	1	0
Prosimulium sp.	larvae						6	0	0	0	0
Twinnia sp.	larvae										
Family : Psychodidae		0	0	0	0	0	0	0	0	0	0
Pericoma sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Tipulidae		0	0	0	0	0	0	0	0	0	0
Dicranota sp.	larvae	1	0	0	0	0	5	0	0	0	0
Hexatoma sp.	larvae	1	1	0	0	0	0	0	0	0	0
Tipula sp.	larvae	0	0	0	0	0	0	0	0	0	0
Rhabdomastix sp.	larvae	0	0	0	0	0	0	0	0	0	0
Limnophila sp.	larvae										
		0	0	0	0	0	0	0	0	0	0
Order : Colembola		0	0	0	0	0	0	0	0	0	0
Family : Sminthuridae		0	0	0	0	0	0	0	5	0	0
Family : Poduridae		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Phylum : Mollusca		0	0	0	0	0	0	0	0	0	0
Class : Gastropoda		0	0	0	0	0	0	0	1	0	0
		0	0	0	0	0	0	0	0	0	0
Oligochaeta		0	0	0	0	0	0	0	0	0	0
Family : Lumbriculidae		16	3	4	4	4	52	10	139	398	300
Family : Planaridae		0	0	0	0	0	0	0	0	0	0
Polycelis coronata		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Phylum : Nemata		0	0	0	0	0	0	0	0	0	1
		0	0	0	0	0	0	0	0	0	0
Class : Crustacea		0	0	0	0	0	0	0	0	0	0
Subclass : Amphipoda		0	0	0	0	0	0	0	0	0	0
Hyalella sp.		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Phylum : Arachnidia		0	0	0	0	0	0	0	0	0	0
Order : Prostigmata		0	0	0	0	0	0	0	0	0	0
Family : Sperchonidae		0	0	0	0	0	0	0	0	0	0
Sperchon sp.		2	2	4	0	5	0	0	1	0	2
Family : Mideopsidae		0	0	0	0	0	0	0	0	0	0
Mideopsis sp.		0	0	0	0	0	0	0	0	0	0
Family : Lebertiidae		0	0	0	0	0	0	0	0	0	0
Lebertia sp.		5	1	5	0	4	0	0	0	1	0
		0	0	0	0	0	0	0	0	0	0
TOTAL		176	137	180	84	213	246	67	366	559	483

	Stage	W9-1	W9-2	W9-3	W9-4	W9-5	W10-1	W10-2	W10-3	W10-4	W10-5
Order : Ephemeroptera		0	0	0	0	0	0	0	0	0	0
Family : Ameletidae		0	0	0	0	0	0	0	0	0	0
Ameletus sp.		24	17	12	8	4	0	0	0	0	0
Family : Baetidae		0	0	0	0	0	0	0	0		0
Baetis sp.	nymph	0	0	0	0	1	1	0	9	6	48
Acentrella sp.	nymph	0	0	0	0	0	0	0	0	0	0
Family : Ephemerellidae	juv	0	0	0	0	0	0	0	0	0	0
Drunella doddsii	nymph	0	0	0	0	0	0	0	0	0	0
Drunella coloradensis	nymph	0	0	0	0	0	0	0	0	0	0
Family : Heptageniidae	juv	76	10	12	4	0	0	1	0	0	0
Cinygmula sp.	nymph	0	0	0	0	0	0	0	0	0	0
Epeorus sp.	nymph	6	0	2	2	2	0	1	0	0	0
Rhithrogena sp.	nymph	1	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Plecoptera	juv	0	0	0	0	0	0	0	0	0	0
Family : Nemouridae		0	36	0	0	0	38	44	236	282	252
Zapada sp.		90	61	35	4	12	0	0	0	0	0
Nemoura sp.			3	45	311	62	45	40	7	77	73
Family : Perlodidae		4	0	0	0	0	0	0	0	0	1
Megarcys sp.		0	0	0	0	0	0	0	0	0	0
Skwala sp.		0	0	0	0	0	0	0	0	0	0
Family : Chloroperlidae		12	0	0	0	0	0	0	0	0	4
Sweltsa sp.		0	0	0	0	0	0	0	0	0	0
Suwallia sp.		0	0	0	0	0	0	0	0	0	0
Alloperla fraterna		0	0	0	0	0	0	0	0	0	0
Family : Capniidae		136	128	136	91	93	67	42	104	21	0
Family : Leutridae		0	0	0	0	0	0	0	0	0	0
Family : Taeniopterygidae		0	0	0	0	0	0	0	0	0	0
Taenionema sp.	larvae	0	20	40	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Coleoptera		0	0	0	0	0	0	0	0	0	0
Family : Hydrophilidae	larvae	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Trichoptera	larvae	0	0	0	0	0	0	0	0	0	0
Family : Rhyacophilidae	larvae	0	0	0	0	0	0	0	0	0	0
Rhyacophila sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Apatniidae		0	0	0	0	0	0	0	0	0	0
Apatnia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Glossosomatidae		0	0	0	0	0	0	0	0	0	0
Glossosoma sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Limniphilidae		0	0	0	0	0	0	0	0	0	0
Dicosmoecus sp.	larvae	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Hemiptera		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Diptera	pupa	0	0	0	0	0	0	0	0	0	0
Family : Chironomidae		0	0	0	0	0	0	0	0	0	0
Subfamily : Chironominae	pupa	0	0	0	0	0	0	0	0	0	0
Subfamily : Orthocladiinae	larvae	0	0	0	0	0	0	0	4	0	0
Cricotopus/Orthocladius sp.	larvae	0	8	0	0	0	0	2	4	2	16
Chaetocladius sp.?	larvae				4	0	4	0	0	0	0
Eukiefferiella sp.	larvae	0	0	20	16	1	11	13	12	0	0
Diplocladius sp.	larvae							1	0	0	0
Pseudosmittia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Psectrocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0
Rheocricotopus sp.	larvae	0	0	0	0	0	0	0	0	0	0
Synorthocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0
Thiennemanimyia sp.	larvae						10	9	8	2	0
Tvetenia sp.	larvae	0	0	0	0	0	0	0	0	0	0

Appendix D – Benthic Invertebrates
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	Stage	W9-1	W9-2	W9-3	W9-4	W9-5	W10-1	W10-2	W10-3	W10-4	W10-5
Subfamily : Diamesinae	larvae	0	0	0	0	0	0	0	0	0	0
Diamesa sp.	larvae	155	275	214	114	156	37	90	49	22	57
Pagastia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Pseudodiamesa sp.	larvae								0	1	3
Family :Ephrididae	larvae						2	9	1	0	0
Family : Ceratopogonidae	larvae	0	0	0	0	0	0	0	0	0	0
Bezzia/Palpomyia sp.	larvae	0	0	0	0	0	0	2	1	0	0
Culicoides sp.	larvae	0	0	0	0	0	1	1	0	2	0
Family : Empididae	larvae	0	0	0	0	0	0	0	0	0	0
Chelifera/Metachela sp.	larvae	4	9	0	0	16	2	0	0	0	0
Clinocera sp.	larvae	0	0	0	0	0	1	1	8	0	0
Oreogeton sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Simuliidae	pupa	0	0	0	0	0	0	0	0	0	0
Simulium sp.	larvae	0	0	0	0	0	0	0	0	0	0
Prosimulium sp.	larvae	0	0	0	0	0	0	0	0	0	0
Twinnia sp.	larvae					4	0	0	0	0	0
Family : Psychodidae		0	0	0	0	0	0	0	0	0	0
Pericoma sp.	larvae	4	0	0	0	0	0	8	20	4	0
Family : Tipulidae		0	0	0	0	0	0	0	0	0	0
Dicranota sp.	larvae	0	0	0	0	0	1	0	5	0	0
Hexatoma sp.	larvae	0	0	0	0	0	0	0	0	0	0
Tipula sp.	larvae	2	1	0	0	0	1	1	0	0	0
Rhabdomastix sp.	larvae	0	0	0	0	0	0	0	0	0	0
Limnophila sp.	larvae										
		0	0	0	0	0	0	0	0	0	0
Order : Colembola		0	0	0	0	0	0	0	0	0	0
Family : Sminthuridae		0	0	0	24	0	12	0	0	0	0
Family : Poduridae		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Phylum : Mollusca		0	0	0	0	0	0	0	0	0	0
Class : Gastropoda		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Oligochaeta		0	0	0	0	0	0	0	0	0	0
Family : Lumbriculidae		582	671	484	177	136	10	15	25	11	176
Family : Planaridae		0	0	0	0	0	0	0	0	0	0
Polycelis coronata		0	0	0	0	0	0	0	0	0	2
		0	0	0	0	0	0	0	0	0	0
Phylum : Nemata		0	0	0	0	4	0	1	0	0	0
		0	0	0	0	0	0	0	0	0	0
Class : Crustacea		0	0	0	0	0	0	0	0	0	0
Subclass : Amphipoda		0	0	0	0	0	0	0	0	0	0
Hyalella sp.		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Phylum : Arachnidia		0	0	0	0	0	0	0	0	0	0
Order : Prostigmata		0	0	0	0	0	0	0	0	0	0
Family : Sperchonidae		0	0	0	0	0	0	0	0	0	0
Sperchon sp.		0	0	0	0	0	0	0	0	0	0
Family : Mideopsidae		0	0	0	0	0	0	0	0	0	0
Mideopsis sp.		0	0	0	0	0	0	0	0	0	0
Family : Lebertiidae		0	0	0	0	0	0	0	0	0	0
Lebertia sp.		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
TOTAL		1096	1239	1000	755	491	243	281	493	430	632

	Stage	W13-1	W13-2	W13-3	W13-4	W13-5	W21-1	W21-2	W21-3	W21-4	W21-5
Order : Ephemeroptera		0	0	0	0	0	0	0	0	0	0
Family : Ameletidae		0	0	0	0	0	0	0	0	0	0
Ameletus sp.		0	2	1	0	0	0	3	1	0	0
Family : Baetidae		0	0	0	0	0	0	0	0	0	0
Baetis sp.	nymph	1	1	0	0	1	0	0	0	1	0
Acentrella sp.	nymph	0	0	0	0	0	0	0	0	0	0
Family : Ephemerellidae	juv	1	0	0	0	0	26	26	19	12	22
Drunella doddsii	nymph	0	0	0	0	0	0	0	0	0	0
Drunella coloradensis	nymph	1	0	0	0	0	2	2	1	1	0
Family : Heptageniidae	juv	0	0	0	0	0	9	33	16	40	29
Cinygmula sp.	nymph	18	27	21	20	12	3	24	25	36	21
Epeorus sp.	nymph	8	10	16	20	4	74	20	25	30	16
Rhithrogena sp.	nymph	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Plecoptera	juv	0	0	0	0	0	0	0	0	0	0
Family : Nemouridae		0	0	0	0	0	0	0	0	0	0
Zapada sp.		94	21	75	517	81	19	11	13	36	15
Nemoura sp.		0	0	0	0	0	0	0	0	0	0
Family : Perlodidae		2	0	2	0	0	0	0	0	0	0
Megarcys sp.		2	0	0	0	0	0	0	0	0	0
Skwala sp.		0	0	0	0	0	0	0	0	0	0
Family : Chloroperlidae		1	0	0	0	1	0	2	10	14	8
Sweltsa sp.		2	0	0	10	0	0	0	0	0	0
Suwallia sp.		0	0	0	0	0	0	1	0	0	0
Alloperla fraterna		0	0	0	0	0	0	0	0	0	0
Family : Capniidae		5	0	7	16	4	5	14	4	10	5
Family : Leutridae		0	0	0	0	0	1	1	0	0	2
Family : Taeniopterygidae		0	0	0	0	0	0	0	0	0	0
Taenionema sp.	larvae	2	1	0	0	0	2	3	8	7	1
		0	0	0	0	0	0	0	0	0	0
Order : Coleoptera		0	0	0	0	0	0	0	0	0	0
Family : Hydrophilidae	larvae	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Trichoptera	larvae	0	0	0	0	0	0	0	0	0	0
Family : Rhyacophilidae	larvae	0	0	0	0	0	0	0	0	0	0
Rhyacophila sp.	larvae	7	0	5	14	6	30	5	12	12	8
Family : Apatniidae		0	0	0	0	0	0	0	0	0	0
Apatnia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Glossosomatidae		0	0	0	0	0	0	0	0	0	0
Glossosoma sp.	larvae	24	5	4	0	8	0	0	0	0	0
Family : Limniphilidae		1	0	0	0	0	0	0	0	0	0
Dicosmoecus sp.	larvae	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Hemiptera		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Diptera	pupa	0	0	0	0	0	0	0	0	0	0
Family : Chironomidae		0	0	0	0	0	0	0	0	0	0
Subfamily : Chironominae	pupa	0	0	0	0	0	0	0	0	0	0
Subfamily : Orthocladiinae	larvae	0	0	0	0	0	0	0	0	0	0
Cricotopus/Orthocladius sp.	larvae	83	5	19	306	59	11	4	6	16	10
Chaetocladius sp.?	larvae	0	0	0	0	0	0	0	0	0	0
Eukiefferiella sp.	larvae	26	0	6	52	10	0	0	0	0	0
Diplocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0
Pseudosmittia sp.	larvae	0	0	0	0	0	0	0	2	0	1
Psectrocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0
Rheocricotopus sp.	larvae	0	0	0	0	0	0	0	0	0	0
Synorthocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0
Thiennemanimyia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Tvetenia sp.	larvae	0	0	0	0	0	0	0	0	0	0

Appendix D – Benthic Invertebrates
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	Stage	W13-1	W13-2	W13-3	W13-4	W13-5	W21-1	W21-2	W21-3	W21-4	W21-5
Subfamily : Diamesinae	larvae	0	0	0	0	0	0	0	0	0	0
Diamesa sp.	larvae	0	2	0	0	0	7	0	3	4	2
Pagastia sp.	larvae	0	0	1	16	0	7	0	0	0	0
Pseudodiamesa sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family :Ephrididae	larvae	1	0	0	0	0	0	0	0	2	0
Family : Ceratopogonidae	larvae	0	0	0	0	0	0	0	0	0	0
Bezzia/Palpomyia sp.	larvae	2	0	1	4	0	1	0	2	1	0
Culicoides sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Empididae	larvae	0	0	0	0	0	0	0	0	0	0
Chelifera/Metachela sp.	larvae	22	3	2	46	5	3	0	0	0	0
Clinocera sp.	larvae	0	0	0	0	0	0	0	0	0	0
Oreogeton sp.	larvae	0	0	0	0	0	5	3	9	8	14
Family : Simuliidae	pupa	0	1	0	0	0	0	0	0	0	0
Simulium sp.	larvae	0	0	0	0	0	0	0	0	0	0
Prosimulium sp.	larvae	9	40	11	32	0	0	0	0	0	0
Twinnia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Psychodidae		0	0	0	0	0	0	0	0	0	0
Pericoma sp.	larvae	1	1	2	27	3	0	0	3	0	2
Family : Tipulidae		0	0	0	0	0	0	0	0	0	0
Dicranota sp.	larvae	0	0	0	0	0	0	0	0	0	0
Hexatoma sp.	larvae	0	0	0	0	0	0	0	0	0	0
Tipula sp.	larvae	0	0	0	0	0	0	0	0	0	0
Rhabdomastix sp.	larvae	0	0	0	0	0	0	0	0	0	0
Limnophila sp.	larvae								0		
		0	0	0	0	0	0	0	0	0	0
Order : Colembola		0	0	0	0	0	0	0	0	0	0
Family : Sminthuridae		0	2	3	0	0	4	13	15	10	1
Family : Poduridae		0	0	0	0	0	1	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Phylum : Mollusca		0	0	0	0	0	0	0	0	0	0
Class : Gastropoda		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Oligochaeta		0	0	0	0	0	0	0	0	0	0
Family : Lumbriculidae		246	42	30	112	66	294	150	291	409	145
									0		
Family : Planaridae		0	0	0	0	0	0	0	0	0	0
Polycelis coronata		6	0	3	0	0	0	0	2	6	1
		0	0	0	0	0	0	0	0	0	0
Phylum : Nemata		0	0	0	0	0	2	0	0	1	0
		0	0	0	0	0	0	0	0	0	0
Class : Crustacea		0	0	0	0	0	0	0	0	0	0
Subclass : Amphipoda		0	0	0	0	0	0	0	0	0	0
Hyalella sp.		0	0	0	0	0	0	2	4	0	2
		0	0	0	0	0	0	0	0	0	0
Phylum : Arachnidia		0	0	0	0	0	0	0	0	0	0
Order : Prostigmata		0	0	0	0	0	0	0	0	0	0
Family : Sperchonidae		0	0	0	0	0	0	0	0	0	0
Sperchon sp.		0	0	6	0	0	2	3	5	8	2
Family : Mideopsidae		0	0	0	0	0	0	0	0	0	0
Mideopsis sp.		0	0	0	0	0	0	0	0	0	0
Family : Lebertiidae		0	0	0	0	0	0	0	0	0	0
Lebertia sp.		19	6	5	70	6	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
TOTAL		584	169	220	1262	266	508	320	476	664	307

	Stage	W22-1	W22-2	W22-3	W22-4	W22-5	W23-1	W23-2	W23-3	W23-4	W23-5
Order : Ephemeroptera		0	0	0	0	0	0	0	0	0	0
Family : Ameletidae		0	0	0	0	0	0	0	0	0	0
Ameletus sp.		0	3	0	9	0	0	0	0	1	2
Family : Baetidae		0	0	0	0	0	0	0	0	0	
Baetis sp.	nymph	0	0	0	0	0	0	0	0	0	0
Acentrella sp.	nymph	0	0	0	0	0	4	0	0	1	2
Family : Ephemerellidae	juv	2	3	2	0	1	2	0	0	0	0
Drunella doddsii	nymph	0	0	0	0	0	18	8	15	26	10
Drunella coloradensis	nymph	0	0	0	0	0	6	7	3	2	2
Family : Heptageniidae	juv	0	0	0	0	0	0	0	0	0	0
Cinygmula sp.	nymph	12	21	17	16	11	30	55	9	44	31
Epeorus sp.	nymph	7	14	18	11	11	33	38	16	25	17
Rhithrogena sp.	nymph	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Plecoptera	juv	0	0	0	3	0	0	0	0	0	0
Family : Nemouridae		0	0	0	0	0	0	0	0	0	0
Zapada sp.		14	17	14	6	23	16	13	2	19	2
Nemoura sp.		0	0	0	0	0	0	0	0	0	0
Family : Perlodidae		0	0	1	0	0	0	0	0	0	1
Megarcys sp.		0	0	3	1	1	0	0	0	0	0
Skwala sp.		0	0	0	0	0	1	0	0	0	0
Family : Chloroperlidae		6	5	12	15	9	1	0	5	1	20
Sweltsa sp.		0	0	0	1	0	0	0	0	0	0
Suwallia sp.		0	1	2	1	0	1	11	3	7	2
Alloperla fraterna		0	0	0	0	0	0	0	0	0	0
Family : Capniidae		2	2	2	3	3	2	7	0	11	19
Family : Leutridae		3	1	4	5	8	2	0	0	1	0
Family : Taeniopterygidae		0	0	0	0	0	0	0	0	0	0
Taenionema sp.	larvae	19	8	12	0	14	2	3	3	4	3
		0	0	0	0	0	0	0	0	0	0
Order : Coleoptera		0	0	0	0	0	0	0	0	0	0
Family : Hydrophilidae	larvae	0	0	0	0	0	0	1	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Trichoptera	larvae	0	0	0	0	0	0	0	0	0	0
Family : Rhyacophilidae	larvae	0	0	0	0	0	0	0	0	0	0
Rhyacophila sp.	larvae	4	7	8	2	10	3	6	0	3	0
Family : Apatniidae		0	0	0	0	0	0	0	0	0	0
Apatnia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Glossosomatidae		0	0	0	0	0	0	0	0	0	0
Glossosoma sp.	larvae	0	0	0	1	1	13	13	0	3	1
Family : Limniphilidae		0	0	0	0	0	1	0	0	0	0
Dicosmoecus sp.	larvae	0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Hemiptera		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Diptera	pupa	0	0	0	0	0	0	0	0	0	0
Family : Chironomidae		0	0	0	0	0	0	0	0	0	0
Subfamily : Chironominae	pupa	0	4	0	0	5	0	0	0	0	0
Subfamily : Orthocladiinae	larvae	5	0	0	0	0	0	0	0	0	0
Cricotopus/Orthocladius sp.	larvae	3	10	6	2	17	31	11	6	44	12
Chaetocladius sp.?	larvae	0	0	0	0	0	0	0	0	0	0
Eukiefferiella sp.	larvae	0	0	0	0	0	89	0	0	5	13
Diplocladius sp.	larvae	0	0	0	0	0	0	13	0	0	0
Pseudosmittia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Psectrocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0
Rheocricotopus sp.	larvae	0	0	0	0	0	2	0	0	0	0
Synorthocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0
Thiennemanimyia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Tvetenia sp.	larvae	0	0	0	0	0	0	2	0	0	21

	Stage	W22-1	W22-2	W22-3	W22-4	W22-5	W23-1	W23-2	W23-3	W23-4	W23-5
Subfamily : Diamesinae	larvae	0	0	0	0	0	0	0	0	0	0
Diamesa sp.	larvae	0	2	0	0	0	2	5	0	0	0
Pagastia sp.	larvae	0	1	0	0	0	0	0	1	0	0
Pseudodiamesa sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family :Ephrididae	larvae	0	0	0	0	0	0	0	0	0	0
Family : Ceratopogonidae	larvae	0	0	0	0	0	0	0	0	0	0
Bezzia/Palpomyia sp.	larvae	1	0	0	0	0	5	2	2	0	1
Culicoides sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Empididae	larvae	0	0	0	0	0	0	0	0	0	0
Chelifera/Metachela sp.	larvae	0	0	1	0	1	4	5	0	0	1
Clinocera sp.	larvae	0	0	0	0	0	0	0	0	0	0
Oreogeton sp.	larvae	12	24	18	23	11	0	4	1	1	3
Family : Simuliidae	pupa	0	0	0	0	0	0	0	0	0	0
Simulium sp.	larvae	0	0	0	0	0	0	0	0	0	0
Prosimulium sp.	larvae	4	3	0	0	2	0	0	2	2	2
Twinnia sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Psychodidae		0	0	0	0	0	0	0	0	0	0
Pericoma sp.	larvae	0	0	0	0	0	0	0	0	0	0
Family : Tipulidae		0	0	0	0	0	0	0	0	0	0
Dicranota sp.	larvae	0	0	0	0	0	1	0	0	0	0
Hexatoma sp.	larvae	0	0	0	2	0	0	0	1	0	0
Tipula sp.	larvae	0	0	0	0	0	0	0	0	0	0
Rhabdomastix sp.	larvae	0	0	0	0	1	1	0	0	0	0
Limnophila sp.	larvae	1	0	5	0	4	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Order : Colembola		0	0	0	0	0	0	0	0	0	0
Family : Sminthuridae		0	0	0	0	1	1	1	0	0	0
Family : Poduridae		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Phylum : Mollusca		0	0	0	0	0	0	0	0	0	0
Class : Gastropoda		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Oligochaeta		0	0	0	0	0	0	0	0	0	0
Family : Lumbriculidae		103	22	112	44	82	26	19	23	5	78
Family : Planaridae		0	0	0	0	0	0	0	0	0	0
Polycelis coronata		0	2	1	4	0	0	0	0	0	2
		0	0	0	0	0	0	0	0	0	0
Phylum : Nemata		1	0	2	0	3	1	10	0	0	1
		0	0	0	0	0	0	0	0	0	0
Class : Crustacea		0	0	0	0	0	0	0	0	0	0
Subclass : Amphipoda		0	0	0	0	0	0	0	0	0	0
Hyalella sp.		0	0	0	0	0	0	0	0	0	0
		0	0	0	0	0	0	0	0	0	0
Phylum : Arachnidia		0	0	0	0	0	0	0	0	0	0
Order : Prostigmata		0	0	0	0	0	0	0	0	0	0
Family : Sperchonidae		0	0	0	0	0	0	0	0	0	0
Sperchon sp.		0	0	0	5	0	22	6	0	0	0
Family : Mideopsidae		0	0	0	0	0	0	0	0	0	0
Mideopsis sp.		0	0	0	0	0	0	0	0	0	0
Family : Lebertiidae		0	0	0	0	0	0	0	0	0	0
Lebertia sp.		0	0	0	0	1	0	0	0	0	2
		0	0	0	0	0	0	0	0	0	0
TOTAL		199	150	240	154	220	320	240	92	205	248

	Stage	W1-1	W1-2	W1-3	W1-4	W1-5	W5-1	W5-2	W5-3	W5-4	W5-5	W21-1	W21-2	W21-3	W21-4	W21-5	W22-1	W22-2	W22-3	W22-4	W22-5	W26-1	W26-2	W26-3	W26-4	W26-5	W27-1	W27-2	W27-3	W27-4	W27-5	W29-1	W29-2	W29-3	W29-4	W29-5
Order: Ephemeroptera	adult	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Ameletidae																																				
Ameletus sp.	nymph	2	0	4	10	2	3	2	1	1	0	10	3	0	0	14	9	2	0	2	0	0	0	1	7	34	0	0	0	0	0	3	0	0	0	0
Family: Baetidae																						0	0	0	0	0										
Baetis sp.	nymph	6	1	22	2	1	140	52	54	59	74	12	42	7	46	0	38	41	46	79	19	0	0	0	0	0	11	8	22	11	26	75	53	6	11	14
Baetis bicaudatus	nymph	0	0	0	1	0	0	0	0	1	0	0	11	0	7	1	0	0	0	0	1	0	1	0	0	0	4	4	7	6	6	0	0	0	0	0
Family: Ephemerellidae	nymph (juv./dam.)	2	1	8	1	0	8	8	11	5	16	88	77	17	60	10	17	14	7	28	3	0	0	2	0	1	0	0	4	1	2	4	12	13	16	8
Drunella doddsi	nymph	0	0	0	0	0	14	1	6	7	0	0	0	0	0	0	0	1	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Drunella grandis	nymph	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Heptageniidae	nymph (juv./dam.)	47	94	124	105	55	57	6	12	2	34	318	112	35	109	40	5	5	5	26	6	1	5	14	23	41	4	0	8	4	6	7	26	6	4	8
Cinygmula sp.	nymph	1	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Epeorus sp.	nymph	0	0	2	1	1	0	0	1	2	0	0	4	0	4	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhithrogena sp.	nymph	1	13	14	2	16	0	0	1	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	1
Order: Plecoptera	adult	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Plecoptera	nymph (juv./dam.)	0	0	2	0	15	11	2	2	4	4	2	0	0	0	0	0	0	0	0	0	0	1	0	16	12	4	2	12	0	6	0	0	0	2	0
Family: Capniidae	nymph (juv./dam.)	91	86	144	131	195	316	314	82	30	312	312	136	157	132	41	42	49	19	81	10	6	5	6	62	215	31	43	53	40	31	53	46	21	25	24
Family: Chloroperlidae	nymph (juv./dam.)	0	0	16	2	12	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alloperla fraterna	nymph	0	8	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Suwallia sp.	nymph	9	32	42	15	39	3	4	11	8	10	10	10	7	13	4	6	10	6	28	28	1	0	2	1	0	2	1	1	0	6	9	8	8	21	14
Sweltsa sp.	nymph	5	1	10	13	5	3	0	2	0	2	8	3	1	0	3	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Family: Leuctridae	nymph (juv./dam.)	4	3	10	3	0	8	10	0	7	6	0	1	0	0	0	0	0	5	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Family: Nemouridae	nymph (juv./dam.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	0	0	1	1	0	0	0	0	0	0	0	0
Podmosta sp.	nymph	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	5	4	0	0	0	0	0	0	0	0	0	0
Zapada sp.	nymph	9	14	122	2	65	151	69	11	6	74	110	144	18	207	30	21	28	28	37	10	4	3	3	0	0	7	3	14	9	10	29	26	4	0	4
Zapada columbiana	nymph	1	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Zapada oregonensis group	nymph	2	4	30	0	13	0	0	0	0	2	0	0	1	4	5	5	0	2	0	2	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0
Family: Perlodidae	nymph (juv./dam.)	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1.3	0	0	0	0
Isoperla sp.	nymph	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Skwala sp.	nymph	0	0	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Taeniopterygidae																																				
Taenionema sp.	nymph (juv./dam.)	0	4	2	0	1	68	16	30	27	12	0	27	5	46	0	0	0	18	15	10	0	0	0	0	7	155	109	444	192	277	14	13	9	5	16
																												0	0		0					
Order: Trichoptera	larvae (juv./dam.)	0	0	18	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Brachycentridae	larvae (juv./dam.)	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Glossosomatidae																																				
Glossosoma sp.	larvae	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	3	0	3	0	0	0	0	0	0	0	0	0	0	3	3	3	1	4
Family: Limnephilidae	larvae (juv./dam.)	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0
Ecclisomyia sp.	larvae	1	1	0	3	0	0	0	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Family: Rhyacophilidae																																				
Rhyacophila sp.	larvae	2	2	0	0	0	5	1	1	2	4	14	12	0	19	2	4	4	3	3	5	0	0	0	0	0	3	0	4	0	9	3	0	0	1	1
Family: Uenoidae	larvae (juv./dam.)	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oligophlebodes sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	0	0	0
Order: Coleoptera																																				
Family: Hydraenidae	larvae (juv./dam.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Family: Staphylinidae	adult	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Order: Diptera UID	larvae (juv./dam.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	3	2	0	3	0	0	0	0	0	0	0	0	0	0
Family: Ceratopogonidae	larvae (juv./dam.)	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Alluaudomyia sp.	larvae	0	0	0	0	0	3	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Culicoides sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0
Mallochohelea sp.	larvae	0	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monohelea sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Probezzia sp.	larvae	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Chironomidae	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subfamily : Chironominae	pupa	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Micropsectra sp.	larvae	0	0	0	0	0	57	13	2	4	44	4	8	3	8	4	15	12	3	5	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Subfamily : Orthocladiinae	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	128	38	10	35	3	0	0	0	0	0	0	0	0
Cricotopus/Orthocladius sp.	larvae	21	0	48	0	3	0	21	5	5	24	0	0	0	0	0	1	13	4	1	0	0	9	15	0	0	12	8	0	0	0	0	0	1	1	2
Chaetocladius sp.?	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Eukiefferiella sp.	larvae	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diplocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Heleniella sp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0

	Stage	W1-1	W1-2	W1-3	W1-4	W1-5	W5-1	W5-2	W5-3	W5-4	W5-5	W21-1	W21-2	W21-3	W21-4	W21-5	W22-1	W22-2	W22-3	W22-4	W22-5	W26-1	W26-2	W26-3	W26-4	W26-5	W27-1	W27-2	W27-3	W27-4	W27-5	W29-1	W29-2	W29-3	W29-4	W29-5
Pseudosmittia sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Psectrocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rheocricotopus sp.	larvae	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Synorthocladius sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Thiennemanimyia sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tvetenia sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subfamily : Diamesinae	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Diamesa sp.	larvae	75	15	492	5	56	0	0	1	0	0	14	41	12	34	8	0	2	0	3	3	17	0	0	3	0	38	78	150	95	90	9	5	3	8	4
Pagastia sp.	larvae	78	19	238	6	47	30	5	2	3	20	12	3	3	7	1	0	1	3	4	0	0	0	0	0	0	15	8	43	21	21	3	5	0	0	2
Pseudodiamesa sp.	larvae	32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	6	0	0	0	2	0	0	0	0	0	0	0	0
Pseudokiefferiella sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Subfamily : Podonominae	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichotanypus sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Empididae	larvae (juv./dam.)	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Chelifera/Metachela sp.	larvae	0	0	2	0	0	0	5	0	1	0	2	0	0	0	0	6	10	0	0	0	0	0	0	0	0	5	3	1	1	0	18	0	0	0	1
Oreogeton sp.	larvae	0	11	4	1	7	8	1	2	0	0	6	6	2	14	0	7	3	6	4	18	0	0	0	0	0	0	0	2	0	2	7	4	2	1	4
Family: Muscidae	larvae (juv./dam.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3	0	1	0	0	1	0	0	1	0	0	0	0	0
Family: Psychodidae UID	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pericoma sp.	larvae	1	1	4	1	1	0	2	3	0	0	0	4	2	3	3	0	1	1	0	0	11	8	8	4	2	35	7	13	15	24	0	0	0	1	0
Family: Simuliidae	adult	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Family: Simuliidae	larvae (juv./dam.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Prosimulium sp.	larvae	0	2	26	0	0	0	0	3	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Tipulidae	larvae (juv./dam.)	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dicranota sp.	larvae	3	0	6	3	5	0	1	0	0	0	4	2	4	4	4	0	0	1	0	0	0	1	0	0	0	5	4	6	4	3	0	0	0	2	0
Gonomyodes sp.	larvae	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hexatoma sp.	larvae	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tipula sp.	larvae	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Collembola																																				
Family: Poduridae	larvae	22	7	16	9	6	0	0	0	0	0	4	4	1	2	6	0	0	0	0	1	15	13	30	110	63	11	0	0	2	2	0	0	1	0	0
Family: Sminthuridae	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Class: Crustacea																																				
Order: Amphipoda	juv.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Gammarus sp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hyalella sp.		0	0	0	0	0	0	0	0	0	0	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Copepoda		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	0	0	0	0	0	0	0	0	0
Class: Harpacticoida		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	8	0	0	0	0	0	0	0	0	0	0	0	0
Order: Ostracoda		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0						0	0	0	0	0	0	0	0	0	0
Super-Order: Acariformes	deutonymph	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Hydrozetidae	adult	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Family: Hygrobatidae																																				
Hygrobates sp.	adult	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Lebertiidae																																				
Lebertia sp.	adult	0	0	0	0	0	8	1	0	0	4	0	0	0	0	0	1	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Family: Sperchontidae																																				
Sperchon sp.	adult	0	1	2	0	5	8	1	3	0	2	4	0	0	0	0	2	4	4	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Class: Turbellaria		0	0	0	0	0	0	0	0	0	0											0	0	1	0	0		0	0		0					
Order: Tricladida		0	0	0	0	0	0	0	0	0	0																									
Polycelis coronata		0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	4	0	2	22	0	0	0	0	0	0	17	9	1	0	0
Phylum: Annelida		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												0	0		0					
Class: Oligochaeta		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												0	0		0					
Family: Lumbriculidae		32	125	172	18	97	5	9	9	1	8	106	48	62	32	102	50	137	37	117	88	40	83	226	256	74	49	11	29	11	30	190	211	76	61	159
Rhynchelmis sp.		0	0	0	0	0	5	0	0	0	2	0	0	0	0	0	0	0	0	0	3	1	4	0	4	0	0	0	0	0	0	0	0	0	0	0
Sub-Family: Tubificinae		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	57	56	27	0	0	0	0	0	0	0	0	0	0
Phylum: Nemata		2	0	0	0	2	0	3	4	1	0	0	1	0	2	0	1	3	3	5	0	6	0	6	0	0	1	3	5	4	0	5	8	1	0	5
TOTAL		**456**	**447**	**1608**	**355**	**663**	**918**	**569**	**265**	**179**	**658**	**1050**	**701**	**338**	**757**	**333**	**235**	**351**	**214**	**446**	**216**	**242**	**219**	**552**	**611**	**499**	**431**	**300**	**819**	**420**	**552**	**452**	**432**	**156**	**163**	**273**

	Stage	W1-1	W1-2	W1-3	W1-4	W1-5	W5-1	W5-2	W5-3	W5-4	W5-5	W21-1	W21-2	W21-3	W21-4	W21-5	W22-1	W22-2	W22-3	W22-4	W22-5	W23-1	W23-2	W23-3	W23-4	W23-5	W27-1	W27-2	W27-3	W27-4	W27-5	W29-1	W29-2	W29-3	W29-4	W29-5
Order: Ephemeroptera	adult																					0	2	0	1	0										
Order: Ephemeroptera	nymph (juv./dam.)																															0	1	0	0	0
Family: Ameletidae																											0	0	0	0	0	0	0	0	0	0
Ameletus sp.	nymph	12	3	20	0	8	0	0	0	2	0	0	0	18	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Baetidae	nymph (juv./dam.)											0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Acentrella sp.	nymph	0	0	0	0	0	1	2	2	0	1	0	0	0	0	1	0	0	0	0	0	8	14	16	10	9	0	0	0	0	0	1	0	1	0	3
Baetis sp.	nymph	4	4	0	1	1	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	2	0	0	4	0	1	0	0	0	0	0	0	0	0
Baetis bicaudatus	nymph	12	8	5	2	6	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Ephemerellidae	nymph (juv./dam.)						0	0	0	1	0	17	8	119	8	30	0	0	0	0	0	2	0	3	4	0	0	2	0	0	0	3	1	0	1	0
Drunella coloradensis	nymph	0	0	1	0	1	0	0	0	0	0	2	1	0	1	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
Drunella doddsi	nymph	0	0	0	0	0	21	12	11	17	11	1	0	0	0	0	4	2	0	2	0	9	38	39	34	31	0	0	0	0	0	5	0	4	2	5
Family: Heptageniidae	nymph (juv./dam.)	19	9	10	8	4	13	6	13	31	5	16	37	55	24	36	4	2	1	4	6	8	19	10	12	17	0	0	0	0	0	12	3	7	17	7
Cinygmula sp.	nymph	27	7	11	8	10	0	2	0	7	3	3	0	6	0	9	3	9	2	7	25	2	4	6	11	6	0	0	0	0	0	6	0	4	8	5
Epeorus sp.	nymph	21	29	1	4	5	19	4	1	14	8	13	21	9	29	33	14	14	7	18	11	13	35	12	11	26	1	1	0	1	0	15	10	8	12	4
Rhithrogena sp.	nymph	7	7	1	19	2	1	1	0	1	1	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Order: Plecoptera	nymph (juv./dam.)																0	0	0	1	0	1	0	0	1	0	0	2	0	0	0	0	0	0	0	0
Family: Capniidae	nymph (juv./dam.)	2	3	1	2	0	12	11	5	11	4	2	2	7	0	0	0	0	0	1	0	11	12	6	7	16	0	1	3	0	0	0	3	1	3	0
Family: Chloroperlidae																																				
Alloperla sp.	nymph	10	0	4	0	3	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Suwallia sp.	nymph	23	10	11	24	15	5	4	2	6	4	0	5	15	3	3	2	1	2	8	19	10	6	4	2	1	1	0	1	0	0	4	7	1	5	2
Sweltsa sp.	nymph	15	4	4	1	6	0	0	0	0	0	0	1	0	0	2	3	1	2	0	5	1	2	0	0	0	1	0	0	0	0	0	1	0	0	0
Famliy: Leuctridae	nymph (juv./dam.)	17	3	3	3	4	4	0	5	6	0	0	0	0	1	1	0	1	0	2	1	2	3	0	0	1	0	0	0	0	0	2	1	0	0	1
Family: Nemouridae	nymph (juv./dam.)																					0	0	0	0	0	7	0	0	3	0	0	0	0	0	0
Zapada sp.	nymph	26	55	27	38	75	3	1	0	3	5	5	3	7	5	2	2	0	4	6	14	2	14	3	1	13	0	10	2	7	0	0	0	0	7	1
Zapada columbiana	nymph	1	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Zapada oregonensis group	nymph	9	4	5	5	0	0	3	1	0	6	0	3	0	5	6	1	5	3	2	1	0	11	2	9	1	2	2	1	1	0	4	0	1	0	0
Family: Perlodidae	nymph (juv./dam.)	1	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Megarcys sp.	nymph	6	1	2	1	1	0	0	0	0	0	0	0	0	0	0						0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
Family: Taeniopterygidae	nymph (juv./dam.)	2	1	0	1	0	0	0	0	0	0	0	3	1	1	1	0	0	0	0	1	2	0	0	0	1	8	12	6	19	1	2	1	2	4	1
Order: Trichoptera	larvae (juv./dam.)											0	0	0	0	1	0										0	0	1	1	0	0	0	0	0	0
Family: Glossosomatidae																																				
Glossosoma sp.	larvae	0	0	2	1	6	1	0	1	1	0	1	5	2	12	6	21	8	2	8	16	5	6	5	4	5	1	0	0	0	0	8	1	2	2	4
Family: Limnephilidae	larvae (juv./dam.)	1	0	1	0	1	0	1	0	1	0	0	0	3	1	2	0	0	0	1	2	0	1	0	1	0	0	0	1	1	0	0	3	1	0	0
Ecclisomyia sp.	larvae	1	0	3	1	6	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0															
Family: Rhyacophilidae		0	0	0	0	0																														
Rhyacophila sp.	larvae	2	4	1	1	2	2	0	1	3	1	4	1	0	7	10	1	4	2	4	14	2	5	5	3	3	9	2	2	7	0	4	1	2	1	0
Family: Uenoidae		0	0	0	0	0																														
Oligophlebodes sp.	larvae	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Coleoptera																																				
Family: Hydrophilidae	larvae (juv./dam.)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Diptera UID	pupae											0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Order: Diptera UID	larvae	1	1	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
Family: Ceratopogonidae																																				
Culicoides sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
Mallochohelea sp.	larvae	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monohelea sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Probezzia sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Family: Chironomidae	pupae	3	0	3	0	7	1	1	2	2	0	0	4	0	0	1	4	2	2	0	1	0	18	0	0	5	0	0	0	0	0	0	0	0	0	0
Subfamily : Chironominae	larvae																0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Micropsectra sp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Subfamily : Orthocladiinae																																				
Cricotopus/Orthocladius sp.		0	5	7	6	7	15	6	9	3	16	0	0	0	0	0	1	0	0	0	1	13	26	15	22	4	42	38	44	27	26	2	1	1	3	4
Eukiefferiella sp.		0	15	3	5	3	0	0	0	0	0	4	3	4	5	3	0	0	0	0	0	8	9	4	11	12	4	2	0	0	0	0	0	0	0	0
Synorthocladius sp.		0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tvetenia sp.		9	0	0	0	0	0	0	0	0	0	0	0	0	13	1	0	0	0	0	0	0	34	17	18	8	0	0	0	0	0	0	0	0	0	0
Subfamily : Diamesinae																																				
Diamesa sp.		0	4	3	0	0	0	0	0	0	0	0	2	0	6	2	1	0	0	0	0	0	0	0	0	0	127	140	54	74	26	0	0	0	1	2
Pagastia sp.		11	10	4	20	34	1	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	1	1	3	0	0	0	1	3	0	8	1	2	2	2
Pseudodiamesa sp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Subfamily : Podonominae																																				
Trichotanypus sp.		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Deuterophlebiidae	larvae (juv./dam.)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Empididae	larvae (juv./dam.)																					0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Chelifera/Metachela sp.	larvae	1	1	0	2	0	0	0	0	0	0	0	0	3	1	0	1	0	0	0	3	0	0	2	1	4	1	4	4	1	4	0	0	0	1	1
Hemerodromia sp.	larvae	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oreogeton sp.	larvae	12	9	2	4	1	1	0	0	2	1	1	16	3	4	9	13	10	2	16	22	0	7	0	0	0	4	0	4	1	1	1	1	2	6	7

	Stage	W1-1	W1-2	W1-3	W1-4	W1-5	W5-1	W5-2	W5-3	W5-4	W5-5	W21-1	W21-2	W21-3	W21-4	W21-5	W22-1	W22-2	W22-3	W22-4	W22-5	W23-1	W23-2	W23-3	W23-4	W23-5	W27-1	W27-2	W27-3	W27-4	W27-5	W29-1	W29-2	W29-3	W29-4	W29-5
Family: Muscidae																																				
Limnophora sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	4	4	1	0	0	0	0	0
Family: Psychodidae UID	larvae	2	2	0	0	0	0	0	0	0	1	0	0	0	3	2	0	0	0	0	0	0	1	0	0	0	36	8	14	6	2	1	2	0	1	1
Pericoma sp.	larvae	0	0	0	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	2	3	0	1	0	0	0	0	0	0	0	0	0	0
Family: Simuliidae	pupae	0	1	0	0	0											0	0	1	0	0	1	2	0	1	0	0	0	0	0	0	1	0	0	0	0
Prosimulium sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Simulium sp.	larvae	0	0	0	0	0	5	2	0	1	0	0	0	0	1	0	0	0	0	0	0	9	20	0	0	3	0	0	0	0	0	0	0	0	0	0
Family: Tipulidae	larvae (juv./dam.)																					0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Dicranota sp.	larvae	4	1	2	0	2	0	0	0	0	0	0	0	2	1	0	0	1	0	0	0	1	0	0	0	2	0	0	2	0	2	2	0	0	0	0
Gonomyodes sp.	larvae	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hexatoma sp.	larvae	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Limnophila sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Molophilus sp.	larvae	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhabdomastix sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0
Tipula sp.	larvae	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
																																0	0	0	0	0
Order: Collembola	larvae	0	0	0	0	0						1	0	0	0	0						0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Family: Poduridae	larvae	2	1	2	0	0	0	0	0	0	0	0	8	1	0	3	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Class: Crustacea														0								0														
Family: Amphipoda																																				
Gammarus sp.		0	0	0	0	0	0	0	0	0	0	0	0	7	3	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Super-Order: Acariformes	deutonymph	0	1	0	0	1	0	0	0	0	0						0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Family: Hydrozetidae	adult	2	1	0	0	0						0	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Family: Hydryphantidae																	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wandesia sp.	adult	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Family: Hygrobatidae																																				
Hygrobates sp.	adult	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Family: Lebertiidae																																				
Lebertia sp.	adult	1	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	1	1	1	0	4	3	5	1	0	0	0	0	0	0	1	0	0	2
Family: Sperchontidae																																				
Sperchon sp.	adult	2	0	1	0	4	1	2	4	5	1	4	2	0	1	2	4	3	5	2	3	1	2	2	7	6	0	0	0	0	0	4	1	2	4	5
Class: Turbellaria		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Order: Tricladida		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0
Phylum: Annelida																																				
Class: Oligochaeta																																				
Family: Lumbriculidae		373	145	170	122	50	6	1	3	5	0	83	335	100	102	197	134	47	3	62	176	7	14	15	21	2	4	1	3	3	1	176	67	76	173	69
Sub-Family: Naidinae		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0						0	0	1	0	0	0	0	0	0	0
Phylum: Nemata		0	1	0	0	0	3	0	2	2	3	1	1	3	0	1	1	3	0	1	2	4	4	6	5	8	7	5	5	5	0	1	2		1	2
Total		**641**	**355**	**311**	**280**	**269**	**124**	**60**	**67**	**127**	**73**	**160**	**463**	**379**	**242**	**387**	**218**	**116**	**45**	**150**	**326**	**126**	**326**	**180**	**213**	**194**	**258**	**236**	**155**	**168**	**66**	**266**	**110**	**117**	**258**	**129**