Enclosure No. 1
Duke Letter Dated: December 11, 2009

Attachment 89S-4

Derwort, J.E. and J.J. Hall, 2009,

Macroinvertebrate Surveys on London Creek, Cherokee Co., South Carolina

MACROINVERTEBRATE SURVEYS ON LONDON CREEK, CHEROKEE CO., SOUTH CAROLINA

Macroinvertebrate sampling area at Location 1.7 in London Creek, SC.

by

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November 13, 2009

This report is a compilation of the macroinvertebrate surveys conducted in both 2008 and 2009. The report summarizing only the 2008 studies (*Macroinvertebrate Surveys on London Creek, Cherokee County, SC* by John E. Derwort and James J. Hall - December 12, 2008) remains a stand-alone document, but it was also completely assimilated into this 2009 report in order to have both years of data under the same cover.

EXECUTIVE SUMMARY

Macroinvertebrate sampling was conducted at three locations on London Creek during March and September of 2008 and 2009, and at an additional location in June 2009. The purpose of the monitoring was to provide macroinvertebrate bioassessment data prior to construction of Make-Up Pond C in the London Creek valley.

Total and EPT taxa numbers showed no consistent seasonal or spatial patterns during 2008, however, in 2009 total taxa were slightly higher in September than in March, while the opposite was true with EPT taxa. Both total and EPT taxa numbers were most often higher in 2009 than in 2008. Bioclassification scores during both sampling periods and at all locations were in the "Fair" range in 2008 and mostly in the "Good-fair" range in 2009. Total and EPT taxa numbers, as well as bioclassification scores, were generally lower at the one location sampled in June 2009 than at other locations sampled in March and September 2009. This was likely due to earlier emergence of certain taxa found in the spring. Low seasonal and spatial variability in 2008 was probably due to similar habitat conditions at all locations and/or erratic flow regimes due to low rainfall in spring and early summer 2008, followed by heavy rainfall events in late summer prior to sampling. The higher bioclassification scores and numbers of taxa in 2009 as compared to 2008 were likely due to more normal rainfall during most of 2009.

Comparisons with macroinvertebrate studies by South Carolina state biologists at other sites in Cherokee County showed that bioassessment scores from London Creek in 2008 and 2009 were generally lower than those of streams sampled by state biologists. Additionally, based on the proportions of low tolerance taxa in all streams, London Creek was less suitable for low tolerance macroinvertebrate taxa than most streams sampled by South Carolina Department of Health and Environmental Control (SCDHEC). This disparity was likely due more to the periodic flow regimes in London Creek, as compared to the perennial streams sampled by SCDHEC.

INTRODUCTION

London Creek is a small, intermittent, second order stream in east-central Cherokee County, SC whose headwaters originate from Lake Cherokee, an 18.2-ha (45-ac) impoundment owned by the SC Department of Natural Resources. The majority of the water in London Creek, with the exception of the small, intermittent, un-named streams/seeps that flow into London Creek, is provided by the over-the-standpipe spillage from Lake Cherokee. London Creek flows 5.3 km (3.3 mi) in a northeasterly direction from Lake Cherokee and enters the upper end of Ninety-Nine Islands Reservoir, a Duke Energy Corporation run-of-the-river hydroelectric impoundment on the Broad River.

A mixed hardwood and pine plantation forest covers the majority of the London Creek valley, interspersed with pastureland and some upslope farmsteads/residences. As mentioned earlier, the flow of London Creek is largely dependent on Lake Cherokee which has a 0.4 km^2 (0.2 mi^2) watershed and an average depth 3.4 m (11 ft). Considering the small watershed and high dependency on water from Lake Cherokee, low-rainfall seasons such as the spring and summer of 2008, resulted in extended periods when London Creek was essentially dry, with only a series of small, shallow, isolated pools.

Zoological (fish, aquatic macroinvertebrates, avian, mammal, and amphibian/reptile) and botanical investigations were designed and conducted during 2008 and 2009. The purpose of these studies was to characterize the flora and fauna of selected areas of the London Creek valley.

The objective of this study was to characterize the London Creek macroinvertebrate communities at three specific sites in 2008 and 2009, and an additional site in 2009 where land agreements/easements for the first time permitted access to this section of the stream. Surveys were conducted in March and September of both 2008 and 2009, and at one previously unsampled location in June 2009, to provide seasonal information regarding macroinvertebrate community composition and diversity. Macroinvertebrate communities were also used to help characterize ambient water quality.

METHODS AND MATERIALS

Macroinvertebrate bioassessment sampling was conducted on London Creek on March 10 and 11, and September 22 and 23, 2008. During 2009, sampling was conducted on March 23, June 23, and September 2. This monitoring was undertaken to provide a baseline assessment of macroinvertebrate communities in the stream. Samples were collected at three locations in London Creek during March and September of each year (Figures 1 and 2). These locations are designated by river mile distances from the Broad River. Location 2.6 is the most upstream location, just 0.7 mi (1.2 km) downstream of Lake Cherokee, Location 1.7 is the intermediate location 1.6 mi (2.6 km) downstream of Lake Cherokee, and Location 0.9 in the most downstream location 0.9 mi (1.4 km) upstream of the Broad River. In June 2009, an additional location (3.2) was sampled to provide additional survey data on a stream segment where ingress was not previously available. Location 3.2 is 0.55 mi (0.8 km) upstream of Location 2.6, just below the outfall from Lake Cherokee. This location was sampled only in June of 2009 to provide baseline data from this area.

Sampling procedures and assessment criteria for benthic communities were determined using the Standard Qualitative Bioassessment Method as outlined in the North Carolina Department of Environment and Natural Resources (NCDENR) Standard Operating Procedures (SOP) (NCDENR 2006). This protocol is accepted by the state of South Carolina. Samples were collected from each major habitat and the organisms were sorted from debris in the field (Figure 2). Organisms were placed into labeled containers, preserved in 95% ethyl alcohol, returned to the laboratory, and identified to the lowest practicable taxon. Analysis resulted in a bioassessment for each location which gives equal consideration to the number of Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa present and the biotic index value. The biotic index value is calculated using taxa tolerance values assigned by NCDENR biologists. A score is assigned to the EPT value and to the mean biotic index. The mean of these two scores is used to assign one of five bioassessments; Poor, Fair, Good/Fair, Good, and Excellent (NCDENR 2006). Bioassessments were determined using Piedmont criteria, with appropriate seasonal corrections, as outlined in the NCDENR SOP. The assessment of the balanced and indigenous nature of the benthic community is determined by comparing both total and EPT taxa abundance which results in the water quality bioassessments. The bioassessment method also requires a visual assessment of the substrate and habitat types at each sampling location.

Dissolved oxygen, water temperature, and specific conductance were measured at each sampling location following the Duke Energy Scientific Services Procedures Manual (Duke Energy 2007). In March 2008, dissolved oxygen and temperature data were collected *in situ* using a pre-calibrated YSI Model 55 Handheld Dissolved Oxygen System (Procedure-1531), while water samples for determination of specific conductance were collected at each location, placed on ice, and returned to the laboratory for analysis. March 2008 conductivities were determined within one week of sampling using a calibrated Hydrolab® datasonde (Procedure 3210.3). During September 2008 and March, June, and September 2009 sampling, a pre-calibrated Hach HQ40d was used for *in situ* measurements of temperature, dissolved oxygen, specific conductance, and pH (Procedure 2206).

RESULTS AND DISCUSSION

Habitat and Water Quality

During the sampling surveys in 2008 and 2009, London Creek was observed to be a shallow stream with alternating riffles and pools covered by a hardwood forest canopy. The stream banks at the upstream location (2.6) and the midstream location (1.7) are much steeper and less stabilized than the downstream location (0.9). The downstream location is less-incised with a gentle gradient which results in more stable banks than the upstream locations. The available sampling habitats at all three locations are very similar being comprised of shallow riffles with cobbles, pools, root masses, leaf packs, and sand/silt substrate. Location 0.9 also has a short section of bedrock, which receives more sunlight and is partially covered by moss. Location 3.2, the farthest upstream location (just 0.15 mi below the outfall from Lake Cherokee) was added to the survey in 2009 to provide baseline data from this previously unsampled area. The hardwood covered shoreline at Location 3.2 is fairly stable and drops off a few feet to the streambed which has similar habitat as the other three locations. Due to very low rainfall in the spring/summer of 2008, nearly all the riffle areas in the creek dried up leaving only isolated pools. Several heavy rainfall events in early September 2008 recharged the stream to the point where there was running water the entire length of London Creek during the September 22 – 23, 2008 sampling dates. Near average rainfall occurred during 2009 allowing for reasonably continuous stream flows, with the exception of comparatively dry conditions from late June through early August.

Temperature, dissolved oxygen, and specific conductance were measured during each sampling period, and pH values were determined beginning in September 2008 (Table 2).

Water quality data observed during seasonal macroinvertebrate sampling in London Creek was consistent with expectations for a small, intermittent, Piedmont stream with highly variable flow regimes. All parameters were within acceptable ranges for indigenous macroinvertebrate communities.

Bioassessment

During 2008, no clear or consistent spatial or seasonal trends of total and EPT taxa were apparent among sampling locations (Figures 3 and 4). The average of total taxa from all locations was slightly higher in March than in September, while the opposite was the case with EPT taxa. Total and EPT taxa were highest at Location 1.7 in March and at Location 0.9 in September. The lowest number of taxa was observed at Location 0.9 in March and Location 2.6 in September, while the lowest number of EPT taxa was recorded from Location 2.6 in March and Location 1.7 in September (Figures 3 and 4; Tables 2 through 4).

Total taxa and EPT taxa numbers in 2009 from Locations 0.9, 1.7, and 2.6 were notably higher than from these locations in 2008 during both sample periods (Figures 3 and 4). Also, consistent seasonal patterns were observed in 2009, with higher total taxa recorded from September than from March 2009, while fewer EPT taxa were counted in September than in March. As with 2008, no consistent spatial patterns among total and EPT taxa were observed in 2009. Total taxa numbers were very similar among all locations during both sample periods, while there were generally fewer EPT taxa recorded from Location 1.7 than from Locations 0.9 and 2.6.

Location 3.2, in the uppermost reach of London Creek, had fewer total and EPT taxa in June 2009 than at all other locations sampled in March and September 2009 (Figures 3 and 4; Table 5). Lower taxa numbers at this location may have been due to earlier development and emergence among aquatic macroinvertebrates prior to June. Eggs deposited by emerging adults may not have developed into viable larvae prior to June sampling, but would have been present for collection in September.

Bioassessment scores from all locations in both March and September 2008 were in the "Fair" range (Figure 5). Variability of scores among locations was quite low and likely due to similar habitat and substrate conditions at all locations. Additionally, exceptionally low rainfall during the spring and summer of 2008 caused the stream to dry up in many places, leaving only a series of small, isolated, pools. During early September, prior to sampling,

heavy rainfall events helped recharge the stream establishing similar flow conditions at all locations.

During 2009, bioassessment scores ranged from "Fair" at Location 1.7 in September and Location 3.2 in June, to "Good-fair" at all locations in March and Locations 0.9 and 2.6 in September (Figure 5; Tables 2 through 5). Generally, bioassessment scores were notably higher during 2009 than during 2008, with the exception of Location 1.7 in September of 2009. Although habitat characteristics were similar at all locations, rainfall conditions during 2009, with the exception of the June – August timeframe, were considerably improved from the previous year, providing more consistent flows though the course of London Creek.

Comparisons With Other Stream Sites

Duke Energy biologists have not conducted macroinvertebrate sampling at any other sites in Cherokee County or adjacent counties that are comparable to London Creek, however, the South Carolina Department of Health and Environmental Control (SCDHEC) conducted macroinvertebrate surveys on several streams in Cherokee County during the summer periods (July – September) of 1989 – 2004 (unpublished data from SCDHEC). SCDHEC used the same methods as Duke Energy biologists to sample available habitats. These streams included the Bowen River, Buffalo Creek, Cherokee Creek, Gilkey Creek, Goforth Creek, Kings Creek, Ross Creek, Suck Creek, and Thicketty Creek.

Habitats in the streams sampled by SCDHEC varied considerably and included root masses, leaf packs, logs/sticks, and combinations of rock, gravel, sand, and silt. The primary difference between these sites and London Creek is that the streams surveyed by SCDHEC are perennial with variable but continuous flow, while London Creek is an intermittent stream which largely dries up during prolonged periods of low rainfall. Bioassessment scores from the streams sampled by SCDHEC ranged from "Fair" (Cherokee Creek, 1989) to "Excellent" (Kings Creek, 1995 and 1999), with most ratings in the "Good-fair" and "Good" ranges, as compared to "Fair" ratings at all London Creek sites in 2008 (Figure 6). Based on the SCDHEC data, most of the sites sampled from 1989 – 2004 had higher bioclassification scores than those reported from London Creek in 2008.

Although overall stream conditions showed improvement during 2009 likely due to higher rainfall and more consistent flow rates, and overall bioassessment scores from London Creek locations were higher than in 2008, they were still lower than at most SCDHEC locations

sampled from 1989 – 2004 (Figure 6). Generally lower scores from London Creek may still be related to the intermittent flow regimes in London Creek even during years of normal rainfall, especially considering that principal inputs to the creek are mostly dependant on overflow from Lake Cherokee.

London Creek summer 2008 samples yielded 86 taxa (not counting species of Oligochaeta), of which 56 were also found in the other streams in Cherokee County sampled by SCDHEC. Of the 110 taxa recorded from 2009, 75 were also recorded from SCDHEC sites (Table 6). The total number taxa recorded by Duke Energy biologists from both years of sampling in London Creek was 129, of which 84 were found among streams sampled by SCDHEC. Among the 84 shared taxa from London Creek, most had similar abundance ratings at one or more locations sampled by SCDHEC. The SCDHEC locations yielded from 49 (Ross Creek) to 152 (Thicketty Creek) taxa. Thicketty Creek had more collections than all of the other streams sampled by SCDHEC hence the greater number of taxa. London Creek had fewer taxa than all but Cherokee Creek, Suck Creek, and Ross Creek based on 2008 data. In 2009, London Creek more taxa than two-thirds of the streams sampled by SCDHEC, and the total number of taxa from both 2008 and 2009 showed that London Creek had more taxa than all but Thicketty Creek.

The sensitivity of many macroinvertebrates to environmental perturbations has been documented and various taxa are assigned a tolerance rating. Perturbation tolerance values listed in Table 6 ranged from "0", the least tolerant, to "10", the most tolerant. London Creek demonstrated the highest percentage (32.3%) of rated taxa in the high tolerance range (7.1 – 10.0), while low tolerance taxa (0 – 3) accounted for only 12.1% of the rated taxa, a lower percentage than two-thirds of the streams sampled by SCDHEC (Table 7). This would indicate that conditions in London Creek were less suitable for macroinvertebrate communities than in most of the streams sampled by SCDHEC.

CONCLUSION

Macroinvertebrate sampling in London Creek during 2008 and 2009 revealed no consistent spatial or seasonal trends of total and EPT taxa among locations during 2008. During 2009, both total and EPT taxa numbers were higher than in 2008 and consistent seasonal patterns were observed, with higher total taxa and lower EPT taxa in September than in March. Location 3.2, in the uppermost reach of London Creek, was only sampled in June 2009 and had fewer total and EPT taxa than all other locations sampled in 2009 due to emergence of

adults and larval development before and after June sampling, respectively. Total taxa numbers in 2009 were similar among Locations 0.9 – 2.6 during both sampling periods, while fewer EPT taxa were recorded from Location 1.7 than Locations 0.9 and 2.6. Bioassessment scores during 2008 were "Fair" at all locations during both seasons, while in 2009, bioassessment were most often in "Good-fair" range. Low variability of bioassessment scores in 2008 was likely due to similar habitat and stream flow conditions at all locations. Higher bioassessment scores in 2009 compared to 2008 were likely due to more consistent stream flow resulting from near normal rainfall conditions in 2009.

Fewer taxa were collected from London Creek in 2008 than most streams sampled by SCDHEC from 1989 – 2004, while in 2009, more taxa were recorded from London Creek than two-thirds of the SCDHEC-sampled streams. When the number of taxa recorded from 2009 sampling was added to the 2008 list, the total taxa for both years was higher than all but one stream sampled by SCDHEC. Of the taxa from London Creek shared with SCDHEC-sampled streams, most had similar abundance ratings from one or more SCDHEC streams. Bioassessment scores from London Creek in both 2008 and 2009 were lower than those of most streams sampled by SCDHEC. Additionally, London Creek demonstrated the highest proportion of taxa in the high perturbation tolerance range, while the proportion of low-tolerance taxa in London Creek was lower than most streams sampled by SCDHEC. Based on comparisons of bioassessment scores and proportions of high and low tolerance taxa, conditions in London Creek appeared less suitable for low tolerance macroinvertebrate taxa than SCDHEC-sampled streams. This was likely due to the periodic lack of stream flow in London Creek due to low rainfall in 2008 and intermittent outflow from Lake Cherokee in 2009 as compared to the perennial, continuous-flow streams sampled by SCDHEC.

LITERATURE CITED

Duke Energy. 2007. Scientific Services Procedures Manual. 2007 update. Duke Energy, Charlotte NC.

North Carolina Department of Environment and Natural Resources (NCDENR). 2006. Standard Operating Procedures for Benthic Macroinvertebrates. NCDENR Division of Water Quality, Section. Raleigh, North Carolina.

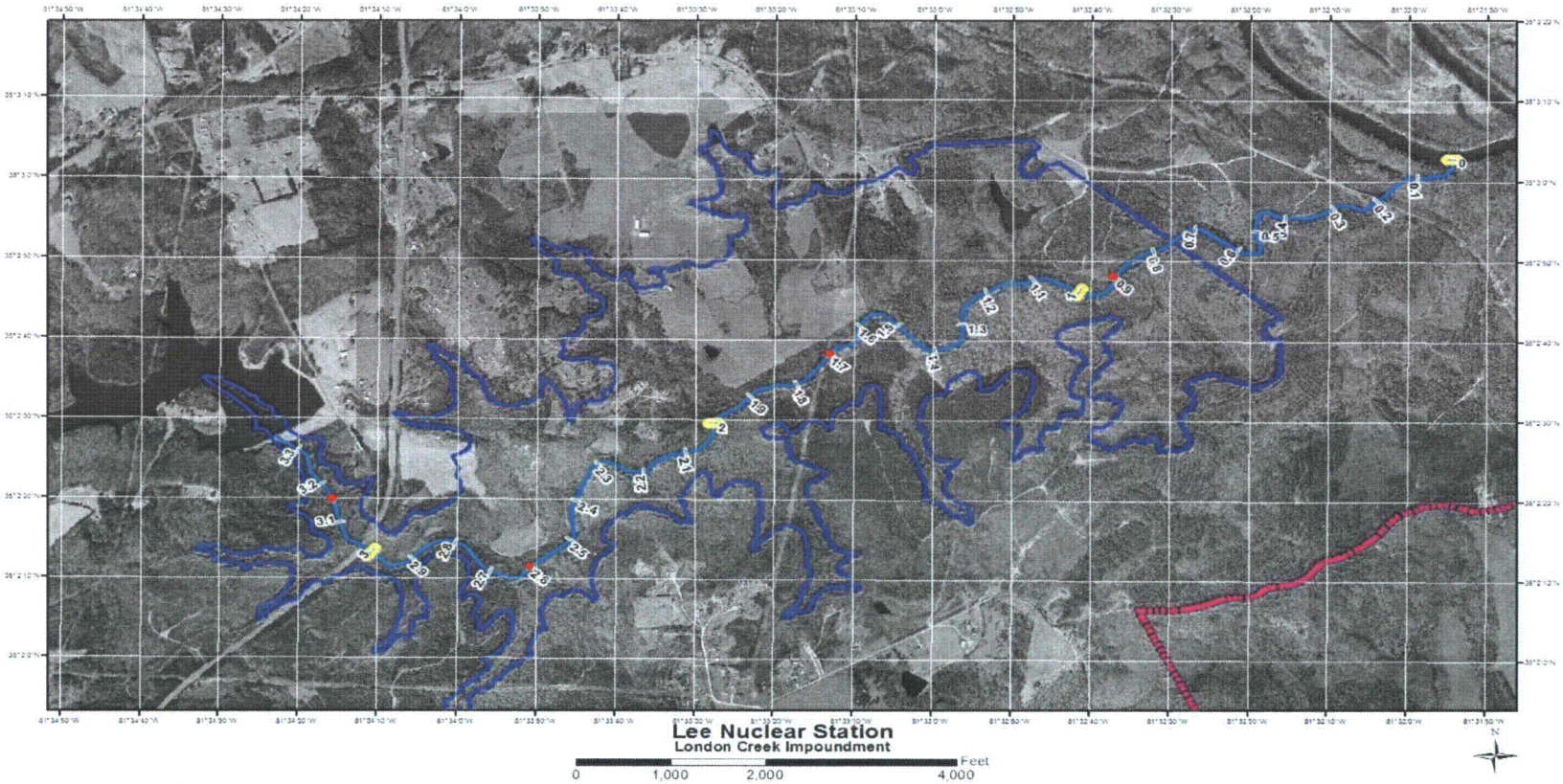

Figure 1. Aerial photograph of London Creek and associated macroinvertebrate sampling locations (in red). The Broad River is in the upper right hand corner and Lake Cherokee is at the left. Stream distances are approximate miles from the confluence with the Broad River. The outline of the proposed reservoir is in blue, London Creek is teal colored, and a segment of the Lee Nuclear Station project boundary is in pink.

Figure 2. Pictures showing kick net sampling at Location 1.7 (A), sorting macroinvertebrate samples (B and C), and habitat at Location 1.7 (D).

Figure 3. Total taxa collected from London Creek during sampling periods in March and September 2008 and 2009, and June 2009.

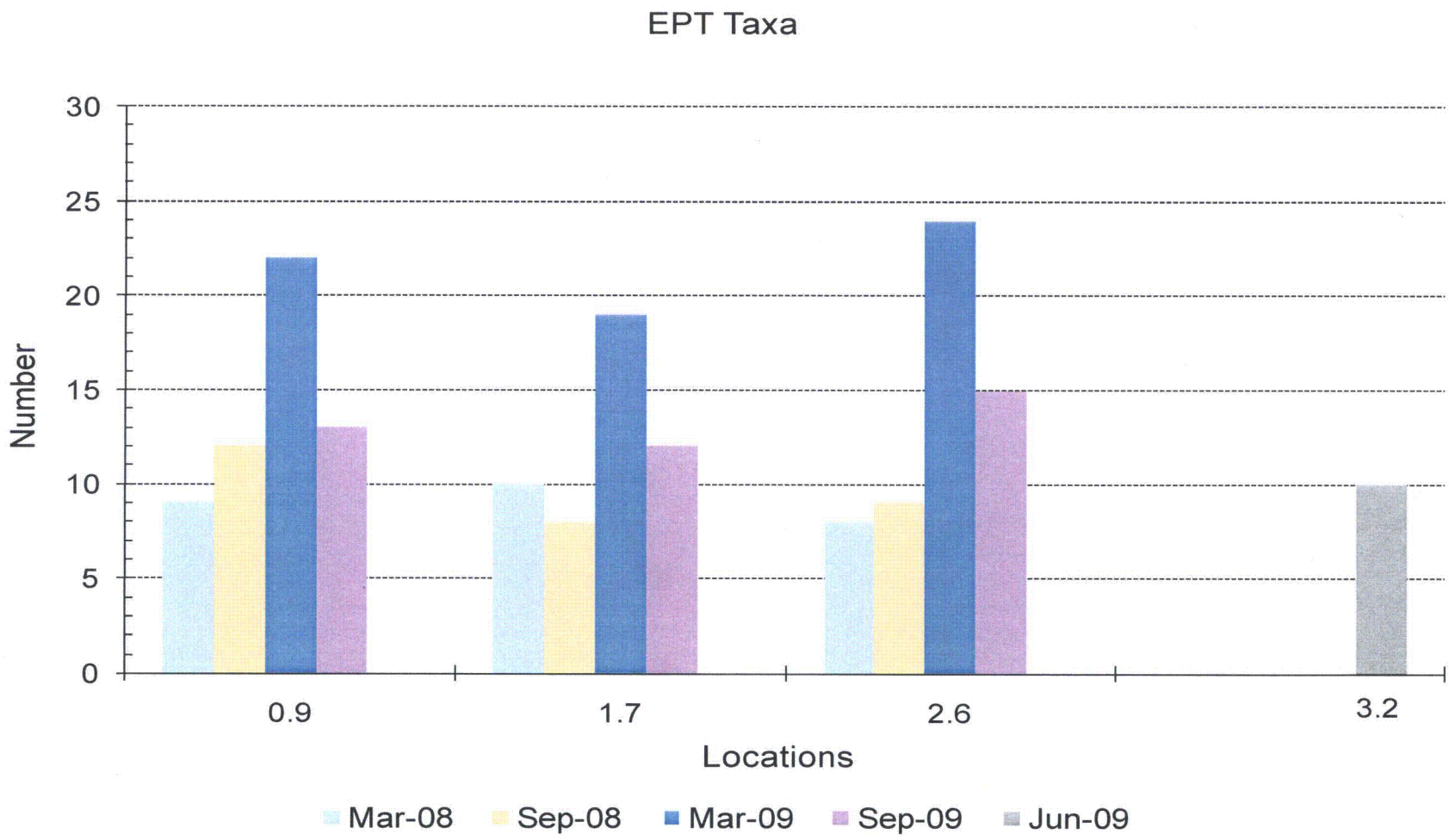

Figure 4. Number of EPT taxa collected from London Creek during sampling periods in March and September 2008 and 2009, and June 2009.

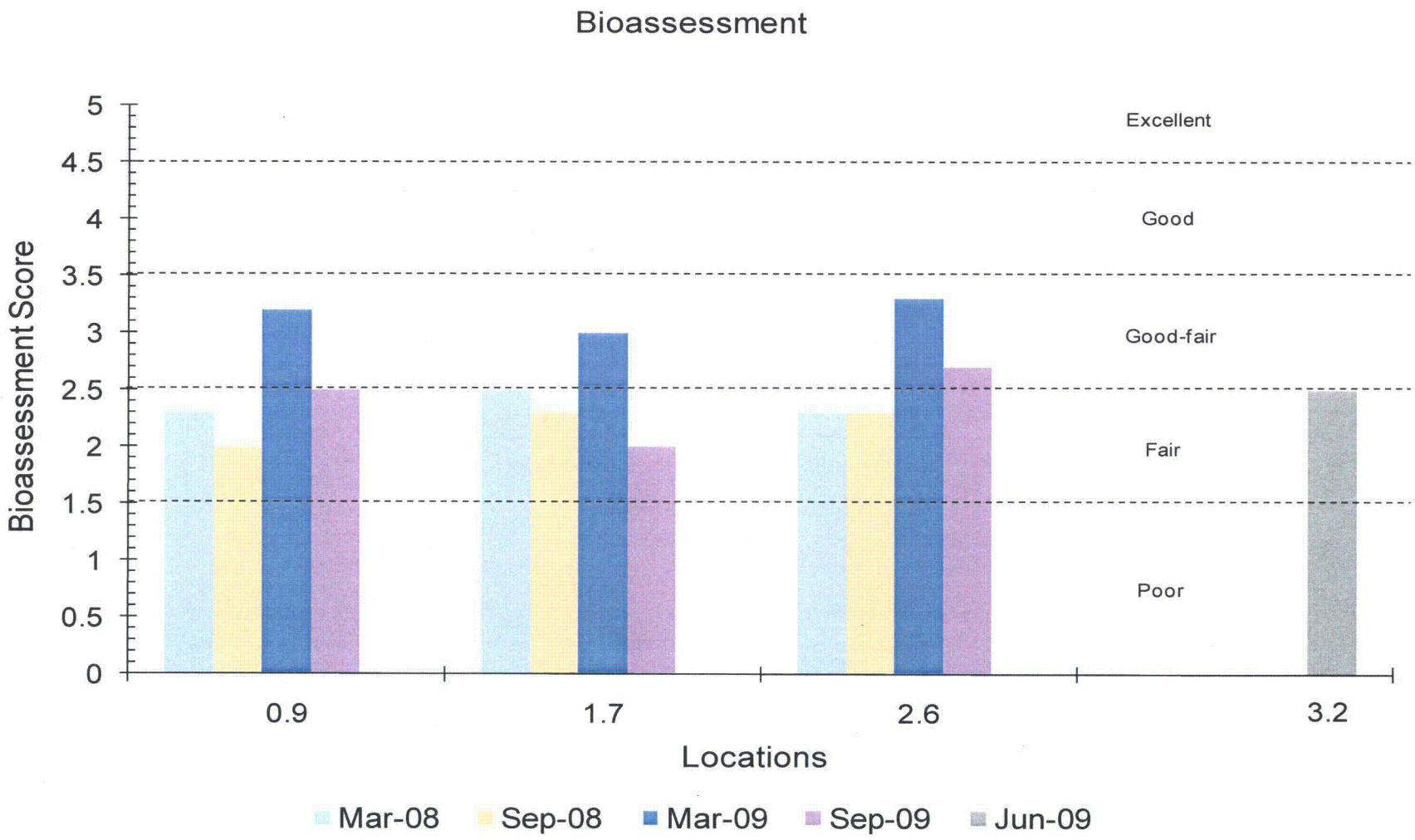

Figure 5. Water quality bioclassifications based on macroinvertebrate collections from London Creek during sampling periods in March and September 2008 and 2009, and June 2009.

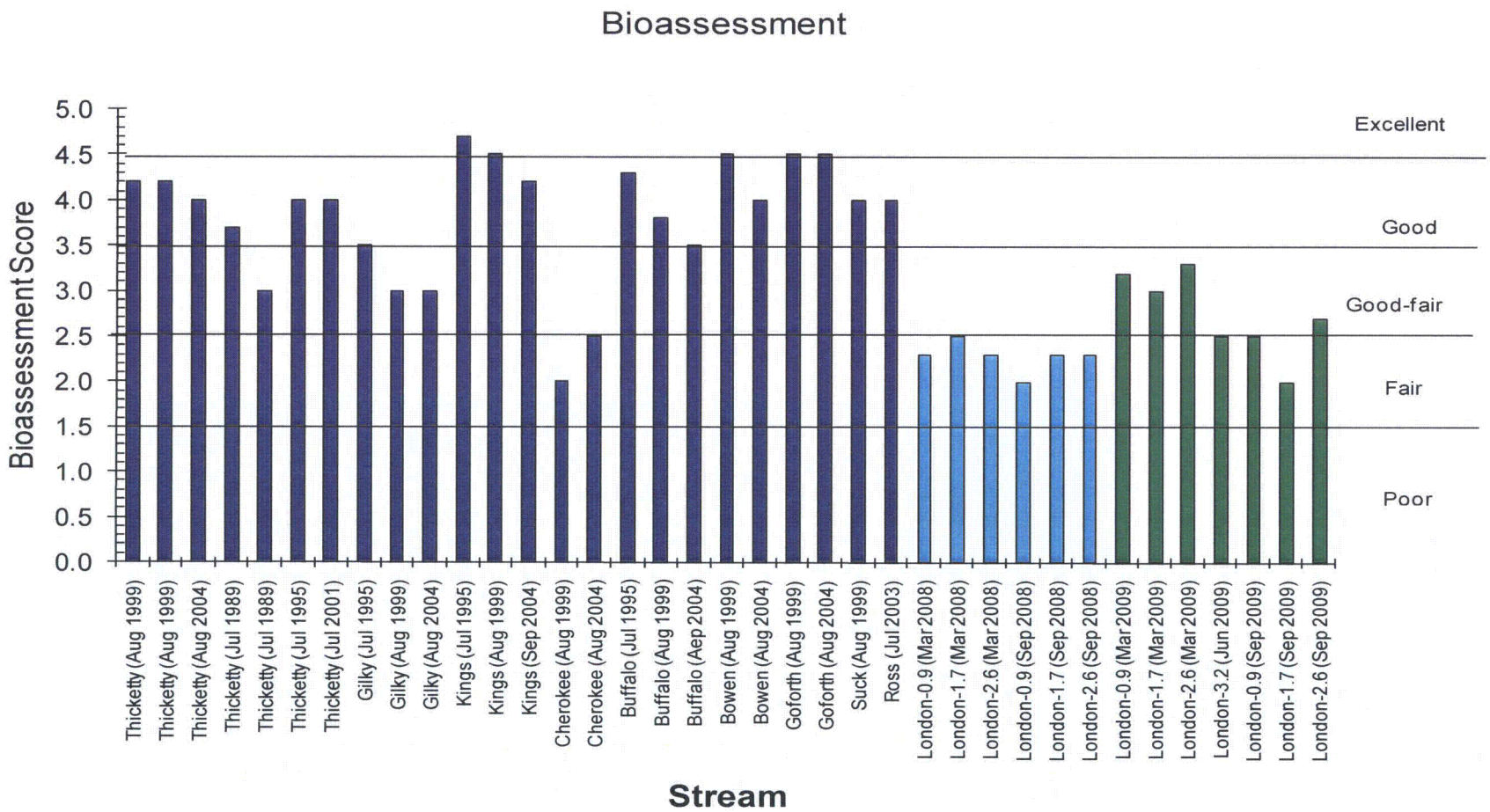

Figure 6. Water quality bioclassification scores from Thicketty Creek, Gilky Creek, Kings Creek, Cherokee Creek, Buffalo Creek, the Bowen River, Goforth Creek, Suck Creek, and Ross Creek in summer periods 1989, 1995, 1999, 2001, and 2004 (dard blue) compared to bioclassification scores from London Creek in March and September of 2008 (light blue) and 2009, and June 2009 (green).

Table 1. Water quality parameters recorded during 2008 and 2009 macroinvertebrate sampling of London Creek (NS = Not Sampled).

Location	Parameter	Mar 2008	Sep 2008	Mar 2009	Jun 2009	Sep 2009
0.9	Temperature °C (°F)	5.5 (41.9)	18.7 (65.7)	11.7 (53.1)	N/S	19.3 (66.7)
	Dissolved oxygen mg/L	11.7	8.9	10.6		8.0
	Conductivity µs/cm	85.4	90.3	80.1		98.7
	pH (SU)	N/S	7.0	7.7		7.0
1.7	Temperature °C (°F)	11.9 (53.4)	21.5 (70.7)	15.6 (60.1)	N/S	21.7 (71.1)
	Dissolved oxygen mg/L	11.3	8.7	10.3		8.4
	Conductivity µs/cm	83.9	86.1	74.4		87.9
	pH (SU)	N/S	7.0	7.4		7.0
2.6	Temperature °C (°F)	7.5 (45.5)	18.0 (64.4)	12.5 (54.5)	N/S	20.1 (68.7)
	Dissolved oxygen mg/L	10.4	7.9	11.4		7.7
	Conductivity µs/cm	78.3	83.8	74.0		92.4
	pH (SU)	N/S	6.9	7.5		6.9
3.2	Temperature °C (°F)	N/S	N/S	N/S	22.2 (72.0)	N/S
	Dissolved oxygen mg/L					
	Conductivity µs/cm					
	pH (SU)					

Table 2. Macroinvertebrates collected from London Creek Location 0.9 during March and September 2008, and March and September 2009. "R"= Rare (1-2 individuals collected), "C"= Common (3-9 individuals collected), an "A" = Abundant (10 or more individuals collected).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Annelida				
Oligochaeta				
Branchiobdellida				
Branchiobdellidae		R		
Tubificida				
Enchytraeidae	A			
Naididae				
Nais communis	R			
Pristina sima	R			
Stylaria lacustris				R
Tubificidae	C		R	R
Lumbriculida				
Lumbriculidae	C	C	C	C
Lumbriculus spp.	R	R		R
Stylodrilus heringianus			C	
Arthropoda				
Crustacea				
Amphipoda				
Talitridae				
Hyalella azteca	A	C	A	A
Decapoda				
Cambaridae				
Cambarus acuminatus		A	A	A
Procambarus acutus		R		C
Insecta				
Coleoptera				
Dryopidae				
Helichus spp.	C	A	C	A
Dytiscidae				
Neoporus spp.	C	A	A	R
Elmidae				
Ancyronyx variegatus		R		R
Dubiraphia vittata	R		R	R
Macronychus glabratus	C	R		R
Optioservus spp.		C		
Stenelmis spp.	C	A	A	C
Gyrinidae				
Dineutus spp.		A		A
Gyrinus spp.	R			
Haliplidae				
Peltodytes spp.	C	C	C	C
Hydrophilidae				

Table 2. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Sperchopsis tessellatus	R			
Psephenidae				
Ectopria nervosa	R		R	
Psephenus herricki	A		C	C
Ptilodactylidae				
Anchytarsus bicolor				R
Diptera				
Ceratopogonidae				
Palpomyia-Bezzia complex		C		R
Chironomidae-Chironominae				
Cladopelma spp.				R
Cladotanytarsus spp.				C
Cryptochironomus spp.			R	A
Dicrotendipes neomodestus		R	R	A
Microtendipes spp.		R		
Microtendipes pedellus gr.				A
Nilothauma spp.				C
Paratendipes spp.		R	A	A
Phaenopsectra spp.	C	R	A	A
Phaenopsectra punctipes				C
Polypedilum aviceps			A	
Polypedilum fallax		R		
Polypedilum flavum		A	A	C
Polypedilum illinoense		A	A	
Polypedilum scalaenum	R			A
Pseudochironomus spp.				R
Rheotanytarsus spp.				R
Stempellina spp.		R		
Stenochironomus spp.	R			C
Tanytarsus spp.	C	C	A	C
Chironomidae-Diamesinae				
Potthastia longimana gr.			R	
Chironomidae-Orthocladiinae				
Chaetocladius spp.	A			
Corynoneura spp.	C	R	A	R
Cricotopus bicinctus		A	C	R
Cricotopus politus			C	
Cricotopus varipes gr.			A	
Cricotopus vierriensis		C		
Diplocladius cultriger	C			
Eukiefferiella spp.	C	R		
Eukiefferiella brehmi			A	
Eukiefferiella claripennis			A	
Nanocladius spp.	R			
Orthocladius doranus	A			

Table 2. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Orthocladius lignicola	C			
Orthocladius nigritus	R			
Orthocladius robacki	A		A	
Parakiefferiella spp.			R	C
Parametriocnemus spp.	C	R	A	
Rheocricotopus robacki			R	
Thienemanniella spp.				C
Thienemanniella xena	R	R	C	R
Xylotopus par			R	
Chironomidae-Tanypodinae				
Ablabesmyia mallochi	R	C	A	A
Conchapelopia gr.	R	C	C	A
Labrundinia spp.				C
Natarsia spp.			R	R
Zavrelimyia gr.	R		R	
Culicidae				
Anopheles spp.				C
Dixidae				
Dixella spp.			C	A
Simuliidae				
Prosimulium mixtum	A		A	
Simulium venustum		R	A	C
Tabanidae				
Tabanus spp.		R	R	R
Tipulidae				
Antocha spp.				C
Tipula spp.	R	C	A	C
Ephemeroptera				
Baetidae				
Baetis flavistriga		R		C
Baetis intercalaris		R		
Baetis pluto				A
Centroptilum spp.		C	A	A
Heterocloeon amplum			A	
Plauditus dubius gr.	C			
Pseudocloeon spp.		R		
Caenidae				
Caenis spp.	R	R	C	R
Ephemerellidae				
Ephemerella dorothea			C	
Eurylophella versimilis	R		C	
Ephemeridae				
Hexagenia spp.				R
Heptageniidae				
Maccaffertium modestum			A	A

Table 2. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Maccaffertium terminatum		R		
Stenacron interpunctatum	R		R	C
Stenonema femoratum		C		
Leptophlebiidae				
Leptophlebia spp.			R	
Oligoneuriidae				
Isonychia spp.				R
Siphlonuridae				
Ameletus lineatus	C		C	
Hemitpera				
Corixidae				
Sigara spp.			A	
Nepidae				
Ranatra spp.				R
Megaloptera				
Corydalidae				
Corydalus cornutus		C	R	A
Nigronia fasciatus		R		R
Nigronia serricornis				C
Sialidae				
Sialis spp.		R		R
Odonata-Anisoptera				
Aeshnidae				
Basiaeshna janata				R
Boyeria vinosa				A
Cordulegastridae				
Cordulegaster maculata	R			
Corduliidae				
Somatochlora spp.		C	C	A
Gomphidae				
Gomphus spp.	R	R		C
Macromiidae				
Macromia georgina			R	R
Odonata-Zygoptera				
Calopterygidae				
Calopteryx spp.				R
Coenagrionidae				
Argia spp.		R		R
Plecoptera				
Peltoperlidae				
Tallaperla spp.			R	
Perlidae				
Acroneuria abnormis				R
Eccoptura xanthenes		R		
Perlesta spp.	C		A	

Table 2. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Trichoptera				
Hydropsychidae				
Cheumatopsyche spp.		C	A	A
Diplectrona modesta		R	R	
Hydropsyche betteni			C	A
Hydroptilidae				
Hydroptila spp.			R	
Leptoceridae				
Triaenodes ignitus			R	
Limnephilidae				
Ironoquia spp.			A	
Ironoquia punctatissima	C			
Pycnopsyche spp.	R		C	R
Philopotamidae				
Chimarra spp.		R	R	A
Wormaldia spp.			C	
Phryganeidae				
Ptilostomis spp.		C		
Psychomyiidae				
Psychomyia flavida	R			
Rhyacophilidae				
Rhyacophila carolina			A	
Uenoidae				
Neophylax spp.			R	
Mollusca				
Gastropoda				
Basommatophora				
Physidae				
Physella spp.	C	C	R	R
Mesogastropoda				
Pleuroceridae				
Elimia proxima	C	R		
Pulmonata				
Planorbidae				
Helisoma anceps	A	C	R	C
Pelecypoda				
Heterodonta				
Sphaeriidae				
Musculium partumeium	A	R	A	
Heterodontida				
Corbiculidae				
Corbicula fluminea	C	R	R	
Nematoda				R
Platyhelminthes				
Turbellaria				

Table 2. (Continued).[1]

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Tricladida				
Planariidae				
Dugesia spp.			R	R
Total Taxa Collected	**53**	**58**	**73**	**77**
Total EPT Taxa Collected	**9**	**12**	**22**	**13**
Biotic Index Value	**6.23**	**6.54**	**6.16**	**6.33**
EPT Score	**1.6**	**2**	**3.4**	**2**
Biotic Index Score	**3**	**2**	**3**	**3**
Final Bioassessment	**Fair**	**Fair**	**Good-fair**	**Good-fair**

[1] Eight Plecoptera were identified from samples collected in March 2008, and March 2009, but were not included in the location taxa lists. These taxa are considered winter/spring Plecoptera and were omitted from all analyses in 2008 and 2009 to derive appropriate seasonal corrections, as outlined in NCDWQ SOP (NCDENR 2006). The taxa were: *Allocapnia* spp. and *Strophopteryx* spp. (all locations, March 2008), *Amphinemura* spp. (all locations, March 2009), *Taeniopteryx* spp. (Locations 0.9 and 1.7, March 2008), *Isoperla biliniata* (Locations 1.7 and 206, March 2008; all locations, March 2009), *Cleoperla clio* (Location 2.6, March 2008; Locations 0.9 and 1.7, March 2009), *Diploperla duplicate* (Location 0.9, March 2009), and *Eccoptura xanthenes* (Location 1.7, March 2009).

Table 3. Macroinvertebrates collected from London Creek Location 1.7 during March and September 2008 and March and September 2009. "R"= Rare (1-2 individuals collected), "C"= Common (3-9 individuals collected), an "A"= Abundant (10 or more individuals collected).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Annelida				
Oligochaeta				
Tubificida				
Enchytraeidae	R			
Naididae	R			
Nais communis		R		
Nais variabilis		R		
Pristina sima	R			
Pristinella osborni	R			
Stephensoniana tandyi		R		
Stylaria lacustris				C
Tubificidae	A	R	A	
Aulodrilus limnobius			R	
Limnodrilus hoffmeisteri				R
Telmatodrilus vejdovskyi		R		
Lumbriculida				
Lumbriculidae	C	C	R	C
Lumbriculus spp.		R		R
Stylodrilus heringianus			C	R
Arthropoda				
Crustacea				
Amphipoda				
Talitridae				
Hyalella azteca	A	R	A	A
Decapoda				
Cambaridae				
Cambarus acuminatus	C	C	C	C
Procambarus acutus	C	C	R	C
Insecta				
Coleoptera				
Dryopidae				
Helichus spp.	A	A	A	C
Dytiscidae				
Neoporus spp.	R	A	A	C
Elmidae				
Ancyronyx variegatus				R
Dubiraphia vittata		C	C	R
Macronychus glabratus	C			R
Stenelmis spp.	C	A	A	C
Gyrinidae				
Dineutus spp.	R			A
Gyrinus spp.			R	R

Table 3. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Haliplidae				
Peltodytes spp.	C	R	C	A
Psephenidae				
Ectopria nervosa	R			
Psephenus herricki	A			C
Ptilodactylidae				
Anchytarsus bicolor		R		
Diptera				
Chironomidae-Chironominae				
Chironomus spp.	C			R
Cladotanytarsus spp.		R		A
Cryptochironomus spp.			R	A
Dicrotendipes neomodestus	R	A	C	A
Microtendipes spp.	A	R		
Microtendipes pedellus gr.				A
Nilothauma spp.		R		C
Paratanytarsus spp.				C
Paratendipes spp.		C	C	
Phaenopsectra spp.	C	R	C	C
Phaenopsectra punctipes				R
Polypedilum aviceps	R		A	
Polypedilum fallax			R	C
Polypedilum flavum		A	A	
Polypedilum illinoense		R	R	R
Polypedilum scalaenum				A
Pseudochironomus spp.				C
Rheotanytarsus spp.	C			
Stempellinella spp.				R
Stenochironomus spp.				A
Tanytarsus spp.	A	C	A	A
Chironomidae-Orthocladiinae				
Corynoneura spp.			A	R
Cricotopus bicinctus		R		
Cricotopus politus			R	
Cricotopus varipes gr.			A	
Diplocladius cultriger	C			
Eukiefferiella spp.	A			
Eukiefferiella brehmi			C	
Eukiefferiella claripennis			R	
Nanocladius spp.	R	R		R
Orthocladius doranus	A			
Orthocladius lignicola	R			
Orthocladius nigritus	R			
Orthocladius robacki	A		A	
Parakiefferiella spp.			C	

Table 3. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Parametriocnemus spp.	A	R	A	
Psectrocladius spp.	C			
Thienemanniella xena			C	
Zalutschia spp.	R		C	
Chironomidae-Tanypodinae				
Ablabesmyia mallochi	R	C	C	A
Clinotanypus spp.	R			
Coelotanypus spp.	R			
Conchapelopia gr.	A	C	C	A
Labrundinia spp.				C
Natarsia spp.	R			A
Nilotanypus spp.				A
Procladius spp.	C			R
Zavrelimyia gr.	R		C	R
Culicidae				
Anopheles spp.				C
Dixidae				
Dixella spp.		C	R	C
Simuliidae				
Prosimulium mixtum	A		R	
Simulium venustum	C		A	R
Tipulidae				
Tipula spp.	A	R	A	R
Ephemeroptera				
Baetidae				
Baetis flavistriga				C
Baetis pluto				R
Centroptilum spp.		R	C	A
Heterocloeon amplum			A	
Plauditus dubius gr.	C			
Pseudocloeon spp.		R		
Caenidae				
Caenis spp.	A		R	C
Ephemerellidae				
Ephemerella dorothea			A	
Eurylophella versimilis			A	
Serratella deficiens	C			R
Heptageniidae				
Maccaffertium modestum	A	A	A	A
Stenacron interpunctatum	R	R	R	C
Leptophlebiidae				
Leptophlebia spp.			A	
Oligoneuriidae				
Isonychia spp.				C
Siphlonuridae				

Table 3. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Ameletus lineatus	A		A	
Hemitpera				
Corixidae				
Sigara spp.		R		
Megaloptera				
Corydalidae				
Chauliodes rastricornis		R		
Corydalus cornutus		R		C
Nigronia fasciatus			R	R
Nigronia serricornis	R	R	R	A
Sialidae				
Sialis spp.		R		A
Odonata-Anisoptera				
Aeshnidae				
Basiaeshna janata		R	R	C
Boyeria vinosa	C	R		A
Cordulegastridae				
Cordulegaster maculata	R	R	R	C
Corduliidae				
Helocordulia uhleri	C	R		
Somatochlora spp.		C	C	A
Tetragoneuria spp.				R
Gomphidae				
Gomphus spp.	R		R	A
Hagenius brevistylus	R			
Lanthus spp.		R		
Ophiogomphus spp.				R
Stylogomphus albistylus	C		R	
Libellulidae				
Plathemis lydia	R			
Macromiidae				
Didymops transversa				C
Macromia georgina			R	
Odonata-Zygoptera				
Calopterygidae				
Calopteryx spp.		C	R	A
Coenagrionidae				
Argia spp.	R		R	A
Enallagma spp.				A
Ischnura spp.	C	R		
Plecoptera				
Peltoperlidae				
Tallaperla spp.		R		
Perlidae				
Acroneuria abnormis				R

Table 3. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Perlesta spp.	A		A	
Trichoptera				
Hydropsychidae				
Cheumatopsyche spp.		C	C	A
Diplectrona modesta		A	R	
Hydropsyche betteni				C
Hydroptilidae				
Hydroptila spp.			C	
Lepidostomatidae				
Lepidostoma spp.			R	
Leptoceridae				
Triaenodes melaca			R	
Limnephilidae				
Ironoquia spp.	R		A	
Pycnopsyche spp.			A	
Philopotamidae				
Chimarra spp.	R	C		A
Psychomyiidae				
Lype diversa			R	
Uenoidae				
Neophylax spp.			C	
Neophylax oligius	R			
Mollusca				
Gastropoda				
Basommatophora				
Physidae				
Physella spp.	A		C	C
Mesogastropoda				
Pleuroceridae				
Elimia proxima	A		R	
Pulmonata				
Planorbidae				
Helisoma anceps			R	R
Pelecypoda				
Heterodonta				
Sphaeriidae				
Musculium partumeium	A	R	C	C
Heterodontida				
Corbiculidae				
Corbicula fluminea	R			
Total Taxa Collected	**68**	**54**	**72**	**77**
Total EPT Taxa Collected	**10**	**8**	**19**	**12**
Biotic Index Value	**6.10**	**6.04**	**6.00**	**6.69**
EPT Score	**2**	**1.6**	**3**	**2**
Biotic Index Score	**3**	**3**	**3**	**2**
Final Bioassessment	**Fair**	**Fair**	**Good-fair**	**Fair**

Table 4. Macroinvertebrates collected from London Creek Location 2.6 during March and September 2008 and March and September 2009. "R"= Rare (1-2 individuals collected), "C"= Common (3-9 individuals collected), an "A"= Abundant (10 or more individuals collected).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Annelida				
Oligochaeta				
Tubificida				
Naididae	R			
Nais communis				C
Nais variabilis				R
Stylaria lacustris				R
Tubificidae	A	R	C	R
Telmatodrilus vejdovskyi		R		
Lumbriculida				
Lumbriculidae	A	A		C
Lumbriculus spp.	A	R	A	C
Stylodrilus heringianus			C	C
Arthropoda				
Crustacea				
Amphipoda				
Talitridae				
Hyalella azteca	A	C	A	A
Decapoda				
Cambaridae				
Cambarus acuminatus	C	A	R	C
Procambarus acutus	C	C	R	R
Insecta				
Coleoptera				
Dryopidae				
Helichus spp.	A	A	A	C
Dytiscidae				
Neoporus spp.	A	C	A	
Elmidae				
Ancyronyx variegatus	R			R
Dubiraphia vittata				R
Macronychus glabratus	R			
Stenelmis spp.	C	A	A	C
Gyrinidae				
Dineutus spp.		C		A
Gyrinus spp.	R			
Haliplidae				
Peltodytes spp.	R	C	C	
Psephenidae				
Psephenus herricki	A		C	C
Ptilodactylidae				
Anchytarsus bicolor		R		R

Table 4. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Diptera				
Ceratopogonidae				
Palpomyia-Bezzia complex				R
Chironomidae-Chironominae				
Chironomus spp.	C	R		C
Cryptochironomus spp.			R	C
Dicrotendipes neomodestus	R	R	R	R
Glyptotendipes spp.		R		
Microtendipes pedellus gr.			R	C
Paratendipes spp.		A	A	C
Phaenopsectra spp.		R	R	A
Phaenopsectra punctipes				C
Polypedilum aviceps			C	
Polypedilum fallax	R	R		C
Polypedilum flavum		A	A	R
Polypedilum illinoense		A	C	
Polypedilum scalaenum				C
Rheotanytarsus spp.				R
Stempellina spp.		R		
Stictochironomus spp.				A
Tanytarsus spp.	R	C	C	C
Chironomidae-Diamesinae				
Potthastia spp.		R		
Potthastia longimana gr.			C	
Chironomidae-Orthocladiinae				
Cricotopus politus			C	
Cricotopus varipes gr.			A	
Diplocladius cultriger	C			
Eukiefferiella spp.	R			
Eukiefferiella brehmi			A	
Eukiefferiella claripennis			R	
Orthocladius doranus	R			
Orthocladius lignicola	R			
Orthocladius nigritus	R			
Orthocladius robacki	R		A	
Parakiefferiella spp.	R		C	C
Parametriocnemus spp.	C	R	A	
Psectrocladius spp.	R			
Rheocricotopus robacki				R
Thienemanniella xena			C	
Chironomidae-Tanypodinae				
Ablabesmyia spp.		R		
Ablabesmyia mallochi		C	C	A
Conchapelopia gr.		R	A	C
Labrundinia spp.		C		

Table 4. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Natarsia spp.	C			C
Zavrelimyia gr.	C			
Culicidae				
Anopheles spp.				R
Empididae			R	
Dixidae				
Dixa spp.				R
Dixella spp.		R		C
Simuliidae				
Prosimulium mixtum	A		R	
Simulium venustum			A	
Tabanidae				
Tabanus spp.	R			
Tipulidae				
Hexatoma spp.	R			R
Tipula spp.	C	C	A	C
Ephemeroptera				
Baetidae				
Baetis flavistriga		R		A
Baetis pluto				A
Centroptilum spp.		R	A	C
Heterocloeon amplum			A	
Caenidae				
Caenis spp.			A	
Ephemerellidae				
Ephemerella dorothea			A	
Eurylophella versimilis	A		A	
Serratella deficiens	A			
Heptageniidae				
Maccaffertium modestum			A	A
Stenacron interpunctatum			C	A
Stenonema femoratum		R	R	C
Leptophlebiidae				
Habrophleboides spp.				C
Leptophlebia spp.	A		A	
Oligoneuriidae				
Isonychia spp.				R
Siphlonuridae				
Ameletus lineatus	A		A	
Tricorythidae				
Tricorythodes spp.				R
Hemitpera				
Corixidae				
Sigara spp.	R		R	
Megaloptera				

Table 4. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Corydalidae				
Corydalus cornutus	C			
Nigronia fasciatus	A	C	C	A
Nigronia serricornis	C	C		A
Sialidae				
Sialis spp.		R		C
Odonata-Anisoptera				
Aeshnidae				
Basiaeshna janata		R		
Boyeria vinosa			R	A
Cordulegastridae				
Cordulegaster maculata	R			R
Corduliidae				
Helocordulia uhleri	R	R		
Somatochlora spp.	R	R	A	A
Tetragoneuria spp.		R		
Gomphidae				
Gomphus spp.				C
Stylogomphus albistylus				R
Macromiidae				
Macromia georgina				R
Odonata-Zygoptera				
Calopterygidae				
Calopteryx spp.			R	C
Coenagrionidae				
Argia spp.			R	R
Enallagma spp.			R	R
Plecoptera				
Perlidae				
Acroneuria abnormis		R	R	C
Perlesta spp.			A	
Trichoptera				
Calamoceratidae				
Anisocentropus pyraloides			R	
Hydropsychidae				
Cheumatopsyche spp.		C	C	A
Diplectrona modesta		C	C	
Hydropsyche bettini		R	R	A
Hydroptilidae				
Hydroptila spp.			C	
Leptoceridae				
Triaenodes ignitus				C
Triaenodes melaca			R	
Limnephilidae				
Ironoquia spp.	C		C	

Table 4. (Continued).

Taxon	3/10/2008	9/22/2008	3/23/2009	9/2/2009
Pycnopsyche spp.			A	R
Odontoceridae				
Psilotreta frontalis	R			
Philopotamidae				
Chimarra spp.		C	C	A
Phryganeidae				
Ptilostomis spp.		R		
Psychomyiidae				
Lype diversa	C			
Psychomyia flavida	R			
Rhyacophilidae				
Rhyacophila carolina			A	
Rhyacophila nigrita			R	
Uenoidae				
Neophylax spp.			C	
Mollusca				
Gastropoda				
Basommatophora				
Physidae				
Physella spp.	A	C	R	C
Lymnophila				
Lymnaeidae				
Pseudosuccinea columella				R
Mesogastropoda				
Pleuroceridae				
Elimia proxima	A	A	C	C
Pulmonata				
Planorbidae				
Helisoma anceps	C		R	
Pelecypoda				
Heterodonta				
Sphaeriidae				
Musculium partumeium	A	C	C	A
Heterodontida				
Corbiculidae				
Corbicula fluminea	R	R		R
Nematoda				R
Platyhelminthes				
Turbellaria				
Tricladida				
Planariidae				
Dugesia spp.				R
Total Taxa Collected	**54**	**51**	**70**	**75**
Total EPT Taxa Collected	**8**	**9**	**24**	**15**
Biotic Index Value	**5.99**	**6.08**	**5.84**	**6.29**
EPT Score	**1.6**	**1.6**	**3.6**	**2.4**
Biotic Index Score	**3**	**3**	**3**	**3**
Final Bioassessment	**Fair**	**Fair**	**Good-fair**	**Good-fair**

Table 5. Macroinvertebrates collected from London Creek Location 3.2 during June 2009. "R"= Rare (1-2 individuals collected), "C"= Common (3-9 individuals collected), an "A"= Abundant (10 or more individuals collected).

Taxon	6/23/2009
Annelida	
Oligochaeta	
Tubificida	
Naididae	
Nais variabilis	R
Tubificidae	R
Lumbriculida	
Lumbriculidae	R
Lumbriculus spp.	C
Arthropoda	
Crustacea	
Amphipoda	
Talitridae	
Hyalella azteca	A
Decapoda	
Cambaridae	
Cambarus acuminatus	A
Insecta	
Coleoptera	
Dryopidae	
Helichus spp.	C
Dytiscidae	
Neoporus spp.	A
Elmidae	
Stenelmis spp.	R
Gyrinidae	
Dineutus spp.	C
Psephenidae	
Ectopria nervosa	C
Psephenus herricki	C
Diptera	
Chironomidae-Chironominae	
Chironomus spp.	C
Cryptochironomus spp.	R
Dicrotendipes neomodestus	C
Microtendipes pedellus gr.	A
Nilothauma spp.	C
Paratanytarsus spp.	A
Phaenopsectra spp.	A
Polypedilum fallax	C
Polypedilum flavum	A
Polypedilum illinoense	R
Rheotanytarsus spp.	R

Table 5. (Continued).

Taxon	6/23/2009
Stenochironomus spp.	R
Tanytarsus spp.	A
Chironomidae-Orthocladiinae	
Cricotopus varipes gr.	C
Parametriocnemus spp.	R
Rheocricotopus robacki	C
Chironomidae-Tanypodinae	
Ablabesmyia mallochi	A
Clinotanypus spp.	R
Natarsia spp.	A
Procladius spp.	C
Culicidae	
Anopheles spp.	C
Dixidae	
Dixella spp.	R
Tipulidae	
Hexatoma spp.	R
Tipula spp.	A
Ephemeroptera	
Baetidae	
Baetis flavistriga	C
Heptageniidae	
Maccaffertium modestum	A
Stenacron interpunctatum	A
Stenacron pallidum	A
Hemiptera	
Nepidae	
Ranatra spp.	R
Megaloptera	
Corydalidae	
Corydalus cornutus	R
Nigronia fasciatus	C
Nigronia serricornis	A
Sialidae	
Sialis spp.	C
Odonata-Anisoptera	
Aeshnidae	
Boyeria vinosa	R
Gomphidae	
Gomphus spp.	C
Stylogomphus albistylus	A
Macromiidae	
Macromia georgina	R
Odonata-Zygoptera	
Coenagrionidae	
Argia spp.	R

Table 5. (Continued).

Taxon	6/23/2009
Ischnura spp.	C
Trichoptera	
Hydropsychidae	
Cheumatopsyche spp.	A
Diplectrona modesta	R
Hydropsyche betteni	C
Leptoceridae	
Triaenodes ignitus	R
Limnephilidae	
Pycnopsyche spp.	R
Psychomyiidae	
Lype diversa	R
Mollusca	
Gastropoda	
Basommatophora	
Physidae	
Physella spp.	R
Mesogastropoda	
Pleuroceridae	
Elimia proxima	A
Pulmonata	
Planorbidae	
Helisoma anceps	R
Pelecypoda	
Heterodontida	
Corbiculidae	
Corbicula fluminea	A
Total Taxa Collected	**61**
Total EPT Taxa Collected	**10**
Biotic Index Value	**6.40**
EPT Score	**2**
Biotic Index Score	**3**
Final Bioassessment	**Fair**

Table 6. Taxa collected by Duke Energy in London Creek in September of 2008 (LON-08), and June and September of 2009 (LON-09), and total numbers of taxa collected by SCDHEC in other streams in Cherokee County during summer periods (July – September) of 1989 – 2004 along with abundance ratings (see Table 2) and tolerance values (TV) for each evaluated taxon (NE = taxon not evaluated). SCDHEC streams are abbreviated as follows: THI = Thicketty, KIN = Kings, GIL = Gilky, CHE = Cherokee, BUF = Buffalo, BOW = Bowen, GOF = Goforth, SUC = Suck, and ROS = Ross. Highlighted taxa are those common to London Creek and streams sampled by SCDHEC. NOTE: SCDHEC did not identify Oligochaeta to lower taxonomic levels, therefore these taxa identified by Duke Energy biologists were omitted from this table.

TAXON	TV	LON-08	LON-09	THI	KIN	GIL	CHE	BUF	BOW	GOF	SUC	ROS
Annelida												
Hiruninea												R
Rhynchobdellida												
Hirudinidae												
Batracobdella spp.				A								
Oligochaeta	7.9	R	C	C	R	R	R	R	R	R	R	
Arthropoda												
Arachnoidia												
Hydracarina	5.5				R				R			
Crustacea												
Amphipoda												
Talitridae												
Hyallela azteca	7.8	C	A			R						
Decapoda												
Cambaridae	7.5	C	C	C	C	C	R	C	C	C	C	R
Cambarus acuminatus	7.6	A	A									
Cambarus spp.	7.6			R		R	R		R	R	R	
Procambbarus acutus	7.0	C	C									
Isopoda												
Aselidae												
Caecidotae spp.	9.1			R					R			
Insecta												
Hexapoda												
Coleoptera												
Dryopidae												
Helichus basalis	4.6			R								
Helichus spp.	4.6	A	C	C	C	C		R	C	A	A	R
Dytiscidae												
Copelatus spp.	10.0					C						
Coptotomus interrogatus	4.0			R								
Hydroporus spp.	8.6					R		R	R			
Laccophilus spp.	10.0			R								
Neoporus spp.	8.6	A	C									
Elmidae												
Ancyronyx variegatus	6.5	R	R	C	R	C	A	A	C	C	R	R
Dubiraphia quadrinotata	6.4			R	R							
Dubiraphia vittata	4.1	R	R	C	A	R		C				
Dubiraphia spp.	5.9			A	A	C		A	C	C		
Macronychus glabratus	4.6	R	R	A	A	A	C	A	C	A	A	
Microcylloepus pusillus	2.1			R	R				A	R	R	R
Optioservus spp.	2.4	R					R					
Promoresia elegans	2.2				R					C		

Table 6. (Continued).

TAXON	TV	LON-08	LON-09	THI	KIN	GIL	CHE	BUF	BOW	GOF	SUC	ROS
Promoresia tardella	0.0									R		
Stenelmis spp.	5.1	A	C	C		R	R	R	C	R		
Gyrinidae												
Dineutus spp.	5.5	C	A	C	C	C	R	C	R	C	R	
Gyrinis spp.	6.2		R									
Haliplidae												
Peltodytes muticus	NE			R								
Peltodytes spp.	8.7	C	C									
Helodidae												
Cyphon spp.	NE					R						
Hydrophilidae												
Berosus spp.	8.4				R							
Derallus altus	NE			R								
Enochrus spp.	8.8					R						R
Hydrochus spp.	6.6			R								
Sperchopsis tessellatus	6.1			C							C	
Tropisternus collaris	6.0				R							
Tropisternus spp.	9.7					R						
Noteridae												
Hydrocanthus spp.	7.1			R								
Psephenidae												
Ectopria nervosa	4.2		R									
Ectopria spp.	4.2				R							
Psephenus herricki	2.4		C							R		R
Ptilodactylidae												
Anchytarsus bicolor	3.6	R	R							R	R	
Diptera												
Ceratopoganidae												
Palpomyia-Bezzia complex	6.9	R	R					R				
Ceratopogonidae												
Ceratopogoniinae												
Chirominidae												
Ablabesmyia mallochi	7.2	C	A	C	C	C	R		R		C	
Ablabesmyia parajanta/janata	7.4			R		C	C		R			
Ablabesmyia rhamphe grp.	8.4			R	C	R		C				
Ablabesmyia spp.	7.2	R		R				R				
Alotanypus spp.	NE					R						
Brillia spp.	5.2			R								R
Cardiocladius spp.	5.9					R			R			
Chironomus spp.	9.6	R	C									
Cladopelma spp.	3.5		R									
Cladotanytarsus spp.	4.1	R	C	R								
Clinotanypus pinguis	8.7				R							
Clinotanypus spp.	8.7			R		R						
Coelotanytarsus spp.	8.0											
Conchapelopia grp.	8.4	C	A	R	C	A	A	C	C	R	A	
Corynoneura spp.	6.0	R	R	R							R	R
Cricotopus bicinctus	8.5	C	R		C							
Cricotopus varipes gr.	6.4		R									
Cricotopus vierriensis	4.4	R										
Cricotopus/Orthocladius	NE			R	R	C	R		R			
Cryptochironomus spp.	6.4		C	R		R		R		R		R
Cryptotendipes spp.	6.2			R		C						
Dicrotendipes neomodestus	8.1	C	C									

Table 6. (Continued).

TAXON	TV	LON-08	LON-09	THI	KIN	GIL	CHE	BUF	BOW	GOF	SUC	ROS
Dicrotendipes spp.	8.1				R	R		R				
Eukiefferiella spp.	3.6	C										R
Glytotendipes spp.	9.5	R										
Kiefferulus dux	10.0								R			
Labrundinia spp.	5.9	R	C	R	C	R					R	
Microtendipes pedellus grp.	5.5		A	R		R		R	R			
Microtendipes rydalensis grp.	5.5			C		C						
Microtendipes spp.	5.5	C		R								
Nanocladius spp.	7.1	R	R	R	R	R			R	R	R	
Natarsia spp.	10.0		C	R	R		C					
Nilotanypus spp.	3.9	R	R	R				R				
Nilothauma spp.	5.0	R	C									
Omisus pica	4.0						R	R				
Paracladopelma spp.	5.5					R						
Parakiefferiella spp.	5.4		C									
Parametriocnemus lundbecki	3.7								R	R	R	
Parametriocnemus spp.	3.7	R	R				R		R			C
Paratanytarsus spp.	8.5		R				R					R
Paratendipes spp.	5.1	C	C									R
Pentaneura inconspicua	NE			C	R		A	C				
Pentaneura spp.	4.7			R	R	R	R					
Phaenospectra punctipes	6.5		C									
Phaenospectra spp.	6.5	C	A									
Polypedilum aviceps	3.7	R					C		R	C		A
Polypedilum convictum	4.9			C	R	A	R	C	C	C	C	A
Polypedilum fallax	6.4	R	C	R	R	R	R	R	R			R
Polypedilum flavum	4.9	A	C	R								
Polypedilum halterale	7.3			R	R			C			R	
Polypedilum illinoense	9.0	A	R	C	C	C	A	C	R			R
Polypedilum scalaenum	8.4		A	R			R	R	R		C	
Polypedilum tritum	9.5				R	R						
Polypedilum spp.	6.0			C						R		
Potthastia spp.	6.4	R										
Procladius spp.	9.1		R						R			
Pseudochironomus spp.	5.4		R									
Rheocricotopus robacki	7.3		R	C		R	C	C		C	C	C
Rheocricotopus spp.	7.3			R								
Rheotanytarsus spp.	5.9		R	C	C	C	C	C	R	R	C	C
Stelechomyia perpulchra	5.0			R								
Stempellina spp.	0.0	R										
Stempellinella spp.	NE	R										
Stenochironomus perpulchra	NE			R								
Stenochironomus spp.	6.5		C	C		R	R	R			R	
Stictochironomus spp.	6.5		C	R		C			C		R	
Tanytarsus spp.	6.8	C	C	C	C	C	C	R		R	R	R
Thienemanniella xena	5.9	R	R									
Thienemanniella spp.	5.9		R	R								
Thienemannimyia grp.	8.8			R	A	A	R	R	R	C		A
Tribelos fusicorne	6.3			R	R		R					
Tribelos jucundum	6.3			R		A	A	R	C	R	R	
Tribelos spp.	6.3			C		R						
Tvetenia spp.	3.6									R		
Xenochironomus spp.	4.0				R	R						
Xestochironomus spp.	0.0					R						
Xylotopus par	6.0				R							

Table 6. (Continued).

TAXON	TV	LON-08	LON-09	THI	KIN	GIL	CHE	BUF	BOW	GOF	SUC	ROS
Zavrelimyia grp.	9.1		R									R
Culicidae												
Anopheles spp.	8.6		C	R	R	C	C	R		R		
Unidentified Culicidae				R		C						
Dixidae												
Dixa spp.	2.6		R	R		R						
Dixella spp.	NE	R	C			R			R	R		
Simuliidae												
Simulium venustum	7.1	R	R									
Simulium spp.	6.0			A	C	C	R	A	C	A		A
Tabanidae										R		
Tabanus spp.	9.2	R	R	R								
Tipulidae												
Antocha spp.	4.3		R				R		R			
Hexatoma spp.	4.3		R	R				R		R	C	
Tipula spp.	7.3	C	C	C	R		C			R		
Ephemeroptera												
Baetidae				A								
Acentrella spp.	4.0				A	R		R	R	R		
Baetis brunneicolor	1.6				A			R				
Baetis flavistriga	7.0	R	C				C		R			R
Baetis intercalaris	7.0	R		A	C	C	C	R	C	R		C
Baetis pluto	4.3		C		A		R	R	A	A		C
Baetis spp.	NE			C								
Callibaetis spp.	9.8					R				R		
Centroptilum spp.	6.6	R	C	R	R	C	R	R	R			
Heterocloeon spp.	3.5				A					R		
Plauditus spp.	4.0				R							
Procloeon spp.	5.0			C	R	R		R				
Pseudocloeon ephippiatum	3.7			C								
Pseudocloeon propinquum	5.8			A	A	C	A	A	C	C		A
Pseudocloeon spp.	4.0	R										
Baetiscidae												
Baetisca carolina	3.5										R	
Baetisca spp.	3.4										R	
Caenidae												
Caenis diminuta	NE			R	C	A						
Caenis diminuta/punctata	NE					C						
Caenis maccaferti	NE			R						R	R	C
Caenis spp.	7.4	C	C	R							R	
Ephemerellidae												
Serratella deficiens	2.8		R	C	C	C		C	A	C	C	
Serratella serratoides	1.9				C				R			
Serratella sordida	NE				R							
Ephemeridae												
Hexagenia spp.	4.9		R	C	R			A	C	C	R	
Heptageniidae												
Epeorus spp.	1.3									R		
Heptagenia spp.	2.6			R	C				C	C		
Leucrocuta spp.	2.4				C							
Maccaffertium exiguum	3.8			R				R				
Maccaffertium integrum	5.8			R								
Maccaffertium modestum	5.5	C	A	A	A	A	C	A	A	A	A	A

Table 6. (Continued).

TAXON	TV	LON-08	LON-09	THI	KIN	GIL	CHE	BUF	BOW	GOF	SUC	ROS
Maccaffertium terminatum	4.1	C		R				R				C
Maccaffertium spp.	NE			A	A	A	A	C	A			
Stenacron interpunctatum	6.9	C	C	R	A	C	C		C	A		R
Stenacron pallidum	2.7		C						R	C		
Stenacron spp.	NE			R								
Stenonema femoratum	7.2	R	R									
Isonychiadea												
Isonychia spp.	3.5		C	A	A	A	R	A	A	A	C	A
Leptophlebiidae												
Habrophleboides spp.	1.0		R									
Paraleptophlebia spp.	0.9									R	R	
Polymitarcyidae												
Ephoron leukon	1.3			C								
Tricorythidae												
Leptohyphes spp.	1.4			R								
Tricorythodes spp.	5.1		R	C	A	R	R	A	C	A		
Hemiptera												
Corixidae												
Sigara spp.	9.1	R										
Heteroptera												
Corixidae												
Trichocorixa spp.	6.0								R			
Gelastocoridae												
Gelastocoris oculatus	NE			R								
Gerridae												
Gerris spp.	6.0			R								
Metrobates spp.	NE			R								
Hydrometridae												
Hydrometra martini	NE			R								
Nepidae												
Ranatra buenoi	6.4			R	R	R						
Ranatra spp.	7.8		R									
Vellidae												
Microvelia spp.	NE			R								
Rhagovelia obesa	NE			R			R					
Unidentified Velidae						R						
Lepidoptera												
Pyralidae												
Petrophila spp.	NE				R							
Unidentified Pyralidae					C							
Megaloptera												
Corydalidae												
Chauliodes rastricornis	8.4	R		R								
Corydalus cornutus	5.2	R	C	C	A	A	C	A	C	A	R	R
Nigronia fasciatus	5.6	R	C									
Nigronia serricornis	5.0	C	A	R	R	R	R	R	C	R	C	C
Sialidae												
Sialis spp.	7.2	R	C	C	C	C		R	R	R		R
Odonata												
Aeshnidae												
Basiaeschna janata	7.4	R	R	R	R	C		C	R			
Boyeria vinosa	5.9	R	A	A	A	C	A	A	C	C	A	R
Calopterygidae										R		
Calopteryx spp.	7.8	R	C	C	R	R	C	R	C	R	C	

Table 6. (Continued).

TAXON	TV	LON-08	LON-09	THI	KIN	GIL	CHE	BUF	BOW	GOF	SUC	ROS
Hetaerina americana	4.0				R							
Hetaerina tittia	4.0			R	C	R						
Hetaerina spp.	5.6			R								
Unidentified Calopterygidae										R		
Coenagrionidae												
Argia sedula	8.5			R	C			R				
Argia spp.	8.2	R	C	C		A	R	R	R			
Coenagrionidae							C					
Enallagma spp.	8.9		C			C		R				
Ischnura/Anomalagrion	NE					R						
Ischnura spp.	9.5	R										
Plathemis lydia	10.0					R						
Cordulegasteridae												
Cordulegaster maculata	5.7	R	R									
Cordulegaster spp.	5.7			R					R		R	
Corduliidae												
Epitheca spp.	NE					C						
Helocordulia uhleri	4.9	R										
Helocordulia spp.	4.8					R						
Somatochlora spp.	9.2	C	A									
Tetragoneuria spp.	8.6	R	R									
Gomphidae												
Arigomphus spp.	NE			R	C	C	R		C	C		R
Dromogomphus spp.	5.9			R	C	R						
Gomphus spp.	5.8	R	C	C	R	R		R				
Hagenius brevistylus	4.0			R		R	R	R	R	C		
Lanthus spp.	1.8	R										
Ophiogomphus spp.	5.5		R			R			R		C	R
Progomphus spp.	NE			C		C	C	C	C	C	A	
Stylogomphus albistylus	4.7		C							C		
Stylurus spp.	NE			C		R	R	R		R	R	
Unidentified Gomphidae				R		R						
Libellulidae												
Macromiidae												
Didymops transversa	2.4		R									
Macromia georgina	6.2		R									
Macromia spp.	6.2			C	C	A	C	C	R	R	R	
Plecoptera												
Capniidae												
Chloroperlidae												
Alloperla spp.	1.2			R								
Leuctridae												
Leuctra spp.	2.5									C	R	A
Peltoperlidae												
Tallaperla spp.	1.2		R		R							
Perlidae												
Acroneuria abnormis	2.1	R	C									
Acroneuria spp.	2.1			A	C	R		A	R			R
Acroneuria/Eccoptura.	NE			C						R	A	
Eccoptura xanthenes	3.7	R						R		R	R	R
Neoperla spp.	1.5			C								
Paragnetina fumosa	3.4			A	R	R		A		R	R	
Paragnetina spp.	1.5			C	R							
Pteronarcidae												
Pteronarcys dorsata	1.8			A	R			C				

Table 6. (Continued).

TAXON	TV	LON-08	LON-09	THI	KIN	GIL	CHE	BUF	BOW	GOF	SUC	ROS
Pteronarcys spp.	1.7			C							A	
Trichoptera												
Brachycentridae												
Brachycentrus nigrosoma	2.3			C				R		R	C	
Brachycentrus numerosus	1.7			A								
Micrasema wataga	2.6				C			R	R	R		
Helicopsychidae												
Helicopsyche borealis	0.0				R							
Hydropsychidae												
Ceratopsyche sparna	2.7			C	A	C		A	A	C		R
Cheumatopsyche spp.	6.2	C	A	A	C	A	A	A	A	A	A	A
Diplectrona modesta	2.2	C	R									R
Hydropsyche betteni	7.8	R	C	C	R	C	A	C	A	A		R
Hydropsyche demora	2.1				C							
Hydropsyche elissoma	4.0			R								
Hydropsyche rossi	4.8			A	C	C		A				
Hydropsyche venularis	5.0				A			R		R		
Hydropsyche spp.	NE			R								
Hydroptilidae												
Hydroptila spp.	6.2				R	R		R	R	R		
Leucotrichia pictipes	4.1				C				C			
Oxyethira spp.	2.2				C							
Unidentified Hydroptilidae						R		R				
Hydropsyche venularis	5.0				A			R		R		
Hydropsyche spp.	NE			R								
Hydroptilidae												
Hydroptila spp.	6.2				R	R		R	R	R		
Leucotrichia pictipes	4.1				C				C			
Oxyethira spp.	2.2				C							
Unidentified Hydroptilidae						R		R				
Lepidostomatidae												
Lepidostoma spp.	0.9										R	
Leptoceridae												
Ceraclea ancylus/flavus	2.3			R	R	R			C	C		
Nectopsyche exquisita	4.1			A	R	R	R	C	R			
Nectopsyche pavida	4.1			R								
Nectopsyche spp.	2.9			C			R	C		R		
Oecetis morsei/sphyra	0.0			R	R			R				
Oecetis nocturna	4.1					R						
Oecetis persimilis	4.7			R	C	R	R	R	R	R	R	
Oecetis spp.	4.7			R	R			R		R		
Oecetis Sp. F (Floyd 95)	3.5					R						
Triaenodes ignitus	4.6		R	A	C	C	C	C	A	C	A	R
Triaenodes injusta	2.5				C							
Triaenodes marginatus	2.2					R						
Triaenodes spp.	4.5			C	C	R	R	C	C	C	C	
Limnephilidae												
Neophylax spp.	2.2									R		R
Pycnopsyche antica/guttifer	2.6								R		C	
Pycnopsyche luculenta	2.5					R		R	R	C	A	A
Pycnopsyche spp.	2.5		R	R					C			
Philopotamidae												
Chimarra aterrima	NE					R						
Chimarra obscura	NE					C						

Table 6. (Continued).

TAXON	TV	LON-08	LON-09	THI	KIN	GIL	CHE	BUF	BOW	GOF	SUC	ROS
Chimarra spp.	2.8	C	A		C	A	R		A	A	A	
Psychomyiidae												
Lype diversa	4.1		R									
Phtyganaidae												
Ptilostomis spp.	6.4	R										
Polycentropodidae												
Cernotina spp.	4.0			R	R			R				
Neureclipsis spp.	4.2							R				
Polycentropus/Cernotina	NE			C	R	R		R	R	R		
Rhyacophilidae												
Rhyacophila torva	1.6								R			
Mollusca												
Gastropoda						C						
Basommatophora												
Ancylidae					R						R	
Ferrissia spp.	6.6					R						
Lymnaeidae												
Pseudosuccinea columella	7.7		R			C						
Physidae												
Physella spp.	8.8	C	C	R	R	R	R		R			
Lymnophila												
Mesogastropoda												
Pleuroceridae												
Elimia proxima	2.4	C	C									
Elimia spp.	2.5						R			R		
Unidentified Gastropoda												
Pulmonata												
Planorbidae												
Helisoma anceps	6.2	R	R									
Pelycopoda												
Heterodonta												
Sphearidae												
Musculium partumeium	7.5	R	C									
Heterodontida												
Corbiculidae												
Corbicula fluminea	6.1	R	C	A	C	A	A	C	R			
Nematoda	NE		R									
Tricladida												
Planariidae												
Dugesia spp.	NE		R									
TOTAL TAXA		86	110	152	112	118	67	91	88	87	59	49
TOTAL TAXA: LONDON CR-2008-2009		129										

Table 7. Percent of evaluated taxa in low, middle, and high tolerance ranges from London Creek in September 2008 and June and September 2009, and streams sampled by SCDHEC during summer periods (July – September) of 1989 – 2004.

STREAM	LOW (0.0-3.0)	MID (3.1-7.0)	HIGH (7.1-10.0)
LONDON CR.	12.1	55.6	32.3
THICKETTY CR.	15.1	59.5	25.4
KINGS CR.	20.6	56.9	22.5
GILKY CR.	9.3	59.8	30.9
CHEROKEE CR.	6.8	62.7	30.5
BUFFALO CR.	11.9	64.3	23.8
BOWEN R.	17.1	58.5	24.4
GOFORTH CR.	24.7	58.4	16.9
SUCK CR.	18.5	61.1	20.4
ROSS CR.	17.4	63.0	19.6