Biological Assessment of the Macroinvertebrate and Fish Communities of Great Brook, Plainfield, Vt

The integrity of the aquatic life of Great Brook was assessed from 2 stream reaches **Figure 1**. The reaches were selected to be representative of the streams present habitat and water quality conditions within the lower reaches and the headwaters of the brook. Both fish and macroinvertebrates were sampled from site 1.3 in the lower reaches of the brook in October1998, and the macroinvertebrate assemblage again in October 2000. Macroinvertebrates were sampled at site 5.3 an upper reach of the brook in October 2000.

Figure 1: Location of macroinvertebrate and fish sampling reaches on Great Brook.

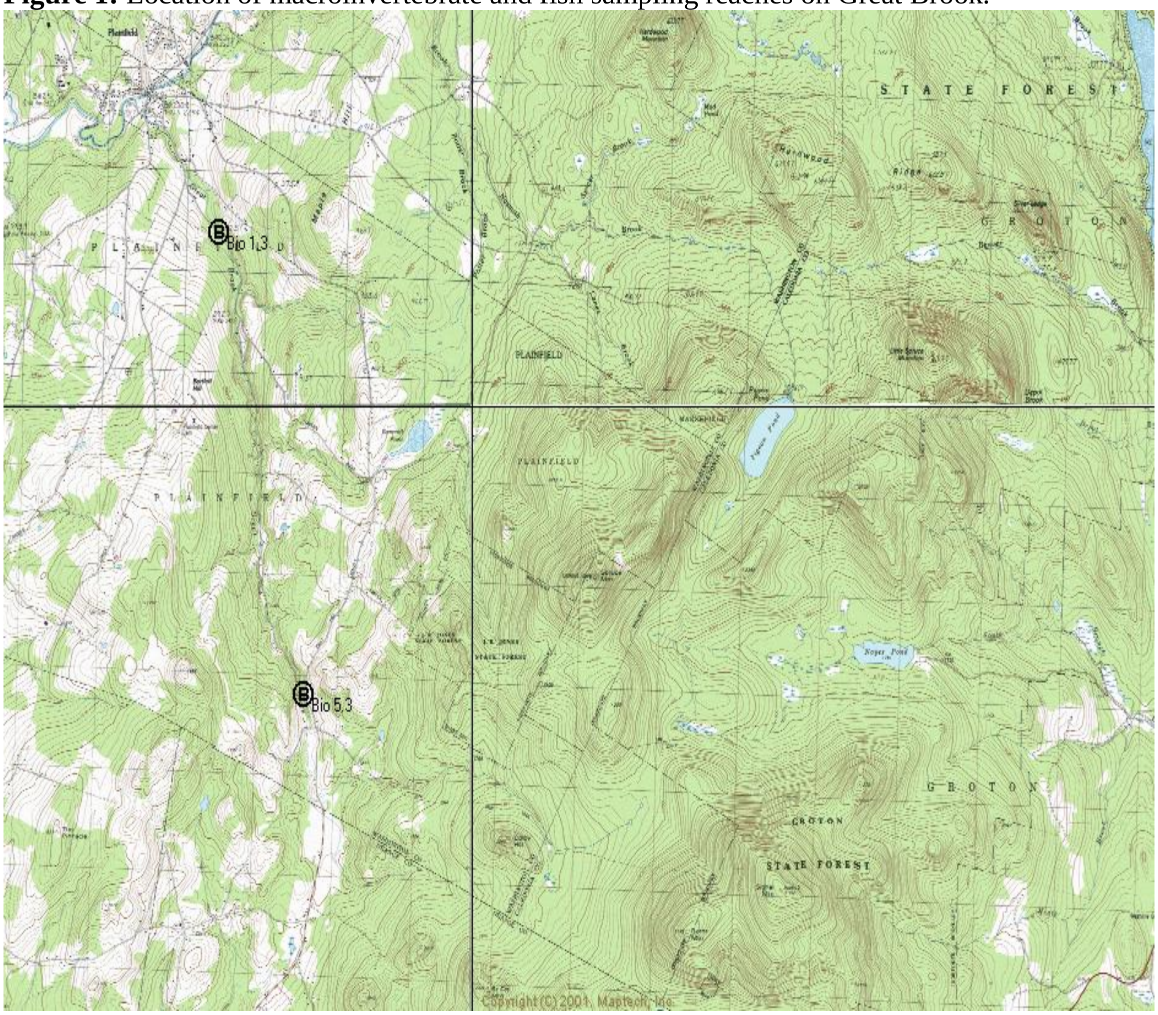

Table 1 describes the landscape features of each sampled reach. The site number represents the river mile up from its confluence with the Winooski River. The lower reach of Great Brook at an elevation of 866 feet, and a drainage area of 23+ km square is larger and therefore has been categorized as a Medium High Gradient stream type. The upper reach site 5.3, with its smaller drainage area and higher elevation is categorized as a Small High Gradient stream type.

At the time of sampling during each year a number of physical and chemical habitat measures and observations were taken to describe the overall habitat conditions at each reach. **Table 2** presents the physical and chemical habitat measures and observations for both sites. These observations show site 1.3 to be more alkaline with consistently higher pH and alkalinity values then site 5.3. **Table 2:** Physical and Chemical habitat descriptors of the Great Brook biomonitoring sites The lower site 1.3 seems to have increased in gravels and sand between 1998 and 2000. The upper site 5.3 was more dominated by boulder and cobble substrate. The canopy cover at site 1.3 is very low due to flooding causing an over widening of the stream channel and resulting loss of the riparian zone. The periphyton community was dominated by diatoms at both sites. Site 1.3 also had a presence of Blue Green, filamentous green and green algae. Only site 5.8 contained any moss (5%), which is generally considered very sensitive to siltation, and scour.

Table 1: Landscape level features and location descriptions of the Great Brook biomonitoring sites

Stream Reach site # (river mile)	Great Brook lower 1.3	Great Brook upper 5.3
Drainage Area km^2	23.3	15.9
Elevation ft	866	1305
Latitude/Longitude	441556 / 722452	441326 / 722405
Stream Type	**M**edium **H**igh **G**radient (MHG)	**S**mall **H**igh **G**radient (SHG)
Description	Located immediately above (bugs), and 100m below (fish) the fourth upstream bridge crossing, near old sandpit.	Located off Brook road 100m below junction with East Hill Road.

Table 2: Selected physical chemical measures collected at the time of biological sample collection from two sites on Great Brook, Plainfield, Vt.

Stream Reach site # (river mile)	Great Brook lower 1.3		Great Brook upper 5.3
Year	1998	2000	2000
pH	8.21	8.45	8.10
Alkalinity mg/l	105	121	97.5
Conductivity ohms	218	172	201
Temperature C	12 @ 10:00	7.0 @ 8:00	7.8 @ 11:00
% Embeddedness	25-50	50-75	25-50
% Boulder	35	15	30
% Cobble	35	15	30
% C.Gravel	15	25	25
% Gravel	10	35	10
% Sand	5	10	5
%Canopy	10	10	70
%Diatoms	100	100	100
%Blue Greens	10	0	10
%Filamentous Green	5	10	0
%Green	0	20	0
%Moss	0	0	5

The macroinvertebrate community metrics or community descriptors are presented in **Table 3**. The table also presents the minimum metric values used by VTDEC to determine if the macroinvertebrate community for each stream type is supporting a Class "B" level community, and the range of each metric from streams in Vt that are considered to be in very good to excellent condition (VTDEC 2001). The biometrics used to evaluate the macroinvertebrate community integrity are defined in **Appendix 1**. A complete list of the taxa collected from Great Brook by sampling date is found in **Appendix 2**.

The community metrics show that both sites were in very good to excellent condition in 2000. Densities at both sites were just below the median from reference level sites. The taxa richness was at or above the median of the reference streams. The number of EPT taxa was within the range of the reference streams. The PMA-O shows the composition of the orders was very similar to that of the reference streams, as was the Bio Index value, the percent Oligochaeta, EPT/EPT&c ratio, and the composition of the functional groups PPCS-F. This was not the case in 1998 at the lower site 1.3. In 1998 the community was low in density and the number of taxa , and EPT taxa. This caused the site to be rated as only in fair condition in 1998. The cause of the lower biological integrity in the late summer of 1998 may be in part due to the abnormally high flow of the brook during that summer, causing the stream bed to move and scour the macroinvertebrate community.

Table 3: Macroinvertebrate community metrics from several sites on Great Brook, the VTDEC water quality Aquatic Life use Support (ALS) Class "B" biocriteria, for Medium High Gradient (MHG) streams, Small High Gradient streams (SHG) and the median and 25-75 percentile values from reference quality streams of each stream type. The Class "B" narrative ALS is **Moderate** Change from the Reference Condition. Site number is the river mile above the confluence with the Winooski River.

Medium **H**igh **G**radient Stream Type					**S**mall **H**igh **G**radient Stream Type		
Stream Site(rmi) Date	Great Brook **1.3** 10/1998	Great Brook **1.3** 10/2000	**Reference** n= 68 **median,** 25-75 percentile	**Class "B"** Biocriteria Threshholds	Great Brook **5.3** 10/2000	**Reference** n=40 **median**, 25-75 percentile	**Class "B"** Biocriteria Threshholds
Overall Condition	Fair	Very Good			Excellent		
Density	482	1298	**1797** 1259 - 2359	>300	963	**1016** 699-1716	>300
Richness	25	43.5	**45.8** 43.3 - 51.8	>30	41	**40.0** 36-43.5	>27
EPT	19	24	**27** 24.5 - 28.5	>18	22	**23.5** 21.5-25.3	>16
PMA-O	86	92	**83** 78 - 86	>45	76	**76** 70 - 84	>45
BI (0-10)	3.35	3.01	**3.20** 2.8 - 3.6	<5.00	1.46	**2.3** 1.9-2.8	<4.50
% Oligo	0	0	**0.1** 0.0 - 0.4	<12	0	**0.2** 0.0 - 0.3	<12
EPT/ EPT+C	0.96	0.87	**0.9** 0.8 - 0.9	>0.45	0.94	**0.9** 0.8- 0.9	>0.45
PPCS-FG	0.46	0.64	**0.64** 0.58 - 0.72	>0.40	0.61	**0.60** 0.52 - 0.65	>0.40

The fish community was sampled at river mile 1.3 near the Brook Road Bridge Crossing. Two electrofishing runs were conducted on an 88 m. stream section. The section was divided into two channels where the river had “braided”. There was noticeable deposition of fine materials on the substrate. The physical habitat appeared to be degraded in that sedimentation had occurred and the stream channel had perhaps widened and was as a result overall very shallow.

The fish assemblage was comprised (in order abundance) of rainbow trout, slimy sculpin, blacknose dace, longnose dace, brook trout and brown trout **Table 4**. The health of the community was assessed using the Coldwater Index of Biotic Integrity (CWIBI) devised by the VTDEC. The assemblage was rated as “very good”, scoring an CWIBI of 36 out of a possible 45. This score indicated that the habitat and water quality were not significantly limiting the structure of the fish community. Most of the three trout species collected were young-of-the-year an indication that sedimentation was not limiting natural reproduction to any obvious extent. The three trout species and slimy sculpin made up 81 % of the sampled assemblage. These four species are all relatively intolerant to silt and high temperatures. Numbers of the native brook trout were lower than expected. The non-native rainbow and brown trout made up about 60% of the community. The high density of brown trout was probably responsible for reducing the density of brook trout in the section due to the effects of competition.

Table 4: The fish species collected from Great Brook site 1.3 in October 1998. Total fish collected, number of fish estimated in 100m2 of brook, and the percent composition.

Species	Total	NPer100m2	PercentC
Blacknose Dace	15	4.17	10.42
Brown Trout	5	1.16	3.47
Brook Trout	5	1.16	3.47
Longnose Dace	13	3.94	9.03
Rainbow Trout	82	21.10	56.94
Slimy Sculpin	24	6.96	16.67

Future Monitoring

In the future it would be valuable to continue to monitor the above two stations to gain a longterm picture of the biological integrity of the brook. It would also be beneficial to evaluate the biota of the following stream reaches within the Great Brook watershed. The lower reach of Great brook within the village of Plainfield. The upper headwater reaches of the main branch. The only significant tributary stream Bancroft Brook. Other reaches that maybe considered are any, which are thought to be under stress from pollutants or reaches that may undergo significant stream corridor management activities.

Appendix 1: The following pages list the selected metrics, their ecological significance, interpretation, and calculation**.**

Density - Density is the relative abundance of animals in a sample (unit sampling effort). The relative abundance is a basic measure of a stream's secondary productivity. The density criteria was set very conservatively but is needed to ensure some basic level of macroinvertebrate productivity is maintained. The density will generally decrease due to both habitat and toxic impacts. It can also be relatively low in naturally unproductive streams which is why the minimum criteria is very conservative. Nutrient enrichment will often increase the overall density of a stream. It is an important metric to use in determining the causes and mechanisms of disturbances to the macroinvertebrate community.

> *Calculation:* Density is calculated by totaling the number of organism found in a sample. If less than the entire sample is processed, numbers tabulated in the sub-sample are adjusted to reflect "unit sampling effort" density. When replicate samples are collected from a site, this metric is calculated as the mean density by adding the density from each replicate and dividing by the number of replicates.

Taxonomic Structure and Compositional metrics

Richness- Species richness is the number of species in a sample unit. It is perhaps the most basic and accepted measure of assemblage diversity. Species richness will decrease when an assemblage is stressed from habitat degradation or poor water quality conditions (Plafkin et al. 1989). It can increase slightly in streams that are moderately enriched, and can also be naturally lower in smaller headwater streams (Bode et al.,1996). The richness expectation in the SHG streams was significantly lower then the larger stream types and the threshold biocriterion has been adjusted accordingly.

> *Calculation*: Richness is the total number of distinct taxa identified in a sample. Note: immature organisms identified to family or genus are not considered a distinct new taxa if a genus or species identification is determined within its group in a sample. When replicate samples are collected from a site, this metric is calculated as the mean richness by adding the taxa richness from each replicate and dividing by the number of replicates.

EPT Index- The EPT index is a subset of the above richness measure. It is the number of species in the sample in the generally more environmentally sensitive orders Ephemeroptera, Plecoptera, and Trichoptera. EPT richness will decrease when an assemblage is stressed from habitat degradation or poor water quality conditions (Lenat 1989). The number of EPT taxa will increase from slight enrichment, but are generally the first to decrease from moderate to extreme enrichment. The expected number of EPT species were found to be slightly lower in the SHG and WWMG stream types. The EPT biocriteria values for both these stream types have been adjusted slightly to account for the lower EPT expectation.

> *Calculation*: The number of distinct taxa identified in a sample from the insect orders Ephemeroptera, Plecoptera, Trichoptera. Note: immature organisms identified to family or genus are not considered a distinct new taxa if a genus or species identification is determined within its group in a sample. When replicate samples are collected from a site, this metric is calculated as the mean richness by adding the taxa richness from each replicate and dividing by the number of replicates.

Percent Model Affinity of Orders - (PMA-O) Is a measure of order level similarity to a model based on the reference streams (Novak and Bode 1992). The PMA-O decreases with increasing environmental stress on the macroinvertebrate assemblage. This is due to the general trend of decreasing abundance of the more pollution sensitive orders, and increasing abundance of the more pollution tolerant orders in highly polluted streams. The PMA-O reference condition was found to be relatively similar between the three stream types. The slightly lower affinity value from the SHG streams was not great enough to justify a threshold biocriterion adjustment.

Calculation: **PMA-O is calculated by determining the percent composition for each major group - Coleoptera, Diptera, Ephemeroptera, Plecoptera, Trichoptera, Oligochaeta, Other - at the assessment site and comparing them to the mean percent composition values from the reference condition (model). The model order percentages are then arrayed with the assessment site order percentages. The sum of the lower of the two values for each order is the PMA-O.**

$$\textbf{PMA-O} = 3\ \textbf{min}\ (X_a\ \textbf{or}\ X_r)$$

Where: X_a **= the percent composition of order X from the assessment site;**

X_r **= the percent composition of order X from the appropriate reference condition;**

Indicator taxa and functional group metrics

Hilsenhoff Biotic Index- BI (0-10) - The HBI is a measure of the macroinvertebrate assemblage tolerance toward organic (nutrient) enrichment (Hilsenhoff 1987). In many ways this index is both an indicator taxa metric and functional group metric, since those taxa which become more dominant in moderately enriched streams are those which are taking advantage of shifts in the available food base in the stream. There were significant differences in the reference condition between all three of the high gradient stream types. This may be due to both a natural shift in the food web from coarse allochthonous detritus and diatoms in SHG streams to one more dominated by fine particulate organic matter, and greater autotrophic production with a shift toward other algal groups in WWMG streams. These types of food web shifts have been described in detail in the literature and form the basis of the river continuum concept (Cummins 1974; Vannote et al.1980; Culp and Davies 1982). The threshold biocriteria values for each stream type were adjusted to reflect differences in the reference condition BI value.

Calculation : **The BI is calculated by: 1) multiplying the number of individuals of each taxon in a sample by that taxon•s assigned tolerance value, as assigned by VTDEC after Hilsenhoff 1987; Bode 1996; 2) adding the total of all these taxon/tolerance value products; and 3) dividing the resulting sum by the total number of individuals of all taxa assigned a tolerance value. The resulting number is the Bio Index value.**

$$\textbf{HBI} = 3\ \frac{n_i\, a_i}{N}$$

Where:- ■n• is the number of individuals of the ■i•th taxon;
- ■a• is the index value of that taxon;
- N is the total number of individuals in the sample;

% Oligochaeta - Percent Oligochaeta is a measure of the percent of the macroinvertebrate community made up of the Order Oligochaeta. The percent Oligochaetes in the community increases with increased amounts of sedimentation and nutrients or organic matter in the stream. Many Oligochaetes in streams are burrowers by habit and generally feed on organic particulates that settle on the bottom substrate in streams. The percent Oligochaetes in the reference streams is very low and not significantly different between stream types. The presence of relatively higher percent Oligochaetes was consistently found in impacted streams associated with high sedimentation indicators such as percent sand, embeddedness and siltation.

Calculation: The number (abundance) of Oligochaeta in a sample divided by the total number of animals in the sample.

EPT/EPT & Chironomidae -EPT/EPT plus Chironomidae is a measure of the ratio of the abundance of the intolerant EPT orders to the generally tolerant Diptera family Chironomidae. With increased ecological degradation often associated with non-point pollution causing stream warming, habitat impairment from silt/sediment, and enrichment, the more tolerant species of Chironomidae will dominate the stream community causing the ratio to decrease. This metric is less robust then some, in that it only demonstrated impairment in about 10 percent of the impacted sites.

Calculation: The number (abundance) of animals from the orders Ephemeroptera, Trichoptera and Plecoptera in a sample divided by the above plus the number of Chironomidae.

Pinkham-Pearson Coefficient of Similarity - Functional Groups - (PPCS-F) - The PPCS-F is a measure of functional feeding group similarity to a model based on the reference streams. It is similar in concept to the **PMA-O** in that a site is compared to a model of the composition of the functional feeding groups in the reference condition as opposed to order level taxonomic changes. Also the Pinkham-Pearson Coefficient of Similarity (Pinkham and Pearson 1976) was used as the similarity index. Significant departures in functional group similarity to the reference streams indicates that the energy pathways thru the aquatic ecosystem have been significantly altered compared to that of the reference stream model (Shackleford 1988).

Calculation: **PPCS-F is calculated by first determining the percent composition of the six major functional groups (collector gatherer, collector filterer, predator, shredder-detritus, shredder-herbivore, scraper) as assigned by VTDEC after Merrit and Cummins (1996) and Bode (1996) at the assessment site. For each functional group determine the quotient of min/max between the assessment site and the reference model for the stream type. The sum of these quotients divided by six (# of functional groups) is the PPCS-F.**

$$\text{PPCS-F} = 1/k \sum_{I=1}^{K} \text{minimum}(xia, xib)/\text{maximum}(xia, xib)$$

Where:
- **k = the number of comparisons between stations (6)**
- **xi = the number of individuals in functional group I**
- **a, b = site a, site b**

Appendix 2:
The macroinvertebrate taxa collected from Great Brook at site 1.3 in October 1998. The density and percent composition estimates are based on two replicate KN samples.

Order	Genera	Species	Density	Percent Compostion	CommonName
COLEOPTERA	OPTIOSERVUS	sp	3	0.6	
COLEOPTERA	OPTIOSERVUS	ovalis	2	0.3	
DIPTERA	BEZZIA	sp	2	0.3	
DIPTERA	POLYPEDILUM	aviceps	15	3.1	
DIPTERA	SIMULIUM	tubersom	101	20.9	
DIPTERA	ANTOCHA	sp	2	0.3	
DIPTERA	HEXATOMA	sp	3	0.6	
EPHEMEROPTERA	BAETIDAE	imm	83	17.1	Small Minnow Mayfly
EPHEMEROPTERA	BAETIS	flavistriga	11	2.2	
EPHEMEROPTERA	BAETIS	intercalaris	6	1.2	
EPHEMEROPTERA	BAETIS	tricaudatus	47	9.7	
EPHEMEROPTERA	ACENTRELLA	sp	27	5.6	
EPHEMEROPTERA	EPHEMERELLIDAE	imm	12	2.5	
EPHEMEROPTERA	RHITHROGENA	sp	30	6.2	
EPHEMEROPTERA	ISONYCHIA	sp	3	0.6	
TRICHOPTERA	BRACHYCENTRUS	numerosus	2	0.3	
TRICHOPTERA	GLOSSOSOMA	sp	3	0.6	
TRICHOPTERA	SYMPHITOPSYCHE	sp	42	8.7	
TRICHOPTERA	SYMPHITOPSYCHE	morosa	2	0.3	
TRICHOPTERA	SYMPHITOPSYCHE	slossonae	12	2.5	
TRICHOPTERA	LEPIDOSTOMA	sp	5	0.9	Little Plain Brown Sedge
TRICHOPTERA	DOLOPHILODES	sp	50	10.3	
PLECOPTERA	CHLOROPERLIDAE	unid	8	1.6	
PLECOPTERA	PARAGNETINA	sp	6	1.2	
PLECOPTERA	AGNETINA	capitata	5	0.9	Northern Sone
PLECOPTERA	ISOGENOIDES	sp	2	0.3	
PLECOPTERA	ISOPERLA	sp	5	0.9	

Appendix 2 cont. Macroinvertebrate taxa collected FROM great Brook site 1.3 Oct 2000.

Order	Genera	Species	Density	PercentComp	CommonName
COLEOPTERA	HELICHUS	basilus	1	0.1	
COLEOPTERA	OPTIOSERVUS	sp	18	1.4	
COLEOPTERA	OPTIOSERVUS	trivittatus	5	0.4	
COLEOPTERA	OPTIOSERVUS	ovalis	9	0.7	
COLEOPTERA	PROMORESIA	tardella	4	0.3	
COLEOPTERA	ECTOPRIA	leechi	1	0.1	
COLEOPTERA	PSEPHENUS	herricki	3	0.2	
DIPTERA	ATHERIX	sp	2	0.2	
DIPTERA	BEZZIA	group	1	0.1	
DIPTERA	CRICOTOPUS	spa	86	6.6	
DIPTERA	CRYPTOCHIRONOMUS	sp	2	0.2	
DIPTERA	DIAMESA	sp	10	0.8	
DIPTERA	EUKIEFFERIELLA	devonica	5	0.4	
DIPTERA	EUKIEFFERIELLA	claripennis	3	0.2	
DIPTERA	ORTHOCLADIUS	sp	47	3.6	
DIPTERA	SYNORTHOCLADIUS	sp	1	0.1	
DIPTERA	THIENEMANNEMYIA	group	6	0.5	
DIPTERA	TVETENIA	discoloripes	3	0.3	
DIPTERA	TVETENIA	bavarica	2	0.2	
DIPTERA	EMPIDIDAE	unid	2	0.2	Aquatic Dance Fly
DIPTERA	SIMULIUM	tubersom	33	2.5	
DIPTERA	ANTOCHA	sp	5	0.4	
DIPTERA	HEXATOMA	sp	23	1.8	
DIPTERA	PSEUDOLIMNOPHILA	sp	1	0.1	
EPHEMEROPTERA	BAETIDAE	imm	17	1.3	Small Minnow Mayfly
EPHEMEROPTERA	BAETIS	flavistriga	1	0.1	
EPHEMEROPTERA	BAETIS	intercalaris	13	1.0	
EPHEMEROPTERA	ACENTRELLA	sp	49	3.8	
EPHEMEROPTERA	ACENTRELLA	turbida	41	3.2	
EPHEMEROPTERA	EPHEMERELLIDAE	imm	65	5.0	
EPHEMEROPTERA	EPHEMERELLA	subvaria	37	2.8	
EPHEMEROPTERA	HEPTAGENIIDAE	unid	18	1.4	Flatheaded Mayfly
EPHEMEROPTERA	EPEORUS	sp	25	1.9	
EPHEMEROPTERA	RHITHROGENA	sp	208	16.0	
EPHEMEROPTERA	STENONEMA	luteum	2	0.2	
EPHEMEROPTERA	PARALEPTOPHLEBIA	sp	63	4.8	
TRICHOPTERA	MICRASEMA	sp	1	0.1	
TRICHOPTERA	GLOSSOSOMA	sp	13	1.0	
TRICHOPTERA	CHEUMATOPSYCHE	sp	13	1.0	
TRICHOPTERA	SYMPHITOPSYCHE	bronta	23	1.7	
TRICHOPTERA	SYMPHITOPSYCHE	morosa	75	5.8	
TRICHOPTERA	SYMPHITOPSYCHE	slossonae	86	6.6	
TRICHOPTERA	SYMPHITOPSYCHE	sparna	120	9.3	
TRICHOPTERA	LEPIDOSTOMA	sp	11	0.9	Little Plain Brown Sedge
TRICHOPTERA	DOLOPHILODES	sp	63	4.8	
TRICHOPTERA	RHYACOPHILA	fuscula	14	1.1	
TRICHOPTERA	RHYACOPHILA	melita	5	0.4	
PLECOPTERA	CHLOROPERLIDAE	imm	14	1.1	Green Stonefly
PLECOPTERA	ACRONEURIA	abnormis	1	0.1	Common Stone
PLECOPTERA	PARAGNETINA	immarginata	4	0.3	Beautiful Stone
PLECOPTERA	AGNETINA	capitata	9	0.7	Northern Sone
PLECOPTERA	ISOGENOIDES	sp	3	0.3	
PLECOPTERA	ISOPERLA	sp	9	0.7	
PLECOPTERA	MALIREKUS	sp	8	0.6	
PLECOPTERA	PTERONARCYS	biloba	1	0.1	Knobbed Salmonfly
ODONATA	LIBELLULIDAE/CORDULI	group	1	0.1	
MEGALOPTERA	NIGRONIA	sp	9	0.7	

Appendix 2 cont. Macroinvertebrate taxa collected from Great Brook site 5.3 Oct. 2000.

Order	Genera	Species	Density	PercentComp	CommonName
COLEOPTERA	OPTIOSERVUS	sp	3	0.3	
COLEOPTERA	OPTIOSERVUS	trivittatus	3	0.3	
COLEOPTERA	OPTIOSERVUS	ovalis	18	1.9	
COLEOPTERA	OULIMNIUS	latiusculus	3	0.3	
COLEOPTERA	PROMORESIA	tardella	6	0.6	
COLEOPTERA	ECTOPRIA	leechi	3	0.3	
COLEOPTERA	PSEPHENUS	herricki	3	0.3	
DIPTERA	ATHERIX	sp	6	0.6	
DIPTERA	EUKIEFFERIELLA	brevicalar	3	0.3	
DIPTERA	PARACHAETOCLADIUS	sp	6	0.6	
DIPTERA	PARAMETRIOCNEMUS	sp	3	0.3	
DIPTERA	POLYPEDILUM	aviceps	3	0.3	
DIPTERA	RHEOTANYTARSUS	distinctissimus	3	0.3	
DIPTERA	THIENEMANNEMYIA	group	3	0.3	
DIPTERA	TVETENIA	bavarica	27	2.8	
DIPTERA	MICROPSECTRA	sp	3	0.3	
DIPTERA	DICRANOTA	sp	9	0.9	
DIPTERA	HEXATOMA	sp	21	2.2	
DIPTERA	MOLOPHILUS	sp	3	0.3	
EPHEMEROPTERA	BAETIDAE	imm	6	0.6	Small Minnow Mayfly
EPHEMEROPTERA	BAETIS	tricaudatus	9	0.9	
EPHEMEROPTERA	ACENTRELLA	sp	6	0.6	
EPHEMEROPTERA	EPHEMERELLIDAE	imm	33	3.4	
EPHEMEROPTERA	EPHEMERELLA	sp	24	2.5	
EPHEMEROPTERA	EPHEMERELLA	subvaria	15	1.6	
EPHEMEROPTERA	HEPTAGENIIDAE	unid	12	1.2	Flatheaded Mayfly
EPHEMEROPTERA	EPEORUS	sp	60	6.2	
EPHEMEROPTERA	RHITHROGENA	sp	123	12.8	
EPHEMEROPTERA	PARALEPTOPHLEBIA	sp	102	10.6	
TRICHOPTERA	GLOSSOSOMA	sp	6	0.6	
TRICHOPTERA	SYMPHITOPSYCHE	morosa	9	0.9	
TRICHOPTERA	SYMPHITOPSYCHE	slossonae	12	1.2	
TRICHOPTERA	SYMPHITOPSYCHE	sparna	63	6.5	
TRICHOPTERA	LEPIDOSTOMA	sp	3	0.3	Little Plain Brown Sedge
TRICHOPTERA	APATANIA	sp	9	0.9	Early Smoky Wing Sedge
TRICHOPTERA	DOLOPHILODES	sp	198	20.6	
TRICHOPTERA	RHYACOPHILA	fuscula	33	3.4	
PLECOPTERA	CHLOROPERLIDAE	imm	36	3.7	Green Stonefly
PLECOPTERA	PARAGNETINA	media	15	1.6	Embossed Stone
PLECOPTERA	AGNETINA	capitata	27	2.8	Northern Sone
PLECOPTERA	ISOPERLA	lata	3	0.3	Dark Stripetail
PLECOPTERA	ISOPERLA	sp a	6	0.6	
PLECOPTERA	PTERONARCYS	biloba	6	0.6	Knobbed Salmonfly
PLECOPTERA	PTERONARCYS	proteus	3	0.3	Appalachian Salmonfly
PLECOPTERA	TAENIOPTERYX	sp	12	1.2	
ODONATA	BOYERIA	sp	3	0.3	Stream Darner
TRICHOPTERA	RHYACOPHILA	melita	5	0.4	
PLECOPTERA	CHLOROPERLIDAE	imm	14	1.1	Green Stonefly
PLECOPTERA	ACRONEURIA	abnormis	1	0.1	Common Stone
PLECOPTERA	PARAGNETINA	immarginata	4	0.3	Beautiful Stone
PLECOPTERA	AGNETINA	capitata	9	0.7	Northern Sone
PLECOPTERA	ISOGENOIDES	sp	3	0.3	
PLECOPTERA	ISOPERLA	sp	9	0.7	
PLECOPTERA	MALIREKUS	sp	8	0.6	
PLECOPTERA	PTERONARCYS	biloba	1	0.1	Knobbed Salmonfly
ODONATA	LIBELLULIDAE/CORDULI	group	1	0.1	
MEGALOPTERA	NIGRONIA	sp	9	0.7	