



**U.S. Army
Corps of Engineers**
New England District
Concord, Massachusetts



**U.S. Environmental
Protection Agency**
New England Region
Boston, Massachusetts

**2007 Post-Remediation
Aquatic Community Assessment
1 ½ Mile Removal Reach
Environmental Remediation Contract
GE/Housatonic River Project
Pittsfield, Massachusetts**



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LIST OF ACRONYMS

cm	centimeters
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ft	feet
GE	General Electric
GERG	Geochemical & Environmental Research Group
mm	millimeters
MS/MSD	matrix spike/matrix spike duplicate
NA	non-attainment
PCB	polychlorinated biphenyl
TL	total length
tPCBs	total PCBs

1. INTRODUCTION

A Post-Remediation Aquatic Community Assessment of the 1½-Mile Reach of the Housatonic River was conducted in the summer of 2007. The 1½-Mile Reach represents a section of the East Branch of the Housatonic River between Lyman Street Bridge and the confluence of the East and West Branches of the Housatonic River. The two aquatic communities that were evaluated were fish and benthic macroinvertebrates. Benthic macroinvertebrate sampling and surveys were completed in similar areas in 2000. Three transects were sampled for this study: T-170, T-134, and T-070 (Appendix A). This report compares recent survey macroinvertebrate results to baseline data collected in July 2000. This report also summarizes the results of the 2007 fish survey. The assessment was performed in accordance with the June 2007 Aquatic Invertebrate and Fish Sampling Work Plan. All work associated with this sampling effort was conducted from 25 June through 27 June 2007.

2. OBJECTIVES

The objectives of the sampling and the surveys were the following: 1) measure polychlorinated biphenyl (PCB) tissue concentrations in benthic macroinvertebrates; 2) evaluate the diversity and abundance of benthic macroinvertebrates; and 3) to characterize the fish species present and their relative abundance following the completion of remediation. The macroinvertebrate community characterization survey results and the PCB tissue results were compared to the pre-remediation data collected in 2000.

3. BIOLOGICAL CHARACTERIZATION

Biological communities reflect overall ecological integrity by integrating physical, chemical, and biological habitat conditions. Thus, the evaluation of these communities can provide diagnostic indicators of river health. Two biological communities, benthic macroinvertebrates and fish, were characterized for this assessment.

Benthic macroinvertebrates are aquatic organisms that live primarily along the bottoms of water bodies and can be seen without magnification; the most common benthic macroinvertebrates in freshwater systems are typically aquatic insects. Diverse taxonomic groups of insects are represented, including commonly the early life stages (larvae and/or pupae) of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera). Insects are represented in a number of general functional groups (collectors, predators, scrapers, and shredders) and are particularly important in processing and breaking down organic material. They also serve as a primary food source for many fish species

Benthic macroinvertebrates are good indicators of localized habitat conditions because they spend a majority of their aquatic life cycle in a limited area. Macroinvertebrate assemblages are made up of species that constitute a broad range of trophic levels and habitat tolerances, thus, the relative abundance of different macroinvertebrate taxa can provide an indication of overall river ecosystem health. One commonly used indicator of ecosystem health is the EPT Index, the total number of distinct taxa within the insect orders Ephemeroptera (E), Plecoptera (P), and Trichoptera (T). This index summarizes taxa richness within the groups of aquatic insects that generally are considered pollution sensitive. Characterizing these assemblages can be used during long-term monitoring to assess the success of restoration efforts.

The presence and relative abundance of fish species in an area can also be used to estimate the suitability of localized conditions because it is assumed that a species will only be present if desirable habitat characteristics are present. Habitat restoration activities following remediation in the Reach included the re-establishment of runs, riffles, and pools and the installation of boulders and wing deflectors, which act to increase habitat diversity under low-flow conditions and provide cover. Characterizing fish usage of the Reach can also be used to assess the success of restoration efforts.

4. METHODOLOGY

4.1 BENTHIC MACROINVERTEBRATES

Benthic macroinvertebrate samples were collected from three locations previously sampled in 2000 (Appendix A) during low-flow conditions to characterize the post-remediation re-establishment of communities and to obtain samples for analysis of tissue PCB concentrations. Sampling locations reflected, to the extent possible, typical conditions in each of the three areas based on substrate, riparian cover, and channel width, depth, and velocity.

At each location, 12 samples were collected using a 9 by 18-inch rectangular dip net with a 500-micron (0.5-millimeter [mm]) mesh. The 12 sample locations for each transect were equally spaced (approximately 2 feet [ft] apart) and traversed the riffle width in an upstream zigzag pattern. A 1-meter square grid was deployed upstream of the net to define the sampling area at each sample location. At location T-070, which was characterized by loose, sandy substratum, the sediment within the 1-meter grid was “kicked” by one individual for 2 minutes. The benthic invertebrates and other material dislodged thereby were carried downstream into the sampling net. Due to the armored, cobble and boulder substratum at locations T-170 and T-134, the bed was picked and scrubbed by hand for 2 minutes by three individuals during each sample collection. All samples were preserved in 0.5-liter plastic containers with 95% denatured ethanol in the field, and then delivered to Lotic, Inc. (Unity, Maine) for taxonomic identification and enumeration.

At each of these transects, an approximate 10-gram benthic macroinvertebrate tissue sample was collected by hand from rocks and other in-stream structures in the immediate vicinity of the bottom-sampling locations using chemically decontaminated forceps. These tissue collections focused on the larger and more numerically dominant benthic organisms in order to provide sufficient biomass to satisfy laboratory requirements for the analysis. Samples were placed in pre-cleaned 4-ounce glass jars with river water during collection and then placed on wet ice for return to the laboratory. In the laboratory, samples were drained, weighed, and preserved by freezing at approximately 0°F. Samples were then shipped frozen to the Geochemical & Environmental Research Group (GERG) at the College of Geosciences Texas A&M University for PCB tissue analyses. The sample from Transect T-134 was collected in triple volume to be analyzed in duplicate and matrix spike/matrix spike duplicate (MS/MSD).

4.2 SAMPLE RECEIPT AND PROCESSING

The 36 benthic macroinvertebrate samples were shipped to Lotic, Inc. In the laboratory, the samples were re-sieved through a standard #40 sieve (mesh opening of 0.425 mm) and completely sorted using a stereomicroscope at 6-15X magnification. All specimens were identified to the lowest practical identification level, generally genus, or to species level when possible. Some damaged or immature specimens were identified to the family level. Organisms were identified using the most current taxonomic references. Chironomids were mounted onto microscope slides in CMCP-9 mounting medium; oligochaetes were mounted in polyvinyl lactophenol. Both groups were then identified using a compound microscope. The three benthic macroinvertebrate tissue samples were shipped to GERG. The sample from Transect T-134 was collected in triple volume. In the lab the sample was homogenized and extracted in three separate aliquots. One aliquot was analyzed as a parent sample, one as a duplicate and one as a MS/MSD.

4.3 FISH

Fish surveys were conducted by backpack electroshocker. Three 600-foot reaches of river were surveyed. Surveyed reaches were located at transects where benthic macroinvertebrates were collected previously (T-070, T-134, and T-170); however, each location was extended 300 ft upstream and downstream of each transect marker. Each location was electroshocked in a zigzag pattern from bank to bank, in an upstream direction. In addition, areas identified as suitable fish habitat (e.g., pools, riffles, and runs) were shocked more intensively. One staff member operated the electroshocker while two staff netted fish. Staff netted fish behind the person shocking to better capture stunned fish floating downstream. Fish were then identified and total length (TL) was measured in centimeters (cm) before being returned, unharmed, to the river near their point of capture. All instrumentation and sampling gear was decontaminated prior to sample collection with a de-ionized water rinse.

5. RESULTS AND DISCUSSION

5.1 BENTHIC MACROINVERTEBRATE COMMUNITY CHARACTERIZATION

Data from location T-134 collected in 2007 were very similar to results from the 2000 sampling, with a slight increase in taxa richness and moderate increases in EPT richness and percent dominance. The percent dominance (percent of the total faunal abundance attributable to the single dominant taxon – generally, a lower number indicates higher diversity and is considered “better”) increased to 23.5%, which, although an increase from 2000, was similar to the percent dominance at T-70 and T-170 in 2007.

Location T-170 showed dramatic improvements in community structure from 2000 to 2007. The dominant organism had shifted from the tolerant Oligochaete (*Limnodrilus*) to the slightly less tolerant caddisfly (*Hydropsyche*).

The results from the 2007 sampling at location T-070 indicated a more dramatic recovery than either of the other sample areas. Table 1 summarizes the changes in key metrics between 2000 and 2007. A detailed summary of the 2007 community characterization data is provided in Appendix B.

Given the lack of a suitable reference site, it is difficult to use many of the metrics in the Environmental Protection Agency Rapid Bioassessment Protocol manual (Barbour et al., 1999), which uses comparisons with a reference condition to make evaluations of benthic macroinvertebrate communities. Lotic, Inc., however, has been using an in-house model, which is based on 12 years of benthic community data, to evaluate community conditions. Lotic Inc.’s model is designed to correspond with the Maine Department of Environmental Protection linear discriminant model (Davies et al., 1999). The Lotic, Inc. model assigns the following classifications based on benthic community structure:

- **Class A:** High quality water; aquatic life as naturally occurs.
- **Class B:** Good quality; no detrimental changes to the biological community.
- **Class C:** Lowest quality, some changes to aquatic life; maintains the structure and function of the resident biological community.
- **Non-attainment (NA):** Does not attain Class A, B, or C standards.

Table 1

**Comparison of Taxa Measures (Per m²) Between 2000 and 2007 Samples.
 Capital Letters indicate Estimated Water Classification based on the Lotic, Inc.
 Model**

Location	Taxa Richness	Abundance	EPT Richness	Dominant Organism	Chironomidae Richness
T-134 2000	75 B	3300	17 A/B	<i>Hydropsyche</i> 9.3% A/B	30
T-134 2007	78 B	3584	25 A/B	<i>Microtendipes pedellus</i> grp. 23.5% B	29
Change	+3 (4.0%)	+284 (8.6%)	+8 (47.0%)	+14.2%	-1 (3.4%)
T-170 2000	31 B	401	6 NA	<i>Limnodrilus</i> 41.6% NA	13
T-170 2007	63 B	5419	19 B	<i>Hydropsyche</i> 21.2% B	28
Change	+32 (103.2%)	+5018 (1251.4%)	+13 (216.7%)	-20.4%	+15 (115.4%)
T-070 2000	18 NA	978	2 NA	<i>Limnodrilus</i> 91.7% NA	11
T-070 2007	82 B	3869	20 B	<i>Limnodrilus</i> 19.5% B/C	30
Change	+64 (355.6%)	+2891 (295.6%)	+18 (900.0%)	-72.2%	+19 (172.7%)

Notes:

m² = square meter

5.2 BENTHIC MACROINVERTEBRATES - PCB TISSUE RESULTS

In 2000, only location T-134 was sampled for PCB tissue analysis. The other two locations T-70 and T-170 did not contain sufficient mass of invertebrate tissue for PCB analysis. Because only

location T-134 was sampled in both 2000 and 2007, all discussion of comparative PCB concentrations between pre- and post-remediation samples refers to samples from this location.

Total Polychlorinated Biphenyls

Analytical results for total PCBs (tPCBs) are shown in Table 2. A number of important observations can be made from these results. A substantial decrease in tissue PCB concentrations, a reduction of more than 99% between the 2000 and 2007 collections, is evident and indicates the effects of the remediation, which was also reflected in the sediment PCB concentrations. The low tPCB concentrations in 2007 were consistent at all three locations sampled, and in both replicate analyses from location T-134. Tissue percent lipid concentrations were generally equivalent in both the 2000 and 2007 samplings and at all three locations sampled in 2007, so this decrease is reflected in the lipid-normalized concentrations as well.

Table 2

Analytical Results for tPCB, Percent Lipid, and Lipid-Normalized tPCB for 1½-Mile Reach Benthic Invertebrate Sampling, 2000 and 2007

	2000		2007			
	T-134	T-134 (dup)	T-070	T-134	T-134 (dup)	T-170
tPCB (mg/kg)	485.1	187.6	1.06	1.56	1.70	0.71
Percent Lipid	1.7	2.7	1.5	2.4	2.4	1.1
tPCB (mg/kg/Lipid)	28535.3	6948.1	70.7	65.0	70.8	64.5

Notes:

tPCB used in table 2 based on the Congener analysis

mg/kg = milligrams per kilogram

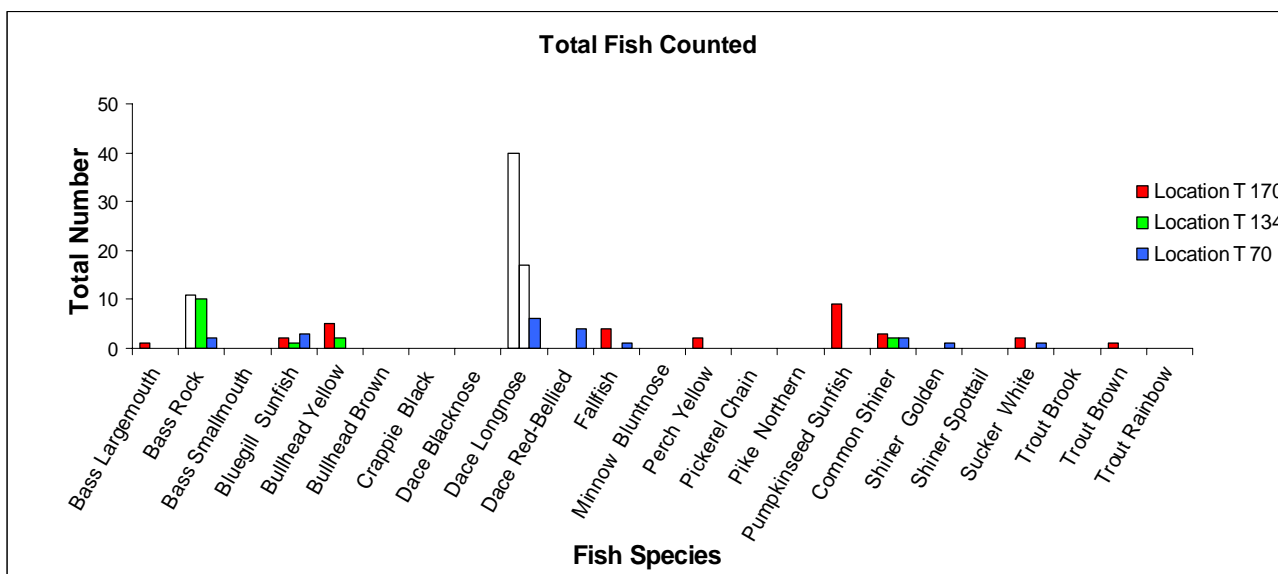
Complete analytical results for the PCB congener analysis, as well as percent lipids are presented in Appendices C (2000) and D (2007). Also included are results for total PCBs, Aroclors, and level-of-chlorination PCB homologues; these latter parameters were summed by the analytical laboratory from the appropriate individual congener results.

5.3 FISH

Of fish species surveyed from all reaches, longnose dace (*Rhinichthys cataractae*) were most abundant (Figure 1), particularly at location T-170 (Appendix A). Rock bass (*Ambloplites rupestris*) were moderately abundant at T-170 and T-134, while pumpkinseed sunfish (*Lepomis gibbosus*) were the only other abundant fish at T-170. Location T-170 had the highest total number of fish (80) and the highest diversity of fish species (11 species). This reach included expansive riffle and pool sections, which are utilized by fish in the Cyprinidae and Centrarchidae families. Location T-134 had low species diversity, despite having the best habitat consisting of deeper water, consistent flow, sheltered pools, and large in-stream boulders. Location T-070 had the lowest total number of fish (20) and low species diversity (8 species). Habitat within this reach consisted of shallow, warm water, sandy substrate with one riffle section. Consequently, more heat-tolerant fish species were found in this section of river.

Figure 1

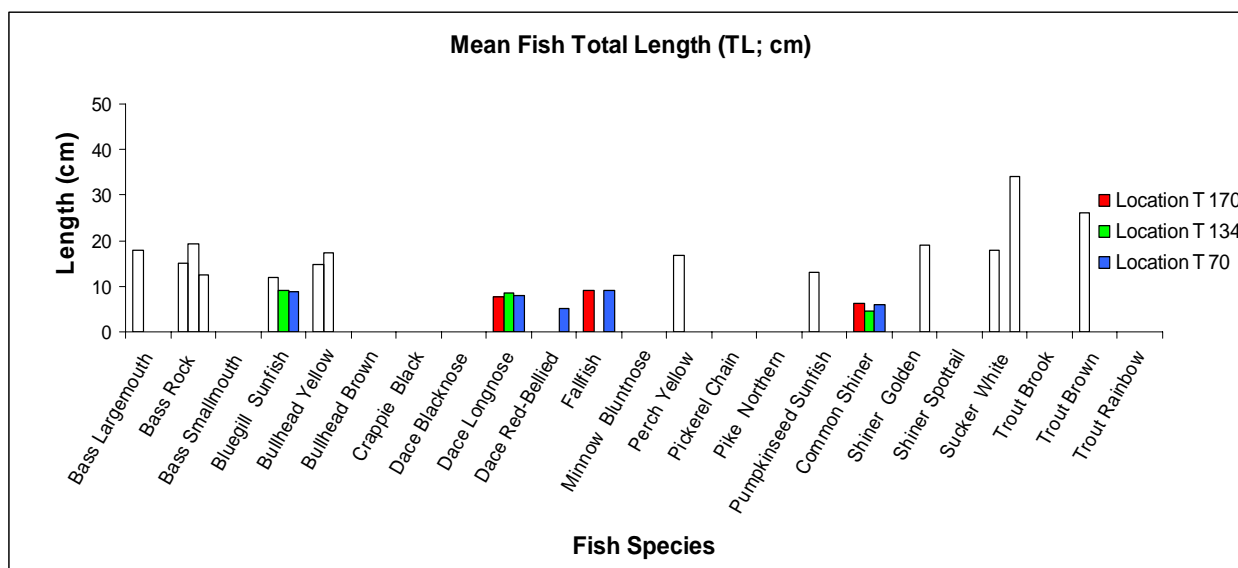
**Total Fish Surveyed from Locations T-170, T-134, and T-070
 in the 1½ Mile Reach of the Housatonic River,
 Pittsfield, Massachusetts, June 2007**



Mean total length of all fish species surveyed was also recorded (Figure 2). Based on measured lengths, one 1-year-old largemouth bass (*Micropterus salmoides*) and one 3-year-old brown trout (*Salmo trutta*) were identified. The majority of cyprinids, rock bass, and sunfish species surveyed were identified as adult stages.

Figure 2

Mean Total Fish Length (TL; cm) of All Species Surveyed at Locations T-170, T-134, and T-070 in the 1½ Mile Reach of the Housatonic River, Pittsfield, Massachusetts, June 2007



6. DISCUSSION

Pollution tolerance differs among invertebrate taxa. The EPT Index is an effective and readily understood tool to evaluate aquatic health; mayflies (E), stoneflies (P), and caddisflies (T) are extremely sensitive to changes in water quality. Their presence indicates a high quality of water, while their absence suggests water may be polluted. High-quality streams usually also have the greatest species richness. Many aquatic insect species are intolerant of pollutants and will not be found in contaminated waters. The greater the pollution, the lower the species richness expected.

Based on taxa and EPT richness at location T-134, water quality conditions are good to high relative to the same location in 2000. The increases in overall taxa richness and EPT richness at location T-170 would seem to indicate fair/good habitat and water quality. The large increase in EPT and overall richness at location T-070, combined with the dramatic reduction in dominance of *Limnodrilus*, indicate good water/habitat quality.

Fish species that have been documented previously in the Housatonic River that were not surveyed in this 2007 study included chain pickerel (*Esox niger*), northern pike (*Esox lucius*), brook trout (*Salvelinus fontinalis*), and rainbow trout (*Oncorhynchus mykiss*). These fish were all documented downstream in habitat that is not found in this reach of river, therefore, their absence in 2007 was expected. Water temperature was recorded by a data-logger at the Pomeroy

Avenue Bridge (Station 08), which is located slightly downstream of location T-170. Average water temperature during the survey period (June 25-27, 2007) was 21.1°C, which was near or exceeded the maximum preferred temperature of brook trout, rainbow trout, and chain pickerel.

Critical life history variables for fish (and all aquatic organisms) are regulated by temperature (Hauer and Lamberti, 1996). Most freshwater fish can tolerate a relatively wide range of temperatures, although each species prefers a specific range within which growth, reproduction, and survival are optimized. Some species, such as brook trout, exhibit a more rigid requirement in regard to upper and lower temperature thresholds, requiring a year-round supply of cold, oxygenated water for survival. Others, such as white sucker (*Catostomus commersoni*), are adaptable to a much wider range of temperatures. The average daily water temperature during the survey was likely to have inhibited heat-intolerant species from utilizing the surveyed portions of the Housatonic River. Fish diversity may increase some in the future as woody debris and aquatic vegetation become more prevalent. The abundance and diversity of fish species identified appears to indicate good water and habitat quality.

7. REFERENCES

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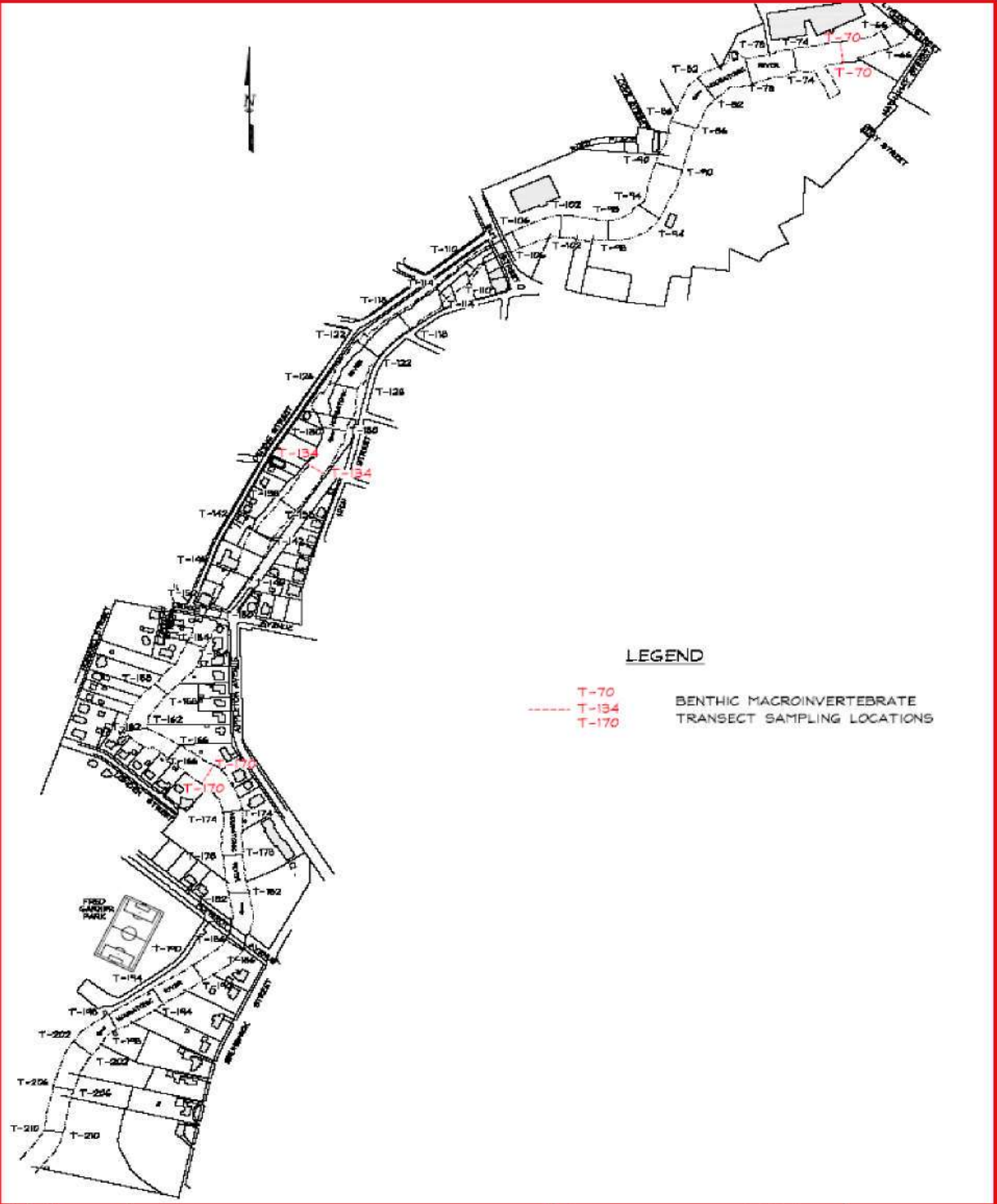
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APPENDIX A

**BENTHIC MACROINVERTEBRATE AND FISH SAMPLING
LOCATIONS IN THE 1½-MILE REACH OF THE HOUSATONIC RIVER**



LEGEND

- T-70 BENTHIC MACROINVERTEBRATE
- T-134 TRANSECT SAMPLING LOCATIONS
- T-170

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APPENDIX B

**BENTHIC MACROINVERTEBRATE COMMUNITY
CHARACTERIZATION DATA (2007)**

2007 Post-Remediation Aquatic Assessment Monitoring
Macroinvertebrate Community Characterization
GE/Housatonic River Project
Pittsfield, Massachusetts

Sampling Location T-70													
Organism Description	Sample location along Transect												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Ablabesmyia	8	4					1						13
Acricotopus nitidellus	2												2
Ancylidae		5	1	2			5	2		1			16
Ancyronyx						1							1
Antocha	15	47	4		3	7	13	13	1		5		108
Baetis flavistriga	1	12	2		1		1	1	1	1	2		22
Boyeria					1								1
Boyeria vinosa							1						1
Brillia											1		1
Caenis		1					1						2
Cambaridae	2												2
Centropilum	2					3							5
Centropilum semirufum			14	2									16
Ceraclea				1	1	1	1						4
Cheumatopsyche	21	47	4		2	5	6	5	2		13		105
Chironomus	298	52	128	196	3	9	4	1	3	1	2		697
Cladotanytarsus	6	4		4			1			2			17
Corixidae					1								1
Cricotopus	2	16	4	4		1		1	1	1			30
Cricotopus bicinctus		3	4	4	4	7			3	1			26
Cricotopus trifascia	2						1						3
Cryptochironomus	20		4	12				1				1	38
Cryptotendipes	2												2
Derallus					1								3
Dicranopselaphus		1											1
Dicrotendipes	4	20	16	16	4	14	24	9	1		2		110
Dubiraphia	1		3	3	1	2	1						11
Endochironomus				16									16
Ephemera			2		1		1						4
Eurylophella		1	1		1								3
Gomphidae							2						2
Gyraulus												1	1
Hemerodromia							1			1			2
Heterocloeon							1						1
Hydrobiidae												1	1
Hydropsyche	8	10				1	2	4	1	6	11		43
Hydropsychidae	7	42		1						3	5		58
Hydroptila					1		2						3
Hydroptilidae							1	1					2
Isonychia						1							1
Larsia								1					1
Lebertia	2	2											4
Leptoceridae				1									1
Limnodrilus	84	78	165	350	4	20	3	12	12	22	3	1	754
Limnodrilus cervix	28		70	40	1	10		11		2	1		163
Limnodrilus hoffmeisteri	14	30	14	160		5	1	5	10	7	2	1	249
Limnodrilus udekemianus										3			3
Lymnaeidae												2	2
Maccaffertium			5	1	7	13	10	13	1		1		51
Maccaffertium modestum			2	1		6	4						13
Maccaffertium pulchellum						4	2						6
Macronychus				1	1		4	3			1		10
Microtendipes pedellus-grp.	180	74	28	4	1	1	4	9	1	18	10	8	338
Naididae							1	1					2
Nais	4	12				2	1	6			8		33
Nanocladius	4	4	4			2							14
Nectopsyche									1				1
Nematoda	1												1

Sampling Location T-70													
Organism Description	Sample location along Transect												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Nigronia							1						1
Ophiogomphus	1			1									2
Optioservus		2		3			1			3	2	1	12
Orconectes		6	25	6				1					38
Orthocladius	32		4		2	3	3					5	49
Orthocladius lignicola											1		1
Paracladopelma									6	9			15
Parametriocnemus											1		1
Paratanytarsus	16	8	8		2		4	1					39
Paratendipes	2	4	20	28	2	7	3	1	1	1	1		70
Procladius			4		1								5
Peltodytes	1			1		1			1				4
Phaenopsectra		8	16	4	1		4		6	7	7	12	65
Physidae										1			1
Plautitus	8		1	2	2		1	1	1			2	18
Plautitus gloveri		16	3							6	7		32
Plautitus punctiventris	7	8								2	3		20
Polypedilum	6			8	2					3	1	1	21
Potthastia		4											4
Proclaeon	1	1											2
Proclaeon rivulare		3	8	1					2		2		16
Psectrocladius	8	4					1						13
Psephenus								1					1
Pseudochironomus	2							2					4
Pseudosmittia	2												2
Psychomyia	1		2		1			2			1		7
Rheotanytarsus						2		1	1		1		5
Sialis				1			1						2
Simulium										1			1
Sphaerium										1			1
Stenacron			2			4	4	4					14
Stenelmis	2	1				2				5	1		11
Stylogomphus					1	0							0
Tanytarsus	36	16	12	8	4	4	5	3		1	2	1	92
Thienemanniella						1	3						4
Thienemannimyia/Arctopelopia group	50	12	12				2		1				77
Trichocorixa	6												6
Tricorythodes	13	10	20	15	1	1	3	3	2	4	1	1	74
Tubificidae	28	6	14	60		2	3		6				119
Abundance	940	574	626	957	58	142	139	119	65	113	103	33	3869

2007 Post-Remediation Aquatic Assesment Monitoring
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Sampling Location T-134 Organism Description	Sample location along Transect												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Ablabesmyia									2				2
Ancylidae	1	2	3			1		3	3		1	1	15
Ancyronyx		1							1				2
Anthopotamus	1												1
Antocha	13	25	37	50	29	24	10	13	26	11	19	24	281
Baetidae			1					1					2
Baetis flavistriga	1	2	7	7	6	3		1	4	3	1	5	40
Caenis			1		1								2
Cambaridae	14	9	13	9	3	1	1	3	5	3	2	2	65
Centroptilum semirufum		1											1
Ceraclea		1							2				3
Cheumatopsyche	18	30	33	28	22	21	10	27	37	17	8	11	262
Chironomus												2	2
Cladotanytarsus	4	4	16	6		2	1		3		3	2	41
Crangonyx												1	1
Cricotopus	4			4	2		2						12
Cricotopus bicinctus		4	2	6		2					1		15
Cryptochironomus	2	6	2		2		1	1	1			2	17
Dicrotendipes	10	16	12	14	8	2	3		4	11	3	16	99
Dubiraphia	1	1	1							1	1		5
Elmidae	2	1											3
Endochironomus			2										2
Ephemera										1			1
Eurylophella		1		4		1		1			3		10
Gomphus		1								1			2
Hydatophylax									1				1
Hydropsyche	52	68	83	137	71	72	28	74	48		38	37	708
Hydropsychidae	5	10	8	5	8	5	2	3		53	2	4	105
Hydroptila										4			4
Lebertia	1		1	1					2				5
Limnodrilus	1		3	4				1					9
Limnodrilus hoffmeisteri			3	1		2			1				7
Limnodrilus udekemianus									1				1
Lymnaeidae			1										1
Maccaffertium	7	7	7	27	5	1	1	7	11		3	9	85
Maccaffertium modestum						1				5			6
Maccaffertium pulchellum						1		1					2
Macronychus		1	1	2	3	3	3	1	3		3	1	21
Microtendipes pedellus-grp.	100	118	86	140	70	69	40	56	84		27	52	842
Naididae	1	2					1	2	1	34	3		44
Nais	5	22	14	12	27	19	21	21	12		14	27	194
Nanocladius	4					1			3	21			29
Nectopsyche					1								1
Nematoda			1			1						1	3
Nigronia												1	1
Nilotanytus fimbriatus			2										2
Nilothauma		2											2
Ophiogomphus	2												2
Optioservus		4	5		1		1						11
Orthocladius		2				3	5	2	3		3	4	22
Orthocladius lignicola	2												2
Pagastia		2		6				2	1				11
Parametriocnemus			2						1			1	4
Paratanytarsus		6	2	2					3	1		1	15
Paratendipes				2									2
Perlesta					1								1
Phaenopsectra	8	10	6	8	4	5	6	1	7		4	1	60

Sampling Location T-134													
Organism Description	Sample location along Transect												
	1	2	3	4	5	6	7	8	9	10	11	12	Total
Planariidae		1		2					1	1			5
Plauditus				2									2
Plauditus gloveri		1						2				2	5
Plauditus punctiventris		3										1	4
Polycentropodidae					1								1
Polypedilum	4	2		2									8
Polypedilum aviceps			4	2		2	1		3	1	3		16
Polypedilum fallax grp.						2				1		1	4
Polypedilum flavum							1	5					6
Polypedilum halterale grp.					2						1		3
Polypedilum scalaenum grp.		16	20		2	4			3	2	5	3	55
Pristina				2									2
Procloeon rivulare		1						1					2
Psephenus	2	2	1								1		6
Psychomyiidae	1												1
Rhagovelia			1										1
Rheotanytarsus			6	2	4	2	2		5	7	1	3	32
Rhyacophila											1		1
Serratella				1									1
Sialis		1									1	1	3
Sperchon					1								1
Sphaeriidae			1										1
Sphaerium											1		1
Stenacron				1			1						2
Stenelmis	18	15	17	13	7	6	6	8	8	3	5	8	114
Stenochironomus										8			8
Stylogomphus			1	1									2
Tanytarsus		6	12	6	4	3	4	3	10	1	2	5	56
Thienemanniella			2		2	2		1					7
Thienemannimyia/Arctopelopia group	4	16	8	6	8	5	1	2	8		3	2	63
Tricorythodes	6	8	3	6	4	6	2	6	7		1	6	55
Tubificidae		2							2	2			6
Tvetenia			2		6			1	1	2	1		13
Tvetenia vitracea				2		6				2			10
Abundance	294	433	433	523	305	278	156	249	315	196	165	237	3584

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Sampling Location T-170 Organism Description	Sample location along Transect												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Acentrella turbida	5	1	1	1	1			2		4			15
Ancylidae					3	5	1	1	1	3			14
Antocha	2	10	13	3	2	4	1	2	2	9	11	4	63
Baetidae	24		14	1	1			1			3		44
Baetis flavistriga	7	6	11	6	7	1	1	2		9	16	19	85
Baetis intercalaris	6												6
Baetis tricaudatus				1	1								2
Brachycentridae	1												1
Brachycentrus		3					1						4
Brillia									1	14		2	17
Caecidotea			1							1			2
Cambaridae		1	1							2			4
Cardiocladius										12			12
Ceraclea		1											1
Cheumatopsyche	124	151	133	74	110	34	12	70	73	133	44	28	986
Chimarra									1				1
Chironomus			2										2
Cladotanytarsus	4		2	4		2		2					14
Crangonyx	2			1									3
Cricotopus									15		5		20
Cricotopus bicinctus	24	10	24	16	14	6	2	26					122
Cricotopus trifascia	70	40	50	60	42	48	13	70	29	40	50	12	524
Cryptochironomus	2		2		2	2				2			10
Dicretendipes			2					2	1	4	2		11
Enchytraeidae					3					1			4
Eukiefferiella	14	10	4	6	4	4		4		5			51
Eurylophella												1	1
Gyraulus	1								1				2
Hydropsyche	80	181	174	85	92	29	22	62	57	206	100	62	1150
Hydropsychidae	98	139	153	69	77	63	15	54	36	87	30	11	832
Hydroptila									1	1			2
Hydroptilidae								2					2
Leucotrichia									1				1
Leuctra										1			1
Limnephilidae			1										1
Limnodrilus	6	12	9	3	1				4		6	1	42
Limnodrilus hoffmeisteri	2		4		2								8
Limnophyes	2												2
Lymnaeidae	2		1		2	2	1					2	10
Maccaffertium		1	4	2	1	1			3	4	2	3	21
Microtendipes pedellus-grp.	30	20	48	24	14	16	3		12	8	13	16	204
Naididae			7				2		5				14
Nais	7	17	17	6	26	13	10	18	12	13	13	9	161
Nanocladius			2		2								4
Nematoda			1										1
Optioservus	24	7	19	6	19	9	5	5	3	6	9	4	116
Orthocladius	28	20	32	26	26	32	2	30	5	14	15		230
Parametrioctenemus			4										4
Paratanytarsus	4												4
Perlesta								1		1			2
Perlidae		1	1										2
Phaenopsectra	10		4		2	4					2		22
Planaridae									1	1			2
Plauditus	6	2		1		2	3		11	3	4	1	33
Polypedilum		10	6										16
Polypedilum aviceps	8	20		6								9	43
Polypedilum bergi	2												2

Sampling Location T-170													
Organism Description	Sample location along Transect												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Polypedilum fallax grp.			2										2
Polypedilum flavum	4	20	6	6	16		9	4	8	16	9	6	104
Polypedilum halterale grp.	8			2		10	7	16			6	9	58
Potthastia									1				1
Rheotanytarsus			6		4			4	1			4	19
Simulium	2	1				1			1				5
Sperchon			1	1							1		3
Stenelmis	5	3	9	5	2	3	3	3	1	9	4	2	49
Stenochironomus					2								2
Sublettea coffmani		1											1
Tanytarsus			6	2									8
Thienemanniella			2	2		2		2					8
Thienemannimyia/Arctopelopia group			4	4				4	6	18		4	40
Tricorythodes							1		1	1	1		4
Tubificidae		7	6	2	1			4		1	1	1	23
Tvetenia	4												4
Tvetenia vitraces	20	30	32	18	12	2		4	3		10	4	135
Abundance	638	725	821	439	495	295	114	395	297	629	357	214	5419

APPENDIX C

**BENTHIC MACROINVERTEBRATE
PCB TISSUE DATA (2000)**

**2000 Post-Remediation Aquatic Assessment Monitoring
Macroinvertebrate PCB Data
GE/Housatonic River Project
Pittsfield, Massachusetts**

Location Field Sample ID Date Sample Type	Transect 134	Transect 134
	H2-TW02CF01-0-0G17 08/17/2000	H2-TW02CF02-0-0G18 08/18/2000
Analyte		Duplicate
PCBS		
AROCLOR-1242 (ug/kg)	196.1 U	74.1 U
AROCLOR-1248 (ug/kg)	196.1 U	74.1 U
AROCLOR-1254 (ug/kg)	24264	28156.9
AROCLOR-1260 (ug/kg)	461016.2	159556
PCB, TOTAL by Aroclors (ug/kg)	485280.2	187712.9
PCB CONGENERS		
PCB-77 (ug/kg)	2.697	0.009 J
PCB-81 (ug/kg)	0.174 J	0.0741 U
PCB-126 (ug/kg)	0.839 J	0.0741 U
PCB-169 (ug/kg)	0.061 J	0.0741 U
PCB-105 (ug/kg)	2158.579	798.741
PCB-114 (ug/kg)	0.1961 U	0.0741 U
PCB-118 (ug/kg)	3730.338	1704.029
PCB-149/123 (ug/kg)	34535.697	12302.133
PCB-156 (ug/kg)	2911.322	1377.477
PCB-201/157/173 (ug/kg)	2201.89	712.287
PCB-167 (ug/kg)	957.201	604.346
PCB-189 (ug/kg)	532.193	314.138
PCB-1 (ug/kg)	0.1961 U	2.801
PCB-101/90 (ug/kg)	13210.194	5937.015
PCB-107 (ug/kg)	305.425	115.441
PCB-110 (ug/kg)	7809.249	3206.484
PCB-119 (ug/kg)	122.704	92.214
PCB-128 (ug/kg)	2667.338	1375.316
PCB-129 (ug/kg)	726.644	341.288
PCB-130 (ug/kg)	373.5	141.623
PCB-135 (ug/kg)	7268.742	3077.118
PCB-136 (ug/kg)	3964.766	1478.954
PCB-138/160 (ug/kg)	37568.532	16108.839
PCB-141/179 (ug/kg)	16743.774	6013.452
PCB-146 (ug/kg)	5175.563	2539.55
PCB-15 (ug/kg)	191.406	197.368
PCB-151 (ug/kg)	13802.357	5147.062
PCB-153/132 (ug/kg)	57837.962	23030.047
PCB-158 (ug/kg)	4361.918	2238.928
PCB-16/32 (ug/kg)	51.95	34.423
PCB-166 (ug/kg)	22.111	8.728
PCB-170/190 (ug/kg)	18301.912	7358.208
PCB-171/202 (ug/kg)	6186.902	2731.67
PCB-172 (ug/kg)	3619.869	1574.917
PCB-174 (ug/kg)	23615.148	7876.274
PCB-175 (ug/kg)	1200.2	517.877
PCB-176/137 (ug/kg)	4416.145	1840.094
PCB-177 (ug/kg)	10038.023	4074.358
PCB-178 (ug/kg)	4546.345	1695.913
PCB-18/17 (ug/kg)	77.207	48.013
PCB-180 (ug/kg)	53269.303	19735.893
PCB-183 (ug/kg)	12294.146	5359.093
PCB-185 (ug/kg)	4095.738	1546.495
PCB-187 (ug/kg)	31756.383	10426.747
PCB-191 (ug/kg)	1008.413	487.747
PCB-193 (ug/kg)	2947.877	1183.528
PCB-194 (ug/kg)	12651.993	4370.14
PCB-195/208 (ug/kg)	6014.472	2137.873
PCB-197 (ug/kg)	366.007	116.343

Location Field Sample ID Date Sample Type	Transect 134	Transect 134
	H2-TW02CF01-0-0G17 08/17/2000	H2-TW02CF02-0-0G18 08/18/2000
Analyte		Duplicate
PCB-199 (ug/kg)	13455.52	4115.712
PCB-200 (ug/kg)	2114.34	666.889
PCB-203/196 (ug/kg)	16006.502	5622.383
PCB-205 (ug/kg)	630.115	230.775
PCB-206 (ug/kg)	3343.376	850.188
PCB-207 (ug/kg)	565.351	115.551
PCB-209 (ug/kg)	62.075	15.914
PCB-22/51 (ug/kg)	32.461	10.861
PCB-24/27 (ug/kg)	56.045	69.833
PCB-25 (ug/kg)	52.266	60.868
PCB-26 (ug/kg)	85.903	90.459
PCB-28 (ug/kg)	158.945	67.736
PCB-29 (ug/kg)	12.452	12.194
PCB-30 (ug/kg)	0.1961 U	2.199
PCB-31 (ug/kg)	149.806	61.911
PCB-33/20 (ug/kg)	45.123	17.76
PCB-39 (ug/kg)	0.1961 U	0.0741 U
PCB-40 (ug/kg)	80.19	12.978
PCB-41/64 (ug/kg)	792.092	286.816
PCB-42/59/37 (ug/kg)	204.197	96.614
PCB-44 (ug/kg)	986.738	382.704
PCB-45 (ug/kg)	38.965	9.49
PCB-46 (ug/kg)	27.66	16.782
PCB-47/75 (ug/kg)	954.624	802.185
PCB-48 (ug/kg)	0.1961 U	0.0741 U
PCB-49 (ug/kg)	1263.436	875.896
PCB-52 (ug/kg)	2643.074	1229.55
PCB-53 (ug/kg)	139.508	110.494
PCB-56/60 (ug/kg)	853.95	129.166
PCB-63 (ug/kg)	0.1961 U	0.0741 U
PCB-66 (ug/kg)	348.548	114.157
PCB-67 (ug/kg)	87.36	82.942
PCB-69 (ug/kg)	11.411	15.08
PCB-7/9 (ug/kg)	3.713	4.624
PCB-70 (ug/kg)	2206.876	798.779
PCB-72 (ug/kg)	19.692	19.95
PCB-74/61 (ug/kg)	744.516	302.492
PCB-8/5 (ug/kg)	12.334	12.178
PCB-82 (ug/kg)	609.886	143.062
PCB-83 (ug/kg)	229.4	85.905
PCB-84 (ug/kg)	1386.973	481.862
PCB-85 (ug/kg)	841.799	350.41
PCB-87/115 (ug/kg)	2992.379	1159.781
PCB-91/55 (ug/kg)	948.425	487.752
PCB-92 (ug/kg)	1962.705	869.7
PCB-95/80 (ug/kg)	8621.006	3156.24
PCB-97 (ug/kg)	1647.657	588.219
PCB-99 (ug/kg)	2082.022	1027.928
TOTAL DCB (ug/kg)	62.075	15.914
TOTAL DICB (ug/kg)	207.453	214.17
TOTAL HPCB (ug/kg)	177828.597	66722.952
TOTAL HXCB (ug/kg)	188917.488	75784.861
TOTAL MCB (ug/kg)	196.1 U	2.801
TOTAL NCB (ug/kg)	3908.727	965.739
TOTAL OCB (ug/kg)	53440.839	17972.402
TOTAL PCB (ug/kg)	47713.852	19717.04
TOTAL TCB (ug/kg)	12351.436	5773.827
TOTAL TRICB (ug/kg)	722.158	476.257
PCB, TOTAL by Congeners(ug/kg)	485152.625	187645.963
ORGANIC		
PERCENT LIPIDS (GC) (%)	1.7	2.7

U- non detect
J- estimated value

APPENDIX D

**BENTHIC MACROINVERTEBRATE
PCB TISSUE DATA (2007)**

2007 Post-Remediation Aquatic Assessment Monitoring
Macroinvertebrate PCB Data
GE/Housatonic River Project
Pittsfield, Massachusetts

Location Field Sample ID Date Sample Type	Transect 70	Transect 170	Transect 134	Transect 134
	H2-TMI00070-0-C001 06/26/2007	H2-TMI00170-0-C001 06/25/2007	H2-TMI00134-0-C001 06/26/2007	H2-TMI00134-1-C001 06/26/2007 Duplicate
Analyte				
PCBS				
AROCLOR-1242 (ug/kg)	27.17 U	27.17 U	27.17 U	27.17 U
AROCLOR-1248 (ug/kg)	263.5	211.8	464.8	508.3
AROCLOR-1254 (ug/kg)	474.2	317.7	697.1	762.5
AROCLOR-1260 (ug/kg)	316.1	176.5	387.3	423.6
PCB, TOTAL by Aroclors (ug/kg)	1053.8	706	1549.2	1694.4
PCB CONGENERS				
PCB-77 (ug/kg)	0.239	0.128	0.248	0.318
PCB-126 (ug/kg)	0.144 J	0.055 J	0.096 J	0.133
PCB-169 (ug/kg)	0.161 J	0.044 J	0.031 J	0.026 J
PCB-105 (ug/kg)	17.582	10.652	17.656	18.509
PCB-114 (ug/kg)	0.03 U	0.03 U	0.03 U	0.03 U
PCB-118 (ug/kg)	56.916	36.177	58.399	70.347
PCB-149/123 (ug/kg)	13.56	18.336	46.512	42.207
PCB-156 (ug/kg)	15.713	7.219	15.704	19.625
PCB-201/157/173 (ug/kg)	1.394	1.071	2.425	2.736
PCB-167 (ug/kg)	6.833	3.247	6.219	7.447
PCB-189 (ug/kg)	0.636	0.225	1.552	1.205
PCB-1 (ug/kg)	18.328	9.199	12.447	12.523
PCB-101/90 (ug/kg)	62.243	36.647	95.207	111.955
PCB-107 (ug/kg)	14.156	3.619	9.264	9.210
PCB-110 (ug/kg)	23.928	30.908	60.558	58.579
PCB-119 (ug/kg)	4.565	3.386	7.52	7.837
PCB-128 (ug/kg)	10.778	7.044	12.309	15.774
PCB-129 (ug/kg)	4.475	1.652	3.377	4.187
PCB-130 (ug/kg)	0.220	1.607	3.988	3.993
PCB-135 (ug/kg)	2.027	5.12	14.763	13.749
PCB-136 (ug/kg)	0.283	0.313	4.095	6.590
PCB-138/160 (ug/kg)	84.035	49.552	100.233	119.384
PCB-141/179 (ug/kg)	15.484	11.885	32.122	31.326
PCB-146 (ug/kg)	29.339	9.366	27.994	27.762
PCB-15 (ug/kg)	13.225	11.123	23.577	28.481
PCB-151 (ug/kg)	16.130	7.546	20.590	20.414
PCB-153/132 (ug/kg)	122.090	71.253	149.305	177.647
PCB-158 (ug/kg)	11.228	8.040	14.926	17.146
PCB-16/32 (ug/kg)	5.583	2.544	4.914	6.189
PCB-166 (ug/kg)	0.965	0.232	0.482	0.580
PCB-170 (ug/kg)	28.566	14.784	31.820	37.878
PCB-171/202 (ug/kg)	3.874	1.991	5.580	5.235
PCB-172 (ug/kg)	3.571	2.204	6.023	6.144
PCB-174 (ug/kg)	8.104	5.155	13.274	11.662
PCB-175 (ug/kg)	2.755	0.685	1.622	1.398
PCB-176/137 (ug/kg)	5.738	1.939	3.797	3.573
PCB-177 (ug/kg)	6.379	3.416	9.333	9.755
PCB-178 (ug/kg)	5.252	1.603	6.714	7.132
PCB-18/17 (ug/kg)	4.189	1.532	5.493	5.688
PCB-180 (ug/kg)	61.589	29.287	62.895	76.143
PCB-183 (ug/kg)	11.914	5.712	15.98	16.480
PCB-185 (ug/kg)	2.199	0.661	2.955	2.922
PCB-187 (ug/kg)	26.138	11.561	35.071	37.425
PCB-191 (ug/kg)	1.02	0.519	0.987	0.984
PCB-193 (ug/kg)	3.193	1.477	3.637	4.396
PCB-194 (ug/kg)	9.557	4.058	10.421	13.353
PCB-195/208 (ug/kg)	2.041	1.199	3.743	4.054
PCB-197 (ug/kg)	0.083	0.080	0.240	0.2665
PCB-199 (ug/kg)	0.954	1.962	4.783	4.039

Location Field Sample ID Date Sample Type	Transect 70	Transect 170	Transect 134	Transect 134
	H2-TMI00070-0-C001	H2-TMI00170-0-C001	H2-TMI00134-0-C001	H2-TMI00134-1-C001
	06/26/2007	06/25/2007	06/26/2007	06/26/2007
				Duplicate
Analyte				
PCB-200 (ug/kg)	0.203	0.098	0.430	0.356
PCB-203/196 (ug/kg)	6.732	3.393	10.101	12.719
PCB-205 (ug/kg)	0.474	0.311	0.961	1.007
PCB-206 (ug/kg)	1.103	0.241	1.130	1.004
PCB-207 (ug/kg)	0.127	0.154	0.276	0.241
PCB-209 (ug/kg)	0.128	0.081	0.142	0.171
PCB-22/51 (ug/kg)	2.400	6.605	9.869	11.463
PCB-24/27 (ug/kg)	0.03 U	2.945	7.201	9.362
PCB-25 (ug/kg)	4.853	2.514	7.460	6.298
PCB-26 (ug/kg)	2.628	2.277	8.171	8.788
PCB-28 (ug/kg)	7.674	3.884	5.085	5.917
PCB-29 (ug/kg)	2.271	1.292	0.03 U	1.656
PCB-30 (ug/kg)	1.255	0.03 U	0.03 U	0.03 U
PCB-31 (ug/kg)	5.022	2.583	5.331	5.192
PCB-33/20 (ug/kg)	1.559	0.455	0.483	0.03 U
PCB-39 (ug/kg)	1.844	0.261	0.03 U	0.03 U
PCB-40 (ug/kg)	1.027	0.194	0.579	0.538
PCB-41/64 (ug/kg)	0.03 U	0.03 U	0.03 U	0.03 U
PCB-42/59/37 (ug/kg)	0.257	4.335	6.68	6.335
PCB-44 (ug/kg)	6.86	9.213	20.210	19.237
PCB-45 (ug/kg)	0.03 U	1.001	0.03 U	0.03 U
PCB-46 (ug/kg)	6.453	0.03 U	0.03 U	0.03 U
PCB-47/75 (ug/kg)	42.607	37.665	72.639	85.320
PCB-48 (ug/kg)	1.894	2.543	4.018	4.527
PCB-49 (ug/kg)	24.787	25.376	62.168	60.263
PCB-52 (ug/kg)	29.660	23.594	63.315	75.933
PCB-53 (ug/kg)	2.791	3.732	13.431	12.549
PCB-56/60 (ug/kg)	10.182	3.283	4.889	5.224
PCB-63 (ug/kg)	0.998	0.03 U	0.03 U	0.03 U
PCB-66 (ug/kg)	5.986	4.821	10.010	10.612
PCB-67 (ug/kg)	0.03 U	3.077	9.851	9.082
PCB-69 (ug/kg)	0.03 U	0.03 U	0.03 U	0.03 U
PCB-79 (ug/kg)	0.03 U	0.201	0.03 U	0.708
PCB-70 (ug/kg)	13.739	14.293	21.805	27.607
PCB-72 (ug/kg)	0.03 U	1.511	3.608	2.710
PCB-74/61 (ug/kg)	8.089	5.156	8.728	11.641
PCB-8/5 (ug/kg)	8.993	3.808	3.435	3.202
PCB-82 (ug/kg)	9.737	2.649	6.098	6.369
PCB-83 (ug/kg)	0.545	1.544	4.566	5.077
PCB-84 (ug/kg)	9.418	5.232	14.172	11.456
PCB-85 (ug/kg)	20.934	8.168	13.916	14.615
PCB-87/115 (ug/kg)	13.488	14.358	28.130	25.654
PCB-91/55 (ug/kg)	2.990	6.306	18.012	19.418
PCB-92 (ug/kg)	0.818	7.916	24.221	24.149
PCB-95/80 (ug/kg)	21.747	17.565	39.629	41.992
PCB-97 (ug/kg)	5.989	9.453	20.060	17.177
PCB-99 (ug/kg)	26.113	23.840	47.5	47.438
TOTAL DCB (ug/kg)	0.1 J	0.1	0.1 J	0.2 J
TOTAL DICB (ug/kg)	22.2 J	15.1	27 J	32.4
TOTAL HPCB (ug/kg)	170.9	81.2	201.2	222.3
TOTAL HXCB (ug/kg)	333.2	202.4	452.6	504.8
TOTAL MCB (ug/kg)	18.3 J	9.2	12.4 J	12.5 J
TOTAL NCB (ug/kg)	1.2 J	0.4	1.4 J	1.2 J
TOTAL OCB (ug/kg)	21.4 J	12.2	33.1	38.5
TOTAL PCB (ug/kg)	288.6	212.3	447.3	470.8
TOTAL TCB (ug/kg)	39.3 J	148.1	326.4	357.1
TOTAL TRICB (ug/kg)	164.3	26.9	54	60.6
PCB, TOTAL by Congeners(ug/kg)	1059.5	707.9	1555.5	1700.4
ORGANIC				
PERCENT LIPIDS (OTHER) (%)	1.5	1.1	2.4	2.4

U- non detect
J- estimated value