



## MEMORANDUM

**TO:** Mike Rolband  
**FROM:** Alison Robinson  
**CC:** Ben Rosner, Mark Headly, Scott Petrey  
**RE:** Northern Virginia Stream Restoration Bank  
The Glade- Design Reaches 5 and 6  
Supplemental Biological Monitoring 2012 (Year 2)  
WSSI #20030, Task M1a  
**DATE:** November 27, 2012

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Per maintenance and monitoring requirements defined in the "Northern Virginia Stream Restoration Bank Banking Instrument", Section VI.B.2.(i), biological monitoring will be conducted prior to stream restoration, then in years 1, 5, and 10 in The Glade- Design Reaches 5 and 6<sup>1</sup>. However, monitoring was undertaken voluntarily in Year 2 (2012) at biomonitoring Reaches 1-A through 1-C to better understand and document the effects of stream restoration on the benthic community within The Glade Watershed<sup>2</sup>. Field work was conducted by WSSI environmental scientists Lauren Shaffer and Mark Navarro on April 14, 2012. Benthic macroinvertebrate habitat field data sheets and benthic macroinvertebrate bench sheets for each reach are enclosed within.

Habitat results for Year 2 (Post-Construction) show that all of the biomonitoring reaches sampled in The Glade have "Optimal" habitat conditions ([Table 1](#), [Figure 1](#)). The average habitat assessment score for all restored biomonitoring reaches assessed in 2012 is 166 (Optimal) out of 200 following restoration. These results show improved habitat conditions following restoration, with scores exceeding the pre-restoration average of 154 (Sub-Optimal) out of 200. Improved habitat assessment scores following restoration relate to the continued success of the vegetated and stabilized banks with little erosion and depositional zones present in the restored portions of the monitoring reaches, as well as the continued stability of the non-restored portions of the Glade.

The results of our data analysis indicate that the benthic macroinvertebrate community at all three biomonitoring reaches were in "Severe Stress" in 2012, based on their Stream Condition Index for Virginia Non-coastal Streams (VA-SCI)<sup>3</sup> scores ([Table 2](#), [Figure 2](#)). The average VA-SCI numerical score for all reaches assessed in 2012 is 20.07 ("Severe Stress"). The 2012 average VA-SCI score is still lower than the pre-restoration average of 34.34 ("Severe Stress"); however, biomonitoring reaches 1-B and 1-C showed individual improvement from the 2011 post-construction VA-SCI scores. Note that biomonitoring reach 1-A showed almost no difference from its 2011 post-construction VA-SCI score, but that this area was impacted by a

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<sup>1</sup> Biomonitoring reach locations were selected prior to the design phase; therefore, biomonitoring reaches 1-A through 1-C are located within Design Reaches 5 and 6.

<sup>2</sup> Note that Reach 1-A is 10% restored and Reach 1-B is 50% restored. Reach 1-C is the only fully restored reach in Design Reaches 5 and 6.

<sup>3</sup> The VA-SCI is a multi-metric Index of Biotic Integrity developed for the DEQ to assess Streams of the Commonwealth.

storm event in September 2011 which resulted in the reconstruction of the portion of Design Reach 6 immediately upstream from biomonitoring reach 1-A.

In conclusion, the results of the 2012 supplemental monitoring indicate that there has been a continued improvement of habitat scores and a slight improvement of the benthic community composition in the 2012 sampled reaches as compared to the first year following restoration in 2011.

Enclosures

Table 1. 2012 Total Habitat Assessment Scores		
BIOMONITORING REACH	Total Habitat	Narrative Rating
1-A (10% Restored)	146	Suboptimal
1-B (50% Restored)	172	Optimal
1-C (100% Restored)	180	Optimal
<b>Average</b>	<b>166</b>	<b>Optimal</b>

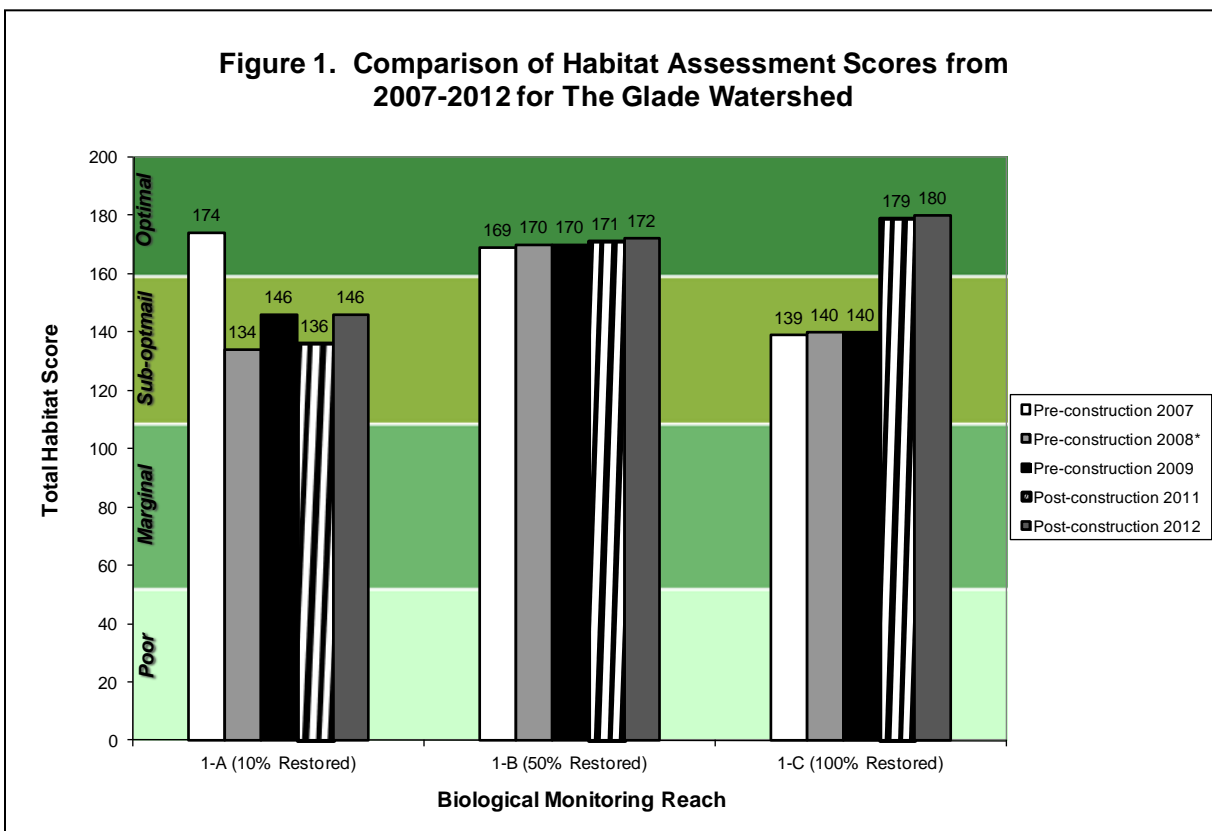
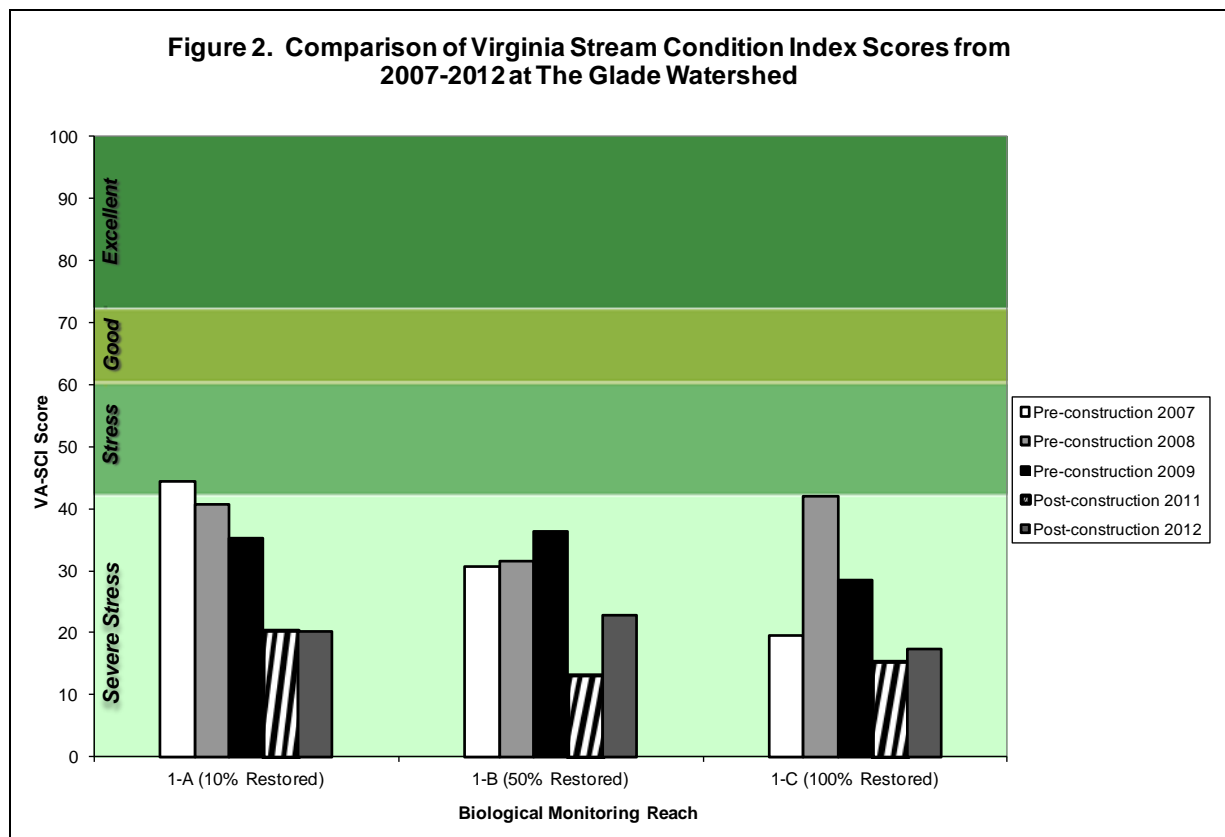


Table 3. 2012 Biotic Metric and Index Weighting and VA-SCI at The Glade.			
WEIGHTED METRIC	BIOLOGICAL MONITORING REACH		
	1-A (10% Restored)	1-B (50% Restored)	1-C (100% Restored)
Total Taxa	31.82	27.27	27.27
EPT Taxa	27.27	0.00	18.18
Percent Ephemeroptera	1.50	0.00	0.00
Percent Plecoptera + Trichoptera (Excluding Hydropsychidae)	2.58	0.00	5.30
Percent Scrapers	1.78	0.00	5.48
Percent Chironomidae	20.18	66.67	9.43
Percent Top Two Dominant	18.56	28.34	8.18
HBI	57.20	60.41	64.23
<b>VA-SCI Numerical Score</b>	20.11	22.84	17.26
<b>VA-SCI Narrative Score</b>	Severe Stress	Severe Stress	Severe Stress
<b>Average VA-SCI Numerical Score</b>	<b>20.07</b>		
<b>Average VA-SCI Narrative Score</b>	<b>Severe Stress</b>		



*\*Note that biological monitoring reach 1-G was not sampled in 2008 and 2009 and biological monitoring reach 3-A was not sampled in 2009 due to the lack of flowing water during the time of the sampling fieldwork.*



# EXHIBIT 6: HABITAT ASSESSMENT FIELD DATA SHEET - SUMMARY WORKSHEET

<b>Project Name and WSSI Number:</b> Northern Virginia Stream Restoration Bank: The Glade (WSSI # 20030)															
<b>Stream ID:</b> The Glade and Unnamed Tributaries of The Glade							<b>Date:</b> 4/26/12								
<b>Evaluators:</b> LLS/MN							<b>HUC:</b> 02070008								
<b>Assessment Period:</b> Post-construction - Year 2															
Assessment Reach Name		Condition Category										TOTAL SCORE	Condition	Reach Length	Stream Type
		Substrate	Embedded-ness	Velocity	Sediment Deposition	Flow Status	Channel Alteration	Frequency of Riffles	Bank Stability*	Vegetation Protection*	Riparian Zone*				
Stream 1	1-A	Suboptimal	Suboptimal	Optimal	Suboptimal	Optimal	Optimal	Marginal	Suboptimal	Suboptimal	Optimal	146	Suboptimal	300	R3
	1-B	Optimal	Suboptimal	Marginal	Optimal	Optimal	Optimal	Optimal	Suboptimal	Optimal	Optimal	172	Optimal	300	R3
	1-C	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal	180	Optimal	300	R3
	1-D	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-E	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-F	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	1-G	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream 2	2-A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream 3	3-A	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Average</b>											166	<b>Total</b>	900		

\* The score for Bank Stability, Vegetation Protection and Riparian Zone combines the left and right bank scores.

\*\* The stream is characterized as non-perennial by Fairfax County and is thus either intermittent or ephemeral.

## Benthic Macroinvertebrate and Habitat Field Data Sheet

Station ID:	Reach 1-A	Ecoregion:	Piedmont	Land Use:	Urban
Field Team:	LLS/MN	Survey Reason:	Year 2 Biomonitoring	Start time:	
Stream Name:	Glade	Location:	Reston, Virginia	Finish time:	
Date:	4/26/2012	Latitude:	38°55'50"	Longitude:	-77°19'29"

### Stream Physiochemical Measurements

Instrument ID number:	N/A	pH:	N/A
Temperature:	N/A °C	Conductivity:	N/A uS/cm
Dissolved Oxygen:	N/A mg/L	Did instrument pass all post-calibration checks?	N/A
		If NO- which parameter(s) failed and action taken:	N/A

### Benthic Macroinvertebrate Collection

Method Used:	Single Habitat (Riffle):	Multi Habitat (Logs, Plants, etc.):	X
Riffle Quality:	Good	Marginal	X
Habitats Sampled:	Riffle	Snags	X
# Jabs:	9	2	8
			1

### Weather Observations

Current Weather:	Cloudy	X	Clear		Rain/Snow		Foggy	
Recent Precipitation:	Clear	X	Showers		Rain		Storms	
Stream Flow:	Low		Normal	X	Above Normal		Flood	

### Biological Observations

Periphyton	2	Salamanders	0	Other....	Iron Oxidizing Bacteria=1
Filamentous Algae	0	Warmwater Fish	1	0= Not observed	
Submerged Macrophytes	0	Coldwater Fish	0	1= Sparse	
Emergent Macrophytes	2	Beavers	0	2= Common to Abundant	
Crayfish	0	Muskrats	0	3= Dominant-	
Corbicula	0	Ducks/Geese	0	abnormally high density where other taxa	
unionidae	0	Snakes	0	are insignificant in relation to the dominant	
Operculate Snails	0	Turtles	0	taxa. There can be situations where multiple	
Non-operculate Snails	0	Frogs/Tadpoles	0	taxa are dominant such as algae and snails	

Notes

### High Gradient Habitat Data


Habitat Parameter	Condition Category				
	Optimal	Suboptimal	Marginal	Poor	Score
<b>1. Epifaunal Substrate/ Available Cover</b>	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble, or other stable habitat and at stage to allow full colonization potential (i.e. snags/logs that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization.	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.	
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	15
<b>2. Embeddedness</b>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.	
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	12
<b>Velocity/Depth Regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast shallow)(slow is <0.3m/s, deep is >0.5 m).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).	
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	16
<b>4. Sediment Deposition</b>	Little or no enlargement of islands or point bars and <5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	11



## Benthic Macroinvertebrate and Habitat Field Data Sheet

Habitat Parameter	Condition Category				
	Optimal	Suboptimal	Marginal	Poor	Score
<b>5. Channel Flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.	
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	16
<b>6. Channel Alteration</b>	Channelization or dredging absent or minimal; stream width normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging, may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.	
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	16
<b>7. Frequency of Riffles</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distances between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.	
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	10
<b>8. Bank Stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.	
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	8
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	7
<b>9. Vegetation Protection (score each bank) Note: Determine left or right side by facing downstream.</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetation disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.	
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	8
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	8
<b>10. Riparian Vegetative Zone Width (score each bank riparian zone)</b>	Width of riparian zone >18 meters; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.	
Score Left Bank	10 9	8 7 6	5 4 3	2 1 0	9
Score Right Bank	10 9	8 7 6	5 4 3	2 1 0	10
<b>Total Score</b>					146

# WSSI BENTHIC MACROINVERTEBRATE BENCH SHEET

Job Name/#	Glade - 20030	Sample subsorted by:	BNR		
Station ID:	Reach 1-A	Date Subsorted:	9/4/12		
Stream Name:	The Glade	# of Grids subsorted	6		
Date Sampled:	4/26/12	Total # of subsorted insects:	120	Total # identified:	109
Sampling Method:	Multihabitat	Sample Identified by:	ABR	Date Identified:	9/27/12

## Taxa Collected:

Porifera	Spongillidae			Metretopodidae			Lepidostomatidae	
Ostracoda	Unknown			Neophemeridae			Leptoceridae	
Flatworms	Tricladida			Oligoneuridae			Limnephilidae	
	Planariidae			Psuedironidae			Molannidae	
Gastropoda	Unknown			Polymitarciidae			Odontoceridae	
Limpets	Ancylidae			Potamanthidae			Philopotamidae	
Snails	Immature			Siphonuridae			Phryganeidae	
	Lymnaeidae		Zygoptera	Tricorythidae			Polycentropodidae	1
	Physidae			Early Instar and/or damaged			Psychomyiidae	
	Planorbidae			Calopterygidae			Ryacophilidae	
	Hydrobiidae			Coenagrionidae	8		Sericostomatidae	
	Pleuroceridae			Lestidae			Uenoidae	
	Viviparidae		Anisoptera	Protoneuridae		Lepidoptera	Early Instar and/or damaged	
Bivalvia	Immature			Early Instar and/or damaged			Pyrilidae	
	Corbiculidae			Aeshnidae		Coleoptera	Early Instar and/or damaged	
	Sphaeriidae			Cordulegastridae			Chrysomelidae	
	Unionidae			Corduliidae			Curculionidae	
Oligochaeta	Unknown	1		Gomphidae			Dryopidae	
Lumbriculida				Libellulidae			Dytiscidae	
	Lumbriculidae			Macromiidae			Elmidae	
				Petaluridae			Gyrinidae	
Tubificida				Cordullidae/Libellulidae			Halplidae	
	Enchytraeidae		Plecoptera	Early Instar and/or damaged			Helodidae	
	Naididae			Capniidae			Helophoridae	
	Tubificidae			Chloroperlidae			Hydraenidae	
Haplotaxida				Leuctridae			Hydrochidae	
	Haplotaxidae			Nemouridae			Hydrophilidae	
Leeches	Hirudinea			Peltoperlidae			Limnichidae	
	Erpobdellidae			Perlidae			Noteridae	
	Glossiphoniidae			Perlodidae			Psephenidae	
	Hirudinidae			Pteronarcyidae			Ptilodactylidae	
	Piscioidae			Taeniopterygidae			Scirtidae	
Branchiobdellida	Branchiobdellidae		Hemiptera	Early Instar and/or damaged		Diptera	Early Instar and/or damaged	
Copepoda	Unknown			Belostomatidae			Athericidae	
Decapoda	Cambaridae			Corixidae			Blephariceridae	
	Portunidae			Gelastocoridae			Canaceidae	
Shrimp				Gerridae			Ceratopogonidae	
	Palaemonidae			Hebridae			Choaboridae	
Isopoda				Hydrometridae			Chironomidae	87
	Asellidae			Mesovellidae			Culicidae	
Amphipoda				Naucoridae			Dixidae	
	Crangonyctidae			Nepidae			Dolichopodidae	
	Gammaridae			Notonectidae			Epididae	
	Talitridae			Veliidae			Ephydriidae	
Water Mites				Pleidae			Muscidae	
	Hydracarina		Neuroptera				Nymphomyiidae	
Ephemeroptera	Early Instar and/or damaged			Sisyridae			Pelecorhynchidae	
	Acanthometropodidae		Megaloptera				Psychodidae	
	Ameletidae			Corydalidae			Ptychopteridae	
	Baetidae			Sialidae			Sciomyzidae	
	Baetiscidae		Trichoptera	Early Instar and/or damaged			Simuliidae	7
	Behningiidae			Branchycentridae			Stratiomyidae	
	Caenidae			Calamoceratidae			Syrphidae	
	Ephemerellidae			Glossosomatidae			Tabanidae	
	Ephemeridae			Goeridae			Tanyderidae	
	Heptageniidae	1		Heliicopsychidae			Thaumaleidae	
	Isonychiidae			Hydropsychidae	4		Tipulidae	
	Leptophlebiidae			Hydroptilida				95
TOTAL:		2	TOTAL:		12	TOTAL:		





## Benthic Macroinvertebrate and Habitat Field Data Sheet

Station ID:	1-B	Ecoregion:	Piedmont	Land Use:	Urban
Field Team:	LLS/MN	Survey Reason:	YR 2 Biomonitoring	Start time:	
Stream Name:	Glade	Location:	Glade	Finish time:	
Date:	4/26/2012	Latitude:	38°55'26"	Longitude:	-77°19'55"

### Stream Physiochemical Measurements

Instrument ID number:	N/A	pH:	N/A
Temperature:	N/A °C	Conductivity:	N/A uS/cm
Dissolved Oxygen:	N/A mg/L	Did instrument pass all post-calibration checks?	N/A
		If NO- which parameter(s) failed and action taken:	N/A

### Benthic Macroinvertebrate Collection

Method Used:	Single Habitat (Riffle)	Multi Habitat (Logs, Plants, etc.)	X
Riffle Quality:	Good X	Poor	None
Habitats Sampled:	Riffle X	Snags	Banks X
# Jabs:	15		5

### Weather Observations

Current Weather	Cloudy X	Clear	Rain/Snow	Foggy
Recent Precipitation	Clear X	Showers	Rain	Storms
Stream Flow	Low	Normal X	Above Normal	Flood

### Biological Observations

Periphyton	0	Salamanders	0	Other....
Filamentous Algae	3	Warmwater Fish	1	0= Not observed
Submerged Macrophytes	1	Coldwater Fish	0	1= Sparse
Emergent Macrophytes	0	Beavers	0	2= Common to Abundant
Crayfish	0	Muskrats	0	3= Dominant-
Corbicula	0	Ducks/Geese	0	abnormally high density where other taxa
unionidae	0	Snakes	0	are insignificant in relation to the dominant
Operculate Snails	0	Turtles	0	taxa. There can be situations where multiple
Non-operculate Snails	0	Frogs/Tadpoles	0	taxa are dominant such as algae and snails

Notes

## High Gradient Habitat Data


Habitat Parameter	Condition Category				
	Optimal	Suboptimal	Marginal	Poor	Score
<b>1. Epifaunal Substrate/ Available Cover</b>	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble, or other stable habitat and at stage to allow full colonization potential (i.e. snags/logs that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization.	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.	
<b>Score</b>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	17
<b>2. Embeddedness</b>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.	
<b>Score</b>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	18
<b>Velocity/Depth Regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast shallow)(slow is <0.3m/s, deep is >0.5 m).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).	
<b>Score</b>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	10
<b>4. Sediment Deposition</b>	Little or no enlargement of islands or point bars and <5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.	
<b>Score</b>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	19



## Benthic Macroinvertebrate and Habitat Field Data Sheet

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
<b>5. Channel Flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		19
<b>6. Channel Alteration</b>	Channelization or dredging absent or minimal; stream width normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging, may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		16
<b>7. Frequency of Riffles</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distances between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		20
<b>8. Bank Stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		7
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		9
<b>9. Vegetation Protection (score each bank) Note: Determine left or right side by facing downstream.</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetation disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		9
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		9
<b>10. Riparian Vegetative Zone Width (score each bank riparian zone)</b>	Width of riparian zone >18 meters; human activities (i.e. parking lots, roadbeds, clearcuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		9
<b>Total Score</b>						172

# WSSI BENTHIC MACROINVERTEBRATE BENCH SHEET

Job Name/#	Glade - 20030	Sample subsorted by:	ABR		
Station ID:	Reach 1-B	Date Subsorted:	9/26/12		
Stream Name:	The Glade	# of Grids subsorted	7		
Date Sampled:	4/26/12	Total # of subsorted insects:	103		
Sampling Method:	Multihabitat	Sample Identified by:	ABR	Total # identified:	102
				Date Identified:	9/26/12

## Taxa Collected:

Porifera	Spongillidae			Metretopodidae			Lepidostomatidae	
Ostracoda	Unknown			Neophemeridae			Leptoceridae	
Flatworms	Tricladida			Oligoneuridae			Limnephilidae	
	Planariidae			Psuedironidae			Molannidae	
Gastropoda	Unknown			Polymitarciidae			Odontoceridae	
Limpets	Ancylidae			Potamanthidae			Philopotamidae	
Snails	Immature			Siphonuridae			Phryganeidae	
	Lymnaeidae		Zygoptera	Tricorythidae			Polycentropodidae	
	Physidae			Early Instar and/or damaged			Psychomyiidae	
	Planorbidae			Calopterygidae			Ryacophilidae	
	Hydrobiidae			Coenagrionidae			Sericostomatidae	
	Pleuroceridae			Lestidae			Uenoidae	
	Viviparidae		Anisoptera	Protoneuridae		Lepidoptera	Early Instar and/or damaged	
Bivalvia	Immature			Early Instar and/or damaged			Pyralidae	
	Corbiculidae			Aeshnidae		Coleoptera	Early Instar and/or damaged	
	Sphaeriidae	48		Cordulegastridae	1		Chrysomelidae	
	Unionidae			Corduliidae			Curculionidae	
Oligochaeta	Unknown	16		Gomphidae			Dryopidae	
Lumbriculida				Libellulidae			Dytiscidae	
	Lumbriculidae			Macromiidae			Elmidae	
Tubificida				Petaluridae			Gyrinidae	
	Enchytraeidae		Plecoptera	Cordullidae/Libellulidae			Halipidae	
	Naididae			Early Instar and/or damaged			Helodidae	
	Tubificidae			Capniidae			Helophoridae	
Haplotaxida				Chloroperlidae			Hydraenidae	
	Haplotaxidae			Leuctridae			Hydrochidae	
Leeches	Hirudinea	1		Nemouridae			Hydrophilidae	
	Erpobdellidae			Peltoperlidae			Limnichidae	
	Glossiphoniidae			Perlidae			Noteridae	
	Hirudinidae			Perlodidae			Psephenidae	
	Pisciolidae			Pteronarcyidae			Ptilodactylidae	
Branchiobdellida	Branchiobdellidae		Hemiptera	Taeniopterygidae		Diptera	Scirtidae	
Copepoda	Unknown			Early Instar and/or damaged			Early Instar and/or damaged	
Decapoda	Cambaridae			Belostomatidae			Athericidae	
	Portunidae			Corixidae			Blephariceridae	
Shrimp				Gelastocoridae			Canaceidae	
	Palaemonidae			Gerridae			Ceratopogonidae	
Isopoda				Hebridae			Choaboridae	
	Asellidae			Hydrometridae			Chironomidae	34
Amphipoda		1		Mesoveliidae			Culicidae	
	Crangonyctidae			Naucoridae			Dixidae	
	Gammaridae			Nepidae			Dolichopodidae	
	Talitridae			Notonectidae			Epididae	
Water Mites				Veliidae			Ephydriidae	
	Hydracarina		Neuroptera	Pleidae			Muscidae	
Ephemeroptera	Early Instar and/or damaged						Nymphomyiidae	
	Acanthometropodidae		Megaloptera	Sisyridae			Pelecorhynchidae	
	Ameletidae						Psychodidae	
	Baetidae			Corydalidae			Ptychopteridae	
	Baetiscidae		Trichoptera	Sialidae			Sciomyzidae	
	Behningiidae			Early Instar and/or damaged			Simuliidae	
	Caenidae			Branchycentridae			Stratiomyidae	
	Ephemerellidae			Calamoceratidae			Syrphidae	
	Ephemeridae			Glossosomatidae			Tabanidae	
	Heptageniidae			Goeridae			Tanyderidae	
	Isonychiidae			Heliicopsychidae			Thaumaleidae	
	Leptophlebiidae			Hydropsychidae			Tipulidae	1
TOTAL:		66		Hydroptilidae		1		35

## Benthic Macroinvertebrate and Habitat Field Data Sheet

Station ID:	1-C	Ecoregion:	Piedmont	Land Use:	Urban
Field Team:	LLS/MN	Survey Reason:	YR 2 Biomonitoring	Start time:	
Stream Name:	Glade	Location:	Reston, Virginia	Finish time:	
Date:	4/26/2012	Latitude:	38°55'23"	Longitude:	-77°20'12"

### Stream Physiochemical Measurements

Instrument ID number:	N/A	pH:	N/A
Temperature:	N/A °C	Conductivity:	N/A uS/cm
Dissolved Oxygen:	N/A mg/L	Did instrument pass all post-calibration checks?	N/A
		If NO- which parameter(s) failed and action taken:	N/A

### Benthic Macroinvertebrate Collection

Method Used:	Single Habitat (Riffle):	Multi Habitat (Logs, Plants, etc.):	X
Riffle Quality:	Good X	Marginal	Poor
Habitats Sampled:	Riffle X	Snags	Banks: Vegetation
# Jabs	20		

### Weather Observations

Current Weather:	Cloudy X	Clear	Rain/Snow	Foggy
Recent Precipitation:	Clear X	Showers	Rain	Storms
Stream Flow:	Low	Normal X	Above Normal	Flood

### Biological Observations

Periphyton	1	Salamanders	0	Other....
Filamentous Algae	3	Warmwater Fish	1	0= Not observed
Submerged Macrophytes	0	Coldwater Fish	0	1= Sparse
Emergent Macrophytes	0	Beavers	0	2= Common to Abundant
Crayfish	0	Muskrats	0	3= Dominant-
Corbicula	0	Ducks/Geese	0	abnormally high density where other taxa
unionidae	0	Snakes	0	are insignificant in relation to the dominant
Operculate Snails	0	Turtles	0	taxa. There can be situations where multiple
Non-operculate Snails	0	Frogs/Tadpoles	0	taxa are dominant such as algae and snails
Notes				

## High Gradient Habitat Data

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
<b>1. Epifaunal Substrate/ Available Cover</b>	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble, or other stable habitat and at stage to allow full colonization potential (i.e. snags/logs that are not new fall and not transient).	40-70% mix of stable habitat; well suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization.	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.		
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		19
<b>2. Embeddedness</b>	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.		
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		18
<b>Velocity/Depth Regime</b>	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast shallow)(slow is <0.3m/s, deep is >0.5 m).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).		
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		18
<b>4. Sediment Deposition</b>	Little or no enlargement of islands or point bars and <5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand, or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand, or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.		
Score	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0		17




## Benthic Macroinvertebrate and Habitat Field Data Sheet

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
<b>5. Channel Flow status</b>	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	19	
<b>6. Channel Alteration</b>	Channelization or dredging absent or minimal; stream width normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging, may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	16	
<b>7. Frequency of Riffles</b>	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distances between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.		
<i>Score</i>	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0	19	
<b>8. Bank Stability (score each bank)</b>	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0	9	
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0	9	
<b>9. Vegetation Protection (score each bank) Note: Determine left or right side by facing downstream.</b>	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or non-woody macrophytes; vegetation disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0	10	
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0	9	
<b>10. Riparian Vegetative Zone Width (score each bank riparian zone)</b>	Width of riparian zone >18 meters; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters; little or no riparian vegetation due to human activities.		
<i>Score Left Bank</i>	10 9	8 7 6	5 4 3	2 1 0	10	
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0	7	
<b>Total Score</b>					180	



# WSSI BENTHIC MACROINVERTEBRATE BENCH SHEET

Job Name/#	Glade - 20030	Sample subsorted by:	ASO,BC,SG,EJ		
Station ID:	Reach 1-C	Date Subsorted:	6/29/12		
Stream Name:	The Glade	# of Grids subsorted	7		
Date Sampled:	4/26/12	Total # of subsorted insects:	119	Total # identified:	106
Sampling Method:	Multihabitat	Sample Identified by:	ABR	Date Identified:	9/6/12

## Taxa Collected:

Porifera	Spongillidae			Metreopodidae			Lepidostomatidae	
Ostracoda	Unknown			Neophemeridae			Leptoceridae	
Flatworms	Tricladida			Oligoneuridae			Limnephilidae	
	Planariidae			Psuedironidae			Molannidae	
Gastropoda	Unknown			Polymitarciidae			Odontoceridae	
Limpets	Ancylidae			Potamanthidae			Philopotamidae	
Snails	Immature			Siphonuridae			Phryganeidae	
	Lymnaeidae	Zygoptera		Tricorythidae			Polycentropodidae	
	Physidae			Early Instar and/or damaged			Psychomyiidae	
	Planorbidae			Calopterygidae			Rhyacophilidae	
	Hydrobiidae			Coenagrionidae			Sericostomatidae	
	Pleuroceridae			Lestidae			Uenoidae	
	Viviparidae	Anisoptera		Protoneuridae	Lepidoptera		Early Instar and/or damaged	
Bivalvia	Immature			Early Instar and/or damaged			Pyralidae	
	Corbiculidae			Aeshnidae	Coleoptera		Early Instar and/or damaged	
	Sphaeriidae			Cordulegastridae			Chrysomelidae	
	Unionidae			Corduliidae			Curculionidae	
Oligochaeta	Unknown	4		Gomphidae			Dryopidae	
Lumbriculida				Libellulidae			Dytiscidae	
	Lumbriculidae			Macromiidae			Elmidae	1
				Petaluridae			Gyrinidae	
Tubificida				Corduliidae/Libellulidae			Halplidae	
	Enchytraeidae	Plecoptera		Early Instar and/or damaged			Helodidae	
	Naididae			Capniidae			Helophoridae	
	Tubificidae			Chloroperlidae			Hydraenidae	
Haplotaxida				Leuctridae			Hydrochidae	
	Haplotaxidae			Nemouridae			Hydrophilidae	
Leeches	Hirudinea			Peltoperlidae			Limnichidae	
	Erpobdellidae			Perlidae			Noteridae	
	Glossiphoniidae			Perlodidae			Psephenidae	
	Hirudinidae			Pteronarcyidae			Ptilodactylidae	
	Piscioidae			Taeniopterygidae			Scirtidae	
Branchiobdellida	Branchiobdellidae	Hemiptera		Early Instar and/or damaged	Diptera		Early Instar and/or damaged	
Copepoda	Unknown	2		Belostomatidae			Athericidae	
Decapoda	Cambaridae			Corixidae			Blephariceridae	
	Portunidae			Gelastocoridae			Canaceidae	
Shrimp				Gerridae			Ceratopogonidae	
	Palaemonidae			Hebridae			Choaboridae	
Isopoda				Hydrometridae			Chironomidae	96
	Asellidae			Mesoveliidae			Culicidae	
Amphipoda				Naucoridae			Dixidae	
	Crangonyctidae			Nepidae			Dolichopodidae	
	Gammaridae			Notonectidae			Epididae	
	Talitridae			Veliidae			Ephydriidae	
Water Mites				Pleidae			Muscidae	
	Hydracarina	Neuroptera					Nymphomyiidae	
Ephemeroptera	Early Instar and/or damaged			Sisyridae			Pelecorhynchidae	
	Acanthometropodidae	Megaloptera					Psychodidae	
	Ameletidae			Corydalidae			Ptychopteridae	
	Baetidae			Sialidae			Sciomyzidae	
	Baetiscidae	Trichoptera		Early Instar and/or damaged			Simuliidae	
	Behningiidae			Branchycentridae			Stratiomyidae	
	Caenidae			Calamoceratidae			Syrphidae	
	Ephemerellidae			Glossosomatidae			Tabanidae	
	Ephemeridae			Goeridae			Tanyderidae	
	Heptageniidae			Heliicopsychidae			Thaumaleidae	
	Isonychiidae			Hydropsychidae	1		Tipulidae	
	Leptophlebiidae			Hydroptilida	2			97
TOTAL:		6		TOTAL:		3	TOTAL:	