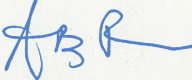




MEMORANDUM

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 2013 (Year 3)
WSSI #20030, Task M2a
DATE: August 5, 2013

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 6¹. However, monitoring was undertaken voluntarily in Year 3 (2013)² 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 Watershed³. Field work was conducted by WSSI environmental scientists Mark Navarro, WPIT and Michael Kopansky on March, 27 2013. Benthic macroinvertebrate habitat field data sheets and benthic macroinvertebrate bench sheets for each reach are enclosed within.

Habitat results for Year 3 (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 2013 is 178 (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 2013, based on their Stream Condition Index for Virginia Non-coastal Streams (VA-SCI)⁴ scores (Table 2, Figure 2). The average VA-SCI numerical score for all reaches assessed in 2013 is 27.16 ("Severe Stress"). The 2013 average VA-SCI score is still lower than the pre-restoration average of 34.34 ("Severe Stress"); however, the average 2013 VA-SCI score exceeds the average VA-SCI score (20.07) for the Year 2 (2012) biomonitoring.

¹ 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.

² Voluntary biomonitoring was conducted in Year 2 (2012), as described in a previous memo.

³ 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.

⁴ The VA-SCI is a multi-metric Index of Biotic Integrity developed for the DEQ to assess Streams of the Commonwealth.

In conclusion, the results of the 2013 supplemental monitoring indicate that there has been a continued improvement of habitat scores and a slight improvement of the benthic community composition in the 2013 sampled reaches as compared to the first two years following restoration in 2011 and 2012.

Enclosures

Table 1. 2013 Total Habitat Assessment Scores		
BIOMONITORING REACH	Total Habitat	Narrative Rating
1-A (10% Restored)	170	Suboptimal
1-B (50% Restored)	180	Optimal
1-C (100% Restored)	184	Optimal
Average	178	Optimal

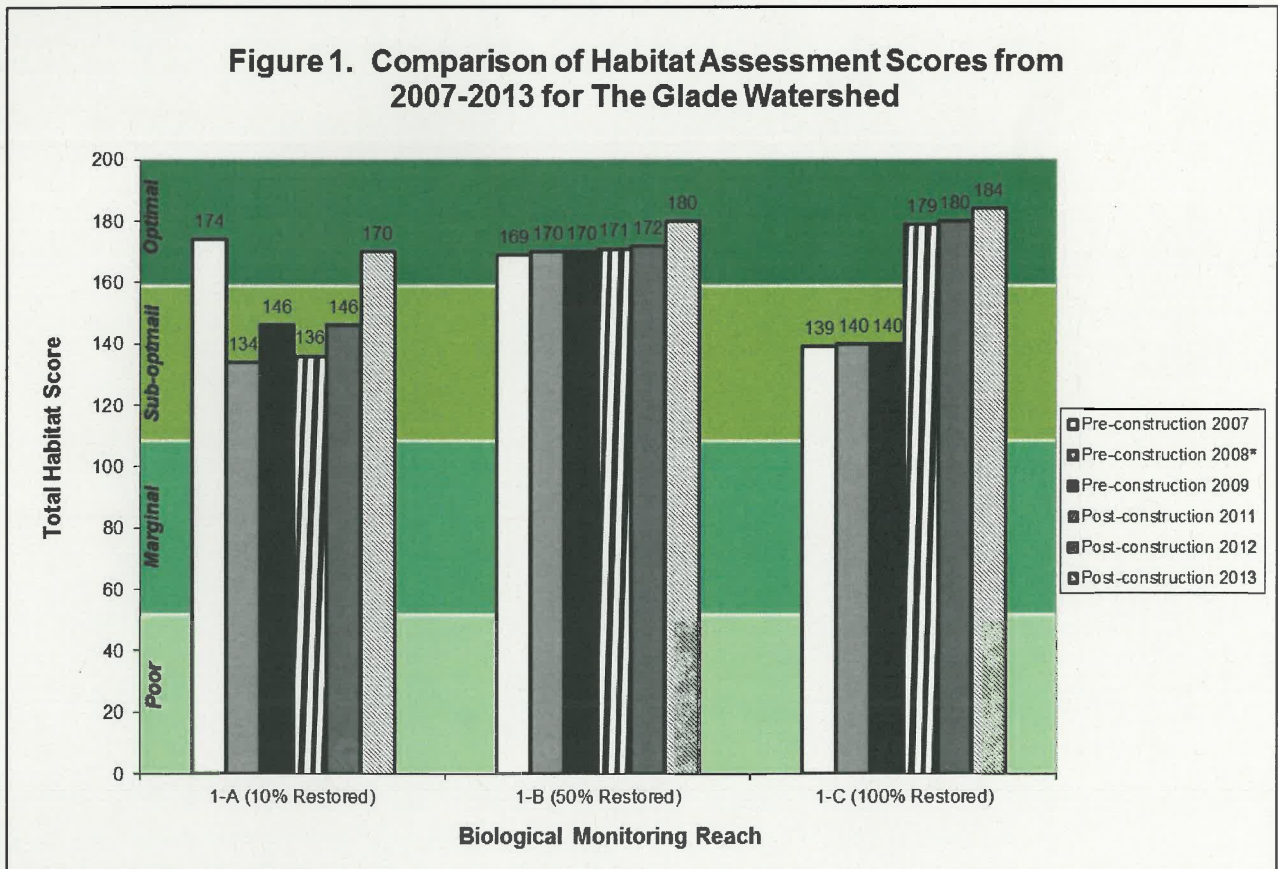
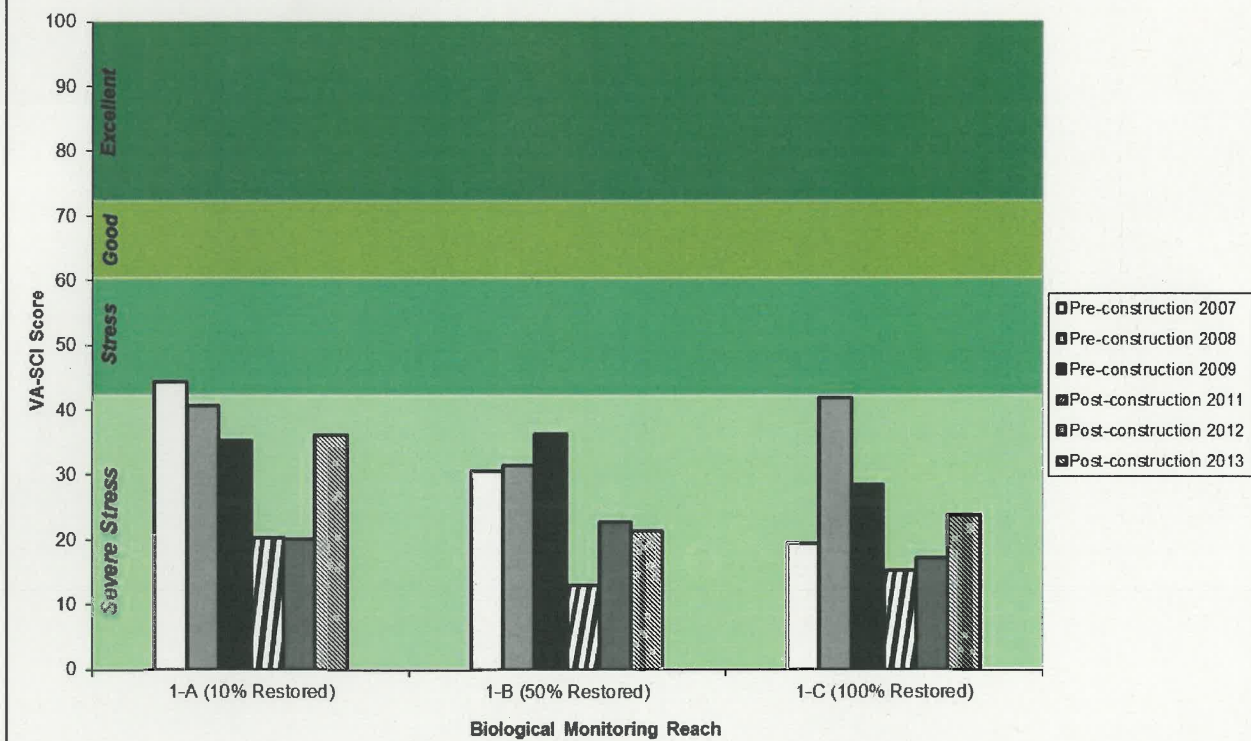


Table 3. 2013 Biotic Metric and Index Weighting and VA-SCI at The Glade.

WEIGHTED METRIC	BIOLOGICAL MONITORING REACH		
	1-A (10% Restored)	1-B (50% Restored)	1-C (100% Restored)
Total Taxa	59.09	40.91	31.82
EPT Taxa	18.18	9.09	9.09
Percent Ephemeroptera	3.84	0.00	0.00
Percent Plecoptera + Trichoptera (Excluding Hydropsychidae)	0.00	6.17	0.00
Percent Scrapers	27.36	12.78	7.45
Percent Chironomidae	51.76	18.68	41.35
Percent Top Two Dominant	49.30	17.47	23.62
HBI	80.28	66.26	77.35
VA-SCI Numerical Score	36.23	21.42	23.83
VA-SCI Narrative Score	Severe Stress	Severe Stress	Severe Stress
Average VA-SCI Numerical Score	27.16		
Average VA-SCI Narrative Score	Severe Stress		

Figure 2. Comparison of Virginia Stream Condition Index Scores from 2007-2013 at The Glade Watershed





Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient

Job # Task: 20030	
Station ID: Reach 1-A	Ecoregion: Piedmont
Field Team: MN/MK	Location: Reston, VA
Site: The Glade	Latitude:
Date: 3/27/2013	Longitude:
Land Use: Urban	Survey Reason: Year 4 Biomonitoring
Start time:	Finish time:

Stream Physiochemical Measurements

Instrument ID number: _____	N/A	pH: _____	N/A
Temperature: _____ °C	N/A	Conductivity: _____ uS/cm	N/A
Dissolved Oxygen: _____ mg/L	N/A	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 _____
	Woody _____	None _____	
Habitats Sampled:	Riffle X _____	Debris X _____	Banks X _____
	Vegetation X _____		
# Jabs:	10 _____	1 _____	8 _____
			1 _____

Weather Observations

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

Biological Observations

Periphyton _____	2	Salamanders _____	1	Other.... _____
Filamentous Algae _____	2	Warmwater Fish _____	1	0= Not observed
Submerged Macrophytes _____	2	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 are insignificant in relation to the dominant taxa.
Unionidae _____	0	Snakes _____	0	There can be situations where multiple taxa are dominant such as algae and snails
Operculate Snails _____	0	Turtles _____	0	
Non-operculate Snails _____	0	Frogs/Tadpoles _____	0	

High Gradient Habitat Data Sheet

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
1. Epifaunal Substrate/ Available Cover	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	18	
2. Embeddedness	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	17	
Velocity/Depth Regime	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	15	
4. Sediment Deposition	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	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	14	




Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
5. Channel Flow Status	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		18
6. Channel Alteration	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		17
7. Frequency of Riffles	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		14
8. Bank Stability (score each bank) Note: Determine left or right side by facing downstream.	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		10
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
9. Vegetation Protection (score each bank)	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
10. Riparian Vegetative Zone Width (score each banks riparian zone)	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		9
Total Score						170

Notes:

WSSI BENTHIC MACROINVERTEBRATE BENCH SHEET

Job Name/#	Glade - 20030	Sample subsorted by:	MK	
Station ID:	Reach 1-A	Date Subsorted:	5/7/13	
Stream Name:	The Glade	# of Grids subsorted	13	
Date Sampled:	3/27/13	Total # of subsorted insects:	99	
Sampling Method:	D-NET	Sample Identified by:	ABR	
		Total # identified:	85	

Taxa Collected:

Phylum	Family	Count	Class	Family	Count	Class	Family	Count
Porifera	Spongillidae			Metreopodidae			Lepidostomatidae	
Ostracoda	Unknown			Neophemeridae			Leptoceridae	
Flatworms	Tricladida			Oligoneuridae			Limnephilidae	
	Planariidae			Psuedironidae			Molannidae	
Gastropoda	Unknown			Polymitarcyidae			Odontoceridae	
Limpets	Ancylidae			Potamanthidae			Philopotamidae	
Snails	Immature			Siphonuridae			Phryganeidae	
	Lymnaeidae		Zygotera	Tricorythidae			Polycentropodidae	
	Physidae			Early Instar and/or damaged			Psychomyiidae	
	Planorbidae	3		Calopterygidae			Ryacophilidae	
	Hydrobiidae			Coenagrionidae	2		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	3		Cordulegastridae			Chrysomelidae	
	Unionidae			Corduliidae			Curculionidae	
Oligochaeta	Unknown	15		Gomphidae	2		Dryopidae	
Lumbriculida				Libellulidae			Dytiscidae	
	Lumbriculidae			Macromiidae			Elmidae	7
Tubificida				Petaluridae			Gyrinidae	
	Enchytraeidae		Plecoptera	Cordullidae/Libellulidae			Halipidae	3
	Naididae			Early Instar and/or damaged			Helodidae	
	Tubificidae			Capniidae			Helophoridae	
Haplotaxida				Chloroperlidae			Hydraenidae	
	Haplotaxidae			Leuctridae			Hydrochidae	
Leeches	Hirudinea			Nemouridae			Hydrophilidae	
	Erpobdellidae			Peltoperlidae			Limnichidae	
	Glossiphoniidae			Perlidae			Noteridae	
	Hirudinidae			Periodidae			Psephenidae	
	Piscioidae			Pteronarcyidae			Ptilodactylidae	
Branchiobdellida	Branchiobdellidae		Hemiptera	Taeniopterygidae			Scirtidae	
Copepoda	Unknown	2		Early Instar and/or damaged		Diptera	Early Instar and/or damaged	
Decapoda	Cambaridae			Belostomatidae			Athericidae	
	Portunidae			Corixidae			Blephariceridae	
Shrimp				Gelastocoridae			Canaceidae	
	Palaemonidae			Gerridae			Ceratopogonidae	
Isopoda				Hebridae			Choaboridae	
	Asellidae			Hydrometridae			Chironomidae	41
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	2		Goeridae			Tanyderidae	
	Isonychiidae			Helicopsychidae			Thaumaleidae	
	Leptophlebiidae			Hydropsychidae	3		Tipulidae	1
				Hydroptilida				52
TOTAL:		26	TOTAL:		7	TOTAL:		



Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient

Job # Task	20030				
Station ID:	Reach 1-B	Ecoregion:	Piedmont	Land Use:	Urban
Field Team:	MN/MK	Location:	Reston, VA	Start time:	
Site:	The Glade	Latitude:		Finish time:	
Date:	3/27/2013	Longitude:		Survey Reason:	Year 4 Biomonitoring

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
	Woody		None
Habitats Sampled:	Riffle X	Banks X	Vegetation
# Jabs:	17	3	

Weather Observations

Current Weather	Cloudy	Clear X	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	0	0= Not observed	
Submerged Macrophytes	2	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 are insignificant in relation to the dominant taxa.	
Unionidae	0	Snakes	0	There can be situations where multiple taxa are dominant such as algae and snails	
Operculate Snails	0	Turtles	0		
Non-operculate Snails	0	Frogs/Tadpoles	0		

High Gradient Habitat Data Sheet

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
1. Epifaunal Substrate/ Available Cover	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		18
2. Embeddedness	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		17
Velocity/Depth Regime	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		15
4. Sediment Deposition	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	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		19




Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
5. Channel Flow Status	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		18
6. Channel Alteration	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		17
7. Frequency of Riffles	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
8. Bank Stability (score each bank) Note: Determine left or right side by facing downstream.	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
9. Vegetation Protection (score each bank)	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		10
10. Riparian Vegetative Zone Width (score each banks riparian zone)	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		9
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
Total Score						180

Notes:

WSSI BENTHIC MACROINVERTEBRATE BENCH SHEET

Job Name/#	Glade - 20030	Sample subsorted by:	MK		
Station ID:	Reach 1-B	Date Subsorted:	9/26/12		
Stream Name:	The Glade	# of Grids subsorted	9		
Date Sampled:	3/27/13	Total # of subsorted insects:	101		
Sampling Method:	D-NET	Sample Identified by:	ABR	Date Identified:	

Taxa Collected:

Porifera	Spongillidae		Metreopodidae		Lepidostomatidae	
Ostracoda	Unknown		Neophemeridae		Leptoceridae	
Flatworms	Tricladida		Oligoneuridae		Limnephilidae	2
	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		Pyrilidae	
	Corbiculidae		Aeshnidae	Coleoptera	Early Instar and/or damaged	
	Sphaeriidae		Cordulegastridae		Chrysomelidae	
	Unionidae		Corduliidae		Curculionidae	
Oligochaeta	Unknown	3	Gomphidae		Dryopidae	
Lumbriculida			Libellulidae		Dytiscidae	1
	Lumbriculidae		Macromiidae		Elmidae	6
Tubificida			Petaluridae		Gyrinidae	
	Enchytraeidae	Plecoptera	Cordullidae/Libellulidae		Haliplidae	
	Naididae		Early Instar and/or damaged		Helodidae	
	Tubificidae		Capniidae		Helophoridae	
Haplotaxida			Chloroperlidae		Hydraenidae	
	Haplotaxidae		Leuctridae		Hydrochidae	
Leeches	Hirudinea		Nemouridae		Hydrophilidae	
	Erpobdellidae		Peltoperlidae		Limnichidae	
	Glossiphoniidae		Perlidae		Noteridae	
	Hirudinidae		Perlodidae		Psephenidae	
	Piscioidae		Pteronarcyidae		Ptilodactylidae	
Branchiobdellida	Branchiobdellidae	Hemiptera	Taeniopterygidae		Scirtidae	
Copepoda	Unknown		Early Instar and/or damaged	Diptera	Early Instar and/or damaged	
Decapoda	Cambaridae		Belostomatidae		Athericidae	
	Portunidae		Corixidae		Blephariceridae	
Shrimp			Gelastocoridae		Canaceidae	
	Palaemonidae		Gerridae		Ceratopogonidae	1
Isopoda			Hebridae		Choaboridae	
	Asellidae		Hydrometridae		Chironomidae	74
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		Pelecchynchidae	
	Ameletidae				Psychodidae	
	Baetidae		Corydalidae		Ptychopteridae	
	Baetiscidae	Trichoptera	Sialidae		Sciomyzidae	
	Behningiidae		Early Instar and/or damaged		Simuliidae	1
	Caenidae		Branchycentridae		Stratiomyidae	
	Ephemerellidae		Calamoceratidae		Syrphidae	
	Ephemeridae		Glossosomatidae		Tabanidae	
	Heptageniidae		Goeridae		Tanyderidae	
	Isonychiidae		Hellicopsychidae		Thaumaleidae	
	Leptophlebiidae		Hydropsychidae		Tipulidae	2
TOTAL:		4	Hydroptilida	0		87



Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient

Job # Task: 20030	
Station ID: Reach 1-C	Ecoregion: Piedmont
Field Team: MN/MK	Location: Reston, VA
Site: The Glade	Latitude:
Date: 3/27/2013	Longitude:
Land Use: Urban	Start time:
	Finish time:
	Survey Reason: Year 4 Biomonitoring

Stream Physiochemical Measurements

Instrument ID number: _____	N/A	pH: _____	N/A
Temperature: _____ °C	N/A	Conductivity: _____ uS/cm	N/A
Dissolved Oxygen: _____ mg/L	N/A	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 _____
		Woody _____	None _____
Habitats Sampled:	Riffle X _____	Banks _____	Vegetation X _____
	# Jabs: 18 _____		2 _____

Weather Observations

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

Biological Observations

Periphyton	1	Salamanders	1	Other....	_____
Filamentous Algae	3	Warmwater Fish	1	0= Not observed	
Submerged Macrophytes	2	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 are insignificant in relation to the dominant taxa.	
Unionidae	0	Snakes	0	There can be situations where multiple taxa are dominant such as algae and snails	
Operculate Snails	0	Turtles	0		
Non-operculate Snails	0	Frogs/Tadpoles	0		

High Gradient Habitat Data Sheet

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
1. Epifaunal Substrate/ Available Cover	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		18
2. Embeddedness	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		19
Velocity/Depth Regime	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
4. Sediment Deposition	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	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		17




Benthic Macroinvertebrate and Habitat Field Data Sheet - High Gradient

Habitat Parameter	Condition Category					Score
	Optimal	Suboptimal	Marginal	Poor		
5. Channel Flow Status	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
6. Channel Alteration	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		17
7. Frequency of Riffles	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		18
8. Bank Stability (score each bank) Note: Determine left or right side by facing downstream.	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		10
<i>Score Right Bank</i>	10 9	8 7 6	5 4 3	2 1 0		10
9. Vegetation Protection (score each bank)	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		10
10. Riparian Vegetative Zone Width (score each banks riparian zone)	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		10
Total Score						184

Notes:

WSSI BENTHIC MACROINVERTEBRATE BENCH SHEET

Job Name/#	Glade - 20030	Sample subsorted by:	MK, MN		
Station ID:	Reach 1-C	Date Subsorted:	5/5/13		
Stream Name:	The Glade	# of Grids subsorted	10		
Date Sampled:	3/27/13	Total # of subsorted insects:	112	Total # identified:	104
Sampling Method:	D-NET	Sample Identified by:	ABR	Date Identified:	5/31/13

Taxa Collected:

Porifera	Spongillidae		Metretopodidae		Lepidostomatidae	
Ostracoda	Unknown		Neophemeridae		Leptoceridae	
Flatworms	Tricladida		Oligoneuridae		Limnephilidae	
	Planariidae		Psuedironidae		Molannidae	
Gastropoda	Unknown		Polymitarcyidae		Odontoceridae	
Limpets	Ancylidae		Potamanthidae		Philopotamidae	
Snails	Immature		Siphonuridae		Phryganeidae	
	Lymnaeidae	3	Tricorythidae		Polycentropodidae	
	Physidae		Early Instar and/or damaged		Psychomyiidae	
	Planorbidae		Calopterygidae		Ryacophilidae	
	Hydrobiidae		Coenagrionidae	1	Sericostomatidae	
	Pleuroceridae		Lestidae		Uenoidae	
	Viviparidae		Protoneuridae		Early Instar and/or damaged	
Bivalvia	Immature		Early Instar and/or damaged		Pyralidae	
	Corbiculidae		Aeshnidae		Early Instar and/or damaged	
	Sphaeriidae	11	Cordulegastridae		Chrysomelidae	
	Unionidae		Corduliidae		Curculionidae	
Oligochaeta	Unknown	26	Gomphidae		Dryopidae	
Lumbriculida			Libellulidae		Dytiscidae	
	Lumbriculidae		Macromiidae		Elmidae	1
			Petaluridae		Gyrinidae	
Tubificida			Cordullidae/Libellulidae		Haliplidae	
	Enchytraeidae		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	
	Piscioliidae		Taeniopterygidae		Scirtidae	
Branchiobdellida	Branchiobdellidae		Early Instar and/or damaged		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	61
	Asellidae		Mesoveliidae		Culicidae	
Amphipoda			Naucoridae		Dixidae	
	Crangonyctidae		Nepidae		Dolichopodidae	
	Gammaridae		Notonectidae		Epididae	
	Talitridae		Veliidae		Ephydriidae	
Water Mites			Pleidae		Muscidae	
	Hydracarina				Nymphomyiidae	
Ephemeroptera	Early Instar and/or damaged		Sisyridae		Pelecrohynchidae	
	Acanthotetropodidae				Psychodidae	
	Ameletidae		Corydalidae		Ptychopteridae	
	Baetidae		Sialidae		Sciomyzidae	
	Baetiscidae		Early Instar and/or damaged		Simuliidae	
	Behningiidae		Branchycentridae		Stratiomyidae	
	Caenidae		Calamoceratidae		Syrphidae	
	Ephemerellidae		Glossosomatidae		Tabanidae	
	Ephemeridae		Goeridae		Tanyderidae	
	Heptageniidae		Helicopsychidae		Thaumaleidae	
	Isonychiidae		Hydropsychidae	1	Tipulidae	
	Leptophlebiidae		Hydroptilida			62
TOTAL:		40	TOTAL:	2	TOTAL:	