Methods for Conducting Resource Extraction Intensive Surveys for General Permits

Commonwealth of Kentucky
Energy and Environment Cabinet
Department for Environmental Protection
Division of Water

Effective Date: January 15, 2011
Revision Date: February 12, 2012
Revision Date: July 31, 2013
Reviwsion Date: June 15, 2014

Revision No: 4.0

Document Control No: DOWSOP03042

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Document Revision History

Date of Revision	Page(s) Revised	Revision Explanation
June 15, 2014	Addendum	Added addendum for gerneal permits addressing macroinvertebrate pick methodology
June 30, 2013	Title page, throughout entire document	**Methods for Conducting Resource Extraction Intensive For General Permits,** updating SOP to fit new general permit provisions
February 10, 2012		Appendices Replacement of low gradient habitat sheet with high gradient habitat sheet
January 2011		**Methods for Conducting Resource Extraction Intensive Surveys in OSRWs With the Federally Endangered Blackside Dace, *Phoxinus cumberlandesis*** original document; extracted in part from "Methods for Conducting Coal-Mining Individual Permit Intensive Surveys in Non-OSRW Streams of the Eastern Kentucky Coalfields, February 2010"

Suggested Citation: Kentucky Division of Water (KDOW). 2013. Methods for conducting resource extraction intensive surveys for general permits. Kentucky Department for Environmental Protection, Division of Water, Frankfort, Kentucky.

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PROCEDURES

1. Scope and Applicability

This manual has been developed by the Kentucky Division of Water (KDOW) as guidance for the uniform and accurate collection, field processing, field handling, and quality assurance/quality control (QA/QC) of habitat and biological data from resource extraction intensive surveys in Outstanding State Resource Waters (OSRWs) with the federally listed fish species. The methods defined herein are required for all resource extraction intensive surveys in eastern Kentucky. Resulting data may be used for water quality assessments by KDOW. Any data submitted to KDOW for review will undergo QA/QC and those identified as not following the methods set forth in this document will be flagged.

2. Definitions

Aufwuchs - The plants and animals adhering to parts of rooted aquatic plants and other open surfaces. Also organisms and detritus coating rocks and plants in an aquatic environment often fed on by fish specialized as scrapers.

Benthic Macroinvertebrate - KDOW defines benthic macroinvertebrates as organisms large enough to be seen by the unaided eye, retained by a U.S. Standard No. 30 sieve (28 mesh/inch, 600µm openings) and live at least part of their life cycle within or upon available substrates of a water body.

Dip Net – A net (of appropriate size for size fish being collected) with 3/16 inch mesh affixed to a fiberglass handle.

Electrofishing – The use of electricity to provide a sufficient electrical stimulus in fish to permit easy capture by netting.

ETOH- Ethyl Alcohol

KDOW- Kentucky Division of Water

High-Gradient Streams - High-gradient streams are defined as streams that have velocities greater than 0.013 m/sec (0.5 ft/sec) and naturally contain riffle habitat.

MT – Mountain Bioregion

ORSW – Outstanding State Resource Waters as designated by 401 KAR 10:026

QA/QC- Quality Assurance and Quality Control

Rapid Bioassessment Protocols (RBP) – An inexpensive, easily implemented screening tool, developed by EPA (Barbour et al. 1999), for determining if a stream is in support or non-support of its designated use.

Seine – A type of net used for collecting fish samples, typically 15 feet long, 6 feet wide and with a mesh size of 3/16th inch.

Shocking seconds – Time (in seconds, recorded by the backpack electrofisher) that the unit is actively electrofishing

SOP- Standard Operating Procedure

Thalweg – Path of deepest thread of water

3. Personnel Qualifications

In order to conduct intensive surveys, **all biologists will meet the following minimum qualifications:**

1. Meet the minimum job classification requirements of an Environmental Biologist Consultant as specified by the Kentucky Department of Personnel (Appendix A).

2. Biologists performing macroinvertebrate analysis must be proficient in the identification of macroinvertebrates to the genus level.

3. Biologists performing fish collections and analysis must be proficient in the identification of fish to the species level. Most fish identification will be conducted in the field.

4. Attend a minimum of one professional conference or workshop annually in order to stay current with changing biological methods and taxonomy.

5. Biologists performing federally listed fish population and macroinvertebrate studies must have proper/valid state and federal collecting permits.

4. Equipment and Supplies

4.A. Equipment for Macroinvertebrate Collection

• High Gradient Stream Data Sheet (Appendix B)
• Chain of Custody
• Sample Labels
• 800 x 900µm D-frame dip net
• U.S. Number 10 sieve
• U.S. Number 30 sieve
• 2- 600µm mesh wash buckets
• Medium-sized bucket
• 300µm nitex sampler/mesh
• Fine-tipped forceps
• 95% ethyl alcohol
• White picking pans
• Sample jars

4.B. Equipment for Macroinvertebrate Sample Analysis

• Compound Microscope with 40X, 100X and 1000X capabilities
• Stereomicroscope (Dissecting Scope) with 10X ocular and appropriate zoom
• Standard Light Source
• Fine-tipped Forceps
• Probes
• Counter
• 22.8 X 34.3 cm Glass Dish
• 70% ETOH
• Glass Specimen Jars
• Glass Shell Vials
• CMC Mounting Media
• Glass Slides and Cover Slips
• Cotton Balls
• Macroinvertebrate Bench Sheets
• Sample Logbook
• Taxonomic References (Section 14.B.)

4.C. Equipment for Fish Collection

• Waterproof Notebook
• Dipnets (Minimum of 3)
• DC backpack shocker (Gasoline or Battery Power)
• 2 Probes with rings
• Spare probe and rings
• Rat tail
• Fuel: gasoline and oil or batteries
• Two cycle oil (gasoline powered electrofisher)
• Seine (at least 10 foot)
• Field guide (e.g. Peterson's Field Guide Freshwater Fishes)
• Formalin and MSDS sheet
• Fish jars (Various sizes)
• 5 gal bucket
• Waterproof paper for sample labels
• Lineman's gloves
• Polarized sunglasses
• Copies of field protocols
• Pencils
• Clipboard
• First aid kit
• Global Positioning System (GPS) Unit

4.D. Equipment for Fish Sample Analysis

• Stereomicroscope (Dissecting) w/ 10X ocular and appropriate zoom magnification
• Plastic pans (assorted sizes)
• Forceps (specimen and fine-tip)

• Probes
• Compressed air
• Disposable gloves
• Counter
• Fume hood
• 70% ETOH
• Glass specimen jars (assorted sizes)
• Bench sheets
• Sample log
• Taxonomic literature (Section 14.C.)

5. Study Plan

Before collecting any biological, chemical or habitat data, the investigator/consultant must submit a study plan as a part of the Quality Assurance Project Plan application to KDOW for approval.

6. Water Chemistry and In-Situ Physicochemical Collection and Processing Methods

Collection and processing of water chemistry samples, flow and in-situ physicochemical data will be conducted using Kentucky Division of Water (2009, 2010a, and 2010c) Standard Operating Procedures. In-stream, water chemistry parameters to be sampled are listed in the individual permit provision documents. In-situ physicochemical measurements collected at each monitoring station include the following:

1. flow (cfs)
2. water temperature (C),
3. specific conductance (uS/cm),
4. dissolved oxygen (mg/L), and
5. pH

In-stream water chemistry sampling sites should coincide with macroinvertebrate sites.

7. Habitat Assessment Methods

1. A habitat assessment will be conducted at every biological sampling reach, during the time of biological sampling. This assessment will allow investigators to evaluate the quality of in-stream and riparian habitat.

2. Habitat assessment procedures follow those outlined in *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (Barbour et al. 1999).

3. Habitat assessments can be used to document physical changes that occur at a sampling reach over time.

7.A. Assessment Procedures

1. The field crew will conduct a visual-based habitat evaluation of the stream reach by filling out the High-Gradient Habitat Assessment Sheet (Barbour et al. 1999) in the eastern coalfields (Appendix B) and the Low-Gradient Habitat Assessment Sheet (Barbour et al. 1999) in the western coalfields (Appendix B).

2. The field crew will fill out the metadata located at the top portion of the Habitat Assessment Sheet:

a. stream name,
b. station location,
c. station ID,
d. basin,
e. GPS field verified lat/long,
f. county,
g. date,
h. time and
i. investigators names

3. The field crew will check off what type of biological collection is being conducted.

4. The field crew will record shocking seconds and seining minutes in the appropriate spaces.

5. The field crew will conduct the habitat assessment as a group reaching consensus for each habitat parameter.

6. The habitat assessment will be conducted after biological sampling has occurred. Field crews shall make mental notes of the kinds of habitats available during biological sampling allowing for better assessment of habitat quality. All of the areas within the reach should be evaluated together as a composite.

7. For each of the 10 habitat parameters, the investigators will determine which of the following conditions exist at the sampling reach: Optimal (20-16), Suboptimal (15-11), Marginal (10-6) or Poor (5-0) and score that parameter accordingly. Note: the last 3 parameters require the investigators to score each bank and then total each for the parameter score (Barbour et al. 1999).

8. At the end or the assessment, the investigators will total all of the parameter ratings to obtain a final habitat ranking (Barbour et al. 1999). This score will be recorded on theHabitat Assessment Sheet in the appropriate space.

7.B. Parameters for High-Gradient Habitat Assessment

This Habitat Assessment Sheet will be used only in the eastern coalfields.
Photographs of each condition within a parameter can be found in *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (Barbour et al. 1999).

7.B.1.Epifaunal Substrate/Available Cover

This metric measures the relative quantity and the variety of stable structures, such as cobble, boulders, fallen trees, logs, branches, root mats, undercut banks, aquatic vegetation, etc., that provide refugia, feeding opportunities and sites for spawning and nursery functions.

*Areas with bedrock or sand/fines alone will not be considered stable habitat. Greater than 70% of the sample reach with a mix of stable substrate/cover will be considered optimal.

7.B.2. Embeddedness

The extent to which rocks and snags are covered or sunken into the silt, sand, mud or biofilms (algal, fungal or bacterial mats) of the stream bottom. Generally, as rocks become embedded, the surface area available to macroinvertebrates and fish (for shelter, spawning and egg incubation) is decreased; assess in the upstream or central portions of riffles.

*At a minimum, a total of 10 riffle rocks from 2 separate riffles will be examined to determine embeddedness. This parameter will be considered optimal if fines/sediment is surrounding less than 25% of the rock's lateral surfaces.

7.B.3. Velocity/Depth Regime

The best streams in most high-gradient regions will have all of the following patterns of velocity and depth: 1) slow-deep, 2) slow-shallow, 3) fast-deep and 4) fast-shallow; the occurrence of these four patterns relates to the stream's ability to provide and maintain a stable aquatic environment.

*Wadeable streams (>5 mi^2): Deep = >1 m
Fast = surface of the water broken with turbulence
*Headwater streams (<5 mi^2): Deep = > 0.5 m
Fast = surface of the water broken with turbulence
*Shallow areas adjacent to the thalwag in headwater streams will be considered as slow-shallow. A stream with all four velocity/depth regimes is considered optimal.

7.B.4. Sediment Deposition

This metric measures the amount of sediment that has accumulated in pools and changes that have occurred to the stream bottom as a result of deposition. This may cause the formation of islands, point bars (areas of increased deposition usually at the beginning of a meander that increases in size as the channel is diverted toward the outer bank) or shoals or result in the filling of runs and pools. Sediment is often found in areas that are obstructed and areas where the stream flow decreases, such as bends. Deposition is a symptom of an unstable and continually changing environment that becomes unsuitable for many organisms.

*For this parameter, determine the percent of bottom that is being affected by sediment deposition for the entire sampling reach. Use this percentage to categorize the site as optimal, suboptimal, marginal or poor. Examine bars/shoals within the biological station to assist in scoring the parameter within the determined category. This parameter will be considered optimal if less than 5% of the bottom is affected by sediment deposition.

7.B.5. Channel Flow Status

This metric measures the degree to which the channel is filled with water. The score will change with the seasons.

*Estimate the percentage of the channel that is wet using the low water mark. If water reaches the base of both low water marks, then this parameter is considered to be optimal.

7.B.6. Channel Alteration

This metric measures the large-scale, direct changes in the shape of the stream channel. Channel alteration is present when 1) artificial embankments, rip-rap and other forms of bank stabilization or structures are present, 2) the stream is very straight for significant distances because of channelization, 3) dams and bridges are present that obstruct flow and/or 4) dredging or other substrate mining activities are occurring or have occurred.

*If channelization or dredging is absent or minimal, then this parameter will be considered optimal.

7.B.7. Frequency of Riffles

This metric measures the sequence of riffles and thus the heterogeneity occurring in a stream.

*Estimate riffle frequency by determining the ratio of distance between riffles divided by the average width of the stream. The field crew will estimate this ratio for a minimum of 3 riffle distances. These 3 ratios will be averaged to get the final riffle frequency ratio. Ratios less than 7:1 are considered to be optimal.

7.B.8. Bank Stability

This metric measures whether the stream banks are eroded or have the potential to erode.

*Each bank is scored independently from 0-10. The left bank is defined as the left-descending bank when facing downstream. Use the % of bank affected to place the bank stability into one of the four categories. The severity of erosion then can be used to give the bank a score within the determined category. If less than 5% of the bank is affected by erosion, then the bank is considered stable and optimal.

7.B.9. Vegetative Protection

This metric measures the amount of vegetative protection afforded to the stream and the near-stream portion of the riparian zone.

*Each bank is scored independently from 0-10. The left bank is defined as the left-descending bank when facing downstream. Determine what vegetative types (trees, understory shrubs, herbs and non-woody macrophytes) are present on each bank. Those stream banks with different vegetative types provide better erosion protection and provide more of a variety of allochthonous food material. Native vegetation scores higher than invasive or non-native vegetation. If greater than 90% of the bank and immediate riparian zone is covered by natural vegetation, including trees, understory shrubs, herbs and non-woody macrophytes, then that bank is scored optimal.

7.B.10. Riparian Vegetative Zone Width

This metric measures the width of the natural vegetation from the edge of the stream bank through the riparian zone. The presence of old fields, paths, walkways, etc., in otherwise undisturbed riparian zones may be judged to be inconsequential to highly destructive to the riparian zone.

*Each bank is scored independently from 0-10. The left bank is defined as the left-descending bank when facing downstream. When determining final scores, the age and density of the riparian vegetation should be evaluated. A width of greater than 18 m is considered optimal. (Ex. A score of 9, instead of 10, should be given to a riparian zone that is over 20 m in width, but is dominated by 5-10 year old hardwood trees).

7.C. Parameters for Low-Gradient Habitat Assessment

This Habitat Assessment Sheet will only be used in the western coalfields. Photographs of each condition within a parameter can be found in *Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers* (Barbour et al. 1999).

7.C.1. Epifaunal Substrate/Available Cover

This metric measures the relative quantity and the variety of stable structures, such as cobble, boulders, fallen trees, logs, branches, root mats, undercut banks, aquatic vegetation, etc., that provide refugia, feeding opportunities and sites for spawning and nursery functions.

*Areas with bedrock or sand/fines alone will not be considered stable habitat. Greater than 50% of the sample reach with a mix of stable substrate/cover will be considered optimal.

7.C.2. Pool Substrate Characterization

This metric evaluates the type and condition of bottom substrates found in pools of low-gradient streams. Firmer sediment types, such as gravel and hard sand with rooted aquatic plants, support a wider variety of organisms than pools dominated by mud or bedrock and no plants.

*This parameter will be considered optimal if there is a mixture of substrate material, including gravel and hard sand, with root mats or aquatic vegetation.

7.C.3. Pool Variability

This metric rates the overall mixture of pool types found in low-gradient streams according to their size and depth. The four types of pools are large-shallow, large-deep, small-shallow and small-deep. A stream with many pool types will support a wide variety of aquatic species. Streams with low sinuosity (few bends) and monotonous pool characteristics do not have sufficient quantities and types of habitat to support a diverse aquatic community.

*Large = length or width of pool greater than half the cross-section of the stream.

*Deep = depth greater than 1 meter.

*A stream with all four pool types is considered optimal.

7.C.4. Sediment Deposition

This metric measures the amount of sediment that has accumulated in pools and changes that have occurred to the stream bottom as a result of deposition. This may cause the formation of islands, point bars (areas of increased deposition usually at the beginning of a meander that increases in size as the channel is diverted toward the outer bank) or shoals or result in the filling of runs and pools. Sediment is often found in areas that are obstructed and areas where the stream flow decreases, such as bends. Deposition is a symptom of an unstable and continually changing environment that becomes unsuitable for many organisms.

*For this parameter, determine the percent of bottom that is being affected by sediment deposition for the entire sampling reach. Use this percentage to categorize the site as optimal, suboptimal, marginal or poor. Examine bars/shoals within the biological station to assist in scoring the parameter within the determined category. This parameter will be considered optimal if less than 20% of the bottom is affected by sediment deposition.

7.C.5. Channel Flow Status

This metric measures the degree to which the channel is filled with water. The score will change with the seasons.

*Estimate the percentage of the channel that is wet using the low water mark. If water reaches the base of both low water marks, then this parameter is considered to be optimal.

7.C.6. Channel Alteration

This metric measures the large-scale, direct changes in the shape of the stream channel. Channel alteration is present when 1) artificial embankments, rip-rap and other forms of bank stabilization or structures are present, 2) the stream is very straight for significant distances because of channelization, 3) dams and bridges are present that obstruct flow and/or 4) dredging or other substrate mining activities are occurring or have occurred.

*If channelization or dredging is absent or minimal, then this parameter will be considered optimal.

7.C.7. Channel Sinuosity

This metric evaluates the meandering or sinuosity of a low-gradient stream. A high degree of sinuosity provided for diverse habitats for stream organisms. Highly sinuose streams are better at absorbing stream energy during high-flow events protecting stream banks from excessive erosion.

*The evaluators may need to walk upstream and downstream of the sampling reach to make this determination. If the bends of the stream increase the stream length 2 to 3 times longer than it was in a straight line, then this metric would be considered optimal.

7.C.8. Bank Stability

This metric measures whether the stream banks are eroded or have the potential to erode.

*Each bank is scored independently from 0-10. The left bank is defined as the left-descending bank when facing downstream. Use the % of bank affected to place the bank stability into one of the four categories. The severity of erosion then can be used to give the bank a score within the determined category. If less than 5% of the bank is affected by erosion, then the bank is considered stable and optimal.

7.C.9. Vegetative Protection

This metric measures the amount of vegetative protection afforded to the stream and the near-stream portion of the riparian zone.

*Each bank is scored independently from 0-10. The left bank is defined as the left-descending bank when facing downstream. Determine what vegetative types (trees, understory shrubs, herbs and non-woody macrophytes) are present on each bank. Those stream banks with different vegetative types provide better erosion protection and provide more of a variety of allochthonous food material. Native vegetation scores higher than invasive or non-native vegetation. If greater than 90% of the bank and immediate riparian zone is covered by natural vegetation, including trees, understory shrubs, herbs and non-woody macrophytes, then that bank is scored optimal.

7.C.10. Riparian Vegetative Zone Width

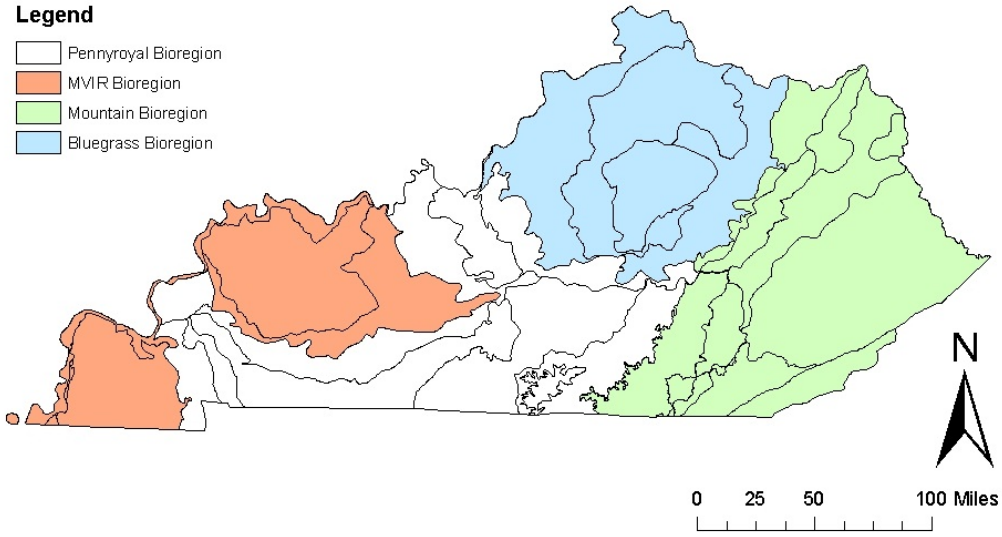
This metric measures the width of the natural vegetation from the edge of the stream bank through the riparian zone. The presence of old fields, paths, walkways, etc., in otherwise undisturbed riparian zones may be judged to be inconsequential to highly destructive to the riparian zone.

*Each bank is scored independently from 0-10. The left bank is defined as the left-descending bank when facing downstream. When determining final scores, the age and density of the riparian vegetation should be evaluated. A width of greater than 18 m is considered optimal. (Ex. A score of 9, instead of 10, should be given to a riparian zone that is over 20 m in width, but is dominated by 5-10 year old hardwood trees).

7.D. Habitat Criteria

Historical and current reference reach habitat data were used to produce habitat criteria for the bioregions of Kentucky. The scores for all reference reach stations were ranked and divided into percentiles. The 50th percentile was considered the dividing line between stations containing excellent available habitat and those with good available habitat. Likewise, the lower quartile (25th percentile) was considered the dividing line between those stations with fair and good available habitat. Habitat was considered to be poor if it fall below the lowest reference condition score for that area. For assessment purposes, habitat scoring criteria are grouped in the same manner as Bioregions (Figure 1).

Figure 1. Designated habitat bioregions of Kentucky



Mountainous Ecoregions of the Commonwealth provided similar habitat opportunities for aquatic community colonization and use. Habitat scores from reference sites in the Central Appalachian, Southwestern Appalachian and Western Allegheny Ecoregions reflected these similarities. Therefore, habitat data from all of these ecoregions were

combined to develop habitat criteria for the Mountains (MT). **These ratings will be used for the eastern coalfields.**

Figure 2. Scoring for narrative habitat ratings in the Mountains (Eastern Coalfields).

Bioregion	Rating	Area Scoring	
		Headwater (<5.0 mi^2)	Wadeable (>5.0 mi^2)
Mountain (MT)	Excellent	169 and above	166 and above
	Good	158-168	155-165
	Fair	131-157	117-154
	Poor	130 and below	116 and below

Streams sampled within the Mississippi Valley Loess Plains and Interior River Valleys and Hills Ecoregions were generally low-gradient streams with very few riffles. These Ecoregions were combined to form the Mississippi Valley-Interior Rivers (MVIR) Bioregion. Low-gradient habitat assessment sheets were used in these Ecoregions to evaluate the available habitat. **These ratings will be used for the western coalfields.**

Figure 3. Scoring for narrative habitat ratings in the MVIR (Western Coalfields).

Bioregion	Rating	Area Scoring	
		Headwater (<5.0 mi^2)	Wadeable (>5.0 mi^2)
Mississippi Valley Interior River (MVIR)	Excellent	145 and above	133 and above
	Good	126-144	124-132
	Fair	114-125	106-123
	Poor	113 and below	105 and below

7.D. Photo documentation

1. At each biological/habitat station, photographs need to be taken of the sampling zone, upstream of the sampling zone, downstream of the sampling zone and typical in-stream habitat for the station.

2. Each photograph shall be labeled with stream name, location, station number, sampling date and whether the photograph is of the sampling zone, upstream or downstream.

3. Photographs will be submitted with the chemical, habitat and biological data in the annual report.

8. Macroinvertebrate Field Collection Methods

Macroinvertebrates will be collected at in-stream sampling stations that have a drainage area less than 200 $miles^2$.

8.A. Eastern Coalfield Methods

In general, collection methods used in these intensive surveys are similar to those discussed in Lenat (1988), Plafkin et al. (1989), Klemm et al. (1990), Eaton and Lenat (1991), U.S. EPA (1997b) and Barbour et al. (1999). A macroinvertebrate sample from one intensive survey station consists of the following:

1. A standardized, semi-quantitative collection (1m^2 kick-net)

AND

2. A qualitative multi-habitat sweep collection.

8.A.1. Sampling Periods

Collection of benthic macroinvertebrate samples within the designated index periods is critical for accurate assessments.

1. Headwater streams (<5mi^2 drainage area) must be sampled between February 15th and May 31st.

2. Wadeable streams (>5mi^2 drainage area) must be sampled between May 1st and September 30th.

3. Samples collected outside of these index periods will be considered unacceptable.

4. Benthic macroinvertebrate samples must not be collected during periods of excessively high or low flows or within two weeks of a known scouring flow event.

8.A.2. Sampling Methods

The methods described in this section are modifications of the single habitat and multihabitat approaches outlined by Barbour et al. (1999).

1. For intensive surveys, the 1-m^2 kick-net, single habitat samples will be kept separate from the multi-habitat sweep collections.

2. Field personnel should avoid walking through areas designated for collection of benthic macroinvertebrates until sampling has been completed. Failure to use caution could result in sample degradation.

3. The designated sample reach will be at least 100 m but not more than 300 m and will consist of at least 2 riffle/run/pool sequences. This sample reach will be for macroinvertebrate sampling only.

8.A.3.Wadeable-High-Gradient

A summary of collection techniques required for wadeable-high-gradient streams is shown in Table 9.C.1. For intensive surveys, it is important that both single habitat and multi-habitat sampling are conducted.

8.A.3.A. Single Habitat Riffle (Semi-Quantitative) (1 m^2 kick-net)

1. The objective of this technique is to sample the riffle habitat which is the most productive habitat niche found in high-gradient streams.

2. Four (4) 0.25m^2 samples are taken from mid-riffle or the thalweg using a 0.25 m^2, 600 µm mesh kick-net.

3. The four riffle samples will be collected from a minimum of 2 (4 maximum) different riffles, separated by at least one pool or run within the sampling reach.

4. Dislodge benthos by vigorously disturbing 0.25 m^2 (20 x 20 in.) of substrate in front of the net.

5. Large stones, leaves and sticks are individually rinsed into the 600 µm mesh wash bucket and inspected for organisms before being discarded.

6. Small stones and sediment are removed by elutriation using the wash bucket and U.S. No. 30 sieve.

7. The contents of the net are washed into the mesh wash bucket.

8. All four samples are composited in the bucket.

9. After all of the kick-net samples have been collected, the contents of the bucket will be placed into a glass, sampling jar with 95% ETOH.

10. The mesh wash bucket will be picked clean of any remaining macroinvertebrates and those placed into the sampling jar.

11. The sample jar will be labeled with appropriate information and will be ready for transport to the lab for analysis.

8.A.3.B. Multi-Habitat Sweep Sample

1. The investigator will sample a variety of non-riffle habitats with the aid of an 800 x 900 µm mesh triangular or D-frame dip net.

2. Each habitat will be sampled in at least three (3) replicates.

3. After all habitats have been sampled, the contents of the mesh wash bucket will be composited into a glass, sampling jar with 95% ETOH.

4. The wash bucket will be picked clean of any remaining macroinvertebrates.

5. The sample jar will be labeled with appropriate information and will be ready for transport to the lab for analysis.

6. Each of these following habitats will be sampled:

A. Undercut Banks/Root Mats

1. These are sampled by placing a large root wad into a triangular or D-frame dip net and shaking vigorously.

2. The contents are removed from the dip net and placed into a mesh wash bucket.

3. If undercut banks are present in both run and pool areas, each is sampled separately.

B. Marginal Emergent Vegetation (exclusive of water willow, *Justicia Americana*, beds)

1. This habitat is sampled by thrusting (i.e., "jabbing") the dip net into the vegetation for approximately 1m, and then sweeping through the area to collect dislodged organisms.

2. Material is then rinsed in the wash bucket and any sticks, leaves and vegetation are thoroughly washed and inspected before discarding.

C. Bedrock or Slab-Rock Habitats

1. These habitats are sampled by placing the edge of the dip net flush on the substrate, and disturbing approximately 0.1 m^2 of area to dislodge attached organisms.

2. Material is emptied into a wash bucket, rinsed, inspected for organisms and discarded.

D. *Justicia americana* (water willow) Beds

1. These are sampled by working the net through a 1m section in a jabbing motion.

2. The material is then emptied into a wash bucket and any *J. americana* stems are thoroughly washed, inspected and discarded.

E. Leaf Packs

1. Leaf packs are preferably collected from "conditioned" (i.e., not new-fall material) material when possible.

2. Three replicate samples are taken from a diversity of habitats (i.e., riffles, runs and pools) and placed into the wash bucket.

3. Material is thoroughly rinsed to dislodge organisms, inspected and discarded.

F. Silt, Sand, and Fine Gravel

1. A U.S. No. 10 sieve is used to sort larger invertebrates (e.g., mussels, burrowing mayflies, dragonfly larvae) from silt, sand and fine gravel by scooping the substrate to an approximate depth of 5cm along the margins of the stream.

2. A variety of collection sites are sampled in order to obtain three (3) replicates.

G. *Aufwuchs* Sample

1. Small invertebrates associated with this habitat are obtained by washing a small amount of rocks, sticks, leaves, filamentous algae and moss into a medium-sized bucket half filled with water.

2. The material is then elutriated and sieved with the nitex sampler/mesh.

H. Rock Picking

1. Benthic macroinvertebrates are picked from 15 rocks (large cobble/small boulders; 5 each from riffle, run and pool).

2. Selected rocks are washed in a bucket half filled with water and then carefully inspected to remove organisms.

I. Wood Sample

1. Pieces of submerged wood, ranging from roughly 3 to 6 meters (10 to 20 linear feet) in length and ranging from 5–15 cm (2–6 inches) in diameter, are individually rinsed into the wash bucket.

2. Pieces of wood are inspected for burrowers and crevice dwellers and are removed with fine-tipped forceps.

3. Large diameter, well-aged logs should be inspected and hand-picked with fine-tipped forceps.

Table.8.A.3. Summary of sampling methods for high-gradient, wadeable streams in Eastern Coalfields

Technique	Sampling Device	Habitat	Replicates (composited)
$1m^2$ Kicknet/Seine[1]	Kicknet/seine and wash bucket	Riffle/Run	4 – $0.25m^2$
Multi-Habitat Sweep			
Undercut Banks/Roots	D-frame dip net and wash bucket	All Applicable	3
Emergent Vegetation	D-frame dip net and wash bucket	All Applicable	3
Bedrock/Slabrock	D-frame dip net and wash bucket	All Applicable	3
J. americana Beds	D-frame dip net and wash bucket	All Applicable	3
Leaf Packs	D-frame dip net and wash bucket	Riffle-Run-Pool	3
Silt, Sand, Fine Gravel			
Coarse Sieve	U.S. Number 10 Sieve	Margins	3
Aufwuchs Sample	300µm nitex sampler/mesh	Riffle-Run-Pool	3
Rock Pick	Fine-tipped forceps and wash bucket	Riffle-Run-Pool	15 total (5 each Riffle-Run-Pool)
Wood Sample	Fine-tipped forceps and wash bucket	Riffle-Run-Pool	3-6 linear meters

[1]Kicknet sample contents kept separate from the multi-habitat sample.

8.A.4. Headwater-High-Gradient

1. In these small streams, riffle habitat predominates and is the primary targeted habitat.

2. A collection consists of a composited semi-quantitative, riffle sample and a composited, multi-habitat sample.

3. These two sample types must be kept separate for a more effective diagnosis of impairment.

4. A summary of these collection techniques is shown in Table 9.C.2.

8.A.4.A. Single Habitat Riffle Sample (Semi-quantitative, $1m^2$ kick-net)

1. Four 0.25 m^2 quadrat kick net samples are collected within the thalweg of cobble-boulder riffle habitat. This habitat is targeted to ensure the highest species richness and abundance of benthic macroinvertebrates. The thalweg of a riffle also guarantees the most flow permanence and substrate stability in these often intermittent streams.

2. Two kick net samples are allocated to each of two distinct riffles (at minimum) that are separated by at least one pool or run. This is done to help reduce between-riffle variability. However, if there are several riffles located within the reach, the sampling effort should be spread across the reach to give a comprehensive evaluation of the entire community.

3. The four samples are composited into a 600 µm mesh wash bucket to yield a $1m^2$ semiquantitative sample.

4. The composited sample is partially field processed using a U.S. No. 30 sieve (600 µm) and wash bucket.

5. Large stones, leaves and sticks are individually rinsed and inspected for organisms and then discarded.

6. Small stones and sediment are removed by elutriation using the wash bucket and U.S. No. 30 sieve.

7. The contents of the cleaned wash bucket are placed into a glass, sample jar with 95% ETOH.

8. The wash bucket will be picked clean of any remaining macroinvertebrates.

9. The sample jar will be labeled with the appropriate information and will be ready for transport to the lab for analysis.

8.A.4.B. Multi-Habitat Sample

Collecting macroinvertebrates in headwater high-gradient streams using multi-habitat sampling methodology is similar to collecting in wadeable high-gradient streams with the exception of several key differences:

1. The headwater multi-habitat typically does not include emergent vegetation bedrock/slabrock, *J. americana* beds or aufwuchs as the wadeable sites more often do, therefore these habitats are not required to be sampled;

2. Rock picks are only required from pools; and

3. Pieces of submerged wood less than 2 m are picked instead of the larger pieces as required for wadeable stream sites.

Table.8.A.4. Summary of sampling methods for high-gradient, headwater streams in Eastern Coalfields

Technique	Sampling Device	Habitat	Replicates (composited)
1m2 kicknet/siene[1]	Kicknet/seine and wash bucket	Riffle	4 – 0.25m2
Multi-habitat Sweep			
Undercut Banks/Roots	D-frame dip net and wash bucket	All Applicable	3
Sticks/Wood	D-frame dip net and wash bucket	All Applicable	3
Leaf Packs	D-frame dip net and wash bucket	Riffle-Run-Pool	3
Silt/Sand/Fine Gravel	D-frame dip net and wash bucket	Margins	3
Rock Pick	Fine-tipped forceps and wash bucket	Pool	5 small boulders
Wood	Fine-tipped forceps and wash bucket	Riffle-Run-Pool	2 linear m

[1]Kicknet sample contents kept separate from the multi-habitat sample.

8.B. Western Coalfield Method

Collection methods to be used in the western coalfields are similar to those discussed in the Mid-Atlantic Coastal Plain Streams Workshop (MACS) protocol (USEPA 1997a) and more generally to thosed discussed in Lenat (1988), Plafkin et al. (1989), Klemm et al. (1990), Eaton and Lenat (1991), USEPA (1997b) and Barbour et al. (1999). **A macroinvertebrate sample from a western coalfields station will consist of a 20 jab qualitative multi-habitat collection.**

8.B.1. Sampling Periods

Collection of benthic macroinvertebrate samples within the designated index periods is critical for accurate assessments.

1. Headwater streams (<5mi^2 drainage area) must be sampled between February 15th and May 31st.

2. Wadeable streams (>5mi^2 drainage area) must be sampled between May 1st and September 30th.

3. Samples collected outside of these index periods will be considered unacceptable.

4. Benthic macroinvertebrate samples must not be collected during periods of excessively high or low flows or within two weeks of a known scouring flow event.

8.B.2. 20 Jab Qualitative Multi-Habitat Method

1. Field personnel shold avoid walking through areas designated for collection of benthic macroinvertebrates until sampling has been completed. Failure to use cation could result in sample degradation.

2. The designated sample reach will be at least 100 m but not more than 300 m. This sample reach will be form macroinvertebrate sampling only.

3. A summary of collection techniques required for low-gradient streams is shown in Figure 8.B.2. **This collection method and these sampling techniques apply to headwater and wadeable streams <200 mi^2.**

4. The most productive habitats of these streams are typically woody snags, undercut banks and aquatic vegetation.

5. A proportional sampling technique is used in the 20 jab method in which some predetermined number of sample units (20 in this case) is allocated among distinct and productive habitats in relation to their proportion found within the sample reach.

6. A sample unit is called a “jab” in which a D-frame is thrust into the targeted habitat in a jabbing motion for approximately 0.5 m.

7. After jabbing, the targeted habitat is swept with the net 2 or 3 times to collect the dislodged organisms.

8. If the jab becomes heavily clogged with debris and sediment, discard and repeat the jab.

9. All material is composited into a wash bucket for further processing.

10. Large leaves and twigs can be washed, inspected and discarded to reduce the volume of the debris in the sample.

11. Sand and sediment can be elutriated using a bucket and a 600 µm sieve.

12. Each of these following habitats will be sampled:

A. Vegetated Banks/Root Mats

1. These are sampled by placing a large root wad into a D-frame dip net and shaking it vigorously.

2. The contents are removed from the net and placed into the mesh wash bucket.

3. If undercut banks are present in both run and pool areas, each is allotted jabs.

B. Submerged Vegetation

1. In deep water, this habitat is sampled by drawing the dip net through the vegetation from the bottom to the surface (no more than 0.5m). In shallower water, jab the net along the bottom in the rooted area and then sweep through the area to collect dislodged organisms.

2. Material is then rinsed in the wash bucket and any sticks, leaves and vegetation are thoroughly washed and inspected before discarding.

C. Snags/Woody Debris

1. Snag samples are preferably collected from “conditioned” (i.e. not new-fall) material. If possible, avoid large snags as they are difficult to sample. Medium-sized snags can be kicked first to dislodge organisms, but only after the net has been placed downstream of the disturbance. Woody debris is sampled by jabbing and sweeping the submerged area.

2. Large diameter, well-aged logs can be inspected and handpicked with fine-tipped forceps.

3. Woody material is emptied into a wash bucket, rinsed, inspected for organisms and discarded.

D. Cobble/Gravel

1. Shallow cobble/gravel areas are sampled by disturbing the substrate 0.5 m above the net. The net must remain in close contact to the bottom of the stream for at least 30 seconds after kicking has stopped. Sweep through a 1 m section in a jabbing motion to collect dislodged macroinvertebrates.

2. The material is emptied into a wash bucket and thoroughly washed. The organisms in the sample can be elutriated away from the gravel, after which the gravel is inspected and discarded.

E. Silt, Sand and Fine Gravel

1. This habitat is sampled with a bumping motion as opposed to jabbing, to reduce the amount of fines/debris in the net.

2. The collected material is treated similarly to the cobble/gravel sample.

F. Leaf Packs

1. Leaf packs are collected from conditioned material.

2. Samples are taken from runs and pools and placed into the wash bucket.

3. Leaf material is thoroughly rinsed to dislodge organisms, inspected and discarded.

13. Each available habitat is allotted a percentage of the 20 available jabs (e.g. if 4 major habitat types were equally present, 5 jabs would be taken from each major habitat).

Technique	**Sampling Device**	**Habitat**	**Replicates (composited)**
$1m^2$ Kicknet/Seine[1]	Kicknet/seine and wash bucket	Riffle/Run	4 – $0.25m^2$
Multi-Habitat Sweep			
Undercut Banks/Roots	D-frame dip net and wash bucket	All Applicable	3
Emergent Vegetation	D-frame dip net and wash bucket	All Applicable	3
Bedrock/Slabrock	D-frame dip net and wash bucket	All Applicable	3
J. americana Beds	D-frame dip net and wash bucket	All Applicable	3
Leaf Packs	D-frame dip net and wash bucket	Riffle-Run-Pool	3
Silt, Sand, Fine Gravel			
Coarse Sieve	U.S. Number 10 Sieve	Margins	3
Aufwuchs Sample	300µm nitex sampler/mesh	Riffle-Run-Pool	3
Rock Pick	Fine-tipped forceps and wash bucket	Riffle-Run-Pool	15 total (5 each Riffle-Run-Pool)
Wood Sample	Fine-tipped forceps and wash bucket	Riffle-Run-Pool	3-6 linear meters

9.D. Sample Labeling

1. While at the sampling location, all macroinvertebrate samples will receive a label.

2. The label will be written on waterproof paper with a pencil and placed into the glass, sampling jar.

3. The label will consist the following:

a. station ID,
b. stream name,
c. location,
d. county,
e. date sampled,
f. type of collection (semi-quantitative or multi-habitat), and
g. the collector's initials.

9.E. Quality Control and Quality Assurance

1. All samples will be clearly and correctly labeled in the field as described above.

2. After sampling has been completed, all sampling gear will be thoroughly cleaned to remove all benthic macroinvertebrates so that specimens are not carried to the next site.

3. The equipment shall be examined prior to sampling at the next site to ensure that no benthic macroinvertebrates are present.

4. Five percent (5%) of samples collected within one year will be replicated to evaluate precision and repeatability of the technique and the sampling crew.

5. The replicate samples will be selected by using a random numbers table or other random numbering method.

6. Replicates will be collected by a different macroinvertebrate biologist during the same field visit.

7. If this does not occur, all macroinvertebrate biologists will meet to assess the issue and take corrective actions which will be documented with other QA files.

10. Macroinvertebrate Laboratory Methods

The following sections describe the methods that should be followed when processing, identifying and recording benthic macroinvertebrate samples in the laboratory.

10.A. Logging Samples

1. All samples should be logged into the appropriate macroinvertebrate sample logbook upon returning from the field.

2. Information included in the logbook (or file) are as follows:

a. station ID,

b. stream name,
c. county,
d. latitude and longitude,
e. date collected,
f. collectors,
g. type of sample (i.e., semi-quantitative or multi-habitat),
h. number of samples, and
i. date-to-lab.

3. Upon completion of sample identification, the taxonomist should record the following information in the logbook:

a. date identified,
b. the date of taxonomic QA/QC (if required),
c. date of entry into database, and
d. the initials of the appropriate party completing each task.

10.B. Sample Preservation

1. Field samples are preserved in 95% ETOH.

2. Upon returning to the laboratory, samples will be changed into 70% ETOH for storage and identification.

3. When changing the preservatives at the lab, place a U.S. Standard No. 30 sieve (600 µm wire mesh) under the area where the preservative change is going to take place in case of sample spillage.

4. Organisms captured in the sieve during a sample spill are picked and placed in the storage container.

10.C. Labeling

1. A sample label will be placed in the collection jar when the sample is returned to the laboratory or before identified.

2. The label will include the same information as identified in Section 9.D.

10.D. Sample Processing (Full Pick) Method

1. The macroinvertebrate biologist will pick all macroinvertebrates from the 1 m^2 kick and the multi-habitat sample jars.

2. Approximately a tablespoon of sample content is placed into a small, glass dish.

3. The dish is placed under the stereomicroscope and ready to be picked.

4. All macroinvertebrate individuals are picked from the dish and placed into a vial designated for each macroinvertebrate order.

5. Larger specimens (i.e. crayfish, helgrammites) are placed into a new, glass sample jar with 70% ETOH.

6. The leftover material in the dish is placed into a collecting bucket.

7. Step 4, 5 and 6 are repeated until all of the sample has been fully picked.

8. Vials containing individuals of each macroinvertebrate order are filled with 70% ETOH, capped with a cotton ball and placed into the sample jar that was used in Step 5.

9. The sample label from the old sample jar is removed and placed into the new sample jar.

10. The sample is now ready to be identified.

11. Ten percent of all sorting pans will be checked by a second sorter to assure that samples are being picked thoroughly.

12. Once picking and QA checks have been conducted, properly dispose of leftover material.

13. Log results of QA checks into QA logbook.

10.E. Taxonomy

1. All taxonomic identifications are made to the lowest positive level (e.g. genus/species) using the most current taxonomic references available.

2. Most specimen IDs will be made using a stereomicrosope or dissecting scope at low magnifications.

3. Identification of smaller individuals or small parts of macroinvertebrates will be done on a compound light microscope.

4. A partial list of suggested taxonomic references used by KDOW can be found in Section 14.B.

5. A current master taxa list is found in Appendix C.

6. For each 1m^2 kicknet sample, each individual organism will be identified and enumerated. Data from this sample will be utilized in all of the Macroinvertebrate Bioassessment Index metrics.

7. For each multi-habitat sample, each taxa is identified as being present, but individuals of each taxa do not have to be enumerated.

8. Each taxa identified from the multi-habitat sample that was not identified and enumerated in the 1m^2 kicket sample is added to the final species list. These additional taxa are then used in the Genus Richness and EPT Genus Richness metrics of the Macroinvertebrate Bioassessment Index. (See Appendix H for an example).

10.F. Data and Records Management

1. All data acquired during the macroinvertebrate identification process will be recorded on a macroinvertebrate bench sheet similar to the one found in Appendix D.

2. Bench sheets will be permanently retained by the taxonomist who processed the sample.

3. All data will be entered into a spreadsheet or database as promptly as possible.

10.G. Quality Assurance and Quality Control

1. Five percent of all identified samples will be re-identified to insure QA/QC by a second taxonomist.

2. Ninety percent or greater composition comparability (e.g., abundance and richness) is the target success criteria.

3. If there is less than 90% comparability between the taxonomists, then taxonomy must be reconciled by both taxonomists and a third taxonomist, if deemed necessary.

4. A minimum of 10% of the sites will be chosen for data entry QA/QC. Selection will be accomplished through use of a random numbers table based on biological monitoring stations listed in the logbook.

5. With each chosen site, all benthic data entry for that site will be checked to ensure that all station information and macroinvertebrate data agree.

6. The quality assurance check will be performed by someone who did not enter any of the data.

7. Data entry errors will be corrected as they are encountered.

8. Error rate will be determined by dividing the number of incorrect entries by the number of entry fields for that sheet.

9. Entries shall be 95% correct to pass quality assurance.

10. If data entry is less than 95% correct, then another data entry record by the same entry individual will be checked.

11. This will be continued until the entering individual has achieved a 95% correct level.

12. Quality assurance will be recorded on the individual logbook for each type of information collected.

13. If patterns of data entry error exist and data entry error rate is less than 95%, all sample sites should be checked for specific errors.

14. Samples selected for QA/QC will be chosen randomly using a random numbers table or other random selection methodology.

15. QA/QC will be documented on a duplicate bench sheet, attached to the original bench sheet and appended to the yearly summary report.

11. Macroinvertebrate Data Analysis - Macroinvertebrate Bioassessment Index (MBI)

Macroinvertebrate data analysis for wadeable or headwater streams is accomplished by using a multi-metric approach, the Macroinvertebrate Bioassessment Index (MBI). Metric criteria are based on reference reach data and may vary from region to region and with stream size (i.e., wadeable or headwater). Core metrics in wadeable streams are Genus Richness, modified Hilsenhoff Biotic Index, EPT Genus Richness, modified %EPT Abundance and %Chironomidae+Oligochaeta Abundance and % Clinger Abundance. **For headwater streams, those with a catchment area less than or equal to 5 mi^2, an additional metric is used, %Ephemeroptera Abundance (Pond et al. 2003).**

11.A. MBI Metrics

The KDOW's metric selection process uses statistical properties of redundancy and sensitivity to evaluate the power of metrics that can discriminate between impaired and unimpaired sites. Metric scoring criteria are established using percentiles of the reference and non-reference data distribution. The following is a list and explanation of each metric used by KDOW in the MBI for wadeable streams (>5 mi^2).

11.A.1. Genus Richness

This refers to the total number of distinct genera present in the composited sample. In general, increasing genera richness reflects increasing water quality, habitat diversity and/or habitat suitability.

11.A.2. Ephemeroptera, Plecoptera, Trichoptera Richness (EPT)

This is the total number of distinct genera within the generally pollution-sensitive insect orders of Ephemeroptera, Plecoptera and Trichoptera found in the composited sample. This index value will usually increase with increasing water quality, habitat diversity and/or habitat suitability.

11.A.3. Modified Hilsenhoff Biotic Index (mHBI)

The HBI was developed to summarize the overall pollution tolerance of a benthic arthropod community with a single value (Klemm et al. 1990). Hilsenhoff (1977), using a range of 0-5, originally developed the index for Wisconsin riffle/run streams experiencing organic pollution. Hilsenhoff (1982, 1987) later refined the index, expanding the scale to range from 0 to 10. Plafkin et al. (1989) modified the index to include non-arthropod benthic macroinvertebrates. Hilsenhoff (1987) developed tolerance values for a variety of macroinvertebrates from Wisconsin, and Plafkin et al. (1989) added additional tolerance values. However, KDOW uses tolerance values developed by North Carolina Division of Environmental Management (NCDEM) (Lenat 1993) as well as values developed from KDOW data. These HBI values have been regionally modified for streams of the southeastern United States. Both Hilsenhoff (1988) and NCDEM have developed seasonal correction factors for the HBI. Several states, including Kentucky, have used the mHBI to assess impacts other than organic enrichment and found the mHBI to be a valuable metric. An increasing mHBI value indicates decreasing water quality.

The formula for the mHBI is as follows:

$$mHBI = \frac{\Sigma n_i x a_i}{N}$$

where:
n_i = number of individuals within a species (maximum of 25),
a_i = tolerance value of the species,
N = total number of organisms in the sample.

mHBI tolerance values can be found in the macroinvertebrate master species list in Appendix C.

11.A.4. Modified Percent EPT Abundance (m%EPT)

This metric measures the abundance of the generally pollution-sensitive insect orders of Ephemeroptera, Plecoptera and Trichoptera. The relatively tolerant and ubiquitous caddisfly, *Cheumatopsyche sp.*, is excluded from the calculation. Increasing values indicate increasing water quality and/or habitat conditions.

11.A.5. Percent Chironomidae+Oligochaeta (%Chir+%Olig)

This metric measures the relative abundance of these generally pollution tolerant organisms. Increasing abundance of these groups suggests decreasing water quality conditions.

11.A.6. Percent Primary Clingers (%Clingers)

This habit metric measures the relative abundance of those organisms that need hard, silt-free substrates to "cling" to. Merritt et al. (2008) and Barbour et al. (1999) list habits for most insect genera. Habit information for non-insect taxa can be determined from Pennak (1989), Thorp and Covich (2001) and Barbour et al. (1999). Habits for Kentucky macroinvertebrates are listed in the macroinvertebrate master species list in Appendix C.

For headwater streams (< 5 mi^2), the MBI is calculated with the above metrics as well as the one described below.

11.A.7. Percent Ephemeroptera (%Ephem)

The relative abundance of mayflies is calculated to show impacts of metals and high conductivity associated with mining and oil well impacts. Ephemeroptera abundance normally declines in the presence of brine and metal contamination.

11. B. Metric Scoring Formulae

The 95th %iles have been calculated using the reference dataset for each metric that has a negative relationship to increased pollution so that metric values could be normalized. Likewise, the 5th%iles have been calculated using the reference dataset for each metric that has a positive relationship to increased pollution so that metric values could be normalized. Each metric is then scored on a continual scale of 0-100 percent, and the MBI is calculated as the average of all equally weighted metric scores (after Gerritsen et al. 2000). If a calculated metric scored over 100 (i.e., a value above the 95th %ile) then it was corrected to the maximum score of 100. The formulae and the metric scores are automatically calculated in the MBI template. Instructions of its use are found in Section 11.C.

The appropriate metric scoring formulae for the seven headwater metrics are shown below along with an example MBI calculation for Bear Branch, a headwater mountain stream (< 5 mi^2).

Figure 3. Metric scoring formulae and headwater mountain stream example

Metric	**95th or 5th%ile**	**Formula$**	**Bear Branch Example$**	**Metric Score for Bear Branch$**
Genus TR*	63	GTR ----------X 100 95th%ile	42 -----X100 63	66.67
Genus EPT TR*	33	GEPT ----------X 100 95th%ile	17 -----X 100 33	51.54
mHBI	2.18	10-mHBI ----------X 100 10-5th%ile	10 – 4.12 ----------X 100 10-2.18	75.19
m%EPT	86.9	m%EPT ----------X 100 95th%ile	63.81 ------X 100 86.9	73.43
%Ephemeroptera	66.5	%Ephem ----------X 100 95th%ile	18.09 ------X 100 66.5	27.2
% Chir+Olig	0.68	100-%Chir +Olig ----------X 100 100-5th%ile	100-9.53 ----------X 100 100-0.68	91.09
%Clingers	75.5	%Clingers ----------X 100 95th%ile	34.82 ------X 100 75.5	46.12
			MBI Score$	**61.6 (Fair)**

*Both 1m^2 kicknet and multi-habitat taxa are used for these metrics.
$Automatically calculated by the MBI template.

The appropriate metric scoring formulae for the six wadeable stream metrics are shown below along with an example MBI calculation for Kinniconick Creek, a wadeable mountain stream (>5 mi^2).

Figure 4. Metric scoring formulae and wadeable mountain stream example

Metric	**95th or 5th%ile**	**Formula$**	**Kinniconick Creek Example$**	**Metric Score for Kinniconick Creek$**
Genus TR*	74	GTR ----------X 100 95th%ile	53 -----X100 74	71.62
Genus EPT TR*	30	GEPT ----------X 100 95th%ile	19 -----X 100 30	63.33
mHBI	3.11	10-mHBI ----------X 100 10-5th%ile	10 – 4.49 ----------X 100 10-3.11	80.03
m%EPT	74	m%EPT ----------X 100 95th%ile	79.69 ------X 100 74	100.0
% Chir+Olig	1.0	100-%Chir +Olig ----------X 100 100-5th%ile	100-5.04 ----------X 100 100-1.0	95.92
%Clingers	74	%Clingers ----------X 100 95th%ile	60.45 ------X 100 74	81.09
			MBI Score$	**82.09 (Excellent)**

*Both $1m^2$ kicknet and multi-habitat taxa are used for these metrics.
$Automatically calculated by the MBI template.

<u>11.C. MBI Calculations Using the MBI Template (Pond et al. 2003):</u>

Step 1: Generate a metric score for each metric listed above.

Step 2: Open the MBI calculation template (Genus Species Full Pick Method) under **Index Calculation Documents** at: http://water.ky.gov/Pages/SurfaceWaterSOP.aspx).

Step 3: Determine the type of stream (headwater or wadeable) being assessed.

Step 4: Activate the appropriate tab (headwater or wadeable) at the bottom of the MBI calculation template.

Step 5: Record the metric scores into the appropriate cells of the MBI calculation template. These have a heading with a yellow background.

Step 6: For each metric score generate a percentage score (range 0-100) based upon the percent of the standard metric value (i.e. the 95th percentile or 5th percentile of the reference condition). This step is done in the MBI calculation template.

Step 7: If an individual metric scores greater than 100, then a score of 100 is given to the metric. This is done manually by the person entering the data.

Step 8: Sum the individual metric scores. This step is done in the MBI calculation template.

Step 9: Average the metric scores to produce an MBI value. This step is done in the MBI template.

Step 10: Activate the Criteria and Map Tab at the bottom of the MBI calculation template.

Step 11: Compare the MBI value to the criteria for either a MT headwater or MT wadeable stream. (See below)

Step 12: Activate the Headwater or Wadeable Tab to return to the calculated MBI value.

Step 13: Record the narrative MBI rating in the column next to the MBI value in the template.

Step 14: Provide electronic copies of MBI calculation template and macroinvertebrate bench sheets in the annual report to KDOW and USFWS.

Figure 5. MBI scoring criteria

Wadeable	50th and 5th %ile	50th and 5th %ile	50th and 5th %ile	75th and 25th %ile
Rating	BG	MT	PR	MVIR
Excellent	≥ 70	≥ 82	≥ 81	≥ 58
Good	61–69	75–81	72–80	48–57
Fair	41–60	50–74	49–71	24–47
Poor	21–40	25–49	25–48	13–23
Very Poor	0–20	0–24	0–24	0–12

Headwater

Rating	BG	MT	PR	MVIR
Excellent	≥ 58	≥ 83	≥ 72	≥ 63
Good	51–57	72–82	65–71	56–62
Fair	39–50	48–71	43–64	35–55
Poor	19–38	24–47	22–42	19–34
Very Poor	0–18	0–23	0–21	0–18

12. Federally Listed Fish Population Study Methods

12.A. When to Conduct Fish Population Surveys?

A. Fish population studies **must** be conducted for **two years prior** to resource extraction and other land use activities.

B. During active resource extraction activities through Phase 2 bond release, **yearly** federally listed fish population studies **shall** be conducted.

C. Fish collections will be conducted **from September through March**. (Limiting the surveys to this time period is designed to avoid potential stress or mortality to the fish during breeding season (April to July), and to avoid the higher stream temperatures of summer which can cause stress to the species during sampling).

D. Federally listed fish population studies conducted outside of this index period will NOT be accepted.

12.B. Sample Reach

A. The fish survey shall include: a) a control reach (upstream of and clearly unaffected by the proposed project area), and b) the remaining length of stream downstream of the proposed project area.

B. All streams shall be partitioned into segments of at least 100 m, not to exceed 300 m, in length for federally listed fish population sampling, unless specified otherwise by KDOW/USFWS.

C. The exact location (latitude and longitude) of the downstream and upstream boundaries of each sampling reach must be recorded on each field data sheet and noting accuracy of the GPS unit, so that future sampling efforts can be duplicated.

D. Each sampling segment will be flagged at the upstream and downstream boundaries.

12.C. Backpack Electrofishing Methods for Federally Listed Fish Population Studies

Population studies for federally listed fish will be conducted using **backpack electroshocking techniques.**

12.C.1. Instrument Calibration

Select the electrofisher settings based on the conductivity of the water. To minimize stress and mortality, it is important to use the minimum amount of electrical energy to stun fish. Select initial voltage setting (150-400 V for high conductivity (>300 µS/cm), 500-800 V for medium conductivity (100 to 300 µS/cm) and 900-1100 V for low conductivity (<100 µS/cm) waters) pulse width (2-6 ms) and pulse frequency (40-60 Hz). Adjust the voltage, pulse width and pulse frequency to efficiently capture fish without inducing excessive stress and mortality.

12.C.2. General Precautions

A. While following these sampling methods, it is important to keep the sampling reach intact and undisturbed.

B. Field personnel shall not walk through the reach until sampling has occurred.

C. If the sampling reach has been disturbed by other activities, sufficient time **must** be allowed for the water to clear and fish to settle back into normal habitats.

D. Electrofishing in turbid water can result in underestimates of fish populations.

E. The experience of the crew and their ability to see and net the fish improves the effectiveness of sampling the reach.
F. Polarized sunglasses are recommended when electrofishing, since they will cut down on the glare of the water.

G. If these conditions are not adequate or practical, sampling needs to be postponed until an efficient sampling effort can be obtained.

H. Upon review of study results of the population study, if KDOW or USFWS determine that the above precautions were not followed, then another fish population survey may be requested.

12.C.3. Types of Collections

To ensure collection of standardized data, stream size (i.e., drainage area) has been used to designate streams into two classes, headwater and wadeable, and a set methodology is outlined for each classification.

A. Headwater streams are streams with a drainage area < 5 mi^2.

B. Wadeable streams are streams with a drainage area $\geq$ 5 mi^2.

12.C.4. Headwater Backpack Electroshocking Technique

A. The sampling crew should consist of a minimum of two members including one qualified fisheries biologist.

B. One individual operates the backpack electrofishing unit while the other(s) work with dip nets to collect fish and carry a bucket.

C. The backpack electrofishing operator should also carry a dip net (Barbour et al. 1999) if using one probe and rat tail configuration.

D. Sampling consists of using a backpack electrofisher unit working in an upstream direction in a side-to-side/bank-to-bank sweeping technique.

E. One pass of the reach is sampled from the downstream end to the upstream end, with all recognizable habitats thoroughly sampled (Barbour et al. 1999).

F. The electrofishing duration within the sample reach should be a minimum of 600 “shocking” seconds to a maximum of 1000 seconds.

G. Crew members with dip nets walk alongside and behind the electrofishing operator to collect stunned fish.

H. Collected fish shall be transferred immediately from dip nets into a bucket of water to lessen stress and mortality.

I. To reduce stress and mortality of any federally listed fish captured, the field crew must process (identify, enumerate, and release) all fish in the bucket as soon as a specific habitat type (i.e. pool or riffle) has been sampled.

J. In addition to identification and enumeration, federally listed fish species age classes shall be determined by taking total length measurements (mm) of all captured individuals. These measurements will be used to prepare a size-frequency histogram.

K. The general health and condition of captured federally listed fish species shall also be assessed.

L. All fish identification, enumeration, measurement and health/condition data shall be recorded in a field logbook on site.

M. As fish are processed, they shall be released into the same habitat and approximate area from which they were captured.

N. Several photographs of federally listed fish species captured shall serve as identification vouchers.

O. All other fish species encountered during a segment should be identified and enumerated. This data and photographs of each species shall be submitted in the annual report.

P. Electrofishing resumes through the next habitat type.

Q. Once all of the habitat types within the reach have been sampled, the electroshocking seconds are recorded in the field logbook in association with the data from the reach.

R. The electroshocking seconds are cleared before the next sampling reach is electroshocked.

12.C.5. Wadeable Backpack Electroshocking Technique

A. The sampling crew should consist of a minimum of two members including one qualified fisheries biologist.

B. One individual operates the backpack electrofishing unit while the other(s) work with dip nets to collect fish and carry a bucket.

C. The backpack electrofishing operator should also carry a dip net (Barbour et al. 1999) if using one probe and rat tail configuration.

D. Sampling consists of using a backpack electrofisher unit working in an upstream direction in a side-to-side/bank-to-bank sweeping technique.

E. One pass of the reach is sampled from the downstream end to the upstream end, with all recognizable habitats thoroughly sampled (Barbour et al. 1999).

F. The electrofishing duration within the sample reach should be a minimum of 600 “shocking” seconds, to a maximum of 1800 shocking seconds. Best professional judgment by the collector is used to determine the appropriate gear and effort for a particular habitat, but a combination of the two methods (seine and electrofisher) must be used. Typically, a reach is thoroughly sampled when no new species are being collected and all habitats have been thoroughly sampled.

G. Crew members with dip nets walk alongside and behind the electrofishing operator to collect stunned fish.

H. Collected fish shall be transferred immediately from dip nets into a bucket of water to lessen stress and mortality.

I. To reduce stress and mortality of any federally listed fish, the field crew must process (identify, enumerate, and release) all fish in the bucket as soon as a specific habitat type (i.e. pool or riffle) has been sampled.

J. In addition to identification and enumeration, federally listed fish species age classes shall be determined by taking total length measurements (mm) of all captured individuals. These measurements will be used to prepare a size-frequency histogram.

K. The general health and condition of captured federally listed fish species shall also be assessed.

L. All fish identification, enumeration, measurement and health/condition data shall be recorded in a field logbook on site.

M. As fish are processed, they shall be released into the same habitat and approximate area from which they were captured.

N. Several photographs of federally listed fish species captured shall serve as identification vouchers.

O. All other fish species encountered during a segment should be identified and enumerated. This data and photographs of each species shall be submitted in the annual report.

P. Electrofishing resumes through the next habitat type.

Q. Once all of the habitat types within the reach have been sampled, the electroshocking seconds are recorded in the field logbook in association with the data from the reach.

R. The electroshocking seconds are cleared before the next sampling reach is electroshocked.

12.D. Data Management

A. Species lists shall be compared to the KDOW master species list to verify proper taxonomic classification of species encountered. The KDOW master species list can be found in Appendix E.

B. Species and number of individuals collected are recorded on data sheets (Appendix F) and used for evaluating species composition, relative abundance, species richness, presence/absence of indicator species and calculation of the community metrics.

C. The occurrence of species that are listed as rare, endangered or threatened by federal or state agencies is also documented, and the appropriate agencies are notified with the Threatened/Endangered Species Report Form (Appendix G).

13. Data Reporting

A. Water chemistry data associated with these provisions must be submitted to the Surface Water Permit Branch of KDOW and USFWS on a quarterly basis.

B. A final report containing a yearly comparison of all past reported data shall be submitted to the Surface Water Permit Branch of KDOW and USFWS. This comparison will include but not limited to water quality data, habitat assessment, federally listed fish population data and macroinvertebrate community assessment. The permittee has one calendar year from the time the last macroinvertebrate sample was collected for that permit to process and analyze

the data that will be included in the annual report. The permittee has 30 days from the time the data is analyzed to submit the annual report to KDOW and USFWS.

C. A final report shall at least consist of the following:

a. a table identifying all in-stream stations by latitude and longitude in decimal degrees and mile point,

b. a table summarizing station water chemistry,

c. a table summarizing station macroinvertebrate index scores,

d. a table summarizing station habitat scores,

e. b, c, and d above can be consolidated into one or two tables,

f. a table summarizing fish population results for each assessment segment,

g. station description section,

h. results section summarizing macroinvertebrate community metrics as compared to conductivity, embeddedness, sediment deposition and total habitat scores and any observations,

i. copies of the field data/habitat assessment sheet with date, time, meter readings and total habitat score,

j. photographs of habitat within the sampling reach,

k. copies of the macroinvertebrate benchsheets,

l. copies of the MBI templates with all stations for each permit*.

* For macroinvertebrates: calculation of the Macroinvertebrate Bioassessment Index (MBI) will be included in the report. The MBI template to be used is titled MBI Template – Genus Species Full Pick Method, located at this website: http://water.ky.gov/permitting/Pages/Mining/.

m. results section summarizing fish population data as compared to conductivity, embeddedness, sediment deposition and total habitat scores,

n. copies of the fish field data sheets with numbers of each fish species per assessment segment and age classes of federally listed species,

o. histograms of federally listed fish age classes and comparisons with previous years,

p. photographs of all fish species collected during the population study,

q. a summary (narrative and charts) of the pebble count results, as well as an electronic copy of the completed Excel Pebble Count Template, and

r. QA/QC results.

D. A hardcopy and an electronic copy of the annual report will be sent to KDOW and USFWS.

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APPENDIX A

Qualifications for an Environmental Biologist Consultant

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COMMONWEALTH OF KENTUCKY

CLASS SPECIFICATION

CLASS TITLE: ENVIRONMENTAL BIOLOGIST CONSULTANT	
TITLE CODE: 3062	**GROUP:** AGRICULTURAL AND ENVIRONMENTAL
SELECTION METHOD: 100% QUAL **REV. 01-04** **NO. OF TEST QUESTIONS:** **SELECTION ID: 7217** **EXAM NO.**	**SALARY: (MIN-MID) $3230.84 - $4280.10** **GRADE: 15** **SPECIAL ENTRANCE RATE: No**
POSITIONS IN THIS CLASS GENERALLY REPORT TO: ENVIRONMENTAL BIOLOGIST IV	
PRIMARY USER AGENCY: ENVIRONMENTAL AND PUBLIC PROTECTION CABINET, TRANSPORTATION CABINET	

CHARACTERISTICS OF THE CLASS: CHARACTERISTICS OF A CLASS ARE GENERAL STATEMENTS INDICATING THE LEVEL OF RESPONSIBILITY AND DISCRETION OF POSITIONS IN THAT JOB CLASSIFICATION.

Coordinates and participates in assessments of environmental quality; determines impacts or potential impacts from point and non-point sources or other natural or man-induced conditions. Provides technical assistance as a specialist in a biological program area(s); and performs other duties as required.

MINIMUM REQUIREMENTS: MINIMUM REQUIREMENTS ARE COMPREHENSIVE STATEMENTS OF THE MINIMUM BACKGROUND AS TO EDUCATION, EXPERIENCE, AND OTHER QUALIFICATIONS WHICH WILL BE REQUIRED IN ALL CASES AS EVIDENCE OF AN APPOINTEE'S ABILITY TO PERFORM THE WORK PROPERLY.

EDUCATION: Graduate of a college or university with a bachelor's degree in a biological, environmental or natural science, which includes at least thirty credit hours in the biological sciences.

EXPERIENCE: Must have three years of professional experience in research, environmental impact assessment or related environmental program areas.

SUBSTITUTION CLAUSE:

EDUCATION: Graduate work in the biological, environmental or natural sciences will substitute for the required experience on a year-for-year basis.

EXPERIENCE: None

SPECIAL REQUIREMENTS: (AGE, LICENSURE, REGULATION, ETC.)

None

EXAMPLES OF DUTIES OR RESPONSIBILITIES OF THE CLASSIFICATION:
EXAMPLES OF DUTIES OR RESPONSIBILITIES ARE NOT TO BE CONSTRUED AS DESCRIBING WHAT THE DUTIES OR RESPONSIBILITIES OF ANY POSITION SHALL BE AND ARE NOT TO BE CONSTRUED AS LIMITING THE APPOINTING AUTHORITY'S ABILITY TO ADD TO, OR OTHERWISE ALTER THE DUTIES AND RESPONSIBILITIES OF A POSITION. THE USE OF AN INDIVIDUAL EXPRESSION OR ILLUSTRATION AS TO DUTIES OR RESPONSIBILITIES SHALL NOT BE REGARDED AS EXCLUDING ASSIGNMENT OF OTHERS NOT MENTIONED WHICH ARE OF SIMILAR KIND OR QUALITY.

Coordinates and participates in the analysis of impacts on the environment from natural or man-induced conditions. Prepares and edits professional and technical reports of assessments. Collects, analyzes and interprets physical, chemical and biological data, both current and historic, pertaining to environmental conditions. Assesses impacts or potential impacts to the environment and biological integrity. Designs, coordinates and performs field and laboratory studies. Performs qualitative and quantitative analyses of biological collections. Performs quality assurance procedures on field and laboratory equipment. Maintains records for quality assurance. Reviews public notices and documents and provides comments and recommendations on impacts or potential impacts to the environment. Attends hearings, meetings, symposia and seminars concerning proposed activities that will affect the environment. Serves as an expert witness in court actions and public hearings. Responds to emergencies as necessary. Trains employees.

TYPICAL WORKING CONDITIONS AND UNIQUE PHYSICAL REQUIREMENTS:
INCUMBENTS IN THIS CLASSIFICATION WILL TYPICALLY PERFORM THEIR PRIMARY JOB DUTIES UNDER THESE CONDITIONS, HOWEVER, THESE CONDITIONS MAY CHANGE ON OCCASION IN PERFORMING THE DUTIES OF AN INDIVIDUAL POSITION.

Work is typically performed in an office setting, laboratory setting and in the field. An incumbent to this class may be subject to changes in temperature and terrain. There is the possibility of exposure to snake and insect bites and the possibility of minor cuts and abrasions due to broken glass and pieces of rusted metal in streams. Hypothermia, electrocution from electro-fishing and exposure to water borne pathogens is possible.

ADDITIONAL REQUIREMENTS:

Applicants and employees in this classification may be required to submit to a drug screening test and background check.

DATE CLASS ESTABLISHED: 05/16/1985	**DATE OF LAST REVISION:** 02/16/2007
THE COMMONWEALTH OF KENTUCKY DOES NOT DISCRIMINATE ON THE BASIS OF RACE, COLOR, RELIGION, NATIONAL ORIGIN, SEX, AGE, DISABILITY, SEXUAL ORIENTATION, GENDER IDENTITY, ANCESTRY OR VETERAN STATUS. REASONABLE ACCOMMODATIONS ARE PROVIDED UPON REQUEST.	

APPENDIX B

High-Gradient Habitat Assessment Sheet

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HIGH-GRADIENT HABITAT ASSESSMENT SHEET

STREAM NAME:	**LOCATION:**
STATION #: **MILE:**	**BASIN:**
GPS Verified: LAT.: **LONG.:**	**COUNTY:**
DATE: **TIME:** ☐AM ☐PM	**INVESTIGATORS:**

Type Sample: ☐ P- Chem ☐ Fish ☐ Macroinvertebrate

P-CHEM Instrument Used: ____ Date Calibrated: _____

Temp(ºC)_____D.O. (mg/l)_____ %Saturation_____ pH(S.U.)_____ Cond._____ Turb._____

Instream Features: Stream Width_____ Maximum Depth_____ Reach Length _____

Shocking Seconds: **Seining Minutes:**

Habitat	**Condition Category**			
Parameter	**Optimal**	**Suboptimal**	**Marginal**	**Poor**
1. Epifaunal Substrate/ Available Cover	Greater than 50% 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., logs/snags that are not new fall and not transient).	30-50% 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 (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% 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
2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; 80% 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
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 the channel substrate is exposed.	Water fill 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
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr.) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 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

7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note – channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.	The bends in the stream increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
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 in 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 ____ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative 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 ____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank 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.
SCORE ____(LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ____(RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score

NOTES/COMMENTS:

APPENDIX C

KDOW Macroinvertebrate Master Taxa List

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KDOW MACROINVERTEBRATE MASTER TAXA LIST

NOTE: A key to feeding groups is at the end of the appendix

Order	Family	FinalID	Tol Val	FFG	Habit
Amphipoda	-	Unid. Amphipod	7.97	CG	
Amphipoda	Crangonyctidae	Crangonyx obliquus richmondensis	8	SH	
Amphipoda	Crangonyctidae	Crangonyx sp	8	SH	
Amphipoda	Crangonyctidae	Stygobromus exilis gp	8	SH	
Amphipoda	Crangonyctidae	Unid. Crangonyctidae sp	8	SH	
Amphipoda	Gammaridae	Gammarus sp	8	CG	
Amphipoda	Talitridae	Hyalella azteca	7.75	CG	
Annelida	-	Unid. Oligochaeta	8.2	CG	
Basommatophora	Physidae	Physella sp	8.84	SC	
Basommatophora	Physidae	Unid. Physidae sp	8.81	SC	
Bryozoa	Pectinatellidae	Pectinatella magnifica	3	CG	
Bryozoa	Plumatellidae	Plumatella emarginata	5	CF	
Bryozoa	Plumatellidae	Plumatella repens	5	CF	
Bryozoa	Plumatellidae	Plumatella sp	5	CF	
Coleoptera	Chrysomelidae	Donacia sp	8	SH	
Coleoptera	Chrysomelidae	Unid. Chrysomelid sp	8	SH	clinger
Coleoptera	Curculionidae	Bagous sp	10	SH	
Coleoptera	Curculionidae	Lixus sp	10	SH	
Coleoptera	Curculionidae	Unid. Curculionid sp	10	SH	
Coleoptera	Dryopidae	Helichus basalis	4.6	SC	clinger
Coleoptera	Dryopidae	Helichus fastigiatus	4.6	SC	clinger
Coleoptera	Dryopidae	Helichus lithophilus	4.6	SC	clinger
Coleoptera	Dryopidae	Helichus sp	4.6	SC	clinger
Coleoptera	Dryopidae	Helichus striatus	4.6	SC	clinger
Coleoptera	Dryopidae	Pelonomus obscurus	5.4	SC	
Coleoptera	Dryopidae	Unid. Dryopid sp	5	SC	
Coleoptera	Dystiscidae	Ilybius sp	9	PR	
Coleoptera	Dystiscidae	Lioporeus sp	9	PR	
Coleoptera	Dyticidae	Unid. Hydroporinid	8	PR	
Coleoptera	Dytiscidae	Acilius semisulcatus	9	PR	
Coleoptera	Dytiscidae	Acilius sp	9	PR	
Coleoptera	Dytiscidae	Agabus ambiguus	8.9	PR	
Coleoptera	Dytiscidae	Agabus disintergratus	8.9	PR	
Coleoptera	Dytiscidae	Agabus gatates	8.9	PR	
Coleoptera	Dytiscidae	Agabus glabrasellus	8.9	PR	
Coleoptera	Dytiscidae	Agabus johannis	8.9	PR	
Coleoptera	Dytiscidae	Agabus johannis	8.9	PR	
Coleoptera	Dytiscidae	Agabus punctatus	8.9	PR	
Coleoptera	Dytiscidae	Agabus sp	8.9	PR	

Order	Family	FinalID	Tol Val	FFG	Habit
Coleoptera	Dytiscidae	Agabus sp. A Epler	8.9	PR	
Coleoptera	Dytiscidae	Agabus staninus	8.9	PR	
Coleoptera	Dytiscidae	Anacaena sp	8.3	PR	
Coleoptera	Dytiscidae	Bidessonotus longovalis	9	PR	
Coleoptera	Dytiscidae	Celina sp	9	PR	
Coleoptera	Dytiscidae	Copelatus glyphicus	9.1	PC	
Coleoptera	Dytiscidae	Copelatus punctulatus		PC	
Coleoptera	Dytiscidae	Copelatus sp	9.1	PC	
Coleoptera	Dytiscidae	Coptotomus interrogatus	9.2	PR	
Coleoptera	Dytiscidae	Coptotomus loticus	9.2	PR	
Coleoptera	Dytiscidae	Coptotomus sp	9.26	PR	
Coleoptera	Dytiscidae	Coptotomus venustus	9.2	PR	
Coleoptera	Dytiscidae	Cybister sp	9.1	PR	
Coleoptera	Dytiscidae	Deronectes sp	4	PR	
Coleoptera	Dytiscidae	Desmopachria convexa	8.9	PR	
Coleoptera	Dytiscidae	Dytiscus carolinus nimbatus	8.9	PR	
Coleoptera	Dytiscidae	Dytiscus hybridus	8	PR	
Coleoptera	Dytiscidae	Dytiscus sp	9.1	PR	
Coleoptera	Dytiscidae	Graphoderus sp	8	PR	
Coleoptera	Dytiscidae	Heterosternuta sp		PR	
Coleoptera	Dytiscidae	Hydaticus sp	9.1	PR	
Coleoptera	Dytiscidae	Hydrochus callosus	9	PR	
Coleoptera	Dytiscidae	Hydrochus sp	6.55	PR	
Coleoptera	Dytiscidae	Hydrocolus sp	8.9	PR	
Coleoptera	Dytiscidae	Hydroporus blanchardi	8.9	PR	
Coleoptera	Dytiscidae	Hydroporus niger		PR	
Coleoptera	Dytiscidae	Hydroporus sp	8.62	PR	
Coleoptera	Dytiscidae	Hydroporus undalatus	8.9	PR	
Coleoptera	Dytiscidae	Hydrovatus platycornis	9	PR	
Coleoptera	Dytiscidae	Hydrovatus sp	10	PR	
Coleoptera	Dytiscidae	Hygrotus nubilis	9	PR	
Coleoptera	Dytiscidae	Hygrotus sp	9	PR	
Coleoptera	Dytiscidae	Ilybius biguttulus	8	PR	
Coleoptera	Dytiscidae	Ilybius oblitus	9.1	PR	
Coleoptera	Dytiscidae	Laccobius agilis	8	PR	
Coleoptera	Dytiscidae	Laccophilus fasciatus	10	PR	
Coleoptera	Dytiscidae	Hygrotus nubilis	9	PR	
Coleoptera	Dytiscidae	Agabus johannis	8.9	PR	
Coleoptera	Dytiscidae	Hygrotus sp	9	PR	
Coleoptera	Dytiscidae	Ilybius biguttulus	8	PR	
Coleoptera	Dytiscidae	Ilybius oblitus	9.1	PR	

Order	Family	FinalID	Tol Val	FFG	Habit
Coleoptera	Dytiscidae	Laccobius agilis	8	PR	
Coleoptera	Dytiscidae	Laccophilus fasciatus	10	PR	
Coleoptera	Dytiscidae	Laccophilus gentilis	10	PR	
Coleoptera	Dytiscidae	Laccophilus maculosus maculosus	10	PR	
Coleoptera	Dytiscidae	Laccophilus schwarzi	10	PR	
Coleoptera	Dytiscidae	Laccophilus sp	10	PR	
Coleoptera	Dytiscidae	Laccophilus vacaensis	9	PR	
Coleoptera	Dytiscidae	Lioporeus pilatei	9	PR	
Coleoptera	Dytiscidae	Lioporeus sp	9	PR	
Coleoptera	Dytiscidae	Lioporeus triangularis	9	PR	
Coleoptera	Dytiscidae	Neoporus carolinus	8.9	PR	
Coleoptera	Dytiscidae	Neoporus clypealis	8.9	PR	
Coleoptera	Dytiscidae	Neoporus dixianus	8.9	PR	
Coleoptera	Dytiscidae	Neoporus hybridus	8.9	PR	
Coleoptera	Dytiscidae	Neoporus mellitus	8.9	PR	
Coleoptera	Dytiscidae	Neoporus mixtus	8.9	PR	
Coleoptera	Dytiscidae	Neoporus psammodytes	8.9	PR	
Coleoptera	Dytiscidae	Neoporus shermani	8.9	PR	
Coleoptera	Dytiscidae	Neoporus sp	8.9	PR	
Coleoptera	Dytiscidae	Neoporus straitopunctatus	8.9	PR	
Coleoptera	Dytiscidae	Neoporus undulatus	8.9	PR	
Coleoptera	Dytiscidae	Neoporus vittatipennis	8.9	PR	
Coleoptera	Dytiscidae	Oredytes sp	9.1	PR	
Coleoptera	Dytiscidae	Rhantus sp	3.61	PR	
Coleoptera	Dytiscidae	Thermonectus basillarus	9	PR	
Coleoptera	Dytiscidae	Unid. Dyticid sp	8	PR	
Coleoptera	Dytiscidae	Uvarus granarius	10	PR	
Coleoptera	Dytiscidae	Uvarus lacustris	10	PR	
Coleoptera	Dytiscidae	Uvarus sp	10	PR	
Coleoptera	Elmidae	Ancyronyx variegatus	6.49	SC	clinger
Coleoptera	Elmidae	Dubiraphia bivittata	5.9	SC	clinger
Coleoptera	Elmidae	Dubiraphia minima	4.05	SC	clinger
Coleoptera	Elmidae	Dubiraphia quadrinotata	5.9	SC	clinger
Coleoptera	Elmidae	Dubiraphia sp	5	SC	clinger
Coleoptera	Elmidae	Dubiraphia vittata	4.05	SC	clinger
Coleoptera	Elmidae	Gonielmis sp		SC	
Coleoptera	Elmidae	Macronychus glabratus	4.58	CG	clinger
Coleoptera	Elmidae	Macronychus sp	4.58	CG	
Coleoptera	Elmidae	Microcylloepus pusillus	2.11	SC	clinger
Coleoptera	Elmidae	Microcylloepus sp	2.11	SC	clinger
Coleoptera	Elmidae	Optioservus immunis	2.36	SC	clinger
Coleoptera	Elmidae	Optioservus ovalis	2.36	SC	clinger

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Coleoptera	Elmidae	Optioservus sp	2.36	SC	clinger
Coleoptera	Elmidae	Optioservus trivittatus	2.36	SC	clinger
Coleoptera	Elmidae	Oulimnius latiusculus	1.78	SC	clinger
Coleoptera	Elmidae	Promoresia elegans	2.15	SC	clinger
Coleoptera	Elmidae	Promoresia sp	2.35	SC	clinger
Coleoptera	Elmidae	Promoresia tardella	0	SC	clinger
Coleoptera	Elmidae	Stenelmis bicarinata	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis concinna	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis crenata	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis decorata	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis humerosa	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis hungerfordi	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis lateralis	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis markeli	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis morsei	5.1	SC	
Coleoptera	Elmidae	Stenelmis musgravei	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis quadrimaculata	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis sandersoni	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis sexlineata	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis sp	5.1	SC	clinger
Coleoptera	Elmidae	Stenelmis vittipennis	5.1	SC	clinger
Coleoptera	Elmidae	Unid. Elmid sp	4.2	SC	clinger
Coleoptera	Gyrinidae	Dineutus assimilis	5.5	PR	
Coleoptera	Gyrinidae	Dineutus ciliatus	5.5	PR	
Coleoptera	Gyrinidae	Dineutus discolor	5.5	PR	
Coleoptera	Gyrinidae	Dineutus emarginatus	5.5	PR	
Coleoptera	Gyrinidae	Dineutus nigrior	5.5	PR	
Coleoptera	Gyrinidae	Dineutus robertsi	5.5	PR	
Coleoptera	Gyrinidae	Dineutus serrulatus	5.5	PR	
Coleoptera	Gyrinidae	Dineutus sp	5.54	PR	
Coleoptera	Gyrinidae	Gyretes iricolor	5.8	PR	
Coleoptera	Gyrinidae	Gyretes sp	5.8	PR	
Coleoptera	Gyrinidae	Gyrinus analis	6.2	PR	
Coleoptera	Gyrinidae	Gyrinus borealis	6.2	PR	
Coleoptera	Gyrinidae	Gyrinus discolor	6.2	PR	
Coleoptera	Gyrinidae	Gyrinus lugens	6.2	PR	
Coleoptera	Gyrinidae	Gyrinus marginellus	6.2	PR	
Coleoptera	Gyrinidae	Gyrinus pachysomus	6.2	PR	
Coleoptera	Gyrinidae	Gyrinus sp	6.17	PR	
Coleoptera	Gyrinidae	Gyrinus woodruffi		PR	
Coleoptera	Gyrinidae	Unid. Gyrinid sp	6	PR	
Coleoptera	Haliplidae	Haliplus fasciatus	8.7	PH	

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Coleoptera	Haliplidae	Haliplus sp	8.71	PH	
Coleoptera	Haliplidae	Haliplus triopsis	8.7	PH	
Coleoptera	Haliplidae	Peltodytes dietrichi	8.7	PH	
Coleoptera	Haliplidae	Peltodytes duodecimpunctatus	8.7	PH	
Coleoptera	Haliplidae	Peltodytes floridensis	8.7	PH	
Coleoptera	Haliplidae	Peltodytes lengi	8.7	PH	
Coleoptera	Haliplidae	Peltodytes muticus	8.7	PH	
Coleoptera	Haliplidae	Peltodytes oppositus	8.7	PH	
Coleoptera	Haliplidae	Peltodytes sexmaculatus	8.7	PH	
Coleoptera	Haliplidae	Peltodytes sp	8.73	PH	
Coleoptera	Helophoridae	Helophorus sp	7.57	SH	
Coleoptera	Hydraenidae	Hydraena sp	5	PR	clinger
Coleoptera	Hydrophilidae	Anacaena limbata	8.3	PR	
Coleoptera	Hydrophilidae	Berosus aculeatus	8.43	PH	
Coleoptera	Hydrophilidae	Berosus acuminatus	8.43	PH	
Coleoptera	Hydrophilidae	Berosus exiguus	8.43	PH	
Coleoptera	Hydrophilidae	Berosus ordinatus	8.43	PH	
Coleoptera	Hydrophilidae	Berosus pantherinus	8.43	PH	
Coleoptera	Hydrophilidae	Berosus peregrinus	8.43	PH	
Coleoptera	Hydrophilidae	Berosus sp	8.43	PH	
Coleoptera	Hydrophilidae	Berosus striatus	8.43	PH	
Coleoptera	Hydrophilidae	Berosus youngi	8.43	PH	
Coleoptera	Hydrophilidae	Cercyon sp		PR	
Coleoptera	Hydrophilidae	Colymbetes sp		PR	swimmer
Coleoptera	Hydrophilidae	Cymbiodyta chamberlaini		PR	burrower
Coleoptera	Hydrophilidae	Cymbiodyta sp	8.3	PR	
Coleoptera	Hydrophilidae	Cymbiodyta vindicta	8.3	PR	
Coleoptera	Hydrophilidae	Derallus altus	9	PR	
Coleoptera	Hydrophilidae	Derallus sp	9	PR	
Coleoptera	Hydrophilidae	Enochrus hamiltoni	8.75	PR	
Coleoptera	Hydrophilidae	Enochrus ochraceus	8.75	PH	
Coleoptera	Hydrophilidae	Enochrus pygmaeus nebulosus	8.75	PR	
Coleoptera	Hydrophilidae	Enochrus sayi	8.75	PR	
Coleoptera	Hydrophilidae	Enochrus sp	8.75	PR	
Coleoptera	Hydrophilidae	Helobata sp		CG	
Coleoptera	Hydrophilidae	Helochares maculicollis	8.3	PR	
Coleoptera	Hydrophilidae	Helochares sp	8.3	PR	
Coleoptera	Hydrophilidae	Helocombus bifidus	8.5	CG	
Coleoptera	Hydrophilidae	Helocombus sp	8.5	CG	
Coleoptera	Hydrophilidae	Hydrobiomorpha sp			climber
Coleoptera	Hydrophilidae	Hydrobius molaenus	8.3	PH	

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Coleoptera	Hydrophilidae	Hydrobius sp	8.3	PH	
Coleoptera	Hydrophilidae	Hydrobius tumidus	8.3	PH	
Coleoptera	Hydrophilidae	Hydrochara sp	8.3	PR	
Coleoptera	Hydrophilidae	Hydrophilus sp		PR	
Coleoptera	Hydrophilidae	Hydrophilus triangularis	8.3	PR	
Coleoptera	Hydrophilidae	Laccobius sp	7.32	PR	
Coleoptera	Hydrophilidae	Paracymus sp	8	PR	
Coleoptera	Hydrophilidae	Paracymus subcupreus	3.5	PR	
Coleoptera	Hydrophilidae	Sperchopsis tesselatta	6.5		
Coleoptera	Hydrophilidae	Tropisternus blatchleyi blatchleyi	9.7	CG	
Coleoptera	Hydrophilidae	Tropisternus collaris	9.7	CG	
Coleoptera	Hydrophilidae	Tropisternus lateralis nimbatus	9.7	CG	
Coleoptera	Hydrophilidae	Tropisternus mixtus	9.7	CG	
Coleoptera	Hydrophilidae	Tropisternus natator	9.7	CG	
Coleoptera	Hydrophilidae	Tropisternus sp	9.68	CG	
Coleoptera	Hydrophilidae	Unid. Hydrophilid sp	6.3	PR	
Coleoptera	Limnichidae	Lutrochus laticeps	5	SC	clinger
Coleoptera	Noteridae	Hydrocanthus atripennis	6.9	PR	
Coleoptera	Noteridae	Hydrocanthus iricolor	6.9	PR	
Coleoptera	Noteridae	Hydrocanthus sp	6.9	PR	
Coleoptera	Noteridae	Suphisellus sp	7	CG	
Coleoptera	Psephenidae	Ectopria nervosa	4.16	SC	clinger
Coleoptera	Psephenidae	Psephenus herricki	2.35	SC	clinger
Coleoptera	Psephenidae	Unid. Psephenidae sp	3.56	SC	
Coleoptera	Ptilodactylidae	Anchytarsus bicolor	3.64	SH	clinger
Coleoptera	Scirtidae	Cyphon sp	5	SC	
Coleoptera	Scirtidae	Elodes sp	5	SC	
Coleoptera	Scirtidae	Prionocyphon sp	5	SC	
Coleoptera	Scirtidae	Scirtes sp	5	SH	
Coleoptera	Scirtidae	Unid. Scirtid sp	5	SH	
Coleoptera	Staphylinidae	Micralymma sp	8	PR	
Coleoptera	Staphylinidae	Thinobius sp		PR	
Collembola	Entomobryidae	Unid. Entomobryid sp			
Collembola	Isotomidae	Folsomia sp	5	CG	
Collembola	Isotomidae	Isotoma sp	5	CG	
Collembola	Isotomidae	Isotomurus sp	5	CG	
Collembola	Isotomidae	Unid. Isotomid sp		CG	
Collembola	Sminthuridae	Unid. Sminthurid sp			
Decapoda	Cambaridae	Barbicambarus cornutus	4.6	CG	
Decapoda	Cambaridae	Cambarus bartonii cavatus	4.59	CG	
Decapoda	Cambaridae	Cambarus batchi	4.9	CG	

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Decapoda	Cambaridae	Cambarus buntingi	4.9	CG	
Decapoda	Cambaridae	Cambarus cumberlandensis	4.14	CG	
Decapoda	Cambaridae	Cambarus diogenes	7.52	CG	
Decapoda	Cambaridae	Cambarus distans	3.88	CG	
Decapoda	Cambaridae	Cambarus dubius		CG	
Decapoda	Cambaridae	Cambarus friaufi	4.9	CG	
Decapoda	Cambaridae	Cambarus graysoni	4.9	CG	
Decapoda	Cambaridae	Cambarus ortmanni	6.15	CG	
Decapoda	Cambaridae	Cambarus parvoculus	3.24	CG	
Decapoda	Cambaridae	Cambarus polychromatus	4.9	CG	
Decapoda	Cambaridae	Cambarus robustus	4.9	CG	
Decapoda	Cambaridae	Cambarus rusticiformis	3.97	CG	
Decapoda	Cambaridae	Cambarus sciotensis	6.36	CG	
Decapoda	Cambaridae	Cambarus sp	4.9	CG	
Decapoda	Cambaridae	Cambarus sphenoides	4.9	CG	
Decapoda	Cambaridae	Cambarus striatus	4.9	CG	
Decapoda	Cambaridae	Cambarus tenebrosus	6.45	CG	
Decapoda	Cambaridae	Cambarus veteranus	4.9	CG	
Decapoda	Cambaridae	Fallicambarus fodiens	7	CG	
Decapoda	Cambaridae	Orconectes australis australis	5.49	CG	
Decapoda	Cambaridae	Orconectes australis packardi	5.49	CG	
Decapoda	Cambaridae	Orconectes barrenensis	5.49	CG	
Decapoda	Cambaridae	Orconectes bisectus	5.49	CG	
Decapoda	Cambaridae	Orconectes burri	4.92	CG	
Decapoda	Cambaridae	Orconectes compressus	5.49	CG	
Decapoda	Cambaridae	Orconectes cristavarius	5.47	SC	
Decapoda	Cambaridae	Orconectes durelli	5.49	CG	
Decapoda	Cambaridae	Orconectes immunis	5.49	CG	
Decapoda	Cambaridae	Orconectes jeffersoni	5.49	CG	
Decapoda	Cambaridae	Orconectes juvenilis	5.99	CG	
Decapoda	Cambaridae	Orconectes kentuckiensis	5.49	CG	
Decapoda	Cambaridae	Orconectes palmeri palmeri	5.49	CG	
Decapoda	Cambaridae	Orconectes pellucidus	5.49	CG	
Decapoda	Cambaridae	Orconectes placidus	5.49	CG	
Decapoda	Cambaridae	Orconectes putnami	5.49	CG	
Decapoda	Cambaridae	Orconectes rafinesquei	5.49	CG	
Decapoda	Cambaridae	Orconectes rusticus	5.92	CG	
Decapoda	Cambaridae	Orconectes sanborni sanborni	6.54	CG	
Decapoda	Cambaridae	Orconectes sp	5.49	CG	
Decapoda	Cambaridae	Orconectes tricuspis	5.49	CG	
Decapoda	Cambaridae	Procambarus acutus acutus	7.02	CG	
Decapoda	Cambaridae	Procambarus clarkii	7.02	CG	

Order	Family	FinalID	Tol Val	FFG	Habit
Decapoda	Cambaridae	Procambarus sp	7.02	CG	
Decapoda	Cambaridae	Unid. Cambarid sp	6	OM	
Decapoda	Palaemonidae	Palaemonetes kadiakensis	5	CG	
Decapoda	Palaemonidae	Palaemonetes sp	7.1	CG	
Diptera	Athericidae	Atherix sp	2.1	PR	
Diptera	Ceratopogonidae	Alluaudomyia sp	6.8	PR	
Diptera	Ceratopogonidae	Atrichopogon sp	6.49	PR	
Diptera	Ceratopogonidae	Bezzia sp	6.9	PR	
Diptera	Ceratopogonidae	Bezzia/Palpomyia gp	6.9	PR	
Diptera	Ceratopogonidae	Ceratopogon sp	6.8	PR	
Diptera	Ceratopogonidae	Culicoides sp	7.7	PR	
Diptera	Ceratopogonidae	Dasyhelea sp	6.7	CG	
Diptera	Ceratopogonidae	Forcipomyia sp	6.8	SC	
Diptera	Ceratopogonidae	Isohelea sp	6.8	PR	
Diptera	Ceratopogonidae	Monohelea sp	6.8	PR	
Diptera	Ceratopogonidae	Palpomyia sp	6.86	PR	
Diptera	Ceratopogonidae	Palpomyia/Sphaeromias gp	6.9	PR	
Diptera	Ceratopogonidae	Probezzia sp	6.9	PR	
Diptera	Ceratopogonidae	Serromyia sp		PR	
Diptera	Ceratopogonidae	Sphaeromias sp	6.9	PR	
Diptera	Ceratopogonidae	Stilobezzia sp	6.9	PR	
Diptera	Ceratopogonidae	Unid. Ceratopogonid sp	6.7	PR	
Diptera	Chaoboridae	Chaoborus punctipennis	8.5	PR	
Diptera	Chaoboridae	Chaoborus sp	8.5	PR	
Diptera	Chaoboridae	Eucorethra underwoodi	8	PR	
Diptera	Chironomidae	Ablabesmyia (Karelia) sp	7.2	PR	
Diptera	Chironomidae	Ablabesmyia annulata	2.04	PR	
Diptera	Chironomidae	Ablabesmyia janta	6	PR	
Diptera	Chironomidae	Ablabesmyia mallochi	7.19	PR	
Diptera	Chironomidae	Ablabesmyia parajanta	7.37	PR	
Diptera	Chironomidae	Ablabesmyia peleensis	9.67	PR	
Diptera	Chironomidae	Ablabesmyia rhamphe	7.5	PR	
Diptera	Chironomidae	Ablabesmyia simpsoni	4	PR	
Diptera	Chironomidae	Ablabesmyia sp	7.2	PR	
Diptera	Chironomidae	Apedilum sp		CG	
Diptera	Chironomidae	Apsectrotanypus sp	0	PR	
Diptera	Chironomidae	Axarus sp	7	CG	
Diptera	Chironomidae	Brillia flavifrons	5.18	SH	
Diptera	Chironomidae	Brillia parva	5.18	SH	
Diptera	Chironomidae	Brillia sera	5.18	SH	
Diptera	Chironomidae	Brillia sp	5.18	SH	

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Diptera	Chironomidae	Cardiocladius albiplumus	6.2	PR	clinger
Diptera	Chironomidae	Cardiocladius obscurus	6.2	PR	clinger
Diptera	Chironomidae	Cardiocladius sp	5.87	PR	clinger
Diptera	Chironomidae	Chaetocladius sp		CG	sprawler
Diptera	Chironomidae	Chironomus cf Florida (Epler)	7	CG	burrower
Diptera	Chironomidae	Chironomus crassicaudatus	9.6	CG	
Diptera	Chironomidae	Chironomus decorus gp	9.6	CG	
Diptera	Chironomidae	Chironomus longipes	10	CG	burrower
Diptera	Chironomidae	Chironomus plumosus	9.6	CG	
Diptera	Chironomidae	Chironomus riparius	9.6	CG	
Diptera	Chironomidae	Chironomus sp	9.63	CG	
Diptera	Chironomidae	Chironomus staegeri		SH	
Diptera	Chironomidae	Chironomus stigmaterus	9.6	CG	
Diptera	Chironomidae	Cladopelma sp	3.49	CG	
Diptera	Chironomidae	Cladotanytarsus sp	4.09	CG	
Diptera	Chironomidae	Cladotanytarsus sp C. (Epler)	4	CG	
Diptera	Chironomidae	Clinotanypus pinguis	8.74	PR	
Diptera	Chironomidae	Clinotanypus sp	8.74	PR	
Diptera	Chironomidae	Coelotanypus scapularis	6.2	PR	
Diptera	Chironomidae	Coelotanypus sp	8	PR	
Diptera	Chironomidae	Conchapelopia aleta	8.7	PR	
Diptera	Chironomidae	Conchapelopia sp	8.7	PR	
Diptera	Chironomidae	Conchapelopia/Helopelopia sp	7.5	PR	
Diptera	Chironomidae	Constempellina sp	4.2	CG	
Diptera	Chironomidae	Corynoneura sp	6.01	CG	
Diptera	Chironomidae	Corynoneura sp B (Epler)		CG	
Diptera	Chironomidae	Corynoneura sp C (Epler)	6.2	CG	
Diptera	Chironomidae	Corynoneura sp E (Epler)	6.2	CG	
Diptera	Chironomidae	Corynoneura taris	6.2	CG	
Diptera	Chironomidae	Cricotopus absurdus	5	CG	
Diptera	Chironomidae	Cricotopus annulator	7	SH	clinger
Diptera	Chironomidae	Cricotopus annulator complex	7	SH	
Diptera	Chironomidae	Cricotopus bicinctus gp	8.54	SH	
Diptera	Chironomidae	Cricotopus cylindraceus	2.28	CG	
Diptera	Chironomidae	Cricotopus sp	7	SH	
Diptera	Chironomidae	Cricotopus sp 2 (Beck)	7.7	SH	clinger
Diptera	Chironomidae	Cricotopus sp Ozarks	7	CG	sprawler
Diptera	Chironomidae	Cricotopus sylvestris gp	10	SH	clinger
Diptera	Chironomidae	Cricotopus triannulatus	7	SH	clinger
Diptera	Chironomidae	Cricotopus trifascia	2.84	SH	clinger
Diptera	Chironomidae	Cricotopus trifasciatus	7	SH	clinger
Diptera	Chironomidae	Cricotopus vierriensis	4.35	SH	clinger

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Diptera	Chironomidae	Cricotopus/Orthocladius gp	7.1	CG	
Diptera	Chironomidae	Cryptochironomus sp	6.4	PR	
Diptera	Chironomidae	Cryptotendipes sp	6.19	CG	
Diptera	Chironomidae	Demicryptochironomus sp	2.12	CG	
Diptera	Chironomidae	Diamesa sp	8.12	CG	clinger
Diptera	Chironomidae	Diamesa sp.B (Epler)		CG	
Diptera	Chironomidae	Dicrotendipes fumidus	7.9	CG	
Diptera	Chironomidae	Dicrotendipes leucocelis	7.9	CG	
Diptera	Chironomidae	Dicrotendipes lucifer	7.95	CG	
Diptera	Chironomidae	Dicrotendipes modestus	8.73	CG	
Diptera	Chironomidae	Dicrotendipes neomodestus	8.1	CG	
Diptera	Chironomidae	Dicrotendipes nervosus	9.76	CG	
Diptera	Chironomidae	Dicrotendipes simpsoni	9.95	CG	
Diptera	Chironomidae	Dicrotendipes sp	8.1	CG	
Diptera	Chironomidae	Diplocladius sp	7	CG	
Diptera	Chironomidae	Djalmabatista pulcher	9.3	PR	
Diptera	Chironomidae	Einfeldia sp	7.08	CG	
Diptera	Chironomidae	Endochironomus nigricans	7.79	SH	clinger
Diptera	Chironomidae	Endochironomus sp	7.8	SH	
Diptera	Chironomidae	Endochironomus subtendens	7.8	SH	
Diptera	Chironomidae	Endotribelos sp		CG	
Diptera	Chironomidae	Epoicocladius #3 (Jacobsen)	0.1	OT	
Diptera	Chironomidae	Epoicocladius sp	2	CG	
Diptera	Chironomidae	Eukiefferiella brehmi gp	2.72	CG	
Diptera	Chironomidae	Eukiefferiella brevicalcar gp	2.23	CG	
Diptera	Chironomidae	Eukiefferiella claripennis gp	5.58	CG	
Diptera	Chironomidae	Eukiefferiella corulescens gp (Epler)	2.2	CG	
Diptera	Chironomidae	Eukiefferiella devonica gp	2.59	CG	
Diptera	Chironomidae	Eukiefferiella devonica gp B (Epler)	2.6	CG	
Diptera	Chironomidae	Eukiefferiella gracei gp	3.44	CG	
Diptera	Chironomidae	Eukiefferiella pseudomontana	4	CG	
Diptera	Chironomidae	Eukiefferiella sp	3.4	CG	
Diptera	Chironomidae	Eukiefferiella tirolensis		CG	
Diptera	Chironomidae	Euryhapsis sp		CG	
Diptera	Chironomidae	Glyptotendipes barbipes	9.4	SH	
Diptera	Chironomidae	Glyptotendipes lobiferus	9.4	SH	
Diptera	Chironomidae	Glyptotendipes meridionalis	9.4	SH	
Diptera	Chironomidae	Glyptotendipes paripes	9.4	SH	
Diptera	Chironomidae	Glyptotendipes sp	9.4	SH	
Diptera	Chironomidae	Glyptotendipes sp B (Epler)	9.4	SH	
Diptera	Chironomidae	Glyptotendipes sp.F (Epler)	9.4	SH	
Diptera	Chironomidae	Glyptotendipes sp	7	SH	burrower

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Diptera	Chironomidae	Goeldichironomus holoprasinus	10	CG	
Diptera	Chironomidae	Guttipelopia sp	6.3	PR	
Diptera	Chironomidae	Harnischia curtilamellata	9	CG	
Diptera	Chironomidae	Harnischia sp	9.07	CG	
Diptera	Chironomidae	Hayesomyia senata		PR	
Diptera	Chironomidae	Hayesomyia sp	6.2	PR	
Diptera	Chironomidae	Heleniella sp	0	CG	clinger
Diptera	Chironomidae	Helopelopia sp	6.2	PR	
Diptera	Chironomidae	Heterotrissocladius marcidus	5.4	CG	
Diptera	Chironomidae	Heterotrissocladius sp	5.23	CG	
Diptera	Chironomidae	Hydrobaenus pilipes	9.5	SC	
Diptera	Chironomidae	Hydrobaenus sp	9.54	SC	
Diptera	Chironomidae	Kiefferulus dux	0	CG	
Diptera	Chironomidae	Krenopelopia sp	6.2	PR	
Diptera	Chironomidae	Krenosmittia sp	0	CG	
Diptera	Chironomidae	Labrundinia becki	5.9	PR	
Diptera	Chironomidae	Labrundinia maculata	6	PR	
Diptera	Chironomidae	Labrundinia pilosella	5.91	PR	
Diptera	Chironomidae	Labrundinia sp		PR	
Diptera	Chironomidae	Labrundinia virescens	4.33	PR	
Diptera	Chironomidae	Larsia decolorata	8.3	PR	
Diptera	Chironomidae	Larsia indistincta	8.3	PR	
Diptera	Chironomidae	Larsia sp	9.3	PR	
Diptera	Chironomidae	Limnophyes sp		CG	
Diptera	Chironomidae	Lopescladius sp	1.67	CG	
Diptera	Chironomidae	Macropelopia sp		PR	
Diptera	Chironomidae	Meropelopia americana	6.2	CG	
Diptera	Chironomidae	Meropelopia sp	6.2	CG	
Diptera	Chironomidae	Mesocricotopus sp		CG	
Diptera	Chironomidae	Mesosmittia sp		CG	
Diptera	Chironomidae	Micropsectra polita	1.4	CG	clinger
Diptera	Chironomidae	Micropsectra sp	1.52	CG	clinger
Diptera	Chironomidae	Micropsectra sp.E (Epler)		CG	
Diptera	Chironomidae	Microtendipes pedellus gp	5.5	CF	clinger
Diptera	Chironomidae	Microtendipes rydalensis gp	5.5	CF	
Diptera	Chironomidae	Microtendipes sp	5.5	CF	
Diptera	Chironomidae	Monodiamesa bathyphila	7.9	CG	
Diptera	Chironomidae	Monodiamesa sp	5	CG	sprawler
Diptera	Chironomidae	Monopelopia sp	6.2	PR	
Diptera	Chironomidae	Nanocladius alternantherae	7	CG	
Diptera	Chironomidae	Nanocladius branchicolus	5	OT	
Diptera	Chironomidae	Nanocladius distinctus	7.2	CG	

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Diptera	Chironomidae	Nanocladius downesi	2.45	CG	
Diptera	Chironomidae	Nanocladius rectinervis	7.1	CG	
Diptera	Chironomidae	Nanocladius sp	7.07	CG	
Diptera	Chironomidae	Nanocladius sp.5 (Epler)	7.2	CG	sprawler
Diptera	Chironomidae	Nanocladius spiniplenus	7.2	CG	
Diptera	Chironomidae	Natarsia baltimoreus	10	PR	
Diptera	Chironomidae	Natarsia sp	9.95	PR	
Diptera	Chironomidae	Natarsia sp A (Epler)	10	PR	
Diptera	Chironomidae	Neozavrelia sp	3	CG	climber
Diptera	Chironomidae	Nilotanypus americanus	3	PR	
Diptera	Chironomidae	Nilotanypus fimbriatus	4	PR	
Diptera	Chironomidae	Nilotanypus sp	3.9	PR	
Diptera	Chironomidae	Nilothauma babyi	5.5	CG	
Diptera	Chironomidae	Nilothauma sp	5.03	CG	
Diptera	Chironomidae	Orthocladius annectens	9.2	CG	
Diptera	Chironomidae	Orthocladius carlatus	6.4	CG	
Diptera	Chironomidae	Orthocladius dentifer	7	CG	spraw/bur
Diptera	Chironomidae	Orthocladius dorenus	6.7	CG	
Diptera	Chironomidae	Orthocladius dubitatus	9.1	CG	
Diptera	Chironomidae	Orthocladius lignicola	3	CG	
Diptera	Chironomidae	Orthocladius mallochi	9.2	CG	
Diptera	Chironomidae	Orthocladius nigritus	0.9	CG	
Diptera	Chironomidae	Orthocladius obumbratus	8.8	CG	
Diptera	Chironomidae	Orthocladius oliveri	6.4	CG	
Diptera	Chironomidae	Orthocladius rivulorum	3	CG	clinger
Diptera	Chironomidae	Orthocladius robacki	6.62	CG	
Diptera	Chironomidae	Orthocladius rubicundus	5.7	CG	sprawler
Diptera	Chironomidae	Orthocladius sp	7.3	CG	
Diptera	Chironomidae	Pagastia sp	1.77	CG	
Diptera	Chironomidae	Pagastiella sp	2.2	CG	
Diptera	Chironomidae	Paraboreochlis sp		CG	
Diptera	Chironomidae	Parachaetocladius abnobaeus	6.7	CG	
Diptera	Chironomidae	Parachaetocladius sp	0	CG	
Diptera	Chironomidae	Parachironomus abortivus	8.32	PR	
Diptera	Chironomidae	Parachironomus carinatus	9.42	CG	
Diptera	Chironomidae	Parachironomus directus	9.42	PR	
Diptera	Chironomidae	Parachironomus frequens	9.42	PR	
Diptera	Chironomidae	Parachironomus hirtalatus	9.42	PR	
Diptera	Chironomidae	Parachironomus pectinatellae	6.45	PR	
Diptera	Chironomidae	Parachironomus schneideri	8.86	PR	
Diptera	Chironomidae	Parachironomus tenuicaudata gp	5.4	CG	

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Diptera	Chironomidae	Parachironomus sp	9.42	PR	
Diptera	Chironomidae	Paracladopelma neries	0.9	CG	
Diptera	Chironomidae	Paracladopelma sp	5.51	CG	
Diptera	Chironomidae	Paracladopelma undine	4.9	CG	
Diptera	Chironomidae	Paracricotopus sp	4.7	CG	
Diptera	Chironomidae	Parakiefferiella sp	5.4	CG	
Diptera	Chironomidae	Parakiefferiella sp A (Epler)	5	CG	
Diptera	Chironomidae	Paralauterborniella nigrohalteralis	4.77	CG	clinger
Diptera	Chironomidae	Paramerina cf anomalum	5	PR	sprawler
Diptera	Chironomidae	Paramerina sp	4.29	PR	
Diptera	Chironomidae	Parametriocnemus lundbecki	3.65	CG	
Diptera	Chironomidae	Parametriocnemus sp	3.65	CG	clinger
Diptera	Chironomidae	Paraphaenocladius exagitans		CG	
Diptera	Chironomidae	Paratanytarsus dissimilis	8.45	CG	
Diptera	Chironomidae	Paratanytarsus sp	8.45	CG	clinger
Diptera	Chironomidae	Paratendipes albimanus	9.2	CG	clinger
Diptera	Chironomidae	Paratendipes sp	5.11	CG	
Diptera	Chironomidae	Paratrichocladius sp		CG	
Diptera	Chironomidae	Pentaneura sp	4.7	PR	
Diptera	Chironomidae	Pentaneurella sp		PR	
Diptera	Chironomidae	Phaenopsectra flavipes	7.94	SC	clinger
Diptera	Chironomidae	Phaenopsectra obediens gp	6.8	SC	clinger
Diptera	Chironomidae	Phaenopsectra punctipes gp	6	CG	clinger
Diptera	Chironomidae	Phaenopsectra sp	6.5	SC	clinger
Diptera	Chironomidae	Phaenopsectra/Tribelos sp	6.8	CG	clinger
Diptera	Chironomidae	Platysmitia sp	4	CG	clinger
Diptera	Chironomidae	Platysmittia fimbriata		CG	
Diptera	Chironomidae	Polypedilum aviceps	3.65	SH	clinger
Diptera	Chironomidae	Polypedilum bergi	7	SC	clinger
Diptera	Chironomidae	Polypedilum braseniae	6.1	SH	
Diptera	Chironomidae	Polypedilum fallax	6.39	SH	clinger
Diptera	Chironomidae	Polypedilum fallax gp	6.39	SH	clinger
Diptera	Chironomidae	Polypedilum flavum	5.3	SH	clinger
Diptera	Chironomidae	Polypedilum halterale	7.31	SH	clinger
Diptera	Chironomidae	Polypedilum illinoense	9	SH	clinger
Diptera	Chironomidae	Polypedilum laetum	1.37	SH	clinger
Diptera	Chironomidae	Polypedilum ontario	6.8	SH	
Diptera	Chironomidae	Polypedilum scalaenum gp	8.4	SH	clinger
Diptera	Chironomidae	Polypedilum simulans/digitifer	6.8	SH	clinger
Diptera	Chironomidae	Polypedilum sp	6.8	SH	clinger
Diptera	Chironomidae	Polypedilum sp C (Epler)	6.8	SH	clinger

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Diptera	Chironomidae	Polypedilum trigonus	6.8	CG	clinger
Diptera	Chironomidae	Polypedilum tritum	6.8	SH	clinger
Diptera	Chironomidae	Potthastia longimanus	6.46	CG	
Diptera	Chironomidae	Potthastia sp	6.4	CG	
Diptera	Chironomidae	Procladius bellus	9.3	PR	
Diptera	Chironomidae	Procladius sp	9.1	PR	
Diptera	Chironomidae	Procladius sublettei	9.3	PR	
Diptera	Chironomidae	Psectrocladius psilopterus gp	3.8	CG	
Diptera	Chironomidae	Psectrocladius simulans		CG	
Diptera	Chironomidae	Psectrocladius sp	3.59	CG	
Diptera	Chironomidae	Psectrotanypus dyari	10	PR	
Diptera	Chironomidae	Psectrotanypus sp	0	PR	
Diptera	Chironomidae	Pseudochironomus sp	5.36	CG	
Diptera	Chironomidae	Pseudorthocladius sp	1.51	CG	
Diptera	Chironomidae	Pseudosmittia sp	6	CG	
Diptera	Chironomidae	Psilometriocnemus sp		CG	
Diptera	Chironomidae	Rheocricotopus pauciseta	6.8	CG	
Diptera	Chironomidae	Rheocricotopus robacki	7.28	CG	
Diptera	Chironomidae	Rheocricotopus sp	7.3	CG	
Diptera	Chironomidae	Rheocricotopus tuberculatus		CG	
Diptera	Chironomidae	Rheocricotopus unidentatus		CG	
Diptera	Chironomidae	Rheopelopia paramaculipennis		CG	
Diptera	Chironomidae	Rheopelopia sp		PR	
Diptera	Chironomidae	Rheosmittia sp	7	CG	
Diptera	Chironomidae	Rheotanytarsus exiguus gp	6.4	CF	clinger
Diptera	Chironomidae	Rheotanytarsus pellucidus	5.89	CG	
Diptera	Chironomidae	Rheotanytarsus sp	6.4	CF	clinger
Diptera	Chironomidae	Robakia demeijerei	3.74	CG	clinger
Diptera	Chironomidae	Saetheria sp 1 (Epler)	4	CG	
Diptera	Chironomidae	Saetheria tylus	7.07	CG	
Diptera	Chironomidae	Smittia sp	6	CG	
Diptera	Chironomidae	Stelechomyia perpulchra	5.02	SH	
Diptera	Chironomidae	Stempellina sp	0	CG	clinger
Diptera	Chironomidae	Stempellina sp A (Epler)	0	CG	clinger
Diptera	Chironomidae	Stempellinella cf leptocelloides	4	CG	clinger
Diptera	Chironomidae	Stempellinella sp	4.62	CG	clinger
Diptera	Chironomidae	Stempellinella sp A (Epler)	3	CG	sprawler
Diptera	Chironomidae	Stenochironomus hilaris	6.4	CG	
Diptera	Chironomidae	Stenochironomus sp	6.45	CG	
Diptera	Chironomidae	Stictochironomus devinctus	6.5	CG	
Diptera	Chironomidae	Stictochironomus sp	6.52	CG	
Diptera	Chironomidae	Stilocladius sp	5	CG	

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Diptera	Chironomidae	Sublettea sp	7	CF	
Diptera	Chironomidae	Symposiocladius sp	5.4	CG	
Diptera	Chironomidae	Sympotthastia sp	5.09	CG	
Diptera	Chironomidae	Sympotthastia spinifera	5.7	CG	
Diptera	Chironomidae	Sympotthastia zarreli		CG	sprawler
Diptera	Chironomidae	Syndiamesa sp	5.1	CG	
Diptera	Chironomidae	Synorthocladius semivirens	4.7	CG	
Diptera	Chironomidae	Synorthocladius sp	4	SC	
Diptera	Chironomidae	Tanypus carinatus	9.2	PR	
Diptera	Chironomidae	Tanypus neopunctipennis	9.2	PR	
Diptera	Chironomidae	Tanypus punctipennis	9.2	PR	
Diptera	Chironomidae	Tanypus sp	9.19	PR	
Diptera	Chironomidae	Tanypus stellatus	9.2	PR	
Diptera	Chironomidae	Tanytarsus sp	6.7	CF	clinger
Diptera	Chironomidae	Tanytarsus sp A (Epler)	7	CG	sprawler
Diptera	Chironomidae	Tanytarsus sp C (Epler)		CG	clinger
Diptera	Chironomidae	Tanytarsus sp D (Epler)	6	CG	
Diptera	Chironomidae	Tanytarsus sp E (Epler)		CG	clinger
Diptera	Chironomidae	Tanytarsus sp G (Epler)	6.7	CG	clinger
Diptera	Chironomidae	Tanytarsus sp L (Epler)		CG	clinger
Diptera	Chironomidae	Tanytarsus sp M (Epler)		CG	clinger
Diptera	Chrionomidae	Tanytarsus sp. N (Epler)	6.7	CF	clinger
Diptera	Chironomidae	Tanytarsus sp P (Epler)		CG	clinger
Diptera	Chironomidae	Tanytarsus sp S (Epler)		CG	clinger
Diptera	Chironomidae	Tanytarsus sp T (Epler)	6.7	CF	clinger
Diptera	Chironomidae	Tanytarsus sp U (Epler)	7	CG	clinger
Diptera	Chironomidae	Thienemanniella similis	5.86	CG	
Diptera	Chironomidae	Thienemanniella sp	5.86	CG	
Diptera	Chironomidae	Thienemanniella sp B (Epler)	5.9	CG	
Diptera	Chironomidae	Thienemanniella xena	5.9	CG	
Diptera	Chironomidae	Thienemannimyia sp	5.9	PR	
Diptera	Chironomidae	Tribelos atrum	6.3	CG	
Diptera	Chironomidae	Tribelos fuscicorne	6.3	CG	
Diptera	Chironomidae	Tribelos jucundum	6.3	CG	
Diptera	Chironomidae	Tribelos sp	6.31	CG	
Diptera	Chironomidae	Tribelos/Phaenopsectra gp	6.6	CG	
Diptera	Chironomidae	Trissopelopia ogemawi	5	PR	
Diptera	Chironomidae	Tvetenia bavarica gp	3.65	CG	
Diptera	Chironomidae	Tvetenia discoloripes gp	3.61	CG	
Diptera	Chironomidae	Tvetenia paucunca	3.65	CG	
Diptera	Chironomidae	Tvetenia sp	3.6	CG	
Diptera	Chironomidae	Tvetenia vitracies	4	CG	

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Diptera	Chironomidae	Unid. Chironomid sp	7	CG	
Diptera	Chironomidae	Unid. Diamesinae sp		CG	clinger
Diptera	Chironomidae	Unid. Orthoclad sp	7	CG	
Diptera	Chironomidae	Unid. Podonominae sp		CG	
Diptera	Chironomidae	Unid. Tanypodinae sp	6.2	PR	
Diptera	Chironomidae	Xenochironomus sp	7	PR	
Diptera	Chironomidae	Xenochironomus xenolabis	7.1	PR	
Diptera	Chironomidae	Xestochironomus sp		OM	
Diptera	Chironomidae	Xylotopus par	5.99	SH	
Diptera	Chironomidae	Zalutschia sp	5	SC	
Diptera	Chironomidae	Zavrelia sp	5.3	CG	
Diptera	Chironomidae	Zavrelimyia sinuosa complex	9.1	PR	
Diptera	Chironomidae	Zavrelimyia sp	9.11	PR	
Diptera	Chironomidae	Zavrelimyia thryptica complex	9.1	PR	
Diptera	Corethrellidae	Corethrella sp	5	PR	
Diptera	Culicidae	Aedes sp	9.4	CG	
Diptera	Culicidae	Anopheles sp	8.58	CG	
Diptera	Culicidae	Culex sp	10	CF	
Diptera	Culicidae	Culex sp	10	CF	
Diptera	Culicidae	Unid. Culicidae sp	9	FC	
Diptera	Dixidae	Dixa sp	2.55	CG	
Diptera	Dixidae	Dixella sp	5	PR	
Diptera	Dolichopodidae	Unid. Dolichopodid sp	5	PR	
Diptera	Empididae	Chelifera sp	8.1	PR	
Diptera	Empididae	Clinocera sp	8.1	PR	clinger
Diptera	Empididae	Hemerodromia sp	8.1	PR	
Diptera	Empididae	Trichoclinocera sp		PR	
Diptera	Empididae	Unid. Empidid sp	8.1	PR	
Diptera	Ephydridae	Brachydeutera sp	9	CG	
Diptera	Ephydridae	Ephydra sp	9	SH	
Diptera	Ephydridae	Hydrellia sp	8	SH	
Diptera	Ephydridae	Scatella sp	9	CG	
Diptera	Ephydridae	Setacera sp	9	SH	sprawler
Diptera	Ephydridae	Unid. Ephydrid sp	9	SH	
Diptera	Muscidae	Limnophora sp	8.4	PR	
Diptera	Muscidae	Unid. Muscid sp	8		
Diptera	Psychodidae	Maruina sp	10	SC	
Diptera	Psychodidae	Pericoma sp	10	CG	
Diptera	Psychodidae	Psychoda alternata	9.9	CG	
Diptera	Psychodidae	Psychoda sp	9.9	CG	
Diptera	Ptychopteridae	Bittacomorpha sp	7	CG	
Diptera	Ptychopteridae	Ptychoptera sp	7	CG	

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Diptera	Sciaridae	Unid. Sciarid sp	5	SH	
Diptera	Sciomyzidae	Sepedon sp	6	PR	
Diptera	Sciomyzidae	Unid. Sciomyzid sp	6	PR	
Diptera	Simuliidae	Cnephia sp	4	CF	clinger
Diptera	Simuliidae	Prosimulium sp	4.01	CF	clinger
Diptera	Simuliidae	Simulium sp	4.4	CF	clinger
Diptera	Simuliidae	Unid. Simuliid sp	4.6	CF	clinger
Diptera	Stratiomyidae	Allognosta sp	10	CG	
Diptera	Stratiomyidae	Caloparyphus sp	10	CG	
Diptera	Stratiomyidae	Myxosargus sp	10	CG	
Diptera	Stratiomyidae	Odontomyia cinacta		CG	
Diptera	Stratiomyidae	Odontomyia sp	10	CG	
Diptera	Stratiomyidae	Oxycera sp	10	SC	
Diptera	Stratiomyidae	Stratiomys sp	8.08	CG	
Diptera	Stratiomyidae	Unid. Stratiomyidae sp	9.68	CG	
Diptera	Syrphidae	Chrysogaster sp	10	CG	
Diptera	Tabanidae	Chlorotabanus sp	9	PR	
Diptera	Tabanidae	Chrysops furcatus	6.7	PR	
Diptera	Tabanidae	Chrysops sp	6.73	PR	
Diptera	Tabanidae	Haematopota sp	8	PR	
Diptera	Tabanidae	Hybomitra sp	5	PR	sprawler/ burrower
Diptera	Tabanidae	Tabanus reinwardtii	9.2	PR	
Diptera	Tabanidae	Tabanus sp	9.22	PR	
Diptera	Tabanidae	Tabanus/Whitneyomyia/ Atylotus sp	9.2	PR	
Diptera	Tabanidae	Unid. Tabanid sp	8.6	PR	
Diptera	Tanyderidae	Protoplasa fitchii	4.33	PR	
Diptera	Tipulidae	Antocha saxicola	4.25	PR	clinger
Diptera	Tipulidae	Antocha sp	4.25	PR	clinger
Diptera	Tipulidae	Cryptolabis sp	4.9	SH	
Diptera	Tipulidae	Dicranota sp	0	PR	
Diptera	Tipulidae	Dolichopeza sp	5.5	CG	
Diptera	Tipulidae	Erioptera sp	5	PR	
Diptera	Tipulidae	Gonomyia sp	5		
Diptera	Tipulidae	Helius sp	5.3	CG	
Diptera	Tipulidae	Hexatoma longicornis	4.31	PR	
Diptera	Tipulidae	Hexatoma sp	4.31	PR	
Diptera	Tipulidae	Limnophila macrocera	4.9	PR	
Diptera	Tipulidae	Limnophila sp	4.9	PR	
Diptera	Tipulidae	Limonia sp	9.64	SC	
Diptera	Tipulidae	Lipsothrix sp	1	CG	miner
Diptera	Tipulidae	Molophilus sp	5	SH	
Diptera	Tipulidae	Ormosia sp	4.9	CG	

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Diptera	Tipulidae	Pedicia sp	4.9	PR	
Diptera	Tipulidae	Pilaria sp	4.9	PR	
Diptera	Tipulidae	Prionocera sp	4.9	SH	
Diptera	Tipulidae	Pseudolimnophila sp	7.22	PR	
Diptera	Tipulidae	Tipula sp	7.3	SH	
Diptera	Tipulidae	Unid. Tipulid sp	5	CG	
Ephemeroptera	Ameletidae	Ameletus lineatus	2.38	SC	
Ephemeroptera	Ameletidae	Ameletus sp	2.38	SC	
Ephemeroptera	Ameletidae	Unid. Ameletid sp	2	SC	
Ephemeroptera	Baetidae	Acentrella sp	3.6	CG	
Ephemeroptera	Baetidae	Acentrella turbida	3.6	CG	
Ephemeroptera	Baetidae	Acerpenna macdunnoughi	5.4	CG	
Ephemeroptera	Baetidae	Acerpenna pygmaea	3.88	CG	
Ephemeroptera	Baetidae	Acerpenna sp	5	CG	
Ephemeroptera	Baetidae	Baetis brunneicolor	5.4	CG	
Ephemeroptera	Baetidae	Baetis flavistriga	6.58	CG	
Ephemeroptera	Baetidae	Baetis intercalaris	4.99	CG	
Ephemeroptera	Baetidae	Baetis pluto	4.28	CG	
Ephemeroptera	Baetidae	Baetis sp	5.4	CG	
Ephemeroptera	Baetidae	Baetis tricaudatus	1.63	CG	
Ephemeroptera	Baetidae	Callibaetis pretiosus	9.84	CG	
Ephemeroptera	Baetidae	Callibaetis sp	9.84	CG	
Ephemeroptera	Baetidae	Centroptilum sp	6.6	CG	
Ephemeroptera	Baetidae	Centroptilum vividocularis	6.6	CG	
Ephemeroptera	Baetidae	Cloeon sp	7.4	CG	
Ephemeroptera	Baetidae	Diphetor hageni	1.62	CG	
Ephemeroptera	Baetidae	Fallceon quilleri	5.4	CG	
Ephemeroptera	Baetidae	Fallceon sp	5.4	CG	
Ephemeroptera	Baetidae	Heterocloeon amplum	3.61	CG	
Ephemeroptera	Baetidae	Heterocloeon curiosum	3.5	CG	
Ephemeroptera	Baetidae	Heterocloeon frivolus	3.6	CG	
Ephemeroptera	Baetidae	Paracloeodes minutum	8.3	SC	
Ephemeroptera	Baetidae	Paracloeodes sp	8.3	SC	
Ephemeroptera	Baetidae	Plauditus dubius	5.4	CG	
Ephemeroptera	Baetidae	Plauditus sp	5.4	CG	
Ephemeroptera	Baetidae	Procloeon sp	5	CG	
Ephemeroptera	Baetidae	Pseudocentroptiloides sp	5	CG	
Ephemeroptera	Baetidae	Pseudocloeon ephippiatus	3.7	CG	
Ephemeroptera	Baetidae	Pseudocloeon frondalis	7.4	CG	
Ephemeroptera	Baetidae	Pseudocloeon longipalpus	5.6	CG	
Ephemeroptera	Baetidae	Pseudocloeon propinquus	5.7	CG	
Ephemeroptera	Baetidae	Pseudocloeon sp	4.02	CG	

Order	Family	FinalID	Tol Val	FFG	Habit
Ephemeroptera	Baetidae	Unid. Baetid sp	5	CG	
Ephemeroptera	Baetiscidae	Baetisca berneri	2.02	SC	
Ephemeroptera	Baetiscidae	Baetisca gibbera	1.43	SC	
Ephemeroptera	Baetiscidae	Baetisca lacustris	1	SC	
Ephemeroptera	Baetiscidae	Baetisca sp	2.1	SC	
Ephemeroptera	Caenidae	Brachycercus sp	3.01	CG	
Ephemeroptera	Caenidae	Caenis amica	7.41	CG	
Ephemeroptera	Caenidae	Caenis anceps	7.41	CG	
Ephemeroptera	Caenidae	Caenis diminuta	7.4	CG	
Ephemeroptera	Caenidae	Caenis hilaris	7.4	CG	
Ephemeroptera	Caenidae	Caenis latipennis	7.4	CG	
Ephemeroptera	Caenidae	Caenis macafferti	7.4	CG	
Ephemeroptera	Caenidae	Caenis punctata	7.4	CG	
Ephemeroptera	Caenidae	Caenis sp	7.41	CG	
Ephemeroptera	Caenidae	Caenis tardata	7.4	CG	
Ephemeroptera	Caenidae	Cercobrachys sp	1	CG	
Ephemeroptera	Caenidae	Unid. Caenid sp	7.6	CG	
Ephemeroptera	Ephemerellidae	Attenella attenuata	1.56	CG	clinger
Ephemeroptera	Ephemerellidae	Attenella sp	1.56	CG	clinger
Ephemeroptera	Ephemerellidae	Drunella cornutella	0	SC	clinger
Ephemeroptera	Ephemerellidae	Drunella lata	0	SC	clinger
Ephemeroptera	Ephemerellidae	Drunella longicornis	0.7	SC	clinger
Ephemeroptera	Ephemerellidae	Drunella sp	0.7	SC	clinger
Ephemeroptera	Ephemerellidae	Drunella walkeri	0.98	SC	clinger
Ephemeroptera	Ephemerellidae	Ephemerella argo	1.7	CG	clinger
Ephemeroptera	Ephemerellidae	Ephemerella catawba	4.4	CG	clinger
Ephemeroptera	Ephemerellidae	Ephemerella crenula	1.7	CG	clinger
Ephemeroptera	Ephemerellidae	Ephemerella dorothea	1.7	CG	clinger
Ephemeroptera	Ephemerellidae	Ephemerella hispida	0.84	CG	clinger
Ephemeroptera	Ephemerellidae	Ephemerella inconstans	1.7	CG	clinger
Ephemeroptera	Ephemerellidae	Ephemerella needhami	0	CG	clinger
Ephemeroptera	Ephemerellidae	Ephemerella rotunda	2.6	CG	clinger
Ephemeroptera	Ephemerellidae	Ephemerella septentrionalis	2	CG	clinger
Ephemeroptera	Ephemerellidae	Ephemerella sp	2.04	CG	clinger
Ephemeroptera	Ephemerellidae	Ephemerella subvaria	0	CG	clinger
Ephemeroptera	Ephemerellidae	Eurylophella bicolor	4.86	CG	clinger
Ephemeroptera	Ephemerellidae	Eurylophella funeralis	2.05	CG	clinger
Ephemeroptera	Ephemerellidae	Eurylophella sp	4.34	CG	clinger
Ephemeroptera	Ephemerellidae	Eurylophella temporalis	4.32	CG	clinger
Ephemeroptera	Ephemerellidae	Eurylophella verisimilis	0.31	CG	clinger
Ephemeroptera	Ephemerellidae	Serratella deficiens	2.75	CG	clinger
Ephemeroptera	Ephemerellidae	Serratella serrata	1.88	CG	clinger

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Ephemeroptera	Ephemerellidae	Serratella sordida	1.7	CG	clinger
Ephemeroptera	Ephemerellidae	Serratella sp	2.7	CG	clinger
Ephemeroptera	Ephemerellidae	Serratella spiculosa	2.7	CG	clinger
Ephemeroptera	Ephemerellidae	Timpanoga lita	0	CG	clinger
Ephemeroptera	Ephemerellidae	Timpanoga simplex	3.9	CG	clinger
Ephemeroptera	Ephemerellidae	Timpanoga sp	2	CG	clinger
Ephemeroptera	Ephemerellidae	Unid. Ephemerellid sp	1	CG	clinger
Ephemeroptera	Ephemeridae	Ephemera blanda		CG	burrower
Ephemeroptera	Ephemeridae	Ephemera guttulata	0	CG	
Ephemeroptera	Ephemeridae	Ephemera simulans	2.2	CG	
Ephemeroptera	Ephemeridae	Ephemera sp	1.1	CG	
Ephemeroptera	Ephemeridae	Ephemera varians	2.2	CG	
Ephemeroptera	Ephemeridae	Hexagenia sp	4.9	CG	
Ephemeroptera	Heptageniidae	Cinygmula sp	0	SC	clinger
Ephemeroptera	Heptageniidae	Epeorus dispar	1.03	SC	clinger
Ephemeroptera	Heptageniidae	Epeorus rubidus	1.22	SC	clinger
Ephemeroptera	Heptageniidae	Epeorus sp	1.27	SC	clinger
Ephemeroptera	Heptageniidae	Heptagenia julia	0	SC	clinger
Ephemeroptera	Heptageniidae	Heptagenia marginalis	2.26	SC	clinger
Ephemeroptera	Heptageniidae	Heptagenia pulla	1.94	SC	clinger
Ephemeroptera	Heptageniidae	Heptagenia sp	2.57	SC	clinger
Ephemeroptera	Heptageniidae	Leucrocuta aphrodite	2.42	SC	clinger
Ephemeroptera	Heptageniidae	Leucrocuta hebe	2.8	SC	clinger
Ephemeroptera	Heptageniidae	Leucrocuta juno	2.8	SC	clinger
Ephemeroptera	Heptageniidae	Leucrocuta maculipennis	2.8	SC	clinger
Ephemeroptera	Heptageniidae	Leucrocuta sp	2.4	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium bednariki	5	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium carlsoni	2.08	SC	
Ephemeroptera	Heptageniidae	Maccaffertium exiguum	3.83	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium integrum	5.75	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium ithaca	3.58	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium mediopunctatum	3.77	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium meririvulanum	0.13	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium modestum	5.5	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium pudicum	2.01	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium pulchellum	4.1	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium sp	4.1	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium terminatum	4.1	SC	clinger
Ephemeroptera	Heptageniidae	Maccaffertium vicarium	1.26	SC	clinger
Ephemeroptera	Heptageniidae	Nixe sp		CG	clinger
Ephemeroptera	Heptageniidae	Rhithrogena amica	0.3	SC	clinger
Ephemeroptera	Heptageniidae	Stenacron candidum	4	CG	clinger
Ephemeroptera	Heptageniidae	Stenacron carolina	1.14	CG	clinger
Ephemeroptera	Heptageniidae	Stenacron gildersleevi	2.5	SC	clinger
Ephemeroptera	Heptageniidae	Stenacron interpunctatum	6.87	CG	clinger

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Ephemeroptera	Heptageniidae	Stenacron minnetonka	4	CG	clinger
Ephemeroptera	Heptageniidae	Stenacron pallidum	2.72	SC	clinger
Ephemeroptera	Heptageniidae	Stenacron sp	4	CG	clinger
Ephemeroptera	Heptageniidae	Stenonema femoratum	7.18	SC	clinger
Ephemeroptera	Heptageniidae	Unid. Heptageniid sp	3.2	SC	clinger
Ephemeroptera	Isonychiidae	Isonychia sp	3.45	CF	
Ephemeroptera	Leptophlebiidae	Choroterpes sp	2.3	SC	clinger
Ephemeroptera	Leptophlebiidae	Habrophlebia sp	0.5	SC	
Ephemeroptera	Leptophlebiidae	Habrophlebiodes sp	2.3	SC	
Ephemeroptera	Leptophlebiidae	Leptophlebia sp	6.23	CG	
Ephemeroptera	Leptophlebiidae	Paraleptophlebia debilis	0.9	CG	
Ephemeroptera	Leptophlebiidae	Paraleptophlebia sp	0.94	CG	clinger
Ephemeroptera	Leptophlebiidae	Unid. Leptophlebiid sp	3.3	CG	
Ephemeroptera	Neoephemeridae	Neoemphemera purpurea	1.57	CG	
Ephemeroptera	Palingeniidae	Pentagenia sp	5	CG	
Ephemeroptera	Polymitarcydae	Ephoron sp		CG	
Ephemeroptera	Polymitarcyidae	Ephoron album	2	CG	
Ephemeroptera	Polymitarcyidae	Ephoron leukon	1.32	CG	
Ephemeroptera	Potamanthidae	Anthopotamus myops	1.6	CG	
Ephemeroptera	Potamanthidae	Anthopotamus sp	1.6	CG	
Ephemeroptera	Potamanthidae	Anthopotamus verticis	1.6	CG	
Ephemeroptera	Siphlonuridae	Siphlonurus sp	5.81	CG	
Ephemeroptera	Tricorythidae	Tricorythodes sp	5.06	CG	
Gnathobdellida	Hirudinidae	Haemopis grandis	8.2	PC	
Gnathobdellida	Hirudinidae	Haemopis marmorata	8.2	PC	
Gnathobdellida	Hirudinidae	Unid. Hirudinea sp	8.2	PC	
Gordioidea	Gordiidae	Gordius sp	5	OT	
Gordioidea	Gordiidae	Unid. Gordiidae sp	5	OT	
Gordioidea	Parachordodidae	Paragordius sp	5.9	OT	
Haplosclerina	Spongillidae	Spongilla sp	3	CF	
Haplosclerina	Spongillidae	Unid. Spongillid sp	3	CF	
Haplotaxida	Enchytraeidae	Enchytraeus sp	10	CG	
Haplotaxida	Enchytraeidae	Unid. Enchytraeid sp	10	CG	
Haplotaxida	Lumbricidae	Haplotaxis sp	9	CG	
Haplotaxida	Lumbricidae	Unid. Lumbricid sp	5	CG	
Haplotaxida	Naididae	Arcteonais lomondi	8	CG	
Haplotaxida	Naididae	Aulodrilus pigueti	5.52	CG	
Haplotaxida	Naididae	Aulodrilus pleuriseta	5	CG	
Haplotaxida	Naididae	Aulodrilus sp	5.5	CG	
Haplotaxida	Naididae	Branchiura sowerbyi	8.28	CG	
Haplotaxida	Naididae	Bratislavia unidentata	9	CG	
Haplotaxida	Naididae	Chaetogaster sp	6	CG	

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Haplotaxida	Naididae	Dero digitata	10	CG	
Haplotaxida	Naididae	Dero furcata	9	CG	
Haplotaxida	Naididae	Dero nivea	10	CG	
Haplotaxida	Naididae	Dero sp	9	CG	
Haplotaxida	Naididae	Dero trifida	8	CG	
Haplotaxida	Naididae	Haemonais waldvogeli	9.5	CG	
Haplotaxida	Naididae	Ilylodrilus templetoni	9.26	CG	
Haplotaxida	Naididae	Limnodrilus cervix	9	CG	
Haplotaxida	Naididae	Limnodrilus claparedeianus	9.6	CG	
Haplotaxida	Naididae	Limnodrilus hoffmeisteri	9.47	CG	
Haplotaxida	Naididae	Limnodrilus maumeensis	9	CG	
Haplotaxida	Naididae	Limnodrilus rubripenis		CG	
Haplotaxida	Naididae	Limnodrilus sp	9.5	CG	
Haplotaxida	Naididae	Limnodrilus ukedemianus	9.49	CG	
Haplotaxida	Naididae	Nais barbata	5	CG	
Haplotaxida	Naididae	Nais bretscheri	8	CG	
Haplotaxida	Naididae	Nais communis	8.81	CG	
Haplotaxida	Naididae	Nais simplex	8.8	CG	
Haplotaxida	Naididae	Nais sp	8.88	CG	
Haplotaxida	Naididae	Nais variabilis	8.9	CG	
Haplotaxida	Naididae	Ophidonais serpentina	7.5	CG	
Haplotaxida	Naididae	Pristina aequiseta	9	CG	
Haplotaxida	Naididae	Pristina jenkinae		CG	
Haplotaxida	Naididae	Pristina leidyi	9	CG	
Haplotaxida	Naididae	Pristina longeseta		CG	
Haplotaxida	Naididae	Pristina longidentata	8	CG	
Haplotaxida	Naididae	Pristina longisoma	7.74	CG	
Haplotaxida	Naididae	Pristina osborni	8	CG	
Haplotaxida	Naididae	Pristina sp	9.56	CG	
Haplotaxida	Naididae	Pristina synclites	8	CG	
Haplotaxida	Naididae	Ripistes parasita	2	CG	
Haplotaxida	Naididae	Slavina appendiculata	7.06	CG	
Haplotaxida	Naididae	Slavina sp	7	CG	
Haplotaxida	Naididae	Spirosperma ferox	7.7	CG	
Haplotaxida	Naididae	Stephensoniana trivandrana	9.1	CG	
Haplotaxida	Naididae	Stylaria fossularis	8.5	CG	
Haplotaxida	Naididae	Stylaria lacustris	8.5	CG	
Haplotaxida	Naididae	Stylaria sp	8.5	CG	
Haplotaxida	Naididae	Tubifex sp	10	CG	
Haplotaxida	Naididae	Tubifex tubifex	10	CG	
Haplotaxida	Naididae	UIW/OCS sp	9	CG	
Haplotaxida	Naididae	UIWCS sp	9	CG	

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Haplotaxida	Naididae	Uncinais uncinata		CG	
Haplotaxida	Naididae	Unid. Naidid sp	9.1	CG	
Hemiptera	Belostomatidae	Belostoma flumineum	9.8	PR	
Hemiptera	Belostomatidae	Belostoma lutarium	9.8	PR	
Hemiptera	Belostomatidae	Belostoma sp	9.8	PR	
Hemiptera	Belostomatidae	Unid. Belostomatid sp	10	PR	
Hemiptera	Corixidae	Corixini sp	9	PH	
Hemiptera	Corixidae	Hesperocorixa brimleyi	9	PH	
Hemiptera	Corixidae	Hesperocorixa sp	9	PH	
Hemiptera	Corixidae	Palmacorixa sp	9	PH	
Hemiptera	Corixidae	Sagara sp	9	PH	
Hemiptera	Corixidae	Sigara modesta	9	PH	
Hemiptera	Corixidae	Sigara sp	9.06	PH	
Hemiptera	Corixidae	Sigara variabilis	9	PH	
Hemiptera	Corixidae	Trichocorixa sp	9	PR	
Hemiptera	Corixidae	Unid. Corixid sp	9	PH	
Hemiptera	Gelastocoridae	Gelastocoris oculatus	9	PR	
Hemiptera	Gelastocoridae	Gelastocoris sp		PR	
Hemiptera	Gerridae	Aquarius remigeris		PR	
Hemiptera	Gerridae	Aquarius sp		PR	
Hemiptera	Gerridae	Gerris conformis	9	PR	
Hemiptera	Gerridae	Gerris marginatus	9	PR	
Hemiptera	Gerridae	Gerris nebularis	9	PR	
Hemiptera	Gerridae	Gerris remigis	9	PR	
Hemiptera	Gerridae	Gerris sp	9	PR	
Hemiptera	Gerridae	Limnoporus canaliculatus	9	PR	
Hemiptera	Gerridae	Limnoporus sp	9	PR	
Hemiptera	Gerridae	Metrobates hesperius	9	PR	
Hemiptera	Gerridae	Metrobates sp	9	PR	
Hemiptera	Gerridae	Neogerris sp	9	PR	
Hemiptera	Gerridae	Rheumatobates rileyi	9	PR	
Hemiptera	Gerridae	Rheumatobates sp	9	PR	
Hemiptera	Gerridae	Rheumatobates tenuipes	9	PR	
Hemiptera	Gerridae	Trepobates imermis	9	PR	
Hemiptera	Gerridae	Trepobates pictus	9	PR	
Hemiptera	Gerridae	Trepobates sp	9	PR	
Hemiptera	Gerridae	Trepobates subnitidus	9	PR	
Hemiptera	Gerridae	Unid. Gerrid sp	9	PR	
Hemiptera	Hebridae	Hebrus sp		PR	skimmer
Hemiptera	Hebridae	Merragata sp	10	PR	
Hemiptera	Hydrometridae	Hydrometra australis	9	PR	
Hemiptera	Hydrometridae	Hydrometra hungerfordi	9	PR	

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Hemiptera	Hydrometridae	Hydrometra martini	9	PR	
Hemiptera	Hydrometridae	Hydrometra sp	9	PR	
Hemiptera	Hydrometridae	Hydrometra wileyae	9	PR	
Hemiptera	Mesoveliidae	Mesovelia amoena	9.8	PR	
Hemiptera	Mesoveliidae	Mesovelia cryptophila	9.8	PR	
Hemiptera	Mesoveliidae	Mesovelia mulsanti	9.8	PR	
Hemiptera	Mesoveliidae	Mesovelia sp	9.8	PR	
Hemiptera	Nepidae	Nepa apiculata	9	PR	
Hemiptera	Nepidae	Nepa sp	9	PR	
Hemiptera	Nepidae	Ranatra australis	7.8	PR	
Hemiptera	Nepidae	Ranatra buenoi	7.8	PR	
Hemiptera	Nepidae	Ranatra fusca	7.8	PR	
Hemiptera	Nepidae	Ranatra kirkaldyi	7.8	PR	
Hemiptera	Nepidae	Ranatra nigra	7.8	PR	
Hemiptera	Nepidae	Ranatra sp	7.82	PR	
Hemiptera	Notonectidae	Notonecta irrorata	9	PR	
Hemiptera	Notonectidae	Notonecta rahleighi	9	PR	
Hemiptera	Notonectidae	Notonecta sp	8.71	PR	
Hemiptera	Notonectidae	Unid. Notonectidae sp	9	PR	
Hemiptera	Pleidae	Neoplea sp	9	PR	
Hemiptera	Pleidae	Neoplea striola	9	PR	
Hemiptera	Pleidae	Paraplea sp	9	PR	
Hemiptera	Saldidae	Pentacora sp		PR	
Hemiptera	Veliidae	Microvelia americana	9	PR	
Hemiptera	Veliidae	Microvelia paludicola	9	PR	
Hemiptera	Veliidae	Microvelia sp	9	PR	
Hemiptera	Veliidae	Rhagovelia obesa	9	PR	
Hemiptera	Veliidae	Rhagovelia sp	9	PR	
Hemiptera	Veliidae	Steinovelia sp	9	PR	
Hemiptera	Veliidae	Unid. Veliid sp	9	PR	
Heterodonta	Sphaeriidae	Musculium lacustre	7.7	CF	
Heterodonta	Sphaeriidae	Musculium partumeium	7.7	CF	
Heterodonta	Sphaeriidae	Musculium securis	7.7	CF	
Heterodonta	Sphaeriidae	Musculium sp	7.7	CF	
Heterodonta	Sphaeriidae	Musculium transversum	7.7	CF	
Heterodonta	Sphaeriidae	Pisidium dubium	6.5	CF	
Heterodonta	Sphaeriidae	Pisidium fallax	6.5	CF	
Heterodonta	Sphaeriidae	Pisidium sp	6.48	CF	
Heterodonta	Sphaeriidae	Sphaerium fabale	7.6	CF	
Heterodonta	Sphaeriidae	Sphaerium occidentale	7.6	CF	
Heterodonta	Sphaeriidae	Sphaerium rhomboideum	7.6	CF	
Heterodonta	Sphaeriidae	Sphaerium sexmaculatus	7.6	CF	

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Heterodonta	Sphaeriidae	Sphaerium simile	7.6	CF	
Heterodonta	Sphaeriidae	Sphaerium sp	7.58	CF	
Heterodonta	Sphaeriidae	Sphaerium striatinum	7.6	CF	
Heterodonta	Sphaeriidae	Unid. Sphaerriid sp		CF	
Hoplonemertea	Prostomidae	Prostoma sp	6.14	PR	clinger
Hydracarina	Hydrachnidae	Unid. Hydracarina (mite) sp	5.5	PR	
Hydroida	Hydridae	Hydra sp	5	CG	
Isopoda	Asellidae	Caecidotea sp	9.11	CG	
Isopoda	Asellidae	Lirceus fontinalis	7.85	CG	
Isopoda	Asellidae	Lirceus sp	7.85	CG	
Isopoda	Asellidae	Unid. Asellid sp	8	CG	
Isopoda	Asellidae	Unid. Isopoda sp	8	CG	
Lepidoptera	Nepticulidae	Nepticula sp			
Lepidoptera	Noctuidae	Archanara sp	5	SH	
Lepidoptera	Noctuidae	Simyra sp		SH	climber
Lepidoptera	Pyralidae	Acentria sp		SH	
Lepidoptera	Pyralidae	Crambus sp	5	SH	
Lepidoptera	Pyralidae	Munroessa gyralis	5	SH	
Lepidoptera	Pyralidae	Munroessa/Synclita sp		SH	
Lepidoptera	Pyralidae	Parapoynx obscuralis	1	SH	clinger
Lepidoptera	Pyralidae	Parapoynx sp	3	SH	climber
Lepidoptera	Pyralidae	Petrophila confusalis	1.8	SC	clinger
Lepidoptera	Pyralidae	Petrophila fulicalis	1.8	SC	clinger
Lepidoptera	Pyralidae	Petrophila sp	1.8	SH	clinger
Lepidoptera	Pyralidae	Unid. Pyralid sp	8	SH	
Lepidoptera	Tortricidae	Archips sp		SH	burrower/ climber
Lumbriculida	Lumbriculidae	Eclipidrilus palustris		CG	
Lumbriculida	Lumbriculidae	Eclipidrilus sp	7.3	CG	
Lumbriculida	Lumbriculidae	Lumbriculus sp	7.3	CG	
Lumbriculida	Lumbriculidae	Lumbriculus variegatus	7.3	CG	
Lumbriculida	Lumbriculidae	Unid. Lumbricid sp	7.3	CG	
Lumbriculida	Lumbriculidae	Unid. Lumbriculid sp	7.3	CG	
Lymnophila	Ancylidae	Ferrissia fragilis	6.55	SC	
Lymnophila	Ancylidae	Ferrissia rivularis	6.55	SC	
Lymnophila	Ancylidae	Ferrissia sp	6.55	SC	
Lymnophila	Ancylidae	Laevapex fuscus	7.49	SC	
Lymnophila	Ancylidae	Laevapex sp	7.5	SC	
Lymnophila	Ancylidae	Unid. Ancylid sp	5	SC	
Lymnophila	Lymnaeidae	Fossaria sp	7	SC	
Lymnophila	Lymnaeidae	Lymnaea sp	7	SC	
Lymnophila	Lymnaeidae	Pseudosuccinea columella	7.65	SC	

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Lymnophila	Lymnaeidae	Radix auricularia	8.5	SC	
Lymnophila	Lymnaeidae	Stagnicola sp	8.22	SC	
Lymnophila	Lymnaeidae	Unid. Lymnaeid sp	7	SC	
Lymnophila	Planorbidae	Gyraulus parvus	7.5	SC	
Lymnophila	Planorbidae	Gyraulus sp	7.5	SC	
Lymnophila	Planorbidae	Helisoma anceps anceps	6.23	SC	
Lymnophila	Planorbidae	Helisoma sp	6.2	SC	
Lymnophila	Planorbidae	Helisoma trivolis	6.2	SC	
Lymnophila	Planorbidae	Micromenetus dilatatus	8.23	SC	
Lymnophila	Planorbidae	Micromenetus sp		SC	
Lymnophila	Planorbidae	Planorbella sp	6.82	SC	
Lymnophila	Planorbidae	Planorbula sp	6.8	SC	
Lymnophila	Planorbidae	Promenetus exacuous	7.5	SC	
Lymnophila	Planorbidae	Promenetus sp	7.5	SC	
Lymnophila	Planorbidae	Unid. Planorbid sp	7	SC	
Megaloptera	Corydalidae	Chauloides pecticornis	9.55	PR	clinger
Megaloptera	Corydalidae	Chauloides pectinicornis	9.55	PR	clinger
Megaloptera	Corydalidae	Chauloides rastricornis	8.42	PR	clinger
Megaloptera	Corydalidae	Chauloides sp	9.17	PR	clinger
Megaloptera	Corydalidae	Corydalus cornutus	5.16	PR	clinger
Megaloptera	Corydalidae	Nigronia fasciatus	5.55	PR	clinger
Megaloptera	Corydalidae	Nigronia serricornis	4.95	PR	clinger
Megaloptera	Corydalidae	Nigronia sp	5.3	PR	clinger
Megaloptera	Corydalidae	Unid. Corydalid sp	6	PR	
Megaloptera	Sialidae	Sialis aequalis	7.2	PR	burrower
Megaloptera	Sialidae	Sialis americana	7.2	PR	burrower
Megaloptera	Sialidae	Sialis infumata	7.2	PR	
Megaloptera	Sialidae	Sialis iola	7.2	PR	burrower
Megaloptera	Sialidae	Sialis itasca	7.2	PR	burrower
Megaloptera	Sialidae	Sialis mohri	7.2	PR	burrower
Megaloptera	Sialidae	Sialis sp	7.17	PR	burrower
Megaloptera	Sialidae	Sialis vagans	7.2	PR	burrower
Megaloptera	Sialidae	Sialis velata	7.2	PR	burrower
Megaloptera	Sialidae	Unid. Sialid sp	8	PR	
Mesogastropoda	Hydrobiidae	Amnicola sp	5.2	SC	
Mesogastropoda	Hydrobiidae	Cincinnatia integra	5.7	SC	
Mesogastropoda	Hydrobiidae	Somatogyrus integra	6.5	SC	
Mesogastropoda	Hydrobiidae	Somatogyrus sp	6.37	SC	
Mesogastropoda	Hydrobiidae	Unid. Hydrobiid sp	5.6	SC	
Mesogastropoda	Pleuroceridae	Elimia costifera	2.5	SC	
Mesogastropoda	Pleuroceridae	Elimia ebenum	2.5	SC	

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Mesogastropoda	Pleuroceridae	Elimia laqueata costulata	2.5	SC	
Mesogastropoda	Pleuroceridae	Elimia laqueata laqueata	2.5	SC	
Mesogastropoda	Pleuroceridae	Elimia livescens	2.5	SC	
Mesogastropoda	Pleuroceridae	Elimia plicatastriata	2.5	SC	
Mesogastropoda	Pleuroceridae	Elimia semicarinata	2.5	SC	
Mesogastropoda	Pleuroceridae	Elimia sp	2.46	SC	
Mesogastropoda	Pleuroceridae	Leptoxis praerosa	1.6	SC	
Mesogastropoda	Pleuroceridae	Leptoxis sp	1.79	SC	
Mesogastropoda	Pleuroceridae	Lithasia obovata	3	SC	
Mesogastropoda	Pleuroceridae	Lithasia sp	3	SC	
Mesogastropoda	Pleuroceridae	Pleurocera acuta	3	SC	
Mesogastropoda	Pleuroceridae	Pleurocera canaliculata	3	SC	
Mesogastropoda	Pleuroceridae	Pleurocera sp	3	SC	
Mesogastropoda	Pleuroceridae	Unid. Pleuroceridae sp	2.69	SC	
Mesogastropoda	Pomatiopsidae	Pomatiopsis cincinnatiensis	5	SC	
Mesogastropoda	Viviparidae	Campeloma crassulum	5	SH	
Mesogastropoda	Viviparidae	Campeloma decisum	6.45	SH	
Mesogastropoda	Viviparidae	Campeloma integrumd	5	SH	
Mesogastropoda	Viviparidae	Campeloma sp	5	SH	
Mesogastropoda	Viviparidae	Unid. Viviparid sp	5	SC	
Mesogastropoda	Viviparidae	Viviparus sp	5	SC	
Neuroptera	Sisyridae	Climacia areolaris	8.4	PR	
Neuroptera	Sisyridae	Climacia sp	8.4	PR	
Neuroptera	Sisyridae	Sisyra sp	5	PR	
Odonata	Aeshnidae	Aeshna sp	7.1	PR	
Odonata	Aeshnidae	Aeshna umbrosa	7.1	PR	
Odonata	Aeshnidae	Aeshna verticalis	7.1	PR	
Odonata	Aeshnidae	Anax junius	7.1	PR	
Odonata	Aeshnidae	Anax longipes	7.1	PR	
Odonata	Aeshnidae	Anax sp	7.1	PR	
Odonata	Aeshnidae	Basiaeschna janata	7.35	PR	climber
Odonata	Aeshnidae	Basiaeschna pentacantha	7.7	PR	
Odonata	Aeshnidae	Basiaeschna sp	7.7	PR	
Odonata	Aeshnidae	Boyeria grafiana	6.05	PR	
Odonata	Aeshnidae	Boyeria sp	6	PR	
Odonata	Aeshnidae	Boyeria vinosa	5.89	PR	
Odonata	Aeshnidae	Nasiaeschna pentacantha	8.14	PR	climber
Odonata	Aeshnidae	Nasiaeschna sp	8	PR	
Odonata	Aeshnidae	Unid. Aeshnid sp	7	PR	
Odonata	Calopterygidae	Calopteryx angustipennis	7.8	PR	
Odonata	Calopterygidae	Calopteryx dimidiata	7.8	PR	climber
Odonata	Calopterygidae	Calopteryx maculata	7.8	PR	climber

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Odonata	Calopterygidae	Calopteryx sp	7.8	PR	
Odonata	Calopterygidae	Hetaerina americana	6.2	PR	
Odonata	Calopterygidae	Hetaerina sp	5.61	PR	
Odonata	Calopterygidae	Hetaerina titia	6.2	PR	
Odonata	Calopterygidae	Unid. Calopterygid sp	7	PR	
Odonata	Coenagrionidae	Amphiagrion saucium	9	PR	
Odonata	Coenagrionidae	Anomalagrion hastatum	9	PR	
Odonata	Coenagrionidae	Argia apicalis	8.2	PR	
Odonata	Coenagrionidae	Argia bipunctulata	8.2	PR	
Odonata	Coenagrionidae	Argia fumipennis violacea	8.2	PR	climber
Odonata	Coenagrionidae	Argia moesta	8.2	PR	
Odonata	Coenagrionidae	Argia sedula	8.46	PR	
Odonata	Coenagrionidae	Argia sp	8.17	PR	
Odonata	Coenagrionidae	Argia tibialis	8.2	PR	
Odonata	Coenagrionidae	Argia translata	8.2	PR	
Odonata	Coenagrionidae	Enallagma basidens	8.9	PR	
Odonata	Coenagrionidae	Enallagma civile	8.9	PR	
Odonata	Coenagrionidae	Enallagma daecki	8.9	PR	climber
Odonata	Coenagrionidae	Enallagma divagans	8.9	PR	climber
Odonata	Coenagrionidae	Enallagma dubium	8.9	PR	climber
Odonata	Coenagrionidae	Enallagma exsulans	8.9	PR	
Odonata	Coenagrionidae	Enallagma geminatum	8.9	PR	
Odonata	Coenagrionidae	Enallagma pallidum	8.9	PR	climber
Odonata	Coenagrionidae	Enallagma sexsulans	8.9	PR	
Odonata	Coenagrionidae	Enallagma signatum	8.9	PR	climber
Odonata	Coenagrionidae	Enallagma sp	8.91	PR	
Odonata	Coenagrionidae	Enallagma sulcatum	8.9	PR	
Odonata	Coenagrionidae	Enallagma traviatum	8.9	PR	
Odonata	Coenagrionidae	Enallagma vesperum	8.9	PR	climber
Odonata	Coenagrionidae	Ischnura kellicotti	9.5	PR	
Odonata	Coenagrionidae	Ischnura posita	9.5	PR	climber
Odonata	Coenagrionidae	Ischnura prognatha	9.5	PR	
Odonata	Coenagrionidae	Ischnura ramburi	9.5	PR	climber
Odonata	Coenagrionidae	Ischnura sp	9.52	PR	
Odonata	Coenagrionidae	Ischnura verticalis	9.5	PR	
Odonata	Coenagrionidae	Nahalennia irene		PR	
Odonata	Coenagrionidae	Unid. Coenagrionid sp	9	PR	
Odonata	Cordulegastridae	Cordulegaster erronea	5.7	PR	
Odonata	Cordulegastridae	Cordulegaster fasciata	5.7	PR	
Odonata	Cordulegastridae	Cordulegaster maculata	5.7	PR	burrower
Odonata	Cordulegastridae	Cordulegaster obliqua	5.7	PR	
Odonata	Cordulegastridae	Cordulegaster sp	5.73	PR	

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Odonata	Cordulidae	Macromia annulata	6.2	PR	sprawler
Odonata	Corduliidae	Didymops sp	5.9	PR	
Odonata	Corduliidae	Didymops transversa	5.9	PR	sprawler
Odonata	Corduliidae	Epicordulia princeps	5.6	PR	
Odonata	Corduliidae	Helocordulia selysii	5.9	PR	
Odonata	Corduliidae	Helocordulia sp	4.83	PR	
Odonata	Corduliidae	Helocordulia uhleri	4.86	PR	
Odonata	Corduliidae	Macromia alleghaniensis	6.2	PR	
Odonata	Corduliidae	Macromia illinoiensis/georgina	6.2	PR	
Odonata	Corduliidae	Macromia illinoiensis/illinoiensis	6.2	PR	
Odonata	Corduliidae	Macromia sp	6.16	PR	
Odonata	Corduliidae	Macromia taeniolata	6.2	PR	sprawler
Odonata	Corduliidae	Neurocordulia alabamensis	5.4	PR	
Odonata	Corduliidae	Neurocordulia molesta	1.8	PR	
Odonata	Corduliidae	Neurocordulia obsoleta	5.15	PR	
Odonata	Corduliidae	Neurocordulia sp	5.03	PR	
Odonata	Corduliidae	Neurocordulia virginiensis	2.05	PR	
Odonata	Corduliidae	Somatochlora provocans	9.15	PR	
Odonata	Corduliidae	Somatochlora sp	9.15	PR	
Odonata	Corduliidae	Somatochlora tenebrosa	9.15	PR	
Odonata	Corduliidae	Unid. Corduliid sp	6.6	PR	
Odonata	Gomphidae	Dromogomphus armatus	5.9	PR	
Odonata	Gomphidae	Dromogomphus sp	5.92	PR	
Odonata	Gomphidae	Dromogomphus spinosus	5.9	PR	
Odonata	Gomphidae	Dromogomphus spoliatus	5.9	PR	
Odonata	Gomphidae	Erpetogomphus designatus	6.3	PR	
Odonata	Gomphidae	Gomphus abbreviatus	5.8	PR	
Odonata	Gomphidae	Gomphus borealis	5.8	PR	
Odonata	Gomphidae	Gomphus cavillaris	5.8	PR	
Odonata	Gomphidae	Gomphus descriptus	5.8	PR	
Odonata	Gomphidae	Gomphus dilatatus	5.8	PR	
Odonata	Gomphidae	Gomphus externus	5.8	PR	
Odonata	Gomphidae	Gomphus fraternus	5.8	PR	
Odonata	Gomphidae	Gomphus hybridus		PR	burrower
Odonata	Gomphidae	Gomphus lineatifrons	5.8	PR	
Odonata	Gomphidae	Gomphus lividus	5.8	PR	
Odonata	Gomphidae	Gomphus notatus	5.8	PR	
Odonata	Gomphidae	Gomphus pallidus	5.8	PR	
Odonata	Gomphidae	Gomphus quadricolor		PR	
Odonata	Gomphidae	Gomphus rogersi	5.8	PR	
Odonata	Gomphidae	Gomphus sp	5.8	PR	

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Odonata	Gomphidae	Gomphus spiniceps	5.8	PR	
Odonata	Gomphidae	Gomphus vastus	5.8	PR	
Odonata	Gomphidae	Gomphus viridifrons	5.8	PR	
Odonata	Gomphidae	Hagenius brevistylus	3.99	PR	
Odonata	Gomphidae	Hagenius sp	4	PR	
Odonata	Gomphidae	Lanthus parvulus	1.8	PR	
Odonata	Gomphidae	Lanthus sp	1.77	PR	
Odonata	Gomphidae	Lanthus vernalis	1.8	PR	
Odonata	Gomphidae	Ophiogomphus carolinus	5.5	PR	
Odonata	Gomphidae	Ophiogomphus mainensis	5.5	PR	
Odonata	Gomphidae	Ophiogomphus rupinsulensis	5.5	PR	
Odonata	Gomphidae	Ophiogomphus sp	5.54	PR	
Odonata	Gomphidae	Progomphus obscurus	8.22	PR	burrower
Odonata	Gomphidae	Progomphus sp	8.7	PR	
Odonata	Gomphidae	Stylogomphus albistylus	4.72	PR	
Odonata	Gomphidae	Stylogomphus sigmastylus	4.7	PR	
Odonata	Gomphidae	Stylogomphus sp		PR	
Odonata	Gomphidae	Stylurus laurae		PR	
Odonata	Gomphidae	Stylurus sp	6.2	PR	
Odonata	Gomphidae	Stylurus spiniceps	6.2	PR	
Odonata	Gomphidae	Unid. Gomphid sp	6	PR	
Odonata	Lestidae	Archilestes grandis	8	PR	
Odonata	Lestidae	Lestes sp	9.42	PR	
Odonata	Libellulidae	Celithemis amanda	9	PR	
Odonata	Libellulidae	Celithemis elisa	9	PR	
Odonata	Libellulidae	Erythemis simplicicollis	9.72	PR	sprawler
Odonata	Libellulidae	Erythrodiplax berenice	9	PR	
Odonata	Libellulidae	Erythrodiplax sp	9	PR	
Odonata	Libellulidae	Libellula auripennis	9.6	PR	
Odonata	Libellulidae	Libellula insecta	9.6	PR	
Odonata	Libellulidae	Libellula luctuosa	9.6	PR	
Odonata	Libellulidae	Libellula needhami	9.6	PR	
Odonata	Libellulidae	Libellula pulchella	9.6	PR	
Odonata	Libellulidae	Libellula semifasciata	9.6	PR	
Odonata	Libellulidae	Libellula sp	9.64	PR	
Odonata	Libellulidae	Libellula vibrans	9.6	PR	
Odonata	Libellulidae	Nannothemis bella	9	PR	sprawler
Odonata	Libellulidae	Pachydiplax longipennis	9.86	PR	sprawler
Odonata	Libellulidae	Perithemis sp	9.85	PR	
Odonata	Libellulidae	Perithemis tenera	9.85	PR	sprawler
Odonata	Libellulidae	Plathemis lydia	10	PR	sprawler

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Odonata	Libellulidae	Sympetrum ambiguum	7.3	PR	
Odonata	Libellulidae	Sympetrum sp	7.29	PR	
Odonata	Libellulidae	Sympetrum vicinum	7.3	PR	
Odonata	Libellulidae	Tetragoneuria cynosura		PR	
Odonata	Libellulidae	Tetragoneuria sp	9	PR	
Odonata	Libellulidae	Tetragoneuria spinosa	9	PR	
Odonata	Libellulidae	Tramea carolina	9.8	PR	
Odonata	Libellulidae	Unid. Libellulid sp	9.1	PR	
Pelecypoda	Corbiculidae	Corbicula fluminea	6.12	CF	
Pelecypoda	Dreissenidae	Dreissena polymorpha	5	CF	
Pelecypoda	Unionidae	Actinonaias ligamentina	5	CF	
Pelecypoda	Unionidae	Actinonaias pectorosa	1	CF	
Pelecypoda	Unionidae	Alasmidonta atropurpurea	1	CF	
Pelecypoda	Unionidae	Alasmidonta marginata	3	CF	
Pelecypoda	Unionidae	Alasmidonta viridis	3	CF	
Pelecypoda	Unionidae	Amblema plicata	5	CF	
Pelecypoda	Unionidae	Anodonta suborbiculata	5	CF	
Pelecypoda	Unionidae	Anodontoides ferussacianus	3	CF	
Pelecypoda	Unionidae	Arcidens confragosus	3	CF	
Pelecypoda	Unionidae	Cumberlandia monodonta	1	CF	
Pelecypoda	Unionidae	Cyclonaias tuberculata	5	CF	
Pelecypoda	Unionidae	Cyprogenia stegaria	1	CF	
Pelecypoda	Unionidae	Dromus dromas	1	CF	
Pelecypoda	Unionidae	Ellipsaria lineolata	3	CF	
Pelecypoda	Unionidae	Elliptio crassidens	5	CF	
Pelecypoda	Unionidae	Elliptio dilatata	5	CF	
Pelecypoda	Unionidae	Epioblasma arcaeformis	1	CF	
Pelecypoda	Unionidae	Epioblasma marginata	1	CF	
Pelecypoda	Unionidae	Epioblasma brevidens	1	CF	
Pelecypoda	Unionidae	Epioblasma capsaeformis	1	CF	
Pelecypoda	Unionidae	Epioblasma haysiana	1	CF	
Pelecypoda	Unionidae	Epioblasma lewisii	1	CF	
Pelecypoda	Unionidae	Epioblasma obliquata obliquata	1	CF	
Pelecypoda	Unionidae	Epioblasma obliquata perobliqua	1	CF	
Pelecypoda	Unionidae	Epioblasma triquetra	1	CF	
Pelecypoda	Unionidae	Fusconaia ebena	5	CF	
Pelecypoda	Unionidae	Fusconaia flava	5	CF	
Pelecypoda	Unionidae	Fusconaia subrotunda	1	CF	
Pelecypoda	Unionidae	Lampsilis abrupta	1	CF	
Pelecypoda	Unionidae	Lampsilis cardium	3	CF	
Pelecypoda	Unionidae	Lampsilis fasciola	3	CF	
Pelecypoda	Unionidae	Lampsilis ovata	1	CF	

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Pelecypoda	Unionidae	Lampsilis siliquoidea	5	CF	
Pelecypoda	Unionidae	Lampsilis teres	3	CF	
Pelecypoda	Unionidae	Lasmigona complanata complanata	3	CF	
Pelecypoda	Unionidae	Lasmigona compressa	3	CF	
Pelecypoda	Unionidae	Lasmigona costata	5	CF	
Pelecypoda	Unionidae	Lasmigona subviridis	3	CF	
Pelecypoda	Unionidae	Leptodea fragilis	5	CF	
Pelecypoda	Unionidae	Leptodea leptodon	1	CF	
Pelecypoda	Unionidae	Lexingtonia dolabelloides	1	CF	
Pelecypoda	Unionidae	Ligumia recta	3	CF	
Pelecypoda	Unionidae	Ligumia subrostrata	3	CF	
Pelecypoda	Unionidae	Medionidus conradicus	1	CF	
Pelecypoda	Unionidae	Megalonaias nervosa	5	CF	
Pelecypoda	Unionidae	Obliquaria reflexa	1	CF	
Pelecypoda	Unionidae	Obovaria olivaria	1	CF	
Pelecypoda	Unionidae	Obovaria retusa	1	CF	
Pelecypoda	Unionidae	Obovaria subrotunda	1	CF	
Pelecypoda	Unionidae	Pegias fabula	1	CF	
Pelecypoda	Unionidae	Plectomerus dombeyanus	1	CF	
Pelecypoda	Unionidae	Plethobasus cicatricosus	1	CF	
Pelecypoda	Unionidae	Plethobasus cooperianus	1	CF	
Pelecypoda	Unionidae	Plethobasus cyphyus	3	CF	
Pelecypoda	Unionidae	Pleurobema clava	1	CF	
Pelecypoda	Unionidae	Pleurobema coccineum	1	CF	
Pelecypoda	Unionidae	Pleurobema cordatum	5	CF	
Pelecypoda	Unionidae	Pleurobema oviforme	1	CF	
Pelecypoda	Unionidae	Pleurobema plenum	1	CF	
Pelecypoda	Unionidae	Pleurobema rubrum	1	CF	
Pelecypoda	Unionidae	Pleurobema sintoxia	1	CF	
Pelecypoda	Unionidae	Potamilus alatus	5	CF	
Pelecypoda	Unionidae	Potamilus capax	1	CF	
Pelecypoda	Unionidae	Potamilus ohiensis	3	CF	
Pelecypoda	Unionidae	Potamilus purpuratus	3	CF	
Pelecypoda	Unionidae	Ptychobranchus fasciolaris	5	CF	
Pelecypoda	Unionidae	Ptychobranchus subtentum	1	CF	
Pelecypoda	Unionidae	Pyganodon grandis	5	CF	
Pelecypoda	Unionidae	Quadrula apiculata	1	CF	
Pelecypoda	Unionidae	Quadrula cylindrica	1	CF	
Pelecypoda	Unionidae	Quadrula fragosa	1	CF	
Pelecypoda	Unionidae	Quadrula metanevra	3	CF	
Pelecypoda	Unionidae	Quadrula nodulata	3	CF	

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Pelecypoda	Unionidae	Quadrula pustulosa	5	CF	
Pelecypoda	Unionidae	Quadrula quadrula	5	CF	
Pelecypoda	Unionidae	Quadrula sparsa	1	CF	
Pelecypoda	Unionidae	Simpsonaias ambigua	1	CF	
Pelecypoda	Unionidae	Strophitus undulatus	3	CF	
Pelecypoda	Unionidae	Toxolasma lividus	3	CF	
Pelecypoda	Unionidae	Toxolasma parvus	5	CF	
Pelecypoda	Unionidae	Toxolasma texasiensis	5	CF	
Pelecypoda	Unionidae	Tritogonia verrucosa	5	CF	
Pelecypoda	Unionidae	Truncilla donaciformis	3	CF	
Pelecypoda	Unionidae	Truncilla truncata	3	CF	
Pelecypoda	Unionidae	Unid. Unionid sp		CF	
Pelecypoda	Unionidae	Uniomerus tetralasmus	5	CF	
Pelecypoda	Unionidae	Utterbackia imbecillis	5	CF	
Pelecypoda	Unionidae	Villosa fabalis	1	CF	
Pelecypoda	Unionidae	Villosa iris	3	CF	
Pelecypoda	Unionidae	Villosa lienosa	3	CF	
Pelecypoda	Unionidae	Villosa ortmanni	3	CF	
Pelecypoda	Unionidae	Villosa taeniata	5	CF	
Pelecypoda	Unionidae	Villosa trabalis	1	CF	
Pelecypoda	Unionidae	Villosa vanuxemensis	3	CF	
Pharygobdellidae	Erpobdellidae	Mooreobdella melanostoma	7.8	CG	
Pharyngobdellida	Eropolellidae	Erpobdella sp	8.33	CG	
Pharyngobdellida	Erpobdellidae	Dina anoculata	8.2	PC	
Pharyngobdellida	Erpobdellidae	Dina parva	8.2	CG	
Pharyngobdellida	Erpobdellidae	Erpobdella punctata	7.8	CG	
Pharyngobdellida	Erpobdellidae	Mooreobdella fervida	7.8	CG	
Pharyngobdellida	Erpobdellidae	Mooreobdella microstoma	7.8	CG	
Pharyngobdellida	Erpobdellidae	Mooreobdella sp	7.8	CG	
Pharyngobdellida	Erpobdellidae	Unid. Erpobdellid sp	8.2	CG	
Plecoptera	Capniidae	Allocapnia forbesi	2.52	SH	
Plecoptera	Capniidae	Allocapnia rickeri	2.52	SH	
Plecoptera	Capniidae	Allocapnia sp	2.52	SH	
Plecoptera	Capniidae	Allocapnia vivipara	2.52	SH	
Plecoptera	Capniidae	Neocapnia carolina	1.5	SH	
Plecoptera	Capniidae	Paracapnia angulata	0.12	SH	
Plecoptera	Capniidae	Paracapnia sp	0.12	SH	
Plecoptera	Capniidae	Unid. Capniid sp	2.8	SH	
Plecoptera	Chloroperlidae	Alloperla sp	1.22	PR	clinger
Plecoptera	Chloroperlidae	Haploperla brevis	0.98	PR	clinger
Plecoptera	Chloroperlidae	Haploperla sp		PR	
Plecoptera	Chloroperlidae	Rasvena terna	0.5	PR	clinger

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Plecoptera	Chloroperlidae	Sweltsa sp	0	PR	clinger
Plecoptera	Chloroperlidae	Unid. Chloroperlid sp	0.8	PR	clinger
Plecoptera	Leuctridae	Leuctra sp	0.67	SH	sprawler
Plecoptera	Leuctridae	Megaleuctra sp	1	SH	sprawler
Plecoptera	Leuctridae	Paraleuctra sara	2.8	SH	
Plecoptera	Leuctridae	Paraleuctra sp	2.8	SH	sprawler
Plecoptera	Leuctridae	Unid. Leuctrid sp	1	SH	sprawler
Plecoptera	Leuctridae	Zealeuctra claasseni	1	SH	sprawler
Plecoptera	Leuctridae	Zealeuctra sp		SH	
Plecoptera	Nemouridae	Amphinemura delosa	3.33	SH	sprawler
Plecoptera	Nemouridae	Amphinemura nigritta	3.33	SH	sprawler
Plecoptera	Nemouridae	Amphinemura sp	3.33	SH	sprawler
Plecoptera	Nemouridae	Amphinemura wui	3.33	SH	sprawler
Plecoptera	Nemouridae	Ostrocerca sp	2.5	SH	
Plecoptera	Nemouridae	Paranemura perfecta	2	SH	sprawler
Plecoptera	Nemouridae	Prostoia sp	5.78	SH	sprawler
Plecoptera	Nemouridae	Soyedina vallicularia	0	SH	
Plecoptera	Nemouridae	Unid. Nemourid sp	4.5	SH	sprawler
Plecoptera	Peltoperlidae	Peltoperla arcuata	1	SH	clinger
Plecoptera	Peltoperlidae	Peltoperla sp	1	SH	clinger
Plecoptera	Peltoperlidae	Tallaperla maria	1.2	SH	clinger
Plecoptera	Peltoperlidae	Tallaperla sp	1.2	SH	clinger
Plecoptera	Perlidae	Acroneuria abnormis	2.06	PR	clinger
Plecoptera	Perlidae	Acroneuria arenosa	1.4	PR	clinger
Plecoptera	Perlidae	Acroneuria carolinensis	0	PR	clinger
Plecoptera	Perlidae	Acroneuria evoluta	1.4	PR	clinger
Plecoptera	Perlidae	Acroneuria frisoni	4	PR	clinger
Plecoptera	Perlidae	Acroneuria internata	1.4	PR	clinger
Plecoptera	Perlidae	Acroneuria lycorias	2.12	PR	clinger
Plecoptera	Perlidae	Acroneuria mela	0.89	PR	clinger
Plecoptera	Perlidae	Acroneuria perplexa	1.4	PR	clinger
Plecoptera	Perlidae	Acroneuria sp	1.4	PR	clinger
Plecoptera	Perlidae	Agnetina capitata	0	PR	clinger
Plecoptera	Perlidae	Agnetina flavescens	3	PR	clinger
Plecoptera	Perlidae	Agnetina sp	1.5	PR	
Plecoptera	Perlidae	Attaneuria ruralis	3	PR	clinger
Plecoptera	Perlidae	Eccoptura xanthenes	3.74	PR	clinger
Plecoptera	Perlidae	Neoperla sp	5	PR	clinger
Plecoptera	Perlidae	Paragnetina immarginata	1.38	PR	clinger
Plecoptera	Perlidae	Paragnetina kansensis	1.99	PR	clinger
Plecoptera	Perlidae	Paragnetina media	1.8	PR	clinger
Plecoptera	Perlidae	Paragnetina sp	1.54	PR	clinger

Order	Family	FinalID	Tol Val	FFG	Habit
Plecoptera	Perlidae	Perlesta sp	4.7	PR	clinger
Plecoptera	Perlidae	Unid. Perlid sp	3	PR	clinger
Plecoptera	Perlodidae	Clioperla clio	4.72	PR	clinger
Plecoptera	Perlodidae	Cultus decisus	1.57	PR	clinger
Plecoptera	Perlodidae	Diploperla duplicata	2.68	PR	clinger
Plecoptera	Perlodidae	Diploperla robusta	2.7	PR	clinger
Plecoptera	Perlodidae	Diploperla sp		PR	clinger
Plecoptera	Perlodidae	Isoperla bilineata	5.44	PR	clinger
Plecoptera	Perlodidae	Isoperla cotta	2.2	SC	clinger
Plecoptera	Perlodidae	Isoperla holochlora	0	PR	clinger
Plecoptera	Perlodidae	Isoperla lata	0	PR	clinger
Plecoptera	Perlodidae	Isoperla nana	1.8	PR	clinger
Plecoptera	Perlodidae	Isoperla similis	0.2	PR	clinger
Plecoptera	Perlodidae	Isoperla sp	1.8	PR	clinger
Plecoptera	Perlodidae	Malirekus hastatus	1.15	PR	clinger
Plecoptera	Perlodidae	Malirekus sp	1.15	PR	clinger
Plecoptera	Perlodidae	Remenus bilobatus	0.28	PR	clinger
Plecoptera	Perlodidae	Unid. Perlodid sp	2	PR	clinger
Plecoptera	Perlodidae	Yugus kirchneri	0	PR	clinger
Plecoptera	Perlodidae	Yugus sp	0	PR	clinger
Plecoptera	Pteronarcyidae	Pteronacys comstocki	1.7	SH	clinger
Plecoptera	Pteronarcyidae	Pteronarcys biloba	1.7	SH	clinger
Plecoptera	Pteronarcyidae	Pteronarcys dorsata	1.76	SH	clinger
Plecoptera	Pteronarcyidae	Pteronarcys proteus	1.7	SH	clinger
Plecoptera	Pteronarcyidae	Pteronarcys sp	1.67	SH	clinger
Plecoptera	Taeniopterygidae	Strophopteryx appalachia	2.5	SC	sprawler
Plecoptera	Taeniopterygidae	Strophopteryx fasciata	2.5	SC	sprawler
Plecoptera	Taeniopterygidae	Strophopteryx sp	2.7	SC	sprawler
Plecoptera	Taeniopterygidae	Taenionema atlanticum	5	SH	sprawler
Plecoptera	Taeniopterygidae	Taeniopteryx burksi	6.12	SH	sprawler
Plecoptera	Taeniopterygidae	Taeniopteryx metequi	1.42	SH	sprawler
Plecoptera	Taeniopterygidae	Taeniopteryx sp	5.37	SH	sprawler
Rhynchobdellida	Glossiphoniidae	Batracobdella phalera	7.61	PC	
Rhynchobdellida	Glossiphoniidae	Desserobdella phalera	8.5	PC	
Rhynchobdellida	Glossiphoniidae	Gloiobdella elongata		CG	
Rhynchobdellida	Glossiphoniidae	Helobdella elongata	9.47	PC	
Rhynchobdellida	Glossiphoniidae	Helobdella fusca	8.2	PC	
Rhynchobdellida	Glossiphoniidae	Helobdella papillata	8.2	PC	
Rhynchobdellida	Glossiphoniidae	Helobdella sp	8.2	PC	
Rhynchobdellida	Glossiphoniidae	Helobdella stagnalis	8.63	PC	
Rhynchobdellida	Glossiphoniidae	Helobdella transversa	8.2	PC	
Rhynchobdellida	Glossiphoniidae	Helobdella triserialis	9.2	PC	

Order	Family	FinalID	Tol Val	FFG	Habit
Rhynchobdellida	Glossiphoniidae	Oligobdella biannulata	8.2	PC	
Rhynchobdellida	Glossiphoniidae	Placobdella montifera	8.2	PC	
Rhynchobdellida	Glossiphoniidae	Placobdella multilineata	8.2	PC	
Rhynchobdellida	Glossiphoniidae	Placobdella ornata	8.2	PC	
Rhynchobdellida	Glossiphoniidae	Placobdella papillifera	8.96	PC	
Rhynchobdellida	Glossiphoniidae	Placobdella parasitica	8.69	PC	
Rhynchobdellida	Glossiphoniidae	Placobdella sp	9	PC	
Rhynchobdellida	Glossiphoniidae	Unid. Glossiphoniid sp	8.2	PC	
Rhynohobdellida	Piscicolidae	Myzobdella lugubris	8.2	PC	
Rhynohobdellida	Piscicolidae	Piscicola punctata	8.2	PC	
Rhynohobdellida	Piscicolidae	Piscicolaria reducta	8.2	PC	
Trichoptera	Brachycentridae	Brachycentrus nigrosoma	2.33	CF	clinger
Trichoptera	Brachycentridae	Brachycentrus numerosus	1.74	CG	clinger
Trichoptera	Brachycentridae	Brachycentrus sp	2.08	CG	clinger
Trichoptera	Brachycentridae	Micrasema charonis	0.75	SH	clinger
Trichoptera	Brachycentridae	Micrasema rusticum	0	SH	clinger
Trichoptera	Brachycentridae	Micrasema sp	1	SH	clinger
Trichoptera	Brachycentridae	Micrasema wataga	2.6	CG	clinger
Trichoptera	Brachycentridae	Unid. Brachycentrid	2.2	CF	
Trichoptera	Calamoceratidae	Anisocentropus pyraloides	0.85	SH	
Trichoptera	Calamoceratidae	Heteroplectron americanum	3.23	SH	sprawler
Trichoptera	Dipsuedopsidae	Phylocentropus carolinus	5.6	CF	
Trichoptera	Dipsuedopsidae	Phylocentropus placidus	3.5	CF	clinger
Trichoptera	Dipsuedopsidae	Phylocentropus sp	4.5	CF	
Trichoptera	Glossosomatidae	Agapetus hessi	0	SC	clinger
Trichoptera	Glossosomatidae	Agapetus illini	3	SC	clinger
Trichoptera	Glossosomatidae	Agapetus sp	0	SC	clinger
Trichoptera	Glossosomatidae	Glossosoma intermedium	1.55	SC	clinger
Trichoptera	Glossosomatidae	Glossosoma nigrior	1.55	SC	clinger
Trichoptera	Glossosomatidae	Glossosoma sp	1.55	SC	clinger
Trichoptera	Glossosomatidae	Matrioptila jeanae	0	SC	clinger
Trichoptera	Glossosomatidae	Protoptila maculata	2.6	SC	clinger
Trichoptera	Glossosomatidae	Protoptila palina	2.6	SC	clinger
Trichoptera	Glossosomatidae	Protoptila sp	2.55	SC	clinger
Trichoptera	Glossosomatidae	Unid. Glossosomatid sp	1.42	SC	
Trichoptera	Helicopsychidae	Helicopsyche borealis	5	SC	clinger
Trichoptera	Helicopsychidae	Helicopsyche sp	5	SC	clinger
Trichoptera	Helicopsychidae	Unid. Helicopsychidae sp	5	SC	
Trichoptera	Hydropsychidae	Ceratopsyche alhedra	0	CF	clinger
Trichoptera	Hydropsychidae	Ceratopsyche bifida	1	CF	clinger
Trichoptera	Hydropsychidae	Ceratopsyche bronta	2.7	CF	clinger
Trichoptera	Hydropsychidae	Ceratopsyche cheilonis	1.4	CF	clinger

Order	Family	FinalID	Tol Val	FFG	Habit
Trichoptera	Hydropsychidae	Ceratopsyche morosa	3.2	CF	clinger
Trichoptera	Hydropsychidae	Ceratopsyche slossonae	0	CF	clinger
Trichoptera	Hydropsychidae	Ceratopsyche sp	1.4	CF	clinger
Trichoptera	Hydropsychidae	Ceratopsyche sparna	3.2	CF	clinger
Trichoptera	Hydropsychidae	Ceratopsyche ventura	0	CF	clinger
Trichoptera	Hydropsychidae	Cheumatopsyche sp	6.22	CF	clinger
Trichoptera	Hydropsychidae	Diplectrona metaqui	2	CF	clinger
Trichoptera	Hydropsychidae	Diplectrona modesta	2.21	CF	clinger
Trichoptera	Hydropsychidae	Diplectrona sp	4	CF	
Trichoptera	Hydropsychidae	Homoplectra doringa	3	CF	clinger
Trichoptera	Hydropsychidae	Homoplectra sp		CF	
Trichoptera	Hydropsychidae	Hydropsyche betteni gp	7.78	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche bidens	4	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche cuanis	5	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche demora	2.06	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche depravata	4	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche dicantha	4	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche frisoni	4	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche hageni	5	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche orris	4	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche patera	4	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche phalerata	3.62	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche simulans	4	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche sp	4	CF	clinger
Trichoptera	Hydropsychidae	Hydropsyche valanis	4	CF	clinger
Trichoptera	Hydropsychidae	Macrostemum sp	3.6	CF	clinger
Trichoptera	Hydropsychidae	Macrostemum zebratum	3.6	CF	clinger
Trichoptera	Hydropsychidae	Paraspyche cardis	0	CF	clinger
Trichoptera	Hydropsychidae	Potamyia flava	5	CF	clinger
Trichoptera	Hydropsychidae	Unid. Hydropsychid sp	4	CG	
Trichoptera	Hydroptilidae	Agraylea multipunctata	5.9	PH	clinger
Trichoptera	Hydroptilidae	Agraylea sp	5.9	PH	clinger
Trichoptera	Hydroptilidae	Dibusa angata	3	SH	clinger
Trichoptera	Hydroptilidae	Hydroptila sp	6.22	PH	clinger
Trichoptera	Hydroptilidae	Ithytrichia sp	3	SC	clinger
Trichoptera	Hydroptilidae	Leucotrichia pictipes	4.06	SC	clinger
Trichoptera	Hydroptilidae	Mayatrichia ayama	1	SC	clinger
Trichoptera	Hydroptilidae	Neotrichia sp	2	SC	clinger
Trichoptera	Hydroptilidae	Ochrotrichia arva	1.5	SC	clinger
Trichoptera	Hydroptilidae	Ochrotrichia eliaga	1	SC	clinger
Trichoptera	Hydroptilidae	Ochrotrichia reisi	1	SC	clinger
Trichoptera	Hydroptilidae	Ochrotrichia shawnee	1	SC	clinger

Order	Family	FinalID	Tol Val	FFG	Habit
Trichoptera	Hydroptilidae	Ochrotrichia sp	3.95	CG	clinger
Trichoptera	Hydroptilidae	Ochrotrichia spinosa	4	CG	clinger
Trichoptera	Hydroptilidae	Ochrotrichia tarsalis	3.5	SC	clinger
Trichoptera	Hydroptilidae	Ochrotrichia xena	3	SC	clinger
Trichoptera	Hydroptilidae	Orthotrichia sp	5	CG	clinger
Trichoptera	Hydroptilidae	Oxyethira sp	2.22	CG	clinger
Trichoptera	Hydroptilidae	Stactobiella delira	1.5	SC	clinger
Trichoptera	Hydroptilidae	Stactobiella palmata	1.5	CG	clinger
Trichoptera	Hydroptilidae	Stactobiella sp	1.29	CG	clinger
Trichoptera	Hydroptilidae	Unid. Hydroptilid sp	3	CG	clinger
Trichoptera	Lepidostomatidae	Lepidostoma sp	0.9	SH	
Trichoptera	Lepidostomatidae	Lepidostoma togatum	1	SH	
Trichoptera	Lepidostomatidae	Theliopsyche melas	1	SC	clinger
Trichoptera	Leptoceridae	Ceraclea ancylus	2.29	PR	
Trichoptera	Leptoceridae	Ceraclea cancellata	2.5	PR	
Trichoptera	Leptoceridae	Ceraclea diluta	2.3	PR	
Trichoptera	Leptoceridae	Ceraclea flava	1	PR	
Trichoptera	Leptoceridae	Ceraclea maculata	6.5	PR	
Trichoptera	Leptoceridae	Ceraclea neffi	1	PR	
Trichoptera	Leptoceridae	Ceraclea punctata	5	SC	
Trichoptera	Leptoceridae	Ceraclea sp	2.01	PR	clinger
Trichoptera	Leptoceridae	Ceraclea tarsipunctata	3	PR	
Trichoptera	Leptoceridae	Ceraclea transversa	2.54	PR	
Trichoptera	Leptoceridae	Mystacides sepulchralis	2.69	PR	
Trichoptera	Leptoceridae	Mystacides sp	2.5	PR	
Trichoptera	Leptoceridae	Nectopsyche candida	5.46	PR	climber
Trichoptera	Leptoceridae	Nectopsyche exquisita	4.1	PR	
Trichoptera	Leptoceridae	Nectopsyche pavida	4.14	PR	
Trichoptera	Leptoceridae	Nectopsyche sp	2.94	PR	
Trichoptera	Leptoceridae	Oecetis avara	5.7	PR	
Trichoptera	Leptoceridae	Oecetis cinerascens	5.7	PR	
Trichoptera	Leptoceridae	Oecetis ditissa	5.7	PR	
Trichoptera	Leptoceridae	Oecetis inconspicua	1.85	PR	
Trichoptera	Leptoceridae	Oecetis nocturna	4.1	PR	
Trichoptera	Leptoceridae	Oecetis parva	5.7	PR	
Trichoptera	Leptoceridae	Oecetis persimilis	4.7	PR	
Trichoptera	Leptoceridae	Oecetis sp	4.7	PR	
Trichoptera	Leptoceridae	Setodes sp	0	SC	
Trichoptera	Leptoceridae	Triaenodes abus	4.06	PR	
Trichoptera	Leptoceridae	Triaenodes cumberlandensis	3.5	SC	
Trichoptera	Leptoceridae	Triaenodes flavescens	3	PR	
Trichoptera	Leptoceridae	Triaenodes helo		PR	

Order	Family	FinalID	Tol Val	FFG	Habit
Trichoptera	Leptoceridae	Triaenodes ignitus	4.58	PR	
Trichoptera	Leptoceridae	Triaenodes injustus	2.47	PR	
Trichoptera	Leptoceridae	Triaenodes marginatus	4.5	PR	
Trichoptera	Leptoceridae	Triaenodes melacus		PR	
Trichoptera	Leptoceridae	Triaenodes nox		PR	
Trichoptera	Leptoceridae	Triaenodes perna	4.06	PR	
Trichoptera	Leptoceridae	Triaenodes perna/helo	4.5	PR	
Trichoptera	Leptoceridae	Triaenodes sp	4.46	PR	
Trichoptera	Leptoceridae	Triaenodes tardus	4.58	PR	
Trichoptera	Leptoceridae	Unid. Leptocerid sp	3.6	PR	
Trichoptera	Limnephilidae	Goera sp	0.13	SC	
Trichoptera	Limnephilidae	Goera stylata	0.13	SC	
Trichoptera	Limnephilidae	Goerita betteni	0.5	SC	
Trichoptera	Limnephilidae	Hydatophylax argus	2.17	SH	
Trichoptera	Limnephilidae	Ironoquia punctatissima	7.78	SH	
Trichoptera	Limnephilidae	Ironoquia sp	7.7	SH	
Trichoptera	Limnephilidae	Limnephilus sp		SH	
Trichoptera	Limnephilidae	Pseudostenophylax sp	2	SC	
Trichoptera	Limnephilidae	Pycnopsyche gentilis	0.57	SH	
Trichoptera	Limnephilidae	Pycnopsyche lepida	2.68	SH	
Trichoptera	Limnephilidae	Pycnopsyche sp	2.52	SH	
Trichoptera	Limnephilidae	Unid. Limnephilid sp	7.7	SH	
Trichoptera	Molannidae	Molanna blenda	2	SC	
Trichoptera	Molannidae	Molanna sp	2	SC	
Trichoptera	Odontoceridae	Psilotreta labida	0	SC	clinger
Trichoptera	Odontoceridae	Psilotreta sp	0	SC	clinger
Trichoptera	Philopotamidae	Chimarra sp	2.76	CF	clinger
Trichoptera	Philopotamidae	Dolophilodes distinctus	0.8	CF	clinger
Trichoptera	Philopotamidae	Dolophilodes sp	0.81	CF	clinger
Trichoptera	Philopotamidae	Unid. Philopotamid sp	2	CF	
Trichoptera	Philopotamidae	Wormaldia moesta	0.65	CF	clinger
Trichoptera	Philopotamidae	Wormaldia shawnee	0.65	CF	clinger
Trichoptera	Philopotamidae	Wormaldia sp	0.65	CF	clinger
Trichoptera	Phryganeidae	Phryganea sayi	6	SH	
Trichoptera	Phryganeidae	Phryganea sp	6	SH	
Trichoptera	Phryganeidae	Ptilostomis postica	6.4	SH	
Trichoptera	Phryganeidae	Ptilostomis sp	6.37	SH	
Trichoptera	Polycentropodidae	Cernotina sp	4	PR	clinger
Trichoptera	Polycentropodidae	Cyrnellus fraternus	7.34	CF	clinger
Trichoptera	Polycentropodidae	Neureclipsis crepuscularis	4.2	CF	clinger
Trichoptera	Polycentropodidae	Neureclipsis parvulus	4.2	CF	clinger
Trichoptera	Polycentropodidae	Neureclipsis sp	4.19	CF	clinger

Order	Family	FinalID	Tol Val	FFG	Habit
Trichoptera	Polycentropodidae	Nyctiophylax affinis	0.9	PR	clinger
Trichoptera	Polycentropodidae	Nyctiophylax moestus	0.31	PR	clinger
Trichoptera	Polycentropodidae	Nyctiophylax sp	0.85	PR	clinger
Trichoptera	Polycentropodidae	Polycentropus sp	3.53	PR	clinger
Trichoptera	Polycentropodidae	Unid. Polycentropodid sp	4	PR	
Trichoptera	Psychomyiidae	Lype diversa	4.05	SC	clinger
Trichoptera	Psychomyiidae	Psychomyia flavida	2.91	CG	clinger
Trichoptera	Psychomyiidae	Psychomyia sp	2.47	CG	clinger
Trichoptera	Rhyacophilidae	Rhyacophila carolina	1	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila carpenteri	1	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila fuscula	1.88	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila glaberrima	0.8	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila invaria gp	0	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila ledra/fenestra	3.86	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila lobifera	2.5	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila minor	0	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila nigrita	0	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila sp	0.8	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila torva	1.59	PR	clinger
Trichoptera	Rhyacophilidae	Rhyacophila vibox	0.8	PR	clinger
Trichoptera	Rhyacophilidae	Unid. Rhyacophilid sp	1.19	PR	
Trichoptera	Uenoidae	Neophylax autumnus	1.6	SC	clinger
Trichoptera	Uenoidae	Neophylax concinnus		SC	clinger
Trichoptera	Uenoidae	Neophylax consimilis	1.46	SC	clinger
Trichoptera	Uenoidae	Neophylax fuscus	0	SC	clinger
Trichoptera	Uenoidae	Neophylax lewisae	0	SC	clinger
Trichoptera	Uenoidae	Neophylax mitchelli	0	SC	clinger
Trichoptera	Uenoidae	Neophylax oligius	2.23	SC	clinger
Trichoptera	Uenoidae	Neophylax sp	2.2	SC	clinger
Trichoptera	Uenoidae	Unid. Uenoid sp	1.3	SC	
Tricladida	Planariidae	Dugesia sp	5	CG	
Tricladida	Planariidae	Phagocata sp	5	CG	
Tricladida	Planariidae	Planaria sp	5	CG	
Tricladida	Planariidae	Unid. Planariid sp	5	CG	
Vestimentifera	Aeolosomatidae	Aeolosoma sp	5	CG	

CF= Collector/filterer, CG=Collector/gatherer, OT=Other, OM=Omnivore, PC=Parasite carnivore, PH=Predator herbivore, PR=Predator, SC=Scraper, SH=Shredder

APPENDIX D

Macroinvertebrate Bench Sheet

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Macroinvertebrate Bench Sheet				
Station ID:		**Stream:**		**ID By:**
Location:			**County:**	
Collectors:	**Method:**		**Date Collected:**	
% subsample	**Final ID**	**Quan**	**Qual**	**Comments**

APPENDIX E

KDOW Fish Master Taxa List

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KDOW Fish Master Taxa List

Family	Species	Fish Type	NAT	OMN	FC	INT	INS	WC	TOL	SL
Acipenseridae	Acipenser fulvescens		X		X					X
Acipenseridae	Scaphirhynchus albus		X		X					X
Acipenseridae	Scaphirhynchus platorynchus		X		X					X
Polyodontidae	Polyodon spathula		X		X	X				X
Amiidae	Amia calva		X		X			X		
Anguillidae	Anguilla rostrata		X		X					
Aphredoderidae	Aphredoderus sayanus		X		X		X			
Atherinidae	Labidesthes sicculus		X		X		X			
Atherinidae	Menidia beryllina		X		X		X			
Clupeidae	Alosa alabamae		X		X					X
Clupeidae	Alosa chrysochloris		X		X					
Clupeidae	Alosa pseudoharengus				X					
Clupeidae	Dorosoma cepedianum		X	X	X					
Clupeidae	Dorosoma petenense		X	X	X					
Catostomidae	Carpiodes carpio	SUC	X	X	X					
Catostomidae	Carpiodes cyprinus	SUC	X	X	X					
Catostomidae	Carpiodes velifer	SUC	X	X	X					
Catostomidae	Catostomid fry	SUC	X		X				X	X
Catostomidae	Catostomus commersonii	SUC	X	X					X	X
Catostomidae	Catostomus sp.	SUC	X		X				X	X
Catostomidae	Cycleptus elongatus	SUC	X		X	X	X	X		X
Catostomidae	Erimyzon claviformis	SUC	X		X		X	X		
Catostomidae	Erimyzon sucetta	SUC	X	X	X					
Catostomidae	Hypentelium nigricans	SUC	X				X	X		X
Catostomidae	Ictiobus bubalus	SUC	X	X	X					
Catostomidae	Ictiobus cyprinellus	SUC	X	X	X					
Catostomidae	Ictiobus niger	SUC	X	X	X					
Catostomidae	Minytrema melanops	SUC	X		X		X	X		X
Catostomidae	Moxostoma anisurum	SUC	X		X	X	X	X		X
Catostomidae	Moxostoma breviceps	SUC	X			X	X	X		X
Catostomidae	Moxostoma carinatum	SUC	X		X	X	X	X		X
Catostomidae	Moxostoma duquesnei	SUC	X		X	X	X	X		X
Catostomidae	Moxostoma erythrurum	SUC	X		X		X	X		X
Catostomidae	Moxostoma lacerum	SUC	X			X	X	X		X
Catostomidae	Moxostoma poecilurum	SUC	X		X		X	X		X
Catostomidae	Moxostoma sp.	SUC	X		X		X	X		X
Catostomidae	Moxostoma valenciennesi	SUC	X		X		X	X		X
Catostomidae	Thoburnia atripinnis	SUC	X			X	X	X		X
Cyprinidae	Campostoma a. pullum	MIN	X							
Cyprinidae	Campostoma anomalum	MIN	X		X					

Family	Species	Fish Type	NAT	OMN	FC	INT	INS	WC	TOL	SL
Cyprinidae	Campostoma oligolepis	MIN	X		X					
Cyprinidae	Carassius auratus	MIN	X	X	X				X	
Cyprinidae	Clinostomus elongatus	MIN	X			X	X	X		X
Cyprinidae	Clinostomus funduloides	MIN	X			X	X	X		X
Cyprinidae	Ctenopharyngodon idella	MIN			X					
Cyprinidae	Cyprinella camura	MIN	X		X	X	X	X		
Cyprinidae	Cyprinella galactura	MIN	X		X	X	X	X		
Cyprinidae	Cyprinella lutrensis	MIN	X	X	X					
Cyprinidae	Cyprinella spiloptera	MIN	X		X		X	X		
Cyprinidae	Cyprinella spiloptera x Lythrurus fasciolaris	MIN					X	X		
Cyprinidae	Cyprinella venusta	MIN	X		X		X	X		
Cyprinidae	Cyprinella whipplei	MIN	X		X		X	X		
Cyprinidae	Cyprinid sp.	MIN	X		X					
Cyprinidae	Cyprinus carpio	MIN		X	X				X	
Cyprinidae	Erimystax dissimilis	MIN	X		X	X	X	X		X
Cyprinidae	Erimystax insignis	MIN	X		X		X	X		X
Cyprinidae	Erimystax x-punctatus	MIN	X			X	X	X		X
Cyprinidae	Hemitremia flammea	MIN	X		X		X	X		
Cyprinidae	Hybognathus hayi	MIN	X		X					
Cyprinidae	Hybognathus nuchalis	MIN	X	X	X					
Cyprinidae	Hybognathus placitus	MIN			X					
Cyprinidae	Hybopsis amblops	MIN	X		X	X	X	X		X
Cyprinidae	Hybopsis amnis	MIN	X		X		X	X		
Cyprinidae	Hypophthalmichthys molitrix	MIN			X					
Cyprinidae	Hypophthalmichthys nobilis	MIN							X	
Cyprinidae	Luxilus chrysocephalus	MIN	X		X		X		X	X
Cyprinidae	Luxulus chrysocephalus X Phoxinus erythrogaster	MIN					X		X	X
Cyprinidae	Lythrurus fasciolaris	MIN	X		X		X	X		
Cyprinidae	Lythrurus fumeus	MIN	X		X		X		X	
Cyprinidae	Lythrurus umbratilis	MIN	X		X		X	X		X
Cyprinidae	Macrhybopsis gelida	MIN	X		X	X	X	X		
Cyprinidae	Macrhybopsis hyostoma	MIN	X		X	X	X	X		
Cyprinidae	Macrhybopsis meeki	MIN	X		X	X	X	X		
Cyprinidae	Macrhybopsis storeriana	MIN	X		X		X	X		
Cyprinidae	Nocomis biguttatus	MIN	X	X	X	X				X
Cyprinidae	Nocomis effusus	MIN	X		X	X	X	X		X
Cyprinidae	Nocomis micropogon	MIN	X		X	X	X	X		X
Cyprinidae	Notemigonus crysoleucas	MIN	X	X	X				X	
Cyprinidae	Notropis albizonatus	MIN	X		X	X	X	X		X
Cyprinidae	Notropis ariommus	MIN	X		X	X	X	X		X
Cyprinidae	Notropis atherinoides	MIN	X	X	X					X

Family	Species	Fish Type	NAT	OMN	FC	INT	INS	WC	TOL	SL
Cyprinidae	Notropis blennius	MIN	X		X		X	X		X
Cyprinidae	Notropis boops	MIN	X		X		X	X		X
Cyprinidae	Notropis buccatus	MIN	X	X	X				X	
Cyprinidae	Notropis buchanani	MIN	X		X		X	X		
Cyprinidae	Notropis hudsonius	MIN	X		X		X			
Cyprinidae	Notropis leuciodus	MIN	X		X	X	X	X		
Cyprinidae	Notropis maculatus	MIN	X		X			X		
Cyprinidae	Notropis micropteryx	MIN	X		X	X	X	X		X
Cyprinidae	Notropis nubilus	MIN	X		X		X			
Cyprinidae	Notropis photogenis	MIN	X		X	X	X	X		X
Cyprinidae	Notropis rubellus	MIN	X		X	X	X	X		X
Cyprinidae	Notropis shumardi	MIN	X		X					
Cyprinidae	Notropis sp.	MIN	X		X					
Cyprinidae	Notropis sp. cf. N. spectrunculus	MIN	X		X	X	X	X		X
Cyprinidae	Notropis stramineus	MIN	X							
Cyprinidae	Notropis telescopus	MIN	X		X	X	X	X		
Cyprinidae	Notropis volucellus	MIN	X	X	X					
Cyprinidae	Notropis wickliffi	MIN	X		X					
Cyprinidae	Opsopoeodus emiliae	MIN	X	X	X	X				
Cyprinidae	Phenacobius mirabilis	MIN	X		X		X	X		X
Cyprinidae	Phenacobius uranops	MIN	X		X	X	X	X		X
Cyprinidae	Phoxinus cumberlandensis	MIN	X	X		X				X
Cyprinidae	Phoxinus erythrogaster	MIN	X	X		X				X
Cyprinidae	Phoxinus oreas	MIN			X					
Cyprinidae	Pimephales notatus	MIN	X	X	X				X	
Cyprinidae	Pimephales promelas	MIN	X	X	X				X	
Cyprinidae	Pimephales sp.	MIN	X	X	X				X	
Cyprinidae	Pimephales vigilax	MIN	X	X	X				X	
Cyprinidae	Platygobio gracilis	MIN	X		X		X		X	
Cyprinidae	Rhinichthys cataractae	MIN			X		X			X
Cyprinidae	Rhinichthys obtusus	MIN	X		X		X		X	X
Cyprinidae	Semotilus atromaculatus	MIN	X	X					X	
Fundulidae	Fundulus catenatus		X		X		X			X
Fundulidae	Fundulus chrysotus		X		X		X			
Fundulidae	Fundulus dispar		X		X		X			
Fundulidae	Fundulus notatus		X		X		X			
Fundulidae	Fundulus olivaceus		X		X		X			
Poeciliidae	Gambusia affinis		X		X		X		X	
Esocidae	Esox americanus		X		X			X		
Esocidae	Esox lucius				X					
Esocidae	Esox masquinongy		X		X			X		

Family	Species	Fish Type	NAT	OMN	FC	INT	INS	WC	TOL	SL
Esocidae	Esox niger		X		X			X		
Umbridae	Umbra limi		X			X	X			
Gadidae	Lota lota		X		X					X
Gasterosteidae	Culaea inconstans				X		X			
Hiodontidae	Hiodon alosoides		X		X		X			
Hiodontidae	Hiodon tergisus		X		X		X			
Lepisosteidae	Atractosteus spatula		X		X			X		
Lepisosteidae	Lepisosteus oculatus		X		X			X		
Lepisosteidae	Lepisosteus osseus		X		X			X		
Lepisosteidae	Lepisosteus platostomus		X		X			X		
Lepisosteidae	Lepisosteus sp.		X		X			X		
Mugilidae	Mugil cephalus		X							
NA	Hybrid sp.									
NA	No Fish									
Centrarchidae	Ambloplites rupestris	SUN	X		X			X		
Centrarchidae	Centrarchus macropterus	SUN	X		X		X	X		
Centrarchidae	Lepomis auritus	SUN			X		X		X	
Centrarchidae	Lepomis cyanellus	SUN	X		X		X		X	
Centrarchidae	Lepomis cyanellus X L. macrochirus	SUN			X				X	
Centrarchidae	Lepomis cyanellus X L. megalotis	SUN			X				X	
Centrarchidae	Lepomis gibbosus	SUN	X		X		X	X		
Centrarchidae	Lepomis gulosus	SUN	X		X		X	X		
Centrarchidae	Lepomis humilis	SUN	X		X		X	X		
Centrarchidae	Lepomis macrochirus	SUN	X		X		X		X	
Centrarchidae	Lepomis macrochirus X L. cyanellus				X				X	
Centrarchidae	Lepomis macrochirus X L. megalotis	SUN			X					
Centrarchidae	Lepomis marginatus	SUN	X		X		X	X		
Centrarchidae	Lepomis megalotis	SUN	X		X		X	X		
Centrarchidae	Lepomis microlophus	SUN	X		X		X	X		
Centrarchidae	Lepomis miniatus	SUN	X		X	X	X	X		
Centrarchidae	Lepomis sp.	SUN	X		X		X			
Centrarchidae	Lepomis symmetricus	SUN	X		X		X	X		
Centrarchidae	Micropterus coosae				X					
Centrarchidae	Micropterus dolomieu		X		X			X		
Centrarchidae	Micropterus punctulatus		X		X			X		
Centrarchidae	Micropterus salmoides		X		X				X	
Centrarchidae	Micropterus sp.		X		X					
Centrarchidae	Pomoxis annularis		X		X			X		
Centrarchidae	Pomoxis nigromaculatus		X		X			X		
Elassomatidae	Elassoma zonatum		X				X	X		
Moronidae	Morone chrysops		X		X					

Family	Species	Fish Type	NAT	OMN	FC	INT	INS	WC	TOL	SL
Moronidae	Morone chrysops x M. saxatilis				X					
Moronidae	Morone mississippiensis		X		X					
Moronidae	Morone saxatilis				X					
Moronidae	Morone sp				X					
Percidae	Ammocrypta clara	DAR	X		X	X	X			X
Percidae	Ammocrypta pellucida	DAR	X		X	X	X			X
Percidae	Ammocrypta vivax	DAR	X		X	X	X			X
Percidae	Crystallaria cincotta	DAR	X		X	X	X			X
Percidae	Etheostoma asprigene	DAR	X				X			
Percidae	Etheostoma baileyi	DAR	X			X	X			X
Percidae	Etheostoma barbouri	DAR	X			X	X			
Percidae	Etheostoma barrenense	DAR	X			X	X			
Percidae	Etheostoma bellum	DAR	X		X	X	X			
Percidae	Etheostoma bison	DAR	X				X			X
Percidae	Etheostoma blennioides	DAR	X		X		X			X
Percidae	Etheostoma caeruleum	DAR	X				X			X
Percidae	Etheostoma camurum	DAR	X		X	X	X			X
Percidae	Etheostoma cf. spectabile "Mamequit"	DAR	X				X			X
Percidae	Etheostoma cf. spectabile "Sheltowee"	DAR	X				X			X
Percidae	Etheostoma cf. stigmaeum "Bluegrass"	DAR	X		X	X	X			X
Percidae	Etheostoma cf. stigmaeum "Longhunt"	DAR	X		X	X	X			X
Percidae	Etheostoma chienense	DAR	X				X			
Percidae	Etheostoma chlorosoma	DAR	X				X			
Percidae	Etheostoma cinereum	DAR	X		X	X	X			
Percidae	Etheostoma crossopterum	DAR	X				X			
Percidae	Etheostoma derivativum	DAR	X			X	X			
Percidae	Etheostoma flabellare	DAR	X				X			
Percidae	Etheostoma flavum	DAR	X			X	X			X
Percidae	Etheostoma fusiforme	DAR	X			X	X			
Percidae	Etheostoma gracile	DAR	X				X			
Percidae	Etheostoma histrio	DAR	X		X	X	X			X
Percidae	Etheostoma kantuckeense	DAR	X				X			X
Percidae	Etheostoma kennicotti	DAR	X				X			X
Percidae	Etheostoma lawrencei	DAR	X				X			
Percidae	Etheostoma lynceum	DAR	X		X		X			X
Percidae	Etheostoma maculatum	DAR	X		X	X	X			X
Percidae	Etheostoma microlepidum	DAR	X		X	X	X			
Percidae	Etheostoma microperca	DAR	X			X	X			
Percidae	Etheostoma nigrum	DAR	X		X		X			
Percidae	Etheostoma obeyense	DAR	X			X	X			
Percidae	Etheostoma occidentale	DAR	X			X	X			X

Family	Species	Fish Type	NAT	OMN	FC	INT	INS	WC	TOL	SL
Percidae	Etheostoma oophylax	DAR	X				X			
Percidae	Etheostoma orientale	DAR	X			X	X			X
Percidae	Etheostoma parvipinne	DAR	X			X	X			
Percidae	Etheostoma percnurum	DAR	X			X	X			
Percidae	Etheostoma proeliare	DAR	X			X	X			
Percidae	Etheostoma pyrrhogaster	DAR	X			X	X			
Percidae	Etheostoma rafinesquei	DAR	X			X	X			
Percidae	Etheostoma rufilineatum	DAR	X		X	X	X			
Percidae	Etheostoma sagitta	DAR	X			X	X			
Percidae	Etheostoma sanguifluum	DAR	X		X	X	X			
Percidae	Etheostoma simoterum	DAR	X			X	X			X
Percidae	Etheostoma smithi	DAR	X			X	X			X
Percidae	Etheostoma sp.	DAR	X			X	X			X
Percidae	Etheostoma spectabile	DAR	X				X			X
Percidae	Etheostoma squamiceps	DAR	X				X			
Percidae	Etheostoma stigmaeum	DAR	X		X	X	X			X
Percidae	Etheostoma susanae	DAR	X			X	X			
Percidae	Etheostoma swaini	DAR	X			X	X			X
Percidae	Etheostoma tecumsehi	DAR	X				X			X
Percidae	Etheostoma tippecanoe	DAR	X		X	X	X			X
Percidae	Etheostoma variatum	DAR	X		X	X	X			X
Percidae	Etheostoma virgatum	DAR	X			X	X			
Percidae	Etheostoma zonale	DAR	X		X		X			X
Percidae	Etheostoma zonistium	DAR	X			X	X			X
Percidae	Perca flavescens		X		X					
Percidae	Percina burtoni	DAR	X		X	X	X			X
Percidae	Percina caprodes	DAR	X		X		X			X
Percidae	Percina copelandi	DAR	X		X	X	X			X
Percidae	Percina evides	DAR	X		X	X	X			X
Percidae	Percina macrocephala	DAR	X		X	X	X			X
Percidae	Percina maculata	DAR	X		X		X			X
Percidae	Percina oxyrhynchus	DAR	X		X	X	X			X
Percidae	Percina phoxocephala	DAR	X		X	X	X			X
Percidae	Percina sciera	DAR	X		X	X	X			X
Percidae	Percina shumardi	DAR	X		X		X			X
Percidae	Percina squamata	DAR	X		X	X	X			X
Percidae	Percina stictogaster	DAR	X			X	X			X
Percidae	Percina vigil	DAR	X		X	X	X			X
Percidae	Sander canadensis		X		X			X		
Percidae	Sander vitreus		X		X			X		
Sciaenidae	Aplodinotus grunniens		X		X					

Family	Species	Fish Type	NAT	OMN	FC	INT	INS	WC	TOL	SL
Amblyopsidae	Amblyopsis spelaea		X							
Amblyopsidae	Forbesichthys agassizii		X							
Amblyopsidae	Typhlichthys subterraneus		X							
Percopsidae	Percopsis omiscomaycus		X			X	X			
Petromyzontidae	Ichthyomyzon bdellium		X							
Petromyzontidae	Ichthyomyzon castaneus		X							
Petromyzontidae	Ichthyomyzon fossor		X							
Petromyzontidae	Ichthyomyzon gagei		X							
Petromyzontidae	Ichthyomyzon greeleyi		X							
Petromyzontidae	Ichthyomyzon unicuspis		X							
Petromyzontidae	Lampetra aepyptera		X							
Petromyzontidae	Lampetra appendix		X							
Petromyzontidae	Lamprey ammocoete		X							
Petromyzontidae	Lamprey sp.		X							
Osmeridae	Osmerus mordax									
Salmonidae	Oncorhynchus kisutch									
Salmonidae	Oncorhynchus mykiss						X			
Salmonidae	Salmo trutta						X			
Salmonidae	Salvelinus fontinalis						X			
Salmonidae	Salvelinus namaycush									
Cottidae	Cottus bairdii	COT	X			X	X			
Cottidae	Cottus carolinae	COT	X			X	X			
Ictaluridae	Ameiurus catus			X	X		X		X	
Ictaluridae	Ameiurus melas		X	X	X				X	
Ictaluridae	Ameiurus natalis		X	X	X				X	
Ictaluridae	Ameiurus nebulosus		X	X	X		X		X	
Ictaluridae	Ameiurus sp.		X	X	X				X	
Ictaluridae	Ictalurus furcatus		X	X	X					
Ictaluridae	Ictalurus punctatus		X	X	X					
Ictaluridae	Noturus elegans	MAD	X			X	X			
Ictaluridae	Noturus eleutherus	MAD	X			X	X			
Ictaluridae	Noturus exilis	MAD	X			X	X			
Ictaluridae	Noturus flavus	MAD	X			X	X			
Ictaluridae	Noturus gyrinus	MAD	X			X	X			
Ictaluridae	Noturus hildebrandi	MAD	X			X	X			
Ictaluridae	Noturus miurus	MAD	X			X	X			
Ictaluridae	Noturus nocturnus	MAD	X			X	X			
Ictaluridae	Noturus phaeus	MAD	X			X	X			
Ictaluridae	Noturus stigmosus	MAD	X			X	X			
Ictaluridae	Pylodictis olivaris		X		X			X		

APPENDIX F

Fish Bench Sheet

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Fish Bench Sheet

Site #: _____ **Collect Date:** _____

Stream Name _____

Location: _____ **County:** _____

Lat/Long: _____ **Catchment:** _____

Collectors: _____ **TNI** _____

Collection Method: **BPEF Time:** _____ **Seine Time:** _____ **Distance:** _____ **TR** _____

Identified By: _____ **ID Date:** _____ **Date Entered Database:** _____

		# of Specimens			
	Species	**Released**	**Voucher**	**Total**	**Notes**
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
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21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

APPENDIX G

Threatened/Endangered Species Report Form

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THREATENED/ENDANGERED SPECIES REPORT FORM		
Species Collected:		Date Collected:
# Collected:	Released ☐Yes ☐No	
If No, Explain:		
Stream:	Site #:	Basin:
Location:	County:	
Quad:	Collected/Identified by:	
Collection method:		
Comments:		

APPENDIX H

Examples of Data Summary Tables, Figures and Charts

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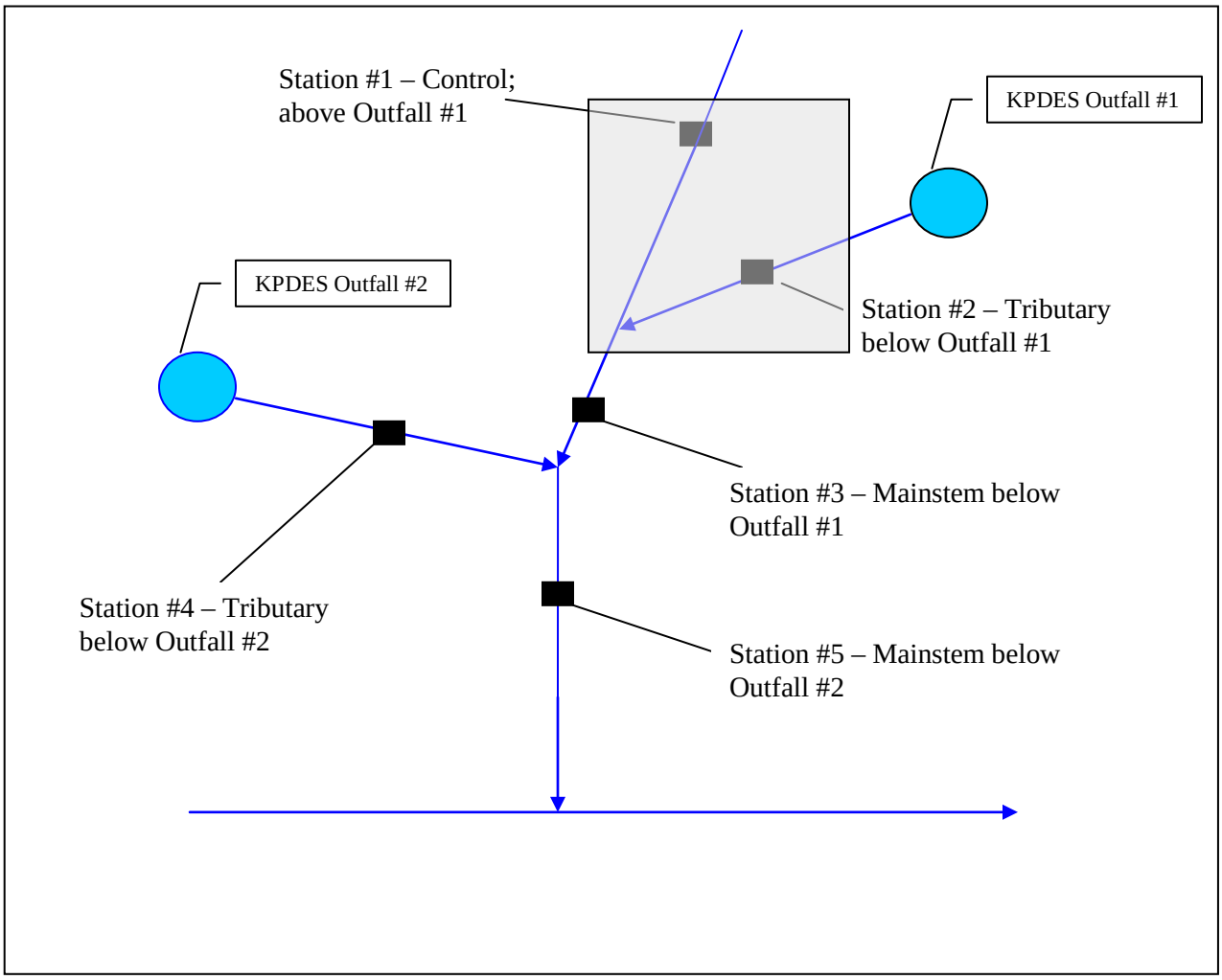
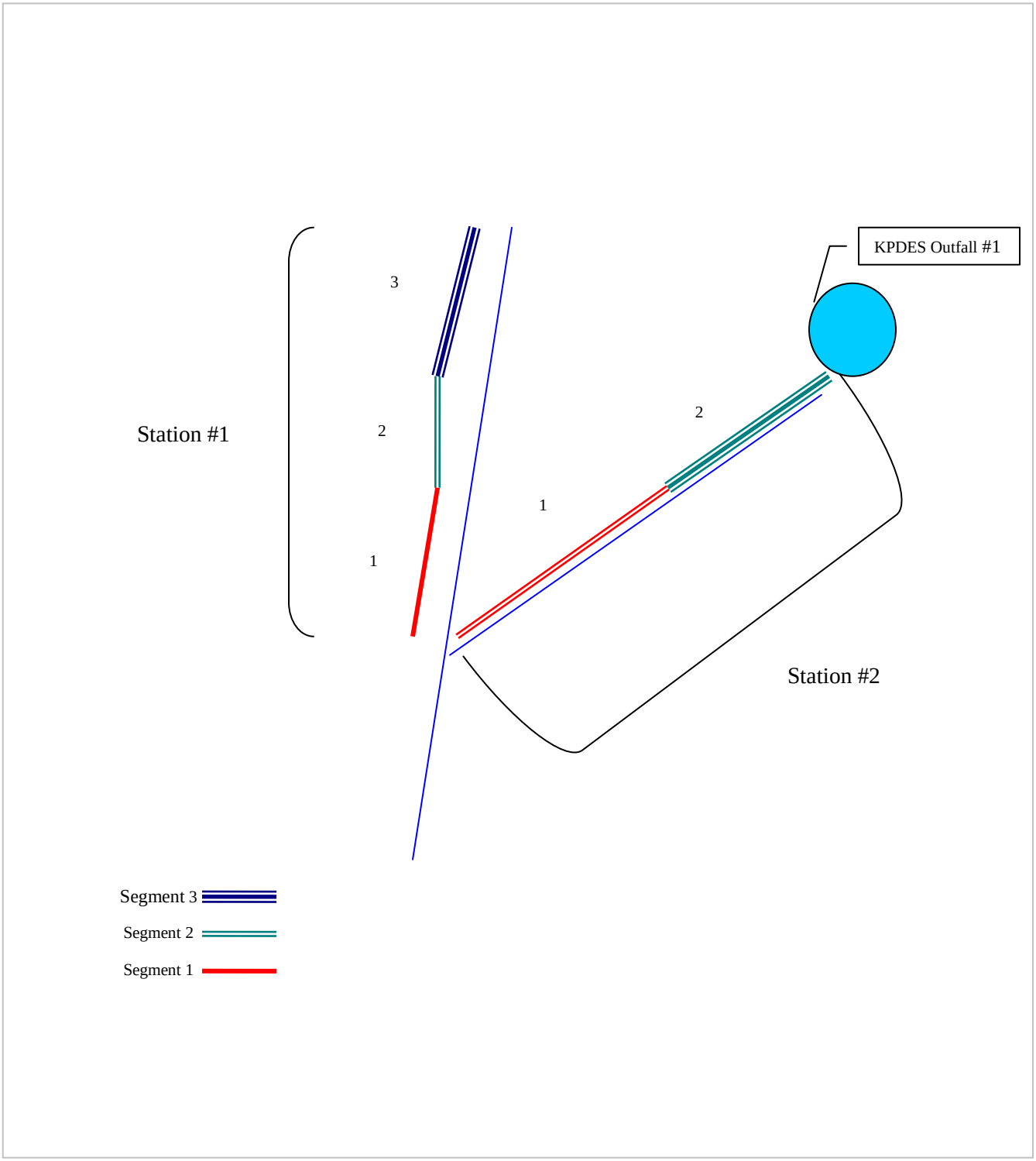
Example Table for Reporting Macroinvertebrate Sampling Results with Metrics and MBI Scores

Taxon	Station 1-HW QUANT	Station 1-HW QUAL	Station 2-HW QUAN	Station 2-HW QUAL	Station 3-WAD QUAN	Station 3-WAD QUAL	Habit	TV
EPHEMEROPTERA								
Acentrella sp.	1	X	7	X	18	X		3.6
Ameletus sp.	2	X	22	X	17	X		2.38
Baetis sp.	33	X	14	X	16	X		5.4
Baetisca sp.			3			X		2.1
Stenonema sp.	15	X	16	X	24	X	Cling	4.1
PLECOPTERA								
Leuctra sp.	3		5		17			0.67
Peltoperla sp.		X		X			Cling	1.0
ODONATA								
Cordulegaster sp.				X		X		5.73
TRICHOPTERA								
Cheumatopsyche sp.	34	X	2	X	31		Cling	6.22
Dolophilodes sp.	5		11		9		Cling	0.81
Neophylax sp.	12		23		27	X	Cling	2.2
COLEOPTERA								
Optioservus sp.	1		12	X	46		Cling	2.36
DIPTERA								
Parametriocneumus sp.	1	X	23	X	20	X	Cling	3.65
Pseudorthocladius sp.	2	X	3		17	X		1.51
Simulium sp.	5		5		35		Cling	4.4
Tanytarsus sp.	6		18	X	9	X	Cling	6.7
Tipula sp.	1		2	X	26	X		7.33
CRUSTACEA								
Cambarus sp.		X		X	5	X		4.9
TOTAL NUMBER OF INDIVIDUALS	121		166		317			
GENUS TAXA RICHNESS	16		18		17			
EPT	9		10		9			
%EPT	86.78		62.05		50.16			
mHBI	3.90		2.94		3.33			
%CLINGERS	65.29		66.27		63.41			
%CHIRONOMIDS + OLIGOCHAETES	7.43		26.5		14.51			
%EPHEMEROPTERA	42.15		31.32		NA			
MBI SCORE	**67.67**		**61.35**		**65.09**			
NARRATIVE SCORE	**Fair**		**Fair**		**Fair**			
X = taxa present								



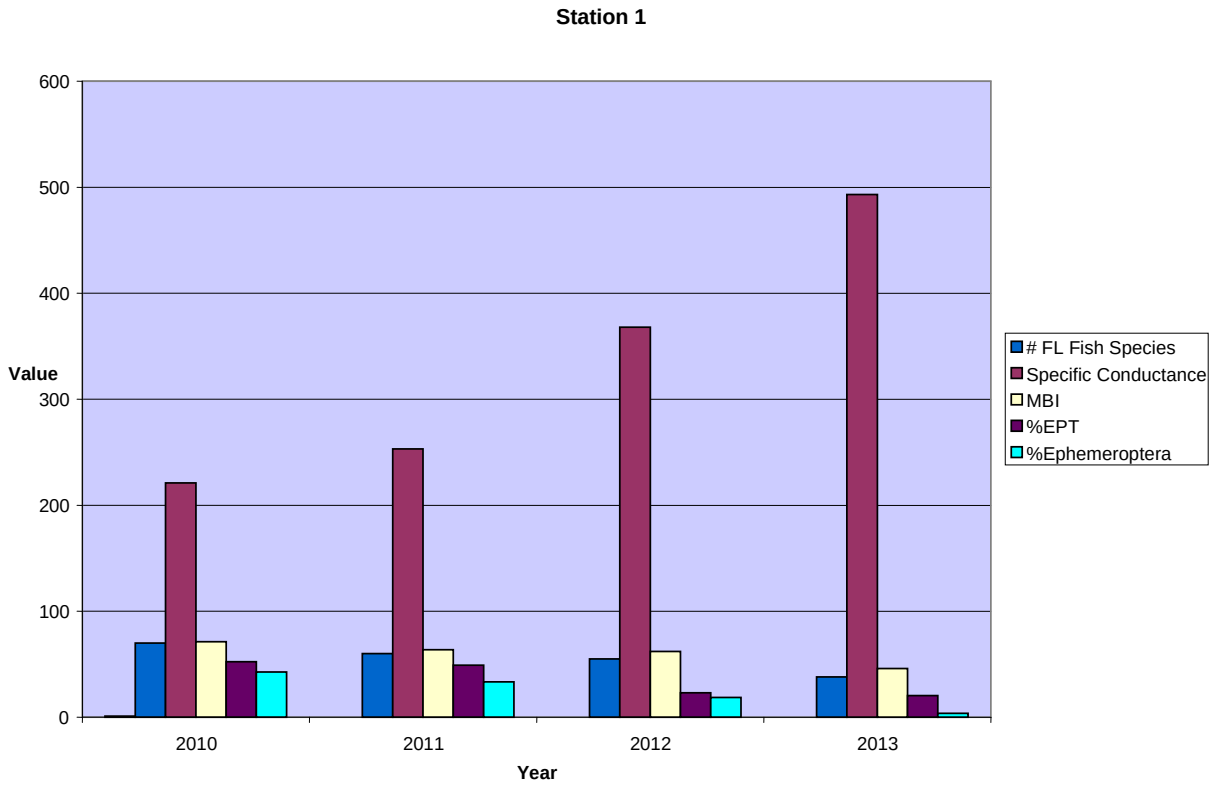
Example placement of sampling stations for study plans. See next page for details of gray inset.



Example of sampling stations #1 and #2, broken into sampling segments.

Example Table for Reporting Fish Sampling Results (see previous two figures for associated schematics).

Species	**Station 1**	**Station 1**	**Station 1**	**Station 2**	**Station 2**
	Segment#1	**Segment#2**	**Segment #3**	**Segment #1**	**Segment #2**
Least Brook Lamprey, *Lampetra aepyptera*				1	2
Creek Chub, *Semotilus atromaculatus*	34	28	44	36	49
Stoneroller , *Campostoma anomalum*	12	3	5		
Western Blacknose Dace, *Rhynichthys obtusus*	11		6		
Blackside Dace, *Phoxinus cumberlandensis*	25	2	19	12	18
Southern Redbelly Dace, Phoxinus erythrogaster	3				
Rainbow Darter, *Etheostoma caeruleum*	3	1			
Stripetail Darter , *Etheostoma kennicotti*	12		8	1	
Arrow Darter, *Etheostoma sagitta*			3		2
Cumberland Darter , *Etheostoma susanae*	3		2	1	
White Sucker, *Catostomus commersonii*	4	4			
Northern Hogsucker , Hypentelium nigricans	5				
Redbreast Sunfish, Lepomis auritus	3	1			
Green Sunfish, *Lepomis cyanellus*			1		
Number of Individuals Per Sampling Segment	115	39	88	61	71
Shocking Seconds Per Segment	515	652	477	722	631
Total Number of Individuals Per Station	242			132	
Total Shocking Seconds Per Station	1644			1353	
Catchment Area Per Station	4.9			1.7	



Example chart displaying a comparison of number of federally listed fish species, specific conductance, MBI scores, %EPT and %EPHEM over time, for Station 1 (a chart like this is required for each station.)

Addendum to: Methods for Conducting Resource Extraction General Permit Intensive Surveys in Non-OSRW Streams in Eastern and Western Kentucky Coalfields

Commonwealth of Kentucky
Energy and Environment Cabinet
Department for Environmental Protection
Division of Water

Effective Date: June 15, 2014

Action By:	**Signature**	**Date**
John Brumley Authored, Environmental Scientist	N/A*	
Andrea Keatley Approved, Manager, Water Quality Branch		
Lisa Hicks Approved, Quality Assurance Officer, Division of Water		

Document Revision History

Date of Revision	Page(s) Revised	Revision Explanation
June 15, 2014	Addendum	Attached Addendum addressing the clarification of a picking methodology for macroinvertebrates.
February 2010		**Methods for Conducting Resource Extraction Individual Permit Intensive Surveys in Non-OSRW Streams of the Western Kentucky Coalfields** original document; extracted in part from "Methods for Assessing Biological Integrity of Surface Waters in Kentucky, February 2008, Revision 3"
* John Brumley extensively reviewed and collaborated on this addendum. His signature was not obtained before he retired from KDOW.		

Suggested Citation: Addendum to: Kentucky Division of Water (KDOW). 2014. Methods for Conducting Resource Extraction General Permit Intensive Surveys in Non-OSRW Streams in Eastern and Western Kentucky Coalfields.
Kentucky Department for Environmental Protection Division of Water, Frankfort, Kentucky.

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Purpose

The addendum applies to coal general and individual permits in eastern and western coalfields and is to clarify which picking method should be used when processing and identifying macroinvertebrates for coal permitting by the Kentucky Division of Water.

9.D.A. Sample Processing (300 Pick Sub-sampling) Method

9.D.A.1. When Is This Method Appropriate to Use?

In instances where the number of macroinvertebrate individuals collected in the semi-quantitative (1 m^2 riffle kick-net) sample exceeds 300 individuals, the macroinvertebrate taxonomist has the option to use the below described 300 + 20% pick sub-sampling protocol instead of the full pick protocols described in the above-cited SOP. When using this processing method, the taxonomist will utilize the attached 300 +20% pick MBI template. If less than 300 individuals are collected in the kick-net sample, then the taxonomist shall utilize the full pick processing methodology. The taxonomist may still utilize the full pick methodology when processing macroinvertebrate samples with large numbers of individuals, if they so choose. The full pick template shall still be used if the full pick methodology is utilized. The multi-habitat sample shall be fully picked no matter what method is used on the kick-net sample. This option should allow for faster processing of macroinvertebrate samples where large numbers of individuals are present. This addendum applies to coal general and individual permits.

9.D.A.2. 300 + 20% Pick Sub-sampling

For samples where large numbers of individuals are present, a 300 + 20% pick sub-sampling laboratory method has been developed. This methodology requires that the semi-quantitative (1 m^2 riffle kick-net) sample be sub-sampled to a fixed-count of 300 individual organisms + 20%. The following describes the process for sub-sampling the semi-quantitative sample in the laboratory.

The first steps in the procedure are to drain the preservative from the sample over a 300 µm sieve, pick any organisms filtered by the sieve and place them back in the sample container.

Refill the container with water and allow the sample to sit for several minutes to rehydrate the organisms. Then drain the contents of the sample over a 300 µm sieve and spread evenly in a 22.8 X 34.3 cm glass sub-sampling dish (casserole dishes or Canton trays work well).

Add just enough water to facilitate even spreading of the organisms in the dish. If large clumps of filamentous algae (i.e. *Cladophora*) are present in the sample, clumps should be cut into small pieces with scissors to allow for easier spreading in the pan.

A paper grid layout containing 24-5.7 x 5.7 cm grids should then be placed underneath the dish. Using a random numbers table, pick four grids minimum initially, place all material from those grids in a separate sub-sampling dish and pick all of the individuals from the sample under a microscope. If more than 300 individual organisms + 20% are sub-sampled from the first four grids, place the contents in a smaller sub-sampling pan and sub-sample again until the desired number is achieved.

Continue to select individual grids after the first four grids have been picked until the desired number of individuals has been sub-sampled.

After sub-sampling is complete, scan the entire sample for rare or large taxa not included in the sub-sample and add these to your multi-habitat data. All taxa with the same final I.D. in the semi-quantitative sample should be stored in a separate glass vial and placed back into the original sample container for future QA analysis.

Reference

KDOW. 2009. Laboratory Procedures for Macroinvertebrate Processing, Taxonomic Identification and Reporting. Kentucky Department for Environmental Protection, Division of Water, Frankfort, KY.