# Table of Contents

# Water Monitoring Field Data Sheets *(p 1 of 13)*

The following data sheets MUST be filled out entirely for the web host. Make sure to include all of the monitors' names, and be sure to write clearly and to use a pencil or waterproof pen.

Date: year_____month_____day_____ Time: _____hour_____minute

(NOTE: Time hr./min. on 24-hour clock, as 10:10 for AM or 22:10 for PM)

County of PaSEC_____Site ID#_____

**Monitor Information**

Name_____

Address_____

City_____State_____Zip_____

Phone (_____)_____Fax (_____)_____

e-mail_____ Identification Number_____

**Monitor Information**

Name_____

Address_____

City_____State_____Zip_____

Phone (_____)_____Fax (_____)_____

e-mail_____ Identification Number_____

**Monitor Information**

Name_____

Address_____

City_____State_____Zip_____

Phone (_____)_____Fax (_____)_____

e-mail_____ Identification Number_____

**Date _____/_____/_____**

**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 2 of 13)*

Date: year_____month_____day_____ Time:_____hour_____minute

**Recorder Information**

Name_____

Address_____

City_____State_____Zip_____

Phone (_____)_____ Fax (_____)_____

E-mail_____ Identification Number_____

**Stream Information**

Watershed Name (instructions on how to obtain via internet can be found on page 24 of the Field Manual) _____

Waterbody Name_____

Township_____ County_____ State _____

Site Description _____

Stream Code (from PA Gazetteer)_____ River Mile Index_____

Latitude: _____ _____ _____ N Longitude: _____ _____ _____ W

Degrees Minutes Seconds (to 2 decimals) Degrees Minutes Seconds

Type of Waterbody: □ stream □ river □ other _____

Length of Assessed Area in meters (The assessed Area is the area that is being monitored. This area should be up to 30 meters in length, or as large as an accessible area as the site allows):

_____ meters

Notes on this site may be added each monitoring event.

**Date _____/_____/_____**
**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 3 of 13)*

## Physical and Chemical Observations

**Precipitation (Check One)**

**In the past 24 hours:**

____ Storm (heavy rain > 2.5 cm)
____ Rain (steady rain .85 to 2.5 cm)
____ Showers (intermittent rain up to .85 cm)
____ Overcast
____ Clear

**Current:**

____ Storm (heavy rain > 2.5 cm)
____ Rain (steady rain .85 to 2.5 cm)
____ Showers (intermittent rain up to .85 cm)____
____ Overcast
____ Clear

**PHYSICAL CHARACTERISTICS ASSESSMENT** *(check all items that apply)*

**Water Appearance** *(choose at least one)*

____ Clear
____ Orange/red
____ Dark brown
____ Green
____ Foamy
____ Milky/white
____ Muddy/cloudy
____ Multi-colored (oily sheen)
____ Non-wadable stream
____ Other (explain)
_____

**Water Odors** *(choose at least one)*

____ Chlorine
____ Sulfur (rotten eggs)
____ Musty
____ Moldy
____ Fishy
____ Sewage
____ Earthy
____ Spicy
____ Non-wadable stream
____ Other (explain)
_____
____ No unusual smells

**Soil Odors** *(in stream bed at test site, scoop up with a spoon to smell) (choose at least one)*

____ Chlorine
____ Sulfur (rotten eggs)
____ Musty
____ Moldy
____ Fishy
____ Sewage
____ Earthy
____ Spicy
____ Non-wadable stream
____ Other (explain)
_____
____ No unusual smells

**Date _____/_____/_____**
**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 4 of 13)*

**Sediment Deposits** *(Examine the stream bottom visually, by looking through the water.) (choose at least one)*

____ Sludge
____ Sawdust
____ Paper fiber
____ Sand
____ Other_____
____ No unusual sediments
____ Non-wadable stream

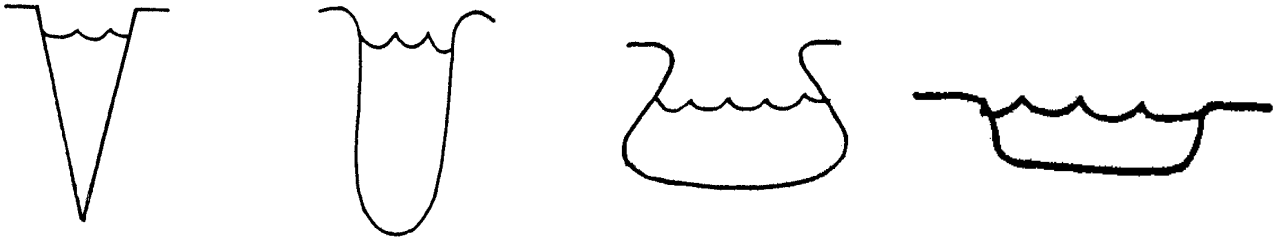
**Stream Type** *(Look upstream and downstream) (choose at least one)*

____ Straight
____ Meandering/curving
____ Braided (small islands present)
____ Channelized (human made sides or bottom)
____ Pool/riffle (calm pools/fast moving rocky areas)

Are there any dams present? ____ yes ____ no

Level of high water mark above present stream level: _____ *(Numeric meters)*
Check here if this is an estimate. ____

**Stream/Bank Cross-section Shape** *at site (check one)*



____ V-shaped ____ U-shaped ____ banks undercut ____ Rectangular

**Stream Bank Erosion** *(Check One)*

____ No sign of erosion
____ Occasional areas of erosion
____ Extensive erosion
____ Artificial stabilization present

**Date _____/_____/_____**
**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 5 of 13)*

**Stream Bottom** *(at least one entry in each category required)*
(Inorganic and Organic combined should total 100%. Begin by estimating the percentage of the stream bottom that is inorganic and that which is organic. Determine this by looking at the surface area that is covered by inorganic or organic materials. For example, if most of the stream bottom is covered by algae or other aquatic plants, the percentage of organic materials would be rated higher overall than the percentage of inorganic. Continue to break down the percentages into specific types of inorganic and organic stream bottom categories based on your visual observations

**Inorganic** *(estimated by percentage)*
____% Bedrock (solid)
____% Boulder (>25 cm diameter)
____% Cobble (6.25 cm - 25 cm)
____% Gravel (.25 cm - 6.25 cm)
____% Sand (up to .25 cm)
____% Silt (soft, fine sand)
____% Clay (fine sand with a sticky texture)
____% Other

**Organic** *(estimated by percentage)*
____% Muck-mud (black, very fine)
____% Pulpy peat (unrecognizable plant parts
____% Fibrous peat (partially decomposed plants)
____% Detritus (sticks, wood, coarse plant material)
____% Logs, limbs
____% Marl (gray, shell fragments)
____% Other

**- or - _____ Non-Wadable Stream**

____% **Total (Inorganic + Organic = 100%)**

**Predominant Surrounding Land Use** *(at least one entry required)*
*(estimated by percentage - should total 100%)*
Tip: Estimate the surrounding land use based on your assessment of the area, a distance of 30 meters back from the edges of the stream on both sides in your monitoring area.

____% Wetlands
____% Forest
____% Cropland
____% Pasture
____% Residential
____% Commercial
____% Industrial
____% Unused/abandoned
____% Overgrown shrubs and small trees
____% Other (explain)
_____

____% **Total (100%)**

**Date _____/_____/_____**
**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 6 of 13)*

**Stream Flow Volume or Discharge** Check to see if the United States Geological Survey (USGS) has the information for Stream Flow Volume or Discharge for your site. Check this Internet address:

**water.usgs.gov/**
"USGS Water Resources of the United States"
Look under "Water Data"; "Real-time"

IF stream discharge data is available for your site, you can use this information rather than performing the procedures on the following pages (stream width, depth, and velocity). Make sure to check for this information BEFORE you go out to the stream site.

If the USGS does not have this information for your site, make sure to do all of the physical assessments and all of the math for the web host.

**Stream Width** Determine the average width of wadable streams by measuring at 5 places within your sampling area and dividing the total by 5. For the purpose of converting feet to meters use: feet x 0.3048 = meters.

| _____ | + _____ | + _____ | + _____ | + _____ | = _____ | ÷ 5 = _____ |
|---|---|---|---|---|---|---|
| *meters* | *meters* | *meters* | *meters* | *meters* | *meters* | *meters* |
| *Sample 1* | *Sample 2* | *Sample 3* | *Sample 4* | *Sample 5* | *Total* | *Average Width* |

____ Non-wadable Stream
For non-wadable streams, if you have recorded stream width, note WHAT you have done below.
Notes: _____
_____
_____

**Stream Depth** Determine the average depth for wadable streams by measuring at 5 equal intervals along the width of the stream and dividing the total by 5. For the purpose of converting use: inches x 2.54 =centimeters centimeters ÷ 100 = meters.

| _____ | + _____ | + _____ | + _____ | + _____ | = _____ | ÷ 5 = _____ |
|---|---|---|---|---|---|---|
| *meters* | *meters* | *meters* | *meters* | *meters* | *meters* | *meters* |
| *Sample 1* | *Sample 2* | *Sample 3* | *Sample 4* | *Sample 5* | *Total* | *Average Depth* |

____ Non-wadable Stream
For non-wadable streams, if you have recorded stream depth, note WHAT you have done below.
Notes: _____
_____
_____

**Date _____/_____/_____**
**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 7 of 13)*

**Surface Velocity**

Complete the following steps to determine the surface velocity of wadable streams:

1. Measure and mark a 10 meter distance at your stream site, using the depth management line as the up stream mark. Each of the 5 intervals marked off to measure stream depth should be used as starting points for the weighted bobber.

2. Release the bobber at each of the 5 intervals, and time how long it takes the bobber to travel from the upstream mark down 10 meters to the downstream mark.

3. Divide the 10 meter distance by the travel time of the bobber to determine the stream's surface velocity.

4. Run the test 5 times, once at each of the 5 intervals you used for measuring depth along the transect, and take the average.

Trial #1: _____ meters ÷ _____ time (seconds) = _____ meters per second

Trial #2: _____ meters ÷ _____ time (seconds) = _____ meters per second

Trial #3: _____ meters ÷ _____ time (seconds) = _____ meters per second

Trial #4: _____ meters ÷ _____ time (seconds) = _____ meters per second

Trial #5: _____ meters ÷ _____ time (seconds) = _____ meters per second

Total = _____ ÷ 5 = _____ meters per second

*Average Velocity*

_____ Non-wadable stream

For non-wadable streams, if you have recorded surface velocity, note WHAT you have done below.

Notes: _____

_____

_____

**Date _____/_____/_____**

**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 8 of 13)*

**Stream Flow Volume or Discharge**

Calculate the streamflow volume (cubic meters/second - cms) using the above measurements.
Check here if stream discharge data was obtained from the USGS. ____
Enter this data below as the Stream Flow Volume in cubic meters/second.
(You will need to convert cubic feet/second to cubic meters/second.)
For the purpose of converting cfs (cubic feet/second) to cms use: cfs x 0.0283 = cms

**w** x **d** x **v** x **k** = **cms**

| _____ | X | _____ | X | _____ | X | _____ | = | _____ | cms |
|---|---|---|---|---|---|---|---|---|---|
| Avg. Width (meters) | / | Avg. Depth (meters) | / | Avg. Velocity (meters sec.) | / | k * (stream bottom constant) | | Streamflow Volume | |

*k = stream bottom constant (0.8 if it's rubble/gravel or 0.9 if it's sand, mud, silt or bedrock)

**Date _____/_____/_____**
**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 9 of 13)*

## CHEMICAL AND TEMPERATURE PARAMETER ASSESSMENT

**Quality Control (QC):** The Colorimeter and Digital Titrator procedures are performed as a method to assure the quality of the data being recorded. The Colorimeter and Digital Titrator tests should be performed every six months (twice a year) as a means of checking the precision and accuracy of the field test kit readings.
- Tests to be performed with the colorimeter: Total Phosphates, Nitrates, and Sulfates.
- Tests to be performed with the Digital Titrator (included in the colorimeter kit): Dissolved Oxygen and Total Alkalinity.

Other quality control checks for the visual test kits include: Field Duplicates, Calibration Standards, Field Blanks, and Standard Checks.

**Tip:** When monitoring for the first time with the visual kits, use the lowest range and move to the higher range, if needed. The next time you monitor, test each parameter in the range in which you expect your results to fall.

**Temperature** *(This test is always performed in the field.)*
**Quality Control (QC): (Take the air and water temperature twice each monitoring visit.)**

| | | |
|---|---|---|
| Result | Air _____ $^{o}$C or _____ $^{o}$F | Water _____ $^{o}$C or _____ $^{o}$F |
| Field Duplicate | Air _____ $^{o}$C or _____ $^{o}$F | Water _____ $^{o}$C or _____ $^{o}$F |

**Average Temperature** (Take the average Air Temperature and Water Temperature and record this data in the database.)

| | | |
|---|---|---|
| Average | Air _____ $^{o}$C or _____ $^{o}$F | Water _____ $^{o}$C or _____ $^{o}$F |

**Dissolved Oxygen** *(This test is always performed in the field.)*
QC:
- Every 6 monitoring visits take a **field duplicate** (repeat the test twice on two different samples of water).
- Every 6 monitoring visits, perform the test with a **digital titrator**

| | | |
|---|---|---|
| Result | _____ | *Results can range from 0.2 to 20 mg/L,* |
| Field Duplicate | _____ | *but anything <5 mg/L should be* |
| Digital Titrator | _____ | *questioned.* |

**Date _____/_____/_____**
**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 10 of 13))*

**pH** *(This test is always performed in the field.)*
QC:

- Every 6 monitoring visits take a **field duplicate** (repeat the test twice on the same sample of water).
- Each visit, test the meter with a **calibration** standard and recalibrate as necessary (detailed instructions for calibrating can be found in Appendix B).
  **NOTE:** Immediately before testing, calibrate the Pocket Pal pH Tester streamside with a pH 7.0 standard.

| | | |
|---|---|---|
| Result | _____ | *Results can range from 0 to 14,* |
| Field duplicate | _____ | *but anything <5 or >9 should be* |
| Calibration standard | _____ | *questioned.* |

**Care of pH Tester:** After you record the pH, rinse the Pocket Pal pH Tester with distilled water. Place several drops of the pH 7.0 buffer solution that was used to calibrate the pH pen in the protective cap to prevent the glass bulb from drying out. Replace the plastic cover on the pH pen. Remember to turn the pH Tester off! Check here upon completion of this task. ____

**Specific Conductance** *(This test is always performed in the field.)*
QC:

- Every 6 monitoring visits take a **field duplicate** (repeat the test twice on the same sample of water).
- Every 6 monitoring visits do a field **blank** - test deionized water as a sample to identify errors or contamination in sample collection and analysis.
- Each visit test the meter with a **calibration** standard and recalibrate as necessary (detailed instructions for calibrating can be found in Appendix B).
  **NOTE:** Immediately before testing, calibrate the conductivity tester streamside with the Sodium Chloride calibration standard solution. There are 2 types of conductivity meters. To determine your type of meter, look at the top left hand corner of the display window. If the number ten is displayed you must multiply your reading by 10. If the unit μS is displayed, record the reading directly.

| | | |
|---|---|---|
| Result | _____ | *Your meter reading can range from 10 to 1,990* μS/cm*. Anything* |
| Field duplicate | _____ | *>600* μS/cm *should be questioned.* |
| Calibration standard | _____ | *The conductivity of PA's waterways normally ranges from 20-600* μS/cm*, however normal is specific to the* |
| Field blank | _____ | *stream and its geological makeup.* |

**Date _____/_____/_____**
**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 11 of 13)*

**Care of the Conductivity Meter:** After you record the Conductivity, rinse the conductivity pen off with distilled water. Conductivity pens should be stored dry, so make sure to simply replace the dry protective cap on the pen. Remember to turn the Conductivity Tester off!

_____ Check here upon completion of this task.

**Nitrate** *(If not done in field, the water sample must be taken in plastic bottle, immediately refrigerated in dark, and test must be done within 48 hours.)*

QC:

- Every 6 monitoring visits take a **field duplicate** (repeat the test twice on the same sample of water).
- Every 6 monitoring visits do a **field blank** - test deionized water as a sample to identify errors or contamination in sample collection and analysis.
- Every 6 monitoring visits perform a **standards check**. To test with the Nitrate-Nitrogen Standard Solution, use the standard as though it is the sample of stream water and run the test as normal, making sure to use the appropriate test range. Your results should be close to the concentration on the bottle!
- Every 6 monitoring visits perform the test with the **colorimeter**.

When instructed to shake in the Nitrate test, it is very important to shake vigorously!

**NOTE:** Store the waste in a container marked "Toxic Waste - Nitrate" to be disposed of at a later date. DO NOT dispose of this waste in the sink!
_____ Check here after having disposed of the waste properly.

| | | |
|---|---|---|
| Result | _____ | *Your test kit reading can range from ND* |
| Field duplicate | _____ | *(non-detectable) to 10 mg/L Nitrate-Nitrogen;* |
| Field blank | _____ | *multiplied by 4.4, your results can range from ND* |
| Standards Check | _____ | *(non-detectable) to 44 mg/L Nitrates. Anything* |
| Colorimeter | _____ | *>8 mg/L Nitrates should be questioned.* |

**Date _____/_____/_____**
**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 12 of 13)*

**Total Phosphate** (*if not done in field, water sample must be taken in a plastic sample bottle, immediately refrigerated in dark and test must be done within 48 hours.)*
QC:

- Every 6 monitoring visits take a **field duplicate** (repeat the test twice on the same sample of water).
- Every 6 monitoring visits do a **field blank** - test deionized water as a sample to identify errors or contamination in sample collection and analysis.
- Every 6 monitoring visits perform a **standards check**. To test with the Phosphate Standard Solution, use the standard as though it is the sample of stream water and run the test as normal, making sure to use the appropriate test range. Your results should be close to the concentration listed on the bottle!
- Every 6 monitoring visits perform the test with the **colorimeter**.

Result _____
Field duplicate_____
Field blank _____
Standards check _____
Colorimeter _____

*Results can range from ND (non-detectable) to 50 mg/L, but anything >0.1 mg/L* should *be questioned.*

**Tips:** 1. After you have established the test range likely needed for your site, mark the Hach instructions for that range so you won't use the procedure for the wrong range.
2. Remember that the Acid Persulfate Digestion procedure comes before all other parts of the Total Phosphate test procedure.

**Date _____/_____/_____**
**Site ID # _____**

# Water Monitoring Field Data Sheet *(p 13 of 13)*

**Sulfate** (*if test not done in field, water sample must be taken in a plastic sample bottle, immediately refrigerated in dark and test must be done within 28 days.)*

QC:

- Every 6 monitoring visits take a **field duplicate** (repeat the test twice on the same sample of water).
- Every 6 monitoring visits do a **field blank** - test deionized water as a sample to identify errors or contamination in sample collection and analysis.
- Every 6 monitoring visits perform a **standards check**. To test with the Sulfate Standard Solution, use the standard as though it is the sample of stream water and run the test as normal, making sure to use the appropriate test range. Your results should be close to the concentration listed on the bottle!
- Every 6 monitoring visits perform the test with the **colorimeter**.

Result _____ *Results can range from 50 to 200 mg/L.*
Field duplicate _____
Field blank _____
Standards check _____
Colorimeter _____

**NOTE:** Store the waste in a container marked "Toxic Waste - Sulfate" to be disposed of at a later date. DO NOT dispose of this waste in the sink!
____ Check here after having disposed of this waste properly.

**Total Alkalinity** (*if not done in field, water sample must be taken in a plastic sample bottle, immediately refrigerated in dark and test must be done within 14 days.)*

QC:

- Every 6 monitoring visits take a **field duplicate** (repeat the test twice on the same sample of water).
- Every 6 monitoring visits, perform the test with a **digital titrator**

Result _____ *Results can range from 5 to 400 mg/L, but anything <20 mg/L should be questioned. (Note: sometimes natural conditions will be less than 20 mg/L due to the geology of the local area.)*
Field Duplicate _____
Digital Titrator _____

**Date _____/_____/_____**
**Site ID # _____**

# Biosurvey

This section can be removed
and placed in a sleeve to be
taken out twice a year
(in the spring and in the fall)
when the Biosurvey procedure
is performed.

# Macroinvertebrate Collection Procedure *(p 1 of 7)*

*(Adapted from Volunteer Stream Monitoring: A Methods Manual, United States Environmental Protection Agency, Office of Water, Draft Document #EPA 841-B-97-003, November 1997.)*

The Biosurvey and Stream Habitat Assessment will be conducted twice a year in the spring and fall. The spring survey will take place from late March through May, and the fall survey will occur from late August through October. The location of the stream within Pennsylvania will determine when to conduct the survey. The northern areas of the state will want to conduct their surveys in May and again in late August or September, while the southern areas will want to conduct their surveys in late March or April and again in September or October.

The method you use to collect macroinvertebrates depends on the type of stream you are sampling - rocky bottom versus muddy bottom. Rocky bottom streams are defined as those with bottoms made up of gravel, cobbles, and boulders in any combination and usually have definite riffle areas. Muddy bottom streams have muddy, silty or sandy bottoms and lack riffles. Generally, these are slow moving, low-gradient streams. The goal is to sample habitats having the greatest abundance and diversity of benthic macroinvertebrates. Habitats that are unimpaired by pollution or alteration are the ones that contain a diverse population of pollution sensitive macroinvertebrates.

**Wadable Rocky Bottom Streams**

Use the following method of macroinvertebrate sampling in wadable streams that have riffles and gravel/cobble substrates. You will collect three samples at each site using the standardized approved kick net and combine them to obtain one large sample.

**1. Identify the Sampling Location**

The sample area will consist of a 30 meter stream reach, or as large an accessible area as the site allows. Mark off your stream reach. If possible, it should begin at least 15 meters upstream of any human-made modification (i.e. bridge, dam, etc.). Choose three spots within the assessed area. The three spots should be in riffles, or if no riffles are present, three run areas with cobble substrate types to maximize the diversity of habitats sampled.

**2. Get Into Place**

Always approach your sampling locations from the downstream end. This keeps you from biasing your second and third collections with dislodged sediment or macroinvertebrates.

**3. Sample the Downstream Site #1 First.**

Select a 1 meter by 1 meter riffle area for sampling at site #1. Have one team member position the net at the downstream end of the sampling area in a cobble area if possible. (Do not place net in gravel bed!) This team member should have the net in front of him/her facing upstream. Hold the kick net handles at a 45 degree angle to the water's surface. Be sure that the bottom of the net fits tightly against the stream bed so no macroinvertebrates escape under the net. Use rocks from the sampling area to anchor the net against the stream bottom. Don't allow any water to flow over the net.

**4. Dislodge the Macroinvertebrates**

A. The second team member should stand within the 1 meter by 1 meter area. Fill a bucket one third full with stream water. Pick up any large rocks (i.e. boulders >10 in.) within the area and look on the bottoms for any organisms, especially case-building cadisfly larvae. Hold them over the bucket and rub the rocks thoroughly with a soft bristled brush (dishwashing brush), so any macroinvertebrates clinging to the rocks will be dislodged into the bucket. Then place the "cleaned" rocks outside of the sampling area. Continue "cleaning" the large rocks over the bucket until there are no large rocks within the sampling area. The large rocks will be returned to the sampling area once the sampling is completed.

B. Thoroughly stir up the sampling area with your feet. Start at the upstream end of the sampling area and work your way towards the net. Stop once you reach the net and have thoroughly stirred up the first two or three inches of the streambed. This should take about 3 minutes. All dislodged organisms will be carried by the stream flow into the net. Before removing the net be sure to rub any large rocks you used to anchor the net to dislodge any organisms.

**5. Remove the Net**

A. Try to remove the net without allowing any of the organisms it contains to wash away. While the net holder grabs the top of the net handles, the kicker grabs the bottom of the net handles and the net's bottom edge. Remove the net from the stream with a forward scooping motion in the upstream direction.

B. Roll the kick net into a cylinder shape and place it vertically in the partially filled bucket. Pour or spray water down the net to flush its contents into the bucket. If necessary, pick debris and organisms from the net by hand. Release any fish, amphibians, or reptiles caught in the net. Return the large rocks to the sampling area.
**[Alternative Procedure:** Spread the net out on the stream side and collect all organisms right off the net. Once you have removed all collectible organisms, repeat sampling steps for the next sampling site.]

C. If the bucket becomes too full with water, pour some out through the kick net screen. The screen will catch any organisms that are being carried by the water, and they should be returned to the bucket sample. You may also use a series of buckets with one of the buckets containing a screened bottom (600 μm mesh).

**6. Collect the Second and Third Samples**

Repeat steps 2 through 5 for the other two sites. Combine the debris and organisms from all three sites into the same bucket. This is called compositing and will provide a better representation of the stream's macroinvertebrate community.

**7. Sorting Macroinvertebrates**

Pour the contents of the bucket into a white dishpan (any large shallow white pan). Add more stream water if needed. Sort through the debris looking for anything that swims, crawls, wriggles, moves or is hiding in a shell. Use tweezers, spoons or turkey basters to remove all the macroinvertebrates to the sorting trays (ice cube trays work great - put similar organisms in the same section).

**8. Identifying Macroinvertebrates**

A. Use a hand lens or magnifying glass along with the aquatic macroinvertebrate identification sheets to identify your organisms.
B. Record the number of individuals of each type of organism you have identified on your field data sheet.
C. Once you have identified all the organisms to the best of your ability, return the macroinvertebrates to the stream. Return the organisms to the downstream section of the stream (near site #1) to allow them to locate suitable attachment sites. Rinse the dishpan, bucket, and kick net making sure there are no organisms clinging to the sides.

**9. Calculating the Stream Water Quality Rating**

Assign one of the following abundance codes to each type of organism. Record the code next to the actual count on the field data sheet.
**R (rare)** = 1 to 9 organisms found in the sample.
**C (common)** = 10 to 99 organisms found in the sample.
**D (dominant)** = 100 or more organisms found in the sample.

The field data sheet divides the macroinvertebrates into three groups based on their ability to tolerate pollution. The three tolerance groups are as follows:
**Group I** - Organisms that are sensitive to pollution and are typically found in good-quality water and/or habitat.
**Group II** - Organisms that are somewhat sensitive to pollution and are typically found in fair-quality water and/or habitat.
**Group III** - Organisms that are tolerant of pollution and are typically found in poor-quality water and/or habitat.
Follow the instructions on the data sheet to calculate the stream water quality rating.

**Wadable Muddy Bottom Streams**

The sample area will consist of a 30-meter stream reach. Mark off your 30-meter stream reach. If possible, it should begin at least 15 meters upstream of any human-made modification (i.e. bridge, dam, etc.).

Use the following method of macroinvertebrate sampling in wadable streams that have muddy, silty or sandy bottoms or lack riffles (for example - slow-moving streams, coastal plain streams). You will combine samples from 20 "jabs" with a 1 foot wide D-frame net to get a representative sample of macroinvertebrates.

**1. Determine Types of Habitats Present**

Muddy bottom streams usually have four habitat types - vegetated bank margins, snags and logs, aquatic vegetation beds and decaying organic matter, and silt/sand/gravel substrate. Not all streams will have all habitats present or present in significant amounts.

**Habitat Descriptions:**

**Vegetated Bank Margin** - This habitat consists of overhanging bank vegetation and submerged root mats attached to banks. The bank margins may also contain submerged, decomposing leaf packs trapped in root wads or lining the stream banks. This is generally a highly productive habitat and is often the most abundant type of habitat.

**Snags and Logs** - This habitat consists of submerged wood, primarily dead trees, logs, branches, roots, and leaf packs lodged between rocks or logs. This is also a very productive habitat.

**Aquatic Vegetation Beds and Decaying Organic Matter** - This habitat consists of beds of submerged, green/leafy plants that are attached to the stream bottom. This habitat can be as productive as vegetated bank margins, and snags and logs.

**Silt/sand/gravel Substrate** - This habitat includes sandy, silty or muddy stream bottoms, rocks along the stream bottom, and/or wetted gravel bars. This habitat may also contain algae-covered rocks. This is the least productive of the four muddy bottom stream habitats.

**2. Determine How Many Jabs in Each Habitat**

The goal is to collect a total of 20 jabs and combine the jabs into one combined sample. The D-frame net used to collect samples is 1 foot wide, and a jab should be approximately 1 foot in length. Thus, 20 jabs equal approximately 20 square feet of combined habitat.

The following are some scenarios to help you determine how many jabs to take in each habitat. No matter what the make-up of your stream's habitats, note on your data sheet the types of habitats present and the number of jabs taken from each habitat. This data will help characterize your findings.

**Scenario 1:** If all four habitats are present in plentiful amounts, jab the vegetated banks 10 times and divide 10 jabs among the remaining three habitats.

**Scenario 2:** If three habitats are present in plentiful amounts and one is absent, jab the silt/sand/gravel substrate - the least productive habitat - 5 times and divide the remaining 15 jabs among the other two more productive habitats.

**Scenario 3:** If only two habitats are present in plentiful amounts, the silt/sand/gravel substrate will most likely be one of those habitats. Jab it 5 times and the more productive habitat 15 times.

**Scenario 4:** If some habitats are plentiful and others are sparse in frequency, sample the sparse habitats to the extent possible, even if you can only take one or two jabs. Take the remaining jabs from the plentiful habitat(s). This rule also applies if you cannot reach a habitat because of unsafe stream conditions. Jab a total of 20 times.

**3. Get Into Place**

This type of sampling requires only one person to disturb the stream habitats. Sampling partners can stand outside of the sampling area holding the bucket and dish pan to assist in rinsing the net contents into the bucket after every few jabs.

Fill the bucket and dish pan with clear stream water. Use the dish pan and assist in rinsing the net contents into the bucket.

Check the net to be sure it is clean from the last use.

Enter the stream outside and downstream of your first sampling location.

**4. Dislodge the Macroinvertebrates**

Approach the first sample site from downstream and sample as you walk upstream. Here is how to sample in four habitat types:

**Vegetated Bank Margins** - Jab the vegetated bank margins vigorously, with an upward motion, brushing the net against vegetation and roots along the bank. The entire jab motion should occur underwater.

**Snags and Logs** - Hold the net with one hand under the section of submerged wood you are sampling. With the other hand (which should be gloved), rub about 1 square foot of area on the snag or log. Scoop organisms, bark, twigs, or other organic matter you dislodge into your net. Each combination of log rubbing and net scooping equals one jab.

**Aquatic Vegetation Beds** - Jab vigorously, with an upward motion, against or through the plant bed. The entire jab motion should occur underwater.

**Silt/sand/gravel Substrate** - Place the net with one edge against the stream bottom and push it forward about a foot (in an upstream direction) to dislodge the first few inches of silt, sand, gravel or rocks. To avoid gathering a net full of mud, periodically sweep the net back and forth in the water, making sure that water does not run over the top of the net. This will allow fine silt to rinse out through the net.

When you have completed each jab (up to 20 jabs) dump the contents of the net in the bucket and rinse the reversed net thoroughly into the bucket to catch remaining bugs. If necessary, pick any clinging organisms from the net by hand and put them in the bucket.

**5. Sorting Macroinvertebrates**

Pour the contents of the bucket into a white dishpan (or other large shallow white pan). Add more stream water if needed. Sort through the debris looking for anything that swims, crawls, wriggles, moves or is hiding in a shell. Use tweezers, spoons or turkey baster to remove the insects to the sorting trays (ice cube trays work great - put like organisms in the same section).

**6. Identifying Macroinvertebrates**

Use a hand lens or magnifying glass along with the aquatic macroinvertebrate identification sheets to identify your organisms.

Record the number of individuals of each type of organism you have identified on your field data sheet.

Once you have identified all the organisms to the best of your ability, return the macroinvertebrates to the stream. Return the organisms to the downstream section of the stream (near site #1) to allow them to locate suitable attachment sites. Rinse the dishpan, bucket, and D-frame net making sure there are no organisms clinging to the sides.

**7. Calculating the Stream Water Quality Rating**

Assign one of the following abundance codes to each type of organism. Record the code next to the actual count on the field data sheet.
**R (rare)** = 1 to 9 organisms found in the sample
**C (common)** = 10 to 99 organisms found in the sample
**D (dominant)** = 100 or more organisms found in the sample.
The field data sheet divides the macroinvertebrates into three groups based on their ability to tolerate pollution. The three tolerance groups are as follows:
**Group I** - Organisms that are sensitive to pollution and are typically found in good-quality water.
**Group II** - Organisms that are somewhat sensitive to pollution and are typically found in fair-quality water.

**Group III** - Organisms that are tolerant of pollution and are typically found in poor-quality water.

Follow the instructions on the data sheet to calculate the stream water quality rating.

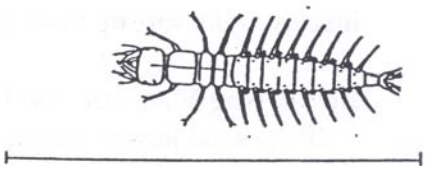
# Biosurvey: Identification Chart *(p 1 of 6)*

*Bar lines next to each organism* |——| *indicate relative size.*

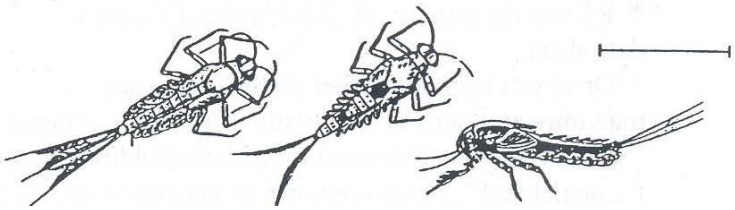
## Group I – sensitive

**Water Penny Larvae** - Order Coleoptera:
4-6 mm flattened disclike forms, found clinging to rocks a dorsal plate conceals the head and 6 legs.


**Dobsonfly Larva (Hellgrammite)** - Order Megaloptera: 25-90 mm, dark colored, 6 legs, well developed chewing mouthparts, 2 short antennae, 8 abdominal segments each with a pair of filaments; 2 anal prolegs with hooks; has gill tufts at base of legs.

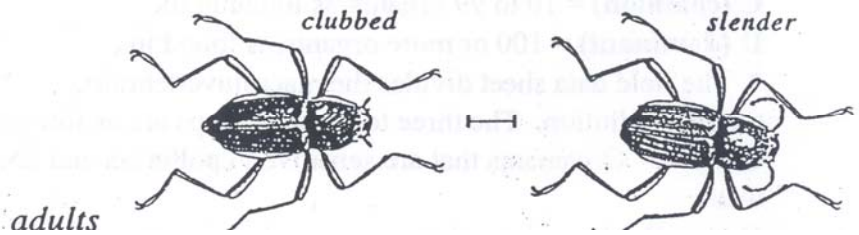


**Mayfly Nymph** - Order Ephemeroptera:
3-20 mm (not including tails), elongate, cylindrical to flattened form, head with slender antennae, 6 legs with one claw or no claw, wing pads present, platelike or feathery gills along abdomen, 3 long tails (sometimes 2).



**Gilled Snail** - Class Gastropoda:
vary in size; a thin, horny plat, the operculum, seals the opening to the shell when the foot is retracted.

**Riffle Beetle** - Order Coleoptera: 1-8 mm, oval elongate body, 6 legs, crawl underwater; antennae usually slender but are sometime clubbed.

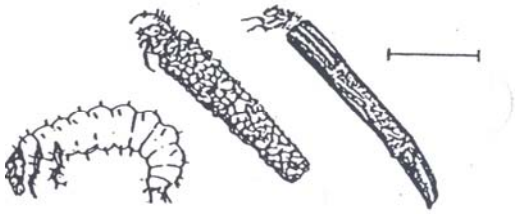



**Stonefly Nymph** - Order Plecoptera:
5-35 mm (not including tails), 6 legs with clawed tips, long slender antennae, 2 tails,gills may be present on mouthparts, thorax, and/or legs, gills, rarely present on abdomen,hardened thoracic segments.

**Biosurvey: Identification Chart** *(p 2 of 6)*

## Group I – sensitive *(continued)*

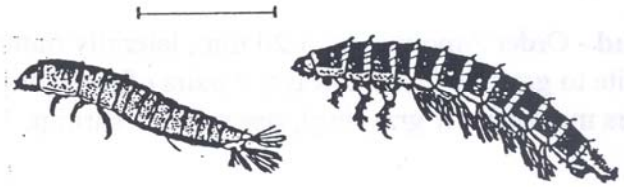
**Non-Net Spinning (Case building) Caddisfly Larva** – Order Trichoptera: 2-40 mm, usually found within a case attached to the bottom of rocks, case made of plant material or rock particles, long and caterpillar-like, distinct head, chewing mouthparts, antennae reduced or inconspicuous, 3 pairs of legs, no wing pads or tails, end of abdomen has prolegs each with a claw.



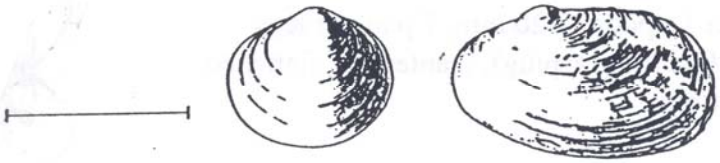
**Biosurvey: Identification Chart** *(p 3 of 6)*

## Group II - somewhat sensitive

**Beetle Larvae** - Order Coleoptera: 2-60 mm, distinct head, 2 antennae, 6 legs, 8 to 10 segmented abdomen, may or may not have abdominal gills orlateral filaments.

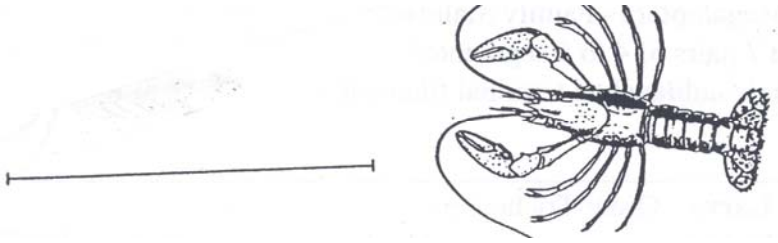


**Clams** - Class Pelecypoda: 2-250 mm, two-piece (bivalve) shell, commonly oval with concentric growth lines.

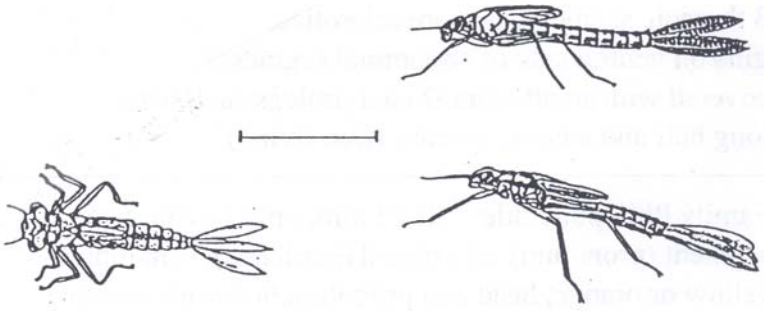


**Cranefly Larva** - Order Diptera - Family Tipulidae: 10 - 100 mm (sometimes larger), white, green or brown caterpillar-like body, segmented, abdomen may be bulbous or end in fleshy projections.

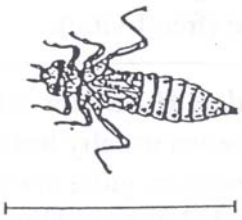
**Crayfish** - Order Decapoda: 10-150 mm, 2 large claws, 8 legs, 2 long antennae, resembles a tiny lobster.



**Damselfly Nymph** - Order Odonata -Suborder Zygoptera: 10-30 mm, elongate and slender forms, 2 antennae, 6 legs, 2 pairs of wing pads, no gills along body, 3 leaflike "tails" (actually the gills) on end of abdomen; distinctive lower lip is large and extendable.



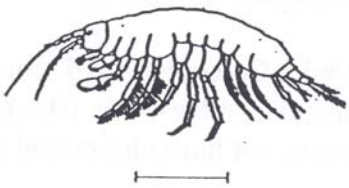
**Dragonfly Nymph** - Order Odonata - Suborder Anisoptera: 12-15 mm, large eyes, wide oval to round abdomen, 6 hooked legs, gills in rectum.



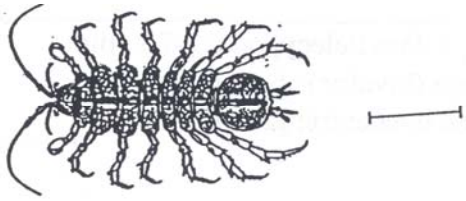
**Biosurvey: Identification Chart** *(p 4 of 6)*

## Group II - somewhat sensitive *(continued)*

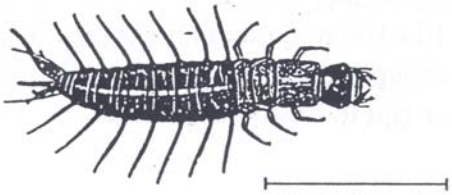
**Scud** - Order Amphipoda: 5-20 mm, laterally flattened, white to grey, swims sideways, 7 pairs of legs (first two pairs modified for grasping), resembles a shrimp.



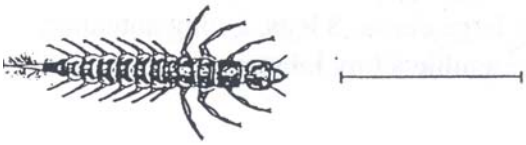
**Sowbug** - Order Isopoda: 5-20 mm, 7 pairs of legs (first pair modified for grasping), 2 antennae, flattened body, top to bottom.



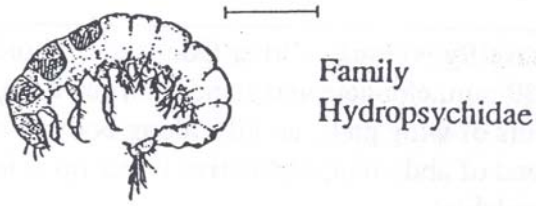
**Fishfly Larva** - Order Megaloptera - Family Corydalidae: 10-25 mm, reddish-tan often with yellowish streaks, no gill tufts underneath abdomen, resembles a small hellgrammite; have 2 breathing tubes on last abdominal segment; 2 anal prolegs with hooks.



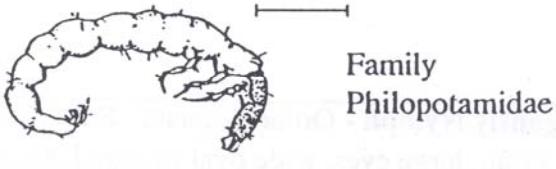
**Alderfly Larva** - Order Megaloptera - Family Sialidae: 10-25 mm, abdomen with 7 pairs of 4 to 5 segmented lateral filaments and a single unbranched terminal filament.



**Net-Spinning Caddisfly Larva** - Order Trichoptera Family Hydropsychidae: 10-16 mm, strongly curved body, 3 thoracic segments that are sclerotized (hardened), branched gills on ventral side of abdominal segments, (abdomen covered with small hairs), 2 anal prolegs each with tuft of long hair and a hook, no case (free-living).



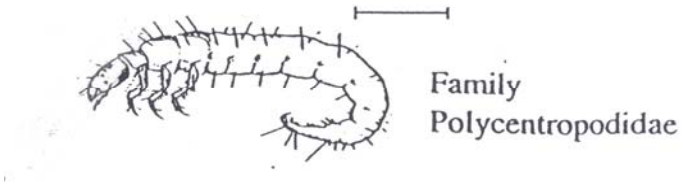

Family Philopotamidae: 10-12 mm, only first thoracic segment (pronotum) sclerotized (hardened), sometimes yellow or orange, head and pronotum brownish orange, pronotum bounded posteriorly by pronounced black line, 3 pairs of legs, no anal prolegs or abdominal gills, abdomen strongly curved, no case (free-living).



**Biosurvey: Identification Chart** *(p 5 of 6)*

## Group II - somewhat sensitive *(continued)*

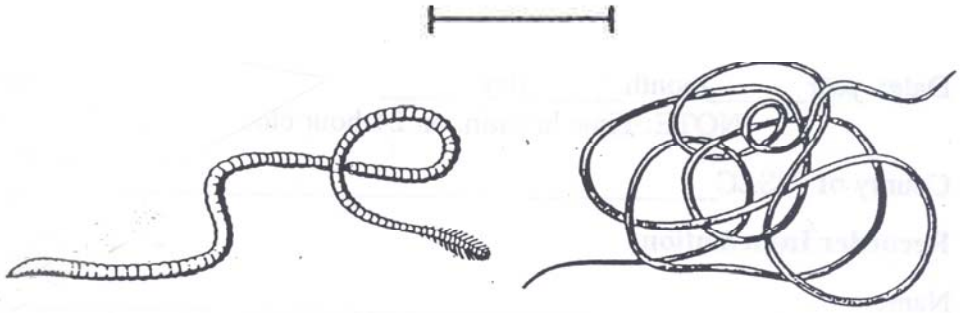
Family Polycentropodidae: 10-25 mm, whitish color tinged with purple, abdomen usually has a lateral fringe of short hairs but never possesses gills, lower end of abdomen strongly curved; 2 anal prolegs.



**Biosurvey: Identification Chart** *(p 6 of 6)*

## Group III - Tolerant

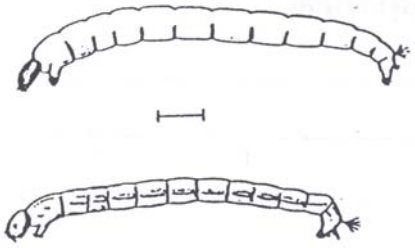
**Aquatic Worm** – Class Oligochaeta: 1-30 mm (sometimes over 100 mm), elongate, cylindrical worms, segmented body (may be difficult to see segments), color variable.



**Blackfly Larva** - Order Diptera - Family Simulidae: 3-12 mm, cylindrical body with one end wider, black head with fanlike mouth brushes.

**Leech** - Order Hirudinea: 5-100 mm, flattened segmented body, both anterior and posterior suckers.

**Midge Fly Larva** - Order Diptera - Family Chironomidae: 2-20 mm, slender and cylindrical curved body, dark head with 2 prolegs on each side of the bottom of the first segment behind the head.



**Other Snails** - Class Gastropoda: non-gill breathing snails, do not have an operculum to close the shell opening.

# Biosurvey: Field Data Sheets *(p 1 of 3)*

Date: year_____month_____day_____ Time: _____hour_____minute
(NOTE: Time hr./min. on 24-hour clock, as 10:10 for AM or 22:10 for PM)

Site ID#_____

**Recorder Information**

Name_____

Address_____

City_____State_____Zip_____

Phone (_____)_____ Fax (_____)_____

e-mail_____Identification Number_____

**Monitor Information**

Name_____

Address_____

City_____State_____Zip_____

Phone (_____)_____ Fax (_____)_____

e-mail_____Identification Number_____

**Monitor Information**

Name_____

Address_____

City_____State_____Zip_____

Phone (_____)_____ Fax (_____)_____

e-mail_____Identification Number_____

**Monitor Information**

Name_____

Address_____

City_____State_____Zip_____

Phone (_____)_____ Fax (_____)_____

e-mail_____Identification Number_____

**Precipitation**

| **In the past 24 hours:** | **Current:** |
|---|---|
| ___ Storm (heavy rain >2.5 cm) | ___ Storm (heavy rain >2.5 cm) |
| ___ Rain (steady rain .85 cm to 2.5 cm) | ___ Rain (steady rain .85 cm to 2.5 cm) |
| ___ Showers (intermittent rain up to .85 cm) | ___ Showers (intermittent rain up to .85 cm) |
| ___ Overcast | ___ Overcast |
| ___ Clear | ___ Clear |

**Biosurvey: Field Data Sheets** *(p 2 of 3)*

# Macroinvertebrate Survey

**Type of Stream**

____ Rocky-bottom ____ Muddy-bottom

Muddy-bottom Sampling Only: Record the number of jabs taken in each habitat type.

_____ Vegetated Bank Margin _____ Aquatic Vegetation Beds
_____ Snags and Logs _____ Silt/sand/gravel Substrate

**Macroinvertebrate Count**

Identify the macroinvertebrates (to order) in your sample using the identification sheets. We are only concerned with organisms that appear on the identification sheets. Record the number of organisms below and then assign them letter codes based on their abundance:

**R** (rare) = 1-9 organisms; **C** (common) = 10-99 organisms; **D** (dominant) = 100 plus organisms.
*example:* *20* ( C ) *WaterPenny larvae*

**(Enter a whole number for each, 0-999)**

**Group I - Sensitive**

_____ (____) Water Penny larvae
_____ (____) Hellgrammites
_____ (____) Mayfly nymphs
_____ (____) Gilled snails
_____ (____) Riffle beetle adults
_____ (____) Stonefly nymphs
_____ (____) Non-net spinning caddisfly larvae

**Group II - Somewhat Sensitive**

_____ (____) Beetle larvae
_____ (____) Clams
_____ (____) Cranefly larvae
_____ (____) Crayfish
_____ (____) Damselfly nymphs
_____ (____) Dragonfly nymphs
_____ (____) Scuds
_____ (____) Sowbugs
_____ (____) Fishfly larvae
_____ (____) Alderfly larvae
_____ (____) Net-spinning caddisfly larvae

**Group III - Tolerant**

_____ (____) Aquatic worms
_____ (____) Blackfly larvae
_____ (____) Leeches
_____ (____) Midge larvae
_____ (____) Snails

**Biosurvey: Field Data Sheets** *(p 3 of 3)*

## The following letter codes will be assigned automatically to each count as it is entered into the database.

R (rare) = 1-9 organisms; C (common) = 10-99 organisms; or D (dominant) 100 plus organisms

The database will then calculate the water quality score for the stream site by adding together assigned index values (a factor by which each count is multiplied) for each group. The Water Quality Score for a stream site will fall into one of the following categories:

_____ Good > 40 _____ Fair 20-40 _____ Poor <20

# Water Quality Rating *(done automatically by database)*

To calculate the index value, add the number of letters found in the three groups above and multiply by the indicated weighing factor.

Group I – Sensitive

(# of R's) x 5.0 = _____
(# of C's) x 5.6 = _____
(# of D's) x 5.3 = _____
**Sum of the Index Value for Group I** = _____

Group II – Somewhat Sensitive

(# of R's) x 3.2 = _____
(# of C's) x 3.4 = _____
(# of D's) x 3.0 = _____
**Sum of the Index Value for Group II** = _____

Group III – Tolerant

(# of R's) x 1.2 = _____
(# of C's) x 1.1 = _____
(# of D's) x 1.0 = _____
**Sum of the Index Value for Group III** = _____

To calculate the water quality score for the stream site, add together the index values for each group. The sum of these values equals the water quality score.

**Water Quality Score =** _____

Compare this score to the following number ranges to determine the quality of your stream site

Good > 40 Fair 20-40 Poor < 20

Note: The tolerance groupings (Group I, II, III) and the water quality rating categories were developed for streams in the Mid-Atlantic states.