EASI

Volunteer Water Quality Monitoring Field Manual

The Volunteer Water Quality Monitoring Field Manual has been compiled by: The Schuylkill Center for Environmental Education and the Environmental Alliance for Senior Involvement

Table of Contents

Water Quality Monitoring Equipment Checklist

(not including equipment for benthic macroinvertebrate survey)

- l EASI Hach Test Kit
  - l Separate inventory sheet checked
- l Disposable vinyl gloves (any non-latex gloves)
- l Waterproof boots/shoes
- l Windbreaker (if cold: pants also available)
- l Towel (for drying equipment and to sit on)
- l Change of clothes and shoes
- l Clipboard
- l Field manual data sheets
- l Painter's masks
- l Pencils/waterproof pens
- l Notebook paper
- l Small towels (hand drying, etc.)
- l Plastic trash bags
- l Camera with film
- l Stop watch
- l 25 meter rope or tape measure
- l Plastic spoon
- l Small glass jar
- l Flow-measuring bobber/20 meter nylon line
- l Waste water disposal container (hazardous)
- l Waste water disposal container (nonhazardous)
- l First aid kit
- l Eyewash bottle
- l Volunteer Monitor ID Card
- l Matches
- l Waterless handwash or Handwipes
- l Meter stick (for depth measurements)
- l Duffle bag
- l Camp table
- l Calculator
- l Extension water sampler/bottle
- l Scissors
- l Matches

EASI Hach Test Kit Inventory

GENERAL EQUIPMENT

Description	Quantity
Goggles, Safety Clear	4
Thermometer, Pocket	1
Screwdriver, Jeweler's	1
Demineralizer Bottle	1
Rinse Bottle	1

14161-33 NITRATE TEST KIT

Part #	Description	Quantity
1732-00	Color Comparator Box, Hach Logo	1
14078-99	Nitriver 3 Pwd Plws 5ml (pkg 100)	1
14120-99	Nitraver 6 Pwd Plws 5ml (pkg 100)	1
14161-88	Instructions, NI-14 Test Kit	1
14171-00	Color Disc, Nitrate Low Range	1
14197-00	Dropper, Glass	1
46600-00	Plastic Color Viewing Tube	2
46600-88	Instructions, Color Viewing Tube	1
46601-00	Blue Carrying Case, HC-1	1
26853-00	Instructions, Safety & Disposal	1
	Material Safety Data Sheets	1

24443-33 ALKALINITY TEST KIT

Part #	Description	Quantity
438-00	Tube, Measuring Plastic 5.83ml	1
942-99	Phenolphthalein Pwd Plws (pkg 100)	1
943-99	Bromcresol Gr-Meth Red Pwd Plws (pkg100)	1
2327-00	Bottle, MXG Marked	1
23497-32	Sulfuric Acid, 0.035N 100ml MDB	1
24443-89	Instructions, AL-AP MG/L	1
26853-00	Instructions, Safety & Disposal	1
44401-00	Blue Carrying Case, HC-1	1
	Material Safety Data Sheets	1

EASI Hach Test Kit Inventory

1469-33 DISSOLVED OXYGEN TEST KIT

Part #	Description	Quantity
438-00	Tube, Measuring Plastic 5.83ml	1
439-00	Bottle, Sq Glass 29ml	1
968-00	Scissors	1
981-99	Dissolved Oxygen 1 Pwd Plws (pkg 100)	1
982-99	Dissolved Oxygen 2 Pwd Plws (pkg 100)	1
987-99	Dissolved Oxygen 3 Pwd Plws (pkg 100)	1
1469-88	Instructions, OX-2P Test Kit	1
1909-02	Bottle, BOD 60ml w/30ml Line	1
5994-35	Plastic Molded Insert	1
24089-32	Sodium Thiosulfate Std, 0.0109N	1
26853-00	Instructions, Safety & Disposal Ea	1
	Blue Carrying Case, HC-3	1
	Material Safety Data Sheets	1

2250-01 TOTAL PHOSPHATE TEST KIT, PO-24

Part #	Description	Quantity
272-42	Water, Deionized (Demineralized)	2
439-00	Bottle, Sq Glass 29ml	1
505-01	Flask, Erlenmeyer 50ml	1
634-00	Clamp, Test Tube	1
1046-33	Filtration Aid Soln 29ml DB	1
1083-97	Funnel, Analytical pp 65mm	1
1730-00	Glass Tube, Color Viewing 5ml Mark	2
1731-00	Stopper, Blue	2
1732-00	Color Comparator Box, Hach Logo	1
1894-57	Filter Paper, Fold 12.5cm (pkg 100)	1
2125-46	Phosver 3 Phosphate Rgt Pwd Plws (pkg 50)	1
2179-00	Cover for Cookit	1
2206-00	Stove, Folding w/Fuel Tablets	1
2250-35	Plastic Molded Insert	1

(continued)

EASI Hach Test Kit Inventory

Part #	Description	Quantity
2250-38	Instructions, PO-24 Test Kit	1
2327-00	Bottle, MXG Marked	1
2414-00	Cylinder	1
2449-32	Sulfuric Acid 5.25N 100ml MDB	1
2450-32	Sodium Hydroxide 5.0N 100ml MDB	1
2451-99	Potassium Persulfate Pwd Plws (pkg 100)	1
14197-00	Dropper, Glass	1
24122-01	Black Box (Long Path Viewing Adaptor)	1
24898-00	Color Disc, Phosphate	1
46605-00	Blue Carrying Case	1
	Material Safety Data Sheets	1

2251-00 SULFATE TEST KIT

Part #	Description	Quantity
12065-66	SulfaVer 4 Pwd Plws (pkg 50)	1
46814-00	Dipstick, Sulfate Measure	1
24102-00	Bottle, Mixing, Plastic	1
2172-40	Cylinder, Graduated, Polymethylpentene	1
	Instructions, SF-1 Test Kit	1
	Material Safety Data Sheets	1

44400-00 CONDUCTIVITY METER

Part #	Description	Quantity
	Calibration Standard	1
	Material Safety Data Sheets	1

44350-33 pH METER

Part #	Description	Quantity
22992-64	Buffer Pwd Plws (pH 4.01 and pH 7.00)	1
	Buffer Pwd Plws (pH 10)	1
	Material Safety Data Sheets	1

Benthic Macroinvertebrate Survey Equipment Checklist

For Semi-annual Monitoring - use with Water Quality Monitoring Equipment Checklist

- l All Equipment on Water Quality Monitoring Checklist
- l Net (1 m X 1 m, 500 *u*m kick net or D-frame net)
- l White dishpan or other shallow white tray
- l Containers for sorting (i.e. ice cube trays)
- l Tweezers, soft paint brush, and/or turkey baster
- l Magnifying lens or box
- l Fishing license

Equipment Maintenance Needs

Equipment Name _____

What's wrong with it?_____

_____

_____

Replacement? _____

Volunteer Name_____

Volunteer ID #_____ Date_____

(Master Sheet - make duplicates for submission.)

Safety and Health Checklist

EASI is pleased that you have decided to be a member of the Senior Environment Corps and a volunteer water quality monitor. Your safety and health are of number-one importance, particularly when you are working outside. There are several important things to remember when you are monitoring at a stream or other body of water. If you follow these "rules of the river" you will have a fun, enjoyable and accident-free experience!

BEFORE VISITING YOUR SITE:

- Always monitor with at least one partner. Teams of three or four are preferred.
- Always let someone else know where you are, when you intend to return, and what to do if you don't come back at the appointed time.
- Carry the phone number and location of the nearest medical center to your monitoring site and the location of a pay phone should you need to call for help.
- Carry the phone number of your program coordinator.
- Listen to weather reports. DO NOT go sampling if severe weather is predicted (i.e. lightening, flooding, ice etc.); stop monitoring if a storm occurs while you are at the site.
- Carry a list of any important medical conditions of team members (e.g. heart conditions or allergic reactions to bee stings) and emergency responses needed.
- Carry a First Aid Kit and be sure to check the contents before leaving to monitor.
- Some of the chemicals in the test kits are poisonous if ingested. Carry the number to the local poison control center.

RULES TO MONITOR BY:

- Never wade in swift or high water.
- DO NOT monitor if the stream is at flood stage.
- If you drive, park in a safe location. Be sure your car doesn't pose a hazard to other drivers and that you don't block traffic.
- Put your wallet and keys in a safe place. If wading in the stream place them in a watertight bag you keep strapped to your waist or they might end up downstream.
- Never cross private property without the permission of the landowner.
- Confirm that you are at the proper site location by checking maps, site descriptions, or directions.

Safety and Health Checklist

If you observe any of the following at your sampling station - STOP! - do not monitor. Call your PA Regional DEP office or 1-800-541-2050 (phone numbers in section titled Emergency Protocol).

STOP! If you observe closed or leaking drums in the stream or on the stream bank

STOP! If you observe an oil sheen on the water.

STOP! If you observe a large quantity of dead fish or other organisms.

STOP! If you observe a pipe discharging some odd looking/smelling substance into the stream.

Do not monitor if stream site is posted as unsafe for body contact.

- During monitoring, keep your hands away from eye and mouth areas. Always wash your hands thoroughly with soap and water after monitoring. Never eat after monitoring without first washing your hands.
- When monitoring at a potentially polluted site or near a wastewater treatment plant, painter's masks should be worn to protect against aerosols. (wind borne contaminants)
- Watch for poison ivy, poison oak, sumac, and other types of vegetation that can cause rashes and irritation.
- Watch for irate dogs, wildlife (particularly snakes), ticks, and insects that may sting. Know what to do if you or your team members get bitten or stung.
- Never drink the water from the stream.
- Do not walk on unstable stream banks that may collapse.

Be very careful when walking in the stream. Rocky-bottom streams can be very slippery and can contain deep pools; muddy-bottom streams might also prove treacherous in areas where mud, silt, or sand have accumulated in sink holes.

If you must cross the stream:

- Use a walking stick to steady yourself and probe for deep water or muck.
- A partner should wait on dry land ready to assist in case of an accident.
- Do not cross streams that are swift and above the knee in depth.
- Wear waders and rubber gloves in streams suspected of having significant pollution problems.

If sampling from a bridge:

- Be wary of passing traffic.
- Never lean over bridge rails unless firmly anchored to the ground or the bridge with good hand and foot holds.

STOP! If at any time you feel uncomfortable about the condition of the stream or your surroundings, stop monitoring and leave the site at once. Your safety is more important than the data!!

CHEMICAL KIT SAFETY

- It is very important when working with chemicals to know the proper handling techniques and possible hazards. Even though the chemicals in the kits are used in very small amounts and are for the most part considered non-hazardous they still can be potentially harmful to you and/or the environment. Following the guidelines below will ensure your safety and well being.
- Know your equipment, sampling instructions, and procedures before going out into the field.

  Enclosed in each test kit and in this manual are Material Safety Data Sheets (MSDS) for each of the chemicals. These sheets are provided by the chemical company and contain very specific information on the chemical and the proper first aid if someone ingests the chemical, or if it comes in contact with someone's eyes or skin.
- Read the MSDS sheet for each chemical that you will be handling to familiarize yourself with the potential hazards. Know where your MSDS sheets are located when monitoring in the field.
- Keep all equipment and chemicals away from small children.
- Avoid contact between chemical reagents and skin, eye, nose, and mouth.
- Wash hands directly after using the chemical tests and before eating.
- Never use your fingers to stopper a sample bottle (e.g. when you are shaking a solution).
- Wear goggles when handling chemicals.
- Know chemical cleanup and disposal procedures. Wipe up all spills when they occur.
- Close all containers tightly after use. Do not switch caps.
- Do not expose chemicals or equipment to temperature extremes or long-term direct sunshine.

Contact/Resource List

Allegheny Conservation District
(412) 921-1999
208 Acacia Building
875 Greentree Road
Pittsburgh, PA 15220-3501

Allen, Chris
(717) 783-7404 • fax (717) 783-8926
Rachel Carson Building
16th Floor
400 Market Street
Harrisburg, PA 17105

Barnes, Tingle
(412) 963-6100 • fax (412) 963-6761
Beechwood Farms
Audubon Society of Western Pennsylvania
614 Dorseyville Road
Pittsburgh, PA 15238

Benjamin, Tom
(888) 423-7855 • fax (540) 788-9301
tom@easi.org
8733 Old Dumfries Road
Catlett, VA 20119

Benthic Invertebrate Help
Katie Shepard
(215) 482-7300

Chastek, Marilyn
(717) 697-5947 • fax (717) 697-1764
Mechanicsburg Area Adult Center
97 West Portland Street
Mechanicsburg, PA 17955

Cohen, Rennie
(610) 828-8110 • fax (610) 828-7187
Center in the Park
113 Shasta Road
Plymouth Meeting, PA 19462

Computer Help
1. Tom Benjamin
(888) 423-7855
2. Peggy Knight
(703) 241-0019

Crawford Conservation District
(814) 724-1793
1012 Water Street Suite 18
Meadville, PA 16335

Crouch-Kraitchman, Marilyn
(412) 361-5003 • fax (412) 361-2737
Vintage, Inc.
401 North Highland Avenue
Pittsburgh, PA 15206

Cummings-Leight, Amy
(215) 362-7432 • fax (215) 368-5720
North Penn Senior Center
315 West Main Street
Lansdale, PA 19446

Database Help
1. Tom Benjamin
(888) 423-7855
tom@easi.org
2. Peggy Knight
(703) 241-0019
Mknighteco@aol.com

Dauphin Conservation District
(717) 921-8100
1451 Peters Mountain Road
Dauphin, PA 17018

EASI
(888) 423-7855 • fax (540) 788-9301
8733 Old Dumfries Road
Catlett, VA 20119
easi@easi.org

Equipment
Peggy Knight
(888) 423-7855 • fax (703) 538-5504
Mknighteco@aol.com

Gaskins, Trudy
(717) 541-9521
RSVP of the Capitol Region
5301 Jonestown Road
Harrisburg, PA 17055

Grove, Elizabeth
(717) 854-0693 • fax (717) 854-7715
Yorktown Senior Center, Inc.
1059 Kelly Drive
York, PA 17404

Hach
(800) 227-4224 (technical support)
Rich Dunn

Harris, Naomi
(717) 963-6740 • fax (717) 963-6401
Lackawanna County Area Agency on Aging
200 Adams Avenue
Scranton, PA 18503

Hill, Brian
(814) 332-2946 • fax (814) 333-8149
Box 172, Allegheny College
Meadville, PA 16335

Holland, Jean
(215) 858-7722 • fax (215) 848-0979
Center in the Park
5818 Germantown Avenue
Philadelphia, PA 19144

Indiana Conservation District
(412) 463-7702
Ag Service Center
251 Rt. 286 North
Indiana, PA 15701-9203

Jacobsburg Environmental Ed Center
(610) 746-2806 • fax (610) 746-2804
Jacobsburg Environmental Education Center
835 Jacobsburg Road
Wind Gap, PA 18091

Kay, Tracy
(215) 482-7300 • fax (215) 482-8158
Schuylkill Center for Environmental Education
8480 Hagy's Mill Road
Philadelphia, PA 19128-1998

Knight, Peggy
(703) 241-0019 • fax (703) 538-5504
5615 N. 26th St.
Arlington, VA 22207-1407
Mknighteco@aol.com

Lehigh Conservation District
(610) 391-9583
Lehigh Agriculture Center
Suite 102, 4184 Domey Park Road
Allentown, PA 18104

Ling, Carol
(412) 349-4500 • fax (412) 349-9535
Aging Services, Inc.
1005 Oak Street, P.O. Box 519
Indiana, PA 15701-0519

Milhaus, David
(814) 332-6942 • fax (814) 332-6121
Northwest Region DEP Field Office
230 Chestnut Street
Meadville, PA 16335

Montgomery Conservation District
(610) 489-4506
1015 Bridge Road, Suite B
Collegeville, PA 19426

Northampton Conservation District
(610) 746-1971
R.R. #4, Greystone Building
Nazareth, PA 18064-9211

PA Department of Environmental Protection-Citizens Monitoring Network
(717) 787-3730

Pocono Environmental Education Center
(717) 828-2319 • fax (717) 828-9695

Roberts, Pamela B.
(814) 336-1792 • fax (814) 336-1705
Active Aging, Inc.
1034 Park Avenue
Meadville, PA 16335

Ruppert, Estelle
(610) 746-2806 • fax (610) 746-2804
Jacobsburg Environmental Education Center
835 Jacobsburg Road
Wind Gap, PA 18091

Schrameyer, Diane
(610) 391-8211 • fax (717) 398-4053
RSVP of Lehigh/Carbon/Northampton
800 Hausman Road
Allentown, PA 18104

Schuylkill Center for Environmental Education
(215) 482-7300 • fax (215) 482-8158
8480 Hagy's Mill Road
Philadelphia, PA 19128-1998

Shepard, Katie
(215) 482-7300 • fax (215) 482-8158
Schuylkill Center for
Environmental Education
8480 Hagy's Mill Road
Philadelphia, PA 19128-1998
katieshepard@erols.com

Stream Assessment Help
Katie Shepard
(215) 482-7300 • fax (215) 482-8158

Supplies
Peggy Knight
(888) 423-7855
(703) 241-0019 • fax (703) 538-5504
Mknighteco@aol.com

Test Kit Help
Katie Shepard
(215) 482-7300
Hach—Rich Dunn
(800) 227-4224

Warren Conservation District
(814) 563-3117
609 Rouse Avenue, Suite 203
Youngsville, PA 16371

Williams, Chris
(814) 398-8616 • fax (814) 398-2373
Cambridge Springs Senior Center
156 Venango Avenue
Cambridge Springs, PA 16403

Wilson, Diane
(717) 787-3730 • fax (717) 783-8926
Rachel Carson Building
16th Floor
400 Market Street
Harrisburg, PA 17105

Emergency Protocol

(What do you do if you have a problem?)

From time to time water quality monitors may come upon situations that may require immediate action.

STOP ! **If you observe any of the following at your sampling station:**

1. Closed or leaking drums in the stream or on the streambank.
2. An oil sheen on the water.
3. A large quantity of dead fish.
4. A pipe discharging some odd looking/smelling substance into the stream.

STOP ! **Do not sample or allow water to come in contact with your skin!**

STOP and call your Pennsylvania DEP Regional office or 1-800-541-2050. You should have your camera with you for use in photo documenting your observations. Following is the listing of regions, counties and call-in numbers for you to use if necessary.

Northwest Region (814) 332-6942

230 Chestnut Street
Meadville, PA 16335

Counties: Butler, Clarion, Crawford, Elk, Erie, Forest, Jefferson, Lawrence, McKean, Mercer, Venango, Warren

Southwest Region (412) 442-4000

400 Waterfront Drive
Pittsburgh, PA 15222-4745

Counties: Allegheny, Armstrong, Beaver, Cambria, Fayette, Greene, Indiana, Somerset, Washington, Westmoreland

Southcentral Region (717) 541-7901

One Ararat Boulevard, Room 147
Harrisburg, PA 17110

Counties: Adams, Bedford, Berks, Blair, Cumberland, Dauphin, Franklin, Fulton, Huntingdon, Juniata, Lancaster, Lebanon, Mifflin, Perry, York

Emergency/Unusual Reading Protocol

Northeast Region (717) 826-5485

2 Public Square
Wilkes-Barre, PA 18711-0790

Counties: Carbon, Lackawanna, Lehigh, Luzerne, Monroe, Northampton, Pike, Schuylkill, Susquehanna, Wayne, Wyoming

Southeast Region (610) 832-6130

Lee Park
555 North Lane, Suite 6010
Conshohocken, PA 19428

Counties: Bucks, Chester, Delaware, Montgomery, Philadelphia

Northcentral Region (717) 327-3574

208 West 3rd Street, Suite 101
Williamsport, PA 17701

Counties: Bradford, Cameron, Centre, Clearfield, Clinton, Columbia, Lycoming, Montour, Northumberland, Potter, Snyder, Sullivan, Tioga, Union

Unusual Reading Protocol

If any of your chemical tests produce unusual readings proceed as follows:

1. Repeat the test.
2. Repeat the test.

At least 2 of the 3 tests should produce similar readings. If that reading is abnormal, proceed as follows:

1. Bracket the extent of any potential abnormal conditions by taking readings at designated upstream and downstream locations.

> If you do not have designated upstream and downstream locations that have been checked for safety and accessibility, DO NOT bracket the test site.

2. Report your results to your Web Host and inform them of your interpretation of the abnormal reading. The Web Host will notify the appropriate individuals.

Chemical Waste Disposal

Environmentally Sound Monitoring

When you are using the chemical test kit to monitor water quality, you are using chemicals that are not already present in the water, and these chemicals must be handled properly to avoid causing pollution. EASI is in the process of developing a program to address the disposal of these chemicals. While EASI and the SECs around Pennsylvania await the implementation of that program, here are the steps to follow to be an "environmentally sound water quality monitor."

Reacted Sample Waste (what's in your test tubes when you finish!)

Two types of waste are generated during chemical analyses: nonhazardous and hazardous. These two types of waste must be separated for proper disposal. All wastes from the dissolved oxygen, total phosphorus, total alkalinity, and the calibration standards from the pH and conductivity meters are classified as nonhazardous. The nitrate test that employs the cadmium reduction method generates small amounts of cadmium, a heavy metal. The sulfate test generates small amounts of barium. The waste from these two chemical tests should be treated as hazardous due to the cadmium and barium in the solution.

Disposing of Nonhazardous Wastes There are two options for disposal:

1. For disposal in a sink: Bring an empty plastic or glass container to your site and use it to collect all wastes from the dissolved oxygen, total phosphorus, total alkalinity, and the calibration standards from the pH and conductivity meters. Take the container of waste and dispose in a sink. Be sure to run plenty of water while disposing and for a few minutes after dumping to dilute the chemicals and prevent corrosion of pipes.
2. For disposal in a trash receptacle: Collect the wastes in a container (an old coffee can works well) filled with an absorbent material like kitty litter. The kitty litter will absorb the water and bind the waste. This container should be tightly covered and may be placed in a trash receptacle as long as there is no free-flowing liquid remaining.

Disposing of Hazardous Wastes

The wastes generated by the nitrate test contains small amounts of cadmium. The sulfate test generates small amounts of barium. Cadmium and barium are classified as a hazardous waste by the US Environmental Protection Agency. Wastes from these tests should be collected separately in a container, such as a wide-mouthed plastic bottle, that is clearly marked as "Toxic Waste." The waste can be concentrated by evaporation (in a safe place, out of reach of children). The waste should be kept in the marked container for proper disposal at a later date.

Care and Feeding of Test Kits

General Cleaning

All labware (i.e. mixing bottles, syringes, sample tubes, etc) should be washed after each use. Any residual contamination may alter test results. Always wear gloves when cleaning labware.

This method applies to all test kits and supplies except the Total Phosphate Test Kit and Nitrate Test Kit (see Acid Wash Procedure below).

1. Clean with a nonabrasive detergent (phosphate-free) or a solvent such as isopropyl rubbing alcohol. Use a brush to clean all surfaces.
2. Rinse three times with cold tap water.
3. Rinse three times with distilled or deionized water.
4. Use a soft cloth (cheesecloth works well) for drying or allow to air dry. Never use papertowels or tissues as they may scratch.

Acid Wash Procedure

This method applies to cleaning labware for the Total Phosphate Test Kit and Nitrate Test Kit. Always wear gloves and protective eyewear.

1. Wash each sample bottle or piece of glassware with a brush and phosphate-free detergent.
2. Rinse three times with cold tap water.
3. Rinse with 10 percent hydrochloric acid.
4. Rinse three times with deionized water.
5. Use a soft cloth (cheesecloth works well) for drying or allow to air dry. Never use papertowels or tissues as they may scratch.

Cleaning Supplies List

Detergent - phosphate-free and nonabrasive

Soft Clothes - cheesecloth works well

Brushes - various shapes and sizes

10% Hydrochloric Acid

Deionized Water

Biosurvey: Macroinvertebrate Collection Procedure

(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.

Rocky Bottom Streams

Use the following method of macroinvertebrate sampling in streams that have riffles and gravel/cobble substrates. You will collect three samples at each site using a 1m X 1m, 500 *u*m 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. 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). Choose three spots within the 30-meter area. The three spots should be in riffles, or if no riffles are present, three run areas with gravel or cobble substrate. Try to sample riffles having different flow velocities and substrate types to maximize the diversity of habitats sampled.
- Sketch the 30-meter stream site using the data sheet indicating the location of the three sampling spots. Mark the downstream site as #1, the midstream site as #2, and the upstream site as #3.

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.

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. 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.

3. Dislodge the Macroinvertebrates

• 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 non-netspinning cadisfly larvae. Hold them over the bucket and rub the rocks thoroughly 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.

• 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.

4. Remove the Net

• 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.

• 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.

• If the bucket becomes too full with water, pour some of the water 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 *u*m mesh).

5. 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.

6. 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 basters to remove the insects to the sorting trays (ice cube trays work great - put like organisms in the same tray).

7. 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 kick net making sure there are no organisms clinging to the sides.

8. 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.

Muddy Bottom Streams

Use the following method of macroinvertebrate sampling in streams that have muddy, silty or sandy bottoms or lack riffles (slow-moving streams-e.g.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.

Biosurvey: Macroinvertebrate Collection Procedure

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.

• 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.).

• Determine the types of habitats present and sketch the 30-meter stream site indicating the location of the habitat types.

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 the remaining 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.

- Mark on your sketch the habitats that you will sample in and how many jabs you will do in each habitat. Number the habitats starting with the habitat that is in the most downstream location and number progressively as you move upstream.

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 spray bottle and assist in rinsing the net contents into the bucket after every few jabs.
- Fill the bucket and spray bottle with clean stream water.
- 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 the 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 netful 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 all 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 basters to remove the insects to the sorting trays (ice cube trays work great - put like organisms in the same tray).

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

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 Larvae (Hellgrammite) - Order Megaloptera:
25 - 90 mm, dark colored, 6 legs, well developed chewing
mouthparts, 2 short antennae, 8 abdominal segments each
with a filament, 2 anal prolegs with hooks.

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 plate, 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,
slender antennae, crawl underwater.

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, rarely present on abdomen,
hardened thoracic segments.

Non-Net-Spinning Caddisfly Larvae - 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

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 or lateral filaments.

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

Crane Fly Larva - Order Diptera - Family Tipulidae: 10 - 100 mm (sometimes larger), white, green or brown caterpillar-like body, segmented, disc at end with 3 to 6 “fingerlike” appendages on end.

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” on end of abdomen.

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.

Biosurvey: Identification Chart

Group II - somewhat sensitive *(continued)*

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.

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 usually covered with small hairs, anal proleg with tuft of long hair and a hook, no case (free-living).

Family Hydropsychidae

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 legs, no prolegs or abdominal gills, abdomen strongly curved, no case (free-living).

Family Philopotamidae

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

Family Polycentropodidae

Biosurvey: Identification Chart

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 legs on each side.

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

Stream Habitat Assessment Procedure

(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.)

Each time you conduct macroinvertebrate sampling you will also assess the stream habitat for fish, macroinvertebrates, and plants. Just as with macroinvertebrate sampling the type of stream habitat - rocky bottom versus muddy bottom - affects your assessment procedures.

Rocky Bottom Habitats

Conduct the habitat assessment within the 30-meter section that you used for your macroinvertebrate sampling. Use the following definitions when completing the Rocky Bottom Habitat Assessment Field Data Sheet.

The first two assessment factors should be assessed directly at the riffle(s) or run(s) that were used for the macroinvertebrate sampling.

1. **Attachment sites for macroinvertebrates** are essentially the amount of living space or hard substrates (rocks, snags, etc.) available for aquatic insects and snails. Many insects begin their life underwater in streams and need to attach themselves to rocks, logs, branches, or other submerged substrates. In streams unimpaired by pollution, the greater the variety and number of available living spaces or attachment sites, the greater the variety of insects the stream habitat could support. Optimally, cobble should predominate and boulders and gravel should be common. The availability of suitable living spaces for macroinvertebrates decreases as cobble becomes less abundant and boulders, gravel, or bedrock become more prevalent.

2. **Embeddedness** refers to the extent that rocks (gravel, cobble, and boulders) are surrounded by, covered, or sunken into the silt, sand, or mud of the stream bottom. As rocks become embedded, fewer living spaces are available to macroinvertebrates and fish for shelter, spawning and egg incubation.

   To estimate the percent of embeddedness, observe the amount of silt or finer sediments overlying and surrounding the rocks. If kicking does not dislodge the rocks or cobbles, they might be greatly embedded.

The following eight parameters should be assessed in the entire 30 meter section of the stream.

3. **Shelter for fish** and macroinvertebrates includes the relative quantity and variety of natural structures in the stream, such as fallen trees, logs, and branches; root wads; large cobble and boulders; and undercut banks that are available to fish for hiding, sleeping, or feeding. A wide variety of submerged structures in the stream provide fish with many living spaces; the more living spaces in a stream, the more types of fish the stream can support.

4. **Channel alteration** is a measure of large-scale changes in the shape of the stream channel. Many streams in urban and agricultural areas have been straightened, deepened, dredged, or diverted into concrete channels, often for flood control purposes. Such streams have far fewer natural habitats for fish, macroinvertebrates, and plants than do naturally meandering streams. Channel alteration is present when the stream runs through a concrete channel; when artificial embankments, riprap, and other forms of artificial bank stabilization or structures arepresent; when the stream is very straight for significant distances; when dams, bridges, and flow-altering structures such as stormwatwer pipes are present; when the stream is of uniform depth due to dredging; and when other such changes have occurred. Signs that indicate the occurrence of dredging include straightened, deepened, and otherwise uniform stream channels, as well as the removal of streamside vegetation to provide dredging equipment access to the stream.

5. **Sediment deposition** is a measure of the amount of sediment that has been deposited in the stream channel and the changes to the stream bottom that have occurred as a result of the deposition. High levels of sediment deposition create an unstable and continually changing environment that is unsuitable for many aquatic organisms.

   Sediments are naturally deposited in areas where the stream flow is reduced, such as pools and bends, or where flow is obstructed. These deposits can lead to the formation of islands, shoals, or point bars (sediments that build up in the stream, usually at the beginning of a meander) or can result in the complete filling of pools. To determine whether sediment deposits are new, look for vegetation growing on them: new sediments will not yet have been colonized by vegetation.

6. **Stream velocity and depth combinations** are important to the maintenance of healthy aquatic communities. Fast water increases the amount of dissolved oxygen in the water, keeps pools from being filled with sediment, and helps food items like leaves, twigs, and algae move more quickly through the aquatic system. Slow water provides spawning areas for fish and shelters macroinvertebrates that might be washed downstream in high stream velocities. Similarly, shallow water tends to be more easily aerated (i.e. holds more oxygen), but deeper water stays cooler longer. Thus the best stream habitat includes all of the following velocity/depth combinations and can maintain a wide variety of organisms.

   - slow (<1 ft/sec), shallow (<1.5 ft)
   - slow, deep
   - fast, deep
   - fast, shallow

   Measure stream velocity by marking off a 10-meter section of stream run and measuring the time it takes a stick, orange, or other floating biodegradable object to float the 10 meter distance. Repeat 5 times, in the same 10-meter section, and determine the average time. Divide the distance (10 meters) by the average time (seconds) to determine the velocity in meters per second.

Measure the stream depth by using a measuring or load line stick and take readings at various points within your stream site, including riffles, runs, and pools. Compare velocity and depth at various points within the 30-meter site to see how many of the combinations are present.

7. **Channel flow status** is the percentage of the existing channel that is filled with water. The flow status changes as the channel enlarges or as flow decreases as a result of dams and other obstructions, diversions for irrigation, or drought. When water does not cover much of the streambed, the living area for aquatic organisms is limited.

For the last three parameters, evaluate the condition of the right and left stream banks separately. Define the "left" and "right" banks by standing at the downstream end of your study stretch and looking upstream. Each bank is evaluated on a scale of 0-10.

8. **Bank vegetative protection** measures the amount of the stream bank that is covered by vegetation. The root systems of plants growing on stream banks help hold soil in place, reducing erosion. Vegetation on banks provides shade for fish and macroinvertebrates and serves as a food source by dropping leaves and other organic matter into the stream. Ideally, a variety of vegetation should be present, including trees, shrubs, and grasses. Vegetative disruption can occur when the grasses and plants on the stream banks are mowed or grazed, or when the trees and shrubs are cut back or cleared.

9. **Conditions of banks** measures erosion potential and whether the stream banks are eroded. Steep banks are more likely to collapse and suffer from erosion than are gently sloping banks and are therefore considered to have a high erosion potential. Signs of erosion include crumbling, unvegetated banks, exposed tree roots, and exposed soils.

10. The **riparian vegetative zone width** is defined as the width of vegetation from the edge of the stream bank. The riparian vegetative zone is a buffer to prevent pollutants from entering a stream. It also controls erosion and provides stream habitat and nutrient input to the stream.

    A wide, relatively undisturbed riparian vegetative zone helps maintain a healthy stream system; narrow, far less useful riparian zones occur when roads, parking lots, fields, lawns, and other cultivated areas, bare soil, rocks or buildings are near the stream bank. The presence of "old fields" (i.e. previously developed agricultural fields allowed to revert to natural conditions) should be rated higher than fields in continuous or periodic use. In arid areas, the riparian vegetative zone can be measured by observing the width of the area dominated by riparian or water-loving plants, such as willows, marsh grasses, and cotton wood trees.

Muddy Bottom Habitats

Conduct the habitat assessment within the 30-meter section that you used for your macroinvertebrate sampling. Use the following definitions when completing the Muddy Bottom Habitat Assessment Field Data Sheet.

1. **Shelter for fish and attachment sites for macroinvertebrates** are the amount of living space and shelter (rocks, snags, and undercut banks) available for fish, insects, and snails. Many insects attach themselves to rocks, logs, branches, or other submerged substrates. Fish can hide or feed in these areas. The greater the variety and number of available shelter sites or attachment sites, the greater the variety of fish and insects in the stream.

   Many of the attachment sites result from debris falling into the stream from the surrounding vegetation. When debris first falls into the water, it is termed "new fall" and it has not yet been “broken down” or conditioned by microbes for macroinvertebrate colonization. Leaf material or debris that is conditioned is called "old fall." Leaves that have been in the stream for some time, turn brown or dull yellow, become soft and supple with age, and might be slimy to the touch. Woody debris becomes blackened or dark in color; smooth bark becomes coarse and partially disintegrated, creating holes and crevices. It might also be slimy to the touch.

2. **Pool substrate characterization** evaluates the type and condition of bottom substrates found in pools. Pools with firmer sediment types (e.g. gravel, sand) and rooted aquatic plants support a wider variety of organisms than do pools with substrates dominated by mud or bedrock and no plants. In addition, a pool with one uniform substrate type will support far fewer types of organisms than will a pool with a wide variety of substrate types.

3. **Pool variability** rates the overall mixture of pool types found in the stream according to size and depth. The four basic 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. Rivers with low sinuosity (few bends) and monotonous pool characteristics do not have sufficient quantities and types of habitats to support a diverse aquatic community.

4. **Channel alteration** (see description in habitat assessment for rocky bottom streams.)

5. **Sediment deposition** (see description in habitat assessment for rocky bottom streams.)

6. **Channel sinuosity** evaluates the sinuosity or meandering of the stream. Streams that meander provide a variety of habitats (such as pools and runs) and stream velocities that reduce the energy from current surges during storm events. Straight stream segments are characterized by even stream depth and unvarying velocity, and they are prone to flooding. To evaluate this parameter, imagine how much longer the stream would be if it were straightened out.

7. **Channel flow status** (see description in habitat assessment for rocky bottom streams.)

8. **Bank vegetative protection** (see description in habitat assessment for rocky bottom streams.)

9. **Condition of banks** (see description in habitat assessment for rocky bottom streams.)

10. The **riparian vegetative zone width** (see description in habitat assessment for rocky bottom streams.)

Biosurvey: Field Data Sheets

Date _____ Time_____

Name of SEC_____

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_____

Biosurvey: Data Sheets

Stream Information

Watershed Name _____

Waterbody Name _____

Township _____County_____State_____

Site Description_____

Site ID# _____ DEP ID#_____

Latitude: ☐ • ☐ ' ☐ " Longitude: ☐ • ☐ ' ☐ "

(The DEP will provide the above coordinates if you do not know)

Length of Assessed Area (meters):

_____

Precipitation

In past 24 hours:

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

Current:

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

Sketch of Site (Use notepaper in back of Manual)

On your sketch, note features that affect stream habitat, such as: riffles, runs, pools, ditches, wetlands, dams, riprap, outfalls, tributaries, landscape features, logging paths, vegetation, and roads.

Biosurvey: Data Sheets

Macroinvertebrate Survey

Type of Stream

l Rocky-bottom l Muddy-bottom

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

_____ Vegetated Bank Margin

_____ Snags and Logs

_____ Aquatic Vegetation Beds

_____ Silt/sand/gravel Substrate

Macroinvertebrate Count

Identify the macroinvertebrates (to order) in your sample using the identification card. We are only concerned with organisms that appear on the identification card. 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; or **D** (dominant) = 100 plus organisms.

example: _20___ (_C_) Water penny larvae

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

_____ (____) Scuds

_____ (____) Sowbugs

_____ (____) Fishfly larvae

_____ (____) Alderfly larvae

_____ (____) Net-spinning caddisfly larvae

Group III - Tolerant

_____ (____) Aquatic worms

_____ (____) Blackfly larvae

_____ (____) Leeches

_____ (____) Midge larvae

_____ (____) Snails

Biosurvey: Data Sheets

Water Quality Rating

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

l Good >40 l Fair 20 - 40 l 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.

Stream Habitat Assessment Field Data Sheet Riffle/Run Prevalence

Date _____ Time_____ Site ID #_____

Surveyed by: _____ Volunteer ID #_____

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (fish)	Greater than 50% mix of boulder, cobble, submerged logs, undercut banks, or other stable habitat.	30-50% mix of boulder, cobble, or other stable habitat; adequate habitat.	10-30% mix of boulder, cobble, or other stable habitat; habitat availability less than desirable.	Less than 10% mix of boulder, cobble, or other stable habitat; lack of habitat obvious.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Epifaunal Substrate	Well-developed riffle and run; riffle is as wide as stream and length extends two times the width of stream; abundance of cobble.	Riffle is as wide as stream but length is less than 2 times width; abundance of cobble; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and its length is less than 2 times the stream width; gravel or large boulders and bedrock prevalent; some cobble present.	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment.	Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total_____(1-3)

Riffle/Run Prevalence

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
4. Velocity/Depth Regimes	All four velocity/depth regimes present (slow-deep; slow-shallow; fast-deep; fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime (usually slow-deep).
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Alteration	No channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.	New embankments present on both banks; and 40-80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Sediment Deposition	Little or no enlargements of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, course sand on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of the material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total_____(4-6)

Riffle/Run Prevalence

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
7. Frequency of Riffles	Occurrence of riffles relatively frequent; distance between riffles divided by the width of the stream equals 5 to 7; variety of habitat.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream equals 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is >25.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9. Condition of Banks	Banks stable; no evidence of erosion or bank failure.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; up to 60% of banks in reach have areas of erosion.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; on side slopes, 60-100% of bank has erosional scars.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
10. Bank Vegetative Protection	More than 90% of the streambank surfaces covered by vegetation.	70-90% of the streambank surfaces covered by vegetation.	50-70% of the streambank surfaces covered by vegetation.	Less than 50% of the streambank surfaces covered by vegetation.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total_____(7-10)

Riffle/Run Prevalence

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
11. Grazing or Other Disruptive Pressure	Vegetative disruption through grazing or mowing is minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Disruption of streambank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
12. Riparian Vegetative Zone Width	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:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total _____ (11-12)

Total _____ (1-3)

Total _____ (4-6)

Total _____ (7-10)

_____ **TOTAL**

Stream Habitat Assessment Field Data Sheet Rocky Bottom Sampling

Date _____ Time_____ Site ID #_____

Surveyed by: _____ Volunteer ID #_____

Habitat Parameter	Catagory			
	Optimal	Suboptimal	Marginal	Poor
1. Attachment Sites for Macroinvertebrates	Well-developed riffle and run; riffle is as wide as stream and length extends 2 times the width of stream; cobble predominates; boulders and gravel common.	Riffle is as wide as stream but length is less than 2 times width; cobble less abundant; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and length is less than 2 times the stream width; gravel or large boulders and bedrock prevalent; some cobble present.	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Fine sediment surrounds and fills in 0-25% of the living spaces around and in between the gravel, cobble, and boulders.	Fine sediment surrounds and fills in 25-50% of the living spaces around and in between the gravel, cobble, and boulders.	Fine sediment surrounds and fills in 50-75% of the living spaces around and in between the gravel, cobble, and boulders.	Fine sediment surrounds and fills in more than 75% of the living spaces around and in between the gravel, cobble, and boulders.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Shelter for Fish and Macroinvertebrates	Snags, submerged logs, undercut banks, cobble and large rocks, or other stable habitat are found in over 50% of the site.	Snags, submerged logs, undercut banks, cobble and large rocks, or other stable habitat are found in over 30-50% of the site.	Snags, submerged logs, undercut banks, cobble and large rocks, or other stable habitat are found in over 10-30% of the site.	Snags, submerged logs, undercut banks, cobble and large rocks, or other stable habitat are found in less that 10% of the site.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total_____(1-3)

Rocky Bottom Sampling

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
4. Channel Alteration	Stream straightening, dredging, artificial embankments, dams or bridge abutments absent or minimal; stream with meandering pattern.	Some stream straightening, dredging, artificial embankments or dams present, usually in areas of bridge abutments; no evidence of recent channel alteration activity.	Artificial embankments present to some extent on both banks; and 40 to 80% of stream site straightened, dredged, or otherwise altered.	Banks shored with gabion or cement; over 80% of the stream site straightened and disrupted.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at stream obstructions and bends; moderate deposition in pools.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom affected; 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
6. Stream Velocity and Depth Combinations	Slow (<1 ft/s)/deep (>1.5 ft); slow/shallow; fast/deep; fast/shallow combinations all present.	3 of the 4 velocity/depth combinations are present; fast current areas generally dominate.	Only 2 of the 4 velocity/depth combinations present. Score lower if fast current areas missing.	Dominate by 1 velocity/depth category (usually slow/shallow areas).
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. 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; <25% of channel substrate is exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total_____ (4-7)

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
8. Bank Vegetative Protection Note: determine left or right side by facing downstream (score each bank)	More than 90% of streambank surfaces covered by natural vegetation, including trees, shrubs, or other plants; 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 natural vegetation, but one class of plants is not well-represented; some vegetative disruption evident; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; 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 is very high; vegetation has been removed to 2 inches or less in average stubble height.
Score: Left Bank	10 9	8 7 6	5 4 3	2 1 0
Score: Right Bank	10 9	8 7 6	5 4 3	2 1 0
9. Condition of Banks (score each bank)	Banks stable; no evidence of erosion or bank failure; little potential for future problems.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; up to 60% of banks in site have areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank collapse or failure; 60-100% of bank has erosional scars.
Score: Left Bank	10 9	8 7 6	5 4 3	2 1 0
Score: 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 >50 feet; no evidence of human activities (i.e. parking lots, roadbeds, clear-cuts, mowed areas, or crops) within the riparian zone.	Width of riparian zone 35-40 feet.	Width of riparian zone 20-35 feet.	Width of riparian zone <20 feet.
Score: Left Bank	10 9	8 7 6	5 4 3	2 1 0
Score: Right Bank	10 9	8 7 6	5 4 3	2 1 0

Total_____ (8-10)

Total _____ (1-3)

Total _____ (4-7)

_____ **TOTAL**

Stream Habitat Assessment Field Data Sheet Muddy Bottom Sampling

Date_____ Time_____ Site ID #_____

Surveyed by: _____ Volunteer ID #_____

Habitat Parameter	Catagory			
	Optimal	Suboptimal	Marginal	Poor
1. Shelter for Fish and Macroinverte-brates	Snags, submerged logs, undercut banks, rubble or other stable habitat found over 50% of the site; logs/snags are old fall.	Snags, submerged logs, undercut banks, rubble or other stable habitat found over 30-50% of the site; some old fall, but preponderance of new fall.	Snags, submerged logs, undercut banks, rubble or other stable habitat found over 10-30% of the site; appears unstable; some new fall.	Snags, submerged logs, undercut banks, rubble or other stable habitat found over less than 10% of the site; no old or new fall.
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	Pools have mixture of sub-strate materials, with gravel and firm sand preva-lent; root mats and submerged vegetation com-mon.	Pools have mixture of soft sand, mud, or clay substrate; mud may be dominant; some root mats and submerged vegetation present.	Pools have all mud or clay or sand substrate; little or no root mat; no submerged vegetation.	Pools have hard-pan clay or bedrock substrate; 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.	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

Total_____ (1-3)

Muddy Bottom Sampling

Habitat Parameter	Catagory			
	Optimal	Suboptimal	Marginal	Poor
4. Channel Alteration	Stream straightening, dredging, artificial embankments, dams or bridge abutments absent or minimal; stream with meandering pattern.	Some stream straightening, artificial embankments or dams present, usually in areas of bridge abutments; no evidence of recent channel alteration activity.	Artificial embankments present to some extent on both banks; and 40 to 80% of stream site straightened, dredged, or otherwise altered.	Banks shored with gabion or cement; over 80% of the stream site straightened and disrupted.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Sediment Deposition	Less than 20% of stream bottom affected by extensive sediment deposition; minor accumulation of fine and coarse material at snags and submerged vegetation; little or no enlargement of islands or point bars.	20-50% of stream bottom affected by extensive sediment deposition; moderate accumulation; substantial sediment movement only during major storm event; some new increase in bar formation.	50-80% of stream bottom affected by extensive sediment deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Greater than 80% of stream bottom affected by extensive sediment deposition; heavy deposits; mud, silt, and/or sand in braided or non braided channels; pools almost absent due to deposition.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Channel Sinuosity	The bends in the stream would increase the stream length 3 to 4 times longer than if it was in a straight line.	The bends in the stream would increase the stream length 2 to 3 times longer than if it was in a straight line.	The bends in the stream would increase the stream length 2 to 1 times longer than if it was in a straight line.	Channel straight; waterway has been channelized.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total_____ (4-6)

Muddy Bottom Sampling

Habitat Parameter	Catagory			
	Optimal	Suboptimal	Marginal	Poor
7. 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; <25% of channel substrate is exposed.	Water fills 25-75% of the abailable 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
8. Bank Vegetative Protection Note: determine left or right side by facing downstream (score each bank)	More than 90% of the streambank surfaces covered by native vegetation, including trees, understory shrubs, or non-woody 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; some vegetative disruption evident; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; 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 2 inches or less in average stubble height.
Score:	Left Bank 10 9	8 7 6	5 4 3	2 1 0
Score:	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total_____ (7-8)

Muddy Bottom Sampling

Habitat Parameter	Catagory			
	Optimal	Suboptimal	Marginal	Poor
9. Condition of Banks (score each bank)	Banks stable; no evidence of erosion or bank failure; little potential for future problems.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; up to 60% of banks in site have areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank collapse or failure; 60-100% of bank has erosional scars.
Score: Left Bank	10 9	8 7 6	5 4 3	2 1 0
Score: 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 >50 feet; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns, or crops) have not affected riparian zone.	Width of riparian zone 35-40 feet.	Width of riparian zone 20-35 feet.	Width of riparian zone <20 feet.
Score: Left Bank	10 9	8 7 6	5 4 3	2 1 0
Score: Right Bank	10 9	8 7 6	5 4 3	2 1 0

Total_____ (9-10)

Total_____ (7-8)

Total _____ (4-6)

Total _____ (1-4)

_____ **TOTAL**

Stream Habitat Assessment Field Data Sheet
Glide/Pool Prevalence

Date_____ Time_____ Site ID #_____

Surveyed by: _____ Volunteer ID #_____

Habitat Parameter	Catagory			
	Optimal	Suboptimal	Marginal	Poor
1. Instream Cover (fish)	Greater than 50% mix of snags, submerged logs, undercut banks, or other stable habitat; rubble, gravel may be present.	30-50% mix of stable habitat; adequate habitat for maintenance of populations.	10-30% mix of stable habitat; habitat availability less than desirable.	Less than 10% stable habitat; lack of habitat obvious.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Epifaunal Substrate	Preferred benthic substrate (to be sampled) abundant throughout stream site and at stage to allow full colonization potential (i.e., logs/snags that are <u>not</u> new fall and <u>not</u> transient).	Substrate common but not prevalent or well suited for colonization potential.	Substrate frequently disturbed or removed.	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
3. 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

Total_____ (1-3)

Glide/Pool Prevalence

Habitat Parameter	Catagory			
	Optimal	Suboptimal	Marginal	Poor
4. 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
5. Channel Alteration	No channelization or dredging present.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e. dredging (greater than 20 yr) may be present, but recent channelization is not present.	New embankments present on both banks; channelization may be extensive, usually in urban areas or drainage areas of agriculture lands; and >80% of stream reach channellized and disrupted.	Extensive channelization; banks shored with gabion or cement; heavily urbanized areas; 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
6. Sediment Deposition	Less than 20% of bottom affected; minor accumulation of fine and coarse material at snags and submerged vegetation; Little or no enlargement of islands or point bars.	20-50% affected; moderate accumulation; substantial sediment movement only during major storm event; Some new increase in bar formation.	50-80% affected; major deposition; pools shallow, heavily silted; embankments may be present on both banks; frequent and substantial sediment movement during storm events.	Channelized; mud, silt and/or sand in braided or non-braided channels; 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

Total_____ (4-6)

Glide/Pool Prevalence

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
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.	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 1 to 2 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. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
9. Condition of Banks	Banks stable; no evidence of erosion of bank failure; side slopes generally <30%; little potential for future problems.	Moderately stable; infrequent, small areas of erosion mostly healed over, side slopes up to 40% on one bank; slight erosion potential in extreme floods.	Moderately unstable; moderate frequency and size of erosional areas; side slopes side slopes up to 60% on some banks; high erosion potential during extremely high flow.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; side slopes >60% common.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total_____ (7-9)

Glide/Pool Prevalence

Habitat Parameter	Category			
	Optimal	Suboptimal	Marginal	Poor
10. Bank Vegetative Protection	More than 90% of the streambank surfaces covered by vegetation.	70-90% of the streambank surfaces covered by vegetation.	50-70% of the streambank surfaces covered by vegetation.	Less than 50% of the streambank surfaces covered by vegetation.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
11. Grazing or Other Disruptive Pressure	Vegetative disruption is minimal or not evident; almost all plants allowed to grow naturally.	Disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	Disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Disruption of streambank vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
12. Riparian Vegetative ZoneWidth (least buffered side)	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:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Total_____ (10-12)

Total _____ (7-9)

Total _____ (4-6)

Total_____ (1-3)

_____ **TOTAL**

Appendix A

HACH Pocket Pal pH Tester

Instructions:

1. Slide the on/off switch (located on top of the Pocket Pal) to on.
2. Remove the protective cap from the bottom.
3. Before using the Pocket Pal it must be calibrated.
   a. Prepare a pH 7 buffer solution by combining one packet of pH 7 buffer powder with 50 ml of water.
   b. Immerse the bottom of the Pocket Pal 1.0 to 3.5 inches into the buffer solution and read the pH.
      - If it reads 7 the Pocket Pal is calibrated so move on to step 4.
      - If it does not read 7 adjust the reading to 7 using a small screwdriver through the hole in the back. The Pocket Pal is now calibrated so move on to step 4.
   c. If monitoring in acidic waters you must also calibrate the meter with a pH 4.01 standard. If monitoring in basic waters also calibrate with a pH 10 standard.
      To calibrate with a pH 4.01 or pH 10 follow steps a & b, but substitute the appropriate standard.
4. Immerse the bottom of the Pocket Pal 1.0 to 3.5 inches into the stream water sample.
5. Using the Pocket Pal, gently stir the sample for several seconds. Stop stirring and let the reading on the Pocket Pal stabilize. Once the reading stabilizes, read the pH value.
6. Rinse the bottom of the Pocket Pal. Place several drops of water in the protective cap to prevent the glass bulb from drying out. (This will provide a faster response time and longer Pocket Pal life). Replace the protective cover.

Battery Replacement:

1. Remove the case top from the Pocket Pal. Caution: Do not over extend the attached wires.
2. Replace the four batteries with Eveready E675E, Duracell RM 675 or equivalent.

Specifications:

Range: 0.0 - 14.0 pH

Resolution: 0.1 pH

Accuracy: ± 0.2 pH

Operating Temperature: 0 - 50˚ C

Battery Life: 1000 hours continuous use

Appendix A

Dist 3: HANNA Instruments Conductivity and Dissolved Solids Tester

Instructions:

1. Slide the on/off switch (located on top of the tester) to on.
2. Remove the protective cap from the bottom.
3. Before using the conductivity tester it must be calibrated.
    a. Immerse the tester 1.0 to 3.5 inches into the calibration solution. Allow the displayed value to stabilize.
        - If the tester reads a value matching the calibration solution go to step 4.
        - If the tester reads a value that does not match the calibration solution, adjust the reading to match using a small screwdriver through the hole in the back (calibration trimmer). The tester is now calibrated. Go to step 4.
4. Immerse the bottom of the tester 1.0 to 3.5 inches into the stream water sample.
5. Allow the reading on the tester to stabilize. Once the reading stabilizes, read the value on the display.
6. Multiply this reading by 10 to get a direct conductivity reading in uS/cm.
7. Rinse the bottom of the tester and replace the protective cover.

Battery Replacement:

1. The batteries need to be replaced when the tester cannot be switched on or the display fades.
2. Remove the case top from the tester. Caution: Do not over extend the attached wires.
3. Replace the four batteries with four 1.4V alkaline batteries paying attention to their polarity. Always replace all four batteries at once.

Specifications:

Range: 10 to 1990 uS/cm

Resolution: 10 uS/cm

Accuracy: ± 2% of full scale

Temperature Compensation: Automatic from 5 to 50 C

Environment: 0 to 50 C; 95% Relative Humidity

Batteries/Life: 4 x 1.4V alkaline/ 150 hours continuous use

Dimensions/weight: 150 x 30 x 24 mm/ 85 g

Photometric Documentation

Visual documentation of the stream site is an important component of stream monitoring. Photographs will archive changes within the stream and the surrounding habitat and aid in the development of a historical profile. The photographs will also be put on the EASI database and allow volunteers throughout the state the opportunity to share their stream site with other SEC members.

Procedure for Photometric Documentation

1. Frequency:

1) twice annually, when the stream habitat assessment is conducted and,
2) as often as needed to document unusual conditions or changes at the stream site.

2. Number of Pictures:

4 photos minimum:
- upstream from the testing site,
- downstream from testing site,
- directly across waterway from testing site,
- directly behind testing site on the same side of the waterway bank.

Others, as needed to document location and its characteristics accurately.

3. Complete the Photometric Documentation Form and mail the roll of film and form to:

EASI
8733 Old Dumfries Road
Catlett, VA 20119

Photometric Documentation Form

Date Pictures Taken _____ Time Pictures Taken _____

Number of Pictures Taken _____ Number of Rolls of Film _____

Name of SEC_____

Photographer _____

Name_____

Address _____

City _____ State _____ Zip _____

Phone (_____)_____ Fax (_____)_____

e-mail _____Identification Number_____

Stream Information

Watershed Name_____

Waterbody Name_____

Township_____

County _____ State_____

Site ID #_____

Please complete the entire form and mail the roll of film and form to:

EASI
8733 Old Dumfries Road
Catlett, VA 20119

(Master Sheet - make duplicates for submission.)

mm ruler
mm ruler
mm ruler
mm ruler

mm ruler
mm ruler
mm ruler
mm ruler