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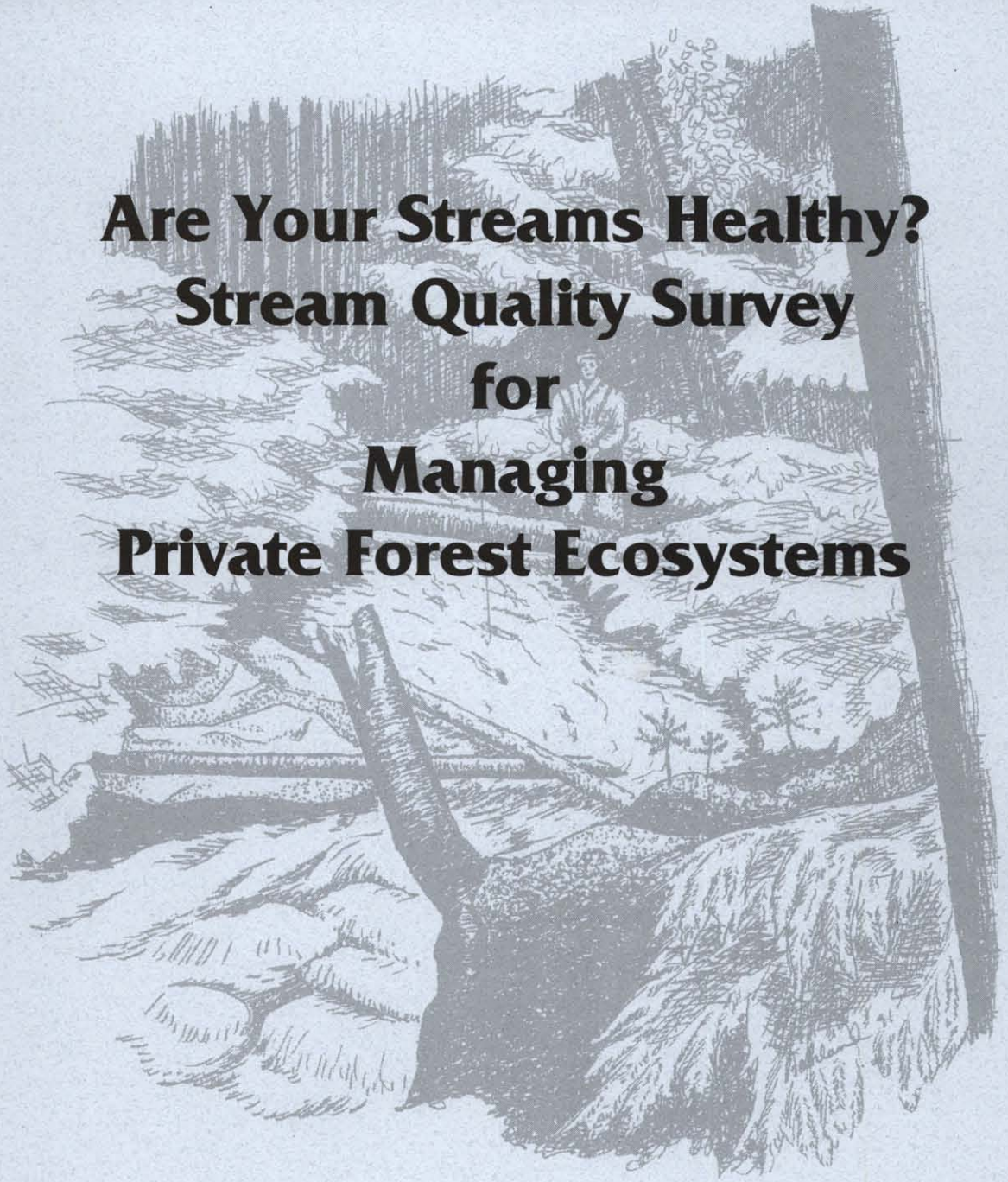

Are Your Streams Healthy? Stream Quality Survey for Managing Private Forest Ecosystems

Pamela Town and Ronald L. Mahoney

IDAHO FOREST, WILDLIFE AND RANGE EXPERIMENT STATION

Director
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Acknowledgments:

Preliminary versions of this publication were evaluated by: Kirk Lohman, Professor of Stream Ecology, University of Idaho; Bob Logan, Extension Forester - Montana State University; Randy Brooks, Extension Educator - 4-H/Forestry/Agriculture, University of Idaho; and Yvonne Carree, Extension Associate - Forestry, University of Idaho. The final version of this survey was reviewed by Steve Clayton, Research Specialist, Riparian and Wetland Research Program, University of Montana. We appreciate their valuable critique and suggestions.

Art work: Lorraine Ashland
Production: Yvonne Carree

For additional current water quality publications, contact your local Extension office.

University of Idaho
Cooperative Extension System

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Implementing Ecosystem Management on NJPF Lands in the Pacific Northwest

Are Your Streams Healthy? Stream Quality Survey for Managing Private Forest Ecosystems

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The purpose of this survey is to assist landowners in evaluating and recording important information about the condition of streams flowing through their forested property. Although the Idaho Forest Practices Act has specific regulations regarding logging operations adjacent to streams, other potential land use disturbances (e.g., recreation, grazing, agriculture) are not governed by regulations that legally protect the stream.

Landowners' objectives may vary their perspective on stream health. While one landowner may define a healthy stream as one possessing pristine conditions with no disturbances, another may define a healthy stream as one possessing a lot of *riparian* (the area between the stream and upland) vegetation, clean water, numerous fish, and access to the stream bank. In general, a forested stream containing no chemical pollution, and having stable banks, low sedimentation, and flowing, shaded water provides "healthy" water conditions which may be able to support aquatic life.

This inventory is designed to record existing stream conditions, identify areas of special concern, and serve as basis for recognizing changes in stream and riparian areas. This information gathering process is the first step in developing a riparian management plan. The process is designed to assist landowners in identifying current or potential problem areas while providing a record of existing stream conditions. Often the evaluation of stream quality is part of a larger examination of forest land conditions in preparation for development of a forest management plan or as a prelude to timber harvest or other activity.

Two companion publications that can help complete a forest examination are *Evaluating Private Forest Ecosystems for Silvicultural Prescriptions and Ecosystem Management Planning* (FWR Station Bulletin No. 59) and *Evaluating Wildlife Habitat for Managing Private Forest Ecosystems in the Inland Northwest* (FWR Station Bulletin No. 60). Both publications can be obtained by contacting your local Extension office.

Landowners may want to seek professional assistance if they feel their forest stream is unhealthy. Idaho is fortunate enough to possess a Streamwalk Program, where stream information can be analyzed and combined with larger *watershed* (a landscape draining into a single stream) data. Landowners interested in this watershed management program should contact the Idaho Water Resources Research Institute at the University of Idaho, 106 Morrill Hall, Moscow, ID 83844, (208) 885-6429. If your stream quality survey shows chemical contamination or other problems requiring regulatory assistance, contact your regional office of the Department of Environmental Quality (DEQ) or the state DEQ office in Boise.

The best time of the year to monitor a stream is late July or early August. Spring runoff has been completed and problem areas, such as eroding banks and siltation are most visible. Surveys of the same monitored area should be completed at approximately the same time each year for consistency in observing any changes. Special attention should be given to riparian areas after a major disturbance occurs within the watershed. Major disturbances include: development, agricultural land expansion, logging, mud slides, increased grazing, increased access and recreation, road construction, wildfire, or periods of heavy rainfall/snowfall.

We recommend that you designate at least one permanent (easy to find in consecutive years) plot along your stream. A plot is a specific point in the stream which provides an average representation of your stream. Most streams have enough variability that at least two or three plots will be required to adequately represent stream conditions. Plots should be permanent so the same exact area can be examined each year, showing changes over time.

An itemized evaluation guide is attached. The numerical instructions will assist you in filling out the field form. Throughout the instructions, there are "red-flag" potential problem areas and suggestions of possible solutions you should consider, and discuss, with any professionals working with you.

The materials required to complete this survey are a pencil, shallow pan (white bottom is best), thermom-

eter, and measuring tape. Other helpful materials include a yard stick (to measure depth), waders or shoes that can get wet (placing felt on the soles will assist in traction), *kick-net* (to capture and record aquatic invertebrates - see Figures 4 and 5), plant identification book, and polarized glasses. When surveying your stream, remember that wet rocks are slippery, logs may roll, and currents may be faster than they appear so consider **safety first**. It is always a good idea to have a partner on shore as a minimum safety practice.

Explanation of Forested Stream Evaluation Field Form

NOTE: This section explains each step on the field form and provides additional comments to "red flag" potential problem areas and offer management solutions. We recommend reading through this section and the field form prior to use. The field form is located at the end of the publication to make it easier to photocopy for additional surveys.

1. Name(s) of actual field observer(s).

2. Date(s) the stream is monitored.

3. Describe the stream location, including landowner's name(s), stream name, and general location of the stream.

4. Directions to the portion of the stream monitored. You should be able to locate the site again (use property boundaries, confluence, landmarks). There is no magic number of how much of the stream you should survey. More information helps determine changes in the stream over time and better evaluates the range of varying conditions in any single stream. A photo taken from the same point each year is helpful for location and evaluation.

5. Record and compare the overall average and actual annual precipitation rate from local sources (e.g., weather station, radio station, Extension office, other agencies).

Dry is when the annual precipitation is below average for the year throughout all seasons. ***Average*** is when the annual precipitation is average for the year throughout all seasons. ***Wet*** is when the annual precipitation is above average for the year throughout all seasons. ***Seasonal*** is when the annual precipitation may be above average in the winter and below average in the summer. Indicate which season possessed each precipitation rate (winter-dry, summer-wet, spring and fall-average).

6. Record the stream class: Class I streams are used for domestic water supply or are important for the spawning, rearing, or migration of fish. Class II streams are usually small streams that drain into Class I streams, and are used by only a few, if any, fish for spawning or rearing.

7. Record the current dominant land uses surrounding the monitored stream. Record the current dominant land uses surrounding the stream and on the property upstream from the monitored stream segment.

The following measurements should be taken at three or more locations along the monitored stream and an average calculated

8. **A.** Water temperature: Place a thermometer in a shaded pool, firmly tied in place for about one hour before recording the temperature. For best results, record temperatures at three or more stream locations, at different daily time intervals, and on various days throughout the summer.

B. After all water temperatures have been recorded, check appropriate box(es). These are general temperature estimates for potential fisheries:

i. Temperature fluctuations are too extreme, decreasing available dissolved oxygen (oxygen needed for life). *Shading is needed.*

ii. Water at these temperatures is "good" for supporting salmonids (trout, salmon).

iii. Water at these temperatures is "fair" for supporting salmonids.

iv. Water at these temperatures can support warm water fishes (bass, carp, catfish).

v. Water temperatures are too high to support fish, *shading is needed.*

9. Indicate the water colors present, after walking along the stream looking for color changes.

i. ***Clear*** indicates good water quality.

ii. ***Reddish*** may be caused by natural tannins (from tree bark and needles or leaves), which indicates fairly good water quality **or** may be from blood or oil spills further upstream, which indicates "poorer" water quality.

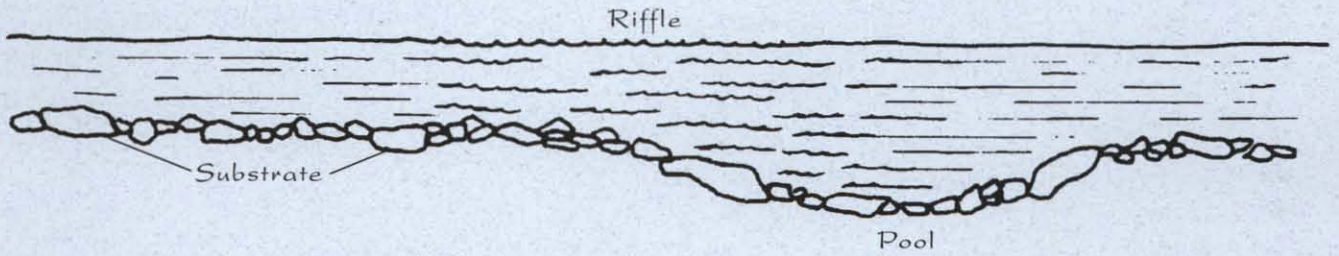
iii. ***Greenish*** may indicate excessive algae growth caused by excessive nutrients upstream (e.g., fertilizers from agricultural crops); poor water quality.

iv. ***Brownish or yellowish*** color indicates erosion or heavy sedimentation problem; poor water quality.

v. ***Iridescent sheen*** on top of the water may indicate rotting vegetation, oil based pesticides, or leaked and/or dumped oil; poor water quality.

10. Stream bed substrate: At three or more *riffles* (areas where surface water is agitated - Figure 1) of the monitored stream, record the overall percent of each stream bed substrate, with 100% total amount of substrate present. *Substrate will help you monitor sedimentation levels, which impact aquatic plants, fish and amphibians.*

Figure 1. Stream Characteristics Defined



i. ***Silt/clay/mud***--fine particles. Very small spaces between particles hold a lot of water, making an ooze-like sediment. *Poor fish spawning habitat.*

ii. ***Sand***--tiny rock particles up to .1 inch. *Poor fish spawning habitat.*

iii. ***Gravel***--stones from tiny 1/4 inch pebbles to 2 inches. *Best fish spawning substrate.*

iv. ***Cobbles***--rocks 2 inches to 10 inches large.

v. ***Boulders***--rocks more than 10 inches large.

vi. ***Bedrock***--solid rock bottom.

Cobbles, boulders, and bedrock are beneficial to fish habitat as long as substantial gravel areas are present for spawning.

11. Embeddedness: Estimate the percent of the larger substrates (cobble or boulders) which are embedded (buried) by smaller substrates and particles. Zero to 25% occurs when most of the substrate is visible and not buried by smaller particles (sand). Greater than 76% occurs when the larger substrate is almost completely buried by the smaller particles. *A stream with a high percentage of embeddedness provides poor fish spawning habitat and lacks cover for fish, amphibians, and aquatic insects.*

12. Record the presence of fish and identify the species, if possible. *Trout/salmon are intolerant to pollution and high water temperatures. Bass are somewhat tolerant of pollution and high water temperatures. Suckers or carp are tolerant of higher levels of pollution and higher water temperatures.*

Lack of fish. *If an intermittent stream is being monitored, the lack of fish may not be a major concern. If water flows year round, the lack of fish may indicate a water quality problem (such as extreme temperatures or lack of oxygen). Some year round streams may serve as a travel corridor for migrating fish, possessing fish only in the spring and fall.*

Riparian Area

Continue to take measurements along the monitored stream to determine the overall condition of the riparian area

The riparian area is the area between the stream and upland system. Riparian areas possess moist soils and (if present) plants adapted to moist conditions (examples: willows, alders, devil's club, oak fern, bluejoint reedgrass). The riparian area may range in width from just a few feet (near steep banks of streams) to hundreds of feet (along lowland streams and rivers).

13. Record whether roads exist within the riparian zone. If roads are present, indicate the amount of use (heavy, moderate, or light use).

14. **A.** Record the total amount of shading over the stream channel and indicate if the shading is consistent or patchy. *Small shallow streams have higher temperature fluctuations; therefore, require more dense and consistent shading for aquatic life. Shading is a subjective judgement affected by many factors including time of day, topographic position, and orientation. Noon to afternoon shading is usually the most critical.*

B. Record the dominant component that shades the stream. *Trees and tall shrubs are the best vegetation to shade the stream as they shade more area; provide bank stability (through an extensive root system); provide food and cover for insects, fish, amphibians, and other wildlife; and can create small dams when they fall into the water, increasing the number of pools.*

15. Record the observed amount of stream side erosion and indicate if the erosion is consistent or patchy. Identify the cause of erosion, if known (animal grazing, floods, ATV crossing). Extra space is available to describe areas of special concern.

If little or no shading occurs or the stream banks are eroding, there are a few options. Grasses can be planted to assist with streamside erosion; however, grasses provide little shading. Tall shrubs or trees can be planted to provide both bank stability and shading. Planting grasses and trees (grasses provide some stability as trees become established) often leads to high maintenance. If left untreated, grasses can outcompete the tree seedlings for light, nutrients, and water, reducing the success rate of establishing trees. Successful tree establishment may require herbicides, mowing, or grazing to reduce vegetative competition. Domestic or wildlife grazing may require tree shelters or other measures to protect tree seedlings.

Bank erosion can further be reduced by preventing or managing domestic animal grazing through seasonal rotation or fencing, constructing bridges or rock fords at areas prone to heavy foot/ATV traffic, or using very large rocks (ripraps - a very expensive method to increase bank stability).

16. **A.** Indicate the average width of the riparian area, in feet. Measure the distance from the high water mark to the outer edge of riparian area (see Figure 2 for pictures on determining the high water mark/stream width). To find the outer edge of the riparian zone, look for a change in vegetation to more upland, drier-site plants and drier soils.

B. Briefly describe the condition of the riparian area to complement the stream condition information already recorded. [e.g., The riparian area was heavily logged 30 years ago; however, trees are now abundant. There are a few areas where past floods have deposited fine particles (needles, small branches, sand). Ground vegetation is sparse, consisting of a few ferns.] *Riparian areas can be extremely biologically productive and diverse due to the water availability to plants and animals. Narrow, less productive riparian areas are common where topography is steep or streams are very small. The width of the riparian area can change naturally or artificially, and these changes can indicate significant alteration of stream quality.*

Permanent Plot

Permanent plots are valuable because the same exact area can be examined in consecutive years, showing changes over time. Changes may be due to weather, upstream land use, or normal stream evolution. Other parts of this survey will help determine impacts of changes and indicate potential for improvement or stabilization. Whether you choose one or several permanent plots, make sure they can be located in subsequent years. Permanent plots (or points) should be established in a riffle (see Figure 1 for pictures defining riffles).

17. Describe the exact location of the plot(s).

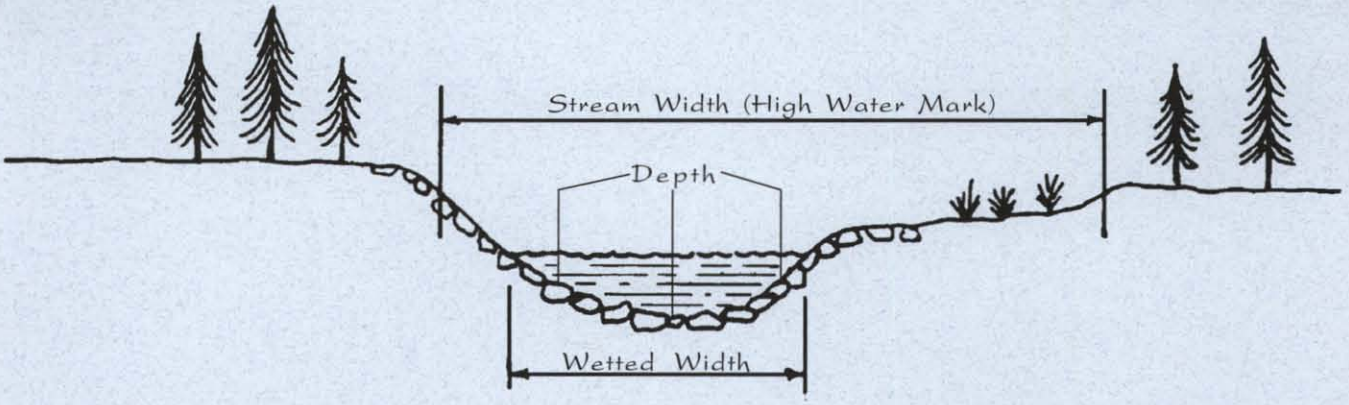
18. Record the stream channel information (see Figure 2):

Wetted width: width of actual water in the stream at the time of measurement.

Stream width: width of stream at high water mark. Stream width can be identified by the scouring of rocks or vegetation created during periods of high water flow, gravel deposits, or a sharp leveling of the bank.

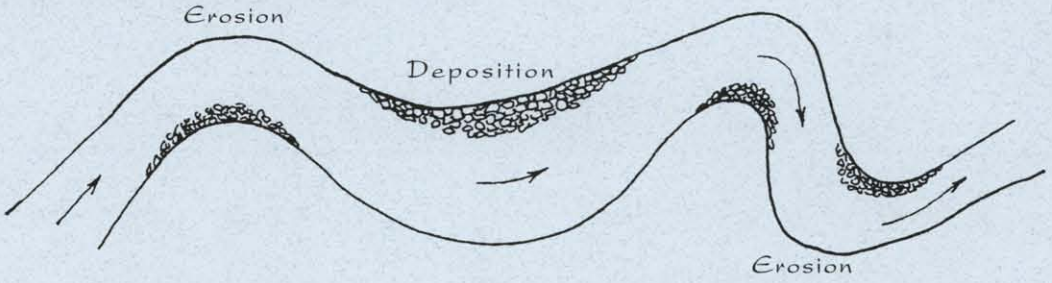
Depth: measure the depth of the water. Take 3 measurements in a straight line across the wetted width and average together.

Figure 2. Cross-Section of a Stream Defining Stream Channel Information



19. Stream cross-sectional shape: Imagine your stream abruptly ended: What would the stream channel look like (check appropriate figure)? *Stream channels are always changing and moving as a natural process. Material is deposited on one side of the channel, while the other side is eroded (see Figure 3). Stream erosion also occurs latitudinally, meaning the flowing water continues to cut (erode) the stream bed. These are natural processes occurring over many years; however, they can be altered by poor riparian management. Streams which become wider and shallower or more braided are subject to higher water temperatures, less available dissolved oxygen, fewer pools (holding tanks) for fish and amphibians, and often possess an increase in sedimentation and bankside erosion.*

Figure 3. Stream Channel Movement



Aquatic Invertebrate Inventory

20. Aquatic invertebrate inventory: to measure aquatic invertebrates, collect and record which species are present in the permanent plot.

The best method to collect and identify aquatic invertebrates is to use a thin-mesh net or *kick net* (Figure 4) placed about an arms-length downstream from you. Hold the net stationary and flat on the stream bottom, with the top angled downstream, away from you. Move toward the net kicking through the stream substrate (Figure 5). The net should trap particles yet allow water to flow through. Once you reach the net, use a scooping, upstream motion to bring the screen above the water surface. Place contents of the net in a shallow, white-bottom pan with a little water. Sifting through the contents will produce a variety of stream organisms to identify. Use letter codes (A = 1-9, B = 10-99, C = >100) to record the numbers of organisms found in each of the 12 boxes on the aquatic invertebrate inventory form on page 13. Then add the number of boxes with a letter in each column and multiply by the indicated index value. The columns are divided based on the organism's sensitivity to pollution. Add the three index values for a total score. *In addition to a total score greater than 12, a variety of aquatic invertebrates is "healthier" than numerous individuals of the same species.* Return contents to the stream when examination is complete. You should collect at least three samples per plot.

Figure 4. Kick Net

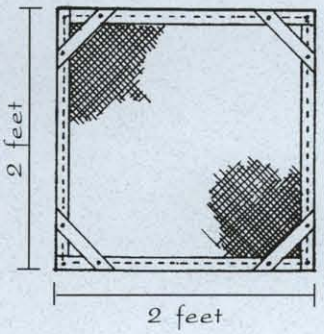
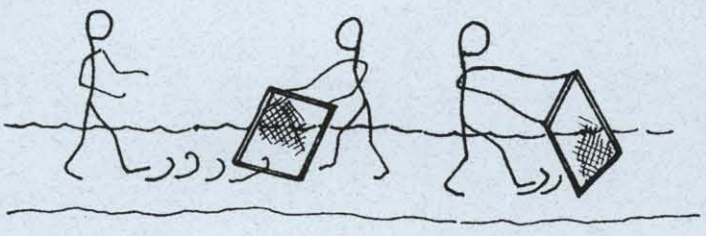


Figure 5. Using Kick Nets



Administrative

21. Give a general description of the overall stream and its interactions with other land uses.

22. List what you feel are the current or potential threats to your stream and riparian area.

23. List other concerns or additional monitoring which may need further evaluation by a specialist or involvement of a DEQ investigator. Describe why such an evaluation may be needed.

24. Provide a description of stream/riparian improvements to be accomplished and projected completion dates.

Forested Stream Evaluation Field Form

1. **Observer(s):** _____

   _____

2. **Date(s) of Stream Monitoring:** _____

3. **Property Owner(s):** _____

   Stream Name: _____

   Stream Location: _____

4. **Directions to Portion of Stream Monitored (include beginning and end):**

   Attach stream photo here.

5. **Annual Precipitation Rate:**

   ____ Dry ____ Average ____ Wet ____ Seasonal

   Notes on Seasonal Precipitation:

6. **Stream Class:** ____ Class I ____ Class II

7. **Current Land Use** Surrounding Monitored Stream and Surrounding Upstream Property (1 = Primary, 2 = Secondary, etc.):

Surrounding Stream	*Surrounding Upstream Property*	*Land Use*
____	____	Timber Production
____	____	Recreation - Foot Traffic
____	____	Recreation - Vehicle Traffic
____	____	Wildlife Management
____	____	Agriculture - Crops
____	____	Agriculture - Idle (CRP, Fallow, etc.)
____	____	Grazing
____	____	Aesthetics
____	____	Residential and Urbanization
____	____	No Active Management
____	____	Other: _____

8. **A. Water Temperature:** ____ ____ ____ ____ ____ ____ Average: _____

B. Temperature Conditions [check appropriate box(es)]:

i. ( ) Water Temperature Exceeds 5° F Change in Temperature
ii. ( ) Average Water Temperature Between 45° - 55° F
iii. ( ) Average Water Temperature Between 32° - 45° F or 55° - 65°F
iv. ( ) Average Water Temperature Between 65° - 80° F
v. ( ) Average Water Temperature Above 80° F

9. **Water Coloration** [check appropriate box(es)]:

i. ( ) Clear *ii.* ( ) Reddish *iii.* ( ) Greenish *iv.* ( ) Brownish or Yellowish *v.* ( ) Iridescent

10. **Stream Bed Substrate** (percent represented):

i. ____ % Silt/Clay/Mud
ii. ____ % Sand
iii. ____ % Gravel
iv. ____ % Cobble
v. ____ % Boulders
vi. ____ % Bedrock

11. **Embeddedness:**

____ < 25% ____ 26% - 50% ____ 51% - 75% ____ > 76%

12. **Fish Observed:**

____ Scattered Individuals ____ Scattered Schools ____ No Fish

If Possible, Identify Fish Species Observed:

Riparian Areas

13. **Roads Within Riparian Areas:**

____ No Roads

____ Existing Roads Amount of Use: ____ Heavy ____ Moderate ____ Light

____ New Construction of Roads

Anticipated Amount of Use: ____ Heavy ____ Moderate ____ Light

14. **A. Average Cover Shading the Stream:**

____ None ____ 1% - 50% ____ 51% - 75% ____ > 76%

____ Consistent Cover _____ Patchy Cover

B. Shade Makeup:

____ Deciduous Trees ____ Coniferous Trees ____ Tall Shrubs ____ Short Shrubs

____ Undercut Banks ____ Grasses, Ferns, & Forbs ____ None

15. Bank Stability:

____ Severe Erosion Above 80% ____ Heavily Eroded 50% - 79% ____ Moderately Eroded 20% - 49% ____ Lightly Eroded 0% - 19%

____ Consistently Eroded _____ Patchy Erosion

Cause(s) of Erosion:

Areas of Special Concern:

16. A. Average Width of Riparian Area: _____ Average: _____

B. Briefly Describe Riparian Area

Permanent Plot

17. Plot Location(s):

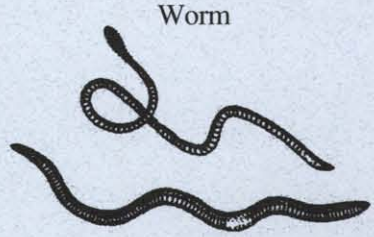
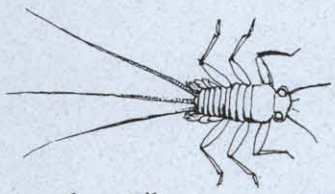
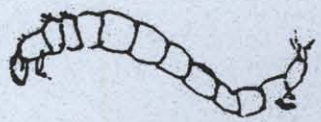
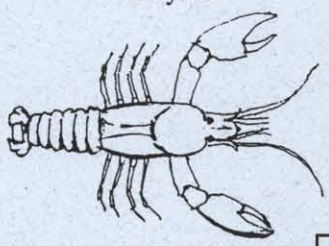
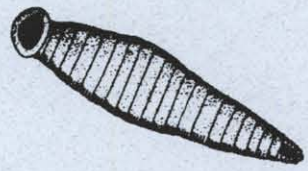
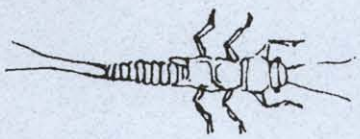
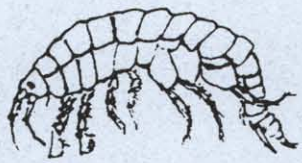
Plot #	Location
____	_____
____	_____
____	_____
____	_____

18. Stream Channel:

Plot #	Wetted Width	Stream Width	Depth
____	_____	_____	_____ Avg: ____
____	_____	_____	_____ Avg: ____
____	_____	_____	_____ Avg: ____

19. Stream Cross-Sectional Shape:

Plot #		Shape	
____	____	V ____ ⊓ ____ U ____	Other:
____	____	V ____ ⊓ ____ U ____	Other:
____	____	V ____ ⊓ ____ U ____	Other:

Sensitive 3 points each	Somewhat-Sensitive 2 points each	Tolerant 1 point each
Caddisfly  * May be in stone, stick, or litter case * Anal hook ☐	Mussel/Clam  * Two piece hinged shell ☐	Worm  * Thin, worm-like body ☐
Mayfly  * Two or three tails * Gills on side of body ☐	Dragonfly * Large compound eye * Short antennae  ☐	Fly Larvae  * No tails, worm-like body * Segmented body ☐
Riffle Beetle  * Large sickle shaped mandibles * Last segment hollow * Shiny black or brown ☐	Crayfish  * Resembles small lobster ☐	Leech  * Brown, slimy body * Suction pads on both ends ☐
Stonefly  * Gills on thorax * Two tails * Two claws at end of each leg ☐	Scud  * Fat body, swims sideways * More than 6 legs * Resembles small shrimp ☐	Snails * Spiral shell   ☐
☐ # of boxes with letters x 3 = _____ Index Value	☐ # of boxes with letters x 2 = _____ Index Value	☐ # of boxes with letters x 1 = _____ Index Value

Add the 3 index values: ____ **Total score: >12 = Excellent water quality; <7 = Poor water quality**

Administrative

21. Describe the Overall Stream and Its Interactions with Other Land Uses:

22. Indicate What You Feel are the Current or Potential Threats to Your Stream and Riparian Areas:

23. Issues/Concerns Needing Additional Information or Professional Assistance:

Issues/Concerns: _____

Why:

24. Description of Stream/Riparian Improvements to be Initiated and Projected Completion Dates:

Notes

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