Chapter 3 -
Habitat Assessment

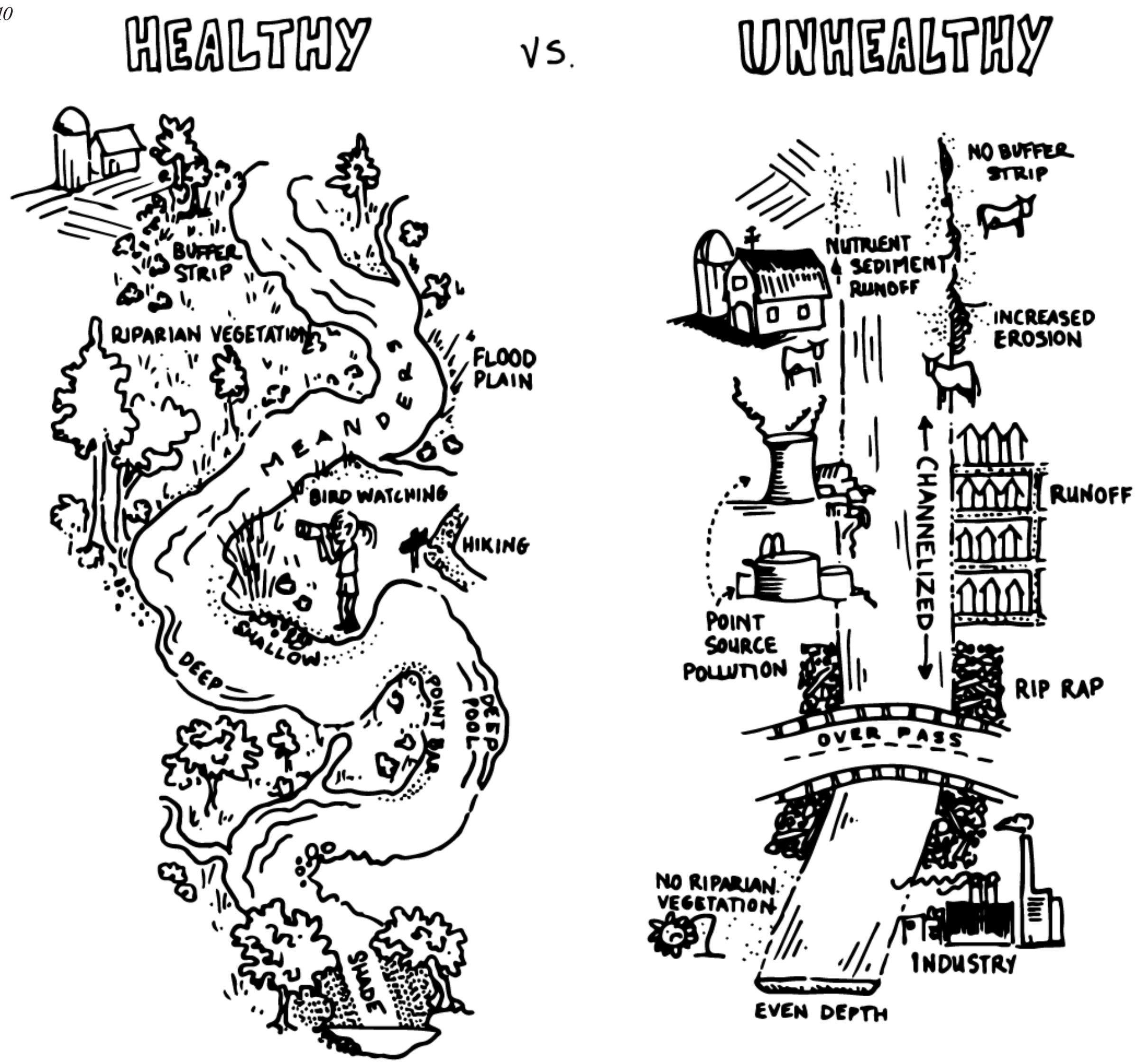
Chapter 2 discussed how water quality is a reflection of the land use in the watershed. However, the condition of land within and along the stream channel is also critical to the health of the stream and its ability to support aquatic life.

What is a Healthy Stream Habitat?

A natural stream channel does not flow in a straight line; it meanders. Rivers meander as they flow because this pattern releases the kinetic energy of the water in the most even or uniform manner. Meanders also provide a variety of habitats for many species of plants and animals. Pools, riffles, undercut banks and snags (fallen limbs or small log piles) all provide different types of habitat. The more types of habitat present in a stream system, the greater the potential for aquatic plant and animal diversity.

A uniformly straight or deep channel provides less potential habitat than a stream with variable flows and depths. Examples of healthy and unhealthy stream habitats are shown in Figures 10 and 11.

Figure 10



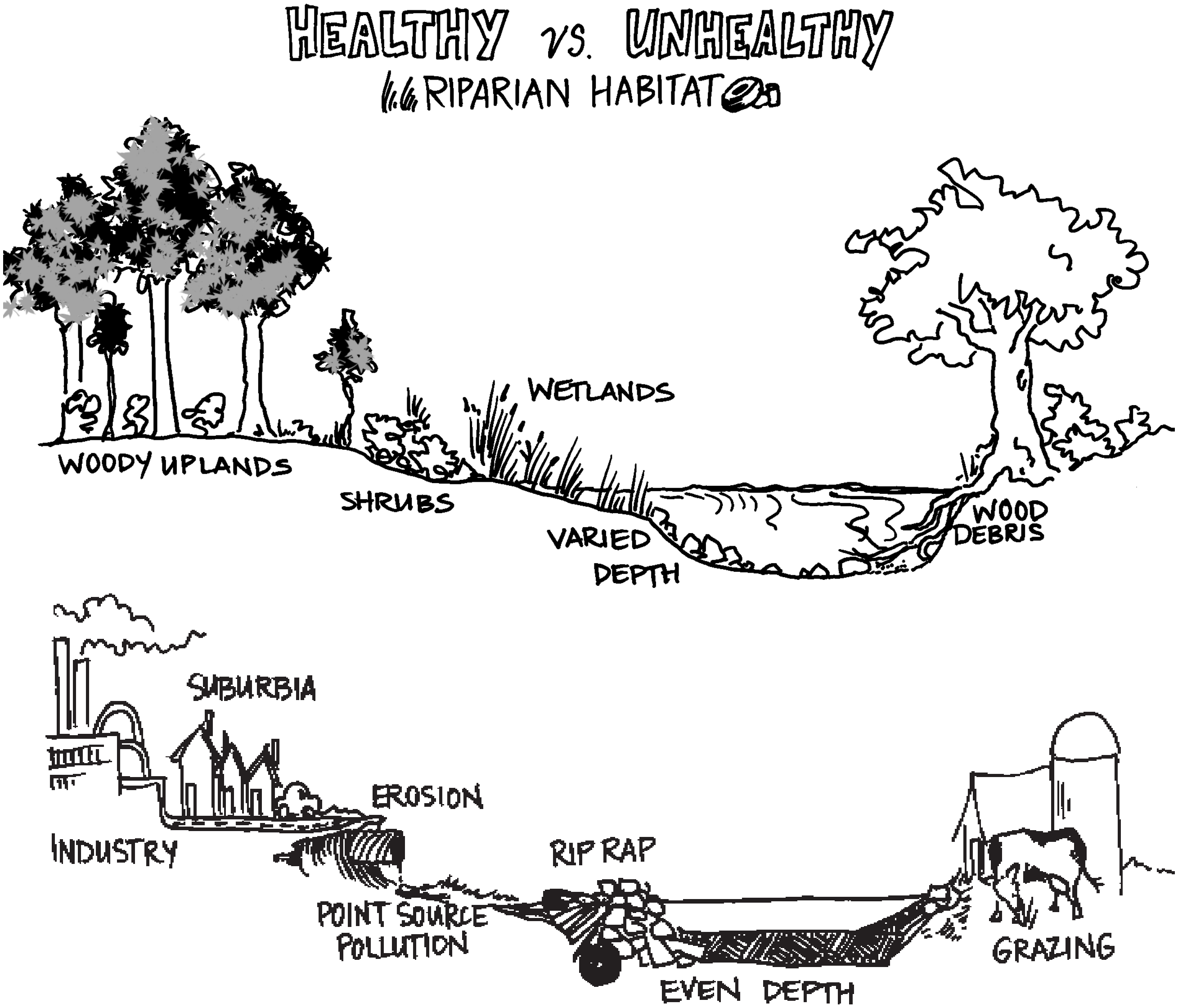
What is a riparian zone?

The term "riparian zone" refers to the areas adjacent to stream channels (Figure 11). The riparian zone is the strip of land between the stream channel and upland hills. Stream riparian zones form an important transition zone between land and freshwater systems. Riparian vegetation refers to the plants that occur naturally on stream banks and along stream channels. They serve as filters for water entering a stream, just as kidneys filter waste products from the bodies of living animals.

Streamside vegetation and wetlands are important components of a stream ecosystem because they provide streams with bank support and stabilization, erosion and flood control, water quality protection, fish and wildlife habitat, and scenic beauty. Plant roots bind soil to stream banks and reduce erosion, and deflect the cutting action of swift flowing stormwater, expanding surface ice, and strong winds. Streamside vegetation keeps the water cool by providing shade, and it provides habitat for aquatic and terrestrial creatures. In addition, plant litter that falls in upland streams is a major source of food for organisms in the stream.

(From the "Streamwalk Training Manual," Thames River Basin Partnership Initiative.)

Figure 11



Citizens Qualitative Habitat Evaluation Index (CQHEI)

This index was developed by the Ohio Environmental Protection Agency as a "Citizens" companion to the Qualitative Habitat Evaluation Index (QHEI) used by the state's professional staff. The diagram's data sheet on pages 26-27 were modified from information provided by the Ohio EPA. The purpose of the index is to provide a measure of the stream habitat and riparian health that generally corresponds to physical factors affecting fish and other aquatic life (i.e., macroinvertebrates). The CQHEI produces a total score that can be used to compare changes at one site over time or to compare two different sites.

NOTE: The CQHEI data sheet was designed to be used primarily in wadeable streams. The index scores do not necessarily reflect the conditions found in intermittent streams or large rivers.

When completing the CQHEI, evaluate your entire stream site (200' section).

In each category choose the most predominant answer. If sections of the stream or stream banks have completely different characteristics, you may check two boxes and average the points to obtain a score for the subsection (a), (b) or (c). An example is provided on page 27.

I. Substrate (Bottom Type) - Max 24 pts
(***Note:*** "smothering" is the same as "embeddedness." See Figure 8 on page 17. Check "yes" for smothering, if the stream bottom is more than 50% embedded.)

II. Fish Cover (Hiding Places) - Max 20 pts
Select all the cover types that you see using Figure 12 on page 25 as a guide. Add the points.

III. Stream Shape and Human Alterations - Max 20 pts

IV. Stream Forests and Wetlands (Riparian Areas) & Erosion - Max 20 pts

a) Width of the Riparian Forest or Wetland - *This is not the width of the stream!* Estimate the width of the area containing trees or wetlands on each side of the stream by answering: "Can you throw a rock to the other side?"

b) See **Appendix C - Glossary** for a description of conservation tillage.

V. Depth & Velocity - Max 15 pts

a) Deepest Pool - If your stream is a consistent depth, select the maximum depth.

b) Select all the flow types that you see and add the points.

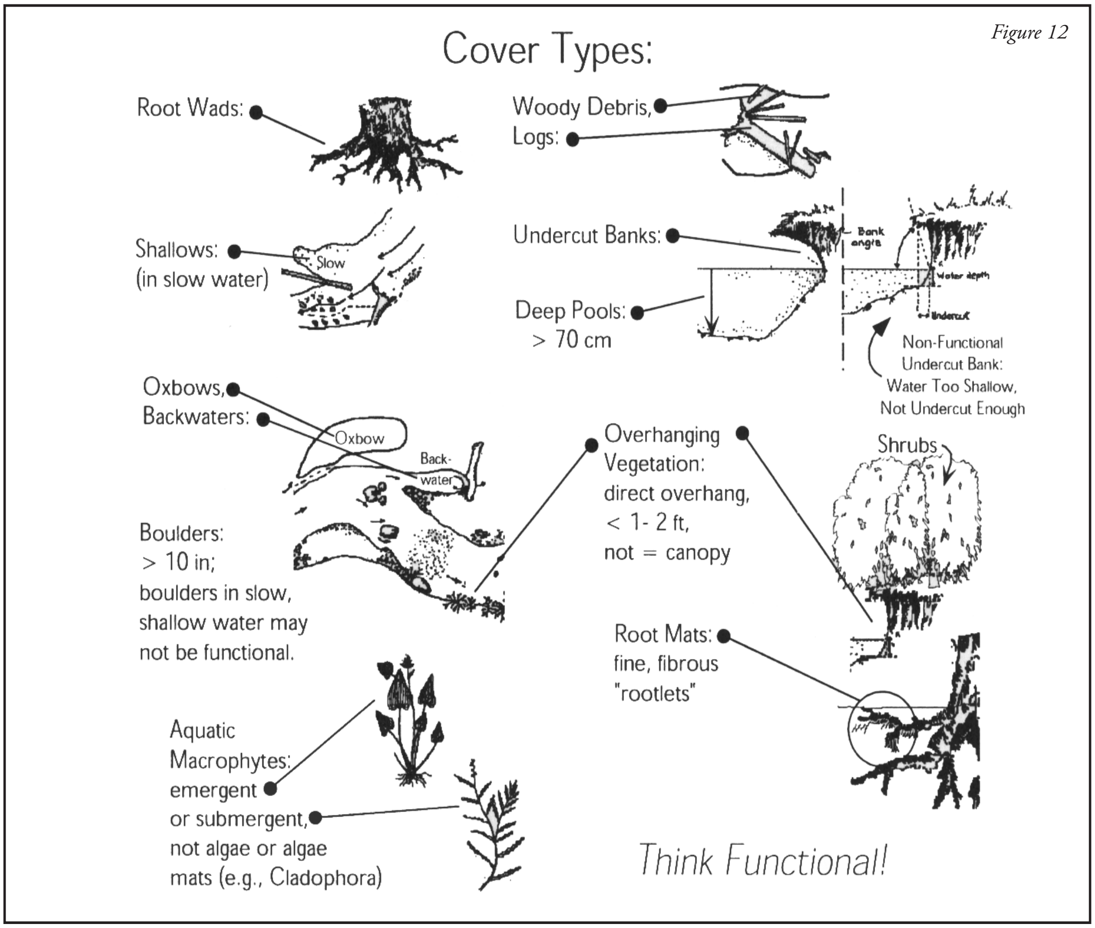
VI. Riffles/Runs (where the current is turbulent) - Max 15
Using the lower diagrams (Figure 13) on page 25 as a guide.

Maximum Total Points for the CQHEI is 114

If the score is over 100, consider it "extra credit." You have an exceptionally high-quality stream.
A set of ranges for Excellent, Medium, Poor, Very Poor has not yet been developed for this index.
But, QHEI scores > 60 have been found to be "*generally conducive to the existence of warmwater fauna.*"

CQHEI Section II: Fish Cover (Hiding Places)

Figure 12



CQHEI Sections V & VI: Depth & Velocity and Riffles/Runs

Figure 13

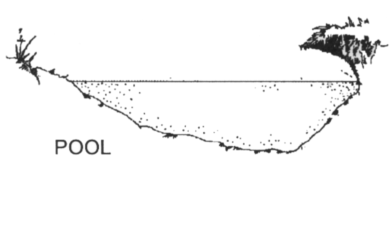
Riffle and Run Habitats:

Riffle - areas of the stream with fast current velocity and shallow depth; the water surface is visibly broken.

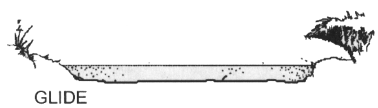
Run - areas of the stream that have a rapid, non-turbulent flow; runs are deeper than riffles with a faster current velocity than pools and are generally located downstream from riffles where the stream narrows; the stream bed is often flat beneath a run and the water surface is not visibly broken.

Pool and Glide Habitats:

Pool - an area of the stream with slow current velocity and a depth greater than riffle and run areas; the stream bed is often concave and stream width frequently is the greatest; the water surface slope is nearly zero.



Glide - this is an area common to most modified stream channels that do not have distinguishable pool, run, and riffle habitats; the current and flow is similar to that of a canal; the water surface gradient is nearly zero.



HINT: These habitat types typically grade into one another. For example a run gradually changes into a pool.

Citizens Qualitative Habitat Evaluation Index (CQHEI)

Date: __/__/__ Volunteer ID: ____________ Site ID: ____________

Stream Name: ____

CQHEI Total

I. SUBSTRATE (bottom type) Score:

a) Size

- [ ] Mostly Large (Fist Size or Bigger) — *14 pt*
- [ ] Mostly Small (Smaller Than Fingernail, but Coarse, or Bedrock) — *6 pt*
- [ ] Mostly Medium (Smaller than Fist, larger than Fingernail) — *10 pt*
- [ ] Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky) — *0 pt*

b) "Smothering"

Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [ ] No — *5 pt*
- [ ] Yes — *0 pt*

Symptoms: Hard to move pieces, often black on bottom.

c) "Silting"

Are Silts and Clays Distributed Throughout Stream?

- [ ] No — *5 pt*
- [ ] Yes — *0 pt*

Symptoms: Light kicking results in substantial clouding for more than a minute.

II. FISH COVER (hiding places) - Add 2 Points For Each One Present Score:

- [ ] Underwater Tree Roots (Large) — *2 pt*
- [ ] Shrubs/Small Trees Hang Over the Bank — *2 pt*
- [ ] Downed Trees, Logs, or Branches — *2 pt*
- [ ] Water Plants — *2 pt*
- [ ] Undercut Banks — *2 pt*
- [ ] Underwater Tree Rootlets (Small) — *2 pt*
- [ ] Backwaters, Oxbows or Side Channels — *2 pt*
- [ ] Shallow, Slow Areas for Small Fish — *2 pt*
- [ ] Deep Areas (Chest Deep) — *2 pt*
- [ ] Boulders — *2 pt*

III. STREAM SHAPE and HUMAN ALTERATIONS Score:

a) "Curviness" or "Sinuousity" of Channel

- [ ] 2 or More Good Bends — *8 pt*
- [ ] Mostly Straight Some Wiggle" — *3 pt*
- [ ] 1 or 2 Good Bends — *6 pt*
- [ ] Very Straight — *0 pt*

b) How Natural Is The Site?

- [ ] Mostly Natural — *12 pt*
- [ ] Many Man-Made Changes, but Some Natural Conditions left (e.g., trees, meanders) — *6 pt*
- [ ] Few Minor Man-Made Changes (e.g., a bridge) — *9 pt*
- [ ] Heavy, Man-made Changes (e.g., leveed or channelized) — *0 pt*

IV. STREAM FORESTS & WETLANDS (riparian area) & EROSION Score:

a) Riparian Width Mostly:

- [ ] Wide (Can't throw a rock through it) — 8 pt
- [ ] Narrow (can throw a rock through it) — 5 pt
- [ ] None — 0 pt

b) Land Use - Mostly:

- [ ] Forest/Wetland — *5 pt*
- [ ] Conservation Tillage — *2 pt*
- [ ] Shrubs — *4 pt*
- [ ] Suburban — *1 pt*
- [ ] Overgrown Fields — *3 pt*
- [ ] Row Crop — *1 pt*
- [ ] Fenced Pasture — *2 pt*
- [ ] Open Pasture — *0 pt*
- [ ] Park (Grass) — *2 pt*
- [ ] Urban/ Industrial — *0 pt*

c) Bank Erosion

- [ ] Stable Hard or Well-Vegetated Banks — *4 pt*
- [ ] Combination of Stable and Eroding Banks — *2 pt*
- [ ] Raw, Collapsing Banks — *0 pt*

d) Stream Shading

- [ ] Mostly — *3 pt*
- [ ] Partly — *2 pt*
- [ ] None — *0 pt*

V. DEPTH & VELOCITY Score:

a) Deepest Pool is At Least:

- [ ] Chest Deep — *8 pt*
- [ ] Knee Deep — *4 pt*
- [ ] Waist Deep — *6 pt*
- [ ] Do Not Exist — *0 pt*

b) Check ALL The Flow Types That You See (Add Points):

- [ ] Very Fast: Hard to Stand in Current — *2 pt*
- [ ] Moderate: Slowly Takes Object Downstream — *1 pt*
- [ ] None — 0 pt
- [ ] Fast: Quickly Takes Object Downstream — *3 pt*
- [ ] Slow: Flow Nearly Absent — *1 pt*

VI. RIFFLES/RUNS (areas where current is fast/turbulent, surface may be broken) Score:

a) Riffles/Runs Are:

- [ ] Knee Deep or Deeper and Fast — *8 pt*
- [ ] Ankle Deep or Less and Slow — *4 pt*
- [ ] Ankle/Calf Deep and Fast — *6 pt*
- [ ] Do Not Exist — *0 pt*

b) Riffle/Run Substrates Are:

- [ ] Fist Size or Larger — *7 pt*
- [ ] Smaller Than Your Fingernails or Do Not Exist — *0 pt*
- [ ] Smaller Than Fist Size, but Larger Than Fingernail — *4 pt*

Citizens Qualitative Habitat Evaluation Index (CQHEI)

Date: 10/ 04/ 2009 Volunteer ID: 1000 Site ID: 1000

Stream Name: Example Stream Indiana

CQHEI Total: 83.5

EXAMPLE

I. SUBSTRATE (bottom type) — Score: 20

a) Size

- [ ] Mostly Large (Fist Size or Bigger) — 14 pt
- [ ] Mostly Small (Smaller Than Fingernail, but Coarse, or Bedrock) — 6 pt
- [X] Mostly Medium (Smaller than Fist, larger than Fingernail) — 10 pt
- [ ] Mostly Very Fine (Not Coarse, Sometimes Greasy or Mucky) — 0 pt

b) "Smothering"
Are Fist Size and Larger Pieces Smothered By Sands/Silts?

- [X] No — 5 pt
- [ ] Yes — 0 pt

Symptoms: Hard to move pieces, often black on bottom.

c) "Silting"
Are Silts and Clays Distributed Throughout Stream?

- [X] No — 5 pt
- [ ] Yes — 0 pt

Symptoms: Light kicking results in substantial clouding for more than a minute.

II. FISH COVER (hiding places) - Add 2 Points For Each One Present — Score: 14

- [X] Underwater Tree Roots (Large) — 2 pt
- [ ] Shrubs/Small Trees Hang Over the Bank — 2 pt
- [X] Downed Trees, Logs, or Branches — 2 pt
- [ ] Water Plants — 2 pt
- [ ] Undercut Banks — 2 pt
- [X] Underwater Tree Rootlets (Small) — 2 pt
- [X] Backwaters, Oxbows or Side Channels — 2 pt
- [X] Shallow, Slow Areas for Small Fish — 2 pt
- [X] Deep Areas (Chest Deep) — 2 pt
- [X] Boulders — 2 pt

III. STREAM SHAPE and HUMAN ALTERATIONS — Score: 15

a) "Curviness" or "Sinuousity" of Channel

- [ ] 2 or More Good Bends — 8 pt
- [ ] Mostly Straight Some Wiggle" — 3 pt
- [X] 1 or 2 Good Bends — 6 pt
- [ ] Very Straight — 0 pt

b) How Natural Is The Site?

- [ ] Mostly Natural — 12 pt
- [ ] Many Man-Made Changes, but Some Natural Conditions left (e.g., trees, meanders) — 6 pt
- [X] Few Minor Man-Made Changes (e.g., a bridge) — 9 pt
- [ ] Heavy, Man-made Changes (e.g., leveed or channelized) — 0 pt

IV. STREAM FORESTS & WETLANDS (riparian area) & EROSION — Score: 13.5

a) Riparian Width Mostly:

- [X] Wide (Can't throw a rock through it) — 8 pt
- [ ] Narrow (can throw a rock through it) — 5 pt
- [X] None — 0 pt

Average: 4 pts

b) Land Use - Mostly:

- [X] Forest/Wetland — 5 pt
- [ ] Conservation Tillage — 2 pt
- [ ] Shrubs — 4 pt
- [ ] Suburban — 1 pt
- [ ] Overgrown Fields — 3 pt
- [ ] Row Crop — 1 pt
- [ ] Fenced Pasture — 2 pt
- [ ] Open Pasture — 0 pt
- [X] Park (Grass) — 2 pt
- [ ] Urban/ Industrial — 0 pt

Average: 3.5 pts

c) Bank Erosion

- [X] Stable Hard or Well-Vegetated Banks — 4 pt
- [ ] Combination of Stable and Eroding Banks — 2 pt
- [ ] Raw, Collapsing Banks — 0 pt

d) Stream Shading

- [ ] Mostly — 3 pt
- [X] Partly — 2 pt
- [ ] None — 0 pt

V. DEPTH & VELOCITY — Score: 11

a) Deepest Pool is At Least:

- [X] Chest Deep — 8 pt
- [ ] Knee Deep — 4 pt
- [ ] Waist Deep — 6 pt
- [ ] Do Not Exist — 0 pt

b) Check ALL The Flow Types That You See (Add Points):

- [ ] Very Fast: Hard to Stand in Current — 2 pt
- [ ] Moderate: Slowly Takes Object Downstream — 1 pt
- [ ] None — 0 pt
- [X] Fast: Quickly Takes Object Downstream — 3 pt
- [ ] Slow: Flow Nearly Absent — 1 pt

VI. RIFFLES/RUNS (areas where current is fast/turbulent, surface may be broken) — Score: 10

a) Riffles/Runs Are:

- [ ] Knee Deep or Deeper and Fast — 8 pt
- [ ] Ankle Deep or Less and Slow — 4 pt
- [X] Ankle/Calf Deep and Fast — 6 pt
- [ ] Do Not Exist — 0 pt

b) Riffle/Run Substrates Are:

- [ ] Fist Size or Larger — 7 pt
- [ ] Smaller Than Your Fingernails or Do Not Exist — 0 pt
- [X] Smaller Than Fist Size, but Larger Than Fingernail — 4 pt

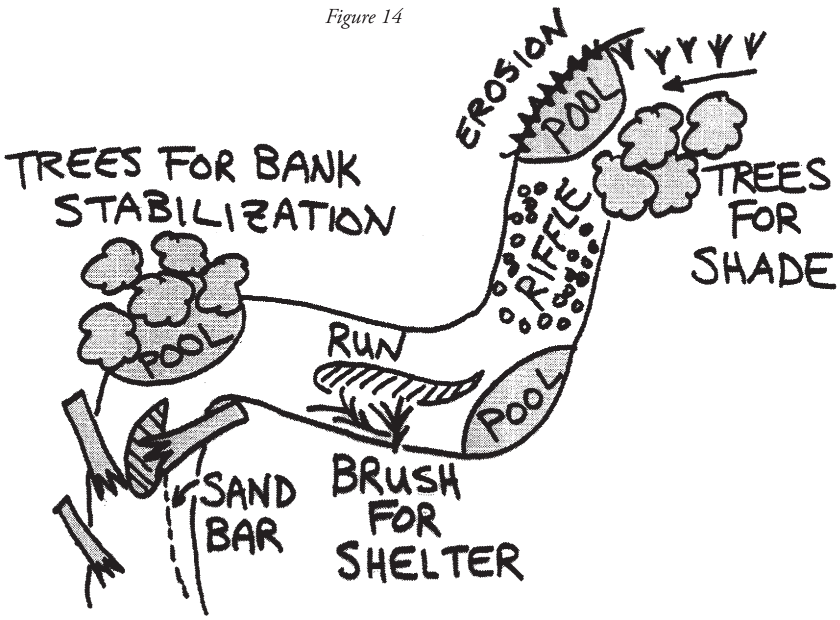
Site Map & Stream Flow

Site Map

Drawing a map of your site location is an excellent first step in getting to know your 200-foot stream segment. Photographs help but don't always capture all the details. Looking at an aerial photograph before or during your visit may also help with familiarization. Continuing this tradition on an annual basis may also alert you to changes at your site that may not have been obvious during regular sampling visits. An example map is shown below (Figure 14) with a map sheet on page 29. The stream map can now be scanned and uploaded to the database, as can photos you take of the site or your sampling event.

Stream Flow Calculations

Figure 14



A work sheet is provided on Page 30 to assist volunteers in determining the stream flow or discharge rate. (See page 31 for a completed example.) Discharge is the amount (volume) of water flowing in the stream per second. Riverwatch uses cubic feet per second as the standard unit of discharge. This measurement is important because it influences other physical, chemical, and biological factors in the stream (i.e., all of our other tests). A high discharge rate may indicate recent rainfall or snowmelt events. When a large amount of rain runs off the land, it often carries sediments and nutrients to the stream. Very low discharge rates may indicate drought conditions, which also affect water quality and aquatic life. The discharge rate is obtained by multiplying the average width, depth, and velocity of the stream. All measurements are taken (or converted) into feet. The data sheet includes a diagram and instructions. Stream flow calculations can be entered into the volunteer monitoring online database (*See Chapter 7)*.

Average Width (W) - width of the stream (flowing area itself) taken from where it touches the stream bank on one side to where it touches the stream bank on the other side - take three width measurements; when possible measure areas that appear most representative of the entire 200 foot stream section

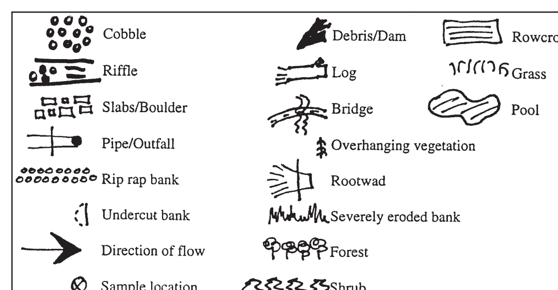
Average Depth (Z) - three depth measurements are taken (using a yardstick) across the stream on three transects - nine total measurements

Average Velocity (V) - how fast the water is moving - measure a distance and time how long it takes a floating object to travel that distance - repeat three times

Roughness Coefficient (n) - select 0.8 for a gravel or rocky bottom; select 0.9 for sandy, muddy or bedrock

Flow (D)= W^{x}Z^{x}V^{x}n

Stream Site Map



Hoosier Riverwatch
Stream Flow (Discharge) Data Sheet

Date ____/____/____ Volunteer ID________________ Site ID ______________________________

Stream Name____

Solving the equation:

FLOW (D) = W x Z x V x n

Where:

W = Average Width

Z = Average Depth

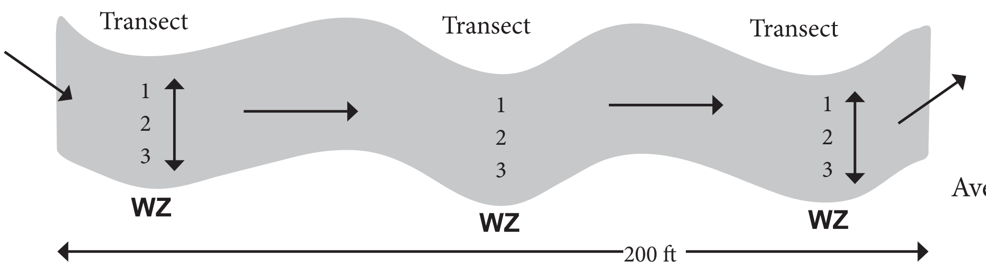
V = Average Velocity

n = Coefficient - 0.8 for gravel/rocky bottom streams
0.9 for muddy or bedrock bottom streams

D = Flow/Discharge

Convert measurements of feet + inches to 10ths of feet. **1 inch = 0.0833 feet**

W
River Width
(one measurement at each transect)



Transect	Width (ft)
1	
2	
3	
Average	

Z
River Depth
(three measurement along each transect)

Transect	Transect 1 (ft)	Transect 2 (ft)	Transect 3 (ft)
1			
2			
3			
Average of Transects			

Average of Averages

V
Surface Velocity = Length/Time
(allow the object to attain velocity before timing)

Transect	Length (ft)	Time (seconds)	Velocity (ft/sec)
1			
2			
3			
Average			

D
Stream Flow or Discharge

W	x	Z	x	V	x	n*	=	D (cfs)

**Coeffecient (0.8 for gravel/rocky bottom streams, 0.9 for muddy or bedrock bottom streams*

Hoosier Riverwatch

Stream Flow (Discharge) Data Sheet

Date 10 / 04 / 09 Volunteer ID 1000 Site ID 1000

Stream Name Example Stream Name

Solving the equation:

FLOW (D) = W x Z x V x n

Where:

W = Average Width

Z = Average Depth

V = Average Velocity

n = Coefficient - 0.8 for gravel/rocky bottom streams
0.9 for muddy or bedrock bottom streams

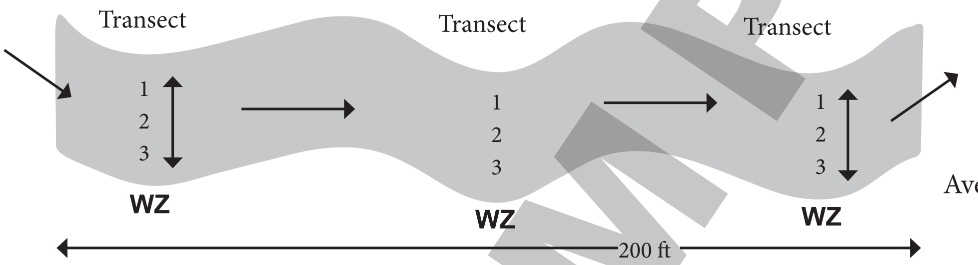
D = Flow/Discharge

Convert measurements of feet + inches to 10ths of feet. **1 inch = 0.0833 feet**

W

River Width

(one measurement at each transect)



Transect	Width (ft)
1	10.03
2	9.67
3	11
Average	10.33

Z

River Depth

(three measurement along each transect)

Transect	Transect 1 (ft)	Transect 2 (ft)	Transect 3 (ft)	Average of Averages
1	0.83	1	1.54	
2	1.42	1.58	1.11	
3	1.08	0.58	1.33	
Average of Transects	1.11	1.05	1.33	*1.16*

V

Surface Velocity = Length/Time

(allow the object to attain velocity before timing)

Transect	Length (ft)	Time (seconds)	Velocity (ft/sec)
1	10	25	0.4
2	10	28	0.36
3	10	26	0.38
Average			0.38

D

Stream Flow or Discharge

W	x	Z	x	V	x	n*	=	D (cfs)
10.33		1.16		0.38		0.8	=	*3.64*

**Coeffecient (0.8 for gravel/rocky bottom streams, 0.9 for muddy or bedrock bottom streams*