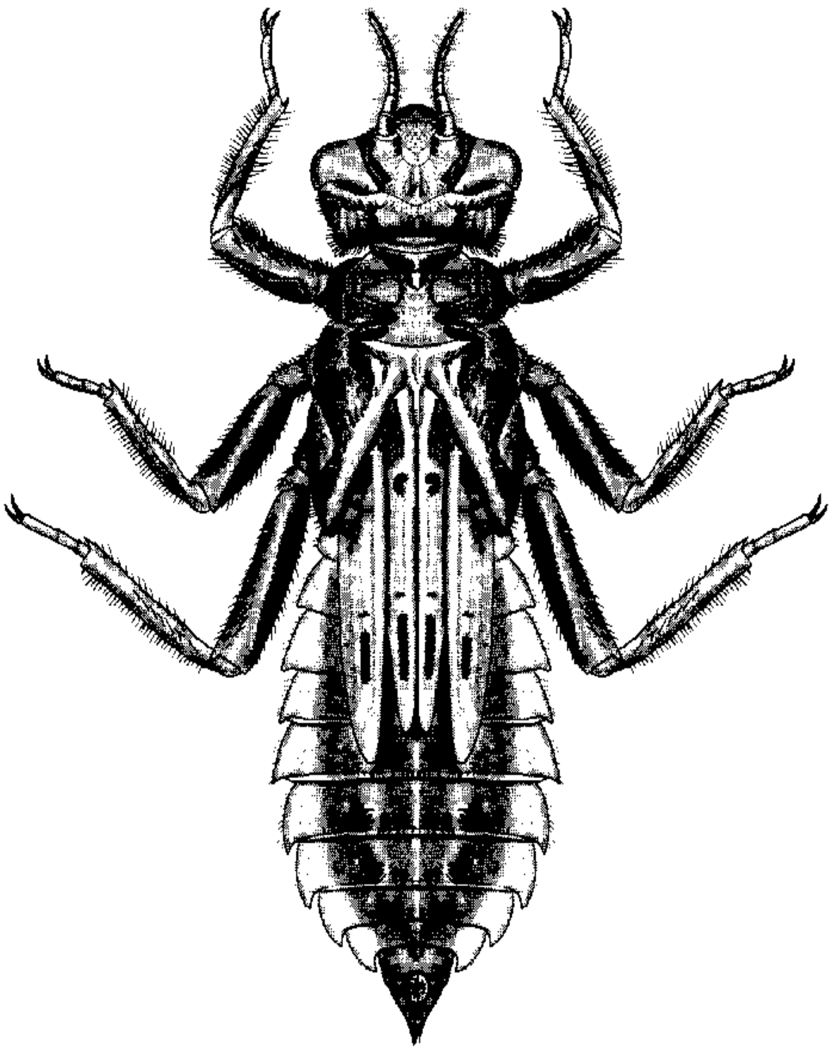
# Fox River Watershed Monitoring Network

FRIENDS OF THE FOX RIVER



# Stream Monitoring Guide

A guide for monitoring the streams of the Fox River Watershed

# Friends of the Fox River

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# STREAM MONITORING GUIDE

A guide for monitoring the
streams of the Fox River Watershed.

By

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Initial Printing:  October 2000
Second Printing:  August 2004

The development and initial printing of this guide was funded by a grant from the Kane County Forest Preserve District.  Printing of additional guides are funded by a grant from the Illinois Department of Natural Resources Conservation 2000 Ecosystems Program.

## A Word from the Director ...

Welcome Watershed Watchdogs.

The Fox River is an invaluable natural, economic and social resource. Its rich cultural and natural history make it a focal point for many communities in Illinois and Wisconsin. Thanks to public action and the resulting governmental standards and initiatives in the 1970s, it is enjoying some of the best water quality in decades. Today that good water quality is under an ever-present and growing threat from the degradation of its feeder streams and the land within its watershed. The general culprit is the human population expansion within the watershed. It will be up to us as Watershed Watchdogs to sniff out potential threats, bark in warning and guide the way to practices that are not detrimental to the health of the watershed. It will be our efforts that will influence the fate of the Fox River.

Our mission is to build a watershed of caretakers. The Friends of the Fox River Watershed Monitoring Network will be the vehicle to protecting, maintaining and restoring the health of the Fox River. It will be our data, information, and educational endeavors that will help develop public awareness and initiate the necessary actions. As Margaret Meade once said, "Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it's the only thing that ever has." As a Watershed Watchdog, you will play a vital role in saving our endangered river. Without us, the Fox River's fate is questionable.

As an educator, this network has been my vision for a decade. A monitoring network is an incredible vehicle to provide meaningful education and water quality protection efforts. We already have many success stories. The strength of any network is in its members. We all can be resources to each other and there are many ways that you can participate. If you get involved in issue awareness, recreational opportunities (canoeing), monitoring, storm drain stenciling, Fox Rescue clean-up, or other events, you can expect full support from us at Friends of the Fox River. The Fox River Watershed needs us as a voice and a guardian. I welcome you into our pack (Friends of the Fox River Watershed Monitoring Network) of Watershed Watchdogs.

Gary Swick
Monitoring Network Director
Friends of the Fox River

October 3, 2000

Fellow Conservationist,

Greetings! So you want to become involved in helping to monitor and preserve our Fox River. Congratulations! I applaud and encourage the step you have taken to become involved in your community. This is the highest responsibility of citizenship and those of us who have gone before you welcome you to the ranks of those who volunteer to preserve and protect our beautiful environment. If you do your job, and stick to your cause, you will send a clear message to your compatriots. Those of us who believe as you do will ally ourselves to you. Those who do not believe in the conservation and preservation of our Fox River will despair and vilify your efforts. This is what we all must expect, but do not be faint of heart for our cause is right. I spent many years fighting those who would despoil our precious resources and again I am delighted to welcome you all to the job at hand.

To those of you who are young— listen to your teachers; to those of you who are young at heart but older— keep the faith. We will yet win others over to our cause.

It will be tough — it always is, but we are on the right track.

Good luck and good hunting.

Respectfully yours,

The FOX

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# Introduction

This guide is dedicated to the many heroes who preceded us in acting as a voice for protecting the water quality of the Fox River; especially, the original Watershed Watchdog, "The Fox," and the founder of Friends of the Fox River, Pat Reese. Both these people sacrificed their personal well-being for the protection of the Fox River. They were the pioneers in this watershed and continue to serve as an inspiration.

It is essential that data be collected to document health trends within our watershed. The threats are so extensive that immediate action is imperative. This publication is a guide to monitoring water quality for action. It has been developed by educators and monitoring experts. You can expect updates and changes as we develop new or additional resources. The guide's purpose is to be an easy-to-use resource for successful educational and environmental protection experiences. If it's not useful, it won't be used, so your input on its effectiveness is requested and appreciated.

Friends of the Fox River is committed to protecting, maintaining and restoring the water quality of the watershed. Water quality data is an essential component to making sound management decisions. This guide will assist you in collecting that data. It is our intent to collect as much data as practical, so we have designed a system for various ability levels of monitoring using a variety of techniques. In addition to techniques, you will find additional resources available to you. Please do what you can and ask for assistance.

We need you in the streams! The awareness that accompanies a visit to a stream is a powerful experience that builds the connections that change the way people think. The understanding that all of our actions within the watershed impact water quality is an important concept. Our goal is to build a watershed of caretakers. We must all understand our connections to the Fox River, and take action to protect its health. Monitoring is the vehicle for awareness, data and action. Go get wet!

# Fox River Biography

The Fox River is the third largest tributary of the Illinois River. The river begins in northern Waukesha County, WI, meanders 130 miles south and west to LaSalle County where it joins the Illinois River. The Fox River basin (the land surrounding the river, also known as a watershed) is 1,720 square miles and includes portions of 11 counties: McHenry, Lake, Kane, DeKalb, Cook, DuPage, LaSalle, Lee, Kendall, Will & Grundy.

Throughout the area of the Fox River basin there are 406 lakes.

The floodplain of the river is dynamic due to the unique topography of the land the river traverses. In the northern portion of the river from Wisconsin to Algonquin, Illinois, the floodplain is very flat. The river is ill-defined as it passes through lakes and marshes. From Algonquin to Aurora the floodplain is narrow with high bluffs, or completely absent. From Aurora the floodplain broadens as it follows the Marseilles Moraine until it empties into the Illinois River in Ottawa.

The Fox River basin has 14 glacial lakes and 4 river segments that are recognized as Biologically Significant Streams because they support threatened or endangered species or have high mussel & fish diversity.

The Glacial Lakes are:

| | | | |
|---|---|---|---|
| Bangs | Cedar | Grays | Lily |
| Cross | Crystal | McCollum | Round |
| Deep | East Loon | Sullivan | Turner |
| West Loon | Wooster | | |

The Biologically Significant Stream segments are:

An unnamed tributary of the Fox at Yorkville
Buck Creek
Morgan Creek
North Branch of the Nippersink Creek

The Fox River basin is a good place to see evidence of glacial activity.  The most prominent features in the northern portion of the basin are the kames, kettle holes, and eskers.  The prominent signs of glacial activity in Northern Illinois are the result of the Wisconsin Glacier of the Pleistocene epoch (10-15 thousand years ago).

Early settlers recognized that the Fox River was an excellent resource, and since the establishment of towns along the river, the population has increased dramatically.  Most of the Fox River municipalities were established and settled during the mid-1830s.  These early settlements began as service centers providing travelers a meal and a bed, or a place to trade.  The river and the surrounding area provided many resources for the settlers.  The gristmills, sawmills, and factories used the river for energy.  The prairie soil was rich in nutrients for agricultural use.  Timber and limestone were available for building materials.  Even mussel shells from the river were a valuable source to produce lime and mortar, and later, buttons.

The basin area’s population exploded after World War II during the classic “flight to the suburbs.”  The population is still drastically increasing.  In 1990, the six-county area (Lake, McHenry, Kane, Kendall, DeKalb and LaSalle) was home to 11% of the state’s population.  Thirty percent growth in the population is expected in the next 20 years.

Boating, hunting, and fishing are among an array of recreational opportunities the river and its surrounding wetlands and lakes provide.  The state operates five major sites in the area with over three million visitors annually.  This has generated $37 million in economic output and provided 500 jobs annually.  There are also 48 nature preserves, 118 natural areas, forest preserves & hiking/biking trails in the area.

The river is a biologically diverse ecosystem.  Forty-four percent of Illinois’ native and naturalized plants occur in the basin (1,389 species).  Of these 77 are listed as state endangered and 25 are state threatened.  At least 248 of the 299 species of Illinois birds can be found in the basin, 30 of which are state threatened or endangered.  Seventy-four percent of the State’s mammals can be found in the area.  Fourteen amphibian and twenty-two reptilian species occur here.

The Fox River basin is a diverse and biologically rich area. Defending and preserving the integrity of the river and its surrounding area is of the utmost importance so that future generations may bask in its glory and benefit from all that it provides.

This information and more can be found in “The Fox River Basin: An Inventory of the Region’s Resources” By the Illinois Department of Natural Resources.

# Monitoring Background

## What is trend monitoring?

Trend monitoring is the primary testing method used by Friends of the Fox River. To get an accurate picture of a stream's water quality, monitoring should be performed on a regular basis over a period of years. Trend monitoring provides a broad view of a stream allowing the seasonal variations to be sorted out from long-term changes. In order to get useful data for trend analysis, a group should consider the long-term commitment involved in this type of monitoring.

## How frequently should a stream site be monitored?

Stream sites should be monitored once a year during the site's assigned monitoring season, either the spring (May 1 - June 30) or fall (Sept. 1 - Oct. 31) stream monitoring window. Additional monitoring is encouraged, but monitoring once per year during the assigned monitoring season is all that is required.

## How long does it take to monitor?

Monitoring a stream site takes one to three hours.

## What parameters are used to monitor water quality in this program?

| Physical Features & Habitat | Chemical | Biological |
|---|---|---|
| Stream Habitat | Temperature | Benthic macroinvertebrates |
| Riparian zone | pH | |
| Bank vegetation, stability, slope | Nitrate | |
| Physical Stream Measurements | Turbidity | |
| | Phosphorus | |
| | Dissolved Oxygen | |
| | Dissolved Oxygen - % Saturation | |
| | Biological Oxygen Demand | |

## What equipment is used?

- Systematic record of observations
- Chemical testing kit
- Kick net, D-net, hand lens or microscope, vials, trays
- Identification key for aquatic insects
- *For a complete checklist of equipment, please see Section G*

## How do volunteers get started?

In order to start a successful Friends of the Fox River stream monitoring program, it is recommended that you thoroughly read this manual and attend a workshop sponsored by Friends of the Fox River. The workshops are free and open to the public and provide hands-on monitoring experience. Please contact Friends of the Fox River Monitoring Network at (815) 356-6605 dates and locations.

## What is the next step?

The Friends of the Fox River Watershed Monitoring Network program is introductory in nature and is designed for use by educators, youth groups, and citizens at large. For individuals ready to take stream monitoring to an advanced level, we encourage our Network members to participate in the Illinois RiverWatch Program. The Fox River Watershed Monitoring Network and Illinois RiverWatch Program share similar goals and serve a resources for one another. We encourage our stream monitors to collect data for both programs. For information about the Illinois RiverWatch Program, call the Illinois RiverWatch Coordinator at 618-468-4870.

## How is monitoring data used?

Friends of the Fox River Watershed Monitoring Network's data is retained and reviewed by our water quality professionals. The data serves as a timely indicator of water quality trends and allows Friends of the Fox River to act promptly should the data indicate immediate action. The data is shared with water quality protection groups and agencies throughout the State of Ilinois, and is accessible on Friends of the Fox River's website at www.friendsofthefoxriver.org.

## Can I submit Additional Detailed Data?

While the monitoring methods outlined in this guide are sufficient for assessing water quality trends, additional detailed data gives Friends of the Fox River more information on which to make assessments and decisions. Therefore, advanced chemical testing equipment and advanced methods for macroinvertebrate identification are encouraged. Questions regarding preferred advanced chemical testing equipment and macroinvertebrate collection methods should be directed to Friends of the Fox River's Monitoring Network Coordinator at 815-356-6605.

# Understanding Watersheds and Stream Systems

## Why are watersheds important?

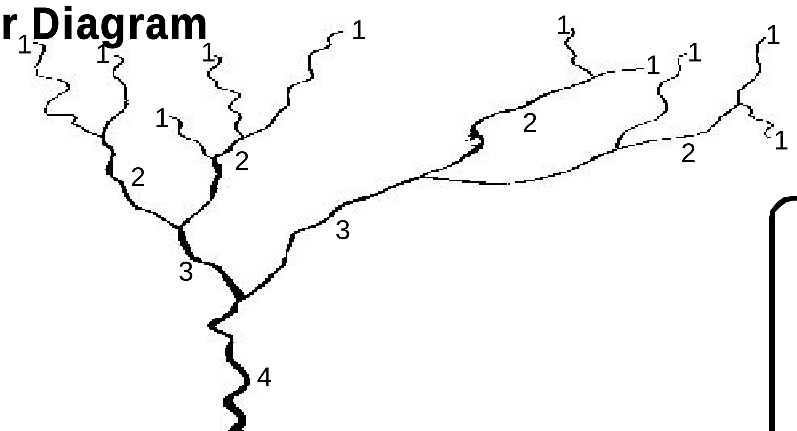
The ability of a stream to support beneficial uses such as fishing, boating and body contact recreation is influenced by the major land uses in the watershed, the nature of the stream channel, the diversity of instream habitats and the character of the stream banks.

## What is a watershed?

A watershed is the total area of land that contributes runoff to a stream. Major land uses in a watershed determine the quality of surface water in the smaller streams and waterways which can influence the water quality of the larger streams. For example, point source discharges, urban runoff, runoff from landfills and runoff from agricultural areas may contain sediments, organic material, nutrients, toxic substances, bacteria or other contaminants. When these substances are present in significant concentrations, they may interfere with some stream uses.

The smallest channels in a watershed have no tributaries and are called first-order streams. When two first-order streams join, a second-order stream is formed. When two second-order streams join, they form a third-order stream, and so on. First and second-order channels are often small, steep or intermittent. Stream orders that are six or greater are large rivers.

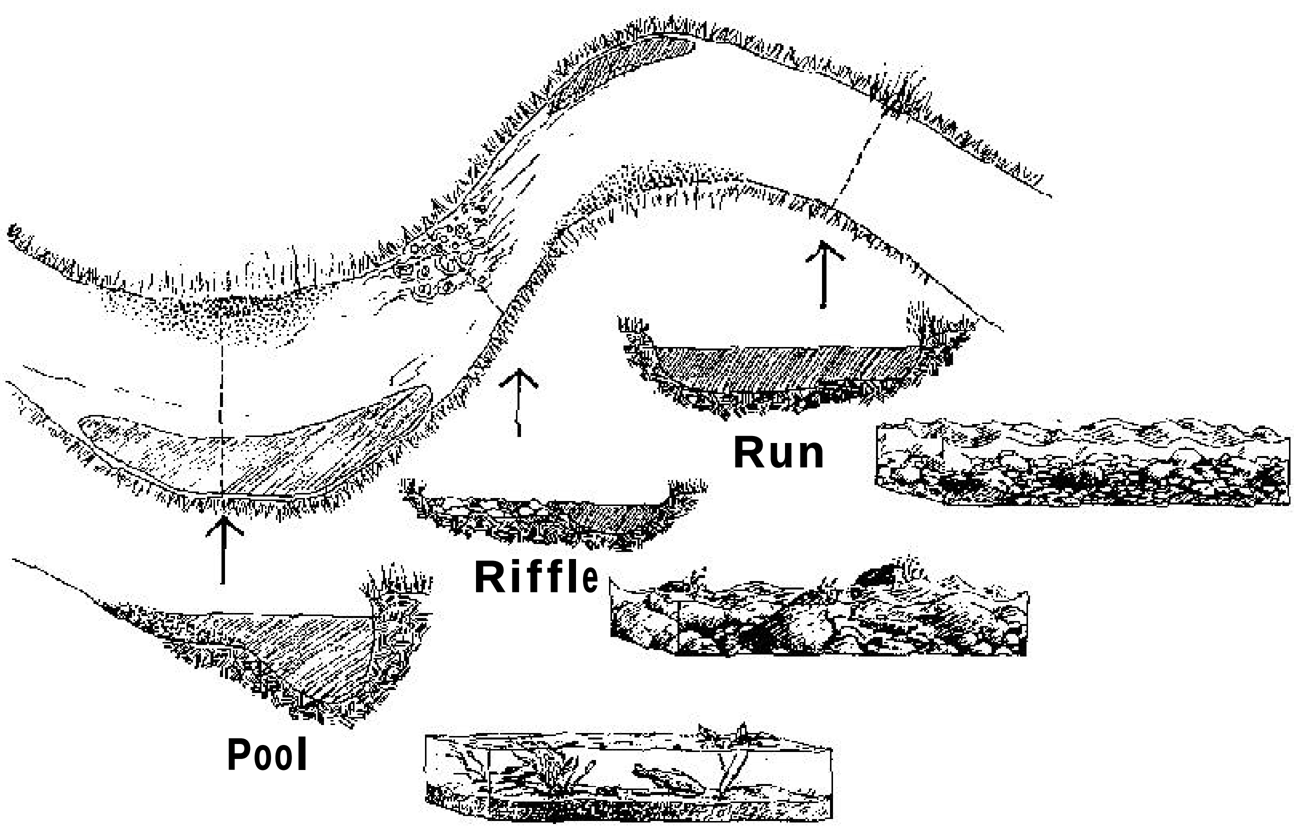
## Stream Order Diagram




**Key**
1 - first order
2 - second order
3 - third order
4 - fourth order

The stream channel is formed by runoff from the watershed as it flows across the surface of the ground following the path of least resistance. The shape of the channel and velocity of flow are determined by the terrain, unless changes have been made by man. When the terrain is steep, the swiftly moving water may cut a deep stream channel and keep the streambed free of sediments. In flatter areas, the stream may be shallow and meandering, with a substrate comprised largely of sediments. A natural stream channel provides a variety of habitats for many species of plants and animals.

Pools, riffles, undercut bands and snags (fallen tree limbs or small log piles) provide different types of habitat. The more types of habitat present in a stream system, the greater the diversity of aquatic plants and animals that would live there. A uniformly straight or deep channel provides less habitat for species to live.



## Streamflow types

Streams can be classified by the period of time during which flow occurs. Perennial streams flow year-round or 90 percent of the time, in a well-defined channel. Intermittent streams flow generally during the wet season, or 50 percent of the time. Ephemeral streams flow during or shortly after extreme precipitation or snowmelt conditions. Ephemeral channels are not well-defined and are usually headwater or low order streams.

## Factors that affect watersheds

Climate - source of water - Water comes to the watershed in seasonal cycles, mainly as rain or snow. Groundwater also contributes water to streams. The seasonal patterns of precipitation and temperature control stream flow and water production.

Physical Features - The area of a watershed affects the amount of water that is produced. The shape and slope of a watershed and the drainage pattern influence surface runoff and seepage in streams that drain the watershed. The steeper the slope, the greater the possibility for rapid runoff and erosion. Plant cover is more difficult to establish and the infiltration of surface water is reduced on steep slopes.

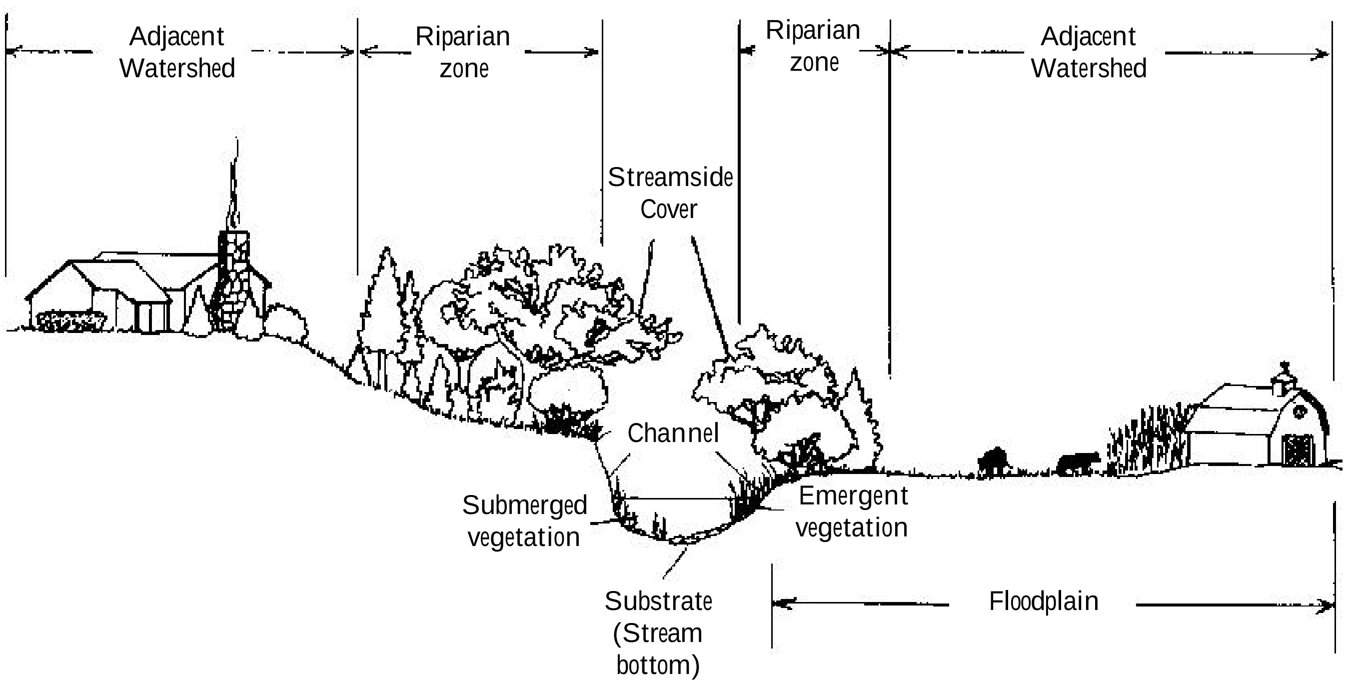
Soils - Soil is a thin layer of the earth's crust. It is composed of mineral particles of all sizes and varying amounts of organic materials. It is formed from breakdown of parent rocks to fine mineral particles. In our area, limestone has led to a higher soil pH.

Vegetative Cover - Grasses, shrubs and trees make up the major plant cover types. These types build up organic litter and affect soil development. A forest includes trees in various stages of growth and an understory of shrubs and ground cover. Tree litter protects the soil's surface. Tree roots grow deep into the soil and help to bind it, and tree crowns help provide the most shade. The plant cover intercepts rain and reduces the force with which raindrops strike the ground. Plants also reduce wind velocity. Fallen leaves and twigs produce litter which decompose and is incorporated into the soil. Stems and roots filter water into the ground.

# What is the riparian zone?

A riparian zone is linear, has a water transport channel and floodplain and is interrelated with upstream and downstream ecosystems. The riparian zone is made up of three areas. The aquatic area is generally the stream channel. The riparian area is a terrestrial zone where annual and intermittent water, a high water table, and wet soils influence vegetation and microclimate. The area of influence is a transition between a riparian area and upland cover. An area of influence has soil moisture and is characterized by a noticeable change in plant composition and abundance. Trees in this area contribute shade, leaves, woody debris and insects to a stream. This stair-stepping of vegetation provides a variety of wildlife habitat.

Riparian vegetation provides essential habitat in and around the stream. When the stream banks are lined with trees, shrubs and non-woody plants, they provide shade for the stream, protect the channel from erosion trap sediments and absorb nutrients.



# Choosing a Monitoring Site

- One of the most important elements of site choice is location. Since trend monitoring is an ongoing process, requiring years of data, the site must be practical and convenient for you to return on a yearly basis.
- Choose a perennial stream site (has water flowing all year).
- Monitoring requires getting in the stream and sometimes getting wet, therefore, choose a section of stream that will allow safe entry and is less than knee-deep.
- If there is a bridge near your site, it is better to monitor upstream from the bridge to minimize human impact of the bridge (runoff, litter, etc.).
- Make sure that you can access at least a 200 foot stretch of the stream.
- Never enter a stream that has a swift current.
- Identify and avoid deep areas in the stream.
- You must be able to obtain permission for monitoring on the site.
- Choose a stream site that has an accessible riffle (shallow water bubbling over rocks) and a variety of habitats.
- Look for a site that offers interesting characteristics such as upstream or downstream from a water treatment plant or outfall pipe (down stream from a dam is a good site).

# Safety

Safety is important to everyone.  In order to have a successful and safe monitoring program, caution should be used while monitoring your stream site.  Never compromise your personal safety.

## Safety Guidelines

- Inform someone where you are going, and what you are doing.  Make sure that someone knows where you are at all times.
- Take a cellular phone if you own one.
- Always take a buddy.
- Be cautious of fast or deep waters.  River and stream currents can be very strong and have very strong undertows.  Never venture past knee deep water.
- Wear shoes that are in good condition and have traction.  Never wear open-toed shoes or barefoot.
- ALWAYS OBTAIN PERMISSION TO CROSS PRIVATE PROPERTY TO GET TO A SAMPLING SITE!  Be sure that the landowners know exactly when and where you will sample.  Try to utilize public property.
- Know your organization's policy and safety guidelines related to water monitoring. (e.g. permission slips or health care requirements)
- Consider contacting your nearest county forest preserve district, local police department or fire department  for specific warnings regarding local streams.  Some stretches of streams may be subject to dangerous water shifts of high levels of pollutants.

- Do not mix chemicals indiscriminately.  Use only the correct chemicals, and the correct amounts that are required to perform the proper analysis.

- Provide wash water at the monitoring site to wash off any chemicals from the eyes or the body.

- Wear gloves and safety goggles when using chemicals.

- Carry a first aid kit.

- Carry appropriate water safety equipment such as life buoys, life jackets, and rescue equipment.

- Leave wildlife alone.  Do not disturb the vegetation on the banks of the stream, or feed the animals.  Strive to have minimal impact on stream integrity.

# Supplies

The following is a list of supplies that are needed or can be helpful on a trip to your monitoring site.  This list may be used as a check off list for trip planning.  Please add any items that you feel can be helpful.

## Supply Check-off List

- ☐ Maps and past data sheets to use as a guide
- ☐ Clipboard
- ☐ China marker or wax pencil and laminated copies of the data sheets
- ☐ Other pens and pencils
- ☐ Calculator
- ☐ 100’ reel tape measure
- ☐ Stopwatch for measuring velocity
- ☐ Floatation device for measuring velocity (practice golf balls)
- ☐ Boots or waders (NEVER PUT CHILDREN IN CHEST WADERS)
- ☐ An extra set of dry clothes and blankets
- ☐ Towels
- ☐ Kick seine net and D-net
- ☐ White sampling trays for collecting benthic macroinvertebrates (ice cube trays work well for sorting organisms)
- ☐ Hand lens or magnifying glass
- ☐ Tweezers or forceps
- ☐ Isopropyl or ethanol
- ☐ Glass vials or jars to hold the insects
- ☐ Rubber gloves
- ☐ Regular or digital camera
- ☐ Compass to help pinpoint the correct direction
- ☐ First aid kit that includes eye wash
- ☐ Whistle or horn and a flash light and batteries
- ☐ Water for drinking
- ☐ Flag markers
- ☐ Non-mercury thermometer
- ☐ Chemical Monitoring Kit and waste bottle
- ☐ GPS unit (optional)

# Stream Walk

The first step to the monitoring process is to familiarize yourself with the stream that you will be monitoring (don't forget to get permission from the land owner before going out to the stream you will monitor). The stream walk portion should take you and your monitoring partners approximately an hour. To familiarize yourself with the stream, walk at least the length of the stream section you will be monitoring. Walking further upstream may provide interesting and important information. It is a great idea to bring a note book and pen / pencil with you to take notes. While you are walking, here is a list of questions you can ask yourself to evaluate the stream:

- What are the land uses surrounding the stream?
- What is the *riparian* zone like?
- Are there signs of streambank stabilization or erosion? (cement, boulders, netting- anything placed there by humans to prevent erosion)
- Do you hear or observe signs of animal use around the stream? (animal tracks, holes, nests, etc.)
- What animals do you see?
- Is there garbage? If so, list and catagorize what kind- consumer waste, industrial waste, etc.
- Are there other signs of human use / abuse?
- Do pipes or drains empty into the stream, or near the stream?
- List observations for future comparison.

# Stream Survey:
## HOW TO COMPLETE THE STREAM SURVEY DATA SHEET

## Section I / Site Information

The site information section provides data relative to the stream monitoring site. This section gives the exact location of the sampling site, so the same location can be consistently monitored, in order to collect data for trend analysis.

1. Date: The date that the samples and information were collected.

2. Time: The time that the sample collection began.

3. Sampling Site Number: The site number is assigned by Friends of the Fox River's Monitoring Network Coordinator - 815-356-6605.

4. Collector(s) Name: If possible, include the names of all the monitoring participants, otherwise include the name of the monitoring leader, or the primary contact for the organization. Note that the first initial and last name of the monitoring leader will be posted on the Friends of the Fox River's website.

5. Organization Name: The name of the organization, agency, corporation, school, class, troop, or group performing the monitoring activities. Please do not abbreviate the name.

6. River or Tributary Name: The official name of the stream that is being monitored. The official name can be found by using U.S. Geological Survey topographic maps. In the case of unnamed streams, indicate the next named stream into which the unnamed stream drains (e.g. tributary to Crystal Creek).

7. Latitude/Longitude: The latitude and longitude can be found by using the United States Geological Survey (U.S.G.S.) topographic maps (Contact Friends of the Fox River for topographic maps or borrow a GPS unit).

8. Nearest City/Town: The nearest community to the sampling site.

9. County: The County in which the sampling is located.

## Section II / Site Survey

The second section of the Site Survey Data Sheet is the Site Survey. The site survey is a general evaluation that is made while sampling each location. This form is used to tabulate data and information about the monitoring site. The site survey provides information on a stream's potential to support biological communities by evaluating in-stream habitat. The site survey data sheet is completed each time the sampling site is monitored. It should be the first data sheet that is completed (followed by chemical, and then biological).

It will take about 60 minutes to complete the site survey the first time. The more familiar you become with the data sheet, the less time it will take.

The following are definitions and guidelines that will help you to complete the site survey.

**In this section, please check all the boxes that apply (on the data sheet).**

## Stream Habitat

A stream with pools, bends, rocks, undercut banks, and snags (fallen branches, small log piles) provide better habitat for the development of a diverse aquatic community than a straight or uniformly deep stream. These features provide food, shelter from predators, and breeding places for animals in the water.

**Riffle** (a stream area, which is relatively shallow, with swift moving, churning water; often upstream of a pool)
**Run** (a stream area, which varies in depth, with moderate, smooth flowing water compared to a riffle or pool, often upstream of a pool)
**Pool** (a stream area, which is relatively deep with slow moving water, often downstream from a riffle)
**Undercut banks** (stream edges, that have nearly verticle or verticle banks with overhanging vegetation and submerged root mats)
**Snags** (submerged logs or branches that are at least four months old)
**Exposed rocks** (exposed boulders rising above the water line)

## Inorganic Substrate

Inorganic substrate is the material that lays on the stream bed that is derived from geologic material.

**Boulders** (>25.5 cm or >10 inch diameter - size of head)
**Cobble** (6.5-25.5 cm or 2.5-10 inch diameter – size of fist)
**Gravel** (2 mm-6.5 cm or 0.1-2.5 inch diameter – size of nose)
**Sand** (0.005-0.20cm or 0.002-0.079 inch diameter)
**Silt** (soft, fine soil - mud)

## Water Odors

**Normal** (not necessarily an indicator of clean water, many pollutants are colorless and odorless)
**Sewage** (septic, sewage)
**Petroleum** (oil, gas)
**Chemical** (chlorine, sulfur-hydrogen sulfide, rotten eggs)
**Fishy** (harsh-fishy)
**Other** (musty-decomposing straw, earthy- peaty or grassy)

## Surface Oils

Indicates the presence of oil or gasoline floating on water surface.

**None** (no oils present)
**Some** (very little to 50% of the surface covered with floating oils)
**Lots** (more than 50% of the surface covered with floating oils)

## Bank Vegetation

The type of vegetation located in the riparian zone affects the health of the stream. Vegetation provides food and shelter for animals and other organisms living in or near the water.

**Bare soil** (no vegetation)
**Turf grass** (mowed lawn)
**Wild grasses** (unmowed grasses & non-woody plants)
**Woody shrubs** (dense growth of bushes or shrubs)
**Deciduous trees** (trees that loose their leaves during seasonal change)
**Conifer trees** (evergreen tree species)
**Other** (rocks or artificial materials)

## Local Land Use

The land use should be determined for the area immediately outside of the riparian zone. Indicate all visible land uses seen from the riparian zone.

**Urban** (high density residential)
**Suburban** (scattered to moderate residential)
**Agriculture** (row crops or pasture)
**Open field** (Unmowed field)
**Park-turf** (turf or city park)
**Park-woods** (woods or forest preserve)
**Other** (disturbed, wetland, mining, construction, etc.)

## Bank Stability

The amount of erosion along the stream bank.

**Stable** (no sign of any bank erosion)
**Slightly eroded** (very occasional and very local erosion)
**Moderately eroded** (some erosion evident)
**Severely eroded** (severe bank failure with extensive slumping and fall-ins)

## Bank Slope

The slope is the angle of the bank. Record the bank slope for both banks. If different, describe the varying slopes in the Survey Notes section.

**Steep** (having a sharp incline, nearly perpendicular, V-shaped slope)
**Moderate** (medium or average incline, wide U-shaped slope)
**Slight** (very little or no incline, slight U-shaped slope)

## Temperature

Record current air and water temperature. Measure temperature by submerging a thermometer 4” below the water surface for at least two minutes. If the stream depth in under 4”, measure temperature at the deepest location where water is flowing. Measure water temperature one mile upstream if the water temperature may be escalated by a discharge source or another source that could artificially raise the water temperature.

## Current & Past Weather Conditions

Record current & past weather conditions. Past weather conditions should reflect the worst weather in the past 48 hours.

**Sunny/Clear**
**Overcast**
**Showers (intermittent rain)**
**Rain (steady rain)**
**Storm (heavy rain)**

## Stream Shading

Stream shading is the percent of shading that occurs over the stream bed by the riparian vegetation. Overhanging trees provide shade that lowers water temperature, and help prevent an imbalance in the amount of plant growth. Stand in the stream and look up. Estimate actual shading.

**0-25%** (very little to no shading of the stream bed from riparian vegetation)
**50-25%** (sparse shading of the stream bed from riparian vegetation)
**75-50%** (moderate shading of the stream bed from riparian vegetation)
**75-100%** (extensive shading of the stream bed from riparian vegetation)

## Siltation

Siltation is the accumulation of fine soil & sediment on the surface of the stream substrate. Estimate the percentage of silt that covers the entire 200 foot stream section.

**0-25%** (silt-free, substrates are exceptionally clean throughout the sampling area)
**25-50%** (Normal silt cover includes areas where silt is deposited in small amounts along the stream margin in pools/slow flowing water, or is present as a dusting)
**50-75%** (Moderate, extensive covering of silt, but with some areas of cleaner substrate, i.e., riffle areas)
**75-100%** (Silt heavy, nearly all of the stream bottom is layered with a deep covering of silt- greater than one inch thick)

## Embeddedness

Rocks within embedded substrates cannot be easily dislodged. As rocks become embedded, fewer living spaces are available to macroinvertebrates and other living organisms. Embeddedness is the degree that rocks (gravel, cobble, and boulders) are surrounded by, covered, or sucken into the silt, sand, or mud of the stream bottom. To estimate the percentage 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. Naturally sandy streams are not considered embedded.

**0-25%** (Fine sediment surrounds and fills 0-25% of the living spaces around and in between the gravel, cobble, and boulders)
**25-50%** (Fine sediment surrounds and fills 25-50% of the living spaces around an in between the gravel, cobble, and boulders)
**50-75%** (Fine sediment surrounds and fills 50-75% of the living spaces around and in between the gravel, cobble, and boulders)
**75-100%** (Fine sediment surrounds and fills 70-100% of the living spaces around and in between the gravel, cobble, and boulders)

## Stream Width

Measure the stream's width from water's edge to water's edge with a tape measure marked in tenths of a foot. If the stream is too deep, fast moving, or you are unable to measure the entire width, establish a safe channel within the stream to measure width. Be sure to indicate on your site sketch where the width measurement was taken.

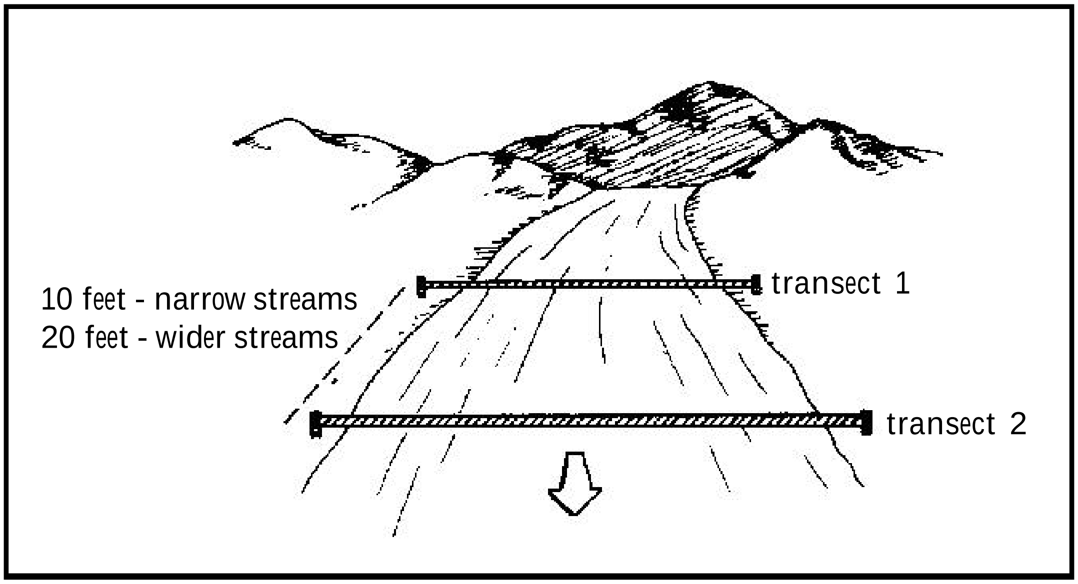
## Average Stream Depth

Average stream depth measurements are to be taken along the line representing stream width. To measure the depth of the stream, use a measuring stick (or place measurements on your net pole) placed in the stream until it hits the stream bed surface. Do not try to jam the stick through the mud or silt. Take 3 measurements that are equal distance across the sampling location (at midpoint and halfway between midpoint and shoreline of each bank). Record measurements to the nearest tenth of a foot. Add the three depth values and divide by three to determine the average depth in feet.

## Average Stream velocity

Stream velocity is the speed water is flowing. To measure the surface velocity, use a tape measure along the stream bank to mark a section 10 feet in length for shallow, narrow streams and a section 20 feet in length for deeper, wider streams (see illustration on page I-8). Select three locations where the velocity measuring device (a practice golf ball is recommended) will travel unobstructed. Position someone at the upstream and someone at the downstream ends of the measured section. Release the velocity measuring device into the main current at the upstream end of the measured section. Use a stop watch to time the passage of the velocity measuring device from the beginning to the end to the marked length. When the velocity measuring device reaches the downstream person, stop the timer. Repeat this test 3 times beginning at different locations along the beginning of the starting point. Make sure the velocity measuring device is unobstructed. Average the results. Calculate the velocity in feet per second.

## Stream velocity




## Stream Discharge

Stream discharge, or flow, is the volume of water moving past a cross-section of a stream over a specific period of time. It is often expressed in cubic feet per second (cfs).

The discharge of a stream is directly related to the amount of water moving off the watershed into the stream channel. It is affected by weather, increasing during rainstorms and decreasing during dry periods. It also changes during different seasons of the year, decreasing during summer months when evaporation rates are high and shoreline vegetation is actively growing and removing water from the ground.

Discharge is a function of water volume and velocity. It is important because of its impact on water quality and on the living organisms and habitats in the stream. Large, swiftly flowing rivers can receive pollution discharges and be little affected, whereas small streams have less capacity to dilute and degrade waste.

Calculating discharge involves solving an equation that examines the relationship among several variables including stream cross-sectional area, stream length, and water velocity. One way to measure flow is to solve the following equation:

**Stream Width x Average Depth x Average Velocity = Discharge**

**Example**

| Stream Width = **10.5 ft.** | Depth Measurements | Velocity (10 ft. stream section) |
|---|---|---|
| | 1. .6 ft. | 10 ft. ÷ 20 seconds = .5 ft/sec |
| | 2. 2.0 ft. | 10 ft. ÷ 22 seconds = .45 ft/sec |
| | 3. 1.6 ft. | 10 ft. ÷ 25 seconds = .4 ft/sec |
| | Average Depth = **1.4 ft.** | Average Velocity = **.45 ft/sec** |

Stream Discharge (width x average depth x average velocity)

| 10.5 ft. | x | 1.4 ft. | x | .45 ft/sec | = | **6.62 ft3/sec.** |
|---|---|---|---|---|---|---|
| Width | | Average Depth | | Average Depth | | Stream Discharge |

## Dams, Channelization & Foam

Note the presence of man-made or natural dams upstream of your monitoring site. Note if your stream site has been channelized.

Note if any foam is present within your monitoring site.

## Section III / Survey Notes

This section is provided so that any items of significance can be added to the site survey data sheet. Is there something just upstream of your monitoring site that may affect the habitat of your stream such as, heavy industry, a wastewater treatment plant or a boat marina? Were there people utilizing the stream for recreational purposes (i.e. fishing, swimming, boating?) Also, did you see any wildlife? Add anything that you feel is important to the site survey (no matter how small).

## Site Photos

Take three photos - 1) facing cross section of the area you have monitored,
2) facing upstream of area monitored (encompassing banks, if possible), and
3) facing downstream of area monitored (encompassing banks, if possible). Take pictures from the same location each time you monitor. Send printed pictures with the data or e-mail digital photos to MonitoringCoordinator@friendsofthefoxriver.org. Note the date, time and monitoring site with each picture.

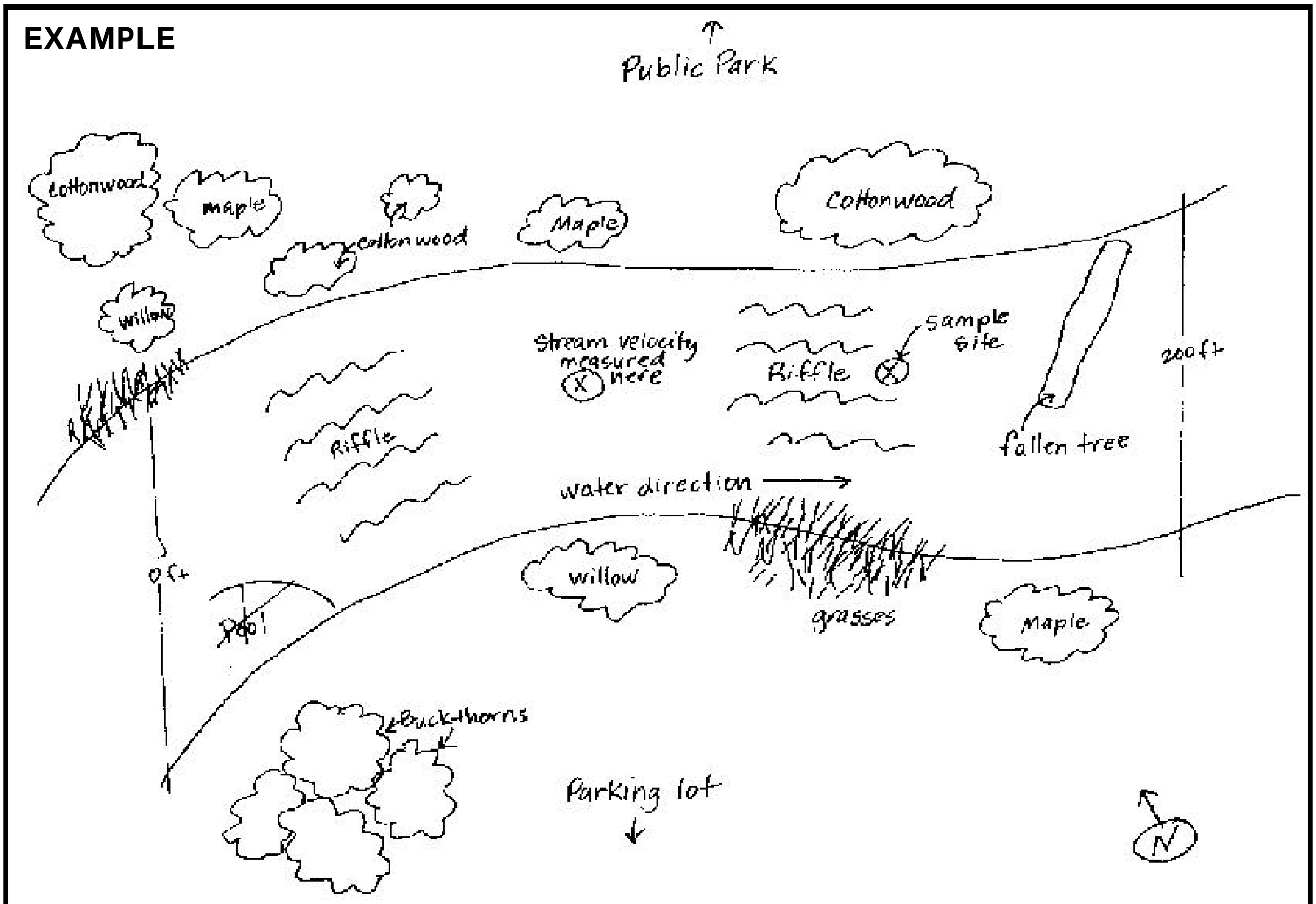
# Section IV / Stream Map

Stream mapping is a critical component to stream monitoring.  By keeping a physical record of the monitoring site, not only will you be able to relocate the same stream, any physical changes may be recorded as well.  A sheet is provided for the map (Note a space is provied for the key).

Include the following information on the map:

- Direction (North ↑, etc.)
- Stream flow (indicated by an arrow)
- Substrate types (boulders, sand, etc.)
- Riffles
- Sample  Location
- Logs
- Debris
- Bridges
- Bank types
- Riparian vegetation (trees, shrubs, grass, etc.)

**EXAMPLE**



# Friends of the Fox River-Site Survey Data Sheet

**Mail completed forms within two weeks after collecting data to:**
**Friends of the Fox River, P.O. Box 1314, Crystal Lake, IL  60039**

## Section I

**SITE INFORMATION**

**Example**

Date 11 / 5 / 00    Time 10 : 30 am or pm    Site #: 4

Collector(s) Name: Skip Wiley    Organization Name: Dragon Flyers

River or Tributary Name: Crystal Creek    Latitude/Longitude: $42^0$10.085N/ $88^0$17.754W

Nearest City/Town: Algonquin    County: McHenry

## Section II

**SITE SURVEY**

**CHECK ALL THAT APPLY**

Stream Habitat
- X Riffle
- X Run
- X Pool
- ___ Undercut banks
- X Snags
- ___ Exposed rocks

Inorganic Substrate
- X Boulders
- X Cobble
- X Gravel
- ___ Sand
- X Silt

Water Odors
- X Normal
- ___ Sewage
- ___ Petroleum
- ___ Chemical
- ___ Fishy
- ___ Other

Surface Oils
- X None
- ___ Some
- ___ Lots

Bank Vegetation
- ___ Bare ground
- X Turf grass
- ___ Unmowed grasses
- ___ Woody shrubs
- X Decidous trees
- ___ Conifer trees
- ___ Other

Local Land Use
- ___ Urban
- X Suburban
- ___ Agriculture
- ___ Park (turf)
- ___ Park (woods)
- ___ Other

**CHECK MOST PREDOMINANT**

Bank Stability
- ___ Stable
- X Slightly eroded
- ___ Moderately eroded
- ___ Severely eroded

Bank Slope
- X Slight
- ___ Moderate
- ___ Steep

Temperature
- $22^0$C Water (at site)
- $20^0$C Air temperature
- $22^0$C Water (1 mile upstream-optional)

**CHECK MOST PREDOMINANT**

Current Weather
- X Sunny/Clear
- ___ Overcast
- ___ Showers (intermittent rain)
- ___ Rain (steady rain)
- ___ Storm (heavy rain)

Past Weather (48 hours)
- X Sunny/Clear
- ___ Overcast
- ___ Showers (intermittent rain)
- ___ Rain (steady rain)
- ___ Storm (heavy rain)

# Friends of the Fox River - Site Survey Data Sheet

**EXAMPLE**

**SITE SURVEY -- continued**

| | | | | |
|---|---|---|---|---|
| **Stream Shading** | **X 0-25%** | **____ 25-50%** | **____ 50-75%** | **____ 75-100%** |
| **Siltation** | **____ 0-25%** | **X 25-50%** | **____ 50-75%** | **____ 75-100%** |
| **Embeddedness** | **____ 0-25%** | **X 25-50%** | **____ 50-75%** | **____ 75-100%** |

**Stream Width** 10.5 **ft** **Avg. Surface Velocity** .45 **ft/sec**

**Avg. Stream Depth** 1.4 **ft** **Stream Discharge** 6.62 **ft3/sec**

**Check all that are present:** Dam Upstream ____ Channelized X Foam ____

## Section III

**SURVEY NOTES**

**Site is located in town park. There are large parking lots, factory, houses and school nearby**

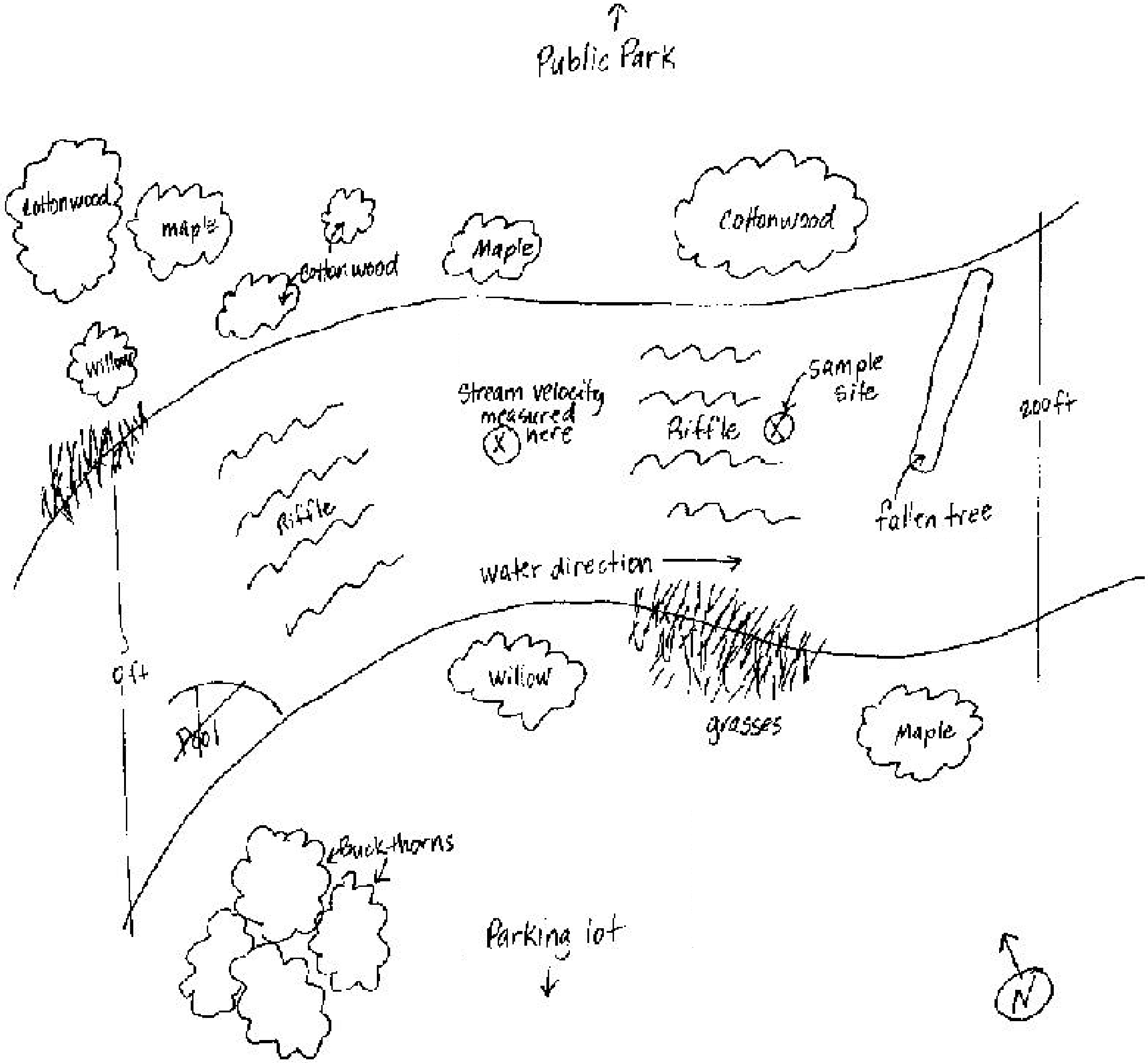
**SITE PHOTOS**

Take three photos - 1) facing cross section of the area you have monitored, 2) facing upstream of area monitored (encompassing banks, if possible), and 3) facing downstream of the area monitored (encompassing banks, if possible). Take pictures from same location each time you monitor. Send the printed pictures with the data or e-mail digital photos to MonitoringCoordinator@friendsofthefoxriver.org. Note the date, time and monitoring site that photos were taken.

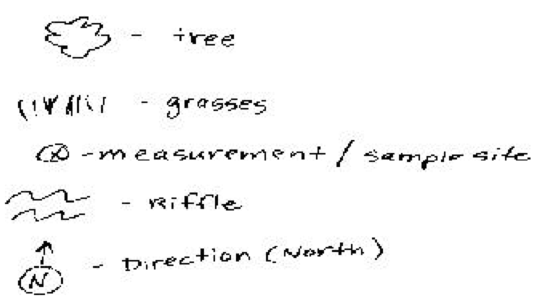
# Friends of the Fox River - Site Survey Data Sheet

## Section Iv

**STREAM MAP**




**STREAM MAP KEY**



# Chemical Monitoring

Follow the instructions that are included with the chemical testing kit that you obtained. Not all test kits follow the same procedures, therefore, there are no instructions in this manual on how to complete the individual tests (such as a HACH Surface Water Kit). The following instructions indicate what must be done with the results that are obtained from the test kits and how to complete the chemical data sheet.

## Hints for Performing Chemical Tests

- Wear protective gloves and safety goggles
- Practice. The more familiar that you are with tests, the easier they will be to perform, and the more accurate your results will be.
- Make sure tests tubes are cleaned and rinsed before testing.
- Discard the waste properly.
- Wash your hands when you are finished.
- Take the water samples for testing from the middle of the stream, about 4-5 inches under the surface.
- Make sure you note on your stream map where your water samples were taken from for testing.

***The following chemical testing instructions are for use with LaMotte's Low Cost Water Monitoring Kit (#5886) Tests.***

## Temperature

Measure water and air temperature with either the liquid crystal temperature strips in the LaMotte Low Cost Chemical Monitoring Kit or an armored non-mercury thermometer.

Water temperature tells many things about the health of a river. Temperature affects: dissolved oxygen levels in water, photosynthesis, animal survival, and sensitivity to toxic wastes and disease.

Water Temperature Test Procedure

(Check off each step as you go.  Remember to wear gloves and goggles.)

1. At the sampling area, lower the thermometer four inches below the surface.  If possible, test the temperature in the area where the water is flowing.
2. Submerge the thermometer in the water for approximately two minutes to ensure an accurate measurement.
3. Record your measurement in degrees Celsius.

Air Temperature Test Procedure

1. Without holding the probe portion,  expose the thermometer to the air.
2. Allow thermometer two minutes to ensure an accurate measurement.
3. Record your measurement in degrees Celsius.

# pH

pH is the measurement of the acidic or basic quality of water.  For example, lemons, oranges and vinegar are high in acid (very acidic).  Acids can sting or burn your skin.  The pH scale ranges from a value of 0 (very acidic) to 14 (very basic), with 7 being neutral.  The pH of natural water is usually between 6.5 and 8.2.  For more background information on pH, see Addtional Chemical Information.

pH Test Instructions

1. Fill the test tube to the 10 mL line with the water sample.
2. Add one pH Wide Range TesTab.
3. Cap and mix by inverting until the tablet has disintegrated.  Bits of material may remain in the sample.
4. Compare the color of the sample to the pH color chart.  Record the result as pH.

## Nitrate (Nitrogen)

Nitrogen is one of the most common elements in the world. All living plants and animals need it to build proteins. Nitrogen and phosphorous are both nutrients. They can be found in plant fertilizers. Like phosphorous, extra nitrogen in water leads to rapid plant growth. The tiny plants grow quickly and then die. They sink to the bottom of the water where the bacteria decompose them. This uses up oxygen and creates a biochemical oxygen demand (B.O.D.).

Nitrate Test Procedures

1. Fill the test tube to the 5mL line with the water sample.
2. Add one Nitrate Wide Range CTA TesTab.
3. Cap and mix by inverting until the tablet has disintegrated. Bits of material may remain in the sample.
4. Wait 5 minutes for the red color to develop.
5. Compare the color of the sample to the Nitrate color chart. Record the result as ppm Nitrate.

## Turbidity

Turbidity is the measure of the relative clarity of water. Turbid water is caused by suspended and colloidal matter such as clay, silt, organic and inorganic matter, and microscopic organisms. Turbidity should not be confused with color, since darkly colored water can still be clear and not turbid. Turbid water may be the result of soil erosion, urban runoff, algal blooms, and bottom sediment disturbances which can be caused by boat traffic and abundant bottom feeders. High turbidity lowers the oxygen levels limiting the ability of fish and insects to survive. Floating particles may also clog fish gills, kill aquatic insect eggs, and limit plant growth.

Turbidity Test Instructions

1. Remove the backing from the Secchi disk icon sticker.
2. Adhere sticker on the inside bottom of the large white jar (kit container). Position the sticker slightly off center to adjust for a refraction of light.
3. Fill the jar to the turbidity fill line located on the outside of the kit label.
4. Hold the Turbidity Chart on the top edge of the jar. Looking down into the jar, compare the appearance of the Secchi disk icon in the jar to the chart. Record the result as Turbidity in Jackson Turbidity Units (JTU).

If you think that your water is turbid, what could be causing this? What do you see happening on the land that would make the water turbid?

## Total Phosphorous

Phosphorous is a nutrient found in all living things. It is also a mineral in nature. Both plants and animals have phosphorus in their bodies. It is in most of the foods we eat. Phosphorous is found in fertilizers for gardens. Plants like algae use phosphorous to grow. When plant growth increases, the water turns pea-green and becomes cloudy. The green color comes from the chlorophyll content of the tiny floating plants. When these plants die, they sink to the bottom where bacteria decomposes the dead plant parts. Bacteria use up more oxygen to decompose the algae than the amount produced by the plants through photosynthesis. Therefore, too many plants from too much phosphorous leads to less oxygen.

1. Fill one test tube to the 10 mL line with the water sample.
2. Add one Phosphorous TesTab.
3. Cap and mix by inverting until the tablet has disentegrated. Bits of material may remain in the sample.
4. Wait 5 minutes for the blue color to develop.
5. Compare the color of the sample to the Phosphate color chart. Record the result as ppm Phosphate.

## Dissolved Oxygen (D.O.)

Clean, healthy water has plenty of dissolved oxygen. When water quality decreases, dissolved oxygen levels drop and it becomes impossible for many animals to survive. Some fish such as trout require lots of dissolved oxygen. Others such as carp can survive in water with low oxygen levels. Organic waste is mainly responsible for dissolved oxygen levels to decrease.

Dissolved Oxygen (D.O.) Test Procedure

1. Record the temperature of the water sample.
2. Submerge the small tube into the water sample. Carefully remove the tube from the water sample, keeping the tube full to the top.
3. Drop two Dissolved Oxygen TesTabs into the tube. Water will overflow when tablets are added.
4. Screw the cap on the tube. More water will overflow as the cap is tightened. Make sure no air bubbles are present in the sample.
5. Mix by inverting the tube over and over until the tablets have disintegrated. This will take about 4 minutes.
6. Wait 5 more minutes for the color to develop.
7. Compare the color of the sample to the Dissolved Oxygen color chart. Record the result as ppm Dissolved Oxygen.

## Calculating Saturation for Dissolved Oxygen

Locate the temperature of the water sample on the % Saturation chart. Locate the Dissolved Oxygen result of the water sample at the top of the chart. The % Saturation of the water sample is where the temperature row and the D.O. column intersect. For example: if the water sample temperature is 22 degrees C and the D.O. result is 4 ppm, then the % Saturation is 46.

### % Saturation

| Temp C° | 0 ppm | 4 ppm | 8 ppm |
|---|---|---|---|
| 2 | 0 | 29 | 58 |
| 4 | 0 | 31 | 61 |
| 6 | 0 | 32 | 64 |
| 8 | 0 | 34 | 68 |
| 10 | 0 | 35 | 71 |
| 12 | 0 | 37 | 74 |
| 14 | 0 | 39 | 78 |
| 16 | 0 | 41 | 81 |
| 18 | 0 | 42 | 84 |
| 20 | 0 | 44 | 88 |
| 22 | 0 | 46 | 92 |
| 24 | 0 | 48 | 95 |
| 26 | 0 | 49 | 99 |
| 28 | 0 | 51 | 102 |
| 30 | 0 | 53 | 106 |

# Biochemical Oxygen Demand (B.O.D.)

B.O.D. is the amount of oxygen needed by aquatic animals to break down organic matter. The B.O.D. test helps determine the amount of organic waste in water. The test measures the amount of oxygen needed by decomposers to eat the organic waste. Since decomposers like bacteria use oxygen to break down organic waste, more organic waste means more bacteria and a bigger drop in oxygen.

B.O.D. Test Procedure

This test measures how much oxygen bacteria use while eating organic waste over a five-day period. Since this test takes 5 days, you must collect the sample 5 days before the testing day. You will do the B.O.D. test on the $5^{th}$ day (testing day) using this water sample. This will give you an approximate answer at the same time the results of the other water tests are known.

1. Submerge the small tube into the water sample. Carefully remove the tube, keeping the tube full to the top. Cap the tube.
2. Wrap the tube with aluminum foil and store it in a dark place at room temperature for 5 days.
3. Unwrap the tube. Add two Dissolved Oxygen TesTabs to the test tube.
4. Cap the tube. Make sure there are no air bubbles. Invert until tablets have disintegrated. Wait 5 minutes.
5. Compare the color of the sample to the D.O. Color Chart

The difference in the D.O. level between the uncovered tube and the covered tube is the Biochemical Oxygen Demand (BOD) of the water sample.

D.O. (original) – D.O. (five day) = B.O.D. level

For example: if the D.O. level of the water sample after five days (covered tube) is 4ppm and the original D.O. level (uncovered tube) of the water sample was 8ppm, the B.O.D. level is 4 ppm.

# Friends of the Fox River
# Chemical Monitoring Data Sheet

## Section I

**Example**

**SITE INFORMATION**

Date **11** / **05** / **00** Time **10** : **30** am or pm    Site #: **4**

Collector(s) Name: **Skip Wiley**    Organization Name: **Dragon Flyers**

River or Tributary Name: **Crystal Creek**    Latitude/Longitude: **42$^0$10.085N/ 88$^0$17.754W**

Nearest City/Town: **Algonquin**    County: **McHen ry**

## Section II

**CHEMICAL TEST RESULTS**

Chemical Kit Name or Equipment Description:

**LaMotte Low Cost Chemical Monitoring Kit (#5886)**

Air Temperature: **20** $^o$C    Water Temperature: **22** $^o$C

pH: **7.5**    Nitrate: **5 ppm**

Turbidity: **>40 JTU**    Phosphorous: **2 ppm**

Dissolved Oxygen: **4 ppm**  % Saturation **46%**  Biological Oxygen Demand: **4 ppm**

## Section III

**ADDITIONAL CHEMICAL TEST RESULTS**

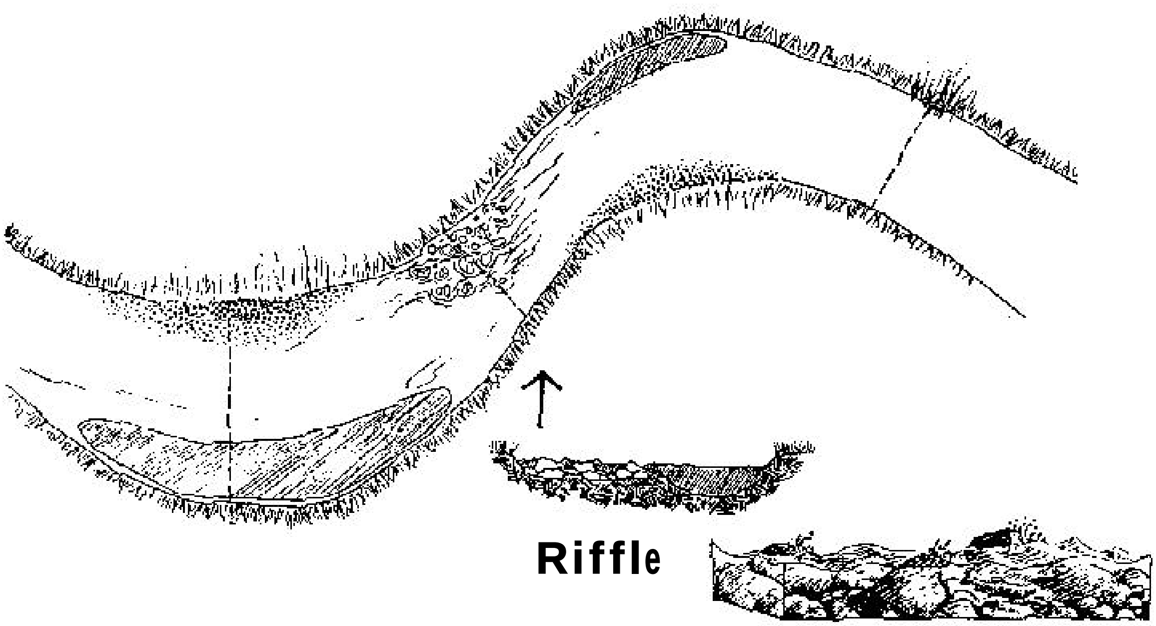
# Biological Monitoring

## Macroinvertebrates and Water Quality

Streams are constantly changing. The section of stream that is polluted today may be flushed clean next week. The effects of pollution, however, may be dramatic, and are reflected in changes in the variety and abundance of macroinvertebrate populations, providing a relative view of the overall quality of a stream at any given moment.

Benthic macroinvertebrates are animals that are big enough (macro) to be seen with the naked eye. They lack backbones (invertebrate) and live at least part of their lives in or on the bottom (benthos) of a body of water. Macroinvertebrates include aquatic insects, crustaceans (crayfish, etc.), mollusks (clams and mussels), gastropods (snails), oligochaetes (worms) and others. Literally thousands of different species of macroinvertebrates have been found in streams and rivers.

The vast majority of stream-dwelling macroinvertebrates live in the riffle areas formed when the water flows over irregularities in the stream bottom such as uneven bedrock layers, and aggregations of pebbles, cobbles, and large boulders. The optimum habitat for macroinvertebrates is a riffle composed of moderately sized particles ranging in size from ten-inch cobbles down to one-inch gravel.



The constant flow of water in the riffle also offers a continuous and plentiful supply of food in the form of plant and animal matter.  The feeding habits of macroinvertebrates show how the stability of one taxa can be dependent upon the welfare of another:

**Shredders**:  such as many stoneflies, feed on detritus (mostly larger dead plant materials such as fallen leaves), by shredding it into smaller particles during the feeding process.

**Collectors**:  Such as most caddisflies and blackflies, feed on the shredded detritus by filtering it from the water and gathering it from the stream bed.

**Grazers**:  such as snails and beetles, roam about the stream bed scraping algae and other organisms from stone and plant surfaces.

**Predators**:  represented by hellgramites, damselfly and dragonfly larvae, attack other living organisms and engulf their prey whole or in parts.

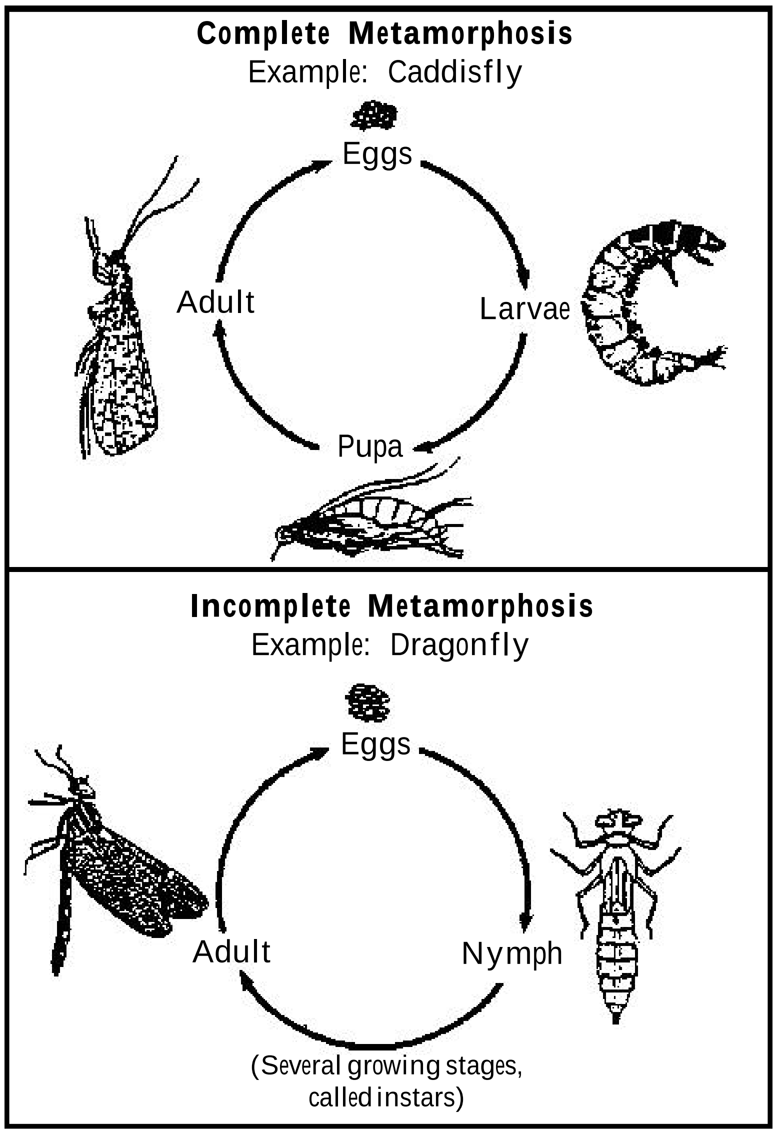
Because of this interdependence, the greater the diversity of organisms, the better the water quality.

Each taxonomic grouping is also species-specific in its tolerance to low oxygen levels and toxic substances.  Being rather restricted to their specific habitats, these organisms cannot escape changes in water quality.  If a mild-to-severe pollution problem impacts the stream, a considerable period of time may be required for the macroinvertebrates to fully recover former community structure.

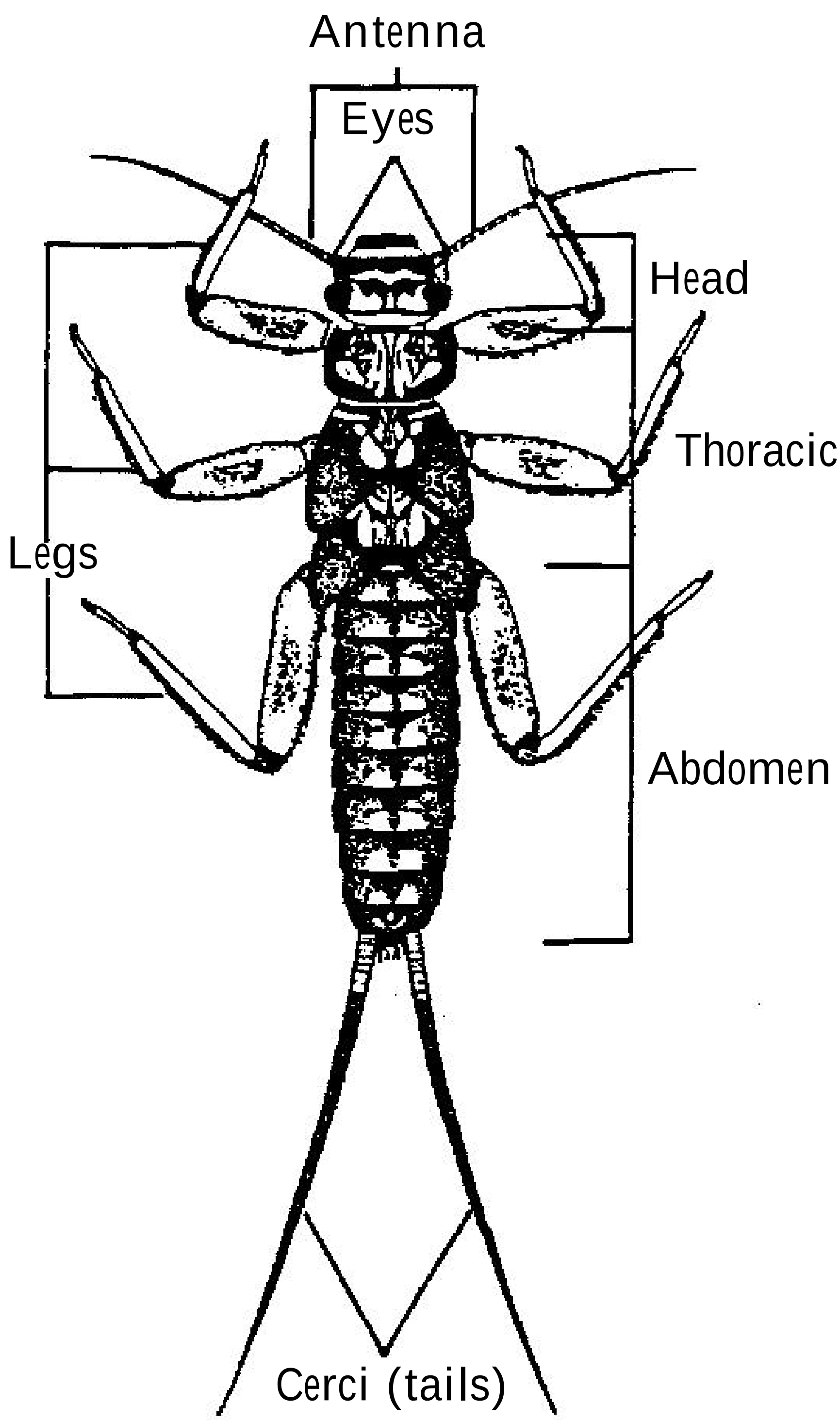
## Life History of Macroinvertebrates

The aquatic insects comprise the  bulk of the benthic macroinvertebrate communities in healthy freshwater streams.  These insects are mostly in their immature form and live their adult life on land, sometimes for only a few hours.  Most aquatic insects can be divided into two separate groups: ones that develop through complete metamorphosis, and ones that develop through *incomplete metamorphosis*.

Metamorphosis is the change that occurs during the organism's development from egg to adult.  Some aquatic insects develop through *complete metamorphosis*, which consists of four stages.  These immature insects are called larvae and they do not resemble the adults and, in fact, may look grossly different.  During the pupae stage, the organisms inhabit a "cocoon-like" structure where the transformation from larvae to adult occurs. *Incomplete metamorphosis* has three main stages of development (except for the mayfly which has two winged growing stages). These immature insects are called nymphs and they undergo a series of molts until the last decisive molt transforms the organism into an adult or imago. There is no intermediate pupae stage where transformation occurs. The nymphs resemble the adults closely except for wing development.



# Insect Anatomy



# How to Complete the Pollution Tolerence Index Data Sheet

## Macroinvertebrate Index

This is the area of the data sheet where you will record the kinds of macroinvertebrates that are collected and their relative abundance. It also provides the information needed to calculate a Pollution Tolerance Index (PTI). Instructions for this area or the data sheet are provided below.

The macroinvertebrate index is divided into Pollution Tolerant Groups (PT Group) 1,2,3 and 4. These PT groups represent the different levels of pollution tolerance. The higher the group number, the higher the tolerance to pollution. This section of the form is where you will be recording the number of insects that are found.

**Example:**

**MACROINVERTEBRATE INDEX**

| PT GROUP 1 | | PT GROUP 2 | | PT GROUP 3 | | PT GROUP 4 | |
|---|---|---|---|---|---|---|---|
| Stonefly Nymph | 1 | Damselfly Nymph | | Midge | 2 | Left-Handed Snail | 1 |
| Snipe Fly | | Dragonfly Nymph | 5 | Black Fly Larvae | 5 | Aquatic Worms | 5 |
| Dobsonfly Larva | | Mayfly Nymph | 7 | Scud | 16 | Leech | |
| | | Caddisfly Larva | 9 | Sowbug | | | |
| | | Crane Fly Larva | 2 | Right-handed snail | | | |
| | | Riffle Beetle | | | | | |
| | | Water Penny | | | | | |
| | | Clams/Mussels | | | | | |
| | | Crayfish | | | | | |

The next row is the # of Taxa. Insects that have the same body shape all belong to the same taxa (for example swimming mayfly and torpedo mayfly are in the same taxa). To find the total number of each taxa for each PT Group you need to add the number of types of taxa for each PT group. It is possible to have particular PT group without any numbers, therefore it will score a zero.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **# of Taxa** | 1 | **# of Taxa** | 4 | **# of Taxa** | 3 | **#of Taxa** | 2 |

*Do not make the mistake of adding the numbers together.*

The next row is the group scores. Multiply each # of taxa by its weight factor. Multiply 4 for PT group 1, 3 for PT group 2, 2 for PT group 3, and 1 for PT group 4. This will be the group scores.

**Example:**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **# of Taxa** | **1** | **# of Taxa** | **4** | **# of Taxa** | **3** | **#of Taxa** | **2** |
| Weighing Factor **X 4** | **4** | **X 3** | **12** | **X 2** | **6** | **X 1** | **2** |

Then total all of the group scores to get the TOTAL TAXA RATING.

**Example:**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **# of Taxa** | **1** | **# of Taxa** | **4** | **# of Taxa** | **3** | **#of Taxa** | **2** |
| Weighing Factor **X 4** | **4** | **X 3** | **12** | **X 2** | **6** | **X 1** | **2** |

**TOTAL TAXA RATING** **24**

The last step is to use the Water Quality Index to find the value.

**Example:**

**WATER QUALITY INDEX VALUE**

| | | |
|---|---|---|
| 33 or More | - | Excellent |
| 23 - 32 | - | Good |
| 13 - 22 | - | Fair |
| 12 or Less | - | Poor |

**WATER QUALITY INDEX VALUE** ***Good***

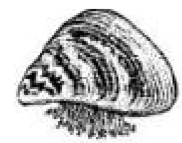
## IMPORTANT QUALITY ASSURANCE PROCEDURE

In order to ensure the accuracy of a stream monitoring macroinvertebrate sample, it is important that all macroinvertebrates are positively identified. If a macroinvertebrate cannot be positively identified, please take one example of the unidentified macroinvertebrate to a Fox River Watershed Monitoring Network equipment loan location for accurate identification or call 815-356-6605 for further direction. Macroinvertebrate samples can be brought to the monitoring equipment loan location live (preferred) or preserved in rubbing alcohol.
Do not guess when identifying macroinvertebrates.

# Non-Native Macroinvertebrates

Non-native macroinvertebrates are increasing in the Fox River Watershed. It is important that the presence and location of these introduced macroinvertebrates are documented.

## Zebra Mussels

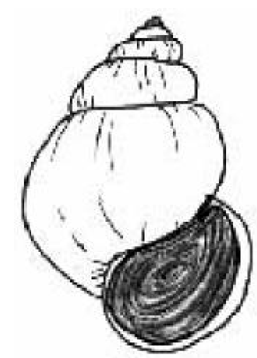


Trianglular-shaped shells, under 1 inch, alternating cream and brown bands, frequently found clumped together attached to hard surfaces such as rocks, pipes, and native mussel shells.

## Asiatic Clams

Rounded to slightly triangular shaped shells, under 1 inch, yellowish brown to black in color on the outside, white on the inside; raised, evenly spaced growth rings.

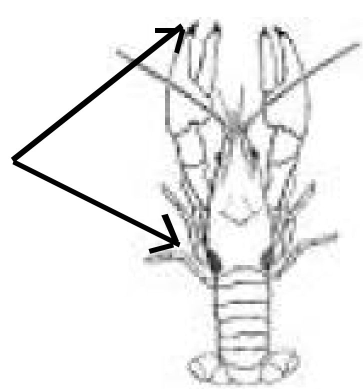
## Chinese Mystery Snails



Right-handed, thin, strong shell, often olive green to brown color, with small dimples (or impressions) on the surface of the shell; its width is equal to the size of its height. (Native snails are usually taller than wide.)

## Rusty Crayfish

Light rusty red to greenish brown in color; distriguishing features are red spots located on either side of the body and a black band with red tips at the top of the pinchers.



# Friends of the Fox River
# Biological Monitoring Data Sheet

## SITE INFORMATION

Date 11/ 05/ 00 Time 10 :30 am or pm Site #: 4

Collector(s) Name: Skip Wiley Organization Name: Dragon Flyers

River or Tributary Name: Crystal Creek Latitude/Longitude: $42^0$10.085N/ $88^0$17.754W

Nearest City/Town: Algonquin County: McHenry

## HABITATS SAMPLED AND METHODS USED
## (CHECK TWO HABITATS)

X Riffle/Kick Seine X Undercut Banks/D-Net ___Snags/D-Net ___Sediment/D-Net ___Leaf Packs

## MACROINVERTEBRATE INDEX

| PT GROUP 1 | | PT GROUP 2 | | PT GROUP 3 | | PT GROUP 4 | |
|---|---|---|---|---|---|---|---|
| Stonefly Nymph | 1 | Damselfly Nymph | | Midge | 2 | Left-Handed Snail | 1 |
| Snipe Fly | | Dragonfly Nymph | 5 | Black Fly Larvae | 5 | Aquatic Worms | 5 |
| Dobsonfly Larva | | Mayfly Nymph | 7 | Scud | 16 | Leech | |
| | | Caddisfly Larva | 9 | Sowbug | | | |
| | | Crane Fly Larva | 2 | Right-handed snail | | | |
| | | Riffle Beetle | | | | | |
| | | Water Penny | | | | | |
| | | Clams/Mussels | | | | | |
| | | Crayfish | | | | | |
| **# of Taxa** | 1 | **# of Taxa** | 4 | **# of Taxa** | 3 | **#of Taxa** | 2 |
| Weighing Factor X 4 | 4 | X 3 | 12 | X 2 | 6 | X 1 | 2 |

**TOTAL TAXA RATING** 24

## NON-NATIVE MACROINVERTEBRATES
## (Enter Number Present)

| Zebra Mussels | Asiatic Clams | Chinese Mystery Snails | Rusty Crayfish |
|---|---|---|---|
| 0 | 0 | 12 | 4 |

## WATER QUALITY INDEX VALUE

33 or more = Exellent
23-32 = Good
13-22 = Fair
12 or less = Poor

Good

# Biological Sampling Methods

**Sample Two Habitats - Riffles provide the most diverse habitat for benthic macroinvertebrates, followed by leaf packs, snags, undercut banks, and the least diverse stream habitat is sediment. Sampling a riffle and one other habitat is preferred.**

***Note: There is a possibility that you will discover insects that are not listed on the Pollution Tolerance Index (i.e., adult dragonflies, water striders, water bugs, etc.). These organisms are not useful as indicators of water quality because they are less dependent on immediate stream conditions as habitat.***

## Kick Seine Method

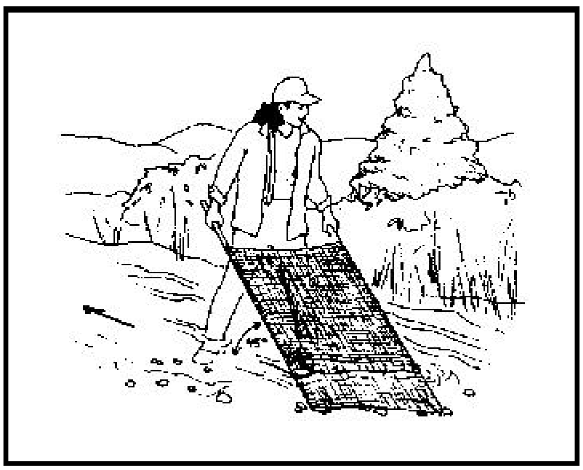
The kick-seining method is a simple procedure for collecting stream-dwelling macroinvertebrates used in riffle areas where the majority of the organisms live. For stream quality assessments, the variety of macroinvertebrates is examined from a collection sample.

## RIFFLE SAMPLING PROCEDURE

1. Riffles are shallow, turbulent, swiftly flowing stretches of water that flow partially or totally over submerged rocks. The water may range in depth from approximately two inches to a foot, with a moderately swift flow. Avoid riffles located in an area of a stream that has been recently disturbed, such as construction from a pipeline crossing or roadway.
2. Once the riffle has been located, select an area measuring one (1) meter square that is typical of the riffle as a whole. Avoid disturbing the stream bed upstream from this area, so as not to alter the sample.

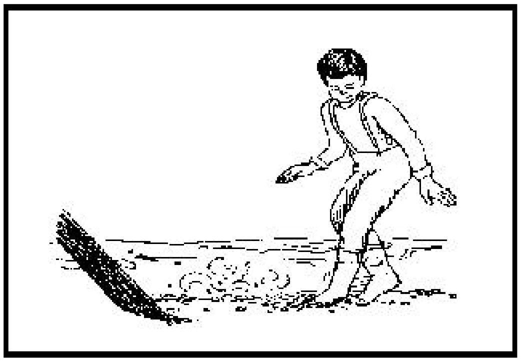
3. Prior to entering the stream, examine the net closely. Make certain that the net is clean and free of holes.
4. APPROACH THE SAMPLING AREA FROM DOWNSTREAM!!!!!

5. Have one person place the net at the downstream edge of the riffle. The net should be held perpendicular to the flow, but at a slight downstream angle. Stretch the net approximately three feet, being certain that the bottom edge is lying firmly against the bed. If water washes beneath or over the net you will lose organisms.

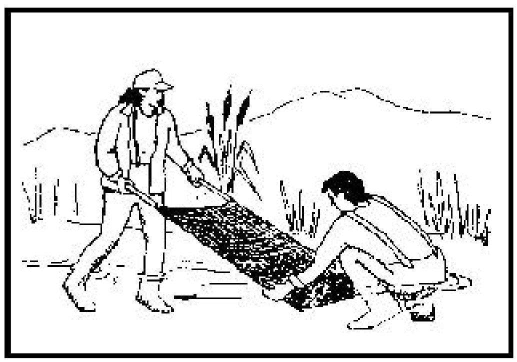


6. STAND BESIDE, NOT WITHIN THE SAMPLING AREA. Place one foot at the upstream edge of the area as a marker. Remove all stones and other objects two inches or more in diameter from the sampling area. Hold each one in front of the net and below the water surface as you brush all organisms from the rock surface into the net. Before placing each rock outside the sampling area, examine the surface to be certain you have not missed any organisms. **Note:** Larger rocks and woody debris within the 1 meter square sampling area may be brought on shore for macroinvertebrate inspection and inclusion in the sample total.

7. When all materials, two inches or larger, have been brushed, step into the upstream edge of the sampling area and kick the stream bed vigorously until you have disturbed the entire sampling area. Kick from the upstream edge toward the net. Try to disturb the bed to a depth of at least two inches. You can also use a small shovel to disturb the bed.



8. Once step 7 is completed, carefully remove the net with a forward upstream scooping motion. DO NOT allow water to flow over the top of the net or you may lose organisms.



9. Carry the seine to a flat area on the stream bank. Remove leaves, rocks, and other debris. Examine them for any attached organisms. Using fingers or forceps, remove organisms from the net and place them in a plastic container for later identification. Examine the net for smaller organisms that remain on the net. If nothing appears to be on the net, leave the net alone for a few minutes. The insects will begin to move around because they are out of the water.
10. Record the presence of each type of organism collected and give an estimate of the number of each type.
11. Determine the tolerance index for the stream site using the calculations available with the pollution tolerance index.

## Undercut Bank Sampling Procedure - Use D-Net

Undercut banks consist of areas where moving water has cut out areas or vertical or nearly vertical banks, just below the surface of the water. Over-hanging vegetation and submerged root mats in such areas may harbor many dragonflies, damselflies, and crayfish.

1. Move the D-net in a bottom-to-surface motion, jabbing at the bank five times to loosen organisms.
2. Inspect and clean any debris collected and place the collected organisms in the bucket.

## Snag Area Sampling Procedure - Use D-Net

Snag areas are accumulations of debris caught or snagged by logs or boulders lodged in the stream current. Caddisflies, stoneflies, riffle beetles, and midges commonly inhabit these areas.

1. Select an area of the snag, tree roots or submerged log which is approximately 3 foot by 3 foot in size. This will be the sampling area for these habitats.
2. Scrape the surface of the tree roots, logs, or other debris with the net. You can also disturb the bark to get at the organisms hiding underneath. In all cases, be sure that your D-net is positioned downstream from the snag, so that dislodged material floats toward the net, not away from it.
3. Place net contents in the bucket. Rinse the D-net contents with the wash bottle filled with stream water to remove any sediment before placing organisms in the bucket. Carefully inspect any leaf litter and organic debris which may have been collected for organisms.
4. Spend 15 minutes inspecting the chosen sampling area for any organisms not collected previously. Using your hands or forceps, remove a log from the water to better see what may be found, but be sure to put it back where it was found.

## Sediment Sampling Procedure - Use D-Net

Select an area within the study reach that consists of mostly sand and/or mud. These areas can usually be found on the edges of the stream, where that water flows more slowly.

1. A netter(s) stands downstream of the sediment area with the net resting on the bottom. A kicker disturbs the sediment to a depth of about 2 inches as he or she approaches the net.
2. The netter(s) sweep the net upward to collect the organisms as the kicker approaches.
3. Wash out the sediment from the D-net by gently moving the net back and fourth in the water of the stream, keeping the opening of the net at least an inch or two above the surface of the water.
4. Place the organisms captured by the net in the bucket.

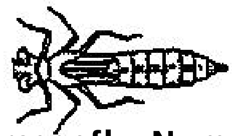
## Leaf Pack Sampling Procedure

Look for leaf packs that are about four to six months old. These old leaf packs are dark brown and slightly decomposed. A handful of leaves is all you need.

1. Position the dip net on the bottom of the stream, immediately downstream from a leaf pack..
2. Gently shake the leaf pack in the water to release some of the organisms, then quickly scoop up the net, capturing both organisms and the leaf pack in the net.
3. Inspect the leaves and other large objects of the leaf pack for organisms before returning them to the stream. These macroinvertebrates are then placed in the bucket containing organisms from the previous sampling efforts.

# Aquatic Insects

## Dragonflies



Dragonfly Nymph

Smallest size range

Largest size range

Order: Odonata
Metamorphosis: Incomplete

Nymphs:

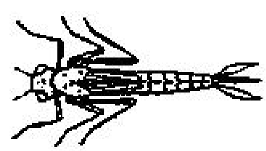
- Shape: Vary in shape, but most have robust, elongated, or “spider-like” bodies, often with algae growing on their backs.
- Legs: They have three pairs of legs at the side of body, or near front of elongated species.
- Eyes: Their eyes are large and are on the sides of head.
- Back: A pair of small wings beginning to develop will be visible on back.
- Color: Their color varies from brown, black, and often green; length up to 2 inches.

Reproduction: eggs are deposited on surface of water and drift to bottom.

Adults: similar to adult damselflies, but the two pairs of wings are laid flat or horizontal at rest; some species can attain lengths over 4 inches.

Food: predaceous, nymphs feed upon other aquatic macroinvertebrates, small fish, and tadpoles.

## Damselflies



Damselfly Nymph

Order: Odonata
Metamorphosis: incomplete

Nymphs:

- Shape: Bodies elongated with three distinct paddle-like tails (actually gills) located at the end of the abdomen.
- Legs: Three pairs of legs positioned near the front of the body.
- Eyes:  Two large eyes on top of head
- Color:  Colors range from green, brown, and black; some are robust, others slender; length up to 2 inches.

Reproduction: females deposit eggs on top of water where they drift to the bottom.

Adults:  possess extremely long abdomens; two pairs of wings that are held upright at rest; very colorful in greens, blues, and reds.

Food:  predaceous, nymphs feed on other aquatic macroinvertebrates.

## Dobsonflies

Order:  Megaloptera
Metamorphosis:  complete

**Dobsonfly Larva**

Larvae: (often called hellgrammites)

- Mouth: possess two large mandibles
- Body:  several filaments are located along the sides of the abdomen
- Tail: one pair of short tail filaments used for grasping
- Color:  brownish to black with a large dark “plate” behind base of head
- Legs:  six legs
- Length: up to 3 inches.

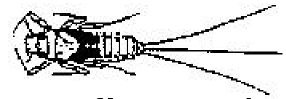
Reproduction: female attaches eggs on overhanging vegetation; when eggs hatch, the larvae fall directly into the water.

Adults: possess two pair of extremely long, colorful wings folded back the length of the body; males possess a pair of long mandibles that can cross, and are used to grasp the female during copulation; females possess one pair of mandibles smaller than those of the male.

Food: predaceous larvae feed upon other aquatic macroinvertebrates; larvae widely used as fish bait; important food source for larger game fish.

## Mayflies

Order: Ephemerophtera
Metamorphosis: incomplete



**Mayfly Nymph**

Nymphs:
- Tail: three distinct cerci (tails), occassionally two. Cerci may be fuzzy or thread-like, but never paddle or fan-like.
- Color: varies from green, brown, gray, but usually black
- Length: total length up to 1 inch.

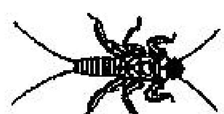
Reproduction: female deposits eggs on top of water where they drift to the bottom; some species crawl under water and attach eggs to submerged objects.

Adults: resemble nymphs, but usually possess two pair of long, lacy wings folded upright; adults usually have only two cerci.

Food: consists of small plant and animal debris, such as algae, diatoms, and plankton; preyed upon by fish, and play important role in the food chain.

## Stoneflies

Order: Plecoptera
Metamorphosis: incomplete



**Stonefly Nymph**

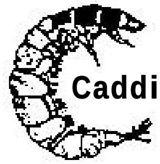
Nymphs:
- Tail: Possess two distinct “tails” called cerci, which are actually sensory feelers.
- Color: Brightly colored in tan, brown, and black
- Length varies, up to 1 inch.

Reproduction: females deposit eggs on top of water where they drift down to the bottom.

Adults: resemble nymphs, but possess a long pair of wings folded down the length of the body.

Food: some stoneflies are carnivorous, others feed on algae, bacteria, and vegetable debris; eaten by a variety of fish species.

## Caddisflies



Caddisfly Larva

Order: Trichoptera
Metamorphosis: complete

Larvae:

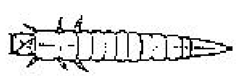
- Shape: Worm-like, soft bodies
- Head: contains a hard covering
- Color: can vary from yellow or brown, but usually green
- Length: up to 1 inch.
- Caddisfly cases: larvae are known for their construction of hollow cases that the either carry with them or attach to rocks. Cases are built from sand, twigs, small stones, crushed shells, rolled leaves, and bark pieces. Cases are used for protection and pupation.

Reproduction: eggs are encased in a gelatinous mass and are attached to submerged vegetation or logs.

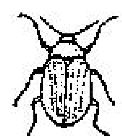
Adults: moth-like, brownish and usually nocturnal; wings thickly covered with hairs.

Food: larvae feed on algae, small bits of plant material, and animals; some species build nets where they catch drifting food; fed upon by several species of fish.

## Riffle Beetles



Riffle Beetle Larva



Riffle Beetle Adult

Order: Coleoptera
Family: Elmidae and Dryopidae
Metamorphosis: complete

Larvae:

- Shape: resemble small “torpedoes” with circular stripes or rings around body. They are pointed at both ends with a “fuzzy” mass at one end.
- Color: usually grayish.
- Length less than ½ inch.

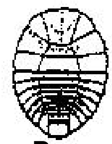
Reproduction: females deposit eggs on plant materials under water.

Adults: unique in that they are also aquatic and are found more often than the larvae; adults are tiny, hard-shelled beetles, and usually black.

Food: primarily plant material such as diatoms and algae.

## Water Penny Beetle

Order: Coleoptera
Family: Psephenidae
Metamorphosis: complete



Water Penny Beetle

Larvae:

- Shape: resemble circular incrustations on rocks. They are sucker-like.
- Color: green, black, but usually tan or brown.
- Length: usually no more than ½ inch.

Reproduction: adult females crawl into water and deposit eggs on underside of stones.

Adults: typical beetle shaped-body; resemble an extremely large riffle beetle (not truly aquatic; can be found on emergent rocks in riffles).

Food: primarily debris such as algae and diatoms.

## Crane Flies

Order: Diptera
Family: Tipulidae
Metamorphosis: complete

Crane Fly Larva

Larvae:

- Shape: definitely "worm-like". Pointed or rounded at one end and a set of disk-like spiracles at the other
- Body: thick-skinned.
- Color: brownish-green to somewhat transparent or whitish.
- Color: may be stained greenish or brownish.
- Length: up to 3 inches.

Reproduction: female deposits eggs on submerged vegetation or other debris.

Adults: best described as “giant mosquitoes” and possess long legs and plump bodies, but are harmless.

Food: moslty plants and debris; some are predaceous.

## Black Flies

Black Fly larva

Order: Diptera
Family: Simuliidae
Metamorphosis: complete

Larvae:
- Shape:  small, worm-like and bulbous at one end; when out of water, they fold themselves in half while wiggling.
- Color: varies from green, brown, gray, but usually black
- Length: up to 1/3 inch.

Reproduction: females deposit eggs on submerged vegetation or other debris.

Adults: fly-like; known as a serious pest because they inflict painful bites to warm-blooded animals.

Food: larvae eat organic debris filtered from water; adult females of many species feed on blood.

## Snipe Flies

Snipe Fly
Larva

Order: Diptera
Family: Athericidae
Metamorphosis: complete

Larvae:
- Shape:  elongated, cylindrical, slightly flattened; cone-shaped abdomen is characteristic.  Two long, fringed filaments at end of abdomen.
- Color: varies
- Length: up to ½ inch.

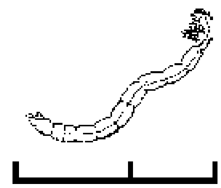
Reproduction: female deposits eggs on overhanging vegetation and immediately dies and remains attached to egg mass; larvae hatch and drop into water.

Adults: a moderately sized fly that is usually found around low bushes, shrubbery, and tall grasses.

Food: larvae are predaceous. Adults mostly feed on blood.

## Midges

Midge Larva



Order: Diptera
Metamorphosis: complete

Larvae:
- ♦ Shape:  Most species are extremly small and thin.
- ♦ Color: varies from gold, brown, green, tan to black.
- ♦ Length: up to ½ inch.

Reproduction: female deposits a gelatinous mass of eggs on the water surface or attaches to submerged vegetation.

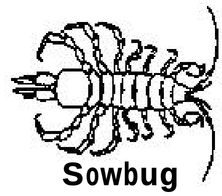
Adults: resembles small mosquitoes with fuzzy antennae on males.

Food: primarily algea and other organic debris.  Many feed on other insect larvae.

# Non-Insect Macroinvertebrates

## Crustacea

### Sowbugs or Aquatic Pill Bugs


Sowbug

Order: Isopoda

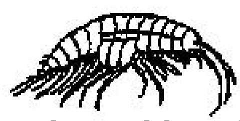
Description:

- Shape: somewhat flattened: resemble their terrestrial cousins.
- Legs: seven pairs of legs.
- Color: varies usually gray but sometimes brown
- Length: less than 1 inch.

Reproduction: eggs are carried under the female's abdomen until they hatch.

Food: characterized as scavengers eating both dead and live plants, and animal debris.

### Scuds or Sideswimmers


Scud or Side-swimmer

Order: Amphipoda

Description:

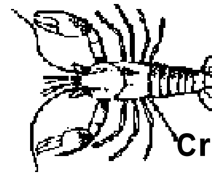
- Shape: possess extremely flattened sides and a hump back. Some what resemble large "fleas".
- Legs: several pair of legs.
- Color: varies from white, brown, but usually gray
- Length: most are very small, but some can reach ½ inch in length.

Reproduction: eggs held by the female in a marsupium (sac) until they hatch.

Food: characterized as scavengers eating both plant and animal debris; scuds are and important food source for a variety of fish species.

## Crayfishes

Order: Decapoda




Description:

- ♦ Shape: resemble miniature “lobsters”.
- ♦ Legs: possess four pairs of walking legs and a pair of strong pinchers.
- ♦ Color: can be brown, green, reddish, or black
- ♦ Length: up to 6 inches.

Reproduction: females carry eggs in a mass (which resembles a raspberry) underneath their tail.

Food: omnivorous, eating plants and animals; pinchers are used for tearing food into edible chunks; crayfish are preyed upon by larger game fish.

# Mollusca

## Right-handed Snails

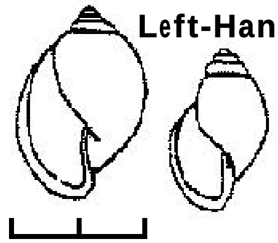
Class: Gastropoda
Family: Lymnaeidae


Description:
These are generally the gill-breathing snails; right-handed snails are identified by their swirling shell opening on the right-hand side as the point is straight up in the air and the opening faces you.
Color is black, brown or gray, often covered with algae.
Length is up to 1 inch

Reproduction: eggs are laid in gelatinous masses usually attached to rocks or other debris.

Food: primarily algae that grows on rocks and other debris; occasionally feeds upon decaying plant and animal matter; are preyed upon by fish, turtles, predatory invertebrates, and leeches.

## Left-handed (Pouch) Snails




Class: Gastropoda
Family: Physidae

Description:
Distinguished from the right-handed snails by the fact that the shell opening is on the left side as the point of the shell is straight up and the opening faces you; does not posses gills, but a sac-like lung with which they can breath air. Color is brown, gray, or black, often with algae growing on the shell. Length is up to ½ inch.

Reproduction: gelatinous egg masses are deposited under rocks or other debris.

Food: algae, other aquatic plants, and sometimes dead animals; preyed upon by fish, birds, and some turtles.

## Other Snails

**Limpets** Family: Anyclidae
**Ramshorn or planorbid Snails** Family: Planorbidae
**Operculate Snails** Various Families

Limpets: this is a snail with a shell that is not coiled, but resembles a cap or an inverted cone.

Ramshorn or Planorbid Snails: this is a snail with a coiled shell that does not form a spire, but is flat and spiral shaped.

Operculate Snails: resemble right-handed snails but have a hard plate, called an operculum, that can seal off the shell opening, protecting the soft-bodied snail inside.

## Freshwater Clams and Mussels


Class: Bivalvia

**Freshwater Mussels** Family: Unioinidae

**Fingernail Clams** Family: Sphaeriidae

Description:

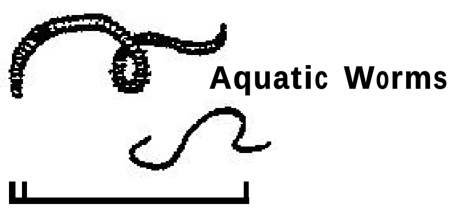
- Fingernail clams are small (no more than ½ inch in diameter), fragile, and are whitish or grayish in color.
- Mussels are often large (up to 9 inches in diameter), robust, thick or thin-shelled, and are usually dark in color.

Reproduction: Fingernail clams are self-fertilizing, the young developing inside the water tubes of the adult; mussels have a very elaborate and intriguing process; the larvae called glochidia, develop inside the adult female and are released into the water where they eventually attach onto a host fish; they then parasitize the fish for about two weeks until they drop off and develop on the stream bottom into an adult.

Food: primarily filter feeders; filter organic debris and plankton out of water; preyed upon by numerous fish and mammals.

# Worms

## Aquatic Worms



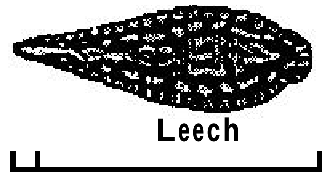

Class: Oligochaeta

Description: resemble earthworms, but more slender, segmented, color is reddish, brown, or gray; reach lengths of up to 3 inches.

Reproduction: hermaphroditic, similar to earthworms; fertilization and development of embryos occur in a cocoon.

Food: like earthworms, they ingest large quantities of mud and filter out organic debris; fed upon by bottom feeders of fish.

## Leeches




Class: Hirundinae

Description:

- Shape: worms that are flattened lengthwise and possess a sucker at each end.
- Color: is green, black, or gray, some with the patterns of bright colors of yellow and red.
- Length: up to 5 inches.

Reproduction: similar to aquatic worms.

Food: some species feed on blood, others eat detritus, decaying plant and animal debris; not an important food source for fish.

# Glossary

## A

**Aestivation:** To pass the summer in a state of torpor (similar to hibernation).

**Algae:** Small plants which lack roots, stems, flowers, and leaves; living mainly in water and using the sun as an energy source.

**Alkalinity:** A measurement of water's ability to neutralize acid.

**Ambient Temperature:** The atmospheric temperature or air temperature.

**Aquatic Habitat:** All of the areas in a stream, lake or wetland that are occupied by an organism, population or community.

**Aquifer:** Any geological formation containing water, especially one that supplies water for wells, springs, etc.

## B

**Banks:** The portion of the stream channel which restricts the movement of the water out of the channel during times of normal water depth. This area of the stream is characterized as being the exposed terrestrial areas on either side of the stream.

**Benthic:** An adjective which describes all things associated with the bottom, or sediments of a stream.

**Bedrock:** Unbroken solid rock, overlain in most places by soil or rock fragments.

## C

**Channelization:** The straightening of a stream or the dredging of a new stream channel to which the steam is diverted. A channelized stream is straight with little or no meanders.

**Class:** A taxonomic rank which falls under the taxonomic rank of order.

**Cobble Streambed:** A watercourse predominantly lined with naturally rounded stones, rounded by the water's action. Size varies from a hen's egg to that used as paving stones.

**Complete Metamorphosis:** The type of insect development that includes four stages; egg, larva, pupa, adult.

## D

**Drainage Basin:** The total land area draining to any point in a stream. A drainage basin is composed of many smaller watersheds.

**Dissolved Oxygen (DO):** The amount of oxygen dissolved in water. Generally, proportionately higher amounts of oxygen can be dissolved in colder waters than in warmer waters.

## E

**Ecology:** The relationship between living things and their environments or the study of such relationships.

**Effluent:** A discharge of partially or completely treated pollutants into the environment; generally used to describe discharge into the water.

**Emergent Plants:** Plants rooted in the bottom of the watercourse, that rise above the water surface.

**Erosion:** The wearing away of the land surface by wind or water.

**Escherichia coli (E. coli):** A bacterium of the intestines of warm-blooded, animals including humans, that is used as an indicator of water pollution for disease producing organisms.

**Eutrophication:** The natural and artificial addition of nutrients to a water body, which may leed to depleted oxygen concentrations. Eutrophicaton is a natural process that is frequently accelerated and intensified by human activities.

## F

**Floodplain:** An area on both sides of a stream where flood waters spread out during high rains. The surface may appear dry for most of the year, but it is generally occupied by plants that are adapted to wet soils.

**Fecal Coliform Bacteria:** The portion of the coliform group which is present in the gut or feces of warm-blooded animals. The presence of fecal coliform bacteria in water is an indication of pollution and potential human health problems.

**Food Chain:** A transfer of energy in a sequence of organisms (algae, fish, etc.) in a commmunity in which each member of the chain feeds on the member below it.

## H

**Habitat:** The area which an organism lives.

**Herbaceous Vegetation:** Plants having a stem that remains soft and succulent, not woody.

## I

**Incomplete Metamorphosis:** The type of insect development that consists of three stages; egg stage, a nymph stage and an adult stage.

**Indicator Organism:** Organisms which respond predictably to various environmental changes, and whose presence or absence, and abundance, are used as indicators of environmental conditions.

**Inorganic:** Any compound not containing carbon.

**Intermittent stream:** A watercouse that flows only at certain times of the year, receivieng water from springs or surface sources; also a watercourse that does not flow continuously, when water losses from evaporation or seepage exceed available stream flow.

**Invertebrate:** An organism without a backbone.

## M

**Macroinvertebrates:** Animals lacking backbones that are large enough to be visible without the aid of a microscope.

**Meanders:** Sinuosity, or snake-like curving of a natural stream channel.

**Metamorphose:** To change into a different form, such as from an insect pupa to an adult.

**Mollusk:** Soft-bodied (usually hard-shelled) animals such as clams or mussels.

## N

**Nitrogen:** A limiting nutrient for the aquatic environment. Nitrogen is considered to be liminting because it is needed by the plants and animals in the stream in moderate amounts. When present in higher amounts, such as large amounts of fertilizer runoff from local farm fields, large algal blooms occur which cause a depletion of dissolved oxygen.

**Nonpoint Source Pollution:** A type of pollution whose source is not readily identifiable as any one particular point, such as pollution caused by runoff from streets and agricultural land.

**Nutrient:** Any substance which is necessary for growth of living things.

**Nymph:** A juvenile, wingless stage of an insect.

## O

**Order:** Taxonomic grouping of related families of organisms.

**Organic Material:** Any compound containing carbon.

## P

**Pathogenic:** Capable of causing disease.

**pH:** The measurement of acidity or alkalinity on a scale of 0 –14. A pH of 7 is neutral, less than 7 is acidic, and more than 7 is basic.

**Phosphorus:** An essential plant nutrient that, in excessive quantities, can contribute to the eutrophication of water bodies.

**Photosynthesis:** Process by which green plants use sunlight to produce food.

**Perennial Stream:** A watercourse that flows contiuously throughout the year and whose upper surface generally stands lower than the water table in the area adjacent to the watercourse.

**Pollution Sensitive Organisms:** Those organisms which cannot withstand many of the stresses applied in the aquatic environment by pollution.

**Pollution Tolerant Organisms:** Those organisms which can withstand many of the stresses applied in the aquatic environment by pollution.

**Point Source Pollution:** Pollutants from a “point” source, such as a pipe, vent or culvert.

**Pools:** In a watercourse, an area often following a rapids (riffle), which is relatively deep with slowly moving water compared to the rapids.

**Pupa:** The stage of an insect in which it is enclosed in a protective case while changing from larva to an adult.

## R

**Riffle:** In a watercourse, an area often upstream of a pool, which is relatively shallow with swiftly moving water compared to the pool.

**Riprap:** Any material (such as concrete blocks, rocks, car tires or log pil-ings) which are used to protect a stream bank from erosion.

**Riparian Zone:** An area, adjacent to and along a watercourse, which is ofen vegetated and constitutes a buffer zone between nearby lands and the watercourse.

**Runoff:** Water from rain, snowmelt, or irrigation that flows over the ground surface and runs into a water body.

## S

**Sediment:** Soil, sand and minerals washed from land into waterways.

**Sedimentation:** The process by which soil particles (sediment) enter, accumulate and settle to the bottom of a waterbody.

**Septic Odor:** The sulfur (rotten egg) smell produced by the decomposition of organic matter in the absence of oxygen.

**Sewage:** The organic waste and wastewater produced by residential and commercial establishments.

**Silt:** Fine particles of soil or rock that can be picked up by air or water and deposited as sediment.

**Siltation**: The process of silt settling out of the water and being deposited as sediment.

**Submergent Rooted Plant:** An aquatic plant whose roots are in the watercourse’s bottom with the upper part of the plant submerged below the surface of the water.

**Substrate:** The surface upon which an organism lives or is attached.

**Species:** A unit of classification for a group of closely related individuals.

**Stream Bed:** The bottom of a stream where the substrate and sediments lay.

**Stream Depth:** A measurement of the depth of a stream from the water's surface to the stream bed.

**Stream Flow:** The amount of water moving in a stream in a given amount of time.

## T

**Tolerant Species:** An organism that can exist in the presence of a certain degree of pollution.

**Toxicity:** A measurement of how poisonous or harmful a substance is to plants and animals.

**Turbidity:** The presence of sediment in water, making it unclear, murky or opaque.

**Trend Data:** Data or measurements of a stream system which will show how particular characteristics change over time.

## U

**Urban Runoff:** Water which is drained from the surface of land which is used for urban uses, such as paved roads, subdivisions or parking lots.

## W

**Wastewater:** Water carrying unwanted material from homes, farms, businesses and industries.

**Water Quality:** The condition of the water with regard to the presence or absence of pollution.

**Watershed:** The entire surface drainage area that contributes water to a stream or river.

**Woody Vegetation:** Plants having a stem or trunk that is fibrous and rigid.

# Additional Chemical Information

## Air Temperature

*Conversion between Fahrenheit and Celsius is: C = (F-32) x 5/9*

Temperature affects water chemistry and the functions of aquatic organisms. Temperature influences:

- The amount of oxygen that can be dissolved in the water.
- The rate of photosynthesis by algae and other aquatic plants.
- The metabolic rates of organisms.
- The sensitivity of organisms to toxic wastes, parasites and disease.
- The timing of reproduction, migration, and aestivation of aquatic organisms.

## What Factors Affect Temperature?

**Natural Factors**

- Sunlight energy: seasonal, daily changes, shade cover, air temperature
- Flow
- Water Depth
- Inflow of ground water: Usually cooler than stream
- Inflow of surface water into stream which is at a different temperature than the stream (i.e. drainage ditch, another stream, etc.)
- Color and turbidity of water: suspended sediments absorb heat.

**Human Factors**

- Removal of riparian vegetation
- Soil erosion
- Stormwater runoff
- Alterations to stream morphology, substrate, flow
- Cooling water discharge from power plants.

## pH

- pH is a measure of how acidic or basic (alkaline) the water is. It is defined as the negative log of the hydrogen ion concentration.
- The pH scale is logarithmic and goes from 0 to 14. For each whole number increase (i.e. 1 to 2) the hydrogen ion concentration decreases ten fold.
- As the pH decreases, water becomes more acidic. As water becomes more basic, the pH increases.
- Many chemical reactions inside aquatic organisms (cellular metabolism) necessary for survival and growth of organisms require a narrow pH range.
- The largest variety of aquatic animals prefer a range of 6.5-8.0.
- At the extreme ends of the pH scale, (2 or 13) physical damage to gills, exoskeleton, fins, occurs.
- Changes in pH may alter the concentrations of other substrates in water to a more toxic form. For example: A decrease in pH may increase the amount of mercury soluble in water.

*pH comes from the French "puissance d'Hydrogene" which means strength of the hydrogen*.

## Dissolved Oxygen (DO)

What is Dissolved Oxygen and why is it important?

The stream system both produces and consumes oxygen. It gains oxygen from the atmosphere and from plants as a result of photosynthesis. Running water, because of its churning, dissolves more oxygen than still water, such as that in a reservoir behind a dam. Respiration by aquatic animals, decomposition, and various chemical reactions consume oxygen.

Wastewater from sewage treatment plants often contains organic materials that are decomposed by microorganisms, which use oxygen in the process. (The amount of oxygen consumed by these organisms in breaking down the waste is known as the biochemical oxygen demand or BOD. Other sources of oxygen consuming waste include stormwater runoff from farmland or urban streets, feedlots, and failing septic systems.

Oxygen is measured in its dissolved form as dissolved oxygen (DO). If more oxygen is consumed than is produced, dissolved oxygen levels decline and some sensitive animals may move away, weaken, or die.

DO levels fluctuate seasonally and over a 24-hour period. They vary with water temperature and altitude. Cold water holds more oxygen than warm water, and water holds less oxygen at higher altitudes. Thermal discharges, such as water used to cool machinery in a manufacturing plant or a power plant, raise the temperature of water and lower its oxygen content. Aquatic animals are most vulnerable to lowered DO levels in the early morning on hot summer days when stream flows are low, water temperatures are high, and aquatic plants have not been producing oxygen since sunset.

## Nitrogen:

Ammonia nitrogen can enter natural water systems from several sources, including industrial wastes, sewage effluents and fertilizers. It is a natural biological degradation product of the excretion and decay of dead organisms. Ammonia is a form of nitrogen that plants can use for growth, but at high concentrations it is poisonous to animals, including humans. The toxicity of ammonia increases as pH increases.

Nitrates are a form of nitrogen, which is found in several different forms in terrestrial and aquatic ecosystems. These forms of nitrogen include ammonia (NH3), Nitrates (NO3), and nitrites (NO2). Nitrates are essential plant nutrients, but in excess amounts they can cause significant water quality problems. Together with phosphorus, nitrates in excess amounts can accelerate eutrophication, causing dramatic increase in aquatic plant growth and changes in the types of plants and animals that live in the stream. This, in turn, affects dissolved oxygen, temperature, and other indicators. Excess nitrates can cause hypoxia (low levels of dissolved oxygen) and can become toxic to warm-blooded animals at higher concentrations (10 mg/L or higher) under certain conditions. The natural level of ammonia or nitrate in surface water is typically low (less than 1 mg/L); in the effluent of wastewater treatment plants, it can range up to 30 mg/L.

Sources of nitrates include wastewater treatment plants, runoff from fertilized lawns and cropland, failing on-site septic systems, runoff from animal manure storage areas, and industrial discharges that contain corrosion inhibitors.

## Fecal Bacteria

Members of two bacteria groups, coliforms and fecal streptococci, are used as indicators of possible sewage contamination because they are commonly found in human and animal feces. Although they are generally not harmful themselves, they indicate the possible presence of pathogenic (disease-causing) bacteria, viruses, and protozoans.

## Phosphorous

**Background**

Both phosphorous and nitrogen are essential nutrients for the plants and animals that make up the aquatic food web. Since phosphorous is the nutrient in short supply in most fresh waters, even a modest increase in phosphorus can, under the right conditions, set off a whole chain of undesirable events in a stream including accelerated plant growth, algae blooms, low dissolved oxygen, and the death of certain fish, invertebrates, and other aquatic animals.

There are many sources of phosphorous, both natural and human. These include soil and rocks, wastewater treatment plants, runoff from fertilized lawns and cropland, failing septic systems, runoff from animal manure storage areas, disturbed land areas, drained wetlands, water treatment, and commercial cleaning preparations.

Phosphorous cycles through the environment, changing form as it does so. Aquatic plants take in dissolved inorganic phosphorous and convert it to organic phosphorous as it becomes part of their tissues. Animals get the organic phosphorous they need by eating either aquatic plants, other animals, or decomposing plant and animal material. Inorganic phosphate is the form required by plants. Animals can use either organic or inorganic phosphate.

# Taxonomic Key to Benthic Macroinvertebrates

The purpose of this taxonomic key is to assist volunteer monitors, who are not trained in taxonomy, with the identification of benthic macroinvertebrates found in Illinois. When using this key please note that each couplet offers two or three options. Each couplet is numbered and the numbers in bold refer to the next couplet (the couplet that you should proceed to).

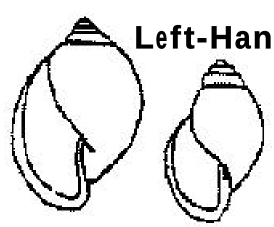
**Please be aware that some insects may have missing body parts so look at more than one organism.**

| | CHOOSE ONE: | GO BELOW TO: |
|---|---|---|
| **(1)a** | Has a shell(s) | **2** |
| **(1)b** | Has no shell | **5** |
| **(2)a** | Has a hinged double shell | **3** |
| **(2)b** | Has a single shell | **4** |
| **(3)a** | Adult under 2 inches long | **19** |
| **(3)b** | About 2-4 inches long | **MUSSEL** |
| **(4)a** | Right-handed opening | **Right-Handed Snail** |

**Right-Handed Snail**

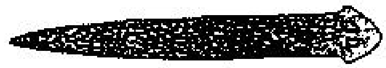
| | | |
|---|---|---|
| **(4)b** | Left- handed opening | **Left-Handed Snail** |

**Left-Handed Snail**



**(5)a** Has a segmented body or looks like a tiny tick **6**

**(5)b** Has an unsegmented body and has an "arrow shaped" head; 2 pigment spots (eyes) Planaria **PLANARIA**



**Palnaria**

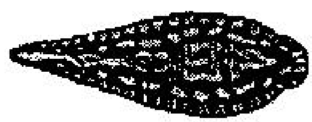
**(6)a** No obvious legs **7**

**(6)b** Obvious legs **12**

**(7)a** Has no obvious appendages (long, tubular body) **8**

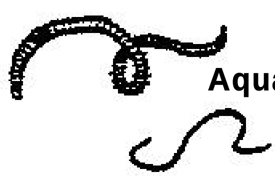
**(7)b** Has some appendages (small tubes, tiny bumps, or feathery structures) **9**

**(8)a** Has a smooth body and suckers Leech **LEECH**



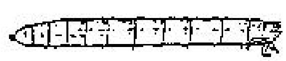
**Leech**

**(8)b** Has rounded body **AQUATIC WORM**



**Aquatic Worms**

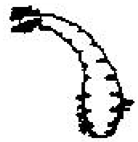
**(9)a** Body black or brown; more than 1/3 inch long; plump and caterpillar like **CRANE FLY LARVAE**



**Crane Fly Larva**

**(9)b** Has one distinct head **10**

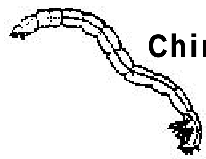
**(10)a** One end of body wider than other end; two tiny feather structures on smaller end **BLACK FLY LARVAE**



**Black Fly larva**

**(10)b** No difference in diameter along body **11**

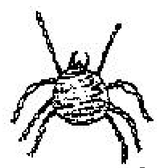
**(11)a** Bright red body **BLOOD WORM MIDGES**



**Chironomid**

**(11)b** Grey body **OTHER MIDGES**

**(12)a** Has four pairs of legs **WATER MITE**



**Water Mite**

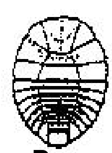
**(12)b** Has three pairs of legs **13**

**(12)c** Has many pairs of legs **25**

**(13)a** Has no wings or short wing pads on back **14**

**(13)b** Has two pairs of wings that cover the abdomen **23**

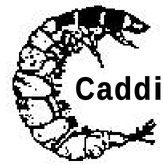
**(14)a** Has a flat, round body with legs underneath (wings not obvious) **WATER PENNY BEETLE**



**Water Penny Beetle**

**(14)b** Not flat, has long body with legs **15**

**(15)a** Lives in a tube or a case or has two hooks in its last segment and is green with 3 plates on back behind head. (The “green caddis” builds a net & tube, but will be washed into the kick net as “free living”). **CADDISFLY LARVAE**



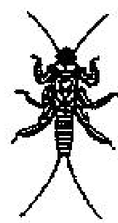
**Caddisfly Larva**

**(15)b** Free-living **16**

**(16)a** Abdomen possesses lateral filaments similar in size to legs **21**

**(16)b** Abdomen does not have “leg-like” filaments (may have feathery “gills”) **17**

**(17)a** Always with only two tail appendages and no abdominal gills. **STONEFLY NYMPH**

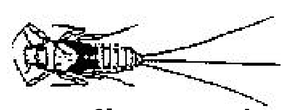


**Stonefly Nymph**

**(17)b** Usually has three tail appendages, and with no lateral gills on abdominal segments **18**

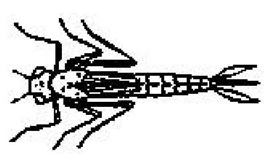
**(17)c** Tail has no appendages **24**

**(18)a** Has long, bristle-like tail appendages, sometimes 2 or 3 **MAYFLY NYMPH**



**Mayfly Nymph**

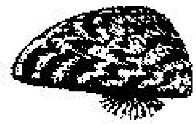
**(18)b** Lower lip formed into extensible scoop-like structure and has leaf-like tail appendages **DAMSELFLY NYMPH**



**Damselfly Nymph**

**(19)a** Small rounded shell **20**

**(19)b** Small triangular shell with alternating cream and dark brown bands **ZEBRA MUSSEL (EXOTIC)**



Zebra Mussel

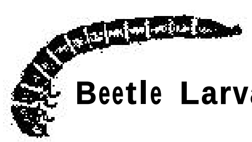
**(20)a** Numerous very fine concentric rows of elevated lines, white or cream colored, with smooth lateral teeth (ridge lines on inside near point) **FINGERNAIL CLAM**

Fingernail Clam

**(20)b** Numerous concentric elevated ridges, yellowish brown to black shell with serrated lateral teeth **ASIATIC CLAM (EXOTIC)**

Asian Clam

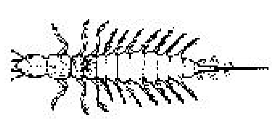
**(21)a** Head narrower than widest body segments **BEETLE LARVAE**



Beetle Larva

**(21)b** Head as wide or wider than other body segments **22**

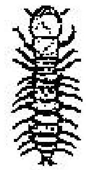
(**22)a** Abdomen with single long filament at end **ALDERFLY**



Alderfly

**(22)b** Abdomen ending with a pair of tiny hooked legs, large head with pincer-like jaws

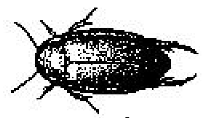
**DOBSONFLY LARVAE**



Dobsonfly Larva

**(23)a** Oval shaped body, legs with feathery swimming hairs

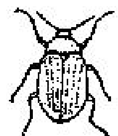
**ADULT WATER BUGS AND WATER BEETLES**



Water bug

**(23)b** All legs smooth, without hairs, crawling

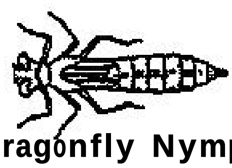
**RIFFLE BEETLE ADULT**



Riffle Beetle Adult

**(24)a** Lower lip formed into scoop-like structure

**DRAGONFLY NYMPH**



Dragonfly Nymph

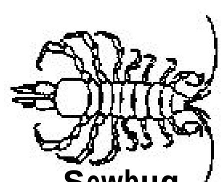
**(24)b** Looks like a tiny millipede

**RIFFLE BEETLE LARVAE**

Riffle Beetle Larva

**(25)a** Flattened top to bottom, crawling looks like “roly-poly” or a “pill bug”

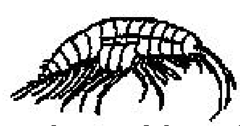
**SOWBUG**



Sowbug

(**25)b** Flattened side to side, swimming looks like tiny shrimp

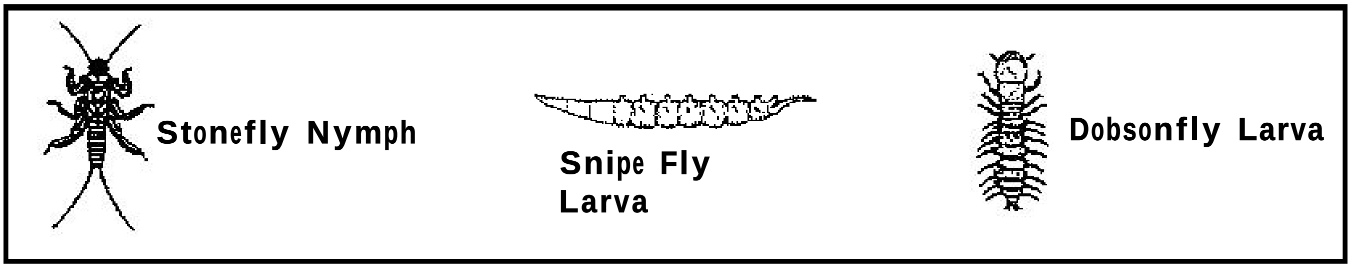
**SCUD**



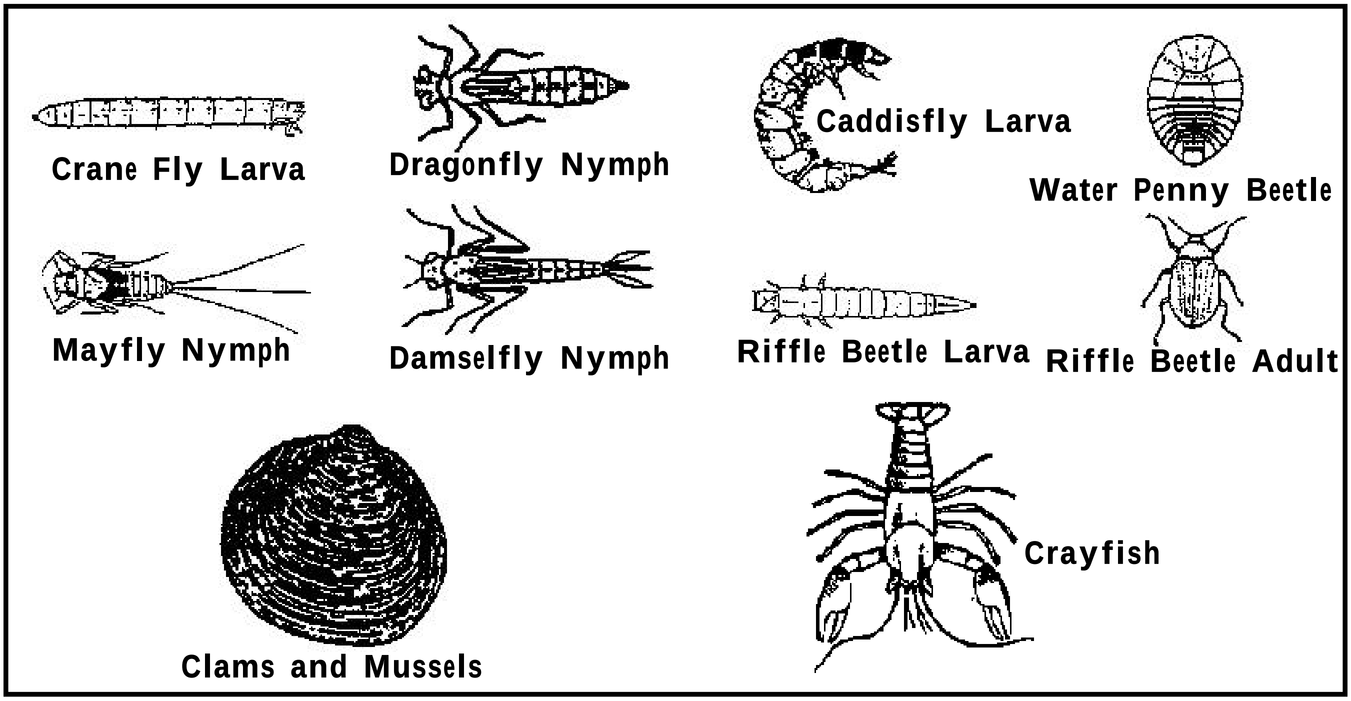
Scud or Side-swimmer

# Macroinvertebrate Picture Key

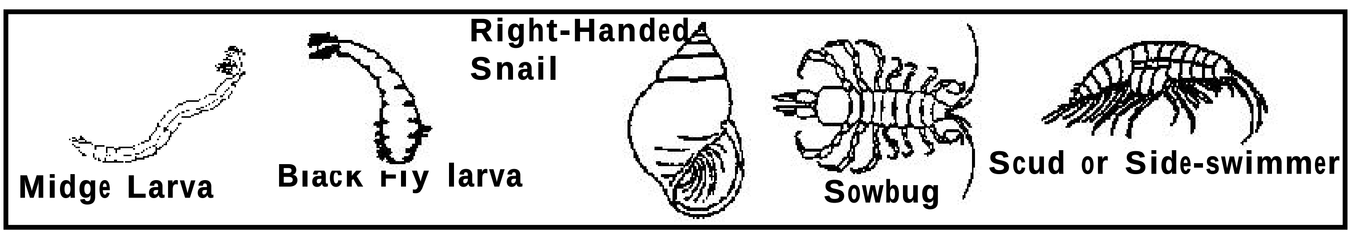
## PT GROUP 1



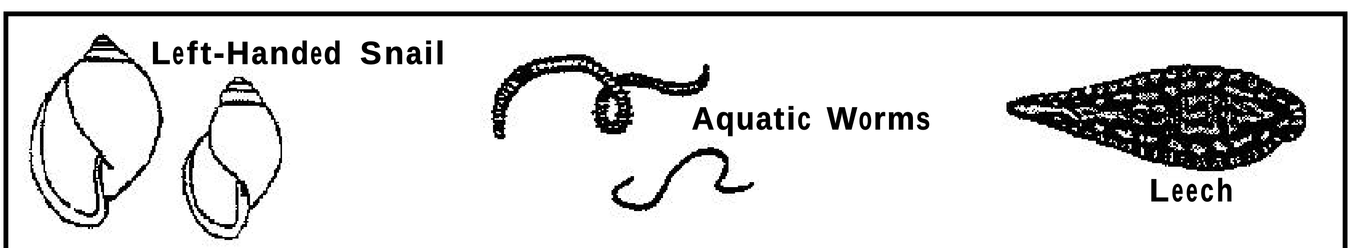

## PT GROUP 2




## PT GROUP 3




## PT GROUP 4



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# Friends of the Fox River-Site Survey Data Sheet

**Mail completed forms within two weeks after collecting data to:**
**Friends of the Fox River, P.O. Box 1314, Crystal Lake, IL 60039**

## Section I

**SITE INFORMATION**

Date______/______/_____ Time ______:______ am or pm Site #: _______________

Collector(s) Name:______________________ Organization Name:____________________

River or Tributary Name:_________________ Latitude/Longitude: ____________________

Nearest City/Town:______________________ County:_______________________________

## Section II

**SITE SURVEY**

**CHECK ALL THAT APPLY**

Stream Habitat
______ Riffle
______ Run
______ Pool
______ Undercut banks
______ Snags
______ Exposed rocks

Inorganic Substrate
______ Boulders
______ Cobble
______ Gravel
______ Sand
______ Silt

Water Odors
______ Normal
______ Sewage
______ Petroleum
______ Chemical
______ Fishy
______ Other

Surface OIls
______ None
______ Some
______ Lots

Bank Vegetation
______ Bare ground
______ Turf grass
______ Unmowed grasses
______ Woody shrubs
______ Decidous trees
______ Conifer trees
______ Other

Local Land Use
______ Urban
______ Suburban
______ Agriculture
______ Park (turf)
______ Park (woods)
______ Other

**CHECK MOST PREDOMINANT**

Bank Stability
______ Stable
______ Slightly eroded
______ Moderately eroded
______ Severely eroded

Bank Slope
______ Slight
______ Moderate
______ Steep

Temperature
______ Water (at site)
______ Air temperature
______ Water (1 mile upstream-optional)

**CHECK MOST PREDOMINANT**

Current Weather
______ Sunny/Clear
______ Overcast
______ Showers (intermittent rain)
______ Rain (steady rain)
______ Storm (heavy rain)

Past Weather (48 hours)
______ Sunny/Clear
______ Overcast
______ Showers (intermittent rain)
______ Rain (steady rain)
______ Storm (heavy rain)

# Friends of the Fox River - Site Survey Data Sheet

**SITE SURVEY -- continued**

| | | | | |
|---|---|---|---|---|
| **Stream Shading** | ____ **0-25%** | ____**25-50%** | ____**50-75%** | ____**75-100%** |
| **Siltation** | ____ **0-25%** | ____**25-50%** | ____**50-75%** | ____**75-100%** |
| **Embeddedness** | ____ **0-25%** | ____**25-50%** | ____**50-75%** | ____**75-100%** |

**Stream Width** __________ **ft** **Avg. Surface Velocity** __________ **ft/sec**

**Avg. Stream Depth** __________ **ft** **Stream Discharge** __________ **ft3/sec**

**Check all that are present:** Dam Upstream ____ Channelized ____ Foam ____

## Section III

**SURVEY NOTES**

**SITE PHOTOS**

Take three photos - 1) facing cross section of the area you have monitored, 2) facing upstream of area monitored (encompassing banks, if possible), and 3) facing downstream of the area monitored (encompassing banks, if possible). Take pictures from same location each time you monitor. Send the printed pictures with the data or e-mail digital photos to MonitoringCoordinator@friendsofthefoxriver.org. Note the date, time and monitoring site that photos were taken.

# Friends of the Fox River - Site Survey Data Sheet

## Section Iv

**STREAM MAP**

**STREAM MAP KEY**

# Friends of the Fox River
# Chemical Monitoring Data Sheet

## Section I

**SITE INFORMATION**

Date______/______/_____ Time ______:______ am or pm Site #: _______________

Collector(s) Name:______________________ Organization Name:____________________

River or Tributary Name:_________________ Latitude/Longitude: ____________________

Nearest City/Town:______________________ County:______________________________

## Section II

**CHEMICAL TEST RESULTS**

Chemical Kit Name or Equipment Description: _____________________________________

______________________________________________________________________________

Air Temperature: __________ ºC Water Temperature: __________ ºC

pH: __________ Nitrate: __________

Turbidity: _________ Phosphorous: __________

Dissolved Oxygen: ______ % Saturation ____ Biological Oxygen Demand: _________

## Section III

**ADDITIONAL CHEMICAL TEST RESULTS**

# Friends of the Fox River
# Biological Monitoring Data Sheet

## SITE INFORMATION

Date______/______/_____ Time ______:______ am or pm Site #: ______________

Collector(s) Name:_____________________ Organization Name:___________________

River or Tributary Name:________________ Latitude/Longitude: ___________________

Nearest City/Town:_____________________ County:_____________________________

## HABITATS SAMPLED AND METHODS USED
## (CHECK TWO HABITATS)

___Riffle/Kick Seine ___Undercut Banks/D-Net ___Snags/D-Net ___Sediment/D-Net ___Leaf Packs

## MACROINVERTEBRATE INDEX

| PT GROUP 1 | | PT GROUP 2 | | PT GROUP 3 | | PT GROUP 4 | |
|---|---|---|---|---|---|---|---|
| Stonefly Nymph | ________ | Damselfly Nymph | ________ | Midge | ________ | Left-Handed Snail | ________ |
| Snipe Fly | ________ | Dragonfly Nymph | ________ | Black Fly Larvae | ________ | Aquatic Worms | ________ |
| Dobsonfly Larva | ________ | Mayfly Nymph | ________ | Scud | ________ | Leech | ________ |
| | | Caddisfly Larva | ________ | Sowbug | ________ | | |
| | | Crane Fly Larva | ________ | Right-handed snail | ________ | | |
| | | Riffle Beetle | ________ | | | | |
| | | Water Penny | ________ | | | | |
| | | Clams/Mussels | ________ | | | | |
| | | Crayfish | ________ | | | | |
| **# of Taxa** | _______ | **# of Taxa** | _______ | **# of Taxa** | _______ | **#of Taxa** | _______ |
| Weighing Factor **X 4** | _______ | **X 3** | _______ | **X 2** | _______ | **X 1** | _______ |

**TOTAL TAXA RATING** _______

## NON-NATIVE MACROINVERTEBRATES
## (Enter Number Present)

| Zebra Mussels | Asiatic Clams | Chinese Mystery Snails | Rusty Crayfish |
|---|---|---|---|
| ___________ | ___________ | ___________ | ________ |

## WATER QUALITY INDEX VALUE

33 or more = Exellent
23-32 = Good
13-22 = Fair
12 or less = Poor