DOCUMENT RESUME

ED 376 028 SE 054 369

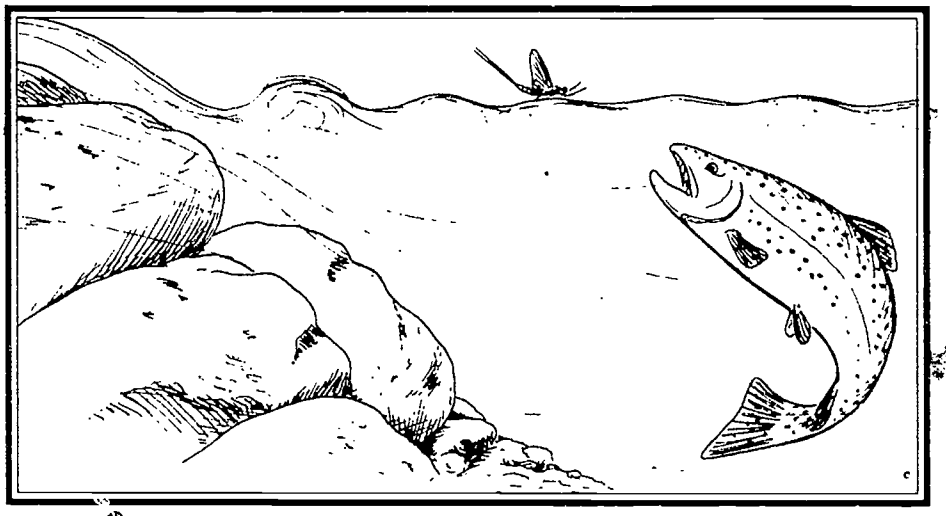
AUTHOR Rhinehart, William C.; Beazley, Lea J.
TITLE Testing the Waters. Duke Power State Park: An Environmental Education Learning Experience Designed for Grades 4-6.
INSTITUTION North Carolina State Dept. of Environment, Health, and Natural Resources, Raleigh. Div. of Parks and Recreation.
PUB DATE Nov 93
NOTE 56p.; For other Environmental Education Learning Experiences, see SE 054 364-371.
AVAILABLE FROM North Carolina Division of Parks and Recreation, P.O. Box 27687, Raleigh, NC 27611-7687.
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Classification; Conservation (Environment); Ecology; *Environmental Education; Experiential Learning; Field Trips; Identification; Intermediate Grades; *Marine Biology; *Outdoor Activities; Outdoor Education; Water Pollution; *Water Quality; Water Resources
IDENTIFIERS Dichotomous Keys; Environmental Issues; *Invertebrates; *North Carolina; State Parks; Watersheds

ABSTRACT

This learning packet, one in a group of eight, was developed by the Duke Power State Park in North Carolina for Grades 4-6 to learn to identify macroinvertebrates found in Lake Norman. Loose-leaf pages are presented in nine sections that contain: (1) introductions to the North Carolina State Park System, the Duke Power State Park, the park's activity packet, and Lake Norman; (2) a summary of the activities that includes major concepts and objectives covered; (3) a pre-visit activity to demonstrate the dichotomous key in identifying tree leaves; (4) an on-site activity to enable students to recognize indicators of water quality and aquatic habitats; (5) a post-visit activity to encourage students to examine conflicting land-use concerns in an effort to preserve a lake; (6) a list of 47 related vocabulary words; (7) necessary park and parental permission forms for the visit; and (8) blank pages for taking notes. Contains 25 references. (MDH)

TESTING



THE WATERS

Duke Power State Park

An Environmental Education Learning Experience

Designed for Grades 4-6

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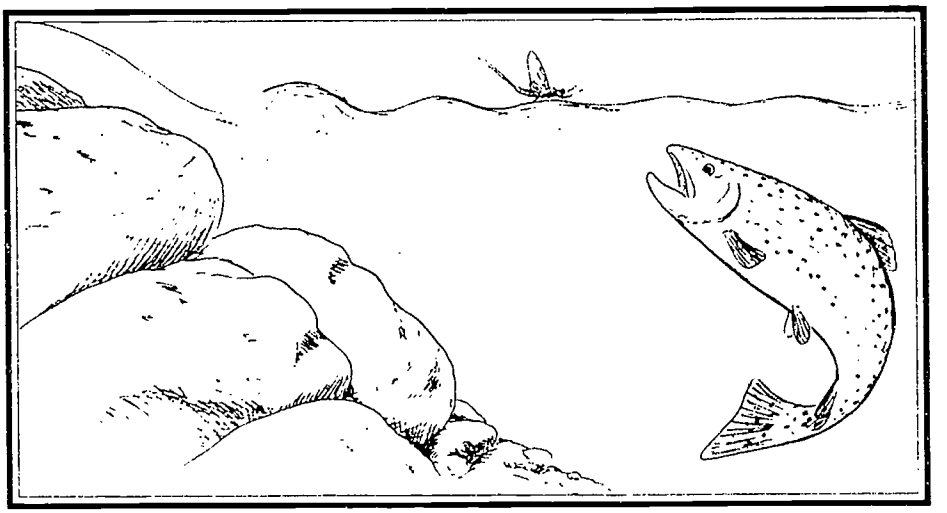


THE WATERS

Duke Power State Park

An Environmental Education Learning Experience

Designed for Grades 4-6

"Earth is home to us all.
Water is life to us all.
Share it responsibly."

- North Carolina Wildlife Resources Commission

Funding for this publication was generously provided by

CP&L

This Environmental Education Learning Experience
was developed by
William C. Rhinehart, Jr. and Lea J. Beazley
Lead Interpretation and Education Ranger and Ranger II
Duke Power State Park

N.C. Division of Parks and Recreation
Department of Environment, Health, and Natural Resources

James B. Hunt Jr.
Governor

Jonathan B. Howes
Secretary

Other Contributors . . .

Park volunteers;

Ken Manuel, Division of Environmental Management, Duke Power Company;

The N.C. Department of Public Instruction;

The N.C. Division of Water Resources;

The N.C. Department of Environment, Health, and Natural Resources;

and the many individuals and agencies who assisted in the review of this publication.

500 copies of this public document
were printed at a cost of $1,750
$3.50 per copy

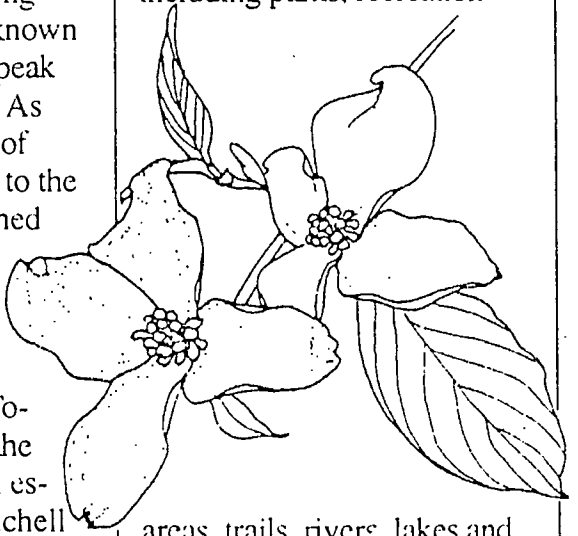
Printed on recycled paper.
11-93

Table of Contents

Introduction to the North Carolina State Parks System

Preserving and protecting North Carolina's natural resources is actually a relatively new idea. The seeds of the conservation movement were planted early in the 20th century when citizens were alerted to the devastation of Mount Mitchell. Logging was destroying a well-known landmark - the highest peak east of the Mississippi. As the magnificent forests of this mile-high peak fell to the lumbermen's axe, alarmed citizens began to voice their opinions. Governor Locke Craig joined them in their efforts to save Mount Mitchell. Together they convinced the legislature to pass a bill establishing Mount Mitchell as the first state park.

That was in 1915. The North Carolina State Parks System has now been established for more than three quarters of a century. What started out as one small plot of public land has grown into 59 properties across the state, including parks, recreation



areas, trails, rivers, lakes and natural areas. This vast network of land boasts some of the most beautiful scenery in the world and offers endless recreation opportunities. But our state parks system offers much more than scenery and recreation. Our lands and waters contain unique and valuable archaeological, geological and biological resources that are important parts of our natural heritage.

As one of North Carolina's principal conservation agencies, the Division of Parks and Recreation is responsible for the more than 125,000 acres that make up our state parks system. The Division manages these resources for the safe enjoyment of the public and protects and preserves them as a part of the heritage we will pass on to generations to come.

An important component of our stewardship of these lands is education. Through our interpretation and environmental education services, the Division of Parks and Recreation strives to offer enlightening programs which lead to an understanding and appreciation of our natural resources. The goal of our environmental education program is to generate an awareness in all individuals which cultivates responsible stewardship of the earth.

For more information contact:

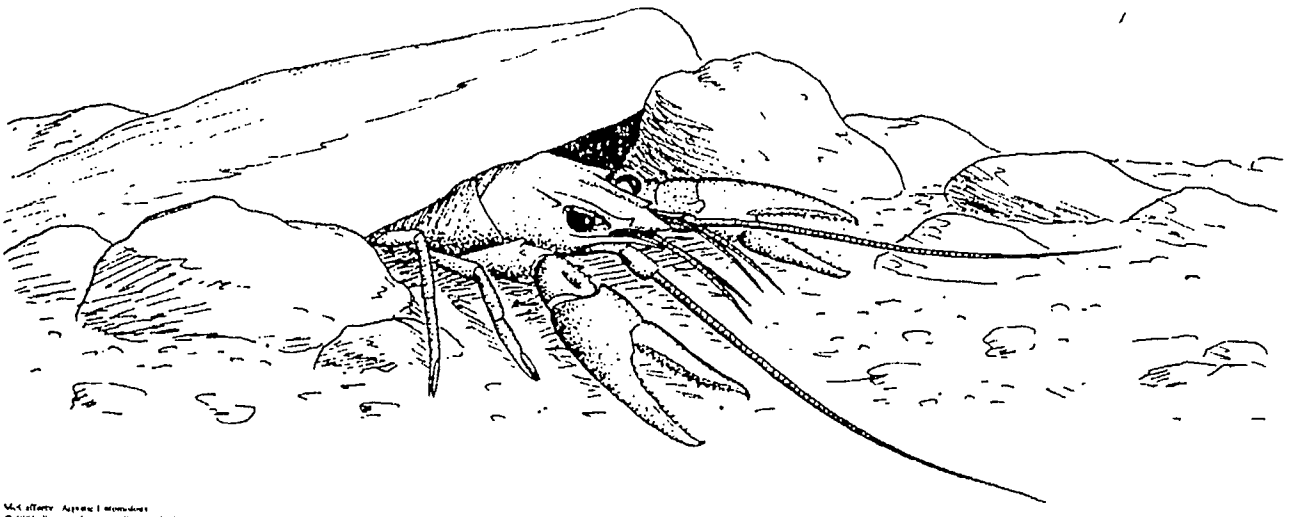
NC Division of Parks and Recreation
P.O. Box 27687
Raleigh, NC 27611-7687
919/ 733-4181

Introduction to Lake Norman

Lake Norman is one of 10 man-made lakes along the Catawba River; but it differs significantly in one aspect– size. In fact, Lake Norman is nearly as large as the other nine lakes combined! The larger of the lakes includes Lake James, Lake Hickory, Lake Wateree and Lake Wylie. When the lake is completely full, it covers 32,510 acres and has 520 miles of shoreline. It's no wonder the lake is nicknamed "the inland sea."

In 1959, 43 years after Duke Power Company announced plans to build the lake, construction of this enormous resource began. Four years later, Cowan's Ford Dam, located near Huntersville, NC was closed and the Catawba River began to back up and form Lake Norman. It took approximately three years to fill the huge basin created by the dam and another year to complete the entire Lake Norman project.

Today, Lake Norman provides electricity to the piedmont of North Carolina in two ways. First, it powers the hydroelectric generators at Cowan's Ford Dam and second, it cools the steam that drives the turbines of Marshall Steam Station and McGuire Nuclear Station. The lake also serves as a water supply for several cities and protects downstream areas from flooding. A variety and abundance of wildlife also benefit from the lake, including osprey, ducks and many species of freshwater fish, such as largemouth and striped bass and catfish. Not only do wild animals call Lake Norman home; over 26,000 people permanently reside along its shores and enjoy boating, fishing, and skiing.



Introduction to Duke Power State Park

"Water, water, everywhere..." and there's plenty for everyone at Duke Power State Park, which is located on the northeastern shore of Lake Norman. As if there wasn't enough water in Lake Norman, the park has its own 33 acre lake, which is separated from Lake Norman by an earthen dam. But water is not all you'll find at the park; there are also about 1,500 acres of rich piedmont forest here, most of which was donated by Duke Power Company. Together, the lake and forest provide homes for a multitude of wildlife. Waterfowl, including ducks, geese, great blue herons and kingfishers are common sights around the water. Below the surface, you'll find a variety of freshwater fish, including largemouth and striped bass, crappie, catfish, and bluegill. On the park grounds there are white-tailed deer, red fox and groundhogs. The water and woods are also home to a variety of insects, amphibians and reptiles. Plant life is abundant; not only are there piedmont species, but several mountain plants as well, including mountain laurel and white pine. And don't forget to look up into the sky above the park, where you might see owls, woodpeckers, hawks and more than 100 species of migrating birds.

Of course, wildlife is not all you'll find at Duke Power State Park. There are also various recreational facilities available. These include two picnic areas, a picnic shelter, over six miles of hiking trails, a swimming area, rowboat and canoe rentals, and family and group campgrounds.

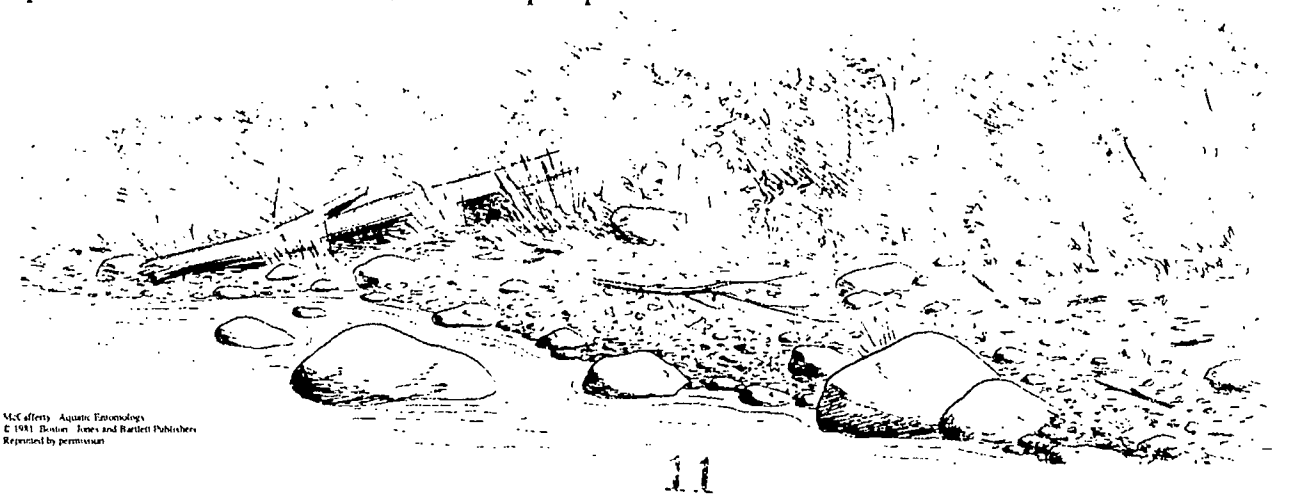
Guidelines for a Rewarding Experience at Duke Power State Park

Groups are encouraged to visit the park during all seasons of the year for hikes, exploration, environmental education programs and activities. Leaders may choose to conduct their own activities or request the help of park staff.

Scheduling a Trip

To make a reservation, contact the park at least two weeks in advance. Complete the scheduling worksheet on page 9.1 and provide the following information:

- Name of group (school).
- Name, address, work, and home telephone numbers of the group contact person.
- Date, time of arrival, and meeting place at the park.
- Departure time from the park.
- Number of participants and adult leaders. **A maximum of 30 participants is recommended. Please have one adult leader per 10 students. Adult leaders are responsible for maintaining control of the group.**
- Age range and/or special needs of participants.
- Desired activities; assistance needed by park staff.



While at the Park

Please obey the following rules:

1. To help you get the most out of the experience and increase the chance of observing wildlife, be as quiet as possible while in the park.

2. On hikes, walk behind the leader at all times. Stay on the trails. Running is not permitted.

3. All plants and animals within the park are protected. Breaking plants and harming animals is prohibited in all state parks. This allows future visitors the same opportunity to enjoy our natural resources.

4. Help keep the park clean and natural; do not litter. If you find litter left by others, please pick it up.

5. Swimming is permitted only in the designated swimming area under the supervision of park lifeguards.

6. In case of accidents or emergencies, contact park staff immediately.

Following the Trip

1. Complete the post-visit activity in the activity packet.

2. Build upon the field experience and encourage participants to seek answers to questions and problems encountered at the park.

3. Relate the experience to classroom activities and curriculum through reports, projects, demonstrations, displays and presentations.

4. Give tests or evaluations if appropriate, to determine if students gained the desired information from the experience.

5. File a written evaluation of the experience with the park. An evaluation form is available on page 9.3.

Park Information

Address:

Duke Power State Park
Route 2, Box 224-M
Troutman, NC 28166
Telephone: (704) 528-6350

Hours of Operation:

November - February	8 a.m. - 6 p.m.
March, October	8 a.m. - 7 p.m.
April, May, September	8 a.m. - 8 p.m.
June - August	8 a.m. - 9 p.m.

Introduction to the Activity Packet for Duke Power State Park

The environmental education learning experience (EELE), "Testing the Waters," was developed to provide environmental education through a series of hands-on activities geared to Duke Power State Park. This activity packet, designed to be implemented in grades 4 - 6, meets curriculum objectives of the standard course of study established by the North Carolina Department of Public Instruction. It includes three types of activities: pre-visit, on-site and post-visit. The on-site activity will be conducted at the park, while pre- and post-visit activities are designed for the classroom. These activities should be performed in a series to build upon students' newly gained knowledge and experiences.

The environmental education learning experience, "Testing the Waters," will acquaint students with the following major concepts:

- **Water quality**
- **Watersheds**
- **Aquatic sampling**
- **Water pollution**
- **Preservation of natural areas**
- **Land use**

Vocabulary words used throughout this environmental education learning experience will appear in **bold type** the first time they are used in each activity. These words and their definitions may be found in the vocabulary list at the back of the activity packet. A list of reference materials used in developing the activities follows the vocabulary list.

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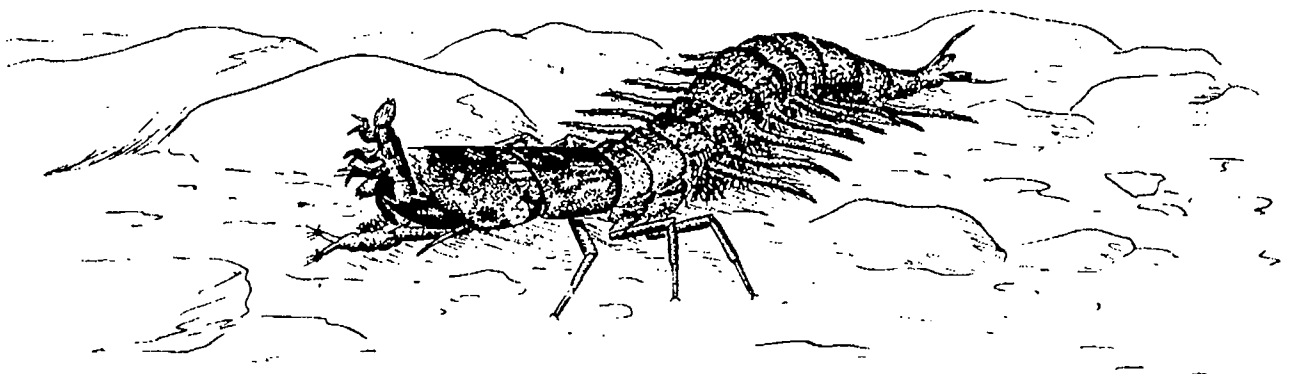
NOTE: The on-site activity may require hiking which could expose the students to hot, humid conditions and poisonous insects, snakes and plants. Accessibility to some of these areas will be difficult for persons with physical handicaps.



Activity Summary

The following outline provides a brief summary of each activity, the major concepts introduced and the objectives met by completion of the activity.

I. Pre-Visit Activity

Key it Out (page 3.1.1)

Introduce your students to the use of dichotomous keys through a series of fun activities. In Part 1, students will use a simple key to identify unknown tree leaves. In Part 2, the students will use a more complex key to identify macroinvertebrates found in Lake Norman.

Major concepts:

Part I

- Dichotomous key
- How to use a key
- Importance of keys for identification

Part II

- Basic taxonomy

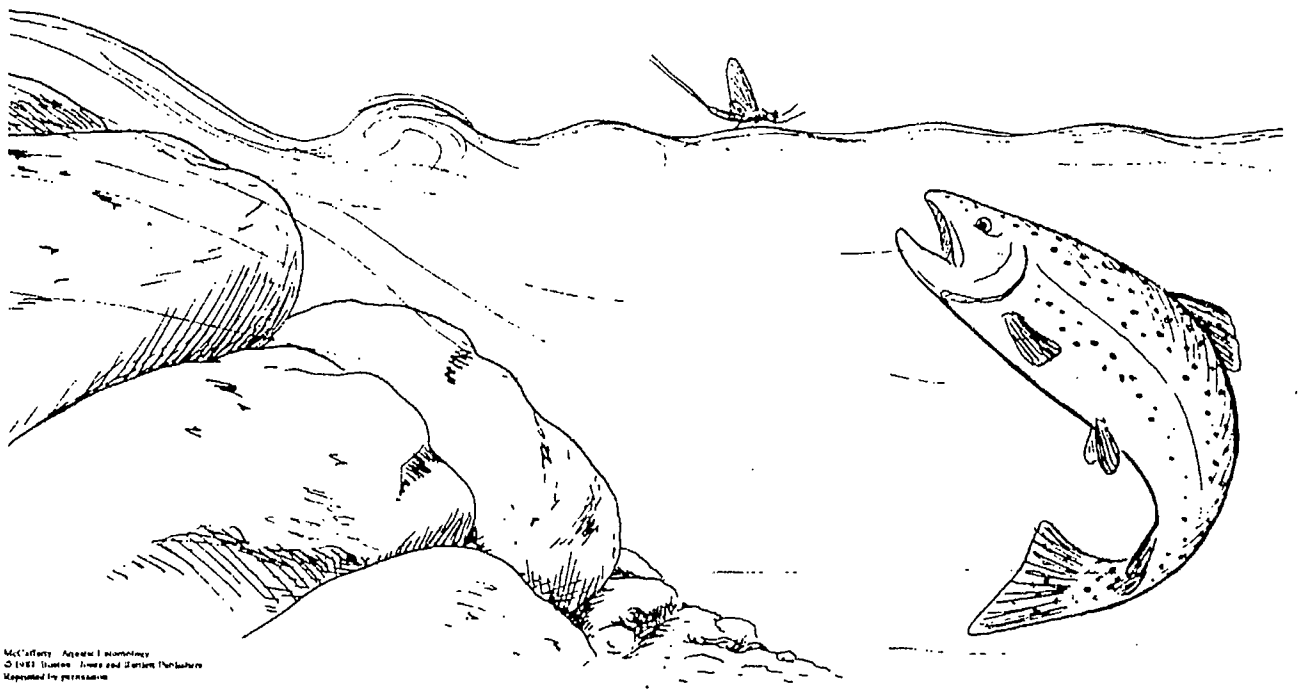
Objectives:

Part I

- Define dichotomous key and explain why it is used.
- Use a simple key to identify five unknown leaves.

Part II

- Define taxonomy.
- Key out at least one macroinvertebrate using a simple key.



II. On-Site Activity

Life at the Bottom (page 4.1.1)

Get wet, have fun, and learn while doing it. Students will use different methods to collect and identify aquatic organisms.

Major Concepts:

- Water quality
- Aquatic sampling
- Indicator species
- Aquatic habitat
- Basic anatomy
- Species identification
- Human influence on water quality

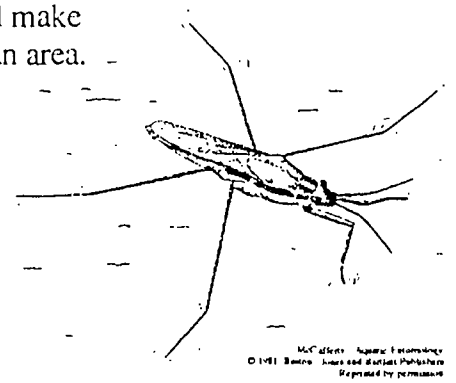
Objectives:

- Describe three characteristics of an aquatic macroinvertebrate.
- Key out and identify three macroinvertebrates.
- Define indicator species.
- Name three indicator species and explain how they are used to determine water quality.
- Use keys and field guides to identify unknown aquatic specimens.
- List three or more ways humans affect aquatic life.

III. Post-Visit Activity

Park Lake (page 5.1.1)

Using a map of Park Lake and land use cutouts, students will make decisions about the development of a portion of the Lake Norman area.



Major Concepts:

- Human impact on watersheds
- Water quality
- Land use planning and its effect on a lake
- Preservation of natural areas
- Resource management

Objectives:

- Evaluate the effects of different imaginary land uses on Park Lake.
- Discuss and list five ways to reduce damages to Park Lake.
- List three ways that people can change their lifestyles to reduce damages to water quality and to Park Lake.
- List three ways local businesses, industries and communities could change the way they do business to decrease their damaging effects on water quality and on Park Lake.

Pre-Visit Activity #1 — Key It Out

Curriculum Objectives:
Grade 4
- Communication Skills: listening, reading, vocabulary and viewing comprehension, study skills using environmental sources
- Guidance: group interaction
- Library/Media Skills: work independently and creatively in preparing assignments
- Science: living things–animals, adaptation to environment, interdependence of animals
- Social Studies: gather, organize and analyze information, draw conclusions, participate effectively in groups

Grade 5
- Communication Skills: listening and visual comprehension, study skills
- Science: earth science, environment

Grade 6
- Communication Skills: listening and visual comprehension, study skills
- Science: earth science, environment
- Math: measurement

Special Considerations:
None

Location: Classroom

Group Size:
30 students, class size

Estimated Time:
Part I: 20 - 30 minutes
Part II: 30 - 50 minutes

Appropriate Season: Any

Materials:
Provided by educator:
Per student: "Key it Out" worksheet, "Key to 10 Common Leaves," pencil
Per group "Key to Aquatic Macroinvertebrates of the Catawba River Watershed," "Aquatic Life Illustrations," ruler

Major concepts:

Part I
- Dichotomous key
- How to use a key
- Importance of keys for identification

Part II
- Basic taxonomy

Objectives:

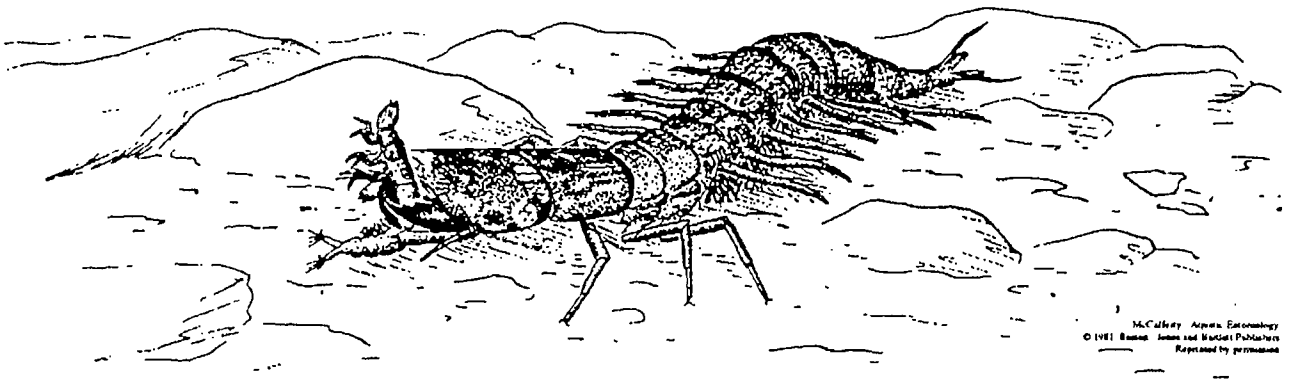
Part I
- Define dichotomous key and explain why it is used.
- Use a simple key to identify five unknown leaves.

Part II
- Define taxonomy.
- Key out at least one macroinvertebrate using a simple key.

Educator's Information:

The purpose of this two-part activity is to introduce the use of a simple dichotomous key. Students will learn what a dichotomous key is, why keys are useful and how to use a simple identification key.

Part I will give students an introduction to the use of a simple key and why keys are useful. In Part 2, the students will be placed into groups and will key out several **macroinvertebrates** using the same key they will use in the on-site activity entitled "Life at the Bottom."



Instructions for Part I:

. Have the students read the Student's Information. Discuss taxonomy and how organisms are grouped into naturally related groups. Define a key and discuss why keys are useful. Explain how a key works. Hand out copies of the "Key to 10 Common Leaves" to each student. Have each student work through this key to identify each of the 10 leaves. As a class, go over the answers and discuss any difficulties encountered.

Instructions for Part II:

Divide the students into groups of four or five. Hand each group a copy of "Aquatic Life Illustrations" and a copy of "Key To Common Macroinvertebrates of the Catawba River Watershed." As a class, work through the key to identify animal number 1 then have the students work within their groups to identify the rest of the macroinvertebrates. When the groups are done, have each group share how they identified one of their macroinvertebrates. Discuss the difficulties encountered and reinforce the importance of keys.

Suggested Extensions:

1. Divide class into groups of five or less and hand each group one picture of a macroinvertebrate. Instruct each group to identify their organism and show how they identified it. Rotate pictures until each group has identified all six organisms.

2. Have students create macroinvertebrate "flash cards" to learn identification.

Student's Information:

Taxonomy is the branch of **biology** that classifies **organisms** by established groups. The word, taxonomy comes from the Greek words meaning arrangement and law. Through taxonomy, organisms are placed into related groups based on similarities in morphology (structure and form), **anatomy**, physiology, genetics, **ecology** and **distribution**.

All organisms are grouped into large groups known as Kingdoms. There are five major kingdoms:

1. Animalia (mammals, **insects**, birds, reptiles, etc.)
2. Plantae (plants)
3. Fungi (mushrooms, molds, yeasts, etc.)
4. Protista (some **algae** and protozoans)
5. Monera (bacteria and blue-green algae)

These kingdoms are further divided into more closely related groups. For example, let's trace the taxonomic **classification** of a dragonfly. Dragonflies belong to the Kingdom Animalia. From here, they are divided into the Phylum Arthropoda which contains all insects and their relatives. Next, they are placed in the Class entitled Insecta. In North America alone there are 88,600 Species of insects. The class insecta is further divided into groups called Orders. In North America there are 27 Orders, each Order containing closely related insects. Dragonflies are in the Order Odanata. The next two divisions are Family and **Genus**. The final division is Species. Worldwide there are about 4,500 Species of dragonflies, while in North Carolina there are only 186 Species. If you have a dragonfly and want to know what Species you have, you would use a **key**.

Keys:

A key is an essential tool used by people studying the science of taxonomy. It is defined as an ordered list of significant characteristics of a group of organisms which are used to identify unknown organisms. Simply put, a key is a list of characteristics that describe an organism. Keys are used by scientists and students to identify unknown organisms. Keys often use a combination of pictures and written descriptions to aid in identification. Once you know an organisms name you can look up information about it.

Dichotomous Keys:

Most keys are **dichotomous**, meaning they divide the characteristics that describe an organism into two choices. At each level of the key, you pick the choice that best describes the organism you are trying to identify.

How a Key Works:

Here's how a dichotomous key works. A list of characteristics is arranged as a series of either/or statements. For each pair of statements, choose the one that best describes the item you're identifying. For example, if you were handed a leaf (from a pine tree) to identify, you would start at the top of the key with these two choices:

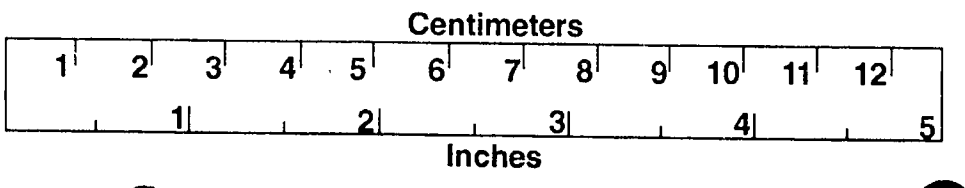
1. Leaves long and needle-like.
2. Leaves not long and needle-like.

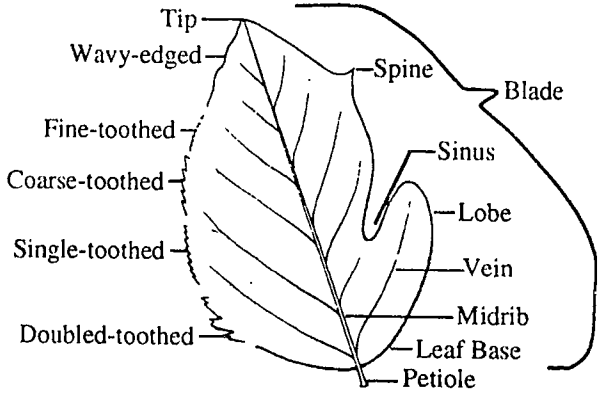
Of course, a pine leaf (or needle) is long and needle-like so you would choose option #1 and continue to the next choice under that side of the dichotomous key.

Key to 10 Common Leaves

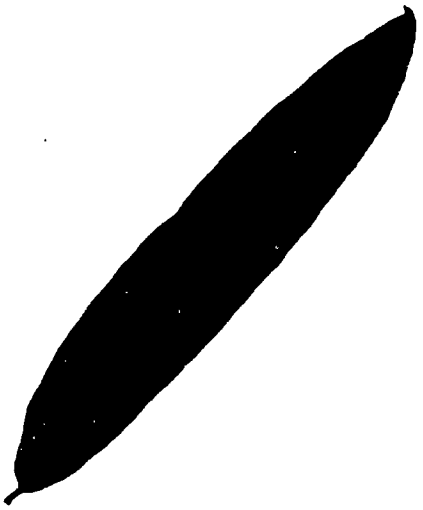
(Tree Leaves)

- Leaf long & needle-like
  - Leaves in group of 2; less than 10 cm long — *Shortleaf pine*
  - Leaves in group of 3; more than 10 cm long — *Loblolly pine*
- Leaf not needle-like
  - Leaf with lobes
    - Edge of leaf without teeth
      - Petiole of leaf 1 cm or longer
        - Leaf petiole less than 2 cm — *Sassafras*
        - Leaf petiole longer than 2 cm — *Tulip poplar*
      - Petiole of leaf less than 1 cm — *White oak*
    - Edge of leaf with teeth
      - Leaf with 5 lobes; petiole 3.5 cm or longer — *Sweet gum*
      - Leaf with 3 lobes; petiole shorter than 3.5 cm — *Red maple*
  - Leaf without lobes
    - Leaf edge with teeth
      - Each tooth with spine — *American holly*
      - Teeth without spines — *River birch*
    - Leaf without teeth — *Willow oak*





10 Common Leaves



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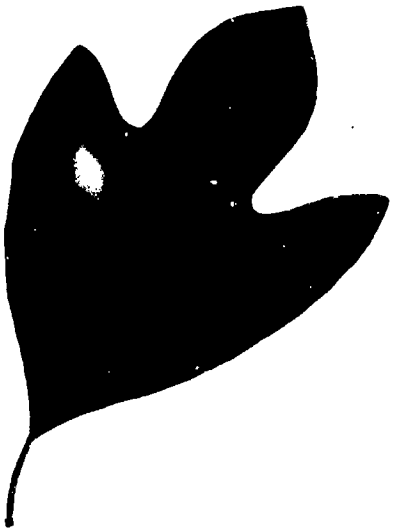

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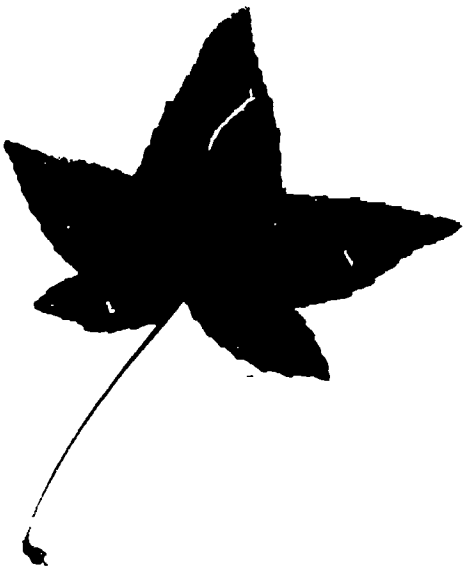

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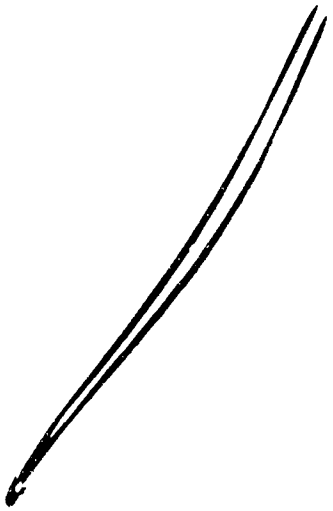

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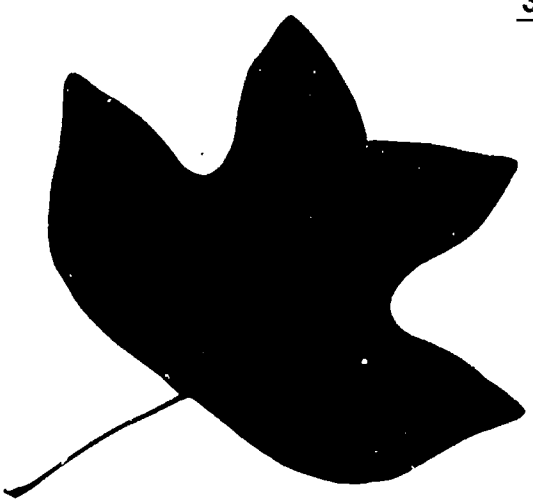

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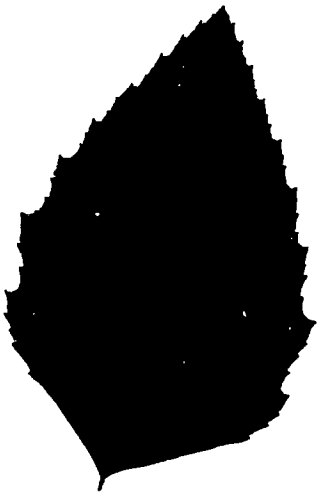

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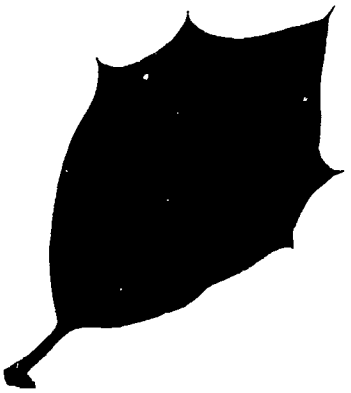

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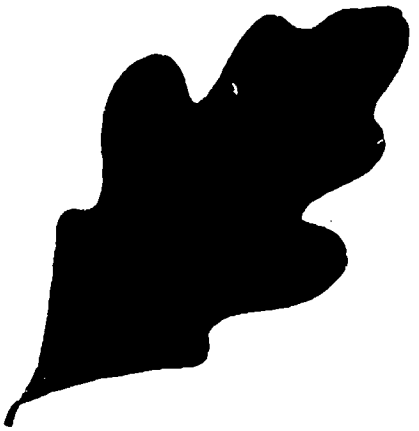

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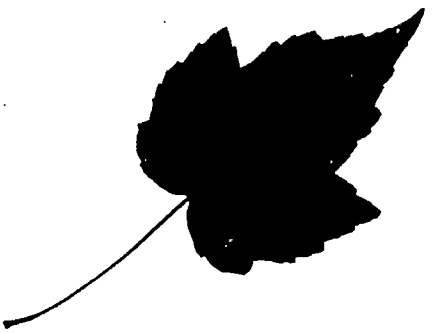

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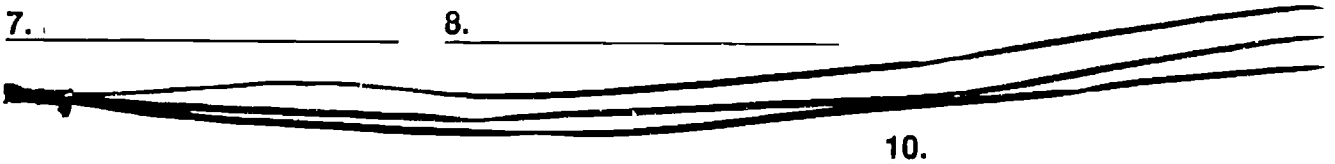

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Key to Aquatic Macroinvertebrates

Macroinvertebrates

with shells

double shell

shell attached to submerged objects

*Zebra mussel (T)

shell unattached

shell oblong

Native freshwater mussel (I)

shell triangular

*Asian clam (T)

single shell

obvious legs

three pairs of legs

two pairs of wings

chewing mouth parts, front wings thick (beetles)

hind legs short (swims on surface)

Whirligig beetle Adult (M)

hind legs long

hind legs paddle-like (swims rapidly)

Predaceous diving beetle (M)

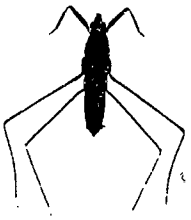
hind legs not paddle-like (crawls on submerged objects)

Riffle beetle adult (M)

sucking mouth parts (true bugs)

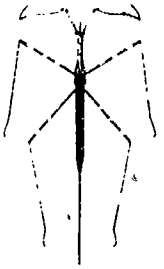
thin body, long spider-like legs

skates on water surface



Water strider adult (M)

walks on bottom near plants



Water scorpion adult (M)

thick body, up to 3" long

Giant water bug adult (M)

no wings, some undeveloped wing pads

entire body soft except head and thorax

dark brown to black body, prominent pinching jaws

Hellgramite, Dobsonfly (M)

white to greenish body, with or without portable case

Caddisfly larva (I)

Caddisfly larva with case (I)

** Non-native nuisance species. The Zebra mussel is not yet known from North Carolina. It is moving into the southern states. Report its occurrence to Park, Wildlife or Duke Power authorities.*

of the Catawba River Watershed

LEGEND	
Pollution Tolerance	Index Value
(I) – Intolerant	Group 1
(M) – Moderate	Group 2
(T) – Tolerant	Group 3

without shells

no obvious legs

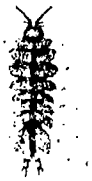
more than three pair of legs (crustacea)

small claws on front legs

body flattened side to side

Anphipod scud (M)

body flattened top to bottom



Isopod, Sowbug (M)

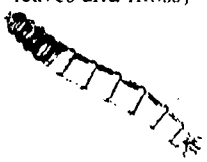
large claws on front legs

Crayfish (M)

worm-like

small appendages

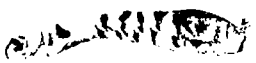
no obvious head (lives on submerged leaves and moss)



Cranefly larva (M)

obvious head

rounded abdomen (attached to rocks and sticks, lives in groups)



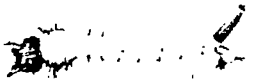
Black fly larva (M)

slender abdomen

bright red body (lives on submerged objects)

Chronomid midge (T)

small hairs on body (lives in stagnant water)



Mosquito larva (T)

no appendages

flattened, gray to black color

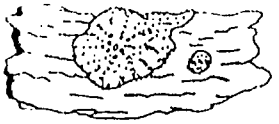
Leech (T)

cylindrical, red color

Aquatic worm (T)

sponge or jelly-like, grows on submerged objects

usually a flattened pad



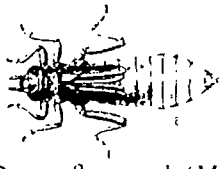
Freshwater sponge (M)

ball-like

Bryozoa (M)

entire body exoskeleton hardened, flattened

no obvious tail



Dragonfly nymph (M)

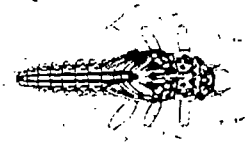
obvious tail

three tails

tails broad, leaf-like

Damselfly nymph (I)

tails slender, gills on abdomen

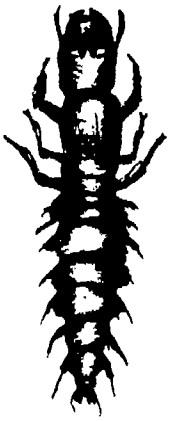


Mayfly nymph (I)

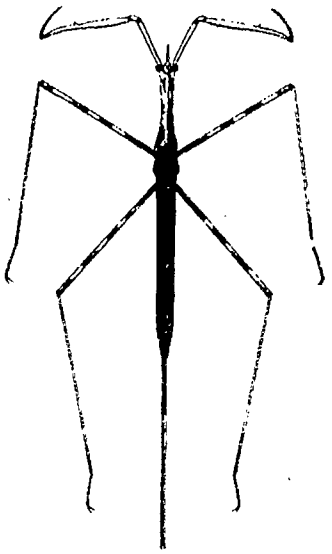
two tails, no gills on abdomen

Stonefly nymph (I)

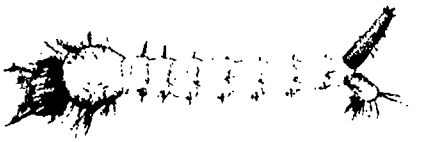
Aquatic Life Illustrations



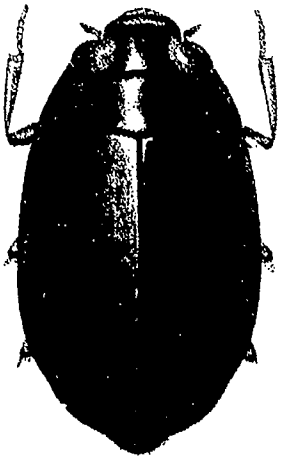
1. _____



2. _____



3. _____



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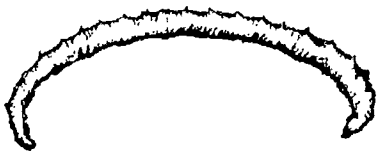
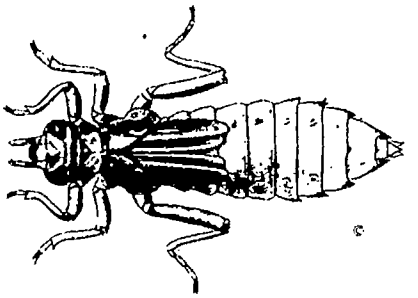
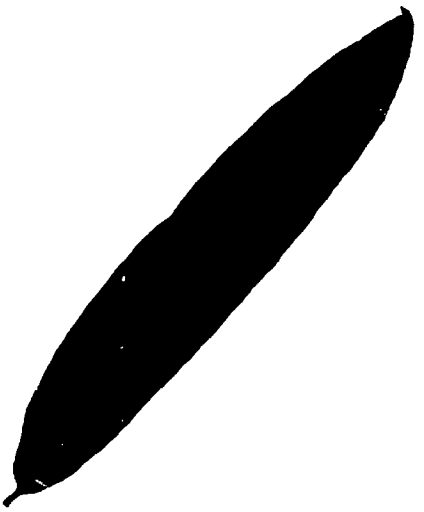


5. _____

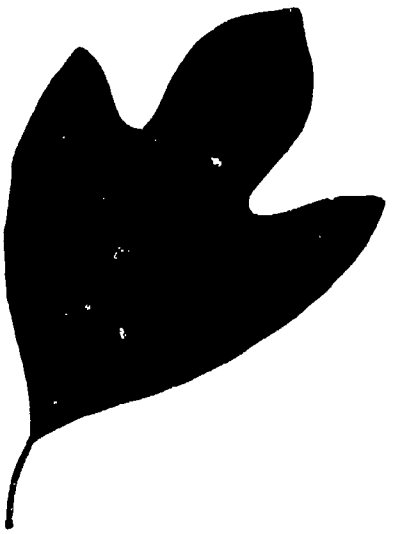


6. _____

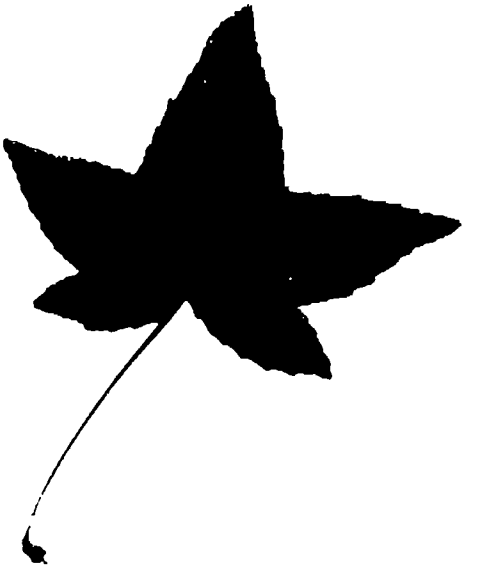
Answer Sheet to 10 Common Leaves



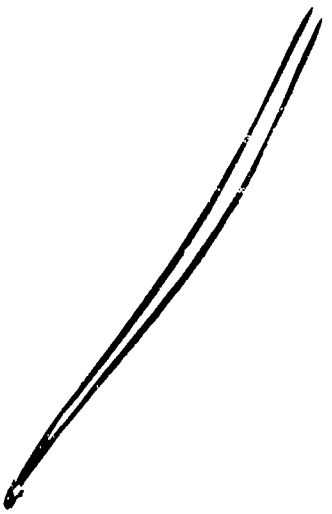
1. *Willow oak*



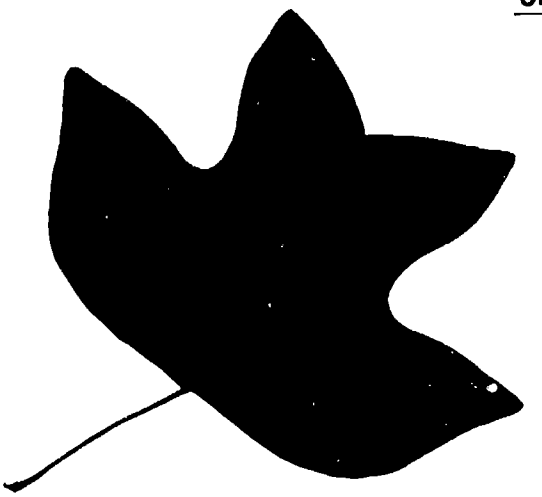
2. *Sassafras*



3. *Sweet gum*

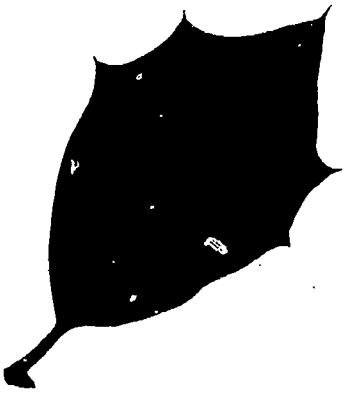


4. *Shortleaf pine*

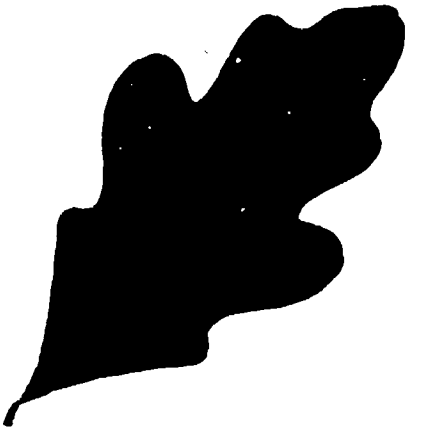


5. *Tulip poplar*

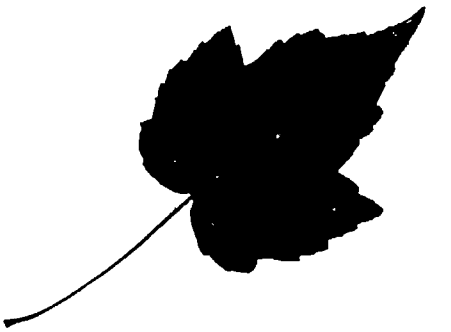
6. *River birch*



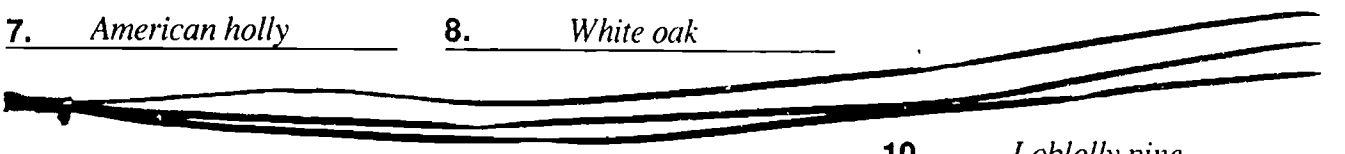
7. *American holly*



8. *White oak*



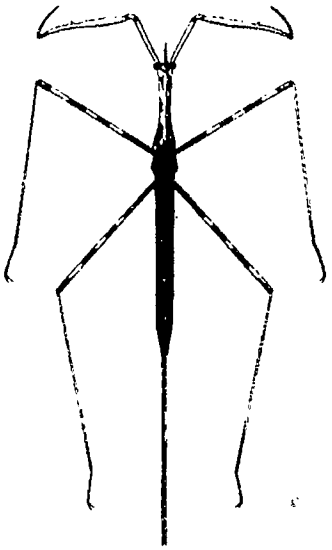
9. *Red maple*



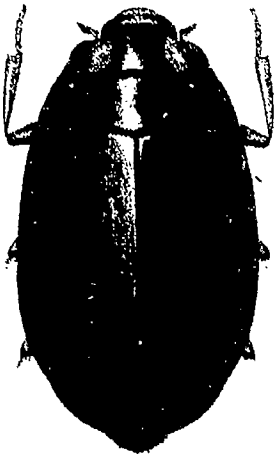
10. *Loblolly pine*

Answer Sheet to Aquatic Life Illustrations

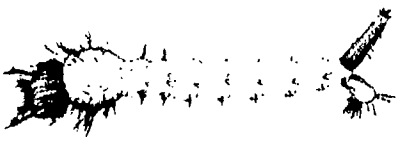
1. *Hellgrammite, Dobsonfly larva*



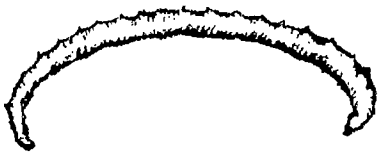
2. *Water scorpion*



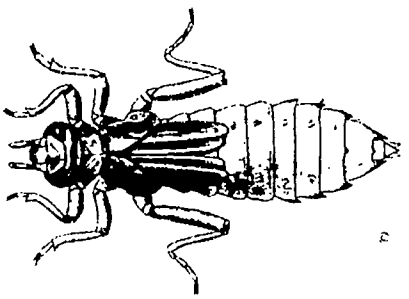
4. *Whirligig beetle*



3. *Mosquito larva*



5. *Aquatic worm*



6. *Dragonfly nymph*

On-Site Activity #1 — Life at the Bottom

Curriculum Objectives:

Grade 4
- Communication Skills: listening, reading, vocabulary and viewing comprehension
- Guidance: group interaction
- Healthful Living: recreational safety
- Mathematics: measurement
- Science: living things–animals, adaptation to environment, interdependence of animals
- Social Studies: gather, organize and analyze information; draw conclusions, participate effectively in groups

Grade 5
- Communication Skills: listening and visual comprehension
- Guidance: group interaction
- Healthful Living: recreational safety
- Math: measurement
- Science: earth science, environment
- Social Science: organize and analyze information, draw conclusions, participate effectively in groups

Grade 6
- Communication Skills: listening and visual comprehension
- Guidance: group interaction
- Healthful Living: environmental health, recreational safety
- Math: measurement
- Science: ecology
- Social Science: organize and analyze information; draw conclusions; participate effectively in groups

Location:
Rental boat dock at Park Lake

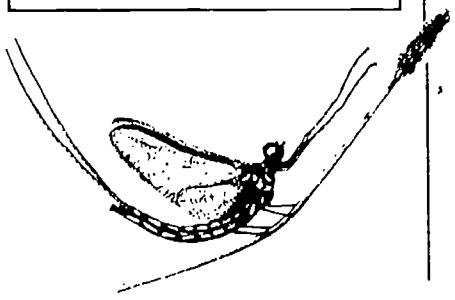
Group Size:
30 or fewer in groups of 5 or less

Estimated Time:
1 - 1 1/2 hours

Appropriate Season:
Spring, summer, fall

Credits:
Adapted from "A Field Manual for Water Quality Monitoring, an Environmental Education Program for Schools" by Mark K. Mitchell and William B. Stapp.

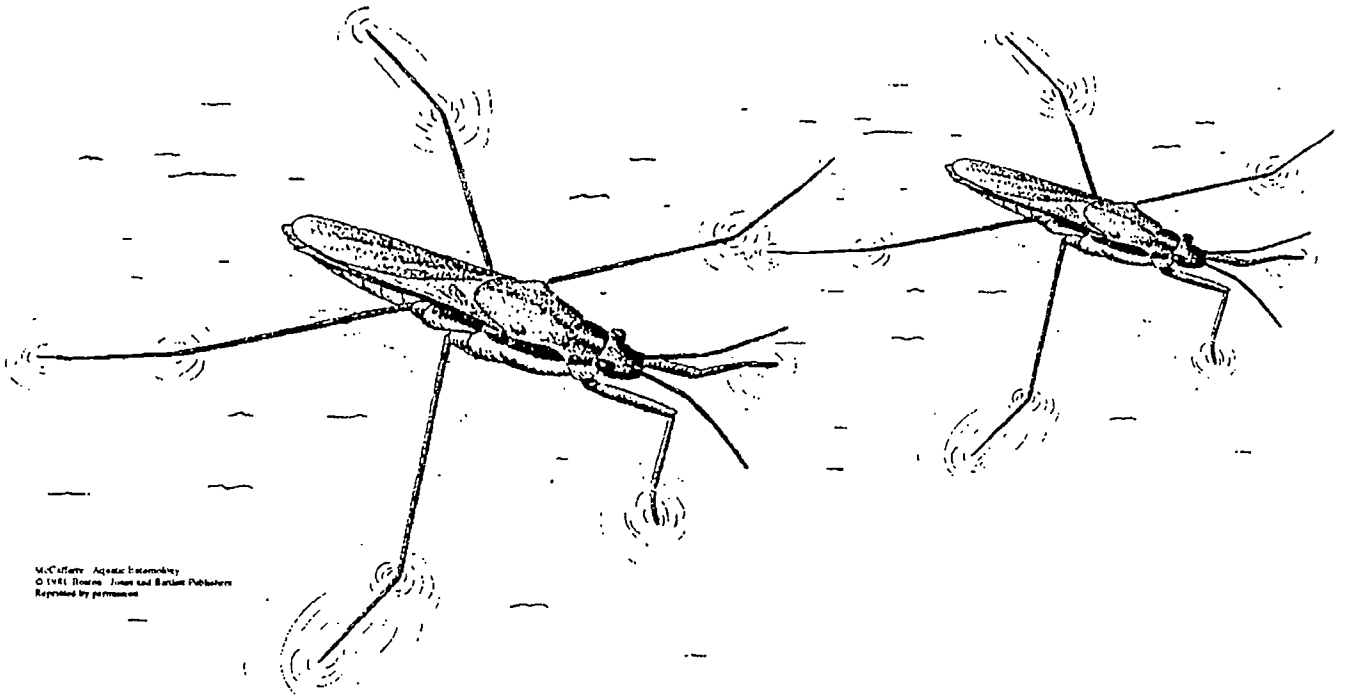
Materials:
Provided by educator:
Per student: pencil, clipboard, "Aquatic Sampling" worksheet, "Key to Aquatic Macroinvertebrates of the Catawba River Watershed," "Pollution Tolerance of Macroinvertebrates"
Provided by park:
Per student: life jackets
Per group: bottom sampling device, kick net, seine net, dip net, plastic cups, aquarium or white tray, dissecting scope, magnifying glass, tweezers or plastic spoons, field guides, table, laminated "Aquatic Macroinvertebrate Key," rubber gloves, extra activity sheets, examples of adult macroinvertebrates



Special Considerations:
Carry rescue throw rope. All students will wear life jackets during this activity. Students should wear gloves when sorting samples. Handle organisms carefully so that they are not harmed and return them to the water after the activity. Before the activity, advise students of appropriate dress (i.e. old shoes without holes in them, old jeans, etc.) Make sure participants bring a complete change of clothes.

Major Concepts:
- Water quality
- Aquatic sampling
- Indicator species
- Aquatic habitats
- Basic anatomy
- Species identification
- Human influence on water quality

Objectives:
- Describe three characteristics of an aquatic macroinvertebrate.
- Key out three macroinvertebrates.
- Define indicator species.
- Name three indicator species and explain how they are used to determine water quality.
- Use keys and field guides to identify unknown aquatic specimens.
- List three or more ways humans affect aquatic life.



Educator's Information:

In ponds and other aquatic environments the presence or absence of certain organisms, called indicator species, reveals much about the quality of the water. These creatures comprise an aquatic index. That is, their absence or presence tells us something about water quality.

Water with a rich and varied range of aquatic creatures is usually a healthy environment, whereas water with just a few species usually indicates less healthy conditions. "Healthy" is used here to mean an environment supportive of life. Pollution generally reduces the quality of the environment and in turn the diversity of life forms. In some cases the actual biomass or amount of living material will increase due to pollution, but the diversity inevitably goes down.

The major purpose of this activity is for students to be able to recognize indicators of water quality in Park Lake and other aquatic habitats.

The students will be involved in collecting macroinvertebrates in the lake and must be dressed appropriately. Life jackets must be worn at all times. A first aid kit will be available.

Park staff will discuss safety considerations and the educator will assist in seeing that all safety precautions are followed. The students will work in groups of four or five, with one person recording the data. After completing the worksheet, students will gather and discuss their results with the park staff.

Have the students read the Student's Information and complete Pre-Visit Activity – "Key It Out." Discuss these topics as a class prior to your visit.

Student's Information:

"Water, Water everywhere nor any drop to drink." So says the sailor in Samuel Taylor Coleridge's "Rime of the Ancient Mariner" as their boat is becalmed at sea. Fortunately, in our area **water** is everywhere and there seems to be plenty to drink. But that may be changing as Lake Norman becomes more developed and is used by more people. Lets take a closer look at water and discover what a fragile and sensitive resource it is.

What is water? The dictionary defines water as a colorless, odorless transparent liquid occurring on earth as rivers, lakes, oceans, etc., and falling from the clouds as rain, snow, ice, etc. Water occupies more than 70 percent of the earth's surface, and it makes up approximately 60 percent of the human body. You may have heard the saying "Water is life." Think about it for a minute. Can you think of any living **organism** that does not depend on water?

David Quammen, in his book, *Natural Acts, A Sidelong View of Science and Nature* says, "Without life, there would still be water. Without water no life."

Recipe for a Lake

Water comes in many forms. To really appreciate it you need to pick out one of its many forms and get to know it personally. For your visit to Duke Power State Park you need to know more about water in the form of a lake.

What is a lake? A lake is defined as a large, inland body of fresh or salt water. Lake Norman is the largest of a series of man-made reservoirs located along the Catawba River. The river is the result of springs, streams and creeks joining together to produce a larger **volume** of flow. These smaller bodies of water are called **tributaries**. The land that a river and its tributaries flow through is called a **watershed**. A healthy river must have a well protected watershed because any kind of disturbance to the watershed has an effect on the river and the lake into which it flows.

Life in a Lake

The various forms of life found in a lake can be compared to a fine stew or soup. Just like a lake, a fine stew or soup needs lots of different ingredients. Usually the more you add, the better the stew. A stew also needs small amounts of spices to make it taste just right. If you try to make a stew with just one ingredient, or if you leave out an important spice, your stew is not going to be good.

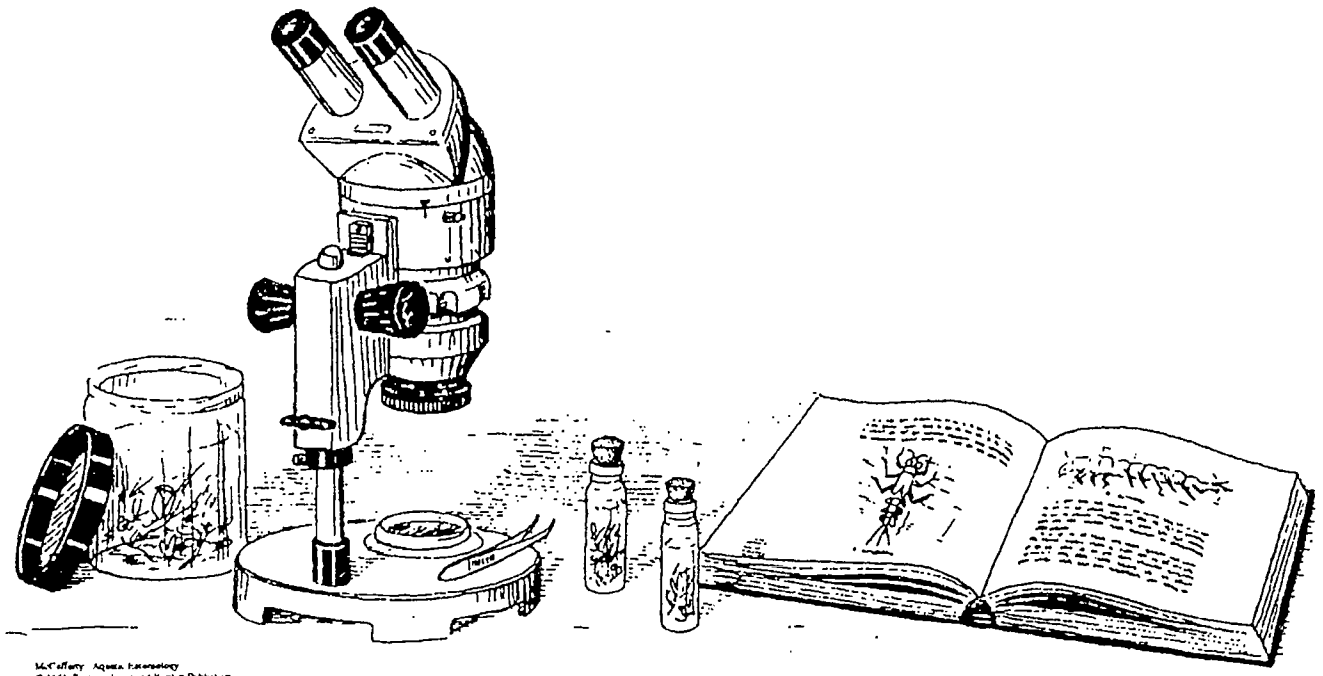
Here then is a recipe for a fine, healthy lake.

Some sunlight – just enough for **algae**, moss, diatoms and **aquatic** plants to **photosynthesize**. (Too much sun heats up the water and robs it of **dissolved oxygen**.)

Dissolved oxygen and carbon dioxide – all the animals in the lake need dissolved oxygen to breathe. These same animals breathe out carbon dioxide which is essential for algae and other aquatic plants. These plants in turn take in the carbon dioxide and give off oxygen.

Fallen leaves – they provide the main source of energy for a river system and thus for a lake as well. In the fall, leaves drift down from the trees into the water where they soon sink to the bottom or get caught in logjams or wedged between rocks. At this point, bacteria and fungi climb aboard the leaves and begin to "munch out," causing the leaves to decompose and break down into smaller pieces. The half-eaten leaves, bacteria and fungi are eventually swept downstream where they provide food for munchers, grazers and filter feeders – the wonderfully adapted **macroinvertebrates** (macros), such as stonefly **nymphs**, mayfly nymphs, and caddisfly **larvae**. These organisms further break down the leaves into a very fine mulch called **detritus**.

In addition to the munchers, grazers and filter feeders, there are other types of macroinvertebrates that prey on other macroinvertebrates. Lots of



different kinds of macros are a sign of a healthy lake or river.

Aquatic plants and animals – aquatic plants provide cover for macros and small minnows. All the aquatic animals in the lake provide food for each other and non-aquatic animals in a complex **food web**. When all these various plants and animals die or excrete waste, they return essential nutrients that were borrowed so that they could live.

Various minerals – the fine spices of a lake include calcium bicarbonate, potassium, nitrates and phosphates. These ingredients help balance a lake's **pH**, provide building material for the shells of snails, **mussels**, clams and crayfish, help fish breathe more efficiently and act as natural fertilizers essential for aquatic plants.

These are just the minimum ingredients needed for a healthy lake or river. Now mind you, a lake or river needs only natural ingredients; unnatural ingredients can have a bad effect. David Quammen sums up what makes a healthy lake or river when he talks about a trout stream. "A good trout stream must first be an excellent **insect** stream, a superior haven for algae and fungi and bacteria, a prime dumping ground for dead leaves, a surpassing reservoir of oxygen and calcium. It will then also, and thereby, be a good osprey stream, a favorite among otters, a salvation to dippers and kingfishers and bank swallows and heron, mergansers and Canada geese and water shrews, mink and muskrat and beaver. Not to mention the occasional grizzly bear. And who knows but that, sometime, a human might want to drink."

If there are plentiful numbers of many different **species** of plants and animals in a lake, then we have a healthy lake. Taking samples of these aquatic plants and animals is a means to monitor the quality of a lake's waters.

Instructions:

1. Park staff will lead a brief discussion focusing on: macroinvertebrates (macros), what they are and why they are important; **metamorphosis**, what it is and how it is accomplished; and **indicator species**, what they are and how they are used to determine the health of a lake. Park staff will also cover how to use sampling equipment and safety precautions that must be followed when using the equipment.

2. Have the students fill in Part A of their worksheet and complete their predictions for Park Lake's **aquatic index**.

3. Briefly review the macroinvertebrate **key**. Be sure to point out that the key is not complete and that the students should therefore key organisms as close as possible. For example, there are 186 dragonfly species in North Carolina. The key shows just one dragonfly larva species but the illustration should be close enough that the students should be successful at identifying any dragonfly larva they find.

4. Demonstrate the technique of collecting bottom samples.

a. Neatly coil the rope and tie the end to the dock.

b. Throw the attached bucket as far as possible out over the lake.

c. Allow the bucket to sink to the lake's bottom.

d. Slowly pull the bucket along the bottom for a few yards then quickly pull it to the surface.

5. Demonstrate the techniques of sample analysis.

a. Fill an aquarium or white tray half way with water.

b. Allow the excess water to drain from the bucket.

c. Put on rubber gloves and pick up some of the mud sample.

d. Spread the sample out evenly on the seine. Keep the seine net at least one inch off the ground whenever there is a sample in it.

e. Carefully pour water over the sample using a plastic cup to wash away **silt**/debris.

f. Search for organisms. (You may have to use magnifying glasses.)

g. Using tweezers or plastic spoons, carefully remove the organisms and place in the aquarium or white tray that is filled halfway with water.

h. Place the aquarium or white tray on the table for observation/identification, using the field guides, laminated invertebrate key and the examples of adult macroinvertebrates.

i. Complete the worksheet.

j. Return all organisms to the water after completing the research.

6. Demonstrate the use of dip, seine and kick nets.

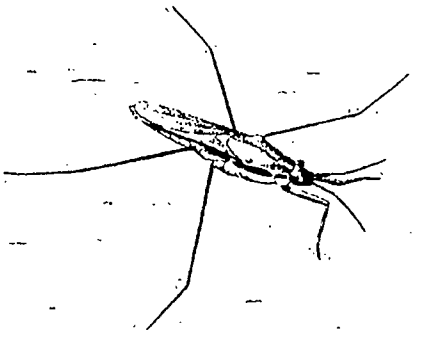
7. Divide the class into groups of five or less, have them pick up their equipment and instruct them to collect samples. As soon as the samples are collected, have the groups move to the shore to complete their worksheets. Remind the students to return the organisms to the water after the animals have been identified.

8. After collecting samples, each group should identify the aquatic macroinvertebrates using the "Key to Aquatic Macroinvertebrates of the Catawba River Watershed." They should also use field guides and dissecting scopes to aid in identification. Have them record their answers on the "Aquatic Sampling Data Sheet" and use their results to determine the Aquatic Index Value (relative health) of the lake.

The Aquatic Index Value groups macros into three categories based on how tolerant or sensitive they are to changes in **water quality**.

Group I includes macros that are very intolerant to water **pollution**. The dominant presence of Group I species is an indication of good water quality. Group I is given an index value of 3.

Group II includes macros that are moderately tolerant to a reduction in water quality. They are given an index value of 2.



Group III represents macros that are tolerant to pollution. Their dominance indicates poor water quality. They are given an index value of 1. The students will learn how to calculate the Aquatic Index Value by using a simple formula:

(3 x number of Group I)
(2 x number of Group II)
+ (1 x number of Group III)

= **Aquatic Index Value**

9. After the students have identified their specimens and determined the Aquatic Index Value, park staff will lead a group discussion summarizing what they've learned, what they've identified from the lake, and the importance of indicator species and the Aquatic Index Value.

10. Instruct the groups to gather their equipment, clean it and return it to where they found it.

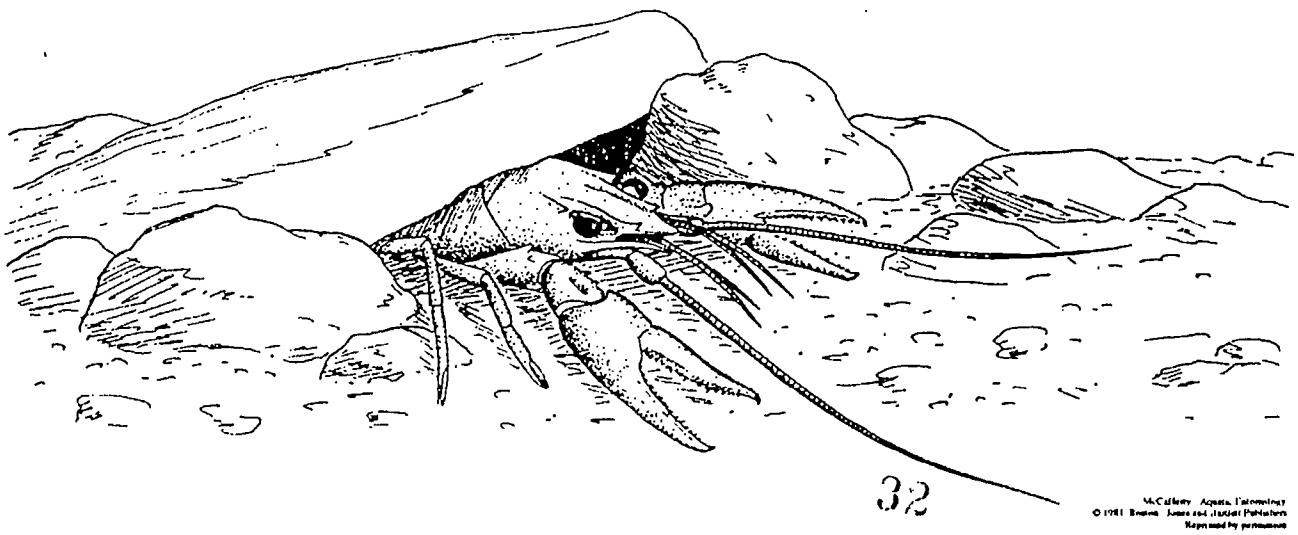
11. Gather the whole class and have each group present their findings. According to their study, what is the rating of the park lake's water quality? How does it compare to the students' initial prediction? If different, encourage students to explore reasons. Do different groups have different results? If so, explore reasons why. (Answers: improper collection/ identification techniques by some; weather; drastic changes in watershed within recent time; etc.)

Suggested extensions:

1. Sample Lake Norman's bottom **sediments** and compare the results to those from the Park Lake.

2. Sample different locations on Park Lake (i.e. below the park lake bridge, near the mouth of the creek, etc.) and compare and contrast results.

3. Sample stream beds of different streams feeding the park lake and compare and contrast results.



Aquatic Sampling Worksheet

Name: _____ Date: _____

Location: _____

Methods used to sample: _____ Aquatic Index Value: _____

A. Prediction of Park Lake's Aquatic Index: Excellent Good Fair Poor
Circle your choice. Why do you think Park Lake will have this Aquatic Index?

_____

_____

B. Instructions:

1. Use the "Key to Aquatic Macroinvertebrates" or "Pollution Tolerance of Macroinvertebrates" chart to identify organisms.
2. Record the species of organisms found in the space below, using the chart to classify them by their tolerance levels. (See example below.)

Group I	**Group II**	**Group III**
1.	1.	1.
2.	2.	2.
3.	3.	3.
4.	4.	4.
5.	5.	5.
6.	6.	6.
7.	7.	7.
Total =	Total =	Total =

3. Calculate the Aquatic Index Value by multiplying the number of species of organisms in each group by the index value for that group. Then, add the resulting three numbers to obtain the Aquatic Index Value (see example below).

(3 x no. of species - Group I)
(2 x no. of species - Group II)
+ (1 x no. of species - Group III)
= **Aquatic Index Value**

Cumulative Index Values	**Aquatic Index Rating**
23 and above	Excellent
17 to 22	Good
11 to 16	Fair
10 to less	Poor

Group I	Group II	Group III
1. hellgramite 4. caddisfly	*1. dragonfly*	*1. black fly*
2. mayfly 5.	*2. crayfish*	*2. freshwater worm*
3. snail	*3.*	*3.*

(3 x **4**) + (2 x **2**) + (1 x **2**) = **18**

[**18** is the aquatic index value, which is a good rating according to the chart above]

Adapted from *A Field Manual for Water Quality Monitoring*, An Environmental Education Program for Schools by Mark K. Mitchell and William B. Stapp.

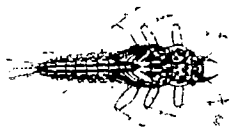
4. How would you describe Park Lake's water quality based on its Aquatic Index?

5. What do you think has caused or contributed to the water quality?

Pollution Tolerance of Macroinvertebrates

Group I - Index Value = 3
These macroinvertebrates can not tolerate pollution or changes in water quality. Their presence or dominance generally indicates good water quality.

Mayfly nymph



Hellgrammite
(dobsonfly larva)

Freshwater mussel

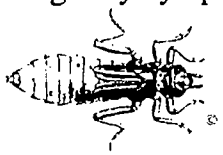
Stonefly nymph

Riffle beetle adult

Caddisfly larva

Group II - Index Value = 2
These macroinvertebrates can exist in a wide variety of water quality conditions.

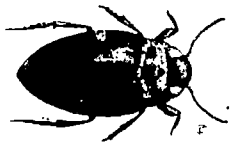
Dragonfly nymph



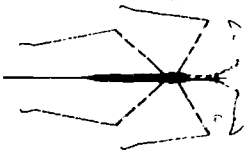
Damselfly nymph

Crayfish

Predaecous diving beetle



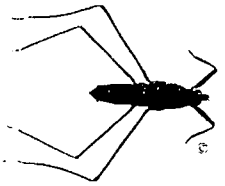
Water scorpion



Scud

Whirligig beetle

Water strider



Isopod (Sowbug)

Group III - Index Value = 1
These macroinvertebrates can exist in polluted water. Their dominance indicates poor water quality.

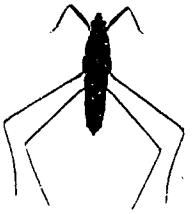
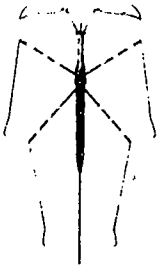
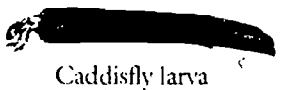
black fly larva

leech

freshwater worm

Key to Aquatic Macroinvertebrates

Macroinvertebrates

- with shells
  - double shell
    - shell attached to submerged objects
      - 
      - *Zebra mussel (T)
    - shell unattached
      - shell oblong
        - 
        - Native freshwater mussel (I)
      - shell triangular
        - 
        - *Asian clam (T)
  - single shell
- obvious legs
  - three pairs of legs
    - two pairs of wings
      - chewing mouth parts, front wings thick (beetles)
        - hind legs short (swims on surface)
          - 
          - Whirligig beetle Adult (M)
        - hind legs long
          - hind legs paddle-like (swims rapidly)
            - 
            - Predaceous diving beetle (M)
          - hind legs not paddle-like (crawls on submerged objects)
            - 
            - Riffle beetle adult (M)
      - sucking mouth parts (true bugs)
        - thin body, long spider-like legs
          - skates on water surface
            - 
            - Water strider adult (M)
          - walks on bottom near plants
            - 
            - Water scorpion adult (M)
        - thick body, up to 3" long
          - 
          - Giant water bug adult (M)
    - no wings, some undeveloped wing pads
  - entire body soft except head and thorax
    - dark brown to black body, prominent pinching jaws
      - 
      - Hellgramite, Dobsonfly (M)
    - white to greenish body, with or without portable case
      - 
      - Caddisfly larva (I)
      - 
      - Caddisfly larva with case (I)

** Non-native nuisance species. The Zebra mussel is not yet known from North Carolina. It is moving into the southern states. Report its occurrence to Park, Wildlife or Duke Power authorities.*

of the Catawba River Watershed

LEGEND	
Pollution Tolerance	Index Value
(I) – Intolerant	Group 1
(M) – Moderate	Group 2
(T) – Tolerant	Group 3

without shells

no obvious legs

more than three pair of legs (crustacea)

small claws on front legs

body flattened side to side

Anphipod scud (M)

body flattened top to bottom

Isopod, Sowbug (M)

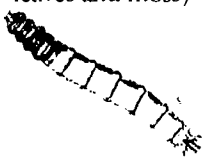
large claws on front legs

Crayfish (M)

worm-like

small appendages

no obvious head (lives on submerged leaves and moss)



Cranefly larva (M)

obvious head

rounded abdomen (attached to rocks and sticks, lives in groups)

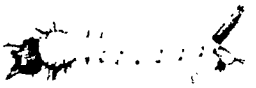
Black fly larva (M)

slender abdomen

bright red body (lives on submerged objects)

Chronomid midge (T)

small hairs on body (lives in stagnant water)



Mosquito larva (T)

no appendages

flattened, gray to black color

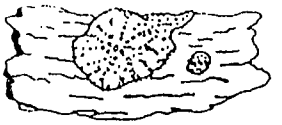
Leech (T)

cylindrical, red color

Aquatic worm (T)

sponge or jelly-like, grows on submerged objects

usually a flattened pad



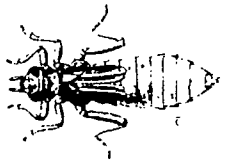
Freshwater sponge (M)

ball-like

Bryozoa (M)

entire body exoskeleton hardened, flattened

no obvious tail



Dragonfly nymph (M)

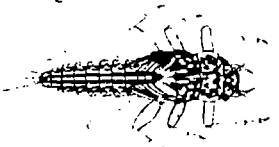
obvious tail

three tails

tails broad, leaf-like

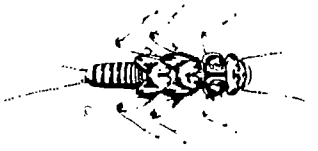
Damselfly nymph (I)

tails slender, gills on abdomen



Mayfly nymph (I)

two tails, no gills on abdomen



Stonefly nymph (I)

Post-Visit Activity #1 · Park Lake

Curriculum Objectives:
Grade 4
- Communication Skills: listening, reading, vocabulary and viewing comprehension; study skills using environmental sources
- Guidance: evaluate the importance of familiar jobs, competency for interacting with others
- Library/Media Skills: work independently and creatively in preparing assignments
- Science: living things–animals, adaptation to environment, interdependence of animals
- Social Studies: gather, organize and analyze information; draw conclusions, use maps, participate effectively in groups

Grade 5
- Communication Skills: listening and visual comprehension, study skills
- Guidance: competency and skill for interacting with others
- Science: earth science, environment
- Social Science: organize and analyze information, draw conclusions, use maps, participate effectively in groups

Grade 6
- Communication Skills: listening and visual comprehension, study skills
- Guidance: competency and skill for interacting with others
- Healthful Living: environmental health
- Science: ecology
- Social Science: organize and analyze information, draw conclusions, use maps, participate effectively in groups

Location: Classroom

Estimated Time:
One to three 45 minute periods

Appropriate Season: Any

Credits:
This activity was adapted from the Aquatic Project WILD activity, Dragonfly Pond.

Materials:
Provided by educator:
Per student: one copy of Student's Information
Per three students: scissors, masking tape, paste or glue, paper, one copy of each of "Land Use Cutouts," "Park Lake Maps"

Major Concepts:
- Human impact on watersheds
- Water quality
- Land use planning and its effect on a lake
- Preservation of natural areas
- Resource management

Objectives:
- Evaluate the effects of different imaginary land uses on Park Lake.
- Discuss and list five ways to reduce damages to Park Lake.
- List three ways that people can change their life-styles to reduce damages to water quality and to Park Lake.
- List three ways local businesses, industries and communities could change the way they do business to decrease their damaging effects on water quality and on Park Lake.

Educator's Information:

The major purpose of this activity is to encourage the students to wrestle with potentially conflicting land-use concerns in an effort to preserve Park Lake and its watershed. After the students reach agreement about where to place local land-uses, they will consider how their decisions affect the aquatic resources downstream. End the activity with consideration of the idea that the earth's aquatic resources are all interconnected, so all land use activities affect other things.

Student's Information:

Every human use of land and **water** affects plant, animal and human **habitats**. What humans do with the world's resources shows what is important to us and our **lifestyles**. The search for the "good life" and all of its conveniences produces mixed results for plants, wildlife and the environment. Some people see natural areas as little more than raw material for human use. Others believe the natural environment should be preserved regardless of human needs. Still others look for a balance between these outlooks. Very real differences of opinion exist between well-meaning people!

Given the extensive impact humans have on the earth, a major challenge we now face is how to be more responsible about this impact. We must develop the awareness, knowledge, skills and commitment necessary to encourage others to act responsibly when it comes to taking care of **watersheds** and the remaining natural areas. We must develop the necessary understanding to restore areas long disturbed by humans.

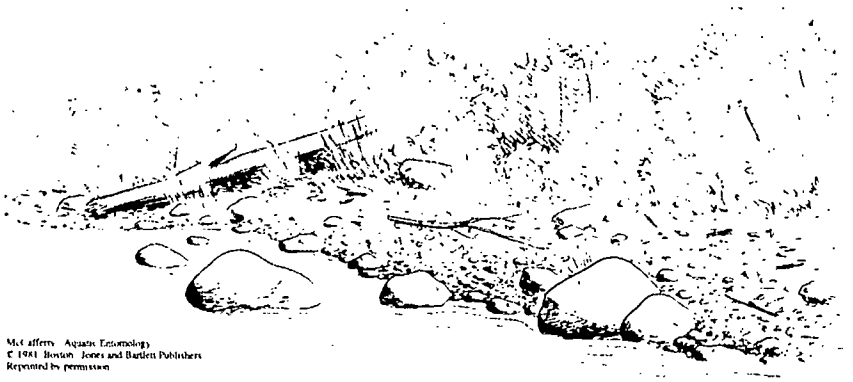
At the center of land use issues is the concept of growth. Growth in natural systems has inherent limits, imposed by a dynamic balance of energy between all parts of the system. Energy in natural systems is translated into food, water, shelter, space and survival. This means that natural systems are self-regulating. This capacity for self-regulation makes it possible for all natural members of an **ecosystem** to live in harmony. All life forms of any ecosystem must be considered. The **macroinvertebrates** in the water are just as necessary to a habitat as the plants and fish. It is this natural balance, with all its inherent and essential parts, that much of human land use has disturbed. Human activities often go beyond the natural limits of a setting.

The Lake Norman area is growing rapidly. Homeowners and industry are spreading out from our cities into the lake area. They seek undeveloped land to use and help our local economy by creating new jobs. This is good, but sometimes development conflicts with protecting the lake and the plants and animals living in and around the lake. This is where different people have different ideas about how to best use the land and water from Lake Norman and still ensure the lake is clean.

Think back to your visit to Duke Power State Park. We know Lake Norman provides water to many towns and cities for drinking, industry and **sewage** treatment. Lake Norman is also used for recreation and is home to a wide variety of plants and animals.

Humans have the ability to import energy sources that allow a system to exceed its natural limits–or to remove energy sources that are necessary for a system to stay in balance. For example, people can dam rivers to make lakes, like Lake Norman, to provide power, drinking water and **irrigation**. Water from Lake Norman can be used in factories, mills, sewage treatment and other industries that need large amounts of water to produce certain products. All of these activities could affect life in Lake Norman.

So how do we make land use decisions that will benefit the local economy and still protect our natural resources? The following activity shows how difficult the decision-making process can be.



Instructions:

1. Prepare copies of the "Land Use Cutouts" and "Park Lake Map" for students. Explain that they will be responsible for arranging the pattern of land use within the Park Lake watershed to best protect this resource.

2. Divide the class into groups of three to five, with each group representing an interest group. Students will stay in these groups until the end of the activity. Interest groups are:

A. Farmers - want to clear and use land to produce food, livestock and lumber.

B. Highway department - wants to build access in the area to provide highways and fire, police and emergency medical services.

C. Permanent residents - want development, but not so much that their homes are affected by noise, traffic, **pollution**, etc.

D. Business interests - want to use the land for commerce and development (home builders, small business, etc.)

E. Public services - want to build and operate a **waste water treatment plant** in the area.

F. Adopt-a-State Park group - wants to help preserve additional land for the area park.

3. Pass out the "Land Use" and "Park Lake" worksheets. Have the students tape Park Lake Map together, cut out the land-use pieces and place them around the lake watershed upstream from the park boundary. Tell them that all of the land use pieces must be used, and none may be placed within the state park. The pieces can be cut smaller, but must not overlap. The students may also develop their own land uses.

4. Once the students have cut out the necessary materials and are ready to begin the process of making land use decisions, have them create a list of pros and cons for each land use. Guide the class discussion so they consider the consequences of each land use. Record these on the chalkboard.

The following are a few examples:

Natural Areas

PRO

- Provide outdoor recreation opportunities such as hiking and nature study
- Provide protection of natural communities and habitats, the watershed, and native **species**
- Bring tourist dollars into local economy as park visitors spend money at local businesses

CON

- Remove lands for possible development (i.e. agriculture, forestry, industry, etc.)

Farms

PRO

- Produce food
- Provide jobs
- Produce lumber and other wood products

CON

- Increase **soil erosion**
- Use chemicals (pesticides, herbicides, etc.) that may harm people and the environment
- Use fertilizers and produce animal wastes which increases nutrient load in the **aquatic** systems
- Sometimes destroy stream buffers, wetlands or other natural areas for fields or to harvest lumber

Homes

PRO

- Provide human shelter
- Provide jobs in construction and maintenance

CON

- Generate waste, sewage, and other pollution (i.e. used oil, lawn chemicals, etc.)
- Contribute to loss of natural areas (i.e. development and energy needs)

Waste Water Treatment Plant

PRO

- Provide for more development
- Provide treatment for waste water
- Provide jobs in construction, maintenance and operation of the plant

CON

- Discharge **effluent** containing chlorine and nutrients into the watershed
- Contribute to loss of natural areas (i.e. construction, maintenance and energy needs)

• Increase **runoff** from **impervious surfaces** (parking lot, roof, etc.) resulting from increased development

Restaurant

PRO

• Provide jobs

CON

• Contribute to loss of natural areas (i.e. energy needs)

• Increased runoff from impervious surfaces (parking lot, roof, etc.)

• Generate waste products

Highways

PRO

• Provide access to area and for emergency medical services

• Provide jobs in construction and maintenance of roads

CON

• Contribute to loss of natural areas (i.e. construction, maintenance and energy needs)

• Increase runoff due to impervious surfaces

• During construction, increase soil erosion

• Disrupt natural water flow and animal migration patterns

• Use herbicides that may harm people and the environment

Laundromat

PRO

• Provide jobs in construction and operation

CON

• Contribute to loss of natural areas (i.e. energy needs)

• May introduce significant amounts of polluted water into watershed

• Increase runoff due to impervious surfaces (parking lot, roof, etc.)

Gas Station

PRO

• Provide jobs in construction, maintenance and operation

CON

• Contribute to loss of natural areas (i.e. energy needs)

• Runoff may contain pollutants such as gasoline and oil

• Increase runoff due to impervious surfaces (parking lot, roof, etc.)

• May contaminate **groundwater** from leaking underground storage tanks

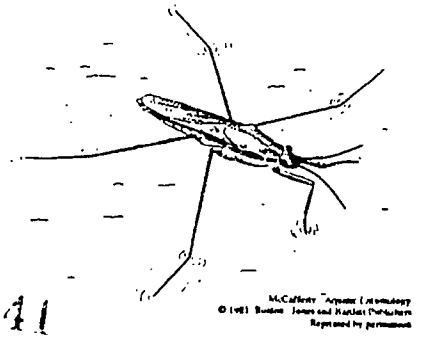
5. Have the students work in their teams long enough to begin serious debate over the land use decisions. Remind them that no land use can be excluded, the river corridor must be preserved, and everyone must reach consensus for each land use. Offer an opposing viewpoint should they need it. Have them lightly fasten the cut-outs to the map by placing small loops of tape on the back of them. This will allow the students to change their minds before they stick the cut-outs down permanently.

6. Invite each group to display and describe their work in progress. Encourage discussion of their choices.

7. Continue the discussion by asking more students to share their proposed plans. Again, be firm in discussing the consequences. Point out that shutting down the businesses or farms could negatively impact the economic base of the area.

8. Give the students additional time to work in their groups to come up with what they believe is the best possible land use plan. Be sensitive to their frustrations and display all the final landuse plans in the classroom for all to see and discuss. Analyze and discuss the merits of each of the approaches. Point out that although their solutions may not be perfect, they can reduce damage to the Park Lake watershed.

9. Display one of the groups' maps on the chalkboard. Next, draw "The Rest of Park Lake" connected to it. Label all the features as indicated.



10. Ask the students to brainstorm possible problems that could be faced within each of these aquatic systems (Norwood Creek, Hicks Creek, and Lake Norman) as a result of the human activities around the Park Lake watershed. Note that all the pollutants dumped into the Park Lake watershed eventually flow downstream. Make inferences and predictions about the potential consequences of these activities. For instance, you could emphasize the wastewater from the laundromat. How will it be treated? Where? By whom? Where will it go? With what effects?

11. Ask the students to look again at all of the land uses in this activity. If they had been considering any of them as inherently bad, have them consider a different question. What could the people who are in charge of these various businesses do to reduce the damage to Park Lake? Have the activity end with a positive emphasis on solutions rather than problems and have them write these solutions on the board.

12. Have the students create a list of things which they personally can do to reduce the potentially damaging effects of their lifestyles on the "downstream" areas they may never have thought about. If possible, invite them to report periodically, throughout the school year, on their progress in carrying out these new practices. Consider with them the idea that all of the waters of the earth are interconnected and are in fact part of a single "Park Lake" watershed.

Suggested extensions:

1. Organize a "Stream Watch" group in your community. Stream Watch groups "adopt" a waterway, or portion of one, and act on its behalf. They take care of the waterway by monitoring water quality, providing educational programs, removing litter, etc. For more information on Stream Watch, contact:

Stream Watch Coordinator, Division of Water Resources, NC Department of Environment, Health and Natural Resources, PO Box 27687, Raleigh, NC 27611, (919) 733-4064

2. Collect newspaper articles for local water-related and landuse issues as a current events activity.

3. Learn more about environmental impact statements. Try to obtain actual statements about natural areas in your region. See what concerns are addressed in these documents.

4. Learn more about private organizations that work to protect natural resources. Examples include:

The North Carolina Environmental Defense Fund, 128 E. Hargett St., Suite #202, Raleigh, NC 27601

The North Carolina Nature Conservancy, Carr Mill Mall, Suite 223, Carrboro, NC 27510

The Catawba Lands Conservancy, 1614 Fountain View Charlotte, NC 28203

Find out what they do and how they do it.

5. Find out about zoning laws and landuse regulations in your area by contacting the following:

City/County:
Director of City/County Planning/Zoning

State:
Division of Environmental Management
PO Box 27687
Raleigh, NC 27611

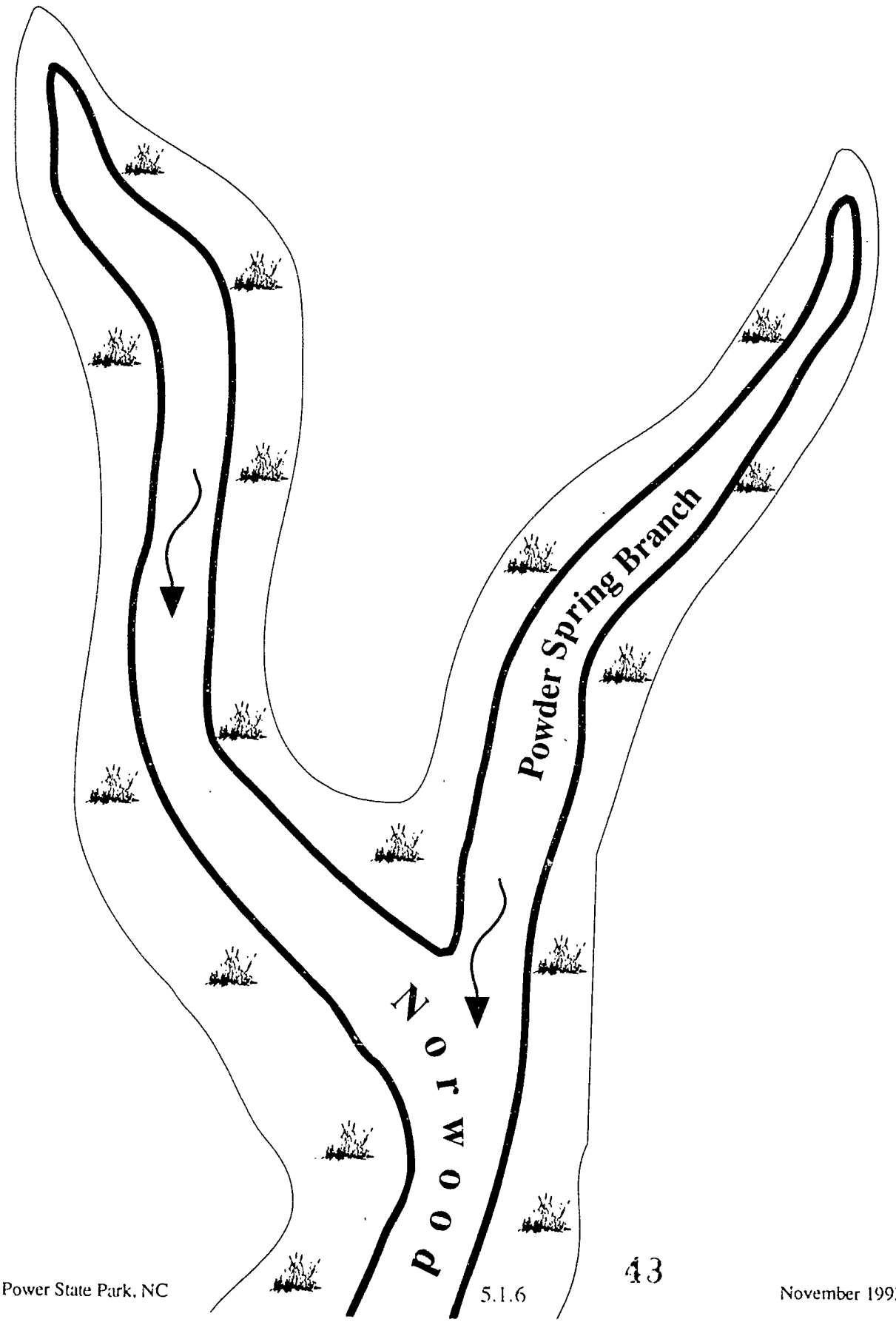
Would the plan your group proposed for the Park Lake watershed be allowed in your community?

6. Send a representative sample of the students land use plans to the park. (We would appreciate the feedback.)

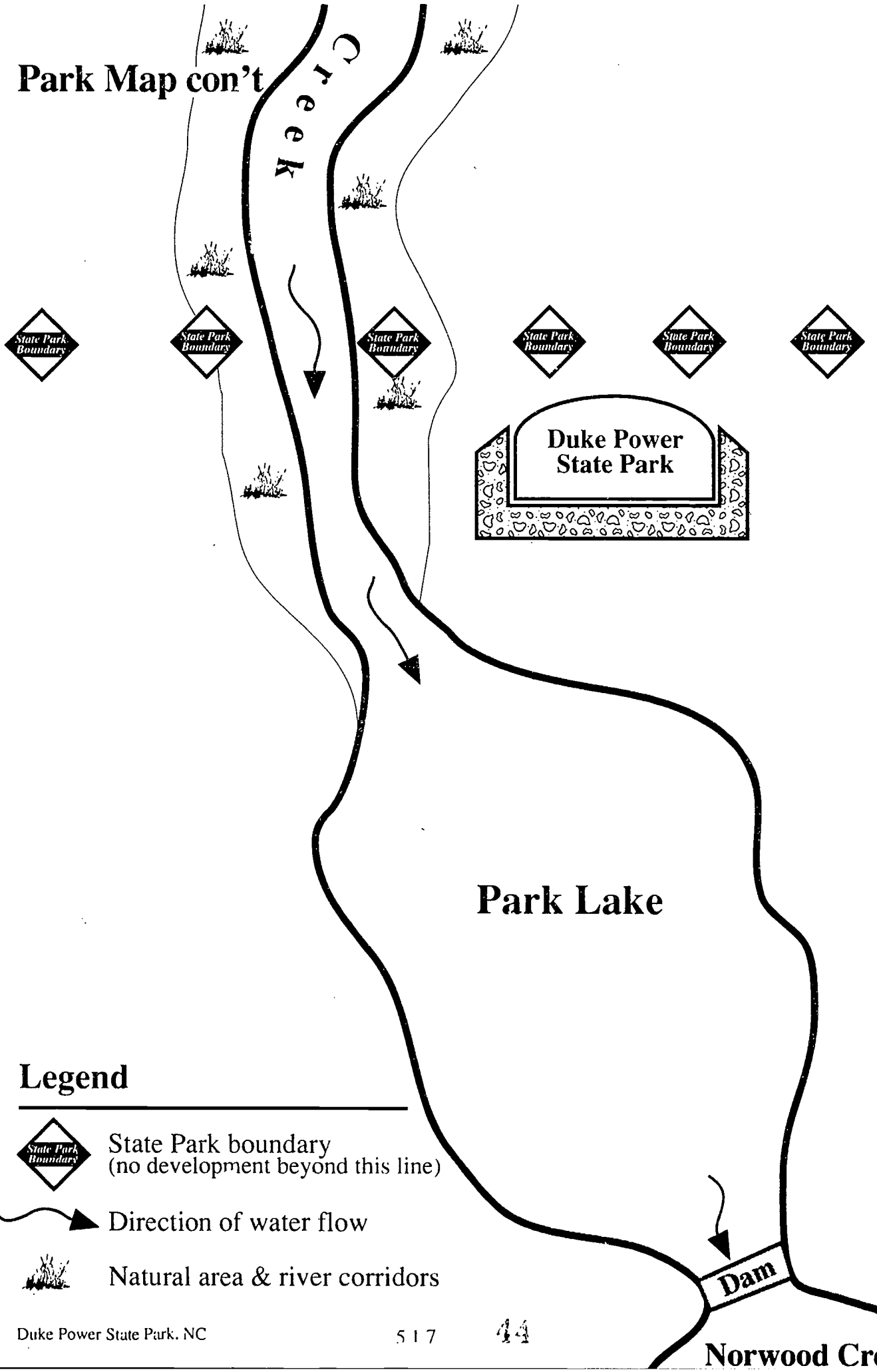
7. Write to the Iredell County Planning Board about any concerns you have with the water quality of Park Lake (the swimming lake) at Duke Power State Park or Iredell County at:

Planning Board, c/o Iredell County Planning Department, Attention: William Allison, PO Box 788, Statesville, NC 28677

Park Lake Map



Park Map con't



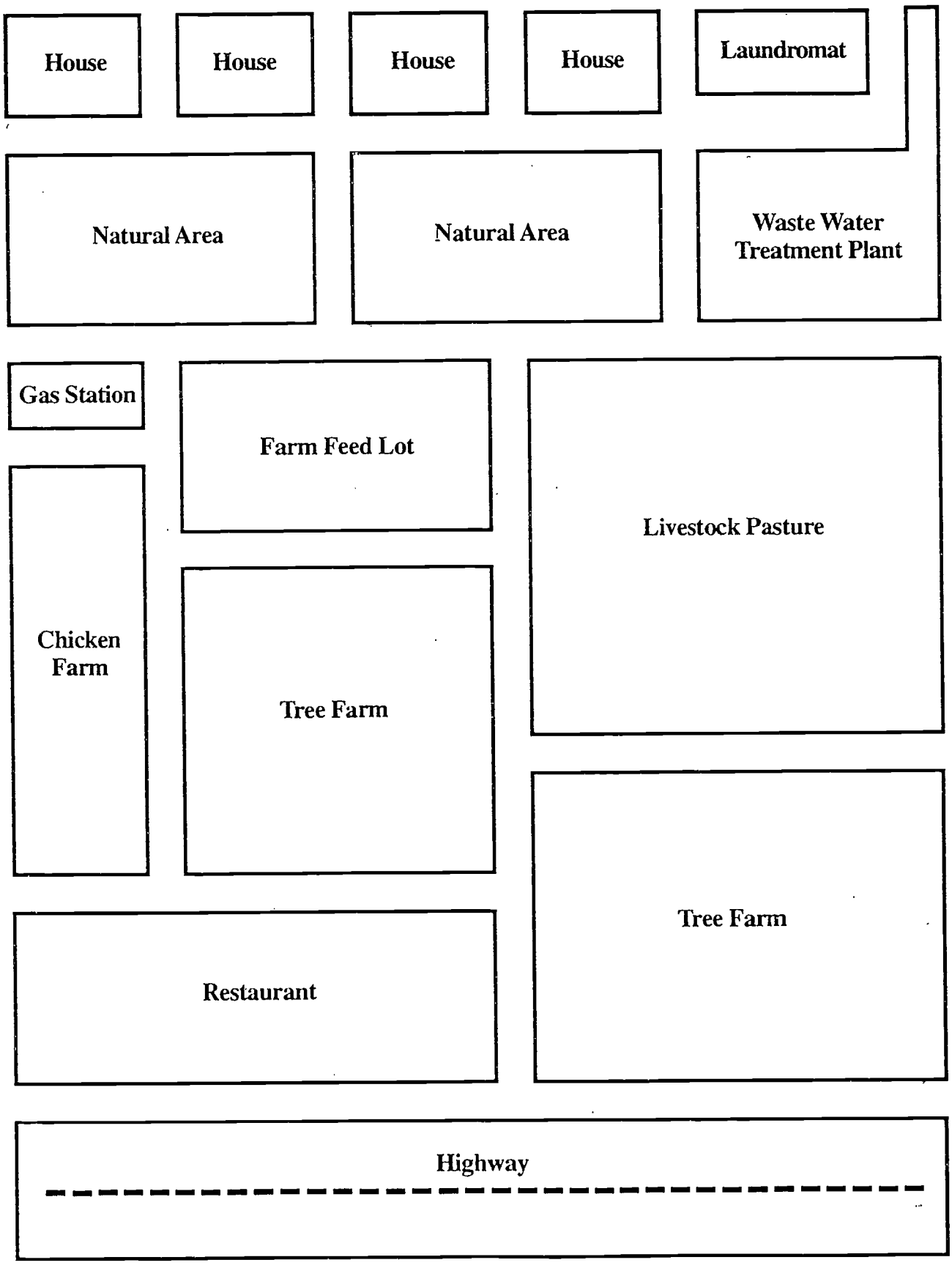
Legend

State Park boundary
(no development beyond this line)

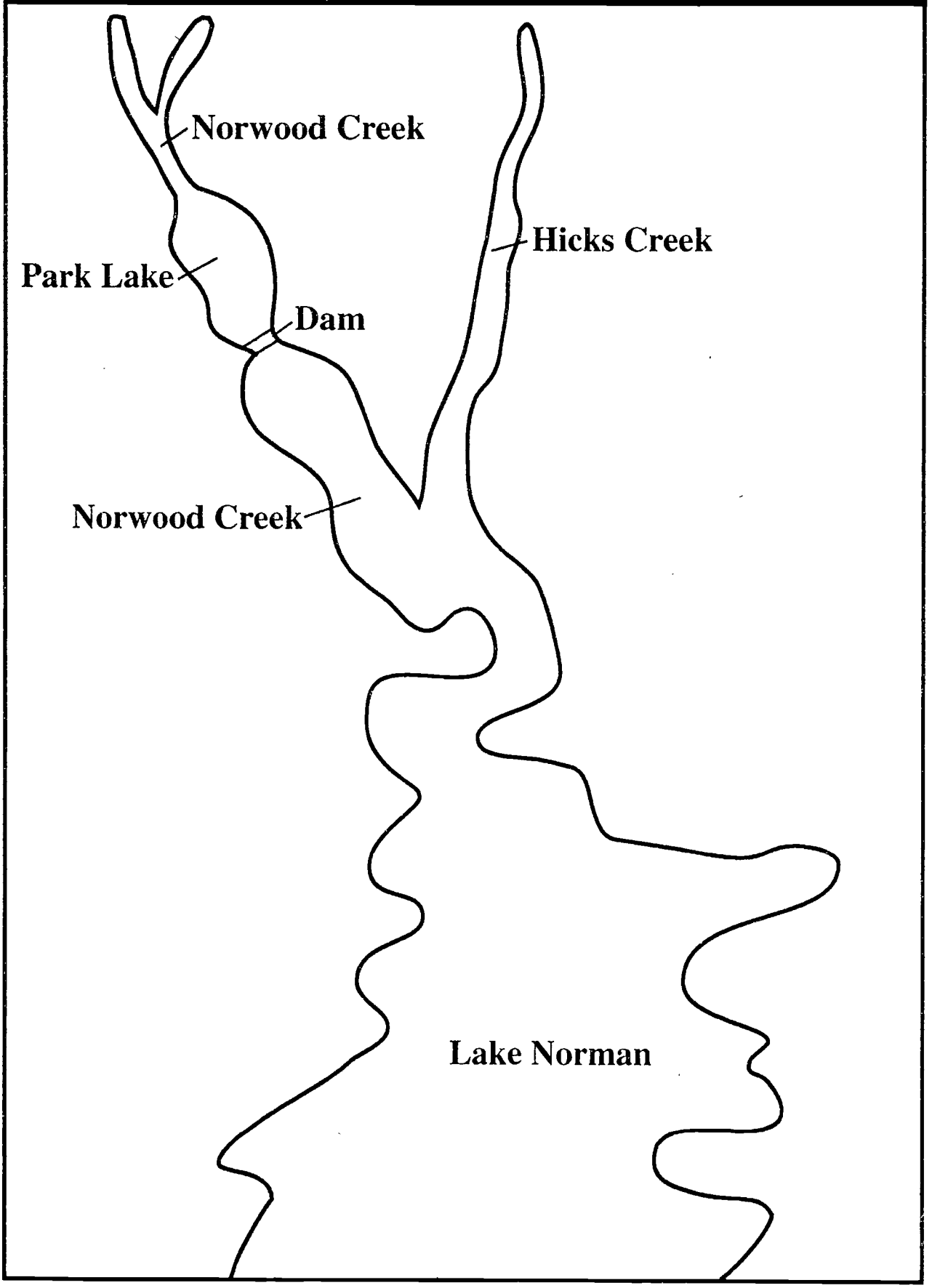
Direction of water flow

Natural area & river corridors

Land Use Cutouts



The Rest of Park Lake



VOCABULARY

Algae - Simple, one-celled or many-celled plants, capable of photosynthesis. They are usually aquatic and have no true root, stem or leaf.

Anatomy - The branch of biology that deals with the structure of plants and animals.

Aquatic - Living or growing in water.

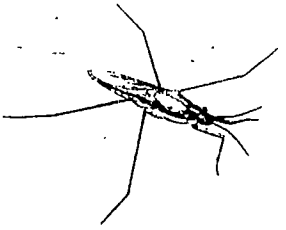
Aquatic index -The relative health of a water body. It is based on the tolerance or sensitivity of a macroinvertebrate to changes in water quality. It is calculated using a simple formula.

Biology - The science that deals with the origin, history, physical characteristics, life processes and habits of plants and animals.

Classification - The grouping of organisms into categories based on shared characteristics or traits. For example, any animal that has feathers is considered a bird and placed in the Class Aves. Furthermore, if the bird has its eyes in front rather than on the side of its head, it is a member of the Order Strigiformes (the owls).

Detritus - Dead organic matter, such as fallen leaves, twigs and other plant and animal material, which exists in any ecosystem.

Dichotomous - Divided into two parts, groups or classes, such as a dichotomous key. Using a dichotomous key, one can identify an unknown organism by following the one branch of each pair that best describes the organism.



Distribution - The act of scattering or spreading out; the geographic range of an organism.

Dissolved oxygen (DO) - The amount of oxygen gas molecules dissolved in water. Fish and other aquatic animals depend on DO to breathe.

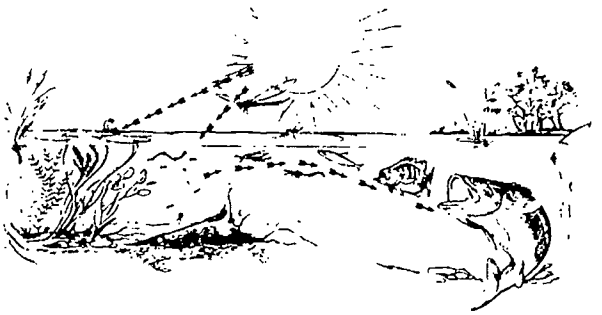
Ecology - The science of the relationships between organisms and their environments.

Ecosystem - Plants, animals and their physical surroundings which interact with environmental conditions, such as temperature and rainfall, forming an interdependent system.

Effluent - A liquid flowing out. The outflow of a sewer, septic tank, etc.

Erosion - The removal or wearing away of soil or rock by water, wind, or other forces or processes.

Food chain - The transfer of energy and material through a series of organisms as each one is fed upon by the next.



Food web - The interlocking pattern of food chains which exist in an ecosystem.

Genus - The taxonomic category located between species and family.

Groundwater - Water that fills the spaces between rocks and soil particles underground. Groundwater is replenished when rainwater trickles through the soil. Surface water, such as lakes and rivers, is often replenished by groundwater.

Habitat - The environmental conditions of an area where a plant or animal naturally grows or lives; its environment.

Impervious surface - A surface that doesn't absorb water, such as a paved parking lot.

Indicator species - An organism whose presence or absence in a particular environment can be used to determine the health of that particular environment.

Insect - Any animal in the Class Insecta. It has a head, thorax, abdomen and three pairs of legs on the thorax. As adults they usually have one or two pairs of wings attached to the thorax as well.

Irrigation - The pumping of water from ponds, lakes or rivers through pipes or canals to supply crops or livestock with water during periods of dry weather.

Key - An ordered list of significant characteristics of a group of organisms used to identify unknown species.

Larva - (larvae, plural) The immature form of an animal that changes structurally when it becomes an adult, usually by complex metamorphosis.

Lifestyle - A way of life, including attitudes, values and priorities.

Macroinvertebrate - Macro means "large", invertebrate means "without a backbone". An invertebrate usually large enough to be seen without the aid of magnification.

Metamorphosis - Meta means "change", morphe means "form". A change in form, structure or function as a result of development. A physical transformation undergone by various animals during development from the larval stage to the adult form. For example, through metamorphosis, a hellgrammite (larval form) becomes a Dobsonfly (adult form). The change from a tadpole (larval form) to a frog (adult form) is another example of metamorphosis.

Mussel - Any of the various freshwater or saltwater bivalves (meaning the two shells), held together by a strong muscle.

Nymph - The young of an insect that undergoes incomplete metamorphosis, differing from the adult primarily in size and structural proportions (i.e. wings).

Organism - A living thing. Examples include plants and animals.

pH - potential of hydrogen. A measure that indicates the relative acidity or alkalinity of a substance. The pH scale is a logarithmic scale ranging from 0 (most acidic) to 14 (most basic), with a pH of 7 being neutral.

Photosynthesis - The chemical process carried on by green plants in which the cells containing chlorophyll use light energy to produce glucose (a plant food) from carbon dioxide and water; oxygen is released as a by-product.

Pollution - A human-caused change in the physical, chemical or biological conditions of the environment that creates an undesirable effect on living things.

Runoff - Rain, melted snow and other materials that drain or flow off surfaces such as city streets, roofs, suburban lawns and agricultural land.

Sediment - Deposits of soil or organic matter which were suspended in water and then settled to the bottom. It is often deposited in the water by runoff.

Sewage - Liquid and solid waste mixed with water.

Silt - A sedimentary material consisting of fine mineral particles intermediate in size between sand and clay.

Soil - A collection of organic and inorganic particles, mainly composed of clay, slit, sand and gravel.

- clay - less than 1/256 of a millimeter (mm) in diameter
- silt - between 1/256 and 1/16 of a mm in diameter
- sand - between 1/16 and 2 mm in diameter
- gravel - over 2 mm in diameter

Species - The taxonomic category following genus which consists of similar organisms that can mate and produce fertile offspring.

Taxonomy - The branch of biology dealing with classifying organisms based on some common factor into naturally related groups.

Tributary - A stream or river flowing into a larger stream, river or lake. The Catawba River is the major tributary of Lake Norman.

Volume - A quantity, bulk, mass or amount. The amount of space occupied in three dimensions.

Waste water treatment plant - A facility where household, business and industrial sewage are treated to remove harmful bacteria and chemicals.

Water - A transparent, odorless, tasteless liquid compound of hydrogen and oxygen (H_2O) which occurs on the earth's surface as oceans, lakes, rivers, etc.

Water quality - A way of determining or measuring certain characteristics of water.

Watershed - The total land area that drains directly or indirectly into a particular stream, river or lake.

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SCHEDULING WORKSHEET

For office use only:
Date request received_____ Request received by_____

1) Name of group (school) _____

2) Contact person _____ _____
name phone (work) (home)

_____
address

3) Day/date/time of requested program _____ _____

4) Program desired and program length _____

5) Meeting place _____

6) Time of arrival at park _____ Time of departure from park _____

7) Number of students _____ Age range (grade) _____

8) Number of chaperones _____

9) Areas of special emphasis _____

10) Special considerations of group (e.g. allergies, health concerns, physical limitations)_____
_____

11) Have you or your group participated in park programs before? If yes, please indicate previous programs attended: _____
_____
If no, mail the contact person an Educator's Guide.

12) Are parental permission forms required? _____ If yes, please use the Parental Permission form on page 8.2.

I, _____, have read the entire Environmental Education Learning Experience and understand and agree to all the conditions within it.

Return to: Duke Power State Park
Route 2, Box 224 - M
Troutman, NC 28166

PARENTAL PERMISSION FORM

Dear Parent:

Your child will soon be involved in an exciting learning adventure - an environmental education experience at _____. Studies have shown that such "hands-on" learning programs improve children's attitudes and performance in a broad range of school subjects.

In order to make your child's visit to "nature's classroom" as safe as possible we ask that you provide the following information and sign at the bottom. Please note that insects, poison ivy and other potential risks are a natural part of any outdoor setting. We advise that children bring appropriate clothing (long pants, rain gear, sturdy shoes) for their planned activities.

Child's name _____

Does your child:

- Have an allergy to bee stings or insect bites?_____
  If so, please have them bring their medication and stress that they, or the group leader, be able to administer it.

- Have other allergies? _____

- Have any other health problems we should be aware of?_____
  _____

- In case of an emergency, I give permission for my child to be treated by the attending physician. I understand that I would be notified as soon as possible.

_____ _____
Parent's signature date

Parent's name _____ Home phone _____
(please print) Work phone _____

Family Physician's name _____ phone _____

Alternate Emergency Contact

Name_____ phone _____

NORTH CAROLINA PARKS & RECREATION
PROGRAM EVALUATION

Please take a few moments to evaluate the program(s) you received. This will help us improve our service to you in the future.

1. Program title(s) _____ Date _____

   Program leader(s) _____

2. What part of the program(s) did you find the most interesting and useful? _____

   _____

3. What part(s) did you find the least interesting and useful?_____

   _____

4. What can we do to improve the program(s)?_____

   _____

   _____

5. General comments _____

   _____

   _____

   _____

LEADERS OF SCHOOL GROUPS AND OTHER ORGANIZED YOUTH GROUPS
PLEASE ANSWER THESE ADDITIONAL QUESTIONS:

6. Group (school) name _____

7. Did the program(s) meet the stated objectives or curriculum needs? _____

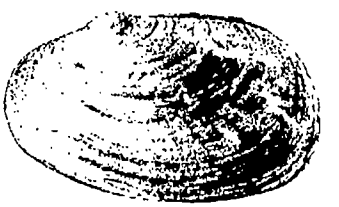
   If not, why? _____

   _____

Please return the completed form to park staff. Thank you.

Duke Power State Park
Route 2, Box 224 -M
Troutman, NC 28166

Notes



Notes