This brochure was a cooperative effort among Red Bluff Bidwell Elementary School, 5th/6th Grade students of teacher Julie Buer; Red Bluff Union High School ROP Sacramento River Discovery Center Natural Resource Intern Students under the direction of teacher Matt Prichard; and University of California Cooperative Extension Tehama County 4-H Youth Development Program Staff Jeanne George and Kirk Vail.

These students worked on the project after school: Brook Maplesden, Trey Nichols, Melissa Renteria, and Linda Servin.

Special thanks to Sacramento River Discovery Center and the Mendocino National Forest (USDA).

Agriculture and Natural Resources, 300 Lakeside Drive, 6th Floor, Oakland, CA 94612-3550, (510) 987-0096.

Welcome to Ben's Pond

Sacramento River Discovery Center
Red Bluff Recreation Area
Mendocino National Forest
1000 Sale Lane, Red Bluff
530.527.1196

Elevation:
230 ft

GPS Location:
N 40° 09' 24"
W 122° 11' 45.4"

UTM 10 T 0568478
4445456

How Do I Get to Ben's Pond?

The Sacramento River Discovery Center is located on the east side of the Sacramento River in Red Bluff. Take the I-5 Antelope Blvd. exit and go east to Sale Lane. Turn south and travel to the end of the road to the lower boat ramp. The pond is located northeast of the group camp. Walk through the group camp following the cement path to the pond.

What About the Pond?

The man-made pond was constructed in 1995 and serves as a research area of native flora and fauna for local school and community groups. Ben Sale, for whom the pond is named, donated his time and equipment to construct the pond. Ground water, rain, and overflow from the East Sand Slough of the Sacramento River supply the pond's water. After being dug, the perimeter of the pond was planted with native plants. Within three years, various water plants had established themselves, and a wide variety of wildlife has colonized the pond. The pond is a part of the forest restoration area which has been identified as a "watchable wildlife site" by the CA Department of Fish & Game.

What Life Is Around the Pond?

Sandbar Willow, Fremont Cottonwood and Cattails predominately ring the perimeter of the pond. Raccoons, deer, wild pig, lizards and snakes frequent the pond's habitat. Many birds visit the pond including blue jays, hawks, woodpeckers, magpies, red-winged blackbirds and migrating waterfowl. Living in the pond are sunfish, bass, catfish, minnows, bullfrogs and salamanders. Insects are abundant.

What Can You Do At The Pond?

Visitors can fish in the pond, do bird watching from the observation deck, explore the habitat, look for animal tracks, or walk their dog on a leash. Or just relax and enjoy the scenery.

How the Pond Was Mapped and What Was Learned?

The pond was mapped by 5th and 6th grade students with high school students helping in early May 2004. The students learned how to use the tools to map the perimeter and depth of the pond. The tools included compass, engineer's ruler, measuring tape and rope, plane table, sighting rod, alidade and sounding line.

The students learned the maximum depth in early May was 7 feet. The length of the pond was over 400 ft and up to 160 ft wide. The water level varies depending upon the ground water, the level of the Sacramento River, and annual rainfall. Their map represents the normal water surface of the pond on May 6, 2004.

May 2004

POND MAPPING

Draft Version January 2005

4-H SERIES

University of California

ACKNOWLEDGEMENTS

The Pond Mapping curriculum is a collaborative venture between the United States Forest Service and the University of California, Division of Agriculture and Natural Resources, Human Resource-Science, Technology, and Environmental Literacy Workgroup. The purpose for the collaboration was to develop activities for youth that will not only increase their environmental literacy, but also expand their mathematical skills. The pond mapping activities bring youth and adults together to explore nature and investigate what is below the pond's surface. The project was funded in 2002 by U.S. Forest Service Contract Number 02-01009E.

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TABLE OF CONTENTS

OVERVIEW

The activities in Pond Mapping are designed to be led by teens with youth as participants that are interested in exploring and learning more about their natural environment. Working together, teens and youth learn to make and use simple surveying equipment to map the bottom contours of a small body of water. Participants exercise their presentation skills by creating a product of their own design to share their research findings with local community groups.

Following is an overview of each of the sessions offered. Each session focuses on a different aspect of the Pond Mapping activity.

SESSION ONE: Getting Started introduces participants to different types of maps and how to read and use them. . Participants will learn common aspects of all maps, i.e. scale, legends, symbols, etc. They will also explore what is a watershed and the interconnection of a watershed and a pond.

SESSION TWO: Tools of the Trade, Part I provides activities for participants to learn about using a compass and understanding the scales and measurements of an engineer's ruler and measuring tape. They will also learn how to orient a map and determine their location by using a compass.

SESSION THREE: Tools of the Trade, Part II provides directions on how to construct simple surveying tools to map a pond. The participants will engage in activities that lead to an understanding of the science of measuring equipment and will develop skill at reading the equipment with accuracy.

SESSION FOUR: Being Prepared guides the participants through the process of selecting a body of water to map and encourages exploration of the geology, ecosystems, folklore, and wildlife of the area. Participants are given the tools to plan a pond mapping activity for youth and adults, and a fun game that teaches safe behavior while out-of-doors and around the water.

SESSION FIVE: On Golden Pond allows the participants to use the tools they constructed in SESSION THREE to survey and measure the perimeter and depth of a body of water. The data collected at the site will allow the participants to prepare a contour map of the body of water.

SESSION SIX: Map Making is the culmination of the activities where the participants learn to create a contour map using the data gathered from the body of water. Participants will identify where to share their finished project and learn how to create a presentation.

WELCOME TO 4-H SERIES

Dear Teen Leader & Adult Coaches,

When I watch news broadcasts or read the newspaper, I continue to be impressed by the enormous importance and ubiquitous nature of science in our daily lives. Scientific discoveries inspire and enrich us, teaching us about the nature of the physical world and our connections to the environment. As we face the challenges of the twenty-first century we find ourselves confronting critical environmental and human issues that require increased scientific literacy. Science literacy has also become the gateway to an increasing number of high-quality jobs.

The 4-H Science Experiences and Resources for Informal Educational Settings (SERIES) is committed to improving the opportunities for teenage and younger youth to explore and learn about their world through the problem-solving and thinking skills of science – what we call sciencing. The 4-H SERIES program and materials are committed to the principle that learning science can be interesting and fun. In 4-H SERIES, you will do more, think more, and learn more about science. Specially trained SERIES teen leaders engage younger youth (ages 9-12) in hands on, inquiry based science activities. Then, as part of the science learning and fun, youngsters design and carry out their own community service project based on the science they have learned.

All the SERIES curriculum units are designed to be presented by teens in an informal setting and in a learn by doing manner. The goal is to have the younger youth observe and experience aspects of the world as they interact with the materials and each other, ask questions, develop ways to find and solve problems using scientific thinking skills, and construct understanding and knowledge in the process. Thus, the youngsters construct knowledge is a way scientists do – by sciencing.

Science is an enterprise make active by our human capacity to think and learn. We invite you to participate in sciencing as a teen leader, an adult coach, or a younger participant. We invite you to learn about the natural world and to explore the idea that knowledge is invented – through scientific investigation you can invent and construct knowledge about the world and the relationships among things in the world. We encourage you to share your discoveries and the joy of sciencing with others.

Sincerely,

Richard C. Ponzio
Director, 4-H SERIES Project
4-H Specialist, Science and Technology
University of California Davis

THE LEARNING CYCLE
In 4-H SERIES Curriculum

Since Socrates' time, and probably even before, teachers have known what we learn best though our own guided investigations followed by thoughtful conversations with others. During the past 30 years, science educators have identified a sequence, known as the learning cycle that has proven to be an effective means for learning concepts and processes of science. The learning cycle also has been found effective for developing reasoning abilities and for reducing scientific misconceptions. The learning cycle used in the 4-H SERIES Project curriculum materials involves four distinct types of instruction strategies presented in sequence.

EXPLORATION

Exploration is an introductory activity designed to provide hands-on, direct experiences on which more elaborate understanding and concepts can be built. Participants learn through their own actions and reactions with minimal guidance or expectation of accomplishment. This can be done as an individual investigation or small group work. Usually this exploration accounts for approximately 30 percent of the activity or session in this curriculum.

DEVELOPING THE CONCEPT

Developing the Concept requires a teen leader to guide the participants in sharing and discussing observations they have made during the exploration phrase. The discussion usually includes developing or discovering the underlying concept or principle based on individual and group observations, comparisons, or data assessment. The concepts then become part of the experience and background the participants can apply to finding and solving problems. Concept development normally accounts for 20 percent of the activity or session in this curriculum.

APPLYING THE CONCEPT

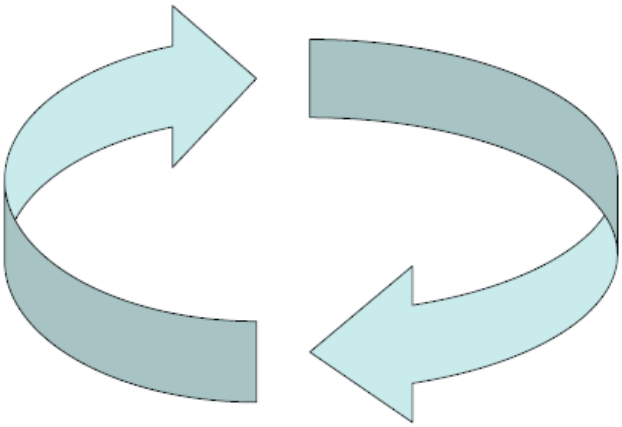
Applying the Concept extends the range of the concept the participants have developed. It provides them with additional time to practice using new concepts and reasoning patterns. The 4-H SERIES projects have shown that learning science involves developing and practicing scientific thinking strategies and decision-making skills rather than just accumulating information about science.

APPLYING THE CONCEPT AT HOME AND IN THE COMMUNITY

Applying the Concept at Home and in the Community is integral to the 4-H SERIES learning cycle because it encourages to improve their homes and communities by applying the science concepts and processes they have learned. In the learning cycle, application activities account for about 50 percent of the educational time.

THE LEARNING CYCLE

1. Exploration



2. Developing the Concept

3. Applying the Concept

Get Ready to Think Like a Scientist!

Good News! Anyone can discover and understand science. Whether you are big or small, female or male, short or tall – all you need is your own exploring mind and the belief that SCIENCE IS FUN!

Underlying all the 4-H SERIES activities are the basic concepts and processes scientists use every day. As a leader, you will be introducing and practicing these with your group.

OBSERVING

Observing is the most basic scientific thinking process. It involves using all of your senses – sight, smell, taste, touch, and hearing – to gather information and construct knowledge about the world and how it works.

Sample: "Using all your senses except taste, describe what you observed as you looked at the soils, heard when rubbed the soil near your ear, smelled when you put your nose to the soil, and felt when you touched the soil."

COMMUNICATING

Communicating is the process by which we create and use language and symbols to share ideas and information with others. We can communicate by using written and oral language to describe observations, events, and data. Video and audio tapes, role-playing and acting, and reports, charts, and graphs are all forms of communication that allow us to share information and ideas with others. Communication lets us learn from the past and share with others in the future.

Sample: "What happened when the soils were allowed to sit after mixing with water?"

COMPARING

Comparing is the process by which we discover, through observation, similarities and differences between ideas or things. To find out more about an unfamiliar object, scientists often compare it to something they know well. Some comparisons may be sensory, such as observing how different things look, smell, taste, feel and sound. Other comparisons may be based on measurements using standard units, such as centimeters, inches, pounds, and liters. When you with things or measure their length or volume to learn more about them, you are making comparisons.

Sample: "Which two soils were most similar? How?"

ORGANIZING

Organizing is the scientific thinking process that deals with patterns of ordering, grouping, and classifying. In this process, we systematically compile, classify and order information that haws been observed and compared. For instance, sequencing objects from smallest to largest, lightest to darkest, or first to last involves organization. Grouping and classifying things accordingly to rationale-based properties, characteristics, and relationships is also an organizing task.

Sample: "What categories did the groups use to sort the seed samples? How many other ways can they sort the samples?"

RELATING

Relating is the scientific thinking process that deals with principles concerning interactions. It is the process by which we see relationships between things. These relationships involve interactions, dependencies, and cause-and-effect events.

Sample: “Which soil might a farmer want to have to grow corn? Wheat? Rice? Trees? Why?”

INFERRING

Inferring deals with ideas that are remote in time and space. Inferences are not directly observable or experienced. Based upon your earlier findings, you can begin to recognize and predict general patterns and relationships, thus forming a more comprehensive theory.

Sample: “Does the ratio of sand, silt, clay and organic matter determine the quality of soil?”

APPLYING

Applying is the process by which we use knowledge to solve problems. Inventing, creating, problem solving, and determining probabilities are ways of using current information to gain further knowledge.

Sample: “Which type of soil might be the best for germinating seed?”

The various activities in each 4-H SERIES unit engage participants in the thinking processes and actions typical of those used by scientists. The participants have the opportunity to organize and classify data, predict outcomes, verify predictions, collaborate with others in looking for solutions, and create new and different approaches to doing common things.

POND MAPPING

Introduction

Two major outcomes of this project are:

1) Youth will learn how to map a pond.
2) Youth will gain a higher level of environmental literacy

WHAT IS POND MAPPING?

Pond mapping is a way to learn what a pond is like under the water's surface. Pond mapping provides a visual representation of the shape and depth of a body of water, small or large. It also provides important information about the pond's ecosystem. A map shows the perimeter of the pond and the depths in contours and may include shoreline features such as campgrounds, boat ramps, and trails.

For simplicity, the term "pond" mapping will be used throughout this curriculum. The techniques and activities may be used for either ponds or lakes.

State agencies began a major effort to map ponds and lakes in the 1930's. At that time, dropping down a weighted line to determine the depth of the pond or lake did mapping. In the early 1950's, echo sounders were first used for mapping. Echo sounders emit a signal and then clock how long it takes for the signal to reach the bottom and return to the boat, resulting in a depth reading. Today, fishermen to locate schools of fish and depths of fishing areas also use this same technology. Other technologies such as computers, and global positioning systems (GPS), have evolved to make pond mapping more precise.

Modern tools add accuracy and speed to mapping but expensive tools are not always appropriate and it takes time to learn how to use them properly. Depending on the purpose and intended use for the map, simple tools can be used to gather the data needed to map the depth contours and perimeter of a pond. One of the major objectives of this training is to bring the youth close to the process by using understandable tools.

HOW CAN WE MAP A POND?

In this curriculum, the "weighted line" will be used to measure depths. This method does not require expensive equipment such as GPS, computers, or echo sounders. Youth will learn and understand the basic equipment and process of pond mapping by participating in the hands-on, inquiry-based activities included in this unit.

Pond mapping requires the ability to cross the pond in a straight line to measure the depth and record. The two methods that are currently used are line of sight, and compass or GPS. For this method, the boat is driven along a path called a transect between visually selected landmarks on shore. Transect locations and directions are recorded. Hazards within the lake, aquatic vegetation, water surface elevation, and other biological information may be collected and recorded, too.

To convert the information collected by line of sight and weighted line, the recorded data is plotted along the transect lines drawn on the perimeter map. Contour lines connect points or similar depths. Once the contours are drawn, the map is complete. The completed map is then ready for distribution to forestry, fisheries, and wildlife personnel; websites; and maps for public use.

WHO USES POND AND LAKE MAPS?

FISHERIES MANAGERS: to help determine fish stocking quotas, provide an estimate of lake volume for chemical rehabilitation projects and vegetation control, and to calculate potential yield of fish in lakes.

FARMERS: to determine how much water is available for irrigation of crops.

BOATERS, ANGLERS, AND SWIMMERS: to find deep or shallow areas, sunken points, drop-offs, mud flats, and other structures within the lake.

HUNTERS: to find points and passes for waterfowl populations.

U.S. GEOLOGICAL SURVEY: to incorporate lake contours into its quadrangle maps.

PUBLISHERS OF OUTDOOR NEWSPAPERS AND ATLASES: to inform their readers about hunting and fishing opportunities.

LAKE ECOLOGISTS: to document lake depths and contours to determine the rate of sedimentation in the basin.

WHY IS IT IMPORTANT FOR CHILDREN TO LEARN ABOUT POND MAPPING?

Now consider what life would be like if all of the lakes and rivers vanished one day. What would happen to the water supply? How would you drink your next glass of water? Many simply go to the faucet, buy bottled water or products containing water and never think twice about how our water got there, who got it there, how pure it is, and how much all life depends on water. As generations of Americans become more distant from their agrarian past, fewer and fewer people understand the importance of water to society. They do not understand the impact water has on the quality of life, i.e. health, the economy, etc. They don't understand the importance of water until it isn't there.

With wildlife areas shrinking and widespread lack of understanding among consumers about the sources of their water and impacts on the environment, environmental education is vitally important to the future of a safe water supply and a healthy environment. Increasingly people with limited environmental knowledge and background are determining environ-mental policy. What the future holds for watersheds and the environment will determine the quality of life for all. All youth, as future voters, will make decisions about our future water supply and our environment. These decisions need to be based on knowledge and understanding.

"Environmental literacy" means understanding, knowledge, and appreciation of the natural environment, including water. Pond mapping participants will learn the importance of watersheds and will develop skills in using simple tools to map the

perimeter and depths of a pond or lake. The term "watershed" means the flow and collection of water from the atmosphere to the mountain ridges to streams to lakes and manmade reservoirs. An environmentally literate person understands the watershed system including history and current economic, social, and environmental significance and particularly, its link to human health and environmental quality to all of earth's inhabitants.

Nationwide, there is a concern to increase youth's level of competency in science, reading, math and language arts. There are many opportunities to teach science concepts and increase environmental literacy by mapping a pond. Pond mapping can engage youth by integrating science, math, reading, and history and can be an effective way to capture student interest in science through "hands on" activities. Technology, teamwork, career exploration, cartography and problem solving are also incorporated.

SESSION ONE

Getting Started

PURPOSE:

Youth will
- understand the interconnection of a watershed and a pond;
- learn about the different types of maps i.e. road, Forest Service and topographic;
- learn how to read maps i.e. legends, scale, declination, symbols, etc.
- explore mapping information on the internet.

BACKGROUND INFORMATION:

A **watershed** is the land that captures water in any form such as rain, snow, dew, hail, etc. All the land whose water drains into a particular stream, pond or lake is the watershed for that body of water. Watersheds capture the water that falls on them, stores the water in the soil and releases the water into streams and rivers by way of surface and ground water. Ridges that separate adjacent watersheds direct water flow. For example, a watershed creates even a puddle in the schoolyard. The Mississippi River is also a watershed. This large watershed, of about 1,243,000 square miles, is made up of thousands of smaller ones. There are many living and non-living thins in our watersheds. Our watersheds are constantly changing and by adopting a pond to map, students will observe seasonal changes including the affects of climate, erosion, pollution, vegetation, and type of soil.

A **map** is a representation of a body of earth, sky, or water usually drawn on paper. Three types of maps will be explored . . . road, forest service and topographic.

Road maps show major roads and boundaries within countries, states, regions, counties, and cities. They may include points of interest for tourists to see. Their main purpose is to help travelers by automobile to get across considerable distances usually by a direct route and in a minimum of time. These maps are available from AAA, gas service stations, etc.

The US Department of Agriculture prints visitor maps of all national forests. These **Forest Service maps** give details of the boundaries, surrounding land ownership, and natural and man-made features i.e. lakes, streams, campgrounds, roads, etc. The maps usually are at a scale of 1:126,720 or one inch equals two miles. Most of the symbols used are the same as on geological survey maps. A comprehensive legend is provided. Color may be used to indicate ownership, where parts of the forest may be privately owned.

Road maps and forest maps are planimetric, which means they do not show the topography of the area or an accurate description of the surface features including valleys and hills. Hills and valleys may not mean much when you are driving a car, but put on your hiking boots and the mood changes. For cross country or any wilderness travel, you

will need a map which shows all the ups and downs, plus major obstacles like swamps and canyon walls.

Topographic maps show a three-dimensional perspective of the land. In the 1950's, the US Department of Interior took aerial photographs that gave a precise picture of the land. Then, cartographers or mapmakers took this information to construct topographic maps. These maps are flat but indicate many features such as land contours and elevations, waterways down to the smallest stream, and natural features that are landmarks. Topographic maps give the greatest amount of detail in terms of the earth's surface.

Topographic maps are relatively easy to read. Contour lines show elevation changes on land and water. Contour elevation changes can be 20, 40, or 80 feet, with every fifth line drawn heavier than the others. You can easily determine the elevations by reading the numbers listed on the heavy lines and adding or subtracting 20, 40, or 80 feet for each of the light lines between them. Contour intervals are listed at the bottom of most topo maps. On a topographic map, the closer together the contour lines are, the steeper the slope will be; the farther apart they are, the flatter or less steep the terrain.

Participants may be aware of other types of maps:

- Relief maps are made of rigid thickened material and show mountains and valleys. They are awkward to carry so they are mostly used for display.

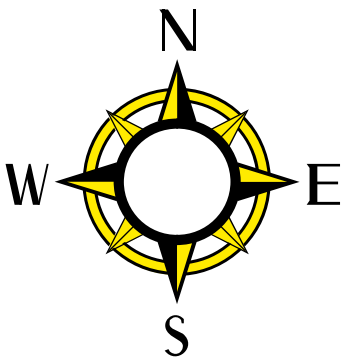
- Charts are maps for bodies of water including oceans.

- Political maps show boundaries, cities and not much else. Examples include a map of the United States showing the outline of states and its counties and major cities or a globe of the world. It may have features such as rivers, roads, etc. but only as reference points.

- Physical geography maps provide more detail about the features of an area. The user of a physical map is more interested in mountain ranges, lakes, rivers, and the contour of the land. The borders and towns are printed in lighter print as only locating guides.

Principles of creating a map

Even a hasty sketch of directions to someone's home is a map, although crude. Creating a map involves a few principles. Orientation to the major points on a compass, usually north is prominently marked on the map to guide the traveler's orientation**.** Scale indicates the distance traveled. Scale is often given in inches to miles, or in the case of simple sketch in blocks or crossroads. Most maps have a legend to describe its symbols.



The top of most maps is oriented to show north or it will designate a compass rose reading on the map. A compass is needed to orient a map to the ground or to your location and where you want to go.

Reference: Catherine M. Scheder, Outdoor Living Skills Program Manual: An Environmentally Friendly Guide, ISBN-0-87603-175-0

When the compass is pointed north, west is to the left, south is opposite of north, and east is to the right. The face of the compass is divided into 360 degrees around the face of the dial.

ACTIVITY A: Watershed Creations

OBJECTIVE: Youth will learn about the interconnection between a watershed and a pond.

MATERIALS THAT YOU WILL NEED

- ❑ 8 ½ " X 11" white paper, one sheet per participant
- ❑ 3 different colors of water-soluble markers
- ❑ Several spray bottles of water
- ❑ Paper towels to wipe up excess water

GETTING READY

- Gather all the materials.
- Be sure to use water-soluble markers—as the markers "bleed" they demonstrate how rain moving through the watershed affects soil erosion and urban runoff.

SUGGESTED GROUPING

Divide participants into groups of 6-8 to share the markers

ACTION:

1. Ask participants to crumple a piece of paper into a tight ball and gently open up the paper, but don't flatten it out completely. The highest points on the paper now represent mountain ridges, and the lowest wrinkles represent valleys.

2. Ask participants to choose one color of water-soluble marker and use it to mark the HIGHEST points on his/her map. These points are mountain ridges.

3. Ask participants to choose a second color, and mark the places where DIFFERENT BODIES OF WATER might be….creeks, rivers, lakes, ponds, etc.

4. With a third color mark four or five places to represent HUMAN SETTLEMENTS, i.e. housing tracts, factories, shopping centers, office building, schools, etc.

5. Use the spray bottles to lightly spray the finished maps. This spray represents rain falling into the watershed.

SCIENCING (observing, communicating, comparing, relating)

1. What does the spray bottles represent?
2. What changes do you observe in the maps?
3. Where does most of the "rain" fall? What path does the water follow?
4. Did any rivers and lakes form?
5. What determined where a pond or lake would form?
6. Where might a dam be built to create a pond or lake to store water?
7. Where does erosion occur? What happens to the human settlements – are any building in the way of a raging river or crumbling hillside?
8. How does the flow of water through the watershed affect our choice of building sites?
9. How does this map demonstrate the idea of watershed?
10. When rain falls, what happens to the water?
11. If rainwater sits in a puddle in the street, what will eventually happen to it?
12. Where does it go?
13. Water also evaporates from streams, rivers, lakes and the ocean. Where does that water go?
14. What happens when the air has as much water as it can hold?
15. What type of map have you created?
16. If you flatten the paper, what type of map do you have?

SOURCE: River of Words Educator's Guide, compiled and edited by Pamela Michael, ROW Executive Director and Carolyn West, Contest Manager. 2530-C San Pablo Avenue, Berkeley, CA 94702 Telephone: 510-548 POEM (http: www.riverofwords.org)

ACTIVITY B: Have Map…Will Travel

OBJECTIVE: Participants will learn about three different types of maps - road, Forest Service and topographic and how to read and use them.

MATERIALS YOU WILL NEED:

- ❑ Road maps of the area i.e. AAA, gas service station, or road atlas.
- ❑ US Forest Service map of the area of interest
- ❑ Topographic map of the area of interest
- ❑ One map for each group of 2-3 participant
- ❑ "Activity B: Have Map . . . Will Travel" Worksheet for each small group, (optional)

GETTING READY:

- Select an area of interest, i.e. a pond, lake, park, campground, etc
- Obtain a good selection of local, county, regional, and state road maps covering the area of interest.
- Contact the US Forest Service local office or sporting goods stores to find forest and topographic maps of the area of interest.

SUGGESTED GROUPING

Divide participants into small groups of 2-3 youth.

ACTION: (communicating, relating)

1. Ask the participants what is a map? How are maps used? Are all maps the same? What can a map tell us?

2. Divide the group into small groups of 2-3 youth and distribute one map to each group and the activity worksheet, if needed.

3. Ask the participants to find a common place on their map i.e. city, lake, campground,

SCIENCING (observing, communicating, comparing, relating)

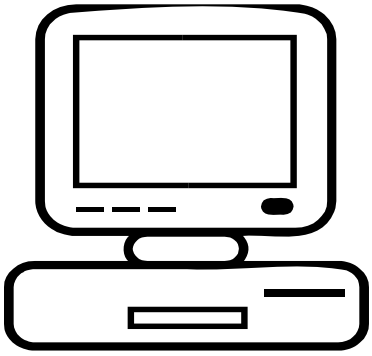
1. After all groups have located the identified place, ask how they found the location? Was it easy to find the location? What steps did they follow? What did they need to know? How did they figure it out? How do they know the place they found is the correct location?

2. Have the groups share their maps. What symbols are on their map? What do the symbols mean on each map? What do the colors mean? Does it tell you contour or elevations of the land? One inch on the map equals how many miles on land?

3. Ask which map would be best for a road trip? Camping or sightseeing by car in a national forest? Hiking, fishing or hunting in a wilderness area? Building a park, a house? How else could you use this map?

ACTIVITY C: Mapping on the Internet

OBJECTIVE: Youth will explore mapping information on the Internet.



MATERIALS YOU WILL NEED:

- ❑ A computer with Internet capabilities

ACTION & SCIENCING (communication, comparing, applying):

1. Explore the United States Geological Survey website, http://www.usgs.gov/education/

   Further explore topics such as water and maps and check out the 'fun stuff' links about map wizard.

2. Do a search for additional web sites. Suggested search topics are: topographic maps, map symbols, cartographers, compass, pond mapping, contour maps, lake maps, etc.

3. Explore web sites that provide directions and maps to various locations. Try your search engine using the words "maps" or "map making". Participants can input starting and ending points of their choice.

   Suggestion: S*tarting point is their home address and; ending point is where they are right now or their school or friend's address.*

   Questions to ask:

   How accurate are the map's directions? How do you know? How could you find out? Are there other directions that could be given? In what ways are the directions helpful?

4. Can the participants find other places in the world with the same name as their town or street where they live? Where were they? What web site did they use?

Have Map . . . Will Travel
Activity Sheet

Name of Map:
_____

Publisher: _____ Date: _____

Type of map: _____ Road ____ Forest Service _____Topographical

_____ Specialty ____ Other: _____

STEP 1: Can you find the points of interest?

_____ YES NO

_____ YES NO

STEP 2: What are the symbols on your map and what do they mean?

STEP 3: What do the colors on your map mean?

STEP 4: Does your map tell you the contour or elevation of the land? YES NO

IF YES, what is the contour interval?

If the contour lines are close together what does that mean?

STEP 5: How many miles does one inch on your map equals?

How do you know?

STEP 6: What are some uses for your map?

Would you use your map for a road trip? YES NO

Would you use your map if you were camping or sightseeing by car in a national forest? YES NO

Would you use your map if you were hiking, hunting or fishing in a wilderness area? YES NO

STEP 7: Be ready to share your map findings with others.

SESSION TWO

Tools of the Trade, Part I
(Tools Too Technical to Be Homemade)

PURPOSE:

Youth will

- learn about compasses, measuring tapes, and engineer rulers that are used in surveying
- understand the science of these tools
- become skilled at using and reading this equipment with accuracy

BACKGROUND INFORMATION:

No one is certain where or how the **compass** first originated, though it appears that the Chinese were first to discover magnetism and its attractive power. Primitive compasses can be seen in Chinese books that date to the 11th and 12th centuries. Today's compasses incorporate complete navigational systems. Most of the mid-priced ($10-$20) models can be consistently read to within two degrees of accuracy.

There are four types of compasses: 1) fixed dial or standard needle, 2) floating dial; 3) cruiser and 4) orienteering. The orienteering compass is the most popular for hiking, hunting, fishing, etc. It is extremely accurate and easy to use. An orienteering compass is recommended for mapping purposes because it has a straight side for drawing lines. The instrument is so simple, a child can often learn to use one in a matter of minutes. Remember, because the compass is magnetic, it must be held away from metal objects including belt buckles and bracelets.

Magnetic north is not the same as "True North" in most places on earth. Topographic maps show the difference in a drawing at the bottom of the map. On the west coast of the US and Canada, the difference, or declination is about 20 degrees to the east. Therefore, 340 degrees points to true north, not 360 degrees. On the east coast, the declination is 20 degrees to the west, thus 20 degrees on the compass points to true north. For the purposes of instruction for the youth in our pond mapmaking, magnetic north and True North may be considered the same. The correction is important when orienteering with a topographic map.

There are many different types of **measuring tapes** depending on the job to be performed. The measurements may be in inches or metric or both. The most readily available is the pocket variety with a retractable tape of 50 feet or less. This type of measuring tape works well for the plane table measurements even though one might be required to measure twice or more along a line on the shoreline. If the markings are in feet and 10ths, it will be easier to plot on a 1:10 scale. For measuring the distance across the lake, a tape of 100 feet or more is needed and it is difficult to measure accurately from one point to the next across the water.

Typically, in our every day use an inch is divided into eight or 16 parts. Pick up a ruler and observe the lines indicating fractions within each inch. Those scales are not convenient for map making so cartographers and others use an **engineer's rule**. An engineer's rule is usually a three-sided ruler that has six possible divisions of an inch; from 10 to 60 per inch representing feet on the ground. An engineer's ruler should be purchased for the best accuracy.

Practice Makes Perfect

This session provides activities to practice using these tools of the trade. The most difficult concepts for the children to learn are understanding the 'direction of travel' of the compass and scales.

References:

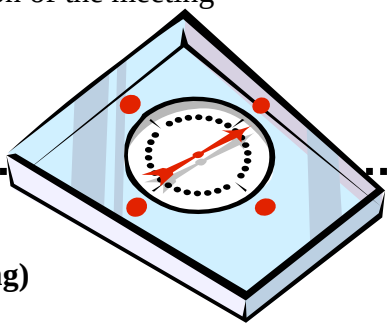
Maps & Compasses: A User's Handbook by Percy W. Blandford, 1984. ISBN 0-8306-06440 The Basic Essentials of Map & Compass by Cliff Jacobson, 1988. ISBN 0-934802-42-4.

ACTIVITY A: Which Way is North?

OBJECTIVE: Youth will learn to use a compass and orient a map to their location by using a compass.

MATERIALS YOU WILL NEED:

- ❑ Any type of map i.e. road or topographic of the location of the meeting
- ❑ Table or flat surface
- ❑ Compass, orienteering type
- ❑ Metal objects, i.e. spoon, ring, penny, paper clips



ACTION & SCIENCING:(observing, communicating, relating)

1. Ask the participants which way is North? Which way is West? How do they know? Have they ever used a compass? What did they use it for? Did it work?

2. Lay the map flat on a table or other surface. Ask the participants which way is North on the map? How do they know?

3. Can they use the compass to determine which way the map needs to lay to match the land? Can they move the map around to match the land? Let them experiment with the compass and map.

4. After experimenting, show or review with the participants how to match the map with the land.

5. Can metal objects interfere with a compass reading? What do you predict will happen?

   Place a metal object next to the needle and observe the needle point toward it or at least deflect.

6. What can you do to eliminate metal interference when using a compass?

7. What else might prevent a compass from not working properly? (*Answer: Compass must be level)*

ACTIVITY B: Finding the Treasure

OBJECTIVE: Youth will learn about degrees of a compass and how to find a bearing on a visible landmark.

MATERIALS YOU WILL NEED:
For each small group of 2-4 participants

- ❑ Compass, 1 per group
- ❑ Clipboard, 1 per group
- ❑ Paper
- ❑ Pencil
- ❑ Finding the Treasure Activity Sheet
- ❑ Two-way radio, optional
- ❑ Item to hide as the treasure, optional

GETTING READY:

For this exercise you will need a compass that has a base plate with a straight edge that has a movable compass ring. Practice using a compass so you can provide instruction.

How to Find a Bearing on a Visible Landmark

If you are traveling towards a visible object in the landscape (e.g. a distant hill or mountain peak), you may need to set your compass to point the direction to this landmark. This procedure enables you to hold your course even if the object is not visible at all times.

1. Sight the landmark along the direction arrows on the base plate. Remember to hold the compass in a horizontal position.
2. Keeping the object on the line and holding the compass steady, turn the compass capsule until the red end of the magnetic needle is pointing in the same direction as the north-south arrow on the bottom of the capsule. The bearing is now set on your compass.
3. Line up the north-south arrow directly under the red end of the magnetic needle every time you check your travel direction.

SUGGESTED GROUPING:

Small groups of 2-4 participants.

TIP:
Make your compass course as easy or as difficult as you like, but always make it as fun as possible!

ACTION:

1. Divide the participants into two or more groups. Give each group a compass, Finding the Treasure Worksheet, pencil, clipboard, and a radio, optional.
2. Assign each group a separate area to design a course using compass bearings and paces for directions. Each group needs to work as a team to design a compass course. Each team will identify compass bearings, the number of paces, and record the bearings and paces on "Finding the Treasure" Activity Sheet for another group to follow. Your compass course directions may look like this:

    - Start at the parking lot.
    - Take a 90º bearing and go 30 paces to the flagpole.
    - Next take a 27º bearing and go 62 paces to the edge of the stream.
    - Take a 90º bearing and go 130 paces to the bridge
    - Next travel 40 paces at 180º

3. Each team has 20 minutes to develop their course directions. The session leader will notify the group leaders by radio when they have 5 minutes left.
4. Optional: Hide clues along the way so that the other team must find them before continuing. Hide a treasure at the end.
5. Now, it is time to test their compass reading abilities. Teams exchange "Finding the Treasure" Worksheets. Teams follow the other group's compass bearings and paces to find the hidden treasure.

TIP:
The formula to use to determine your length of pace is to walk 100 yard or 300 feet and count <u>your</u> steps. Then divide 300 by the number of steps you took; multiply that by 12. This will tell you the length of your pace or step in inches.

SCIENCING: (communicating, observing)

Did you find the hidden treasure at the end of the course?

- Was it easy or difficult to follow the course using the compass bearings?
- How would you do it differently next time?
- How could you make it harder for the other team?
- How could you make it easier for the other team?
- How long were your paces?

Finding the Treasure

Bearing (1 to 360 Degrees)	Distance (Number of paces)	Comments (Physical Characteristics such as uphill or downhill, by a tree, etc.)

ACTIVITY C: Learning about Scales

OBJECTIVE: Youth will practice measuring distances on a map to learn about scales using an engineer's ruler

MATERIALS YOU WILL NEED:
For each small group of 1-3 participants

- ❑ Engineer's Ruler
- ❑ Pencil
- ❑ Activity Sheet "Learning About Scales"
- ❑ Flipchart and pens or blackboard with chalk

SUGGESTED GROUPING:

Individually or small groups of 2-3 participants

GETTING READY:

- Look closely at an engineer's ruler. Understand the markings and scales i.e. 1:10; 1:20; 1:50; and 1:60 scales. For example: a scale of 1:10 is 1 inch equals 10 feet. Note that each marking designates one foot on each scale.
- Make a copy of the Activity Sheet "Learning About Scales" for each group.
- Make a chart to record the results of each group to compare. For example:

Scale 1:50	Group 1	Group 2	Group 3	Group 4
AB				
AE				
BD				
BC				
CE				

ACTION:

1. Have the participants do the Activity Sheet. Using the 60 scale first measure between each points i.e. AB, AE, BD, BC, and CE on the playground.
2. Have participants record their results on the chart.
3. Continue by measuring the distances with different scales of the Engineer's Ruler i.e. 10, 20, and 30 scales.

SCIENCING: (communicating, observing, recording data)

- Have groups compare their data. Does everyone agree?
- Why are the results different? How can an error be made? What do you need to do to decrease the errors?
- Does it make a difference if they measure from the each dot instead of only the line? Did they measure each time the same? Only from the center of the dots or inside of each dot or just the line?
- Did they all take measurements in the same direction? Does it make a difference if you measure from AB or BA?
- What does each mark on the engineer's ruler represent?
- What are the similarities or differences of the scales? Compare the 10 scale with the 20 scale. Or the 30 with the 60? What do the numbers on the chart tell you?

The correct answers are below. Hint: Only measure the actual length of the line and not the dots to get these answers.

	60 Scale	**10 Scale**	**20 Scale**	**30 Scale**
AB =	255 feet	42.5 feet	85 feet	127 feet
AE =	390 feet	65 feet	130 feet	195 feet
BD =	405 feet	67 feet	135 feet	202 feet
BC =	160 feet	26 feet	53 feet	80 feet
CE =	160 feet	26 feet	53 feet	80 feet

60 scale: 1 inch equals 60 feet

10 scale: 1 inch equals 10 feet

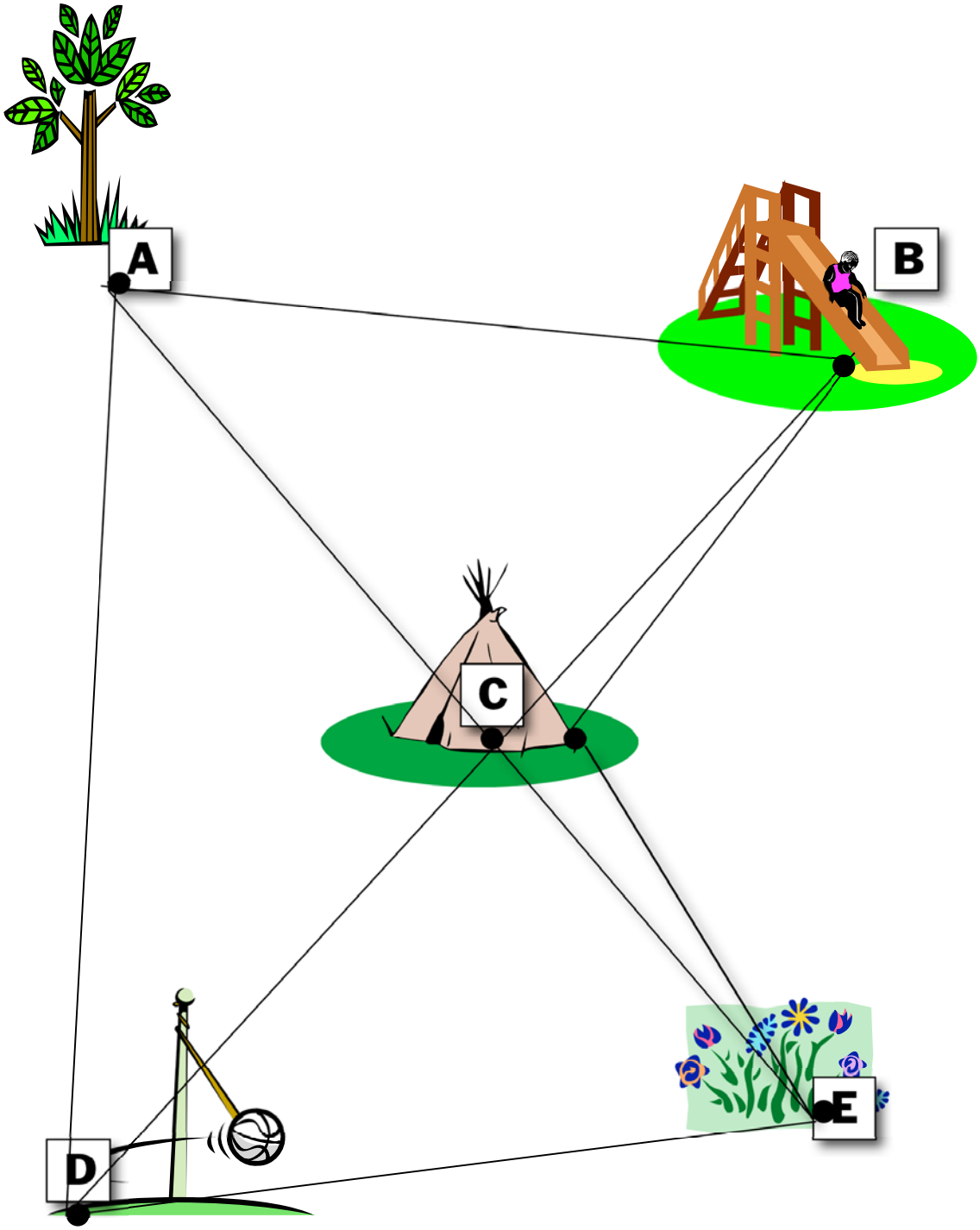
20 scale: 1 inch equals 20 feet

30 scale: 1 inch equals 30 feet

Learning about Scales
Activity Sheet

Using a 60 scale measure the distance between A and B? A and E? B and D? B and C?

C and E? Then measure again using the 10, 20 and 30 scales. Record your results on the chart.

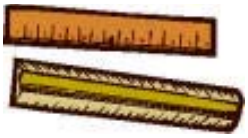


ACTIVITY D: Scaling It Down

OBJECTIVE: Youth will practice measuring distances on the ground, recording and drawing to scale using an engineer's ruler.

MATERIALS YOU WILL NEED:
For each small group of 2-3 participants

- ❑ Large area, preferably outdoors i.e. patio, sidewalk, driveway, stage, etc.
- ❑ Engineer's Ruler
- ❑ Measuring tape, 25 feet or more
- ❑ Paper
- ❑ Pencil
- ❑ Clipboard



SUGGESTED GROUPING:

Small groups of 3-4 participants

GETTING READY:

- Select a large flat area, preferable a rectangle or square, on the ground for participants to measure i.e. patio, sidewalk, driveway, stage, etc.
- Look closely at an engineer's ruler. Understand the markings and scales i.e. 1:10; 1:20; 1:50; and 1:60 scales. For example: a scale of 1:10 is 1 inch equals 10 feet. Note that each marking designates one foot on each scale.

ACTION:

1. Participants will apply new skills to measuring distances of a large area on the ground and then making a drawing of the area on paper.
    A. Request the groups measure the perimeter of the area in all directions using the measuring tape. Record their results.

B. Using the 10 scale, draw lines to scale on the paper. Be sure to identify the measurements on the drawing.

C. Using a different scale (1:30 or 1:50), draw the area again on paper. Continue the activity by drawing using all of the engineer's scales on your ruler.

SCIENCING: (communicating, observing, recording data)

- Have groups compare their data and drawings. Does everyone agree?
- Did they record and draw to scale accurately? Does each drawing look the same except for the size of the drawing?
- Why did we measure and then use scales to draw the area on paper? Why not do it freehand? Wouldn't it look the same?
- Which scale is best for drawing this area on a piece of paper? What if you had smaller paper? Or a larger sheet of paper?
- Did the measurements change with each drawing? How many feet is one inch?
- On maps, does 1 inch always equal a number of feet? Are there maps with inches or mile increments as the measurement? Take a closer look at a road, topographical and/or Forest Service maps. What are their scales? Is it using inches, feet or miles as a measurement?

SESSION THREE

Tools of the Trade, Part II
(Tools You Can Make)

PURPOSE:

Youth will

- learn about the surveying tools needed to map a pond i.e. sounding line, plane table, alidade, and measuring rope.
- build these simple tools
- understand the science of these measuring equipment
- become skilled at using the equipment and reading the measurements with accuracy

BACKGROUND INFORMATION:

This session describes and provides blueprints for building the surveying equipment needed for mapping a pond, road, path and/or any small area of interest. You will be making four pieces of equipment.

- A sounding line
- A plane table
- An alidade and sighting pole
- A measuring rope

The supplies needed to make the equipment are low cost and relatively easy to make. The equipment described may also be purchased ready-made, if desired.

Measuring the Depth

A **sounding line** can be used to determine the bottom contours of a pond or lake. A weighted line is dropped from a boat at pre-determined distances across the pond. By recording the location and depth of each of these soundings, a map indicating the bottom contours can be drawn. A simple sounding line can be made with some nylon line, a fishing weight, a wooden slat and a dowel.

Mapping the perimeter

To map the perimeter of a pond, you take a series of bearings by direct sighting over a piece of paper that will form the working map. You need a sketch board, or a **plane table,** large enough to accommodate the size of the paper that will make the map, and a means of supporting the tabletop in a level position. In its simplest form, a piece of plywood nailed to a single post about 3 feet high will meet the need. But, if you had a board on a tripod you work on an uneven surface without an assistant.

On the plane table, you will need an **alidade**. This is a simple sighting aid. One may be bought, but you can make an equally satisfactory one. You need a piece of wood with a straight edge, at least as long as the longest line you will want to draw. The longer the strip is, the more accurate your sighting will be. The simplest sights are two nails driven into the edge and bent upwards at each end of the piece of wood. You will also need a **sighting pole** using PVC pipe or wooden dowel.

For measuring the distance across the lake, a tape of 100 feet or more is needed and it is difficult to measure accurately from one point to the next across the water. Another alternate to a measuring across the pond is a hip chain. Hip chains are a convenient way to measure distances over any terrain. They are designed to fit on your belt, leaving your hands free for other work. Accurate to 0.2%, a hip chain can measure up to 99,999 without having to reset. It works by having a string or thread travel through a counter as you walk. It is also available in metric or feet measurements.

Both the hip chain and 100 ft measuring tape are expensive to purchase. As an alternative, in this session, participants are given instructions how to make a **measuring rope** from a cotton rope to measure their distance across the pond. The measuring rope is a precursor to inventing a measuring tape. Sailors, and adventurers, often made their own tools to measure items by calibrating a known measurement, transferring it to a rope by marking, and then using the rope to measure longer distances.

Practice Makes Perfect

Making a "closed survey" on dry land is good practice. It can be done on a small scale for training participants, where all points are in view of the start and the instructor can watch for errors as poles or other markers are sighted and measured.

Once the perimeter has been mapped, you can check your surveying by going around the pond in the opposite direction. Besides treating this as a new survey, you can compare compass directions, if you were using a compass and not an alidade. The readings should be opposite of the first, so each should be 180 degrees more or less than previously. Errors may be more likely in distances, particularly if you are pacing over uneven ground. A reverse survey superimposed on the other survey may show you possibly just one error that is the cause of the trouble.

ACTIVITY A: Sounding Line

OBJECTIVE: Youth will learn how to make a sounding line and its use in pond mapping.

MATERIALS YOU WILL NEED:

- ❑ Nylon line, lightweight, 30 feet
- ❑ Lead fishing weight or washers, 2 ounces or more
- ❑ Small amount of paint to paint lead weight OR can of spray paint
- ❑ Waterproof felt pen
- ❑ Wooden doweling, 12" of ½" cut in half
- ❑ Wood slat, 12" of 1" x ½", cut in half
- ❑ Glue
- ❑ Screws or finish nails, 4
- ❑ Sand paper, medium
- ❑ Drill with ½" drill bit
- ❑ Hand saw
- ❑ Masking tape
- ❑ Measuring tape or two yard sticks for each group
- ❑ Safety glasses or goggles to wear when using tools

GETTING READY:

- Obtain all necessary materials.
- This activity is done on long tables or other long, flat surfaces, such as the floor or ground.
- Pre-cutting the wood items and drilling wood slats will facilitate the process.
- The lightweight nylon line needed is also used by contractors to build straight fences and can be purchased at hardware or home supply stores.
- Review safety precautions when using power and or wood working tools.

NOTE: The adult will need to determine how many of each tool is needed. For example, each boat crew needs a sounding line and a measuring rope or hip chain.

SUGGESTED GROUP:

Small groups of 2-3 participants. Groups can be divided among the activities in this session.

ACTION: (communicating, inferring)

SAFETY TIP:
Lead is toxic and must be handled with care. Wash your hands after touching lead. True, it is commonly used for fishing weights and many people handle it without a second thought. In this exercise the lead will be painted so that future exposure would be limited.

1. Show participants each item needed to make the sounding line. Hold up each item and identify it. This will teach terms and verify that each group has all items before starting.

2. Dip the lead weight in paint or spray paint and let dry. The coating of paint will help to decrease the hazards of lead exposure. Discuss hazards of working with lead and warn against handling the lead weight more than necessary.

3. Tie the lead weight to the end of the line.

4. On a flat surface, layout 5 feet of masking tape. Using a waterproof marker, make a line on the masking tape at each one foot interval.

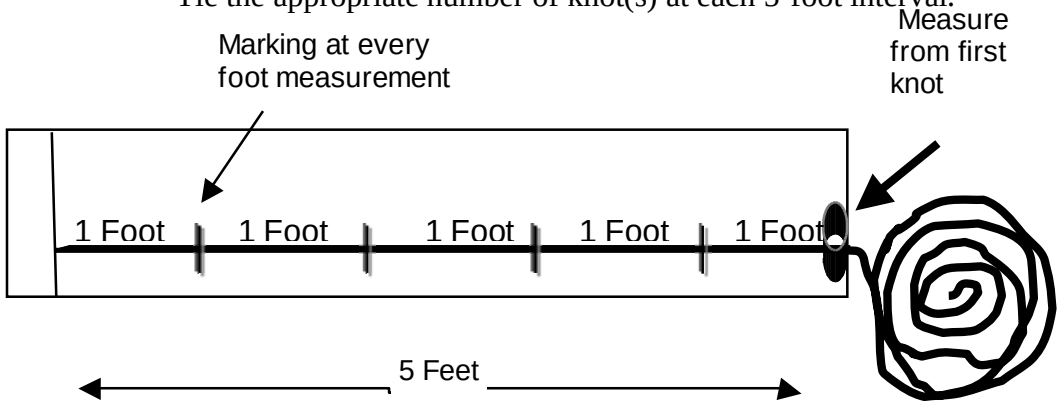
5. Stretch the nylon line beginning at the weight along the masking tape and mark each one-foot interval on the nylon line with a waterproof marker.

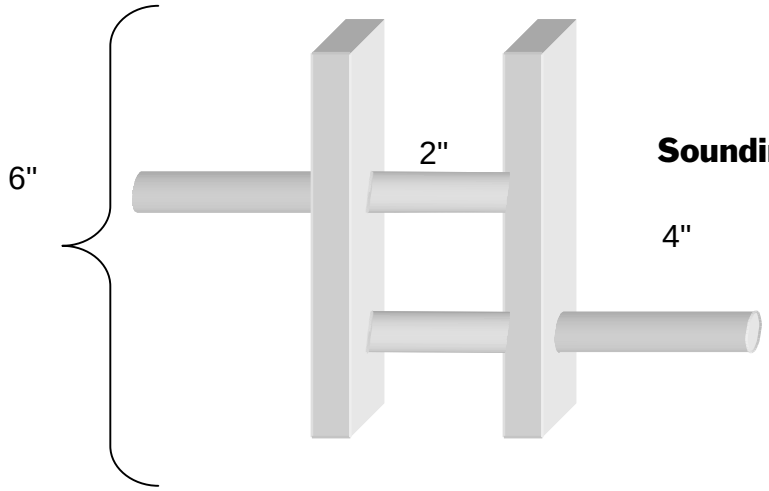
5 Feet = 1 knot
10 Feet = 2 knots
15 Feet = 3 knots
20 Feet = 4 knots
25 Feet = 5 knots
30 Feet = 6 knots

6. At five feet, tie one knot. Measure another five-foot length and tie two knots to show a total of 10 feet. Mark one-foot increments with the waterproof pen. Measure again and tie knots; one knot for every 5 feet. Continue marking and knotting for a length of 30 feet.

7. Another method is to secure two yardsticks or a 5-foot measuring tape to a flat surface with masking tape. Stretch the nylon line along the yardstick or measuring tape. Then mark one-foot intervals and

Tie the appropriate number of knot(s) at each 5-foot interval.





Sounding Line Keeper

8. To make a simple wood keeper for the sounding line,
    a) Drill a ½" hole in the end of each wood slat; four holes total.
    b) Sand the rough edges of the dowels and wood slats.
    c) Insert one dowel into the hole on the end of one slat. Move the first slat so it is approximately 4 inches from the end of the dowel. Insert the second dowel on the other end of the slat flush with the end.
    d) Do the same with the second slat but have the dowel going the opposite direction.
    e) Glue and/or nail/screw these pieces in place.

9. Tie the painted two-ounce lead weight securely at the end of the line marked as one foot.
   Then, tie the other end of the nylon line securely to the middle of one dowel. Roll the line on the keeper.

SCIENCING (communicating, comparing)

- Describe what the keeper and line look like. Are there other simple machines we use that look like this? How are they used? Who uses them?

- If measuring depths of a puddle or wading pool what length would the sounding line need to be? How would you make it?

- Why would you want to know water depth if you were piloting a large river boat? What tools would you use? What would happen if you made a mistake?

- How deep is the pond if 3 knots are under the surface? How about half way between the four and five knots? Is it more than how many feet? Less than how many feet? Test each other.

ACTIVITY B: Plane Table

OBJECTIVE: Youth will build a plane table (drawing board) to be used for mapping and relate geometry to daily tasks.

MATERIALS YOU WILL NEED:

- ❑ ½ inch plywood, a minimum of 24" x 24"
- ❑ 36" long wood stake, minimum of 2" inches in diameter
- ❑ One screw or nail
- ❑ Screwdriver or hammer
- ❑ Yardstick
- ❑ Pencil
- ❑ Safety glass or goggles (optional)

TIP:
8 plane tables can be made from 1 sheet of plywood.

GETTING READY:

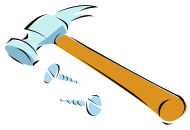
- Review safety precautions when using power and/or woodworking tools.
- Obtain the necessary materials.
- Cut plywood and stake or dowel to required sizes

SUGGESTED GROUPING:

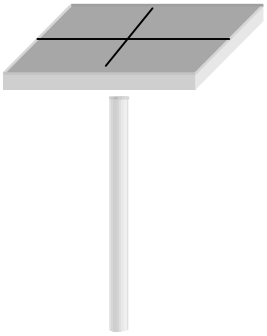
Small groups of 2-3 participants. Groups can be divided among the activities in this session. Each group will not use every tool.

NOTE: The adult will need to determine how many of each tool is needed. For example, each team measuring the perimeter will need a plane table to record the measurements.

ACTION: (communicating, comparing)



1. What's a plane table? How is it used in pond mapping?
2. Measure to find the exact center of the plywood and mark.
3. Nail or screw the plywood to the stake or dowel through the center mark.



SCIENCING: (observing, communicating and comparing)

1. Why do you think this is called a plane table?
2. How would you describe a plane?
3. How many different planes can you identify in this room or area?
4. If the depth of the pond is being measured, why are we talking about planes?
5. How did you find the "exact" center of the plane table?
6. How would you make a three-legged plane table?
7. Which is better a one, three or four-legged plane table? Why? What are the advantages and disadvantages of each?

TIP: Alternative Method for finding the "center" of a plane table

ACTIVITY C: Alidade

OBJECTIVE: Youth will use their math and woodworking skills to build an alidade, a straight edge with sights.

MATERIALS YOU WILL NEED:

- ❑ ¾" x 2" molding, cut 18" long
- ❑ 1 ½" "finishing" nails, 2 nails
- ❑ Saw
- ❑ Hammer
- ❑ Pliers
- ❑ Safety glasses or goggles, (optional)

GETTING READY:

- Review safety precautions when using power and/or woodworking tools.
- Obtain all necessary materials.
- Cut molding to the required length.

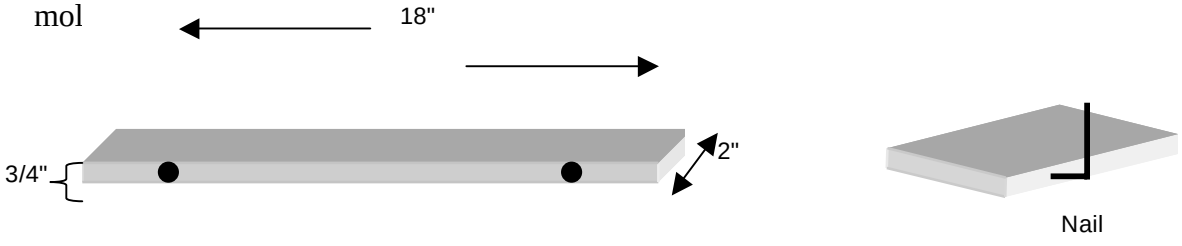
NOTE: The adult will need to determine how many of each tool is needed. For example, one alidade will be needed for each plane table.

SUGGESTED GROUPING:

Small groups of 2-3 participants. Groups can be divided among the activities in this session. Each group will not use every tool.

ACTION: (communicating, comparing)

1. What is an alidade? Why is it important in mapmaking?
2. In the middle of the ¾" edge near each end, drive a finishing nail halfway.
3. Bend nails at a 90 degree angle so they are perpendicular to the 2" side of the mol



SCIENCING: (observing, communicating, comparing, and relating)

- When does connecting two points always make a straight line? When does it not?
- Try drawing a straight line between two points. Try drawing not straight line between two points. Is it possible?
- When does connecting three points make a straight line? When does it not? What other shape can be made connecting three points?
- Does it make a difference if you use the straight edge to draw your lines from the nail side or opposite side of the nail points? What is the difference?
- If you did not have an alidade, what other instrument could you use to determine the line of sight? What else could you use?
- In using an alidade, what errors can occur in your measurements? How could you double check your measurements? Why would you want to double-check your measurements?

ACTIVITY D: Measuring Rope

OBJECTIVE: Youth will learn how to make a simple measuring device that can be used in place of an expensive measuring tape or hip chain.

MATERIALS YOU WILL NEED:
Per team of 2-4 participants

- ❑ Cotton or nylon rope, 200 feet or more; i.e. clothes line
- ❑ BLACK waterproof marker
- ❑ RED waterproof marker
- ❑ Measuring tape, 10 ft minimum
- ❑ Masking tape, 1 roll
- ❑ Empty gallon milk container or electric cord winder or similar object.

GETTING READY:

Obtain all necessary materials. You will need a large flat surface at least 10 ft in length for measuring the rope.

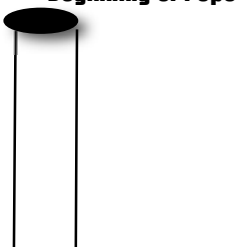
SUGGESTED GROUPING:

Small groups of 2-4 participants. Groups can be divided among the activities in this session. Each group will not use every tool.

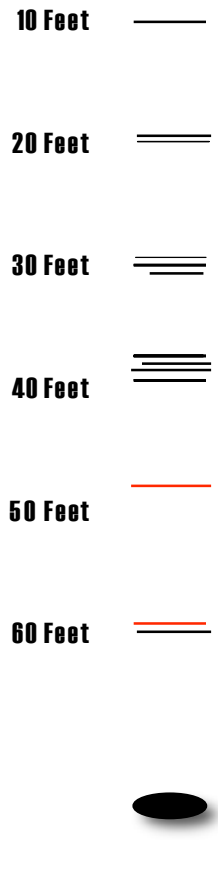
ACTION: (communicating, comparing)

1. On the floor, measure 10 ft. and mark the beginning and end with masking tape.
2. Tie a loop in the end of the line or rope.
3. Measure 10 feet from the knot of the loop. Mark with the BLACK pen; make a ring around the rope.
4. Continue to measure every <u>ten</u> feet. Use the chart below to mark each 10 foot interval on the rope with circles.
5. Use the gallon milk carton to store the rope so that it doesn't get tangled. Put one end of the rope in the carton and gently feed the remaining line through the hole in the top of the carton. Or use an electric cord winder.

B = BLACK = 10 Feet **R = RED = 50 Feet**



Length In Feet	# of BLACK Circles	# of RED Circles
10	B	
20	BB	
30	BBB	
40	BBBB	
50		R
60	B	R
70	BB	R
80	BBB	R
90	BBBB	R
100		RR
110	B	RR
120	BB	RR
130	BBB	RR
140	BBBB	RR
150		RRR
160	B	RRR
170	BB	RRR
180	BBB	RRR
190	BBBB	RRR
200		RRRR



SCIENCING: (communicating, comparing, and relating)

- When finished marking the rope at every ten feet, practice reading the measurements.

  What length is one red and three black circles? Or two red and one black? Test each other.

- What does the marking system resemble?

- What are other ways you could mark the rope as a measuring tool? *(Tie on pieces of fabric)*

- How accurate is your measuring rope? How do you test for accuracy? Why is accuracy important?

- Is there a difference between using cotton or nylon rope? What happens to the cotton rope after the line has gotten wet? What might happen to the markings on either rope?

SESSION FOUR

Being Prepared

PURPOSE:

Youth will

- Identify one or more bodies of water to map
- Explore natural features and terrain of the surrounding area
- Learn about the geological, ecosystem, wildlife, and folklore of the pond
- Plan and organize an outdoor activity
- Develop safety rules for the activity around the pond

BACKGROUND INFORMATION:

This session leads participants through activities that will prepare them for their pond mapping adventure. The first step is to locate a pond suitable for mapping. By exploring maps of the area, ponds can be identified and then selected based upon their location, size, and accessibility. Maps can also tell them about the surrounding terrain, elevation, and watershed.

Once a body of water has been selected, youth will need to request permission from the landowner to conduct their pond mapping activity. If the pond is on public property, participants should notify the appropriate public agency. If private, written permission should be sought.

Participants can find out about the history of the pond by interviewing the landowner and older residents in the community. A trip to the local library and courthouse can provide interesting facts about the body of water as well as possible folklore associated with the pond. Locating old photos and maps can help participants identify changes in the pond and surrounding areas that have occurred over time.

Holding an activity outdoors provides many opportunities for youth to learn environmental stewardship. One activity included is about what is beneath the water surface. By using a bottom dredge, children will explore living and non-living things in the mud! This is a great opportunity to help children use the power of wonder. Children have the ability to be serious scientists. They observe and hypothesize and are eager to share their observations. Encourage all the theorizing you can with the children. Why do birds built their nests in trees? Or why do worms live underground? You will be helping them to develop to be true stewards of the land, and gaining new insights about the world around us. This activity is just the beginning to further explore habitats or ecosystems around the pond.

Plan on meeting with your group before the activity to go over the safety rules. A game about safety outdoors and around water is fun to play. Be sure to make a chart of the safety rules so that everyone knows and understands the rules.

Additional 4-H resources available to supplement these lessons include

Exploring Your Environment (4HCCS-7708)
Outdoor Adventures (4HCCS-8047)

Both curriculums were published by the 4-H Cooperative Curriculum System and may be ordered from the National 4-H Council. Check your local Cooperative Extension Service for these and other resources helping children to understand and appreciate and experience the environment.

ACTIVITY A: Finding a Pond

OBJECTIVE: Youth will select a body of water to map and explore the terrain of the surrounding area.

MATERIALS YOU WILL NEED:

- ❑ Forest Service and/or topographic maps of area of interest
- ❑ Magnifying glass, 1 per small group of 2-3 youth

GETTING READY:

1. Collect road maps, Forest Service and topographic maps of the area of interest. Remember: Topographical maps will show more detail.

2. To order topographical maps, use one of the following options:

   - Refer to your local phone book's yellow pages for the sporting goods dealers that sell USGS maps and contact them directly for pricing and ordering information. Buying from a retailer is usually the fastest way to obtain a USGS topographic map in the size format most user friendly.

   - Topographical maps of nearly all the United States are available from the Office of the U.S. Geological Survey (often referred to as USGS) and can be found on the Internet at: http://www.usgs.gov/pubprod/index.html#maps

   - The Web page titled "View USGS Maps and Aerial Photo Images Online" offers several links to locate and print maps. The address is http://geography.usgs.gov/partners/viewonline.html

   - Contact any USGS Earth Science Information Center (ESIC) for more information or ordering assistance. Call 1-888-ASK-USGS (1-888-275-8747) or write:

     USGS Information Services
     Box 25286
     Denver, Colorado 80225

3. Other sources include the U.S. Forest Service and the National Park Service. Both agencies have developed planimetric and topographical maps of many of the areas that they administer.

4. Identify possible ponds in the area of interest. The age of the participants and their safety should be the major factor in your decision making

SUGGESTED GROUPING:

Small groups of 2-3 participants

ACTION:

1. Have the participants take a close look at the area by exploring the map(s). Are there any ponds of less than 10 acres? How do you know? Are there outlines of the lake perimeter available?

2. Identify possible ponds in the area. The age of the participants and their safety should be the major factor in your decision making.

SAFETY TIP
It is best to choose a body of water where powerboats are not allowed.

3. Use one or more of the maps to decide the route the group will take to get to the pond that you will be mapping.

4. Are the ponds selected on private or public lands? Do you think you will be able to receive permission to map the pond? How will you go about getting permission?

5. Make a final selection based upon the size of the pond, route to the pond, accessibility, and safety for participants.

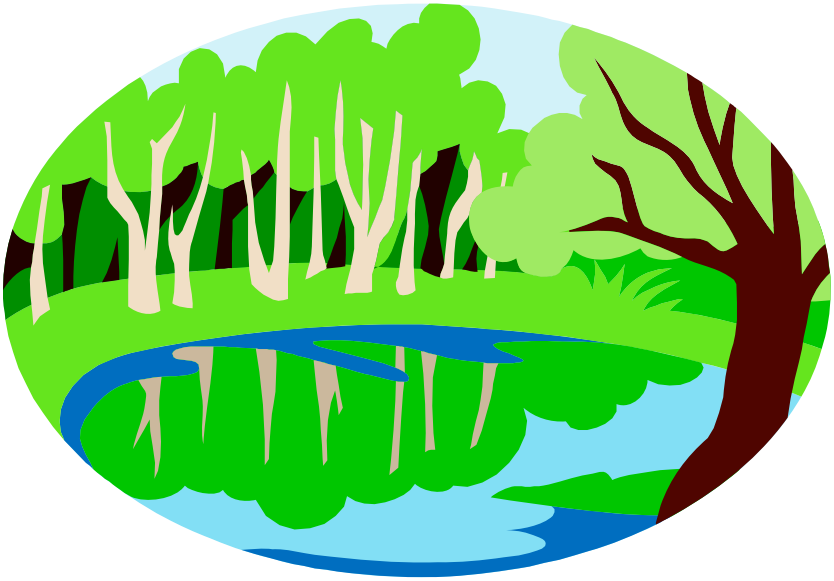
SCIENCING: (observing, communicating, comparing, relating)

- What elevation is each of the ponds? Which ponds are accessible by automobile? What road and/or weather conditions should be considered if you were visiting the ponds? (i.e. paved or dirt road, snow level during winter months, drought, other? etc.)

- How far is each pond from their home? Is it a day trip? Is camping an option? Is there a campground?

- After selecting the pond, do some exploring on the maps.

    - ✓ How does the pond receive its water?
    - ✓ Follow the small streams on the map to the higher elevations. How many streams feed the pond?
    - ✓ Identify the valleys and ridges surrounding the pond. How do they impact the water flow to the pond?
    - ✓ Is the pond natural or man-made? What else can you tell by the map? What is meant by watershed?



ACTIVITY B: Learning about the Pond

OBJECTIVE: Youth will explore ways to learn more about the pond i.e. geology, ecosystem, folklore, and wildlife. They will learn how to make simple water quality measuring devices.

MATERIALS YOU WILL NEED:

- ❑ Topographical map of the pond and its surrounding area
- ❑ Field Guides, i.e. wildlife, birds, insects, plants
- ❑ Paper
- ❑ Pencils
- ❑ Telephone book of the area
- ❑ Calendar

GETTING READY:

After selecting the pond, collect any written information from the landowner and/or public agency about the history of the pond.

SUGGESTED GROUPING:

Divide participants into teams of 2 or more to interview public agencies, landowner, historians, biologist, etc.

ACTION:

1. List the individuals that may know more about the pond.

_____ _____

_____ _____

2. What public agencies have jurisdiction in the area?

_____ _____

_____ _____

3. Is there a local historian?

_____ _____

4. List questions you could ask these individuals. Some samples are:
   - Have you worked in the area or near the pond?
   - What type of work was performed?
   - Have you done any experiments about the pond? What were the results?
   - Do you know the history of the pond?
   - Is the pond man-made or natural?
   - Is the pond seasonal or year around?
   - Where does the pond get its water?
   - Has the pond ever been surveyed?
   - What do you know about the depth and contours of the pond?
   - What are some of the uses of the pond?
   - Additional questions?

   _____

   _____

   _____

5. Visit your local library for resources about the area and the pond. Check out the local newspaper archives, courthouse records, and memories of residents. Is there any folklore associated with the pond?

6. Using field guides, the Internet and other resources, list the animals, birds, fish, and other wildlife you might expect to see while visiting the pond. What determines which wildlife may be present? (elevation, soil type, temperature, and available water, food, and shelter)

TIP:
Contact the local U.S. Forest Service office to locate publications identifying the flora and fauna of the region.

7. Are there endangered species in the pond and/or surrounding area? How are they being protected?

8. Has the habitat changed in recent years? How important are plants to the ecosystem? Are there different plants today then 10 years ago? Twenty years ago? Who would you ask? What observations or experiments could you do to measure any change in the ecosystem and habitat?

9. Define erosion, runoff, sediment, and filters. How do they affect the ecosystem of the pond? (An ecosystem consists of all living and non-living things and how they function together as a unit in nature.)

10. How could you measure the water quality of the pond? What can you do to help improve water quality?

11. Is the pond an isolated ecosystem?

12. If it has a dam, what material was used to make the dam? Earth? Cement?

13. Are there wood boards in the spillway to raise the water?

14. Is there a pipe in the bottom of the dam? What is the purpose of the pipe?

15. If the dam broke, would it cause damage downstream?

16. Do any fish live in the pond? Are there any species of fish that would not be good to have downstream?

SCIENCING: (observing, communicating, comparing, relating)

- Share your findings with others

ACTIVITY C: Planning for the Day

OBJECTIVE: Youth will make decisions about date(s), travel arrangements, supplies and equipment needed, and other activities.

MATERIALS YOU WILL NEED:

- ❑ Pencil
- ❑ Notebook or paper
- ❑ Calendar
- ❑ List of all participants with telephone numbers and addresses

GETTING READY

Be familiar with the pond mapping activities and materials needed. Ask about any requirements such as permission and medical release forms, use agreements, etc. from your sponsoring agency and/or landowner.

SUGGESTED GROUPING

A committee, of 4-5 individuals, should be appointed to finalize the planning. Youth and adults should be involved.

ACTION:

1. As a group, you first need to decide if mapping the pond will be a day trip or an overnight activity. Ask these questions:

    a. How many miles to the pond? What is the travel time to the pond?

    b. Are there maps and/or directions to the pond site?

    c. What are the roads like? Paved? Dirt? Curves? Steep?

    d. Can you travel to and from and map the pond in one day?

    e. Are participants willing to travel and stay one night? Two nights?

2. Pick a date(s) and times. When can most participants attend?

3. What adults are available to provide transportation? Do the roads require any special vehicles i.e. 4 wheel drive. How many individuals and gear can each adult take?

4. Will everyone be responsible for their own food or do you want to eat as a group? What meals will be provided? Who decides the menu? Who will buy the food? Who will prepare the food?

5. Is there a campground with facilities nearby i.e. tables, stoves, campfire pits, toilets, garbage collection, potable water, etc.? If not, will you need to bring tables, stoves, water, wood, etc.? Do you need a fire permit? Who will carry the trash out?

6. What personal items will participants need to bring? Should groups or families be assigned to bring tents, chairs, etc.?

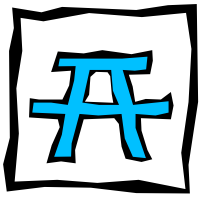
7. What other activities do the participants want to do? Are there areas of interest nearby?

8. What are the anticipated weather conditions? Does weather vary from the valley to the mountains? How can you prepare for rain and/or cold temperatures? What is the best clothing and footgear to wear?

9. What supplies do you need for the pond mapping? Are there small boats and life jackets available? How can you transport the boats to the pond?

10. What are the expenses? How will the trip be paid for? Fund raising activities? Donations? Individual costs?

11. Should chairs and committees be formed to accomplish these tasks?

ACTIVITY D: Beneath the Surface

OBJECTIVE: A bottom dredge can be used to collect mud and debris from the bottom of a body of water. This activity will give you instructions on how to build a bottom dredge to further explore the life beneath the surface of the pond.

MATERIALS YOU WILL NEED:

- One empty can (3 lb. coffee can or #10 can) or a plastic 1-gallon milk jug
- Medium weight wire or cord, 3 feet
- Hammer and nail
- Wire cutters or scissors
- Heavy duty sandpaper or metal file if using a metal can
- Heavy rope or cord, 20 feet
- Hand lens
- Plastic containers such as buckets, dishpans, clear jars, trash bags, tablecloths
- Field Guides, i.e. wildlife, birds, insects, plants

GETTING READY

Gather all supplies.

ACTION: Making the Bottom Dredge

1. Cut the top off of the milk jug to resemble the size of a large coffee can. Or be sure there are no sharp edges on the top of the metal can, if so, sand the edges of the can.

2. Use the hammer and nail to make several holes in the bottom of the can or milk jug. Make three equally spaced holes in the top edges of the can or jug.

3. Cut three 12 inches length of wire or cord. Attach each piece of wire or cord to one of the three holes at the top of the can or jug. Tie the three pieces together.

4. Make a loop and attach the longer rope to the three pieces tied to the can or jug.

ACTION: Using the Bottom Dredge at the Pond

1. Toss the bottom dredge into the water and allow it to settle to the bottom. *Be sure to hold the free end of the rope to avoid losing the dredge.*
2. Retrieve the dredge by pulling it along the bottom of the pond. The dredge scrapes mud and debris samples from the bottom as excess water drains through the holes.
3. Pour the mud and debris sample into a plastic container or spread it out on a plastic tablecloth or bag.
4. Examine the mud and debris samples carefully with a hand lens, and look for signs of life. Break apart the sample, looking closely for small animals that may be swimming around. Insects, frog eggs, worms, spiders, and other small creatures should be found.
5. Put some pond water and mud mixture in a clear plastic jar. Shake it and then let it stand for 30 minutes. What happens?
6. Give the children time to further explore this new habitat and its creatures. Older children could try to identify living plants and animals by using a field guide.
7. After the samples have been viewed, return the organisms and mud to the pond.

SCIENCING (observing, comparing, relating):

- What living and non-living things did you find? ? Is mud living or non-living?
- Why would living creatures be found in the mud? How do animals depend upon mud?
- Where did you find them? Were they on the bottom of the pond? Or were they floating on top of the water?
- Were they hiding? Why were they hiding?
- What do the creatures eat? How do they breathe underwater?
- How can plants grow in water? Why don't they drown?
- What would happen if there weren't any mucky mud in wetlands? What is needed to make the mud in wetlands?
- Did they like digging through the mud with their hands? Would they like to live in the mud? Would they like to find their food in the mud?
- Beside mud, what other kinds of habitat can you find around a pond?
- What does your findings tell you about the ecosystem?

ACTIVITY E: Safety First

OBJECTIVE: Youth will learn safety rules for around bodies of water and in the forest and make a list of safety rules for their outing.

MATERIALS YOU WILL NEED:

- ❑ Duplicate "Safety First" Game Cards
- ❑ Scissors
- ❑ Large open area, at least 30 feet long, i.e. playing field, parking lot
- ❑ Poster paper
- ❑ Marking pens

GETTING READY:

- Read the rules of the game and gather all supplies.
- Duplicate Pond Safety Game Cards, 1 set for each team of 2-10 players
- Use scissors to cut apart the game cards on the dotted lines
- Identify start and end location in the open area.

SUGGESTED GROUPING:

Small groups of 2-10 individuals.

ACTION:

1. The game is similar to "Mother-May-I". Select a person to serve as the "Safety Leader" and the other players line up at the beginning location facing the leader.
2. The "Safety Leader" has the deck of "Safety Game" cards. The "Safety Leader" draws a card, reads the situation, and asks the first player to respond by saying the situation is "SAFE" or "UNSAFE".
3. At each turn, discuss why the situation is SAFE or UNSAFE.
4. Alternate: There could be teams of players and they could discuss with each other how to answer the question.
5. The "Safety Leader" instructs the player to move forward or backward a number of steps depending on the "SAFE" or "UNSAFE" response. (*A player that provides the*

correct response to the question is instructed to take steps forward, incorrect responses are instructed to take steps back).

6. The "Safety Leader" selects another "Safety Game" card, reads the situation, and asks the second player to respond, and etc.
7. The first player to reach the end location knows how to be safe around a body of water and in the forest!
8. After playing the game, as a group, identify a list of safety rules for your outing.

SCIENCING (observing, comparing, relating):

- After playing the SAFETY GAME, gather participants into a large group.
- Ask participants to make a list of safety rules for their outing. What safety rules should we have when we visit the pond?
- Using a marking pen and piece of poster paper, record the safety rules that participants want to add. You can use the list of SAFETY RULES to get your group started.
- Discuss each rule. Why is it important?
- What happens if someone doesn't follow the rules? What are the consequences?

Remember to take the poster with you to the lake or pond so you can review the rules with the group when you arrive.

Separate SAFETY GAME cards by cutting on the solid lines.

You forgot to wear your personal floatation device (PFD) or lifejacket while in the boat. SAFE: Go back to START UNSAFE: Go forward 2 GIANT steps	Someone has fallen from a boat into the water. You swim out to them to help. SAFE: Go back to START UNSAFE: Go forward 4 BUNNY hops
You put on your lifejacket or personal floatation device (PFD) on before getting into the boat. SAFE: GO forward 4 BUNNY hops UNSAFE: Go back to START	Someone has fallen from a boat into the water. You first try to reach them from the shore. SAFE: Go forward 2 BACKWARDS steps UNSAFE: Go back to START
You are wearing a personal floatation device (PFD) or lifejacket that is too big for you. SAFE: Go back to START UNSAFE: Go forward 3 REGULAR steps	Someone has fallen from a boat into the water. You throw something to the person that will help them float in the water. SAFE: Go forward 2 SCISSOR steps UNSAFE: Go back to START
Your boat flipped over and you stay calm, yell and wave your arms, and stay with the boat waiting for help. SAFE: Go forward 2 SCISSOR steps UNSAFE: Go back to START	After mapping the pond, you leave the flags along the shoreline. SAFE: Go back to START UNSAFE: Go forward 6 BABY steps
You took the boat alone across the lake. SAFE: Go back to START UNSAFE: Go forward 2 GIANT steps	After mapping the pond, as a group, everyone picks up the flags, their trash and other trash along the shoreline and trail. SAFE: Go forward 3 REGULAR steps UNSAFE: Go back to START

Separate SAFETY GAME cards by cutting on the solid lines.

Everyone in your boat stayed seated at all times. SAFE: Go Forward 2 SCISSOR steps UNSAFE: Go Back to START	**BONUS – Go Forward 2 Regular Steps**
Someone has fallen from a boat into the water. You go find an adult to help. SAFE: Go forward 4 BUNNY hops UNSAFE: Go back to START	You and others go on a hike to explore the stream that feeds the pond. You get separated from the group and you follow the stream back to the pond to a familiar place. SAFE: Go forward 6 BABY steps UNSAFE: Go back to START
A friend and you are in a two-person boat. You find another friend along the shore and you agree to give him a ride back to the dock. SAFE: Go back to START UNSAFE: Go forward 2 GIANT steps	You and others go on a hike to explore the stream that feeds the pond. You get separated from the group and as soon as you realize you are lost, you find an open place, yell for help, and stay there until you are found. SAFE: Go forward 4 BUNNY hops UNSAFE: Go back to START
You see floating in the water an empty soda can. You reach out with your hand to get it. SAFE: Go back to START UNSAFE: Go forward 3 REGULAR steps	You are a member of the flag crew and you get thirsty. You take a drink from the pond. SAFE: Go back to START UNSAFE: Go forward 2 SCISSOR steps
You see floating in the water an empty soda can. You maneuver the boat so the can is very close to the side and you carefully reach out with a net and retrieve the trash. SAFE: Go forward 3 BACKWARDS steps UNSAFE: Go back to START	You are a member of the flag crew and you have brought water and a snack in a backpack. SAFE: Go forward 3 REGULAR steps UNSAFE: Go back to START

You and others go on a hike to explore the stream that feeds the pond. You get separated from the group and go cross-country in the direction, you believe, is camp. SAFE: Go back to START UNSAFE: Go forward 4 BABY steps	You are a member of the flag crew and as you are waiting for the boat to return, you see a mountain lion or a bear. You become afraid and run back to camp. SAFE: Go back to START UNSAFE: Go forward 2 GIANT steps
You are in a small boat and you throw all of your gear in the boat without worrying if the boat remains balanced. SAFE: Go back to START UNSAFE: Go forward 2 SCISSOR steps	You are hiking around the pond and discover a boggy area. You take off your shoes and walk through it. SAFE: Go back to START UNSAFE: Go forward 2 GIANT steps
You and others go on a hike to explore the stream that feeds the pond. You get separated from the group and go cross-country in the direction, you believe, is camp. SAFE: Go back to START UNSAFE: Go forward 4 BUNNY hops	You are a member of the flag crew and as you are waiting for the boat to return, you see a bear. You watch the movements of the bear and do not make eye contact. You hold your arms up high or open your jacket so you appear bigger. SAFE: Go forward 3 BACKWARDS steps UNSAFE: Go back to START
You are in a small boat and you know that it is easy to become unbalanced and turn oven. So, when you must move you make sure that someone else moves the opposite way to counterbalance the boat. SAFE: Go forward 4 BUNNY hops UNSAFE: Go back to START	You and others decide it would not be camping without a campfire. You check with the forest service for the fire danger and obtain the proper permit. You have a shovel, bucket and water next to the campfire. SAFE: Go forward 2 GIANT steps UNSAFE: Go back to START
You are hiking around the pond and discover a boggy area. You find a different path to go around the pond and not cross the boggy area. SAFE: Go forward 4 BUNNY hops UNSAFE: Go back to START	You are hiking around the pond and discover the shoreline is very steep with shale. You climb to the top of the steep slope and bypass the unsafe area. SAFE: Go forward 3 REGULAR steps UNSAFE: Go back to START

It is late in the summer and it is very dry and hot. You and others decide it would not be camping without a campfire. You gather wood in the forest and start the biggest campfire you can. SAFE: Go back to START UNSAFE: Go forward 3 BACKWARDS steps	You and others had an evening fire to keep warm and enjoy the outdoors camping. When it was time to go to bed, you poured several buckets of water on it and stirred the coals. SAFE: GO forward 2 GIANT steps UNSAFE: Go back to START
You and others had an evening fire to keep warm and enjoy the outdoors camping. When it was time to go to bed, you let the fire burn itself out. SAFE: Go back to START UNSAFE: Go forward 6 BABY steps	You are a member of the flag crew and it is boring waiting for the boat crew to return. To keep busy, you have brought along binoculars and a bird watching field guide. SAFE: Go forward 2 GIANT steps UNSAFE: Go back to START
It is a nice sunny day in the mountains. You will be around water and it just seems an opportunity to get a good suntan. So, you wear your shorts and sleeveless shirt. SAFE: Go back to START UNSAFE: Go forward 3 REGULAR steps	You are a member of the boat crew. You decide to wear a wide brimmed hat, sunglasses, long pants, long sleeve shirt, and sunscreen to protect yourself from the sun's rays at high altitudes and from the glare of the water. SAFE: Go forward 3 REGULAR steps UNSAFE: Go back to START
It is a nice sunny day in the mountains and you will be outdoors surveying the pond. You decide to wear a wide brimmed hat, long pants, and put on sunscreen lotion. SAFE: Go forward 2 GIANT steps UNSAFE: Go back to START	You are a member of the boat crew and it is hot out in the boat! You dipped your hat in the water to get it wet for additional cooling. SAFE: Go forward 2 GIANT steps UNSAFE: Go back to START
At high elevations, a day in the sun can lead to sunburn. To protect yourself, you apply a sunscreen, at least SPF15, liberally to all exposed skin at least 30 minutes before sun exposure. SAFE: Go forward 2 SCISSOR steps UNSAFE: Go back to START	You are a member of the flag crew and it is boring waiting for the boat crew to return. To keep busy, you are throwing rocks into the pond and over the trees. SAFE: Go back to START UNSAFE: Go forward 4 BUNNY hops

SAFETY RULES

- ✓ All boat crewmembers **must** wear life jackets.
- ✓ Don't overload boat.
- ✓ Stay seated and centered in boat.
- ✓ No horseplay while working.
- ✓ Be alert and aware of others making sure they are not in trouble.
- ✓ An adult should be in each boat.

✓ _____

✓ _____

✓ _____

✓ _____

✓ _____

✓ _____

✓ _____

✓ _____

✓ _____

✓ _____

✓ _____

✓ _____

✓ _____

THINK SAFETY FIRST

SESSION FIVE

On Golden Pond

PURPOSE:

Youth will

- Apply the use of surveying tools and measuring equipment
- Collect, record, and compile data
- Accurately read measuring equipment
- Cooperatively work together to achieve a goal

BACKGROUND INFORMATION:

In this session, participants will use the tools they constructed in Session 2 and 3: Tools of Trade to survey and measure the perimeter and depth of a body of water. The Pond mapping project can be done on any size body of water available.

The first activity suggests practicing using the steps and techniques in mapping a small area such as a playground, sidewalk, or space outlined with a rope or cones. Make it simple without the water. Then next, the group can map larger areas including bodies of water such as a swimming pool, water hazard on a golf course, stock pond on a farm, or a small lake.

The data collected at the site will allow participants to prepare a contour map of the body of water. Session 6: Map Making provides activities and instructions for using their data to make a contour map of the body of water that they visited.

It is important that all participants learn to use each of the tools and measuring equipment, so make plans to rotate teams. It may be necessary to pair an older participant with younger participants to ensure safety on and around the water.

ACTIVITY A: Mapping the Shoreline

OBJECTIVE: Youth will use surveying and measuring equipment to map the perimeter of a small body of water.

MATERIALS YOU WILL NEED:
Per small team of 4-5 participants

- ❑ Plane table
- ❑ Compass
- ❑ Alidade
- ❑ Engineer's Ruler
- ❑ Sighting Pole, 8 ft of PVC pipe or wooden dowel
- ❑ Measuring tape, 50 ft or more, or hip chain
- ❑ Surveyor's flagging tape/flags/cones to identify transect stations or points on the perimeter of the pond
- ❑ Paper, large enough to cover plane table
- ❑ Pencil & eraser
- ❑ Masking Tape
- ❑ Surveyor's orange vests, optional

SUGGESTED GROUPING:

Small group of 3-5 participants

GETTING READY:

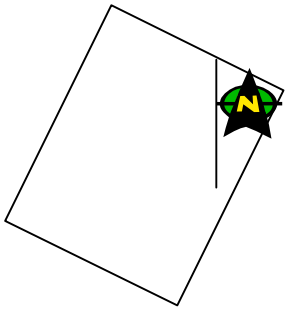
- Identify the shoreline mappers - Three to five people as follows:
  a) One person to steady the plane table keeping it level and align it with North;
  b) One person to mark the paper with points, sight with the alidade, and draw lines on the paper using the alidade;
  c) One person to hold the sighting pole; and
  d) One person to measure the land between points and mark the distance from point to point on the paper using the engineer ruler's scale.
- Gather all materials needed.

ACTION:

1. It is suggested that you do this activity before you get to the pond for practice and to be sure everyone knows the steps to measuring the perimeter and drawing it on paper. An easy way to practice is to set up an imaginary pond with a rope or cones or just draw a road or playground area. It should be at least 50 feet in diameter.

2. Attach a piece of paper to the plane table with masking tape. Adjust the plane table, so the paper will accommodate the shape and size of the body of water.

3. Using your compass, draw a line near an outside edge of the paper that will serve as the north/south direction of your map. Having North/South line square to the paper is convenient.



Pencil a line at the edge of the compass and label North

4. Determine what scale will accommodate your map the best i.e. 1" = 10 feet; 1" = 20 feet; or 1"

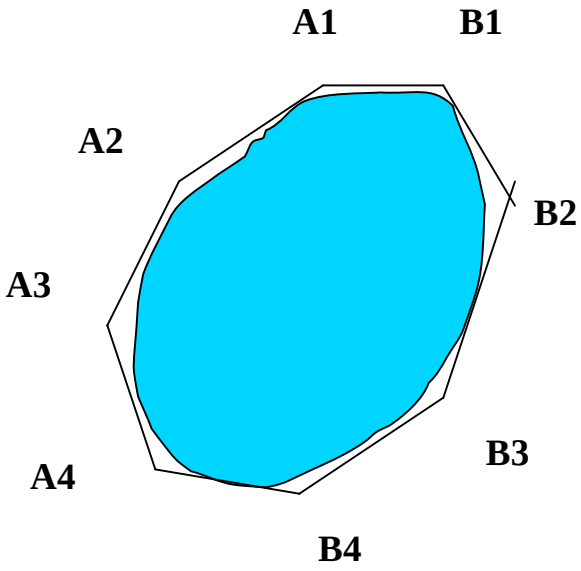
   TIP: If the scale is 1:10 (or 1 ***to*** *10), it means that one inch on the engineer's ruler is 10 feet on the ground. If it is 1:20, one inch is 20 feet on the ground, and etc. Measure or estimate the total length of what you are going to map. If your pond is 150 feet long and your map paper is 16 inches long, you can use the 1:10 scale to fit the map of the pond on the* paper or you may want to use the 1:20 scale to allow more open space on your paper.

5. The transect stations can be the points measured to and from around the perimeter or can be any straight edge along the body of water. Some of the perimeter points should be the same as the transect stations so the contours will be accurate. **Be sure to note the transect stations on your perimeter map.**

6. At the start of your survey, position the plane table's leg above the starting place, Point A1. Use a compass to be sure the plane table is positioned correctly with the North direction.

7. Mark the starting dot, Point A1, on the paper. Line up the straight edge (with the nails) of the alidade with the point so it can pivot against it and sight along it to the sighting pole your assistant is holding at the next key position, Point A2. When you are satisfied that the bearing is correct, using a pencil, draw a line along the alidade from the point of A1, across the paper.

8. Next, measure along the ground from Point A1 to Point A2 (from the plane table's leg to the sighting pole). On the paper, mark the distance along the line on the paper from the starting dot, Point A1, to Point A2 using the engineer's ruler and selected scale. Be sure to mark on the paper all Points. Erase any line that goes beyond Point A2.



Your line on the plane table is drawn straight as it should be; however, the shoreline or road is not straight. At this point, you can become an artist and use your best estimate in drawing the shape of the shore.

9. Move your plane table to the position you sighted, Point A2. Set the plane table so the North line agrees with the compass. Realign the alidade with A2. The assistant takes his sighting pole to the next position that should be A-3. Take another sighting with the alidade against Point A2 to Point A3.

10. Draw that line from Point A2 across the paper. Measure the distance on the ground from Point A2 to A3 and then determine the distance on the paper for Point A3 using the selected scale of the engineer's ruler. Mark the position as Point A3. Erase any line that goes beyond Point A3

11. Continue in this way until you have mapped the perimeter of the body of water. The above example is using the transect stations around the lake that have been numbered A1 through B4. If the points are not transect stations, be sure to identify your perimeter points with a different numbering system such as A, B, C, E, etc.

12. If you want to add a landmark on your map, you can use the same steps. At a suitable point, you sight the landmark with the alidade and draw a line. Later you take another sighting from another site. Then a third sighting can be used to confirm the other two. The intersection of the two or three lines marks the location of the objects sited.

Note:
Producing a map by sighting with a compass or working on a plane table with an alidade achieve very similar results. In practice, there may be little difference between the two methods. If you take compass bearings and measure the distances between points and record the data, you will then create the map using a protractor and ruler. Using an alidade, eliminates the need to read angles and transfer them later with a protractor and ruler. The maps created by either method should look the same.

13. You will be finished when your surveying brings you back to the starting point. The fact that both ends of the line that you are drawing on the map should meet gives you a check on the accuracy of your surveying. Perfection may be difficult to achieve, but you and your team members will have to decide what margin of error the team is willing to accept.

14. After completing the measuring and drawing the perimeter on the paper, take a look at the pond. Does it look similar to what has been written on the paper? Is the shape similar? How about the width and length ratio? Are there any special features i.e. big rocks, creek inflow or outflow, dam, vegetation, campground, etc. that should be noted on the perimeter map?

15. Go to Activity C: Checking Our Data for the SCIENCING for Activities A and B.

ACTIVITY B: Mapping the Depth of a Body of Water

OBJECTIVE: Youth use surveying equipment and tools to measure and record the depth of a small body of water

MATERIALS YOU WILL NEED:

Per small team of 4-5 participants

- ❑ Small boat, raft, canoe, or inner tubes
- ❑ Life Jackets, one for each person in the boat
- ❑ Flotation cushion, one for each boat
- ❑ Surveyor's flagging tape, flags or cones to identify transect stations
- ❑ Flags (bright colored vinyl 2' x2' on a 3' stick), two per team *(a water-ski or construction site flag can be used)*
- ❑ Sounding line, one per team
- ❑ Data recording sheets "4-H Pond Depth Survey" one for each transect station
- ❑ Pencil
- ❑ Clipboard
- ❑ Measuring rope, width of pond (100 ft or more, or hip chain), one per team

GETTING READY:

- Gather all materials needed.
- Determine if it is possible to walk along the shore completely around the circumference of the body of water. Some areas may be swampy and would require the shoreline flaggers to be in boats.
- Estimate how many people and boats are needed. If your group members don't own boats, sources might be: local yacht clubs, sporting goods stores, fishing clubs, or tire shops for inner tubes.
- Determine the crews needed to accomplish tasks:

    a) Flag crew-1-2 people on each side of the lake holding the large, bright colored flag. These people keep the boat lined up on the transect as it makes its way across the lake.

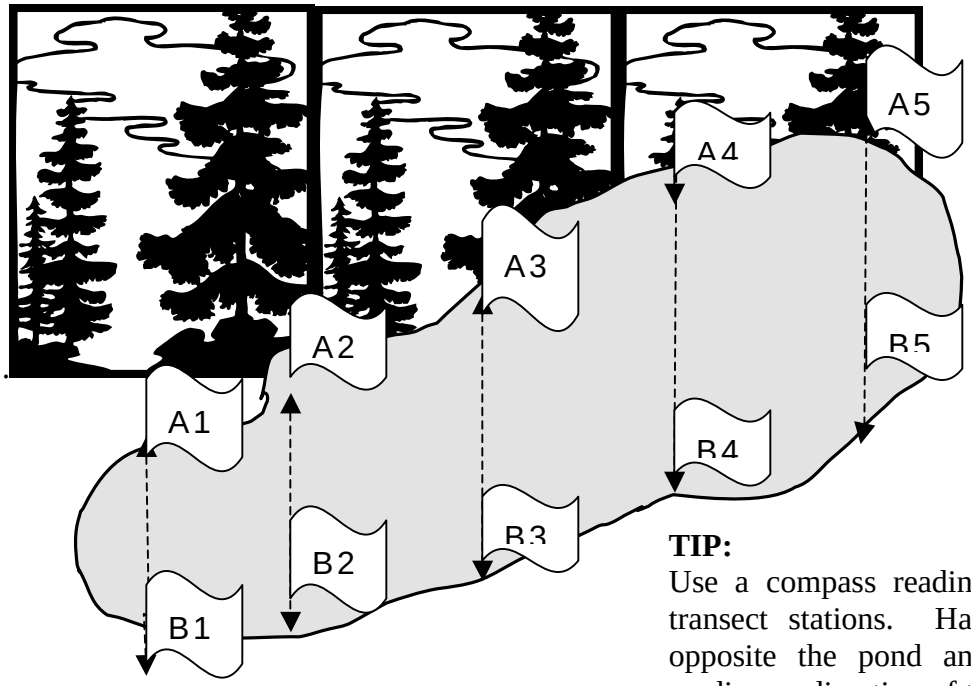
b) Boat crew- 2-3 people in each boat to row, note distance traveled, take depth measurements using sounding line and record on data sheet.

ACTION: (Communicating, measuring, comparing, recording)

First, have the group select transect stations and mark with the flagging tape, cones, or flags.

Transect stations are the positions on each side of the body of water where the boat crew begins and ends each trip across when they are measuring the depth of the pond. The more stations there are, the more accurate the contour map will be.

Determine an A side and B side of the body of water. All flags on one side of the lake will be labeled A1-10+. The other side of the lake will be labeled B1-10+. Walk around the body of water and tie flagging tape at each site with the station number written on the flag. If working with an existing perimeter map, note locations of stations on the map.



TIP:
Use a compass reading to make parallel transect stations. Have a person stand opposite the pond and take a compass reading as direction of travel and then mark the spots (A1 & B1). The same compass reading should be used for all transects.

2. Flag Crew duties:

A. One of each pair of flaggers goes to the A side of the lake, the other partner goes to the B side. Each partner finds and stands by the flagging tape with the first assigned transect station number. Note the station number.

B. When the boat crew arrives, tell them the station number so they can record it on the data sheet.

C. To anchor the line of the hip chain or measuring rope, the flagger, at whose station the boat crew begins, ties the line to a tree or tule. Or the flagger holds or stakes the end of the measuring rope and gives the rest back to the boat crew.

> Hint:
> If you use a measuring rope and it is long enough, the rope can be tied on each side of the pond and the boat can move along the rope. This helps the boat

D. As the boat makes its way across, both flaggers hold their flag where the boat crew can see it. They draw an imaginary line between each other across the lake. The flaggers' call to the boat crew and point their flag in the direction the boat needs to be to stay on course. (Some drifting will occur.)

E. Once the boat reaches the opposite shore the flagger breaks the line of the hip chain or lets go of the measuring tape or rope. It can then be rolled up from the opposite side to be used again. To keep the environment clean, gathered up the linen threads of the hip chain and discard them properly.

F. Move to the next station. Keep the boat on course as they approach you. Repeat as many times as the number of stations the boat crew is assigned. You can begin measuring from the A side or the B side, just be sure to write down the beginning and ending station on the data sheet designating the direction of travel.

Boat Crew duties:

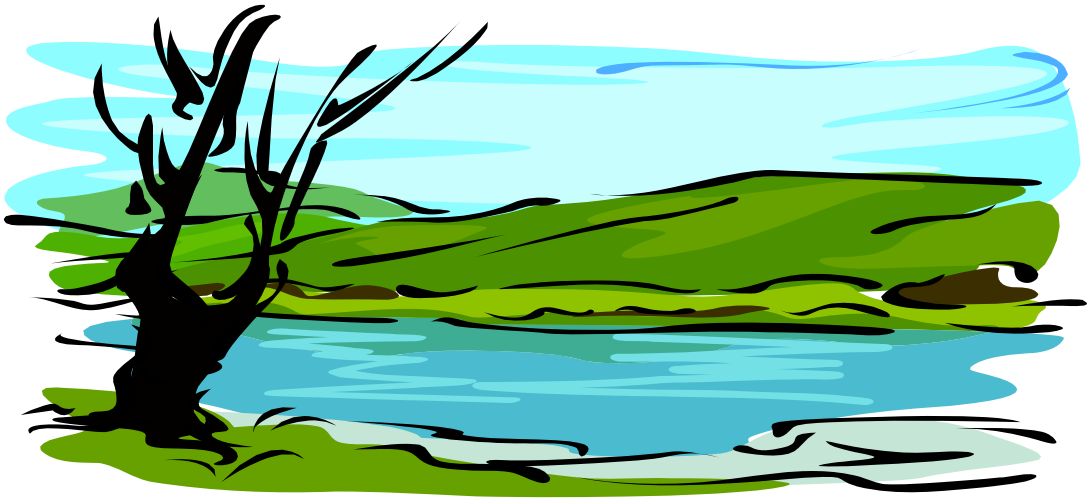
A. Oarsperson rows or paddles boat and keeps the boat in a straight line between stations. Keeps the boat in position while depths are taken.

B. Sounder watches the hip chain or measuring rope distance and lets oarsperson know when the distance is reached. The sounder will measure the depth of the water using the sounding line.

C. Recorder writes the depth and location on the data sheet. Any notes are made regarding obstructions such as rocks, stumps, or vegetation. *(This job may also be done by the sounder or oarsperson.) See the sample data sheet*

D. As a team, record on the data sheet the transect station number and the depth using the sounding line five feet from the shore. Continue taking depths every 10 feet or less depending upon size of the body of water and entering values on the data sheet. When boat reaches opposite shore, note station on data sheet and proceed to next station.

Go to Activity C: Checking Our Data for the SCIENCING for Activities A and B.



4-H Pond Depth Survey

From transect station _A1_ to transect station _B1_ Page 1 of _1_

Name of Pond: Shadow Lake

Date: June 6, 2004

ONE Survey Form is needed for EACH transect.

Distance in feet from shore	Depth of Water	Comments
As you approach the opposite shore, make soundings at your best estimate of 5 feet& 2 feet from shore and enter in the distance column, e.g. 185, 187 **Measuring Rope Markings** B=BLACK & R= RED	Measure the depth in 10' intervals depending upon the width of the body of water.	Note weed beds or anything of interest. There are places the weeds may be too dense for the boat to pass. Make your best attempt to measure.
2	2	Reeds along the shore
5	6	Large rock on the bottom
10 B	8	
20 BB	9	
30 BBB	9	
40 BBBB	10	
50 R	10	
60 B R	12.5	
70 BB R	15	
80 BBB R	16	
90 BBBB R	16	Large rock on the bottom
100 RR	15	
110 B RR	13	
120 BB RR	11	
130 BBB RR	11	
140 BBBB RR	8	
150 RRR	7	
160 B RRR	6	
170 BB RRR	6	
180 BBB RRR	5	
~~190~~ 185 ~~BBBB RRR~~	3	Reeds along the bank
~~200~~ 187 ~~RRRR~~	2	Reeds along the bank

Use additional data sheets, if necessary. Be sure to accurately record the distance from shore.

4-H Pond Depth Survey

From transect station ____ to transect station ____ Page 1 of ____

Name of Pond: _____

Date: _____

ONE Survey Form is needed for EACH transect.

Distance in feet from shore	Depth of Water	Comments
As you approach the opposite shore, make soundings at your best estimate of 5 feet & 2 feet from shore and enter in the distance column, e.g.185, 185 **Measuring Rope Markings** B=BLACK & R= RED	Measure the depth in 10' intervals depending upon the width of the body of water.	*Note weed beds or anything of interest. There are places the weeds may be too dense for the boat to pass. Make your best attempt to measure.
2		
5		
10 B		
20 BB		
30 BBB		
40 BBBB		
50 R		
60 B R		
70 BB R		
80 BBB R		
90 BBBB R		
100 RR		
110 B RR		
120 BB RR		
130 BBB RR		
140 BBBB RR		
150 RRR		
160 B RRR		
170 BB RRR		
180 BBB RRR		
190 BBBB RRR		
200 RRRR		

Use additional data sheets, if necessary. Be sure to accurately record the distance from shore.

ACTIVITY C: Checking Our Data

OBJECTIVE: Youth will take a closer look at their data to determine if their pond map data is accurate. They will also have the opportunity to further explore the pond's habitats, ecology, geology, landmarks, etc.

MATERIALS THAT YOU WILL NEED:

- ❑ Pencil
- ❑ Notebook or paper
- ❑ All of the data collected during Session 5, Activity A and B
- ❑ Easel and/or area to post results

GETTING READY:

When all of the data has been collected including the perimeter of the pond and depth measurements, all participants should meet to discuss their findings.

SUGGESTED GROUPING:

All participants should gather at a large table or seating area. Be sure everyone is able to hear and clearly see the posted data.

SCIENCING: (communicating, observing, comparing, inferring and relating)

1. Did your surveying create an outline of the pond on paper? Does it look like the body of water you surveyed? If not, what could be the errors in measuring or using the equipment? Should you measure it again?

2. Which landmarks did you identify? How did you measure them? How many sightings did you do for each landmark? Comparing your map and looking at the pond place, are the landmarks placed correctly on your map of the pond?

3. What are some additional landmarks that could be added to make the map more complete and accurate?

4. Was the body of water as deep as you thought? Did you find an area that was difficult to measure? Why was it difficult? How accurate do you think you are?

5. If you were to re-measure the pond, what would you do differently?

6. How well did your team work together? Was there a leader? What conflicts did you have?

7. Did everyone have an opportunity to do the different roles? Which role did you like best?

8. What other data can be collected to learn more about the pond?

    a. Do you know the temperature of the water? Is the temperature warmer or colder at the inlets and outlets? How does the surface temperature compare to the temperature of the air? Does the temperature change at different depths?

    b. What is the water quality? Can you see the bottom? If not, at what depth does the water become cloudy or opaque? Are there living organisms in the water?

    c. What is the bottom of the pond like? Does it vary because of depth and/or distance from the shoreline? What factors affect the bottom of the pond?

9. Did anyone see any wildlife, fish, birds, or insects? What types of animals would you expect to see? What are some signs that wildlife has visited the pond and its surroundings?

10. What types of plants are near the pond? Are the plants the same all around the pond? If not, why do some plants grow in places others do not? How many different varieties of trees did you see?

11. What is the elevation? Does elevation affect the types of plants and animals that may live here?

12. Of the landmarks that you identified, which ones are natural? Man-made? How do they affect the water flow and/or create habitat?

SESSION SIX

Map Making

PURPOSE:

Youth will

- Understand contour lines on a map
- Create a contour map using data gathered from a small body of water
- Present their findings

BACKGROUND INFORMATION:

A map is a representation, at a reduced size, of part of the surface of the earth. Maps are usually drawn on paper and there are many different type of maps. A good map tells five things:

Description: Gives the name of the area and tells where on earth it is found.

Details: Landscape features are shown on the map by easily understood signs.

Directions: The top of the map is usually north. That makes the bottom south, the left side west, and the right side east.

Distances: A scale in the bottom margin give the means for measuring distances.

Designations: Lakes, rivers, towns, and other features are designed by their names and symbols as listed in the legend.

One of the most widely used of all maps is the topographic map. The characteristic that distinguishes topographic maps from other maps is the use of contour lines to portray the shape and elevation of the land. Topographic maps render the three-dimensional ups and downs of the terrain on a two- dimensional surface.

TIP:
An easy way to remember map directions is the phrase, Never Eat Sour Watermelons.

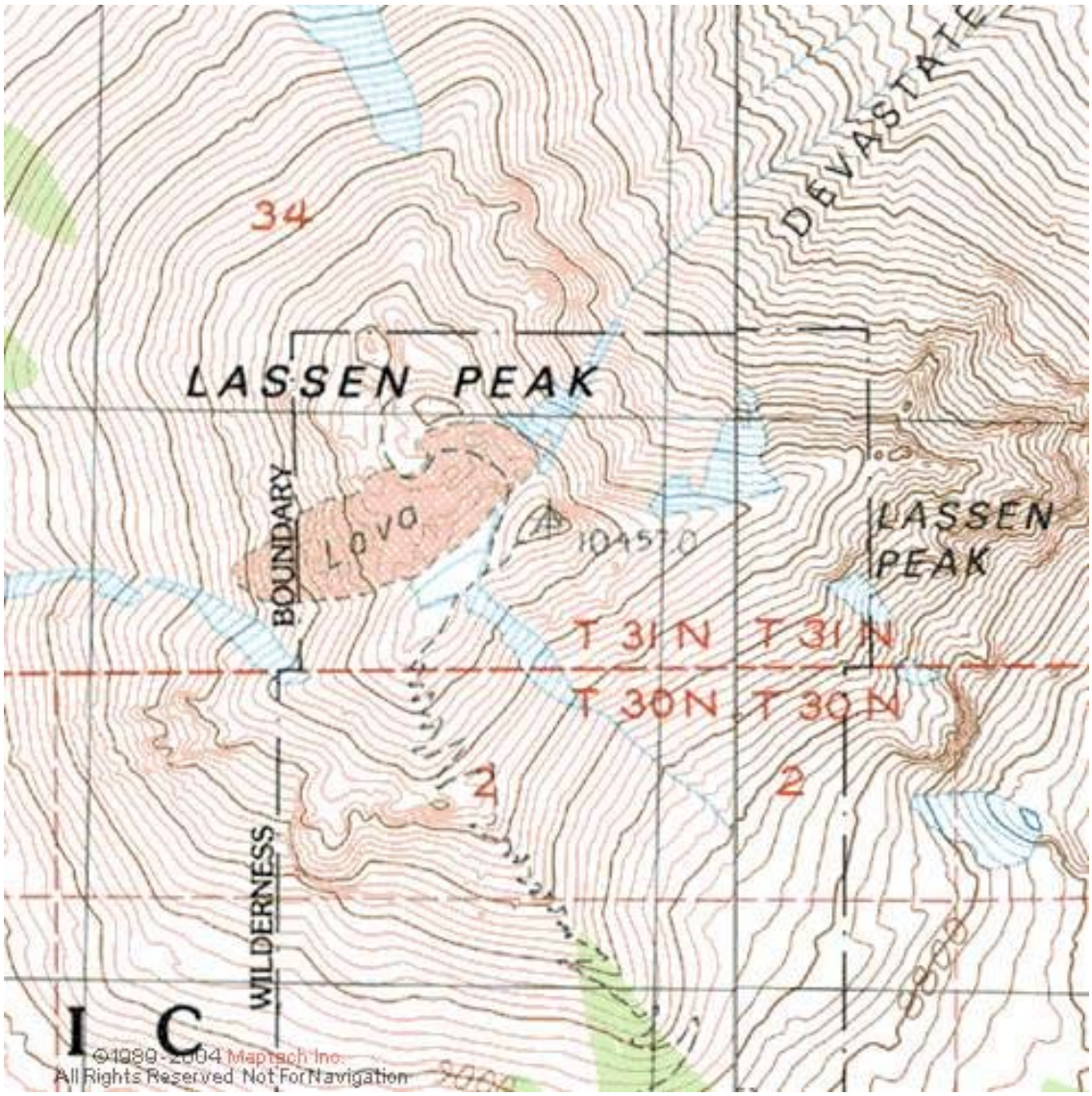
Visualize a clock, at the top is the word Never, at 3:00 is the word Eat, at 6:00 Sour, and at 9:00 Watermelons.

Contour lines on a map represent terrain. Small circles are the tops of hills. Numerous contour lines that are close together indicate steep changes. If the lines are far apart, they represent a gentler slope. Contour lines can be drawn at any desired intervals.

Contour lines connect point of *equal* elevation. You will gain or lose elevation only when you travel from one contour line to another. If you walk along a contour line, you will be level.

The contour interval is the vertical distance between contour lines. Its value in feet or meters is given on the map. If the contour interval is 50 feet, each successive contour line on the map increases or decreases in elevation by exactly 50 feet. Every fifth contour line, darkest in color, is usually labeled with a number that gives the actual elevation above sea level.

Here's a topographic map of Lassen Peak, Lassen National Park, California. The map shows the elevation of the peak (10,457 feet), steep terrain, a trail, lava flow and glaciers.



ACTIVITY A: Understanding Contour Lines

OBJECTIVE: Participants will gain an understanding of the meaning of contour lines on a map by drawing lines on their own fist.

MATERIALS YOU WILL NEED:

- ❑ Sharp tip washable markers, Dark colors, 1 per participant
- ❑ Topographical map (s)

GETTING READY:

1. Make a poster showing basic rules for contour lines.
2. Gather all supplies as listed above.

SUGGESTED GROUPING:

Large or small groups

Basic Rules for Contour Lines

A contour line must never split or divide.

A contour line must never simply end EXCEPT at the edge of the map.

A contour line must represent one and only one elevation

A contour line may never intersect other contour lines. Overhanging cliffs are the exception

Closely spaced contour lines represent a steep slope, widely spaced lines indicate a gentle slope.

ACTION:

1. Ask participants to make a fist with one hand. Explain that your fist has height, width, and length just like the land.
2. Holding their fist steady, tell participants to draw a level circle on their HIGHEST knuckle. Draw another level circle just below that one.
3. Start a third line a little lower. Keep the circles the same distance apart. Notice that to keep the line level, the pen may have to encircle another knuckle before the third circle is closed.
4. Tell participants to continue drawing 5-6 more circles on their fist.
5. After all the lines are drawn, tell participants to spread their hand flat.

SCIENCING: (communicating, comparing and relating)

1. By looking at the contour lines you have drawn, can you imagine the shape of your fist?
2. What do the small circles show?
3. What do the lines that are close together indicate? What do lines that are far apart mean?
4. Do any of your lines cross? Do any divide?
5. Looking at a topographical map, do you see any similarities to the lines on the back of your hand?

ACTIVITY B: Creating Contour Lines

OBJECTIVE: Youth will learn how to create a map indicating the bottom contours of a small body of water.

MATERIALS YOU WILL NEED:

One per participant or team

- ❑ Sharp pencil
- ❑ Engineer's Ruler
- ❑ Tracing paper, 11" x 17", 1 Sheet each
- ❑ Copy of "Shadow Lake" Perimeter Map, and Depth Survey Sheet for each team

SUGGESTED GROUPING:

Individuals or teams of 2 participants

GETTING READY:

- Duplicate "Shadow Lake" Depth Survey Sheet and Perimeter Map
- Display poster on "Basic Rules for Contour Lines", from Activity A
- Remember, a contour line is a line that connects locations that have the same data value.

ACTION:

1. Continue to draw lines connecting the perimeter points (i.e. A1 to B1, etc.) to designate each transect on the perimeter map. The first two transect (A1:B1, A2:B2) are drawn on the sample.

2. Using an engineer's ruler and the perimeter map's scale, record the depth from the depth survey forms on the appropriate transect lines. The depths are recorded for two transect lines (A1:B1, A2:B2) on the sample.

3. Determine the spacing or intervals of the contour lines. What will be the elevation or depth change between the contour lines? To determine the number of contours lines that are needed to illustrate the change in the slope of the bottom of the pond, subtract the number depicting the shallowest part of the pond from the deepest part of the pond. The remainder is the total change from the top to the bottom. Of the pond. In the sample, it is 8 feet. The deepest is 8 feet and the shallowest is the shoreline at 0 feet.

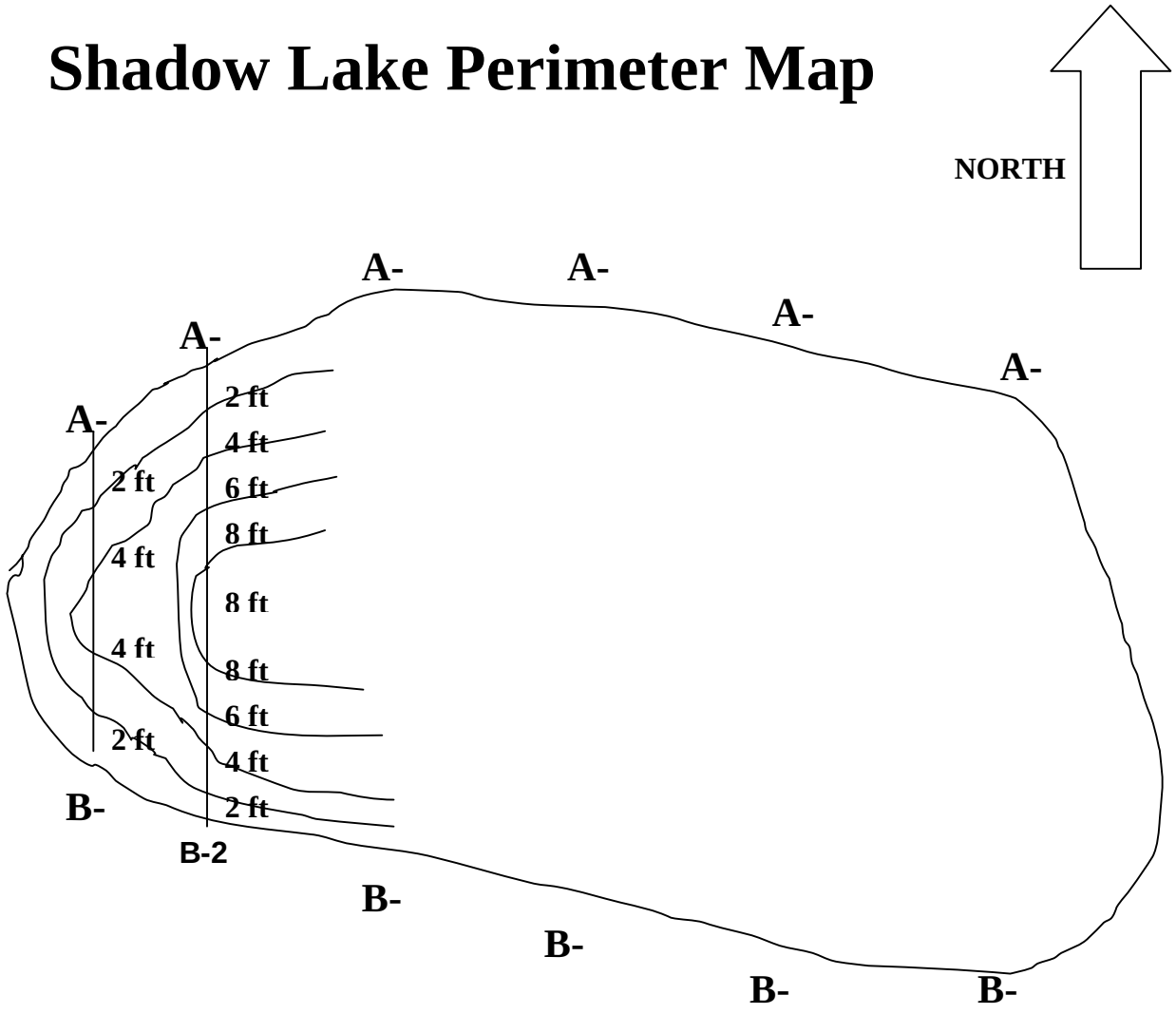
   For this sample pond, a contour line every 2 feet change in depth would be appropriate. Therefore, if you want to have a contour interval every 2'; divide the contour change by 2: the elevation change is 8 feet divided by 2. Your map will have 4 contour lines with each contour line representing an increase/decrease in depth by 2 feet.

4. Using a sharp pencil, continue to connect all the 2s together in a smooth line following the shoreline of the pond. Connect the 4s in the same way, following the curve of the 2s, and continue with each higher number.

5. Remember, like numbers are the same elevation. The grouping of t 8s is the bottom depth of the Shadow Lake. One large circle should be drawn connecting all of the 8s closest to the shoreline. Enter depth data from the survey forms on appropriate transect line.

6. After the contours are drawn on top of the numbers, place a piece of tracing paper over the map and carefully trace the lines to make the FINAL map. Be sure to identify the depth of each contour line and the direction of north.

Shadow Lake Perimeter Map



Shadow Lake Depth Survey Sheets

Station A-1 to B-1

Distance from Shore	Depth
10 feet	2 ft
20 feet	4 ft
30 feet	4 ft
40 feet	2 ft
50 feet	
60 feet	
70 feet	
80 feet	
90 feet	

Station A-2 to B-2

Distance from Shore	Depth
10 feet	2 ft
20 feet	4 ft
30 feet	6 ft
40 feet	8 ft
50 feet	8 ft
60 feet	8 ft
70 feet	6 ft
80 feet	4 ft
90 feet	2 ft

Station A-3 to B-3

Distance from Shore	Depth
10 feet	2 ft
20 feet	4 ft
30 feet	6 ft
40 feet	8 ft
50 feet	8 ft
60 feet	8 ft
70 feet	6 ft
80 feet	4 ft
90 feet	2 ft

Station A-4 to B-4

Distance from Shore	Depth
10 feet	2 ft
20 feet	4 ft
30 feet	6 ft
40 feet	8 ft
50 feet	8 ft
60 feet	6 ft
70 feet	6 ft
80 feet	4 ft
90 feet	2 ft

Station A-5 to B-5

Distance from Shore	Depth
10 feet	2 ft
20 feet	4 ft
30 feet	6 ft
40 feet	4 ft
50 feet	2 ft
60 feet	
70 feet	
80 feet	
90 feet	

Station A-6 to B-6

Distance from Shore	Depth
10 feet	2 ft
20 feet	2 ft
30 feet	2 ft
40 feet	2 ft
50 feet	
60 feet	
70 feet	
80 feet	
90 feet	

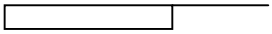
SCIENCING: (communicating and relating)

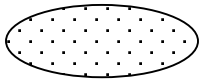
- What activities happen at Shadow Lake? Using the traced map, plan the recreational development of Shadow Lake.

- Use the following symbols on your map to indicate the location of the developments. What other symbols might you use?

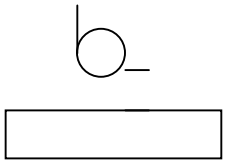
- Be prepared to tell why you selected the location you did for each of the developments.

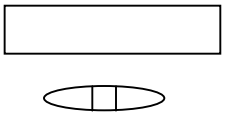
- How does you Shadow Lake map compare to a USGS topographical map?

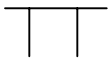
Swimming float 

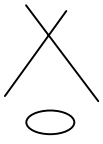
Beach 

Trail ----------

Handicapped fishing pier 

Dock for canoes and rowboats 

Picnic Area 

Campsite 

ACTIVITY C: Putting It All Together

OBJECTIVE: Youth will understand what a contour line means and create a contour map based on actual data they have acquired while depth sounding a small body of water.

MATERIALS YOU WILL NEED:

For each group of 3-4 participants

- ❑ Plane table or flat surface
- ❑ Tracing paper, 11” x 17”
- ❑ Pencil
- ❑ Engineer’s Ruler
- ❑ Copies of pond perimeter map and recording sheets from SESSION FIVE: Activity A: Mapping the Shoreline and Activity B: Mapping the Depth of a Body of Water

SUGGESTED GROUPING:

Small groups of 3-4 participants

GETTING READY:

- Duplicate recording sheets and perimeter map for each group.
- Tape the perimeter map of the body of water completed in SESSION 5, ACTIVITY A to the plane table or flat surface.
- Remember, a contour line is a line that connects locations that have the same data value.

ACTION:

1. On the perimeter map, use a pencil and ruler to draw lines that connect transect stations (A-1 to B-1; A-2 to B-2, etc).

2. Based on the scale of your perimeter map, insert data from recording sheets on the transect lines at the appropriate distance.

3. To determine the number of contour lines that are needed to illustrate the changes in the slope of the bottom of the pond, subtract the number depicting the shallowest part of the pond from the deepest part of the pond. The remainder is the total change in contour of the bottom of the pond. The shallowest would be 0 ft if there is a gradual slope to the shoreline.

4. If you want to have a contour interval every 5'; divide the contour change by 5 i.e. the evaluation change is 30 feet divided by 5. Your map will have 5 contour lines plus a shoreline at 0 ft.

5. Locate one point for each contour line that will be the starting point for that line.

6. Draw in the contour lines by connecting points of equal data. You will need to extrapolate or estimate some points to make your lines flow smoothly. The lines that you make should be straight, parallel, and the ends need to connect.

7. When all contour lines have been completed, place tracing paper over map.

8. Carefully trace perimeter and contour lines onto the tracing paper. Be sure to add the depths, north direction, and any landmarks noted.

9. You have created a contour map of a body of water!

Basic Rules for Contour Lines

- A contour line must never split or divide.
- A contour line must never simply end EXCEPT at the edge of the map.
- A contour line must represent one and only one elevation
- A contour line may never intersect other contour lines. Overhanging cliffs are the exception
- Closely spaced contour lines represent a steep slope, widely spaced lines indicate a gentle slope.

SCIENCING: (**communicating, observing, comparing, inferring, relating)**

1. How did you determine how many contour lines to draw on your map?
2. What does it mean if the contour lines are close together? If the lines are far apart?
3. What is the contour interval or vertical distance between lines?
4. Describe 3 features you observed on the map.
5. Was the bottom contour of the body of water what you expected? How was it different?
6. What is the steepest slope on the map? Locate the deepest part of the pond.
7. How close did you come to representing the real thing?
8. What kind of story, if any, do images of the bottom of the pond tell us?
9. Does your map look different than the other groups' maps? Why?

ACTIVITY D: Sharing Your Discoveries

OBJECTIVE: Youth will identify where to share their finished product and learn how to create a presentation.

MATERIALS YOU WILL NEED:

- ❑ Pencil
- ❑ Notebook or writing paper

GETTING READY:

Once you have done the fieldwork and produced a clean map it is time to present your results. Gather all of the other information you have collected about your pond i.e. photographs, habitat, wildlife, recreational uses, etc. If you have done a complete job of information collection you will be able to use the information more than once by making some changes to fit the new audience.

SUGGESTED GROUPING:

One to four individuals could work together to make a presentation.

ACTION: (communicating)

1. Select the audience. For example, you may want to share the information with those who utilize the pond for recreation. Or make decisions regarding the future management of the pond. Or you may want to teach the general public or landowner about the pond and its habitat and wildlife. Or share with others how to map a pond. What are some other audiences?

2. What delivery method will be most appropriate for your audience? Post the map and relevant information on a bulletin board at the pond or produce handouts to be distributed at the site or put the information on the agency's or your web site? Or you may want to write an article for the newspaper or a magazine. Or you could make a speech, poster display, or video of your results. What are other ways you could share your information?

3. What are the major parts of a presentation? It could be oral or written.

TITLE
INTRODUCTION
BODY
SUMMARY

And WHO, WHAT, WHEN, WHERE, and WHY will help you tell your story.

And a couple of good pictures are worth a thousand words in the newspaper article, brochure or poster display.

Be sure to show your finished product . . . a clean map on 8 ½ x 11 or larger piece of paper.

4. It is important to give credit to anyone, person or agency, which assisted in gathering information or mapping the pond.

5. If you develop a handout or display, share it with others in the 'draft' form for their input. If you are giving an oral presentation, share your outline and practice before family and friends so you are well prepared before your formal presentation.

6. Keep your map and the notes you gather since they might be useful for another presentation. One of the great secrets of the school system, and future work, is that the same information can be used in more than one class or occasion if it is modified to fit the assignment. Just think, it could also be used in a mystery plot – what if that strange shallow spot the sounding line hit near shore turned out to be a treasure chest?

7. Two flyers that were developed by groups pilot-testing these activities are presented in the appendix.

GLOSSARY

ALIDADE – a rule equipped with simple sights used for the determination of direction

BIOLOGIST – a person with specialized knowledge of the plant and animal life of a region or an environment.

CHARTS – a map used by those traveling by water, sail, or vessel.

CIRCUMFERENCE – an external boundary of an area; a continuous line enclosing an area.

CLARITY-level of being able to easily see through

COMPASS – a device for determining directions by means of a magnetic needle that turns freely on a pivot and pointing to the magnetic north.

CONTOUR LINES – a line (as on a map) connecting the points on a land surface that have the same elevation.

CONTOUR MAP – a map that shows connecting points on a land surface that have the same elevation.

ELEVATION- the height to which ground is raised above sea level.

ENDANGERED SPECIES- plants or animals that are at risk of dying out.

ECOSYSTEM – a complex pattern of relations between organisms and their environment that form a functioning community in nature

EROSION – the process of wearing away by the action of water, wind, or glacial ice.

ENVIRONMENT – The climatic, land, air, water and life factors that act upon an organism and ultimately determine its form and survival.

FAUNA – animal life that has adapted to living in a specified environment.

FILTERS – a porous article though which a gas or liquid is passed to separate out matter in suspension.

FLORA – plant life characteristic of region, period or special environment.

FLOATATION CUSHION – allows person to be suspended in water, without sinking.

HABITAT – the place or type of site where a plant or animal naturally or normally lives and grows.

ISOLATED ECOSYSTEM – separate functioning communities in nature

JURISDICTION – the authority of a sovereign power to govern or legislate

MAN MADE – manufactured or created by man

OPAQUE – capacity of matter to obstruct light rays

ORGANISM – structure of interdependent and subordinate elements whose relations and properties are largely determined by their function in the whole.

ORIENT- set or arrange in any determinate positions in relation to a compass

POLITICAL MAP – a map that shows boundaries, cities, and not much else. A map of the United States or a World Globe are examples.

PERIMETER – bounding line of an area

PHYSICAL GEOGRAPHY MAP – a map that provides detail about the features of an area, i.e. rivers, mountain ranges, lakes and contour lines.

PLANE TABLE – an instrument that consists of a drawing board on a tripod with a ruler pointed at the object observed and is used for plotting the lines of a survey directly from the observation point.

PUBLIC DOMAIN OR PUBLIC PROPERTY – land owned directly by the government. The property belongs to the community-at large.

RELIEF MAP – a map depicting elevations of land surfaces and is usually made from a thickened material to show mountains and valleys.

ROAD MAP – a map that includes roads and highways that traverse a specific area. Road maps are helpful when driving from one location to another.

RUN OFF – the portion of rain or snow that falls on the land that ultimately reaches the streams.

SCALE – a divided line on a map indicating the length used to represent a larger unit of measure (as an inch to a mile)

SEDIMENT – the matter that settles to the bottom of a liquid.

SOUNDING LINE – a line, wire, or cord weighted at one end used to ascertain the depth of a body of water where the line will reach the bottom.

SURVEY – to determine the form, extent, and position of an area by taking linear and angular measurements and by applying the principles of geometry and trigonometry.

SURVEYOR – a person that specializes in taking linear and angular measurements and can apply the principles of geometry and trigonometry to interpreting those measurements.

SWAMPY – wet spongy land saturated and sometimes partially or occasionally covered with water.

TERRAIN – the physical features of a tract of land.

TOPOGRAPHY – the make up of a surface including its elevations and the positions of its natural and man-made features.

TOPOGRAPHICAL MAPS – maps that show a 3-dimensional perspective of the land with contour lines that indicate elevations.

TRACING PAPER- thin paper that can be used to copy the lines or letters as seen through a transparent superimposed sheet.

TRANSECT – cut across; go from one side of the body of water to the other side

USGS – United States Geographical Survey

VISIBILITY – the measure of the ability of radiant energy to evoke visual sensation.

WATERSHED - a region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.

REFERENCE:
Webster's Seventh New Collegiate Dictionary, Rand McNally & Company, Chicago, Illinois, U.S.A., Copyright, 1969, G. & C. Merriam Company

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