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AQUATICS RESOURCES C.D.E.
THIS IS A 2-DAY EVENT

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Websites: PA Department of Conservation and Natural Resources: <http://www.dcnr.state.pa.us/index.aspx>
PA Envirothon: <http://www.envirothonpa.org>
PA Game Commission: <http://www.pgc.state.pa.us>
PA Fish & Boat Commission: <http://www.fish.state.pa.us>

Tuesday

Identification of ten species in each of four groups: (1) fish, (2) reptiles and amphibians, (3) birds and mammals, (4) equipment used in aquatic study, (5) aquatic insects, and (6) aquatic plants. Plus, there will be a 50-question test including questions on aquatic resources and their management.

Wednesday

Participation in three of the practicums listed below and any remaining identification events from Tuesday.

Part I - Written Test (200 points)

This section includes 50 comprehensive questions on Limnology (stream ecology), groundwater, ecology of aquatic species, management practices, Fish Commission laws, etc. Suggested references are:

- PFBC "Sport Fishes of Pennsylvania"
- PFBC "Pennsylvania Fishes"
- PFBC "Pennsylvania Reptiles and Amphibians"
- PFBC "Summary of Fishing Regulations and Laws" - current year
- PFBC "Planning and Management of Small Ponds for Fishing"
- PFBC "Endangered and Threatened Species of Pennsylvania"
- PFBC "Acid Precipitation"
- PFBC "Water Pollution"
- PFBC "Wetlands: Natural and Necessary"
- PSU, Cooperative Extension "Groundwater and Agriculture in Pennsylvania"
- NRCS "Conservation and the Water Cycle"
- NRCS "What is a Watershed?"

Part II - Identification of Aquatic Species, Insects and Plants (300 points)

This section will include 10 of each:

- | | |
|---------------------------|-------------------|
| • Fish | • Equipment |
| • Reptiles and Amphibians | • Aquatic Insects |
| • Birds and Mammals | • Aquatic Plants |

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Mounted, preserved, or live specimens, body parts, pictures, and/or colored slides may be used for identification in the part of the event. The following is a suggested study reference list:

Fish	PFBC wall chart: "Sport fishes of PA" PFBC wall chart: "PA Fishes"
Reptiles & Amphibians	PFBC wall chart: "PA Reptiles and Amphibians" Assorted field guides to reptiles and amphibians
Birds & Mammals	PGC wall charts PGC "Mammals of PA," PGC "Birds of PA" Assorted field guides to birds and mammals
Equipment	Forestry Suppliers Inc. Catalog P. O. Box 8397 Jackson, MS 39284-8397 1-800-647-5368
Insect References	SVNC: Biotic Index Activity guide included in the practicum section of this event, "Insects at Susquehanna Valley Nature Center" DCNR: "A Guide to Common Freshwater Animals"
Plant References	PSU Cooperative Extension: "Aquatic Plants--Management and Control in Pennsylvania" PFBC: "Aquatic Plant Control" PSU Cooperative Extension: "Aquatic Plants--A Guide to Identification and Control in Pennsylvania"

Part III - Practicums: Problem Solving/Analysis (150 Points)

Practicum activities will be held on site (local pond/stream) and transportation is provided.

Participants should bring: pencil, calculator, clipboard, 50' measuring tape, watch (with second hand), waders and/or clothing to wade in stream, hand lens, and biotic sampling/collecting equipment (i.e., sieve, seine screen, white plastic pan, tweezers, etc.). All other supplies and equipment will be supplied.

This part will consist of three of the following hands-on activities:

1. Water testing (using Hach/Lamotte test kit):
 - dissolved oxygen,
 - temperature,
 - pH,
 - turbidity
2. Stream flow and volume of water in a stream/pond
3. Calculate biotic index
4. Determining watershed boundaries
5. Pond management

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AQUATIC RESOURCE C.D.E.

MASTER SCORE SHEET

Name _____ Student No. _____

School _____ Score _____

Scoring:	<u>Maximum Score</u>	<u>Points Earned</u>	<u>Total Score</u>
Part I -- Written Test (200 pts.) (50 questions at 4 points each)			
Total Score Part I	200	_____	_____
Part II -- Identification (300 pts.) (200 spp. Ea.; 5 points each)			
A. Fish	(50 pts.)	_____	
B. Reptiles & Amphibians	(50 pts.)	_____	
C. Birds & Mammals	(50 pts.)	_____	
D. Equipment	(50 pts.)	_____	
E. Aquatic Insects	(50 pts.)	_____	
F. Aquatic Plants	(50 pts.)	_____	
Total Score Part II	300		_____
Part III -- Practicums (150 pts.) (3 at 50 pts. Each chosen from below)			
Practicum 1: D.O., Temp., pH		_____	
Practicum 2: Stream Flow		_____	
Practicum 3: Biotic Index		_____	
Practicum 4: Determining Water- Shed Boundaries		_____	
Practicum 5: Pond Management		_____	
Total Score Part III	150		_____
Maximum Total Possible FINAL TOTAL SCORE	650		_____

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AQUATIC RESOURCE C.D.E.
GENERAL KNOWLEDGE EXAM (200 PTS.)

Name _____ Student No. _____

School _____ Score _____

- | | | |
|-----------|-----------|-----------|
| 1. _____ | 18. _____ | 35. _____ |
| 2. _____ | 19. _____ | 36. _____ |
| 3. _____ | 20. _____ | 37. _____ |
| 4. _____ | 21. _____ | 38. _____ |
| 5. _____ | 22. _____ | 39. _____ |
| 6. _____ | 23. _____ | 40. _____ |
| 7. _____ | 24. _____ | 41. _____ |
| 8. _____ | 25. _____ | 42. _____ |
| 9. _____ | 26. _____ | 43. _____ |
| 10. _____ | 27. _____ | 44. _____ |
| 11. _____ | 28. _____ | 45. _____ |
| 12. _____ | 29. _____ | 46. _____ |
| 13. _____ | 30. _____ | 47. _____ |
| 14. _____ | 31. _____ | 48. _____ |
| 15. _____ | 32. _____ | 49. _____ |
| 16. _____ | 33. _____ | 50. _____ |
| 17. _____ | 34. _____ | |

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IDENTIFICATION OF AQUATIC SPECIES -- ANSWER SHEET

Name _____ Student No. _____

School _____ Score _____

Place the number of the species from your master list to the number of the slide/specimen you think identifies that particular species.

A. Fish
(50 points) (Use
YELLOW master sheet)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

C. Birds/Mammals
(50 points) (Use
BLUE master sheet)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

E. Aquatic Insects
(50 points)
GREEN master sheet)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

B. Reptiles/Amphibians
(50 points) (Use
YELLOW master sheet)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

D. EQUIPMENT
(50 points) (Use
BLUE master sheet)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

F. Aquatic Plants
(50 points) (Use
GREEN master sheet)

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

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IDENTIFICATION OF AQUATIC SPECIES
A. IDENTIFICATION OF FISH

Name _____ Student No. _____

School _____ Score _____

Basses (True)

- _____ Hybrid Striped Bass
- _____ Striped Bass
- _____ White Bass

Pikes

- _____ Chain Pickerel
- _____ Muskellunge
- _____ Northern Pike

Catfishes

- _____ Brown Bullhead Catfish
- _____ Channel Catfish
- _____ Yellow Bullhead Catfish

Suckers

- _____ Northern Hogsucker
- _____ White Sucker

Eels

- _____ American Eel

Sunfishes

- _____ Black Crappie
- _____ Bluegill
- _____ Green Sunfish
- _____ Largemouth Bass
- _____ Pumpkinseed
- _____ Redbreast Sunfish
- _____ Rockbass
- _____ Smallmouth Bass
- _____ White Crappie

Herrings

- _____ American Shad
- _____ Gizzard Shad

Minnows

- _____ Blacknose Dace
- _____ Bluntnose Minnow
- _____ Carp
- _____ Central Stoneroller
- _____ Common Shiner
- _____ Creek Chub
- _____ Cutlips Minnow
- _____ Fathead Minnow
- _____ Fallfish
- _____ Golden Minnow
- _____ Longnose Dace

Trouts/Salmon

- _____ Brook Trout
- _____ Brown Trout
- _____ Coho Salmon
- _____ Lake Trout
- _____ Palomino Trout
- _____ Rainbow Trout

Perches

- _____ Darter
- _____ Sauger
- _____ Walleye
- _____ Yellow Perch

_____ Tilapia

Number Correct x 5 = SCORE _____

Means divide

IDENTIFICATION OF AQUATIC SPECIES
B. IDENTIFICATION OF REPTILES AND AMPHIBIANS

Name _____ Student No. _____

School _____ Score _____

REPTILES

AMPHIBIANS

Lizards

- _____ **Broad head skink**
- _____ **Coal skink**
- _____ Fence lizard
- _____ Five-lined skink

Snakes

- _____ Black Racer
- _____ Black Rat
- _____ Brown
- _____ Copperhead
- _____ Corn
- _____ Cottonmouth
- _____ **Eastern Worm**
- _____ Garter
- _____ Hognose
- _____ Milk
- _____ Queen
- _____ Redbelly
- _____ Ribbon
- _____ Ringneck
- _____ **Rough Green**
- _____ Smooth Earth
- _____ **Smooth Green**
- _____ Timber Rattlesnake
- _____ Water

Turtles

- _____ Box
- _____ **Eastern Mud**
- _____ Map
- _____ Painted
- _____ Red eared
- _____ Snapping
- _____ **Spiny Softshell**
- _____ Spotted
- _____ Wood

Toads

- _____ American
- _____ Fowler's

Frogs

- _____ Bullfrog
- _____ Gray/Green Treefrog
- _____ Green
- _____ Leopard
- _____ Pickerel
- _____ Spring Peeper
- _____ Wood

Salamanders

- _____ Dusky
- _____ Four-toed
- _____ Hellbender
- _____ Jefferson
- _____ Longtail
- _____ Red
- _____ Redback
- _____ Red-spotted Newt
- _____ Slimy
- _____ Spotted
- _____ Spring
- _____ Two-lined

Number Correct x 5 = SCORE _____

Means divide

IDENTIFICATION OF AQUATIC SPECIES
C. IDENTIFICATION OF BIRDS AND MAMMALS

Name _____ Student No. _____

School _____ Score _____

BIRDS

MAMMALS

Birds of Prey

- _____ Bald Eagle
- _____ Marsh Hawk (N. Harrier)
- _____ **Osprey**

- _____ Beaver
- _____ Black Bear
- _____ Mink
- _____ Mole
- _____ Mouse
- _____ Muskrat
- _____ Nutria
- _____ Otter
- _____ Raccoon
- _____ Shrew
- _____ Vole
- _____ White-tailed Deer

Marsh and Water

- _____ Belted Kingfisher
- _____ Coot
- _____ Egret
- _____ **Greenback Heron**
- _____ Great Blue Heron
- _____ Herring Gull
- _____ Least Tern
- _____ Marsh Wren
- _____ Red-winged Blackbird
- _____ Ring-billed Gull
- _____ Snipe
- _____ Tree Swallow

Waterfowl

- _____ Black Duck
- _____ Blue-winged Teal
- _____ Canada Goose
- _____ Common Merganser
- _____ Green-winged Teal
- _____ Mallard Duck
- _____ Pintail Duck
- _____ Tundra Swan
- _____ Wood Duck

Number Correct x 5 = SCORE _____

Means divide

IDENTIFICATION OF AQUATIC SPECIES
D. IDENTIFICATION OF EQUIPMENT

Name _____ Student No. _____

School _____ Score _____

- _____ Bottom-sampling dredge
- _____ Chemical Waste jug
- _____ Color Comparator
- _____ Conductivity Meter
- _____ Dissolved oxygen water test kit / meter
- _____ Fish measuring board
- _____ **GPS Locator**
- _____ Hach kit for water quality
- _____ Hip boots
- _____ Kick net / aquatic net
- _____ Periphyton (multi-plate) sampler
- _____ pH meter
- _____ pH water test kit
- _____ Plankton net
- _____ refractormeter
- _____ Secchi disk
- _____ Seine
- _____ Sieve
- _____ Stream bottom (surber) sampler
- _____ Topographic map
- _____ **Turbidity Tube**
- _____ Water sample bottle
- _____ Water sampler / Kemmerer Sampler
- _____ Water Thermometer

Number Correct x 5 = SCORE _____

Means divide

IDENTIFICATION OF AQUATIC SPECIES
E. IDENTIFICATION OF AQUATIC INSECTS

Name _____ Student No. _____

School _____ Score _____

Pollution Intolerant (Class I)

- _____ Caddisfly
- _____ Freshwater clam
- _____ Hellgramite
- _____ Mayfly
- _____ Riffle Beetle
- _____ Stonefly
- _____ Waterpenny

Facultative (Class II)

- _____ *Aquatic Sowbug*
- _____ Blackfly
- _____ Cranefly
- _____ Crayfish
- _____ Damselfly
- _____ Dragonfly
- _____ Fingernail clam
- _____ Flatworm
- _____ Gill Snail
- _____ Horsefly

Pollution Tolerant (Class III)

- _____ Air-breathing snail
- _____ Aquatic earthworm
- _____ Backswimmer
- _____ Freshwater shrimp
- _____ Leech
- _____ Limpet
- _____ Midge
- _____ Mosquito
- _____ Moth Fly
- _____ Rat-tailed Maggot
- _____ Scud-side Swimmer
- _____ Sea Lamprey
- _____ Water boatman
- _____ Water Strider
- _____ Whirligig Beetle
- _____ Zebra Mussel

Number Correct x 5 = SCORE _____

Means divide

IDENTIFICATION OF AQUATIC SPECIES
F. IDENTIFICATION OF AQUATIC PLANTS

Name _____ Student No. _____

School _____ Score _____

Emergents

- _____ Arrowhead
- _____ Cattail
- _____ **Cinnamon Fern**
- _____ **Cinquefoil**
- _____ **Horsetail**
- _____ Hydrilla
- _____ Jewelweed
- _____ **Marsh Marigold**
- _____ Pennyweed
- _____ **Purple Loosestrife**
- _____ Rushes
- _____ Sedges
- _____ Sensitive fern
- _____ Skunk cabbage
- _____ Water cress
- _____ Water Hemlock
- _____ Water Smartweed

Floaters

- _____ Algae
- _____ Duckweed
- _____ Spatterdock
- _____ Watershield
- _____ White Water Lily
- _____ Yellow water Lily

Submergents

- _____ American (floating) Pondweed
- _____ Bladderwort
- _____ Common Elodea (waterweed)
- _____ Coontail
- _____ Curly Pondweed
- _____ Milfoil (water Milfoil)
- _____ Sago Pondweed

Trees & Shrubs

- _____ **Ash**
- _____ Black Gum (tupelo)
- _____ Blueberry
- _____ **Box Elder Maple**
- _____ Elderberry
- _____ Elm
- _____ Hemlock
- _____ **Honey Locust**
- _____ **Larch**
- _____ Mimosa Tree
- _____ Rhododendron
- _____ **Silver Maple**
- _____ Speckled Alder
- _____ **Spice Bush**
- _____ Sycamore
- _____ Willow
- _____ **Yellow Birch**

Number Correct x 5 = SCORE _____

PART III: PRACTICUMS

Name _____ Student No. _____

School _____ Score _____

1. Water Testing: Dissolved Oxygen (D.O.), Temperature, and pH

- A. Using the test kit(s) and thermometer provided, perform the following water tests on the sample and record the results below:

Test Results: D.O. _____

Temp. _____

- B. Based on the Dissolved Oxygen level you found, use the chart below to predict the major species of aquatic life supported in this water:

Dissolved Oxygen Requirements for Native Fish and Other Aquatic Life

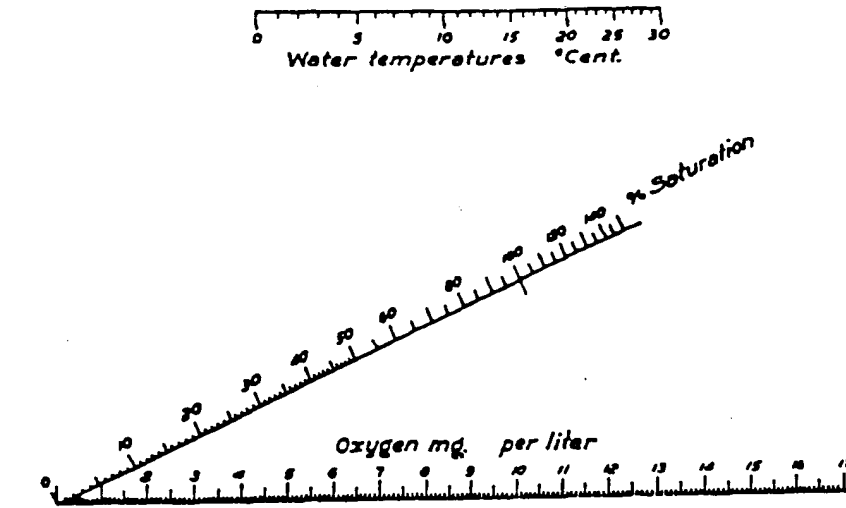
Examples of Life	D.O. in parts per million or/milligrams per liter
Cold-water organisms, including salmon and trout spawning, growth and well-being (caddisfly, stonefly, mapfly)	6 ppm and above
Warm-water organisms (including game fish such as bass, crappie, cat fish and carp) growth and well-being (some caddisfly)	5 ppm and below

- C. Based on the Temperature you found, use the following chart to predict the major species of aquatic life supported in this water:

Temperature Requirements for Native Fish and Other Aquatic Life

Examples of Life	Temperature
Cold-water organisms, including salmon and trout, caddisfly, stonefly, and mapfly nymphs	<55 F
Mayfly nymphs, caddisfly larvae, water beetles, water striders	55-60
Some plant life, some fish diseases, trout, stonefly nymphs	61-68
Much plant life, many fish diseases, bass, crappie, bluegill, catfish and carp	Above 68

- D. Based on both temperature and dissolved oxygen you found, use the following percent saturation chart to determine the percent saturation of your water sample with dissolved



oxygen:

Temperature conversion formulas:

$$C = \frac{F - 32}{1.8} \quad F = (C \times 1.8) + 32$$

Percent Saturation _____

- E. Based on the pH you found, use the chart below to predict the major species of aquatic life supported in this water

pH Ranges that Support Aquatic Life

	<u>Most Acid</u>					<u>Neutral</u>						<u>Most Alkaline</u>		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bacteria	<u>1.0</u> _____ <u>13.0</u>													
Plants (algae, rooted, etc.)						<u>6.5</u> _____ <u>12.0</u>								
Carp, suckers, catfish, some insects						<u>6.0</u> _____ <u>9.0</u>								
Bass, crappie						<u>6.5</u> _____ <u>8.5</u>								
Snails, clams, mussels						<u>7.0</u> _____ <u>9.0</u>								
Largest variety of animals (trout, mayfly-stonefly, caddisfly)						<u>6.5</u> <u>7.5</u>								

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PART III: PRACTICUMS (continued)

Name _____ Student No. _____

School _____ Score _____

2. Stream Flow

For Stream

- A. Measure and mark a 100-foot distance along a straight section of your stream. If you can't find a 100-foot section, use 25' or 50'. Throw a stick (5 or 6 inches long; or 1.27 or 15.2 cm. long) in the water above the upstream marker. Record the number of seconds it takes to float downstream between the markers. Record below. Now **divide** the 100-foot distance by the total seconds it took the stick to float between the markers. Do this three times and use the average time.

1st measurement: 100 ft. ÷ _____ = _____ ft./second
(distance) (total seconds to float 100 ft.) (# of feet stick floated each second)

2nd measurement: 100 ft. ÷ _____ = _____ ft./second

3rd measurement: 100 ft. ÷ _____ = _____ ft./second

Total _____ ÷ 3 = _____
(ft./second) (ft./second average)

- B. Find the average width of your section of the stream. Measure the width of the stream at three places within the 100-foot area, then **divide** the total by three to get the average width of the stream.

1st measurement _____ ft.

2nd measurement _____ ft.

3rd measurement _____ ft.

Total _____ ft. ÷ 3 = _____ ft. (average width)

- C. Find the average depth of your section of the stream. Measure the depth of the stream in three places across the stream in a straight line, then **divide** the total by four to get the average depth of the stream.

1st measurement _____ ft.

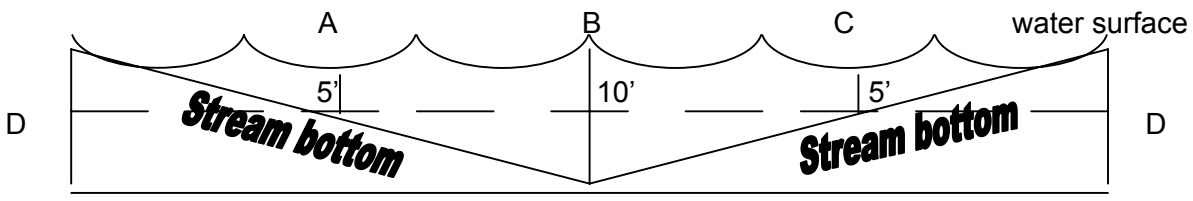
2nd measurement _____ ft.

3rd measurement _____ ft.

Total _____ ft. ÷ 4 = _____ ft. (average depth)

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Note: The reason you take three depth measurements then divide by 4 is to take into account the shallow areas of the stream. It can be explained by the following example of a drawing of a stream cross-section. If depth in three places is A (5'), B (10') and C (5'), (total 20'), find an average by **dividing** by 3: $20' \div 3 = 6 \frac{2}{3}'$. Now look at the area or average depth (D), which is 5'. Take total of depths and **divide** by 4: $20' \div 4 = 5'$, the correct average depth.



D. Find the cubic feet of water per second: multiply the average width, average depth, and the number of feet the stick floated each second. (A cubic foot is water in a container 1 foot wide, 1 foot high, and 1 foot long, or 7.48 gallons. A cubic meter of water is the amount in a container 1 meter wide, 1 meter high, and 1 meter long, or 1,000 liters.)

$$\frac{\text{Average width}}{\text{width}} \text{ ft. x } \frac{\text{Average depth}}{\text{depth}} \text{ ft. x } \frac{\text{\# of feet}}{\text{per second}} = \frac{\text{Cubic feet of water}}{\text{flowing per second}}$$

E. The average person uses about 200 gallons (757 liters) of water a day for home use. (This does not reflect each person's share of water used for public service and industrial and commercial uses.) In order to find out how many people could get their water needs for 1 day from this stream, complete the following calculations.

$$\frac{\text{Streamflow in}}{\text{cu. ft/second}} \text{ ft. x } \frac{\text{Gallons in 1}}{\text{cu. ft. of water}} \text{ ft. x } \frac{\text{Gallons of}}{\text{water/second}}$$

$$\frac{\text{Gallons per}}{\text{Second}} \text{ ft. x } \frac{\text{Seconds in}}{\text{minutes}} \text{ ft. x } \frac{\text{Gallons of water}}{\text{per minute}}$$

$$\frac{\text{Gallons of}}{\text{cu. ft/second}} \text{ ft. x } \frac{\text{\# of minutes}}{\text{cu. ft. of water}} \text{ ft. x } \frac{\text{Total gallons of}}{\text{water/second}} \div 200 \text{ gals. (amt. of water 1 person uses per day)} = \frac{\text{Total \# of people}}{\text{who could get daily waters from this stream}}$$

÷ means divide

For Pond or Lake

Instructions for collecting and recording volumes of water in a pond or lake. For metric application, substitute meters for feet and liters for gallons.

- A. Find the average diameter (distance across) of the pond. Measure the length and width of the pond. You may have to take several length and width measurements and get an average of them.

Pond width _____ ft.

Pond length _____ ft.

Total _____ ft. ÷ 2 = _____ ft. (average diameter)

Average diameter _____ ft. x 3.14 (_____) ÷ 4 = _____ sq. ft. surface
(area of pond)

- B. Find the average depth of the pond or lake. Measure the depth in three places along a line (transect) across the pond, as near the middle as possible. Add these depths and **divide** by four (see explanation below) to get the average depth. (If additional accuracy is desired, repeat this process along additional transects and average results.)

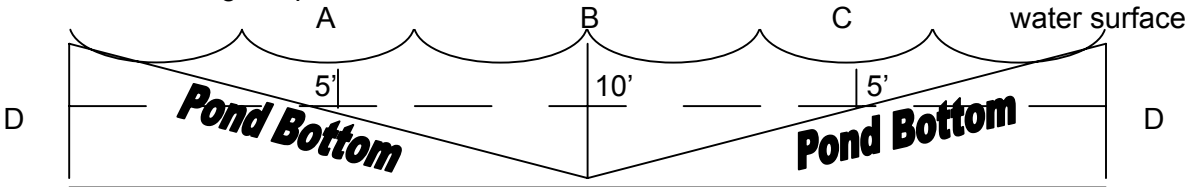
1st measurement _____ ft.

2nd measurement _____ ft.

3rd measurement _____ ft.

Total _____ ft. ÷ 4 = _____ ft. (average depth)

Note: The reason you take three depth measurements then **divide** by 4 is to take into account the shallow areas of the stream. It can be explained by the following example of a drawing of a stream cross-section. If depth in three places is A (5'), B (10') and C (5'), (total 20'), find an average by **dividing** by 3: $20' \div 3 = 6 \frac{2}{3}'$. Now look at the area or average depth (D), which is 5'. Take total of depths and **divide** by 4: $20' \div 4 = 5'$, the correct average depth.



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- C. Formula for computing number of gallons of water in pond.

$$\frac{\text{Area of pond}}{\text{Area of pond}} \times \frac{\text{Average depth}}{\text{Average depth}} = \frac{\text{Volume in cu. Ft.}}{\text{Volume in cu. Ft.}} \text{ cu. ft.}$$

$$\frac{\text{Volume in cu. ft.}}{\text{Volume in cu. ft.}} \times 7.48 = \frac{\text{\# of gals. water in pond}}{\text{\# of gals. water in pond}}$$

(A cubic foot of water is the water in a container 1 foot wide, 1 foot high, and 1 foot long, 7.48 gallons. A cubic meter of water is the amount in a container 1 meter wide, 1 meter high and 1 meter long, or 1,000 liters.)

- D. Formula for computing the volume using acre feet of water. (No meter equivalent included.)

$$\frac{\text{Area of pond}}{\text{In feet}} \times \frac{\text{Average depth}}{\text{in feet}} = \frac{\text{Volume in cu. Ft.}}{\text{Volume in cu. Ft.}} \text{ cu. ft.}$$

$$\frac{\text{Volume in cu. ft.}}{\text{cu. ft.}} \times 43,560 \text{ (sq. ft. in an acre)} = \frac{\text{Acre feet of water}}{\text{Acre feet of water}}$$

$$\frac{\text{Acre feet cu. ft.}}{\text{cu. ft.}} \times 395,900 \text{ Gallons per acre foot} = \frac{\text{\# of gallons in pond}}{\text{\# of gallons in pond}}$$

- E. The average person uses about 200 gallons (757 liters) of water a day for home use. (This does not reflect each person's share of water used for public services and industrial and commercial uses.) In order to find out how many people could get their water needs for 1 day from this pond, complete the following calculations.

$$\frac{\text{Gallons of water in pond}}{\text{Gallons of water in pond}} \div \frac{\text{Amount of water one uses per day}}{\text{Amount of water one uses per day}} = \frac{\text{Total \# of people who could get daily water needs from pond}}{\text{Total \# of people who could get daily water needs from pond}}$$

PART III: PRACTICUMS (continued)

Name _____ Student No. _____

School _____ Score _____

3. Biotic Index

Collecting actual specimens from the stream with equipment provided (students may bring their own collection equipment, hand-lens, etc.); OR, using the given specimens collected from a stream, calculate the biotic index of this stream. Use the attached aquatic insect identification guide to calculate the number of insects in each category.

The biotic index is calculated using the following formula:

$$(2 \times \text{number of Class I X's}) + (\# \text{ of Class II X's}) = \text{Biotic Index}$$

Put an "X" next to each specie you identify.

<u>Class I</u>	<u>Class II</u>
___ Caddisfly	___ Blackfly
___ Freshwater clam	___ Cranefly
___ Hellgramite	___ Crayfish
___ Mayfly	___ Damselfly
___ Riffle beetle	___ Dragonfly
___ Stonefly	___ Fingernail clam
___ Waterpenny	___ Flatworm
	___ Gill snail
	___ Horsefly
	___ Sowbug
(2X ___) +	(___) = ___ stream pollution index number)

Stream Pollution Index Number:

- B.I. 10 or greater = Clean stream
- B.I 1-9 = Moderately polluted
- B.I 0 = Severely polluted

Stream Pollution Index Number = _____

SCORE _____

PART III: PRACTICUMS (continued)

Name _____ Student No. _____

School _____ Score _____

4. Determining Watershed Boundaries

Define what you think a watershed is:

Find your location on this stream (pond, lake) on the map.

Where does the water come from? _____

Where does it go? _____

Draw lines around the boundaries of our watershed. Which watershed are we in?

AWARENESS: WATERSHED MAP

Concept: Watershed map interpretation can provide preliminary information about water quality.

Activity: Have students use the enclosed map of the watershed to answer the questions below.

Using the enclosed map, locate:

1. Where the water quality is the best. (Upland tributaries which are relatively undisturbed by human activity.)

2. Where would you find the greatest amount of pollution from human wastes. (Below the town's sewage treatment plant.)

3. Where the stream velocity is the greatest; the lowest. (Greatest: where the contour lines are closest; lowest: where the contour lines are furthest apart.)

4. Where surface runoff has the highest contamination from fertilizer. (Downstream from agricultural area.)
