CLINTON RIVER
WATERSHED COUNCIL

STREAM LEADERS

Teacher & Mentor Basic Training

the Clinton River
Watershed Council

MISSION

To protect, enhance and celebrate the Clinton River, its watershed and Lake St. Clair

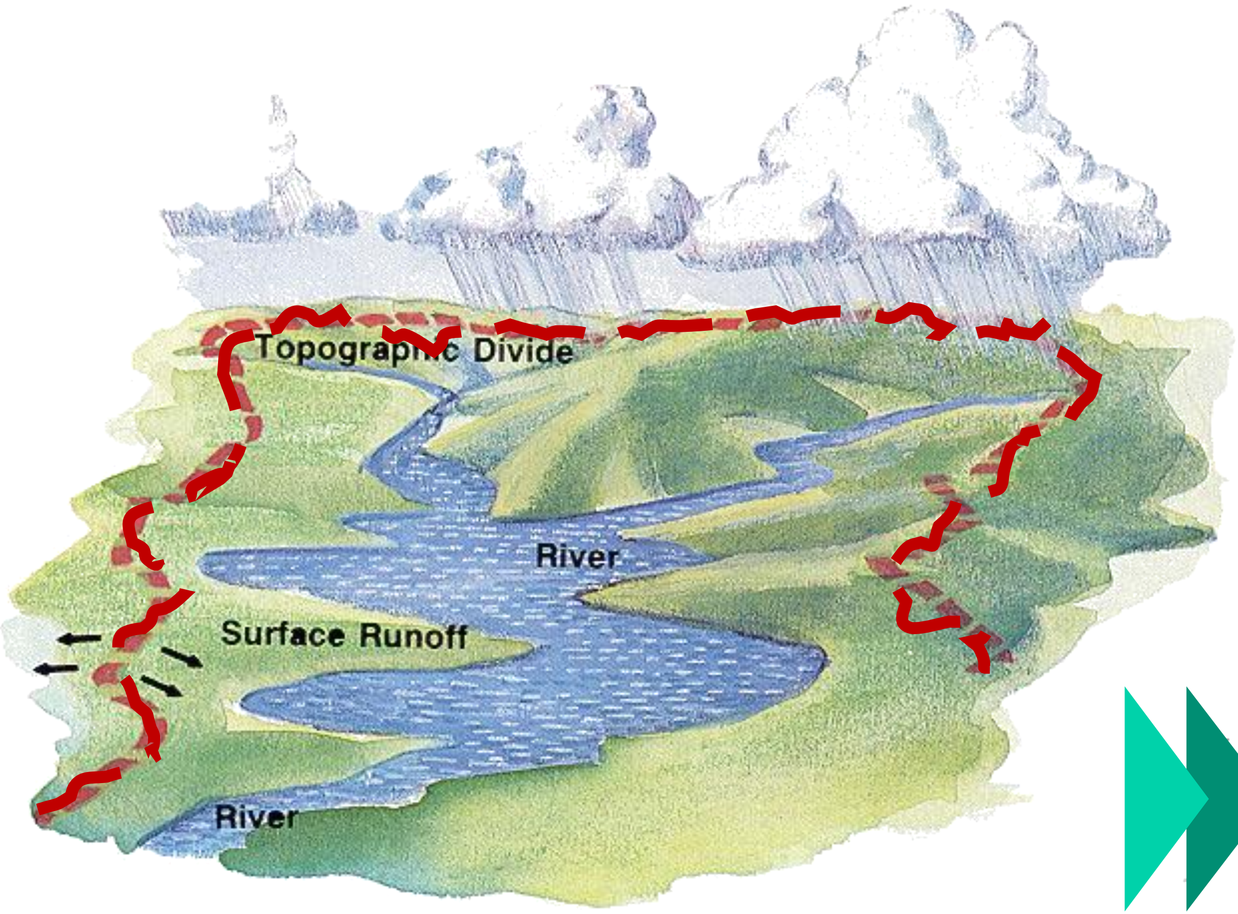
Photos by: John Meyland

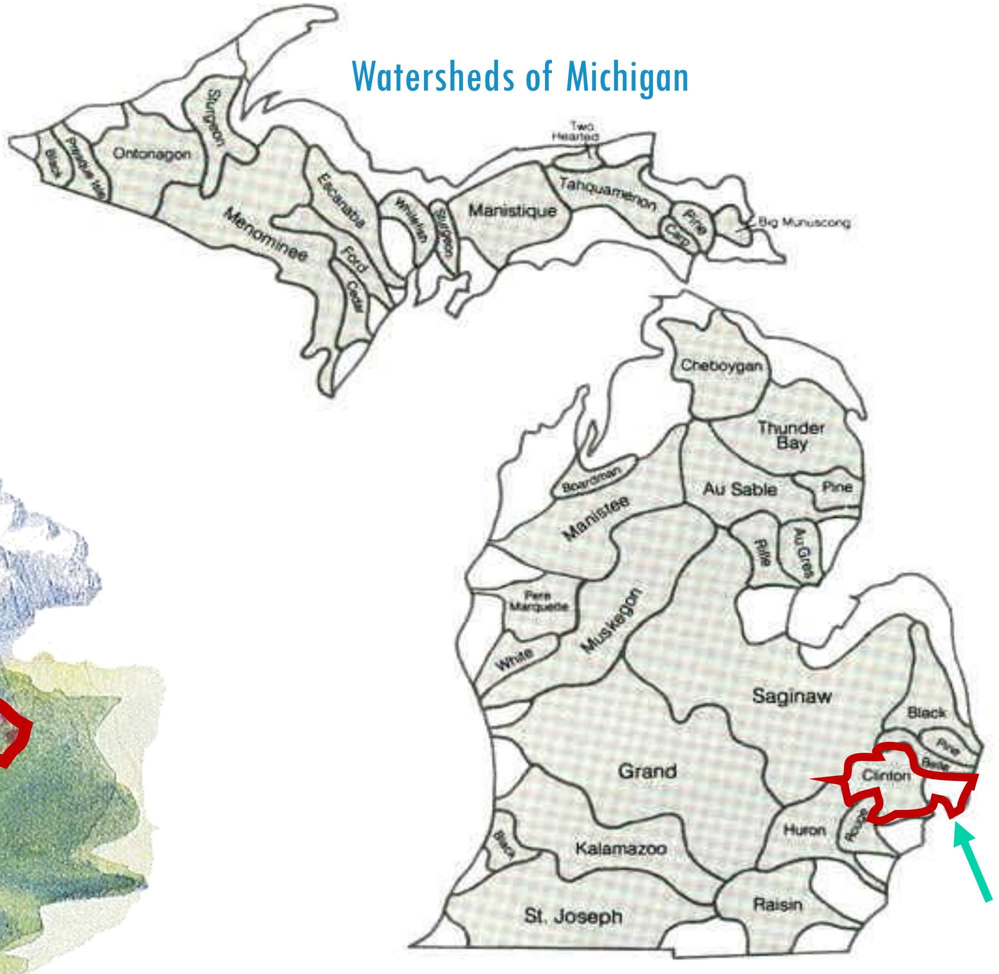
CRWC

CLINTON RIVER WATERSHED COUNCIL

- Members include individuals, businesses, local governments and community organizations
- Funded through local government membership dues, private contributions and grants
- 7 staff working in 3 program areas:
  - Education
  - Stewardship
  - Watershed Management

What is a WATERSHED?





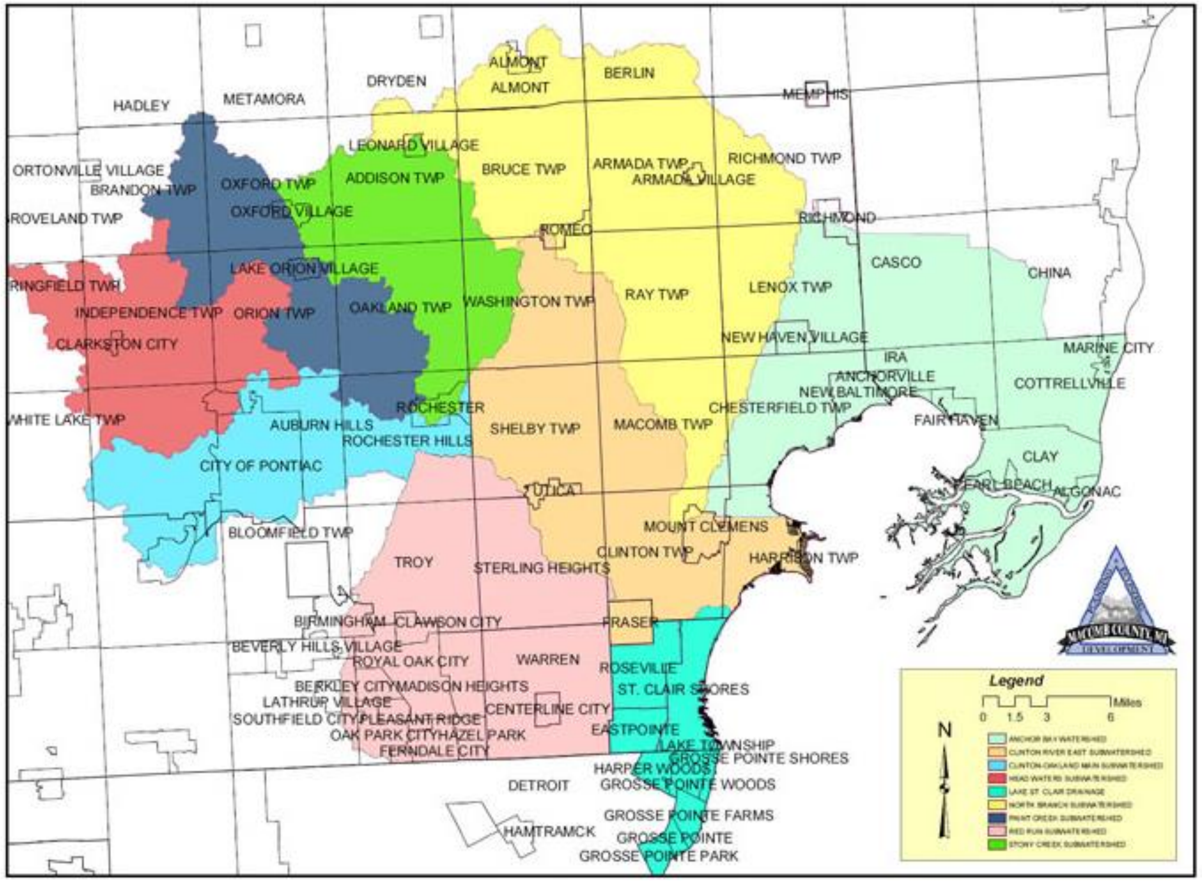
The region draining into a river, river system, or other body of water.

the CLINTON RIVER WATERSHED

"The Clinton River is one of the 7 environmental wonders of southeast Michigan"

-- Model D Media

- Four counties – Lapeer, St. Clair, Oakland, Macomb
- 63 communities within the watershed
- 12 additional Lake St. Clair direct drainage communities
- 760 Square Miles
- 1.5 million people

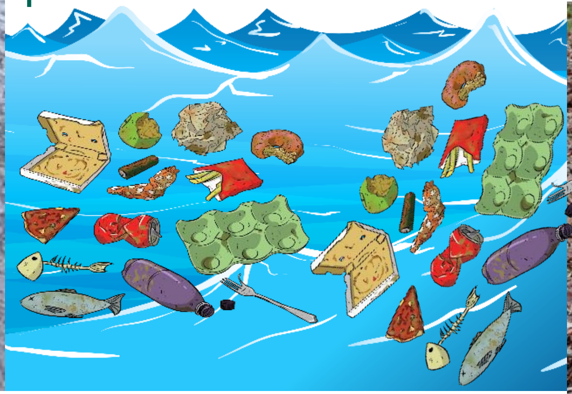


WATER QUALITY
in the Clinton River Watershed

- Current Water Quality Problems:
  - Bacterial contamination from sewer overflows and failing septic systems
  - Persistent contaminated sediments from before the clean water act
  - But what is the single greatest source of impairments in the Clinton River?

STORMWATER POLLUTION!

What STORMWATER is POLLUTION?



When it rains on impervious surfaces, it picks up pollutants such as dirt, oils, grease, pesticides, fertilizers, and pet waste…

These pollutants are carried by this stormwater runoff to our drainage systems and eventually end up in our waterways.

Why is RUNOFF a PROBLEM?

Runoff from roads and lawns…

Dirt, oils, metals, salts

Animal waste, fertilizers, pesticides

…or directly off streambanks and shorelines

Drains to roadside ditches…

…and into our lakes and rivers

Causing many issues…

Sedimentation & erosion

Algae blooms, low oxygen levels, polluted waters

Why Do We MONITOR STREAMS?

- Michigan streams are part of the Great Lakes watershed.
- Once baseline data is collected, you can use the data to monitor future changes: impacts or improvements.
- If you identify problems, you can develop a plan to improve the aquatic habitat.
- If you identify a healthy stream, you can take actions to protect the watershed from future impairments.

U.S. Army Corps of Engineers, Detroit District

STREAM LEADERS

Program Overview




"Children between the ages of 8 and 18 years spend an average of nearly 6.5 hours a day with electronic media"

– Rideout, V.J., & Hamel, E. (2006)

"In one generation, the percentage of people who reported that the outdoors was the most influential environment of their childhood dropped from 96% to 46%."

– Rachel Sebba (1991)

STUDIES HAVE SHOWN…

"Exposure to natural settings may be widely effective at reducing ADHD Symptoms"

– Wells, N.M. (2000)

"Schools with environmental education programs score higher on standardized tests in math, reading, writing, and listening"

– Evergreen State College (2003)

PROGRAM MISSION

to raise young peoples' awareness of the importance of water quality and to help cultivate a connection to a Great Lakes identity through a multidisciplinary, school-based initiative that provides students with an educational experience in water quality monitoring, data interpretation, and citizen action.

GOALS

- Increase water quality Education and Stewardship
- Identify and report potential water quality problems throughout the watershed
- Develop long-term records/trends of benthic macroinvertebrate communities and habitat quality

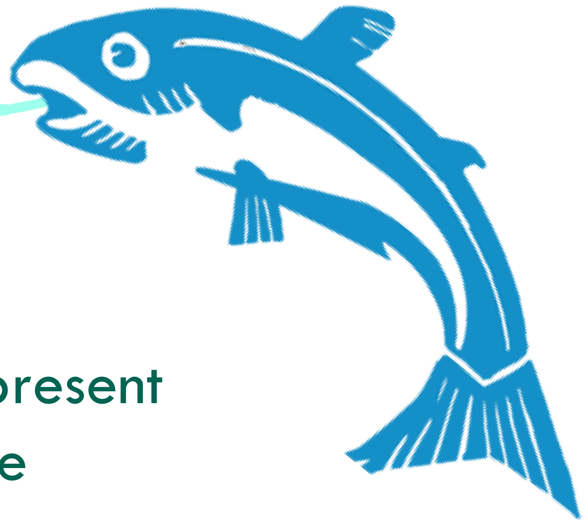
REPORTING

- Data can be used to establish a baseline for water quality at specific sites in the Clinton River and its tributaries.
- Data can be reported to local governments, and the DEQ.

Stream leaders connects students to REAL-WORLD SCIENCE
Through Integrated Curriculum & Long-Term Learning

- Conducting data collection and learning on local body of water
  - Physical, chemical and biological testing is conducted at designated sampling sites
  - Students learn "in the creek" plus take data back to classroom
- Correlated to GLCE's (Grade Level Content Expectations)
- Community involvement component
  - Mentors (volunteers) take an orientation session, then help out on the two 1-day Monitoring Days (spring & fall)
  - Mentors are Parents, corporate sponsors, other teachers, etc. from the community
- Data reporting & peer presentation in class and at Student Congress in the Fall

STEPS to take



1. What is your **question**? What are you investigating?
2. Gather existing information! **Research** past & present watershed land uses around your monitoring site
3. State your **hypothesis**
4. Collect & analyze your **data**
5. Form a **conclusion**! – is your stream healthy? Why or why not?
6. **Present** your data – in the classroom and/or at CRWC's Student Congress

Let's talk about MONITORING

- **WHEN:** Fall (October) and Spring (April/May)
- **WHAT:** Chemistry, Physical, and Biological testing
- **WHERE:** A tributary local to your school

Station #1 CHEMICAL ANALYSIS

You will measure **8** different chemical aspects of the water:

- Dissolved Oxygen
- Biochemical Oxygen Demand (BOD)
- Coliform Bacteria
- Nitrate
- pH
- Phosphate
- Temperature
- Turbidity

Station #1 DATA SHEET

Chemical

Each chemical test comes with a set of directions for completing the test as well as an explanation of what each test means.

TO DETERMINE OVERALL WATER QUALITY: Add up total # of checks for each category and multiply the sums by number specified. Add up the products and divide by *n*. n = the number of tests performed

Clinton River Watershed Council

September 2003

Clinton River Stream Leaders
GREEN Data Sheet

School: ______________________ Teacher(s): ______________________

Date: ______________ Time: ______________

Test location: ____

River Branch: ______________ Tributary: ______________

Weather conditions: ____________ Air temp: ______ °C Water temp: ______ °C

Rainfall in the last 5 days? Y N If yes, approximately how much? ____________

	4 Excellent	3 Good	2 Fair	1 Poor
Dissolved Oxygen (% saturation)	☐ 110 - 91	☐ 90 - 71	☐ 70 - 51	☐ <50
BOD (ppm = mg/L) DO original sample ________ DO incubated sample ________	☐ 0	☐ 4	☐ 8	☐ >8
Nitrate (ppm) **(note that values are estimated)**	☐ 0	☐ 1 - 4	☐ 5	☐ 20, 40 ppm
pH	☐ 7	☐ 6, 8	☐ 5, 9	☐ 4, 10, 11
Phosphate (ppm)	☐ 1	☐ 2	☐ 4	☐ >4
Temperature change (°C) downstream T ________ upstream T ________ difference ________	☐ 0 - 2	☐ 3 - 5	☐ 6 - 10	☐ >10
Turbidity (JTU)	☐ 0	☐ >0 - 40	☐ >40 - 100	☐ >100
Fecal Coliform Bacteria (colonies/100mL)	☐ 0	☐ Negative 1 - 300	☐ 301 - 500	☐ Positive >500

Overall water quality:

Excellent ______ x 4 ☐ + # Good ______ x 3 ☐ + # Fair ______ x 2 ☐ + # Poor ______ x 1 ☐ = ☐ ÷ **n** = ☐

n = number of tests performed

Dissolved Oxygen (DO): Essential for supporting fish habitat in rivers. It is needed for respiration of aerobic (oxygen breathing) plants and animals, photosynthesis, decomposition of organic matter, and many other things. The colder the water, the more DO is in the water., Optimal levels are 5 – 7ppm.

Biochemical Oxygen Demand (BOD): the quantity of dissolved oxygen used by bacteria as they break down organic waste. High levels of BOD indicate increased levels of nutrients from natural and/or human induced activities. BOD is reported as milligrams of oxygen used per liter (ppm).

Fecal Coliform Bacteria: Fecal coliforms are naturally present in the guts of humans and animals. Presence of fecal coliform bacteria in the water is an indicator of sewage or fecal contamination. Finding low levels of fecal coliform bacteria in the river is normal as it occurs in all animal waste (fish, birds, etc.).

Nitrates: An essential nutrient for plant growth and protein building. In excess, nitrogen can stimulate rapid algal and aquatic vascular plant growth. To indicate your nitrat levels, they are mixed with nitrites and measured in milligrams per Liter. Optimal levels are less than 4ppm.

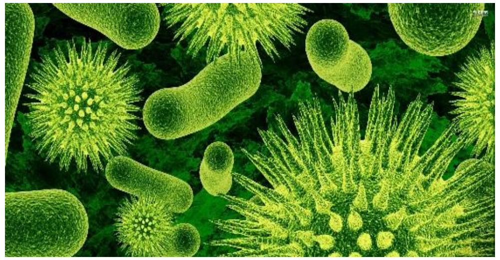
pH: pH is a measure of the hydrogen ion activity in a solution. Measurements range from 1 to 14: 1 being most acidic, 7 being neutral, and 14 being basic. Optimal levels are between 6.5-8.2 (closest to neutral).

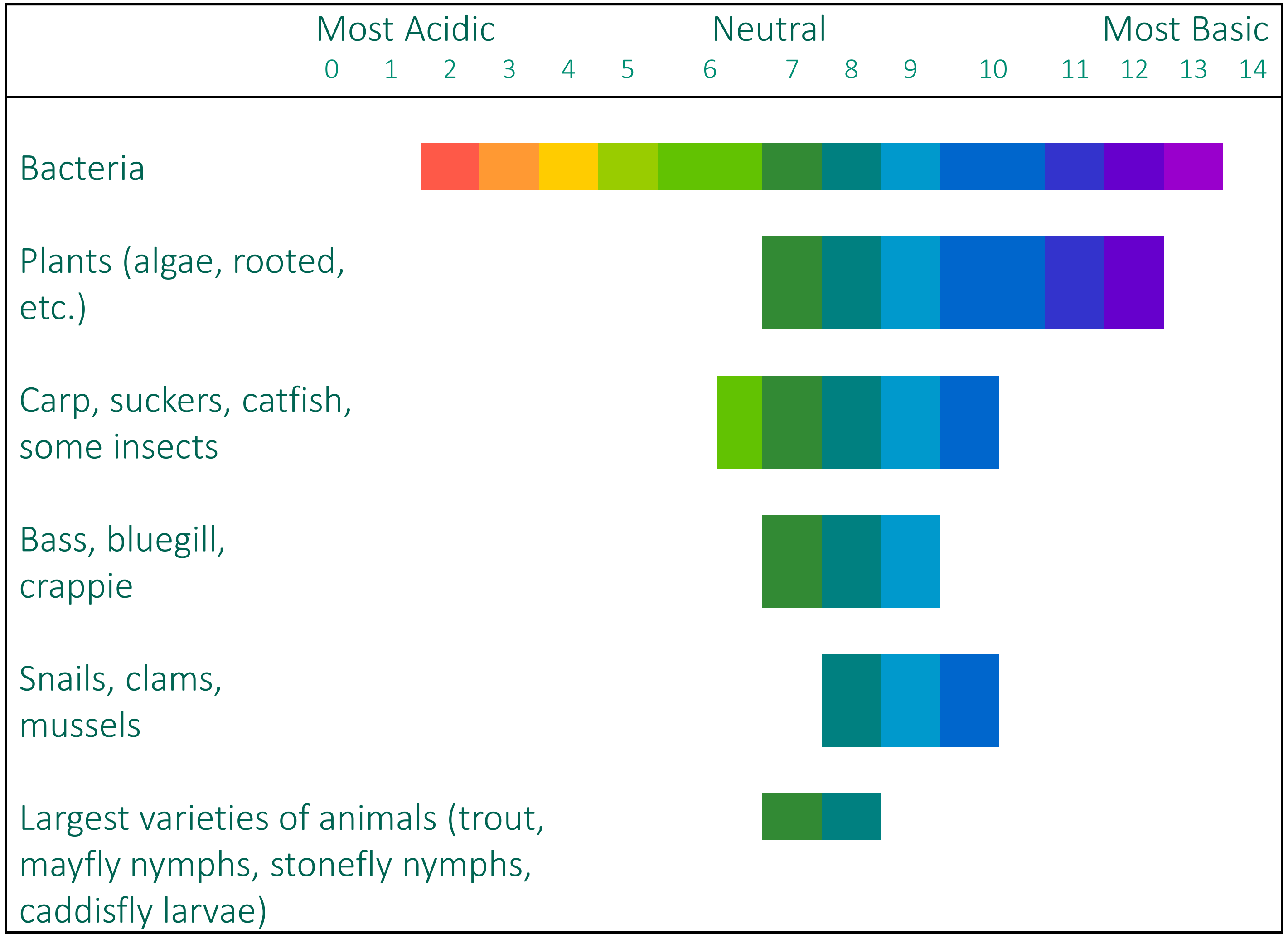
Total Phosphate: phosphorous is an essential nutrient for plant growth. Michigan has naturally high phosphorous levels in the soil. Excess amounts cause excessive plant growth. Optimal level is < 0.03ppm

Turbidity: Measurement of the <u>relative clarity</u> of the water. Not to be confused with the color of the water. Can be caused by clay and sediments from erosion, urban runoff, boat traffic, and abundant bottom feeders. When water has high turbidity, it looses its ability to support a diversity of organisms. Suspended solids can clogs gills and reduce growth rates and egg and larval development. Settled particles can also suffocate fish eggs and aquatic insects. Measured in JTUs (Jackson Turbidity Units).

Water Temperature: Water temperature directly effects any physical, biological, and chemical characteristics of a river. < 20°C is the optimal temp for sensitive macroinvertebrates, trout, and other cold water species

pH Ranges That Support AQUATIC LIFE





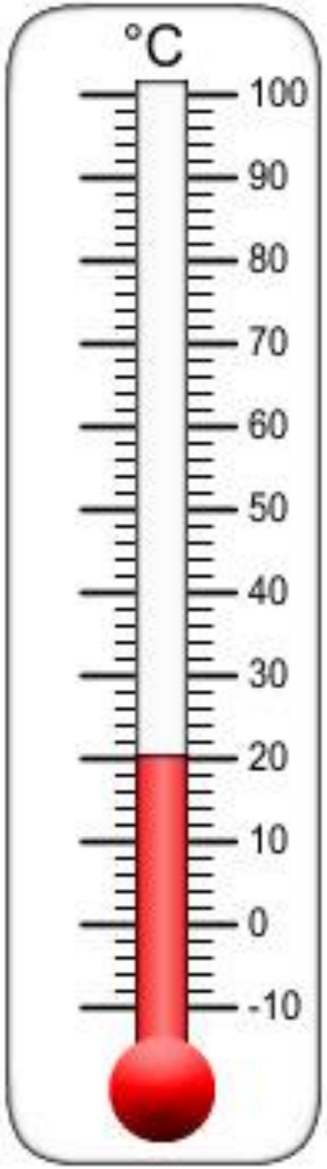
Field manual for Low Cost Water Quality Monitoring (11th Edition, William Stapp & Mark Mitchell)

Temperature Ranges That Support AQUATIC LIFE

More than 20 °C (>68 °F):
Many plants, warm water fish such as bass, crappie, bluegill, carp, sucker, many fish diseases

20 - 14 °C (68 - 57 °F):
Some plant life, walleye, northern pike, caddisfly larvae

Less than 14 °C (<57 °F):
Few plants, cold water fish such as salmon and trout; aquatic insects such as stonefly and mayfly nymphs; few fish diseases



Station #2 PHYSICAL HABITAT

Students will Measure:

- Average stream width
- Average stream depth
- Average surface water velocity
- Estimated flow
- Water temperature
- Air temperature

Students will Observe:

- Weather conditions
- Soil type
- Stream bank
- Water color and odor
- substrate composition
- Substrate embeddedness
- Riparian vegetation
- Stream habitat types
- Surrounding land use
- Aquatic plants
- Pollution sources
- Present wildlife

Station #2 DATA SHEET

PHYSICAL (pg. 1)

NOTE: If it says "average" measurement, more than one measurement is required.

Make sure Section 1 is completed! (consider having the students fill this in before they go out to monitor)

Section 1: General Information

School: ____________ Teacher(s): ____________

Date: ______ Time: ______ Township / City: ____________ County: ______

Test location: ____________

River Branch: ____________ Tributary: ____________

If the access point to this site is a road crossing, does a road ditch discharge directly into the stream at the crossing?

yes no

Section 2: Weather Conditions

sunny partly cloudy cloudy rain

Any precipitation in the last 5 days? yes no If yes, approximate amount: ______

Air temperature: ______ °C Water temperature: ______ °C

Section 3: Stream Habitat

3.1) Average stream width (0.1ft): ______ 1. ____ + 2. ____ + 3. ____ = ______ ÷ 3

Average stream depth (0.1ft): ______ 1. ____ + 2. ____ + 3. ____ = ______ ÷ 3

3.2) Surface water velocity (0.1 ft / sec): ______

distance (0.1 ft): ____ distance (0.1 ft): ____ distance (0.1 ft): ____

time (sec): ____ time (sec): ____ time (sec): ____

Test 1 velocity: ____ + Test 2 velocity: ____ + Test 3 velocity: ____ = ______ ÷ 3

3.3) Estimated flow (width x depth x velocity): ______

3.4) Has the stream been channelized? yes no

3.5) Dominant watershed soil type: clay loam / sand organic

3.6) Water color Water Color Clear [ ] Gray [ ] Brown [ ] Black [ ] Green [ ]
Water odor (describe): ____________

3.7) Trash in stream along banks? yes no

Trash / debris in trees (or shrubs) above stream? yes no

3.8) Substrate (Rank relative abundance; 1 = most common, 2 = next most abundant, etc. Leave blank if absent)

_____ Clay
_____ Silt
_____ Sand
_____ Gravel (0.25" - 2")
_____ Cobble (2" - 10")
_____ Boulder (>10")

3.9) Obvious Siltation?

yes
no

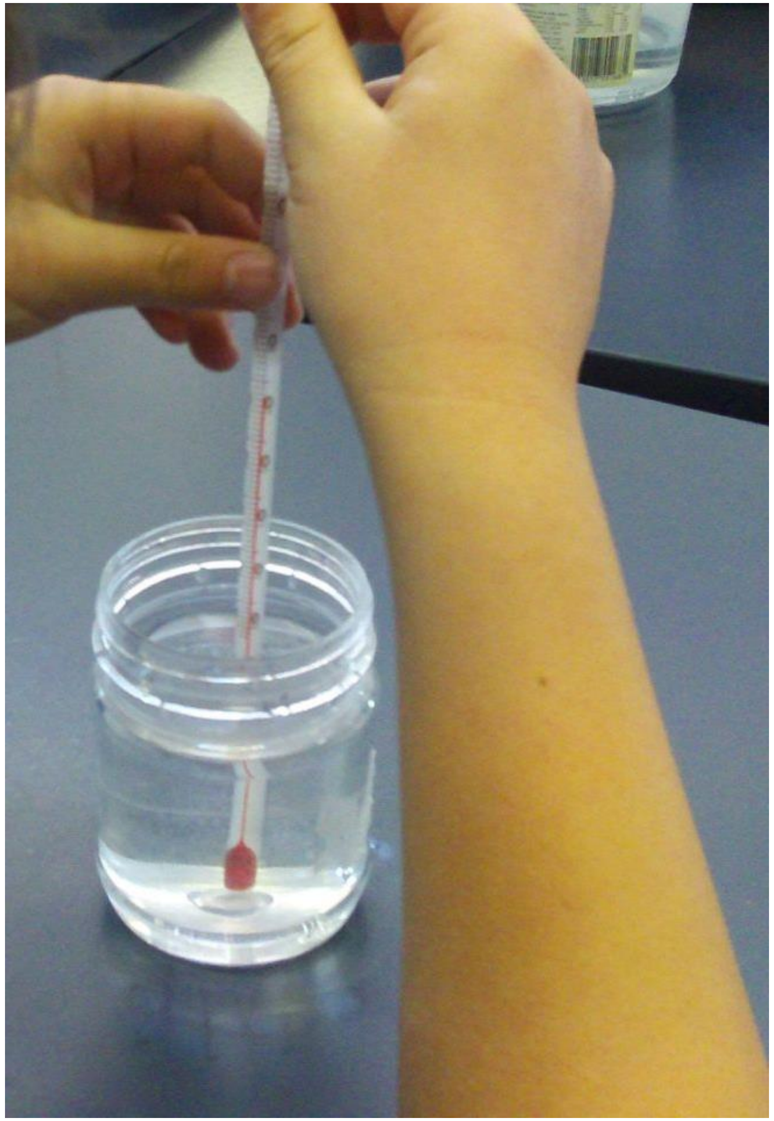
3.10) Substrate Embeddedness (Circle One)

WATER & AIR TEMPERATURE

AIR TEMP: Hold thermometer in the air for 2 minutes and record results.

WATER TEMP: Placing the thermometer inside a container, submerge it in a representative location within your reach. The thermometer and the container should be held horizontally in the stream, with the mouth of the container facing upstream. After 1 minute, Remove the container from the stream, keep the thermometer bulb in the water-filled container, and read the water temperature as quickly as possible.

BE SURE TO RECORD RESULTS IN °C



STREAM WIDTH

STEP 1: have 2 students measure the width of the wet bank in 3 different spots along your tributary.

STEP 2: find the average width of your stream using these three measurements.

STREAM DEPTH

STEP 1: have 1 student measure the depth in 3 different spots along 1 transect in the tributary.

STEP 2: find the average depth of your stream using these 3 measurements.

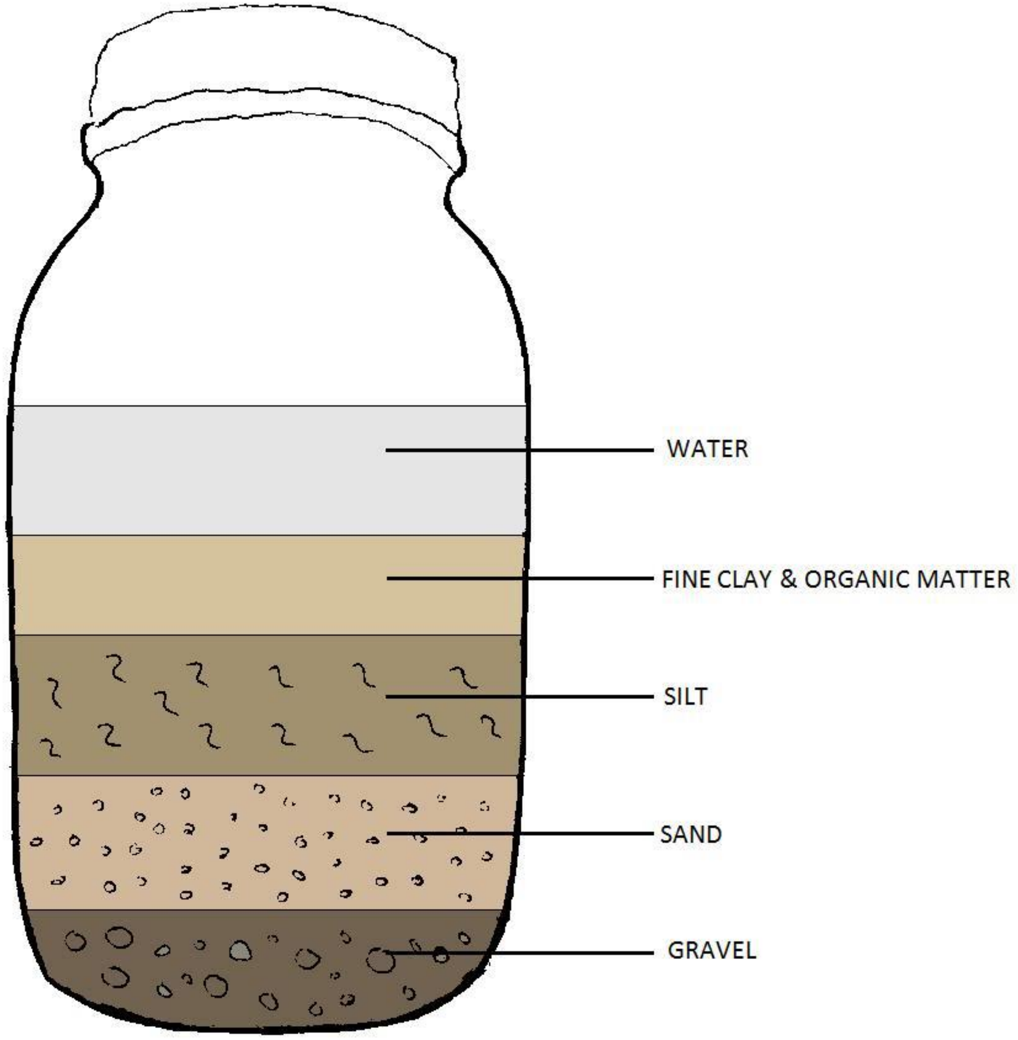
CHANNELIZED or NATURAL?

NATURAL STREAM has not been altered from its defined pattern, dimension and profile by artificial means

CHANNELIZED STREAM is a maintained stream channel that is actively controlled through dredging, widening, straightening, or the formation of dikes along the stream channel. The stream channel is straight, wide and shallow at low flow, and has a uniform cross section. Bank vegetation is typically sparse or very young.

WATERSHED SOIL TYPE

- This is a good thing to look up before you go out to monitor.
  - NRCS Soil Data
- Maybe have kids do a mini research project?
- Collect a soil sample and run a soil test to get the results back in the classroom.



WATER
COLOR & ODOR

Neutral Water Odors:
- Dirt, leaves, earthy, woody, no odor

Unusual Odors:
- Fishy, Sulphur, gas, chemical, metallic


Brown


Grey


Green

One good way to check water color is by observing it against a white background.

TRASH?

Is it a good location for a cleanup?

SUBSTRATE COMPOSITION

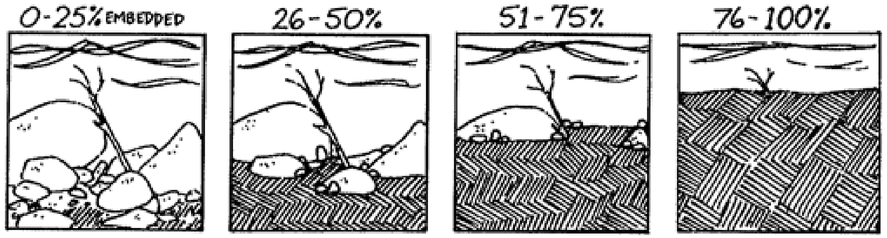
Clay: hard, very compact fine particles
Silt: AKA. Detritus, muck, etc.
Sand: feels gritty to the touch, individual grains are visible with unaided eye.
Gravel: small, individual stones (0.25" – 2")
Cobble: medium, individual stones (2" – 10")
Boulder: large rocks (>10")

OBVIOUS SILTATION?

Siltation refers to both the increased concentration of suspended sediments, the increased accumulation (temporary or permanent) of fine sediments on river bottom or along river edge.

Station #2 DATA SHEET

PHYSICAL (pg. 2)



3.11) Riparian Vegetation (Rank relative abundance; 1 = most abundant, 2 = next most abundant, etc. Leave blank if absent)

_______ Trees

_______ Shrubs

_______ Herbaceous plants

_______ Grass

_______ Bare

3.12) Stream Shading

100 - 76%

75 - 51%

50 - 26%

25 - 0%

3.13) Bank Erosion

extensive

moderate

little / none

Other (please describe): ____

3.14) Estimated width of riparian vegetation corridor (ft): _______

3.15) Stream Habitat (circle if present)

3.16) Woody Debris

abundant

common

rare

none

3.17) Dams present: yes no If yes: man-made beaver / log jam

3.18) Aquatic plants: algae filamentous algae vascular plants

Are any of these plants very abundant? yes no Which one(s)? algae
filamentous algae
vascular plants

3.19) Surrounding Land Use: (Rank relative abundance; 1 = most abundant, 2 = next most abundant, etc. Leave blank if absent)

_______ Woodland _______ Wetland _______ Open field

_______ Farmland _______ Residential _______ Commercial

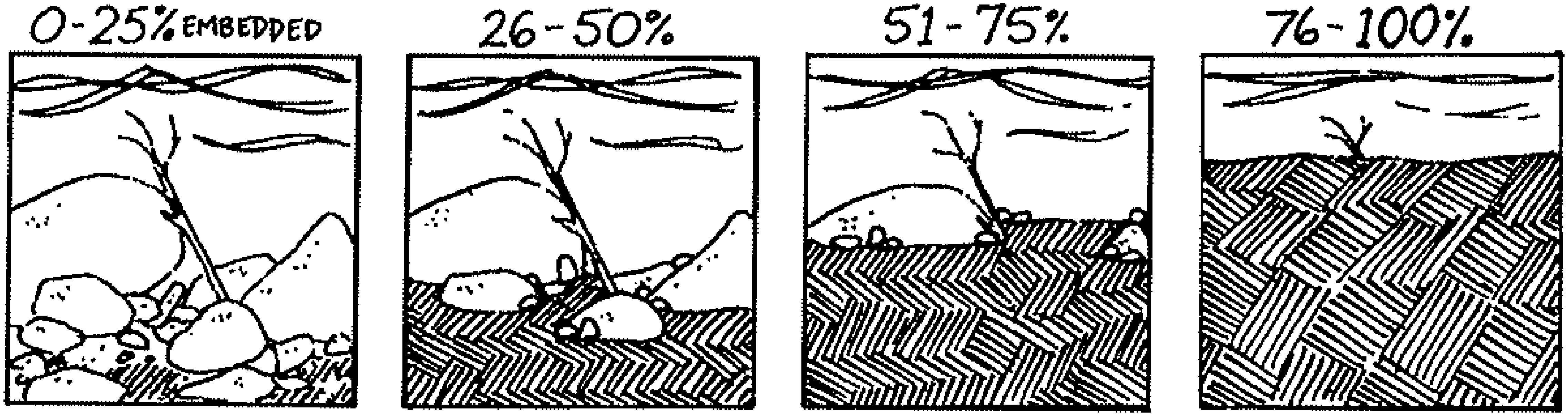
Other (please describe): ____

3.20) Any obvious pollution sources? yes no

If yes, please describe:

SUBSTRATE EMBEDDEDNESS

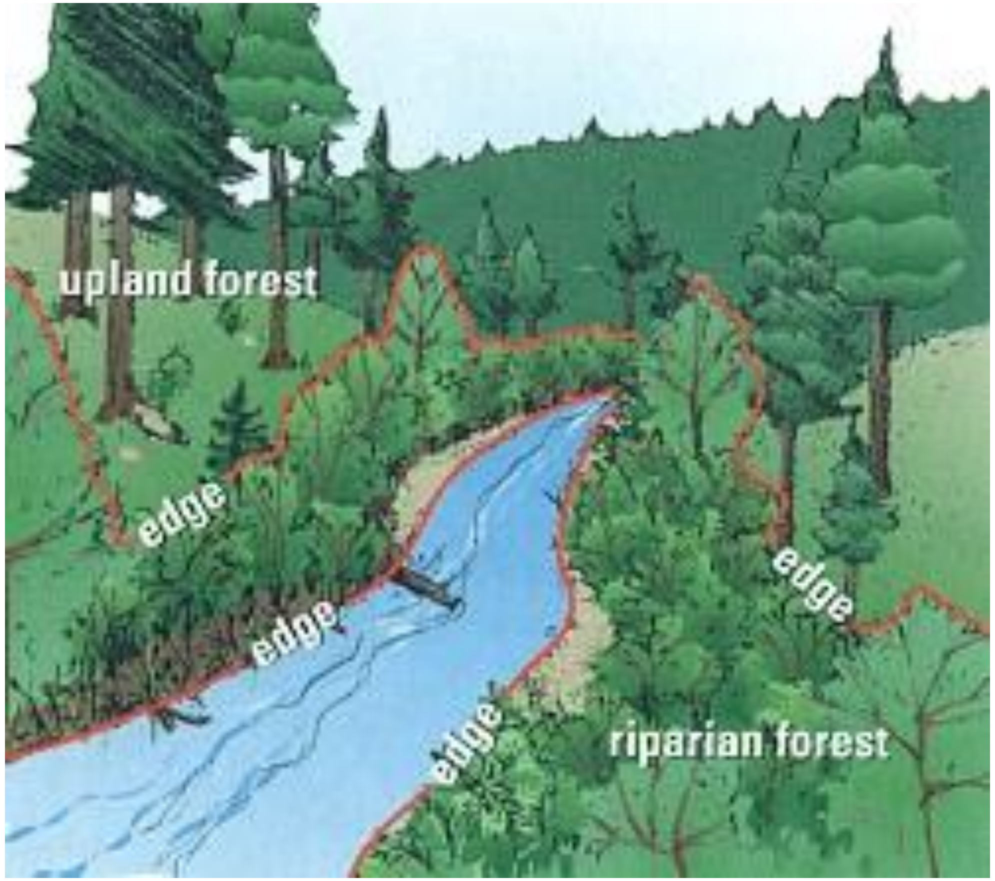
Embeddedness is the degree to which rocks and snags are covered or sunken into silt, sand, or mud in the stream/river bottom. It is a result of sediment movement and deposition and is a parameter typically evaluated in the riffles and runs streams.



To estimate embeddedness gently pick up several rocks, one at a time, from the observation area and watch for "plumes" of sediment to rise into the water column as you move the rocks. Record the average embeddedness value for these observations.

RIPARIAN VEGETATION

Riparian Vegetation is the natural vegetation (plant) area along the stream/river/drain banks (within the first 20ft or so of the water's edge).



Trees: woody plants 15ft or taller

Shrubs: woody vegetation <15ft high

Herbaceous Plants: grasses, wildflowers, ferns, sedges, (diverse)

Grass: lawn

Bare: bare ground. No, or almost no streamside vegetation

You will also need to estimate the width of the riparian area on the left and right bank. If width is greater than 20ft, just record >20ft.

STREAM SHADING

Within the section of stream being monitored, estimate the percentage of stream that is shaded.

Undercut banks

Overhanging branches/ tree canopy

STREAMBANK EROSION

Water wearing away at the banks of a stream or river

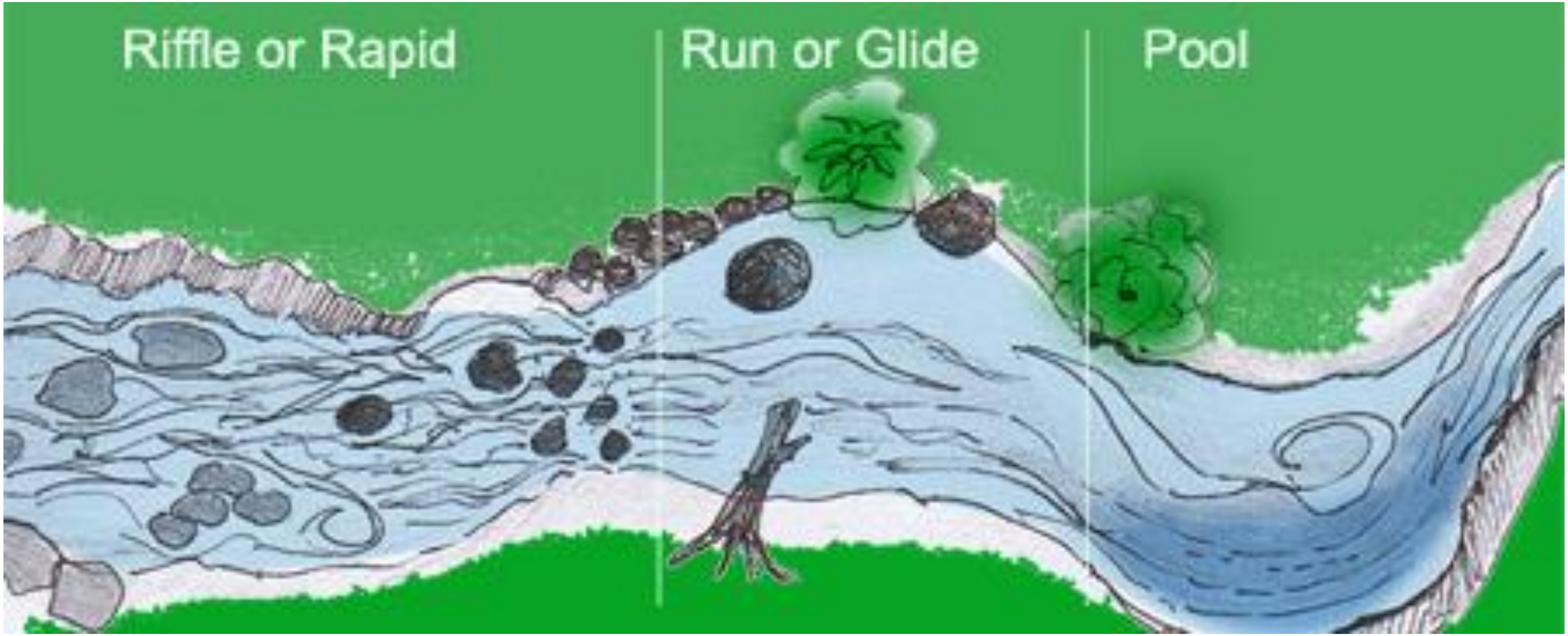
Extreme

Moderate

Little to none

STREAM HABITAT

Riffle: shallow, fast moving water
Run: deeper, fast moving water
Pool: deep, very slow moving/still water



WOODY DEBRIS

Logs and woody debris (small or large branches, leaves, roots or trunks) in the stream or along the water's edge can slow or divert water to provide important habitat for fish and aquatic macroinvertebrates. Excessive amounts of debris or logs can cause localized flooding.

ANY DAMS PRESENT?

Dams can actually segment streams by acting as barriers that prevent fish passage upstream.

Beaver / log-jam

Man-made

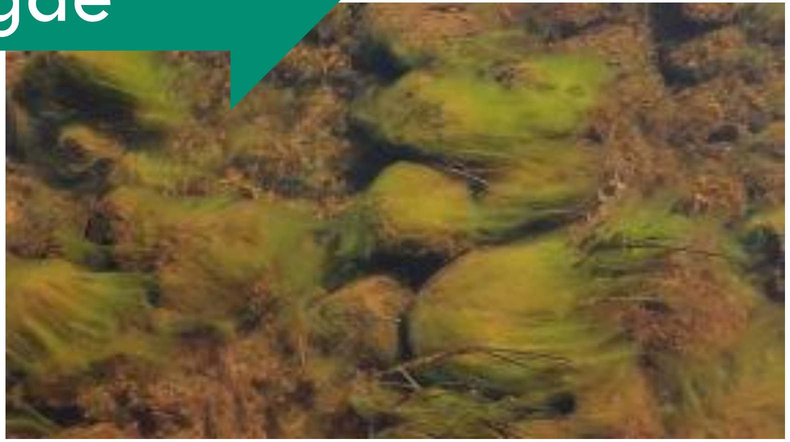
AQUATIC PLANTS PRESENT?

Algae: single celled flagellates with no root system

Vascular Plants: have a root / vascular system

Vascular Plants

Algae



SURROUNDING LAND USE

Any obvious POLUTION SOURCES?

- Parking lot
- Stormwater pipe
- Agriculture
- Industry
- Subdivision
- Etc.

Station #2 DATA SHEET

PHYSICAL (pg. 3)

3.21) During the sampling and evaluation, did you observe any fish or wildlife? yes no

If yes, please describe (if possible):

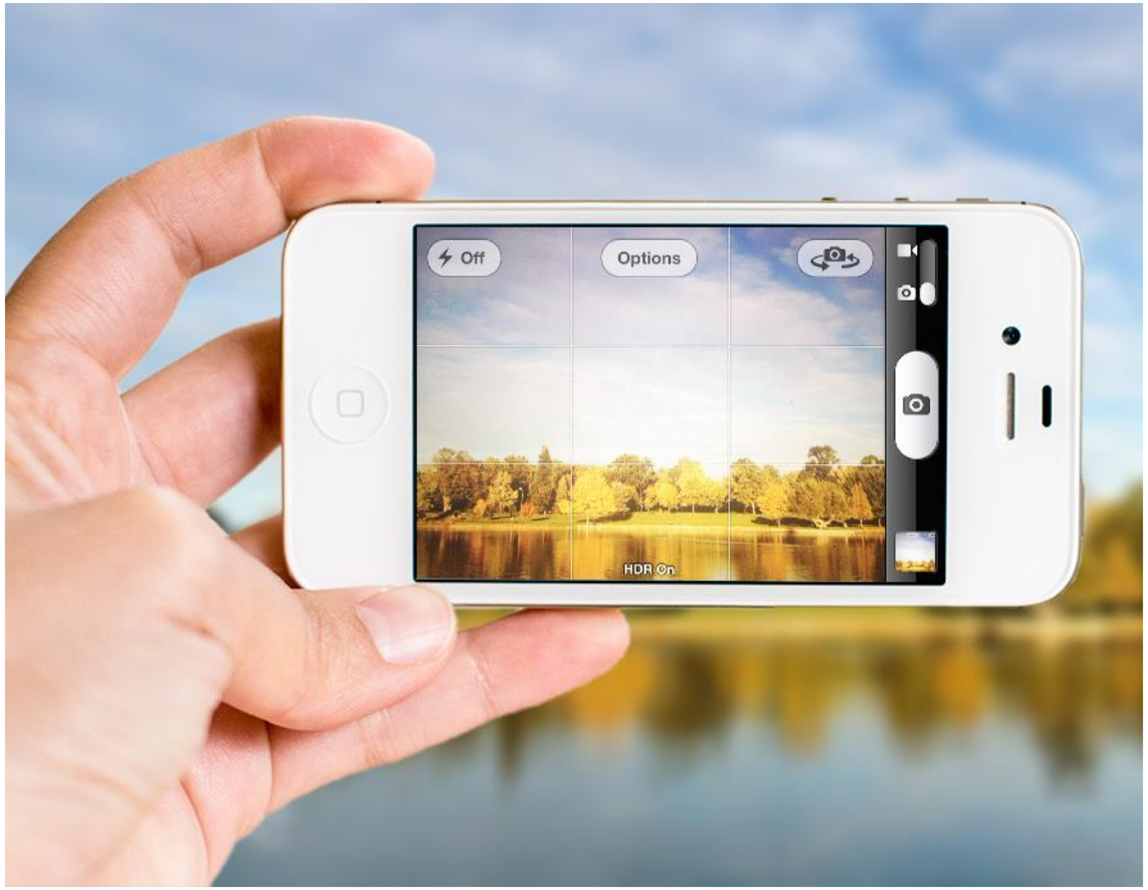
3.22) Other observations:

3.23) Attach any photos to survey form (downstream, upstream, and others of interest).

3.23) Attach any photos to survey form (downstream, upstream, and others of interest).

WILDLIFE & OTHER OBSERVATIONS

- Did you observe any fish or other wildlife?
- Did you have any other notable observations
- Make sure to document your site by taking photos of upstream, downstream, and other areas of interest!

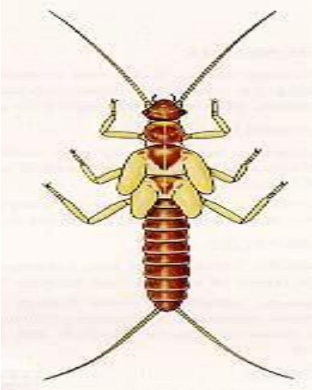


Station #3 BIOLOGICAL

Students will collect and learn to identify benthic macroinvertebrates from the stream!

Benthic = Bottom dwellers - Live in, crawl upon, or attach themselves to the bottom substrate
Macro = large enough to see with unaided eye
invertebrates = no backbone

BENTHIC MACROINVERTEBRATES



Why are benthic macroinvertebrates used to indicate health of the stream? Because they…

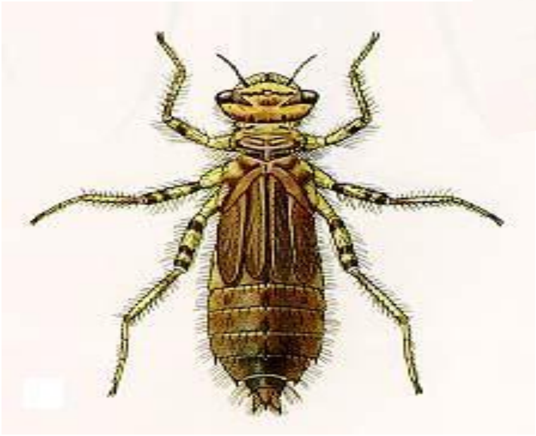
- live in the water for all or most of their life
- often live for more than one year
- have limited mobility making them easy to collect
- are easy to identify in a laboratory
- differ in their tolerance to amount of pollution causing them to stay in areas only suitable for their survival
- are indicators of environmental condition

Often go unnoticed because of their size and habitat, but are extremely important to a river ecosystem because they serve as a primary food source for fish and other aquatic animals.

BENTHIC
MACROINVERTEBRATES

Quantity & Quality

- Bugs are rated according to their pollution tolerance
- Some organisms can tolerate an abundance of sediment, high water temperatures, or low dissolved oxygen levels
- The ratio of tolerant to intolerant macroinvertebrates creates an index of biodiversity
  - More diverse = Stable environment
  - Less diverse = Unstable environment



GROUP 1
Macroinvertebrates

Pollution sensitive organisms found in good quality water

- Stonefly
- Caddisfly
- Water Penny
- Riffle Beetle
- Mayfly
- Dobsonfly
- Gilled Snail

GROUP 2
Macroinvertebrates

Somewhat pollution tolerant organisms found in good or fair quality water

- **Crayfish**
- **Sowbug**
- **Dragonfly**
- **Damselfly**
- **Fishfly**
- **Alderfly**
- **Cranefly**
- **Beetle**
- **Net-spinning Caddisfly**

GROUP 3
Macroinvertebrates

Pollution tolerant organisms found in any quality of water

- **Aquatic Worm**
- **Midge fly**
- **Black fly**
- **Leech**
- **Pouch/Pond snail**
- **Other snails**

Station #3 DATA SHEET

BIOLOGICAL

STREAM LEADERS MACROINVERTEBRATE IDENTIFICATION

School: ____________________ Teacher(s): ____________________

Date: __________ Time: __________ Township / City: ______________ County: __________

Test location: ____

River Branch: ____________________ Tributary: ____________________

Benthos Identifier(s): ____

Use letter codes (Rare = 1-10, Common = 11+) to record the approximate numbers of organisms in each group found in the stream reach.

Group 1 Sensitive	Group 2 Somewhat-sensitive	Group 3 Tolerant
_____ Beetle adults (*Coleoptera*)	_____ Alderfly larvae (*Megaloptera*)	_____ Aquatic worms (*Oligochaeta*)
_____ Blackfly larvae (*Diptera*)	_____ Beetle larvae (*Coleoptera*)	_____ Leech (*Hirudina*)
_____ Caddisfly larvae (*Trichoptera*)	_____ Clam (*Pelecypoda*)	_____ Midge larvae (*Diptera*)
_____ Gilled Snail (*Gastropoda*)	_____ Cranefly larvae (*Diptera*)	_____ Other *Diptera* (Watersnipe, Horsefly)
_____ Hellgrammites (*Megaloptera*)	_____ Crayfish (*Decapoda*)	_____ Pouch Snail, Orb Snail (*Gastropoda*)
_____ Mayfly nymph (*Ephemeroptera*)	_____ Damselfly nymph (*Odonata*)	_____ Sowbug (*Isopoda*)
_____ Stonefly nymph (*Plecoptera*)	_____ Dragonfly nymph (*Odonata*)	_____ True bugs (*Hemiptera*) **(Backswimmer, Giant Water Bug, Waterboatman, Water strider)**
_____ Water penny (*Coleoptera*)	_____ Scud (*Amphipoda*)	

Group 1	Group 2	Group 3
_____ # of Rs x 5.0 = _____	_____ # of Rs x 3.0 = _____	_____ # of Rs x 1.1 = _____
_____ # of Cs x 5.3 = _____	_____ # of Cs x 3.2 = _____	_____ # of Cs x 1.0 = _____
Group 1 total = _____	Group 2 total = _____	Group 3 total = _____

Total stream quality score (sum of totals for Groups 1 - 3) = __________

☐ Excellent (49+) ☐ Good (48 - 34) ☐ Fair (33 - 19) ☐ Poor (18 - 0)

MONITORING EQUIPMENT

- Waders
- D-nets
- Kick nets
- Buckets
- Water bottles
- Spoons
- Tweezers
- Pipettes
- Ice cube trays
- ID guides

QUESTIONS FOR STUDENTS

- Is the stream changing over time?
- Is the stream cleaner upstream or downstream from a certain place?
- How do the habitat quality, water chemistry, biological diversity, and physical characteristics compare among different streams.
- Does the stream change throughout the year?
- What lives in this stream?
- Will this stream support trout or another species of fish?
- Are land use activities affecting stream health?

SHARING WITH THE COMMUNITY

- Describe your project in the school newsletter.
- Post photos and results on school website.
- Make presentations to your school board, city council, conservation district, etc.
- Request funding and equipment from local organizations and businesses.
- Compare stream data with other schools at CRWC's Student Congress
- Other ideas?

RESOURCES

- http://www.crwc.org/programs/stream-leaders/resources/